NATIONAL PETROLEUM INSTITUTE
MINISTRY OF MINERAL RESOURCES
REPUBLIC OF MOZAMBIQUE

PREPARATORY SURVEY
ON
UREA FERTILIZER COMPLEX PROJECT
IN
THE REPUBLIC OF MOZAMBIQUE

FINAL REPORT

AUGUST 2014

JAPAN INTERNATIONAL COOPERATION AGENCY

SUMITOMO CORPORATION
ORIENTAL CONSULTANTS CO., LTD.
PACIFIC CONSULTANTS CO., LTD.

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Abbreviations and Glossary

AFAP	African Fertilizer and Agribusiness Partnership
AfDB	African Development Bank
AMITSA	Regional Agricultural Input Market Information and Transparency System for East and Southern Africa
ANE	National Road Administration
Ara	Regional Water Administration
Ara Centro	Regional Water Administration of Central **Mozambique**
BaU	One Stop Shop
BOO	Build – Own – Operate
BOT	Build – Operate – Transfer
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
BTU	British Thermal Unit
CAADP	Comprehensive Africa Agriculture Development Program
CAP	Agricultural Census
CdM	Cornelder de Mozambique
CEPAGRI	Center for Agricultural Promotion
CFM	Mozambique Ports and Railways
CIIR	Commercial Interest Reference Rate
CPI	Investment Promotion Center
DAP	Diammonium-phosphate fertilizer
DNTF	National Land and Forests Directorate
DPA	Provincial Directorate of Agriculture
DWT	Dead Weight Tonnage
ECA	Export Credit Agency
EIS	Environmental and Social Impact Study

EMP	Environmental Management Plan
ENH	Empresa Nacional de Hidrocarbonetos
EPC	Engineering, Procurement, Construction
EPDA	Environmental Pre-Feasibility Study and Scope Definition Report
ERM	Environment Resource Management
ESIA	Environmental and Social Impact Assessment
EU	European Union
FAAP	Framework for African Agricultural Productivity
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	FAO Statistical Database (www.faostat.fao.org/)
FIPAG	Fundo de Investimento e Patrimonio do Abastecimento de Agua
FOB	Free on Board
GAZEDA	Special Economic Zones Office
GDP	Gross Domestic Product
GF	Guarantee Fund
GOM	Government of Mozambique
IAM	Mozambican Cotton Institute
ICC	The International Criminal Court
ICSID	International Centre for Settlement of Investment Disputes
IFA	International Fertilizer Industry Association
IFDC	International Fertilizer Development Center
IFPRI	International Food Policy Research Institute
IFZ	Industrial Free Zone
IIAM	Mozambican Agricultural Research Institute
INCAJU	Cashew Promotion Institute
INE	National Statistics Institute (Instituto Nacional de Estatística)

INP	Instituto Nacional de Petroleo
IRRI	International Rice Research Institute
JBIC	Japan Bank for International Cooperation
JICA	Japanese International Cooperation Agency
KfW	German Development Bank
L10	Noise Level exceeded for 10% of the time
L90	Noise Level exceeded for 90% of the time
LDA	Closely Held Limited Liability Company
MFC	Mozambique Fertilizer Company (fertilizer mixing/blending company in Chimoio)
MIC	Ministry of Industry and Commerce
MICOA	Ministry of Coordination of Environmental Affairs
MIGA	Multilateral Investment Guarantee Agency
MINAG	Ministry of Agriculture (Ministério da Agricultura)
MMBTU	Million BTU
MMR	Ministry of Mineral Resources
mmscfd	Million Standard Cubic Feet Per Day
MOP	Muriate of Potash
MPD	Ministry of Planning and Development
MT	Metical (Mozambican abbreviation)
NEXI	Nippon Export and Investment Insurance
NGO	Nongovernmental Organization
NPK	Nitrogen, Phosphorus (Phosphate), Potassium Fertilizer
O&M	Operation and Maintenance
ODA	Official Development Assistance (grants plus concessionary loans)
OECD	Organization for Economic Co-operation and Development
OPIC	Overseas Private Investment Corporation

PAAO	Agricultural Activity Plan
PAPA	Food Production Action Plan (Plano de Acção para a Produção de Alimentos)
PARP	Action Plan for the Reduction of Poverty (Plano de Acção para a Redução da Pobreza)
PARPA	Action Plan for the Reduction of Absolute Poverty (Plano de Acção para a Redução da Pobreza Absoluta)
PEDSA	Strategy and Plan for Agro-Development (Plano Estratégico de Desenvolvimento Agrário)
PES	Economic and Social Plan
PFI	Private Finance Initiative
PM_{10}	Particle Matter 10
PPP	Public Private Partnerships
PQG	National Development Plan
PSA	Product Sharing Agreement
ROMPCO	Republic of Mozambique Pipeline Investments Company
SA	Limited Liability Stock Company
SADC	Southern Africa Development Community
SCADA	Supervisory Control and Data Acquisition
SDAE	District Economic Activities Services
SES	Simplified Environmental Study
SEZ	Special Economic Zone
SPE	Special Purpose Entity
SSA	Sub-Saharan Africa
TCF	Trillion Cubic Feet
TEU	Twenty-foot Equivalent Unit
TIA	Rural Household Income Surveys (Trabalho de Inquerito Agrícola)
TSP	Total Suspended Particles
UK	United Kingdom

USA	United States of America
USAID	United States Agency for International Development
USD	United States Dollar
VAT	Value Added Tax (or IVA)
VOC	Volatile Organic Compounds
WB	World Bank
WGS84	World Geodetic System 1984
WHO	World Health Organization

Chapter 1 Study Outline

1.1 Background of the Survey

Mozambique has recently achieved remarkable economic development and become one of the leading countries for Africa's economic development. Due to the remarkable growth in construction, agriculture and energy sectors and financial improvement, GDP growth rate since 2000 has become around 8%.

Agriculture is one of the major industries in Mozambique and currently accounts for 25% of GDP in 2011 and 75% of the working population in 2007. However it still needs to develop for the following reasons:

- Low productivity
- Low marketability
- Low Productivity in small-scale production

Under these circumstances, in May 2011 GOM published the "Strategic Plan for Agricultural Development, PEDSA 2010-2019" for developing the agricultural sector.

The latest strategies aim to improve the productivity of agriculture and then stimulate the demand for fertilizer whilst maintaining environmental standards. The plan includes the construction of at least two fertilizer plants by 2014.

The proposed urea fertilizer complex project (hereinafter referred to as "the Project") would become the first fertilizer plant in Mozambique, and it is in line with the aforesaid strategy of GOM. Therefore, the success of the proposed urea fertilizer complex project will contribute to the development of the agricultural industry and employment. Also, it will promote the achievement of the MDGs and the economic growth of Mozambique.

GOM and Japan International Cooperation Agency (hereinafter referred as "JICA") have made several preliminary discussions in order to identify priority projects in the field of agricultural infrastructure, including fertilizer production facilities and its utility facilities, and have agreed to conduct a survey on the feasibility of the Project (hereinafter referred as "the Survey").

1.2 Objectives of the Survey

The objective of the Project is to supply domestic fertilizer to farmers in Mozambique by constructing and operating the Urea Fertilizer Complex, which is most likely to be located in the New Industrial Area in Beira, in order to improve agricultural productivity and enhance industrialization and creation of job opportunities in the Republic of Mozambique.

1.3 Scope and Approach of the Survey

1.3.1 Project Site

The Project site is located within the Beira New Industrial Area which will be provided by Beira Municiparity. The site survey also includes surrounding infrastrutures i.e. access roads, railways, and the Beira Port.

Source: JICA Survey Team

Figure 1.3.1 Site Location Map

1.3.2 Proposed Outline of the Project

(1) Scheme and Structure of the Project

This Project will be executed under the PPP scheme, and will consist of:

- Urea Fertilizer Complex which the private sector, together with the public sector, will invest, finance, design, build and provide facility management for maintenance services under a long term agreement.
- Support facilities necessary for the complex, such as port facilities and roads, which the public sector will design, build, finance and provide facility management for maintenance services.

(2) Construction/Operation and Maintenance of Urea Fertilizer Complex

The Complex is outlined as follows;

- Project site: Beira New Industrial Area
- Production Volume: Urea 4,000 ton/day (to be determined through the Survey)
- Places of Distribution: Mozambique, Zambia, Zimbabwe, Malawi, India etc.
- Raw Material: Natural gas from the Pande/Temane gas field, or any other gas fields to be confirmed by the GOM.
- Processing: Ammonia – KBR
  Urea – TOYO Engineering Corporation
- Power Supply: In-house gas field power plant
- Water Supply: To be supplied from the public water pipeline
- Off-site facilities: Ammonia tank/Urea tank 50-kg bagging facility

(3) Support Facilities

Support facilities, such as port facilities, roads, etc., are necessary for the implementation of the Project. A survey will be conducted to clarify necessary facilities and, if necessary, a development plan will be proposed.

Gas pipelines need to be newly constructed. Details of the support facilities shall be studied in the Survey.

(4) Supply of Natural Gas from Pande/Temane Gas Field

The Survey shall be conducted on the assumption that natural gas will be supplied from the Pande/Temane gas field as proposed by the Survey Team.

In this regard, further detailed information on acquiring a supply of natural gas from the Pande/Temane gas field to the proposed Urea Fertilizer Complex is required in order to commence the Survey, and the following GOM's cooperation is required:

- To provide the Survey Team with GOM's strategy/policy for natural gas allocation to be produced from the Pande/Temane gas field, and
- To encourage developers of the Pande/Temane gas field to make timely decesions.

If the Pande/Temane gas field is unavailable, GOM should also provide information on alternate gas fields which could be developed as the feed stock of the Project.

(5) Roles of Public and Private Sector for the Implementation of the Project

Detailed discussion is required on the roles of the public and private sectors for each component of the Project.

(6) Project Implementation Schedule

This Project is taegeted to start the operation from around 2020.

(7) Estimate of the Total Project Cost

In this Survey, the total project cost including gas pipeline and other related infrastructures will be estimated based on a urea production capacity of 4,000 ton/day.

1.4 Basic Policy of Survey

1.4.1 Study of Financial Risks associated with PPP Project

Risks associated with this PPP Project will be carefully examined together with countermeasures to each risk. The following risks shall be noted in particular:

- Risk of change in policies, legislation and taxation
- Foreign exchange, interest rate and inflation risk
- Changes in market needs risk
- Force majeure risk
- Confirmation of the plant site and natural gas supply source
- Review and selection of optimum plant scale

1.4.2 Environmental and Social Considerations

The scoping study as well as collection of information about the environmental and social considerations will be carried out in the Survey to determine alternative plans, important environmental factors and survey methods considering the laws and regulations in Mozambique.

The study results should contribute to the smooth implementation and approval of the official environmental and social impact assessment (ESIA) which shall be conducted after the plans of the project are determined.

(1) Collection of Information on Laws and Regulations related to Environmental and Social Considerations in Mozambique

The following are laws and regulations related to the environmental and social considerations in Mozambique;

- Environment Law (No.20/1997)
- ESIA Regulation (decree No.45/2004)
- Environmental Auditing (decree No.32/2003)
- Land Law (No.19/97)
- Forest (and Fauna) Law (No.10/99)
- National Environmental Management Program (NEMP)

The Survey Team will confirm specific procedures that are required for the Project by reviewing current laws and regulations.

(2) Overview of Environmental and Social Circumstances relating to the Project

Environmental and social circumstances will be surveyed through discussions with the relevant organizations in Mozambique, through the collection of information from individuals and organizations which are familiar with the project area, and also by reviewing the existing literature and reconnaissance surveys. As for the gas pipeline route, the survey will be conducted to the possible extent. The Survey will also refer to "JICA Guidelines for Environmental and Social Considerations (April 2010)".

1.4.3 Undertaking by GOM

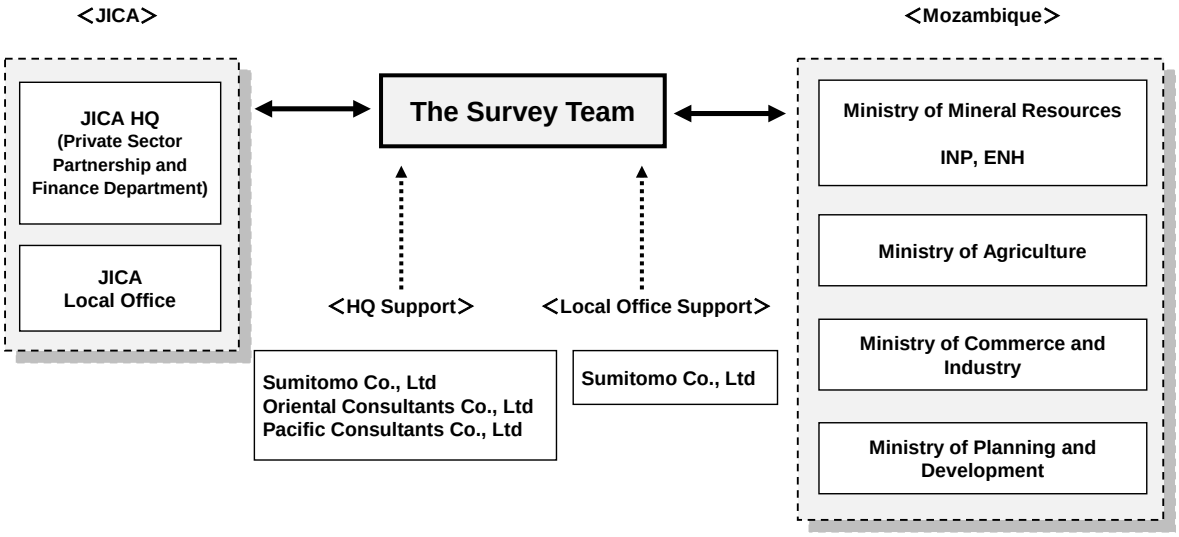
GOM shall appoint a counterpart agency who acts as a coordinating body with other concerned organizations for the smooth implementation of the Survey.

GOM shall, at its own expense, provide the Survey Team with the following items:

- Security-related information as well as measures to ensure the safety of the Survey Team;
- Data and information required for the Survey;
- Entry permits necessary for field surveys;
- Support for obtaining other privileges and benefits if necessary

1.4.4 Sharing Information with GOM

Participation of GOM in the Project is essential for its success. Laws and regulations related to PPP were introduced in August 2010 in Mozambique, which need to be reviewed for the Survey. The Survey will be conducted in close communication with the Survey Team's counterparts in Mozambique.



Source: JICA Survey Team

Figure 1.4.1 Support System and Related Institutions

1.4.5 Consideration of the Safety and Emergency Response

Collection of security information of the Survey area will be conducted in advance to carry out a smooth investigation and ensure the safety of the Survey Team. In particular, when the Survey of the natural gas supply pipeline route is undertaken, the Survey Team will pay due attention to safety management such, as emergency communication systems.

1.5 Terms of Reference of the Survey

1.5.1 Review of Background and Necessity of the Project

- Review the current status of social and economic conditions in Mozambique
- Review the current conditions of the agriculture sector and the development plan of GOM
- Review of laws and regulations of PPP projects in Mozambique
- Review the current activities of the other companies/countries for similar projects
- Review of the natural conditions of the Project site
- Collection of basic data for fertilizers other than urea
- Confirmation of the necessity of the Project

- Review of consistency with other countries assistance programs and the JICA country policy

1.5.2 Demand Forecast of the Project

- GOM's view on demand in Mozambique and surrounding countries
- Research of fertilizer prices and analysis of fertilizer demand

1.5.3 Confirmation of Natural Gas Supply

Investigation on the status of natural gas production and the future plan and assumption of the amount of natural gas that can be used for this Project will be conducted through discussions with organizations such as the Ministry of Mineral Resources, ENH and INP.

1.5.4 Study of PPP Project Scheme

- Study of roles of the public and private sectors
- Study of alternatives and development of the business scheme

1.5.5 Investigation of Road Infrastructure

The following investigations for road infrastructure will be carried out:

1) Identification of the existing roads that will be in service for the construction and operation of the proposed Urea Fertilizer Complex

2) Field survey of the identified existing roads

3) If improvement and expansion of the existing roads is necessary, the following studies will be carried out:
   - Identification of the scope of the road project
   - Project cost estimate

1.5.6 Investigation of Port Infrastructure

The following investigations on port infrastructure will be carried out:

1) Identification of the existing port facilities that will be in service for the construction and operation of the proposed Urea Fertilizer Complex

2) Field survey of the identified existing port facilities

3) If improvement and expansion of the existing port facilities is necessary, the following studies will be carried out:

- Identification of the scope of the port infrastructure project
- Project cost estimate

1.5.7 Investigation of Gas Pipeline Facilities

The following works for the gas pipeline will be carried out:

- Study of the gas pipeline route connecting the gas field and the Urea Fertilizer Complex and the identification of expected problems
- Site investigation where problems are expected (where possible)
- Collection of information such as topography, soil conditions and buried objects on the route
- Identification of the scope of the project
- Study of a project implementation schedule and constuction plan
- Project cost estimate

1.5.8 Conceptual Design of Urea Fertilizer Plant and Cost Estimate for the Construction and O&M

- Conceptual design of the Urea Fertilizer Complex
- Investigation for the study of operation
- Estimation of CAPEX and development of the project implementation schedule
- Calculation of O&M costs (OPEX)
- Development of construction plan

1.5.9 Review of PPP Project Scheme

- Study of project implementation organizations (SPE, government agencies, third sector)
- Identification of laws, regulations and permissions applied to agreements/contracts for the Project
- Review of funding options and development of a funding plan
- Study of terms and conditions of the contract between SPE and GOM

- Proposal of a procurement package
- Risk assessment
- Analysis of financial situation in SPE's business and study of the financial plan
- Financial analysis of the Project
- Financial analysis for the private sector
- Economic analysis for the public sector
- Risk analysis and proposition of a risk management policy
- Proposition for the current legal system
- Development of a project implementation plan
- Setting of effectiveness indicators of the Project

1.5.10 Evaluation of the Viability of the Project

- Evaluation of economic and financial viability
- Evaluation of environmental and social conditions
- Evaluation of implementation bodies

1.5.11 Environmental and Social Considerations

- Check of the environmental and social conditions (living area, land use, natural environment, economic and social conditions, etc.)
- Confirmation of environmental and social systems and organizations
- Preparation of a draft scoping report

1.5.12 Collection of Information of Northern Region

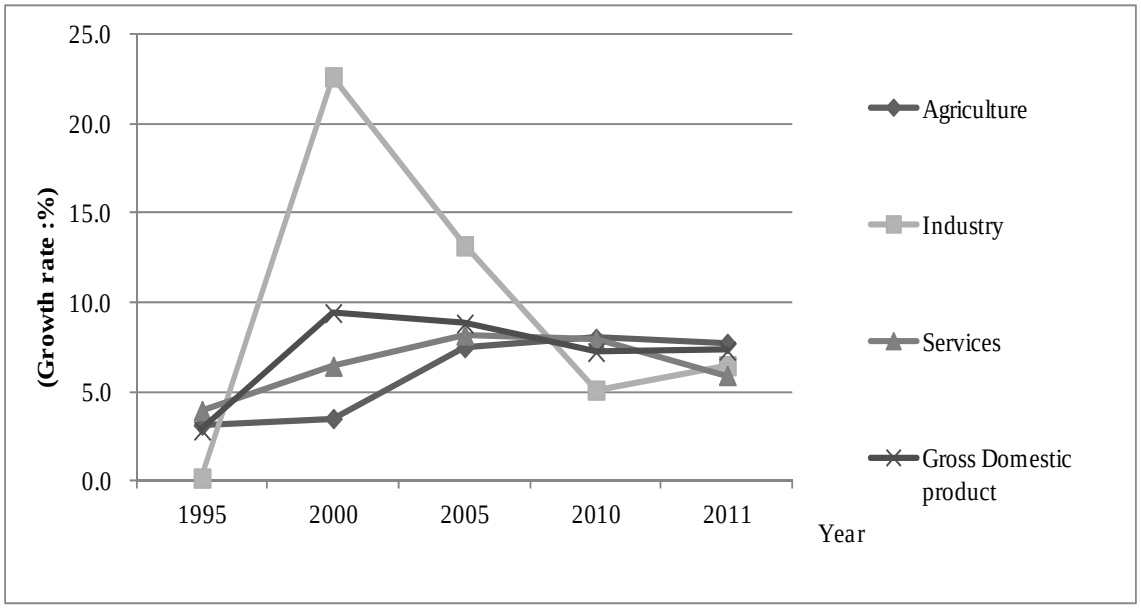
- Current gas field development situation
- Development and allocation plans in the future
- Information on a candidate site of the fertilizer plant construction
- Information on a candidate pipeline route
- Information on related infrastructure such as a port and roads around the candidate fertilizer plant site

Chapter 2 Review of Socio-Economic Conditions and Agricultural Sector in Mozambique

2.1 Present Socio-economic Conditions

2.1.1 Economic Growth and Structure

The GDP of Mozambique has maintained steady growth around 8% per annum since 2000. The GDP structure by broad sector in 2011 was 27% in agriculture, 23% in industry and 50% in services.



Source: Instituto Nacional de Estatistica (INE)

Figure 2.1.1 GDP Growth by Sector (Constant Prices: Base Year 2003)

Table 2.1.1 shows the composition of the GDP during 1991-2011 by economic activity. The shares of agriculture, livestock, hunting and forestry have slightly decreased since 1991 although the importance of these sectors has remained. The share of the fishery sector decreased from 4.3% to 1.5% during 1991-2011. The manufacturing sector and electricity & water supply sector sharply grew during 1995-2005. The commerce sector and transportation sector have each held about a 10-12% share of the GDP since 1995. The financial sector has grown since 2005.

Table 2.1.1 Gross Domestic Product of Mozambique by Economic Activity

GROSS DOMESTIC PRODUCT at Factor Prices; Constant Prices (Base year: 2003) Unit: Million MT

Economic Activity	1991	1995	2000	2005	2010	2011*
Agriculture, livestock, hunting, forestry	14,229	16,522	19,946	29,227	43,503	46,909
Fishery, aquaculture and related service activities	2,021	1,876	1,924	2,150	2,622	2,781
Mining and quarrying	205	227	397	1,135	2,151	2,553
Manufacturing	4,659	4,100	9,703	19,235	22,886	24,203
Electricity and water supply	355	377	3,798	6,911	8,895	9,491
Construction	807	1,366	2,952	4,029	6,238	6,525
Commerce	6,882	6,465	7,981	12,745	19,952	20,147
Repair of motor vehicles, motorcycles and personal/household items	0	0	438	487	659	728
Hotels and restaurants	457	795	1,400	1,898	2,902	3,182
Transportation, storage and communication	2,951	5,773	8,742	12,334	21,306	23,705
Financial activities	1,509	1,739	2,387	6,929	9,960	10,605
Real estate, renting and business services	6,903	8,161	9,925	11,386	12,026	12,233
Public administration, defense and social security	3,103	2,493	3,004	4,623	6,786	7,402
Education	1,623	1,779	2,710	4,573	7,345	7,803
Health and social work	453	662	1,089	1,527	2,575	2,758
Other professional services for community, social and personal services	1,031	1,233	2,107	2,495	2,810	2,877
Total value added at basic prices	47189	53569	78504	121684	172617	183902
FISIM	-264	-620	-779	-3,512	-5,809	-6,194
Taxes on products	1,499	1,226	7,265	11,591	17,242	19,817
VAT	0	0	4,977	6,084	8,757	10,720
Import duties	1,499	1,226	1,509	2,362	4,513	5,064
Other taxes on products	0	0	779	3,146	3,972	4,034
Gross Domestic product	48,425	54,174	84,989	129,764	184,050	197,526

Share (Percentage) of GROSS DOMESTIC PRODUCT at Factor Prices; Constant Prices (Base year: 2003) Unit: Percentage

Economic Activity	1991	1995	2000	2005	2010	2011*
Agriculture, livestock, hunting, forestry	30.2	30.8	25.4	24.0	25.2	25.5
Fishery, aquaculture and related service activities	4.3	3.5	2.5	1.8	1.5	1.5
Mining and quarrying	0.4	0.4	0.5	0.9	1.2	1.4
Manufacturing	9.9	7.7	12.4	15.8	13.3	13.2
Electricity and water supply	0.8	0.7	4.8	5.7	5.2	5.2
Construction	1.7	2.6	3.8	3.3	3.6	3.5
Commerce	14.6	12.1	10.2	10.5	11.6	11.0
Repair of motor vehicles, motorcycles and personal/household items	-	-	0.6	0.4	0.4	0.4
Hotels and restaurants	1.0	1.5	1.8	1.6	1.7	1.7
Transportation, storage and communication	6.3	10.8	11.1	10.1	12.3	12.9
Financial activities	3.2	3.2	3.0	5.7	5.8	5.8
Real estate, renting and business services	14.6	15.2	12.6	9.4	7.0	6.7
Public administration, defense and social security	6.6	4.7	3.8	3.8	3.9	4.0
Education	3.4	3.3	3.5	3.8	4.3	4.2
Health and social work	1.0	1.2	1.4	1.3	1.5	1.5
Other professional services for community, social and personal services	2.2	2.3	2.7	2.1	1.6	1.6
Total value added at basic prices	100.0	100.0	100.0	100.0	100.0	100.0

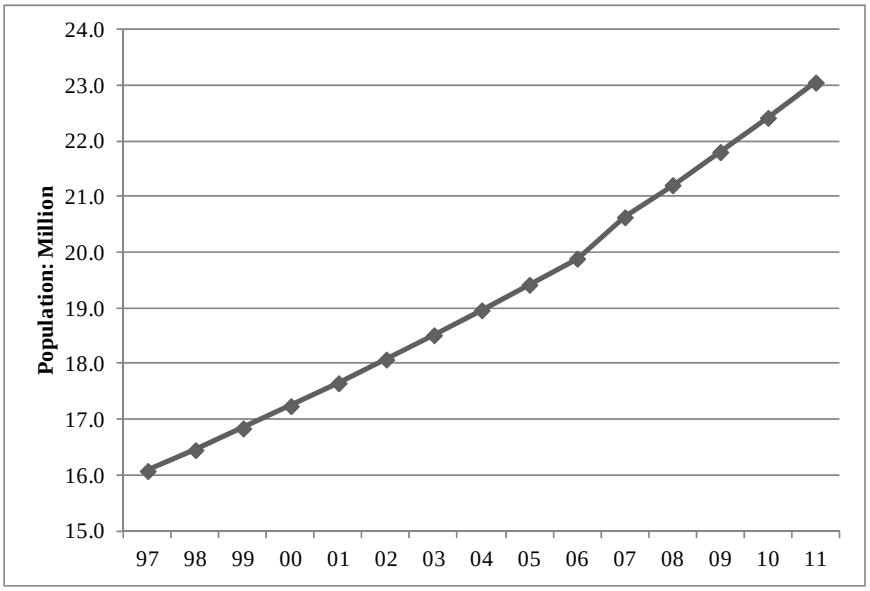
Source: INE

* Preliminary figures

2.1.2 Population and GDP per Capita

Based on the General Census of Population and Housing in 2007, the population of Mozambique was 20.63 million. It increased at the rate of about 2.5% per annum between 1997 and 2007, with a population of 16.08 million in 1997. It is estimated that the population in 2011 was 23.05 million with an annual growth rate of 2.8% in 2007 – 2011.

On the other hand, the GDP per capita has increased from USD 251 in 2000 to USD 588 in 2011 in current prices.



Sources: National Statistical Yearbooks, INE, Various Years, Annual Population Projection 2007-2040, INE

Figure 2.1.2 Population Growth of Mozambique (1997-2011)

2.1.3 Labor Force

As shown in Table 2.1.2, inthe economically active population of people more than 15 years old, the share of the agriculture sector is dominant, although it decreased from 80.9% in 1997 to 75.2% in 2007. The agriculture sector is followed by commerce & finance at 10.0%, other services at 5.1% and manufacturing at 3.2% in 2007. The shares of mining, manufacturing, energy, construction, commerce and finance, and other services increased from 1997 to 2007.

Table 2.1.2 Number of Economically Active Population more than 15 years old by Economic Activity in 1997 and 2007

Economic Activity	1997		2007	
	Persons	(%)	Persons	(%)
Agriculture, Livestock, Fishery & Forestry	4,742,508	80.9	5,543,928	75.2
Mining	28,479	0.5	52,707	0.7
Manufacturing	177,986	3.0	238,270	3.2
Energy	7,923	0.1	13,964	0.2
Construction	119,619	2.0	184,357	2.5
Transport & Communication	68,890	1.2	85,437	1.2
Commerce & Finance	405,383	6.9	740,624	10.0
Administrative Services	160,461	2.7	120,134	1.6
Other Services	86,712	1.5	372,538	5.1
Not Classified	67,459	1.2	19,000	0.3
Total	5,865,420	100.0	7,370,959	100.0

Source: General Census of Population and Housing 1997 and 2007, INE

The official unemployment ratio in the country was 18.7% based on INE's Integrated Survey on the Labor Force (IFTRAB) in May 2004. As shown in Table 2.1.3, the unemployment ratio in urban areas was much higher than that in rural areas. By age group, unemployment of the younger generation (age group of 15 – 19 and 20 – 24) was extremely high.

Table 2.1.3 Unemployment Ratio by Urban/Rural and by Age Group in May 2004

(Unit: %)

	Urban	Rural	Total
Total	31.0	12.9	18.7
by Age Group			
15-19	56.8	26.4	36.8
20-24	45.1	16.6	27.2
25-29	30.9	14.0	19.6
30-34	22.3	11.9	15.1
35-39	18.9	7.7	11.1
40-44	14.5	8.1	10.3
45-49	13.9	7.7	9.6
50-54	15.0	5.3	8.2
55-59	13.3	5.5	7.4
60-64	15.9	7.2	9.2
65+	15.3	6.5	8.2

Source: INE, Integrated Survey on the Labour Force (IFTRAB) 2004/05

2.1.4 Balance of Payment and Investment

The balance of payment in recent years in Mozambique is summarized in Table 2.1.4. In recent years, the balances of trade and services have been negative since 1996 with an increase in 2011. In the Capital and Financial Accounts, a surge in foreign direct investment was seen in 2011.

Table 2.1.4 Balance of Payments of Mozambique, 1996-2011

(Unit: million USD)

	1996	2000	2005	2011
A. Current Account	-561	-697	-761	-1615
Trade Balance	-478	-693	-497	-1411
Balance of Services	-95	-126	-307	-796
Balance of Income	-92	-193	-360	-207
Current Transfer	104	315	403	798
B. Capital and Financial Account	483	724	465	1885
Capital Transfers	150	306	193	379
Financial Account	333	418	271	1506
Direct Investment	73	139	108	2093
Portfolio Investment	0	0	-88	-32
Other Investment (Asset)	0	-145	-78	-144
Other Investment (Liability)	419	501	201	-88
Reserve Assets	-158	-77	130	-321
C. Errors and Omissions (Net)	78	-27	296	-270

Source: INE

The basic macro-economic data of Mozambique from the view point of expenditure are summarized in Table 2.1.5. The table shows that the economy of Mozambique is driven by consumption. Also, it should be noted that the share of imports is significantly high compared to exports. The gross fixed capital formation (GFCF) amounted to MT 41.8 million in 2011 using the GFCF data in real terms given by INE. The incremental capital to output ratio (ICOR) is calculated, although all the data is not shown in Table 2.1.5. For the 10-year period of 2000-2011, the increase in the GDP is MT 112.5 million and the cumulative GFCF mounts to MT 311.6 million, both in 2003 prices. Therefore, the ICOR during this period is calculated to be 2.77. Consequently, the investment in this period seems to be rather efficient.

Table 2.1.5 GDP Composition from the Viewpoint of Expenditure, 1995-2011

(Unit: million MT)

	1995	2000	2005	2010	2011*
Final Consumption	58.7	77.7	126.1	174.2	190.4
Private consumption	53.7	68.7	109.8	147.7	161.9
Final consumption, government	4.9	8.9	16.3	26.5	28.6
Gross fixed capital formation	12.1	26.5	25.7	38.3	41.8
Changes in inventories	2.2	2.1	0.2	4.3	2.6
Exports	5.5	11.8	37.5	53.8	64.2
Goods	3.1	8.7	31.7	44.7	56.4
Services	2.4	3.0	5.9	9.2	7.9
Less: Imports	24.2	33.1	59.8	86.6	101.6
Goods	19.5	26.6	47.2	71.1	82.7
Services	4.7	6.5	12.5	15.5	18.9
Gross Domestic Product	54.2	85.0	129.8	184.0	197.5

*Preliminary figures

Source: INE

2.1.5 Poverty and Inequality

Based on the analysis of the current situation of poverty described in PARP and the Third National Poverty Assessment 2010, the poverty ratio based on consumption poverty (measured by the national incidence of poverty) declined significantly from 69% to 54% between 1997 and 2003, while the level of poverty in 2009 remained essentially the same as in 2003. The vulnerability of almost half of the population lying below the poverty line appears to be significant.

In terms of the distribution of wealth, the poorest 10% earned 2.4% of total revenue and the richest 10% earned 50.8% in 1997. However, in 2003, the poorest 10% earned only 2.1%, while the most affluent 10% earned 53.3% of revenue. This suggests that there was an increase in inequality in the country between 1997 and 2003.

2.1.6 External Trade Structure and Relationships

The external trade turnover of Mozambique has developed rapidly in recent years. The total external trade turnover reached USD 5,807 million in 2010, consisting of USD 2,243 million export and USD 3,564 million import. In import, it increased at an annual average rate of 15.7% for 1995-2000 and slowed down to 8.2% for 2005-2010. As for export, they accelerated at an annual average rate of 36.8% for 1995-2000, but slowed down to 5.1% for 2005-2010 similar to import (see Table 2.1.6).

Of the total import value, South Africa and the Netherlands accounted for 36.5% and 18.0% respectively in 2010, followed by India, Portuagal, China and Japan. Major export destinations in 2010 were also South Africa and the Netherlands. The total value of export by these two countries amounted to USD 1,754 million, which accounted for more than 70% of the total export.

Major import commodities of Mozambique in 2010 were mineral fuels (19.9%), vehicles (10.3%), machinery (10.1%), electrical machinery (4.3%), cereals (4.2%) and iron and steel products (2.9%) as shown in Table 2.1.7.

On the other hand, export was led by aluminium with a dominant 51.7% share of the total export value in 2010, followed by mineral fuels (19.9%), tobacco (6.4%), fish (2.5%), wood (2.5%), edible fruits and nuts (1.9%), and oil seeds (1.4%).

The balance of trade has been negative in recent years. In other words, the total value of import was much larger than that of export, although the annual growth rate of export during 2000-2010 was 22.4% which was higher than that of import (13.3%) in the same period.

Table 2.1.6 External Trade Structure of Mozambique by Country

Imports Unit: US$ million

Country	2000	(%)	2005	(%)	2008	(%)	2010	(%)
Southern Africa*	461.2	39.7	1030.7	42.8	1210.7	30.2	1299.2	36.5
South Africa	451.0	38.8	980.8	40.7	1164.9	29.1	1226.8	34.4
Malawi	0.6	0.1	28.6	1.2	7.9	0.2	6.4	0.2
Zambia	0.4	0.0	2.1	0.1	14.6	0.4	1.1	0.0
Tanzania	1.9	0.2	3.6	0.1	8.1	0.2	61.7	1.7
Zimbabwe	7.3	0.6	15.5	0.6	15.2	0.4	3.2	0.1
EU**	184.8	15.9	570.0	23.7	1090.2	27.2	1086.7	30.5
Netherlands	5.8	0.5	300.4	12.5	698.0	17.4	642.9	18.0
Portugal	88.8	7.6	85.4	3.5	115.5	2.9	164.2	4.6
Others	90.2	7.8	184.2	7.7	276.7	6.9	279.6	7.8
USA	40.6	3.5	70.9	2.9	160.4	4.0	74.6	2.1
India	20.4	1.8	96.7	4.0	144.4	3.6	201.7	5.7
China	22.4	1.9	68.3	2.8	156.1	3.9	130.0	3.6
Japan	53.2	4.6	62.6	2.6	127.8	3.2	126.3	3.5
UAE	2.7	0.2	37.9	1.6	103.6	2.6	47.6	1.3
Others	377.0	32.4	471.1	19.6	1014.6	25.3	598.1	16.8
Total	1162.3	100.0	2408.2	100.0	4007.8	100.0	3564.2	100.0
Annual Growth rate (%)			*15.7*	(2000-2005)			*8.2*	(2005-2010)

Exports Unit: US$ million

Country	2000	(%)	2005	(%)	2008	(%)	2010	(%)
Southern Africa*	128.7	35.4	377.6	21.6	400.7	15.1	571.2	25.5
South Africa	53.3	14.6	280.4	16.1	265.5	10.0	467.2	20.8
Malawi	11.0	3.0	49.4	2.8	46.8	1.8	27.0	1.2
Zambia	0.1	0.0	1.4	0.1	5.9	0.2	1.9	0.1
Tanzania	0.0	0.0	0.5	0.0	1.1	0.0	3.0	0.1
Zimbabwe	64.4	17.7	46.0	2.6	81.3	3.1	72.1	3.2
EU**	93.8	25.8	1123.6	64.4	1661.3	62.6	1377.4	61.4
Netherlands	3.8	1.0	1042.9	59.8	1476.4	55.6	1181.9	52.7
Portugal	42.3	11.6	21.9	1.3	26.4	1.0	108.3	4.8
Others	47.7	13.1	58.8	3.4	158.5	6.0	87.1	3.9
USA	17.2	4.7	17.8	1.0	18.2	0.7	16.4	0.7
India	17.8	4.9	26.6	1.5	28.4	1.1	30.4	1.4
China	2.7	0.7	34.1	2.0	51.6	1.9	79.6	3.5
Japan	15.6	4.3	8.8	0.5	13.3	0.5	3.9	0.2
Others	88.0	24.2	156.8	9.0	479.8	18.1	164.2	7.3
Total	364.0	100.0	1745.3	100.0	2653.3	100.0	2243.1	100.0
Annual Growth rate (%)			*36.8*	(2000-2005)			*5.1*	(2005-2010)

	2000	2005	2008	2010
Balance	-798.316	-662.939	-1354.506	-1321.2

Source: JETRO Trade Database (Global Trade Atlas)

* South Africa, Malawi, Zambia, Tanzania and Zimbabwe

** EU25

Table 2.1.7 External Trade Structure of Mozambique by Commodity

(1) Imports from World Unit: US$ Thousand

Rank	HS	Commodity Description	2000	(%)	2005	(%)	2008	(%)	2010	(%)	AGR 2000-10 (%)
1	27	Mineral Fuel, Oil, etc.	158,227	13.6	162,733	6.8	811,445	20.2	711,014	19.9	18.2
2	99	Special Provisions, Nesoi	29,176	2.5	631,617	26.2	674,864	16.8	617,199	17.3	40.4
3	87	Vehicles, except Railway	148,463	12.8	236,537	9.8	413,887	10.3	368,595	10.3	10.6
4	84	Boilers, Machinery, etc.	186,552	16.1	198,330	8.2	313,404	7.8	360,835	10.1	7.6
5	85	Electrical Machinery	88,812	7.6	159,576	6.6	218,693	5.5	152,632	4.3	6.2
6	10	Cereals	58,073	5.0	172,291	7.2	244,236	6.1	149,165	4.2	11.1
7	73	Articles of Iron or Steel	41,935	3.6	54,924	2.3	87,738	2.2	102,544	2.9	10.4
8	72	Iron and Steel	22,938	2.0	43,705	1.8	80,383	2.0	85,319	2.4	15.7
9	15	Animal or Vegetable Fats, Oil, etc.	12,413	1.1	34,874	1.4	111,892	2.8	77,725	2.2	22.6
10	25	Salt, Sulfur, Earth and Stone, etc.	10,596	0.9	34,998	1.5	57,718	1.4	66,834	1.9	22.7
11	39	Plastics and Articles Thereof	17,533	1.5	37,106	1.5	81,465	2.0	62,763	1.8	15.2
12	31	Fertilizers	2,162	0.2	20,670	0.9	72,752	1.8	46,925	1.3	40.8
13	30	Pharmaceutical Products	14,509	1.2	35,741	1.5	61,319	1.5	45,139	1.3	13.4
14	40	Rubber and Article Thereof	16,144	1.4	28,464	1.2	38,720	1.0	42,725	1.2	11.4
15	48	Paper and Paperboard	23,773	2.0	30,104	1.3	43,823	1.1	41,897	1.2	6.5
		Others	330,971	28.5	526,524	21.9	695,428	17.4	632,918	17.8	-
		Total	1,162,278	100.0	2,408,195	100.0	4,007,763	100.0	3,564,229	100.0	13.3

(2) Exports to World Unit: US$ Thousand

Rank	HS	Commodity Description	2000	(%)	2005	(%)	2008	(%)	2010	(%)	AGR 2000-10 (%)
1	76	Aluminum and Articles Thereof	60,167	16.5	1,022,506	58.6	1,452,525	54.7	1,160,046	51.7	38.9
2	27	Mineral Fuel, Oil, etc.	76,409	21.0	260,268	14.9	287,708	10.8	447,449	19.9	21.7
3	24	Tobacco	7,822	2.1	43,244	2.5	195,022	7.4	144,528	6.4	38.3
4	99	Special Provisions, Nesoi	7,073	1.9	8,064	0.5	198,959	7.5	83,655	3.7	31.6
5	03	Fish, Crustaceans, etc.	98,310	27.0	86,504	5.0	75,690	2.9	56,646	2.5	-5.9
6	44	Wood & Articles of Wood	14,311	3.9	32,353	1.9	38,931	1.5	55,917	2.5	16.3
7	08	Edible Fruits & Nuts	20,789	5.7	24,385	1.4	38,114	1.4	43,429	1.9	8.5
8	12	Oil seeds, Misc. Grain, etc.	6,712	1.8	12,983	0.7	39,602	1.5	30,416	1.4	18.3
9	50	Silk, including Yarns and Woven Fabric	155	0.0	0	0.0	0	0.0	29,057	1.3	78.9
10	07	Edible Vegetables	1,574	0.4	5,745	0.3	10,846	0.4	28,744	1.3	38.1
11	84	Boilers, Machinery, etc.	4,720	1.3	29,033	1.7	53,134	2.0	23,645	1.1	19.6
12	26	Ores, Slag and Ash	6	0.0	1,388	0.1	39,432	1.5	21,217	0.9	150.0
13	49	Printed Books, Newspapers, etc.	16	0.0	18,685	1.1	9,713	0.4	13,050	0.6	110.7
14	11	Milling Products, Malt, Starch	487	0.1	2,398	0.1	1,813	0.1	10,321	0.5	40.4
15	72	Iron and Steel	1,590	0.4	11,207	0.6	21,419	0.8	9,389	0.4	21.8
		Others	63,822	17.5	186,492	10.7	190,353	7.2	85,559	3.8	-
		Total	363,962	100.0	1,745,256	100.0	2,653,260	100.0	2,243,069	100.0	22.4

(3) Balance of Commodity Trade with World Unit: US$ Thousand

	2000		2005		2008		2010		AGR 2000-10 (%)
Total	-798,316	-	-662,939	-	-1,354,504	-	-1,321,160	-	5.8

Source: JETRO/Global Trade Atlas

2.2 Present Conditions and Development Plans in Agricultural Sector

2.2.1 Present Conditions in Agricultural Sector

Agriculture is one of the major economic sectors in Mozambique, generating 24% of the GDP in 2009 (INE). It is estimated that the sector absorbs about 80% of the total labor force (90% of the female labor force and 70% of the male labor force). Though the average contribution of agriculture on GDP has decreased in recent years, this change is mostly due to an influx of energy-related mega-projects such as MOZAL SEZ, Pande and Temane gas development, etc. and the effects of changing climate. The contribution of the agricultural sector to GDP is still high and will be increasing.

The growth rate for the agricultural sector increased during 1994-2007, with an average annual growth rate of 8%; but the rate fell to 6.7% in 2008 due to the rise in world food and oil prices and was 6.1% in 2009 (PEDSA, 2011-2020).

Table 2.2.1 shows production and trade of major food crops in Mozambique. It indicates that Mozambique has nearly achieved self-sufficiency of major food crops except for wheat and rice. Domestic consumption for both crops has been increasing, despite the decreasing consumption of traditional food crops, i.e. maize, sorghum and millet. Considering the potential for increased food consumption in the country, rice development might be apossible future project in Mozambique.

Table 2.2.1 Production and Trade of Major Food Crops (Average of 2005 to 2007)

(x 1,000 ton)

Food Crop	Production (a)	Import (b)	Export (c)	a+b-c
Maize	1,170.7	148.7	41.3	1,278.0
Cassava	6,066.0	0.0	0.0	6,066.0
Wheat	2.3	486.3	1.0	487.7
Rice (milled equivalent)	59.7	365.0	0.0	424.7
Sorghum	163.3	8.7	1.0	171.0

Source: FAOSTAT

According to the Agriculture Census in 2009-2010 carried out by lNE, the number of total farm-households (agriculture & livestock) in Mozambique is 3,827,797. The agricultural land accounts for 15% (11,991,000 ha) of the total land area of Mozambique and the total cultivated area is only 5,633,850 ha. The farm-households are predominatly small-scale farmers and their average cultivated area is only l.47 ha as shown in Table 2.2.2. They use minimal farming aids, such as improved seeds, chemical fertilizer and irrigation. The percentage of medium-scale and large-scale farmers is relatively high in Tete, Gaza and Maputo provinces, while the percentage is very limited in the northern provinces, which is the production center in the country.

Table 2.2.2 Number of Farm-households and their Cultivated Area in Mozambique

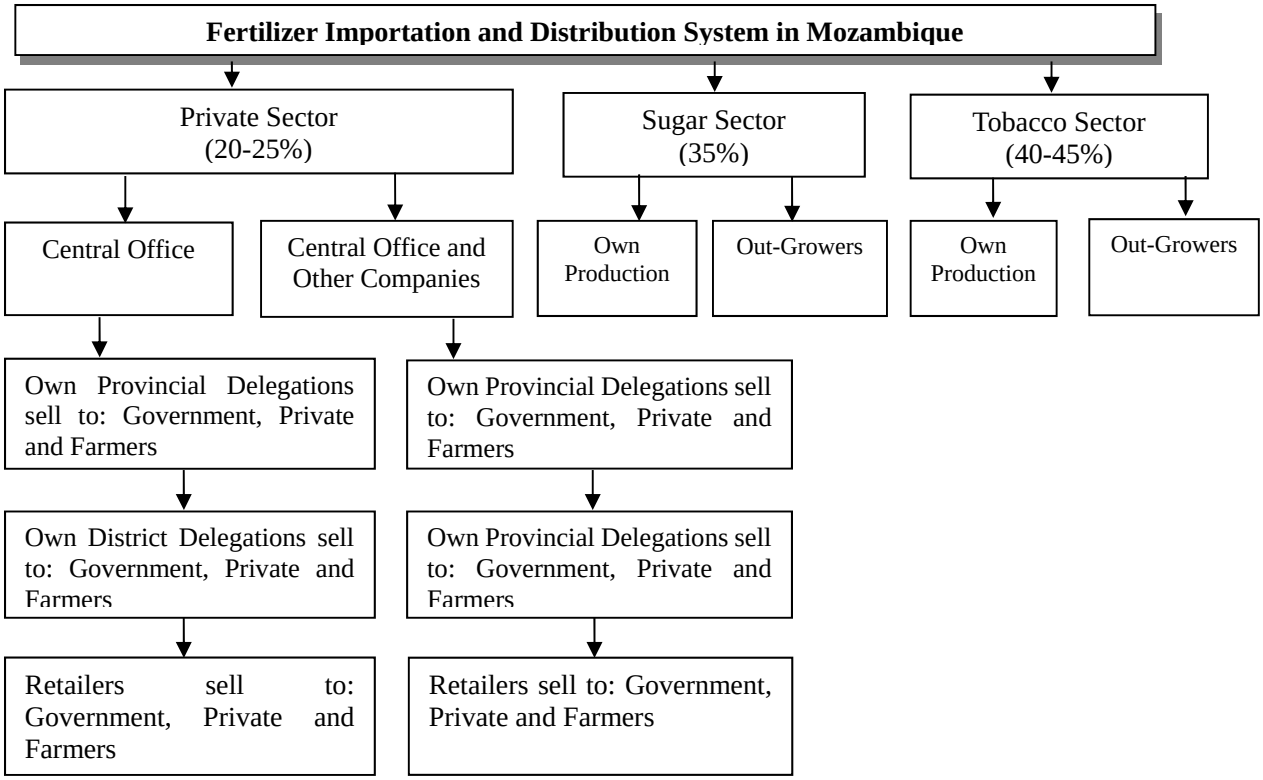
	Small	Medium	Large	Total
Farm-households	3,801,259	25,654	884	3,827,797
	(99.3%)	(0.7%)	(0.0%)	(100%)
Cultivated area (ha)	5,428,571	130,651	74,628	5,633,850
	(96.4%)	(2.3%)	(1.3%)	(100%)
Average cultivated area (ha/household)	1.43	5.09	84.4	1.47

Source: Agriculture Census in 2009-2010, INE

The small-scale farmers prefer to cultivate new land rather than invest in improved technologies. This is one of the reasons why the average rate of fertilizer use in Mozambique is very low (5 kg/ha in Mozambique while 8 kg/ha for Africa according to the National Fertilizer Strategy in Mozambique). The current levels of fertilizer adoption are also very low (less than 8%) for cereals and horticultural crops; for most crops, no fertilizer is used at all. About 90% of the total fertilizer consumed is applied only on two commercial crops – sugarcane and tobacco.

Mozambique's agricultural sector must be modernized in order to improve productivity. This requires better access to, and availability of, improved technologies and an increased use of fertilizer. However, most farmers are unable to invest in the farming aids (such as improved seeds, chemical fertilziers and irrigation) necessary to increase agricultural yields or expand the scale of their operations, unless they have better access to financial assistance and markets in which they can sell their goods.A poor distribution system for farming aids is also areason for the low use of fertilizers. There are three entry points for fertilizers in Mozambique: Beira Port, Nacala Port and South Africa (by truck). However, these distribution networks do not have full access to rural areas which results in poor access to these farming aids. In many regions, farmers have to travel 30-40 or more kilometers (km) to buy farming aids (*Pitoro et al., 2007*). These long distances not only increase the cost of fertilizers but also discourage farmers from utilizing these materials. The current system of supply and distribution of fertilizers in Mozambique is summarized in Figure 2.2.1.

The importation of fertilizers by the private sector is generally in small amounts from South Africa and is transported by road, which results in high transaction costs.



Source: National Fertilizer Strategy in Mozambique

Figure 2.2.1 Current Fertilizer Supply and Distribution System

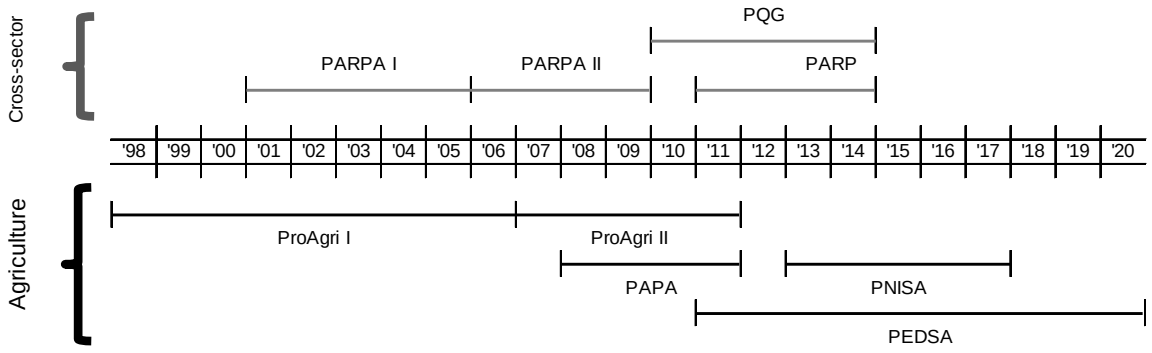
2.2.2 Agricultural Development Plans in Mozambique

At the cross-sectorial level, there are the government's five-year plan, PQG, and the poverty reduction strategy paper, PARP, both covering almost the same time period. For agriculture, the guiding framework is the PEDSA, which has a longer, ten-year timeframe. These broad multi-year strategy documents are to guide shorter-term and more specific activity plans, such as the PES at the cross-sectorial level and PAAO for the agricultural sector. PAAO receives inputs from activities proposed by district and provincial agricultural offices, and in turn is meant to feed into the development of the cross-sectorial PES. Table 2.2.3 summarizes the key documents of the planning and budgeting process and Figure 2.2.2 highlights the time dimension to which selected key strategy and budgeting documents apply.

Table 2.2.3 Key Documents and Reports in the Agricultural Planning and Budgeting Process

	Document	Description	Instrument	Time Frame	Lead Agency
Not specific to agriculture	**PARPA I**	PRSP	Planning	5 years (2001-05)	MPD
	PARPA II	PRSP	Planning	4 years (2006-09)	MPD
	PARP	PRSP	Planning	4 years (2011-14)	MPD
	PQG	Government 5-year plan (drawn from ruling party's platform)	Planning	5 years (2010-14)	Government/ Ruling Party
	CFMP	MTFF (yearly rolling)	Planning	3 years	MPD
	PES	Economic & social plan	Planning	1 year	MPD
	PAF	Performance assessment framework	Planning	1 year	GBS donors
	OE	National budget	Budgeting	1 year	MF
	BdPES	Report on PES execution	Reporting	1 year	MPD
	CGE	Final report	Reporting	1 year	MF
	TA report	Report by the Auditor General	Reporting	1 year	TA
	REOE	Budget execution report	Reporting	1/4 year	MF
	JR	Joint review on budget support	Monitoring	1 year	GBS donors
Specific to agriculture	**PEDSA**	Strategy document (inalignment with CAADP)	Planning	10 years (2011-20)	MINAG
	PNISA	Investment Plan (for implementation of PEDSA)	Budgeting	5 years (2013-17)	MINAG
	PAPA	Strategy document (to face the food price crisis)	Planning	3 years (2008-11)	MINAG
	ProAgri II	Strategy document (for sector budget support)	Planning	8 years (2006-11)	MINAG
	ProAgri I	Strategy document (for sector budget support)	Planning	6 years (1998-06)	MINAG
	PAAO	Agricultural activity plan	Planning	1 year	MINAG
	PTAO	Agricultural activity plan	Planning	1/4 year	MINAG
	APAR	Performance report	Reporting	1 year	MINAG
	FMR	Financial management report	Reporting	1/4 year	MINAG
	JRag	Review of agricultural sector	Monitoring	1 year	GBS gonors

Source: Public Expenditures in Agriculture in Mozambique, IFPRI



Source: Public Expenditures in Agriculture in Mozambique, IFPRI

Figure 2.2.2 Timeline of Main Cross-sectorial and Agriculture-specific Strategies

(1) PQG (National Development Plan) 2010-2014

PQG is a policy document that shows the vision of national development. GOM approved the Fourth PQG (2010-2014) in the congress in April 2010. In the Fourth PQG, the poverty reduction is listed as one of the key issues and the poverty reduction and the improvement of absolute poverty through education, health preservation and rural development is set as a goal.

(2) PARP (Action Plan for the Reduction of Poverty)

Apart from PQG, there is the Action Plan for the Reduction of Absolute Poverty (PARPA) along the poverty reduction strategy, which is positioned as action targets for achieving the policy objectives of PQG. PARPA I was enforced in 2001-2005 and PARPA II was enforced in 2006-2010. GOM recently drew up PARP, which is the poverty reduction action plan to be the successor of PARPA II.

PARP states that the improvement of agricultural productivity and employment in cities are priority issues. Agriculture is an important industry because about 80% of the workforce is engaged in it. However, the development of infrastructure has not progressed well and agricultural productivity is low, and these are the biggest causes of poverty in rural areas.

(3) PAPA (Food Production Action Plan)

Apart from PEDSA, details of which are described hereinbelow, the Three-Year Food Production Action Plan (PAPA) relating to agricultural productivity was enforced in 2008-2011. PAPA cosists of the following four action plans:

a) Making certified seed and fertilizer available to small-scale farmers in irrigated systems to intensify and extensify production

b) Providing of threshing equipment and tractors (hire) to farmers (subsidized)

c) Marketing

d) Providing of rice milling machines to farmers' associations

(4) PEDSA

Agricultural development always has a high priority in Mozambique because of its contribution to the economy. However, its productivity and production are still at low levels. In order to improve this situation, GOM adopted the strategy of the Green Revolution in 2007. The Green Revolution marks a reaffirmation of GOM’s priority, establishing a command for the tranformation of a predominantly subsistence agriculture into a commercial agriculture.

According to the Maputo Declaration in 2003, the CAADP framework has two major objectives: (i) achieving a 6% annual growth rate for the agriculture sector and (ii) allocation of at least 10% of the state budget to the agriculture sector. The medium/long-term vision to achieve priority agricultural objectives in Mozambique is articulated in the country's Strategic Plan for

Agricultural Development (PEDSA), which is aligned to the CAADP framework and covers the planning period 2011-2020.

The strategy targets at least 7% agricultural growth and includes increases in both productivity and area cultivated. PEDSA aims at increasing incomes and food security for agricultural producers in a competitive and sustainable way. PEDSA consists of four (4) pillars:

Pillar I Agrarian Productivity - increasing productivity, production and competitiveness in agriculture

Pillar II Market Access – improving services and infrastructures for access to the market and guiding framework for agricultural investment

Pillar III Natural Resources - to promote sustainable use and exploitation of resources (land, water, forest and fauna)

Pillar IV Institutions - to strengthen agricultural institutions.

In planning to transform agriculture from subsistence to commercial status, PEDSA indicates that the government should provide the appropriate environment for investment through policy reforms and the provision of public services in infrastructure, market information and management of natural resources, research and extension.

PEDSA clearly shows a strategy of expanding and enhancing the use of fertilizers through the strengthening of capacity to produce fertilizer and regional procurement of fertilizers. Strengthening the capacity of the private sector to provide agricultural aids, such as seeds and fertilizers, developing and implementing a medium-term programme for human resources and thedevelopment of the agriculture sector and other strategies relating to the expansion of fertilizer use are also stated in PEDSA.

(5) National Fertilizer Strategy

The National Fertilizer Strategy became effective in July 2012. This strategic program aims at establishing a framework that will lead to the improvement of the quantity and quality of fertilizers available to farmers through sensitization and strengthening of national structures on the importance of fertilizer, on the quality of products as well as their sustainable use.

It expects the following results:

- Availability and consumption of fertilizers increased.
- System for quality control on fertilizer established.
- Technicians, farmers, extension agents and others taught to properly use and manage fertilizers.
- Favorable environment for the establishment of a fertilizer industry established.
- Soil mapping updated.

- Number of farmers using fertilizers increased.
- New technologies for production of organic fertilizers generated.
- Fertilizer regulations approved and implemented.
- Fertilizer subsidy programs prepared and implemented.

The five-year budget is as shown in Table 2.2.4.

Table 2.2.4 Budget for the Implementation of the National Fertilizer Strategic Program

(Unit: USD)

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Total
1. Elaboration of Fertilizer Regulations	7,000					7,000
2. Dissemination of Fertilizer Regulations	60,000	60,000	30,000			150,000
3. Baseline Study	30,000					30,000
4. Establishment of 4 Labs	512,000	512,000				1,024,000
5. Implementation of Subsidy Programs	210,000,000	210,000,000	210,000,000	210,000,000	210,000,000	1,050,000,000
6. Training of Technicians	100,000	100,000	100,000	100,000		400,000
7. Expansion of Retailer Network	2,000,000	1,500,000	1,000,000	500,000	100,000	5,100,000
8. Quality Control	50,000	100,000	150,000	200,000	250,000	750,000
9. Strengthening Research in Fertilizers	500,000	500,000	1,000,000	1,000,000	1,000,000	4,000,000
10. Mapping of Soil Fertility in 6 Corridors	3,000,000	3,000,000	3,000,000			9,000,000
11. Extension and Dissemination of Technologies	500,000	500,000	500,000	500,000	500,000	2,500,000
12. Supervision of the Program	50,000	50,000	50,000	50,000	50,000	250,000
Sub-total	216,809,000	216,322,000	215,830,000	212,350,000	211,900,000	1,073,211,000
Contingencies (5%)	10,840,450	10,816,100	10,791,500	10,617,500	10,595,000	53,660,550
TOTAL	**227,649,450**	**227,138,100**	**226,621,500**	**222,967,500**	**222,495,000**	**1,126,871,550**

Source: National Fertilizer Strategy

In accordance with this program, some actions have already been in the undertaking stage and the Fertilizer Regulation was issued in July 2013. The Fertilizer Act is also under preparation.

2.2.3 Relevant Institutes and Organization

Among the institutions concerned with agricultural activities in Mozambique, the Ministry of Agriculture (MINAG) centralizes and coordinates actions at the national level, having the function to formulate, plan and implement its policies and strategies for agricultural development of the country. Among its duties are the administration, and regulation of, the use, management, protection and conservation of essential resources to farming activities, such as land, water, forests and fauna.

MINAG promotes activities to foster the production, agro-industrial processing and marketing of farming aids and agricultural products, as well as agricultural research and technical assistance and rural extension. Among other roles and duties, MINAG also highlights the following:

- To ensure animal and plant sanitary protection
- To implement programs of agricultural research and dissemination of results
- To promote basic infrastructure and services to the activities of economic agents in the agricultural sector
- To register land use right and manage cadastre.

In research and development activities, MINAG has three subordinate institutes, namely:

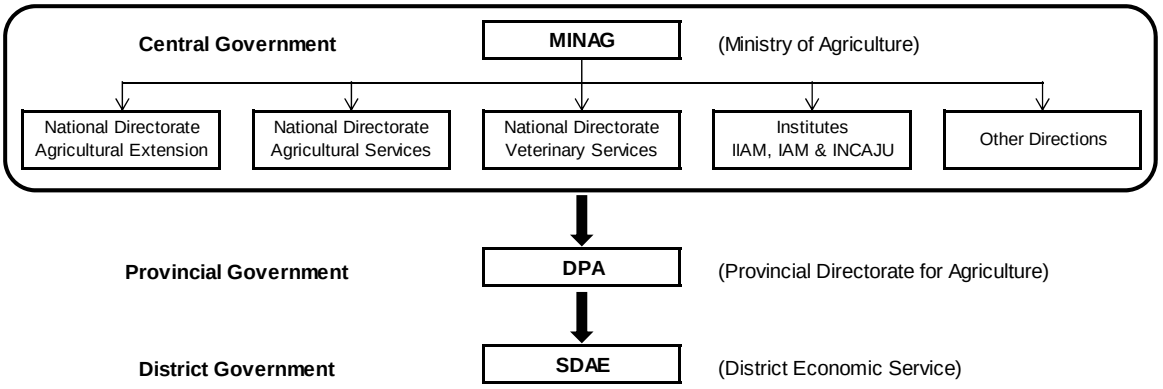
- IIAM－Mozambican Agricultural Research Institute－IIAM's function is to generate knowledge and technological solutions for sustainable development of agribusiness and food and nutritional security.
- IAM－Mozambican Cotton Institute－The institution aims to promote activity in cotton, with the function to supervise, guide and regulate the production, marketing and export of the product, as well as cooperate with IIAM for research.
- INCAJU－Cashew Promotion Institute －The institution aims to promote programs that foster the planting and production of cashew and industrial processing.

MINAG has another subordinate institution, the Center for Agricultural Promotion (CEPAGRI), which aims to attract investment in agriculture. The CEPAGRI acts in a coordinated manner with the lnvestment Promotion Center－CPI, which is responsible for promotion to attract national and foreign direct investment in all activities.

Concerning the land system, the National Land and Forests Directorate (DNTF) was established for land surveying, registration and demarcation of land as a subordinate to MINAG. The DNTF gathers information and enables government authorities to manage land appropriately.

In the provinces the implementation of strategic policies for agricultural development is the responsibility of the respective Provincial Directorates of Agriculture (DPAs), which coordinates activities at the District Economic Activities Services (SDAE) at the district level.

The figure below shows the administrative structure of the agricultural activities of the three levels of government in Mozambique.



Source: JICA Survey Team

Figure 2.2.3 Administrative Structure of the Agricultural Activities

2.2.4 Outline of JICA Assistance

JICA established its Mozambique office in 2003 and its assistance has been expanding recently. Mozambique is one of the poorest countries in the world and assistance to reduce poverty is JICA's key mission.

Assistance to the agricultural sector is also in line with the above mentioned mission. The projects illustrated in Figure 2.2.4 support JICA's mission in Mozambique.

At the Camp David Summit held in May 2012, G8 and African leaders committed to the New Alliance for Food Security and Nutrition. This commitment aims at achieving sustained and inclusive agricultural growth and raising 50 million people out of poverty over the next 10 years by the partnership of G8, African partner countries and private sectors. Japan and USA, as co-chairs, contribute to formulate the New Alliance Cooperation Frameworks.

Source: JICA Survey Team

Figure 2.2.4 JICA's Assistance in Agricultural Sector

(1) Programme of Triangular Cooperation by Japan, Brazil and Mozambique for Developing Agriculture in the Tropical Savannahs (ProSAVANA)

ProSAVANA aims at improvement of living of local residents who maily work as small-scale farmers in the Nacala Corridor located in the northern part of Mozambique through sustainable agricultural development with supports of Japan and Brazil. At present, three projects are in progress:

"Project for improving research capacity for Nacala Corridor agriculture development"

"Support for Agricultural Development Master Plan for Nacala Corridor in Mozambique"

"The Project for establishment of development model at communities' level under Nacala corridor agricultural development"

(2) Others

Self-sufficiency rate of rice (productivity) improvement is an important policy in Mozambique, and as described below, JICA has undertaken the official aid in Zambezia and Chokwe.

a) Project for Rice Productivity Improvement in Chokwe Irrigation Scheme, 2011 - 2014

b) Project for Improvement of techniques for increasing rice cultivation productivity in Nante, Maganja da Costa District, Zambezia Province, 2010 - 2014

While there has been some success,the following problems have been discovered:

- In order to scale up the project achievements, cooperation of institutions in the district province and central government is necessary.
- New technologies need to be adopted.
- Operational support, including support to the production stage, processing, marketing, and strengthening of sales is effective for the improvement of agricultural production and income of small scale farmers.
- Since time is needed to strengthen farmers' organizations, long-term support is necessary.

2.3 Activities of Private Sector and Other Donors

(1) Investment by Private Sector

In order to promote private investment, GOM has taken measures, such as providing incentives. CPI is a government agency which was established to implement support for private investment and has a role of consultation about investment including support for land acquisition. According to CPI, although it is not so concrete, some agriculture-related PPP projects have already been implemented.

Currently there are no fertilizer factories in Mozambique. Information on the following private investment projects was obtained; however, it seems that these projects are still in the preliminary concept stage.

- Phosphorus-based fertilizer plant in Evate
- Urea fertilizer plant in Palma

(2) Activities by Other Donors

There are many support projects for the agricultural sector in Mozambique and, including JICA projects, more than 140 projects are now in progress. These projects cover a wide range of aspects from policies on the agricultural sector to education of farmers. USA, UK and Nordic countries such as Sweden, Belgium and Denmark are major bilateral donors who have provided support.

WB and AfDB are major multilateral donors, whose major activities are as shown in Table 2.3.1.

Table 2.3.1 Major Supports by WB and AfDB

Donor	Project	Outline of Project
WB	ProIRRI Sustainable Irrigation Development	The objective is to increase agricultural production and raise farm productivity in the Provinces of Sofara, Manica and Zambesia through the investments in irrigation systems and support infrastructure, institutional capacity development, etc. Project period: 2011 - 2017 Total project cost: USD 70.0 million
	Integrated Growth Pole Project	The objective is to improve the performance of enterprises and smallholdersin the Zambesi Valley and Nacala Corridor, forcusing on identified high growth poles through support for the Tete agribusiness growth pole in the Zambesi Valley, support for the Nacala Special Economic Zone (SEZ) in the Nacala Corridor, institutional development and capacity building, etc. Project period: 2013 - 2019 Total project cost: USD 119.1 million
AfDB	Baixo Limpopo Irrigation and Climate Resilience Project	The objective is to contributr towards poverty reduction in the Gaza Province through infrastructure development (cold storage, irrigation and drainage, rural roads, etc.), capacity building, etc. Project period: 2013 - 2017 Total project cost: USD 44.1 million

Source: Information collected by JICA Survey Team

Table 2.3.2 shows activities by other major donors other than JICA.

Table 2.3.2 Activities by Other Major Donors

Donors	Program
AGRA	Soil Fertility Management Productivity Improvement Fertilizer Availability Improve Food Security Education for African Crop Improvement Fund for the Improvement and Adoption of African Crops
Asdi/Sweden	Malonda Programme for poverty reduction Credit guarantee Banco Terra Capacity building cluster programme, UNAC
Austrian Development Cooperation	PASF Sofala - Project Support for Agricultural Production of Family Sector in the Province of Sofala Support implementation of PNISA
Belgian Development Agency (BTCCTB)	Contribution to the implementation of PEDSA/PNISA Belgian Fund for Food Security (FBSA)
Denmark	AGRO-INVESTE (Increasing incomes of smallholders through improved and marketed production)
European Union	Local Economic Development Program (ProDEL) Accompanying Measures Sugar Protocol (AMSP) Sustainable development of 5 agro-schools in Sofala
FAO	Reducing risks of highly hazardous pesticides Protecting and Improving Household Food Security and Nutrition in HIV/AIDS Affected Areas in Manica and Sofala Provinces Support to accelerate progress towards MDG 1c in Mozambique Contribution to Strengthening the Ministry of Education's Capacity in Agriculture, Entrepreneurship and Nutrition Training Food Security and Nutrition Programme (FSNP) Value chains - Agricultural production and productivity, post-harvest and access to markets Program support for governance, institutional development and capacity building of the land sector
Finland	Support to smallholder production
IFAD	PRONEA Support Project (Improvement of food security) PROMER - Rural Markets Promotion Programme PAFIR - Rural Finance Support Programm
Italian Cooperation	Program to Support Rural Development Rehabilitation of agro institutes schools Support to smallholder agricultural development and experimental crops in Artemisia
Ireland	Community based agriculture and natural resources management (ARENA) Food Security and Nutrition (PROSAN)
Netherlands	Beira Agricultural Growth Corridor (BAGC) Seed Multiplication Project to Empower Small Commercial Farmers
Swiss Development and Cooperation Agency (SDC)	INOVAGRO I & 2 FIDES HORTISEMPRE
UK AFSI (DFID)	Community Land Use Fund Beira Agricultural Growth Corridor (BAGC)
USAID	Food for Peace (Smallholder agricultural development and nutrition) Agriculture Research and Technology Transfer Mozambican Capacity for Improved Agriculture and Nutrition Policy Analysis and Planning (MOZCAPAN) Agricultural loan guarantees FINAGRO (Financing Agribusiness) Agribusiness Value Chains

Source: Information collected by the JICA Survey Team

2.4 Current Situation of Fertilizer Use

Table 2.4.1 shows the fertilizer consumption in Mozambique. According to the information from MINAG, 40 – 50% of fertilizer used in Mozambique is urea.

Table 2.4.1 Fertilizer Consumption (ton), 2006-2011

Year	Tobacco	Sugar	Others	Total	Average kg/ha
2006-2007	13,000	10,000	5,000	28,000	
2007-2008	13,000	10,000	5,000	28,000	4.8
2008-2009	15,000	12,000	5,000	32,000	5.3
2009-2010	16,000	12,000	5,000	33,000	
2010-2011	31,400	15,000	5,000	51,400	

Source: From Table 1 in Fertilizer Strategy

Fertilizer use is extremely low for a majority of crops whose cummlative use is about 5,000 ton/year. Compare that to the fertilizer use for commercial tobacco and sugarcane, which is over 90% of fertilizer used in 2010. The issue, therefore, is not just "increasing" use but also introducing fertilizer to a majority of farmers who do not have any experience or knowledge of its agronomic or economic benefits. Building a knowledge base through training of value chain participants and through implementation of market-friendly targeted programs to introduce fertilizers to resource-poor farmers is an important objective.

Table 2.4.2 shows consumption rates of fertilizer in Mozambique. According to the Agricultural Census in 2009-2010 carried out by INE, the total cultivated land area is 5,633,850 ha, slightly larger than the cultivated land area shown in the table; however, it can be said that the fertilizer use in Mozambique is very low at less than 10 kg/ha, compared with neighboring countries such as Malawi, Zambia and Zimbabwe (see Tables 2.4.3 and 2.4.4).

