Predicting The Gas Demand In Bangladesh –

A Sectorwise Regional Forecast

by

Md. Lutfar Rahman
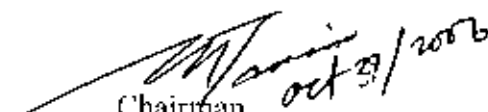
MASTER OF SCIENCE IN PETROLEUM ENGINEERING

Department Of Petroleum And Mineral Resources Engineering

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY
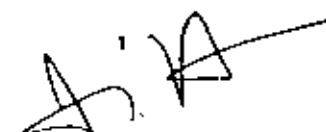
September 2007

The thesis titled 'PREDICTING THE GAS DEMAND IN BANGLADESH- A SECTORWISE REGIONAL FORECAST' submitted by Md. Lutfar Rahman, Roll No. 100013023(P), Session- October 2000, has been accepted as satisfactory in partial fulfillment of the requirements for the degree of **Master of Science in Petroleum Engineering** in October 2006.

BOARD OF EXAMINERS

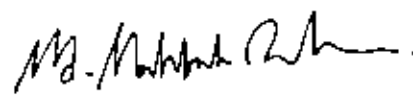Dr. Mohammad Tamim
Professor & Head of Department
Department of PMRE
BUET, Dhaka

Chairman
(Supervisor)
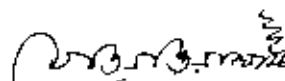
Dr. Ijaz Hossain
Professor
Department of Chemical Engineering
BUET, Dhaka

Member

Dr. Mohammed Mahbubur Rahman
Assistant Professor
Department of PMRE
BUET, Dhaka

Member

Md. Abdul Aziz Khan
General Manager
Production and Marketing Division
Petrobangla
Kawran Bazar, Dhaka

Member
(External)

Candidate's Declaration

It is declared that this thesis or any part of it has not been submitted elsewhere for the award of any degree or diploma.

Signature of the Candidate

Md. Lutfar Rahman

DEDICATION

To my well wishers

ACKNOWLEDGEMENT

ABSTRACT

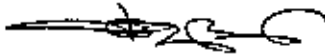Over the last four and a half decade natural gas has emerged as the only fuel that meets the lion's share of commercial energy requirement in Bangladesh. In this country secured supply of energy is synonymous to supplying of natural gas to a great extent at the present and will remain so for quite sometime in the future. Being produced by three national and four International Oil Companies, gas is distributed by four distribution companies in four regions while one transmission company is entrusted with the responsibility of gas transmission. Government has a plan to extend gas network to the southern region by founding another distribution company. In view of the growing gas demand in different sectors vis-à-vis the resource constraint, it is of paramount importance to have a realistic gas demand projection along with infrastructure development program. However making a projection energy demand projection for a country is a difficult task especially for a long-term given the uncertainties involved.

Historical consumption patterns in different sectors both regional and sub-regional basis has been thoroughly studied for the purpose of this thesis. The non-bulk sectors, industrial and captive power sectors in particular that have manifested remarkable growth in recent years, have been studied with special attention. Historical gas consumption indicates a direct link between industrial sector gas consumption and export earning from manufacturing goods. This study has identified the high growing areas for the industrial consumption and other non-bulk sectors.

Power sector has been the leading consumer of gas and will remain so in the foreseeable future. Forecast for the power sector gas demand has been made as envisaged in the Power sector Master Plan Update 2006 for different GDP growth scenarios. No remarkable change in the fertilizer sector is expected. For long term demand forecast in the industrial and captive power sector, industry categorywise gas demand has been determined considering that the dominance of the weaving sector will continue.

The demand forecast has been presented in three different scenarios viz. Base Case, High Case and Low Case. It is felt that meeting the increasing demand would be a great challenge for the country's gas sector.

Table of Contents

List Tables

List of Figures

ABBREVIATIONS/ACRONYMS

BAPEX = Bangladesh Exploration and Production Company Limited

Bcf = Billion cubic feet

BCIC = Bangladesh Chemical Industries Corporation

BGFCL = Bangladesh Gas Fields Company Limited

BGSL = Bakhrabad Gas Systems Limited

CAGR = Compound Average Growth Rate

CC = Combined Cycle

CNG = Compressed Natural Gas

CT = Combustion Turbine

FY = Financial Year

GDP = Gross Domestic Product

GSMP = Gas Sector Master Plan

GT = Gas Turbine

GTCL = Gas Transmission Company Limited

GWh = Gigawatt-Hour

IOC = International Oil Company

JGTDSL = Jalalabad Gas Transmission and Distribution Systems Limited

LPG = Liquefied Petroleum Gas

MCF = Thousand Cubic Feet

MIS = Management Information Services

MMBTU = Million British Thermal unit

MMSCFD = Million Standard Cubic Feet per Day

MW= Megawatt

NPD = Norwegian Petroleum Directorate

NPV = Net Present Value

PDB = Power Development Board

PDF = Price Deficit Fund

PGCL = Pashchimanchal Gas company Limited

PSMP = Power Sector Master Plan

RPGCL = Rupantarita Prakritik Gas Company Limited

S&SW = South and South-West

SCGT = Simple Cycle Gas Turbine

SGFL = Sylhet Gas Fields Limited

Tcf = Trillion cubic feet

TGTDCL = Titas Gas Transmission and Distribution Company Limited

UFG = Unaccounted For Gas

WDI = World Development Indicators

CHAPTER 1

INTRODUCTION

Per-capita energy consumption is one of the development indicators of any country. Bangladesh's per-capita total commercial fuel consumption is 120 kgoe - very low even in the regional standard. Myanmar consumes 1.7 times as much as Bangladesh does while Nepal consumes 2.3 times, Sri Lanka 2.8 times and Pakistan 2.9 and India 3.3 times higher than Bangladesh *(WDI 2005)*. Traditional non-commercial fuel which comes from bio-mass constitutes 40% of the country's primary energy consumption. Rest is met by natural gas, imported oil, coal and hydropower *(Energy Policy 2006)*.

The search for oil and gas in the area constituting Bangladesh began in the later part of the 19th century. However, first breakthrough was made in 1955 through the discovery of Sylhet gas field in 1955. Commercial use of gas started in 1960 in a very limited scale, 1 BCF in the first year *(Petrobangla 2001)*. Over the next ten years from 1961 to 1970 only 67.5 BCF gas was consumed. Gas consumption rose to 279 BCF in the following decade (1971 to 1980) and to 667 BCF during 1981 to 1990 period. During 1991-2000 consumption rose to 2,490 BCF while during last six years, 2001 to 2006, gas consumption was as high as 2,621 BCF. Currently natural gas accounts for about 70% of the commercial fuel consumption of the country with annual consumption of 526 BCF in FY2005-06 *(MIS June 2006)*.

Over the last four and a half decades, not only the amount of gas consumption has increased but the nature of use has also diversified. At the beginning fertilizer and industry used to dominate as gas consumer. During mid seventies power sector gas consumption surpassed the fertilizer sector. At present gas consumption in the country is categorized in nine viz. Power, Fertilizer, Industrial, Captive Power, Commercial, Domestic, Tea Estate, Seasonal and CNG.

Although power sector, the largest gas consuming sector, highly dependent on natural gas with 90% of power generation being gas based, has increased many fold over the years. Yet, the sector could not meet the increasing demand causing much suffering to the public life and hindering the economic activities. Consequently, the industrial entrepreneurs opted for generating electrical power using gas fired engines for their own use termed as captive power, which has demonstrated an unprecedented rise due to exemption of taxes on import of gas engines for industries and favorable fuel price. CNG, the compressed natural gas for

1

automobiles, has emerged as a rapid growing sector from around 0.5 MMSCFD in 2003 to 18 MMSCFD in January 2006. Figure 1 shows the present share of gas consumption by different sectors.
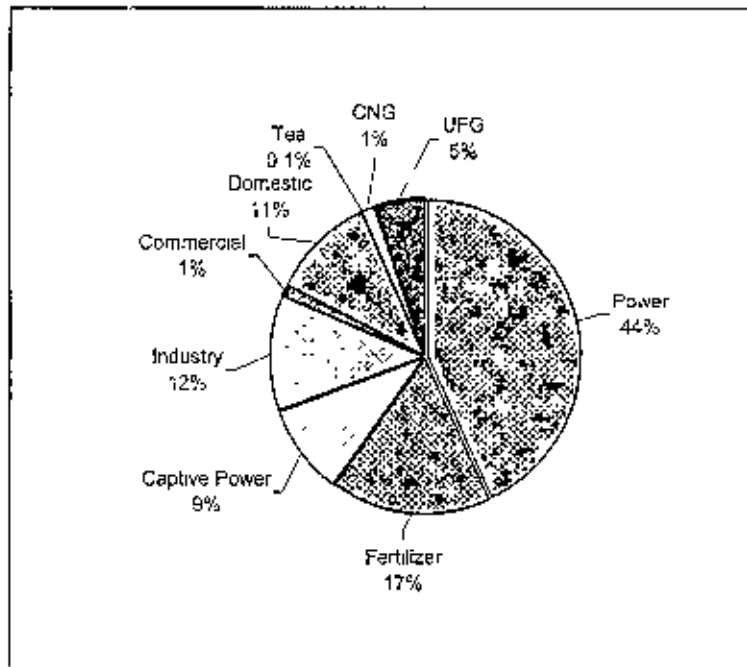
Figure 1: Proportion of Sector wise Gas Consumption in 2005-06
Source: MIS June 2006

Industrial production has shot up and its contribution to GDP is on constant rise; so has the gas consumption in this sector. To keep pace with the development and sustain the economic growth reliable energy supply is very important. Oil price has risen very high in the recent years and it is very unlikely to fall in the near future. For energy starving nations with limited resource like Bangladesh, it is very important that they make best use of the natural gas. Since discovery of new reserve and taking it to the final consumer is investment intensive and time consuming, it is important for planners to know the future gas demand in order to schedule exploration activities and plan infrastructural development.

This study has investigated the growth patterns of individual sectors especially the non bulk sectors of different zones under the distribution companies because it is felt that simply knowing the overall or sector wise gas demand is not enough. Sub-regional gas demand also bears great importance.

Non-bulk sectors especially the industries and captive power, gas consumption has increased rapidly during last ten years outstripping all demand forecasts be it by individuals or institutions. It is time to determine how sustainable this growth trends are. For this it require in depth look into this sector Under this study, industrywise gas consumption from 2000 to 2005 for different consumption centres for both industrial and captive sector has been analyzed. Industrial sector and captive power sector gas demands have been determined ob the basis of demand for each type of industries.

Main objectives of the study are to forecast a nationwide gas demand for the next 20 years upto the year 2024-25 based on regional sectorwise gas demand and to identify the rapid growing regions. Regional and countrywide gas demand forecasts have been made in three-demand scenarios - Base Case, High Case and Low Case

CHAPTER 2
LITERATURE REVIEW

2.0   Demand Theory and Analysis

Demand refers to the number or quantity of goods or services those consumers are willing and able to buy at certain prices during a specified period. Demand theory and analysis can be a source of many useful insights for business decision-making. Indeed it is difficult to overstate the importance of understanding demand. Ultimately success or failure of a business depends primarily on its ability to generate revenues by satisfying the demand of consumers.

2.1   Individual Demand

Consumer choice can be a difficult task in a modern economic system. In determining what to purchase individual consumer face a constrained optimization problem. That is given their income (constraint). they select the combination of goods or services that maximize their personal satisfaction.

One of the most basic concepts in demand theory is the law of demand. In its most simple form, this law states that there is an inverse relationship between price and quantity demanded - as the price increases. quantity demanded would decrease.

The law of demand can be explained in terms of substitution and income effects from price changes. The substitution effect reflects changing opportunity costs. When the price of goods increases. its opportunity cost in terms of other goods also increases. Consequently consumers may substitute other goods that have become more expensive.

Next to consider is the income effect. When the price of good increases, the consumer's purchasing power is reduced. That is at higher prices the individual cannot buy same bundle of goods as before. The change in purchasing power is called income effect become the price increase is equivalent to a reduction in the consumers income.

4

2.2   Market Demand

Although choices by an individual are the basis of the theory of demand, it is the total or market demand that is of primary interest to managers. The market demand for goods or services is the sum of all individual demands (Peterson, 2000).

For example, is a market consists of only two buyers. The demand curves for those two consumers are depicted in the Figure 2.2.1.
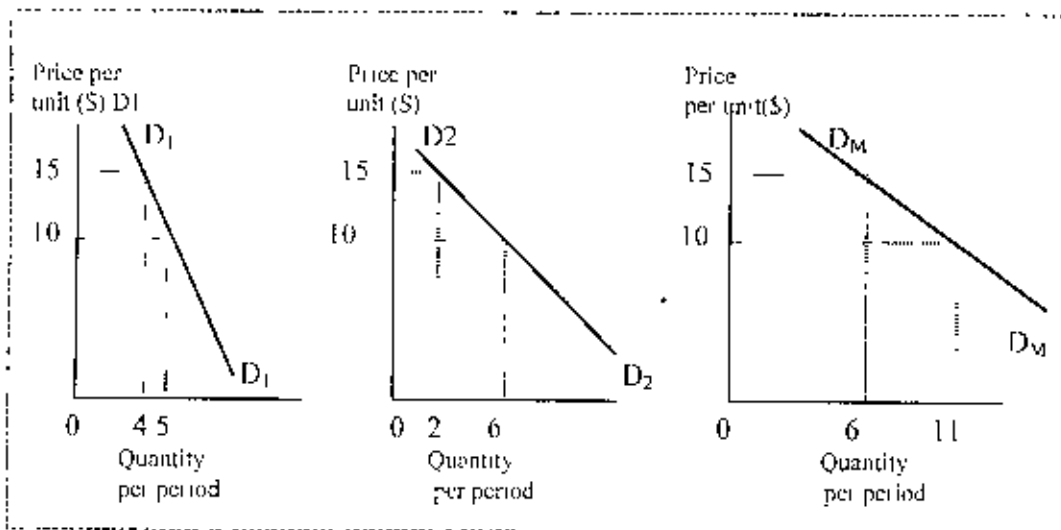
Figure 2.2.1: Market Demand Curve
Source. *Peterson, 2000*

These demand curves show the relationship between price and quantity demanded. Customer 1's demand curve is shown in the first panel (D_1D_1) and that of consumer 2 in the panel (D_2D_2). At a price $10 the individual quantities demanded are 5 and 6 units respectively hence the total market demand (D_MD_M as shown in the third panel) 11 units. The market demand at any price is the sum of the individual quantities demanded at that price. Graphically, market demand curve is the horizontal summation of the individual demand curves. That is, the market demand curve is the sum of horizontal distance from the vertical axis to each individual demand curve.

2.3   Determinants of Market Demand

A movement along the demand curve is caused by changes in price and referred to as a change in quantity demanded. A change in demand is represented by a shift in demand curve. A shift in the right is called an increase in demand, meaning that consumers demand more of

5

the good or service at each price than they did before. A leftward shift indicates decrease in demand. That is, less is demanded at each price than before. Changes in demand are caused by many factors. Some of the most important are consumer preference, income levels and price of other goods and services. Other factors such as population, expectations and government policies can also affect demand.

2.4 Demand Equation

The market demand can be expressed mathematically. If primary determinants of demand are price, income, consumer preferences and the prices of other goods and services, the demand the equation can be written as

$$Q_D = f(P, I, P_0, T) \qquad (2\text{-}1)$$

Where P is the price of the goods or service. I is income, P_0 represents the price of other goods and T is the consumer tastes and preferences *(Peterson 2000)* The equation suggests that there is a correspondence between the quantity demanded and the variables on the right hand side. However, the equation implies only that there are general relationships. It says nothing about their nature and magnitude. For example the Equation (2-1) provides no information about how quantity demanded would be affected by an increase in income. Quantifying this information requires that a functional form be chosen to represent the equation for market demand. The linear form is shown below:

$$Q_D = B + a_P P + a_I I + a_0 P_0 + a_1 T \qquad (2\text{-}2)$$

The coefficients a_P, a_I, a_0 and a_1 indicate the change in quantity demanded for one unit changes in the associated variables. For many purposes it is to focus on the relationship between quantity demanded and the price of the good or service while holding other variables constant. If I, P_0 and T are not allowed to vary, then demand is a function of only P. Hence the linear form of the demand equation can be written as:

$$Q_D = B + a_P P.$$

where, B represents the combined influences of all the other determinants of demand.

2.4.1 Regression Techniques

The most used technique in economic and many other sciences for estimating the relationship between demand and variables is the least square regression method. Specifically managers are interested in estimating the co-efficients a and b of the function

$$Y = a + b X$$

When a set of data are plotted on plain graph a is the intercept with Y axis and b is the slope.

2.4.2 Determination of Coefficients a and b

Statisticians have demonstrated that the best estimate of coefficients of linear function is to fit the line through the data points such that sum squared vertical distances from each point to the line is minimized. This technique is called least squared regression estimation

2.4.3 Testing Regression Estimates

Once the parameters have been estimated. the strength of the relationship between the independent and dependent variable can be measured in two ways. The first uses a measure called coefficient of determination, denoted as R^2, to measure how well the overall equation explains the changes in the dependent variable. The second measure uses the t-statistic to test the relationship between an independent and the dependent variable.

2.4.4 Testing Overall Explanatory Power

Squared deviation of Y_i from the mean of Y is termed as total variation.

$$\text{Total variation} = \Sigma (Yi-Y)^2$$

The total variation can be separated into two components: explained variation and unexplained variation. The squared difference between the predicted value Y and the mean value of Y [i e $(Y-Y)^2$] is defined as the explained variation. The word explained means that the deviation of y from its mean Value Y is the result of (i.e. is explained by) changes in X.

Total explained variation can be found by summing up these squared devotions. That is,

$$\text{Total explained variation} = \Sigma (Y-Y)^2$$

Unexplained variation is the difference between Y_i and Y. That is the part of the deviation form the average value (Y) is explained by the independent variable. X. The remaining deviation, $Yi-Y$ is said to be unexplained. Summing up the squares of these differences yields,

$$\text{Total unexplained variation} = \Sigma (Y-Y)^2$$

The three sources of variations are shown in the Figure 4 4.1.
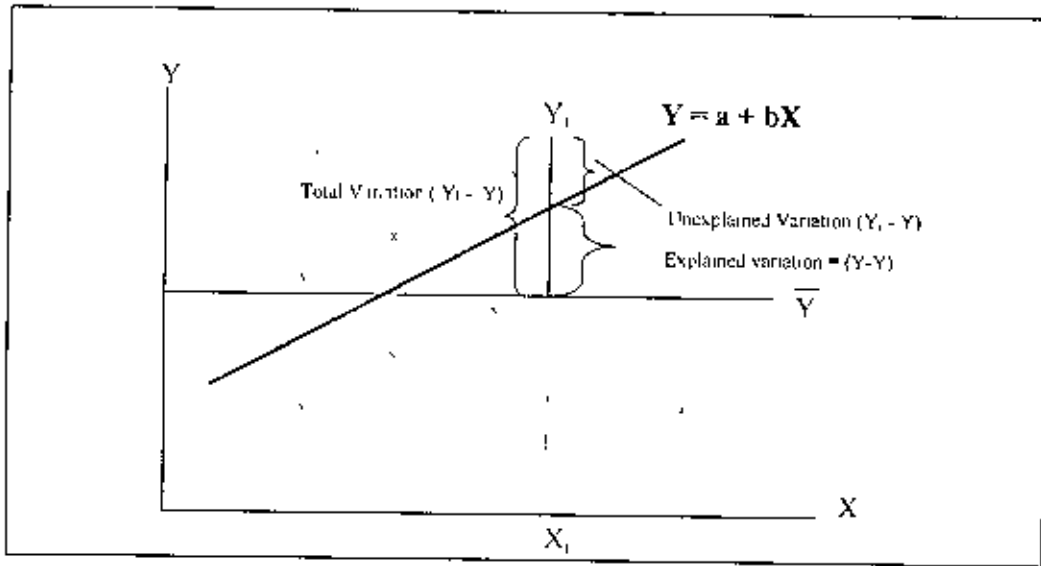
Figure 2.4.1: Sources of Variation in a Regression Model
Source: Peterson 2000

The *coefficient of determination (R²)* measures the proportion of the total variation in the dependent variable that is "explained" by the regression equation. That is.

$$R^2 = \text{(total explained variation)} / \text{(total variation)} = \Sigma \, (Y-\overline{Y})^2 / \Sigma \, (Yi-\overline{Y})^2$$

The value of R^2 ranges from 0 to 1. If the regression equation explains none of the variation in Y (i e. there is no relationship between the independent variable and the dependent variable), R^2 will be zero. If the equation explains all the variation (i e. total explained variation = total variation), the coefficient of determination will be 1. In general, the higher the value of R^2, the better the regression. The term fit is often used to describe the explanatory power of the estimated equation. When R^2 is high, the equation is said to fit the data well. A low R^2 would be indicative if rather poor fit

2.4.5 Multiple Regressions

Estimation of the parameters of an equation with more than one independent variable is called multiple regressions. In principle, the concept of estimations with multiple regression is the same as with simple linear regression, but the necessary computations can be much more complicated.

The multiple regression equation can be written as $\dot{Y}=A + b\,X + c\,Z$

where Y is the dependent variable X and Z independent variable A, b and c are co-efficients to be estimated.

2.4.6 Choice of Functional Form

The Equation (2-1) indicates a general relationship between quantity and factors expected to influence demand. That is,

$$Q_d = f \ (P, \ I, \ P_0, \ T) \qquad (2-3)$$

However, estimation using regression analysis requires the choice of specific functional form for the equation. A linear equation is the simplest possible form. The linear equation corresponding to the general relationships of Equation (2-2) is

$$Q_D = B + a_p \ P + a_i \ I + a_o \ P_o + a_T \ T$$

The linear form has several advantages. First, it can be estimated without modification- no transformations of the data are necessary. Second, the coefficients of the variables have a simple interpretation. If the values of the other independent variables remain unchanged, each coefficient represents the change in quantity per unit change in the associated variables. Furthermore, the estimated changes are constant fro each independent variable and unaffected by values of other variables. These properties make computations much easier.