Table 2.4.2 Fertilizer Consumption Rate in Mozambique

	Fertilizer consump. (ton)	Cultivated land (x 1,000 ha)	Consumption rate (kg/ha)
2005		4,500	
2006		4,800	
2007	28,000	4,800	6
2008	32,000	4,800	7
2009	33,000	5,200	6
2010	51,400	5,200	10

Source: Fertilizer consumption on Fertilizer Strategy
Cultivated land from FAO database

Table 2.4.3 Comparison of Fertilizer Consumption (1)

Year	Mozambique			Zambia			Malawi			Zimbabwe		
	Fertilizer consump. (ton)	Cultivated land (x 1,000 ha)	Consumption rate (kg/ha)	Fertilizer consump. (ton)	Cultivated land (x 1,000 ha)	Consumption rate (kg/ha)	Fertilizer consump. (ton)	Cultivated land (x 1,000 ha)	Consumption rate (kg/ha)	Fertilizer consump. (ton)	Cultivated land (x 1,000 ha)	Consumption rate (kg/ha)
2005		4,500		56,323	2,727	21	71,093	3,200	22	235,084	3,880	61
2006		4,800		115,661	3,013	38	138,247	3,300	42	212,868	4,030	53
2007	28,000	4,800	6	57,158	2,949	19	134,988	3,000	45	264,470	4,030	66
2008	32,000	4,800	7	69,326	3,052	23	67,743	3,400	20	92,091	4,230	22
2009	33,000	5,200	6	86,430	3,350	26	59,558	3,500	17	80,808	4,100	20
2010	51,400	5,200	10	74,388	3,700	20	25,767	3,600	7	119,919	4,100	29

Sources: Fertilizer consumption on Fertilizer Strategy for Mozambique and AfricaFertilizer.org for Zambia, Malawi and Zimbabwe
Cultivated land area from FAO database

Table 2.4.4 Comparison of Fertilizer Consumption (2)

Year	Mozambique			Zambia			Malawi			Zimbabwe		
	Fertilizer consump. (ton)	Cultivated land (x 1,000 ha)	Consumption rate (kg/ha)	Fertilizer consump. (ton)	Cultivated land (x 1,000 ha)	Consumption rate (kg/ha)	Fertilizer consump. (ton)	Cultivated land (x 1,000 ha)	Consumption rate (kg/ha)	Fertilizer consump. (ton)	Cultivated land (x 1,000 ha)	Consumption rate (kg/ha)
2007	28,000	4,800	6	180,000	2,949	61	270,000	3,000	90		4,030	
2008	32,000	4,800	7	192,000	3,052	63	283,500	3,400	83	230,000	4,230	54
2009	33,000	5,200	6	206,100	3,350	62	297,700	3,500	85	300,000	4,100	73
2010	51,400	5,200	10	220,500	3,700	60	312,600	3,600	87	350,000	4,100	85

Sources: Fertilizer consumptions on Fertilizer Strategy for Mozambique, Zambia & Malawi and Presentation Paper (Nov. 2011) by MINAG for Zimbabwe
Cultivated land area from FAO database

Table 2.4.5 shows the consumption of each fertilizer type in Mozambique according to the FAO database. However, the total amount of consumption is considerably different from the amount shown in Table 2.4.2. It seems that the figures shown in Table 2.4.5 are not consumption but import amounts which includes reexport amounts to neighboring countries. Due care is necessary when this data is used, but it should be noted that the proportion of urea to the total is almost 50%.

Table 2.4.5 Fertilizer Consumption in Mozambique (ton)

	2010	2009	2008	2007	2006	2005	2004	2003
Ammonium nitrate	7389	1356	9625	0	1374	524	272	537
Ammonium sulphate	3520	212	3685	0	719	3014	5	20
Calcium ammonium nitrate	0	0	0	0	14	22	30	7692
Diammonium phosphate (DAP)	5139	5889	3005	342	5	154	0	6254
Monoammonium phosphate (MAP)	197	85	0	106	209	0	0	45
NPK complex	0	0	0	0	0	0	0	0
NPK complex <=10kg	1	23	1	1	2	2	0	5
NPK complex >10kg	577	11143	55182	5691	17631	1751	18321	23515
Other nitrogen & phosphates compounds	0	0	928	0	0	0	3	0
Other nitrogen & phosphorus compounds	83	985	1322	46	157	21	0	90
Other NP compounds	0	0	0	0	0	0	0	0
PK compounds	26	12	0	1	38	0	3017	0
Potassium chloride (Muriate of potash)	61	276	1852	0	155	59	8	698
Potassium nitrate	12	0	0	1	1	0	0	1
Potassium sulphate	439	1059	83	0	0	0	1	4
Superphosphate	18	2	305	2	0	0	57	0
Superphosphate above 35%	0	0	0	0	70	0	0	0
Superphosphate other	0	0	0	0	0	0	0	0
Urea	85099	25419	62261	0	30129	11508	1067	38992
Urea and ammonium nitrate solutions	31	21	4	0	0	0	0	597
	102592	46482	138253	6190	50504	17055	22781	78450

Source: FAO

Since the National Fertilizer Strategy and the National Fertilizer Regulation have been enforced, fertilizer dealers are obliged to report their trading situation. GOM is now working on gathering actual trading data and the results will be available soon. In accordance with the information from MINAG, the actual fertilizer consumption in 2012 may be about 80,000 tons, which is almost

equivalent to the projection of fertilizer use in 2016 (78,900 tons) indicated in the National Fertilizer Strategy. Although it is not clear whether this is caused by errors in statistic data or an unexpected increase in fertilizer use, it is clear that the fertilizer use has steadily increased.

According to the data on the fertilizer handling volume submitted by Mozambique Fertilizer Company, which is the largest company for fertilizer blending, about 137,000 tons were imported in 2012 by this company alone. Of this amount, about 60,000 tons were consumed in the domestic market; the remaining fertilizer was exported to Malawi. In addition, about 45% of the fertilizer material for domestic use is urea.

It is well recognized that fertilizer use needs to be increased in order to improve production and productivity in Mozambique. To increase the fertilizer use rates, small farm-households must be motivated to adopt intensive agricultural practices and use fertilizers that promote maximum economic yield for their crops. The primary incentive will come from farmers' ability to access viable markets that can absorb the production. Development of markets is crucial because it produces the economic benefits that allow farmers to increase their use of fertilizers, as well as complementary farming aids such as improved seeds, farm equipment and irrigation. These points are described as the strategy in PEDSA.

Lowering the fertilizer price is also an effective way to improve the low fertilizer use rates and introduction of government subsidies is one of effective ways to lower the fertilizer retail price. However, according to the information from MINAG and concerned organizations, GOM has no intention to introduce direct subsidies for the purchase of fertilizers and improved seeds. In Malawi, the government's finances have been constrained significantly by incorporating subsidy systems. This fact has affected the GOM's strategies.

GOM, instead, is trying to promote the fertilizer use by introducing voucher systems supported by FAO, EU, etc. Furthermore, the customes (2.5%) and VAT on fertilizers are exempted according to the National Fertilizer Strategy.

The proposed PPP project may contribute to lowering the fertilizer price because the freight costs could be saved if the fertilizer is produced in Mozambique, and thus contribute to promoting the fertilizer use in a synergistic manner (refer to 2.5 (3)).

2.5 Fertilizer Price

(1) Information from MINAG, AFAP and IRRI

Major importers of fertilizers are Agrifocus, Tecap, Hygrotech, Agroquimicos, Savon, Green Belt and Mozambique Fertilizer Company according to the National Fertilizer Strategy. The latter two companies perform blending of fertilizers and also supply the fertilizers to large consumers in the sugar and tobacco sectors. Other companies import fertilizers mainly from South Africa, butin small amounts.

Wholesalers purchase fertilizers at USD 70 to USD 80 per 50 kg and sell it to farmers at USD 100 per 50 kg. This is not a reasonable price considering the GDP of Mozambique.

According to information from sources related to the agricultural support activities, large consumers, such as the sugar and tobacco sectors, can purchase fertilizers at a price near the international one. On the other hand, small consumers have to purchase expensive fertilizers on which the margins of some dealers and transportation costs are added before reaching the small consumers. This could be cause of the difference in the above mentioned price and the retail price shown in (2) below.

(2) Information from WB's Report

According to Table 2.5.1 that is exhibited in "Agribusiness Indicators: Mozambique, April 2012" by WB, the ratio of urea prices at retail sales points to the FOB price (from a major foreign supplying point) varied between 1.8 and 2.6 for most months during the reporting period.

Table 2.5.1 Monthly Fertilizer Prices in 2010/11 for Mozambique

(USD/ton)

Fertilizer Type	2010			2011							
	Jun	Aug	Oct	Nov	Jan	Feb	Mar	Apr	May	June	July
CAN 26-0-0		820	469						867	883	
CAN 28-0-0											703
NPK 10-15-10					919						
NPK 10-20-10						898	1,004				
NPK 12-24-12	1,029	738	1,077	801	950	997	1,025	947	1,067	1,043	1,133
NPK 23-21-0 + 4S	1,059										
Urea 46-0-0	882	629	635	677	919	861	917	762	900	948	1,023
FOB urea	239	283	345	383	392	387	358	345	345	492	501
Local/ intl. urea ratio	3.7	2.2	1.8	1.8	2.3	2.2	2.6	2.2	2.6	1.9	2.0
DAP 18-46-0								872			
FOB DAP								621			
Local/intl. DAP ratio								1.4			

Source: AMITSA, IFDC
Note: FOB prices are from the Arab Gulf (urea) and the Baltic Sea ports (DAP). S = sulphur.

According to Table 2.5.2 that is exhibited in "Agribusiness Indicators: Mozambique, April 2012" by WB, a set of cost estimates (late 2011) for import and distribution of urea shows that retail fertilizer sales margins are high in rural Mozambique - 27% for urea and 31% for NPK (12-24-12).

On the other hand, road transport costs in total appear to be barely 5% of the fertilizer retail cost, which seems surprisingly low. It seems that some of the apparent retail margin is made up of additional rural transport costs.

If fertilizer is produced in Mozambique, costs such as freight charge, insurance, import duty and other costs would be saved and thus the retail price would be lowered to about USD 185 /ton.

Table 2.5.2 Fertilizer Import & Distribution Costs in Central Mozambique, late 2011

(USD/ton)

Prices/costs per ton	NPK 12-24-12	Urea	%dUrea Price at Retail
FOB price (at source, Saudi Arabia)		449	43.9
Sea freight and logistics		152.3	
Insurance		4.5	
Warehousing, demurrage, bagging		18.0	
CIF price (at Beira)		623.8	61.0
Import duty @ 2.5%		11.2	
Transport cost to Chimoio		25	
Delivered cost at factory gate		660	64.5
Factory processing costs			
Ex-factory gate price, Chimoio	750	720	70.4
Transport cost to retail sales point	27.5	27.5	
Delivered cost to point of sale	778	748	73.1
Retail price, Manica Province	1133	1023	100.0
Retail margin	356	276	26.9
%retail price	31.4%	26.9%	

Source: "Agribusiness Indicators: Mozambique, April 2012" by WB

(3) Information from IFDC's Database

As shown in Table 2.5.3, the retail price of urea in Mozambique was almost over USD 1,000 /ton after the middle of 2011. This almost coincides with the data shown in Tables 2.5.1 and 2.5.2.

On the other hand, the price in Mozambique is higher than prices in other countries such as Ghana, Malawi, Mali, Rewanda, Senegal and Swaziland. In these countries, the governments grant subsidies to lower the prices; however, GOM has not introduced a subsidy system. This high price is one of the reasons why fertilizer use is very low compared with neighboring countries.

Table 2.5.3 Monthly National Average Prices for Fertilizers in African Countries

(USD/ton)

		2010										2011												2012												2013		
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	April	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Ghana	NPK 15 15 15				675	370	371	380	382	378	373	505	522	648			665	419	395	389	386	368	383	381	539	561	543	535	635	481	476			409	409	408	480	540	509
	NPK 23 10 5 + 4MgO + 2Zn																		392			368																	
	NPK 23 10 5 + 4MgO + 2Zn				686	370	371	380	382	378	373	495	498	652			682	442		389	383		368	361	469	472	624	603		436	431								
	Sulfate of Ammonia 21%				456	247	247	254	255	252	249	360	330	445			472	341	332	325	325	309	356	342	450	492	462		476	495	489			367	388	366	391	486	528
	UREA 46 0 0				548	343	343	352	354	350	346	461	371	580			507	394	378	373	372	358	368	349	469	472	647	581	634	699	691			398	400	398	418	579	618
Kenya	CAN 26 0 0	457	446	445	459	466	467	460	467	501	507	531	552	529		573	559	610	556	578	585	526	644	681	733	677	713	713	694	663	672	685	676	636	651		619	636	631
	DAP 18 46 0	653	669	659	627	673	654	667	700	759	768	780	821	758		887	857	875	823	798	876	798	974	1,040	1,109	1,112	1,038	1,038	1,007	971	990	1,013	989	996	966		937	915	882
	MOP 0 0 60					757										774																							
	NPK 17 17 17	654	617	593	594	624	634	656	638	641	646	664	724	635			689	690	674	657	681	668	799	905	901	975	892	892	887	838	874	871	909	911	829		802	883	
	NPK 20 20 0					584											728																						852
	NPK 20 20 20										556	556																											
	NPK 23 23 0						598			641			727				648					736										865					822		847
	NPK 25 5 5 + 5S	625	673		651	591	646																															
	SSP 0 16 0																473																						
	TSP 0 46 0	875			386	757	383	762					1,275				1,301																						
	UREA 46 0 0	529	536		500	520	528	515	463	515	521	536	606	554		593	643	623	632		666	624	726	788	889	845	845	845	872	822	901	910	848	734	867		762	790	792
Malawi	CAN 26 0 0			714	658	716	735	1,215	664	698	749		707	642		640	914	850	786	951	866	890	965	882	925	1,015	969	969	1,017	951	980	927	924	909	761		916	1,023	750
	MOP 0 0 60			688	688	1,041	1,040																															
	NPK 23 21 0 + 4S			831	558	688	715	1,309	520	611	572		771	755		729	960	959	843	1,033	1,015	1,023	1,037	1,069	1,075	1,178	1,154	1,154	1,197	989	854	997	985	963	940		1,065	1,187	852
	NPK 8 18 15 + 6S + 0.1B (D Compound)			831	831	833	936	1,525	726	944	1,041		925	982		868	1,053	971	828	1,094	1,020	1,015	1,105	1,167	1,052	1,147	1,121	1,121									1,052	1,157	982
	NPK 8 18 15 + 6S + 0.1B (D Compund)																														1,121							
	TSP 0 46 0			688	688	690	689																															
	UREA 46 0 0			779	701	638	722	1,179	645	676	709		710	702		670	859	887	823	1,067	935	947	992	1,016	1,025	1,136	1,060	1,060	1,044	938	1,030	922	1,010	985	996		1,021	1,145	832
Mali	DAP 18 46 0							677	733	728	651		775	758	812					794	789	747	810	668	779	807	799	829	817	769		835	837	878	843	866	869	921	882
	NPK 10 10 20								1,249		994		674	1,083	1,120					898	916	915	861	890	859	886	885					835	866	990				952	922
	NPK 10 15 20																									905												
	NPK 14 18 18 6 1							610	645	642												915		776	812	853	852		870	844		742	799	822	807	829	836	849	823
	NPK 15 15 15							726	656	659	683		773	754	836		667	1,008		822	811	854	804	780	752	748	743	829	817	727		645	785	835	787	803	819	856	832
	NPK 16 26 12 + 5S + 0,3ZN							701	749	748	716		710	731	756					777	759	773	800	791	700	740	718	713	702	682		812	750	836	749	799	819	880	872
	NPK 20 10 10																715																						
	NPK 23 10 5																											889	826		835	866	891					
	NPK 6 20 10																								554	571			560	544		649	673	841					
	UREA 46 0 0							575	520	538	894		709	653	669		685			720	679	688	747	726	716	714	716	743	731	675		680	704	746	716	736	742	774	761
Mozambique	Ammonium Nitrate																														1,074							
	CAN 26 0 0						820		469								867	883		961	992	932	912	719	992	1,028													
	CAN 28 0 0																		703																				
	DAP 18 46 0															872																						
	MAP 39																								973		1,223	1,223											
	NPK 10 15 10											919																											
	NPK 10 20 10												898	1,004																									
	NPK 12 24 12				1,029		738		1,077	801		950	997	1,025		947	1,067	1,043	1,133	1,214	1,215	1,248	1,269	1,333	1,337	1,276	1,264	1,264	1,318	1,255	1,350	1,433			1,230		1,248	1,186	1,149
	NPK 23 21 0 + 4S				1,059																																	
	UREA 46 0 0				882		629		635	677		919	861	917		762	900	948	1,023		1,123	1,075	1,096	1,175	1,062	1,074	1,121	1,121	1,192	1,223	1,137	1,194			1,102		1,106	1,067	1,030
Rwanda	DAP 18 46 0					513	660	769	782	714	657	726	712	831			816	831	822	957	1,018	992	1,013	1,012	1,011	1,011	1,009	1,009	1,008	1,013	1,008	1,000							
	NPK 17 17 17					617	576	557	552	564	574	553	577	543		542	533	547	546	599	645	631	643	638	632	640	639	639	638	642	639	712							
	NPK 20 10 10					502		568	569			564	602																									
	UREA 46 0 0					443	501	568	586	524	499	548	554	577		576	566	607	599		797	754	795	789	795	792	790	790	790	793	790	788							
Senegal	DAP 18 46 0							697				713	759	780	806			637	666	648	659	732	689	712	688	709			696	675	736	631	693	713	700	739			
	NPK 10 10 20							636	651	668	643	619	678	664	896		732	670	737	668	632	602	636	626	630	699			721	661	692	612	833	705	670	719	897	764	2,724
	NPK 14 06 05																																					1,011
	NPK 14 16 28																																					1,085	
	NPK 15 10 10							510	485	532										491	468	467																
	NPK 15 15 15							522	661	775	686	712	790	811	683		604		741	753	624	624	682	649	650	702			689	656	644	594	654	720	603	699	806	798	674
	NPK 15 5 15																	773																				
	NPK 16 26 12 + 5S + 0,3ZN										636	634																											
	NPK 18 46 0								749	776																													
	NPK 23 10 5 + 4MgO + 2Zn														560																								
	NPK 6 20 10							542	506	554	647	570	570										475	497	590			657	666	653	600	632	706	651	669				
	Sulfate of Ammonia 21%														442																								
	UREA 46 0 0							706			547	477	301	632	665		727	520	710	616		496		708	640	743			691	688	770	770	767	707	635	639	927	790	660
Swaziland	LAN 28 0 0																						637	612														
	NPK 2 3 2 (22)																						599	576														
	NPK 2 3 2 (37)																						947	910														
	NPK 2 3 4 (39)																							887														
	UREA 46 0 0																						805	709			1,264	1,264										
Tanzania	CAN 26 0 0			463	537	490	505	502	515	554	582	480	599	578		672	691	676	708	792	744	833	721	884	815	772	885	885	746	833	850	879							
	DAP 18 46 0			716	694	740	736	752	806	853	819	834	920	901		924	968	950	997	1,117	1,036	1,091	997	1,105	1,124	1,096	1,146	1,146	1,192	1,167	1,116	1,206							
	MOP 0 0 60			402	318	313							619				401					1,091																	
	NPK 17 17 17					821	534	757	723	892			875	825		970	824		855	766	842	889		979	958	891	907	907	962	993		1,071							
	NPK 20 10 10			728	743	608	660	659	758		839		942	881		807	902	836	768	900	828	902	765	995	926	939	1,019	1,019	1,036	972		1,093							
	NPK 25 5 5 + 5S					426	430																															
	PHOSPHATE ROCK					293	287																			382				801	642	804							
	Sulfate of Ammonia 21%				426	393	365	363	401				512	504			401																						
	TSP 0 46 0					599	619		690				673																										
	UREA 46 0 0			475	492	466	516	490	546	584	559	594	643	511		672	627	655	704			932	767	954	958	891	998	998	906	1,063	928	1,010							
Zambia	Ammonium Nitrate									1,058	862		964	1,064		1,077	743	792	913		860			735					615		815	951							
	CAN 26 0 0			518	638	619	616	657	632	714	656	691	706	788		905	858	845	840	878	772	893	755	676	1,477	784			769	1,579									
	NPK 10 20 10 + 6S (D Compound)																			1,090																			
	NPK 10 20 10 + 6S (D Compound)			603	645	677	693	679	694	709	740	798	809	894		905	1,006	999	743		891	903	820	750	1,554	814			850	1,641	795								
	UREA 46 0 0			569	615	598	635	638	672	651	701	725	745	894		905	1,002	982	845			719	857		1,702	824				1,619									

Source: IFDC's Database

(4) Trends of FOB Price of Urea

According to the AfricaFertilizer.org's Database shown in Table 2.5.4, the urea FOB price was in a range from USD 380 to 490 /ton in the period from May 2012 to April 2013.

Table 2.5.4 International Monthly Average Prices for Fertilizers

(USD/ton)

c	(all FOB bulk spot, USD/MT)	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Jan-13	Feb-13	Mar-13	Apr-13
N	Urea (prilled, Arab Gulf)	490	428	419	410	395	410	405	398	406	418	401	380
N	Ammonium Sulphate (Black Sea)	192	193	197	223	214	192	198	206	213	204	259	198
P	DAP (Baltic)	451	594	585	585	576	557	530	513	508	508	518	525
P	TSP (North Africa)	516	514	510	502	500	478	458	447	421	400	408	409
P	SOP (in €, North West Europe)	420	420	420	420	420	420	416	410	395	395	395	403
K	MOP (Israel/Jordan)	460	460	460	460	460	460	456	450	400	400	400	400

Source: AfricaFertilizer.org's Database

Trading price of urea varies depending on supply and demand balance in the world in general. There is a tendency for the price of urea to fall since the beginning of 2013. The main causes are as follows.

a) Since production of urea in the new production plants has been taken up mainly in the middle-east countries, the supply capacity exceeds the demand in the world. Therefore, there is a tendency that a competitive environment in international bidding became severe and the urea is traded at a low price.

b) Fertilizer demand season in China, the largest urea production country in the world, has passed and a large amount of urea goes on sale in the international market after July 2013. However, this is due to the cycle of demand season and non-demand season of the year, but does not last years.

c) There is a temporary influence in India, which imports urea of 7 million ton per year, that farmers have reduced fertilizer usage due to the influence of the exchange rate fluctuations and reduction of government subsidies since the second half of 2012.

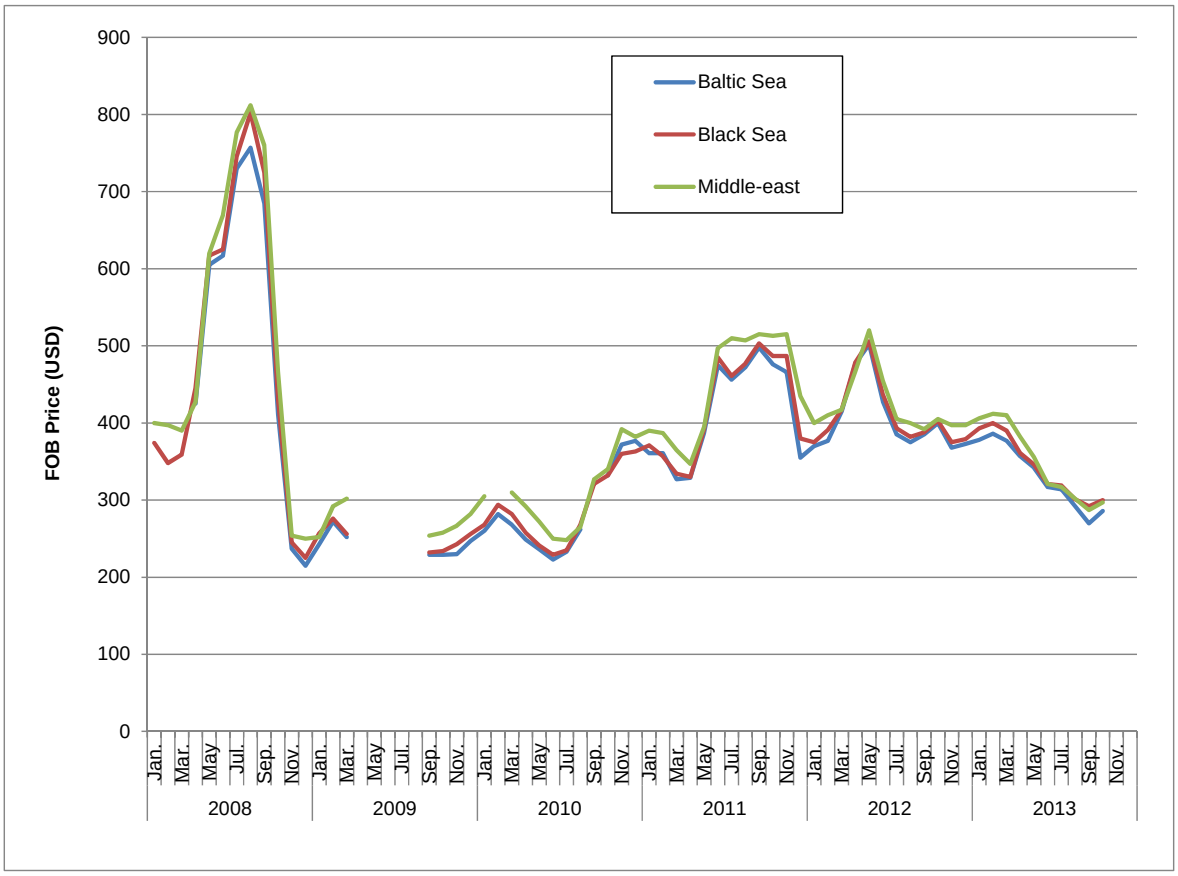
For the purpose of studying the price trends of urea and the future prices, the FOB price of urea exported from the Baltic Sea, Black Sea and the middle-east countries that is published on the Internet is summarized in Figure 2.5.1 and Table 2.5.5.

Table 2.5.5 FOB Price of Urea (Baltic Sea, Black Sea and the middle-east countries)

(USD)

		Baltic Sea	Black Sea	Middle-east	Average
2008	Jan.		374	400	387
	Feb.		348	397	373
	Mar.		359	390	375
	Apr.	425	445	427	432
	May	605	617	620	614
	Jun.	617	625	670	637
	Jul.	730	746	777	751
	Aug.	757	802	812	790
	Sep.	685	725	760	723
	Oct.	411	430	467	436
	Nov.	237	245	254	245
	Dec.	215	225	250	230
2009	Jan.	243	257	252	251
	Feb.	272	276	292	280
	Mar.	252	256	302	270
	Apr.				
	May				
	Jun.				
	Jul.				
	Aug.				
	Sep.	229	232	254	238
	Oct.	229	234	258	240
	Nov.	230	243	267	247
	Dec.	247	256	282	262
2010	Jan.	260	268	305	278
	Feb.	282	294		288
	Mar.	268	282	310	287
	Apr.	249	258	292	266
	May	236	241	272	250
	Jun.	223	229	250	234
	Jul.	233	235	248	239
	Aug.	262	268	265	265
	Sep.		321	327	324
	Oct.	332	332	340	335
	Nov.	372	360	392	375
	Dec.	377	363	382	374
2011	Jan.	361	371	390	374
	Feb.	361	357	387	368
	Mar.	327	334	365	342
	Apr.	329	330	347	335
	May	387	392	395	391
	Jun.	475	485	497	486
	Jul.	456	461	510	476
	Aug.	472	477	507	485
	Sep.	498	503	515	505
	Oct.	476	487	513	492
	Nov.	466	487	515	489
	Dec.	355	380	435	390
2012	Jan.	370	375	400	382
	Feb.	377	391	410	393
	Mar.	415	417	417	416
	Apr.	477	479	467	474
	May	502	506	520	509
	Jun.	428	437	455	440
	Jul.	385	393	405	394
	Aug.	375	382	400	386
	Sep.	385	388	392	388
	Oct.	400	403	405	403
	Nov.	368	375	397	380
	Dec.	373	379	397	383
2013	Jan.	378	393	406	392
	Feb.	386	400	412	399
	Mar.	377	390	410	392
	Apr.	357	361	382	367
	May	342	346	356	348
	Jun.	317	321	321	320
	Jul.	314	319	317	317
	Aug.	292	301	302	298
	Sep.	270	292	287	283
	Oct.	286	300	297	294
	Nov.				
	Dec.				
Ave-1 (2008-2013)		**371**	**378**	**398**	**381**
Ave-2 (2010-2013)		**361**	**367**	**385**	**370**

Source: Several web sites



Source: Several web sites

Figure 2.5.1 FOB Price of Urea (Baltic Sea, Black Sea and the middle-east countries)

As seen in Figure 2.5.1 and Table 2.5.5, there are variations in the price of urea due to changes over a long period and time of year. As described above, this is due to the balance of demand and production capacity and the effect of fertilizer demand season and non-demand season.

As shown in Table 2.5.5, the average FOB price of 2008 - 2013 is USD 381 /ton. On the other hand, there was a very high price for a short period of time in 2008 and there is a loss of data in the 2009. For this reason, it was decided to use the data of 2010 or later for the study of the future FOB prices.

The average price of 2010 or later is USD 370 /ton as shown in Table 2.5.5. It is said that the production cost of urea is around USD 250 /ton although it depends on gas prices, capital investment, etc. Therefore, FOB price of USD 300 /ton or below is unacceptable to producers. It is reasonable to say that, in the long run, the FOB price of USD 350 – 400 /ton should be assumed.

2.6 Review of Fertilizer Demand

2.6.1 Fertilizer Demand in Mozambique

(1) Demand Projection based on Past Consumption Data (Case-1)

Table 2.6.1 Consumption and Projection on Fertilizer Use in Mozambique

Year	Consumption (ton)	Remarks
2007	28,000	Consumption as of 2007
2008	32,200	Projections Average annual growth rate = about 12%
2009	37,000	
2010	42,600	
2011	49,000	
2012	53,900	
2013	59,300	
2014	62,200	
2015	71,700	
2016	78,900	
2017	86,800	

Source: Data taken from Table 5 in Fertilizer Strategy

As shown in Table 2.6.1, it is found that the growth rate in a period from 2007 to 2017 is almost 12% annually. Assuming 12% growth till 2030, the consumptions in 2020, 2025 and 2030 are estimated at about 122,000 tons, 215,000 tons and 379,000 tons respectively. Assuming that the proportion of urea to the consumption is 50%, the urea consumptions in 2020, 2025 and 2030 will become approximately 61,000 tons, 107,500 tons and 189,500 tons respectively.

On the other hand, the actual consumption in the period of 2006 – 20112 is summarized as shown in Table 2.6.2.

Table 2.6.2 Fertilizer Consumption

Year	Consumption (ton)	Growth Rate (%)	Source
2007	28,000	-	Fertilizer Strategy
2008	32,000	14.3	
2009	33,000	3.1	
2010	51,400	55.8	
2011	50,000	-2.8	Information from MINAG
2012	80,000	60.0	
Average Annual Growth Rate		23.4	

Sources: Information from MINAG and Table 1 in Fertilizer Strategy

According to the above table, the consumption after 2010 is higher than the projection in Table 2.6.1 and the consumption in 2012 is especially high at 80,000 tons, almost 1.5 times the projection in Table 2.6.1. It should be noted that the reliability of data in 2012 is high because it is based on the survey result. It is obvious that the growth of fertilizer consumption is much higher than that shown

in Table 2.6.1. However, the average annual growth rate, 23.4% shown in Table 2.6.2, is too high to apply for the prediction of future consumption until 2030. Therefore, it is assumed, in this Survey, that the base consumption is 80,000 tons in 2012 and the annual growth rate is 12% until 2030.

According to the above assumption, fertilizer consumption in 2020, 2025 and 2030 is estimated to be about 198,000 tons (35 kg/ha), 349,000 tons (62 kg/ha) and 615,000 tons (109 kg/ha) respectively. Assuming that the proportion of urea compared to the consumption of all fertilizer is 50%, urea consumption in 2020, 2025 and 2030 becomes aproximately 99,000 tons, 174,500 tons and 307,500 tons respectively.

Table 2.6.3 Future Fertilizer Demand derived from Past Fertilizer Consumption

(ton)

	2020	2025	2030
All Fertilizers	198,000	349,000	615,000
Urea	99,000	174,500	307,500

Source: JICA Survey Team

The Zambezi Valley Agricultural Development is now in the master plan stage with the support of the Netherlands, and the Popo River Irrigation Project by AfDB is also in the preliminary study stage. However, probable increase in the cultivated land and fertilizer consumption due to the implementation of these projects was not considered in the above examination. Accordingly, there is possibility that the further demand may arise in the future.

(2) Demand Projection based on IFDC's Report (Case-2)

In accordance with "Mozambique Fertilizer Assessment, October 2012" by IFDC, to meet the incremental production necessary to achieve the strategic objectives for the targeted crops in PEDSA (7% annual growth), Mozambique requires an additional 312,000 tons of fertilizer (urea, DAP and MOP) in 2020. It should be noted that this estimation was undertaken assuming no significant change in the total cultivated area.

Since the consumption in 2011 was 50,000 tons, the total fertilizer demand becomes 362,000 tons in 2020 (50,000 + 312,000 tons). This is much higher than the prediction in (1) above.

Assuming that the annual growth rate of 7% is maintained after 2020 and the fertilizer demand also increases at the same rate, fertilizer consumption in 2020, 2025 and 2030 are estimated at approximately 362,000 tons (64 kg/ha), 508,000 tons (90 kg/ha) and 712,000 tons (126 kg/ha) respectively. Assuming that the proportion of urea to the consumption of all fertilizer is 50%, urea consumption in 2020, 2025 and 2030 become approximately 181,000 tons, 254,000 tons and 356,000 tons respectively.

Table 2.6.4 Future Fertilizer Demand derived from the Study by IFDC

(ton)

	2020	2025	2030
All Fertilizers	362,000	508,000	712,000
Urea	181,000	254,000	356,000

Source: JICA Survey Team

(3) Consideration for Increase in Cultivated Area

The future demands examined in (1) and (2) above do not consider an increase in cultivated area. The present total cultivated area is about 5,633,850 ha as described in 2.4 and, according to the Agricultural Census 2009 – 2010, small-scale cultivated lands occupy about 96% of the total area (5,428,571 ha). According to FAOSTAT, the agricultural land area in Mozambique was 11,991,000 ha (2005 to 2007), which is almost twice as much as the cultivated area.

Small-scale farmers use these lands on a few years rotation because they do not rely on fertilizers. This means that the agricultural land of small-scale farmers may also be almost twice as much as their cultivated areas, i.e. 10,857,142 ha, which could be potential cultivated land if they start using fertilizers. Since the fertilizer use rate in medium and large-scale farmers is relatively high, it can be assumed that their cultivated lands are almost all of their agricultural lands. Thus, an increase in the fertilizer use due to an increase in the cultivated land is examined focusing on the agricultural lands of small-scale farmers.

Assumptions:

a) The cultivated area increases 20% by 2020, and then increases 50% by 2030. This means that the increased cultivated areas in 2020 and 2030 are 1,085,714 ha and 2,714,285 ha respectively.

b) Fertilizer use rates in the increased cultivated land are 50 kg/ha in 2020 and 100 kg/ha in 2030 referring to the study results in (1) and (2) above.

From the above assumptions, the increase in fertilizer use due to increase in the cultivated area is summarized in Table 2.6.5.

Table 2.6.5 Increase in Fertilizer Use due to Increase in Cultivated Area

	2020	2025	2030
Increased Area (ha)	1,085,714	1,900,000	2,714,285
Use Rate (kg/ha)	50	75	100
All Fertilizers (ton)	54,286	142,500	271,428
Urea (ton)	27,143	71,250	135,714

Notes: 1) Increase in 2025 is derived from those in 2020 and 2030
2) It is assumed that proportion of urea is 50% of all fertilizers.

Source: JICA Survey Team

The above study does not include an increase in the cultivated area due to the agricultural development programs such as the Zambezi Valley Agricultural Development and Popo River Irrigation Project (refer to (1) above). If these programs are implemented, fertilizer consumption would further increase. However, implementation plans for these programs are still immature. Therefore, it was decided that fertilizer demand in these programs should not be considered in this Survey.

(4) Summary of Study Results

Table 2.6.6 summarizes the results of (1) – (3) above.

Case-1: Demand derived from the Past Fertilizer Consumption

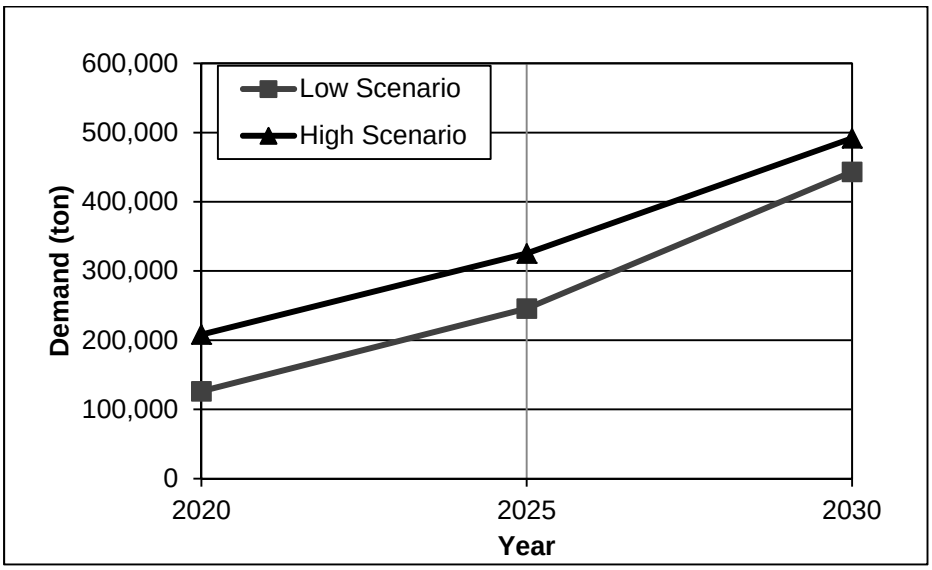
Case-2: Demand derived from the Study by IFDC

Additional: Increase in Fertilizer Use due to Increase in Cultivated Area

Table 2.6.6 Summary of Future Urea Demand in Mozambique

	2020	2025	2030
Case-1 (Low Case) (ton)	99,000	174,500	307,500
Case-2 (High Case) (ton)	181,000	254,000	356,000
Additional Demand (ton)	27,143	71,250	135,714
Cultivated Land (ha)	6,514,285	7,328,570	8,142,856
Low Scenario (ton) (Case-1 + Additional)	126,143	245,750	443,214
	(Urea 19 kg/ha)	(Urea 34 kg/ha)	(Urea 54 kg/ha)
High Scenario (ton) (Case-2 + Additional)	208,143	325,250	491,714
	(Urea 32 kg/ha)	(Urea 44 kg/ha)	(Urea 60 kg/ha)

Source: JICA Survey Team



Source: JICA Survey Team

Figure 2.6.1 Future Urea Demand in Mozambique

Even in the high scenario, the fertilizer use rate in 2030 is 120 kg/ha (Urea consumption is assumed to be 50% of all fertilizers, 60 kg/ha x 2) and this is not too high a value.

Promotion of fertilizer use is crucial to achieve the agricultural sector growth (7%) planned in PEDSA. This issue is also shown in the studies by IFDC. Under this recognition, GOM strongly intends to expand various policies and action plans concerning the use of fertilizer.

From the above mentioned circumstances, it is appropriate to adopt the High Scenario as domestic fertilizer demand in 2020 - 2030.

2.6.2 Fertilizer Demand in Neighboring Countries

(1) Demand Projection based on Data in National Fertilizer Strategy

Table 2.6.7 Current Consumption and Projections on Fertilizer Use in Zambia and Malawi

(ton)

Year	Zambia	Malawi
2007	180,000	270,000
2008	192,600	283,500
2009	206100	297,700
2010	220,500	312,600
2011	235,900	328,200
2012	247,700	338,000
2013	260,000	348,200
2014	273,000	358,600
2015	286,700	369,400
2016	301,000	380,500
2017	316,000	391,900

Source: Data taken from Fertilizer Strategy, Edited

From the above table, it is found that the annual growth rates in Zambia and Malawi after 2012 are almost 5% and 3% respectively. Based on these rates, the consumptions in 2020, 2025 and 2030 are estimated as shown in Table 2.6.8.

Table 2.6.8 Future Fertilizer Demand in Zambia and Malawi

(ton)

		2020	2025	2030
Zambia	All Fertilizers	365,810	466,876	595,865
Malawi	All Fertilizers	428,240	496,447	575,518
Sub-total		796,070	965,348	1,173,413
Urea (50% of All Fertilizers)		398,035	482,674	586,706

Note: It is assumed that proportion of urea is 50% of all fertilizers.
Source: JICA Survey Team

Since these countries have almost no production capacity of fertilizer, almost 100% of fertilizer is imported. Therefore, if Mozambique has enough production capacity to export fertilizer at internationally competitive prices, it may be possible that Zambia and Malawi will import fertilizer from Mozambique since the cost of freight could be saved and it is beneficial to these countries. If this is the case, some of the future consumptions shown in Table 2.6.8 could be expected as an export.

(2) Demand Projection based on Import Data

Table 2.6.9 shows the annual amount of imported fertilizer products in some countries around Mozambique (except Malawi and Zambia). The annual fertilizer production capacity in these countries except South Africa was at most several hundreds tons. South Africa stopped producing urea in 2000 and currently has to import all its urea needs. Therefore, the imported amount shown in the table could be a prospective market for the proposed urea plant.

Table 2.6.9 Annual Amount of Imported Fertilizer (Urea)

(ton)

		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Ethiopia	Urea	48,913	68,478	109,348	15,435	101,522	143,261	140,870	105,000	120,652	202,826
	Total	131,956	263,043	317,609	70,435	390,435	369,565	322,174	358,913	403,478	202,826
Kenya	Urea	37,609	41,739	30,000	35,435	81,087	43,913	71,739	32,826	60,870	19,130
	Total	204,256	219,221	182,684	242,954	249,608	227,053	310,432	198,472	261,322	102,637
Madagascar	Urea				1,957		1,957		4,130	3,261	8,043
	Total	1,852			1,957		1,957		4,130	3,261	8,043
Mauritius	Urea			1,522	870	5,217	10,652	11,087		4,783	14,783
	Total	8,269	3,300	23,965	18,562	13,294	25,985	17,425	29,368	8,140	18,116
South Africa	Urea	510,217	434,783	699,783	487,609	602,826	493,478	586,304	681,739	643,261	650,652
	Total	872,562	655,791	1,096,759	729,063	935,177	702,311	1,104,644	1,079,314	1,191,184	701,052
Tanzania	Urea	40,217	19,783	15,000	45,435	64,783	138,261	86,087	123,043	145,000	95,870
	Total	79,103	30,073	42,314	74,760	123,639	163,639	129,189	189,699	202,753	137,274
Zimbabwe	Urea	19,565	29,130						57,391		
	Total	39,425	40,662	39,785	24,385	15,665	21,514	16,784	87,359	10,523	33,125
Total of Urea		656,521	593,913	855,653	586,741	855,435	831,522	896,087	1,004,129	977,827	991,304

Note: Since the reliability of the data has not been verified, the amounts shown in the table should be regarded as indication
Source: Database of AfricaFertilizer.org

It was found that the total amount of urea imported in 2009 was about 1 million tons. This implies that urea markets are available in these countries and it is likely that this amount may increase by 2020. If the proposed project can offer competitive prices, some countries around Mozambique may purchase urea produced in the proposed urea plant.

The total amount of imported urea increased about 50% in 10 years from 2000 to 2009, and the annual growth rate is calculated as 4.6%. Assuming that this rate is maintained in the future, the total amounts of imported urea in 2020, 2025 and 2030 would be as shown in Table 2.6.10.

Table 2.6.10 Future Urea Import Amount in Other African Countries

(ton)

	2009	2020	2025	2030
Urea	991,304	1,625,756	2,035,700	2,549,014

Note: Annual growth rate is assumed to be 4.6%.

Source: JICA Survey Team

(3) Summary of Study Results

Table 2.6.11 summarizes the study results in (1) and (2) above.

Table 2.6.11 Future Urea Demand in Countries around Mozambique

(ton)

	2020	2025	2030
a. Zambia and Malawi	398,035	482,674	586,706
b. Other Countries	1,625,756	2,035,700	2,549,014
c. Sub-total	2,025,811	2,520,399	3,137,750
Case-A: a. + b. x 10%	560,610	686,244	841,607
Case-B: a. + b. x 20%	723,186	889,814	1,096,509

Source: JICA Survey Team

A large amount of urea and other fertilizers to Malawi have been imported through the Beira Port in Mozambique and then exported to Malawi. From this fact, it is not unreasonable to expect that urea will be exported from the proposed urea plant to Malawi and Zambia in the future.

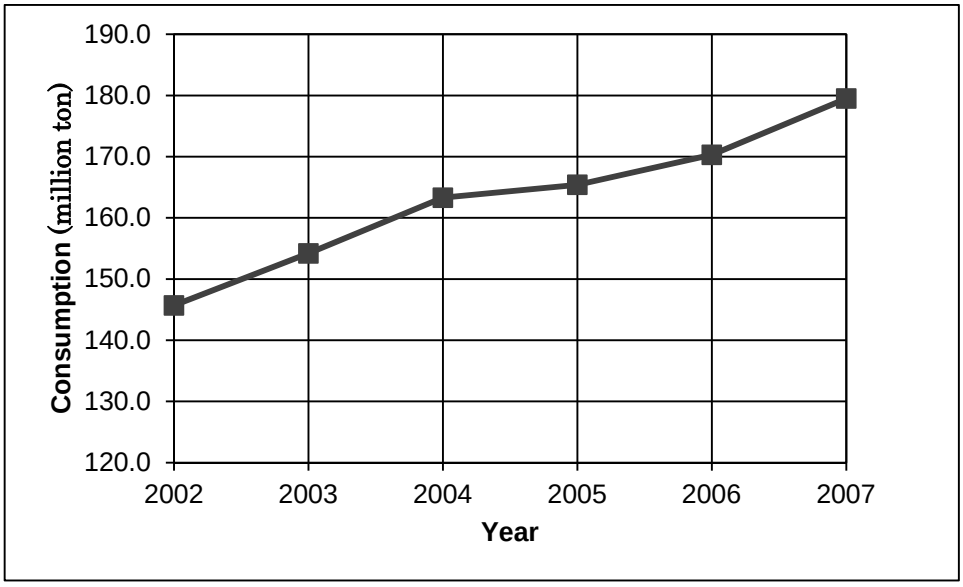
As for the imported amount in other countries, large importers, such as South Africa, possibly import fertilizers based on long-term contracts with suppliers. Therefore, only a part of the fertilizer to be imported in the future could be substituted by that produced in the proposed urea plant. From this viewpoint, it is arbitrarily assumed that 10% or 20% of the imported amount in the future would be supplied by the proposed plant.

Case-A and Case-B in Table 2.6.11 show the results based on the above-mentioned study.

2.6.3 Urea Demand in the World

(1) Trend of Fertilizer Demand in the World

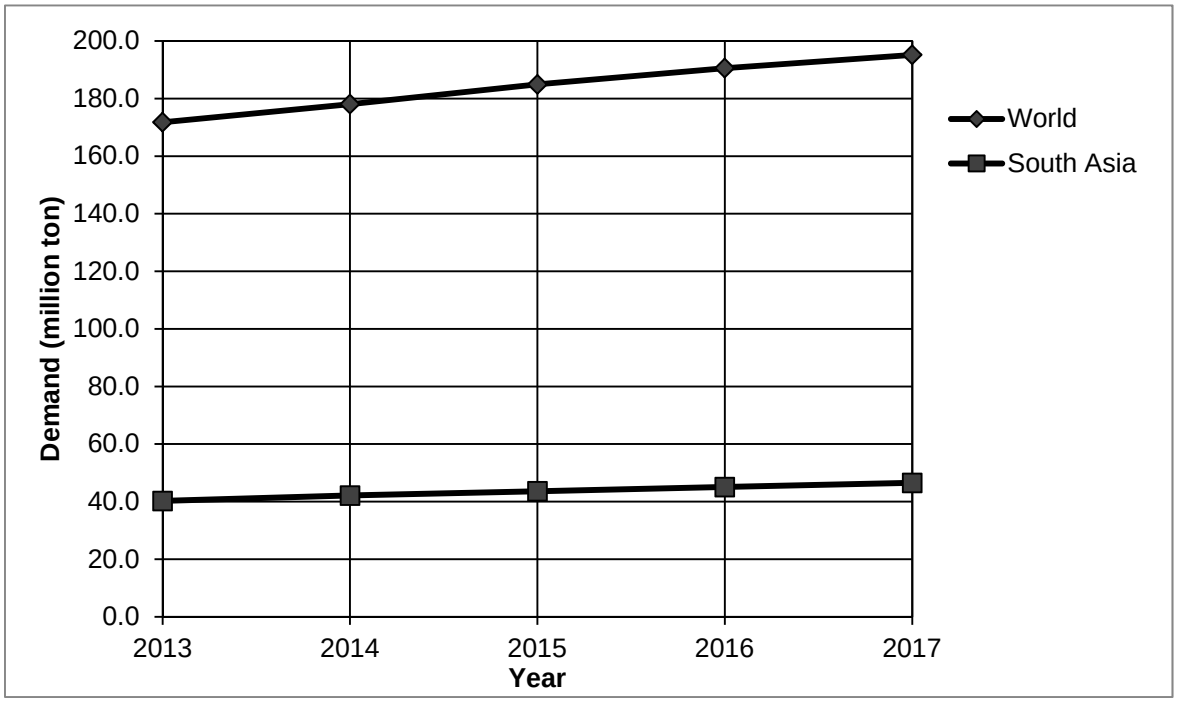
Figure 2.6.2 shows fertilizer consumption around the world in the period from 2002 to 2007 and according to this figure, its annual growth rate is about 4%.



Source: FAOSTAT

Figure 2.6.2 Fertilizer Consumption around the World

In accordance with the database in IFA, it is predicted that urea demand from 2013 to 2017 may increase at average annual growth rates of 3.2% around the world and 3.7% in South Asia as shown in Figure 2.6.3. Urea demand in India occupies 70 – 80% of the total urea demand in South Asia.

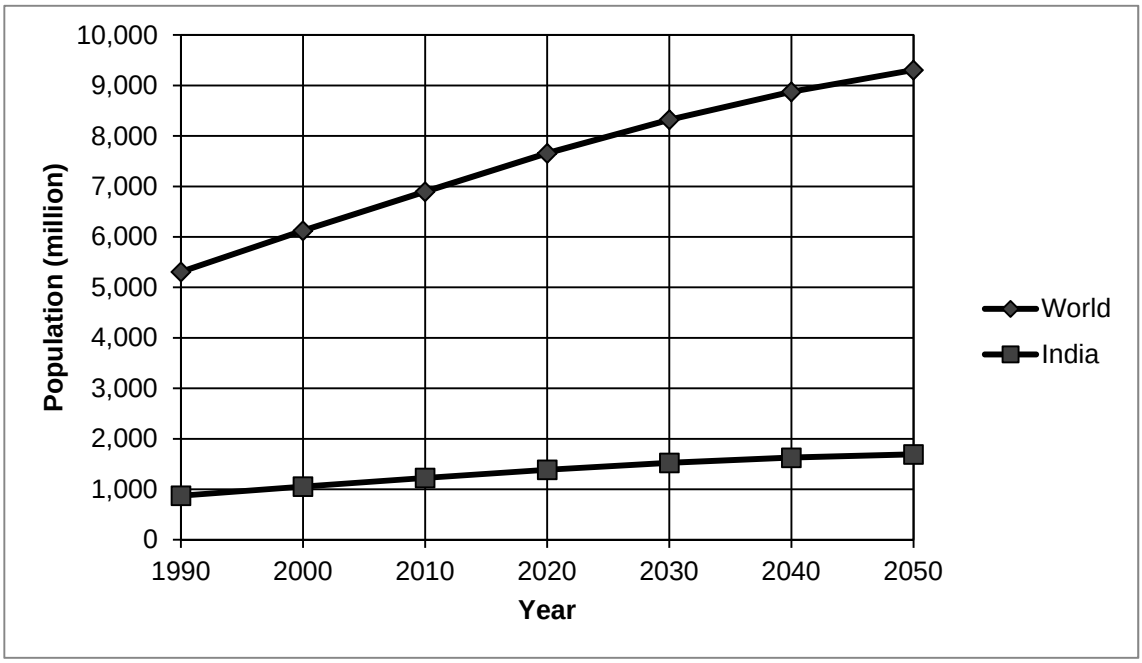


Source: "Production and Trade Statistics", IFA

Figure 2.6.3 Prediction of Urea Demand around the World and in South Asia

The United Nations has predicted that the population around the world and in India may increase at average annual rates of 1% and 1.1% respectively in the period from 2010 to 2030 as shown in

Figure 2.6.4. Population growth leads to an increase in food demand which in turn increases fertilizer demand. Therefore, it is assumed that in accordance with the strong growth in the population, fertilizer demand may also steadily increase.



Source: "World Population Prospects（2010 Revision）", United Nations

Figure 2.6.4 World Population Prospects

(2) Urea Demand in India

The Survey Team considers that India is the most prospective export destination because urea demand in India is increasing rapidly and the import volume is very large.

Table 2.6.12 shows urea consumption and import amounts in India in the period from 2007 to 2011.

Table 2.6.12 Urea Consumption and Import Amount in India

(x 1,000 ton)

	2007	2008	2009	2010	2011
Consumption	26,765	26,395	26,645	28,335	29,944
Import	6,554	6,147	5,700	6,560	7,695

Source: "Production and Trade Statistics", IFA

From the table, it is found that:

a) Import amount in 2011 is 7.7 million tons, which is about 26% of the total consumption (about 30 million tons).

b) An average annual growth of the consumption in the period from 2007 to 2011 is 2.8% while the import amount increased at the average annual growth rate of 4.1% (average annual increase of about 290,000 tons).

c) Increase in 2009 – 2011 is remarkable. In this period, the consumption and import amount increased about 3.3 million tons and about 2 million tons respectively.

Assuming that the consumption will increase at an annual growth rate of 3% in the future, new demand of more than 900,000 tons per year would be created. From this, it may be considered that there is plenty of room in India to accept about 900,000 tons per year of urea produced in the proposed fertilizer plant even though there are other fertilizer plant construction projects.

2.6.4 Summary of Fertilizer Demand

Table 2.6.13 shows the summary of study results in Chapters 2.6.1, 2.6.2 and 2.6.3 above which examined fertilizer demand in Mozanbique, its surrounding countries and India.

Table 2.6.13 Summary of Future Urea Demand

(ton)

		2020	2025	2030
Demand in Mozambique (High Scenario)		208,143	325,250	491,714
Export	Surrounding countries (Case-A)	560,610	686,244	841,607
	India	900,000		
	Export Total	1,460,610	1,586,244	1,741,607
Grand Total		1,668,753	1,911,494	2,233,321

Source: JICA Survey Team

In this Survey, the production capacity of the proposed urea plant is set at 4,000 ton/day (1.3 million ton/year). It can be said that this production capacity is reasonable since there will be a big enough market that can receive urea from this proposed plant.

Chapter 3 Necessity of PPP Scheme and Institutional Framework

3.1 Necessity, Merits and Issues of PPP Scheme

(1) Necessity of PPP Scheme

The definition of PPP (Public-Private Partnership) is a little different in each country according to its background and executing institutions. For example, the System of National Accounts, 2008 defines:

"PPP is a long-term contract between two parties which specifies that one party carries out the operation over a certain period of time as well as construction of single or multiple assets and eventually transfers the asset to the other party. Generally, such contracts are concluded between the private sector and government."

There is also a view that PPP comprehensively means measures that are adopted by a government in a variety of forms such as PFI (Private Finance Initiative), concession and outsourcing to introduce resources of the private sector for public works.

PPP originally began as one of the privatization methods for public projects, which has been promoted in European countries including the United Kingdom (UK) since the 1980's. Until the 1970s, government owned companies were in general responsible for providing infrastructure services such as water supply, roads, electricity, etc. in developed countries, but many of these public projects had problems such as inefficient implementation, excess employment, slow services and relatively expensive tariff. In the UK where economic stagnation and decrease in international competitiveness were serious problems, as the government policy, privatization of infrastructure projects was promoted and then similar practice was also implemented in British Commonwealth countries including New Zealand and Australia. However, simply shifting from state-owned enterprises to the private sector did not necessarily lead to improvement of service quality and reduction in tariff. The private sector gave priority to profit and safety and equality to the service recipients were neglected in some cases.

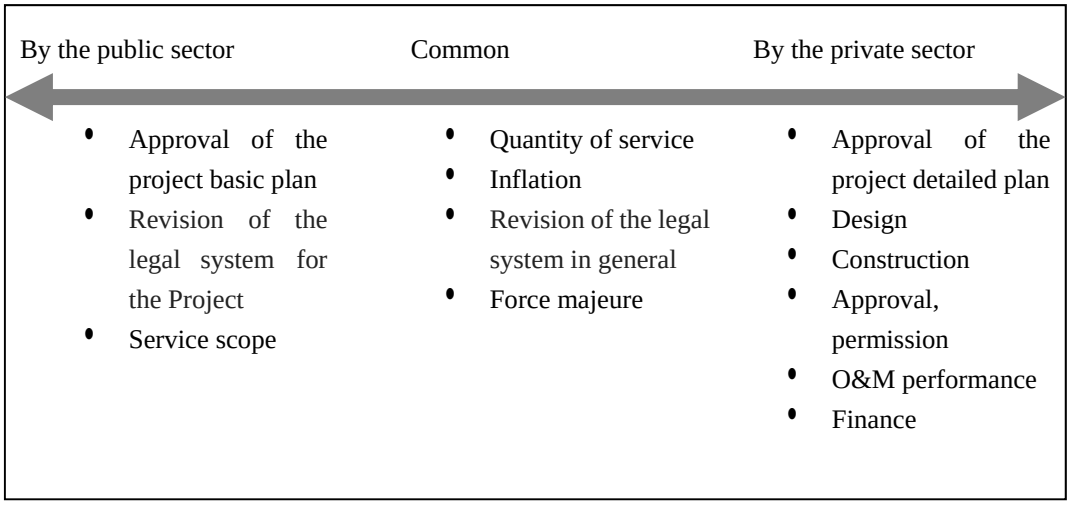
In light of these reflections, in the 1990s, project schemes of not only transferring to the private sector from government ownership, but also, even if the government ownership remains, introducing the know-how of the private sector in various forms and maximizing its effect were studied. PFI was born based on the above consideration and started in the UK in 1992.

In PFI, in accordance with the business plan created by the public sector, the private sector integrally undertakes the financing, design, construction, maintenance and operation. The business agreement should clearly describe quality and quantity of services that the private sector should achieve, monitoring by the public sector, the way of risk sharing between the private sector and public sector, etc. These are necessary for the public sector to control the business from the

viewpoint that it is undertaken as expected by the public sector while incorporating the know-how of the private sector. PFI has been adopted in European countries, Australia, Canada, New Zealand, South Africa, Korea and Japan to reduce the financial burden by leveraging the power of the private sector and provide better services.

In addition, under Blair's government that was established in the UK in 1997, the concept of PPP in which the public sector and private sector enter into public private partnership in various forms such as concession, BOT/BOO method, outsourcing, etc. as well as PFI and realize business was born and it has since been introduced in other countries.

PPP projects implemented in the past mainly focussed on development efficiency of social infrastructure. However, in emerging countries in Asia and Africa, development of not only social infrastructure but also industrial infrastructure is a problem to be solved urgently, and the governments in these countries have actively called for the investment of private capital. On the other hand, it is seen that in the emerging countries, investment does not proceed well because of risk to be taken by the private sector. It is necessary to clarify the risk sharing between the private sector and public sector and reduce the burden on the private sector in terms of land acquisition, the legal system, etc.



Source: JICA Survey Team

Figure 3.1.1 Examples of Risk Sharing

It is essential to introduce a PPP scheme to develop industrial infrastructure and promote the development of domestic industries and the creation of employment in Mozambique although it is also essential to examine the risk sharing.

(2) Merits of PPP Scheme

PPP schemes, in general, have the following merits for infrastructure development in comparison with conventional public works.

a) They can produce better quality in service by utilizing experience, know-how, skilled management, updated innovation, etc. of the private sector.

b) They can deduct the lifecycle cost by combining more tasks in one contract for design, finance, construction, and management.

c) They can utilize long-term financing.

d) They can transfer the risks to the private sector, which is able to manage them.

e) They can transfer the risk of reduction of asset value to the private sector.

f) They can be managed by only one contract between public and private sectors.

(3) Issues of PPP Schemes

The following issues are often encountered especially in newly emerging countries. Both public and private sectors should clarify the related procedures and conduct projects based on a contract in order to avoid these issues.

a) A system to properly monitor the performance of the private sector is necessary.

b) Governments shall commit to the annual expenditure over the long term, which may have an impact on financial adjustments in ordinary accounts.

c) Governments shall pay service fees instead of the transfer of risk of a project to the private sector.

d) In general, financing costs of the private sector are higher than those of the public sector.

3.2 General Legislation in Mozambique

3.2.1 Legislation Related to the Project

		Applicable Legislation
1	Commercial Code	Decree-Law No. 2/2005, from 27th of December
2	Land Legislation	**Land Law:** Law No. 19/97, from 1st of October **Regulation of Urban Soil:** Law No. 60/2006, from 26 th of December **Regulation of Resettlement Procedure Resulting From Economic Activity:** Decree No. 31/2012, from 8 th of August
3	Environmental Legislation	**Environmental Law** Law No. 20/97, from 1st of October **Regulation of Environmental Quality Standards:** Decree No. 18/2004, from 2nd of June **Regulation of Environmental Impact Assessment:** Decree No. 45/2004, from 29 th of September, amended by the Decree n. 42/2008, from 4 th of November

		Applicable Legislation
4	Investment Legislation	**Investment Law** Law No. 3/93, from 24th of June **Regulation of the Investment Law:** Decree No. 43/2009, from 21st of August **Regulation of Hiring of Foreign Employees in IFZ:** Decree No. 75/99, from 24th of December
5	Industrial Licensing	**Regulation of Industrial Licensing** Decree No. 39/2003, from 26th of November
6	Construction Legislation	**Regulation of Licensing of Private Constructions:** Decree No. 2/2004, from 31st of March
7	Foreign Exchange Regulation	**Foreign Exchange Law:** Law No. 11/2009, from 11th of March **Foreign Exchange Law Regulation:** Decree No. 83/2010, from 31st of December
8	Fertilizer Regulation	Decree No. 8/2008, from 16th of April
9	Labour Legislation	**Labour Law:** Law No. 23/2007, from 1st of August **Regulation for Hiring Foreign Employees:** Decree No. 55/2008, from 30th of December **Regulation of Health and Safety at Work in Industrial Establishments:** Legislative Diploma No. 48/73, from 5th of June

3.2.2 Overview of Each Related Legislation

(1) Commercial Code

1) Bookkeeping

The accounting period of companies shall be annual and begins on the 1st of January and ends on the 31st of December, unless otherwise provided in the articles of association and the Tax Authority approval is in place. Every company is obliged to prepare an annual balance sheet of assets and liabilities during the first three months of the immediately following year.

2) Mandatory books

In addition to the bookkeeping and fiscal control records, companies in accordance with their type shall have the minute book of the general assembly, the minute book of the board of directors, the minute book of the supervisory board and so on.

3) Maintenance of the books

Companies shall keep in their custody and under their responsibility properly organized accounting records and other documentation relating to the company for a period of ten years counting from the last entry made in the books, unless determined otherwise in special provisions.

4) Liability for defects in the books

The company is liable for losses caused to third parties by defects observed in its corporate books.

5) The articles of incorporation

It is mandatory for the articles of incorporation to contain the followings.

The special rights of a shareholder can only be created by means of stipulations in the articles of incorporation.

a) The identification of the partners and of those who act as representatives in their stead (unless it is a stock company)
b) The kind of company
c) The business name of the company
d) The objective of the company
e) The head office
f) The duration
g) The capital of the company with an indication of the method and term of its payment (The amount of capital stock is always to be expressed in the national currency)
h) The share capital subscribed by each shareholder, the nature of each shareholder's entry
i) The composition of direction and supervision of the company
j) If the entry wholly or partly is in kind, the description of these assets and an indication of their respective values
k) The date the articles of incorporation are signed

6) Corporate bodies

The corporate bodies of commercial companies are the general assembly, the board of director, and the supervisory committee or the single supervisor. The existence of the supervisory board or of the single supervisor is compulsory in companies that are in any of the following situations:

a) Have ten or more shareholders
b) Issue bonds
c) Take the form of a joint stock company

The supervisory board is composed of three or five members, while the by-laws may determine its replacement by a single supervisor. A supervisory board member or the single supervisor shall be an auditor or a firm of auditors of accounts. The remaining members of the supervisory

board shall be individuals with full legal capacity. Supervision may also be undertaken by an independent auditing company.

7) Types of companies

The most important legal entities available for the conduct of business for profit are the SA companies (Limited Liability Stock Companies) and LDA companies (Closely Held Limited Liability Companies). According to the provisions of the Commercial Code, the main differences between both are the following:

	Limited liability stock companies (SA companies)	**Closely held limited liability companies (LDA companies)**
Liability	Each shareholder's responsibility is limited to the value of the shares subscribed.	Each shareholder's responsibility is limited to the value of the share capital.
Number of shareholders	Minimum requirement of 3 funding shareholders (if GOM is a shareholder, directly or through a parastatal, there is no minimum number of shareholders).	Minimum requirement of 2 funding shareholders (if GOM is a shareholder, directly or through a parastatal, there is no minimum number of shareholders), and the maximum number of shareholders is 30.
Division of share capital	It is split into shares (share certificates are issued and registered into the shares book)	It is split into quotas (representing percentages of ownership). The proof of ownership is the Articles of Association published in the official gazette and the certificate of incorporation (which state the name of each quota-holder and his/her quota value)
Organizational structure	It is mandatory to have the following corporate bodies: Shareholders meeting (there are legal requirements regarding the frequency and the formalities in respect of the convening and conduct of these meetings. Certain shareholders resolutions require the holding of a formally convened general meeting); Board of Directors and Fiscal Council.	The possible corporate bodies are the following: Shareholders meeting (that can be dispensed with for many routine resolutions; and extensive formalities in respect of convening meetings which apply to SA's do not apply to LDA's); board of directors (there are mechanisms to frequent board meetings); a fiscal council (audit committee) is not required by law (it may exist if the shareholders so wish).
Publications required	The articles of association, alterations to the articles of association, notices convening general meetings and annual financial statements are required to be published in the Official Gazette.	Only the articles of association and their alterations should be published in the Official Gazette, and registered at the Commercial Registrar.
Transfer of shares	SAs have a flexible capital structure , so it is easy transfer shares	It is governed by the articles of association which can provide lot of limitations. Some transfer of quotas must be processed by notarial deed.

As for this Project, both options, SA or LDA, can be adopted. However, considering that one of the requirements for the implementation company of the Large Scale Projects according to the PPP Law (refer to Clause 3.3, (3), 1)) is the obligation to reserve a participation for sale in the

stock market preferable for natural Mozambican citizens. If LDA is chosen at the start, when the sale to locals becomes mandatory, the SPE will have to transform the company into SA.

8) Incorporation procedures

To create and register a company, the investors may perform the following steps (that can be adjusted case by case):

a) Preparation of the necessary documentation needed to incorporate the entity including: Reservation of the company name (obtaining the clearance certificate for the name), draft and discuss the articles of association with a partner, issuance of corporate resolutions authorising the incorporation and the subscription of shares.

b) Submission of articles of association, proof of share capital (in case of incorporation of a company with real property) and other documentation, to the Notary

c) Signature of the deed of incorporation (The corporate contract can be concluded in a written document signed by all shareholders or their representatives, with a certified signature by Notary in person. In the case where the incorporation is made using real property, it is necessary to make a public deed.)

d) Issuance by the Notary of a certified copy of the recording (deed of incorporation).

e) Submission for publication of the articles in the Official Gazette and registration of the company with the Registrar Office for Registration of Legal Entities

(2) Land Legislation

In Mozambique the land is property of the State and cannot be sold or otherwise alienated, mortgaged or encumbered. The particulars can have access to land through the right of land use and benefits commonly called DUAT.

This Fertilizer Project will take place in Beira which is a municipal area. In the urban areas, the acquisition of DUAT is regulated by the Regulation of Urban Soil. Thus, from the different ways of acquisition of DUAT of the Municipality (namely authorization, raffle, public auction and private negotiations), only the private negotiation way can be applicable to this Fertilizer Project, as the other ways are applicable exclusively for national citizens or for non industrial projects.

The right of land use and benefit for the purposes of economic activities (like for industrial activity) is subject to a provisional term of two years, which is renewable and has a maximum term of 50 years after becoming definitive, which is a renewal for an equal period upon application by an interested party.

The acquisition of DUAT is subject to registration with the Real Estate Registrar Office.

(3) Environmental Legislation

1) Environmental licensing

According to the Environmental Law, it is prohibited to install infrastructures in which its dimensions, nature or location may cause significant impacts to the environment. The licensing of these kinds of activities is subject to previous environmental licensing, which is based on the environmental and social impact assessment (ESIA).

The ESIA procedures that can be applicable to this Project, as an activity of Category A, is the Environmental and Social Impact Study (EIS), which must be carried on by entities duly authorized and certified by the Ministry for Coordination of Environmental Action (MICOA) through the National Directorate of Environmental Evaluation (DNAIA) and Provincial Directorate for Coordination of Environmental Action, which are also responsible to approve EIS and grant the environmental license.

The procedure for ESIA is the following:

a) Preparation and submission of the pre-feasibility study and scope definition report (EPDA)

EPDA shall be prepared and submitted in order to determine the fatal issues related to the implementation of the activity, the scope of EIS and the draft of the terms of reference (TOR) The TOR is the guidance for EIS which must be pre-approved by MICOA.

b) Evaluation of the pre-feasibility environmental assessment report and TOR

A specialized commission of MICOA will issue binding comments and approval. The approval shall be issued within 30 business days from submission.

c) Implementation of EIS

EIS shall includes the procedure of public participation (which includes the consulting and hearing of all interested and affected parties, directly or indirectly, and is mandatory in the case of resettlement/relocation of population or communities or relocation of goods/assets or limitations on access to natural resources or when the interested citizens, environmental organizations, public and private entities ask for, every time that it is justified by the nature of the project). The notice of public hearing must be published in the main newspaper (and other communication means suitable, for example, Communitarian Radios) with at least 15 days in advance from the provided date. The report of the public participation procedure is included in the EIS report.

d) Submission of the draft EIS report

The draft EIS report in Portuguese shall be submitted to MICOA for approval (both in soft and hard copies).

e) After the evaluation of the EIS report by the specialized commission, final decision from MICOA shall be issued within 45 business days from submission.

f) Issuance of the Environmental Licence

If the EIS report is approved, the Environmental Licence should be issued within 8 business days after payment of the applicable fees (which is 0.2% of the investment amount).

The Environmental Licence is valid for five renewable years and can expire in the case that the implementation of the proposed project does not start within two years from the issuance date, unless it is applied for extension. The application for renewal must be submitted up to 180 days from the expiry date.

The owner of the project shall inform in written MICOA the start, stop and conclusion of the construction phase and the same for the operations phase.

2) Environmental regulations

Environmental regulations on gas and liquid emissions are determined, and it is required to submit the certification of compliance criteria for the acquisition of an environmental licence.

The penalties for non compliance with the environmental legislation is subject to fines and, in some cases may result in the cancellation of the environmental license or suspension of activities.

(4) Investment Legislation

1) Relevant institutions

The Ministry of Planning and Development has the competency to coordinate the investment process, and performs its duties through the following institutions:

a) Investment Promotion Centre (CPI)

A Mozambican State entity with the responsibility for the promotion, reception, analysis, monitoring and verification of investments carried out in Mozambique with the exclusion of SEZ and IFZ

b) Special Economic Zones Office (GAZEDA)

A Mozambican State entity that has been given the authority to coordinate all activities with regard to the establishment, development and management of SEZ and IFZ

2) Minimum value of foreign direct investment

The minimum value of foreign direct investment using the equity capital of a foreign investor to be eligible for tax benefits and investments guarantees is set at MT 2,500,000.00.

3) Investment project proposal

The investment project proposal shall be prepared in English or Portuguese, including: Project Overview, Total amount of the Investment in (Mozambican Meticais (MT) or United States Dollars (USD)), Economic Feasibility Study or Project Progress Plan, Number of local employees to be employed, Number of foreign employees to be employed, Technology and raw material to be used and its origin, Potential countries for exporting the production, and Social responsibility action plans. The following documents should be attached: Banking references or assurance of project funding, Financial statements of the last three years of each company proposing a project (if applicable), Taxpayer Identification Number (NUIT) Document, Authenticated copies of the identification documents of the investors, full Address and contact details (telephone, cell phone, fax and e-mail) of the investors or project managers, commercial registry certificate or name reservation certificate, existing licences (commercial, environmental, industry, etc. according with the project nature).

4) Project implementation commencement

The implementation of a project that has been authorized shall be commenced within a maximum period of 120 days counting from the date of notification of the authorization to the project proponents, unless a different time period is fixed in the authorization.

5) Transfer of investor's position or rights

The investor is allowed to transfer, wholly or in part, the position or rights held in an investment or the equity participation held in it, upon an express and duly founded request (indicating the recipient identity and the terms agreed upon in connection with such transfer or investment rights or position) made to the Minister of Planning and Development submitted through the CPI or Gazeda.

The benefits of such a transfer may only enjoy the guarantees and incentives provided for in the Investment Law if such operation has been approved, effected and registered, and during the period of validity of the authorization granted for the relevant undertaking.

6) Non-Tax incentives

Apart from the tax incentives, the investment legislation provides to the investors non tax incentives, namely:

- Guarantees to the investment (Legal protection of property and rights, including intellectual property rights; Transfer of dividends abroad; Arbitration in accordance with the rules of ICSID or ICC for the settlement of investment disputes; MIGA and OPIC services on issues relating to insurance risk investment etc.)

For those investments in the Special Economic Zones and Industrial Free Zones, additional non tax incentives are provided:

- More flexible employment regime, particularly with regard to the hiring of skilled foreign workers and licensing procedures;
- Special and extensive immigration regime;
- Free foreign exchange regime which also allows free off-shore transactions;
- Administrative and technical assistance available to the investor

7) General tax benefits regime

Mozambican companies or branches can apply for tax benefits that are available in accordance to the Tax Benefits Code. The minimum amount of investment is approximately USD 85,000 (can be through cash or investment in kind), and the main tax incentives are:

- Exemption of customs duties and VAT for products/ goods listed in “K Class” of Customs Tariff Schedule (v.g., machinery, tools, transport equipment)
- Investment Tax Credits (5% - 10%). The taxpayer would be able to deduct 5% - 10% of the investment done in fixed assets (with some exceptions, for example buildings and light passenger vehicles) on the tax computed during the investment period. The tax credit not deducted on the investment year can be carried forward to the following five years.
- Accelerated depreciation rates (increase of 50% of normal rates) of new buildings and equipment.
- Investments on new technologies are deductible (up to 10% of taxable income). The investment must be certified by the local authorities as new technology (there are no key criteria stated on the law).
- Professional training costs are deductible (between 5% - 10% of taxable income).
- Investments on Public Infrastructures are to be considered tax deductible (110% - 120%). The investment must be considered as done on Public Infrastructures and the taxpayer would be able to recognize an additional tax deduction to the taxable income of 10% or 20% of the investment amount.

8) Special tax benefits regime

The proposed Project site (Beira New Industrial Area) is neither IFZ nor SEZ, so the application to "Free Zone Enterprise in isolated Regime" shall be required, and it needs to get the benefit.

Regime	Tax benefits (From the date of the issuance of the respective Certificate of IFZ/SEZ Enterprises)			Other relevant issues
	Exemption in payment of customduties and VAT	**Exemption on CIT**	**Reduction on CIT**	
Industrial Free Zones (IFZ)	• On the importation of construction materials, machinery, equipment, accompanying spare and accessory parts and other goods used in the carrying out of the licensed IFZ/SES activity. • On the VAT on internal /domestic acquisitions as provided for in the VAT Code.	In the first ten (10) tax years	• 50% reduction in the CIT rate from the 11th to the 15th tax year • 25% reduction in the CIT rate for the remaining life of the project.	• 70% of annual production volume is mandatorily for export and only 30% is authorized for local domestic markets. • The sales to the local domestic market is subject to payment of customs duties, VAT and Special Consumption Tax. • The sale of goods and services by local domestic suppliers is considered to be an export. • The procedure to obtain the IFZ company certificate is easier, once the operator grants the compliance with the Customs Regime Regulations requirements. • The procedure to access the land is easy as it is granted by the Operator of the IFZ through a lease agreement. • There is a special employment regime.
Special Economic Zones (SEZ)		In the first three (3) tax years	• 50% reduction in the CIT rate from the 4th to the 10th tax year. • 25% reduction in the CIT rate from the 11th to the 15th tax year.	• It is allowed to sell its products into the local domestic market (with no limitations), subject to payment of customs duties, VAT and Special Consumption Tax). • The sale of goods and services by local domestic suppliers is considered to be an export. • Foreign employees may begin working prior to the issuance of the competent Authorization. • The procedure for obtention SEZ company certificate • The procedure to access to land is easy as it is granted by the Operator of the SEZ through a lease agreement.
Free Zone Enterprises in an Isolated Regime		In the first five (5) tax years	• 50% reduction in the CIT rate from the 6th to the 11th tax year. • 25% reduction in the CIT rate for the remaining life of the project.	• The procedure for obtaining the IFZ company certificate is complex and may consume time, once it involves the inspection of the premises and issuance of a certificate of security systems (provided that the installation complies with the IFZ Customs Regime Regulations). • The applicant is eligible only if the Initial investment is equal to or greater than MT 25,000,000.00 to be realized within the first two years of activity, or if the planned installed power capacity is equal to or greater than 500 kVA. • 70% of the annual production volume is mandatorily for export, and only 30% is authorized for local markets. • The sales to local domestic markets are subject to the payment of customs duties, VAT and Special Consumption Tax). • The sale of goods and services by local domestic suppliers is considered to be an export. • There is a special employment regime.

(5) Industrial Licensing Regulation

1) Application of Alvara

The companies that intend to perform the installation of industrial establishments and carry on industrial activity shall obtain an Industrial License (Alvara) issued by the Ministry of Industry and Commerce (MIC), that authorizes the activity.

Considering that this Fertilizer Project will be classified as large industrial establishment, the application is set out in a letter of request addressed to the Minister of MIC through the One Stop Shop (BaU), attached with the following documents and information:

- Name and details of the company representative, and address of company head office and location of the planned industrial activity;
- Copy of the articles of association duly published in the Official Gazette/certificate of commercial registration;
- Proof of ownership, lease agreement or DUAT
- Project plans that include:
  - A topographical plan including the location of buildings or proposed buildings, access roads, other buildings nearby, public roads and watercourses
  - A plan/layout of the industrial installation site including offices, warehouses, workshops, bathrooms, canteens, toilet facilities, drains and communications as well as elevations and cross sections, showing roofs, chimneys, stairs, the location of appliances, equipment, machinery, burning facilities, power generation facilities, boiler houses, storage of liquid, solid or gas fuels and compressed gases, finances, drying kilns, tanks, lifts, transporters, conveyor belts, cranes, hoists and all other outbuildings and equipment relevant to the establishment's operation
  - Project specifications that mention: manufacturing and process diagrams, information on raw materials with specification and quantities, production capacity and product compliance with legal standards, appliances, machinery and other equipments with their specifications, estimated number and sex of workers to be employed, total electric power capacity to be installed, safety mechanisms and measures foreseen to alleviate or mitigate any harm arising from operations, first aid and social installations, a water supply system, bathroom toilet and shower provisions, waste treatment facilities, etc.
  - Environmental License (including the EIS report)

2) Business licence and import card

For declaring the commencement of activity and enjoying the tax benefits on the importation of goods, it is common that the applicant that intends to carry on industrial activity obtains a commercial business licence with MIC, which is faster and easier to get for certain activities, while the industrial licensing procedure is in progress.

With the business license, it is possible also obtain the import card with MIC, in order to perform importation of goods for the project.

(6) Construction Legislation

The companies that intend to install industrial establishments and it is necessary to carry out civil construction works for this purpose, shall obtain a Building License issued by the Municipality (considering the possible location of the project).

(7) Foreign Exchange Legislation

1) Capital transactions

All funds to be imported into Mozambique and that is considered as capital transactions (in opposite to current transfers-payment of acquisition of goods and services, which is not subject to prior approval) is subject to the foreign exchange control which comprises the prior approval of the transaction and registration of the remittances with the Central Bank.

The remittance of funds that is classified as capital operations or the signature of loan/financial agreement without any authorization from the Central Bank is subject to penalties: from MT 40,000 to MT 1,000,000.

The lack of registration of foreign direct investment, within 90 days from the effective date of authorization or of the effective entry in Mozambique of the investment amount implies the non-recognition of the right to export profits or dividends, as well as the re-export of capital invested or repay the loan. The commercial banks usually do not credit amounts on the company’s bank account without correspondent proof of the capital transaction authorization.

2) Receipt of exportation of goods (current transactions)

Resident entities shall be required to remit to the country their revenues deriving from exports of goods, services and investments abroad, within 90 days from the shipment of goods (this will be the case of this Fertilizer Project).

The revenue remittance shall be done through bank transfer and it shall be recorded in the beneficiary’s bank account in domestic currency, on the basis of the foreign exchange rate of the local bank on the effective remittance date. However, up to 50% of the remittance amount can be kept in foreign currency (normally for the amortization of loans in foreign currency contracted at the national banking system.)

In the other hand, the Central Bank may exempt the resident entity from the requirement of remittance of the revenues, authorizing the withholding abroad of part of revenues for the following purposes: (i) debt amortization and fulfillment of other obligations abroad, (ii) urgent payments to international transportation companies and related activities up to the limit periodically established by the Central Bank. The surplus amount after the fulfillment of the obligations shall be remitted to Mozambique within 90 days after the fulfillment, and the resident entity shall remit to the central Bank on a monthly basis the bank account statement.

3) Opening of bank accounts abroad by resident entity

To make affective the exemption of the abovementioned remittances, it will be necessary to have a bank account with a financial institution abroad. The opening and operation of a bank account abroad is subject to prior authorization from the Central Bank by submitting the proper application form and a written justification for opening the bank account abroad. The bank account shall preferably be opened with a correspondent financial institution of a bank authorized to operate in Mozambique, and the bank account holder shall remit to the Central Bank the number of the bank account opened, within 30 days from the opening date,and submit the respective bank account statement on quarterly basis.

4) Payment of distributed dividends/profits

It is a current transaction and, therefore, not subject to pre-approval from the Central Bank. It is made by submission to the commercial bank of the identification of the parties, the proof of investment registration with the Central Bank, the audited financial statements confirming the profits, the resolution of a general meeting approving the profit distribution, and the tax clearance certificate attesting the payment of taxes related to the transaction.

5) Repayment of loan

It is a current transaction and, therefore, not subject to pre-approval from the Central Bank. It is made by submission to the commercial bank of the identification of the parties, the proof of the loan authorization issued by the Central Bank, proof of registration of the disbursements with the Central Bank, amortization plan or debt notification, and the tax clearance certificate attesting the payment of taxes related to the transaction.

6) Payment of salary abroad

The salary payments to offshore bank accounts is a current transaction and, therefore, not subject to pre-approval from the Central Bank, provided that:

- The employment contract was duly approved by the Ministry of Labour;
- The applicable payroll tax is paid to the Tax Authority.

For the bank transfer, the employer needs to provide to the commercial bank the copy of the certificate of incorporation of the employer (if not available in the bank), the copy of the DIRE (resident permit)/passport of the employee (in case the employee does not have an account in the same bank), the copy of the employment contract, the copy of the approval of the employment contract by the Ministry of Labour, the tax clearance certificate issued by the Tax Authorities confirming the payment of the payroll taxes, and a simple letter issued by the employer detailing the amounts/salary that the employee receives or a payslip.

(8) Fertilizer Legislation

In July 2013 the first Fertilizer Regulation came into force in Mozambique, with the objective to assure the quality of fertilizer in the country, and to protect the public health, the animals and the environment. In this regard and according to the regulation, the production, distribution, importation, exportation and utilization of fertilizer is subject to prior registration through an application submitted to MINAG by a company duly registered in Mozambique that assumes all responsibility for the quality of fertilizer.

1) Registration

The definitive registration is confirmed by the issuance of a registration title which is valid for five years, and shall be renewed up to the termination of the validity date of the previous registration, under penalty of a payment of an additional 50% of the renewal fee, if submitted within two months after expiry, or to perform a new registration, if submitted after two months.

The registration shall be updated every time significant changes (on the technical and scientific data that supported the registration, mainly on the environmental and biological impact) take place and shall perform a new registration when there are changes on the composition or on the type of formulation of a fertilizer. The registration can be revoked by the Register due to institutional, scientific or technical reasons.

2) Production

The production of fertilizer is subject to authorization by MINAG, under the favourable opinion of MICOA, provided it is according to the Mozambican Standards, and in absence, with the International Standards. The application must be attached with the environmental licence and other mandatory licences and proof of payment of the applicable fees. The fertilizer plant must have a laboratory with technical personnel adequate to assure the conformity of the fertilizer with the applicable standards.

(9) Labour Legislation

1) Type of contract

Type	Description	Specific rules	Probation period
Fixed term contract	There is a specific termination date	• It is only allowed for the performance of temporary duties, for as long as is strictly necessary for this purpose. • It is allowed only for a period of up to 2 years, renewable twice by agreement between the parties (under the penalty of being considered as permanent in case that it exceed the maximum period or number of renewals allowed.	• 90 days for contracts for longer than 1 year • 30 days in the case of contracts for a term of between 6 months and 1 year • 15 days for fixed term contracts for up to 6 months
Permanent employment contract	There is no termination date		• 180 days for intermediate and higher level technicians, and employees who hold leadership and management positions • 90 days for other employees
Unspecified term	The termination date is subject to occurrence of specific fact which date is not certain	• It is only allowed where it is not possible to predict, with certainty, the period within which the reasons justifying the term. • The notice period to which the denunciation (termination of an employment contract by one party giving) is subject must have expired and, in any case, there must have occurred an event to which the parties have attributed extinctive effect. • An employee employed for an unspecified term shall be considered as employed permanently if he or she continues in the employer‟s service after the date when the denunciation takes effect.	• 15 days when the term is expected to be 90 days or more.

2) Duration of work

Normal working hours shall not exceed 48 hours per week and eight hours per day, and shall be subject to an interval of at least half an hour, but not longer than two hours, without prejudice to work performed in shifts.

The normal daily working hours may be extended to nine hours per day, provided that the employee is given an extra half day of rest per week.

Under collective labor regulation instruments, normal daily working hours may be increased in exceptional cases by up to a maximum of four hours, provided the weekly working time shall not exceed 56 hours. Only exceptional work and overtime performed for reasons of force majeure shall not count towards this limit.

Establishments engaged in industrial activity may adopt a normal working week of 45 hours, spread out over five days in the week.

Employer's duties regarding the working hours:

- Establish a working hours schedule for their employees, after prior consultation with the relevant trade union body;
- Obtain the endorsement of the working hours by the relevant labor administration office;
- Display the working hours at a visible location in the workplace; and
- Inform the nearest office of the ministry in charge of labor about the implementation of new working hours, by the 15th day of the month following the month in which they are introduced.

The employees in leadership or management positions, or positions of trust or supervision or those whose duties are such that the performance thereof justifies such a regime may be exempt from the working hours' schedule.

In enterprises where work is continuous and in those whose business hours are longer than the maximum limits on normal working hours, employers shall arrange shifts of different staff, provided that the length of each shift may not exceed the maximum limits on normal working hours established in the law, and the shifts function in rotation, so that employees are replaced successively in regular periods of work.

All employees are entitled to a weekly rest period of at least 20 consecutive hours on a day that is normally Sunday.

Work performed on rest day or public holiday is considered exceptional work, and shall be paid at the normal wage rate plus 100%, and shall be entitled to a compensatory full day of rest on one of the following 3 days, unless the exceptional work does not exceed five hours, in which case the employee shall be compensated with a half day of rest.

Work performed over and above the normal daily working hours is considered overtime, and if performed until eight o"clock at night shall be paid at the normal wage rate plus 50%, and overtime performed between eight o"clock at night and the start of the normal working hours of the following day shall be paid at the normal wage rate plus 100%.

Each employee may perform up to 96 hours of overtime per quarter, but no employee shall perform more than eight hours of overtime per week nor exceed 200 hours per year. Employers must keep a register of exceptional work and overtime in specific book, in which relevant notes shall be recorded before the exceptional and overtime work begins and after it ends, and the reasons for it expressly stated and confirmed by the employee who performed it.

3) Annual holidays

Unless there is a better regime provided in the employment contract or collective agreement, the employer shall be entitled to enjoy the following paid annual holidays:

- One day for every month of actual service, during the first year of service;
- Two days for every month of actual service, during the second year of service;
- 30 days for every year of actual service, from the third year onward

The employer, in co-ordination with the trade union body, shall draw up a schedule of annual holidays.

4) Remuneration for work

All employees, whether nationals or foreigners, without distinction based on sex, sexual orientation, race, color, religion, political or ideological convictions, family background or ethnic origin, have the right to receive a wage and to enjoy equal benefits for equal work. The Government, in consultation with the Consultative Commission on Employment, shall set the national minimum wage or wages applicable to categories of employees whose employment conditions are such that the protection of these employees is warranted. The current minimum wage in December 2013 for industrial (manufacturing) sector is MT 3,943.

5) Employment of foreigners

As a general rule, the hiring of foreign employees that entered the country on diplomatic, courtesy, official, tourism, visitor, business or student visas, or that do not have the necessary academic or vocational qualifications, or when there is nationals in sufficient number having the same qualifications is not allowed .

The employment of foreign nationals is subject to the compliance with the specific authorization or communication procedures case according to the applicable regime to each case, under penalty of suspension of the involved employee and a fine in the amount between five and ten times the monthly salary of the foreign worker in relation to whom the violation occurred

a) Employment of foreigners (general regimes)

Hiring regime	Eligible company	Number of foreign employees authorized	Formalities
Quota	Large enterprise (that employs more than 100 employees)	5% of the Mozambican employees	Simple communication of the employment of a foreigner within 15 days of their entry into the country, by attaching the following documents: a) two copies of the communication letter in the proper form, communicating the admission of the foreign citizen and the degree of fulfillment of the quota; b) three copies of the employment contract; c) quittance certificate issued by the National Institute of Social Security ; d) quittance certificate issued by the entity responsible for finance; e) named list of workers for the previous calendar year, in the first communication made; f) Certified copy of the passport or Residence Identification Document for Foreign Citizens (DIRE); g) Deposit slip proving payment of a fee corresponding to three times the minimum wage in force for the company's area of activity.
	Medium-sized enterprise (that employs more than 10 but not more than 100 employees)	8% of the Mozambican employees	
	Small enterprise (that employs up to 10 employees)	10% of the Mozambican employees	
Investment Projects	With the investment approved by CPI/Gazedaor other Government Entity	Provided in the investment project approval document (normally the percentages are more than provided for the quota regime)	Simple communication of the employment of a foreigner within 15 days of their entry into the country, by attaching the copy of the investment project approval document, and the documents provided for the quota regime.
Authorization	All companies	No specific limit	Submission of an application addressed to the Minister responsible for labour, attaching the following documents: a) three copies of the work contract; b) certificate of academic or technical/professional qualification of the foreign citizen to be employed and document proving professional experience, together with the equivalency certificate issued by the Ministry of Education; c) quittance certificate issued by the National Institute of Social Security; d) quittance certificate issued by the entity responsible for finance; e) opinion of the union delegate, union committee or sectoral union; f) deposit slip proving payment of a fee corresponding to ten times the minimum wage in force in the company's sector of activity.

b) Employment of foreigners (special regimes)

Hiring regime	Eligible company	Number of foreign employees authorized	Formalities
Special	IFZ enterprises	Maximumof 15% of the total personnel, excluding leadership positions,and after 7 years these number shall reduce to a maximum of 3 employees, and the general regime should be applicable.	• Foreign employees may begin working prior to the issuance of the official permission under a contract with resolutive condition,provided that the application is submitted to the to the competent labour administration authority within a maximum period of 45 days counted from the date of work commencement by the foreigner. • The application shall be submitted with the following documents and information: a) name, address and employer activity, b) name, age, passport number and nationality, c) tasks to be performed and contract period, d) academic and professional certificates or information reporting workers' professional experience issued by the latest employer and CV, e) four copies of the employment contract signed by the parties with details on work conditions, salary, forms of payment and holiday schedule. • The request is free of charge/fees.
	SEZ enterprises	No specificlimit	• Foreign employees may begin working prior to the issuance of the competent authorization, provided that the application for is submitted through GAZEDA to the to the competent labour administration authority within a maximum period of 15 days counting from the date of the commencement of work by the foreign employee. • The application for registration of the foreign employee shall take place also in 15 days, and shall contain the following items: a) Name, address and activity of the employer; b) Name, age, passport number and nationality of the foreign employee; c) Tasks to be executed and duration of the contract; d) Certificates of educational and technical-professional qualifications or information regarding the employee's professional experience issued by the last employer, and annexed to the employee's "curriculum vitae; e) Declaration of compliance with the communication requirements; f) Quittance certificate issued by the entity responsible for finance; g) quittance certificate issued by the National Institute of Social Security; h) Four copies of the employment contract executed by the parties.

3.3 Legal System Related to PPP Project in Mozambique

(1) Mega-Projects Law

The Mega-Projects Law (law that regulates public-private partnerships, large-scale projects and business concessions), defines the Public-Private Partnership (PPP) as "an undertaking in a

public domain area, excluding that of mineral and petroleum resources or in an area of provision of public services, in which, under contract and with full or partial financing of the private partner, that partner undertakes, vis-à-vis the public partner, to accomplish the necessary investment and to operate the respective activity, for the efficient provision of services or goods, and the Large-scale project (LSP), as the undertaking of an investment authorized or contracted by the Government, the value of which, exceeds MT 12,500,000,000 (twelve billion and five hundred million Meticals)."

The Fertilizer Project will be classified as LSP, considering that the fertilizer production is not integrated in a public domain area.

The law is applicable to all PPP, LSP and Business Concessions undertakings carried out in the country, at the initiative or decision and control of public entities of either the central, provincial and district levels as well as of the Municipalities.

LSP undertakings are subject to sectoral and financial oversight conducted respectively by the Government entity responsible for the area or sector in which each is located and by the Ministry of Finance.

The contractual modality of awarding an LSP undertaking, under the terms of specific legislation on investment, is in the form of the Investment Project Authorization, granted pursuant to the referred legislation.

(2) Legal Regime for Contracting

According to the Mega-projects law, the general legal regime for contracting PPP, LSP and business concessions is the public tender. However, considering the project of high public interest with the fulfillment of legal requirements, the contracting may take the modality of tender with prior qualification or two stages tender.

And in weighty situations and once duly justified, and as a last resort measure subject to prior express approval by GOM, the contracting may exceptionally take the form of negotiation and direct award.

For this Project, due to the weighty situation and high public interest regarding the domestic production and distribution of urea fertilizer and due to the fact that the Survey Team has discussed the gas procurement with a gas supplier including private enterprises, the contracting is considered to take the form of negotiation and direct award.

(3) Benefits in the Investment Project Authorization

The most relevant benefits that shall be included in the Investment Project Authorization are the following:

1) The participation reserved for sale, via the stock market in favor of the economic inclusion, preferably of Mozambican natural persons, in the share capital of the joint venture equity (to take place up to the 5th year of the undertaking, and the par value of the shares shall be accessible to the majority of the Mozambican population with limited financial capacity in a percentage not less than 5% nor greater than 20% of the referred capital).

2) The opportunity for a Mozambican public or private corporate person to participate in the share capital of the undertaking or the equity of the joint venture, under terms to be negotiated and agreed by the parties, without prejudice to the abovementioned rules; and

3) The equitable sharing of the extraordinary direct benefits under the contractually agreed terms and in any one or a combination of the following forms:

   a) Carrying out of reinvestment in the national territory;

   b) Constitution of a reserve for carrying out additional investments or to cover extraordinary losses of the undertaking;

4) Offer of work posts and professional training programs for Mozambican employees, including the transfer of technology and know-how to the Country;

5) Increase and maintenance of the production and export capacity and of the capacity to supply internal market needs;

6) Contribution to the development of Mozambican small and medium enterprises;

(4) According to the regulation of the Mega-Projects Law, the implementing entity of the LSP is responsible for the financing and full realization of the investments needed for the undertaking, in the terms provided in the Investment Project Authorization, for exploration and management of the activity and for maintenance of the undertaking. The procedures for the LSP undertakings will be carried out according to the specific legislation of the industrial sector and investment legislation. The investment project proposals are submitted to GAZEDA by the entity responsible for sectoral oversight, using the proper form, and the evaluation of the proposal of the investment project is made by a technical commission of the GAZEDA and submitted to the competent Government entity for decision.

3.4 Tax Related Legislation in Mozambique and its Overview

3.4.1 Tax Legislation Related to the Project

		Legislation
1	CIT	[CIT Code] **CIT Code:** Law No. 34/2007, from 31st of December **CIT Code amendments:** Law No. 20/2009, from 10th of September Law No. 4/2012, from 23rd of January Law No. 19/2013, from 23rd of September **CIT Code regulation:** Decree No. 9/2008, from 16th of April **CIT Code regulation amendments:** Decree No. 68/2009, from 11th of December Decree No. 3/2012, from 24th of February [CIT assets depreciation regime] Governmental Order No. 20817, from 30th of December(in discussion to be replaced)
2	VAT	[VAT Code] **VAT Code:** Law No. 32/2007, from 31 st of December **VAT Code amendments:** Law No. 3/2012, from 23rd of January **VAT Code regulation:** Decree No. 7/2008, from 16th of April **VAT Code regulation amendments:** Decree No. 4/2012, from 24th of February [VAT refund regime] Decree No. 77/98, from 29th of December
3	PIT	[PIT Code] **PIT Code:** Law No. 33/2007, from 31 st of December **PIT Code amendments:** Law No. 20/2013, from 23rd of September **PIT Code regulation:** Decree No. 8/2008, from 16th of April [PIT withholding tax regime] Ministerial Law No. 109/2008, from 27th of November
4	Social Security	**General law:** Law No. 4/2007, from 7th of February **Regulation:** Decree No. 53/2007, from 3rd of December **Rates:** Decree No. 4/90, from 13th of April
5	Custom Duties	**Customs table and general rules:** Law No. 6/2009, from 10th of March **Specific regulations:** Decree No. 34/2009, from 6th of July Ministerial Law No. 16/2012, from 1 st of February Ministerial Law No. 307/2012, from 15th of November Ministerial Decree No. 116/2013, from 8th of August
6	Stamp Duty Code	Decree No. 6/2004, from 1st of April, amended by Decree No. 38/2005, from 29th of August
7	Others	[TAX benefits] **Tax Benefits code:** Law No. 4/2009, from 12th of January **Tax benefits regulation:** Decree No. 56/2009, from 7th of October [Municipal Tax Code] Law No. 1/2008, from 16th of January

3.4.2 Overview of Each Related Tax Legislation

(1) Corporate Income Tax (CIT)

1) The CIT rate

The CIT rate applicable to the type of business that the Sumitomo Corporation intends to engage in is 32% of taxable net profit (chargeable income).

2) Tax deductible costs

Generally, expenses are deductible for tax purposes, provided that they are indispensable for the obtaining of income. There are some costs that are not deductible for tax purposes, such as:

- Tax penalties and taxes paid on behalf of third parties
- Undocumented expenses
- Excessive depreciations
- Unrealized foreign exchange differences
- 50% of costs with light passenger vehicles(except when the vehicles have as purpose to be used on the scope of the operational activity of a company, namely a car rental activity)
- Publicity expenses exceeding 1% of the turnover
- Interest that would be deemed to be excessive under the thin capitalization rules.

3) Thin capitalization

Mozambique tax law sets out thin capitalization rules. When calculating the taxable profit of a Mozambican company, interest paid by a Mozambican company on excessive debt to a non-resident related party is not deductible.

The Tax Code determines as follows when a non-resident lender is regarded as a related party:

- The non-resident entity holds directly or indirectly at least 25% of the share capital of the resident corporate taxable person (the borrower);
- The non-resident entity, without reaching this level of shareholding, exercises a significant influence in the management of the resident corporate taxable person;
- The non-resident entity and the taxable corporate person are under the control of the same entity, namely by virtue of such entity being a direct or indirect shareholder; and
- One of the entities has provided the other with a guarantee related to a loan

Excess indebtedness occurs when the amount of the borrower’s total debt to each shareholder (at any time in a tax period) exceeds twice the value of the corresponding participation in the equity of the resident taxable person (2:1 ratio) held by that non-resident.

The New Foreign Exchange Regulation that came into force on 11 July, 2011 brought some changes to the related party loan agreement conditions and in particular the interest rates. According to the Regulation, the interest rate, which shall not be equal to or in excess of the interest rate used in the open market, and shall preferably be zero.

4) Tax losses

The tax losses can be carried forward over the following five years. The tax losses may be lost in case there is a significant change in the scope of the activities rendered.

5) Capital allowance

A company is granted a capital allowance for each year of assessment for which the asset was used in the carrying on of business during that period. Depreciation rates can vary from 2% up to 25% depending on the nature of the asset.

Intangible assets are depreciated over its useful life.

6) Transfer pricing

There is a provision in the Mozambican CIT Code that prevents transfer pricing abuses. Where there is a transaction between related entities, the Mozambican CIT Code empowers the tax authorities to provide the necessary corrections to reflect the chargeable income the persons would have realized in an arm's length transaction.

Currently there is no transfer pricing comparable methods published in Mozambique, whereby the taxpayer may use the international guidelines available.

7) Domestic withholding tax rates

The Mozambican CIT Code determines that certain payments, such as dividends, royalties, interest, rents, service fees, rental of equipment, made to any resident entity are subject to a withholding tax. The taxes withheld are required to be delivered to the Mozambican tax authorities on or before the 20th day of the following month in which the taxable event occurs.

8) Income from capital gains

According with the tax frame in force from 1 January 2014 onward, in the event that the capital gain is obtained by non-resident entities from the disposal of shares of a Mozambican entity the effective CIT tax rate is 32%.

Moreover, only 50% of the capital gains derived by non-resident entities from the disposal of immovable property are subject to tax (effective tax rate of 16%).

The capital gains derived from either the disposal of shares or the disposal of immovable property are not liable to any withholding taxation. In this situation, the non-resident entity must nominate

a tax agent in Mozambique in order to submit the tax return and pay the tax to be due under the terms above detailed.

9) Other income

The Mozambican CIT Code determines that certain income tax from payments, such as dividends, royalties, interest, rents, service fees, rental of equipment, made to any non-resident entity are subject to a withholding tax. The withholding rates for dividends, royalties and interest are 20% respectively. The taxes withheld are required to be delivered to the Mozambican tax authorities on or before the 20th day of the following month in which the taxable event occurs.

(2) Value Added Tax

1) General remarks

VAT is an indirect tax and the general rate is 17%. VAT is levied on the supply of goods and services undertaken in the national territory (including importation).

Output VAT and input VAT are assessed on a monthly basis (submission of VAT monthly return) and where the output VAT exceeds the input VAT, the payment should be made up to the last day of the following month.

In Mozambique there is no single VAT registration. There is a single Tax Number (NUIT) that is applicable for all taxes.

The VAT incurred on pre-incorporation or pre-registration of local companies/branches in Mozambique is not recoverable.

The following services provided by non-resident entities are subject to VAT reverse charge method:

- Transfer or right of use copyrights, licenses, trademarks and similar rights;
- Advertising services, telecommunication services;
- Services of consultants, engineers, lawyers, economists and accountants, consultancy bureau in all fields, including management and R&D;
- Banking, financial insurance and reinsurance transactions;
- Supply of staff;
- Leasing of movable property, including the financial leasing thereof;
- Transport services within the national territory; and
- Services related to immovable property located in the national territory.

2) Non-deductible VAT

No VAT can be deducted whenever related to the following expenses:

- Acquisition, manufacture, importation, leasing, including financial leasing, use,transformation and repair of such as light passenger vehicles and motorcycles (except for when the sale or use of goods relate to the main business activity of the taxable person);
- Fuels (not for resale) for motorized vehicles, except for diesel fuel, where 50% of the tax is deductible. For heavy passenger vehicles, vehicles licensed for public transport of passengers, excluding rental cars, machinery consuming diesel that is not registered and tractors used exclusively or predominantly for agricultural activities, 100% of the tax on diesel is deductible.
- Transportation and travel costs of taxable persons and their staff;
- Accommodation, food, beverage and tobacco and hospitality expenses. (except for the accommodation and food costs incurred by travelling business persons acting in their own name and in the course of their business);
- Telephone communications, except for those related to fixed telephones maintained by the taxable person;
- Entertainment and luxury, being costs which are not normal expenses of the business.

3) Exportation of goods

According to the VAT code, the exportation of goods is exempt from VAT.

If the VAT deducted exceeds the VAT payable, the difference may be carried forward for the subsequent periods.

If the taxpayer remains on a VAT credit position, a refund can be requested by the taxpayer, whenever the tax credit remains for a period of, at least, twelve months, and the amount exceeds MT 50,000. This procedure requires the fulfillment of some formalities and requires that all supporting invoices meet the tax legislation requirements and are duly registered (once a limited tax audit is performed by the tax authorities within the refund process).

4) Invoice requirement

A tax invoice is a document which should comply with the requirements established in the VAT Code and other supplementary legislation, in order to enable taxable persons to rebate the VAT incurred on the inputs. Generally, the tax invoice should contain the following information:

- Sequential Number printed by an authorized printer, unless processed by a computer, and in this case invoices processed by a computer shall be communicated to the respective

Tax Department and include the information “process adapor computador” (processed by computer);

- Date of issue;
- Indication of original or copies;
- Complete identification of the supplier (Name, address, and NUIT);
- Complete identification of the recipient (Name, address, and NUIT);
- Quantities and description of goods supplied or services rendered;
- Specific note on returnable packaging “not for sale”, if applicable;
- Unit sale price of supplied goods or rendered services, excluding VAT;
- Total price of the goods supplied and services rendered, excluding VAT (taxable amount);
- VAT rate;
- Tax due obtained by applying the rate to the taxable amount;
- Invoices or equivalent documents (other than processed by computer) printed by authorized printers shall contain information by which to identify the printer, namely the trading name, address information, number of the license issued by the Ministry of Finances and tax identification number;
- Reasons for not applying the tax, if this is the case, indicating any special VAT regime (if applicable) or the concrete VAT exemption applied to the specific transaction (including the relevant article of VAT Code).

Moreover, all invoices must be written in Portuguese (or bilingual as long as a Portuguese translation is included) and should include the amount expressed (or its equivalent) in local currency (Metical).

(3) Personal Income Tax (PIT)

1) Residency

According to the local regulations, an individual is a resident in Mozambique for tax purposes whenever he is more than 180 days in the country or, even if staying less than 180 days, whenever the individual has available permanent residence in conditions that indicate an intention to keep and occupy it as its habitual residence.

If the employees would qualify as residents in Mozambique, they would be liable to PIT on their worldwide income. On the other hand, if the employees would qualify as non-residents in Mozambique, they would be liable to PIT only on the income related with the work performed in Mozambique and other income obtained in this territory.

Moreover, in case the employees are expatriates from countries with a DTA celebrated in Mozambique, they would be able to apply the dispositions of the DTA in order to define its tax residency.

The PIT withholding tax shall be remitted until the 20th of the following month to the tax authorities.

2) Taxable base

For PIT purposes, it is considered as a taxable base related to employment income all remuneration paid resulting from work rendered under an employment or equivalent agreement including salaries, bonus, and other complementary remuneration.

Moreover, the following may also be considered as employment income within certain limits/conditions:

a) Travelling

Travelling and accommodation paid by the employer and not related to the functions undertaken by the employee at the service of the same entity.

b) Meals

Meals cost or allowances that exceed on a monthly basis the official minimum salary for the respective profession should be considered as accessory remuneration and therefore subject to tax.

c) Housing

Housing allowances or the use of a house provided by the employer is considered as a fringe benefit and therefore subject to tax. The amount to be considered as income should be equal to the rent paid by the employer. However, an exception is applicable whenever the houses are located in the employer's yard.

d) Vehicles

The use of a company vehicle is considered as a fringe benefit and therefore subject to tax only when there is a written agreement between the employer and employee for the use of the vehicle. The annual income is equal to 0.25% of the vehicle cost.

e) Taxes

Taxes and other costs due by the employee and borne by the employer

The allowances and benefits liable to taxation exclude the following:

- A reimbursement or discharge of a person's dental, medical, or health insurance expenses where the benefit is available to all full time employees on equal terms;
- The cost of transport to or from Mozambique in respect of an expatriate's appointment or termination of employment where the expatriate is recruited outside Mozambique and is in Mozambique solely for the purpose of serving the employer.
- Where an employer provides accommodation to its employees at the site where the field operation is carried on, i.e. where the field work is performed (e.g. mining, farming, etc);
- A severance payment (under certain conditions);
- A discharge or reimbursement by an employer of an expenditure incurred by an employee on behalf of the employer that serves the proper business purposes of the employer.

3) Tax rates and returns

If the employees would qualify as residents in Mozambique, they would be liable to PIT on their worldwide income at a progressive final tax rate that could arise up to 32%.

In certain situations, a tax credit shall be available in case any foreign taxes were charged on the income obtained outside of Mozambique.

The income related to dependent work shall be subject to final withholding tax on a monthly basis and shall not be included in the annual tax return (Model 10).

If the employees would qualify as non-residents in Mozambique, they would be liable to PIT, only on the income related with the work performed in Mozambique, at a final withholding tax rate of 20%.

Additionally, whenever there is a new employment contract, the Model 11 return must be duly filled by the employee with the information of its marital status and number of dependents. Such a Model must be delivered to the employer in order that the withholding PIT rate can be correctly calculated.

(4) Social Security Contributions

The Social Security contributions are mandatory and are shared between the employer and the employee. The Social Security taxable base is all regular and expectable remunerations from the employment contract. The tax rates are: 4% for the employer and 3% for the employee.

For expatriates, the Social Security contribution can be waived in case it is proved that the individual remains contributing for a public scheme of Social Security in the home country, and an approval is granted by the Mozambican Social Security Institute.

Except in the case of self-employed workers, the employer is responsible for registering the workers.

The Social Security contributions shall be remitted until the 10th of the following month.

(5) Custom Duty

1) Importation of goods

The import duty tax rate should be determined for each specific goods, between 0% and 20%, according to the Customs Table. To proceed with any importation within Mozambique, a local company/branch has to be registered as an import operator.

The import of goods would generally be liable to 17% VAT (some exemptions may be applied), which should be paid at the import date. For the calculation of the taxable amount, the CIF incoterm (transaction value plus transport and insurance costs) is applicable.

A case by case analysis should be pursuit in relation to each specific item to be imported.

2) Temporary importation

According to the Customs Regulation, upon approval from the customs authorities/tax authorities, some equipment can be subject to a duty-free "temporary import" if it would be subsequently exported.

For this purpose, the business entity would have to provide a bank guarantee that could go from 100% (import amount of approximately USD 5,000) to 5% (import amount exceeding approximately USD 1,000,000).

(6) Stamp Duty

Stamp duty is levied on all acts, deeds, documents, securities, and other transactions which are not subject to VAT.

Moreover, any contracts are also liable to Stamp Duty –MT 200 for each contract.

The acquisition of immovable property is also liable to Stamp Duty at a 0.2% tax rate, on the transaction value

(7) Other Taxes

1) Property Transfer Tax

The acquisition of immovable property is liable to Property Transfer Tax at a 2% tax rate (10% if the acquiring entity is a resident of a tax heaven), on the value of the transaction or on the market value of the immovable property, whichever is higher.

2) Property Municipal Tax

The Property Municipal Tax is due on the official evaluation amount of the property (as per the property registration records) or, if that information is not available, on the amount declared by the owner (subject to correction if it is proven that it differs from its market value). The tax rates are 0.4% for housing facilities and 0.7% for other facilities.

The Property Municipal Tax is only due on urban property, which includes any property with a building or other permanent constructions on it.

The Property Municipal Tax is due on an annual basis (considering the owner of the property as of 31 December of the previous year), and should be paid in two installments, in January and in June. The liquidation of the tax should be the responsibility of the municipal services.

3) Personal Municipal Tax

Personal Municipal Tax is levied on all residents national and foreign individuals in the respective Municipality, aged between 18 and 60 years and with respect to who circumstances of occupation and fitness for work apply.

The tax amount in force annually at each municipality is calculated by applying the rates on the minimum national salary at 30 June of the previous year. The rates may vary between 1% and 4%.

In the case of Personal Municipal Tax taxpayers who are simultaneously taxpayers of the PIT (employment income), the tax is collected by withholding the amount on the respective salaries processed by the employer.

4) Municipal Tax on Vehicles

Municipal Tax on Vehicles is levied on the use of vehicles registered with the competent services in the Mozambican Territory or, irrespective of the registry, as soon as 180 days have elapsed from the date of entry in the same territory.

The taxpayers of the Municipal Tax on Vehicles are the owners of the vehicles. The Municipal Tax on Vehicles is annual and, for light vehicles, the tax may vary between MT 50 and MT 4,400, depending on the specific type of vehicle.

Chapter 4 Review of PPP Business Model for Urea Fertilizer Complex

4.1 Review of the PPP Business Plan

4.1.1 Information on Gas Field

In this Project, it is supposed that the gas will be supplied from the Pande/Temane gas field. At Pande/Temane, Sasol is developing a gas field in PSA mining area, and its gas reserves may become clear at the beginning of 2014. Meanwhile, it is said that Sasol plans to start the actual drilling in the area on or after 2015, so it is necessary to keep studying the possibility of gas procurement from the Pande/Temane gas field, with due consideration to Sasol's development plan.

One of the alternative candidates for procurement of gas is the Buzi gas field, which is located near Beira. Buzi Hydrocarbone is preparing for development of the gas field, conducting the tender announcement for necessary equipment, and so on. After the forthcoming geological investigation and preparation of access road, Buzi Hydrocarbone plans to start drilling 2 wells, which is scheduled in May or June, 2014.

Buzi Hydrocarbone has a contract with GOM to develop 4 wells, so Buzi Hydrocarbone needs to develop the remaining two wells sometime in the future. The development schedule of the remaining two wells depends on the production of the first two wells, but anyway the production volume from the gas field will become clear to a certain degree by the initiation stage of this Project. Buzi Hydrocarbone says that they are targeting to start production at the end of 2016, so as well as the Pande/Temane gas field, the Buzi gas field is a candidate for the gas procurement for this Project.

The Buzi gas field is closer to the Project site than the Pande/Temane gas field, which brings advantage on the profitability of the gas pipeline business, but there is a lot of uncertainty regarding the gas reserve in Buzi, so the Survey Team considers the Pande/Temane gas field as the main option for gas procurement for this Project planning.

The Rovuma gas field is also one of the alternative candidates for procurement of gas. Anadarko and Eni are proceeding the development plan mainly for LNG exporting, but it is determined that part of the gas will be allocated for domestic use in Mozambique as Royalty gas. If it becomes impossible to procure the gas from the Pande/Temane or the Buzi gas field, it would be procured from the Rovuma gas field and the Project site needs to be changed from Beira to Nacala accordingly.（Refer to Chapter 5.5）

According to GOM, there is a plan to lay a gas pipeline which will run from the northern region to Maputo, dealing with the possibility of gas utilization of Rovuma as domestic use. When this happens, it is possible to consider Beira as the Project site even if the gas will be procured from Rovuma, but this is not considered in this Survey, as it is still too uncertain whether the pipeline through the northern region to Maputo will come into being.

The information of each gas field is as shown below:

Gas field	Pande/Temane	Buzi	Rovuma
Estimated reserve of gas	4 TCF	0.5 TCF – 3 TCF	more than 150 TCF
Production volume	183 MGJ/year (After production increase in 2012) Out of the above, approx. 37 MGJ/year will be allocated to Mozambique.	Estimated production start in 2016	Production start for LNG in 2019 is planned.
Gas allocation	It is already decided that all the allocated amount for Mozambique will be used for power generation.	Mainly to power generation and fertilizer (but not fixed yet)	Anadarko and Mitsui Corp. advance development for LNG, but the usage for domestic purposes has not been fixed yet.
Location	Middle Mozambique	Middle Mozambique	Northern Mozambique

4.1.2 Procurement Plan for Natural Gas

In this Project, it is supposed that the gas will be supplied from the Pande/Temane gas field in line with its production increase plan. This gas allocation shall be determined in accordance with the national policy of Mozambique, so for the private enterprise, the collaboration with GOM is an essential factor for this PPP Project.

Additionally, on the premise of the above assistance from GOM for the gas procurement, it will be necessary that a long term gas supply contract shall be made with its supplier for the purpose of long term and stable procurement of gas that has roles as feedstock and fuel for power generation for this Project.

4.1.3 Structure and Place for the Project

(1) Project Location

In this Project, it is assumed that the Urea Fertilizer Complex will be constructed at the planned site within the Baira New Industrial Area. The fertilizer will be produced in this complex using the natural gas which will be supplied from the Pande/Temane gas field.

SPE, which will implement this Project, is planned to be located in Maputo for convenience of its operation.

The required period from SPE preparation such as company establishment and its registration to the production start is assumed to be 5.5 years, and the necessary cost during this period is estimated as start-up cost in this Survey. (USD 1 million per year, equals USD 5.5 million in total)

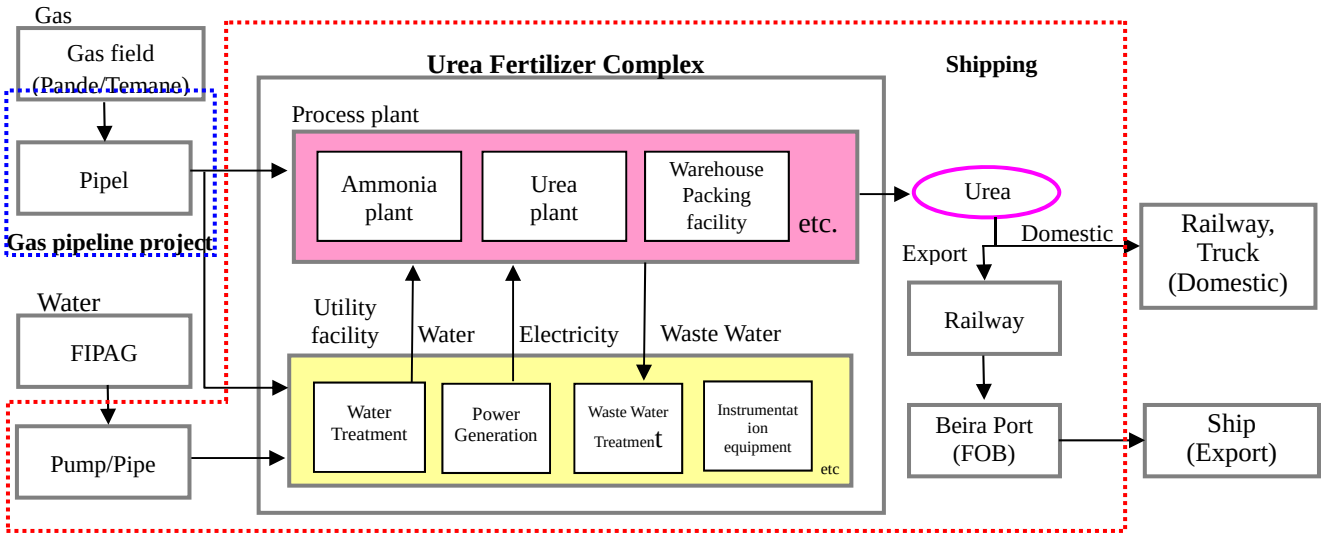
(2) Project Structure

For this Project, in addition to the construction and operation of the Urea Fertilizer Complex, the expansion of pumps and pipelines for utility water supply and the construction and operation of the gas pipeline are also required.

At the beginning of the Survey, a SPE for utility supply was assumed to be separately established. However, because it was found that raw water would be supplied by FIPAG and electricity should be generated in the Urea Fertilizer Complex from an economical point of view, it was concluded that there would be no necessity to establish this SPE.

It was also assumed, at the beginning of the Survey, that a SPE should be established for the Gas Pipeline Project. However, the benefits of the the Gas Pipeline Project and the Urea Fertilizer Complex Project have a trade-off relation, and therefore it was finally cocluded that the Gas Pipeline Project should be performed as a public work.

The following is the proposed picture showing the Project structure.



Source: JICA Survey Team

Figure 4.1.1 Project Structure

(3) Description of the Project

The following are the contents of business for this Project.

Land	SPE will acquire DUAT (right of land-use) from Beira city. The necessary land area is estimated to be approx. 60 ha during the construction period, which includes the plant site (35 ha) and temporary storage area (25 ha), and approx. 35 ha will be used during the operation period. The planned land use period is 3.5 years for the construction and 20 years for the operation.
Construction of facility	SPE will manage the design, construction, operation and maintenance of the fertilizer complex, which consists of a fertilizer plant and utility facilities. At the initial phase of this Survey, two SPEs were planned for the fertilizer plant and utility facilities. But during the Survey, it was found that the scale of utility facilities was not as large as expected because the utility water could be supplied from FIPAG and thus it was ineffective to establish a separate SPE for the utility facilities. Hence, a single SPE for the fertilizer plant including utility facilities is considered in this Survey.

Gas (feedstock, fuel)	The gas for feedstock and fuel for power generation will be supplied from the Pande/Temane gas field through a pipeline which will be newly installed. Since this pipeline business has a public nature due to approval and license procedure, influence on the local community and so on, the construction and operation of the pipeline is assumed to be conducted by GOM as a public project. In this Project, SPE receives the gas at the gas field and use the pipeline bearing the usage fee. Hence, the usage fee for the gas pipeline shall be considered as a part of the procurement cost of feedstock and fuel. In order to secure the profitability of this Project, the financial assistance for this usage fee for the pipeline could need to be borne by GOM in some cases. As for the pipeline within the Project site, SPE will install it by its own funding.
Utility water	It is assumed that the utility water would be supplied by FIPAG. The new water supply pipeline including additional pumps shall be installed from the existing water intake to the Project site. Its cost shall be borne by SPE.
Urea fertilizer (product)	SPE will produce the urea fertilizer at the plant, ship the product to domestic and international purchasers and obtain its sales income. The product for the domestic market will be consigned at the Urea Fertilizer Complex, and the product for export will be consigned at the Beira Port (FOB). SPE will manage the storage in the Complex, loading on the railway wagons or trucks (in case of domestic transportation), transportation to the Beira Port by railway and loading on the ship (in case of export) of the product. The transportation fee to the Beira Port and loading charge at the port shall be borne by SPE as outsourcing fees. The product exported to the neighbouring countries such as Zimbabwe, Malawi and so on can be consigned at the Complex by loading the product on railway wagons, but the Survey Team assumes a simplified model, in the study of the profitability, that all products for export will be transported to the Beira Port and loaded on ships.
Waste water	Waste water generated in the Complex will be treated properly by a treatment facility, and discharged into the nearby river or sea with cooling water. The quality of the discharged water shall comply with regulation on the environmental quality standards in Mozambique and World Bank Guidelines.
Emission gas	Emission gas will be treated properly in the Complex and emitted into the atmosphere.

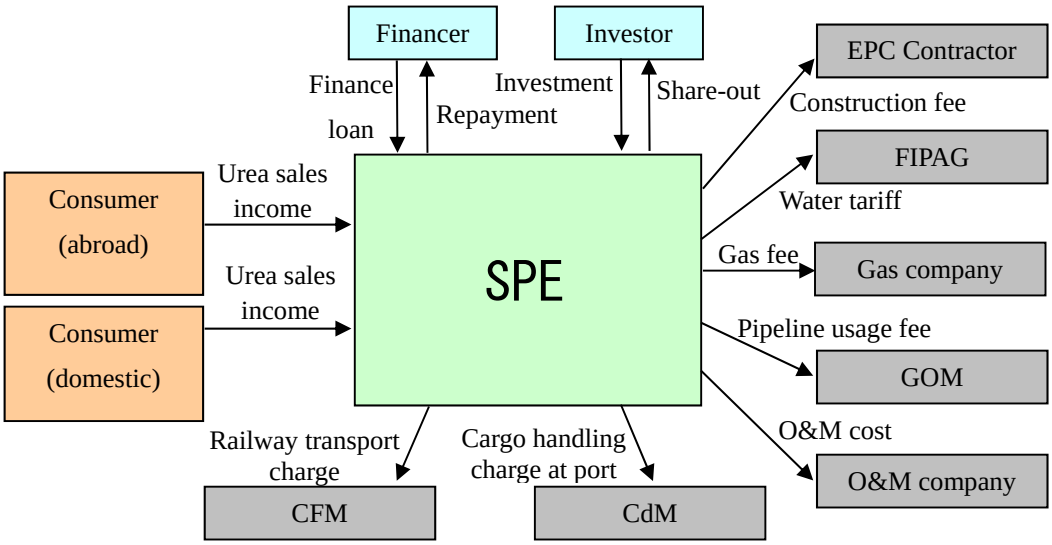
4.2 PPP Model for the Project

4.2.1 Candidate Model and its Issues

(1) Project Scheme

It is assumed that in this Project, SPE will make a financial arrangement from investors and banks to implement the construction and to carry out the business of producing urea fertilizer using natural gas as feedstock. The necessary capital cost and operation cost will be recovered from the sales income of the urea fertilizer.

The following is the compiled figure showing the Project scheme in terms of financial flow:



Source: JICA Survey Team

Figure 4.2.1 Project Scheme

The implementation and operation of the gas pipeline will be conducted by GOM as a public work. SPE will receive the gas at the gas field and use the pipeline bearing the usage fee.

The gas pipeline within the Project site will be installed by SPE by its own funding.

(2) Candidate Model

The following are the envisaged project model and its problems.

1) Financial arrangement plan for the investment

a) Debt/Equity ratio is set to 70:30.

If the debt is increased, the equity portion becomes relatively lower, which enhances the investment return for shareholders. On the other hand, the excessive debt leads to increase the burden of the amortization of principal and the payment of interest, which would influence the project cashflow.

The Survey Team sets the Debt/Equity ratio to 70:30 taking the balance between the investment return and the ability to meet debt payment with reference to the simimar scale of infrastructure project.

b) 20% of the total equity will be invested by GOM, and the remaining 80% will be invested by investors such as foreign fertilizer companies in India.

Assuming that the Project cost is USD 1,556.8 million, the investment amount from GOM would be USD 93.4 million ([USD 1,556.8 million] x [Equity 30%] x [investment amount from Mozambique government 20%]).

2) Consumers of the product

a) 70% of the product will be exported to India and other neighbouring countries such as Zambia, Zimbabwe, Malawi, DRC (Democratic Republic of the Congo) and so on, while the remaining 30% of the product will be supplied to the domestic market in Mozambique.

b) As for the supply to the domestic market, it is assumed that a long term supply contract shall be made, which has turned out to be difficult to get the GOM's guarantee through the discussion with GOM. It is concluded that the long term supply contract shall be considered for the private level after the existence of gas is confirmed.

4.2.2 Role Allotment between Public and Private

(1) Private Part

1) SPE for fertilizer business

SPE will produce the urea fertilizer from natural gas. The foreign companies such as Indian fertilizer companies may participate in this Project as investors together with GOM on the condition that the foreign companies will be the off-taker of the product.

Sumitomo Corporation will consider the investment on the utility supply of this Project such as electricity, water, steam and so on, together with the partner companies such as product off-takers.

Additionally, investment by the firm that will be in charge of operation and maintenance for this Project shall also be considered taking the significance of its role into account.

2) Urea off-taker

SPE mentioned in the above 1) will make a long term urea off-take contract with each company, and these companies will buy the urea fertilizer based on the long term off-take contracts.

As for the export of product, it is assumed that several off-takers such as Indian companies will invest in this Project.

3) EPC contractor

It is assumed that a Japanese engineering company will conduct the design, procurement and construction of the Urea Fertilizer Complex.

4) O&M company

Basically, it is assumed that a private company which has enough O&M experience with a similar kind of fertilizer plant will be employed. If necessary, a SPE for O&M should be established for this Project. The final structure shall be discussed and agreed upon with GOM.

5) Handling at the Beira port

In this Project, 70% of the product is assumed to be exported from the Beira Port. The administration operation of the container terminal and general cargo terminal at the Beira Port has been conducted by Cornelder de Mozambique (CdM), which is the joint venture between CFM and the Rotterdam-based private company, Cornelder Holdings.

It is assumed that the cargo handling operation at the Beira Port (all handling works covering unloading from railway wagons and loading onto ships) will be outsourced to CdM.

(2) Public Part

1) Public works for gas pipeline

It is assumed that GOM will conduct the construction, operation and maintenance of the gas pipeline which transfers the gas for feedstock and fuel for power generation to the Project site as a public work by utilizing financial assistance such as a JICA yen credit.

In the discussion with the Mozambican public entities, there were no negative comments on the assumption above; however, it is difficult to discuss further details because the gas field for this Project has not been decided yet.

GOM is currently preparing the gas master plan, which could affect this Project, so it is necessary to pay due attention to its contents.

2) Supply of raw water

GOM has established FIPAG and conducted the water supplying business through FIPAG.

It is planned that the necessary water for this Project will be supplied by FIPAG.

3) Railway for production transportation

The urea fertilizer which is produced by this Project will be transported by railway to domestic consumers and the Beira Port (for export).

In this Project, the additional railway which connects the Project site with the existing railway will be constructed and the operation and maintenance of this additional railway will be conducted by SPE of this Project.

Transportation of the product including arrangement, operation and maintenance of wagons and locomotives, but excluding loading onto and unloading off from the railway wagons, will be conducted by CFM. SPE will pay the outsourcing fee.

4.3 Review on the PPP Business Scheme

4.3.1 Implementation Structure of PPP Project

The following figure shows the envisaged implementation structure of this Project.

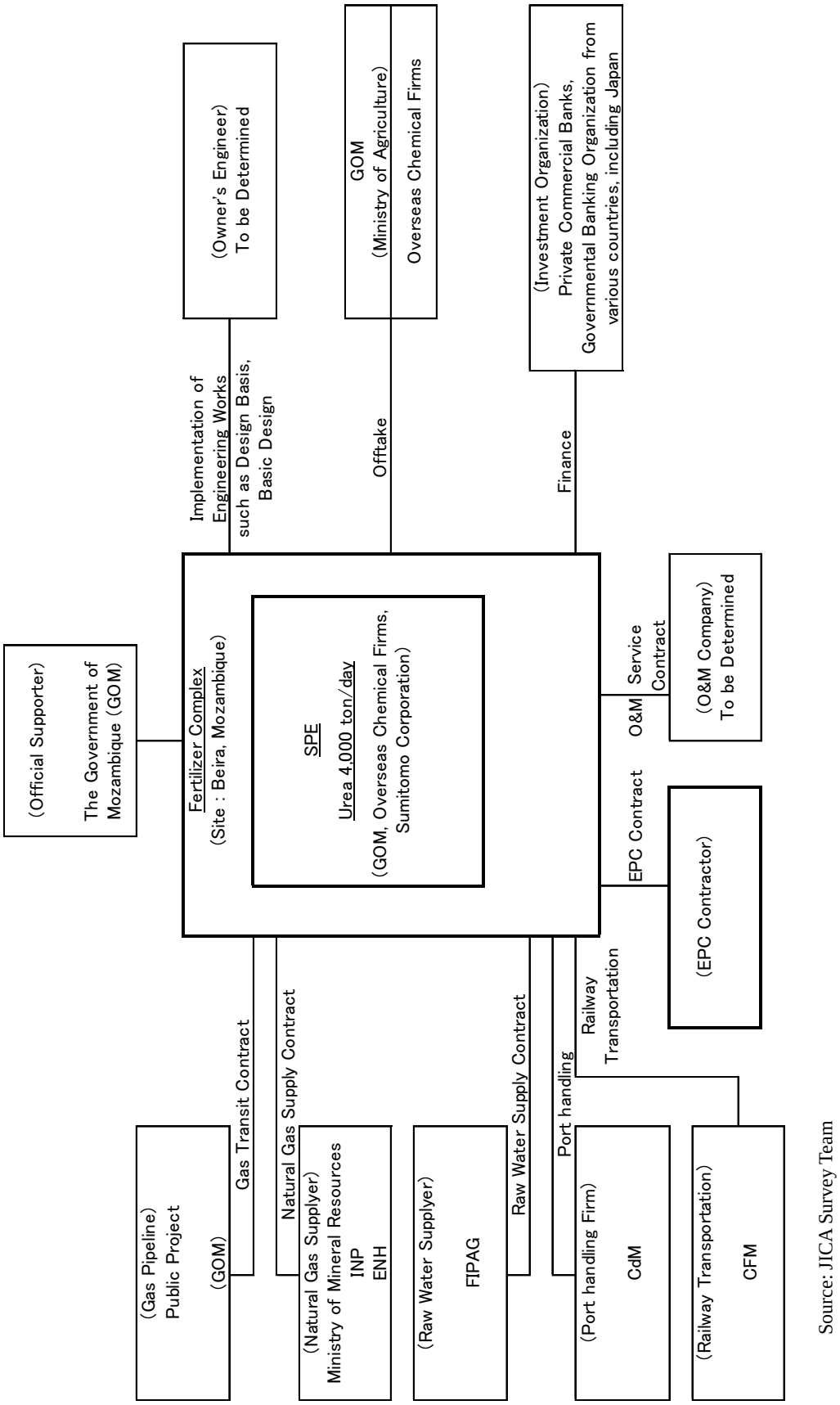


Figure 4.3.1 Implementation Structure

Source: JICA Survey Team

4.3.2 Review and Planning of Financing Arrangement Options

As described in 4.2.1 (2), it is assumed that the Debt/Equity ratio of this Project is 70:30, and 20% of the equity part will be invested by GOM while the remaining 80% of the equity will be invested by foreign companies such as an Indian fertilizer company.

Also, as described in 4.2.1 (1), it is assumed that the implementation and operation of the pipeline will be conducted by GOM as a public work.

Table 4.3.1 Finance Arrangement Plan

	Project cost	Public entity in Mozambique	Private entity	Remarks
Fertilizer Complex	USD 1,556.8 mil.	USD 93.4 mil. (Equity)	USD 373.6 mil. (Equity)	Loan USD 1,089.8 mil.
Gas Pipeline	USD 175.45 mil.	USD 175.45 mil.	-	Public works utilizing e.g. Yen Credit

Source: JICA Survey Team

For the arrangement of the necessary loans which account for 70% of the project cost for the fertilizer plant, the following options are under consideration.

(1) Export Financing and Insurance by the Export Credit Agency (ECA)

Loan arrangement utilizing export finance by JBIC, and the application of political insurance by MIGA to enhance the potential of a loan arrangement by a private financial entity could be considered. The following table shows the overview of JBIC buyer's credit.

Table 4.3.2 Conditions for JBIC Buyer's Credit

Application	Exports to developing countries machinery and equipment produced in Japan, and Japanese technical services
Applicable Conditions	Actual participation of Japanese products and/or technical service through EPC contract
Lenders	60% - Direct loan form JBIC 40% - Loan from commercial banks with the coverage of NEXI's insurance
Loan Amount	• Max. 85% of contract for equipment export and/or technical service excluding down payment • JBIC covers Max. 60% of the above loan agreement
Repayment Period	Determined based on OECD Guidelines（at most 12 years in general）
Interest Rates	Commercial Interest Reference Rates (CIRRs) at the time of commitment are applied.
Merit	Long repayment period with low interest rats

Source: JICA Survey Team

In order to consider the export financing, a sovereign guarantee from GOM will be necessary. For this guarantee process, it seems that congressional authorization by GOM is necessary.

Mozambican public entities, such as ENH, have a negative impression on the guarantee from GOM, so it is necessary to consider its possibility carefully, watching the situation of the gas field development as well as the financial condition of GOM.

(2) Project Finance by Public Entity/Private Bank

In this scheme, the source of reimbursement is limited to the returns from the invested project, and it does not rely on the creditability or mortgage of the sponsors/investors.

Since the urea fertilizer has become a commodity product and an offset for risk of price changes is indispensable, in order to obtain project finance for this Project, it is effective to make a long-term offtake contract with a good off-taker. It is preferable to fix not only the amount but also the price of the product in the contract, but it is assumed to be difficult because the urea fertilizer product is a commodity.

For that reason, it is important to include the price tariff and take-or-pay clause in the contract, which describes the payment to be worth the price of the product in case offtake is not done.

Additionally, it is also important to make a long term supply contract of feedstock gas because it shall be procured at a stable price, from the amount and quality point of view.

And for the realization of project finance, it is necessary to consider not only the participation of private financial entities, but also public finance entities like ECA, which could lead to the diversification of procurement sources as well as increasing the possibility of the participation of private financial entities.

As for the detailed condition, such as the interest and repayment period, it shall be discussed precisely after the gas field for this Project is confirmed.

(3) JICA Public Sector Investment Finance (PSIF)

This option could be considered if a Japanese private company is one of the investors and the company has a certain portion of equity of the SPE.

Since it is almost impossible to cover the total borrowing of this Project by JICA PSIF, joint financing with other international financial institutions shall be necessary.

As for the export financing and insurance by ECA, it is, at present, difficult for GOM to grant a sovereign guarantee that is essential to realize the export financing. It is desired that a sovereign guarantee from GOM would be granted in the future considering further development of the gas field as well as improvement of the GOM's financial condition.

In order to apply project the finance by public entities/private banks, it is desired to to make long-term offtake contracts for the domestic supply and export as well as to confirm enough reserve

of gas and obtain a guarantee for a stable procurement of gas although the gas reserve and its commercialization have not been ensured yet.

4.3.3 Governmental Assistance / Governmental Guarantee

(1) Governmental Assistance

For this Project, it is considered that the following assistance will be necessary both from GOM and the Japanese government.

1) Mozambique

a) Assistance for natural gas supply

The gas for feed stock and fuel for power generation will be supplied under assistance from GOM's organizations such as MIREM, INP, ENH and so on.

It is assumed that the gas will be supplied from the Pande/Temane gas field in line with its production increase plan. Since the gas allocation will be determined based on the national policy, the assistance from GOM is essential.

Additionally, in order to maintain the profitability of this Project, it may be necessary to consider a price incentive for gas supply.

b) Assistance for licensing

In order that SPE can obtain the necessary licenses such as project license, land acquisition license and so on, the governmental assistance such as the support to the communication with the relevant authorities is essential.

c) Off-take assistance for domestic market in Mozambique

This is the project that will contribute to agriculture, which is the main industry in Mozambique, and eventually lead to achieve the poverty reduction plan. For the development of agriculture in Mozambique, the urea fertilizer, which is produced by this Project, shall be widely distributed to farmers in Mozambique.

For that reason, it is envisaged that the 30% of the total product in this Project will be supplied to the domestic market in Mozambique based on a long term supply contract. The product from this Project should have a price advantage of lower transportation cost compared with the imported products, but in order to realize the wide distribution to the farmers in Mozambique, a pricing system which provides the product at a cheaper price to the domestic market by reducing the margin for domestic transportation shall be required. At this point, strong policy promotion by GOM is required.

d) Tax incentive

It is expected that some kinds of tax incentive such as exemption or reduction of customs duties and VAT for construction equipment, corporate income tax and so on can be applied to this Project.

In order to apply this tax incentive, the governmental assistance for its application procedure shall be required.

e) Human development

Lots of human resources are necessary for this Project in the phases from the establishment stage of SPE until plant operation. The promotion of human development led by GOM shall be required.

f) Investment in the fertilizer plant business

Through the discussion with ENH, the Survey Team has obtained positive comments on the participation of Mozambiacan public entity in SPE; however, it is hard for them to come up with the cash for the Equity. ENH proposes that the Equity part of Mozambiacan public entity should be put up tentatively by the private investors, and then cancelled out when they gain the distributed profit after the commencement of production.

Although it is difficult to discuss this in a detailed condition at present since the gas field has not yet been confirmed, it is necessary to continue the discussion on the possibility of a tentative put-up of the Equity cash for the Mozambican public entity by the private investors, as well as the possibility of Equity Back Finance by financial entities.

g) Implementation of gas pipeline business

It is envisaged that the construction and operation of the gas pipeline will be undertaken by GOM as a public work. This pipeline business is quite important and shall be proceeded by GOM without delay because it transfers the natural gas as feedstock of this Project to the Urea Fertilizer Complex.

SPE for the Urea Fertilizer Complex will pay the usage fee of the pipeline to GOM. In order to secure the profitability of this Project, the financial assistance for this usage fee may have to be granted by GOM.

2) Japan

a) Financial assistance for this Project

It is expected that financial support from the Japanese government such as JICA PSIF and JBIC OIL will be applied to this Project.

Meanwhile, the consideration of financial support such as Yen credit to the gas pipeline business, which will be managed by GOM as a public work, will be expected.

b) Human development (technical assistance)

Through the technical assistance for the human development in Mozambique, the human development, which is necessary for this Project, will be expected.

c) The preparation of surrounding infrastructure such as roads and ports is not envisaged at the moment, but the assistance to this preparation might be required in case of a change in the situation.

d) Necessity of financial assistance for the development of the Pande/Temane or Buzi gas field has not been recognized yet. However, there may be a possibility that such necessity will emerge.

e) In addition to the above, the promotion of foreign investment such as by an investment treaty is expected as cooperative support between GOM and the Japanese government.

(2) Governmental Guarantee

In order to increase the feasibility of the Project, the following kinds of governmental guarantee from GOM shall be considered:

1) Sovereign guarantee for the consideration of JBIC buyer's credit

As an option for the debt arrangement, JBIC buyer's credit is considered in this study. For the consideration of buyer's credit, it is necessary to confirm that GOM will be able to apply a sovereign guarantee for this project, and according to GOM, for this guarantee process, it seems that congressional authorization by GOM is necessary.

Mozambican public entities such as ENH have a negative impression on the guarantee from GOM, so it is necessary to consider its possibility carefully, watching the situation of gas field development as well as the financial condition of GOM.

2) Purchase guarantee for the products for the domestic market in Mozambique

According to the discussion with GOM, it is assumed difficult to obtain the governmental guarantee of the offtake for the domestic market.

However, because the offtake guarantee is an important factor in the study of finance arrangement, the establishment of the governmental guarantee system is desired.

Chapter 5 Development Plan for the Project

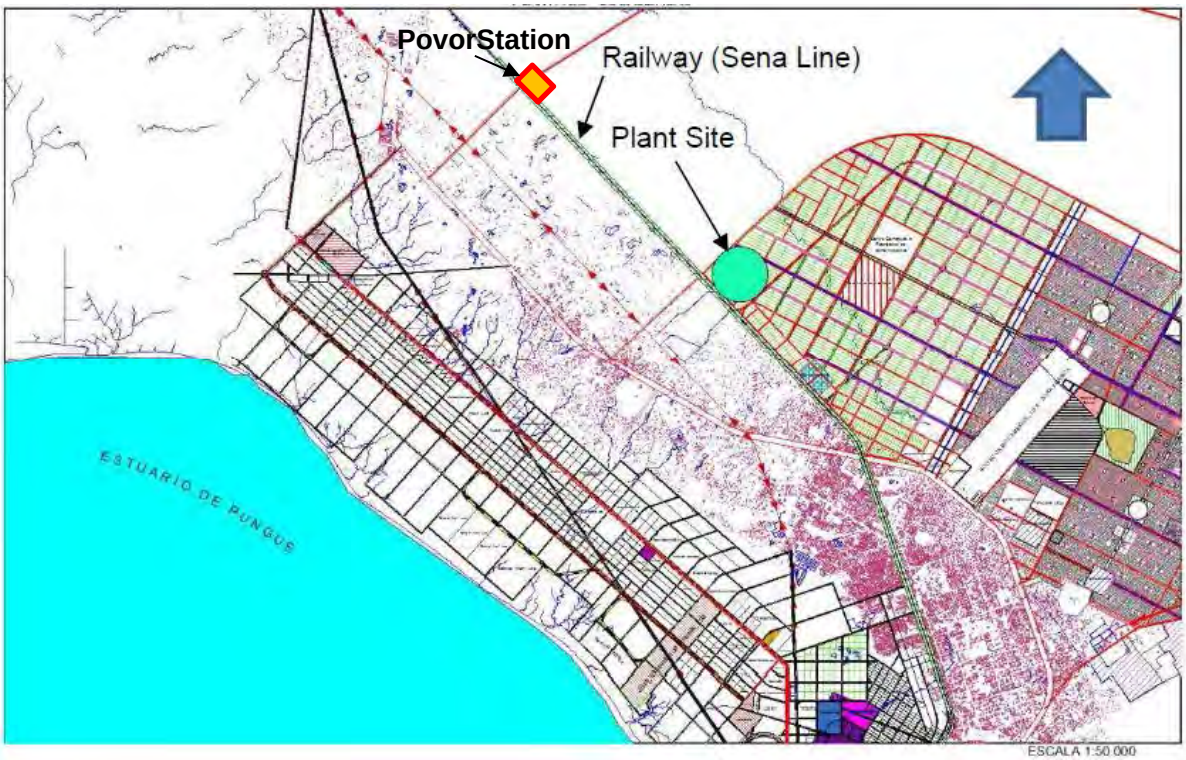
5.1 Urea Fertilizer Complex

This sub-chapter covers the Urea Fertilizer Complex that consists of an ammonia plant (2,300 ton/day), a urea plant (4,000 ton/day) and utility and associated offsite facilities.