- Various functional forms can be used for regression analysis. Other than the linear other than the linear equation, probably the most common is the multiplication equation is

$$Q_d = B \ P^a_p \ I^a_i \ P_o^a_o \ T^a_T \qquad (2-4)$$

In its present form the equation cannot be estimated using ordinary least squares because it is not linear. However, there is a simple transformation of the equation that allows it to be estimated using least squares. First we take logarithm of sides of equation. The result is

$$Q_d = log \ (BP^i_p \ I^a_i \ Po^a_o \ T^i_i)$$

which may be simplified as

$$log \ Q_d = log \ B + a_p \ log \ P + a_i \ log \ I + a_o \ log \ P_o + a_T \ log \ T \qquad (2-5)$$

Because this is linear in terms of logarithms of original variables, coefficients can be estimated using ordinary least square method.

When one independent variable, say P, is used the equation becomes

$$\log Q_d = \log B + a_p \log P \qquad (2-6)$$

Now if log B is replaced by a, a_p is replaced by b and log P is replaced by X, equation (2-6) takes the form of $Y = a + b X$

2.5   Review of Previous Gas Demand Projections

In this section gas demand projections made by different organizations have been discussed and limitations of those projections have been pointed out.

2.5.1   S & W Consultants Demand Forecast-2000

In 2000, S & W Consultant, sponsored by UNOCAL, made gas demand for Bangladesh based on the latest information available at that time (S & W 2000). They identified four discrete sectors viz. power, fertilizer, industrial and domestic plus commercial. They modeled demand relationships by testing different functional forms (linear, log-linear, log-log, log inverse transformation) fitted to historical data. Then they extrapolated the functional forms for the each sector to the year 2020. They adjusted when they did not expect future demand to follow the historical demand relationship embodied in the functional forms. They stated that the power and fertilizer in the short-term and other in the long-run required such adjustments. They presented the demand in billion cubic feet per year and predicted 21 that in 21 years time from 2000 to 2020, the country will require 12.7 trillion cubic feet of gas for its internal use. Table 2.5.1 summarizes their forecast result.

Table 2.5.1: Demand Forecast by S & W Consultants in 2000

Unit BCF

Sector	Year				
	2000	2005	2010	2015	2020
Power	147	200	276.2	361.3	466.9
Fertilizer	99.2	103	102.2	135.5	152.5
Industry	54.6	78	111.9	160.1	229.1
Domestic + Commercial	30.9	39.4	49	59.4	70.4
Total	331.7	422.4	539.3	715.9	918.9

Source: S & W 2000.

The first assumption for macro analysis was that the gas consumption will grow over time based on the relationship between past gas consumption and certain variables such as population and economic activity. The second assumption was that the existing energy infrastructure shortcomings such as bottlenecks in the electric power and natural gas infrastructure will have to be overcome in order for the gas to be consumed as forecasted Although the bottlenecks in both gas and electric power have not been removed fully the gas consumption has superceded the forecasted amounts.

In this GDP based projection. it was said that in the FY2004-05 the consumption would be 422.4 BCF but the actual consumption was 486 BCF which was 15% higher than the projected value. Amount projected for the FY2009-10 appears to be far too lower than expected by now. They assumed 4.4 GDP growth for the base case and 5% for the high case and 3 for low case. It may be mentioned that GDP growth cannot be directly related for the long-term gas demand for the growing economy like Bangladesh. Furthermore. the GDP growth projections were lower the present trend.

2.5.2   Demand Projection by Petrobangla in 2001

Petrobangla made gas demand Projection in 2001 for the period of 2001-2050 (*Petrobangla 2001*). In this projection they used the PSMP95 high case projection as the basis for the power sector gas demand. For the fertilizer sector it pursued the plant by plant approach. In addition to the existing ones, they assumed that Shahjalal fertilizer factory would be installed by 2004 and Sirajgonj would be set up by 2006. It was assumed that additional two fertilizer factories, one at Chandpur and another at Bhola will be installed by 2011. For the industrial sector gas demand projection they used as equation developed by S & W consultants which showed industrial gas sector demand as a function of industrial value added output. First they developed a relation between industrial values added and gross domestic product as.

In (indadd) = 3.41 + 1.44 In (gdpcon) - 0.29 dum 98 + 0.58 AR − 0.9 MA (1)

Where . IN   = natural logarithm
        indadd   = industrial value added
        gdpcons - gross domestic product in constant 1995 dollars
        dum 98   = one in 1998 and otherwise zero.

11

AR(1) = a first order auto-regressive term to correct from auto-correlation, and

MN = a first order moving average term to correct for auto-correlation

The equation for the gas consumption was:

In (indcons) = 7.30 + 1.44 (indadd) + 0.3 (dum 98) + 1.07 MA (1) + 0.5 (4)

Where indcons = industrial gas consumption

For the domestic and commercial as consumption Petrobangla used 4% growth upto 2020 the frost decade and thereafter they used 2%, 1% and 1% growths for the next three decades. The summary of the Petrobangla projection in 2001 is presented in the Table 2.5.2.

Table 2.5.2: Gas Demand Projection by Petrobangla – 2001

Unit MMSCFD

Year	2005	2010	2015	2020	2025	CAGR
Overall	831	1219	1733	2524	2851	6%

Petrobangla showed gas demand for tea gardens and seasonal customers. For the obvious reason they did not find and forecast to gas demand by the CNG sector. Although industrial value added has been used in the calculation of industrial sector gas demand, it is primarily based on the GDP forecast because estimation industrial value was dependent on GDP estimation. Petrobangla could not visualize the industrial boom that took place in the subsequent years.

2.5.3 Demand Projections Econ in 2002

Econ centre for Economic Analysis, a Norwaygean company conducted study tilted Bangladesh Optimal Gas Utilization Study *(Econ 2002)* aimed at identifying the range of future domestic gas demand and the scope for exports. In its background statement Econ said "Bangladesh has sufficient proven reserves to last around 40 years and undiscovered resources last upto 50 to 175 years". They used the BPDB projection for power sector demand. For fertilizer they used the BCIC's projection for the life of existing plants and timing for planned plants with domestic production rising to 3.0 million tons by 2020 in the base case and 3.5 and 2.20 million tons for high and low case by the same period. Non-bulk sector demands were calculated on the basis GDP growth scenario (Table 2.5.3) as in the Table 2.5.4.

12

Table 2.5.3: GDP Growth Scenario used by ECON

Growth Rates (%)	1990-95	1995-00	2000-05	2005-10	2010-15	2015-20	2020-25
Base Case	4.2	5.6	5.1	5 1	5.2	5.0	5.1
High Case	4.2	5.6	5.8	5.6	5.4	5.3	5.2
Low Case	4.2	5.6	4.9	4.1	3 9	3.8	3.7

Table 2.5.4: Gas Demand Projection by Econ 2002

	Year	2000	2005	2010	2015	2020	2025	CAGR
	Base Case	908	1125	1616	1995	2479	3060	5.1%
Total	High Case	908	1417	1977	2608	3481	4281	5.7%
	Low Case	908	1119	1291	1527	1839	2147	3 3%

Source: Econ 2002

Attempt to link the gas consumption to the GDP, which too comparatively low figures, lead to low estimation in the Econ 2002 projection.

2.5.4 Demand Projections by Econ in 2004

Econ revised their earlier projections in 2004 to accommodate the recent growth trend *(Econ 2004)*.

Table 2.5.5: Gas Demand Projection by Econ in 2004

Unit MMSCFD

	Year	2000	2005	2010	2015	2020	2025	CAGR
Total	Base Case	908	1249	1676	2132	2652	3277	4.9%
	High Case		1308	1980	2599	3406	4108	5.9%
	Low Case		1167	1364	1628	1963	2286	3.4%
Power	Base Case		563	756	1044	1409	1831	6.1%
	High Case		563	923	1310	1882	2282	7.2%
	Low Case		543	640	818	1033	1219	4.1%
Fertilizer	Base Case		247	304	306	282	282	0.7%
	High Case		265	342	345	321	321	1.0%
	Low Case		245	245	225	222	222	-0.5%
Industry	Base Case		213	314	410	509	615	5 4%
	High Case		276	408	541	682	836	5.7%
	Low Case		222	285	351	419	491	4.0%
Other	Base Case		158	218	280	360	462	5.5%
	High Case		128	206	290	404	556	7.6%
	Low Case		100	130	167	222	292	5.5%
Losses	Base Case		68	86	92	92	87	1.2%
	High Case		76	101	113	117	114	2.0%
	Low Case		58	65	67	66	62	0.3%

Source: Econ 2004

13

2.5.5 Gas Demand Projection National Committee 2002

In December 2001, Government of Bangladesh constituted two national committees – one to report on the resource potential and recoverable reserve of natural gas in Bangladesh and the demand scenario for future years; another to evaluate and suggest the options available to the to the government for the better utilization of its natural gas resources for the benifit of the country.. For forecasting the committee used methodology based on the Energy intensity (EI) of the economy *(Committee 2002)*. The committee used four energy intensity models for projections. In the report of the committee gas demand in BCF/year as well as cumulative gas requirement for the period 2000 to 2050 at an interval of 5 years were presented. In the summary of the report it has been said:

- If the economy is on the low side (3% GDP growth rate) the total gas requirement will be between 40-44 TCF.

- If the economic performance continues according to the historical trend (Business as usual; 4.55% GDP growth rate) the total gas requirement will be between 64 and 69 TCF.

- If the economic performance is on the moderately high side (6% GDP growth rate gas requirement will be between 101 and 110 TCF.

- If the performance is on the high side (7% GDP growth rate) gas requirement will be between 141 and 152 TCF.

Yearly gas demand vis-à-vis the average daily demand on the basis of committee report is presented in the Table 2.5.6

14

Table 2.5.6 : Demand Projection Summary by National Committee

4.55% GDP Growth +Model I (EI)

Year	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
BCF/Year	331	458	633	873	1206	1665	2298	3173	4380	6047	8348
MMSCFD	904	1251	1730	2385	3295	4549	6279	8669	11967	16522	22809

4.55% GDP Growth +Model II (EI)

BCF/Year	331	443	597	800	1067	1417	1876	2475	3257	4275	5597
MMSCFD	904	1210	1631	2186	2915	3872	5126	6762	8899	11680	15292

3% GDP Growth +Model III (EI)

BCF/Year	331	425	545	698	851	986	1066	1118	1150	1171	1168
MMSCFD	904	1161	1489	1907	2325	2694	2913	3055	3142	3199	3191

4.55% GDP Growth +Mode III (EI)

BCF/Year	331	458	633	873	1147	1433	1669	1886	2090	2292	2465
MMSCFD	904	1251	1730	2385	3134	3915	4560	5153	5710	6262	6735

6% GDP Growth +Model III (EI)

BCF/Year	331	491	726	1074	1511	2022	2523	3055	3626	4261	4907
MMSCFD	904	1342	1984	2934	4128	5525	6893	8347	9907	11642	13407

3% GDP Growth +Model IV (EI)

BCF/Year	331	425	529	632	732	832	927	1012	1083	1136	1168
MMSCFD	904	1161	1445	1727	2000	2273	2533	2765	2959	3104	3191

4.55% GDP Growth +Model IV (EI)

BCF/Year	331	458	614	790	987	1209	1451	1707	1968	2225	2465
MMSCFD	904	1251	1678	2158	2697	3303	3964	4664	5377	6079	6735

6% GDP Growth +Model IV (EI)

BCF/Year	331	491	706	972	1300	1706	2193	2764	3415	4135	4907
MMSCFD	904	1342	1929	2656	3552	4661	5992	7552	9331	11298	13407

7% GDP Growth +Model IV (EI)

BCF/Year	331	515	774	1119	1569	2157	2907	3840	4971	6309	7848
MMSCFD	904	1407	2115	3057	4287	5893	7943	10492	13582	17238	21443

Source : National Committee Report, 2002.

The national committee only attempted to find the national gas demand, it did not endeavor to find secortwise or regionwise gas demand. From the results presented in the report the average daily gas demand for against those years, as presented in the Table 2.5.6, can be found but it has not said anything about the maximum gas demand which is very important for the gas sector future expansion programmes. All infrastructure development has to be

based on the maximum demand. Furthermore, the projections are spread over wide range of options

2.5.6 Demand Projection by Petrobangla in 2005

In 2005 Petrobangla reviewed its earlier forecast made in 2001 taking recent changes in consideration *(Petrobangla 2005)*. Major changes in the projections introduction of gas demand for CNG sector, gas demand for the industrial giant TATA in the industrial power and fertilizer sector. They also assumed steeper growth while making this projection than earlier one. They did not use any formulae based on macroeconomic factor. Rather they used individual judgment based on recent trend and industry experience. First they made sectorwise forecasts of the existing four distribution companies as well for one proposed company in the South and South-West region. The summary of the demand projection is in numerated below in the Table 2.5.7.

Table 2.5.7: Gas Demand Projection by Petrobangla - 2005

Unit MMSCFD

Year	2005	2015	2015	2020	2025	CAGR
Total	1520	2478	3199	4286	4931	6%
Power	792	1168	1679	2474	3132	7%
Fertilizer	300	412	412	412	412	2%
Non-bulk	568	1028	1464	1876	2257	7%

Source : Petrobangla 2005

It assigned gas consumption by the South Western Region by FY2006-07 but the present status of the transmission pipeline indicates that it will not be possible to supply gas to this region before FY2010-11.

2.5.7 Demand Projection in GSMP 2006

Gas Sector Master Plan-2006 consultant, Wood Mackenzie, prepared gas demand projections for the period upto FY2024-25 in there scenarios-Case A, Case B and Case C *(GSMP2006)*. Case B in the reference case. They prepared distribution companywise as well as country wide demand projection. They predicted the GDP growth for three scenarios as shown in Table 2.5.8. For non-bulk sector they first tried a logarithm relation between GDP and the

Table 2.5.8:   GDP Growth and Demand Projections by GSMP2006

Unit MMSCFD

Year	GDP			Demand Projections		
	Case A	Case B	Case C	· Case A	Case B	Case C
2005-06	5.5%	6 0%	7.0%	1,414	1,426	1,440
2006-07	5.5%	6 0%	7.0%	1,503	1,525	1,563
2007-08	5.5%	6.5%	7.0%	1,577	1,619	1,666
2008-09	5.5%	6.5%	7.5%	1,672	1,725	1,785
2009-10	5.5%	7.0%	8.0%	1,795	1,896	1,983
2010-11	5 5%	7.0%	8.0%	1,896	2,022	2,234
2011-12	5.5%	7.0%	8.5%	2,000	2,158	2,426
2012-13	5.5%	7 5%	8.5%	2,096	2,340	2,657
2013-14	5.5%	7.5%	8.5%	2,217	2,518	2,873
2014-15	5.5%	8.0%	9.0%	2,299	2,669	3,087
2015-16	5.5%	7.5%	9.0%	2,386	2,853	3,379
2016-17	5.5%	7.5%	8.5%	2,476	3,030	3,625
2017-18	5.5%	7.0%	8.5%	2,593	3,240	3,942
2018-19	5.5%	7.0%	8.5%	2,754	3,509	4,320
2019-20	5.3%	7 0%	8.0%	2,942	3,818	4,739
2020-21	5.3%	6.5%	8.0%	3,125	4,112	5,193
2021-22	5.3%	6.5%	8.0%	3,312	4,439	5,698
2022-23	5.3%	6.5%	7.5%	3,528	4,792	6,244
2023-24	5.3%	6.5%	7.5%	3,762	5,182	6,830
2024-25	5.3%	6.5%	7.0%	4,005	5,606	7,441

Source GSMP2006

2.5.8 Comparison of Previous Demand Forecasts

Figure 2.5 1 shows the summary of projections done in the recent past by the organizations already mentioned in this chapter The projections done S& W Consultants, Econ and Petrobangla during 2000 to 2004 appear to be too low compared to the present trend. Generally the projections made earlier had come up with smaller figures.
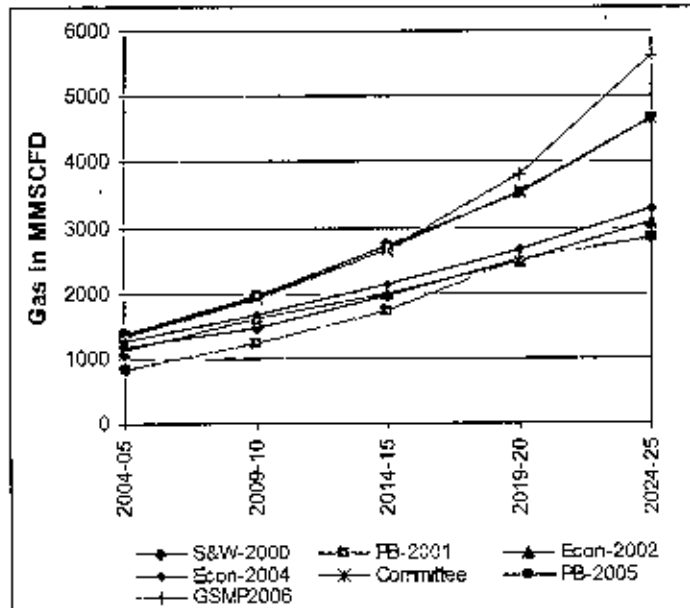
Figure 2.5.1· Previous Demand Forecasts

2.5.9   Comments on Previous Forecasts

Most of the previous gas demand forecasts in Bangladesh were based on the macro economic factors, be it countrywide overall or sectorwise demand. Even these the macroeconomic factors based forecasts were often subjected adjustments to make them realistic. These adjustments in most cases were arbitrary, based on the experience of the authors. Apart from Petrobangla and GSMP consultants, who made forecasts for the country as well as for franchise areas of five distribution companies, other made the forecasts for national level for broad sectors.

While making these projections authors could not foresee the diversification of gas consumptions that have taking place in the country. For example, they could not visualize that the CNG would appears as a big consumer in the country. Transformations in the major industrial consumers were not evident at that time.

In previous forecasts authors used either distribution companywide or countrywide historical data for making such works. None of them tried to understand the sub-regional growth trends. Neither did they have any deep insight into the non-bulk sectors

Failures of the previous forecasts indicate the demand forecast for the natural gas in this country is very complicated in nature and replete with many uncertainties especially first

growing industrial and captive power sector. However, it may be worthwhile to mention that no forecast is meant to exactly match the reality.

CHAPTER 3

PROBLEM STATEMENT

Availability and proper use of natural resources play vital role in the development of a country. Particularly uninterrupted supply of commercial energy is very important for the sustainable economic growth Natural gas has so far been the lone indigenous source of commercial energy in Bangladesh that accounts for around 70% of the commercial energy used in Bangladesh

So far several institutions, committees for different purposes made forecasts on the future demand of natural gas in Bangladesh. Most of those studies were based on the macro economic factors. No significant work has been done to look into the micro level i.e. sub-regional and sub-sectoral demand. Now it is felt that an in depth study should be done to assess the economic activities in different grid zones. For better planning of the infrastructure development potential growth centers must be correctly identified.

This study will examine the regional, sub regional sector-wise and sub-sectorwise gas consumption trend with particular emphasis on the non bulk sector consumption pattern over the last ten years and identify promising regions and consumer groups. A countrywide as well region wise gas demand forecast will be made on the basis of micro level trend.

3.1 Objective with Specific Aims and Possible Outcome

- To investigate growth patterns and to identify high growth centers of natural gas consumption in Bangladesh

- To identify low growth regions and find causes behind them

- To forecast sector-wise, sub sector-wise, region-wise and sub region-wise gas demand

- To aid future infrastructure development planning

3.2 Outline of the methodology:

- Collection of historical data of gas consumption
- Collection of data on future expansion plans of relevant sectors.

- Collection of opinions of professional bodies and individuals.
- Analysis of data.

CHAPTER 4

NATURAL GAS MARKET STRUCTURE

4. 0 Introduction

Both government and private sector entities (IOCs) are working in the gas sector of Bangladesh. Though downstream activities of gas sector in Bangladesh have always been government monopoly, IOC's have been playing important role in the upstream since inception. At present three national production companies along with four IOC's are operating 16 producing fields. Gas used to be transported and distributed by the marketing companies until 1993 when the lone transmission company named Gas Transmission Company Ltd (GTCL) started its journey. Four distribution companies are entrusted with responsibility of marketing the natural gas in the country. However distribution companies still own and operate some transmission lines. Petrobangla, under the direct control of Ministry of Energy and Mineral Resources, owns, coordinates, supervises and controls its subsidiaries in exploration, production and distribution.
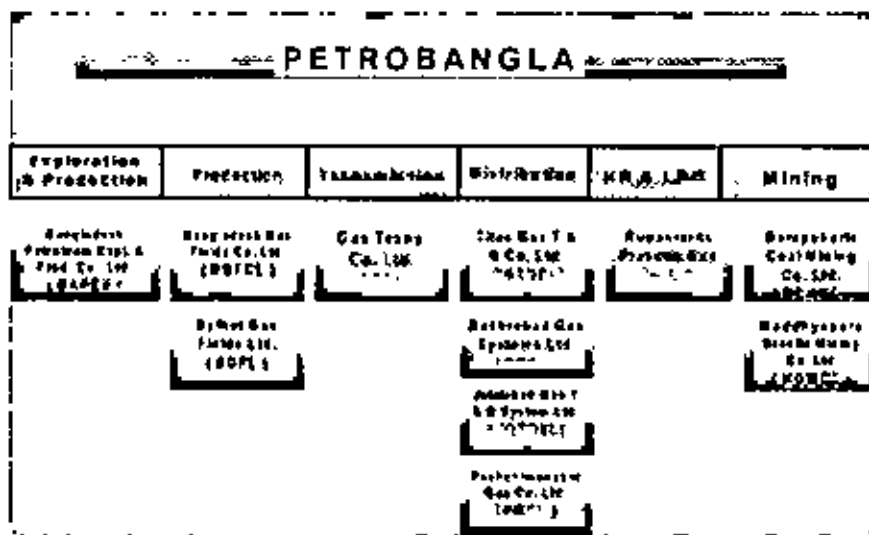
Figure 4.1 Organizational Structure of Petrobangla

After Independence in 1971 Bangladesh Oil and Gas corporation (Petrobangla) was established in 1972 to promote and regulate petroleum activities in Bangladesh either on its on or in joint ventures with foreign companies. Petrobangla was reorganized and renamed the

Bangladesh Oil Gas and Mineral Corporation (BOGMC) as a public sector holding corporation in 1985. In addition Petrobangla owns two mining companies. The organizational structure of Petrobangla is presented in Figure 4 1.

Brief descriptions of exploration, production, transmission and distribution companies are given in the following sections

4.1 Exploration and Production

BAPEX and OICs are working in both exploration and production while BGFCL and SGFL are two companies with the responsibility of gas production only.

4.1.1 Bangladesh Petroleum Exploration and Production Company Limited (BAPEX)

As a part of the 1987 restructuring of Petrobangla, BAPEX was formed with manpower and assets under the former GE division of Petrobangla. It started functioning as a company in its own right in 1989. BAPEX currently employs around 1100 people in total comprising 150 management, 150 technical and 800 support staff BAPEX owns 2 drilling rigs and 1 workover rig and offers geophysical geological and laboratory services.

BAPEX receives revenue from a margin levied on the sale of gas produced by the marketing or distribution companies of Petrobangla. To turn it into a self-funding company, in 2000 BAPEX was authorised by the government to start gas production activities along with its existing exploration activities. Currently BAPEX produces around 55 mmcfd gas from Salda Nadi and Fenchuganj gas fileds. However due to the very low well head price (S.1/Mcf) and the fact that the government receives 55% of the gas revenue and BAPEX gets only a portion of the remaining of the 45 %, it is far from self funding and still has to rely on government funding for exploration activities. BAPEX has an interest in the BAPEX NIKO Joint Venture producing gas from the Feni gas field.

BAPEX has worked over the in Shahbazpur well 1 and the drilling of a second well has been suspended due to the PDB suspending its plan to build a power plant in the region. BAPEX is also going to develop the Semutang gas field.

The 1993 Petroleum Policy stated that BAPEX should drill 4 exploration wells per year. However due to the lack of government funding this target has never been achieved. Government has retained block 11 and 8 exclusively for BAPEX for oil and gas exploration. So far about 650 line-km of seismic survey has been conducted on these blocks. BAPEX only has short term plans to drill development wells on contract for the producing companies It has also been given 10% carried interest in PSCs signed under second round bidding. BAPEX would like to drill an exploration well in Mubarakpur in Block 2. The project proposal is awaiting the approval of the government.

4.1.2   Bangladesh Gas Fields Company Limited

The Bangladesh gas fields company limited (BGFCL) is the largest gas production company in the country. It owns and operates Titas, Habigonj, Bakhrabad, Meghna and Narsingdi gas fields The company currently produces 801 MMSCFD of gas, 51% of national production, from 31 producing wells.

BGFCL was registered in 1968 and was owned by Shell Oil Company until mid seventies when Shell sold its interest to the government of Bangladesh. Gas fields under this company holds of recoverable reserve of 10.364 tcf and upto June 2005, total 4.388 tcf has been produced

Feni and Kmata gas fields were also under this company. But it had to relinquish this low fields when government declared these field as marginal/abandoned gas fields to pave the way for redevelopment under joint venture agreement with IOCs. Recently BGFCL has got a nod from the government to reassess the potential for redevelopment of Kamta gas field following the reluctance by NIKO to redevelop this field.

There is a feeling that BGFCL are just fighting fires and responding to domestic demand requirements. There is forward planning, but a lack of reservoir data and real life demand on production is leading to poor reservoir management.

The wellhead gas is relatively dry, low condensate and gas ratio, in the BGFCL operated gas fields. BGFCL mostly uses glycol dehydration process for gas processing. It has two

condensate fractionation facilities at Titas and Bakharad Fields where they can fractionate up to 1300 barrels/day of condensate into MS and diesel.

4.1.3   Sylhet Gas Fields Limited (SGFL)

SGFL is the second national production company that operates Sylhet, Kailastilla, Rashidpur and Beanibazar gas fields with a current total production capacity of 174MMSCFD. This company is the successor of Burma Petoleum Limited (BPL) and Pakistan Petroleum Limited (PPL). Wellhead gas in SGFL operated gas fields contains relatively higher proportions of condensate. SGFL have 5 silica gel gas process plants and one glycol dehydration gas process plant. They operate one 90MMSCFD Molecular Sieve Turbo expander plant that produces around 22 barrels of NGL per MMSCFD of the natural gas. The company is going to set up another 45 MMSCFD capacity MSTI plant very shortly. The company has two fractionation columns having total 300 barrel/day capacity

4.1.4   International Oil Companies

International Oil Companies played vital roles on the discovery of gas fields in the then East Pakistan and in independent Bangladesh. Between 1960 to1963 Shell discovered four large gas fields viz Rashidpur. Kailshtilla, Titas and Habigonj. In 1974 government enacted the Bangadesh Petroleum Act 1974 to promote production sharing activities. Six production sharing contracts were signed that year. All this contracts were relinquished by 1978 due to various reasons. Discovery of offshore Kutubdia gas field was the only success of these six contracts.

In 1981 a PSC was signed with Shell and in 1987 another PSC was signed with Scimiter. In 1988 a model PSC was introduced and launched a licensing round that year when the country was divided into twenty-three acreage blocks.

The second round bidding was opened in 1996. The successful bidders in this round were a) Cairn energy and Shell in Block 5 and Block 10, b) Triton, Unocal, and PTI Oil and Gas in Block 7. BAPEX participated in this round as carried partner (10%) with Unocal in Block 10 and with Petronas and Mobil in Block 9. At present four IOCs are operating five gas fields in the country

4.1.4.1 Cairn Energy

Cairn involved itself in Bangladesh gas sector since acquiring Holland Sea Search who held an interest in Block 16 in 1994. Cairn discovered the Sangu field in Block 16 in 1996 and took over field operatorship in 2004 following Cairn's acquisition of Shell's Bangladesh interests

Production from the Sangu gas field commenced on 12 June 1998. The project is significant as the first privately operated gas field to be brought on stream in Bangladesh. Cairn now holds a 75% operating interest of the Sangu Development Area and a 90% interest in Blocks 5 & 10.

Cairn acquired 1.244km of seismic data in Block 10 and 70 km in block 5 between April 2004 and the year end. The next contract phase for these blocks begins in June 2005 and includes drilling commitments. Carin has reached an agreement to extend license in certain parts of block 16 where material prospects exist

At present Carin produces at the rate of 130MMSCFD from 6 wells in the Sangu gas field and planning to drill another infill well.

4.1.4.2 Unocal/Occidental/Chevron

Unocal's activity in Bangladesh began in 1974 when the company signed a production-sharing contract with the government for a 10,700 square-kilometer (4,100 square miles) offshore block. The first gas discovery in offshore Bangladesh was made by Unocal in 1977 at Kutubdia # 1 well. Due to the lack of a gas market at the time during seventies Unocal returned this block to the government in 1978.

Unocal returned to Bangladesh in 1996 through a 50/50 joint venture with Occidental in block 12, 13 and 14 in northeastern Bangladesh. After acquiring the stock of Occidental's subsidiaries in Bangladesh in mid 1999, Unocal wholly owned the operation of blocks 12, 13 and 14.

Unocal started natural gas production from the Jalalabad field on Block 13 in February 1999 at a current production rate of 230 MMSCFD. Jalalabad supplies approximately 13 percent of the country's gas demand. Production a rate of 72 MMSCFD from Moulabiabzar commenced in March 2005. At present it is producing at rate of 110 MMSCFD.

Unocal discovered the Bibiyana gas field on block 12 in 1998 which holds as much as 5.5 trillion cubic feet (tcf) of recoverable reserves of natural gas. A gas sales contract was signed in late 2004 to deliver a minimum 200 MMSCFD at the end of 2006. Production is expected to increase in 2008 to 400 MMSCFD under take or pay terms. .

Unocal held interests in three PSCs, to cover Blocks 12, 13 and 14 and the third PSC covers block 7.

Chevron acquired all interests of Unocal in Bangladesh in 2005.

4.1.4.3 Niko Resources

In 2003 Niko Resources of Canada signed a joint venture agreement with BAPEX for the development and production of Feni and Cahattack fields. Government approved the deal that would provide capital to production activities from the fields, which were suspended in 1996 and 1982, respectively.

At Feni, Niko initiated a successful three well development program and began production from the field in November 2004 at a rate of 20 MMSCFD. In January 2005, they upgraded production facilities and are now producing at a rate of approximately 35 MMSCFD. However, in January.2006 the production from Feni Field fell to 20MMSCFD. Niko plan to drill infill wells to maintain production on Feni. Niko estimated recoverable reserves at Feni of between 80-150 BCF.

At Chhatak, Niko completed a 200 sq km 3D seismic program in May 2004, over both the eastern and western sides of the field. They commenced drilling in December 2004 but suffered a blow out in January. As of June 2005, a remedial well was being drilling which also suffered another blowout. Niko is expected to continue with the remainder of their three well programme. Niko estimates gas reserves at Chhatak of 200 BCF. Niko also sees potential in the eastern downthrown section of the field and plan 2 deeper wells to test this.

4.1.4.4 Tullow Oil

Tullow first became active in Bangladesh in 1999 when Okland assigned an 80% working interest in Blocks 17 and 18 to Tullow Oil. Okland had been operating under a technical co-operation agreement with Tullow for the two blocks.

In April 2001, a production sharing contract (PSC) for Block 9 was signed by Tullow Oil (30%), in association with consortium partners Texaco (30%), Chevron (30%) and BAPEX (10%). Tullow's initial drilling programme, which started in December 2003, focused on three areas: Rasulpur, Lalmai and Bangura.

They discovered Bangura gas field in 2005 and started production at a rate of 50 MMSCFD on test basis in second week of May 2006.
Status of the Acreage Blocks in the country is shown in Figure 4.1.1.

BANGLADESH
Concession Status
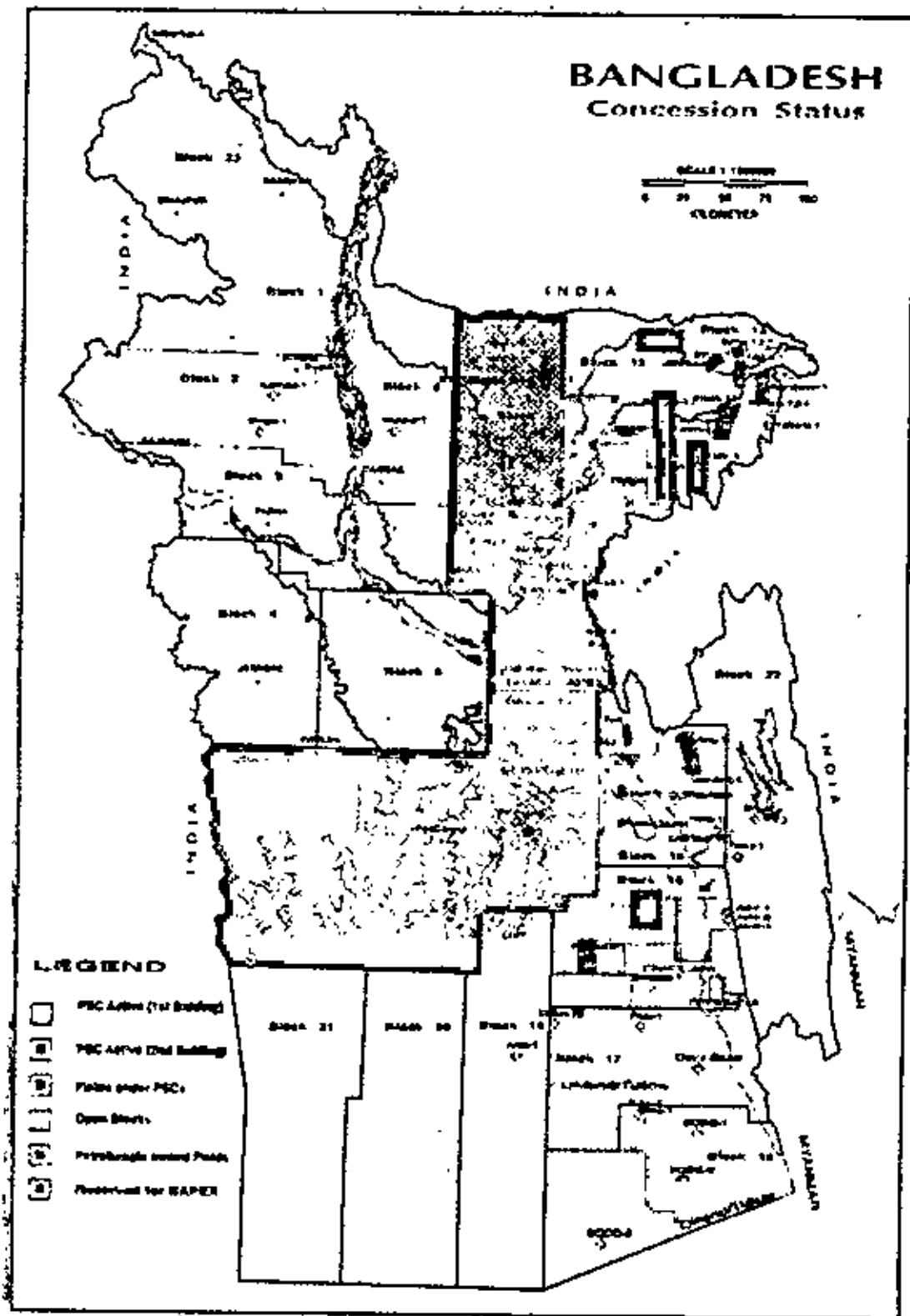
Figure 4.1.1: Status of Acreage Blocks

4.2   Gas Transmission Company Limited (GTCL)

GTCL was formed in 1993. The company owns and operates 24"x 188km North-South pipeline, 30"x 82Km Mucha ito Ashiogonj, 30"x59 km Ashugonj-Bakhrabad pipeline, and 24"/30"/24" x 73 km Elenga-Jamuna Bridge Nalka-Baghabari, 24"x 125 Km BKB Chittagong, 20" BKB-Demra pipeline and gas network related SCADA system. It will eventually take over all high pressure transmission pipelines of the country for centralized operation.

4.3   Distribution

4.3.1   Titas Gas Transmission and Distribution Company Limited (TGTDCL)

TGTDCL, formed in 1964 as a joint stock company, is the oldest and the largest distribution company, which deals in 70-75% of gas sold in Bangladesh It supplies gas to 21 power plants, 4 fertilizer factories, 447 captive power customer, 3,438 industrial customer, 8,680 commercial customer, 95 CNG refueling stations and 11,49,689 domestic customers as on June 2006. The franchise area of this company covers Dhaka division and Brahmanbaria district. It owns 613 km high pressure transmission line, 568 km distribution line and 8,492 km feeder and service line as on June 2006.

4.3.2   Bakhrabad Gas System Limited (BGSL)

BGSL was established in 1980 with threefold responsibility of production, transmission and distribution of natural gas to the southeast Bangladesh. BGSL started its commercial operation in May 1984. However BGSL had to seize its production activities by handing over the Bakhrabad field to BGFCL on 31 May 1989. It had to limit its transmission activity too by handing over the Bakhrabad-Chittagong and Bakhrabad-Demra transmission pipelines to GTCL. The company is now involved mainly in distribution with limited transmission activity. Its franchise area stretches over the Chittagong division apart from Brahmanbaria district. It is the 2nd largest gas marketing company with present maximum consumption of about 250-300 MMSCFD   Company's customer base consists 5 power plants, 3 fertilizer factories, 98 captive power, 926 industrial customer, 3,89 commercial customer, 1 tea garden,

17 CNG refueling stations and 3,51,219 domestic customers as on June 2006. It owns 67 km high-pressure transmission line, 263 km distribution line and 5,247 km feeder and service line.

4.4.3 Jalalabad Gas Transmission and Distribution System Limited (JGTDSL)

JGTDSL is entrusted with the responsibly of supplying gas to customers in Sylhet division. It serves 3 power plants, 1 fertilizer factory, 27 captive power, 37 industrial customers, 847 commercial customers, 88 tea gardens, 5 CNG refueling stations and 97,503 domestic customers as on December 2005. It owns 383 km high-pressure transmission line, 1112 km distribution line and 1,013 km feeder and service line. Although this company was founded in 1978, overall gas consumption has not increased that much. At present its maximum daily sales is 75 MMSCFD with average of 67 in the 2005-06 fiscal year.

4.3.4 Paschimancal Gas Company Limited (PGCL)

PGCL is the youngest distribution company that in started commercial operation in 1999. It is entrusted with the responsibility of supplying gas to Rajshahi Division. So far it has extended its activities to Sirajgonj, Pabna and Bogra. PGCL delivers gas to 3 power plants, 5 captive power, 22 industrial customer, 131 commercial customer, and 19,081 domestic customers as on June 2006. It owns 85 km distribution line and 650 km feeder and service line. Present level of sales of this company ranges from 40-60 MMSCFD with 49MMSCFD average in the FY2005-06.

4.3.5 South-South West Company

A new distribution company will be formed for marketing natural gas to south and southwestern part of the country - Greater Khulna and Barisal region. A cell formed in December 2006 under Petrobangla has already started working to formulate the rules and regulation, market survey and other preliminary works to form the full fledged company. It is expected that the company will be operational by the year 2010.

4.4 Customer Base

Distribution companywide costumer numbers under different sectors are presented in the Table 4 4.1 to give a clear idea about the relative sizes, in terms of customer numbers, of these companies.

Table 4.4.1: Customer Base of Companies as of June 2006

Sectors	Customer Numbers				
	TGTDCL	BGSL	JGTCSL	PGCL	Total
Power	21	5	3	3	32
Fertilizer	4	3	1	0	8
Industry	3,438	926	37	32	4,433
Captive Power	446	99	27	5	577
Commercial	8681	3688	847	131	13347
Domestic	1,149,689	351,215	97,503	19,261	1,617,668
Tea	0	1	88	0	89
CNG	95	17	5	1	118
Brick Field	12	0	0	0	12
Total	1,162,386	355,954	98,511	19,433	1,636,284

Source: MIS June 2006

4.5 Gas Flow Management System

Major amount of gas is transported by GTCL to the distribution companies. Till now distribution companies receives gas directly from some production fields. Figure 4.5.1 illustrates the present gas flow management system.

GAS MANAGEMENT FLOW SYSTEM
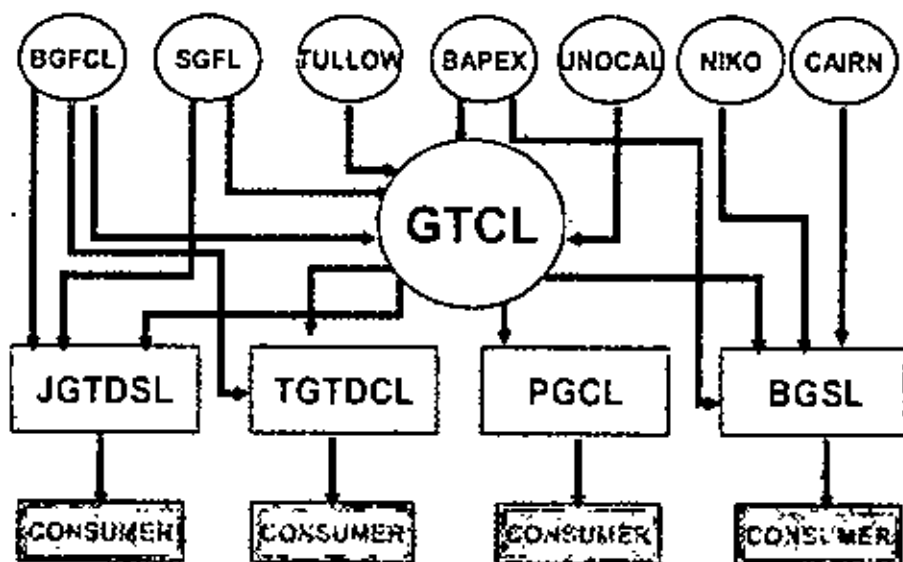
Figure 4.5.1 Gas Flow Management System in Bangladesh

CHAPTER 5
CONSUMING SECTORS AND TARIFF

5.1   Classification of Sectors

Gas consumption pattern has diversified over the last four decades in the country. At the beginning fertilizer and industry used to be the dominant consumer of gas. By the 80's, power appeared as the largest consumer group followed by the fertilizer sector. At present gas consumption is categorized broadly in 9 sectors viz. power, fertilizer, industry, captive power, commercial, domestic, CNG, Tea estate and Seasonal. Power plants and fertilizer factories are called bulk customers while the others in general are termed as non-bulk customers. Each of these nine sectors has separate tariffs.

5.1.1. Power Sector

Power plants, either public or private, that are connected to the grid belong to this tariff category. At present there are 16 large gas fired power plants in the country – 12 plants in the public sector and 4 plants in the private sector. Large power plants in the private sector are termed as Independent Private Power Producers (IPP). Small-scale power plants, 10- 50 MW, are termed as Small Power Plants (SPP).

5.1.2   Fertilizer Sector

There are six urea fertilizer factory in the country- five of them in the in the public sector and one in the private sector. Besides, one Di- Ammonium Phosphate factory has recently been installed in Chittagong.

5.1.3   Industrial Sector

Following are classified as industrial customer·

1   Small and cottage industries in the BSCIC industrial estate.

2   Machine operated factory installed personally or with the help of various money lending agencies like Shilpa Paridaptar, BSCIC etc.

3   Large Scale industry, factory, organization and hotel which are using boiler, generator etc.

4   Factories which are producing bricks, tiles, ceramic, refractories, sanitary, electrical and other goods by machine

5   Machine operated ice and ice cream producing factories and clod stores.

5.1.4 Captive Power

Power generated by an industry for its own use is called captive power. Traditionally gas consumption for this kind of power belonged to the industrial sector. Due to perennial crisis gripping the national grid, government in 1998 decided to waive import duties on the captive power generators which created enormous enthusiasm in the industrial arena and resulted in rapid growth. Textile, garments, spinning, knitting and composite industries dominate this sector. Recently government extended the periphery of captive power by allowing captive power owners to sale power in excess of their own use to the neibourhood

5.1.5 Domestic Sector

House/building used as a residence, flat/colonies of various Government/semi-government/ autonomous organization and hostel, laboratories, canteen, hospital, mess, child home, hermitage, charitable organization are within this sector. Domestic customers are divided into two classes viz, metered and non-metered

5.1.6 Commercial Sector

Commercial organizations those are acting for trade and hand operated/ non-machined small and cottage industries, service centres are within this class. A list of commercial customers is given below:

1   Hotel and residential hotel;

2   Shop/factory, which are producing sweetmeat;

3   Restaurant, canteen and tea-stall,

4.   Chira (flattened rice)/ Muri (cereal of rice parched on hot sand) producing factory;

5. Private clinic/laboratory/hospital;

6. Community centre;

7 Snacks, bakery, confectionery, shemaie factory, biscuit factory (hand operated);

9. Shop, pottery, ceramic, paint, medicine factories (hand operated);

10. Distilled water, dyeing and printing, laundry, tannery, sharee producing factory (hand operated)

11. Ice/ ice cream producing factory (manual).

5.1.7 Seasonal Sector:

Customers who use gas for a certain period of the years are seasonal customer. They are: 1) Seasonal manual brick producing factories, (2) Seasonal tobacco drying factory, and (3) Seasonal sugar cane and fruit processing factories.