The objective of this section is to define the plant facilities and estimate an investment cost for the plant facilities for the economic and financial study of the Project. At this stage, the cost estimate was performed based on assumptions described in this section. In-house cost data from the recent cost estimate work for similar plants and equipment in Africa were referred to.

5.1.1 Project Site

The Project site is located in the Beira New Industrial Area as shown below.



Source: JICA Survey Team

Figure 5.1.1 Project Site

＜Overall View of Project Area＞

<Povor Railway Station>

<From Povor Station to Plant Site (left side)>

<Plant Site (Inhamizur North)>

Source: JICA Survey Team

Figure 5.1.2 View around Project Site

Regarding the site, through the meeting with the Beira Municipal Office, the following has been confirmed.

1) The Project owner is required to make necessary procedures to obtain DUAT since the DUAT procedures for the Beira New Industrial Area have not yet been made. It will take MT 100,000 /ha. The period of land usage is not defined and may be considered to be semi-permanent.

2) Land acquisition tax is approximately MT 30,000. (One time)

3) Residents who did not obtain DUAT illegally live in the Project site at the moment. (According to the information from MPD, the Project owner has to prepare a relocation plan in accordance with the regulation in Mozambique and bear the relocation cost.)

4) The DUAT is not required for the access road from the existing road to the Project site. The temporary access road during the construction shall be constructed by the Project owner and its finishing work (pavement) and maintenance as a public road will be undertaken by the Beira Municipality.

5.1.2 Design Basis

Feed stock compositions and other design basis applied in this Survey are summarized below.

(1) Feedstock Compositions

Based on the discussion with INP, the gas composition from the Pande/Temane gas field dated December 5, 2010 is applied in this Survey.

TO:	CPF					
SECTION:	CPF					
DATE:	2010/12/05					
DATAFILE:	C:\HPCHEM\1\DATA\05DEC10\SIG15638.D					
SAMPLE NAME:	DM2001-TEMANE GAS					
	D					
COMPONENT	MOL%					
Methane	90.89536		Combustion Properties	Units	Specification	Value
Ethane	3.27357					
Propane	1.74942		Energy Content (EC) (Gross)	MJ/nM^3 (101.325 kPa @ 0°C)	38.10-43.50	43.20
iso-Butane	0.44590		Energy Content (EC) (Gross)	MJ/nM^3 (101.325 kPa @ 15°C)	37.40-42.20	40.72
n-Butane	0.55024		Relative density (RD)	101.325 kPa @ 0°C	0.55-0.70	0.628
neo-Pentane	0.00943		Relative density (RD)	101.325 kPa @ 15°C	0.55-0.70	0.630
iso-Pentane	0.17193		Wobbe Index (WI)	MJ/nM^3	45.80-56.00	54.51
n-Pentane	0.13892		Hydrocarbon Dewpoint	°C @ 6.25 Barg	-6.8	15.65
n-Hexane	0.26999		Water Dewpoint	lb/mm scf @ 101 kpa	7	
n-Heptane	0.15629		Total Inerts (N_2, CO_2)	Vol%	5.0 max	2.28
n-Octane	0.04489		Mr	g\mol		18.20
Nonane	0.00787		DMG	gram		1820.11
Decanes	0.00675		H_2S	ppm	4.0 max	0.00
Nitrogen	2.27888					
Carbondioxide	0.00057					
Total Inerts	2.27945					
H2S	0.00000					
Oxygen	0.00000					
Total	100.00000					
Report By:	VIOLET					

TO:	CPF					
SECTION:	CPF					
DATE:	2010/12/05					
DATAFILE:	C:\HPCHEM\1\DATA\05DEC10\SIG15639.D					
SAMPLE NAME:	DM200PANDE GAS					
	D					
COMPONENT	MOL%					
Methane	95.22052		Combustion Properties	Units	Specification	Value
Ethane	1.63286					
Propane	0.54702		Energy Content (EC) (Gross)	MJ/nM^3 (101.325 kPa @ 0°C)	38.10-43.50	40.78
iso-Butane	0.13851		Energy Content (EC) (Gross)	MJ/nM^3 (101.325 kPa @ 15°C)	37.40-42.20	38.49
n-Butane	0.15139		Relative density (RD)	101.325 kPa @ 0°C	0.55-0.70	0.585
neo-Pentane	0.00000		Relative density (RD)	101.325 kPa @ 15°C	0.55-0.70	0.588
iso-Pentane	0.05290		Wobbe Index (WI)	MJ/nM^3	45.80-56.00	53.32
n-Pentane	0.04607		Hydrocarbon Dewpoint	°C @ 6.25 Barg	-6.8	14.86
n-Hexane	0.11589		Water Dewpoint	lb/mm scf @ 101 kpa	7	
n-Heptane	0.07713		Total Inerts (N_2, CO_2)	Vol%	5.0 max	1.97
n-Octane	0.03164		Mr	g\mol		17.00
Nonane	0.00989		DMG	gram		1699.70
Decanes	0.01045		H_2S	ppm	4.0 max	0.00
Nitrogen	1.95976					
Carbondioxide	0.00596					
Total Inerts	1.96572					
H2S	0.00000					
Oxygen	0.00000					
Total	100.00000					
Report By:	VIOLET					

(2) Raw Water Conditions

Since the raw water quality has not been provided by FIPAG, the JICA Survey Team assumes ordinary water quality for this Survey.

(3) Product Design Conditions

Design conditions for the urea granule product are as shown below.

<Urea granule specification>

Capacity	4,000 ton/day
Expected Composition and Specification	
Total Nitrogen	46.3 wt%
Biuret	0.8 wt%
Moisture	0.25 wt%
Formaldehyde	0.45 wt%
Size 1 – 4 mm	95 wt%
Hardness	3 kg for 3 mm granule

(4) Site Conditions

No specific soil data around the site are available. According to the information from construction companies, N-value 50 may be obtained at a depth more than 30 m - 40 m around the site.

(5) Climatic Conditions

1) General

Mozambique has a tropical climate with two seasons, a wet season from October to March and a dry season from April to September. Climatic conditions, however, vary depending on altitude. Rainfall is heavy along the coast and decreases in the north and south. Annual precipitation varies from 500 to 900 mm (19.7 to 35.4 inches) depending on the region, with an average of 590 mm (23.2 inches). Cyclones are common during the wet season.

2) Air Temperature

Based on the meteorological data in the last 10 years provided by INAM in Maputo, air temperature in Beira and the design basis are assumed as shown below.

(a)	Absolute monthly maximum temperature	40.2 °C
	Absolute monthly minimum temperature	9.8 °C
	Average of maximum temperature	28.9 °C
	Average of minimum temperature	20.4 °C
(b)	Design basis for equipment	
	Dry bulb temperature	34 °C (assupmtion by the JICA Survey Team)
	Wet bulb temperature	28 °C (assupmtion by the JICA Survey Team)
(c)	Design basis for air conditioning	
	Outdoor temperature (Summer)	34 °C dry bulb (assupmtion by the JICA Survey Team) 28 °C wet bulb (assupmtion by the JICA Survey Team)
	Indoor temperature	5 °C below outdoor temp. with minimum temp. 20 °C (assupmtion by the JICA Survey Team)
(d)	Design basis for air blowers/compressors	35 °C + 100% RH (assupmtion by the JICA Survey Team)
(e)	Design air temperature for hot insulation	20 °C (assupmtion by the JICA Survey Team)

(f)	Design basis for electrical equipment Instrumentation and associated materials	35 °C + 100% RH (assupmtion by the JICA Survey Team)
(g)	Humidity	
	Maximum	100%
	Minimum	14%

3) Rainfall

Average monthly rainfall	195 mm
Design storm intensity	170 mm/hour
Design storm duration	2 hours

4) Wind

Main wind direction	North-East & South-West
Maximum velocity	25.0 m/sec
Design velocity	33.3 m/sec *) (120 km/hour) in any direction

5) Barometric Pressure

Design maximum	1,023 mb

(6) Noise Level

The maximum noise level of 85 dB(A) shall be applied in all conditions including normal, start-up and shut down conditions or abnormal condition with an exception for the compressor area where the maximum noise level shall be 95 dB(A).

5.1.3 Plant Description

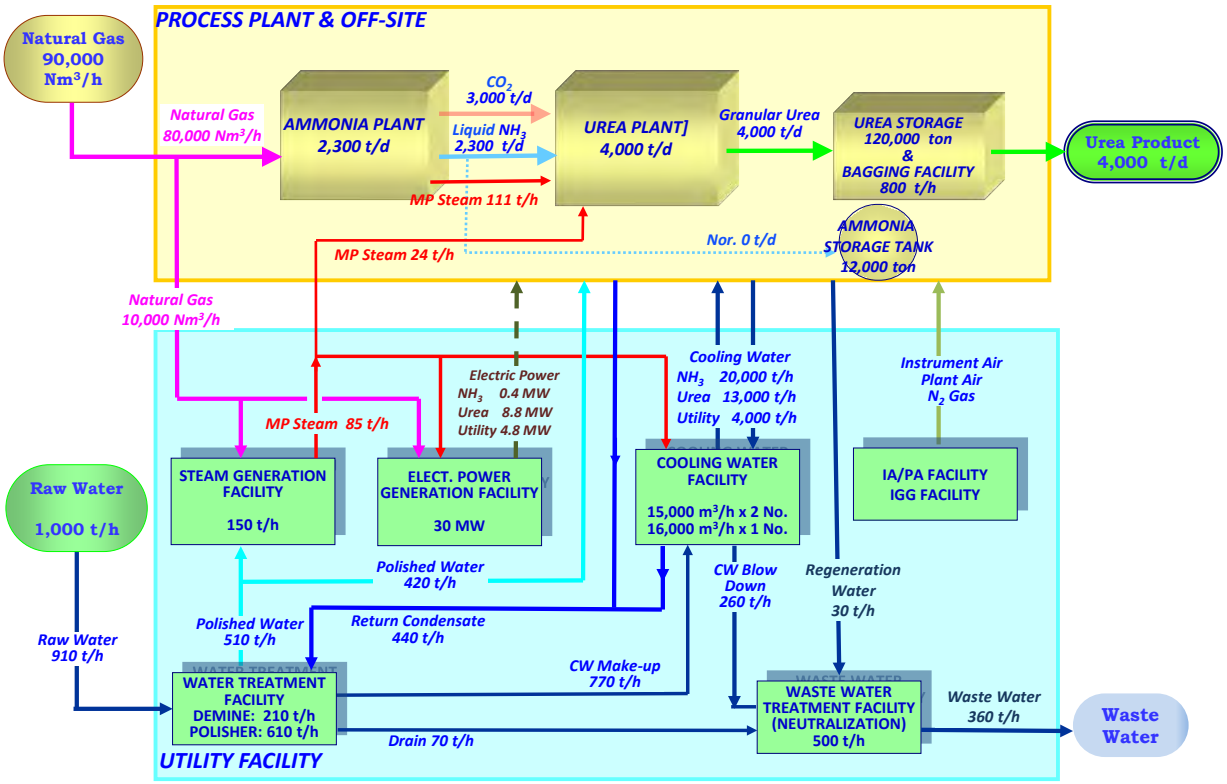
(1) Process Plants

The process plants consist of the following:

- Ammonia plant: 2,300 ton/day
- Urea plant: 4,000 ton/day for the Granulation Unit

(2) Overall Block Flow Diagram and Material Balance

The block flow diagram of the Urea Fertilizer Complex is as shown below.



Source: JICA Survey Team

Figure 5.1.3 Overall Block Flow Diagram

(3) Design Capacity

Design capacity of the Urea Fertilizer Complex is shown below.

No.	Service	Design Capacity	Remarks
1	Raw Water Facility	1,100 m^3/h	Clarifier, Sand Filter, Raw Water Pumps, Clarified Water Pump, Filtered Water Tank
2	Cooling Water Facility	30,000 ton/h &16,000 ton/h	Cooling Tower, Cooling Water Circulation Pumps, Side Filter, Chemical Dosing Facility
3	Demineralization Unit	310 m^3/h	Demineralizer, Demineralized Water Pumps
4	Potable Water System	30 m^3/h	Potable Water Unit, Potable Water Tank, Service Water Pumps
5	Polisher Unit	610 ton/h	Polisher, Polished Water Tank, Polished Water Pumps
6	Fire Fighting Facility	450 m^3/h	Fire Water Pumps, Fire Water Diesel Pump, Fire Water Jockey Pump
7	Boiler Unit	150 ton/h	Deaerator, BFW Pumps, Package Boiler, Flash Drum, Turbine Condenser, Condensate Pumps, Chemical Injection System
8	Power Generation Unit Gas Turbine Generator Steam Turbine Generator	Total 30 MW 8.7 MW 21.3 MW	Gas Turbine and Steam Turbine Generator
9	Emergency Generator	1.6 MW	Diesel Engine Generator
10	Back-up Air System	3,600 Nm^3/h	Air Compressor System

No.	Service	Design Capacity	Remarks
11	IA/PA System	IA 1,000 m^3/h PA 2,800 Nm^3/h	Plant Air Receiver, IA Dryer, IA Receiver
12	Nitrogen Generation System	LP 1,900 Nm^3/h HP 560 Nm^3/h	Air Compressor, IGG, HP/LP Liquid Nitrogen Tank, N_2 Vaporizer, Liquid Nitrogen Pump
13	Flare Stack Front-end Ammonia Tank	380 ton/h 240 ton/h	Flare KO Drum, Flare Stack, Liquid Ammonia Transfer Pump
14	NG Receiving Station	94,000 Nm^3/h	NG pre-treatment, NG metering station NG KO Drum
15	Waste Water Treatment (Including CW Blow-down Water)	500 ton/h	CPI Separator, Oily Water Pit, Neutralization Pit, Final Check Basin

5.1.4 Process Feature and Description

(1) Ammonia Plant

The ammonia plant is to process the feedstock natural gas into the product ammonia and is comprised of 9 sections as shown below.

1) Gas treating and reforming section

Natural gas as feedstock is desulfurized and then processed into H_2 rich reformed gas by steam reforming at this section. The steam reforming reaction takes place in the furnace at high temperature. Efficient heat recovery from the reformed gas effluent is very important for energy saving and high reliability of the furnace is essential for the ammonia plant operation.

2) Shift conversion section

The CO contained in the reformed gas from the reforming section is converted to H_2 and CO_2 by reacting with H_2O under a catalyst in this section. Shift conversion takes place in the furnace at high and low temperature converters. Design consideration has been made with respect to longer catalyst life along with wider and more flexible ranges of operating condition.

3) CO_2 removal section

CO_2 produced in the preceding two sections is removed from the shift converter effluent gas by physical and chemical wet absorption process and then regenerated.

4) Methanation section

The unreacted CO and CO_2 in the raw synthesis gas from the CO_2 absorber are removed in this section by reacting with H_2 forming CH_4 under the catalyst. This section is designed for precluding temperature rise because of rapid methanation reaction.

5) Synthesized gas compression section

The synthesized gas from the methanation section is compressed to the synthesis pressure and at the same time H_2O vapour and CO_2 remaining in the gas in trace quantities are removed completely by molecular sieve dryers in this section.

6) Ammonia synthesis

An inter-cooled type horizontal ammonia synthesis converter where ammonia synthesis from H_2 and N_2 takes place is adopted along with unitized refrigerant exchangers, both of which contribute to energy saving.

7) Refrigeration

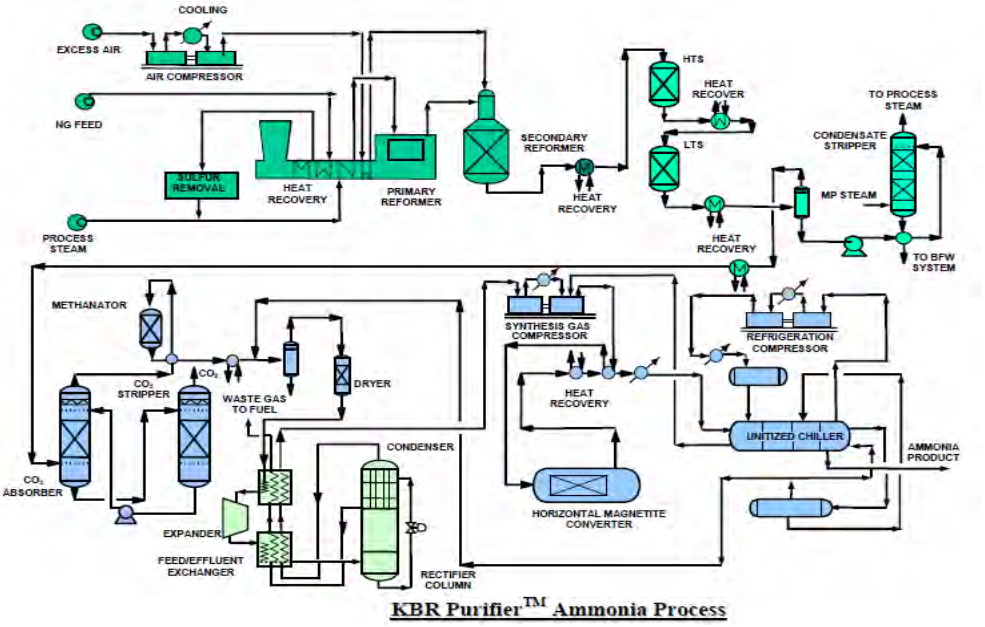
This section is for supplying frigory to the chiller of the ammonia synthesis section. A multi-staged refrigerant compressor is adopted and design consideration has been made with respect to low energy consumption.

8) Process condensate treatment section

The process condensate produced in the plant is recovered and processed into boiler feed water to produce high-pressure steam after removal of impurities. This reduces the demand for make-up water required for the plant largely contributing to water saving. Since high pressure stripping is adopted by using medium pressure steam, which is fed as reformer steam, it contributes to energy saving in addition to reducing boiler feed water make-up.

9) Steam system

High pressure steam is generated by heat recovery in various sections of the ammonia plant. The high-pressure steam is used for driving compressors. Selection of the steam turbine will be carefully undertaken with respect to efficiency performance. Each steam pressure level has been designed to get higher efficiency from the steam system.

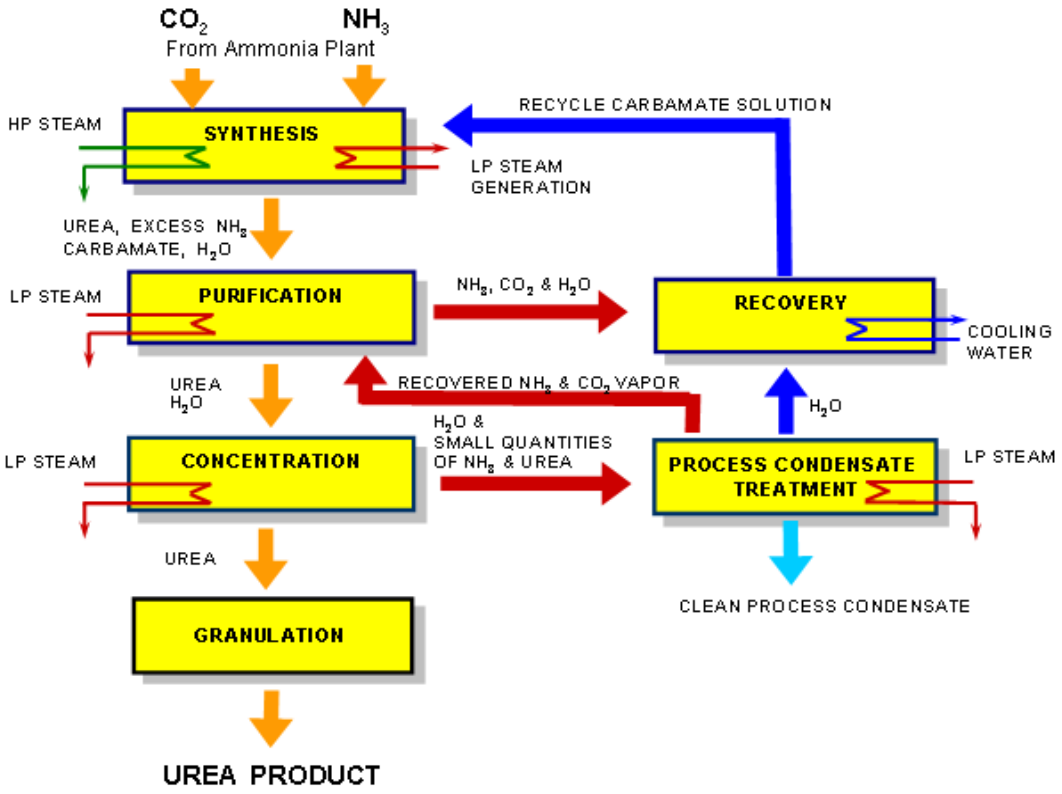


Source: KBR literature "Construction& Commissioning of BFPL's 2200mtpd-World Largest Purifier™ Ammonia Plant"

Figure 5.1.4 KBR Purifier™ Ammonia Process

(2) Urea Plant

ACES (Advanced Process for Cost and Energy Saving) was established by Toyo Engineering Corporation (TOYO) as the most energy efficient urea process in the early 1980's. And using its own expertise and advanced technology, TOYO established the ACES21®, which achieves energy saving and plant cost reduction while maintaining the excellent features of the ACES process such as high performance and high efficiency. The Block Flow Diagram of the Urea Plant is shown below.



Source: JICA Survey Team

Figure 5.1.5 Block Flow Diagram of Urea Plant

The ACES21® process synthesis section consists of a reactor, a stripper and a carbamate condenser. Liquid ammonia is fed to the reactor via the HP Carbamate Ejector which provides the driving force for circulation in the synthesis loop instead of the gravity system of the original ACES. The reactor is operated at an N/C ratio of 3.7 at 182 °C and 152 bar. The CO_2 conversion to urea is as high as 63% at the exit of the reactor.

Required raw materials for the urea production are supplied from the Ammonia Plant with the following specification at the battery limits of the Urea Plant.

1) Ammonia

Composition	
NH_3	99.9 wt% min.
H_2O	0.1 wt% max.
Oil	5 wt ppm max.
Iron	3 wt ppm max.
Pressure	20 kg/cm^2 G min.
Temperature	30 °C

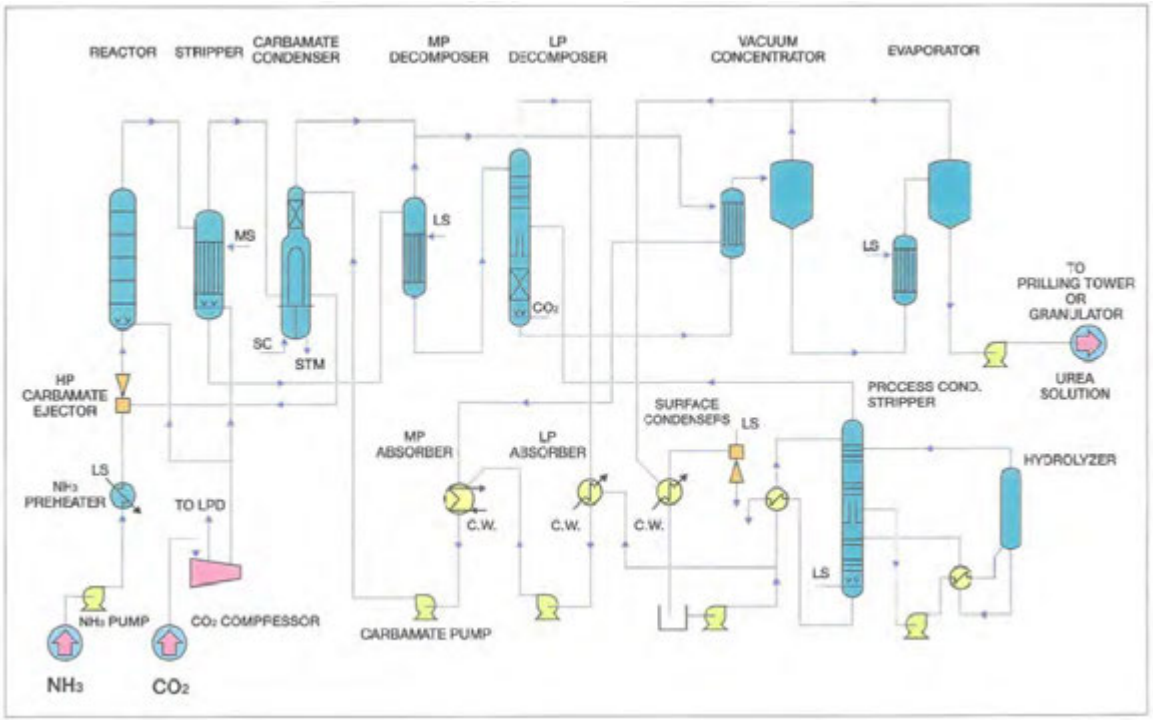
2) Carbon dioxide

Composition	
$CO_{2,}$	99.0 vol. % min.
Inerts (CH4, N2, Ar) and H2, %	1.0 vol. % max
H_2O	Saturated
H_2S	1 ppm max.
Pressure	0.8 kg/cm2 min.
Temperature	40 °C max.

The synthesized urea solution leaving the reactor is fed to the stripper where unconverted carbamate is thermally decomposed and excess ammonia and CO_2 are efficiently separated by CO_2 stripping. The stripped off gas from the stripper is fed to the Vertical Submerged Carbamate Condenser (VSCC), operated at an N/C ratio of 3.0 at 180 °C and 152 bar. Ammonia and CO_2 gas condense to form ammonium carbamate and subsequently urea is formed by dehydration of the carbamate in the shell side. Reaction heat of carbamate formation is recovered to generate 5 bar steam in the tube side. A packed bed is provided at the top of the VSCC to absorb uncondensed ammonia and CO_2 gas into a recycle carbamate solution from the MP absorption stage. Inert gas from the top of the packed bed is sent to the MP absorption stage.

The urea solution from the synthesis section is sent to an MP decomposer at 17 bar and LP decomposer at 2.5 bar for further purification. No pure ammonia recycling is required due to the high separation efficiency in the stripper. The vacuum evaporator unit produces urea melt at the required concentration for either prilling or granulation. The vent scrubber and process condensate treatment unit treat all emission streams; thus, the plant is pollution free. Process condensate is hydrolyzed and reused as boiler feed water.

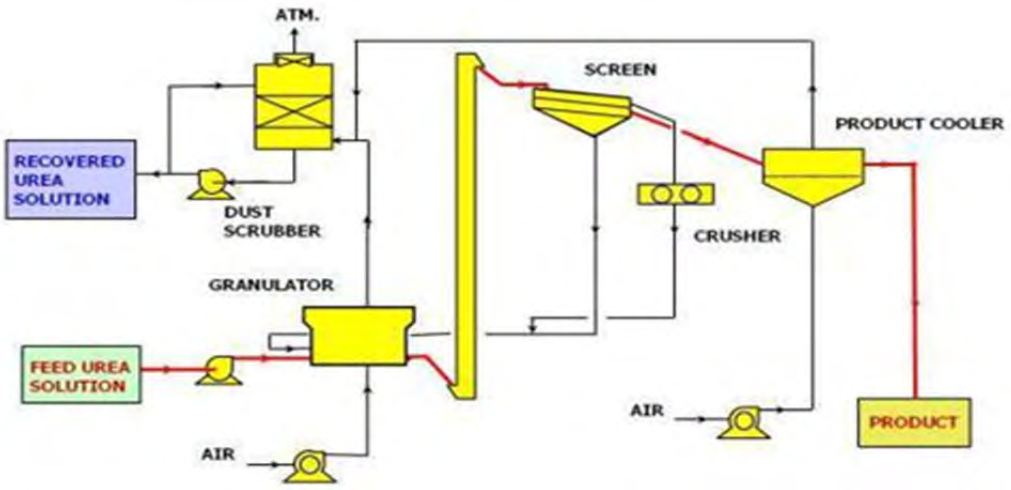
TOYO has a spout-fluid bed granulation technology to produce granular urea, typically 2-4 mm in size. Due to the proprietary granulator, electric power consumption is the lowest among granulation processes.



Source: JICA Survey Team

Figure 5.1.6 TOYO ACES21® Process

TOYO's Granulation Process uses a spout-fluid type granulator as shown below.



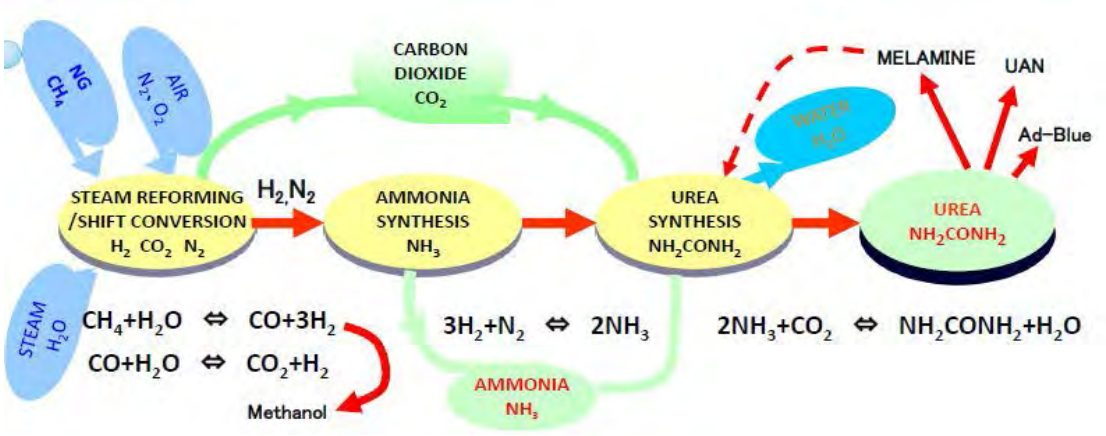
Source: JICA Survey Team

Figure 5.1.7 Urea Granulation Process

The urea solution or molten urea is fed on the spouting urea seeds through multi spray nozzles to enlarge the recycle particles (seeds) in the granulator. The water in the feed urea solution is evaporated by spouting air on the spouted beds in the granulator to produce the urea granules. The enlarged granules are cooled to a suitable temperature by fluidizing air on the internal fluidized beds in the granulator.

Coarse urea granules produced in the granulator are screened to separate the product size granules from over and under size granules through the double deck screen. Small sized granules are recycled back to the granulator as seed and the oversized granules are crushed through the double roller type crusher and recycled back to the granulator together with the under sized granules as the seeds.

Exhaust air from the granulator and cooler is scrubbed in a wet type dust scrubber to recover the urea dusts in the exhaust air. Recovered urea dusts through the dust scrubber are recycled back to the urea plant for recovery.



Source: JICA Survey Team

Figure 5.1.8 Flow of Urea Fertilizer Complex

Source: JICA Survey Team

Figure 5.1.9 Image of Urea Fertilizer Complex

5.1.5 Utility Facilities

Utility facilities required for the Urea Fertilizer Complex are as described below.

(1) Natural Gas Receiving and Fuel Gas Facility

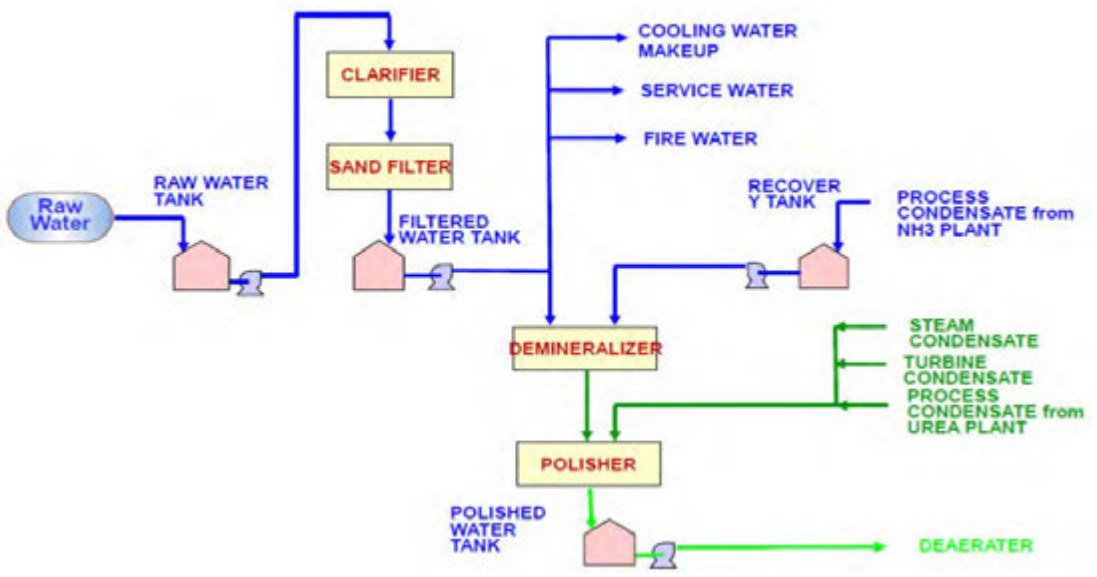
The received natural gas is delivered to the Natural Gas Metering System which consists of a metering skid and flow computer cabinet. The metering skid consists of three streams of retractable assemblies and transmitters including upstream filters and isolation valves. Pneumatically operated valves with buffer tanks are applied to reduce the maintenance for the related equipment such as the gas filter and dryer. These three streams will be skid mounted.

(2) Raw Water Treatment Facility

Raw water is sent to the Water Treatment Facility to produce filtered water, demineralized water and polished water for the Urea Fertilizer Complex. Firstly, the raw water is treated in a clarifier and sent to filters to produce the filtered water. The filtered water is utilized as make-up water for cooling water, firefighting water and other various general purposes needed for the Project.

A part of the filtered water is sent to the Demineralizer and Polisher Unit to produce demineralized water and polished water. The filtered water is sent to the Anion-Cation Tower to eliminate mineral ions in the filtered water. The demineralized water is further treated in the mixed bed type polisher together with process and steam condensate returned from the Ammonia Plant, the Urea Plant and utility Facilities. The polished water is transferred to the Polished Water Tank.

The polished water is sent to the deaerators in the Ammonia Plant and the utility facilities to produce boiler feed water for steam generation.

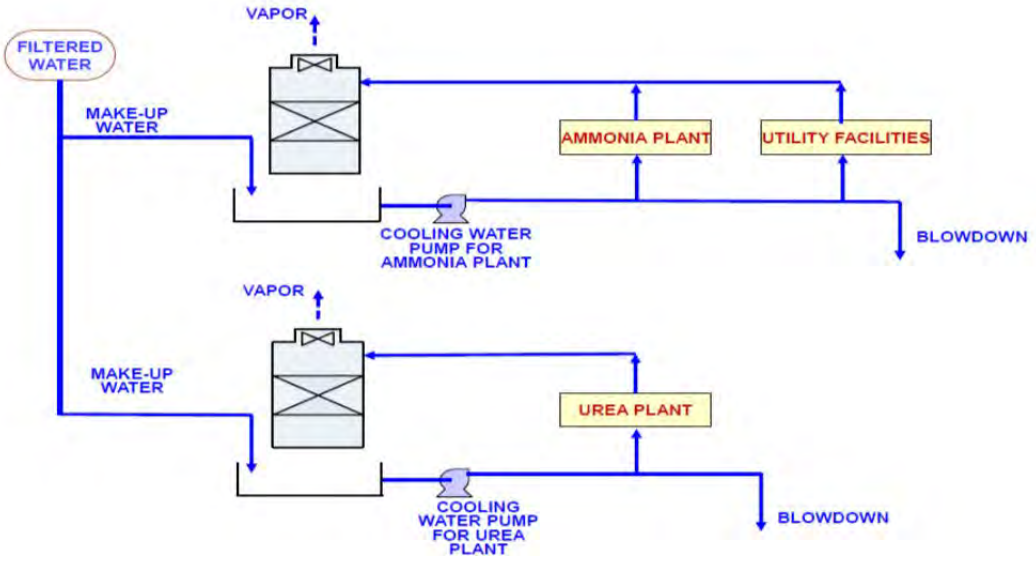


Source: JICA Survey Team

Figure 5.1.10 Raw Water Treatment Facility

(3) Cooling Water Facility

The Cooling Water Facility is a closed circuit system consisting of cooling water pumps, side filters, chemical dosing units and pipe works. The cooling water is used to cool fluids in the Ammonia/Urea Plants, utility facilities and power/steam generation facilities. The main supply and return headers to the Ammonia/Urea Plants will be buried underground.



Source: JICA Survey Team

Figure 5.1.11 Cooling Water Facility

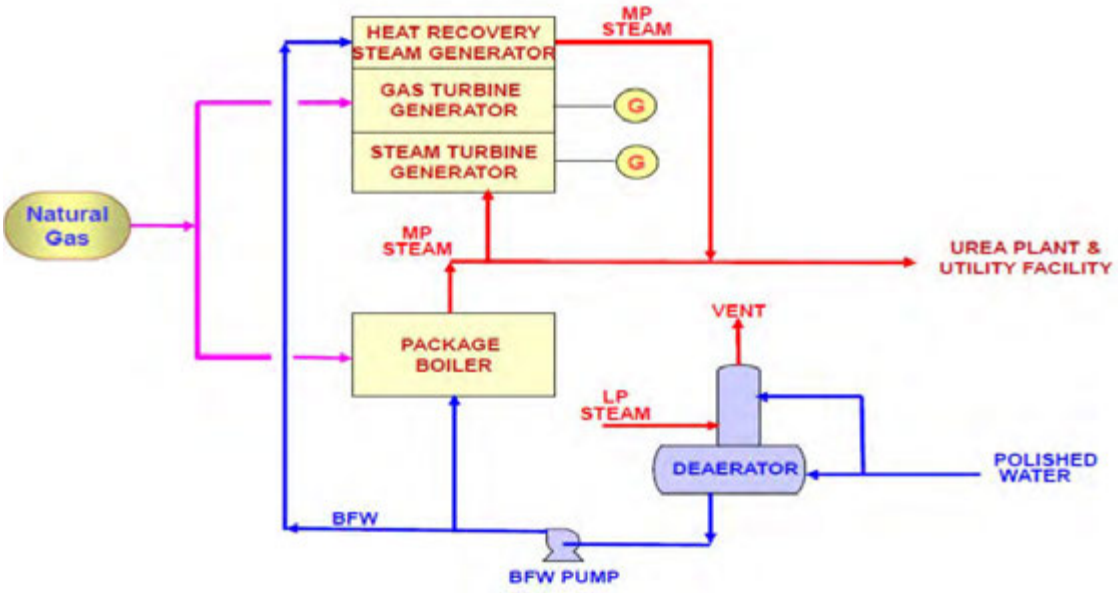
(4) Steam Generation and Power Generation Facilities

Natural gas is utilized for the steam generation and power generation. A Package Boiler and Heat Recovery Steam Generator (HRSG) are installed to supply MP steam. HRSG recovers heat energy from the GTG (gas turbine generators) effluent gas. A natural circulation water tube type package boiler using natural gas as fuel is provided.

The electricity consumed in the Urea Fertilizer Complex is generated in the combination of GTG and steam turbine generators.

An emergency diesel engine generator unit is installed for black start purpose and safe shutdown in case of emergency conditions.

The power generation system is designed to be self-sustained for the electric power of the complex. The block flow for the power and steam generation facilities is shown below.



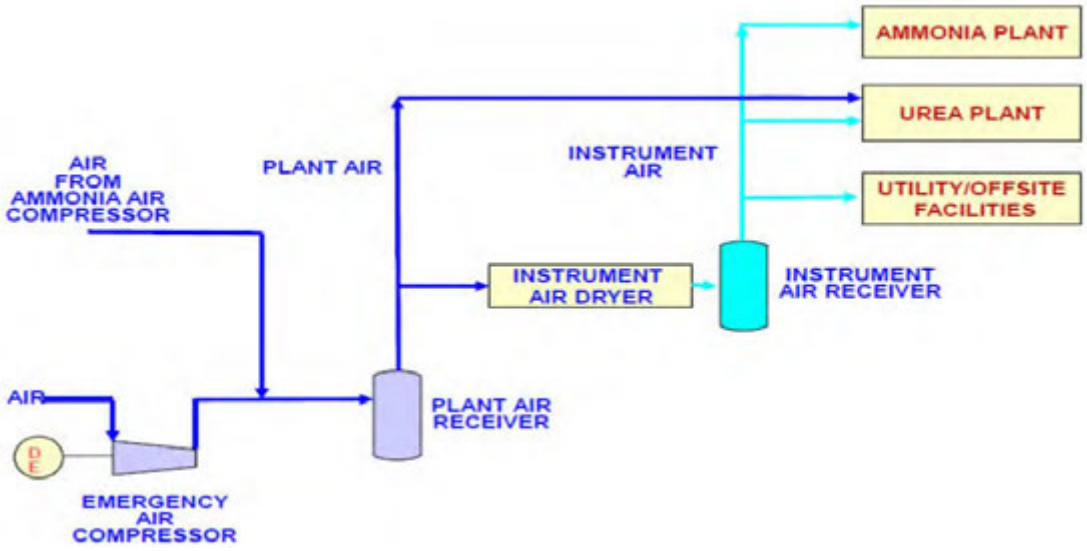
Source: JICA Survey Team

Figure 5.1.12 Power and Steam Generation Facilities

(5) Instrument Air and Plant Air Facility

The plant air is supplied normally from the Process Air Compressor in the Ammonia Plant to the Plant Air Reservoir after being regulated by a pressure control valve in normal operation. This plant air is supplied to the Instrument Air Dyer to remove moisture and is stored in the Instrument Air Reservoir. In addition, a diesel engine driven stand-by air compressor is provided. It will be automatically started to cover instrument air and plant air requirements if the Ammonia Plant Process Air Compressor shuts down and fails to supply the required instrument air and plant air. The Instrument Air and Plant Air Facility consists of the following equipment;

1) Plant Air Compressor (diesel engine driven)
2) Plant Air Reservoir
3) Instrument Air Dyer
4) Instrument Air Reservoir

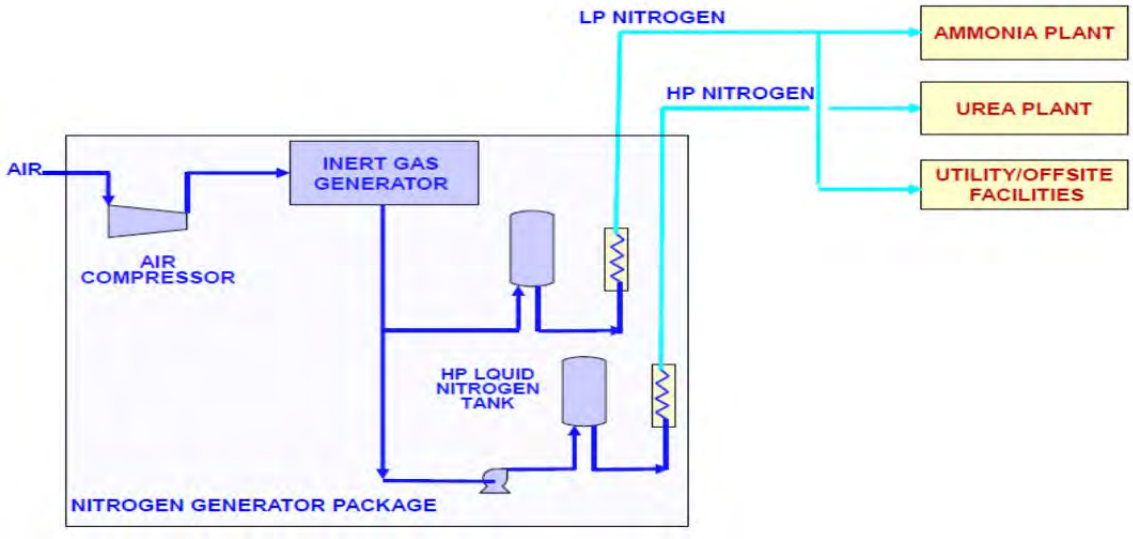


Source: JICA Survey Team

Figure 5.1.13 Instrument Air and Plant Air Facility

(6) Nitrogen Generation Facility

An air cryogenic separation type of nitrogen gas generator is provided for the Nitrogen Generation Facility. Liquid nitrogen is stored in the Liquid Nitrogen Reservoir. In normal operation, both high pressure gaseous nitrogen and low pressure gaseous nitrogen are produced and distributed to the Urea Fertilizer Complex.



Source: JICA Survey Team

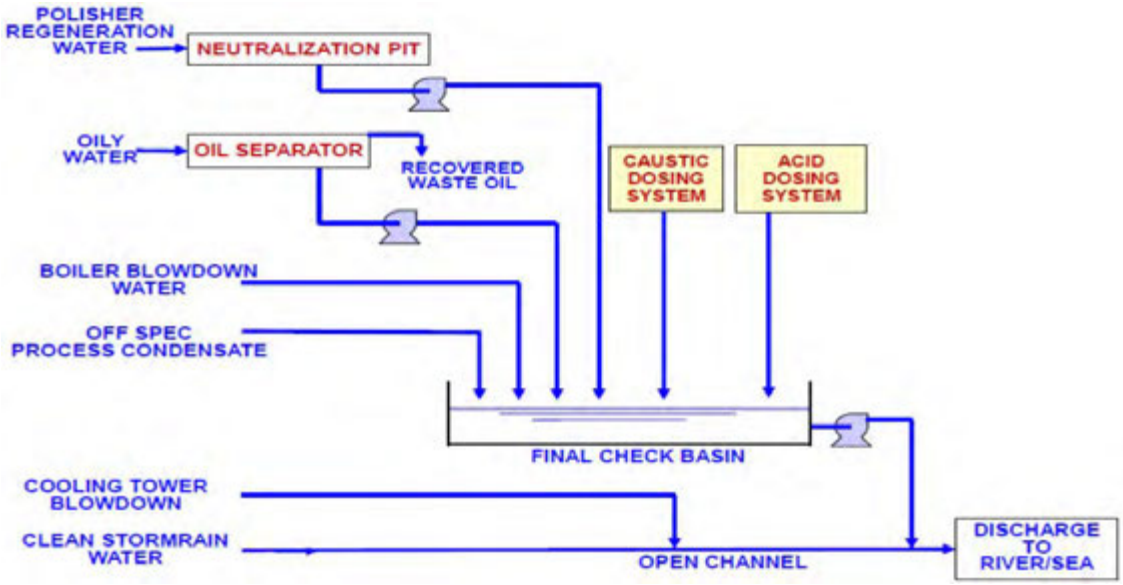
Figure 5.1.14 Nitrogen Generation System

(7) Waste Water Treatment Facility

A final check basin is installed to monitor and control the quality of the waste water before discharging it outside of the Urea Fertilizer Complex. All kinds of waste water from the complex including polisher regeneration water after neutralization, oily water after being treated by a CPI

separator, boiler blow down, regeneration waste water, off spec. process condensate and sanitary waste water are collected in the final check basin. Caustic and acid dosing systems are equipped in the final check basin for adjusting the quality of the waste water. Cooling tower blow-down and non-contaminated storm water will be directly discharged to the river/sea.

The discharged waste water shall meet the quality requirements of the World Bank Guidelines and/or local regulations for industrial waste. A simplified block flow of the waste water system is shown below.



Source: JICA Survey Team

Figure 5.1.15 Waste Water TreatmentFacility

5.1.6 Offsite Facilities

Offsite facilities in this plant mainly consist of the following.

(1) Ammonia Storage Tanks

The following storage tanks are to be provided in the Project;

Product Ammonia Tanks : 12,000 tons

DW (double wall) : CRT (cone roof)

(2) Urea Bulk Storage Buildings

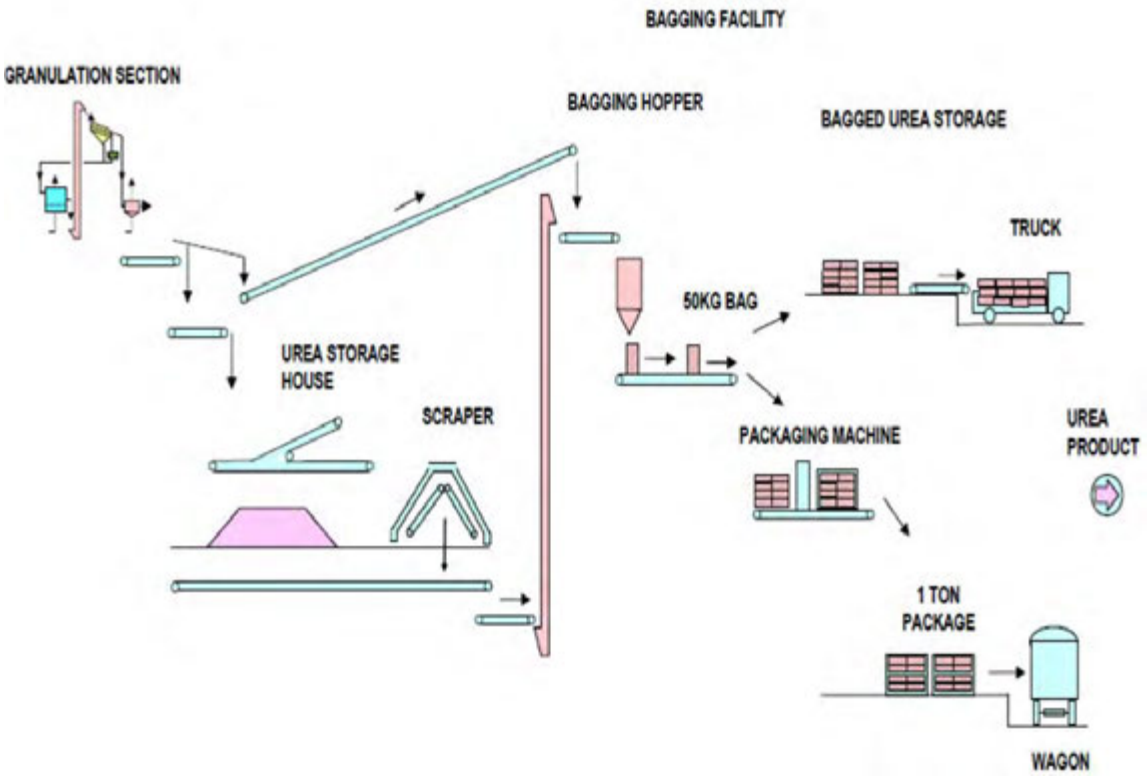
The following bulk storage buildings are provided in the Project;

Urea Storage Buildings : 120,000 tons, 480 m x 60 m

The storage buildings will be constructed of steel with air conditioning devices to avoid absorbing moisture.

(3) Urea Product Handing

Urea is bagged in 50 kg bags by a bagging hopper and then packed onto 1 ton pallets by a packaging machine. The 1 ton pallets are loaded onto railway wagons by fork lifts and sent to the Beira Port for export. Some portion of urea bagged in 50 kg bag is loaded on trucks for domestic delivery.



Source: JICA Survey Team

Figure 5.1.16 Urea Product Handling Facility

(4) Potable Water

A Sodium Hypochlorite Injection Unit is provided in the potable water system for disinfection. The potable water is distributed to eye washers and showers in the entire plant area after disinfection.

(5) Sanitary Water

Sanitary water from buildings is once treated in septic tanks and then transferred to the Biological Treatment Unit in the waste water treatment system.

(6) Gaseous Emissions

Main sources of emission are the gas turbine generators and the primary reformer. Natural gas is burned in the gas turbine generators and the primary reformer. Emissions from all sources will satisfy the limitations in the regulations.

(7) Solid Waste

Sludge is generated in the clarifier in the pre-treatment system and the Biological Treatment Unit in the waste water treatment system. Such sludge will be dewatered independently in each system to facilitate handling. It will require proper disposal to avoid adverse impacts to the environment, particularly to water quality and land contamination.

(8) Flare Stack

Flare stack height shall be decided in accordance with the maximum heat intensity at ground level as is internationally or locally permitted for the subject plant application. To decide the design flare load, the following major circumstances are evaluated;

- Total power failure
- Cooling water failure
- Steam failure
- Single failure (individual failure)

Among the above failures, the case of power failure decides the flaring load.

(9) Fire Water System

The fire water is supplied from the fire water network which is common use for the industrial area. The filtered water stored in the tank can be used as a backup.

(10) Interconnecting Piping

Interconnecting piping is provided between plants, units and facilities. Piping with electrical & instrument cables and conveyors for bulk products will be installed on pipe racks and pipe sleepers.

(11) Common Buildings

The following common buildings are considered in this Survey;

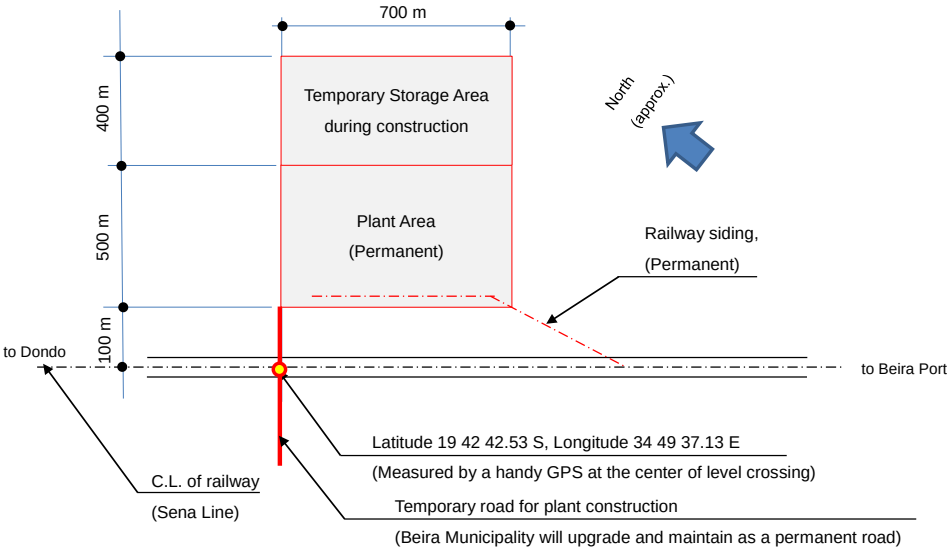
- Central Control Room including Laboratory
- Main Electrical Room for Power Generation
- Electrical Sub-stations
- Administration Building
- Maintenance Shop
- Warehouse
- Chemical Storage
- Gate House/Parking Shed, etc.

A fire station is not considered because the common fire station covering the whole industrial area may be provided by Beira City.

5.1.7 Plant Layout

(1) General Plot Plan

The general plot plan of the Plant is shown below. Area of the Plant is 35 ha.



Source: JICA Survey Team

Figure 5.1.17 Plant Area

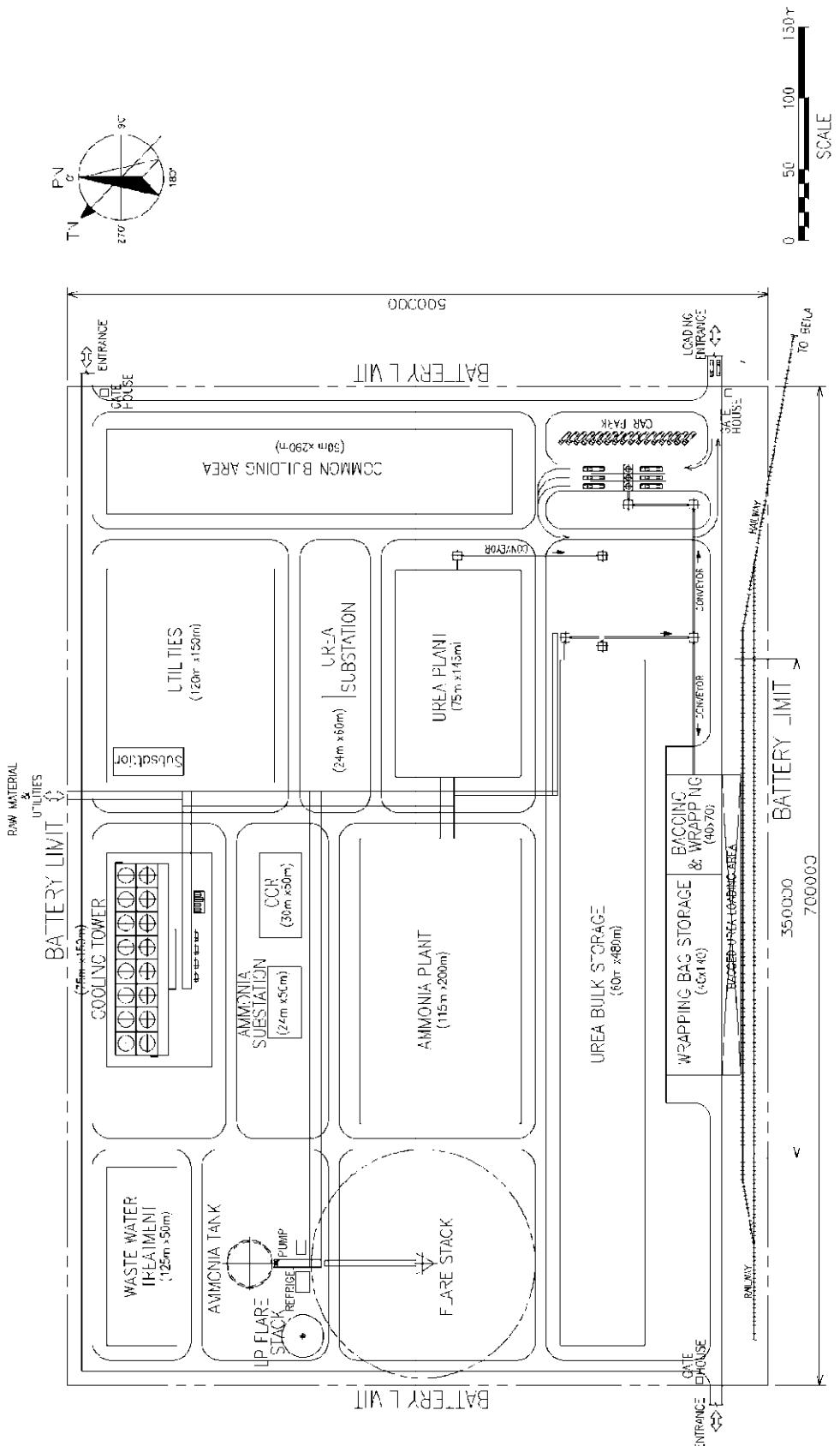


Figure 5.1.18 General Plot Plan

Source: JICA Survey Team

(2) Temporary Area

For the construction work, the following areas for temporary facilities will be required.

- Construction Area : 200,000 m^2
- Camp Facilities Area : 50,000 m^2

5.1.8 Construction Schedule

42 months is expected from the effective date of contract (EDC) to the provisional acceptance (PA) of the Project. This duration consists of:

1) Site preparation: 6 months from EDC
2) EPC of the plant: from 7^{th} to 38^{th} month
3) Commissioning and PA: from 39^{th} to 42^{nd} month

5.1.9 Engineering, Procurement, Construction Plan

(1) Engineering Phase

The phasing of engineering and design work usually depends on the project owner's policy; however, the engineering and design may start with a feasibility study prior to the materialization of the project, followed by Basic Design, Front End Engineering Design (FEED) and Detailed Design.

In the Basic Design phase, the process design employed for the facility and the various basic concepts of the plant design are defined. In some cases, a licensor (a technology owner) undertakes a major role in this phase. Engineers will study the material and heat balances and define major equipment, control systems and instrumentation for all parts of the process. This determines the basic functions of the elements and defines the spatial requirements for the facility.

Following the basic process design, the FEED phase includes sizing of the major components and layout design. The basic design of major components and layout may be fed back to the process design to optimize functional requirements and further refine the skeleton and layout of the facility. The basic design for mechanical equipment, control and electrical systems is undertaken and quotations may be obtained from vendors for critical items during the FEED phase. Piping and civil engineers contribute to develop the overall layout and define the outline of the necessary buildings, structures, roads and other elements as required.

During the Detailed Design phase, a significant number of construction drawings including foundation drawings, steel frame drawings, construction drawings for electrical equipment, instrumentation and piping are prepared. These construction drawings are prepared incorporating

detailed information obtained from suppliers for mechanical equipment, instruments, electrical and other equipment to be included in the facility.

(2) Procurement

Equipment and materials are procured from global sources. It is necessary to implement comprehensive material control that covers the schedule control of fabrication, quality control by inspection and the transportation to the construction site.

1) Expediting

Equipment and materials are ordered considering the requirements for quality, delivery date and budget.

2) Schedule control

The fabrication schedule is controlled by constantly monitoring the whole process from order placement to shipment. It is necessary to ensure the delivery period by detecting any indications of possible delays and proactively formulating the necessary countermeasures in both in-house personnel and external parties.

3) Inspection

Quality assurance is one of the most important key elements in Procurement . It is important not only to confirm the quality assurance organization of manufacturer, but also to inspect and perform tests in-house during fabrication and after completion from the viewpoints of product safety and performance. Then, it is possible to ship reliable equipment and materials.

4) Transportation

To transport enormous amounts of equipment and materials efficiently, considering the shop delivery date and the required date on site, a detailed transport plan and flexible measures are required. In particular, when large and heavy equipment is handled, the timely arrangement of special purpose vessels, vehicles, etc. is the key to the success of the project.

In this Project, equipment and materials will be unloaded at the Beira Port and transported to the site by road. For the transportation of heavy equipment, reinforcement of the existing bridges needs to be considered.

(3) Construction

The construction is started from the soil improvement, site preparation, security of utility such as power and water, camp construction. And then, it extends to civil engineering, equipment and piping installation, electric and instrument system setup, painting and insulation and eventually mechanical completion. In addition, the field manager’s responsibilities include logistics,

procurement, engineering, pre-commissioning, administration, accounting, taxation and local authorities relations.

5.2 Gas Pipeline

It is not economical to develop a gas pipeline only for this Project and it is preferable to develop it considering other purposes such as power generation and industries. However, the gas master plan is under preparation in Mozambique and no plans are available for future gas usage and gas pipeline network. For this situation, a gas pipeline is assumed to be developed only for this Project in this Survey.

The same assumption is applied for the alternative plan in Chapter 5.5 in which the Rovuma gas field is assumed as a gas supply source.

5.2.1 Outline of Pipeline Route

(1) General

The proposed gas transmission pipeline system between the Temane gas field and the Project site in Beira consists of a gas pipeline and related facilities such as block valves and pig launcher/receivers, etc. The reconnaissance by the survey team in November 2013 was limited to only the vicinity of Pande/Temane gas fields and the Project site, and no field survey was carried out in other parts of the pipeline route, due to the uncertain security situation in Mozambique.

As a study result on available information, it is concluded that the onshore route starting at the tie-in point of the Central Processing Facility (CPF) in Temane gas field, going up north along the national road No.428 (EN428) and ending at the fertilizer complex site, is comparatively practical and appropriate for the gas transmission pipeline. The aforesaid gas pipeline route is approximately 305 km long and has a gentle topography with little difference in elevation. However, the ROW shall be finally selected in the basic design stage based on ESIA and investigation such as soil condition, physical obstacles, and river and/or road crossings.

(2) Pipeline Routing

1) Onshore Pipeline Route

The onshore pipeline ROW alignment was partially observed during the field reconnaissance conducted in November 2013. As for the remaining area where the field reconnaissance could not be conducted, its ROW alignment was confirmed on maps.

The preliminary elevation profile of the ROW's ground level is shown in Figure 5.2.1. The highest point is about 70 m above sea level at around 130 km from the start point (CPF). In the terrains between the 80 km point and the 100 km point and between the 225 km point and the 250 km point, comparatively large changes in altitude are observed. There is a long crossing of

the Pungoe River at about the 270 km point where the horizontal directional drilling (HDD) method will be applied. Since the proposed transmission pipeline traverses rural and agricultural areas, there may be several major national road crossings as well as numerous minor roads, localized fields, localized wet areas and small rivers. It is assumed there will be no serious physical obstacles or environmental restrictions throughout the entire ROW.

2) Offshore Pipeline Route

Figure 5.2.2 shows an alternative plan for an offshore gas pipeline route. Its total length is approximately 274 km including the onshore part of about 63 km. This offshore gas pipeline route is preliminarily proposed based on the available sea charts without carrying out a seabed survey. To avoid interference in the busy shipping lanes, the pipeline approach to the sea is planned at the Ponta Tondo seashore near the Temane gas field, then the pipeline will be pulled down to the sea by pulling-back techniques. The shore approach of the Beira side shall be selected so as to make it as short as possible, while keeping away from sunken obstacles, anchorage, quarantine zones, environmentally sensitive areas, military restricted areas, etc. The offshore pipeline route from Ponta Tondo to Beira is selected keeping 20 to 30 m of sea water depth. Accordingly, in order to confirm its appropriateness, further studies are necessary to determine bathymetric and geomorphologic factors such as coastal and foreshore sediment movement, currents, scour, other seabed properties, environmental sensitivities, shore pipeline pull-back method, etc.

3) Comparison of Pipeline Routes

As mentioned in 1) and 2), both onshore and offshore pipeline routes are preliminarily proposed based on the information from the available maps without carrying out sufficient field surveys. Table 5.2.1 compares both pipeline routes to propose more realistic and appropriate plan.

Table 5.2.1 Comparison of Pipeline Routes

	Onshore Route	Offshore Route
Length of Pipeline	305 km	274 km (including 63 km onshore part)
Rough Estimate (Unit Rate)	USD 158 million (USD 32 /inch-meter)	USD 172 million (USD 39 /inch-meter)
Environmental and Social Considerations	The onshore route goes up north along the national road No. 428 and passes through rural and agricultural areas with low population density, but does not interfere with any environmental conservation areas. Therefore, it is expected that there will be no serious environmental restrictions throughout the entire ROW.	The offshore route crosses the Marine Sofala Bank designated as an environmental conservation area. Both shore approaches on the Temane and Beira sides are located in vegetation areas such as mangroves, and the Temane side is near to the Bazaruto National Park.

	Onshore Route	Offshore Route
Constraints on Construction	• Field construction activities may be affected by weather condition in rainy seasons. • Pipelaying work is comparatively easy. • Large wetlands and residential areas can be evaded in selection of a pipeline route. • A fast-tracking implementation method, which deploys several crews at the same time, is applicable for pipelaying work.	Availability of a pipelay barge to be chartered and marine weather condition shall be carefully considered in preparation of a pipeline installation plan.
Flexibility to the future change of pipeline operation system	It is possible to cope with the future change of demand/supply because the additional installation of inlet/outlet in the middle on the onshore pipeline is not difficult even after the completion of installation work.	It is difficult to cope with the future change of demand/supply because the additional installation of inlet/outlet in the middle on the offshore pipeline is difficult after the completion of installation work.

Source: JICA Survey Team

As a result of the above comparison, it is judged that the offshore route plan may have serious problems to be settled in the environmental aspect and is inferior to the onshore route plan in aspects of the construction cost and the flexibility to the future change of pipeline operation system. Thus, in this Survey, the onshore route has been adopted for the conceptual design.

(3) Right of Way (ROW)

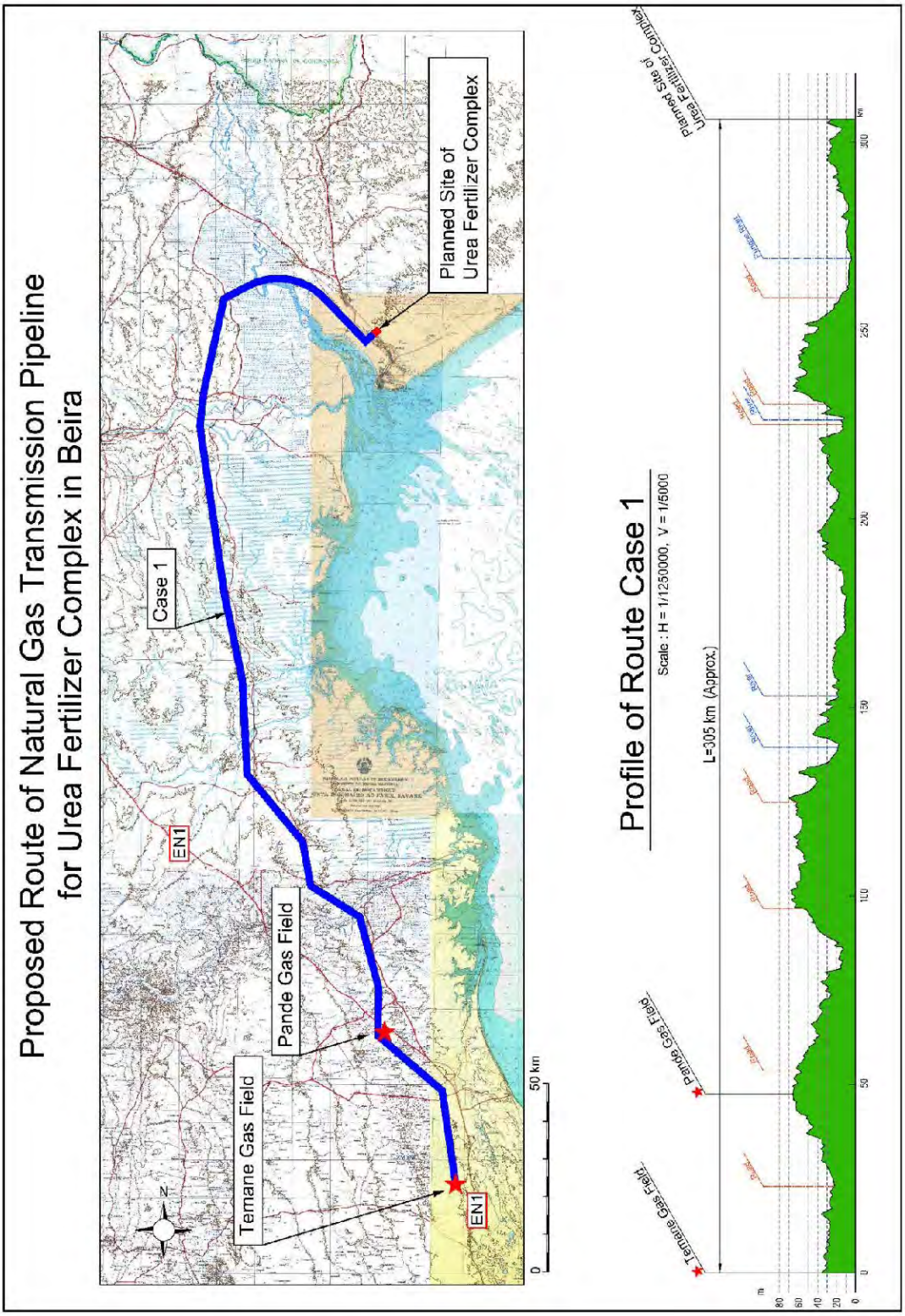
Regarding the statutory ROW, the following information was obtained from ENH.

a) The ROW will be granted to a project owner when INP provides concession.

b) The concession will be granted through the following process:
FS → ESIA → Licence from MICOA → Concession Agreement

Environmental permits and specific crossing permits for rivers, national roads, municipal roads, railways, etc., shall be obtained from Ministry of Coordination of Environmental Affairs (MICOA), Regional Administration of Waters (ARA), National Road Administration (ANE), etc. respectively. Also, the access to private land, if necessary, shall be negotiated with the owners.

The width of ROW will be 20 m, which is similar to the ROMPCO pipeline from Pande/Temane to Secunda, South Africa. A fibre optic cable network for the SCADA system will be installed in the pipeline ROW to operate block valve stations with a remote function. A service track of 5 m to 6 m wide will be provided in parallel with the ROW for access and maintenance of pipeline block valves stations, the cathodic protection equipment and test stations. The final ROW survey and preparation of alignment sheets must be conducted as soon as possible, since this is the foundation for the detailed basic design of the Project.



Source: JICA Survey Team

Figure 5.2.1 Pipeline Route Case 1 (Onshore)

Source: JICA Survey Team

Figure 5.2.2 Pipeline Route Case 2 (Offshore)

5.2.2 Conceptual Design

This sub-chapter addresses the conceptual design aspects of the gas transmission pipeline system to transport the dry gas of 80.4 mmscfd from the CPF in Temane to the Urea Fertilizer Complex in Beira. The system is comprised of gas transmission pipeline sections and associated facilities which include ancillary custody gas metering/pressure regulating facilities, pig launcher/receiving facilities, cathodic protection, block valve facilities, and supervisory control and data acquisition (SCADA) systems. A new control room will be required at the Temane gas field and the Urea Fertilizer Complex.