5.1.8 Tea-estate

Tea-estate who use gas for tealeaf drying and processing except for power generator.

5.2 Tariff

5.2.1 Sectorwise Tariff

Like many other countries Bangladesh has different tariff for different category of customers. Government from time to time revises the tariffs. However these tariffs are very low in comparison with the alternative fuel. Table 5.2.1 shows the present tariff for different customer groups. Although it was mentioned in the Request for Proposals (RFP's) of the IPPs that the tariff for IPP's will be higher than that applicable to PDB, this had not come into effect. In 2006 government decided that IPPs will pay the same tariff for gas as PDB does. At present the tariff for fertilizer is the lowest to keep the cost of fertilizer low in order to lower the production cost of agricultural produces. So far, only exception in the gas pricing is the pricing of gas supply to the Karnafuli Fertilizer Factory (KAFCO). Here, gas price is calculated by a formula, which consists of a fixed component (floor price) and a variable component linked with the fertilizer price in the international market.

Table 5.2.1: Gas Tariff Effective from 01-01-2005

Sl No.	Sector	Tariff (Tk/Mcf)
1	Power	73.91
2	Fertilizer	63.41
3	Captive Power	105.59
4	Industry	148.13
5	Commercial	233.12
6	CNG (Feed gas)	70.00
7	Tea Estate	148.13
8	Brick Fields	230.00
9	Domestic:	
	a) Metered	130.00
	b) Un-Metered	
	i) Single burner (Tk/month)	350.00
	ii) Double burner (Tk/month)	400.00

Source: GOB Gazette, Jan 2005,

5.2.2 Proportioning the Gas Price

Lion share of the gas revenue goes to the government exchequer as Value Added Tax (VAT) and Supplementary Duty (SD). Supplementary Duty is the share of the government in the revenue as the owner of the resource. Government receives 13% as VAT and Tk.1 27 per cubic metre as SD. Production companies get Tk.0.250 per cubic meter as wellhead margin, while transmission companies get Tk.0.360. BAPEX gets $0.048 Tk/M^3$. Distribution margin varies depending upon the consuming sectors. Petrobangla is the buyer of the gas from IOCs. It has busy sell gas at lower price to the customers through distribution companies at lower price that of the IOC purchase price. To compensate this difference between purchase and sales price, a portion of the sales revenue of all gas is deposited in a special fund termed as Price Deficit Fund (PDF). In FY2004-05 government received Tk 18,431.1 million as SD and VAT when total turn over was Tk.42,193.5 million. Sectorwise breakdowns or proportioning of the gas revenue are shown in the Table-5.2.2.

Table 5.2.2: Proportioning of Gas Tariff

TAKA PER CUBIC METRE

Customer Category	GOB's Margin			PB's Margin						End User Price
	VAT	SD	Total	PDF Margin	Bapex Margin	Wellhead Margin	Trans. Margin	Dist. Margin	Total	
1	2	3	4	5	6	7	8	9	10	11 (4+10)
Power	0.340	1.270	1.610	0.071	0.048	0.250	0.360	0.271	1.000	2.61
Fertilizer	0.292	1.270	1.562	0.002	-	0.250	0.360	0.066	0.678	2.24
Captive Power	0.486	1.270	1.756	0.675	0.048	0.250	0.360	0.641	1.974	3.73
Industry	0.682	1.270	1.952	1.610	0.048	0.250	0.360	0.010	3.278	5.23
Tea-Estate	0.682	1.270	1.952	1.567	0.048	0.250	0.360	1.053	3.278	5.23
Commercial	1.073	1.270	2.343	3.452	0.048	0.250	0.360	1.777	5.887	8.23
Seasonal	1.073	1.270	2.343	3.516	0.048	0.250	0.360	1.713	5.887	8.23
Feed Gas for CNG	0.322	1.270	1.592	0.001	0.048	0.250	0.360	0.219	.878	2.47
Domestic	0.599	1.270	1.869	1.265	0.048	0.250	0.360	0.798	2.721	4.59

Source: Accounts Division. Petrobangla

NB: GTCL will get their share of transmission margin for the quantity of gas transmitted through their system. In other cases, this charge goes to Distribution Company's account.

CHAPTER 6

GAS CONSUMPTION GROWTH

6.0   Introduction

In this chapter growths of gas consumption have been examined from different perspectives. First, the countrywide sectorwise consumption patterns have been studied. Next, greater regional growths i.e. growths under distribution companies in different sectors have been investigated. Different sub-regions within two companies, TGTDCL and BGSL, have also been studied in greater detail. Besides, individual categorywise (sub-sector) growths for industrial sector and captive power sector have been studied to have clear understanding about the industrial sector of the country. Category or sub-sector means a group of same type of industries. For example garments, textile, ceramics, paper and food etc. are the different categories or sub-sectors under the industrial sector and captive power sector.

6.1   Countrywide Sectorwise Growth

6.1.1   Power Sector

Gas supply to the power plants started in 1968. Since inception, total gas consumption in this sector till June 2006 is 2.810 TCF, about 43% of total gas production in the country. Historical gas consumption is shown in the Figure 6.1.1. Growth in gas consumption in this sector was very slow till 1983. In fact 80s was the time when fuel switching took place in the power sector from oil to natural gas. From 1984 to 1996 gas consumption increased at 9% per annum and from 1996 to 2002 the growth was 11.5%. Compound Average Growth Rate (CAGR) over the last five years (FY01 to FY06) was 4.81%, which was due to the worst performance of the sector caused by the sluggish implementation of development projects compounded by the myopic outlook of the policy makers. Cancellation of some projects undertaken by the previous government has worsened the situation.

Gas for Power Sector
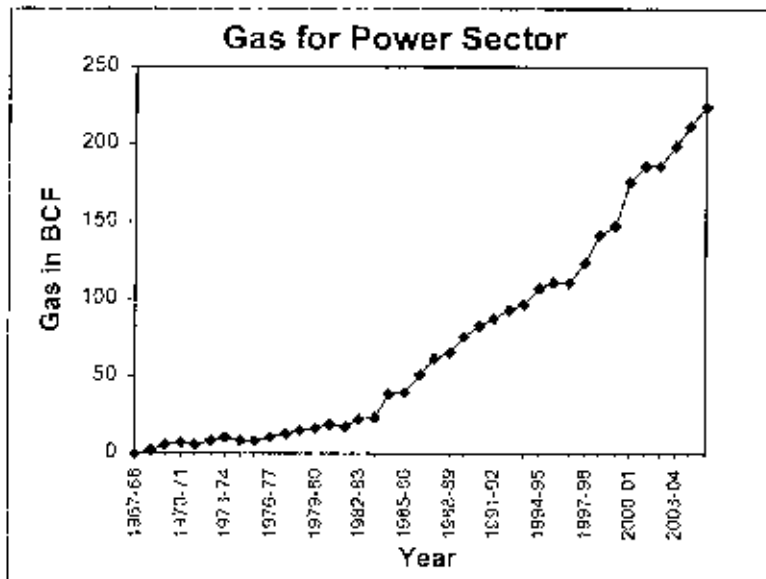
Figure 6.1.1: Countrywide Gas Consumption in Power Sector
Source: Petrobangla 2001 and MIS June 2006

6.1.2   Fertilizer Sector

Starting from 1961 gas consumption in fertilizer sector increased steadily till 1994. Since then increase in sector is not significant because no new factory came into operation except a DAP pant in Chittagong. Over the last five years a 2% growth was encountered in this sector. Since inception total consumption in this sector is 1.787 TCF, which is 27% of total gas consumption in the country. In the FY2005-06 it shared 17% of total consumption. Figure 6.1.2 shows the historical gas consumption.
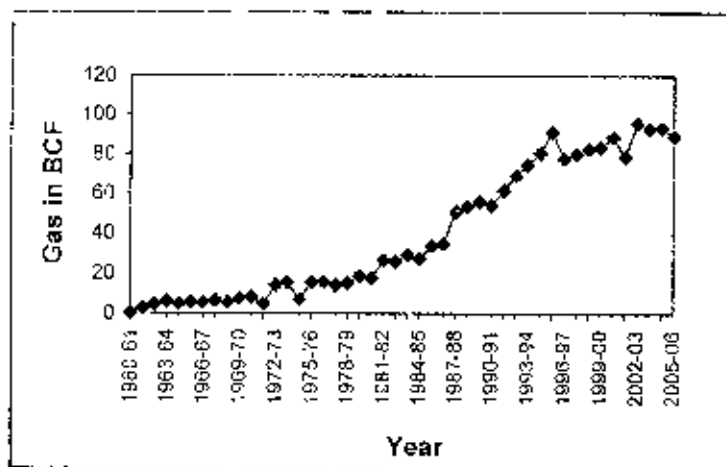
Figure 6.1.2. Countrywide Gas Consumption in Fertilizer Sector
Source. Petrobangla 2001 and MIS June 2006

40

6.1.3 Industrial Sector

Starting from 1960, in the first twelve years the consumption in this sector was very low and it was dominated by Chhatak cement factory which was the only major industrial customer at that time. Countrywide historical gas consumption pattern is depicted in the Figure 6.1.3. During the period of 1987-1992 this experienced negative growth which might had happened due to political turmoil at the fag end of the autocratic rule and subsequent change-over. From 1993 the gas consumption in this sector has been growing sharply and steadily. Total gas consumption in this sector since inception till June 2006 was 708.6 BCF. Over the last five fiscal years the CAGR in this sector was 13%. However it reached a record high growth of 22% in FY2005-06. Installation of composite industries has marked very high growth and special drive by the companies to disconnect dishonest customers substantially contributed to raise the revenue in this sector in this year.
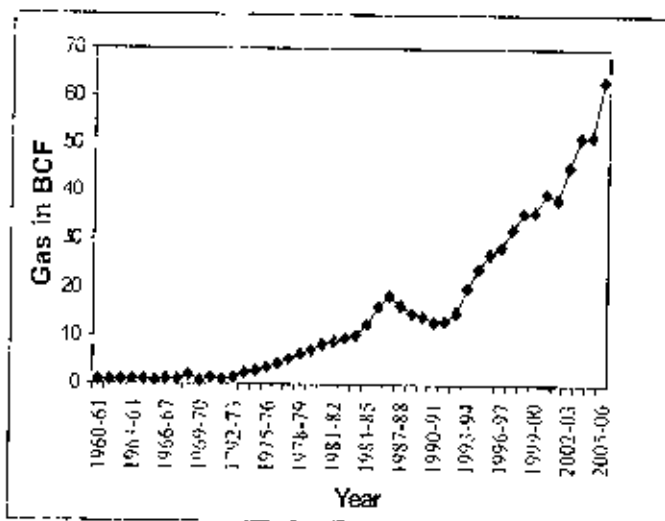
Figure 6.1.3: Countrywide Gas Consumption in Industrial Sector
Source: Petrobangla 2001 and MIS June 2006

6.1.4 Commercial Sector

Gas consumption in the commercial sector started in 1970. During 1978 - 1988 gas consumption in this sector grew steadily. From 1989 to 1996 was the time of recession in this sector. Then it started to grow again. Over the last five fiscal years this sector encountered an average growth of 6%. It may be mentioned here that total gas consumption in this sector since inception is 86 BCF, which is only 1.4% of total gas use. The historical countrywide gas consumption in the commercial sector is shown in the Figure 6.1.4. This fall in gas consumption is not due to fall in actual gas consumption. This was the affect of widening the tariff difference between industrial sector and the commercial sector. When commercial

sector tariff is raised abruptly some customers changes their identity .i.e. they migrate to the industrial sector. It may be mentioned here that the tariffs for industrial sector and commercial sector were nearly equal until 1983. Since then the difference between these two sectors has been increasing

Figure 6 1.4 Countrywide Gas Consumption in Commercial Sector
Source: Petrobangla 2001 and MIS June 2006
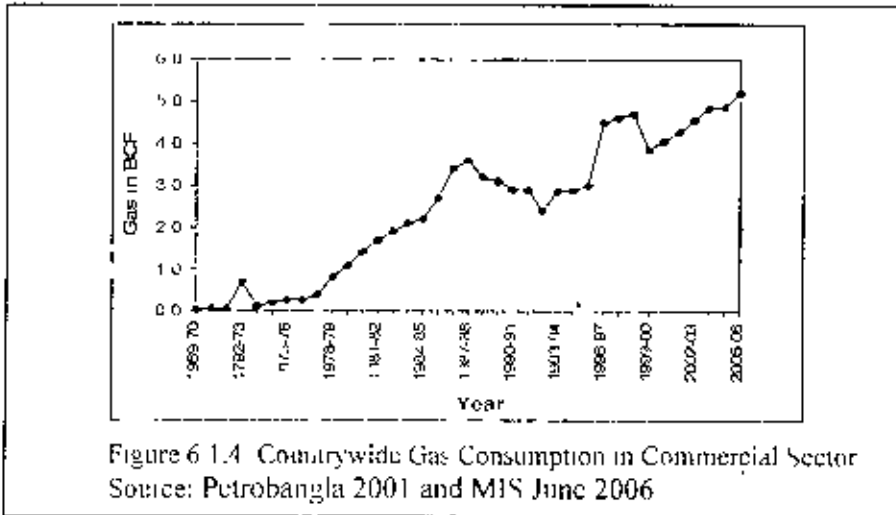
6.1.5   Domestic Sector

Figure 6.1.5 shows the historical gas consumption in the domestic sector. Gas consumption in the domestic sector has always been increasing. In the recent years the growths were higher than past. Over the last five years average growth was 13%. Since   inception 484 BCF gas was used in this sector, which is 8% of the total gas consumption. The growth of urban population (5-6%) directly manifests in the increase in domestic sector gas consumption.
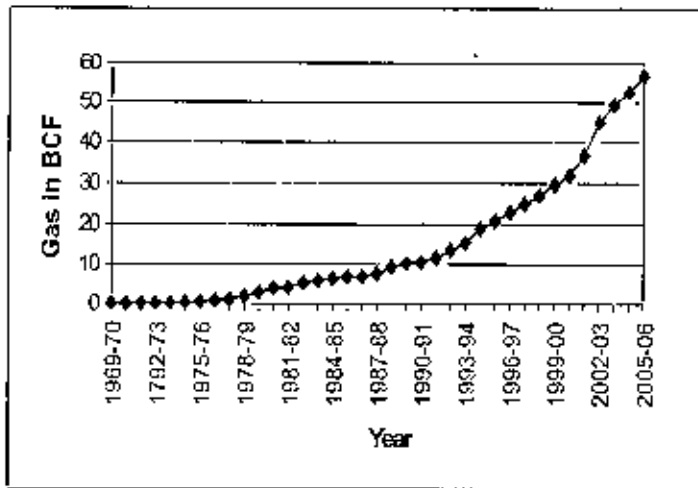
Figure 6.1.5: Countrywide Gas Consumption in Domestic Sector
Source: Petrobangla 2001 and MIS June 2006

6.1.6 Captive Power

Uninterrupted supply with optimum voltage, quality power, is essential for industries that has almost always been missing in this land due to many reasons. Off-grid big factories used to generate power for their own use and the gas consumption belonged to industrial category. Grid power has never been very dependable in the country. Government's generous offer towards captive power generation in the mid nineties sparked tremendous response in the industrial arena to generate own power
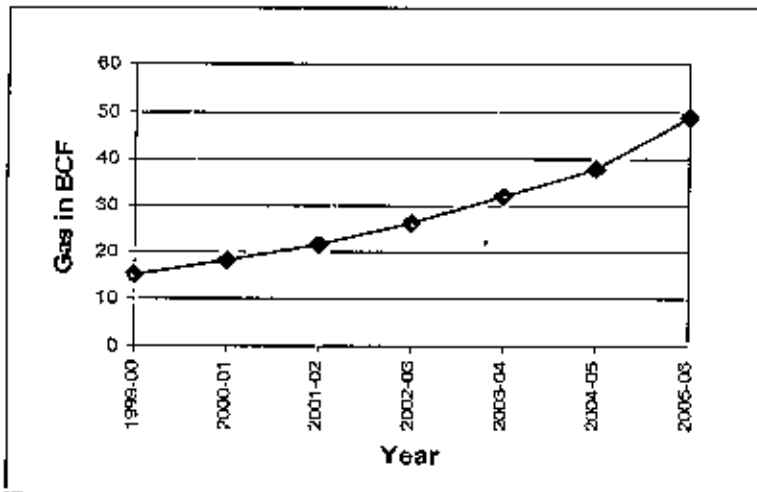
Figure 6.1.6: Countrywide Gas Consumption in Captive Power Sector
Source: Petrobangla 2001 and MIS June 2006

43

using gas generators. Consequently, industrial production loss due to power failure has reduced substantially. Data for Captive power under JGTDSL his available since 1987 and that for BGSl since 1997 but for TGDCL it was available for the last five years only. Available data shows that countrywide gas consumption in the captive power sector has increased at an average of 22 % per year during the last five years which is very much comparable with industrial sector's growth. Gas consumption in the captive power sector during FY1999-00 to FY2005-06 is shown in the Figure 6.1.6

6.1.7   Tea Estates

From 1990-2000 there has been no appreciable change in gas consumption in this sector. Over the last five years consumption has increased by 1%. However during last two years gas consumption in this sector has slightly decreased compared to the consumption in 2003-04 due to poor production. Total consumption in this sector in FY2005-06 was only 0.798 BCF. Figure 6.1.7 shows the historical gas consumption in this sector.
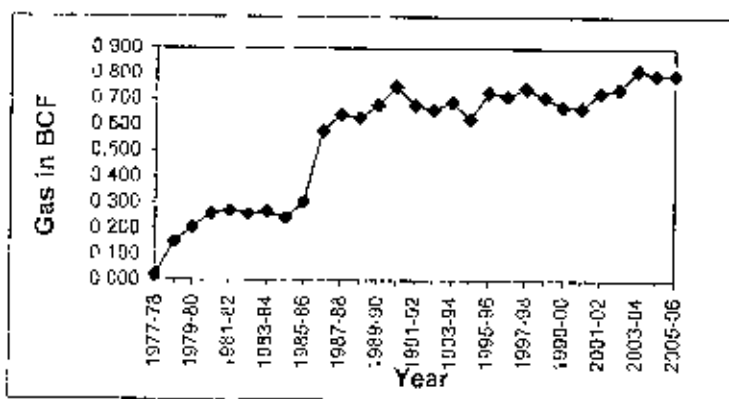
Figure 6.1.7: Countrywide Gas Consumption in Tea Estate Sector
Source. Petrobangla 2001 and MIS June 2006

6.1.8   Historical Share of Consumption by Sectors

Figure 6.8 shows in percentage total shares of gas consumption by different sectors since inception. Power sector ranks the first with share of 45.3%. fertilizer is in the second position with 29.4% share while industry and captive power together is in the third position with 14.5% (industry -11.4% and captive power-3.2%). Gas consumption for captive power used to be very small until very recent times. Domestic sector consumed the 8.7% of total gas consumption. It may be mentioned that Figure 6.1.8 shows the proportions of consumption on the basis of accounted for gas. Real consumption ratios might be slightly different.
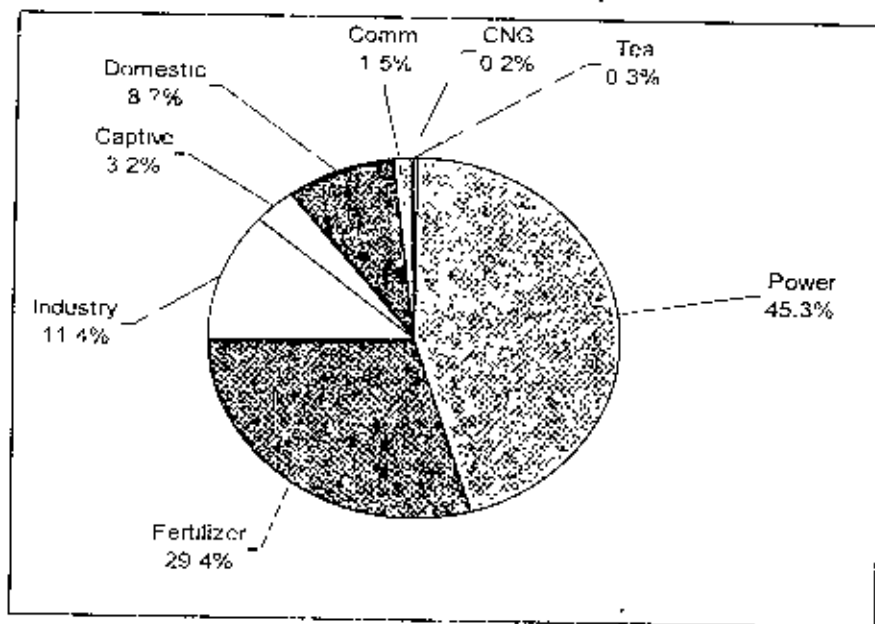
Figure 6.1 8: Proportions of Historical Gas consumption

6.2 Regional Overall Growth

6.2.1 Growth under TGTDCL

Overall gas consumption in the Titas franchise area has grown steadily throughout the lifetime of the company. As of June 2006 total 4,645 BCF gas was consumed in the TGTDCL franchise area, which accounts for 70.8% of total gas consumption in the country. In the FY2005-06 it distributed 384 BCF, 73% of total gas production that year. Barring some exceptions gas consumption in the TGTDCL franchise area is increasing at progressively higher rates every year. This ever rising trend may be attributed to the relentless expansion of the Dhaka city, which is the centre of all commercial and industrial activities in the country. Over the last five years average increment rate was 7.6%. Historical yearly gas consumption is presented in the Figure 6.2.1. More detailed study on the gas consumption in Titas franchise area is presented in the subsequent sections of this chapter

45
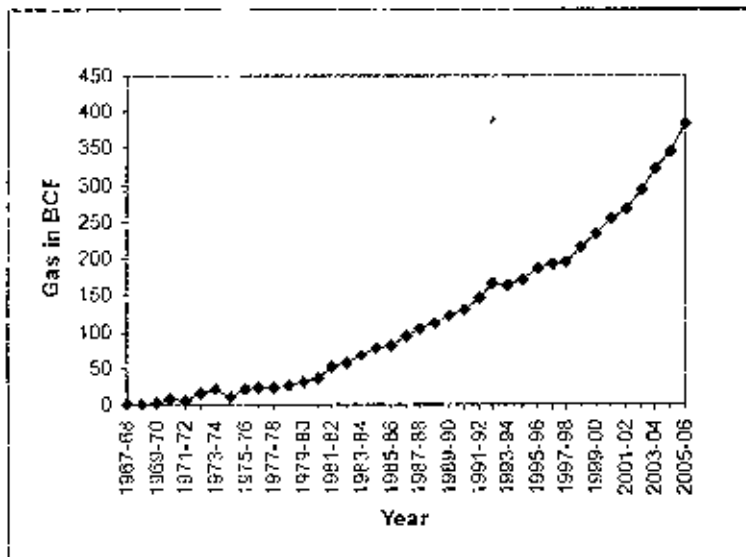
Figure 6.2.1 Gas Consumption in TGTDCL.
Source: TGTDCL June 2006

6.2.2   Growth under BGSL

Gas consumption is increasing in BGSL franchisee area but the increment is somewhat erratic. Gas consumption grew steeply from 1985 to 1988. But some sort of stagnancy had reigned from 1990 to 1993 because no new power or fertilizer customer was added during this time and amount of non bulk consumption was very small. Consumption again increased sharply over next four years with commissioning of the first unit of Rawjan Power plant in 1993 and KAFCO in 1994. In the fiscal year 1997 it dipped abruptly due to restricted gas flow when supply pressure for Bakhrabad gas field had to be reduced. Since 1998 gas consumption in the BGSL franchise area has been on the rise. Gas supply in the BGSL area is excessively dependent on the Sangu gas field. As of June 2006 total gas consumption in BGSL region is 1,140 BCF, which is 17.3 % of total production in the country. Over the last five years it experienced a 4.16% CAGR and last year the growth was 4.6% with respect to the year before. Historical gas consumption is presented in the Figure 6.2.2.
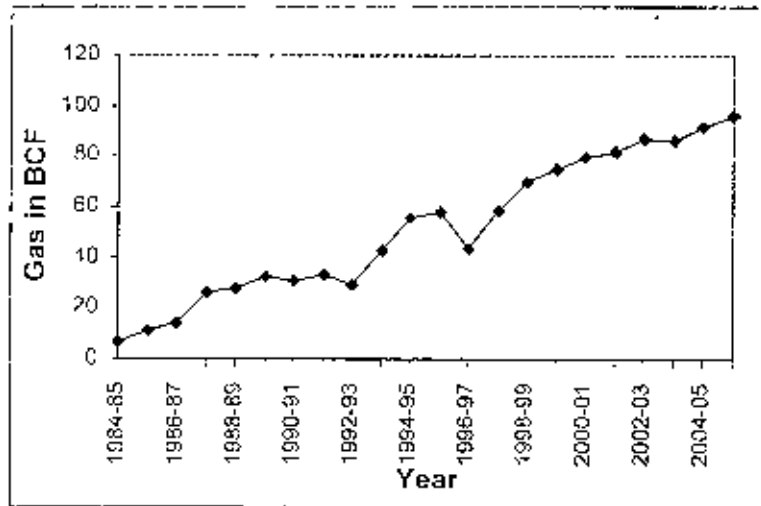
Figure 6.2.2. Gas Consumption in BGSL
Source. BGSL 2000 and MIS June 2006

6.2.3   Growth under JGTDSL

The overall growth scenario in the Jalalabad franchise area is disappointing. This historical gas consumption is shown in the Figure 6 2.3. This company started commercial operation in 1978. Until 1985 gas sales by the company was rather low. In FY1985-86 they started supplying gas to Shahjibazar power plant and in the next year to Natural Gas Fertilizer Factory (NGFF) at Fenchugong came under jurisdiction, which caused considerable rise in sales. With the installation of Fenchugonj 90 MW power plant in 1995 the sales volume gained another rise. During fiscal year 1997-98 gas sales was maximum and then suffered negative growth due bad performance of the 90MW power plant. Since inception it purchased 387 BCF gas as of June 2006, which is 5.9% of total nationwide gas production During last five years consumption has been erratic in nature and marked only 3 % growth. Lack of entrepreneurship by the local people. distance from the capital city and Chittagong port, slow urbanization are the main reasons behind industrial growth. People in this region are more interested to make fortune by migrating to other countries than to launch any industrial venture locally.

47
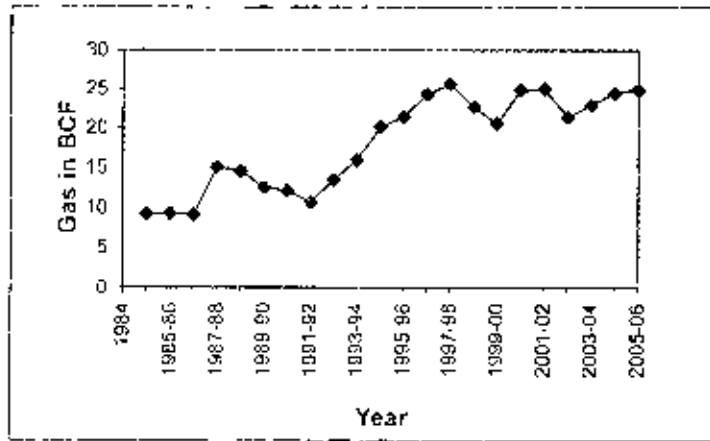
Figure 6.2.3 Gas Consumption in JGTDSL
Source: JGTDSL 1997, MIS June 2006

6.2.4 Growth under PGCL

PGCL started commercial operation in the FY1999-00. Apart from power sector growth, consumption is very low under this company. Over the last seven years it consumed 107 BCF of gas. Around 98% gas consumption in PGCL area is in the power sector. Gas consumption in FY2005-06 was lower than that of previous year because of lower consumption by power plants although consumption in the non bulk sectors has increased. Historical gas consumption by this company is shown the Figure 6.2.4.
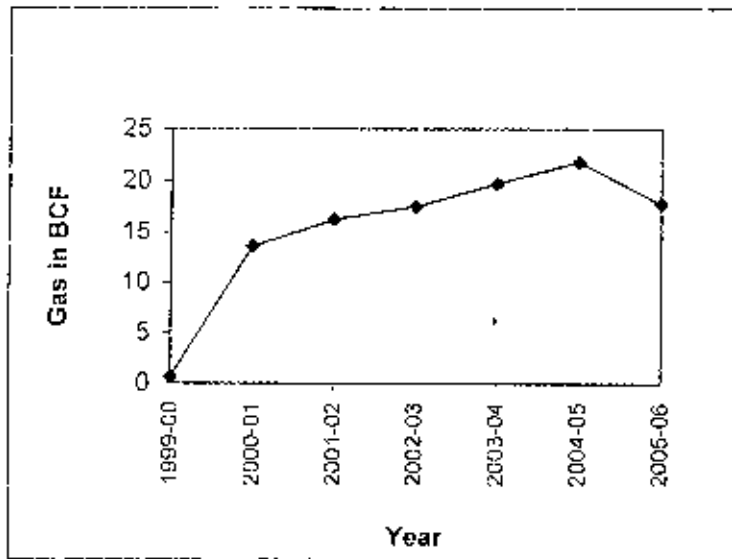
Figure 6.2.4: Gas Consumption in PGCL
Source: MIS June 2003 and MIS June 2006

48

6.3   Regional Sectorwise Growth

6.3.1   Sectorwise Growth under TGTDCL

Power Sector

Most of the large power plants in the country are located in TGTDCL franchise area. Historical gas consumption in the power sector under TGTDCL is presented in the Figure 6.3.1 TGTDCL started gas supply for power generation in 1968. Until 1980 gas consumption remained very low, only 11 BCF in 1980 equivalent to 30 MMSCFD. In 1990 gas consumption in this sector rose to 65 BCF/year equivalent to 180 MMSCFD with CAGR of 22% over this decade In 2000 demand grew to 112.4 BCF or 307MMSCFD marked by 6% CAGR. In 1994 consumption dipped slightly and maintained a sluggish growth till 1998, which is a manifestation of bad performance by the age-old power plants in the government sector. Inadequate supply of gas to the power plants due to shortage of source was another reason for this fall in consumption. Then onwards it again peaked up and since then the trend is rising. This happened due to government policy allowing private sector investment in power generation. AES Meghnagat (450MW) and AES Haripur (360MW) under policy of IPP as well some other small plants under policy of SPP were set up during this period. During the last five years (FY01-06) growth in power sector is 5%. In FY2005-06 the average gas consumption for power was 460 MMSCFD with a maximum of 531 MMSCFD. Total consumption in this year was 167.9 BCF where 74.3 BCF was consumed by private sector power plants.
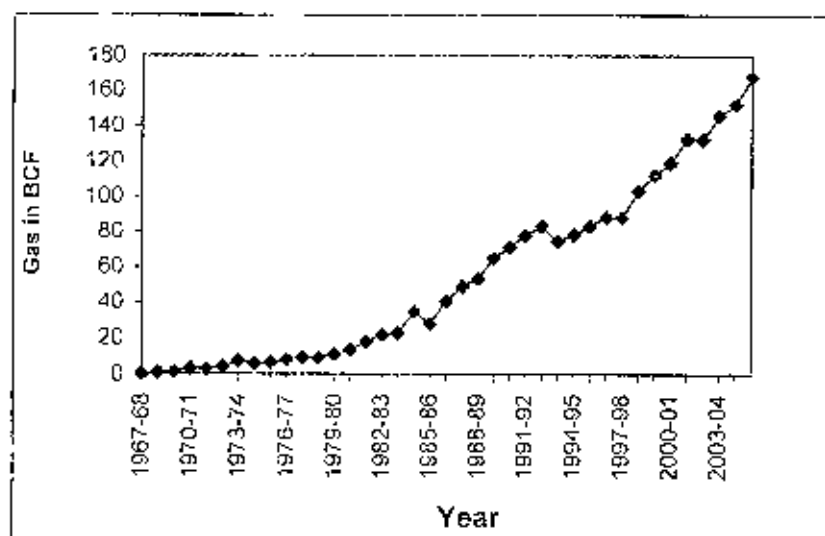
Figure 6.3.1: Gas Consumption in Power Sector in TGTDCL
Source: TGTDCL June 2006

49

Fertilizer Sector

Historical gas consumption in the fertilizer sector under this company is shown in the Figure 6.3.2. Four fertilizer factories namely, Urea Fertilizer Factory Ltd. (UFFL) at Ghorashal, Zia Fertilizer Company Ltd. (ZFCL) at Ashuganj, Palash Urea Fertilizer Factory (PUFF) at Ghorasal and Jamuna Fertilizer Company Ltd (JFCL) at Tarakandi are located in the TGTDCL franchise area. No new fertilizer factory has been installed in this region after the JFCL in 1991. Growth in this sector has virtually stalled since 1993. Maximum consumption in this sector was in the fiscal year 1995-96. During the last five years average growth is nearly 3%. No new fertilizer plant is foreseen in the near future in this region.
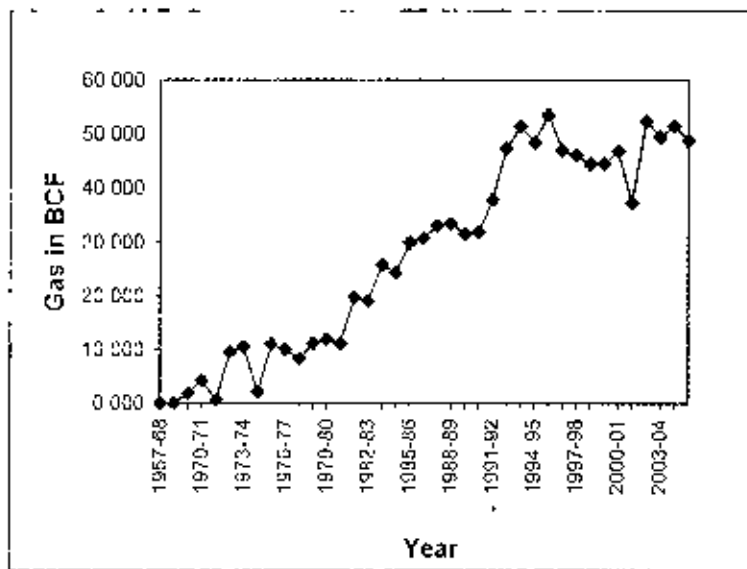
Figure 6.3.2: Gas Consumption in Fertilizer Sector in TGTDCL
Source: TGTDCL June 2006

Industrial Sector

This has emerged as the highest gas consuming sector preceded by power and fertilizer sectors. Historical gas consumption in the industrial sector under TGTCL is given in the Figure 6.3.3 Until 1973 no appreciable growth in the industrial consumption was encountered. This may be attributed to the infancy period of the company and also the political situation in the country. After 1974 consumption in this sector started to really increase and slow but steady growth was experienced upto 1983. From 1983 to 1987, the consumption pattern is erratic. After 1987 this sector showed negative growths and consumption reached to the lowest ebb in 1990-91 year. This is considered to have happened as a consequence of the political turmoil during the last half of eighties. From 1992 to 1999

50

was the period of steady and steep rise. Gas consumption in this sector fell abruptly in 2001. Separation of power gas consumption from industrial, political change over and rise in system loss inflicted this fall. Last three years shows tremendous growth trend. Over the last five years the average growth was 23.5%. Growth in weaving sector (garments, knitting, dyeing) and installation of composite industries are the main contributors behind this steep growth. More detailed discussion will be made on this sector of TGTDCL in the Section 6.5.
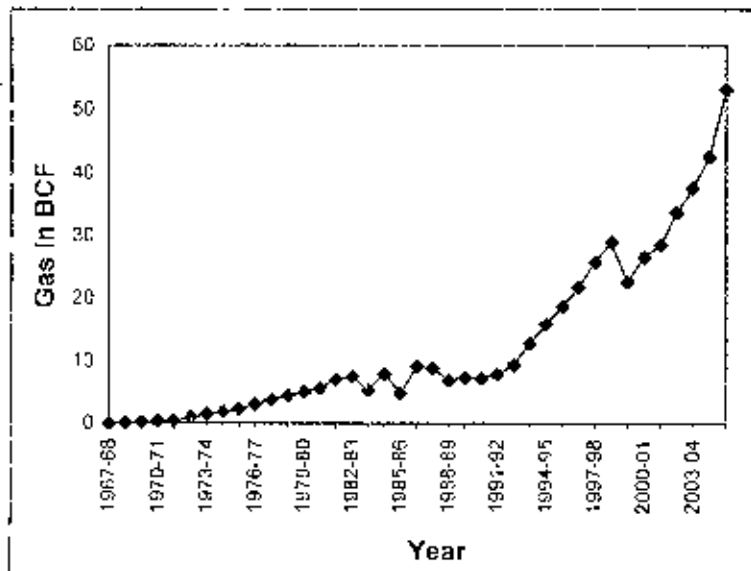
Figure 6.3.3 Gas Consumption in Industrial Sector in TGTDCL.
Source: TGTDCL June 2006

Commercial Sector

Commercial consumption started to increase from 1975 and maintained the trend until 1989 and then experienced a falling trend that continued until 1993. Since then consumption is increasing steadily. However, the amount of gas consumption in this sector very low compared to other sectors. Total consumption in FY2005-06 was 3.072 BCF, equivalent to 9 MMSCFD only. Yearly gas consumptions since the inception are presented in the Figure 6.3.4.
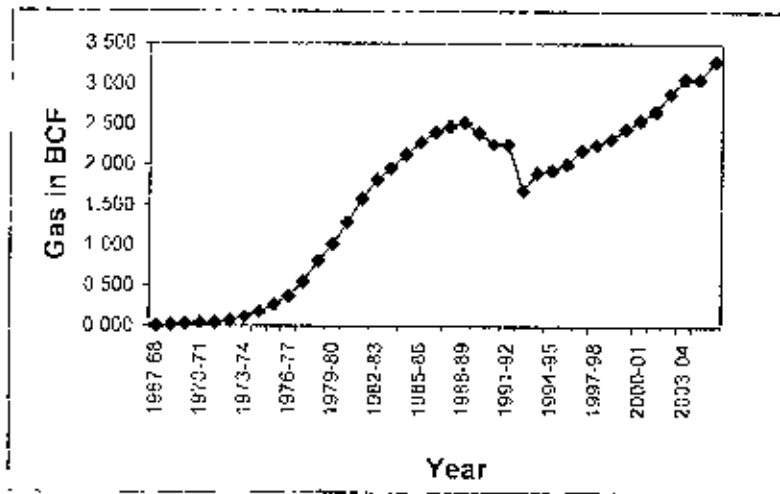
Figure 6.3.4: Gas Consumption in Commercial Sector in TGTDCL.
Source: TGTDCL June 2006

Domestic Sector

Historical gas consumption in the domestic sector under TGTDCL is shown in the Figure 6.3.5. Gas consumption in this sector is gradually increasing. But the period from 1985 to 1992 was relatively slow. Addition new areas with the franchise area of the company lateral expansion and growth housing in Dhaka city have caused the continuous inserting trend. During the last five fiscal years it increased at a rate of 6%, which is very similar to the present urban growth of 5-6%.
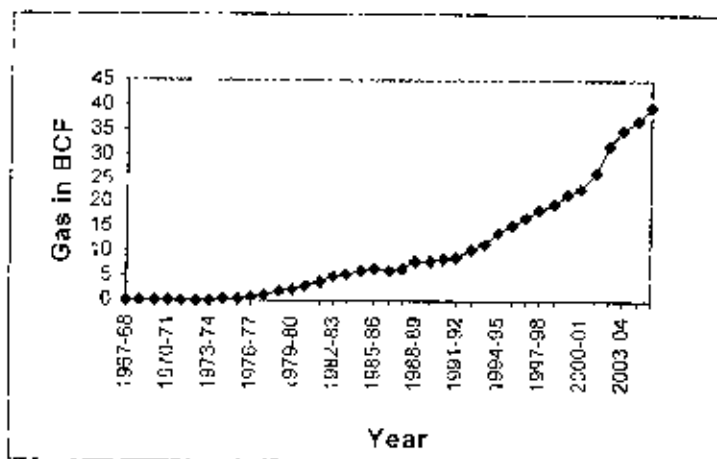
Figure 6.3.5: Gas Consumption in Domestic Sector in TGTDCL
Source: TGTDCL June 2006

52

Captive Power

There has been tremendous growth in captive power generation in the TGTDCL franchise area over the last couple of years. Gas consumption in this sector has increased by 22.3% per annum. Historical gas consumption for captive power sector under TGTDCL for the period of FY1999-00 to FY2005-06 is shown in the Figure 6.3.6.
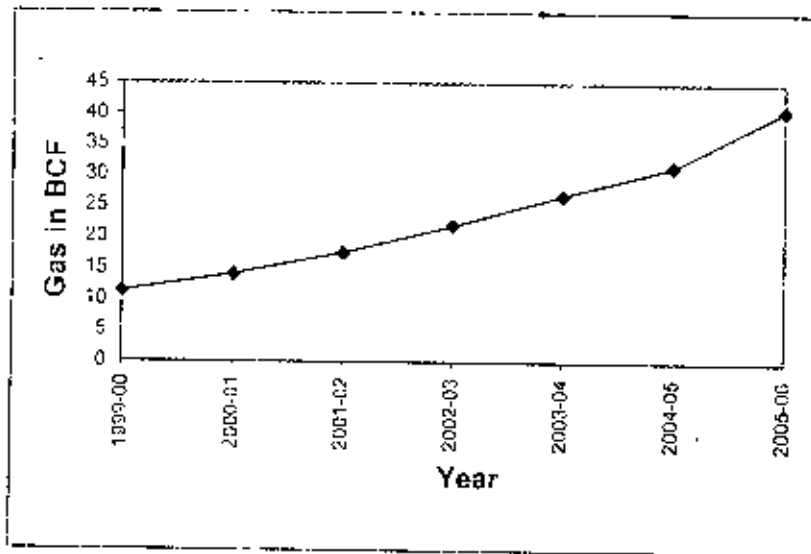
Figure 6.3.6: Gas Consumption in Captive Power Sector in TGTDCL.
Source: TGTDCL June 2006

CNG Sector

CNG sector has attained very high growths during the last three years (FY2003-04 to FY2005-06) to in TGTDCL area. It grew from 0.422 BCF in FY2002-03 to 5.348 BCF in FY2005-06. Introduction of CNG run autorickshaws and ban on air polluting two stroke one has improved the air quality of the Dhaka city. Car owners have been attracted by the favourable tariff of CNG compared to high price of gasoline. Some bus and trucks are also running on CNG. In June 2006 consumption was about 20 MMSCFD in this area.