There is an option that the planned gas pipeline should be utilized not only for this Project but also for other projects in order to lower financial burden on this Project. However, according to ENH, the gas master plan is still under preparation (even delayed) and it is difficult to designate other projects during this Survey. Therefore, the sharing of the planned gas pipeline with other projects is not considered in this Survey.

(1) Gas Supply

The gas of 80.4 mmscfd will be supplied from the Temane gas field for at least 20 years to the Urea Fertilizer Complex.

(2) Basic Design Basis (Assumptions)

The basic design basis used in this Survey is shown in Table 5.2.2.

Table 5.2.2 Basic Design Basis (Assumptions)

Item	Value or Factor	Remarks
1. Design pressure (bar)	125	1,814 psi
2. Design temperature (°C)	28	82.4 °F
3. Flow gas volume (Nm^3/hour)	90,000	80.4 mmscfd
4. Inlet pressure to pipeline (bar)	100	1,450 psi
5. Discharge pressure at Power Generation Facility in the Urea Fertilizer Complex (bar)	Min. 25	355 psi
6. Pipe outside diameter (inch)	16	406.4 mm
7. Design factor	0.5	Class 3[*1]
8. Longitudinal joint factor	1.0	Api 5L seamless
9. Temperature derating factor	1.0	250 °F or less

Note: *1 refer to "(3) Location Class for Design and Construction" in Chapter 5.2.2
Source: JICA Survey Team

(3) Location Class for Design and Construction

The location class for design and construction is studied to adopt the appropriate safe spacing of the pipeline corridors. In accordance with the ASME B 31.8 applicable in Mozambique, the location class criteria shown in Table 5.2.2 are used in this study. As a result of the field surveys

and the review of existing information, no massive population growth and/or urban development is foreseen in the vicinity of the pipeline ROW proposed. Accordingly, almost all of the pipeline ROW, excluding road crossings and railway crossings, are judged as Location Class 1 or 2. However, in this study the Location Class 3 (Design Factor: 0.5) is provisionally applied for all of the pipeline ROW since the entire route survey could not been conducted. The location class for design and construction shall be confirmed again after finishing the whole route survey and environmental impact analysis.

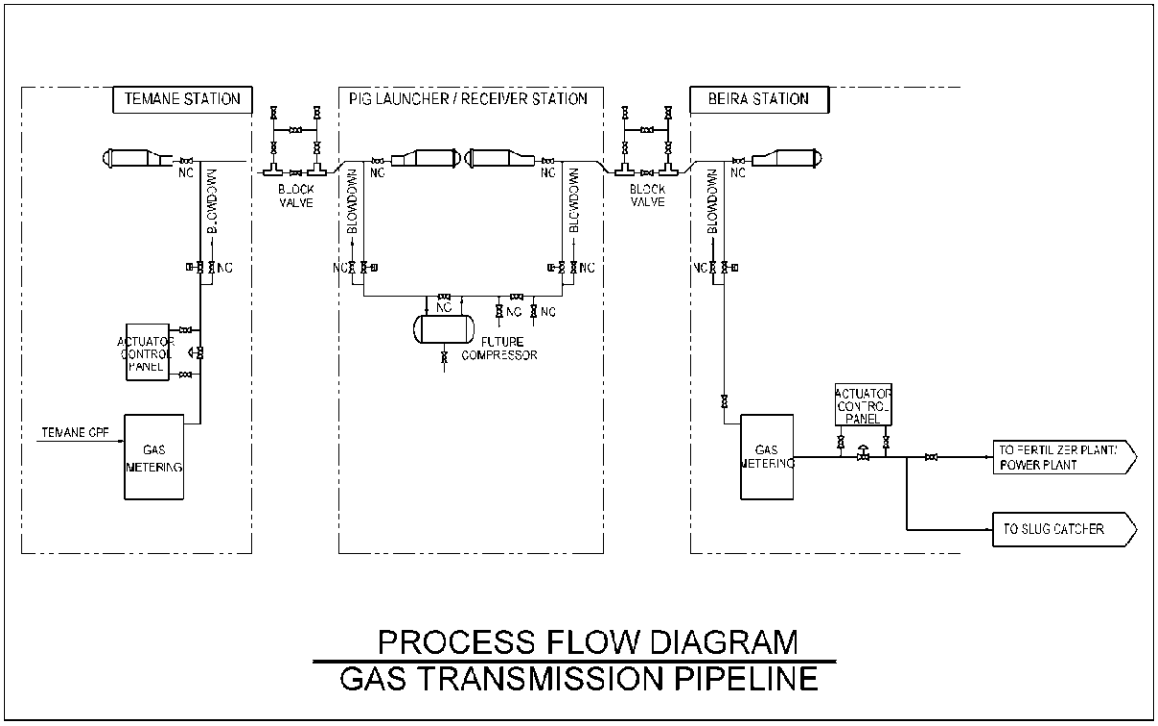
Table 5.2.3 Location Class

Location Class	Description (Number of buildings intended for human occupancy within each zone of 1,600 m x 400 m)	Design Factor
Class 1	10 or fewer buildings Areas such as wasteland, deserts, mountains, grazing land, farmland, and sparsely populated areas.	
Div. 1	Hydrostatic test pressure: 1.25 times the max. operating pressure	0.8
Div. 2	Hydrostatic test pressure: 1.1 times the max.operating pressure	0.72
Class 2	More than 10 but fewer than 46 buildings Areas where the degree of population is intermediate between Location Class 1 and Location Class 3,such as fringe areas around cities and towns, industrial areas, ranches or country estates, etc.	0.6
Class 3	46 or more buildings (except when a Location Class 4 prevails) Areas such as suburban housing developments, shopping centres, residential areas, industrial areas, and other populated areas not meeting Location Class 4 requirements	0.5
Class 4	Areas where multi-storey buildings are prevalent, where traffic is heavy or dense, and where there may be numerous other utilities underground. Multi-storey means four or more floors above ground including the first or ground floor. The depth of basements or number of basement floors is immaterial.	0.4

Source: ASME B 31.8

(4) Pipeline Hydraulic Evaluation

The pipeline is designed to transport the natural gas of 80.4 mmscfd while satisfying the pressure supplied at the Temane inlet as well as the pressure of about 25 bar given at the outlet in the Urea Fertilizer Complex. The process flow diagram of this pipeline system is shown in Figure 5.2.3. The design life for the pipelines shall be 40 years, and 25 years for the electrical and mechanical systems and ancillary equipment. It is thought that no two-phase flow will occur because of the natural gas composition of the existing CPF and the underground condition. The two-phase flow analysis and the uphill and downhill pressure loss analysis have been excluded from the pipeline hydraulic evaluation assuming that in the futures the gas will be delivered to the pipeline as sweet, hydrocarbon and water dry gas at sales gas quality. As a result of the hydraulic evaluation, it is confirmed that the supply pressure of a minimum of 100 bar at the Temane inlet is sufficient to transport the natural gas of 80.4 mmscfd at the pressure of 25 bar up to the outlet at the Power Generation Facility in the Urea Fertilizer Complex. For reference, the supply pressure at the existing Temane CPF is approximately 100 to 120 bar.

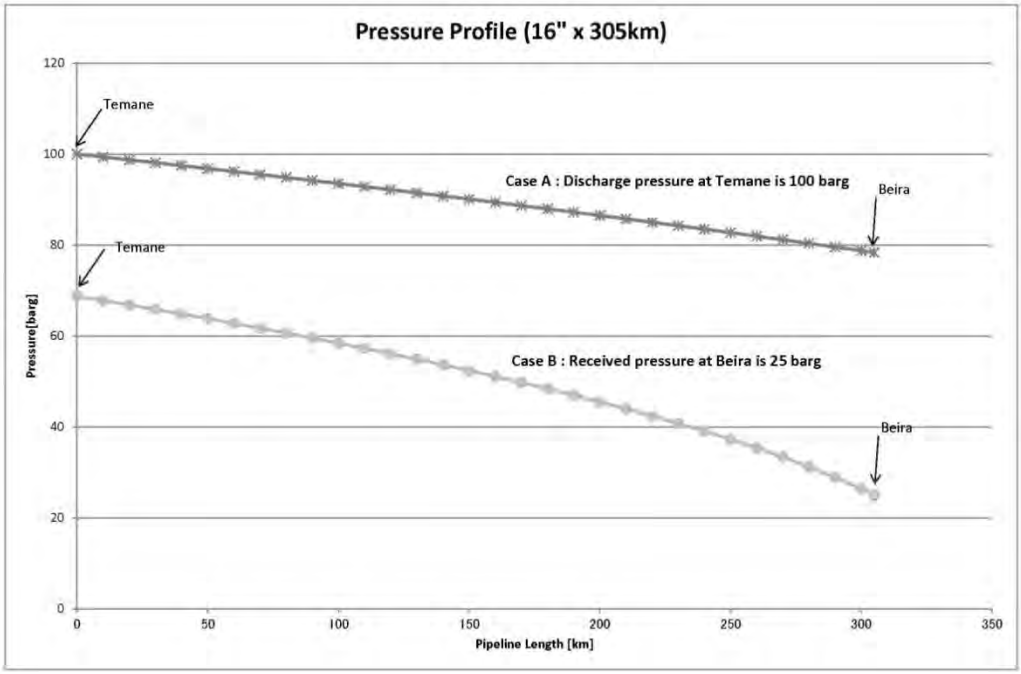


Source: JICA Survey Team

Figure 5.2.3 Process Flow Diagram

Pipe sizing calculations have been performed using the common AGA-3, Panhandle and Weymouth equations for the single phase turbulent flow to calculate the friction losses and pipe sizing without corrections for elevation changes. Although slightly different results have been given by these equations, the overall pipeline is analysed by the result of the AGA equation in consideration of the purpose of this study. Further pipeline hydraulic analysis including corrections for uphill and downhill runs of the pipeline will be required once the ROW line profile and the distance between the gas field and the urea fertilizer complex site are finally confirmed in the detailed design phase.

As for the operational pressure and the temperature condition along the onshore pipeline, the gas contained in the pipeline will be maintained at considerably higher temperature than its dew point and no water will be generated in the pipeline under any operational conditions. As shown in Figure 5.2.4, two cases of pressure drop analysis have been conducted at the maximum capacity of 80.4 mmscfd. The specification of pipe material based on the result of the pipeline hydraulic evaluation at the maximum flow capacity of 80.4 mmscfd is shown in Table 5.2.3.



Source: JICA Survey Team

Figure 5.2.4 Pressure Profile

(5) Gas Composition

The gas compositions of Pande/Temane gas fields are shown in Chapter 5.1 of this report.

(6) Wall Thickness Determination

For this preliminary design, the minimum wall thickness to withstand the operating pressures in the pipeline sections is calculated based on the following ASME B31.8 equation, and its result is shown in Table 5.2.3.

t = (P x D)/(2 x S x F x E x T), where:

t = Minimum wall thickness, inch

P = Design pressure, psi

D = Outside diameter, inch

S = Specific minimum yield strength (SMYS), psi

F = Maximum design factor; for construction locations

E = Longitudinal joint factor

T = Temperature derating factor

Table 5.2.4 Specification of Pipeline Material

Wall Thickness Calculation

$$t = \frac{Pi \times D}{2 \times E \times F \times T \times S}$$

D = 16"

Design Pressure	Pi =	1814.0	psi	127.6	kg/cm^2											
				125.0	bar											
Nominal Dia	D =	16	inch	406.4	mm											
S.M.Y.S	S=	60,000	psi			60,000 psi				65,000 psi				65,000 psi		
F =		0.6		X-60		0.5		X-60		0.6		X-65		0.5		X-65
E =		1.0				1.0				1.0				1.0		
T =		1.0				1.0				1.0				1.0		
Calc.W.T	t =	0.4031111	inch	10.2	mm	0.4837333	inch	12.3	mm	0.3721026	inch	9.5	mm	0.4465231	inch	11.3 mm
Corrosion A.	A =		inch	0	mm		inch	0	mm		inch	0	mm		inch	0 mm
W.T	t+A =	0.4031111	inch	10.2	mm	0.4837333	inch	12.3	mm	0.3721026	inch	9.5	mm	0.4465231	inch	11.3 mm
API W.T		0.406	inch	10.3	mm	0.500	inch	12.7	mm	0.375	inch	9.5	mm	0.469	inch	11.9 mm
Selected W.Thickness			inch		mm		inch		mm		inch		mm	**0.469**	inch	**11.9** mm

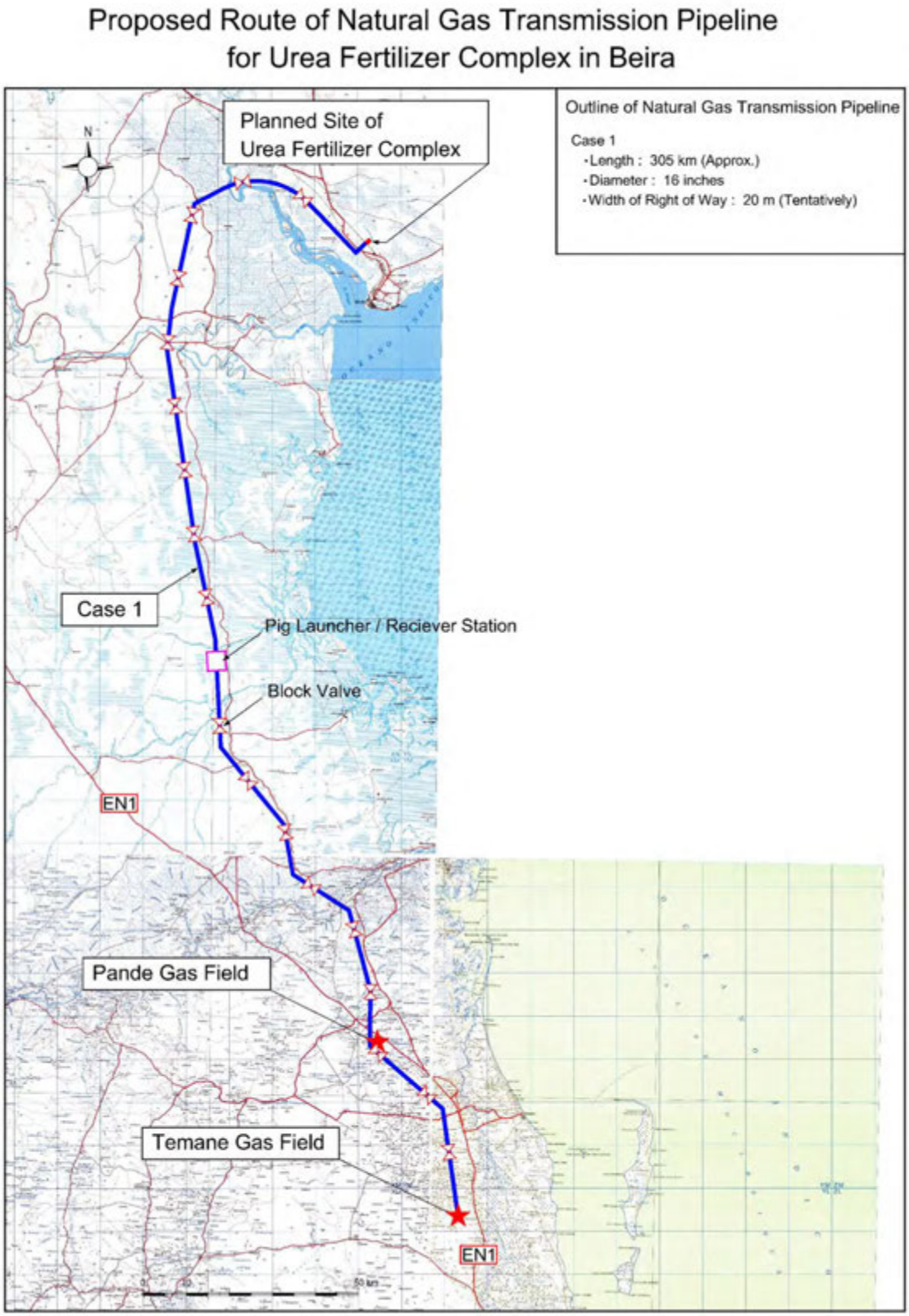
: Selected

Source: JICA Survey Team

(7) Pipeline Block Valve Stations

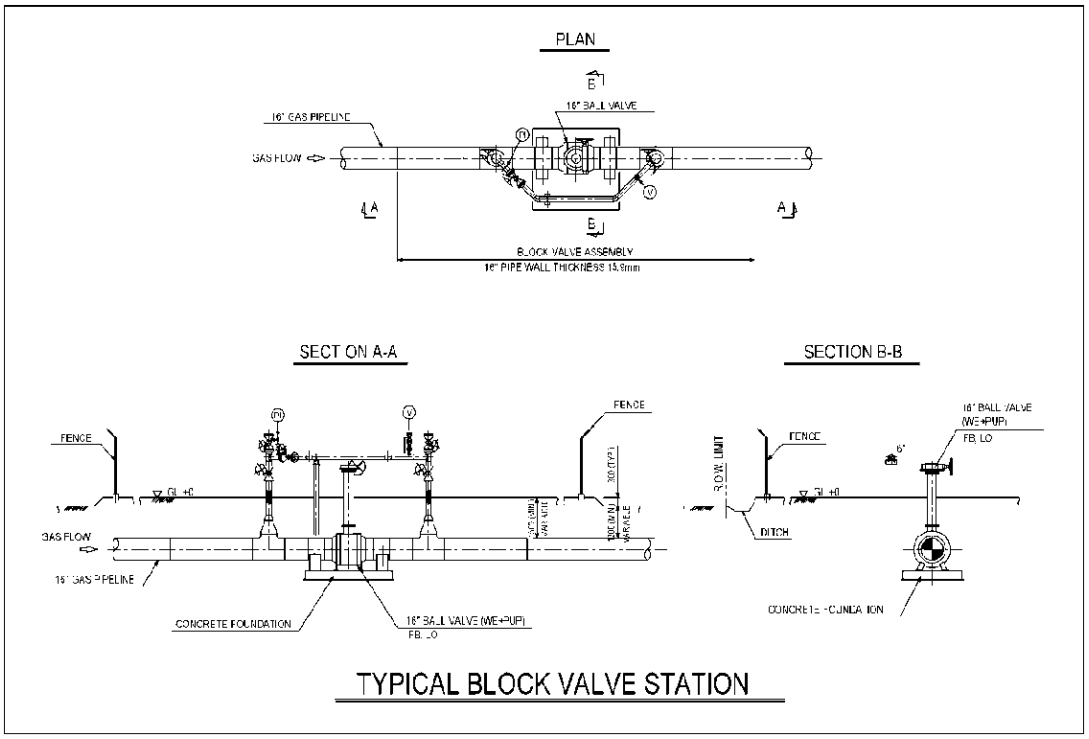
The layout plan and the typical details of the sectionalizing block valves installed on the way and at the ends of the pipeline are presented in Figures 5.2.5 and 5.2.6 respectively. All block valves including blow down valves and main line emergency shutdown valves shall be of a carbon steel full bore type meeting the requirements of API 6D, with flanges of ANSI 600 rating. The intermediate block valves shall be capable of remote/local operation, be furnished with emergency backup power means for gas/hydraulic operation and be installed above ground basically. The block valve station is equipped with blow down valves, manifolded to permit sectionalized gas release from the pipeline at either side of the block valve arrangement. Therefore, its location shall be planned keeping a certain distance from any overhead power transmission line ROW.

The spacing between block valve stations shall not exceed 24 km, 16 km and 8 km for Location Classes 2, 3 and 4 respectively as defined in the ASME B 31.8. However, the aforementioned spacing shall be established during the detailed route design in consideration of the accessibility and convenience of operation and maintenance. In this study, the number of block valves is determined based on the distance of 16 km for Location Class 3.



Source: JICA Survey Team

Figure 5.2.5 Layout of Block Valve and Pig Launcher/Receiver Stations



Source: JICA Survey Team

Figure 5.2.6 Details of Block Valve Station

(8) Pig Launcher/ Receiver Stations

After the installation work, frequent piggings are required for all pipeline sections during pre- and final commissioning work. And periodic pigging and intelligent pigging inspection are required after the commencement of the pipeline operation. The pig launcher and receiver stations are placed at both ends and the middle point (around 150 km from CPF) of the pipeline.

(9) Corrosion and Cathodic Protection

The pipeline system shall be designed to provide cathodic and anodic protection for safeguarding underground pipeline sections, block valve stations, pigging stations and appurtenances in corrosive areas as well as in areas where the pipeline is in close proximity to energized overhead power transmission lines in parallel or being crossed.

The corrosion protection system shall consist of an external coating system (three-layer polyethylene) applied to the pipeline, and the installation of electric powered air-cooled rectifiers on the entire onshore pipeline with conventional ground beds. Each section shall be insulated from the other sections to reduce harmful current densities and increase rectifier efficiencies. To obtain and verify the soil resistivity data necessary to design the type of grounding and the number of anodes required, soil resistivity measurements shall be made after the final route selection of the ROW during the design stage as required. The temporary installation of a galvanic impressed current cathodic protection system, which can be modified for permanent use,

is recommended during the construction stage. The signals from the cathodic protection system will be monitored via the SCADA system interface.

The short circuiting of static electricity in the pipeline installation period is a primary concern in areas where a pipeline is laid close to an energized overhead power transmission line. In such circumstances, mitigation means, such as potential gradient control mats and/or bonding, shall be taken to reduce the potential gradient to a tolerable level in accordance with IEEE-80 standard so that the induced potential difference between the pipeline aboveground facilities, such as block valve station, M/R station, offtake points, pig launcher/receiver station, etc., and the surrounding soil may not reach a hazardous level.

(10) Flow Metering and Regulating Station

The purpose of flow metering and regulating (M/R) stations installed at pipeline terminal points is to measure gas throughput for commercial custody transfer purposes and for use in invoicing sales gas quantities and to adjust gas pressure.

The M/R Stations will be skid mounted field units comprising a number of meter runs to measure gas, and be fully automated with controls and instrumentation located in a weather and explosion proof metering cabinet. The M/R Stations at the power generation facility will be provided with 3 flow-measuring lines or runs that may vary in diameter. The number and size of M/R stations should be determined in the detail design phase.

(11) Supervisory Control and Data Acquisition (SCADA) System

The SCADA system is provided for safe, reliable and efficient operation of the transmission pipeline system and will facilitate smooth communication with the processing operators at the CPF. The basic duties and facilities monitored and remotely controlled from Temane Operation Base are the following:

- Over-all gas delivery scheduling, dispatching and line packing
- All block valves, M/R stations, including those for distribution offtakes
- Cathodic protection system, intermediate line pigging stations, and the fibre optic telecommunication links

The SCADA master control center (MCC) is located at the Temane Operation Base. A sub-station is located at the support control center (SCC) in the Urea Fertilizer Complex. The control philosophy shall be based on partly manual and partly automatic remote condition monitoring and control, and switchover to manual operation shall be possible in case of SCADA breakdown. An on-line real time leak detection system will be installed. A SCADA interface program allows the operators to enter pressure, temperature, flow and composition data to be passed across the

output of the model and alarms and other commands to be sent back, utilizing the fibre optic data network.

(12) Operation and Maintenance Plan

The following Routine Operations & Maintenance (O&M) are required for the gas transmission pipeline.

- Overland pipeline sections, including pig launcher and receiver stations and instrumentation
- Right-of-way maintenance from Temane tie-out to the urea fertilizer complex site
- Cathodic protection systems
- SCADA system including fibre optic telecomm-systems
- M/R Stations
- Calibration of instrumentation and gas quality analyser equipment
- Environmental and safety training

Prior to the final commissioning the EPC Contractor shall submit sets of manuals that describe the O&M functions in detail. In addition the EPC Contractor is to develop a project specific information system in line with ISO 9000 recommendations for recording maintenance data. Furthermore, written procedures to protect maintenance workers or outsourced personnel against dangerous situations shall be included in the O&M plan.

Routine O&M shall be accomplished in day-to-day operations safely and effectively by adopting procedures consistent with ASME B31.8 guidelines. Special plans for other emergency shutdown and O&M activities will be prepared in cooperation with SPE, the pipeline operational departments and outside authorities.

The O&M plan will be developed to provide for the exercise of full control of the gas in the pipeline. In order of importance, the following are among the essential factors to be considered when planning O&M for the transmission network:

- Coordination of gas supply to affected end-users.
- Facilities affected by the shutdown.
- Verification of gas leakage and main line block valve and emergency shutdown valve closures.
- Venting, blow down, purging and re-pressurizing procedures.

(13) Typical Construction Methods

1) Soil investigation

A geological investigation shall be conducted every 500 m in the areas in which the soil properties may adversely affect the pipe laying works. Also, in areas where the crossing pipeline and/or the horizontal directional drilling pipeline are buried more than 1.5 m deep from the ground level to the top of the pipe sections, soil surveys to confirm the soil nature and strength shall be carried out.

2) Pipe laying approach

The pipe laying method will be planned and proposed by the EPC contractor in consideration of the site condition, time schedule, applicable construction equipment and manpower, and others.

3) Trenching aspect

The construction space for the pipeline trench shall be generally 7 to 10 m wide from the ditch centreline and maintain a distance of more than 20 m from the ditch center line to the foot of any adjacent power transmission line towers. The depth of the pipeline trench shall be decided to provide sufficient soil cover (generally 1.5 m above the top of the pipe) for complete compaction. At crossings such as major roads, railways, wide rivers and creeks, and areas where the horizontal directional drilling (HDD) method is necessary, the buried depth of the pipeline will be adjusted in accordance with the curvature radius of the pipeline and the safety requirements for the construction works.

4) Crossing issues

Typical construction methods for the overland crossings anticipated along the pipeline, including horizontal directional drilling methods, are categorized as follows and shown in Figures 5.2.7 to 5.2.10.

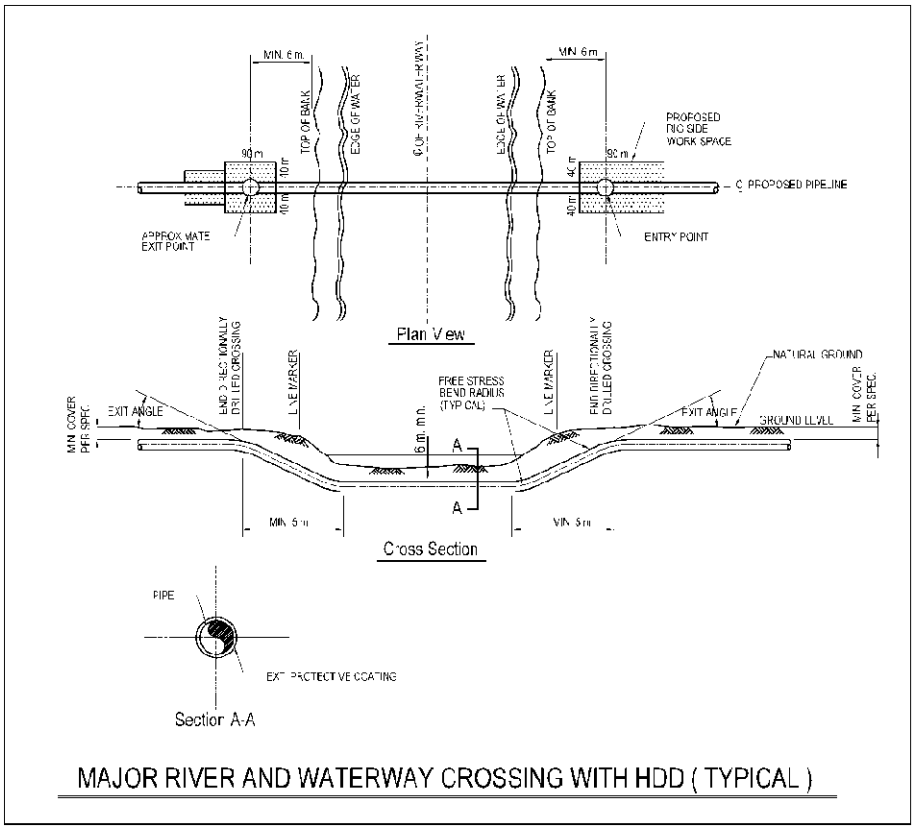
Construction methods for crossings anticipated along the pipeline are categorized as follows.

- For rivers and water courses of generally more than 20 m in width, where temporary bridging is not applicable due to ship navigation, the HDD method will be adopted. (Figure 5.2.7)
- For rivers, creeks and water courses of less than 10 m in width, the pipe laying may be done by diverting the water flow temporarily, then directly excavating the pipe trench and lowering the pipe section into the trench. (Figure 5.2.8)
- If the pipeline sections under construction are exposed to unauthorized personnel in the long range, measures to protect the pipeline from public disturbances, accidental damage by vehicular traffic or other similar causes, shall be taken. For example preparation of detour roads, installation of temporary protective fences, blocks and barricades, etc.

- Crossings of major roads, railways, etc., shall be constructed by means of the Steel Casing Method. The site survey of crossings and the subsequent detailed design shall be performed by EPC Contractor. For crossings of a long distance, the HDD method may be applied. (Figures 5.2.9 and 5.2.10)
- For pipeline crossings of minor roads, cross-country tracks separating rice paddy fields, agricultural areas, fruit orchards etc., the installation work in two stages may be carried out by preparing temporary roads for traffic control and providing guards and traffic lights. The pipe laying work may be done by placing steel plates on the pipeline ditch for only a short period to allow the pedestrian and vehicle traffic.

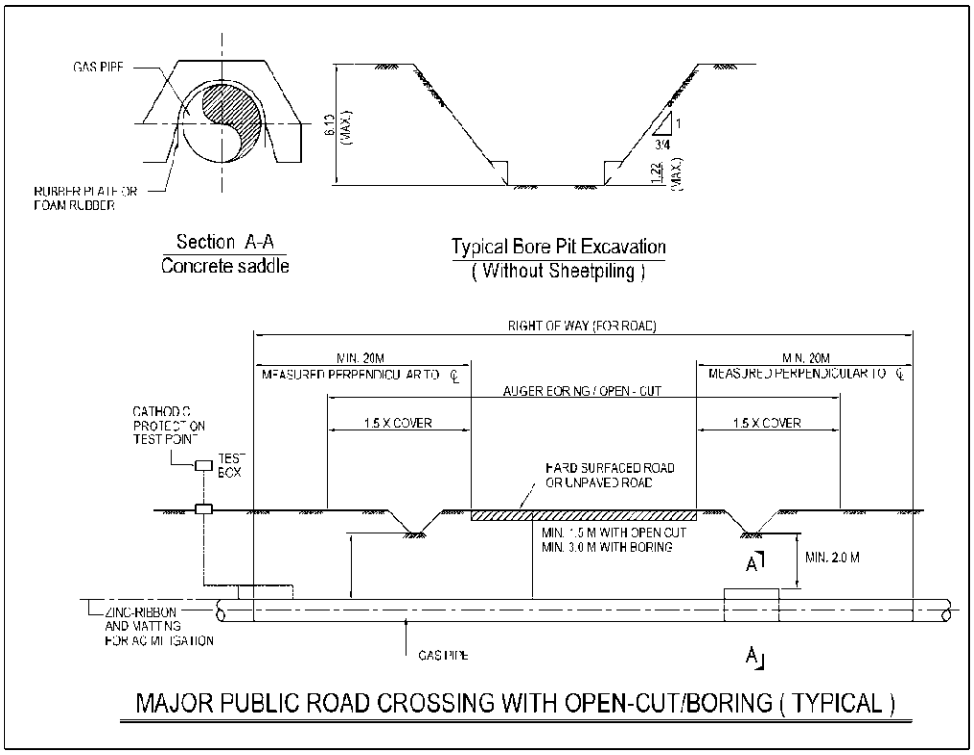
5) Buoyancy control

Pipeline portions which are laid in areas susceptible to floods, wetlands, rice paddies, etc., shall be provided with stabilization such as concrete jacketing, concrete saddles, buoyancy screw anchor clamps and so on. The installation interval of stabilization as well as the required thickness and length of concrete jacketing shall be based on the verification of data from the soil survey along the ROW.



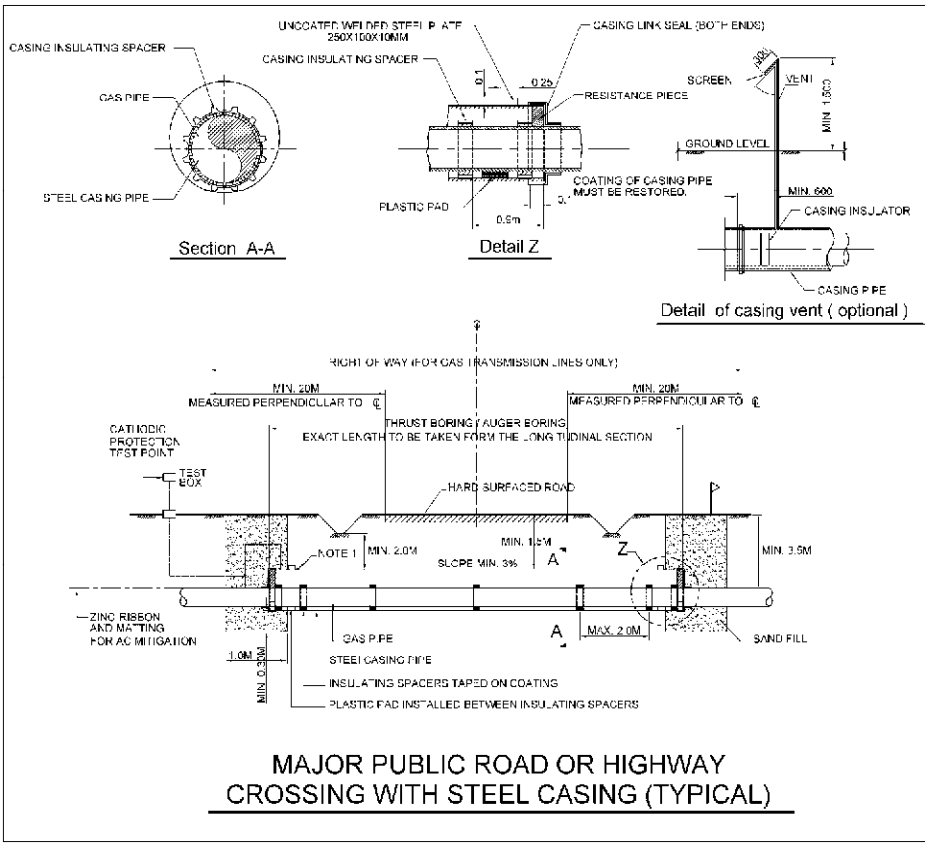
Source: JICA Survey Team

Figure 5.2.7 Major River and Waterway Crossings (HDD Method)



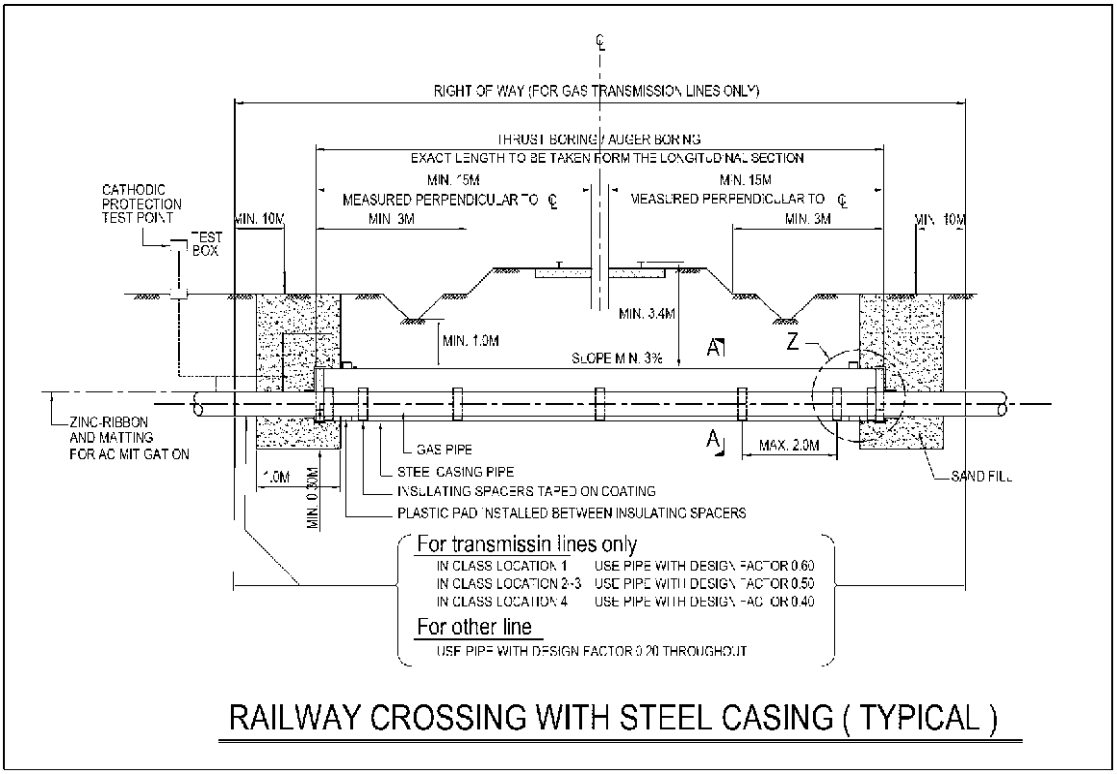
Source: JICA Survey Team

Figure 5.2.8 Major Public Road Crossings



Source: JICA Survey Team

Figure 5.2.9 Major Public Road Crossings (Steel Casing Method)



Source: JICA Survey Team

Figure 5.2.10 Railway Crossings (Steel Casing Method)

(14) Outline of the Components of the Gas Transmission Pipeline System

The outline of the components of the gas transmission pipeline system is as follows.

1) Gas Transmission Pipeline
   - Total length 305 km
   - Pipe Outside Diameter (inch) 16 inches (406.4 mm)
   - Flow gas volume (Nm^3/H) 90,000 Nm^3/hour (80.6 mmscfd)
2) M/R Station 2 places
3) Pipeline Block Valve Stations 18 places
4) Pig Launcher/ Receiver Stations 3 places
5) Corrosion and Cathodic Protection 1 lot
6) SCADA System 1 lot

5.3 Other Infrastructures

5.3.1 Port Facilities

(1) Current Situation and Future Expansion Plan

The Beira Port is one of the major ports in Mozambique and also has an important role as a gateway to the landlocked neighbouring countries such as Zimbabwe, Malawi, Zambia, etc.

The infrastructures such as the railway (Machipanda Line) and roads have been developed between the Beira Port and the border of Zimbabwe and have an important role as a transportation route for the mineral resources (Granite and Ferrochrome), chemical fertilizers, etc. Moreover, the railway line called the Sena Line (approx. 550 km) has also been developed between the Beira Port and Moarize in the Tete Province and is used for the coal transportation. In the future, this line will be further developed to increase the capacity by making it double track.

An ore/coal terminal (cargo handling volume: 20 million tons) is planned in the new project area (50 ha) of the Beira Port corresponding to the expansion of the Sena Line mentioned above.

Source: Google Earth (edited by the JICA Survey Team)

Figure 5.3.1 New Project Area for the Ore/Coal Terminal in Beira Port

CFM consists of CFM-South, CFM-Centro, CFM-North and CFM-Zambezia and these regional branches are independently managed. The Beira Port is managed by CFM-Centro.

Cornelder de Mozambique (CdM) is a private joint venture between CFM and Cornelder Holdings that is based in Rotterdam in the Netherlands. CdM has operated the Container and

General Cargo Terminals in the Beira Port since October 1998 based on the concessionaire agreement with CFM-Centro. CdM has planned the construction of the Multipurpose Terminal Berth (600 m in length).

Source: CdM

Figure 5.3.2 Port Facilities in Beira Port

1) Port facilities (berth length and depth)

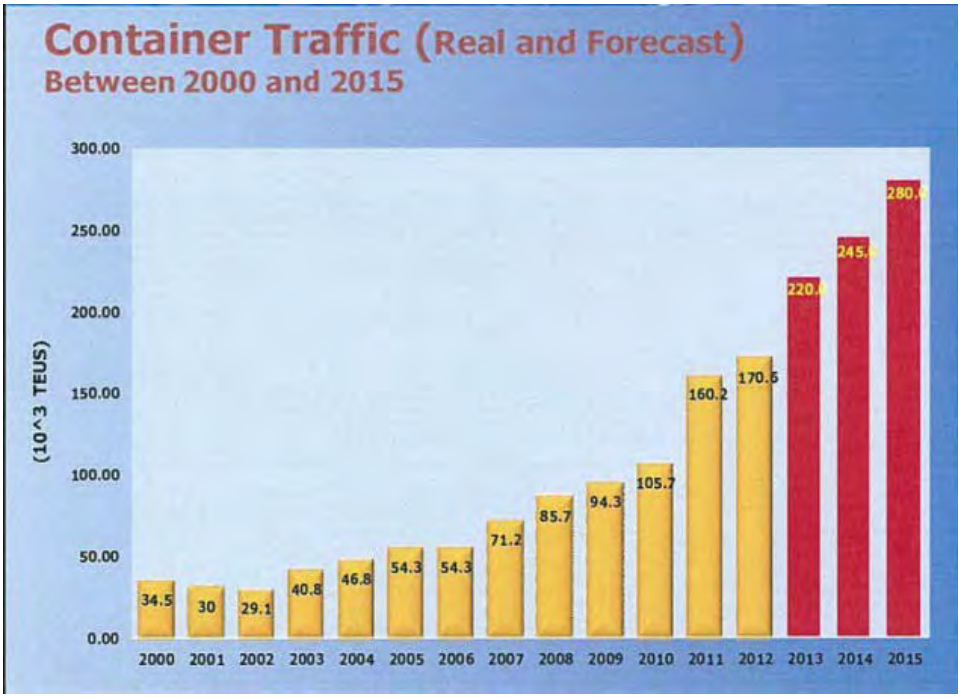
The port has 11 berths in total (total length: 1,994 m) as shown below. However, No. 1 berth is not used due to deterioration and is reserved as the fishing port.

Container Terminal (No. 2 to No. 4)	: Length 484 m, Depth12 m	Containers, Granite, Copper
Container Terminal (No. 5)	:Length162 m, Depth 12 m	Containers, Granite, Copper
General Cargo Terminal (No. 6 to No.7)	:Length 336 m, Depth 10 m	Refrigerated Citrus, Cereals, Vegetables
Coal Terminal (No. 8)	:Length 188 m, Depth 10 m	Coal
General Cargo Terminal (No. 9 to No. 10)	:Length 167 m x 2, Depth10 m	Refrigerated Citrus, Cereals, Vegetables
Oil Terminal	:Length 393 m, Depth 12 m	Bunkering, Oil and Products

2) Cargo throughput

The container throughput in the Beira Port reached 170,500 TEU in 2012, which was the largest handling volume in Mozambique (beyond the Maputo Port). The handling volume of general cargo was 4.31 million tons in 2012. The Beira Port is also taking a very important role for the coal export.

The following figures show the real and forecast throughputs of container cargo and general cargo.



Source: CdM

Figure 5.3.3 Container Cargo Throughput

Source: CdM

Figure 5.3.4 General Cargo Throughput

3) Container handling capacity

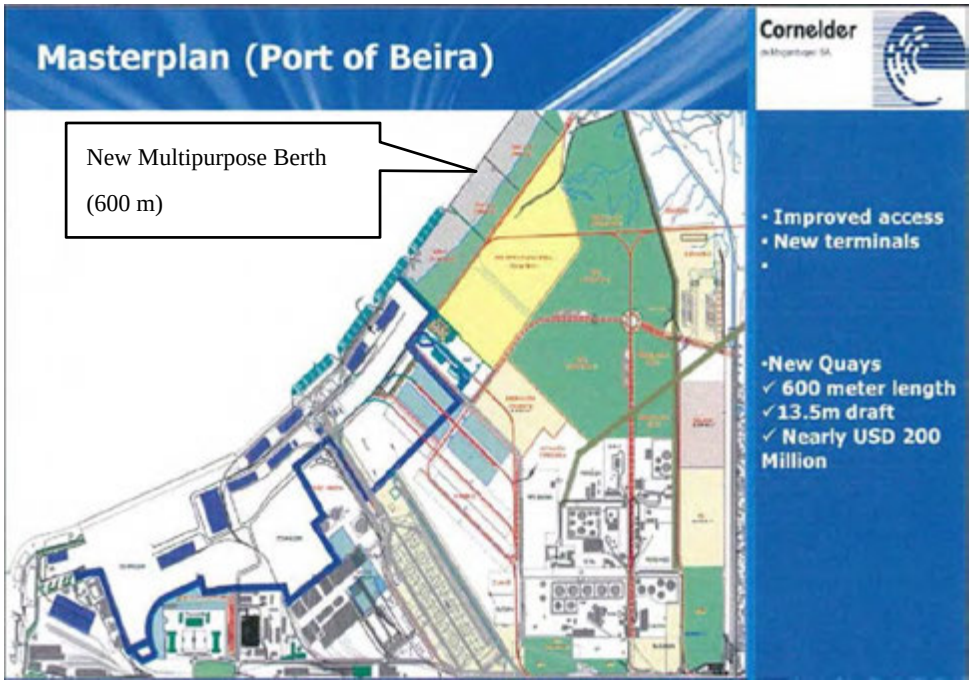
Two ship-to-shore gantry cranes were additionally installed in March 2013 and four gantry cranes are currently used in the container berth. The expansion of the container yard is in progress and the annual container handling capacity will be increased to about 400,000 TEU within 3 years.

Source: CdM

Figure 5.3.5 Container Terminal Expansion Plan

4) Master plan

There is a plan to construct a new multipurpose berth (container & generak cargo terminal: 600 m in berth length, 13.5 m depth, USD 200 million) by arranging CdM's own fund. CdM is currently undertaking some preparatory works such as soil investigation, but an implementation schedule for construction has not been established.



Source: CdM

Figure 5.3.6 Master Plan of Beira Port

5) Dredging maintenance of channel

The Beira Port is located at the mouth of the Pugue River where the Buzi River also joins. The current velocity is fast and the access channel is always exposed to the risk of drifting sand and sedimentation. Tide level difference is very large at about 6 m. Due to these problems, larger and deep-sea vessels have to wait offshore until the tide level becomes high enough. And when the vessels enter the port through the access channel, the tide level and draft of vessels have to be carefully watched.

The distance from the port to the point where the necessary depth for the operation of larger and deep-sea vessels is secured is about 28 km. According to the public dredging company, Empresa Mozambica de Dragagens (EMODRAGA), two Trailing Suction Hopper (TSH) dredgers (1,000 m^3 hopper capacity) which were obtained through the Japanese grant aid scheme and a TSH dredger (2,500 m^3 hopper capacity) which was obtained by Danish assistance and started its operation in June 2013 are working for the dredging to maintain 8.0 m depth in the access channel. The dredging volume is 2.5 - 3.0 million m^3/year.

Source: EMODRAGA

Figure 5.3.7 TSH dredger "MACUTI" (2,500 m^3)

6) Investment program (confirmed)

CdM is proceeding with the following projects:

a) Coal terminal (TCC8): 5 - 6 million tons of yard capacity

Construction was started in February 2012.

b) Dry bulk terminal for ore such as coal, chrome, manganese, etc.

Construction may have been started in 2013 according to the information from CdM (but its commencement has not been confirmed).

c) Fertilizer terminal (warehouse)

Construction of a new warehouse with the storage capacity of 70,000 - 100,000 tons will be commenced in March 2014 (its commencement has not been confirmed). Fertilizer bulk handling volume from vessels will be 60,000 - 80,000 ton/day.

Investment Cost: USD 15 million

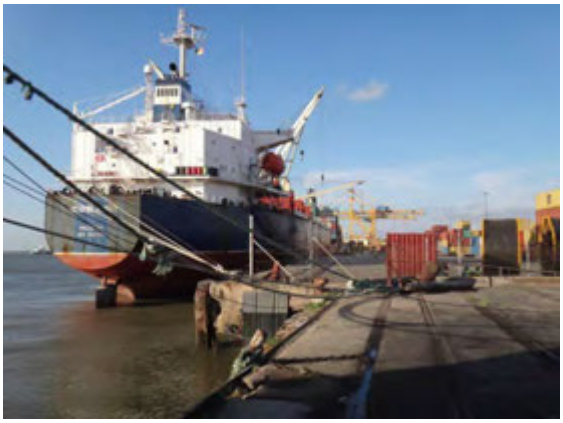
The Fertilizer terminal is currently used for import, but it can be used for export as well.

Source: CdM

Figure 5.3.8 Existing Fertilizer Yard and Planned New Fertilizer Terminal

7) Calling vessels and cargo handling system

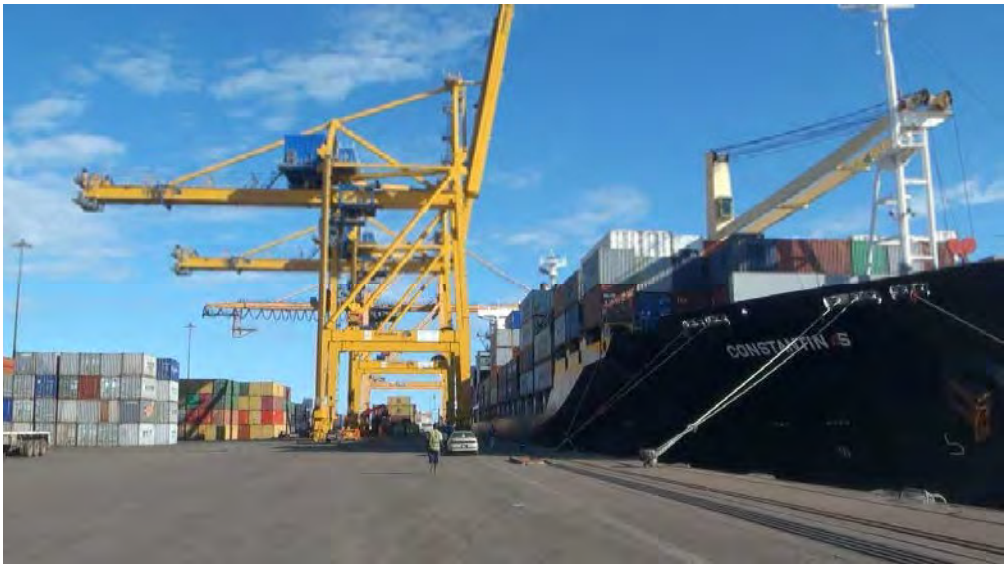
Due to the entering limitation of the access channel depth (8.0 m) and the depth in front of the berths (10 m in General Cargo Berths), mostly Panamax-size vessels berth in the port. Moreover, vessels of 40,000 DWT or larger with draft of less than 7 m also berth as shown below.



Nesrin Aksoy
(46,609 DWT, Draft 6.2 m, LOA 189 m x W 30 m)

SFL Kate
(56,798 DWT, Draft 6.5 m, LOA 189 m x W 32 m)

The gantry cranes are used for the container cargo handling. Bulk cargo is unloaded or loaded by using the ship's gear.



Source: JICA Survey Team

Figure 5.3.9 Container Handling of Gantry Cranes in the Berth

Source: JICA Survey Team

Figure 5.3.10 Bulk Cargo Handling by the Ship's Gear

Bagged cargo is firstly packed into a cargo net by manpower and then unloaded or loaded by using the ship's gear.

Source: Website

Figure 5.3.11 Cargo Handling for Bagged Cargo

8) Necessity of expansion of the Beira Port for the Project

As mentioned above, the expansion of the Beira Port is on-going and accordingly further improvement and/or expansion for this Project is not required.

(2) Cargo Handling System of the Project

Considering the existing condition and the future expansion plans in the Beira Port, the following cargo handling system is appropriate for the urea fertilizer.

1. Railway transport by wagon from the Urea Fertilizer Complex to the Beira

⇩

2. Transshipment from the railway wagon to trucks in the fertilizer terminal

⇩

3. Transport to the berth by truck

⇩

4. Loading onto vessels by the ship’s gear in the berth

In order to handle 3,000 ton/day, it is necessary to raise the cargo handling efficiency by packing 50 kg bags onto 1 ton pallets before loading onto railway wagons in the Urea Fertilizer Complex.

1) Railway transport

1'st Step: Packing 20 pieces of 50 kg bagged fertilizer onto 1 ton pallets in the Urea Fertilizer Complex

2'nd Step: Loading 1 ton pallets onto railway wagons:

a) Capacity of each wagon: about 40 tons

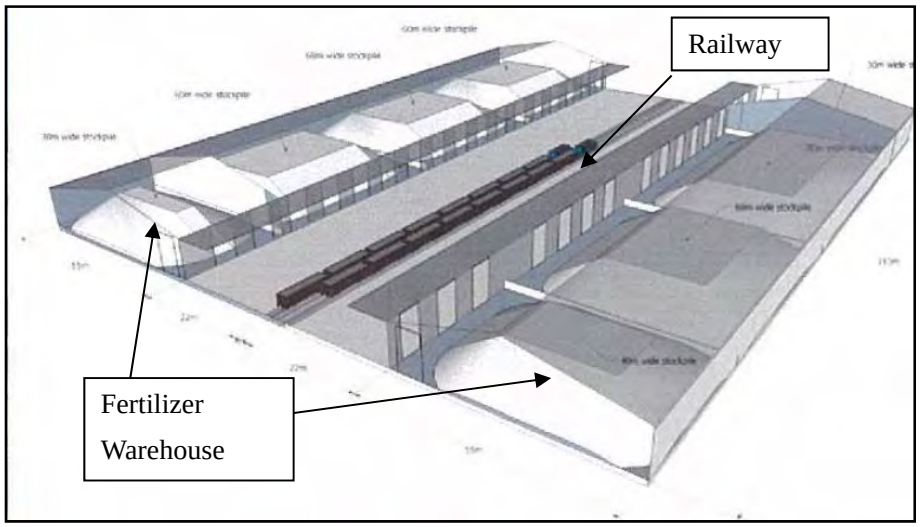
b) One trip uses 20 wagons (about 800 tons in total)

c) 4 trips/day (about 3,000 tons)

While a fertilizer vessel is not available at the berth, the fertilizer should be stored in the warehouse.

2) Fertilizer warehouse

The fertilizer warehouse (capacity: 70,000 - 100,000 tons) to be constructed in 2014 can be used as buffer storage of the fertilizer bags.



Source: CdM

Figure 5.3.12 Planned Fertilizer Terminal

3) Handling efficiency of fertilizer cargo in the berth

The following is an example of cargo handling for 3,000 ton/day of fertilizer using 3 ships' gear.

- Hourly handling capacity of a ship's gear: 50 ton/hour (50 x 1 ton pallets)
- 50 ton/hour x 3 ships' gear x 20 hour/day = 3,000 ton/day

The loading efficiency of ship's gear is in general 12 - 18 times/hour. In order to handle more than 50 pallets in an hour, a cargo hoisting devise as shown below is necessary.


Source: Website

Figure 5.3.13 Sample of Cargo Handling of 1 Ton Pallet

4) Tariff

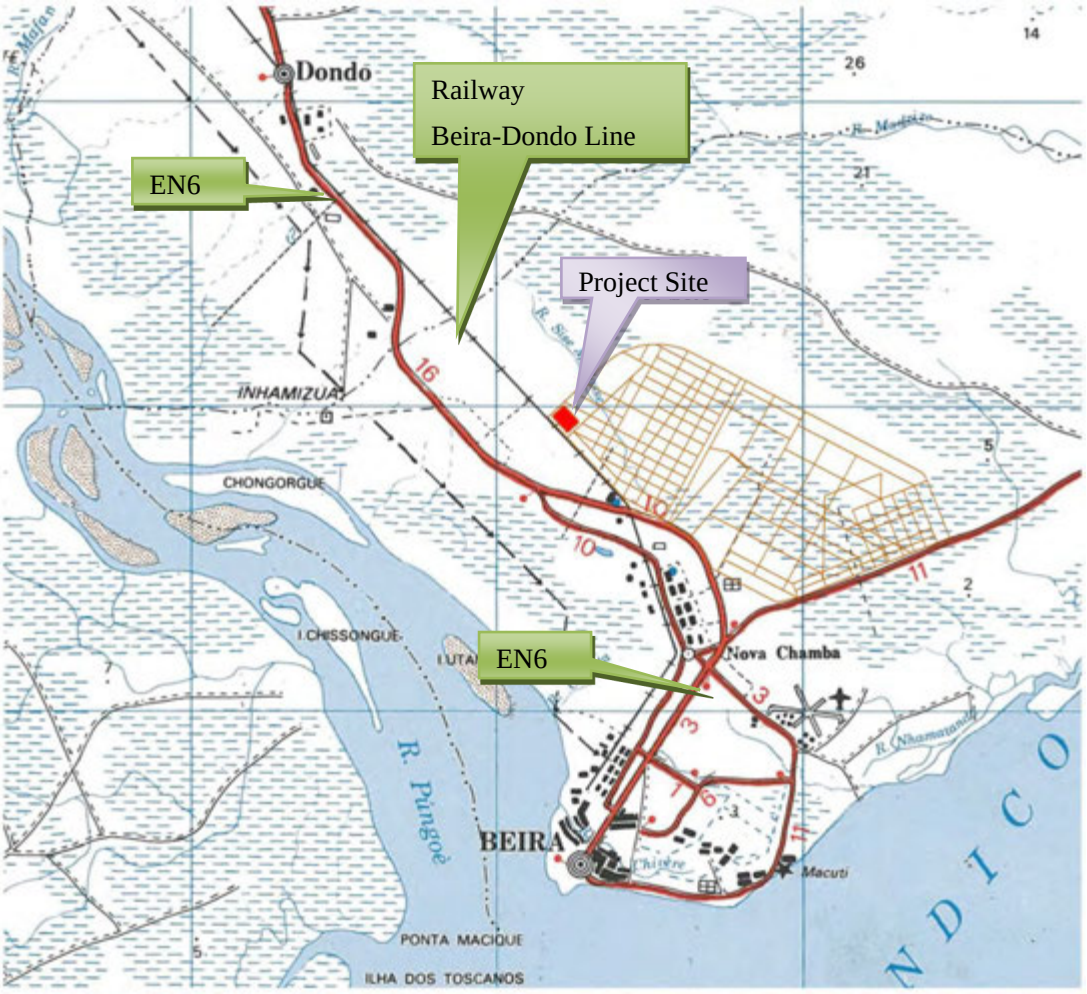
According to the information obtained from CdM, tariff for handling of fertilizer that covers unloading from the railway wagons, handling and storage in the terminal and loading to vessels will be **USD 11～16 /ton**.

5.3.2 Roads

The roads will be used for transportation of material and equipment for the construction and O&M as well as the transportation of product (urea) to the domestic market, while most of the product will be transported to the Beira Port (for export) by the railway system as mentioned in Chapter 5.3.3.

(1) Surrounding Roads

The site is located adjacent to the national road No.6 (EN6) which runs from Beira City to the boundary of Zimbabwe through Dondo and has been used for the transport of cargo as a major economic corridor connecting Zimbabwe and Beira City. Also it is possible to transport goods to the southern and northern regions of Mozambique and to the neighbouring countries such as Malawi through the national road No.1 (EN1). The road conditions can not be said to be good, but if the road is temporarily reinforced or improved for heavy transport in the construction period, it could be used for this Project.



Source: JICA Survey Team

Figure 5.3.14 Surrounding Road Network

Source: JICA Survey Team

Figure 5.3.15 EN6 to Dondo near the Beira Port

Source: JICA Survey Team

Figure 5.3.16 EN6 near the Project Site

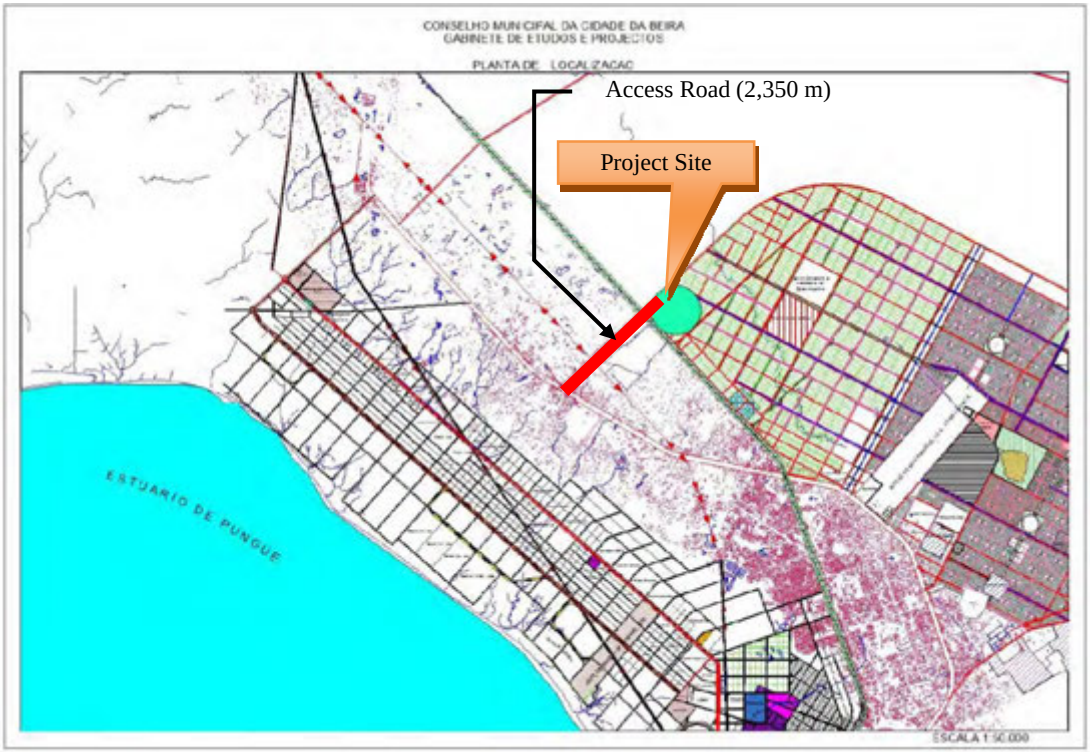
Source: Google Map

Figure 5.3.17 Road Network around the Project Site

(2) Access Roads

The Project site is located within the Beira New Industrial Area, which has been planned by the Beira Municipality including access roads and internal road network. However, the progress of this development is very slow and the municipality budget has not yet been secured. It implies that the access road from EN6 to the Project site may not be ready in time for the commencement of construction of the Urea Fertilizer Complex. Actually, in the meeting with the Beira Municipality, they expressed that the access road for the construction should be prepared by the Project owner. Therefore, a temporary access road between EN6 and the Project site (about 2,350 m) should be planned as a part of the Project.

The following figure shows the Beira New Industrial Area and the Project site.



Source: Beira Municipality

Figure 5.3.18 Beira New Industrial Area Layout Plan

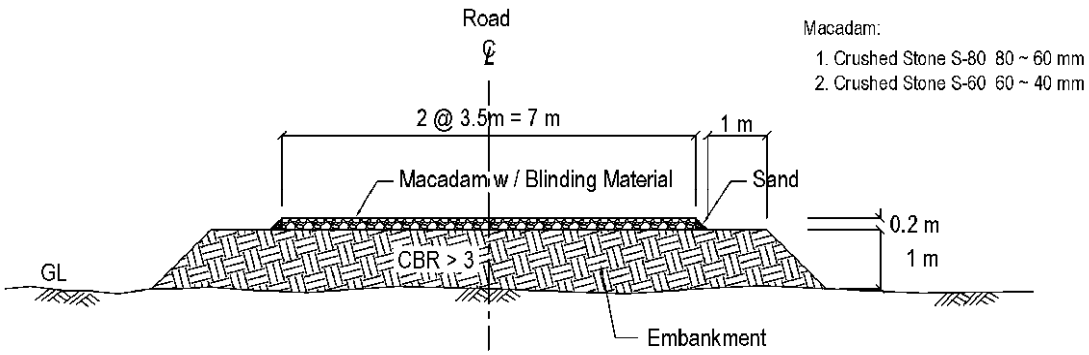
Outline of temporary access road

a. Width: 7.0 m

b. Length: 2,350 m

c. Height: 1.0 m high embankment on the existing ground

d. Typical section: as shown below



Approximate construction cost of the temporary access road is estimated as follows:

a) Unit construction cost per meter

Item		Unit	Quantity	Unit Price (MT)	Amount (MT)
1. Direct Cost					
Filled-up Ground	Spreading	m^3	10.4	2,060	21,424
	Compaction	m^3	10.4	23	239
Subgrade	Spreading	m^3	1.4	2,089	2,925
	Compaction	m^3	1.4	52	73
Subtotal					24,661
2. Indirect Cost (Direct Cost x 20%)		LS	1		4,932
Unit Construction Cost					**29,593**

b) Total construction cost

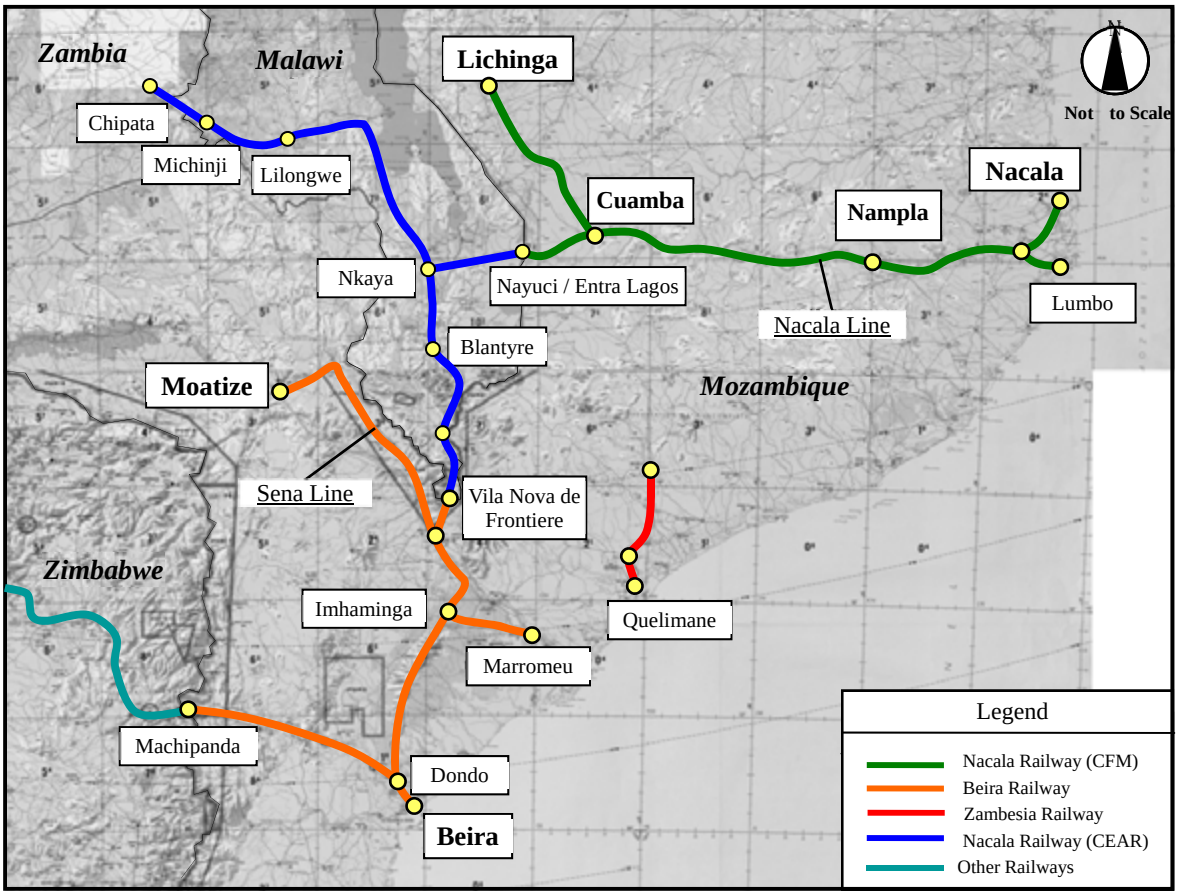
MT 29,593 /m x 2,350 m = MT 69,543,550

It is considered that tax exemption as an incentive will be applicable in this Project. Therefore, the above construction cost does not include VAT (17%).

5.3.3 Railway

(1) Existing Facilities

Since the existing railway (Beira – Dondo – Manica Line) passes close to the Project site, it is expected to use the railway for transportation of product (urea fertilizer) to the Beira Port (3,000 ton/day). It is possible to transport the product from the Project site to Zimbabwe by using the same line. And it is also possible to transport the product to the northern regions of Mozambique and Malawi through the Beira – Sena Line.



Source: JICA Survey Team

Figure 5.3.19 Railway System

According to the CFM-Centro who is the operator of the railway system, coal transportation is a major item and almost 5million ton per year in Beira – Rio Tinto and 0.5million ton per year in areas around Beira are transported. The CFM-Centro intends to enhance the transportation capacity between Beira and Dondo by making the existing line double-track.

Source: JICA Survey Team

Figure 5.3.20 Beira – Dondo Line near the Project Site

Source: JICA Survey Team

Figure 5.3.21 Beira Station at the Beira Port

The CFM-Centro confirmed that the existing railway system could transport 3,000 ton/day of the product although they have a plan to increase the amount of coal transportation in the future. The following information on cost burden and application procedure was provided by the CFM-Centro:

a) The planned railway siding should be constructed and owned by the Project proponent. It is also possible that the CFM-Centro would construct it at a cost burden on the Project owner. This issue will be finally decided after receiving a formal letter from the Project owner.

b) Application of using the existing railway system and constructing a railway siding should be submitted to the CFM-Centro (Executive Director) together with the project plan, technical information, drawings, etc. A permit would be granted within 3 months.

c) The Project owner should be responsible for maintenance of the railway siding. The CFM-Centro should be responsible for the transportation except loading and unloading of the product.

(2) Railway Siding for the Project

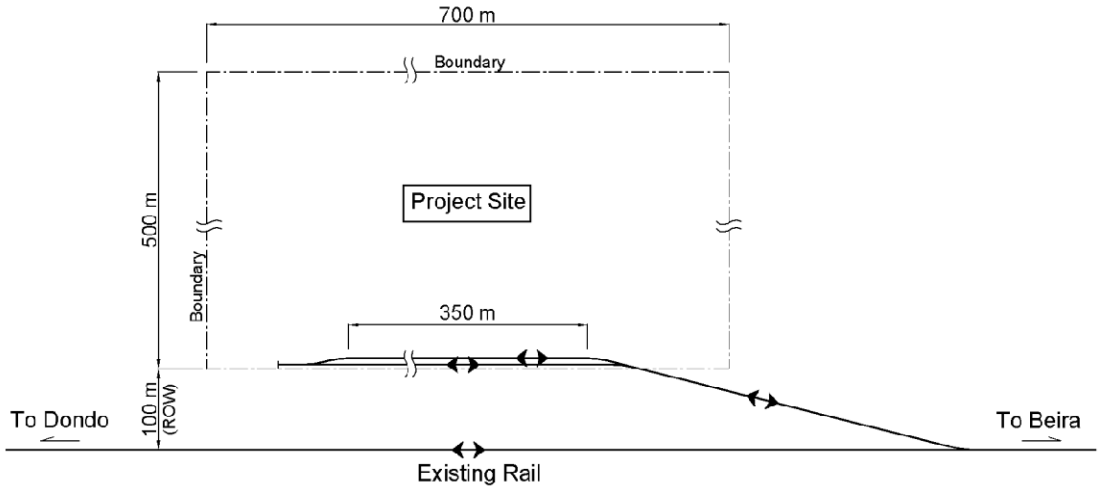
The railway siding will be constructed from the existing railway to the Project site and loading facilities will be constructed within the site. Basic concept for the railway siding is shown as follows;

Design Criteria

a) The product of 3,000 ton/day should be transported in 4 trips (about 800 ton /trip). The maximum allowable traction load of the locomotive is 1,200 tons.

b) It is not allowed to undertake operation such as disconnection of a locomotive, connection, or loading of the product on the existing railway, therefore, a new railway siding should be designed so that such operation can be undertaken on it.