6.3.2   Sectorwise Growth under BGSL

Power Sector

Historical gas consumption in the power sector under BGSL is presented in the Figure 6.3.7. From 1985 to in 1987 consumption in power sector was only 3.6 BCF, which rose to 8.1 BCF in 1988. Next two years consumption fell to 5.3 BCF. It maintained more or less flat trend

from 1988 to 1991. With commissioning of the Rawjan second unit 1994 gas consumption jumped to 19.2 BCF in 1995. In FY1996-97 fell to 8.5 due to gas flow limitation as a consequence of fall in production from Bakhrabad gas field. Next two years it increased rapidly and since then gas consumption by the two power plants has been more or less steady, around 25 BCF per year. Currently two power plants viz. Rawjan 2×210 MW and Sikalbaha (60MW) purchase gas from BGSL.
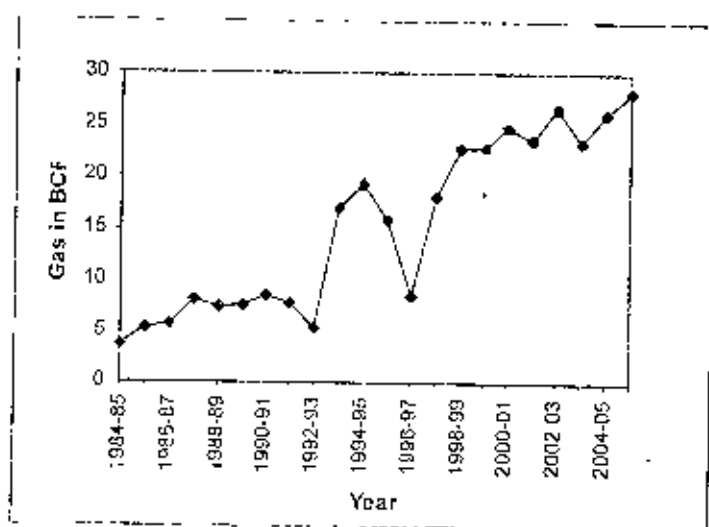
Figure 6.3.7: Gas Consumption in Power Sector in BGSL
Source: BGSL, 2000. MIS June 2002 and MIS June 2006

Fertilizer Sector

As consumption in the fertilizer sector in BGSL franchise area remained very low for the first four years consumption. Historical gas consumption in fertilizer sector under BGSL is shown in the Figure 6.3.8. After starting commercial operation of CUFL gas consumption shot up in FY1987-88 and maintained this level. 5.5 to 5.8 BCF. for next five years. With commission of KAFCO it increased another step then suffered a set back in FY1996-97 fiscal year and in the subsequent years increased steadily although the rate of increment was small. In FY2003-04 it reached a peak of 37.8 BCF. During last two years consumption has fallen due to restricted gas flow to CUFL and to some extent to KAFCO because of flow reduction from Sangu gas field. Four fertilizer factories, namely CUFL, KAFCO, TSP and DAP presently receive gas from BGSL.

54
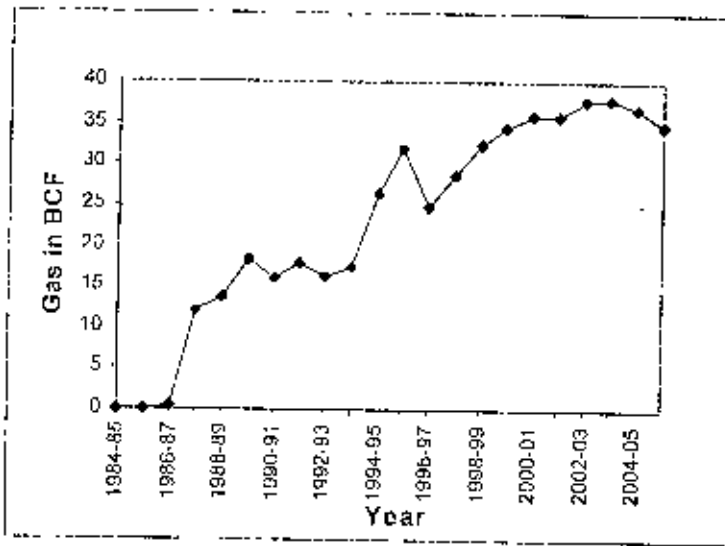
Figure 6.3.8. Gas Consumption in Fertilizer Sector in BGSL.
Source: BGSL. 2000, MIS June 2002 and MIS June 2006

Industrial Sector

Although the country's second commercial centre Chittagong city belongs to the BGSL franchise area growth in sector is not that encouraging. Gas consumption in the industrial sector in the BGSL franchise area did not show any remarkable increase since inception till 2000. Since 2000 it has been increasing albeit at slow pace. Over the last five fiscal years an 8% growth has been observed in the BGSL franchise area. Present consumption level stands at 8.45 BCF per year i.e. 23.1 MMSCFD only. Historical gas consumption is presented in the Figure 6.3.9.
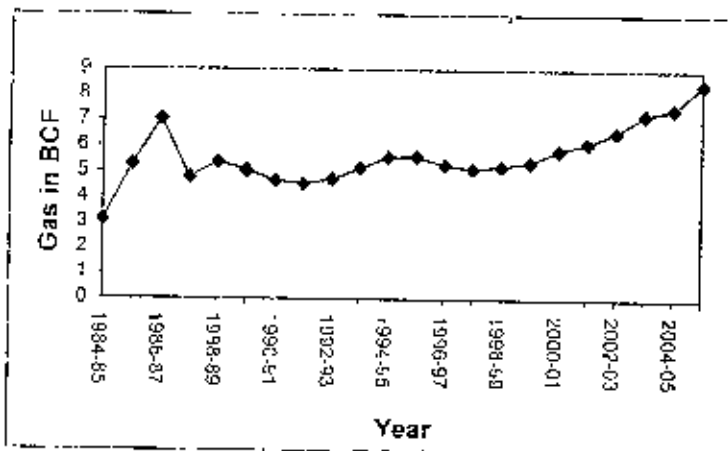
Figure 6.3 9: Gas Consumption in Industrial Sector in BGSL.
Source: BGSL 2000, MIS June 2002 and MIS June 2006

55

Commercial Sector

Gas consumption in this sector in the BGSL franchise is in increasing trend except for the period of 1990 to 1994 when the consumption virtually remained unchanged. Present level of consumption is 1.357 BCF which is equivalent to 3.71 MMSCFD. Historical gas consumption by the commercial sector under BGSL is shown in the Figure 6.3.10.
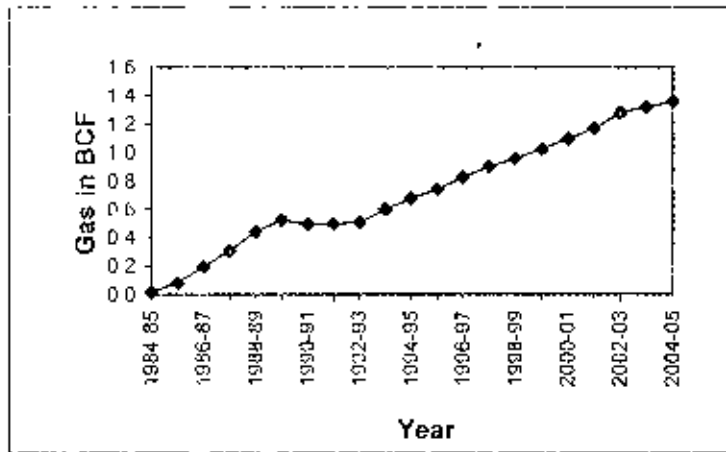
Figure 6.3.10: Gas Consumption in Commercial Sector in BGSL
Source: BGSL 2000, MIS June 2002 and MIS June 2006

Domestic Sector

Domestic sector gas consumption has been on increase throughout the life of BGSL. Over the last five years it has increased at CAGR of 15.3%. Present level of consumption is 12.19 BCF per year or 33.41 million cubic feet per day. Gas consumption by the domestic sector under BGSL since 1984-85 is given in the Figure 6.3.11.
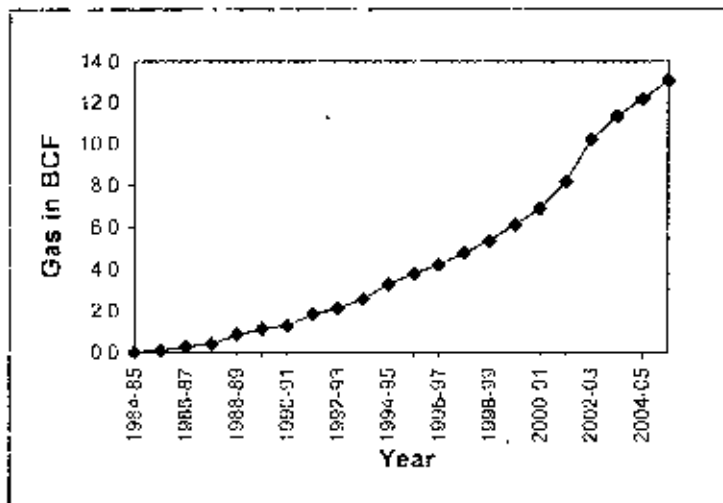
Figure 6.3.11: Gas Consumption in Domestic Sector in BGSL.
Source: BGSL 2000, MIS June 2002 and MIS June 2006

56

Captive Power

Gas consumption in the captive power sector is increasing. During last four years the rise has been very sharp, 23% CAGR. However the overall consumption in this sector is still low, 6.796 BCF per year or 18.6 MMSCFD in 2005-06. Figure 6.3.12 shows the growth trend.
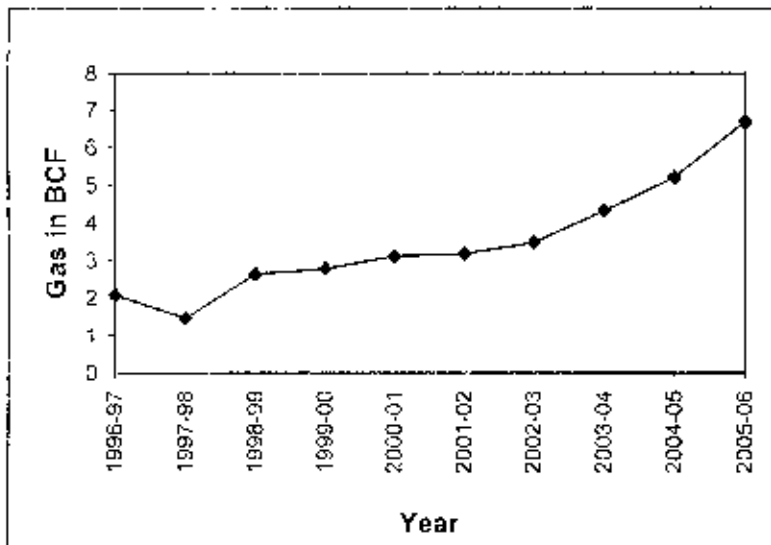
Figure 6.3.12: Gas Consumption in Captive Power Sector in BGSL
Source: BGSL 2000, MIS June 2002 and MIS June 2006

CNG Sector

Gas consumption in this sector in BGSL area started in FY2003-04. There are 17 CNG filling stations in the BGSL franchise area as on June 2006. Consumption in this sector is rising fast, 0.535 BCF per year in FY2004-05 and 1.22 BCF in FY2005-06.

Tea Estate

BGSL has only one Tea Estate customer, which consumed 2 million cubic feet of gas in FY2005-06. No other tea garden is foreseen in the near future.

6.3.3 Sectorwise Growth under JGTDSL

Power Sector

There are three power plants, all of them owned by BPDB, in the franchise area of JGTDSL. They are Sylhet 20MW, Shahzibazar gas turbine (installed capacity 160MW, derated capacity 90MW) and Fenchugonj Combined Cycle (90MW). Historical gas consumption by

57

the power plants under JGTDSL is presented in the Figure 6.3.13. Gas consumption by Sylhet 20MW and Shahzibazr plant fell considerably during 1990 to 1993 due to aging of these two plants. After completion of the rehabilitation program of these two plants and commissioning of Fenchugonj 90MW plant gas consumption increased considerably, 15 BCF in 1998. However, first two plants could not continue to perform up the mark. As a result gas consumption dipped to 10 BCF in 2001. Since then no considerable change has occurred.
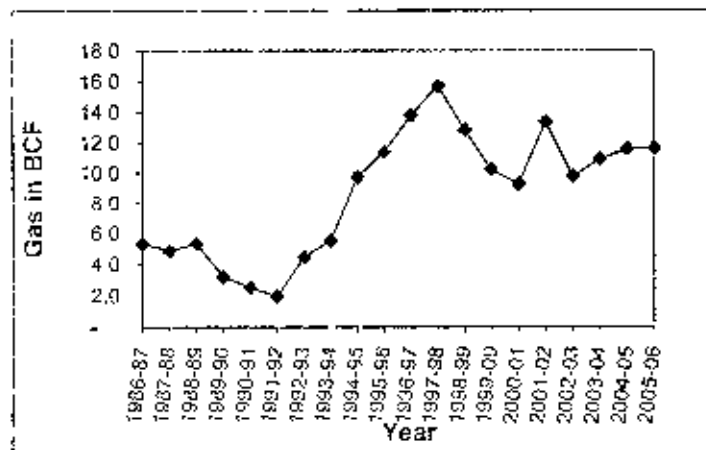
Figure 6.3.13: Gas Consumption in Power Sector in JGTDSL
Source: JGTDSL 1997, MIS June 2002 and MIS June 2006

Fertilizer Sector

Historical gas consumption in fertilizer sector under JGTDSL is given in the Figure 6.3.14. Natural Gas fertilizer Factory limited, set up in 1961 well before the birth of JGTDSL, is the lone customer for gas in fertilizer sector under this marketing company. Gas consumption is fairly constant over the years. 5.5 to 6 BCF per year or 15-16.5 MMSCFD.
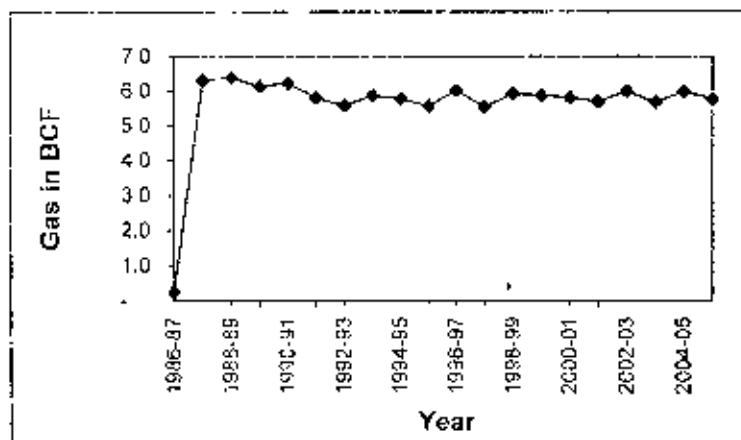
Figure 6.3.14. Gas Consumption in Fertilizer Sector in JGTDSL
Source: JGTDSL 1997, MIS June 2002 and MIS June 2006

58

Industrial Sector

Gas consumption in industrial sector in JGTDSI franchise area has significantly decreased over the last decade. Gas and electricity supply in the Sylhet region is fairly better than other districts. One fact has become very evident here that only supply of utility will not boost the industrialization. Market access, communication, social attitude, are the others factors to be taken into account. It takes long time to reach a commodity to the capital and the port compared to the central part of the country. General attitude of the people of this area is to earn money by working overseas. Entrepreneurship is not that prominent among the people of this region. Ninety of the total gas in this sector was consumed by two industries i.e. Chhatak Cement Factory and Sylhet Paper and Pulp Mill. Closure of Sylhet Pulp and Paper Mill in 2002 caused reduction gas in consumption considerably. Historical gas consumption in the industrial sector under JGTDSI is shown in the Figure 6.3 15.
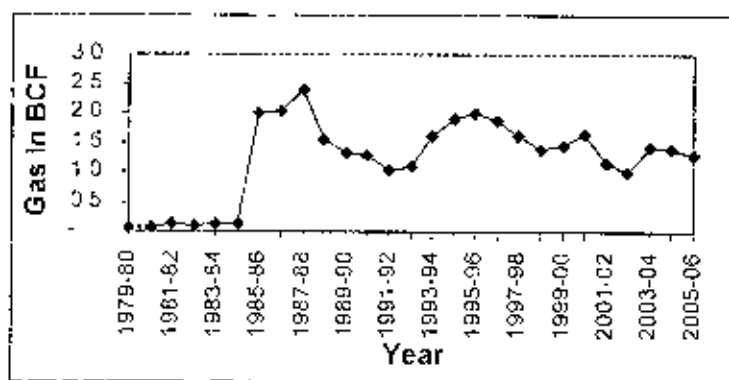
Figure 6.3.15- Gas Consumption Industrial Sector in JGTDSI
Source: JGTDSI, 1997, MIS June 2002 and MIS June 2006

Commercial Sector

Gas consumption in the commercial sector under JGDTSL is rather low. For the last five years growth in this sector has been virtually absent indicating some sort of stagnancy or saturation. During FY2005-06 fiscal year consumption in this sector was only 0.426 BCF or 1.16 MMSCFD. Figure 6.3.16 shows the historical gas consumption in commercial sector under this company.
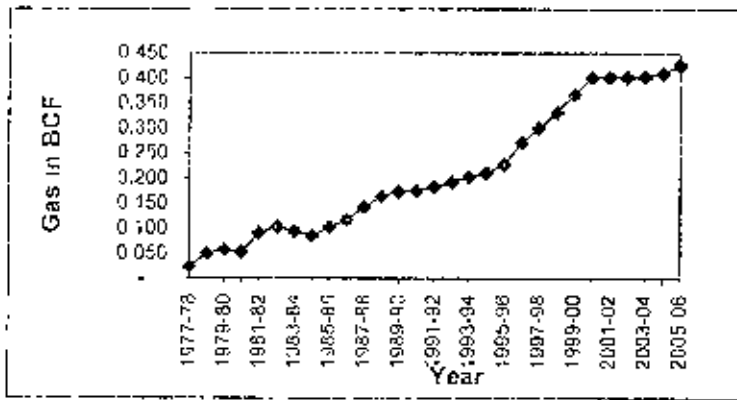
Figure 6.3.16: Gas Consumption Commercial Sector in JGTDSL.
Source: JGTDSL 1997, MIS June 2002 and MIS June 2006

Domestic Sector

Gas Consumption is steadily increasing in Jalalabad franchise area. Over the last five years the average growth in this sector was 11.7%. Amount of gas used in this sector in the fiscal year 2005-06 was 3.472 BCF, which is equivalent to 9.5 MMSCFD. Figure 6.3.17 shows the gas consumption since inception of this company.
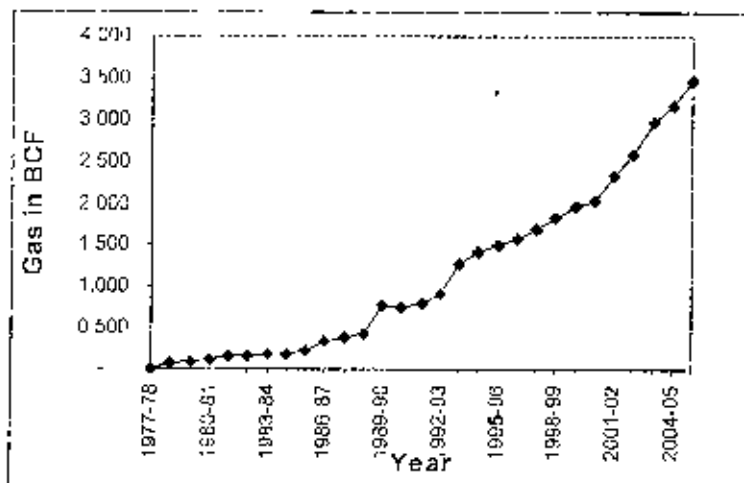
Figure 6.3.17: Gas Consumption Domestic Sector in JGTDSL
Source: JGTDSL 1997, MIS June 2002 and MIS June 2006

Captive Power Sector

Gas consumption in this sector has not seen appreciable change in the JGTDSL franchise area over the years. As in the case industry Chattak Cement Factory, Sylhet Pulp and Paper Mill and the tea gardens are the major consumers in this sector. Lafarge cement factory has also started receiving gas for captive power since 2005. Only three captive power customers, all

60

belong to Saiham, are there other than tea gardens and cement factories. Historical gas consumption in captive power sector under JGTDSL is shown in the Figure 6.3.18.
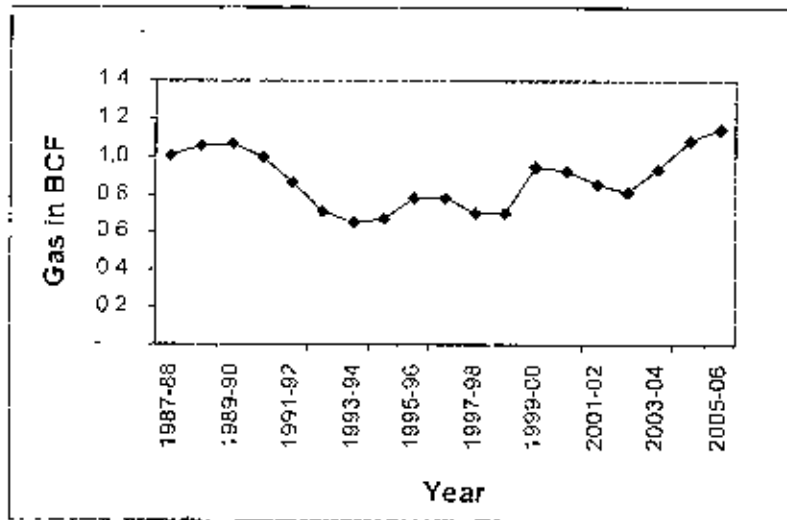
Figure 6.3.18: Gas Consumption Captive Power Sector in JGTDSL
Source: JGTDSL 1997, MIS June 2002 and MIS June 2006

Tea Estate

There are 87 customers in this sector. Gas consumption is this sector was more or less unchanged over the last one and a half decade, which is indicative of saturation of the market. It may be noted that total consumption in this sector is very low, about 0.8 BCF per year. In the off season, November to February, the consumption is almost. Figure 6.3.19 shows historical gas consumption in JGTDSL area.
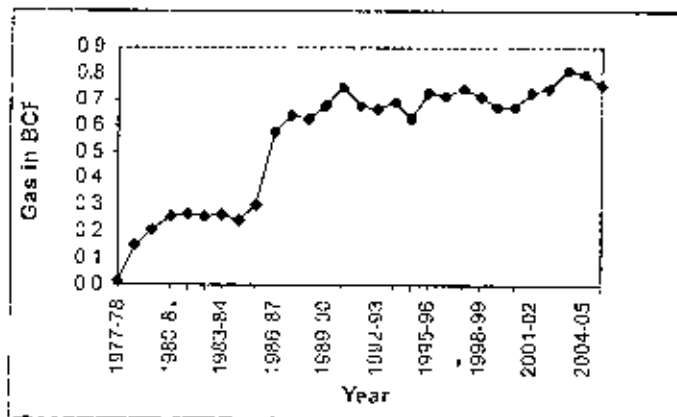
Figure 6.3.19: Gas Consumption in Tea Estates in JGTDSL
Source: JGTDSL 1997, MIS June 2002 and MIS June 2006

61

CNG Sector

Gas consumption in CNG sector in the greater Sylhet started in FY2004-05 with early consumption of 17 MMSCF that year. Total 5 CNG stations consumed 370 MMSCF gas in FY2005-06.