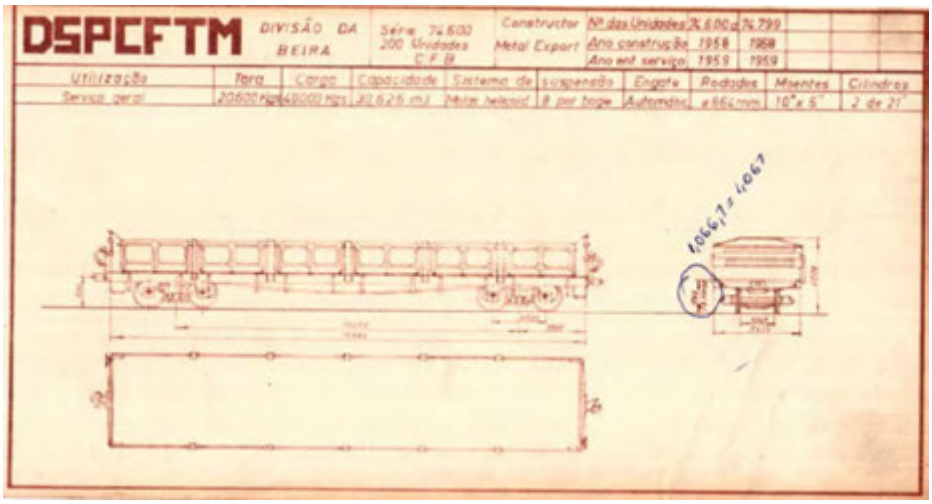
c) Wagons that are used in Mozambique at present should be used for the Project. The loading capacity of a wagon is about 40 ton and therefore 20 wagons should be used for a single transportation. It requires 350 m length to accommodate the wagons and locomotive.



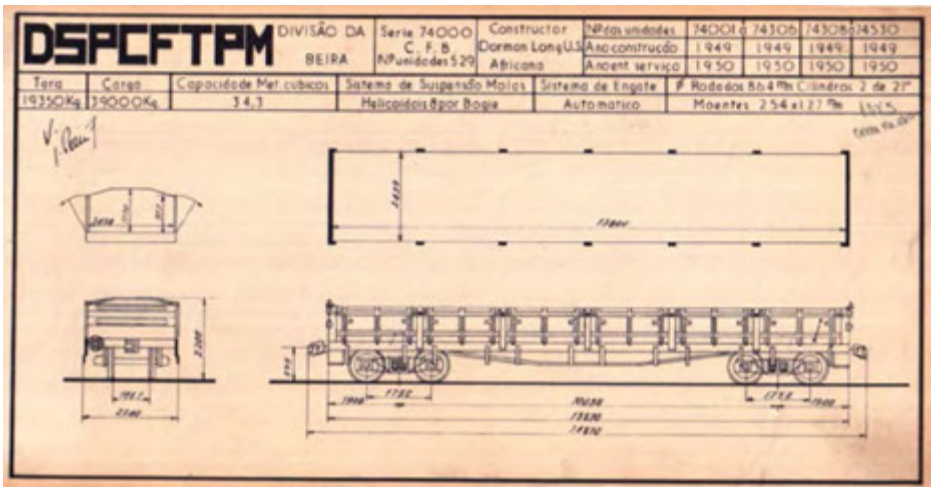
Source: JICA Survey Team

Figure 5.3.22 Proposed Railway Siding

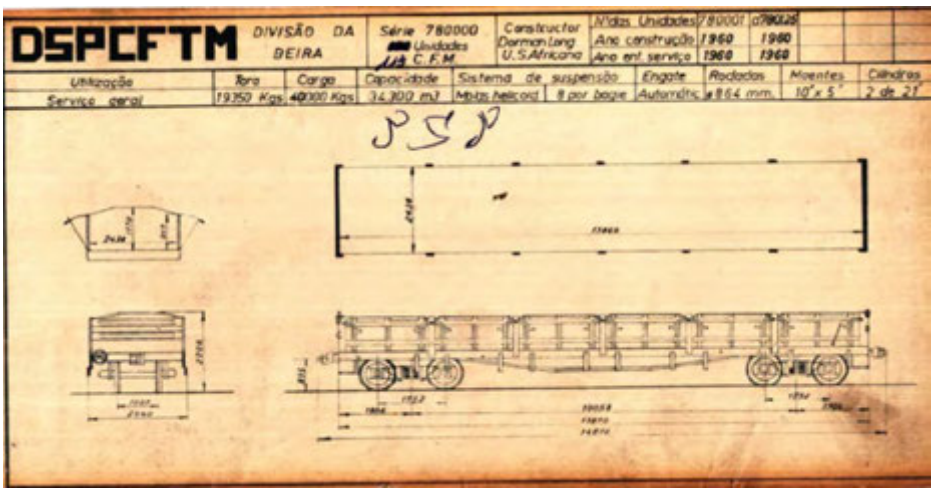
Following are drawings of the wagons used by CFM.



Type 74600



Type 74000



Type 780000

Source: FCM

Figure 5.3.23 Wagon Type

The total length of the railway siding shown in Figure 5.3.22 is about 1,400 m. The unit construction cost of USD 3.0 million/km, which is obtained from CFM, will be used for the cost estimation.

This unit price is generally applied for new railway construction and therefore, seems slightly high for the proposed railway siding on which locomotives and wagons will be operated at low speed. On the other hand, it is considered that soil improvement may be required for the construction since the subsoil condition in the area around the Project site is not good. Considering these factors, it was decided to adopt the unit price of USD 3.0 million/km.

Using this unit price, the construction cost is estimated as:

USD 3.0 million/km x 1.4 km = USD 4.2 million

(3) Tariff

According to the information from CFM,

Shunting charge of wagon: USD 100 /wagon

Transportation charge: USD 221 /wagon

Total: USD 321 /wagon

Assuming that the loading capacity of wagon is about 40 tons, the total charge per ton is calculated as about **USD 8.0 /ton**, which will be regarded as transportation tariff in this Survey.

5.3.4 Water Supply Pipeline

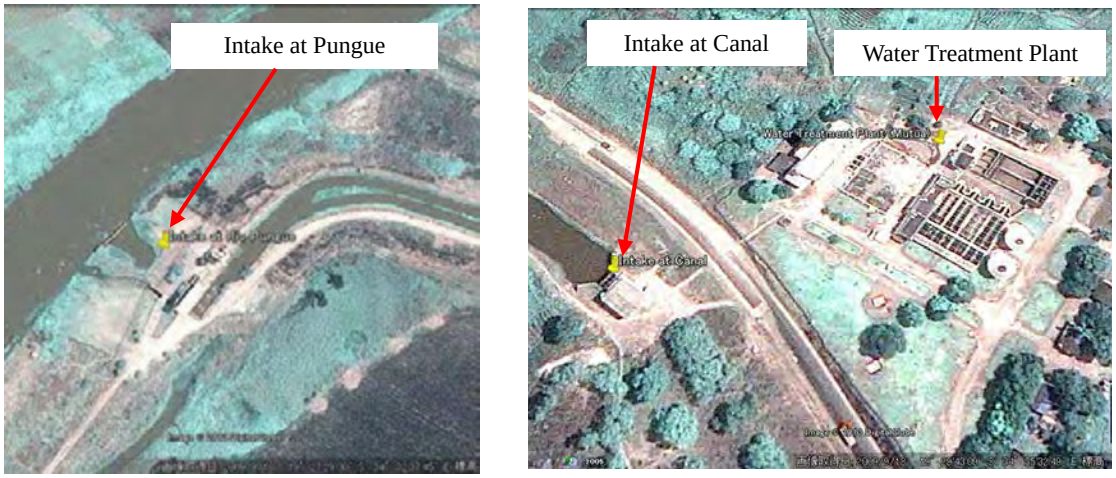
(1) Existing Facilities

In Beira and the surrounding regions, FIPAG Centro (Fund for Investment and Assets of Water Supply in the central regions in Mozambique) has the role to supply drinking water. In the Beira area, FIPAG Centro is operating the water intake and treatment plant in Mutua and supplying drinking water of about 50,000 m^3/day to Beira and Dondo. Since this amount is almost the maximum capability of the facilities, water cannot be supplied from these facilities to the proposed fertilizer complex.

Raw water to produce the drinking water is first pumped up from the Pungue River to the canal and then pumped up to the treatment plant at the second water intake near the plant. According to FIPAG Centro, the capacity of water intake at the Pungue River is 90,000 m^3/day which is equivalent to the maximum water volume permitted by Ara Centro.

Source: Google Earth (edited by the JICA Survey Team)

Figure 5.3.24 Existing Water Supply Facilities



Source: Google Earth (edited by the JICA Survey Team)

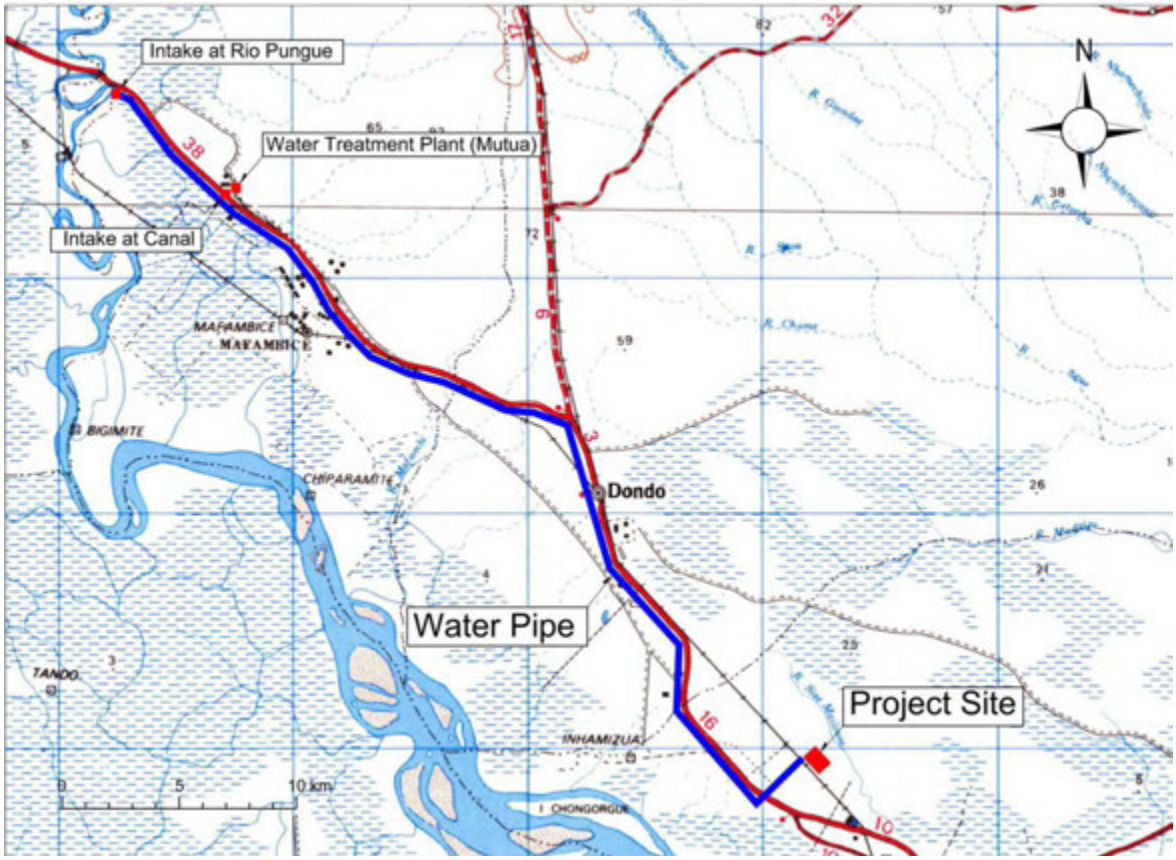
Figure 5.3.25 Existing Water Treatment Facilities at Mutua

The proposed fertilizer complex requires raw water of 24,000 m^3/day (1,000 m^3/h). It was confirmed by FIPAG Centro that the existing water intake at the Pungue River has enough capacity to supply this amount of raw water since its capacity is 90,000 m^3/day and still have a margin of 40,000 m^3/day.

(2) New Water Supply Pipeline

It is necessary to install a new pipeline from the existing water intake to the Project site to supply the required amount of raw water. According to FIPAG Centro, this new pipeline can be installed beside the existing pipeline which is installed along the national road. Although it is necessary to obtain confirmation from FIPAG Centro about the capacity of the water intake, the exact route of the existing pipeline, connection point of the new pipeline, etc., it is estimated that the new pipeline route will be as shown in Figure 5.3.26. Its length will be about 50 km.

From the topographic maps, it is found that the difference in elevations at the water intake and the Project site is 10 – 15 m and there are no obstacles such as rivers. It is considered that there will be no technical difficulty in the installation of the pipeline. Also in accordance with the environmental survey results, it has been confirmed that there would be no significant issues.



Source: JICA Survey Team

Figure 5.3.26 New Pipeline Route

The following study was undertaken to determine the pipe size.

1) Study condition

Pipeline length: 50,000 m

Flow rate: 1,000 m^3/h (6.67 m^3/min)

Lifting height: 15 m (from the topographic map)

Pipe sizes to be studied: 700 mm, 800 mm, 900 mm

Pumps: 2 pumps in operation + 1 stand-by pump (3 pumps in total)

Based on the above condition, specification of pump by pipe size was first determined and then costs of pipe installation, pump installation and their operation were estimated to determine the most economical pipe size. The operation cost is the tariff for electricity that is necessary for the operation of the pumps considering that there is a difference in tariff by pipe size.

Pipe size	900 mm	800 mm	700 mm
Outside diameter	914.4 mm	812.8 mm	711.2 mm
Wall thickness of pipe	8 mm	8 mm	7 mm
Lifting height	31.93 m	42.73 m	65.38 m
Pump type	Double-suction horizontal shaft volute pump		
Operation pumps	2 units		
Stand-by pump	1 unit		
Flow rate of pump	8.33 m^3/min/unit		
Power	75 kW	90 kW	132 kW

2) Construction cost

Construction and operation costs for 900 mm pipeline

Item	Local Currency (MT)	Foreign Currency (USD)	Total (in USD)
1. Direct Cost			
(1) Pipeline			
Material	0	21,648,000	21,648,000
Installation	340,208,000	0	11,493,514
Subtotal	340,208,000	21,648,000	33,141,514
(2) Pump			
Equipment	0	414,000	414,000
Installation	1,221,000	0	41,250
Subtotal	1,221,000	414,000	455,250
Total of Direct Cost	341,429,000	22,062,000	33,596,764
2. Indirect Cost (Direct Cost x 20%)	68,285,800	4,412,400	6,719,353
3. Total of Construction Cost (1+2)	409,714,800	26,474,400	40,316,116
4. Operation Cost (Electricity Tariff for 30 years)	42,574,000	0	1,438,311
Total Cost	**452,288,800**	**26,474,400**	**41,754,427**

Construction and operation costs for 800 mm pipeline

Item	Local Currency (MT)	Foreign Currency (USD)	Total (in USD)
1. Direct Cost			
(1) Pipeline			
Material	0	18,479,000	18,479,000
Installation	310,040,000	0	10,474,324
Subtotal	310,040,000	18,479,000	28,953,324
(2) Pump			
Equipment	0	467,000	467,000
Installation	1,380,000	0	46,622
Subtotal	1,380,000	467,000	513,622
Total of Direct Cost	311,420,000	18,946,000	29,466,946
2. Indirect Cost (Direct Cost x 20%)	62,284,000	3,789,200	5,893,389
3. Total of Construction Cost (1+2)	373,704,000	22,735,200	35,360,335
4. Operation Cost (Electricity Tariff for 30 years)	51,088,000	0	1,725,946
Total Cost	**424,792,000**	**22,735,200**	**37,086,281**

Construction and operation costs for 700 mm pipeline

Item	Local Currency (MT)	Foreign Currency (USD)	Total (in USD)
1. Direct Cost			
(1) Pipeline			
Material	0	14,149,000	14,149,000
Installation	275,449,000	0	9,305,709
Subtotal	275,449,000	14,149,000	23,454,709
(2) Pump			
Equipment	0	591,000	591,000
Installation	1,746,000	0	58,986
Subtotal	1,746,000	591,000	649,986
Total of Direct Cost	277,195,000	14,740,000	24,104,696
2. Indirect Cost (Direct Cost x 20%)	55,439,000	2,948,000	4,820,939
3. Total of Construction Cost (1+2)	332,634,000	17,688,000	28,925,635
4. Operation Cost (Electricity Tariff for 30 years)	74,930,000	0	2,531,419
Total Cost	**407,564,000**	**17,688,000**	**31,457,054**

(Exchange rate: MT 29.6 /USD)

Comparison of study results

	900 mm	800 mm	700 mm
Total cost (Million USD)	41.8	37.1	31.5

From the above, the 700 mm pipe that is the most economical should be adopted. Its construction cost is:

Local currency: MT 332,634,000

Foreign currency: USD 17,688,000

The above costs do not include VAT and customs duties on pipe material and pumps that need to be imported.

(3) Raw Water Tariff

According to the information from FIPAG, the current water tariff is as follows:

Treated water for general use: MT 23 /m^3

Raw water for industrial use: MT 14 /m^3

The total investment cost in this Project includes the construction cost for the new pipeline and pumps that are necessary for the water supply to the Project site. Furthermore, the Project needs raw water. From these, it is reasonable to apply a water tariff that is obtained by deducting the construction cost for the new pipeline and pumps from the raw water tariff for industrial use mentioned above. Construction cost included in the unit water volume is, in a simple manner, calculated as follows:

a) Construction cost for the new pipeline and pumps (converted to the local currency): Approximately MT 856 million

b) Service life: 20 years

c) Total water volume to be supplied in 20 years: 24,000 m^3/day x 330 days/year x 20 years = 158.4 million m^3

d) Construction cost per m^3: MT 856 million / 158.4 million m^3 = MT 5.4 /m^3

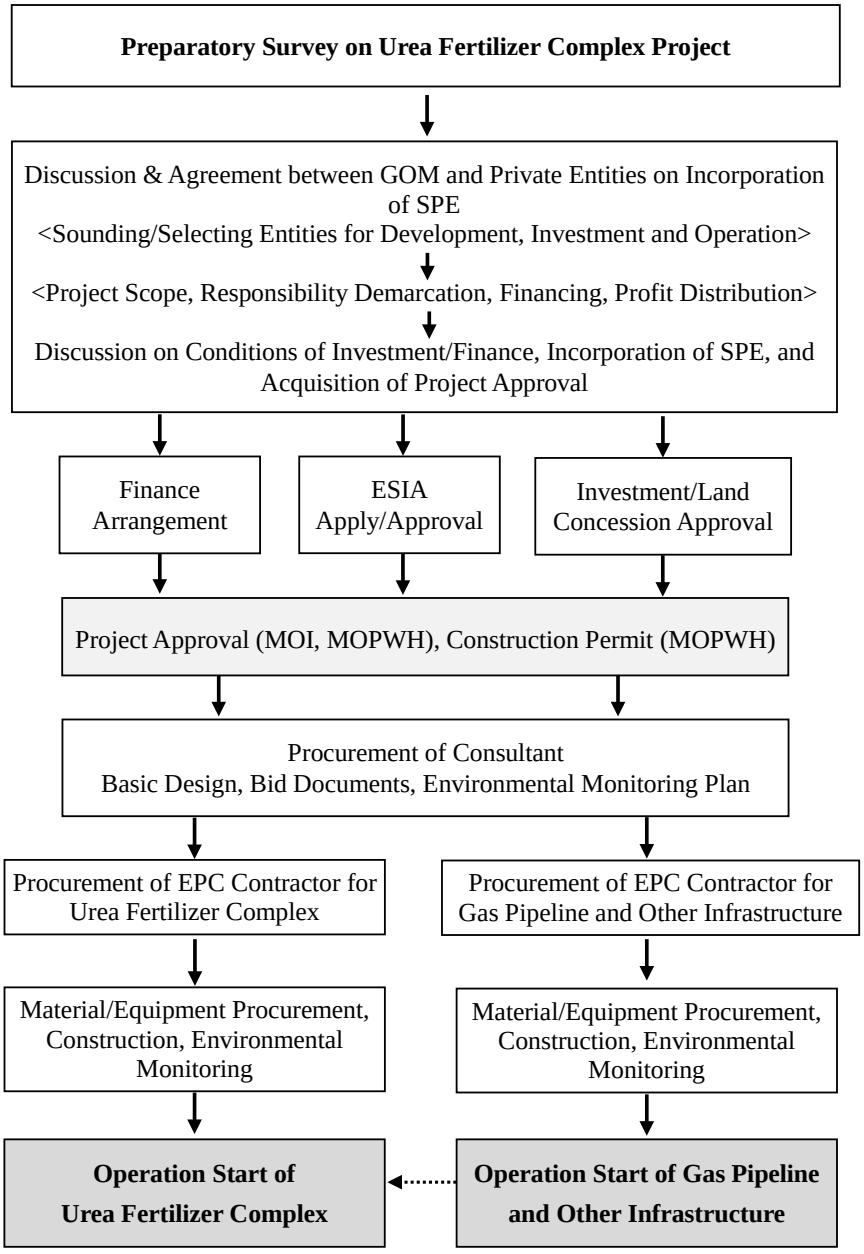
Considering the interest to loan amout, the above "construction cost per m^3" should be increased to about MT 7 /m^3. Therefore, the water tariff to be applied for the Project becomes:

MT 14 /m^3 - MT 7 /m^3 = MT 7 /m^3

5.4 Project Schedule

5.4.1 Project Implementation Flow

In accordance with the Project scheme mentioned in Chapter 4.3, the Special Purpose Entity (SPE) which will be comprised of GOM's organizations, Japanese private companies, investors, financers, and/or business operators, will basically conduct the development, operation and maintenance of this Urea Fertilizer Complex. The flow chart for the Project implementation from the establishment of the SPE to the commencement of operation is shown in Figure 5.4.1.



Source: JICA Survey Team

Figure 5.4.1 Project Implementation Flow

5.4.2 Project Implementation Flow

(1) Project Preparation (Obtaining Approvals and Permits)

Necessary steps for acquiring various governmental approvals and permits with respect to the Project such as SPE establishment and registration, investment permit, land permit, environmental permit, construction permit, etc., shall be taken prior to commencing construction works. If ESIA is conducted within 6 months, the aforementioned steps may be completed in approximately 24 months.

(2) Project Implementation Schedule

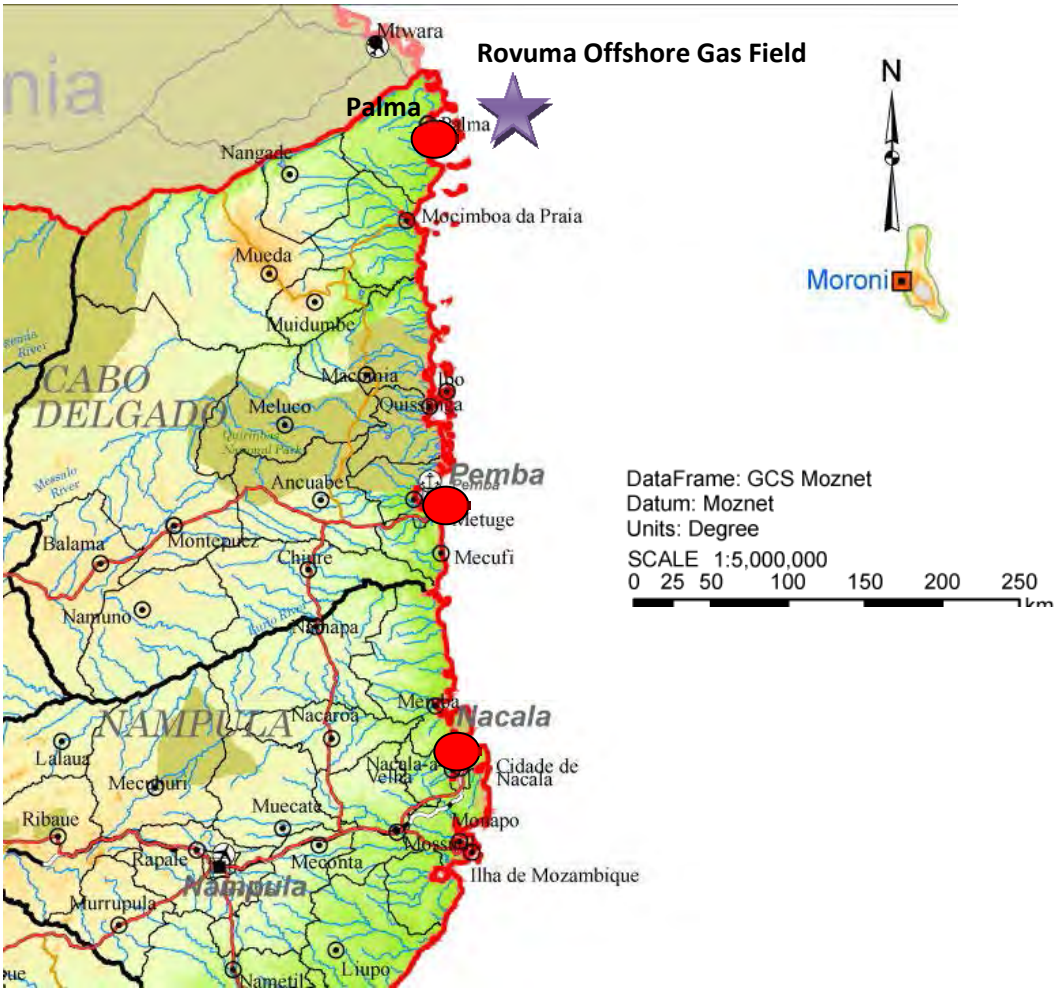
The construction period required for the Urea Fertilizer Complex, the gas transmission pipeline system and other infrastructures, which are the main constituents of the Project, is estimated as 3.5 years after the Project approval, based on the assumption that the EPC Contractor's procurement procedure will be carried out in parallel with the application for approval so that the construction work can be commenced immediately after the issuance of Project approval. During the construction period of 3.5 years for the Urea Fertilizer Complex, all necessary works such as access road preparation, land reclamation of the construction site, detailed design by EPC Contractor, procurement of construction material and equipment, installation works, tests and commissioning, etc. shall be included.

5.5 Study of Alternative Plans

The development plan in Chapters 5.1 – 5.3 is described assuming that the natural gas will be supplied from the Pande/Temane gas field. The following is an alternative development plan assuming that the natural gas will be supplied from the Rovuma gas field via Palma.

5.5.1 Project Location

If the natural gas will be supplied from Rovuma, the fertilizer plant would be constructed in Palma, Pemba or Nacala.



Source: JICA Survey Team

Figure 5.5.1 Project Location

The following are basic requirements to select a project site:

a) The existing infrastructure is well developed and can be utilized for the Project.

b) Investment cost does not exceed an allowable range.

c) Project schedule, including the schedule of obtaining various permissions, etc., is predictable and there are fewer uncertainties.

Considering these basic requirements, the comparison of three candidate sites was undertaken as shown in Table 5.5.1.

Table 5.5.1 Comparison of Candidate Sites

Site		Palma	Pemba	Nacala
		Assuming a site near the gas supply base	Assuming a site near the Pemba Port	Assuming a site in IFZ that has been planned by GAZEDA (the most preferable incentive is expected)
Infrastructure	**General**	GOM authorized PCD which is formed by CFM and ENH to develop, manage and regulate port infrastructure in Palma that should support the offshore oil and gas industry; however, its development plan has not yet been produced.	GOM authorized PCD which is formed by CFM and ENH to develop, manage and regulate port infrastructure in Pemba that should support the offshore oil and gas industry. Masterplan was produced in October, 2013; however, it is still at a concept level and no specific development plans have been produced.	Master plan for development of the Nacala Corridor is being produced with support by JICA and some specific development plans are going to be prepared.
	Port facilities	Palma is a small fishing village having a pier for fishing boats. To construct a new port facility for exporting fertilizer, more than USD 50 million would be required.	Only small/medium-sized vessels can be berthed at the existing jetty. To construct a new port facility for exporting fertilizer, more than USD 50 million would be required.	Rehabilitation and expansion of the Nacala Port have been taken up, and there will be no problems in use of this port for the Project.
	Road	Most of the roads to the surrounding cities are unpaved. A cessna plane is the most convenient way of transportation from Pemba to Palma. There are problems in transportation of construction equipment & material, fertilizer, etc.	Roads near Pemba are paved, but about 130 km of the total 200 km between Pemba and Nacala is unpaved. There are problems in transportation of construction equipment & material, fertilizer, etc.	The surrounding roads including the road to Nampula are paved and maintained in a good condition. There are no problems in transportation of construction equipment & material, fertilizer, etc.
	Railway	No railways are available. There are problems in transportation of construction equipment & material, fertilizer, etc.	No railways are available. There are problems in transportation of construction equipment & material, fertilizer, etc.	The existing railway can be used for transportation of construction equipment & material, fertilizer, etc.
	Electric power	It is considered that there will be shortage in the power supply capacity in all candidate sites. Privately owned power generation facility will be required.		
	Water	It will be difficult to secure the required water (1,000 m^3/h). Desalination plant may be required.	It will be difficult to secure the required water (1,000 m^3/h). Desalination plant may be required.	It will be difficult to secure the required water (1,000 m^3/h). Desalination plant may be required.
	Others	Palma is a small fishing village and no hotels are available. It is necessary to construct a camp for construction and operation in the Project. It is difficult to recruit general local workers.	There are some hotels for foreigners in Pemba. It is still necessary to construct accommodation for workers, but the existing accommodation in the city may also be used. A small-scale airport is available. Recruit of work force may beeasier than Palma.	There are some hotels for foreigners in Nacala. It is still necessary to construct accommodation for workers, but the existing accommodation in the city may also be used. A new airport will be opened soon. Recruit of work force may beeasier than Palma.

Site		Palma	Pemba	Nacala
		Assuming a site near the gas supply base	Assuming a site near the Pemba Port	Assuming a site in IFZ that has been planned by GAZEDA (the most preferable incentive is expected)
Infrastructure	**Summary**	Palma is the worst site in terms of various infrastructures. For transportation of construction equipment & material, a temporary jetty may be required and it may cause higher construction cost. Roads should be paved and well maintained by the public sector in Mozambique.	There are problems in various infrastructures (but better than Palma). For transportation of construction equipment & material, a temporary jetty may be required and it may cause higher construction cost. Roads should be paved and well maintained by the public sector in Mozambique.	No remarkable problems have been found in terms of infrastructures, living environment, etc.
Gas pipeline		A new pipeline from the supply base in Palma is required and its length is assumed to be shorter than 10 km. The installation cost may be about USD 6 million.	A new pipeline from the supply base in Palma is required and its length will be about 260 km. The installation cost may be about USD 145 million.	A new pipeline from the supply base in Palma is required and its length will be about 465 km. The installation cost may be about USD 260 million.
Prospect of the Project schedule		It is difficult to examine the Project schedule since the development schedule of roads, port, etc. is unknown.	It is difficult to examine the Project schedule since the development schedule of roads, port, etc. is unknown.	The development schedule of IFZ is not clearly shown; however, it may be possible to achieve the Project schedule targeting at the operation start from 2021.

Source: JICA Survey Team

The above table does not show the comparison of project costs. In the case of Nacala, the pipeline installation cost is the highest. On the other hand, in the cases of Palma and Pemba, if infrastructures such as port facilities, road pavement, railway, etc. are developed in an equivalent level to those in Nacala, investment costs for the infrastructures would be more than USD 1,000 million in Palma and several hundred million USD in Pemba. These costs depend on the work demarcation between the public and private sectors; however, it should be noted that its implementation is not so easy even for the public sector in Mozambique.

Considering the current conditions of infrastructures such as port facilities, roads, railway, etc., incentives, certainty of the Project schedule and so on, the site in Nacala is the best for the Project.

5.5.2 Fertilizer Plant and Relevant Infrastructures

Even though the Project location would be changed, the project components are basically the same as the development plan in Beira. The plant configuration is considered to be the same as described in Chapter 5.1. However, the following items need to be re-examined:

a) Location of fertilizer plant and its condition

b) Condition of infrastructures in the surrounding area (roads, railway, port, water supply)

c) Installation plan for the gas pipeline

d) Water supply

(1) Fertilizer Plant Site

According to GAZEDA, a development plan of IFZ in Nacala has been studied, although its development schedule has not been determined. This IFZ is located at about 7 km south of the Nacala Port as shown in Figure 5.5.2. Considering the fiscal benefits, convenience of logistics, future infrastructure in the surrounding area, etc., this IFZ is the most suitable site for the proposed fertilizer complex.

1) Major site conditions:

a) The IFZ may have an area of about 500 ha, and therefore, the required area for the proposed fertilizer plant (35 ha) can be secured in this IFZ. It is considered that this Project would not have any environmental problems such as resettlement since the site is located within the IFZ.

b) Urgent rehabilitation and expansion of the Nacala Port are scheduled.

c) The existing railway runs nearby this IFZ and it can be used for the transportation of urea fertilizer produced in the fertilizer plant.

d) Since an access road to the Nacala Port is planned, it is considered that the construction and O&M of the fertilizer plant will not face any difficulties in transportation.

e) Since it is considered that a water supply plan will also be developed together with the the IFZ, there would be no problems in securing water for the Project.

2) Land acquiring cost

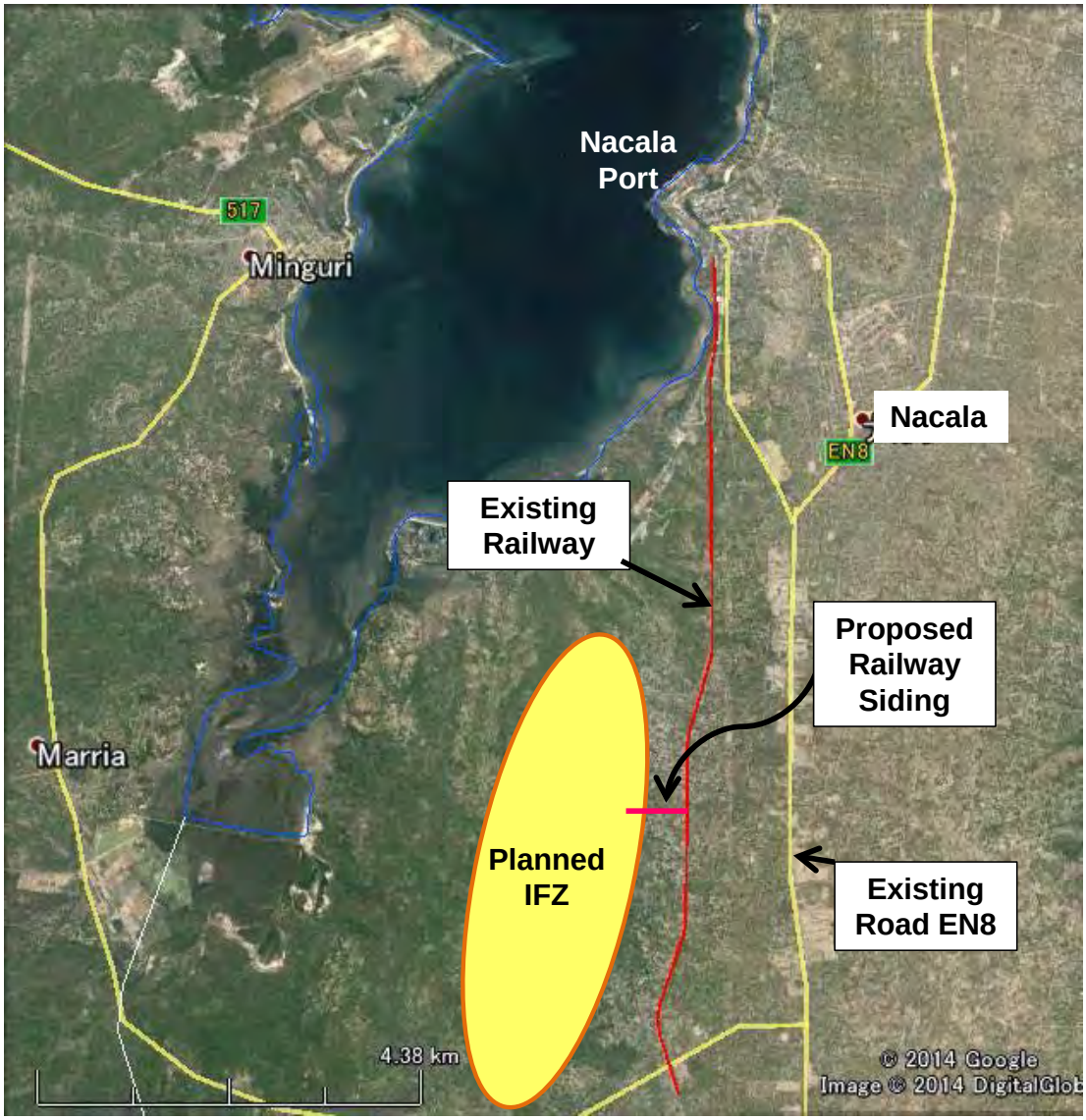
Since land price of this IFZ has not yet been studied, land acquiring cost is estimated referring to the land price in the Beluluane IFZ which has been developed and managed by GAZEDA. The land price and administration charge of this IFZ are USD 20 – 25 /m^2 and USD 0.2 /m^2/month. This land price seems to be very low. There would be some reasons such as that the land reclamation cost was low because of the flat topography, the initial investment cost was low because it was developed fifteen years ago, there is no waste water treatment facility, and GOM tries to keep the price low in order to encourage the industrial investment.

On the other hand, the proposed IFZ in Nacala is located in the hilly area and therefore it is obvious that the land reclamation cost will be much higher than the Beluluane IFZ. In addition, the prices have risen considerably. Considering these facts, it is reasonable to assume the land acquiring price at USD 45 /m^2.

Land price and administration charge of the proposed IFZ in Nacala

Land price: USD 45 /m^2

Administration charge: USD 0.2 /m^2/month



Source: Google Earth (edited by the JICA Survey Team)

Figure 5.5.2 Proposed Project Site

(2) Railway

The existing railway runs 1 – 2 km east of the IFZ in the north – south direction. This railway line passes through Nampura and connects to the western regions of Mozambique and Beira. Although it should be noted that there would possibly be a certain extent of restriction in its operation due to an anticipated increase in coal transportation in the future, it can be said that the railway is still a promising means of transportation to be utilized for the Project.

In order to utilize the railway, a new railway siding is necessary. According to the Google Map, it seems that the difference in height between the IFZ and the existing railway is about 30 m (slightly hilly area). From Figure 5.5.2, the outline of the railway siding should be as follows:

Total length: 3 km (total of length inside and outside the site boundary)

Land (ROW: Right of Way): In addition to the plant site, the following land may be necessary.
2 km x 200 m (ROW) = 40 ha

Since no remarkable obstacles such as large rivers or structures are seen on the map, the railway siding could be constructed at the standard price. Following the cost estimation for the development plan in Beira, the construction cost is estimated using USD 3.0 million/km.

USD 3.0million/km x 3 km = USD 9.0million

On the other hand, the area surrounding the IFZ is also planned as an industrial park and it is considered to be similar to the planned industrial area in Beira. Under this assumption, the land use unit price of the planned industrial area in Beira, 100,000 MT/ha, is applied for estimating land use price for the railway siding.

MT 100,000 /ha x 40 ha = MT 4.0million

It is assumed that the railway transportation tariff is equivalent to the case in Beira (5.3.3, (3)).

(3) Access Road

It is considered that roads around the IFZ will also be developed when the IFZ is developed, and therefore, it is not necessary to construct any access roads in this Project.

(4) Port Facilities

According to the “Preparation Survey for the Nacala Port Development Project” by JICA, the following schedules are proposed for the modernization and expansion of the Nacala Port in cooperation with the industrial development of northern Mozambique.

Emergency repairng project	Completed in 2015
Short-term projects	Completed in 2020
Middle-term projects	Completed in 2025
Long-term projects	Completed in 2030

These projects include port capacity expansion for the bulk handling and geographical expansion of the port, which are beneficial for the Project. Cargo handling amounts in the base case are predicted as follows.

	2008 (at present)	2020	2030
Container (1,000 TEU)	50	211	491
Bulk (1,000 ton)	598	22,450	45,228

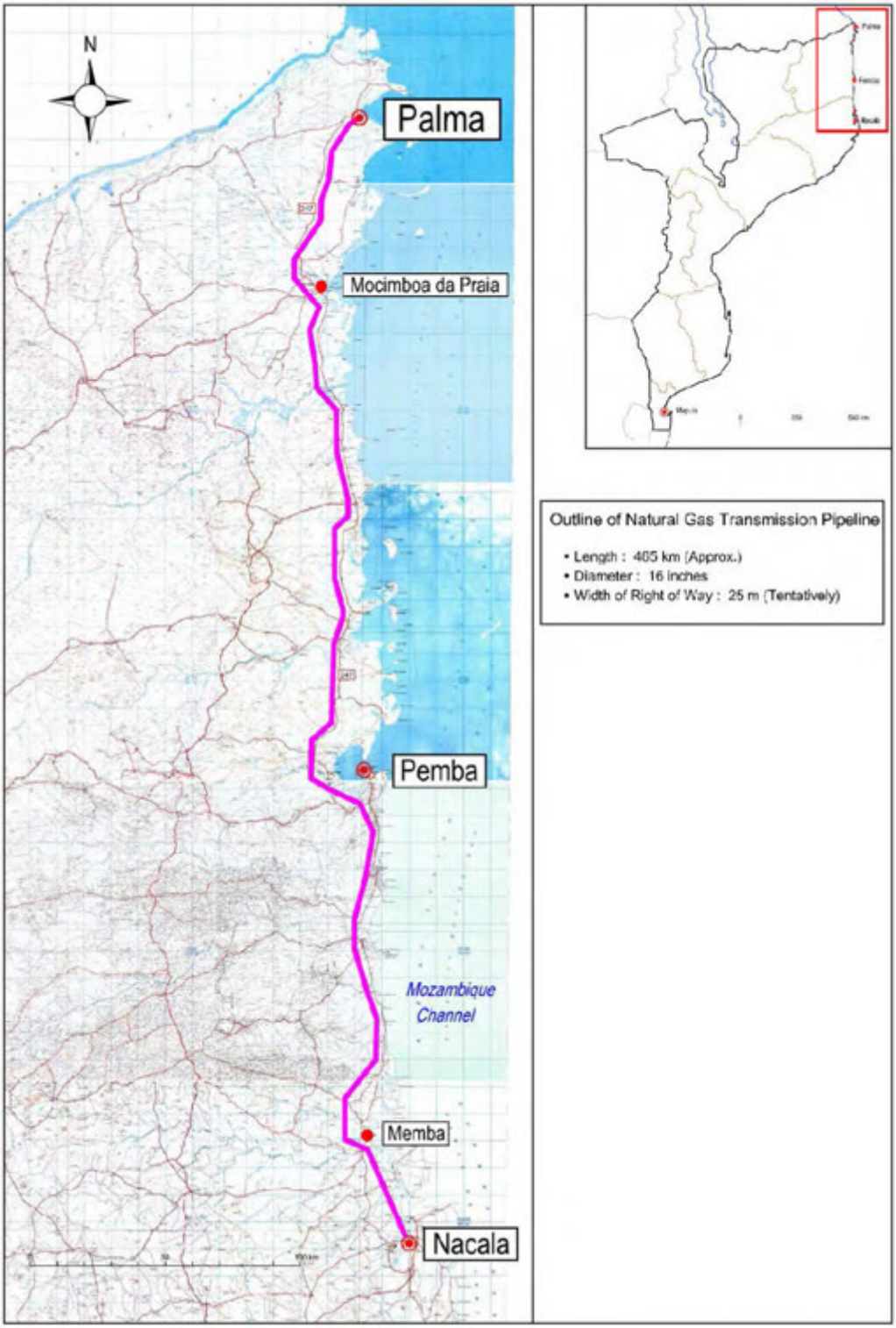
Coal is a major item in the bulk handling (20 million tons in 2020 and 40 million tons in 2030). For other bulk items, the handling volumes increase by about 1.8 million tons in 2020 and about 4.6 million tons in 2030. The annual export amount of urea fertilizer in the Project will be about 1 million ton and thus this amount can be handled after the expansion of the Nacala Port.

Size of ship that can berth at the bulk terminal is proposed as 70,000 DWT and this will not create any problems in the Project.

From the above, no improvement of the Nacala Port is required as a part of the Project.

(5) Gas Pipeline

Figure 5.5.3 shows the proposed gas pipeline route from Palma to Nacala.



Source: JICA Survey Team

Figure 5.5.3 Proposed Gas Pipeline Route

Dimensions of pipeline are:

Total length: 465 km

Diameter: 16 inches

As mentioned in Chapter 5.2.2, this Survey does not consider possibility of common use of the gas pipeline with other projects.

(6) Water Supply

According to GAZEDA, since the water supply capacity in Nacala is low at present, it is essential to enhance it in order to promote the development of IFZ. Further information is not available at the moment, and therefore, it is assumed that water supply facilities would be developed as the IFZ is developed and it is unnecessary to install a water pipeline only for the Project.

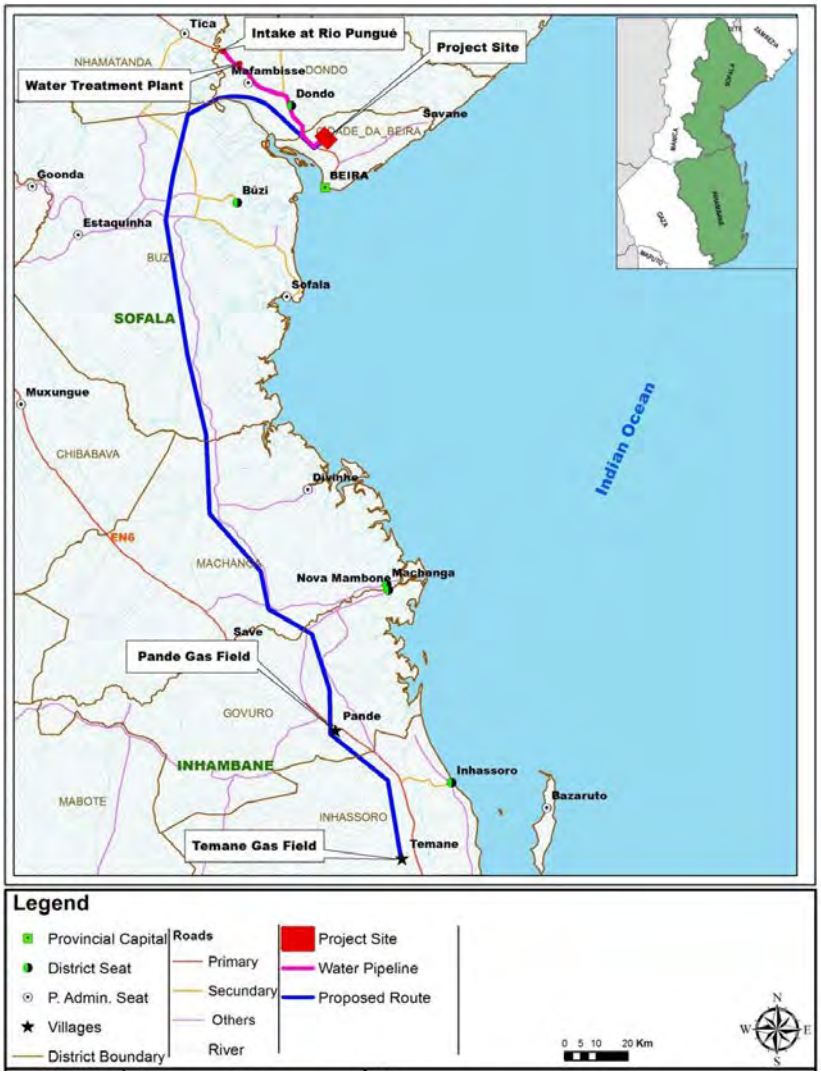
On the other hand, water tariff in Nacala could be more expensive than the tariff for the project scheme in Beira since the construction cost of water supply facilities will be added in the former case, while the construction cost is estimated as a part of the Project cost in the latter case. In this Survey, the raw water tariff of **14 MT/m^3** that was obtained from FIPAG is applied.

Chapter 6 Environmental and Social Considerations

6.1 Location and Area of the Project

The area of the Project consists of the plant area (Urea Fertilizer Complex), temporary area (during construction), and the area along the gas pipeline and water pipeline. All of the aforementioned area is located within the Beira District except the gas pipeline.

The Urea Fertilizer Complex, with total area of 35 ha, will be located at the Beira New Industrial Area. In addition, a temporary area of 25 ha is planned to be used during the construction stage. Therefore the total area related to the Urea Fertilizer Complex is around 60 ha. The Beria New Industrial Area is located north of the Beira city area and is adjacent to the railway Sena Line. The gas pipeline starts from the Pande/Temane gas field in the Inhambane Province and runs north along national road No.428 (EN428), and after it enters the Sofala Province it will run along the national road No.6 (EN6) up to the plant area. The length of the gas pipeline is around 305km. The right of way (ROW) of the gas pipeline is 20 m; therefore, the development area related to the gas pipeline is around 610 ha. The gas pipeline route is located to avoid populated areas, conservation areas, and historical and cultural areas. The water pipeline is planned to be installed from the existing water intake in the Pungue



Source: JICA Survey Team

Figure 6.1.1 Location of the Project

River to the plant area along EN6. The length of the new water pipeline is around 50 km and is planned to be routed adjacent to the existing water pipeline.

6.2 Baseline of the Environment and Social Conditions

6.2.1 Project Area of Influence

The Area of Influence (AI) for this Project was determined by considering all those areas physically disturbed by the proposed activities i.e., the footprint of all project activities, where the Urea Fertilizer Complex, gas and water pipelines, and its surrounding area i.e., landscape, existing infrastructures (road, railways), dwellings, cultivated lands, water resources. The AI considered for this Project included the area of direct influence (Urea Fertilizer Complex, gas and water pipelines) and the area of indirect influence which is 1.5 km surrounding the area of direct influence.

The AI considered in this survey is based on the current plan of the project and it will be reassessed during the EIS phase once the description of the project has sufficient detail to inform impact assessment.

It shall be noted that, due to unstable situation in Sofala and Inhambane Provinces, the site survey for the gas pipeline route was limited and relied basically on literature review.

6.2.2 Environmental Baseline

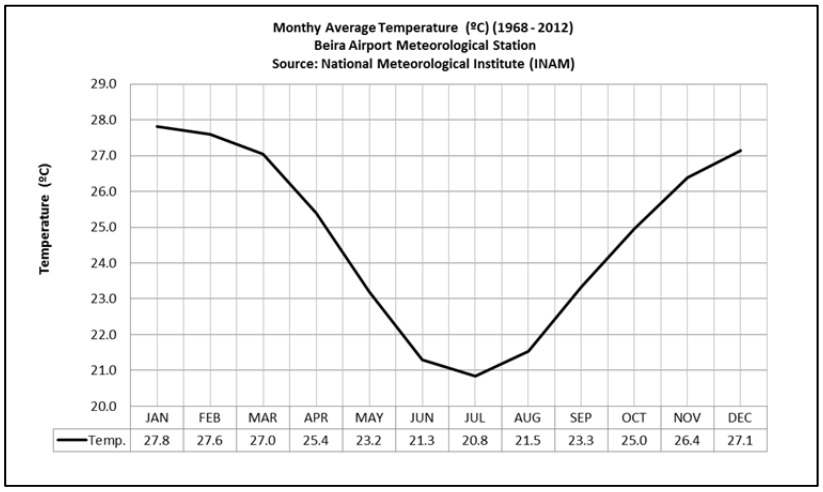
(1) Climate

Data was selected from the Beira Airport weather station and from the Vilanculos weather station. These weather stations were selected because they were the closest to the future Urea Fertilizer Complex and the gas pipeline pathway, respectively.

1) Beira

a) Temperature

The monthly average temperature in Beira from 1968 to 2012 is shown in Figure 6.2.1. Average temperature increases with the onset of the rainy season, between October and November. The warmer months are from December to February ranging from 27°C to 28°C. The coldest month is July, with a monthly average temperature of 21°C, which corresponds to the fresh and dry season.

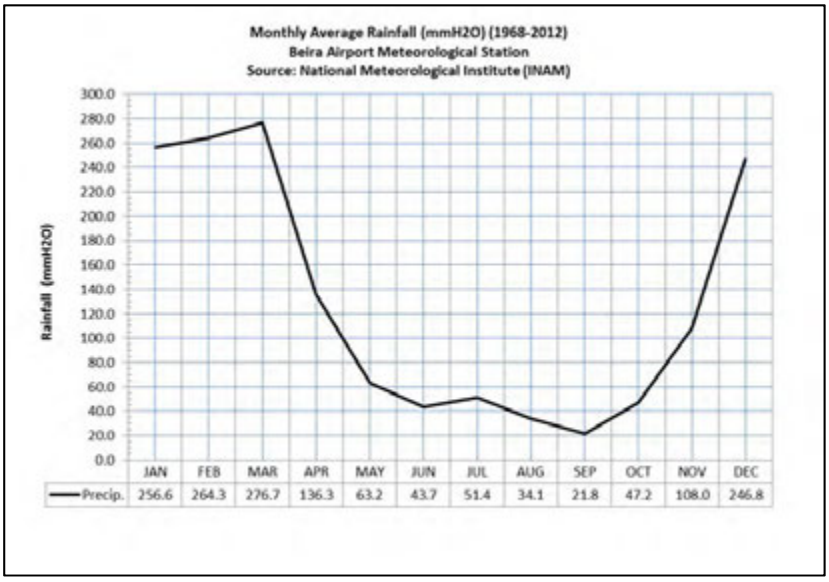


Source: Instituto National de Meteorologia (INAM), 2013

Figure 6.2.1 Monthly Average Temperature in Beira (1968-2012)

b) Precipitation

The monthly average precipitation in Beira from 1968 to 2012 is shown in Figure 6.2.2. The wettest month is March, with precipitation reaching maximum values of 277 mm. The driest month is September with rainfall reaching maximum vales of 22 mm. 95% of the precipitation occurs during the rainy season, which is generally said to be from October to April.

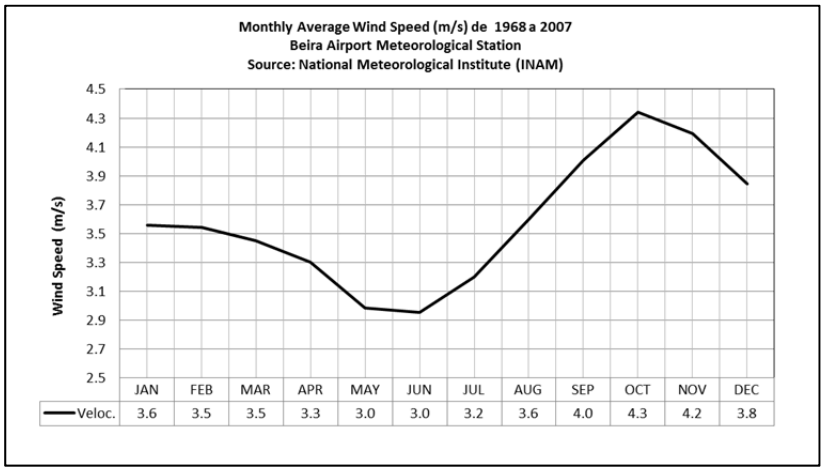


Source: Instituto National de Meteorologia (INAM), 2013

Figure 6.2.2 Monthly Average Precipitation in Beira (1968-2012)

c) Wind direction/velocity

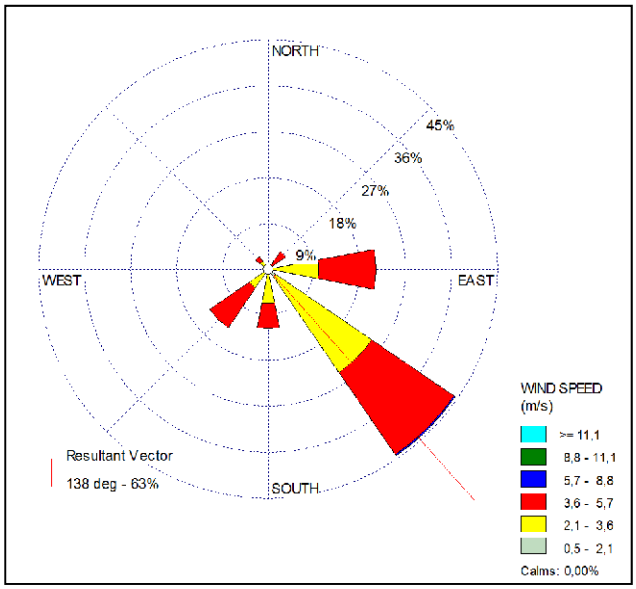
The monthly average wind speed in Beira from 1968 to 2012 is shown in Figure 6.2.3. The strongest winds are recorded in October and November (4.2 m/s). The weakest wind is recorded in May and June (3.0 m/s). The annual average wind speed is 3.6 m/s.



Source: Instituto National de Meteorologia (INAM), 2013

Figure 6.2.3 Monthly Average Wind Speed in Beira (1968-2007)

The annual predominant wind direction observed from 1968 to 2006 is illustrated in Figure 6.2.4. The figure shows the wind direction in twelve directions and the wind speed in different colors. The mean annual frequency of occurrence is described in a concentric circle. The predominant wind direction is from the southeast quadrant and it amounted to 45% of the entire wind followed by wind from the east quadrant. The resultant vector occurs at Southeast quadrant (138deg) at frequency of 62%.



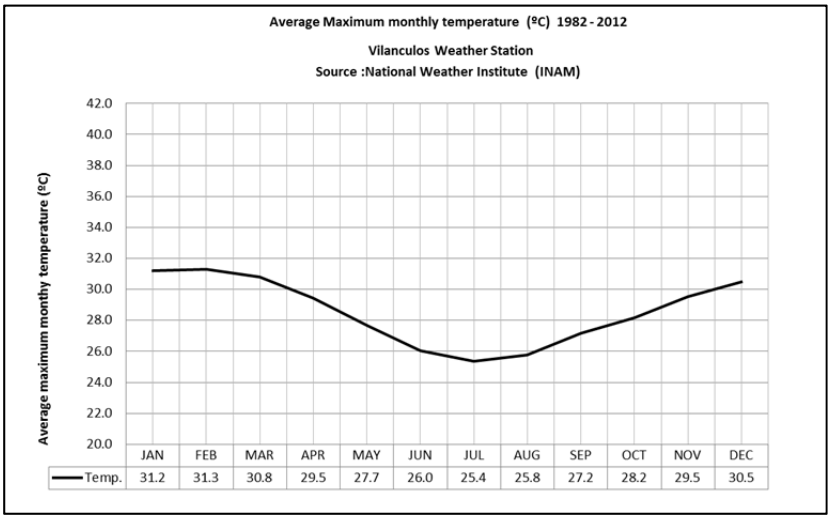
Source: Instituto National de Meteorologia (INAM), 2013

Figure 6.2.4 Annual Predominant Wind Direction in Beira (1968-2007)

2) Vilanculos

a) Temperature

The monthly average temperature in Vilanclos from 1982 to 2012 is shown in Figure 6.2.5. The average temperature increases between December and February recording around 31°C. From May to August, there is a gradual decrease in temperature, with averages dropping to around 26°C.

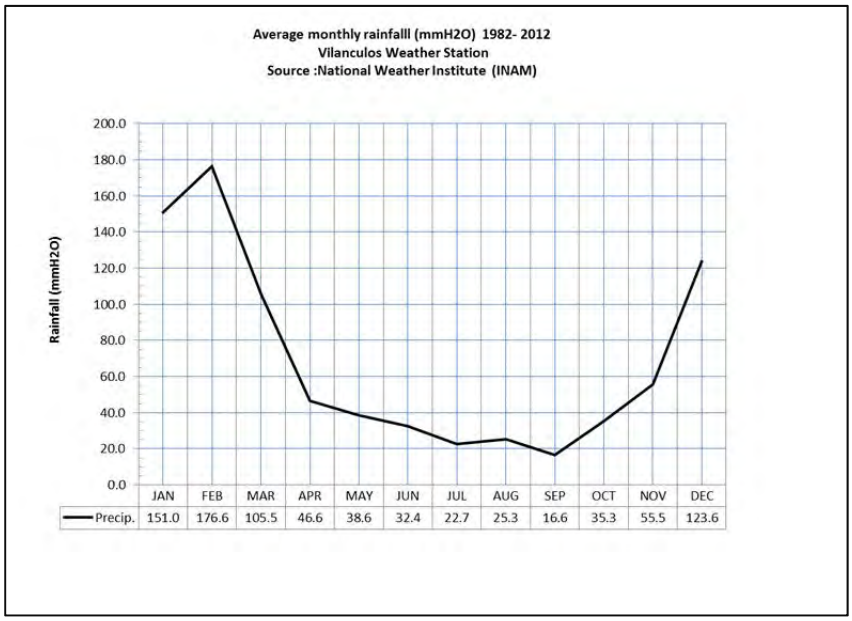


Source: Instituto National de Meteorologia (INAM), 2013

Figure 6.2.5 Monthly Average Temperature in Vilanculos (1982-2012)

b) Precipitation

The monthly average precipitation in Vilanculos from 1982 to 2012 is shown in Figure 6.2.6. The wettest month is February, with precipitation reaching maximum values of 176 mm. The driest month is September with rainfall reaching maximum vales of 17 mm. 95% of the precipitation occurs during the rainy season, which is generally said to be from October to April. As it can be seen in the figure, changes in temperature and precipitation is almost relative.

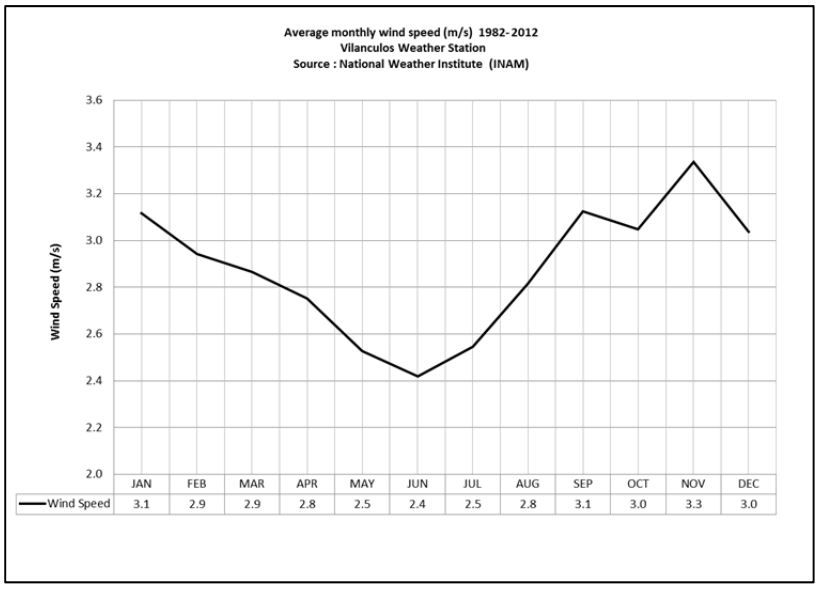


Source: Instituto National de Meteorologia (INAM), 2013

Figure 6.2.6 Monthly Average Precipitation in Vilanculos (1982-2012)

c) Wind direction/velocity

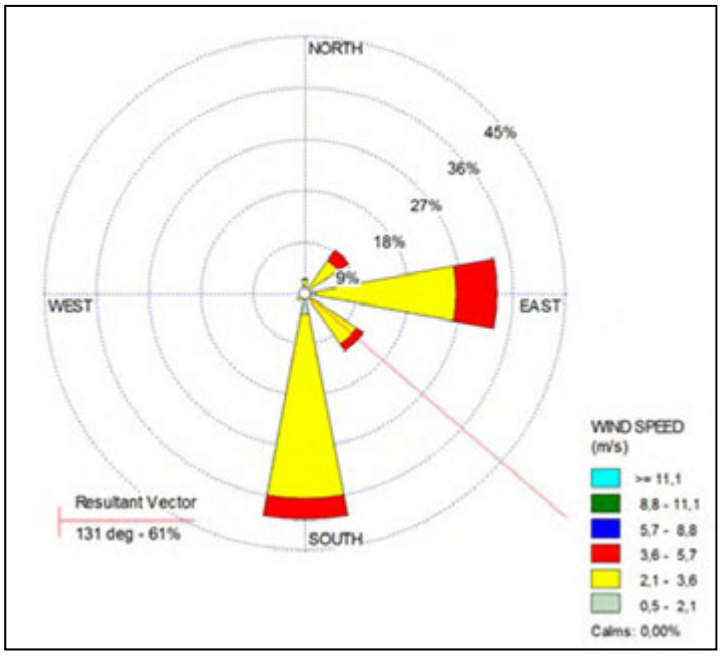
The monthly average wind speed in Vilanculos from 1982 to 2012 is shown in Figure 6.2.7. The strongest winds are recorded in November and December (over 3.2 m/s). The weakest wind is recorded between May and July (2.4 m/s).



Source: Instituto National de Meteorologia (INAM), 2013

Figure 6.2.7 Monthly Average Wind Speed in Vilanculos (1982-2012)

The annual predominant wind direction observed from 1982 to 2012 is illustrated in Figure 6.2.8. The predominant wind direction is from the south and it amounts for 40% of the entire wind followed by wind from the east. The resultant vector occurs at the southeast quadrant (131deg) at a frequency of 61%.



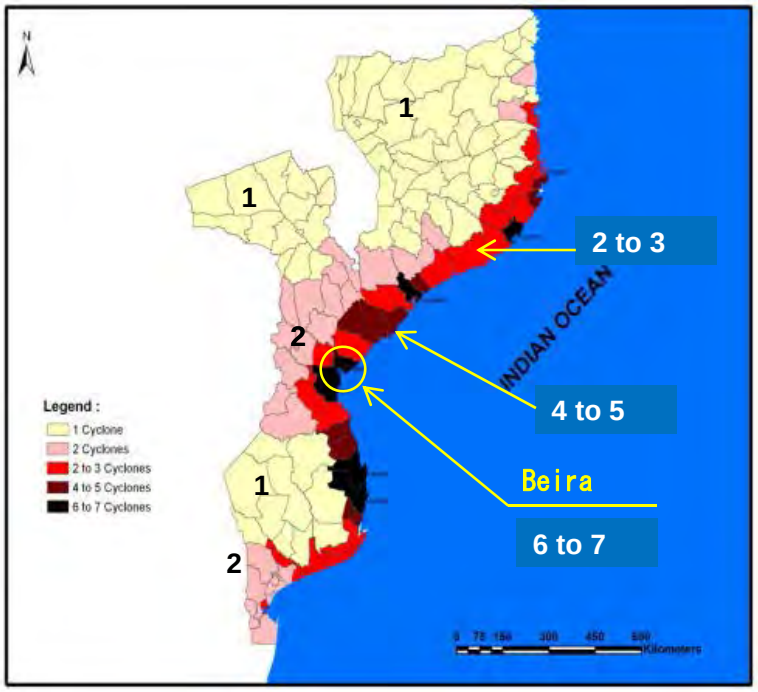
Source: Instituto National de Meteorologia (INAM), 2013

Figure 6.2.8 Annual Predominant Wind Direction in Vilanculos (1982-2012)

(2) Cyclones

Data was selected from the Beira Airport weather station and from the Vilanculos weather station. These weather stations were selected because they were the closest to the future Urea Fertilizer Complex and the gas pipeline pathway, respectively.

Cyclonic activity is strong from November to April in Mozambique. Between 1993 and 2012, 40 cyclones were recorded in Mozambique (INAM, 2012) of which nine were classified as very intense with maximum speeds in excess of 59 m/s (212 km/h). Because the Beira District is located on the east coast, it can be said that there is a high possibility of damage from cyclones.



Source: Environment Resource Management (ERM)

Figure 6.2.9 Occurrence of Tropical Cyclones (1970-2000)

(3) Air Quality

In the city of Beira and its surrounding area, multiple sources of anthropogenic atmospheric pollutants were identified and the following are of particular relevance.

- Beira Port (main products handled in the port are: fuels; clinker; cement, granite, coal, timber, wheat, fertilizers, oil, wheat, sardine)
- Roadway vehicles fleet (consisting of vehicles older than 15 years in operation, and is in a poor state of conservation. Most of the traffic to and from the port consists of these trucks and other vehicles, approximately 800 vehicles per day.)
- Daily activity of small industries in Beira
- The consumption of coal and firewood for domestic purposes (majority of the population in homes.)
- Daily burning of domestic waste in waste storage and dumpsters located near the port (waste consists of materials such as, plastic, rubber, cardboard and paper, etc.)
- Slash-and-burn farming, uncontrolled bushfires

Along the proposed natural gas pipeline route, vehicle traffic on the existing road network (EN428 and EN1) was the major air pollution source identified, contributing to the emission of vehicle exhaust gases and particulate matter, due to vehicle entrainment of dust.

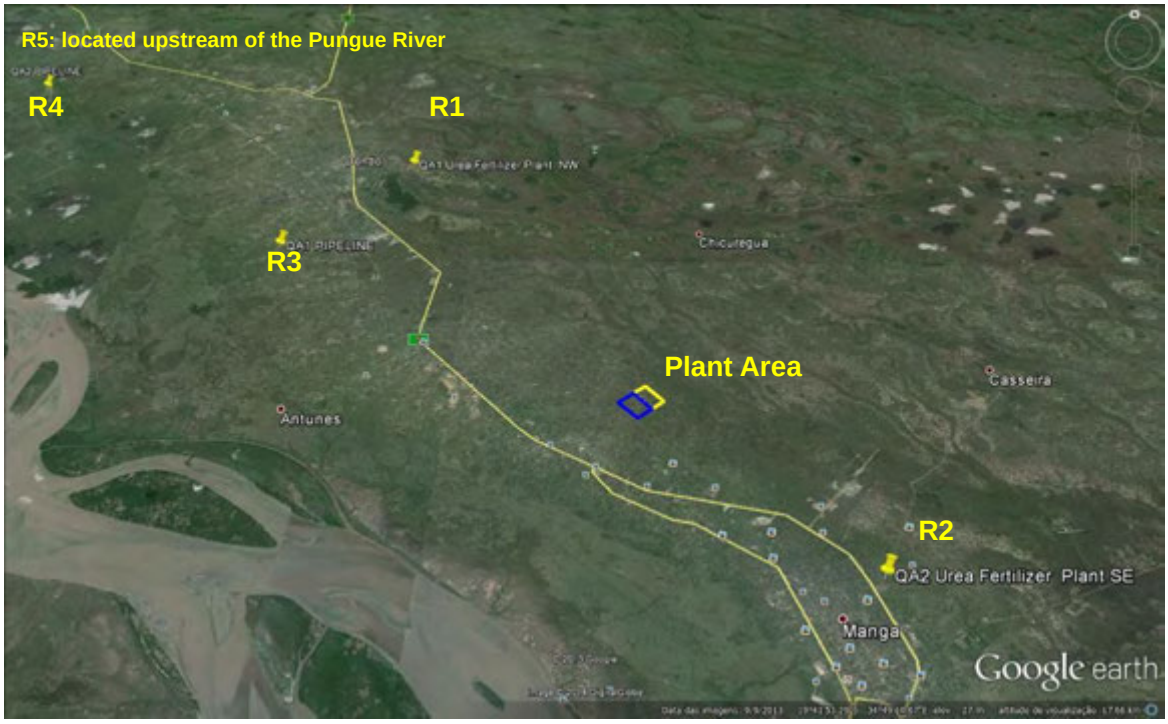
An air quality baseline monitoring campaign was conducted on 14 and 21 January 2014 along the project influence area in a total of eleven sampling points. Details of the sampling points and measurement parameters are explained below.

1) Air quality monitoring points

A total of eleven monitoring points were selected which represents the possible area that could be affected by the implementation of the Project considering the dominant wind directions (2 points for the plant area, 9 points for the gas pipeline and water pipeline routes.)

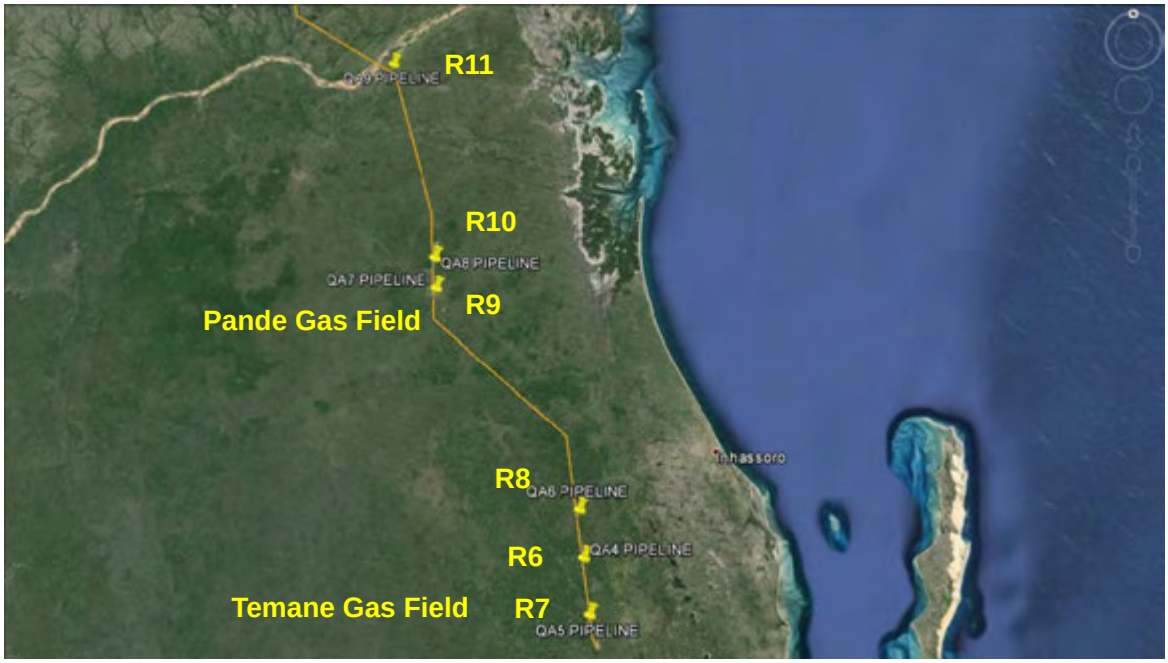
R1 is located in the larger settlement of Dondo. Since the settlement is located on the downwind side (NW) of the plant area, and this monitoring point is important to establish the air quality baseline which will be necessary to assess the impact of the Project. R2 is located upwind (SE) of the Plant Area and is representative of the air emission generated in Beira (the Beira Port). R3 to R11 is located along the gas and water pipeline routes.

The locations of each monitoring point are shown in Figure 6.2.10 and Figure 6.2.11.



Source: Google Earth (edited by the JICA Survey Team)

Figure 6.2.10 Air Quality Monitoring Points in Beira District



Source: Google Earth (edited by the JICA Survey Team)

Figure 6.2.11 Air Quality Monitoring Points in Inhassoro District

Table 6.2.1 Air Quality Monitoring Sampling Points

#	Sampling point	Coordinates X	Coordinates Y
R1	**QA1 - NW Urea Fertilizer Plant**	19°37'5.47"S	34°45'51.83"E
R2	**QA2 - SE Urea Fertilizer Plant**	19°45'22.40"S	34°52'49.59"E
R3	**QA1 - Natural Gas/Water Pipeline**	19°39'27.50"S	34°44'1.04"E
R4	**QA2 - Natural Gas/Water Pipeline**	19°34'27.32"S	34°37'53.01"E
R5	**QA3 - Natural Gas Pipeline**	19°37'26.94"S	34°27'4.09"E
R6	**QA4 - Natural Gas Pipeline**	21°43'44.59"S	35°02'52.73"E
R7	**QA5 - Natural Gas Pipeline**	21°40'7.05"S	35°02'27.50"E
R8	**QA6 - Natural Gas Pipeline**	21°36'59.80"S	35°02'8.81"E
R9	**QA7 - Natural Gas Pipeline**	21°22'24.17"S	34°51'42.16"E
R10	**QA8 - Natural Gas Pipeline**	21°20'21.93"S	34°51'33.96"E
R11	**QA9 - Natural Gas Pipeline**	21°06'41.62"S	34°48'10.31"E

Source: JICA Survey Team

2) Monitoring parameters and equipment

The following parameters were monitored at the monitoring points:

- Particulate material with diameter of 10 μm or less (PM_{10})
- Total suspended particles (TSP)
- Volatile Organic Compounds (VOCs)

The following equipment was used to gather the monitoring samples:

- Particulate matter monitoring - MiniVolt from Airmetrics
- VOC's - Radiello Sorbent Tubes

3) Air quality monitoring results

The following results were obtained from monitoring (24 hours) at each of the monitoring points.

a) TSP, PM_{10}

Table 6.2.2 Particulate Matter Concentrations in terms of TSP and PM_{10} (µg/m^3)

#	Baseline Particulate Matter Concentrations			
	Monitoring Point Name	Geographical Coordinates (WGS 84)	Concentrations (µg/m^3)	
			PM_{10} (*) WHO/EU Guideline: 50 μg/m^3	TSP (**) Moz Regulation: 150 μg/m^3
R1	QA1 – NW Urea Fertilizer Plant	19° 37'5.47"S 34° 45'51.83"E	160.5	291.8
R2	QA2 – SE Urea Fertilizer Plant	19° 45'22.40"S 34° 52'49.59"E	139.3	253.2
R3	QA1 – Natural Gas Pipeline	19° 39'27.50"S 34° 44'1.04"E	103.3	187.8
R4	QA2 – Natural Gas Pipeline	19° 34'27.32"S 34° 37'53.01"E	142.0	258.3
R5	QA3 – Natural Gas Pipeline	19° 37'26.94"S 34° 27'4.09"E	198.3	360.3
R6	QA4 – Natural Gas Pipeline	21° 37'19.19"S 35° 03'45.10"E	36.8	67.0
R7	QA5 – Natural Gas Pipeline	21° 40'7.05"S 35° 2'27.50"E	70.0	127.3
R8	QA6 – Natural Gas Pipeline	21° 37'19.09"S 35° 03'45.10"E	76.4	139.0
R9	QA7 – Natural Gas Pipeline	21° 22'24.17"S 34° 51'42.16"E	64.5	117.2
R10	QA8 – Natural Gas Pipeline	21° 20'21.93"S 34° 51'33.96"E	50.7	92.1
R11	QA9 – Natural Gas Pipeline	21° 6'41.62"S 34° 48'10.31"E	27.7	50.4

(*) WHO and EU Guidelines are 50 μg/m^3 (24 hours)

(**) Regulation of Mozambique is 150 μg/m^3 (Daily mean)

Source: JICA Survey Team

The monitoring results for particulate matter indicate that the ambient air quality of the Beira District (where the monitoring points R1 to R5 are located) is already characterized by high

concentrations of particulate matter, exceeding the Mozambican standard for total suspended particles (TSP - 150 µg/m^3) and the WHO guideline for PM_{10} (50 µg/m^3).

These high PM concentrations are probably correlated with the influence of the human and industrial activities implemented on the principal human settlements located in the vicinity of the sampling sites which already have strong urban and suburban characteristics (Beira, Dondo and Manga settlements). Another strong cause for the obtained results is the traffic circulation on unpaved roads located near the monitoring sites which acts as a line source for particulate emissions.

The remaining locations sampled for particulate matter, namely R6 to R11, which are located along the future natural gas pipeline pathway, in the Inhassoro district, present lower particulate matter concentrations, typical of rural areas, lesser disturbed by human activities. At these locations, TSP concentrations comply with the Mozambican standard. However, the WHO guideline value for PM_{10} of 50 µg/m^3 is slightly exceeded on sampling points R7 to R10.

b) VOC

Table 6.2.3 Total VOC's Concentrations (µg/m^3)

#	Baseline Total VOC's Concentrations						
	Monitoring Point Name		VOC's Groups Concentrations				
		Total Petroleum Hydrocarbons (µg/m^3)	Sum of BTEX			Total Halogenated Volatile Organic Compounds (1.4- Dicloro benzene) (µg/m^3)	Total VOC (µg/m^3) (**)
			Benzene (µg/m^3) (*) Moz Regulation: 4.4 µg/m^3	Toluene (µg/m^3)	Total BTEX (µg/m^3)		
R1	**QA1 – NW Urea Fertilizer Plant**	11.6	**1.8**	**1.0**	2.8	3.0	**17.4**
R2	**QA2 – SE Urea Fertilizer Plant**	6.0	0.5	0.6	1.1	<1.0	**7.10**
R3	**QA1 – Natural Gas Pipeline**	8.1	0.3	<0.4	0.3	1.2	**9.6**
R4	**QA2 – Natural Gas Pipeline**	11.2	0.6	<0.4	1.0	2.3	**14.5**
R5	**QA3 – Natural Gas Pipeline**	8.4	0.4	<0.4	0.4	1.1	**9.9**
R6	**QA4 – Natural Gas Pipeline**	7.7	0.4	<0.4	0.4	1.5	**9.6**
R7	**QA5 – Natural Gas Pipeline**	7.4	0.6	<0.4	0.6	<1.0	**8.0**
R8	**QA6 – Natural Gas Pipeline**	8.8	<0.3	<0.4	<0.4	1.1	**9.9**
R9	**QA7 – Natural Gas Pipeline**	<1.0	<0.3	0.6	0.6	1.2	**1.8**

#	Baseline Total VOC's Concentrations						
	Monitoring Point Name		VOC's Groups Concentrations				
		Total Petroleum Hydrocarbons (µg/m³)	Sum of BTEX			Total Halogenated Volatile Organic Compounds (1.4- Dicloro benzene) (µg/m³)	Total VOC (µg/m³) (**)
			Benzene (µg/m³) (*) Moz Regulation: 4.4 µg/m³	Toluene (µg/m³)	Total BTEX (µg/m³)		
R10	**QA8 – Natural Gas Pipeline**	<1.0	<0.3	<0.4	<0.4	1.3	**1.3**
R11	**QA9 – Natural Gas Pipeline**	8.1	<0.3	<0.4	<0.4	<1.0	**8.1**

(*) The national air quality standard of Mozambique for Benzene is 4.4 µg/m³. WHO does not define a guideline for this pollutant, but it indicates that typical Benzene values for rural areas are 1.0 µg/m³ (WHO, 2000).

(**) Total VOC: (Total Volatile Organic Compounds)

Source: JICA Survey Team

From the VOC's species sampled and analytically determined at each sampling point, only Petroleum Hydrocarbons, BTEX (Benzene, Toluene), and Halogenated Volatile Organic Compounds (1,4 Dichlorobenzene) were found to be above the methods quantification limits. Aromatic Compounds, Alcohols, Aldehydes/Ketones, Polycyclic Aromatic Hydrocarbons (PAH) and Non Halogenated Volatile Organic Compounds were not detected (inferior to the methods quantification limit).

The highest VOC's concentrations were recorded in monitoring point R1 – (QA1 NW), downwind of the proposed plant site. At this monitoring point Benzene reached a concentration of 1.8 µg/m³. While this was the highest concentration measured for Benzene, across all monitoring points, it is still well below the national air quality standard for this pollutant – 4.4 µg/m³. In what regards international standards, while WHO does not define a guideline for this pollutant it indicates that typical Benzene values for rural areas are 1.0 µg/m³ (Air Quality Guidelines for Europe, 2nd edition, 2000), which indicates that while the Benzene concentration measured at this monitoring point is still low, it already reflects some road traffic (tailpipe gases) and industrial influence.

In what regards Toluene, the measured concentration at this monitoring point was 1.0 µg/m³. While this was the highest concentration measured for Toluene, across all monitoring points, it is still well below both the national air quality standard and the international guideline (the aforementioned WHO, 2000) for this pollutant – 260 µg/m³. According to aforementioned WHO (2000), mean ambient air concentrations of toluene in rural areas are generally less than 5 µg/m³, which indicates that the concentrations of toluene measured in the study area are typical of undisturbed areas.

1.4-Diclorobenzene concentrations were also recorded at several of the monitoring points (R1, R3 to R6, R8 to R10), which can be assumed as a result from local and small pesticide use and subsequence volatilization of this compound to the atmosphere.

Overall, however, the Total VOC's result indicates that the anthropomorphic VOC's emissions in the influence area of the Project are still low. As stated above, the recorded VOC's concentrations are likely the result of road traffic and industrial activity in Beira.

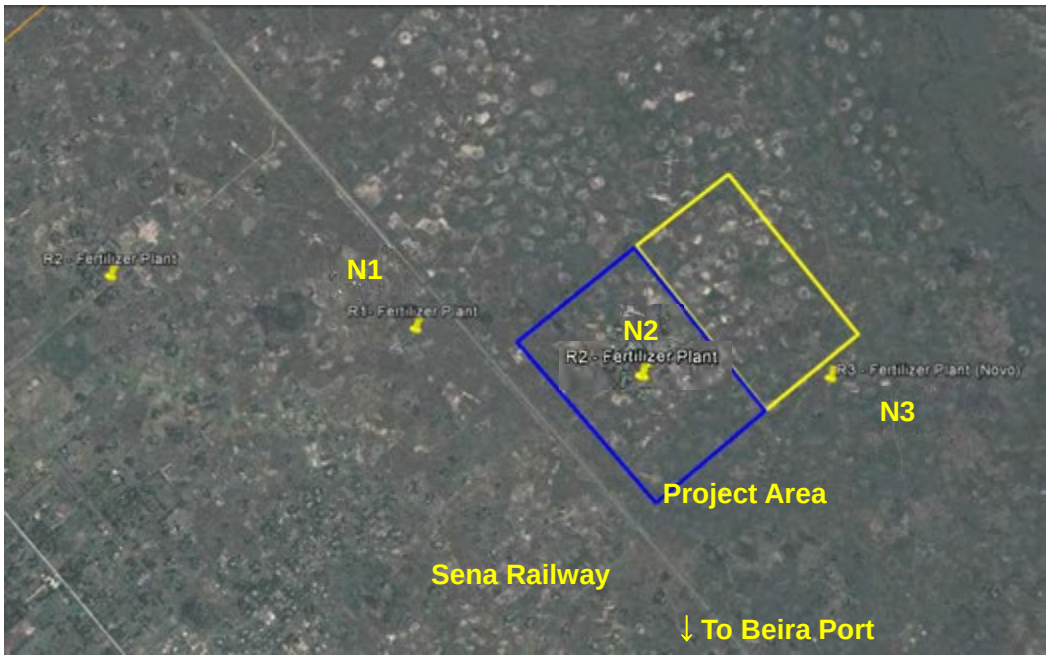
(4) Noise Level

1) Noise monitoring points

A total of six monitoring points were selected which represent the sensitive noise receptors in the Project area of impact.

Since there were no schools, hospitals or clinics confirmed inside the plant area, a settlement located on the downstream of the dominant wind direction from the plant area was selected as one of the monitoring points (N1). Other points were the center of the plant area and a point upstream of the dominant wind direction from the plant area (respectively N2, N3). The distance from the plant boundary to the each of the monitoring points are 340 m for N1 and 198 m for N3. The distance from N3 to the boundary of the temporary area (for construction) is around 80m.

The noise monitoring points near the plant area (3 points), gas pipeline (3 points) are shown in Figure 6.2.12, Figure 6.2.13 and Figure 6.2.14.

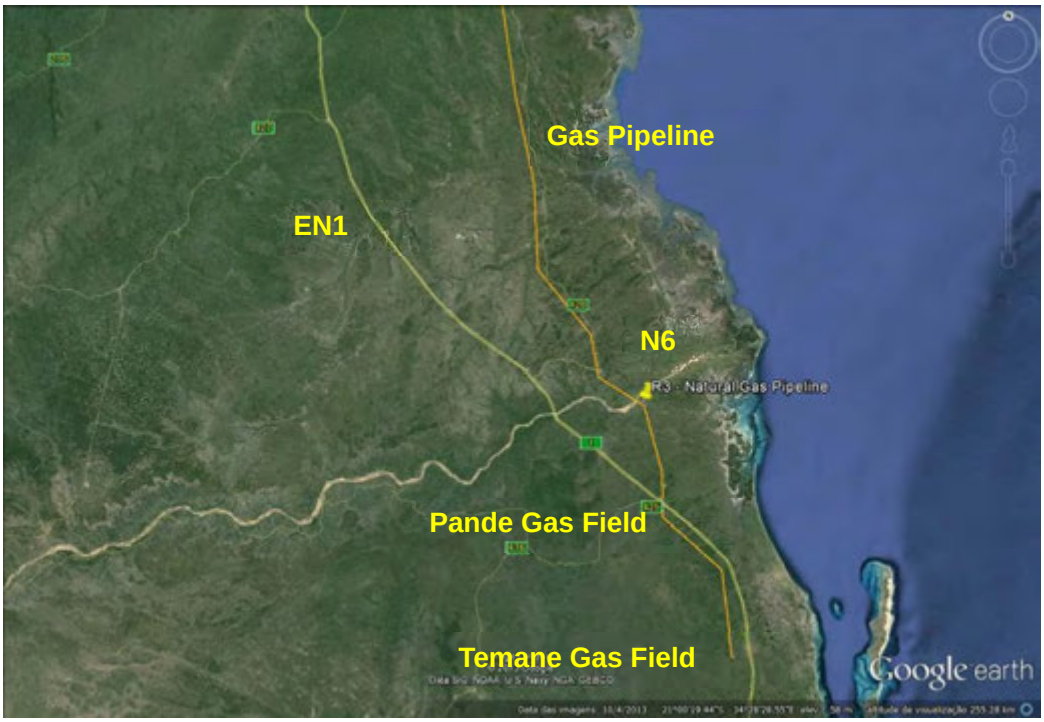


Source: Google Earth (edited by the JICA Survey Team)

Figure 6.2.12 Noise Monitoring Points in the vicinity of the Urea Fertilizer Complex

Source: Google Earth (edited by the JICA Survey Team)

Figure 6.2.13 Noise Monitoring Points along Gas & Water Pipeline Routes (Beira District)



Source: Google Earth (edited by the JICA Survey Team)

Figure 6.2.14 Noise Monitoring Points along the Gas Pipeline Route (Inhassoro District)

Table 6.2.4 Ambient Noise Level Sampling Points

#	Sampling point	Coordinates X	Coordinates Y
N1	**R1 - Urea Fertilizer Plant**	19°42'40.25"S	34°49'27.84"E
N2	**R2 - Urea Fertilizer Plant**	19°42'41.06"S	34°49'53.90"E
N3	**R3 - Urea Fertilizer Plant**	19°42'43.48"S	34°50'14.90"E
N4	**R1 - Natural Gas Pipeline**	19°39'27.29"S	34°44'1.82"E
N5	**R2 - Natural Gas Pipeline**	19°34'30.56"S	34°37'52.29"E
N6	**R3 - Natural Gas Pipeline**	19°06'35.58"S	34°48'14.83"E

Source: JICA Survey Team

2) Monitoring parameters and equipment

The following parameters were monitored at the monitoring points:

- A-weighted equivalent sound pressure level (L_{Aeq})
- Background noise level indicator (L10 and L90)

The following equipment was use to for gathering the monitoring samples:

- Digital sound level meter Blacksolo 01 dB, Class 1

3) Noise (acoustic) monitoring results

Although the planned field campaign included night-time measurements (22:00-07:00), these were not possible to undertake due to security concerns (it was not possible for the regional police to secure the night-time measurement). Therefore, the measurements were all conducted in the daytime reference period (07:00-22:00). The results of measurement in each point are shown in Table 6.2.5.

Table 6.2.5 Ambient Noise Level Monitoring Results

#	Monitoring point and location	Acoustic Survey Results (WHO Guideline: L_{Aeq} 55dB(A), IFC Guildeline: L_{Aeq} 70dB(A)for industrial area)				
		L_{Aeq} dB(A)	**L min dB(A)**	**L max dB(A)**	**L10 dB(A)**	**L90 dB(A)**
N1	**R1 – Urea Fertilizer Plant**	**51.2**	38.5	71.1	52.6	43.0
		48.7	37.6	67.5	50.8	42.5
		47.7	36.0	62.8	49.8	39.7
N2	**R2 – Urea Fertilizer Plant**	**43.9**	37.3	54.8	46.4	39.6
		46.4	37.9	62.9	47.8	39.9
		50.8	39.7	70.2	52.6	42.5
N3	**R3 – Urea Fertilizer Plant**	**47.5**	38.4	55.4	50.6	41.9
		47.6	39.2	56.9	50.6	42.6
		47.7	37.4	56.9	50.5	42.9

#	Monitoring point and location	Acoustic Survey Results (WHO Guideline: L_{Aeq} 55dB(A), IFC Guildeline: L_{Aeq} 70dB(A)for industrial area)				
		L_{Aeq} dB(A)	**L min dB(A)**	**L max dB(A)**	**L10 dB(A)**	**L90 dB(A)**
N4	**R1 – Natural Gas Pipeline**	**41.9**	30.8	62.0	42.3	32.6
		43.5	29.3	66.9	41.7	32.2
		41.5	30.6	61.3	41.2	34.1
N5	**R2 – Natural Gas Pipeline**	**46.6**	30.1	66.7	47.3	34.9
		54.0	32.2	73.9	53.8	35.7
		45.6	29.8	62.2	48.8	35.1
N6	**R3 – Natural Gas Pipeline**	**40.8**	30.0	58.4	42.4	32.5
		45.4	30.1	68.4	44.8	33.6
		42.1	30.9	61.0	42.7	34.0

Source: JICA Survey Team

The acoustic results expressed in the L_{Aeq} – (long duration sound equivalent level parameter) in every monitored point are well below the WHO daytime guideline of 55 dB(A). (55 dB(A) is the noise level in a general office condition.) This is because there are no industrial facilities or roads etc. that could be a source of noise near the monitoring points.

(5) Topography

The plant area is located in the alluvial plain on the left bank of the Pungue River. The elevation is around 25 m above the mean sea level.

The gas pipeline is routed 20 to 50 km inland from the coast line and the total length is around 305 km. The pipeline passes through alluvial plains and depositional depressions areas (Beira). The elevation of the pipeline route is mostly 10 to 30 m above the mean sea level and the topography is relatively flat, excluding areas near the Pande gas field, and some segments from the Temane gas field (100 to 150 km and 230 to 250 km) which are higher than 60 m above the mean sea level (refer Chapter 5 for details).

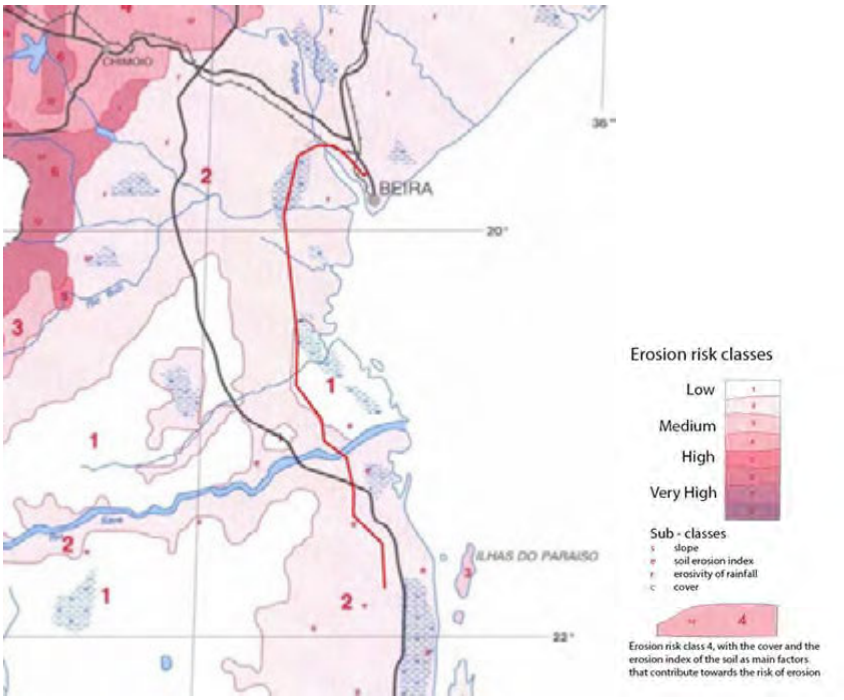
(6) Geology and Soil

The soil textures of the proposed plant area are formed in the Quaternary period and consist of sand to sandy loam and sandy clay. The origin of the soil in the area is likely due to alluvial of the Pungue River.

The soil texture along the gas pipeline route near the Pande/Temane gas field is a mixture of clayey loam, sand, sandy-clay- loam and marl.

(7) Erosion

In accordance with the erosion risk map of Mozambique (SADACC Soil and Water Conservation and Land Utilization Co-ordination Unit), the area of Project is within a low erosion risk area (category 1 and 2). Therefore, is can be said that the risk of erosion is very low. An excerpt of the erosion risk map for the region of interest is shown in Figure 6.2.15.



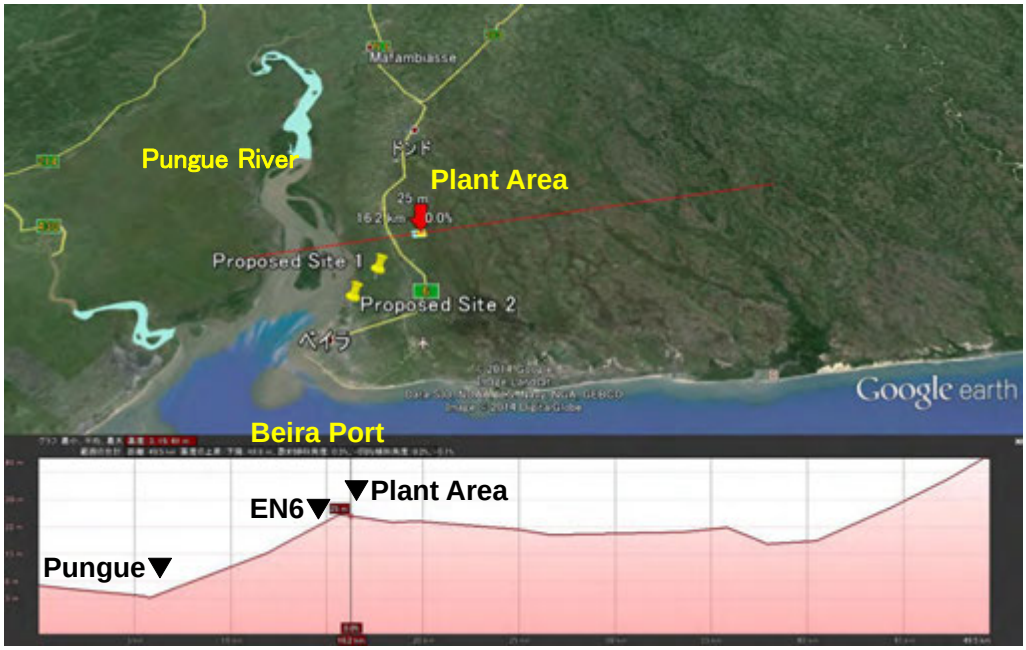
Source: SADACC Soil and Water Conservation and Land Utilization Co-ordination Unit

Figure 6.2.15 Excerpt of the Erosion Hazard Map of Mozambique

(8) Hydrology

The Project area is within the water basin of the Pungue, Save and Buzi Rivers. The gas pipeline passes through all three basins. The plant area and water pipeline is only within the Pungue River basin. Elevation of most of the area in the city of Beira, which is located downstream of the Pungue River, is around 2 to 3 m above mean sea level. The lower basin is often subjected to flooding during the rainy season. Furthermore, when the river flow is low, sea water flows back into the river, reaching up to about 80 to 100 km from the mouth.

The plant area is located on the North side of EN6. EN6 is the main road which extends northwest from the Beira Port along the Pungue River. EN6 and the Pungue River are running almost parallel around the Plant Area, while EN6 runs along the ridge at a higher elevation than the Pungue River. The elevation along EN6 descends gradually towards the northeast direction.



Source: Google Earth (edited by the JICA Survey Team)

Figure 6.2.16 Typical Section of the Plant Site

As shown in Figure 6.2.16, the plant site is located near the boundary of the Pungue River basin. There is a small river which can be seen at the north side (right side in the figure above) of the site which is not included in the Pungue River basin.

(9) Water Quality

1) Water quality monitoring points

The objective of the water quality monitoring campaign is to characterize the current or baseline conditions of surface and ground water in the Project's area of influence. Nine locations for surface water and three locations for ground water sampling were selected. The location of each sampling point and its characteristics are shown in Table 6.2.6.

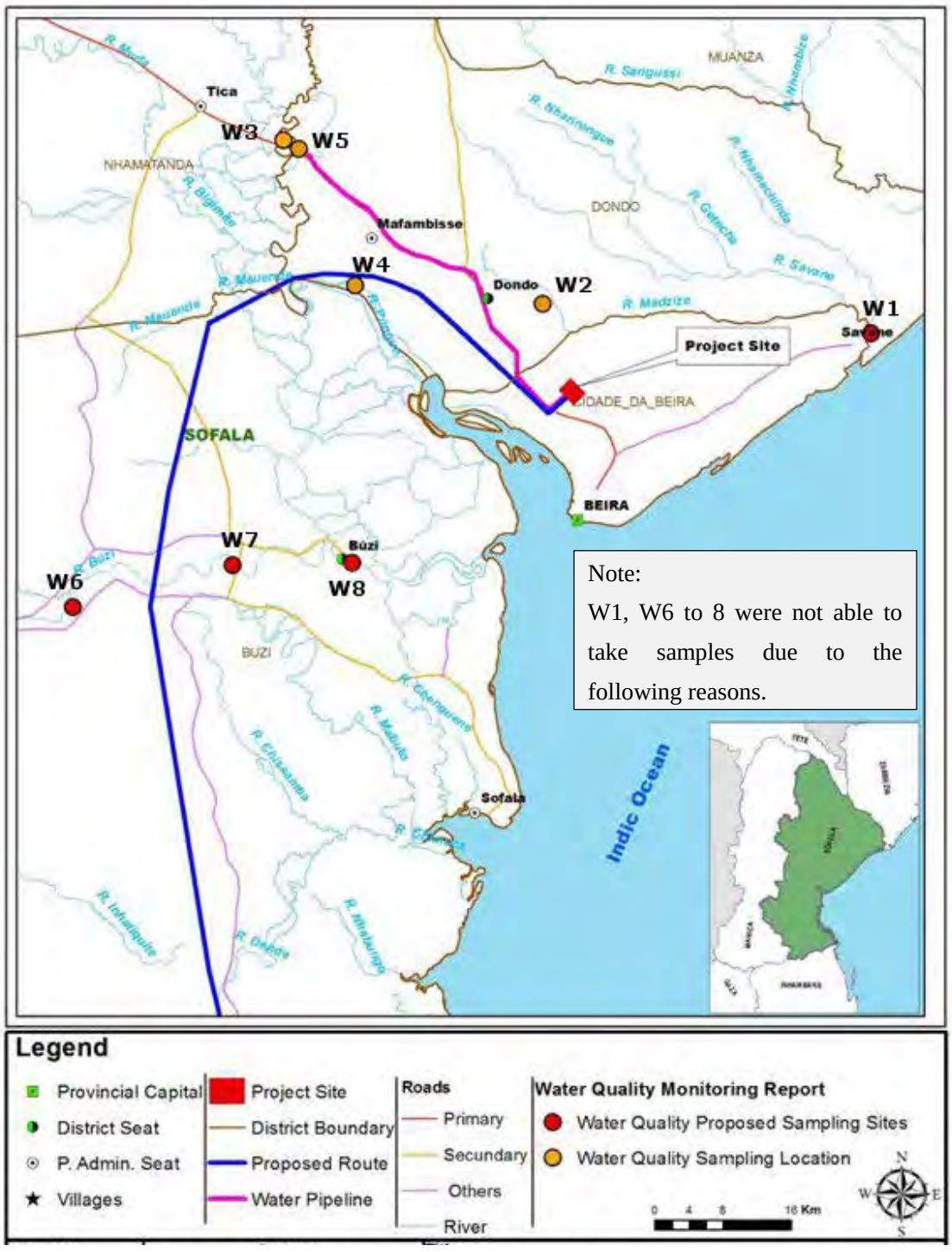
Table 6.2.6 Water Quality Sampling Locations

#	Sampling point	Coordinates		Observations
Surface Water				
W2	Madzize River	19°36'59.2" S	34°48'11.9" E	
W3	Pungué River_01	19°27'10.1" S	34°32'43.5" E	Local where the population crosses the river by boat tine Young people bathing along this site was observed
W4	Pungué River_02	19°35'50.8" S	34°36'18.5" E	Community nearby. Population uses river water for domestic purposes
W5	Pungué River_03	19°26'36.0" S	34°31'46.4" E	Location without nearby communities. Fishing area

#	Sampling point	Coordinates		Observations
W9	Save River_01	21°08'08.3" S	34°34'04.7" E	Population living nearby uses the river water for drinking and domestic purposes (clothing washing, bathing, dish washing, etc.)
W10	Save River_02	21°04'44.8" S	34°49'07.1" E	
W12	Govuro River_01	21°55'40.1" S	35°07'09.2" E	Local with "machambas" (subsistence farm) and dwellings nearby
W13	Govuro River_02	21°41'39.1" S	35°06'56.5" E	Near this place, there were young people bathing and fishing small fish
W14	Govuro River_03	21°29'39.8" S	35°03'40.7" E	
Groundwater				
W15	Poço 01	19º42'52.8" S	34º49'16.2" E	Current use of water for drinking, washing clothes and other domestic activities
W16	Poço 02	19º42'39.1" S	34º48'56.8" E	
W17	Poço 03	19º42'41.8" S	34º49'01.3" E	

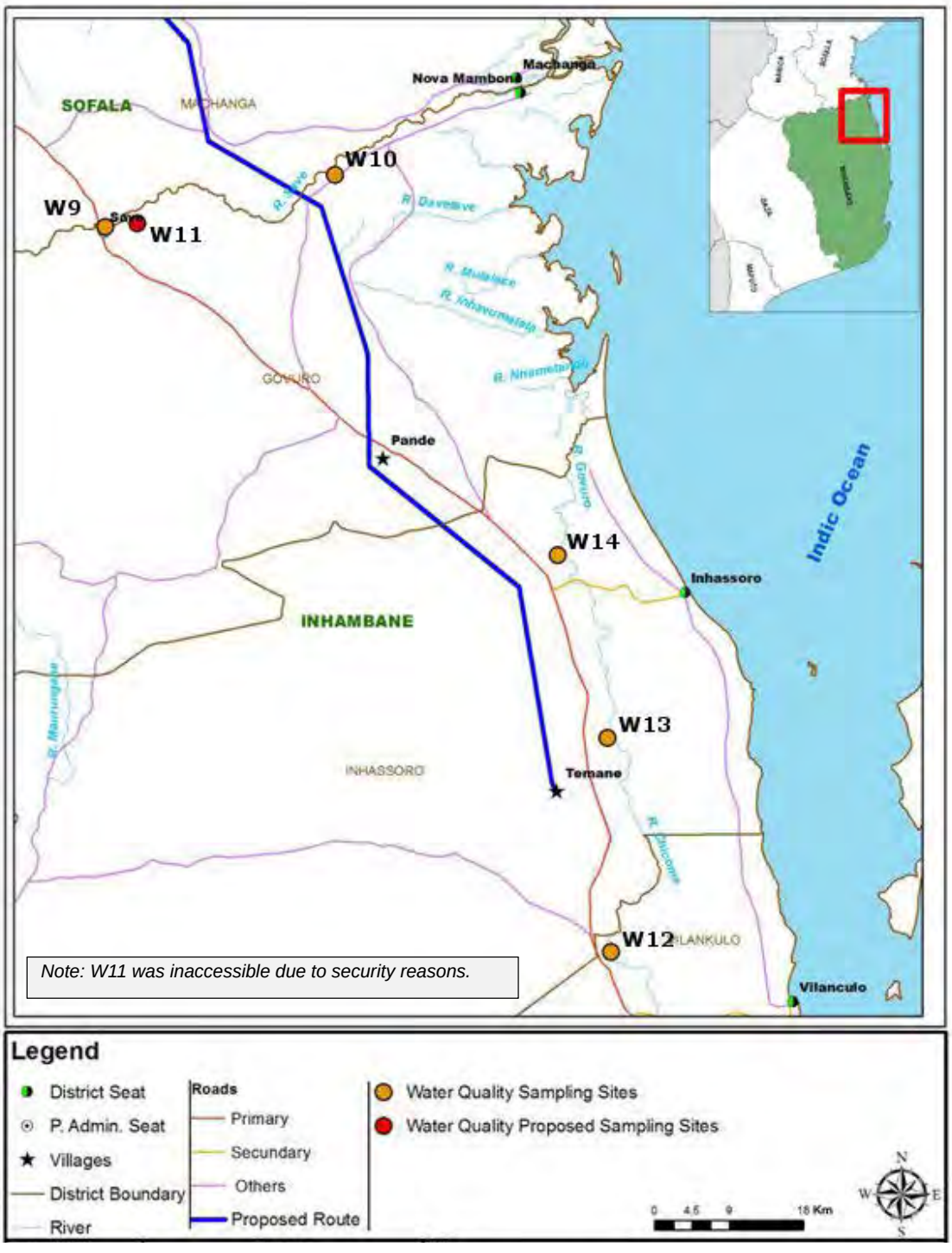
Source: JICA Survey Team

The locations of sampling points are shown in Figures 6.2.17 to 6.2.19.



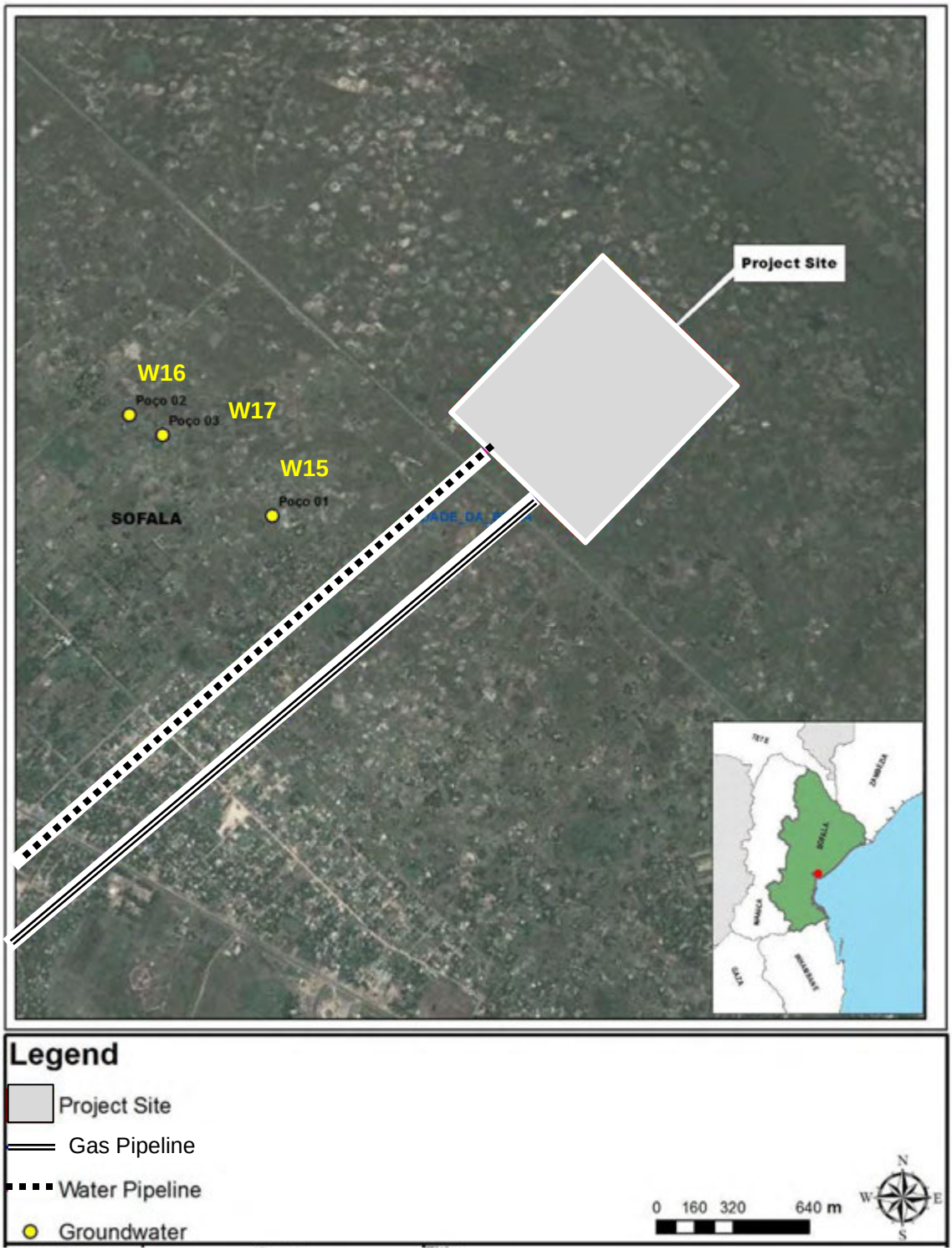
Source: JICA Survey Team

Figure 6.2.17 Locations of Water Quality Sampling (Surface Water-1)



Source: JICA Survey Team

Figure 6.2.18 Locations of Water Quality Sampling (Surface-2)



Source: Google Earth (edited by the JICA Survey Team)

Figure 6.2.19 Locations of Water Quality Sampling (Groundwater)

2) Monitoring parameters

The following parameters were monitored:

- pH
- Electrical Conductivity
- Ammonia-N
- Nitrates
- Nitrites

3) Water quality monitoring results

Table 6.2.7 represents the results of water quality monitoring survey.

Table 6.2.7 Water Quality Monitoring Results

Sampling point	Collection date	Parameter	pH	Electrical Conductivity µS/cm	Ammonia mg/L	Nitrate mg/L	Nitrite mg/L
		Diploma 180/2004	6.5 – 8.5	50-2000	1.5	3.0	50
W2 - Madzize River	09-jan-14		6.88	85.90	3.727	2.394	0.562
W3 - Pungué River 01	13-jan-14		6.92	92.70	3.422	2.374	0.565
W4 - Pungué River 02	13-jan-14		7.56	-	3.469	2.394	0.566
W5 - Pungué River 03	13-jan-14		6.95	84.10	3.621	2.374	0.571
W9 - Save River 01	17-jan-14		7.44	128.3	3.627	2.542	0.641
W10 - Save River 02	17-jan-14		7.42	125.2	3.204	2.671	0.637
W12 - Govuro River 01	18-jan-14		8.09	265.0	3.475	2.621	0.637
W13 - Govuro River 02	18-jan-14		8.10	888.0	3.601	2.602	0.633
W14 - Govuro River 03	19-jan-14		7.74	1,141.0	3.899	2.562	0.638
W15 – Poço 01	10-Jan-14		6.15	181.9	4.111	2.611	0.588
W16 – Poço 02	10-Jan-14		7.30	212.0	3.528	2.384	0.589
W17 – Poço 03	19-Jan-14		5,71	485,0	3,528	2,404	0,579

Source: JICA Survey Team

The groundwater and surface water have similar characteristics with respect to ammonia, nitrite and nitrate parameters. This is not unexpected, since the superficial aquifer has a very shallow water table and has a hydraulic connectivity with the superficial water of the rivers. Comparing the different rivers monitored concludes that there are no significant variations of different parameters. It is noted only that the Govuro River presents a higher conductivity than the other rivers. Comparing the results with the limits established by national legislation (Diploma 180/2004) it is concluded that the analyzed water cannot be directly used for human consumption, because it contains high levels of ammonia.

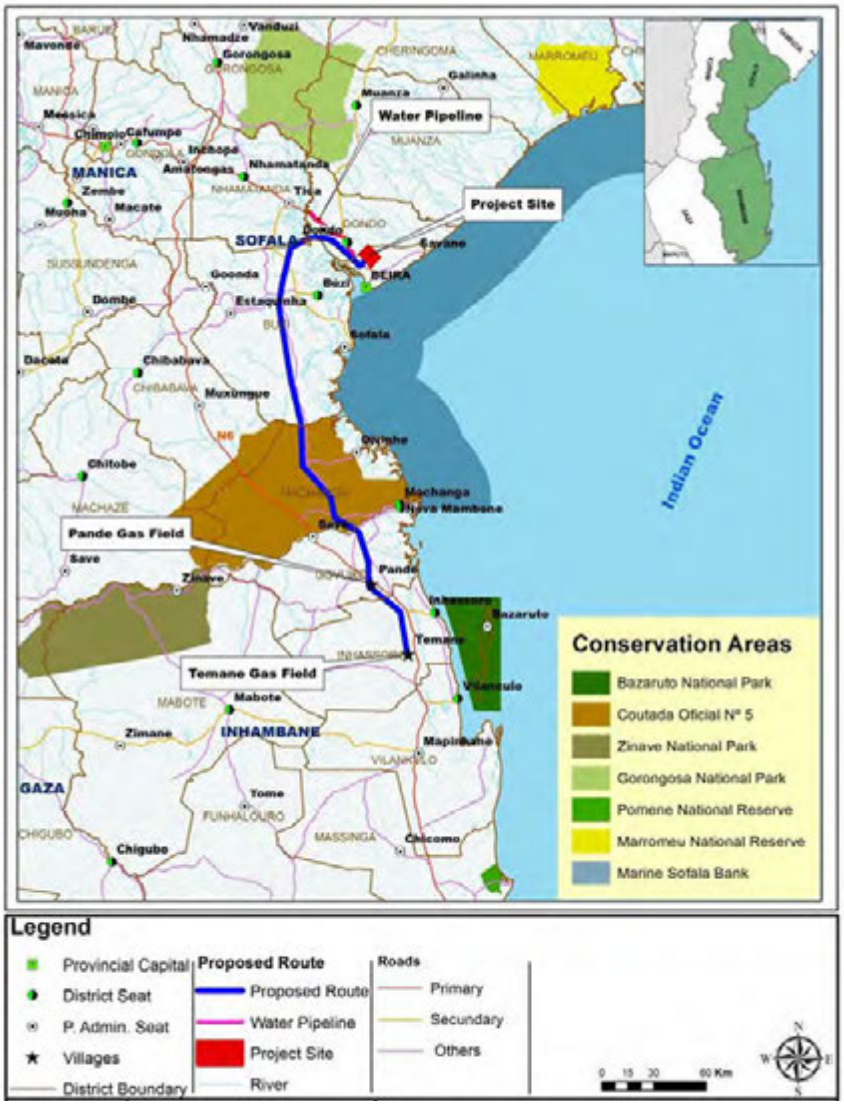
(10) National Parks and Reservation Areas

In Mozambique, according to the Law on Forests and Wildlife (Decree No. 10/99, of July the 07th) the protection areas are classified into three categories:

- National Parks;
- National Reserves; and
- Zones of Use and Cultural and Historical Value

The Land Law (Decree No. 19/1997, of October the 1st) contains additional provisions on protected areas including the strip along the coast, islands, bays and estuaries. The plant area and water pipeline route is not inside boundaries of National Parks or reserves; however, the gas pipeline passes through Game Reserve No.5 (Coutada Oficiala No. 5). Game Reserve No. 5 has a partial conservation status which is set to stimulate and facilitate the promotion of game hunting, hunting tourism and for the protection of species. However, it is not currently being explored and has neither a management plan nor a systematic inventory of its biodiversity (Consultec, 2006).

National Parks and Reservation Areas are shown in Figure 6.2.20.



Source: JICA Survey Team (based on National Directorate of Geography and Cadastre, 1988)

Figure 6.2.20 Conservation Areas

Protected areas for ethnic minorities, indigenous people, and the presence of important cultural heritage were not confirmed in and around the Project area.

6.2.3 Social – Economic Conditions

(1) Administrative Division

The plant area and water pipeline are located in the Sofala Province. The gas pipeline passes through the Inhambane and Sofala Provinces.

The Sofala Province is subdivided into thirteen (13) districts. In total, only five districts will be affected by the project. The Inhambane Province is subdivided into twelve (12) districts. Only two of these districts will be crossed by the gas pipeline.

(2) Demography

The projected population of the affected districts in the Sofala and Inhambane Provinces for 2013 is shown in Table 6.2.8 and Table 6.2.9.

Table 6.2.8 Projected Population for 2013 in Affected Districts of Sofala Province

Province / Districts	Total	% Men	% Women	% Province
Sofala	**1,951,011**	**48.6%**	**51.4%**	**100%**
Cidade da Beira	457,799	50.4%	49.6%	24%
Buzi	183,302	47.2%	52.8%	9.4%
Dondo	165,430	50.3%	49.7%	8.5%
Machanga	60,156	46.2%	53.8%	3.1%
Nhamatanda	263,697	48.5%	51.5%	13.5%

Source: INE, 2013

Table 6.2.9 Projected Population for 2013 in Affected Districts of Inhambane Province

Province / Districts	Total	% Men	% Women	% Province
Inhambane	**1,451,081**	**44.8%**	**55.2%**	**100%**
Inhassoro	57,215	45.9%	54.1%	3.9%
Govuro	40,121	45.8%	54.2%	2.8%

Source: INE, 2013

Among the affected Districts, the greatest growth of population is expected to be in the Nhamatanada District and its rate of increase from 2007 assumed to be 23.7%.

A population estimate of the Beria District, where the plant is proposed, in 2013 is 457,799 and this is the largest amongst the affected districts. Other affected districts, mostly by the gas pipeline, such as Machanga, Inhassoro, Govuro Districts are expected to reach 40,000 to 60,000 in 2013.

(3) Language, Religion and Education

1) Language

The Sofala Province is home to different ethno-linguistic groups, the main languages spoken being Sena and Ndau. It should be mentioned that a considerable number of people (49.6%) speak Portuguese (INE, 2007). In the districts affected by the project the main languages spoken by the population are Sena and Ndau and a few have knowledge of Portuguese (Buzi 7.6%, Dondo 11.7%, Machanga 2.4%, Nhamatanda 11.8%). Regarding the city of Beira, 42.5% of the population speak Portuguese as their main language, 13.6% Sena and the rest speak other languages (INE, 2007).

In the districts of Inhambane which are crossed by the project, Chichope is the main language spoken. In the districts affected by the project, very few people claimed to have knowledge of Portuguese in the 2007 census by INE in 2007 (Inhassoro 3.2%, Govuro 2.3%).

2) Religion

The religions in the districts affected by the project in the Sofala Province are shown in Table 6.2.10.

Table 6.2.10 Religion Practiced in the Affected Districts of Sofala Province (INE 2012)

District	Religion (%)			
	Catholic	Islamic	Zion	Evangelic
Buzi	13.4%	1.5%	37.8%	11.8%
Dondo	18.9%	2.5%	22.7%	19.5%
Machanga	21.8%	1.3%	18.6%	22.3%
Nhamatanda	7.6%	0.9%	29.4%	26.4%

Source: INE, 2007

Catholicism is the predominant religion in Beira, with 31.9% of the population, followed by the Evangelic with 22.7% of the population (INE, 2012).

The religions in the districts affected by the project in Inhambane Province are shown in Table 6.2.11.

Table 6.2.11 Religion Practiced in the Affected Districts of Inhambane Province (INE 2012)

District	Religion (%)			
	Catholic	Islamic	Zion	Evangelic
Govuro	31%	1%	22.9%	12.2%
Inhassoro	29.5%	0.4%	35.3%	15.3%

Source: INE, 2007

3) Education

According to the national education system, school education is divided into different levels namely, primary school (7 years), secondary school (5 years) and Superior education (universities). There is at least one secondary school in all districts that are affected by the project.

(4) Housing

1) Plant area and temporary area during construction

In total, twenty eight existing structures were observed in the area of permanent and temporary occupation by the Urea Fertilizer Complex. Among the twenty eight structures, one structure is assumed to be abandoned. There were sixty nine people who were living or utilizing the structures at the time of the survey. Furthermore, it was observed that a cemetery was located inside the temporary area to be occupied during construction. The temporary area during consutruction is a leased land for the purpose to be utilized for storage of equipment and

materials during construction. The period of utilizing the temporay area is assumed to be four (4) years from the start of construction.

In this area, the main activity is agriculture for direct self-consumption. The main crops produced are: rice, cassava and sweet potatoes, and in some cases fruit trees, mostly mango. When there is a surplus of crops, they are sold in the market and in turn USD 50 to 200 is earned. Other cash income is from labor in areas such as the Dondo District and the city of Beira. It is assumed that the amount is around USD 70 to 100 per month which is an average amount for general labor in the area. The vegetation is dominated by species used as firewood.

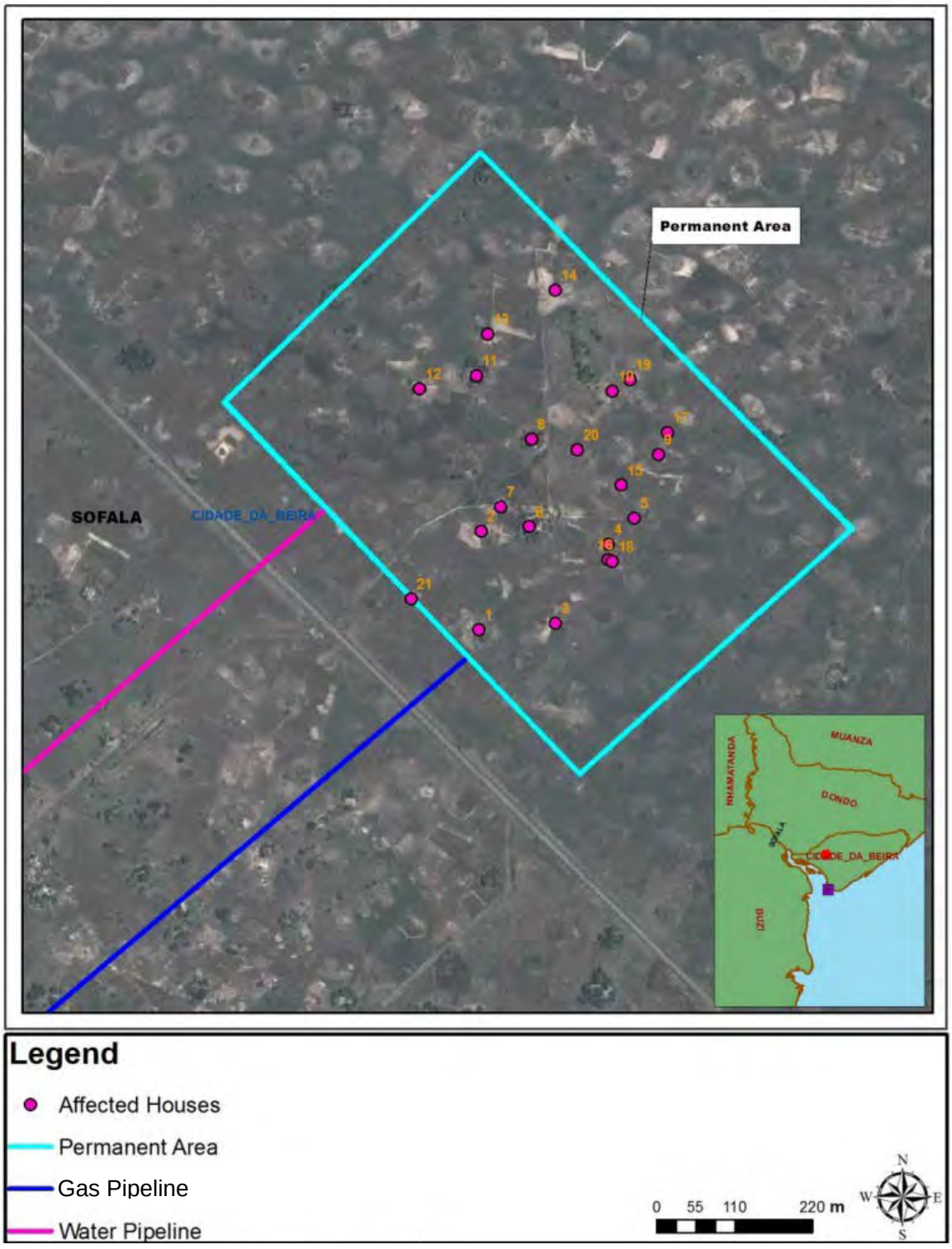
Details of the dwellings are described below.

a) Plant area (permanent occupation)

Twenty one existing structures were observed in the plant area. Among these, one structure is assumed to be abandoned. The remaining twenty structures are used for dwellings, storage, and a mixture of dwelling and storage. In total fifty six people were utilizing the structures.

Most of the houses are constructed of precarious materials, mostly composed of mud-walls, thatched roofs and unpaved floors (some houses are covered with zinc plates). The housing has very poor sanitation conditions with no sewage system, water or power supply. Only one house had a portable power generator. The main water source is traditional wells constructed by local communities.

The location of existing structures inside the plant area is shown in Figure 6.2.21, Figure 6.2.22 and Table 6.2.12.



Source: Google Earth (edited by the JICA Survey Team)

Figure 6.2.21 Existing Structures inside the Proposed Plant Area

Table 6.2.12 Location and Condition of Existing Structures inside the Proposed Plant Area

#	Coordinates		Houses No.	Persons No.	Housing conditions
	South	East			
1	19°42'50.1"	34°49'51.5"			No residence, abandoned by the owner at the site
2	19°42'45.6"	34° 49'51.6"	1	2	Thatched roof and mud-stick wall, unpaved
3	19° 42'49.8"	34° 49'55.0"	1	8	Zinc plates roof, mud-stick walls and straw. Electrical installation, electric generator use.
4	19° 42'46.2"	34° 49'57.4"	1	4	Zinc plates roof, mud-stick walls and unpaved.
5	19° 42'45.0"	34° 49'58.6"	1	3	Mud- stick walls with cement and straw, sticks and plastic roof, unpaved
6	19° 42'45.4"	34° 49'53.8"	1	5	Cement block walls and zinc sheets roof, unpaved.
7	19° 42'44.5"	34° 49'52.5"	2	1	One house is under construction with cement block walls inhabited by the guard, the owner lives in the city of Beira, in the area Munhava, the other house has zinc plate and mat walls covered with zinc plates.
8	19° 42'41.4"	34° 49'53.9"	1	6	Thatched roof, mud-stick walls and unpaved
9	19° 42'42.1"	34° 49'59.7"	1	3	Straw and reed roof, mud-stick walls and unpaved
10	19° 42'39.2"	34° 49'57.6"	2	2	Both houses have thatched and mud-stick walls and are unpaved
11	19° 42'38.5"	34° 49'51.4"	2	7	One of the houses has only thatched roof while the other features a mix of zinc plates and straw, mud-stick walls without flooring. This house and the house #13 belong to the same family.
12	19° 42'39.1"	34° 49'48.8"	1	4	Zinc plates and sticks roof, mud- stick walls and are unpaved
13	19° 42'36.6"	34° 49'51.9"	2	2	Thatched roof, mud-stick walls and unpaved
14	19° 42'34.6"	34° 49'55.0"	1	2	House covered with straw, sticks and plastic, mud-stick walls, unpaved
15	19° 42'43.5"	34° 49'58.0"			Houses under construction, it is anticipated that the walls will be mud-stick
16	19° 42'46.9"	34° 49'57.4"	1	4	House covered sheet and mat, mud- stick walls, unpaved
17	19° 42'41.1"	34° 50'00.1"			House under construction, foundation with blocks and cement
18	19° 42'48.7"	34° 58'03.3"			House under construction, it is anticipated that the walls will be mud-stick
19	19° 42'38.7"	34° 49'58.4"	1		Agricultural storage reed walls and roof. The owner currently lives in another neighborhood
20	19° 42'41.9"	34° 49'56.0"	1	2	Thatched roof and with mixed reeds and mud-stick walls, unpaved
21	19° 42'48.7"	34° 49'48.4"			House under construction with foundation blocks and cement

Source: JICA Survey Team

*) The reference number of the photograph is in relation to the number of existing structures in Table 7.2.12.
Source: JICA Survey Team

Figure 6.2.22 Photos of Existing Structures inside the Proposed Plant Area

b) Temporary area (temporary occupation during construction)

Seven structures were observed in the temporary area. Among these, five structures were dwellings and two were used for agricultural storage. In total thirteen people were utilizing the structures.

Most of the houses are constructed of precarious materials, mostly composed of mud-walls, thatched roofs and unpaved floors (some houses are covered with zinc plates). The housing has

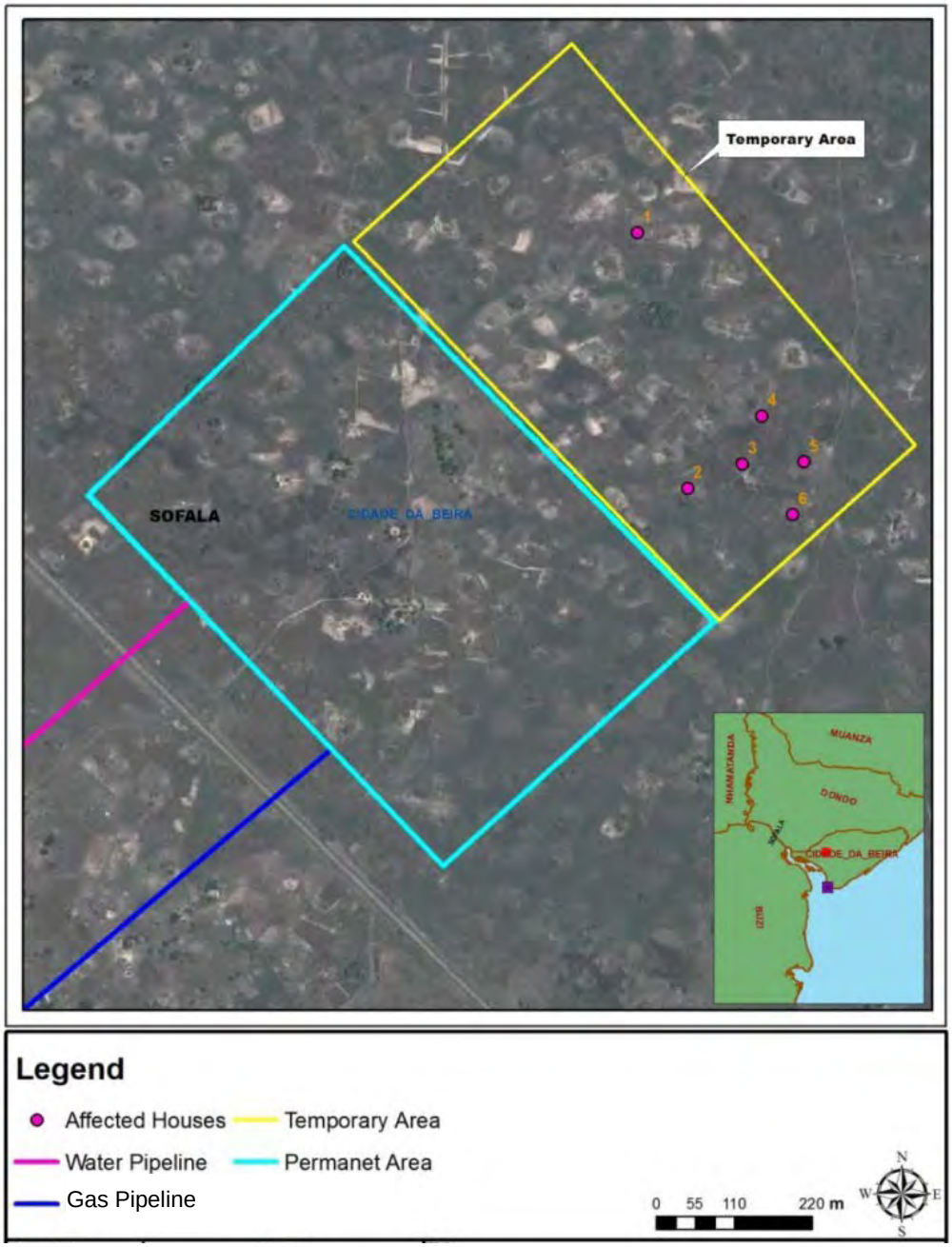
very poor sanitation conditions with no sewage systems, water or power supplies. The main water source is traditional wells constructed by local communities.

Within this area of temporary occupation a family cemetery is located (19º42’31.4” S, 34º50’05.5” E), which belongs to the neighborhood family who lives in the area of permanent occupation.

Source: JICA Survey Team

Figure 6.2.23 Family Cemetery in the Temporary Area

The location of existing structures inside the plant area is shown in Figure 6.2.24, Figure 6.2.25 and Table 6.2.13.



Source: Google Earth (edited by the JICA Survey Team)

Figure 6.2.24 Existing Structures inside the Proposed Temporary Area

Table 6.2.13 Location and Condition of Existing Structures inside the Temporary Area

Site	Coordinates		Houses No.	Persons No.	Housing conditions
	South	East			
1	19° 42'27.7"	34° 50'05.0"	1		Agricultural storage with thatched roof, block and cement walls, unpaved
2	19° 42'39.4"	34° 50'07.3"	2	7	Both houses have thatched roof, mud-stick walls and are unpaved
3	19° 42'38.3"	34° 50'09.8"	1	3	Thatched roof, wall mud-stick walls, unpaved
4	19° 42'36.1"	34° 50'10.7"	1		Agricultural storage with thatched roof, mud-stick walls, unpaved
5	19° 42'38.2"	34° 50'12.6"	1	2	Thatched roof, mud-stick walls, unpaved
6	19° 42'40.6"	34° 50'12.1"	1	1	Zinc plates roof, mud-stick walls, unpaved

Source: JICA Survey Team

1 2 3

Source: JICA Survey Team

Figure 6.2.25 Photos of Existing Structures inside the Temporary Area

2) Gas pipeline route

The gas pipeline is planned, generally, to run along the national road No.428 (EN 428) through the fields and rural area where population density is low. Furthermore, since the degree of freedom in the pipeline route selection is high, the pipeline can be planned to avoid houses and other existing structures. Therefore, is can be assumed that resettlement will not be necessary even though site survey along the gas pipeline route was not carried out due to security reasons.

In addition, according to the information from ENH, the gas pipeline site (ROW) will be handed over to the SPE after Environmental License is granted and, thereafter, the Concession is given to the SPE from INP.

(5) Ethnic Minorities and Indigenous People

As a result of the site reconnaissance and literature survey for the proposed sites of the water supply pipeline and plant area, it was confirmed that protected areas for ethnic minorities, indigenous people, and important cultural heritage does not exist in the aforesaid sites. The gas pipeline is planned along the existing road and from the fact that the right-of-way (ROW) has

already been allocated to these roads, it could be said that the possibility of existence of ethnic minorities, indigenous people, and important cultural heritage is low.

6.3 Environment and Social Consideration System and Related Organization

6.3.1 Environmental Laws and Regulations of Mozambique

Mozambique has a relatively well-developed legal framework for environmental management and protection. Important laws related to environmental and social consideration is shown in Table 6.3.1. The Environmental Law (No. 20/1997) is the umbrella law which mandates environmental matters. Various decrees and regulations are enacted under the Environmental Law in order to enforce the environmental matters in Mozambique. Significant highlights of the Environmental Law include, among others, the following basic principles.

- Rational utilization and management of the environment with the view to the promotion of an improved quality of life for citizens and the maintenance of biodiversity and ecosystems.
- Recognition of traditions and local knowledge which may contribute to the conservation and preservation of natural resources and the environment.
- Equitable access to natural resources for all.
- Public participation.

The domain of the Environmental Law comprises all activities private or public, which directly or indirectly influence the environment and those that all fall under the constitutional provision for "an ecological balanced environment" for all citizens.

Table 6.3.1 Major Laws and Regulations on Environmental in Mozambique

Legislation	Legal Instrument
Environmental Assessment	
National Environmental Policy	Resolution No. 5/95
Environmental Law	Law No. 20/97
Regulation for Environmental Impact Assessment	Decree No. 45/2004, (as amended by Decree No 42/2008)
Regulation on the Environmental Audit Process	Decrees No. 25/2011
Regulation for Environmental Inspections	Decree No. 11/2006
General Guidelines for Environmental Impact Studies	Ministerial Diploma No. 129/2006
Guides to Public Participation Process	Ministerial Diploma No. 130/2006
Atmospheric Emissions and Air Quality	
Regulation for Environmental Standards and Effluent Emissions	Decree No. 18/2004
Changes on Decree No. 18/2004	Decree No. 67/2010
Environmental Law	Law No. 20/97

Legislation	Legal Instrument
Water Resources And Water Quality	
Water Policy	Resolution No. 46/2007
Water Law	Law No. 16/91
Regulations for Environmental Quality Standards and Effluent Emissions	Decree No. 18/2004
Pollution And Waste Management	
Regulation for Waste Management	Decree No. 13/2006
Environmental Law	Law No. 20/97
Land Ownership	
Land National Policy	Resolution No. 10/95
Land Law	Law No. 19/1997
Regulation for Land Law	Decree No. 66/98
Regulation for Territorial Planning	Decree No 66/98
Involuntary Resettlement	
Regulation for the Resettlement Process Resulting from Economic Activities	Decree No. 31/2012
Cultural Heritage	
Cultural Heritage Law	Law No. 10/88
Biodiversity	
Environmental Law	Law No. 20/97
Forest and Wildlife Law	Law No. 10/99
Regulation on the Forest and Wildlife Law	Decree No. 12/2002
Regulation of Fishing Recreation and Sports	Decree No. 51/99

Source: JICA Survey Team

6.3.2 Environmental Impact Assessment System in Mozambique

(1) Legal Basis of Environmental Impact Assessment

The EIA Process in Mozambique is regulated by Decree No. 45/2004, which states that every private or public activity, that may directly or indirectly affect the environment, must be subject to environmental assessment (Article 2). The EIA Regulation also mandates that only EIA professionals (técnicos médios e superiores) who are registered environmental consultants can undertake an EIA process in Mozambique. Consultants are required to register either as individuals, companies or as a consortium of companies (e.g., for a specific project) and are required to have at least five years of relevant experience at the time of registration. Only an 'advanced' professional can act as a project manager and sign on EIA reports. For non-Mozambican companies who wish to conduct an EIA process in the country, the process must be subcontracted to a company registered in Mozambique. In addition, the company must submit documentation consisting of a list of similar projects undertaken, CVs and the qualifications of each member proposed for the EIA team.

(2) Environmental Categorization of the Project

The Regulation for Environmental Impact Assessment (Decree No. 45/2004) states that the level of environmental assessment depends on the sensitivity of the environment and nature of the project. In

order to determine the level of assessment, Projects are screened into one of the three categories namely A, B, C. The Annex of the Decree lists the type of projects for each category.

Screening is based on a compulsory application form called the Preliminary Environmental Information Form (Appendix IV of the Decree) which shall be filed by the project proponent and submitted to MICOA. The three different categories are defined as below.

- **Category A**- activities which may cause negative impacts due to the proposed activities or the sensitivity of the area in which they are located, requiring a full EIA process, including an Environmental Impact Study (EIS) and an Environmental Management Plan (EMP). Appendix I of the EIA Regulation lists the types of projects which are classified as Category A.

  The Urea Fertilizer Complex Project is expected to be classified as of Category A by MICOA, as per letter g) of section 4.2 of Annex I of the EIA Regulation – "production or processing of fertilizers", and letter m) of section 1 of the same annex – "oil, gas and mineral pipelines and submarine cables with more than 10 km of length".

- **Category B-** activities which may cause negative impacts, but of lesser duration, intensity, scope, magnitude and/or significance, requiring a Simplified Environmental Study (SES), and an EMP. Appendix II of the EIA Regulation lists the types of projects which are classified as Category B.

- **Category C-** activities with negligible, minimal or even non-existent negative impacts. They do not cause irreversible impacts and the positive impacts are clearly greater and more significant than the negative ones. Category C projects are exempt from further environmental assessment but are still subject to compliance with good environmental management practices. Appendix III of the EIA Regulation lists the types of projects which are classified as Category C.

(3) Process of Environmental Impact Assessment

The EIA process is regulated by Decree No. 45/2004 of 29 September, 2004, as amended by Decree No. 42/2008 (EIA Process Regulation). According to this Decree the EIA process consists of three main phases, namely:

- Pre-assessment;
- Scope Definition; and
- Impact Assessment.

The documents and steps that the project proponent shall submit and implement are shown for each category A, B, C in Table 6.3.2.