6.3.4 Sectorwise Growth under PGCL

Power Sector

There are three power plants namely: Baghabari 70 MW of PDB. Baghabari 100 MW of Westmont and the Baghabari barge mounted 90 MW. Consumption in these plants increase from 13.5 BCF in 2001 to 21.2 BCF in 2005 but there has been a drop in FY2005-06 due mechanical problem in Westmont power plant. Figure 6.3.20 shows the historical gas consumption in power sector under PGCL.
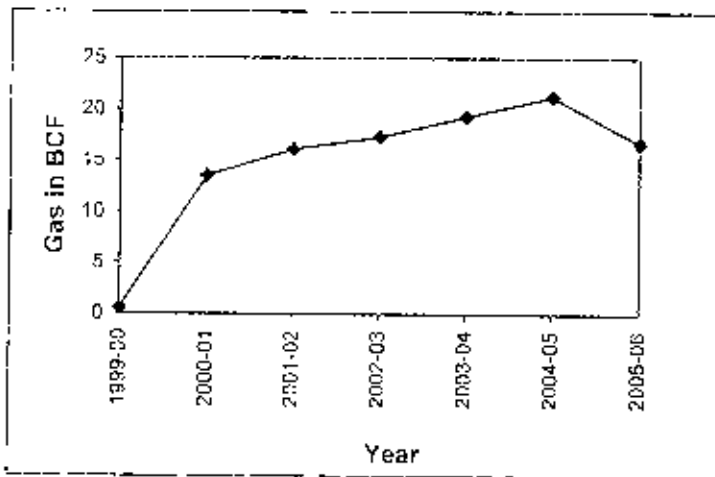
Figure 6.3.20: Gas Consumption Power Sector in PGCL
Source: MIS June 2002 and MIS June 2006

Non Bulk Sectors under PGCL

Domestic sector consumption is increasing fast. As on June there were 19,081 domestic customers in PGCL area. In FY2005-06 domestic sector gas consumption was 0.490 BCF and 33 industrial customers consumed 0.325 BCF in the last fiscal year. Five captive power customers consumed 0.177 BCF while one CNG filling station has just started operation. Overall non-bulk sector gas consumption was only 2.89 MMSCFD in FY2005-06 on average and maximum was 4.5 MMSCFD. This indicates lukewarm response from the entrepreneurs.

6.3.5 Sectorwise Proportions of Gas Consumption under Companies

Total 6.563 TCF of gas was consumed in the country as on June 2006. TGTDCL area alone has consumed 72% followed by BGFCL that consumed 19%. JGTDCL and PGCL, accounted for only 7% and 2% respectively. This proportion indicates that sizes of the distribution companies in terms of gas consumptions are highly disproportionate. In the TGTDCL franchise area, power sector leads in the cumulative gas consumption in all the companies except BGSL where fertilizer is the highest gas consuming sector under BGSL with 45.4% share. Power sector comprises 97.4% gas consumption in the PGCL franchise area. Figure 6.3.21 shows the percentages of gas consumptions under four distribution companies.
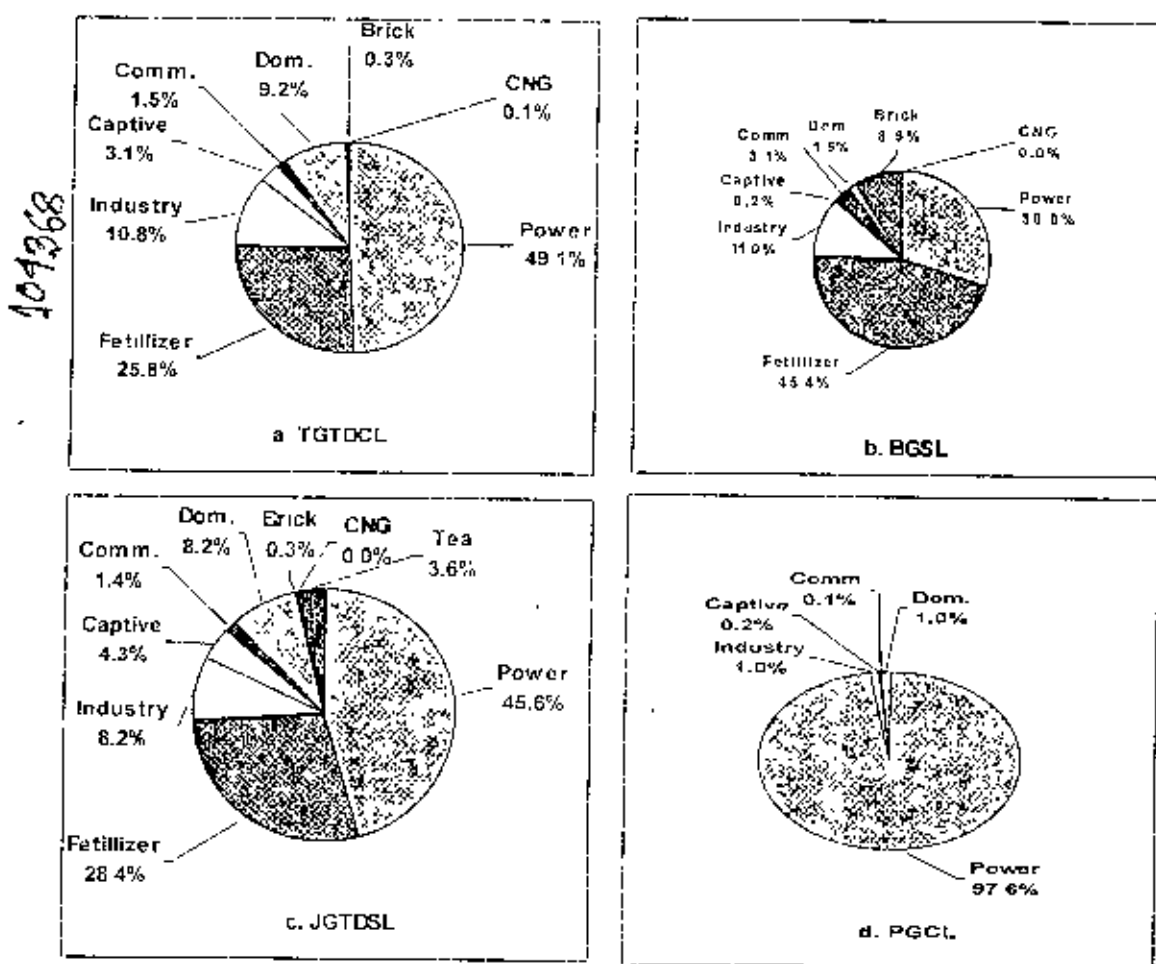
Figure 6.3.21: Proportions of Sectorwise Consumption under Distribution Companies

6.4 Sub-Regional Growth Study

Sales center-wise gas consumption data of the Titas area for non-bulk sectors were collected where possible for the period of 1994-1995 to 2004-05 fiscal years. For BGSL, data of Comilla and Chittagong regions were possible to collect. Sub-regional gas consumption data for the non-bulk sectors are presented in the Appendix A, Table A1 1.1 and Table A1.2.1. It has been noticed that domestic sector consumption has been increasing in all regions irrespective of the distribution companies, while there have been large variation in the growth of others sectors particularly industrial and captive power sector. Depending upon the trend of growth the sub-regions may be classified as high growth areas, medium growth areas and low growth areas. Both growth rate and volume of gas has been taken into consideration while making such classification. Nature and causes of growth in the high and medium growth areas have been discussed into greater detail in the following sub-sections. At the end of this section information on communication, land price and number of industrial growth rate etc are given in the Table 6.4.1.

Table 6.4.1: General Information on Zones

Zones	Distance From Dhaka, (Km)	Mode of Transport			Land Price 000 Tk/per Decimal	No. of Industry	Industrial Growth rate 2000-05 (%)
		Road	Rail	River			
Narayanganj	25	√	√	√	300-120	326	10
Tongi	20	√	√	√	600-100	153	11
Sonargoan	30	√	√	√	200-20	259	11
Joydevpur	35	√	√	X	300-30	279	20
Savar	35	√	√	√	500-40	259	12
Narsindi	45	√	√	√	200-40	157	22
Valuka	140	√	X	√	150-20	24	61
Tangail	60	√	√	√	100-30	28	22
Vairab	84	√	√	√	100-20	8	5
Ashuganj	85	√	√	√	120-30	-	0
B.Baria	110	√	√	√	150-50	9	5
Mymensingh	193	√	√	√	150-50	6	-6
Manikganj	80	√	X	√	120-50	15	3
Munshiganj	60	√	X	√	200-60	17	9

6.4.1 High Growing Areas

Joydevpur, Savar, Sonargoan, Tongi, Valuka, Dhaka metropolitan area under TGTDCL may be classified as the high growing areas in the non-bulk sectors. All of them except Dhaka Metropolitan area having growth rates above 15%, Dhaka has been included in this group in spite of 12% growth because of its volume of consumption. High growing areas are marked in yellow on the franchise area map of TGTDCL as in Figure 6.4.1.

Joydevpur

Over the last five years Joydevpur has experienced an average growth of 39% per year where sector wise growths are: industry-20%, captive power-89%, commercial-15% and domestic-37%. High plain lands at relativity low cost along with good communication with capital are the main attractions for the investors to be interested in this area. It is linked with the Dhaka city by both road and railway. Although land phone connections are not easily available, telecommunication is no more a problem in recent years because mobile phone has mitigated this problem to a great extent. Introduction of corporate customer system by the mobile phone companies has been very useful for the big industries Knitting, dyeing, garments, composite textile-garment factories are the major consumers of gas in the industrial sector as well as captive power sector in this area. There are some ceramic industries in this area and due to their flourishing business they are opening new units. One prospective investor has applied for gas connection for a new ceramic industry. Major fraction of the industrial customers generates electricity for their own use by gas engine driven generator. Due to favourable environment, there have been migrations of industries from Dhaka city to this area and it is expected that this trend will continue. Agricultural crop production used to be the main occupation of the people of this locality. Industries are being set up on the agricultural land. In FY2004-05 average daily consumption was 54 MMSCFD that may reach 170 MMSCFD by FY2009-10.

Savar

Savar region has marked tremendous growth in gas consumption, 23% over the last five years. Sector wise growth rates are: captive power-74%, industry-16%, domestic-15% and commercial-8%. Several factors such as its location, availability of land at lower price, communication, availability of labour, market access are the main reasons behind the high growth of various industries Knitting, dyeing, sweater factories, composite garment factories

are the major consumers in the industrial sector in this area. There are some ceramic industries too. Garments industries use gas for the boiler to generate steam for ironing cloths and for generating power to run machines owing to unreliable grid power. Land is much cheaper than in the city. People can get to the capital within an hour from the work place. Evacuation of products by road can be done very easily. Fixed phones are available although it is very difficult to get a new phone connection. The area is under the coverage of mobile phone operators and mobile phone has greatly eased the telecommunications as elsewhere Agricultural activities used to be the traditional occupation of the people in this area but it is being rapidly replaced by industrial and commercial activities. In FY2004-05 average daily consumption was 48 MMSCFD. It may reach 66 MMSCFD in FY2009-2010.

Sonargoan

Sonargoan has experienced overall growth of 15% over the last five years when the sector wise growths were industry-11%, captive power-20%, commercial-10% and domestic-11%. Sonargoan, Bandar, Rupgonj, Arihazar thanas of Narayanganj district and Gazaria of Munshiganj is under the jurisdiction of Sonargoan sales zone. Textile, knitting, dyeing, cement factory, paper mill, automatic salt industries are the large industries in this area. Most of the large industries are in Sonargoan upzilla while small industries are growing in Bandar upzilla. This area used to be low land but the Tarabo to Dawoodkandi dam has increased the value of this area. Easy communication with Dahka, Chittagong and the other part of the country has been the main reason for rapid industrialisation of this area. Unlike Joydevpur and Savar, Tongi and Metropolitan area Soanrgoan area does not suffer from low gas pressure. Telephone connection is still remains very difficult to get. This area is still under the Narayanganj Telephone exchange However, like other areas, mobile phone companies have successfully served the telecommunication needs. A digital telephone exchange is going to be set up in Rupganj, which might ease the fixed phone crisis. Land is still much cheaper than Narayanganj area. Intensive farming is still the main occupation of the rural people. Sudden price hike of the land changed the fortune of many in this area.

In FY2004-05 average daily consumption was 37 MMSCFD that may reach 68 MMSCFD in FY2009-2010.

Narayanganj

Narayanganj has been a business centre for centuries. Inland river port, road and rail link with the other part of the country have also attracted investors to set up various industries in this region. Overall growth in gas consumption in Narayanganj is 16% while sector wise growths are: industry-10%, captive power-23%, commercial-21% and domestic-24%. Knitting, dyeing, sweater factories, composite garment factories are the major consumers in the industrial sector in this area. There are some lime and re-rolling steel industries in Narayanganj as well. Telephone coverage is good and is comparatively easy get a new phone connection. Industry and trading are the main economic activity of the people of Narayanganj. It may be noted here that theft of gas in the name of system loss is very high in this region. In FY2004-05 average daily consumption was 55 MMSCFD that may reach 81 MMSCFD in FY2009-10.

Valuka

Until very recent times Valuka hardly had any industrial activity. After the natural gas network extension to this area, it has drawn much attention of the entrepreneurs. Dhaka-Mymensingh road has made the communication faster with the capital city. Cheap land and labour are also other attractions of the area. Over the last five years growth was 36% when industrial, captive power and domestics sectors grew at the rates of 61%, 32% and 26% respectively. Now it can be termed as the potential growth centre for industry. Intensive cropping used to be traditional occupation of people of Valuka. Fishery and poultry have emerged as popular economic activity of the local people. In FY2004-05 average daily consumption was 8.7 MMSCFD it may reach 22 MMSCFD in FY2009-10.

Narsingdi

Overall growth in gas consumption in Narsingdi was 26% over the last five years where industrial, captive power and domestic sectors have grown at the rates of 22 and 40% and 31% respectively. Textiles, dyeing, knitting, spinning, pharmaceuticals are dominant industries in this town and in its suburb. In FY2004-05 average daily consumption was 15 MMSCFD which may reach 40 MMSCFD by FY2009-10.

Tangail

Gas demand in Tangail is also growing fast, at an average rate of 39% over the last five years. Sectorwise growths during this period were: Industrial-22%, captive power-60%, domestic-17% and commercial-3%. Spinning, dyeing, textile and pharmaceutical are the dominants industries in Tangail. In FY2004-05 average daily consumption was 7.7 MMSCFD that may rise to 18.5 MMSCFD in FY2009-10.

Dhaka Metropolitan Area

Dhaka is not only the capital city of the country but also the centre of all administrative, commercial and industrial activities. Gas consumption in non-bulk sectors in Dhaka metropolitan area used to constitute the major portion of TGTDCL's non-bulk sales until FY1998-99. Since then dominance of Dhaka is gradually declining due to expansion of regional load centers. Presently it shares around 33% of TGTDCL's non-bulk consumption. Although the costs of land and floor space are getting increasingly expensive, gas consumption in the industrial, commercial and captive power sector is consistently on the rise. Over all growth in the non-bulk sector in the metropolitan area is 12% which quite high given the total volume. Industrial and captive power sector growths are 9% and 39% respectively while CNG has shown a tremendous increase over the last three years-165%. Domestic sector still maintains the growth rate of 10%. According to Real Estate & Housing Association of Bangladesh (REHAB) at the present Dhaka city needs 60,000 new housing units each year while REHAB members can supply 5,000 to 6,000 units per annum. They have estimated 10% growth per annum of their business for the next couple of years. In FY2004-05 average consumption was 126 MMSCFD, is likely to rise up to 175 MMSCFD by FY2009-10.

Figure: 6.4.1: High Growth Areas under TGTDCL

6.4.2 Medium Growing Areas

BGSL has experienced medium pace growth in non-bulk sectors In Chittagong region industrial and captive sector growths were 7 and 8% respectively. Comilla region has grown faster than Chittagong. However, total volume is much higher in Chittagong region than Comilla

6.4.3 Low Growing Areas

Mymensingh, Kishoreganj, Netrokona. Sherpur. Jamalpur Vairab. Brahmanbaria are the areas under TGTDCl. where growth has been minimal over last ten years. Till 2005-06 thre has been no industrial or captive power connection in Kishoreganj. Netrokona. Jamalpur. Sherpur Mymensingh had six units, all of them food and bakery. It has been known that one knitting industry is being set up at Shambugonj in Mymensingh. All utilities are available in Mymensingh. Communication by Rail. road and waterways are available. Lack of entrepreneurship and attraction of people towards capital might be the only reason behind the low industrial growth in Mymensingh. Brahmanbaria has 9 small industrial units consisting of silicates. soap. aluminum etc. for the last couple of years. BGFCL's office is the only captive power customer in B Baria.. Vairab is very much similar to B.baria. Even Ashuganj does not have any industrial customer for gas. There has been hardly any industrial sector gas consumption.

Entire JGDSL franchise has shown very low growth over the years, even negative growth in recent years.

It will be premature to make any firm remark on PGCL area. However. over the last six years non-bulk consumption has been very low which might be considered as a precursor to future low growth.

6.5 Industry Categorywise Gas Consumptions

Both in the industrial and captive power sectors garments, textile, spinning and knitting are the leading consumers which consume 65% of industrial and 43 2% of captive power sector gas of countrywide consumptions in these two sectors. Steel (mainly re-rolling and molding to some extent) occupies the second position in the countrywide industrial sector gas

70

consumption with 9.6% share. Ceramic, chemical, pharmaceuticals paper, packaging food and beverage are the other types of industries whose contributions are worth mentioning.

6.5.1. Industry Categorywise Gas Consumption under TGTDCL

Garments, textiles, spinning and knitting as a group accounts for 68% of industrial, and 76% of captive power sector gas consumption in the TGTDCL franchise area. Steel (mainly re-rolling and molding) consumes 9%; ceramic, chemical each shares 3.3% of the industrial gas consumption of this company. Paper, packaging share 6.5% while ceramic shares 2 4% of captive power sector gas. No other type of industry exceeds 1% as an individual group in the captive power sector Industry categorywise consumption in industrial and captive power sector under TGTDCL is presented in Table 6.5.1 and Table 6.5.2.

Table 6.5.1: Industry Categorywise Gas Consumption, Industrial Sector, TGTDCL

Gas in MMSCM

Type	FY -99-00		FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Garments												
Knitting	813	448.246	882	482.931	975	513.545	1053	624.97	1205	719.322	1337	819.841
Dyeing												
Textile												
Jute	1	1.113	1	1.258	1	1.558	1	1.456	1	1.625	2	2.214
Steel	175	72.269	173	74.243	181	79.672	195	95.833	210	101.429	214	107.175
Metal												
Molding	1	0.006	1	0.006	1	0.006	1	0.007	1	0.007	1	0.007
Wire	0	0.000	1	0.155	1	0.564	1	0.564	1	0.456	1	0.228
Aluminium	1	0.315	1	0.315	1	0.325	1	0.315	1	0.321	2	0.315
Ceramics	25	29.13	24	27.25	27	27.93	28	35.22	29	35.88	29	38.24
Glass	5	2.326	4	2.156	4	2.211	4	2.300	4	2.374	4	2.387
Chemical	53	26.075	53	28.970	52	30.737	56	36.563	60	38.131	63	39.516
Silicate	1	3.518	4	3.5	4	3.679	4	3.62	4	3.644	4	3.449
Soap	17	5.710	17	5.524	18	5.144	18	5.28	18	3.997	18	4.915
Mos. Coil	0	0.000	0	0.000	1	0.199	1	0.226	1	0.215	1	0.215
Pharma	13	3.6953	13	4.51	13	4.662	13	4.6158	15	5.0186	16	5.5681
Plastic			4	0.892	4	0.883	4	0.911	6	1.128	6	1.286
Paper	6	6.535	6	8.375	6	8.392	6	7.791	8	9.014	9	9.657
Packaging	2	0.585	2	0.641	2	0.752	3	0.916	3	0.977	4	1.016
Board	2	2.572	2	2.741	2	2.856	2	2.25	2	1.425	2	3.023
Food & Beverage.	26	5.6406	42	11.254	47	8.853	41	8.234	46	4.609	43	9.776
Bakery	63	13.453	89	15.842	91	17.114	95	23.899	102	26.098	96	28.302
Dairy	0	0.000	0	0.000	0	0.000	0	0.000	1	0.521	1	0.521
Paltry	0	0.000	0	0.000	0	0.000	0	0.000	2	0.560	2	0.590
Battery	1	0.029	1	0.031	1	0.029	1	0.030	1	0.032	2	0.355
Electronics	1	0.590	2	1.370	2	0.730	1	0.710	1	0.750	1	0.740
Lime	14	8.617	12	9.284	11	9.688	14	11.331	11	8.621	12	8.902
Agro	1	1.599	1	1.728	1	1.661	1	1.356	1	2.051	1	2.155
Salt	6	4	7	6	7	6	10	8	17	13	20	15
Sugar	1	0.007	1	0.007	1	0.007	1	0.007	1	0.007	1	0.007
Footwear	2	0.440	2	0.484	2	0.549	2	0.682	2	0.728	2	0.766
Tobacco	2	1.829	2	2.068	2	1.922	2	2.043	2	1.167	2	2.163
Tenary	45	4.350	45	4.350	45	4.355	44	4.852	44	5.172	44	5.164
V. Oil	5	6	5	4	6	5	6	5	7	6	7	6
Others	247	33.395	397	39.26	486	67.024	448	73.068	479	73.186	485	84.719
Total	1562	682.52	1794	758.12	1995	806.44	2054	962.75	2286	1067.73	2432	1204.19

N= Number, V = Volume

Source: RSD Division and Marketing Division, TGTDCL.