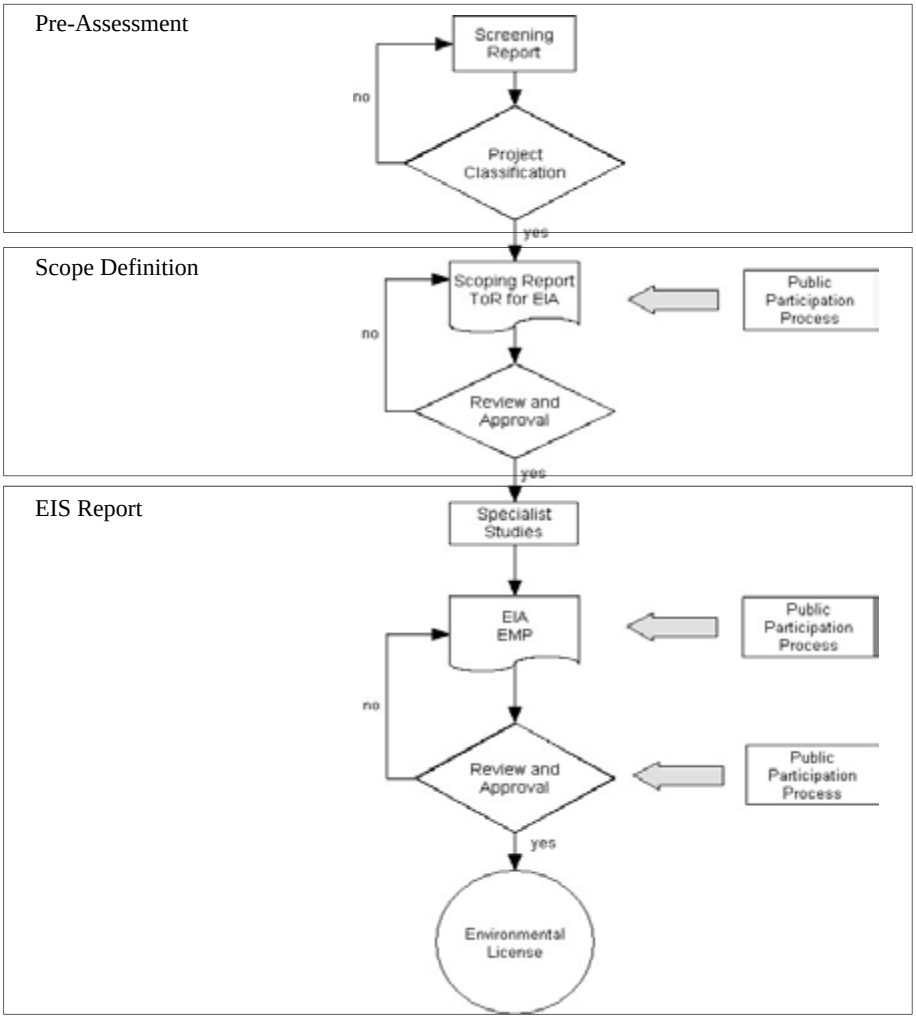
Table 6.3.2 Environmental Category and Required Documents

Process	Category A	Category B	Category C
Application (Screening)	●	●	●
Environmental Pre-Feasibility Study and Scope Definition (EPDA)	●	-	-
Terms of Reference (TOR)	●	●	-
Environmental Impact Study (EIS)	●	-	-
Simplified Environmental Study (SES)	-	●	-
Public Participation Programme	●	△	-
Environmental Management Plan (EMP)	●	●	
Review by Technical Assessment Commission	●	●	-

Source: JICA Survey Team

1) Pre-assessment

MICOA is the entity responsible for project categorization. Project categorization is done through the submission, by the proponent, of a Screening Report and a Preliminary Environmental Information Form. MICOA will determine the Category based on the information submitted by the proponent. As explained above, the Urea Fertilizer Complex Project is expected to be classified as a Category A. Figure 6.3.1 shows the process for Category A projects.



Source: JICA Survey Team

Figure 6.3.1 EIA Process of Category A Projects

2) Scope definition

At this stage, the Environmental Pre-Feasibility Study and Scope Definition Report (EPDA) and Terms of Reference (TOR) for the Environmental Impact Study (EIS) will be submitted for review and approved.

The objectives of the scoping phase are to:

- Gather baseline data about the project area;
- Identify the potential impacts of the proposed project and any fatal flaws;
- Describe those aspects which will require detailed investigation in the EIS phase, i.e., the ToR for the EIS; and
- Compile an EPDA Report (this document) including the TOR for the EIS, and submit these to MICOA (Technical Assessment Committee) for approval.

The EPDA phase also includes a mandatory Public Participation Process (PPP), wherein the EPDA Draft Report and the TOR are disclosed for public comment.

3) Impact assessment

The Environmental Impact Study (EIS) report and the Environmental Management Program (EMP) will be prepared and submitted to MICOA and DNAIA respectively for review approval. The following are the main description to be included in the EIS report:

- Non-technical summary with the main addressed issues, conclusions and proposals;
- The legal scope of the activity and its insertion in the land use plans existing for the direct buffering of the activity;
- The description of the activity and that of the different actions foreseen in the stages of planning, construction, exploration and, should it be a temporary activity, its inactivation;
- The geographic boundary marking and representation, as well as the environmental situation of reference of the buffering of the activity;
- The detailed description and comparison of the different alternatives and the forecast of the future environmental situation with and without mitigation measures;
- Identification and assessment of the impacts and identification of mitigation measures;
- The environmental management plan of the activity, which includes the monitoring of the impacts, an environmental education program and contingency plans in case of accidents;
- The identification of the multi-subject team that elaborated the EIS report;
- The report of public participation

Public participation is mandatory for Category A projects and the proponent must hold a public meeting to receive comments on the EIS. Furthermore, MICOA may seek public comments or hold public hearings during the review process.

4) Issuance of environmental licence

The issuance of the environmental licences are granted by the MICOA and/or DPCA upon the payment of licensing fees applied based on the classification and categorization of the projects as follows:

- Environmental licence for Category A and B projects: 0.2% of the total value of investments
- Issuance for exemption declaration for Category C projects: 0.02% of the total value of investments

(4) Laws and Regulations on Resettlement

The rules and basic principles to be followed for resettlement processes arising from the implementation of public or private economic activities in Mozambique are defined in Decree No. 31/2012 – Regulation for the Resettlement Process Resulting from Economic Activities. The proponent of the activity is responsible to elaborate and implement the Resettlement Plan (Article 11), when resettlement is required by the project. Article 15 states that the Resettlement Plan is a part of the EIA process and that its approval precedes the issuance of the environmental license.

Article 16 defines the Resettlement Model, stating that the resettlement process should provide to the affected people the following. However, it shall be noted that, Decree No. 31/2012 was encacted to address the resettlement issues arising from mega-projects, i.e. resettlement of several communities related to coal minig projects in the Tete Province.

- A regularized housing plot with adequate facilities. The minimum areas for these plots are 800 m^2 in urban areas and 5,000 m^2 in rural areas (as per Article 18);
- At minimum a three-bedroom house typology with an area of 70 m^2, built out of conventional materials and in accordance with an approved project. The houses should respect the social and cultural practices of the resettled area.
- In resettlement areas, livelihoods activities must be maintained, as appropriate, or income generation programs defined;
- The resettlement process includes construction of access roads, water supply system, environment sanitation (if physical and natural conditions do not allow for installation of a water supply system, improved latrines must be constructed at minimum distance of 10 m from the house), electrification, health post, school, kindergarten, market, shops, police station, entertainment sites, and sites for sports, recreation, holy sites and places for meetings;
- The resettlement areas shall include areas for agriculture, livestock and other activities. In rural areas, physical spaces must be provided for horticulture, poultry farming and other animals breeding.

As described above, the current regulation on resettlement is based on resettlement of an entire community. Furthermore, the regulation does not provide exceptions, and does not alow for cash compensations, therefore, all resettlement processes need to be developed according to this decree. However, it is clear that this regulation is difficult to apply to smaller area projects, or to linear projects, where the resettlement includes only a few families and does not affect the current community, and where the construction of infrastructures such as schools, health posts, etc., is disproportionate in relation to the impact. MICOA is aware of this situation.

Given the difficulties that have being encountered in the application of this new regulation, MICOA is currently drafting a guideline to assist in its implementation. If the new guideline is not in effect at the time of implementing this Project, the Resettlement Plan shall be developed in compliance with the Decree No.31/2012, and with close consultation with MICOA and the affected residents to agree on an appropriate and practical Resettlement Plan.

6.3.3 Comparison of Environmental and Social Consideration Guidelines

When comparing the content of the JICA's Guidelines for Environmental and Social Considerations (April 2010) and the requirements of MICOA, no significant differences have been identified. A full comparison is provided in Table 6.3.3, Table 6.3.4, Table 6.3.5 and Table 6.3.6.

Table 6.3.3 JICA and Mozambique's EIA Guidelines - Comparison of Requirements

Scope of Impact Evaluation in Environmental Assessments		
Item	**JICA**	**Mozambique**
Potential Impact	Direct and indirect	Direct/indirect, magnitude and timeframe
Affected Area	Environmental impacts on a local and trans-boundary or global scale, e.g. global warming (note)	Project-related impacts (regional and local level)
Target Items	**Social Environment** ▪ Involuntary resettlement ▪ Local economy, employment and livelihood ▪ Land use and local resources utilization ▪ Existing social infrastructures and services ▪ Local communities ▪ Benefit and damage misdistribution ▪ Gender, children's rights ▪ Cultural heritage ▪ Local conflicts of interests ▪ Public sanitation ▪ Infectious diseases such as HIV/AIDS ▪ Water usage and rights ▪ Traffic accidents	**Socio-economic Environment** ▪ Involuntary resettlement ▪ Government and traditional structures ▪ Demographic characteristics ▪ Culture: ethnic groups, religions and languages ▪ Household structure ▪ Education ▪ Health ▪ Roads, transport and communication ▪ Building materials and basic housing services ▪ Economic Profile ▪ Description of the services and utilities provided ▪ Roles and Decision Making ▪ Livelihoods ▪ Community Conflict Resolution and Decision-Making
	Natural Environment ▪ Global warming, ▪ Biota and ecosystems, ▪ Geographical features, ▪ Soil erosion, ▪ Underground water, ▪ Hydrological situation, ▪ Coastal zone (mangroves, coral reefs, tidal flats, etc.), ▪ Climate ▪ Landscape	**Biotic Environment** ▪ Fauna ▪ Flora and vegetation ▪ Protected areas and species **Physical Environment** ▪ Climate ▪ Air Quality ▪ Noise and Vibration ▪ Geology and Geomorphology ▪ Soils, Erosion Risk and Land use ▪ Surface Water Resources (quality and use) ▪ Groundwater Resources (quality and use) ▪ Landscape
	Pollution ▪ Air pollution ▪ Water pollution ▪ Soil contamination ▪ Waste ▪ Noise and vibration ▪ Ground subsidence ▪ Offensive odours ▪ Bottom sediment in seas and rivers	**Impact assessment** and compliance with national or international standers and legislation for: ▪ Air Quality ▪ Noise and Vibration ▪ Surface Water Resources ▪ Groundwater Resources ▪ Soils ▪ Waste and hazardous materials

Note: Items not common in the two guidelines (JICA and Mozambique) are underlined in the table.
Source: JICA Survey Team

Table 6.3.4 Criteria for Identification of EIA Category

JICA's Environmental and Social Consideration Guidelines	Mozambique's ESIA Law
Category A Likely to have significant adverse impacts on the environment and society. Requires. EIA	**Category A** Projects that could cause significant impacts due to the proposed activities or the sensitivity of the area. Annex I of the ESIA regulation lists the type of projects that are classified as Category A projects. Requires full ESIA.
Category B Potential adverse impacts on the environment and society are less adverse than those of Category A projects. Requires IEE	**Category B** Projects that would also cause negative impacts, although with lower duration, intensity, extension, magnitude and/or significance. Req. SES.
Category C Likely to have minimal or little adverse impact on the environment and society. No IEE/EIA required	**Category C** Activities with negative impacts that are negligible, minimal or even non-existent. No ESIA required.
Category FI JICA's funding of projects is provided to a financial intermediary or executing agency; the selection and appraisal of the sub-projects is substantially undertaken by such an institution only after JICA's approval of the funding, so that the sub-projects cannot be specified prior to JICA's approval of funding (or project appraisal); and those sub-projects are expected to have a potential impact on the environment.	(No such Category similar to JICA's Category FI.)

Note: Items not common in the two guidelines (JICA and Mozambique) are underlined in the table.
Source: JICA Survey Team

Table 6.3.5 Criteria for Public Consultation according to EIA Category

JICA's Environmental and Social Consideration Guidelines	Mozambique's ESIA Law
Category A : JICA encourages project proponents to consult with local stakeholders about their understanding of development needs, the likely adverse impacts on the environment and society, and the analysis of alternatives at an early stage of the project, and assists project proponents as needed.	**Category A :** Mandatory for all projects. Includes two consultation periods: one during the scoping phase (EPDA) and one during the impact assessment phase (EIS).
Category B : JICA encourages project proponents etc. to consult with local stakeholders when necessary.	**Category B:** Not mandatory, recommended for project with resettlement.
Category C : Not required	**Category C :**Not required
Category FI : Not mandatory	Not applicable.

Note: Items not common in the two guidelines (JICA and Mozambique) are underlined in the table.
Source: JICA Survey Team

Table 6.3.6 Gap Analysis between the JICA Guidelines and the Laws of Mozambique

No.	JICA Guidelines	Laws of Mozambique **RP:** Regulation for the Resettlement Process Resulting from Economic Activities (Decree 31/2013 of August) **REIA:** Regulation for Environmental Impact Assessment (Decree 45/2004 as amended by Decree 42/2008) **LL:** Land Law (19/97 of 1 October)	Gap of JICA Guidelines and Laws of Mozambique
1.	Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. (JICA GL)	RP: There is no specification under the RP. REIA: It is required by this law (Regulation of EIA) to explore alternatives of the project to minimize the negative effects. (Art. 10, 11)	Basically there is no significant gap between the JICA GL and Laws of Mozambique.
2.	When population displacement is unavoidable, effective measures to minimize impact and to compensate for losses should be taken. (JICA GL)	RP: This applies to all projects where population displacement is required, and mandates that a Resettlement Plan is developed in order to minimize impacts and compensate for all losses (Art.4, 5).	Basically there is no gap between the JICA GL and Laws of Mozambique.
3.	People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels. (JICA GL)	RP: It is stated that the affected people are entitled to: (a) reestablishment of their income level, at levels equal to or greater than the current level; (b) restoration of their standard of living to a level equal to or greater than the current standard (Art.10).	Basically there is no gap between the JICA GL and Laws of Mozambique.
4.	Compensation must be based on the full replacement cost as much as possible. (JICA GL)	RP: It is not stipulated in the law that the compensation is to be done based on replacement costs. Instead, it stipulates a resettlement model, that includes the definition of type and size of housing, requirement to provide farming land, and land for other economic activities, and the requirement to establish all social infrastructure (roads, water supply, sanitation, electricity grid, health unit, school, market, stores, police station, recreational areas, worship sites, etc.) (Art. 16). LL: It is stipulated that losses of crops are to be compensated at full cost according to official tables published by the Ministry of Agriculture; furthermore, farming land is to be replaced by equal land (Art. 27). This law (LL) is applicable only when a project does not result in physical displacement, but implies the loss of crops or farming land. If any physical displacement occurs, the RP (resettlement law) applies.	The JICA GL is based on "full replacement cost", on the other hand the Laws of Mozambique (RP) is based on re-establishment of the standard of living equal to or above the previous level by providing physical compensation based on the Resettlement Model. The JICA GL and Laws of Mozambique have the above difference in the way of compensation.

No.	JICA Guidelines	Laws of Mozambique **RP:** Regulation for the Resettlement Process Resulting from Economic Activities (Decree 31/2013 of August) **REIA:** Regulation for Environmental Impact Assessment (Decree 45/2004 as amended by Decree 42/2008) **LL:** Land Law (19/97 of 1 October)	Gap of JICA Guidelines and Laws of Mozambique
5.	Compensation and other kinds of assistance must be provided prior to displacement. (JICA GL)	RP: There is no specification under this law. However, this law states that the Resettlement Action Plan (RAP) is part of the EIA process and that RAP preparation and approval precedes the issuance of an environmental license (Art. 15).	The RP does not stipulate that the compensation and other kinds of assistance must be provided prior to displacement. However, while it is not specifically stated in the RP, in practice it is provided in prior.
6.	For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. (JICA GL)	RP: It is the responsibility of a project proponent to prepare and implement the RAP (Art. 11, 19-22). The public participation is guaranteed during the entire preparation and implementation process of the RAP (Art. 13). Interested and affected parties have the right to information about the contents of the studies (Art. 14), public consultation is mandatory during preparation of the RAP (Art.23).	Basically there is no gap between the JICA GL and Laws of Mozambique.
7.	In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. (JICA GL)	RP: The public participation is guaranteed during the entire preparation and implementation process of the RAP (Art. 13). Public consultation is done with affected people and their communities throughout the RAP preparation, with a minimum of 4 public consultations (Art. 23). This should be supported by information disclosure on the RAP (Art. 14). The law also states that the preparation of the RAP is monitored by a Technical Committee, which must include representatives of the affected communities (Art. 8).	Basically there is no gap between the JICA GL and Laws of Mozambique.
8.	When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people. (JICA GL)	RP: There is no specification under the RP.	There is no specification under the RP. However, it is standard practice in Mozambique to do so.
9.	Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans. (JICA GL)	RP: The RAP development and implementation is monitored by a Technical Committee (Art. 7), which must include representatives of the affected people, including 5 members of the affected communities and 3 community leaders (Art. 8).	Basically there is no gap between the JICA GL and Laws of Mozambique.

No.	JICA Guidelines	Laws of Mozambique **RP:** Regulation for the Resettlement Process Resulting from Economic Activities (Decree 31/2013 of August) **REIA:** Regulation for Environmental Impact Assessment (Decree 45/2004 as amended by Decree 42/2008) **LL:** Land Law (19/97 of 1 October)	Gap of JICA Guidelines and Laws of Mozambique
10.	Appropriate and accessible grievance mechanisms must be established for the affected people and their communities. (JICA GL)	RP: There is no specification under the RP.	There is no specification under the RP. However, the law does include a consultation process (Article 23), which includes the reception of grievances and complaints and the requirement to answer them.
11.	Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits. (WB OP4.12Para.6)	RP: A detailed census is undertaken for the RAP which includes a population census, an asset inventory, and a socioeconomic survey (Art. 20).	Basically there is no gap between the JICA GL and Laws of Mozambique.
12.	Eligibility of benefits includes, the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying. (WB OP4.12Para.15)	RP: PAPs (Project Affected Peoples) include people living in the affected area, people who will lose assets and goods and people who suffer permanent or temporary interruption of their economic activities (Art.1). LL: Legal rights to land are regulated by the Land Law, and include rights by formal means, traditional land rights and right by occupation (Art. 9, 10, 11).	Basically there is no gap between the JICA GL and Laws of Mozambique.

No.	JICA Guidelines	Laws of Mozambique **RP:** Regulation for the Resettlement Process Resulting from Economic Activities (Decree 31/2013 of August) **REIA:** Regulation for Environmental Impact Assessment (Decree 45/2004 as amended by Decree 42/2008) **LL:** Land Law (19/97 of 1 October)	Gap of JICA Guidelines and Laws of Mozambique
13.	Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based. (WB OP4.12Para.11)	RP: RAP should provide land for farming, livestock and other economic activities, including traditional subsistence activities (Art.16).	Basically there is no gap between the JICA GL and Laws of Mozambique.
14.	Provide support for the transition period (between displacement and livelihood restoration). (WB OP4.12Para.6)	RP: There is no specification under the RP. Affected persons are entitled to support in moving with their assets to the new residential area (Art. 10).	There is no specification under the RP for the whole transition period. Affected persons are entitled to support in moving with their assets to the new residential area (Art. 10). No other additional support for the transition period is stipulated.
15.	Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc. (WB OP4.12Para.8)	RP: There is no specification under the RP.	There is no specification under the RP.
16.	For projects that entail land acquisition or involuntary resettlement of fewer than 200 people, abbreviated resettlement plan is to be prepared. (WB OP4.12Para.25)	RP: There is no specification under the RP.	There is no specification under the RP for the resettlement of fewer than 200 people. However, MICOA is establishing a new directive on the Resettlement Process which may consider this issue.

Note: Where the JICA Guidelines do not specify the dtailed requerements, as per JICA's policy, the World Bank requirement is referred to in the column of "JICA Guidelines".

Source: JICA Survey Team

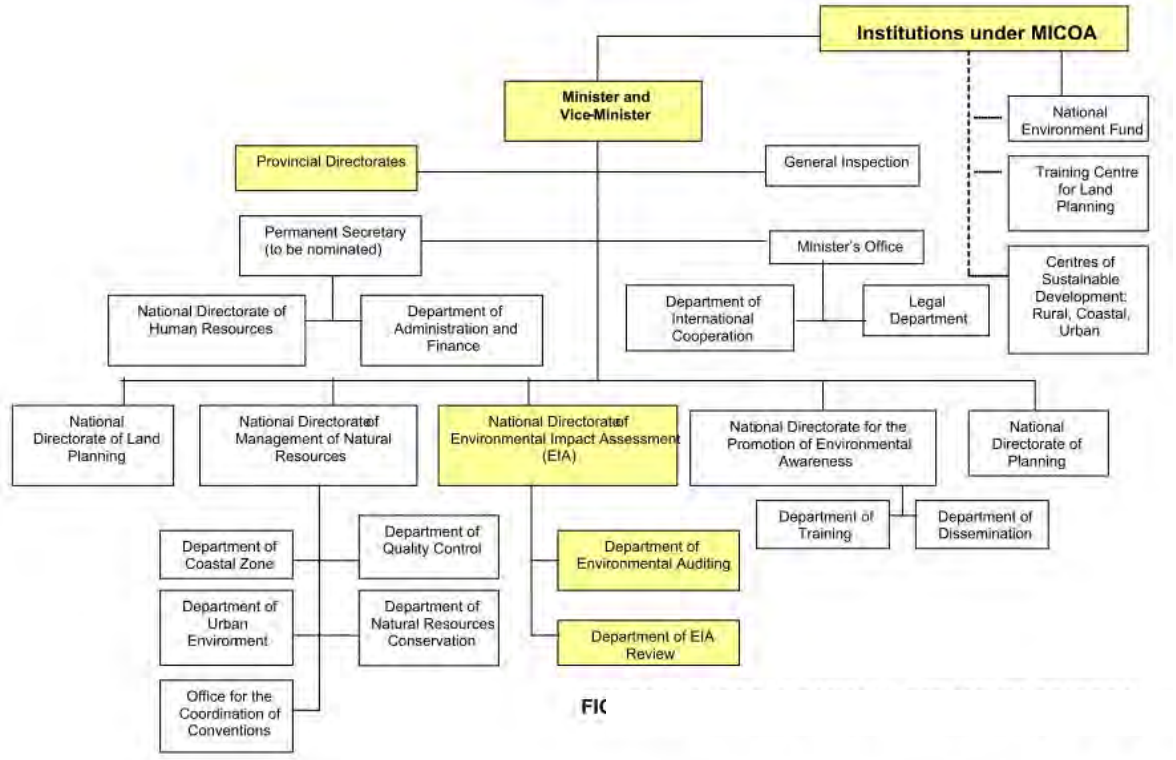
6.3.4 Organization Responsible for ESIA

(1) Ministry of Coordination of Environmental Affairs (MICOA)

MICOA was established in 1995 with the mandate to implement the National Environmental Management Plan, enforce environmental policies and legislation as well as to coordinate with relevant ministries on environmental concerns and ensure that the environmental considerations are integrated into sector plans, programs, policies and development projects. MICOA's organizational structure is shown in Figure 6.3.2.

MICOA is composed of five departments, namely: environmental impact assessment, management of natural resources, land planning, promotion of environmental awareness and planning, for which each department has its own respective mandates. In December 1999, the EIA Department was upgraded to National Directorate of Environmental Impact Assessment in order to effectively and efficiently implement the mandate contained in Law No. 20/97 known as the Environmental Law. The newly enhanced National EIA Directorate comprises of a team of professional staff, including a National Director, accorded flexibly to perform the tasks and supported by the EIA Department and Environmental Auditing Department.

Furthermore, in line with the government's decentralization policy and in order to discharge its mandate more effectively, MICOA established the Provincial Directorates to coordinate environmental affairs (DPCAs) at the provincial level in ten provinces all over the country. In principle, the role of the provincial directorates is to facilitate the implementation of the centrally developed environmental legislation, policies and programs, including EIA regulations and guidelines at the local level. At present, most of the provincial governments have institutionalized a Department of Environmental Management and some provinces have established a separate EIA Department.



Source: Country Report South Africa Development Community Handbook on Environmental Registration

Figure 6.3.2 Organization Structure of MICOA

(2) Other Key Ministries/Departments Involved in Environmental Protection

a) The National Commission for Sustainable Development is linked to the Council of Ministers, which was created in October 2000 by a provision in the Framework Environmental Act. This commission seeks to ensure the effective coordination and integration of sector policies and plans related to environmental management at the highest level.

b) MINAG has a broad responsibility in relation to natural environmental management including agriculture, livestock, forestry and wildlife.

c) The Ministry of National Directorate of Forestry and Wildlife is in charge of managing the country's vast forestry and wildlife resources outside national parks and reserves.

d) The Ministry of Tourism also known as the Directorate for Conservation Areas is responsible for the protection of National Parks, unless these parks have been specifically declared by another agency.

e) The Ministry of Fisheries is responsible for the implementation of Law No. 3/1990 known as the Fisheries Law that covers the management of freshwater and marine fish resources as well as overseeing aqua and marine-culture industries.

f) MIC is involved in large development projects, so called Mega-Projects.

6.3.5 Consideration of Alternatives

(1) Site Alternatives

Two alternative site locations of the plant areas were considered, nonetheless, the project components will be the same in either of the sites. The differences caused by the sites are the physical characteristics of railway siding (to transport the product) and gas and water pipelines. However, the possibility of resettlement at the Nacala site is not confirmed. Comparison of the two sites are shown in Table 6.3.7.

Table 6.3.7 Comparison of the Alternative Sites

	1. Beira New Industrial Area	2. Nacala
(1) Transportation of product	▪ Railway siding from Sena Railway is required. ▪ Length around 1.4 km	▪ Railway siding from Nacala Railway is required. ▪ Length around 3 km
(2) Infrastructure 1) Water 2) Power 3) Road 4) Port 5) Railway	▪ Condition 1) Water pumps and water supply pipeline shall be installed. 2) Power will be provided by in-house generators. 3) There is an existing road from the plant area to the Beira Port. Access road shall be constructed to connect the existing road and plant area. 4) Expansion plan of the Beira Port is under implementation and it would be sufficient for the Project. 5) Plant area is adjacent to the Sena Railway. A railway siding (1.4 km) shall be constructed to transport products to the Beira Port.	▪ Condition 1) Currently the water supply capacity is insufficient. It is expected that supply will be sufficient after the IFZ planned by GAZEDA is completed. 2) Power will be provided by in-house generators. 3) Road from the site to the Nacala Port will be constructed as part of the abovementioned IFZ. 4) Rehabilitation and expansion of the Nacala Port is under implementation and would be sufficient for the Project. 5) Plant area is adjacent to Nacala Railway. A railway siding (3 km) will be constructed to transport products to the Nacala Port.
(3) Gas pipeline	▪ To be constructed ▪ Length 305 km ▪ Land acquisition around 610 ha.	▪ To be constructed ▪ Length 465 km ▪ Land acquisition around 930 ha ▪ Part of the pipeline route passes through Quirimbas National Park
(4) Water pipeline	▪ To be constructed (Length around 50 km)	▪ Unknown ▪ There is no reliable water source in the vicinity of 50 km.
(5) Resettlement	▪ Required ▪ 69 people are thought to be utilizing the area.	▪ Unknown, however, since the plant will be inside the IFZ to be prepared by GAZEDA, resettlement is not expected.

	1. Beira New Industrial Area	2. Nacala
(6) Environment impact	▪ Railway siding is assumed to be shorter compared to site 2. Therefore, impact due to transportation is smaller than site 2. ▪ Length of water and gas pipeline is shorter than site 2. Therefore, impact due to construction is smaller than site 2.	▪ Location of the plant is not determined in detail. However, it can be assumed that the difference of surrounding environment is small.
(7) Rare species and important ecosystem	▪ As a result of literature survey, there is a possibility that rare species exist in the Sofala and Inhambane Provinces. ▪ During the field survey of the plant area, the presence of rare species as described above were not observed; however, further investigation is required in the future. ▪ Due to security concerns, it was not possible to conduct a field survey for the gas pipeline route. Therefore, a it is necessary to conduct a detailed survey in the future.	▪ It is assumed that rare species do not exist since the plant will be constructed inside the IFZ of GAZEDA. ▪ Unknown for the gas pipeline route.
(8) Investment cost, operation income and expenditure of the plant	▪ Investment USD 1,530 mil ▪ Op. income USD 466 mil ▪ Op. expenditure USD 158 mil	▪ Investment USD 1,537mil ▪ Op. income USD 466 mil ▪ Op. expenditure USD 167 mil

Source: JICA Survey Team

(2) Zero Option

Without the Project, in order to satisfy the demand for fertilizer in the country, a larger amount of urea fertilizer needs to be imported. On the other hand, when the abundant natural gas of Mozambique is utilized to produce urea fertilizer inside the country, there is a good possibility that the farmers will obtain the necessary fertilizers at a lower price compared to import or current prices. Furthermore, the surrounding countries in the region can also benefit from lower prices since the transportation distance will be decreased significantly compared to that of imported fertilizer. That is the practical rationale to carry out the Project.

6.3.6 Scoping (items of environmental and social consideration)

This Project is expected to be executed under a PPP scheme. It is proposed that GOM will take part in the Project. However, at this stage, the structure of SPE is not finalized, including the participation of GOM. Therefore, it is not possible to officially apply the Project to the authorities, disclose information to the public, and carry out public consultations. Due to the above reasons, this survey does not include preparation of an official Scoping Report and EIS Report. A draft Scoping Report was prepared under this survey based on the currently available information.

The draft Scoping and items of environmental and social consideration is shown in Table 6.3.8. The mark (+) describes positive impact and (-) negative impact.

Table 6.3.8 Draft Scoping and Important Items of Consideration

Classification	Environmental Parameter and Location of Occurrence	Construction Phase (cause of impact)	Operation Phase (cause of impact)	Provisional Assessment (+)Positive (-)Negative	Reason for Consideration
Environmental quality standard and pollution control	**AIR QUALITY**				
	▪ Urea Fertilizer Plant ▪ Pipeline	▪ Movement of vehicles and machinery	▪ N/A	(-)	▪ Increase of dust, combustion gases concentrations around the urea fertilizer plant and pipeline is expected. Understanding the baseline condition is important to assess the impact.
	▪ Urea Fertilizer Plant	▪ Movement of vehicles and machinery	▪ Gaseous emission from the urea fertilizer plant operation ▪ Exhaust gaseous from vehicle operation	(-)	
	WATER QUALITY				
	▪ Urea Fertilizer Plant ▪ Pipeline	▪ Increase of sediments quantity in water lines due to vegetation and land clearing	▪ N/A	(-)	▪ The quality of surface waters in the site and its surroundings need to be determined in order to understand the current characteristics and to assess the impact.
	▪ Urea Fertilizer Plant	▪ Inadequate management of waste, chemicals, oils, fuel and other pollutants.	▪ Inefficient waste water treatment ▪ Inadequate management of waste, chemicals, oils, fuel and other pollutants	(-)	
	SOIL				
	▪ Urea Fertilizer Plant ▪ Pipeline	▪ Inadequate management of waste, chemicals, oils, fuel and other pollutants.	▪ Inadequate management of waste, chemicals, oils, fuel and other pollutants ▪ Deposition of airborne pollutant particles on soils near the stack.	(-)	▪ The characteristics of soil in the site and its surroundings need to be determined in order to understand the current situation and to assess the impact.

Classification	Environmental Parameter and Location of Occurrence	Construction Phase (cause of impact)	Operation Phase (cause of impact)	Provisional Assessment (+)Positive (-)Negative	Reason for Consideration
Environmental quality standard and pollution control	**NOISE/VIBRATION**				
	▪ Urea Fertilizer Plant	▪ Earthwork activity, operation of heavy equipment and vehicle	▪ Operation of the plant equipment	(-)	▪ The characteristics of noise and vibration in the site and its surroundings need to be determined in order to understand the current situation and to assess the impact.
	▪ Pipeline	▪ Earthwork activity, operation of heavy equipment and vehicle	▪ N/A	(-)	
	WASTE				
	▪ Urea Fertilizer Plant	▪ Construction waste and soil	▪ Sludge from raw water treatment and waste water treatment. ▪ Liquid waste (such as oil and chemicals), and general waste.	(-)	▪ Understanding the baseline condition is important to assess the impact during construction and operation phases. It is necessary to understand the waste disposal standards and to formulate an appropriate waste management plan.
	▪ Pipeline	▪ Construction waste and soil	▪ N/A	▪ N/A	▪ Understanding the baseline condition of waste disposal is important to assess the impact. It is necessary to understand the waste disposal standards and to formulate an appropriate waste management plan.
	LAND SUBSIDENCE				
	▪ Urea Fertilizer Plant ▪ Pipeline	▪ N/A	▪ N/A	▪ N/A	▪ Any work that will cause land subsidence is not expected in the construction and operation stages.
	OFFENSIVE ODOR				
	▪ Urea Fertilizer Plant ▪ Pipeline	▪ N/A	▪ N/A	▪ N/A	▪ Any work that will cause offensive odor is not expected in the construction and operation stages.
Natural environment	**SOIL**				
	▪ Urea Fertilizer Plant ▪ Pipeline	▪ Earthwork ▪ Clearing	▪ N/A	(-)	▪ Prior to construction, it is necessary to determine the current condition of the soil in order to assess the impact due to erosion and/or sedimentation.

Classification	Environmental Parameter and Location of Occurrence	Construction Phase (cause of impact)	Operation Phase (cause of impact)	Provisional Assessment (+)Positive (-)Negative	Reason for Consideration
Natural environment	**HYDROLOGY**				
	▪ Urea Fertilizer Plant	▪ Inadequate management of waste, chemicals, oils, fuel and other pollutants.	▪ Inadequate management of waste, chemicals, oils, fuel and other pollutants.	(-)	▪ Prior to construction, it is necessary to determine the current condition of ground water in order to assess the impact.
	TOPOGRAPHY				
	▪ Urea Fertilizer Plant ▪ Pipeline	▪ N/A	▪ N/A	N/A	▪ The project will not affect or change the geological characteristics of the site.
	FAUNA/FLORA/BIODIVERSITY				
	▪ Urea Fertilizer Plant ▪ Pipeline	▪ Clearing and Leveling of site	▪ N/A	(-)	▪ Prior to construction, it is necessary to determine the current condition of fauna and flora in order to assess the impact.
	PROTECTED AREA				
	▪ Urea Fertilizer Plant	▪ N/A	▪ N/A	▪ N/A	▪ Projected area does not exist in and around the plant, water supply pipeline.
	▪ Pipeline	▪ N/A	▪ N/A	▪ N/A	▪ Gas pipeline passes through the Game Reserve No.5, however, it will not change the current situation since the pipeline is planned to follow the existing road.
Social environment	**RESETTLEMENT**				
	▪ Urea Fertilizer Plant ▪ Pipeline	▪ Construction work	▪ N/A	(-)	▪ It is necessary to understand the current situation in order to assess the resettlement of dwellings, storage and farmlands.
	▪ Urea Fertilizer Plant	▪ Construction work	▪ N/A	(-)	▪ It is necessary to understand the condition of the cemetery in the temporary area in order to consider plans to avoid impact or the possibility of relocation.

Classification	Environmental Parameter and Location of Occurrence	Construction Phase (cause of impact)	Operation Phase (cause of impact)	Provisional Assessment (+)Positive (-)Negative	Reason for Consideration
Social environment	**LOCAL ECONOMY/LIVELIHOOD**				
	▪ Urea Fertilizer Plant	▪ Clearing and Leveling of site	▪ N/A	(-)	▪ It is necessary to determine the possibility of the loss of farmland and mitigation measures.
	▪ Urea Fertilizer Plant	▪ Short term employment opportunities during construction	▪ Long term employment opportunities created by the plant operation	(+)	(Generation of employment opportunities is expected.)
	▪ Urea Fertilizer Plant ▪ Pipeline	▪ Procurement of construction materials	▪ Long term hiring of services and subcontractors during the operational phase	(+)	(Direct positive impact is expected)
	▪ Urea Fertilizer Plant ▪ Pipeline	▪ N/A	▪ Increase of export ▪ Development and increase of agriculture productivity by use of fertilizer ▪ Increase of employment for surrounding and downstream industries	(+)	(Indirect positive impact is expected)
	▪ Urea Fertilizer Plant ▪ Pipeline	▪ Formal and on the job training /technical transfer to local workers	▪ Formal and on the job training /technical transfer to local workers	(+)	(Technical transfer is expected)
	▪ Urea Fertilizer Plant ▪ Pipeline	▪ Short term employment opportunities during construction	▪ Increase of employment opportunities	(-)	▪ Influx of job seekers disrupting social structure may cause increase of crimes, epidemics
	POVERTY				
	▪ Urea Fertilizer Plant ▪ Pipeline	▪ There is a possibility that people living in poverty will be included in the resettlement.	▪ Increase of employment opportunities	(UNKNOWN)	▪ It is necessary to understand the living conditions of the resettled residents.
	ETHNIC MINORITIES AND INDIGENOUS PEOPLE				
	▪ Urea Fertilizer Plant ▪ Pipeline	▪ N/A	▪ N/A	▪ N/A	▪ There are no ethnic minorities and indigenous people in the project area.

Classification	Environmental Parameter and Location of Occurrence	Construction Phase (cause of impact)	Operation Phase (cause of impact)	Provisional Assessment (+)Positive (-)Negative	Reason for Consideration
Social environment	**LAND USE AND RESOURCE UTILIZATION**				
	▪ Urea Fertilizer Plant	▪ Earthwork ▪ Clearing	▪ Water intake from Pungue river	(-)	▪ It is necessary to confirm the presence and loss of cultivated land. ▪ It is necessary to confirm the effect of water intake (approx.. 24,000 m^3/day) from Pungue river.
	▪ Pipeline	▪ Occupation of ROW	▪ Occupation of ROW	(-)	▪ Since ROW is located in rural area where population density is low, impacts to the present land use and resource utilization are estimated to be minor. However. it is necessary to confirm it.
	CURRENT INFRASTRUCTURE AND SOCIAL SERVICES				
	▪ Urea Fertilizer Plant ▪ Pipeline	▪ Movement of vehicles and machinery	▪ N/A	(-)	▪ Traffic congestion during the construction period is expected.
	CULTURAL HERITAGE				
	▪ Urea Fertilizer Plant ▪ Pipeline	▪ N/A	▪ N/A	▪ N/A	▪ There is no cultural heritage in and around the project sites.
	HIV/AIDS, INFECTION OF DISEASES				
	▪ Urea Fertilizer Plant ▪ Pipeline	▪ Influx of labors	▪ N/A	(Unknown)	▪ Influx of labors during construction period may increase infection of diseases.
	WORKING ENVIRONMENT (INCLUDING WORKING SAFETY)				
	▪ Urea Fertilizer Plant ▪ Pipeline	▪ Construction activities	▪ N/A	(Unknown)	▪ It is necessary to consider the working environment during the construction stage.

Source: JICA Survey Team

6.3.7 TOR for Environmental and Social Consideration

The result of the scooping activities is used in drawing out the TOR for the conduct of an environmental impact study. The relevant regulation mandates the disclosure of the Scoping Report (EPDA and TOR) and to receive comments on the documents. However, as explained in the previous section, this survey does not include the preparation of an official Scoping Report and EIS Report. A draft TOR was prepared under this survey based on the currently available information.

A draft TOR for significant issues namely; air quality, noise/vibration, water quality, waste management, social and economic conditions were prepared as shown in Table 6.3.9.

Table 6.3.9 Draft TOR for Environment and Social Consideration

	Environmental and Social Issues / Survey Items	Methodology
1	**Air Quality** ▪ Clarify environmental standards ▪ Review of climate data including temperature, humidity, wind direction and speed, rainfall and solar radiation in nearby observation station including hourly/monthly highest, lowest and average data for the past three years ▪ Establish air quality condition in the Project site for NO_2, SO_2, dust/PM_{10} ▪ Identify current air pollution sources ▪ Evaluate the impact ▪ Recommendation of practical mitigation measures for inclusion in the Environmental Management Plan ▪ Identification of practical and specific monitoring measures, including indicators, monitoring methods and frequency, where applicable ▪ Characterise and identity issues of air quality concern that need to be investigated in detail in order to identify and assess impacts	▪ Collection of secondary data ▪ Interview with relevant agencies ▪ Field reconnaissance survey
2	**Noise/Vibration Level** ▪ Clarify environmental standards ▪ Establish baseline conditions of noise level in the Project site and surrounding areas ▪ Evaluate the impact	▪ Collection of secondary data ▪ Interview with relevant agencies ▪ Field reconnaissance survey
3	**Water Quality** ▪ Clarify water quality environmental standards ▪ Establish the water quality condition in the Pungue River and surrounding area of the site including the following parameters: water temperature, pH, DO (dissolved oxygen), COD, BOD, SS and coli-form,current use ▪ Identify potential impacts of the proposed activities on water resources in generic terms and assess the significance of the potential impacts using the prescribed impact assessment methodology; Particular attention should be paid to project areas located over hunting areas and buffer zones of conservation areas ▪ Define and map the geographical area of influence of the project with regard to impacts on water resources ▪ Recommend practical and appropriate mitigation measures in generic terms for inclusion in the Environmental Management Plan; particular attention should be paid to project areas located over hunting areas and buffer zones of conservation areas ▪ Identify practical and specific monitoring measures, including indicators, monitoring methods and frequency, for inclusion in the Environmental Management Plan ▪ Identify any aspects of the study area's hydrology that may require further detailed investigation to enable an adequate assessment of potential impacts of the proposed activities ▪ Evaluate the impact	▪ Collection of data ▪ Undertake a comprehensive desktop study ▪ Interview with relevant agencies ▪ Field reconnaissance survey
4	**Waste management** ▪ Clarify waste management standards including waste water discharge into rivers and city sewerage ▪ Predict types and generated amounts of construction waste ▪ Identify any areas that are considered to require special consideration and recommend specific mitigation measures for these areas ▪ Identify practical and specific monitoring measures, including indicators, monitoring methods and frequency, for inclusion in the Environmental Management Plan ▪ Evaluate the impact	▪ Collection of data ▪ Undertake a comprehensive desktop study ▪ Interview with relevant agencies

	Environmental and Social Issues / Survey Items	Methodology
5	**Social and economic conditions of the communities surrounding the Project site** ▪ Gather detailed baseline information to clarify social and economic conditions of communities in the surrounding area of the Project site in terms of population dynamics, potentially affected settlements / communities, economic activities, employment and employment opportunities, income generation and distribution, goods and services, existing social infrastructure (e.g. sanitation, water supply, electricity, schools, health posts) public health (including HIV and AIDS and STDs), cultural aspects, costumes, demographics, livelihood and land use ▪ Identify any vulnerable groups that would require special consideration ▪ Identify potential impacts of the proposed activities on the socio-economic environment of the study area in generic terms and assess the significance of the potential impacts using the prescribed impact assessment methodology. The key focus areas are the potential impact of the project on land use by and livelihoods of the local communities ▪ Recommend practical and appropriate mitigation measures in generic terms for inclusion in the Environmental Management Plan, with a specific focus on land use and livelihoods; ▪ Identify practical and specific monitoring measures, including indicators, monitoring methods and frequency, for inclusion in the Environmental Management Plan; and ▪ Identify any aspects of the socio-economic environment of the study area that may require further detailed investigation to enable an adequate assessment of potential impacts of the proposed activities ▪ Evaluate the impact	▪ Interview ▪ Undertake a social survey in potentially affected communities.
6	**Stakeholders' Engagement (Public Participation Process)** ▪ Clarify views and opinion of people about the Project ▪ Clarify environmental and social issues that are important to the people ▪ Evaluate stakeholders' stakes, interest and needs	▪ Perception survey ▪ Stakeholders' meeting/small group discussion/consultation ▪ Consultation with relevant government departments and key stakeholders - MICOA – DNAIA and DPCA-Inhambane and DPCA-Sofala; - Ministry of Tourism – National Directorate for Conservation Areas; - Management of the Gorongosa National Park and Marromeu Reserve; - Private Hunting Areas; - Provincial Services of Forests and Wildlife; - Provincial Directorates of Agriculture; - Provincial Directorates of Education; - Provincial Directorates of Mineral Resources; ▪ Local environmental and social NGOs; - Local associations/ Community representatives

Source: JICA Survey Team

Chapter 7 Risk Analysis

7.1 Risk Allocation Principle in the Context of PPP Project Implementation

It is important to establish an optimal risk allocation scheme in the context of PPP implementation. The common principle for risk allocation is that, “a risk should be allocated to party which is relatively able to manage the risk, or having the least cost of absorbing such risk. If this principle is implemented properly, it is expected that the risk premium and the project cost would be lower leading to positive impact to the project stakeholders.”

7.2 Typical Risk Allocation between Public and Private

The typical allocation of risks between public and private is as described below:

- SPC normally bears the risk related to financing, design, construction, procurement, operation, maintenance and sales (then transfer some of the risk to other party, either consultant, EPC contractor, supplier, operator, products buyer, based on future discussions).
- The public sector, in general, shall be responsible for political risk, including change of law which is generally controlled by the government or public sector.

7.3 Process of Risk Analysis

Risk analysis for the Project has been undertaken through the following process.

1) ***Risk identification*** for the Project has been undertaken through the brainstorming or discussion in the Survey Team. The risk identification is the first step in risk management by the project owner. If any major risks are not identified at this stage, the opportunity to appropriate risk management will be lost, and this may have a significant impact on the management.
2) ***Risk analysis***, including estimation of the risk significance (frequency of occurrence and damage size), has been undertaken using the method of data evaluation, field observation, brainstorming and discussion in the Survey Team.
3) ***Risk evaluation*** has been undertaken by evaluating risks that should be considered for the project implementation and identifying requirements for government guarantee and insurances.

7.4 Risk Significance

Risk significance (frequency of occurrence and damage size) for the identified risks has been assessed based on the table below.

Table 7.4.1 Risk Significance

Frequency	Damageability
Low (L)	Small (S)
Medium (M)	Medium (M)
High (H)	Large (L)

Source: JICA Survey Team

[Frequency]

- High (H) means that the risk is expected to occur one or more times in one to several years.
- Medium (M) means that the risk is expected to occur one or more times in several years to ten-odd years
- Low (L) means that the risk is expected to occur one or more times in ten-odd years to several decades.

[Damageability]

- Small (S) means anticipated loss of no more than approximately USD 1 million
- Medium (M) means anticipated loss of approximately USD 1 million to USD 10 million
- Large (L) means anticipated loss of approximately USD 10 million or more

7.5 Results of Risk Analysis

Table 7.5.1 shows the results of the risk analysis obtained through the above-mentioned process.

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Table 7.5.1 Risk Matrix

1) The party marked "**V**" should bear the risks and the cost in each risk.
2) Private includes SPE. If the risks or the incidents as mentioned below are caused by SPE, SPE should bear the risks and the cost.

Phase	Classification	Risk Events	Description/ Impact to the Project	Risk Allocation		Significance		Risk control Option
				Public	Private	Frequency	Damageability	
Common	Environmental risk	Contamination/pollution to the site environment caused by Private	Cost increase Project delay/halt		**V**	L	M/L	- To comply with the requirements in the approved ESIA and Environmental license - To establish the system to monitor the conformity to the environmental requirements during the construction and operation periods
		Society distress due to potential discomfort from the plant operation and afluent quality caused by Private	Cost increase Project delay/halt		**V**	L	M	
		Failure to comply with ESIA	Cost increase Project delay/halt Project termination		**V**	L	M	
	Sponsor risk	Poor performance of subcontractors (EPC contractor, O&M contractor)	Cost increase Project delay/halt		**V**	M	S	- To appoint creditworthy and experienced subcontractors - To obtain the performance guarantee from the subcontractors
		Subcontractors' default (EPC contractor, O&M contractor)	Cost increase Project delay/halt		**V**	L	M	
		SPE’s default	SPE's default leading to the project termination and/or step-in by financiers		**V**	L	L	- Agreement with GOM should stipulate SPE’s defaults.
		Project sponsors’ default	Cost increase Project delay/halt		**V**	L	M	- Agreement by sponsors should stipulate their defaults.
	Political risk	Currency Inconvertibility	Unavailability and/or uncovertibility of local currency to the investor's home currency Cost increase	**V**		L	M	- Risk cover by public institutions - To insure the political risk - To open the escrow account - To stipulate the immunity against social and political risks in the Agreement with GOM

Phase	Classification	Risk Events	Description/ Impact to the Project	Risk Allocation		Significance		Risk control Option
				Public	Private	Frequency	Damageability	
Common	Political risk	Currency non-transfer	Inability to transfer funds in foreign currency to the investor's home country Cost increase	V		L	M	
		Expropriation risk	Cost increase Project delay/halt Project termination	V		L	L	
		General change in law (including tax such as income tax, VAT)	Cost increase	V	V	M	M	
		Discriminatory or project specific change in law (including effluent standard/environmental standard)	Cost increase (e.g. necessity of modification of facilities) Project delay/halt	V	V	M	M	
		Delay in achieving planning approval	Cost increase Project delay/halt	V		L	S	
		Events of war, riots, civil disturbance, sabotage, pressure by industrial group	Cost increase Project delay/halt Project termination	V		L	L	
	Third party liability	Damage to the third party caused by the conduct attributable to the Public	Cost increase	V		L	L	Agreement with GOM and consignment contract with each government organization should stipulate the extent of damage to the third party caused by the conduct attributable to the Public.
		Damage to the third party caused by the conduct attributable to the Private	Cost increase		V	L	L	Third party liability insurance

Phase	Classification	Risk Events	Description/ Impact to the Project	Risk Allocation		Significance		Risk control Option
				Public	Private	Frequency	Damageability	
Common	Force majeure	Natural disasters	Cost increase Project delay/halt Project termination	V	V	L	L	- The definition of "force majeure" needs to be clarified in the Agreement with GOM. - Basically the Private should be responsible within the coverage by insurance and the remaining amount that is not covered by the insurance should be born by the Public (GOM) in proportion to his share in the total investment.; - EAR (Erection All Risks) / DSU (Delay in Start Up) that covers the fixed cost/debt service in case the property insured suffers the damage caused by insurable peril and delay in the start-up of operation occurs: during construction - PAR (Property All Risks) / BI (Business Interruption) that covers the fixed cost/debt service in case the property insured suffers the damage caused by insurable peril and decrease in the revenue occurs: during operation
		Extreme weather	Cost increase Project delay/halt Project termination		V	M	M	
		Prolonged force majeure	If it lasts more than 6 months, it may cause financial problems unless insurance covers the loss. Cost increase Project delay/halt Project termination	V	V	L	L	
	Financial risk	Fail to achieve financial close			V	L	M	- To appoint creditworthy and experienced lenders and shareholders - In case of finance arrangement as a sovereign finance, to obtain the sovereign guarantee by GOM
		Financial structure risk			V	L	M	
		Foreign exchange rate risk	Cost increase due to fluctuation of foreign exchange rate		V	M	M	
		Inflation risk	Cost increase due to increase in the gas price	V	V	L	M/L	- Long term supply contract with the gas supplier - To pass the cost increase onto the sales price of the products
			Cost increase due to inflation of other goods and services other than gas		V	M	M	

Phase	Classification	Risk Events	Description/ Impact to the Project	Risk Allocation		Significance		Risk control Option
				Public	Private	Frequency	Damageability	
Common	Financial risk	Increase in loan interest rates	Cost increase		V	M	M	Loan agreement with lenders should stipulate the extent of the increase in loan interest rates.
		Insurance risk	Cost increase		V	M	S	- To appoint creditworthy and experienced insurance companies - To stipulate the extent of the increase in premium rates in the Insurance agreement
	Revenue risk	Decrease in sales amount and/or sales price	Difficulty in operation of the Project. Project termination		V	L	L	Long term offtake agreement with creditworthy and experienced offtakers
Preparation phase	Site risk	Delay in acquiring DUAT for the Project site	Delay in commencement of the project Costs increase in SPE's operation		V	L	S	In parallel to the work on the establishment of SPE, to start a discussion with the Beira municipality for acquisition of DUAT
		Delay in resettlement process for the existing residents in the Project site	Delay in commencement of the project Increase in resettlement cost		V	L	S	To proceed the resettlement smoothly in conformity to the law, obtaining the support from the Beira municipality
		Buried object underground	Delay in commencement of the project Cost increase					Before the decision of project commencement, to conduct a precise site survey and confirm whether there are any buried objects
	Risk for licences and permits	Delay in procedures to obtain licences and/or permits which the Private should obtain.	Cost increase Project delay/halt		V	L	S	To obtain cognizance of the Project and support from GOM
		Delay in procedures to obtain licences and/or permits which the Public should obtain.	Cost increase Project delay/halt	V		L	S	
		Fail in obtaining licences and/or permits by the Private.	Project termination		V	L	M	
		Fail in obtaining licences and/or permits by the Public.	Project termination	V		L	M	

Phase	Classification	Risk Events	Description/ Impact to the Project	Risk Allocation		Significance		Risk control Option
				Public	Private	Frequency	Damageability	
Construction phase	Risks for design, construction and commissioning	Additional design works required by the Public (including Beira city)	Cost increase		V	L	M	- To appoint a creditworthy and experienced EPC contractor - To obtain the design guarantee from the EPC contractor (to guarantee the compliance with the requirements in the contract)
		Defect in the EPC contract (unclear/incomplete contract documents and specifications)	Time and cost overruns		V	L	M	To appoint a legal adviser for preparation of contract documents
		Design faults	Cost increase Project delay/halt		V	L	M	- To appoint a creditworthy and experienced EPC contractor - EPC contract should stipulate the extent of the defect liability - Design guarantee by the EPC contractor
		Delay in completion of construction works	Cost increase Repayment by SPE without revenue Project delay/halt		V	L	M	- To insure DSU (Delay in Start-up) - To appoint a creditworthy and experienced EPC contractor - EPC contract should stipulate the extent of the delay in completion.
		Construction mistake	Cost increase Project delay/halt		V	M	M	- To appoint a creditworthy and experienced EPC contractor - EPC contract should stipulate the extent of the defect liability - Performance guarantee by the EPC contractor
Operation phase	Operation risk	Non-performance by the Private	Cost increase Project delay/halt		V	L	L	- To insure BI (Business Interruption) - Agreement in SPE should stipulate the extent of the default condition of private shareholders - Operational agreement should stipulate the extent of the default condition.
		Improper compliance by SPE	Cost increase		V	L	M	To establish the system to monitor the improper compliance including the employee scandal, corruption, etc.

Phase	Classification	Risk Events	Description/ Impact to the Project	Risk Allocation		Significance		Risk control Option
				Public	Private	Frequency	Damageability	
Operation phase	Operation risk	Labor dispute (strike, lockout, go slow, etc.) by operation staff	Cost increase Project delay/halt		V	L	M	To insure the PAR (Property All Risks)
		O&M cost overrun	Cost increase		V	L	M	To appoint a creditworthy and experienced O&M company
		Low productivity due to unsatisfactory performance of the plant	Revenue decrease		V	L	M	- To appoint creditworthy and experienced EPC Contractor and O&M company - Agreement in the EPC contract and the operation contract should stipulate the extent of the liability. - Performance guarantee by the EPC contractor
		Unstable water supply (by FIPAG)	Revenue decrease due to low production Project delay/halt	V	V	L	M	Long term supply contract
		Unstable gas supply)	Revenue decrease due to low production Project delay/halt	V	V	L	M/L	- Long term supply contract - In case the gas supplier is a governmental institute, to obtain the gas supply guarantee by GOM
		Decline of fertilizer price	Revenue decrease		V	L	M	- Long term offtake contract with creditworthy and experienced offtakers - To secure the flexible reimbursement schedule to absorb the variation of cash flow
		Decline of fertilizer demand	Revenue decrease		V	L	M	- Long term offtake contract with creditworthy and experienced offtakers - To secure the flexible reimbursement schedule to absorb the variation of cash flow
	Asset ownership risk	Asset loss events (other than Force Majeure)	Revenue decrease due to shutdown of the plant Cost increase for repair		V	L	M	To insure the PAR (Property All Risks) and BI (Business Interruption)

7.6 Insurance

Types of insurance that the SPE (or its contractors, such as an EPC contractor and an O&M company) needs to obtain for the Project are summarized in Table 7.6.1.

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Table 7.6.1 Types of Insurance

[Construction phase]

Policy	Policy Holder	Outline of Policy	Insured	Policy Period	Sum Insured /Loss Limit
EAR/CAR (Erection / Construction All Risks)	SPE/EPC Contractor	Physical loss of or damage to the permanent and temporary works, materials, buildings, structures, machinery, plant and equipment supplies and all other property for incorporation into the construction of Project.	-SPE -EPC Contractor and his sub-contractors -Finance Parties	Construction period including test and commissioning period plus warranty period	EPC contract value
DSU (Delay in Start Up)	SPE	Loss of or damage to the project during the construction period may result in a delay to the Project and consequently anticipated revenue will not be realized. Delay in Start up insurance will indemnify the project for insured contingencies that are incurred as a result of a delay in commercial operation date (COD) due to loss or damage covered under EAR policy.	-SPE -Finance Parties	Construction period including test and commissioning period (until scheduled COD)	To be determined (i) loss of gross profit or (ii) debt service (interest and capital) and fixed costs or (iii) debt service only.
TPL/CGL (Third Party Liability/ Comprehensive General Liability)	SPE	Third Party Liability insurance will indemnify the insured parties for accidental damage, bodily injury, property damage including coverage for contractors extended maintenance obligations arising out of the design supply, fabrication, construction, testing, commissioning and supply of products of the Plant.	same as EAR	same as EAR	Limit To be determined
Marine cargo	SPE/EPC Contractor	Loss, destruction or damage to all materials, equipment, machinery (excluding contractors plant), spares and other items for incorporation within the project whilst in transit by sea, land or air from the time that the insured items leave the warehouse or factory in the country of origin anywhere in the world until delivery at the project site. Coverage excludes inland transit for locally procured materials which are covered under the EAR policy.	same as EAR	from commencement of the shipment to completion of project	Limit To be determined
Marine DSU (Marine Delay in Start Up)	SPE	Loss or damage to critical plant, equipment or machinery during transit can result in a delay to COD (commercial operation date). Marine DSU insurance will indemnify the project for insured contingencies that are incurred as a result of a delay in COD due to loss or damage covered under Marine cargo policy.	-SPE -Finance Parties	Same as Marine cargo	To be determined (i) loss of gross profit or (ii) debt service (interest and capital) and fixed costs or (iii) debt service only.

Policy	Policy Holder	Outline of Policy	Insured	Policy Period	Sum Insured /Loss Limit
Terrorism	SPE	For the purposes of insurance, an act of terrorism means an act including the use of force or violence of any person or group(s) of persons, whether acting alone or on behalf of or in connection with any organization(s), committed for political, religious or ideological purposes including the intention to influence any government and / or to put the public in fear for such purposes. This insurance will cover loss of or damage to the assets of the Project caused by an act of Terrorism as defined in the policy.	same as EAR	Construction period including test and commissioning period (until scheduled COD)	To be determined
Workers compensation	EPC Contractor	Provides benefits which may become payable to an employee following a work related accident.	-EPC Contractor/ sub-contractors	Construction period	Depends on the contractor
Automobile liability	EPC Contractor	Third party legal liability and owned vehicle damage cover.	-EPC Contractor/ Owner of automobile	Construction period	Depends on the contractor

[Operation phase]

Policy	Policy Holder	Outline of Policy	Insured	Period	Sum Insured/Loss Limit
PAR (Property All Risks)	SPE	This insurance will cover the insureds for "All Risks" of loss or damage to the Property Insured including machinery breakdown occurring during the period of insurance by any cause not otherwise excluded.	-SPE -Finance Parties	1 year	To be determined
BI (Business Interruption)	SPE	Business Interruption Insurance will cover the reduction in gross profit actually sustained or as otherwise agreed, including continuing contractual obligations and the increased cost of working if at any time during the period of insurance any Property Insured suffers insured damage, covered under Property All risks above.	-SPE -Finance Parties	1 year	To be determined (i) loss of gross profit or (ii) debt service (interest and capital) and fixed costs or (iii) debt service only.
TPL/CGL (Third Party Liability/ Comprehensive General Liability)	SPE/O&M Company	Third Party Liability Insurance will cover the insured against legal liability to pay compensation (including claimants' costs, fees and expenses) consequent upon: a) bodily injury, death, illness or disease to any person; b) or loss or damage to any property in accordance with the law of any country,	-SPE - O&M Company -Finance Parties	1 year	To be determined
Terrorism	SPE	same as terrorism during construction period	-SPE -Finance Parties	1 year	To be determined
Workers Compensation	O&M Company/SPE	Provides benefits which may become payable to an employee following a work related accident.	O&M Company/SPE	1 year	Depends on the contractor/SPE
Automobile liability	O&M Company/SPE	Third party legal liability and owned vehicle damage are covered.	Owner of automobile	1 year	Depends on the contractor/SPE
Political Risks (Country Risks)	SPE	Political risks such as governmental expropriation or confiscation of assets, inconvertibility of foreign currency or the inability to repatriate funds, government breach of warranty, war, riots, etc. are covered.	-SPE -Finance Parties	Max. 15 years	To be determined

Chapter 8 Comprehensive Evaluation of Project

8.1 Evaluation of Project Viability

The exploratory surveys in the Pande/Temane gas field and the Buzi gas field are underway, and their gas reserves will be confirmed in 2015 or later. For this reason, a gas supply source for this Project can not be decided. Therefore, in this Survey, the development plan of this Project has been studied assuming that the gas would be supplied from the Pande/Temane gas field.

Evaluation of the Project viability from technical, administrative, financial and environmental aspects are summarized as described below.

8.1.1 Evaluation of Technical Aspect

(1) Demand of Fertilizer and Plant Capacity

Although domestic fertilizer demand in Mozambique largely depends on the progress of the implementation of an agricultural policy by GOM, it is estimated that the domestic demands of urea are about 210,000 tons in 2020 and about 490,000 tons in 2030 according to the Survey results.

Neighboring African countries and India are assumed to be prospective export destinations and their acceptable amounts of urea from the Project have been examined. According to the study results, potential export amounts to these countries are estimated at about 1,460,000 tons in 2020 and about 1,740,000 tons in 2030.

In this Survey, the production capacity of the proposed urea plant is set at 4,000 ton/day (1.3 million ton/year). It can be said that this production capacity is reasonable since there will be a big enough market that can receive urea from this proposed plant.

(2) Site Conditions

A project site is, in general, selected considering land availability, infrastructure in the surrounding area, convenience (in transportation, work force, living conditions, etc.), and environment and so on. It is assumed, in this Survey, that the Urea Fertilizer Complex should be developed in Beira and this assumption is reasonable from the above-mentioned conditions as described below. Especially for the transportation of product from the Urea Fertilizer Complex, it is not too much to say that no other alternative sites are superior to Beira where the existing railway and port facilities are available for the Project.

1) The proposed site is located in the Beira New Industrial Area that is planned to be developed by the Beira Municipality, and therefore the required land can be acquired by applying to the Beira Municipality.

2) Roads and railway are available around the site and can be used for the construction and the transportation of product. The railway transportation of product to the Beira Port has been discussed with CFM and no specific issues have been raised by them.

3) The Beira Port is located at 22 km from the site along the national road EN6 and can be used for the loading of material and equipment for the construction and operation and shipping of product. The usage of the port for the Project has been discussed with CdM (the port operator) and no specific issues have been raised by them.

4) The Urea Fertilizer Complex requires water of 24,000 m^3/day, but it can not be supplied from the existing water supply system operated by FIPAG. It is necessary to install a new water pipeline to supply water from the water source (the Pungue River). Its cost is not significant compared with the construction cost of the Urea Fertilizer Complex and does not have a significant impact on the Project viability.

5) The electricity supply capacity in Mozambique is, in general, not sufficient to supply industries that require a large amount of electricity. In this Project, an in-house power generation facility is planned to overcome this situation.

6) Beira is a large city with about 450,000 people and its living environment is comparatively better.

7) There are 27 households with 69 residents within the proposed site area and it is required to relocate them. No other problems have been found in the environmental aspect.

8) No specific difficulties were found for the gas pipeline and water pipeline.

(3) The geological data of the site was not obtained during the Survey. It seems that there would not be any technical problems that may affect the Project implementation; however, it is essential to conduct a geological investigation and an engineering study on the foundation in the early stage of the Project.

(4) A location where the effluent from the Urea Fertilizer Complex should be discharged has not been designated by the Beira Municipal Office. Further detailed survey should be conducted in the early stage of the Project and this issue should be discussed with Ara Centro to obtain their approval on the discharge point.

8.1.2 Evaluation of Administrative Aspect

(1) Project Cost

The initial investment cost including the construction cost of the Urea Fertilizer Complex and other facilities, cost for survey and investigation, cost for obtaining DUAT, etc. is estimated at USD 1,556.8 million, of which the construction cost for the Urea Fertilizer Complex occupies a large portion as USD 1,200 million. The construction cost for the Urea Fertilizer Complex was

estimated referring to the construction costs of the similar facilities in the past and its accuracy is ±30%. It will be a key issue how the cost increase can be suppressed in the implementation stage.

(2) Implementation Structure

1) Through the discussion with ENH, the Survey Team has obtained positive comments on the participation of the Mozambiacan public entity in SPE; however, it is hard for them to come up with the cash for the Equity. ENH proposes that the Equity part of the Mozambiacan public entity should be put up tentatively by the private investors, and then cancelled out when they gain the distributed profit after the commencement of the production.

2) As for the supply to the domestic market, it is assumed that a long term supply contract shall be made, which has turned out to be difficult to get the GOM's guarantee through the discussion with GOM. It has been concluded that the long term supply contract shall be considered on the private level. Although negotiations on the private level can not be started until the gas supply source and gas price are determined, it is necessary to have entities, such as offtakers in India, who make a purchase guarantee, participate in the Project as one of main business proponents so that the realization of the Project is promoted.

3) In the discussion with the Mozambican public entities, there were no negative comments on the proposal that GOM should conduct the construction, operation and maintenance of the gas pipeline; however, it is difficult to discuss further details because the gas field for this Project has not yet been decided. GOM is currently preparing the gas master plan, which could affect this Project, so it is necessary to pay due attention to its contents.

(3) Risks

The Survey Team reviewed the diverse risks during the preparation, construction and operation periods of this Project, and conducted the analysis of degree of these risks. As a result, the the main risks and control options were identified as follows;

1) Offset risk of change in gas price and gas supply amount

It is considered that this risk can be minimized by such options as a long term supply contract with ENH as the GOM's entity which owns the interest of gas fields or a private enterprise which obtains the interest of the gas field (the contract including the put-or-pay terms to define the payment to be worth of the gas procurement cost in case that the gas supplier cannot supply the gas due to their own responsibility), an offtake contract with passalong terms in case of a price increase of gas procurement, etc.

2) Offset risk of change in sales price and amount of produced fertilizer

For minimizing this risk, long term offtake contracts with creditable and experienced offtakers shall be made. It shall be better to fix the offtake price in the contract; however, if it is impossible, the price tariff shall be defined.

Meanwhile, the take-or-pay terms to define the payment to be worth of the product sales price in case that the offtakers cannot offtake the products due to their own responsibility shall be included in the contract.

3) Risks in obtaining approval / permission

One of the concerns is a delay in the Project commencement and/or an increase of cost due to a delay in obtaining various approvals/permissions for land acquisition, environmental procedures, project activities, etc. Since GOM's support is essential to obtain approval/permission, it is necessary to continue discussion with GOM for their acknowledgement of the Project and support by preparing an implementation plan of the Project that can afford to do it in terms of time.

4) Environmental risk

It is a concern that land contamination and pollution that are attributable to the Project ower may occur and as a result, the Project would suffer from a cost increase, delay or suspension. In order to avoid these situations, it is necessary to strictly observe the environmental requirements identified through ESIA and its approval procedure and also to establish a monitoring system during the construction and O&M periods.

5) Social and political risks

Incidents such as political uncertainty, discontinuance of exchange dealing, increase of the cost, and delay or suspension of the Project due to occurrence of war or riot are of concern.

It is necessary to take the following measures:

- To insure an insurance to compensate for social and political risks
- To open an escrow account
- To stipulate the immunity against social and political risks in the Agreement with GOM

6) Risk relating to EPC contractor

There would be risks of delay or suspension in the construction due to EPC contractor's failure, force majeur, etc. This risk shall be minimized by defining the EPC contractor's responsibility in the contract. Also insurance that covers this risk shall be insured.

The investment insurance by NEXI and the investment guarantee by MIGA should also be applied in order to minimize the risks.

8.1.3 Evaluation of Financial Aspect

(1) Finance

The Survey Team has studied the various options of finance arrangement.

As a business operator of this Project, it is preferable to pursue the possibility of ECA finance including the JBIC's buyer's credit, taking the financial cost into account; however, it is assumed to be difficult because it is unrealistic to expect a governmental guarantee from GOM on the loan. Therefore, for realization of this Project, the Survey Team set the project finance as a financial arrangement option of loan to study the Project feasibility.

However, considering that this is a large scale project of over USD 1,500 million, and the industrial character of urea fertilizer as a commodity product, it is not easy to arrange financing for the project, and it is necessary to consider the high finance cost as well as the offtake contract confirming the long term offtake guarantee.

Taking the above situations into account, it is necessary to realize the finance arrangement of loans, by the combination of the various options.

(2) Results of Financial and Economic Analyses

Based on the financial and economic analyses for the Urea Fertilizer Complex project and the Gas Pipeline project that are major components of the Project and the risk analysis including proposed countermeasures, the Project viability in the financial aspect is summarized as follows:

- The financial and economic analyses were carried out assuming that the Urea Fertilizer Complex project should be undertaken by the private sector and the Gas Pipeline project by the public sector. As a result, it was found that the Urea Fertilizer Complex project is feasible even if it bears the gas pipeline usage fee.
- By the implementation of the Project, the following qualitative economic effects in Mozambique are expected:
  - Improvement of agricultural productivity
  - Improvement of technical capability and human resource development
  - Increase of demand to the existing infrastructures
  - Creation of employment opportunity
- The most critical financial risks are changes in urea demand and price. Trends of the domestic and overseas markets would be a key issue in this Project.

8.1.4 Evaluation of Environmental Aspect

In the environmental aspect, no fatal issues that may affect the realization of the Project were found. However, the following issues shall be further investigated when ESIA is formally conducted.

(1) Issues during the Construction Period

Typical negative impacts due to the construction activities are the contamination of air, water (surface water, underground water) and soil, generation of waste, noise, increase of fluid population, etc. These impacts may occur in the civil and architectural construction works in general, but are regarded as local and short-time ones. It is possible to minimize these impacts to acceptable levels by undertaking proper mitigation measures.

27 structures with 69 residents (and/or users) and their cultivated land and cemetery exist within the site of the Urea Fertilizer Complex and its temporary construction area. Further investigation and study including the public involvement are required in the implementation of ESIA and as a result, the resettlement of the residents and/or review of plant arrangement would be required.

As positive impacts due to the construction activities, creation of employment opportunity, technology transfer, economic effects to the downstream construction industries are expected.

(2) Issues during the O&M Period

There is continuity in negative impacts during the O&M period. These impacts could be mitigated by the proper design of the facilities that should satisfy the environmental requirements (air, water, noise, etc.) at the boundary of the Urea Fertilizer Complex.

As positive impacts, creation of employment opportunity, technology transfer, economic effects to the downstream industries including service industries that support the Project are expected.

8.1.5 Conclusion

This Survey was commenced in June 2013; however, a gas supply source for this Project has not been designated by the counterpart in Mozambique. According to the obtained information, the exploration results of some candidate gas fields will be obtained in a period from the end of 2014 to the end of 2015, and until then, the gas supply source for this Project can not be decided. It is also difficult to further discuss a gas price that affects the profitability of the Project. Since the project viability can not be concluded until the gas supply source and gas price are fixed, it is also difficult to commence procedures for the Project implementation.

Assuming that the gas is supplied from the Pande/Temane gas field and the Urea Fertilizer Complex is constructed in Beira, the business plan was developed and the Project viability was examined. As a result, it was found that a certain extent of profit could be expected although the

Project has some concerns against cost fluctuations and risk occurrence. This Survey is finished; however, the Survey Team intends to follow the exploration results of some gas fields and continue discussions with GOM toward the realization of the Project.

8.2 Operation and Effect Indicators

Referring to "New JICA Guidelines for Project Evaluation, First Edition, June 2010", operation and effect indicators were set as described below.

(1) Operation Indicators

Operation indicators are indicators to quantitatively measure operational status of the project.

Annual production target: 1,320,000 tons

(2) Effect Indicators

Effect indicators: are indicators to quantitatively measure production of effects of the project to its beneficiaries and target area.

a) Domestic sales target in Mozambique (potential effect to the improvement of agricultural productivity):

1^{st} year – 5^{th} year: 200,000 – 300,000 ton/year
From 6^{th} year: more than 300,000 ton/year

b) Number of local employees: more than 250 employees

c) Export amount from the Beira port (effect to the local economy due to the use of railway and port facilities): more than 900,000 ton/year