Table 6.5.2: Industry Categorywise Gas Consumption, Captive Power, TGTDCL

Unit : MMSCM

Type	FY 99-00		FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Garments	9	8.6009	11	20.233	11	27.099	16	41.296	23	49.455	30	57.343
Spinning	19	41.11	27	92.461	36	128.19	46	201.05	51	220.5	63	262.02
Knitting	9	34.607	13	36.77	14	43.325	17	55.734	21	60.071	22	69.575
Dyeing	10	9.104	11	11.385	13	16.996	14	19.826	22	26.053	32	43.525
Textile	40	101.37	44	140.41	50	164.17	58	187.93	74	232	81	253.07
Sub-total	87	197.79	106	301.23	124	380.08	151	505.833	191	588.08	228	685.53
Ceramics	3	2.8058	6	5.2101	7	10.576	7	12.934	11	17.511	11	21.857
Steel	4	2.12	5	4.93	5	4.905	6	5.77	6	6.037	6	6.041
Metal Aluminium	1	1.542	1	1.542	1	1.744	1	1.626	1	1.626	1	1.626
Cement	0	0	0	0	1	0.501	1	0.546	1	0.513	2	0.545
Glass	1	1.1	2	2.181	2	2.299	2	2.379	2	2.315	2	2.404
Jute	1	1.501	2	5.877	2	5.903	2	5.656	2	6.245	3	6.318
Chemical	1	0.5	3	3.46	3	3.9032	5	4.014	6	2.309	7	2.3106
Pharmaceutical	5	4.104	5	7.242	5	7.273	6	8.768	7	9.7704	10	10.149
Paper	4	4.915	9	30.432	9	35.353	10	39.908	15	42.236	15	57.517
Packaging	1	0	1	0.758	2	0.967	3	0.942	3	0.942	3	0.907
Hardboard	2	1.751	2	2.552	3	2.661	6	4.476	6	4.588	6	4.661
Paltry Feed	0	0	0	0	1	0.61	1	0.59	3	1.172	3	1.274
Agri products	1	1.35	1	2.223	1	2.223	1	1.932	1	2.231	1	2.231
Melamine	0	0	1	0.85	2	1.85	2	1.82	2	1.8	2	1.944
Leather	0	0	0	0	0	0	1	0.91	1	0.88	1	0.929
Polythene	0	0	0	0	0	0	1	0.425	1	0.603	1	0.603
Plastic	0	0	0	0	2	1.21	3	4.61	4	8.009	4	9.583
Rubber	0	0	1	1	1	1.281	2	1.281	2	1.221	2	1.281
Polymer	0	0	0	0	1	0.371	1	0.371	1	0.371	1	0.371
Food & Bev.	8	1.061	5	1.905	5	2.985	7	6.63	8	6.96	10	8.494
Bakery	2	0.88	3	1.543	4	1.717	4	2.517	4	2.917	4	3.383
Vegetable Oil	1	1	5	4.256	6	4.525	6	4.425	6	4.956	7	7.7414
Dairy	0	0	0	0	0	0	0	0	2	3.79	2	3.856
Battery	2	1.1	2	1.75	2	1.919	3	2.019	3	2.119	3	2.159
Soap	1	0.53	1	0.48	1	0.85	1	0.32	2	0.8	2	1
Electrical	1	0.59	2	1.37	2	0.75	1	0.71	1	0.75	1	0.74
Sugar Mill	0	0	0	0	0	0	0	0	1	1.5	1	1.67
Cable	1	0.043	1	0.043	1	0.043	1	0.043	1	0.043	1	0.043
Tobacco	2	0.7	2	4.316	2	4.565	2	4.565	2	4.2515	2	4.432
Seed								1.5	1	1.554	1	1.567
Oxygen	1	0.505	1	0.515	1	0.75	1	0.75	1	0.9	1	1.112
Others	2	0.861	12	8.251	19	16.642	19	22.721	36	30.81	43	41.224
Total	132	226.78	179	393.92	215	498.48	257	650.99	334	759.81	387	895.51

Source: RSD Division and Marketing Division, TGTDCL

6.5.2. Industry Categorywise Gas Consumption under BGSL

In the BGSL area though total industrial sector consumption is much lower than that of TGTDCL. Pattern of industries are more or less same. Garments, textiles, spinning and

knitting as a group retain dominance in the industrial and the captive power sectors of BGSL too, but to lesser degree than TGTDCL area. Garments, textiles, spinning and knitting as a group accounts for the 56% of industrial sector gas consumption followed by steel with 16% consumption. Garments, textiles, spinning and knitting as a group consume 26% and steel does the 15% of the captive power sector consumption. Industrywise gas consumption under BGSL is presented in Table 6.5 3 and Table 6.5.4.

Table 6.5.3: Industry Catergoywise Gas Consumption, Industrial Sector, BGSL

Gas in MMSCM

Type	FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V
Garments	164	68	191	71	207	77.5	233	93	240	100
Dyeing & Knitting	50	4	53	5	54	8	61	12	61	15
Textile	4	1	4	1	3	1.56	5	2	5	2
Subtotal	218	73	248	77	264	87.06	299	107	306	117
Ceramic	1	0.08	1	0.07	1	0.07	1	0.07	1	0.07
Steel & Re-rolling	72	30.17	76	33.47	84	36.47	88	34.5	85	33
Aluminium	7	0.55	10	0.77	10	1.15	10	0.62	10	1.06
Engineering	4	0.07	3	0.12	2	0.1	2	0.1	3	0.23
Pharmaceuticals	4	0.21	4	0.39	7	0.46	8	0.49	11	0.71
Bakery/Food	48	4.18	48	4.5	48	5	55	5	66	5.50
Beverage	1	0.61	1	0.69	1	0.7	1	0.88	2	0.73
Edible Oil	2	0.50	2	0.4	1	0.4	1	0.43	1	0.35
Silicate/Chemicals	6	1.36	6	0.97	7	0.93	6	0.53	8	1.34
Soap	27	1.14	27	1.02	27	1	26	1.03	26	0.79
Footwears	1	0.22	1	0.26	1	0.26	1	0.24	1	0.26
Pottery	1	0.05	1	0.05	1	0.04	1	0.04	1	0.05
Autobricks	1	0.02	1	1.32	1	1.3	1	1.42	2	1.98
Salt	9	0.64	14	0.97	18	1.82	23	2	26	3.84
Glass*									1	0.44
Plastic									1	0
Gov Industries		52.71		51.49		49.75		47.33	25	42.6
Total	402	165.5	443	173	473	186.51	523	202	576	210.0

Source: Marketing Division, BGSL

Table 6.5.4 : Industrywise Gas Consumption, Captive-Power, BGSL.

Gas in MMSCM

Type	FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V
Garments	6	9.410	6	10.990	6	11.125	8	16.630	11	19.100
Dyeing & Knitting	3	2.480	5	3.010	5	4.125	5	4.510	6	6.680
Textile	3	6.320	3	7.310	3	6.125	4	8.100	5	11.050
Sub-total	12	18.210	14	21.310	14	21.375	17	29.240	22	36.830
Steel & Re-rolling	2	1.030	2	1.060	2	6.270	4	14.215	4	25.950
Pharmaceuticals	1	0.220	1	0.280	1	0.320	1	0.330	2	0.250
Bakery/Food	4	2.390	5	3.230	5	5.460	8	6.090	9	6.290
Beverage	1	0.000	1	0.000	1	0.000	3	1.220	5	2.700
Edible Oil	1	0.870	1	0.730	1	0.600	1	0.310	1	0.320
Silicate/Chemicals	2	1.480	2	0.310	1	0.280	1	0.280	0	0.000
Salt									1	2.570
Paper & packaging	1	0.190	1	0.490	1	0.470	2	0.970	5	2.870
Jute*	2	2.730	2	2.830	2	3.070	2	3.180	2	3.050
CNG									1	0.450
Eastern Refinery	1	5.100	1	5.100	1	5.645	1	5.100	1	5.100
Cement	1	4.300	1	4.300	2	6.890	2	7.125	2	7.500
Oxygen	2	5.040	3	5.650	4	6.370	3	6.450	4	6.530
PHP Power			1	10.000	1	12.125		16.250	2	19.270
Gov Industries		15.400		39.390		36.070		32.370		29.53
Others			1	0.110	1	0.240	1	0.34	1	0.300
Total	30	87.520	36	94.790	38	105.12	46	123.47	62	149.510

Source: BGSL.

6.5.3 Industry Categorywise Gas Consumption under JGTDSL

Gas consumption by the both in the industrial and captive power sectors is highly dominated by the two cement factories. Chattak Cement Factory and Lafarge Cement factory consume about 89% of total industrial sector consumption, and they consume above 50% of the captive power sector consumption. One thing is gas garments, textile and dyeing factories. However there are three spinning mills owned by Saiham Groups at Shazibazar. Industry categorywise gas consumption in industrial sector and captive power sector from FY1999-00 to FY2004-05 is given in the Table 6.5.5 and Table 6.5.6.

Table 6.5.5: Industry Catergorywise Gas Consumption, Industrial Sector, JGTDSL

Gas in MMSCM

Type	FY 99-00		FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Ceramic	1	0.620	1	0.563	1	0.673	1	0.560	1	0.620	1	0.568
Cement	1	41.063	1	42.063	1	28.715	1	24.058	1	34.811	2	34.566
Food	5	0.487	6	0.870	6	1.650	12	2.247	12	2.125	13	2.291
Aliminium	2	0.121	2	0.122	2	0.137	3	0.121	2	0.121	2	0.121
Bakery	2	0.796	2	0.796	2	0.813	2	0.796	2	0.796	3	0.751
Lime	1	0.125	1	0.124	1	0.156	1	0.125	1	0.125	1	0.125
Board	1	0.127	1	0.127	1	0.143	2	0.284	2	0.284	2	0.264
Other	1	0.075	1	0.110	1	0.120	2	0.218	2	0.156	3	0.215
Total	14	43.414	15	44.775	15	32.407	23	28.409	23	39.038	27	38.901

Table 6.5.6 : Industry Categorywise Gas Consumption, Captive Power Sector, JGTDSL

Type	FY 99-00		FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Spinning	2	5.795	2	5.795	2	5.795	2	5.795	2	5.795	3	10.563
Cement	1	16.205	1	16.205	1	9.971	1	11.349	1	14.6	2	16.439
Tea	20	4.8	20	5.389	20	8.582	20	5.838	20	4.25	20	3.93
Total	23	26.8	23	27.389	23	24.351	23	22.982	23	24.645	25	30.936

Source: Marketing Division, JGTDSL.

6.5.4 Industry Categorywise Gas Consumption under PGCL.

Table 6.5.7 and Table 6.5.8 show industry categorywise gas consumption under PGCL in industrial and captive power sectors. Total consumption is very low. Given the age of the company, it would be premature to make any comment about the pace of growth in these two sectors under this company. However, types of industries are more diversified than those under JGTDSL.

Table 6.5.7 : Industry Categorywise Gas Consumption, Industrial Sector, PGCL

Gas in MMSCM

Type	FY 99-00		FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Dyeing			2	0.126	2	0.126	2	0.134	2	0.154	2	0.161
Textile			1	0.401	1	1.436	1	1.854	1	2.774	2	3.329
Sub-total			3	0.527	3	1.562	3	1.988	3	2.928	4	3.49
Jute			1	0.075	1	0.114	1	0.165	1	0.192	1	0.187
Steel			2	0.058	2	0.058	2	0.058	2	0.069	2	0.071
Chemical							1	0.125	1	0.258	1	0.274
Silicate					1	0.307	1	0.675	1	0.935	1	0.944
Pharamaceutical											1	0.744
Lime									1	0.615	1	0.647

Table 6.5.7 : Industry Categorywise Gas Consumption, Industrial Sector, PGCL

Type	FY 99-00		FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Food							3	0.154	4	0.445	4	0.413
Bakery									1	0.146	2	0.175
Salt	1	0.065	1	0.065	1	0.065	1	0.075	1	0.069	1	0.083
Others							2	0.315	2	1.030	2	1.04
Total	1		7	0.725	8	2.106	14	3.555	17	6.687	20	8.068

Table 6.5. 8: Industry Categorywise Gas Consumption, Captive Power Sector, PGCL

Gas in MMSCM

Type	FY 99-00		FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Spinning												
Textile									1		1	0.122
Cement			1	0.307	1	0.881	1	0.091	1	0.006	1	0.558
Pharmaceutical											1	0.099
Total	0	0	1	0.307	1	0.881	1	0.091	2	0.006	3	0.779

Source: Marketing Division, PGCL

6.6 System Loss

System Loss also called Unaccounted for Gas (UFG) of gas transmission and distribution system is the difference between the net purchase or throughput and the total sales. Theoretically there should not be any significant loss of gas in transmission apart from accidental loss which happens in rare occasions. However, the inherent nature of 'no two meter give identical readings' leaves scope of dissimilarity between the input and output of any transmission system. In Bangladesh transmission company has been exempted from system loss; transmission loss is distributed among the distribution companies in pro rata basis. System loss in a gas transmission and distribution may arise out of two principal sources: (a) technical or operational factors and (b) various non-technical sources. Much of the technical or operational losses are inevitable and the level of the same depends on such things as conditions of physical facilities, methods of operation, quality of gas handled, skill of operating people climatic/environmental conditions and so forth. On the other hand non technical loss is the theft or pilferage of gas by customers, very often in connivance with company employees, through illegal means including but not limited to illegal connections, meter by passing, meter tampering, regulator tampering, under billing by suppressed meter reading. It has been generally observed that smaller companies have been able to keep the system loss bridled better than the larger ones. Since bulk sectors i.e. power and fertilizer are ot liable to system loss, non-bulk sectors are contributors to the system loss. Company wise system loss history is shown in the following subsections.

6.6.1 System Loss in TGTDCL

System loss in TGTDCL rose to an alarming level. 7.57% in 2004-05 and dropped 6.5% in 2005-06. Until 1980 system loss was very low even negative i e. overall gain. Criminalization started during eighties. From below 1% in 1980 system loss jumped to 3.07% in 1985 and to 8.40% in 1990. Steepest rise took place during the period of 1997-98 to 2000-01 and reached maximum ratio 9 56% in 2001. Although in the subsequent years the rise has been somewhat stalled, yet it can not be seen as a sign of cure.

Historical system loss in volume is shown in Figure 6.6.1. In the TGTDCL system total system loss since inception is 302.18 BCF which is worth Tk.29,373 million in present day weighted average gas price and as a volume higher than gas fields like Beanibazar, Narsingdi, Meghna etc.
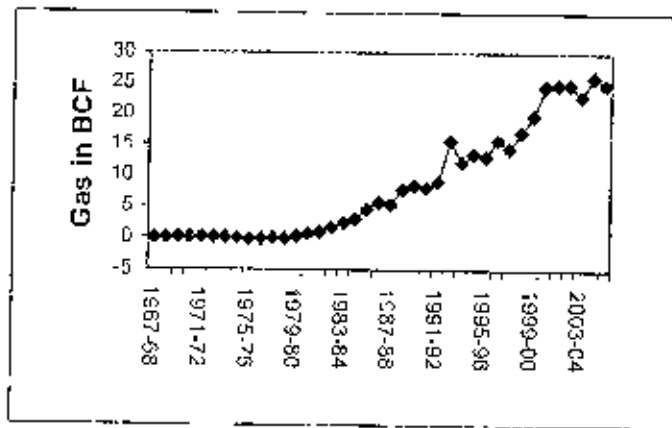
Figure 6.6.1: System Loss in TGTDCL.
Source: Azad 2006 and MIS June 2006

6.6.2 System Loss in BGSL

System loss in BGSL area has remained relatively low in compared to that of TGTDCL. It was the worst in 2002 when reached 3.3%. In 2005 system loss in BGSL was 1.97% Historical system loss under BGSL is shown in the Figure 6.6.2.

78
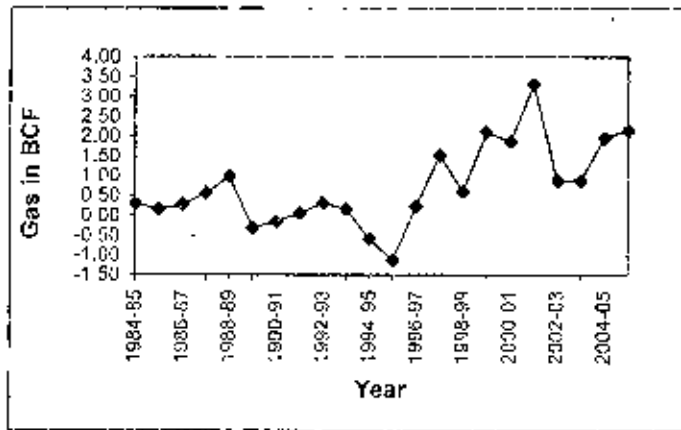
Figure 6.6.2: System Loss in BGSL.
Source: BGSL 2000, MIS June 2002 and MIS June 2006

6.6.3 System loss in JGTDSL

System loss in JGTDSL area has been very low.

6.6.4 System Loss in PGCL

Until now gas consumption in the non-bulk sectors is very low. System loss in PGCL area is also very low

6.7   Load Curves

6.7.1   Daily Load Curve

Gas consumption generally remains high from 9:00 am to 10 pm. During a 24 hour period two peaks are seen, one from 10:00 am to 03:00 pm and other from 06:00 to 11:00 pm. Consumption starts falling at 11:00 pm the trend continues till early morning when it starts rising again   Evening peak could be much more prominent had the power sector performed satisfactorily and gas supply was adequate. Figure 6 7.1 shows gas consumption Load Curve for 7 June 2006. On that day total consumption during 24 hours (from 08:00 hours on 7-6-2006 to 08:00 hours on 8-6-2006) was 1.540 MMSCF. Maximum consumption took place at 12:00 hours at a rate of 1.627 MMSCFD while the minimum was 1.407 MMSCFD 05 00 hours on 8-6-2006. Maximum consumption was 16% higher than the minimum consumption. Maximum consumption could be even higher had there been no supply constraint.

79
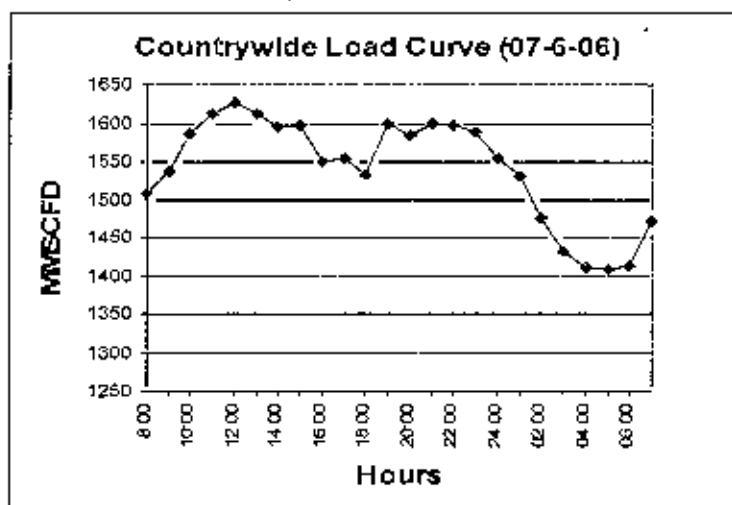
Figure 6 7.1: Daily Load Curve

6.7.2 Monthly Load Curve

A look at the monthly consumption curve presented in the Figure 6.7.2 shows that on Friday (weekend), gas consumption is much less than normal week days. This difference is the in order of 150 to 200 MMSCFD at present.
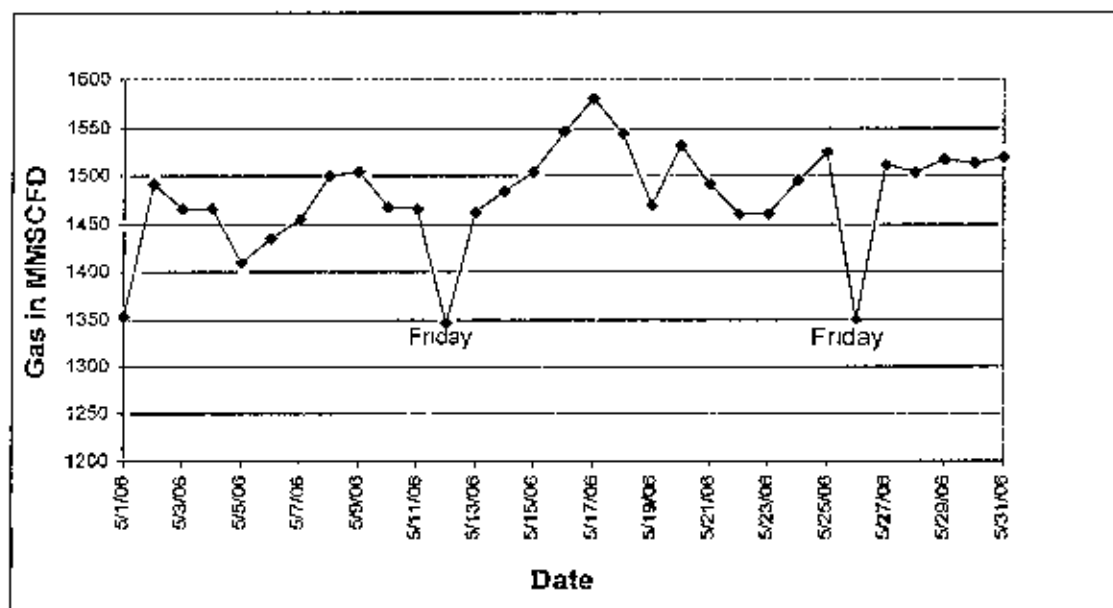
Figure 6.7.2: Monthly Load Curve (May 2006)
Source: Daily Report, Petrobangla

6.7.3   Seasonal Load Variation:

Variation of daily consumption over the year is not clearly noticeable. It is due to two reasons. Firstly, the weather in Bangladesh is not extreme thus variation in temperature is not

80

that prominent. Secondly, capacity constraints of gas and power sectors are also responsible for this phenomenon. During summer and irrigation season consumption could be higher if both power and gas sector were healthy in terms of production. The gas supply constraint or failure in adequate electricity production kept the consumption level low slashing the peak demand period. Seasonal variation in the gas consumption in FY2005-06 is presented in the Figure 6 7.3. It may be mentioned that the consumption in the domestic sector (not measured) increases due water heating for hot bath. But it does not affect overall consumption due to savings from the electricity because fans and air coolers are not needed during winter.
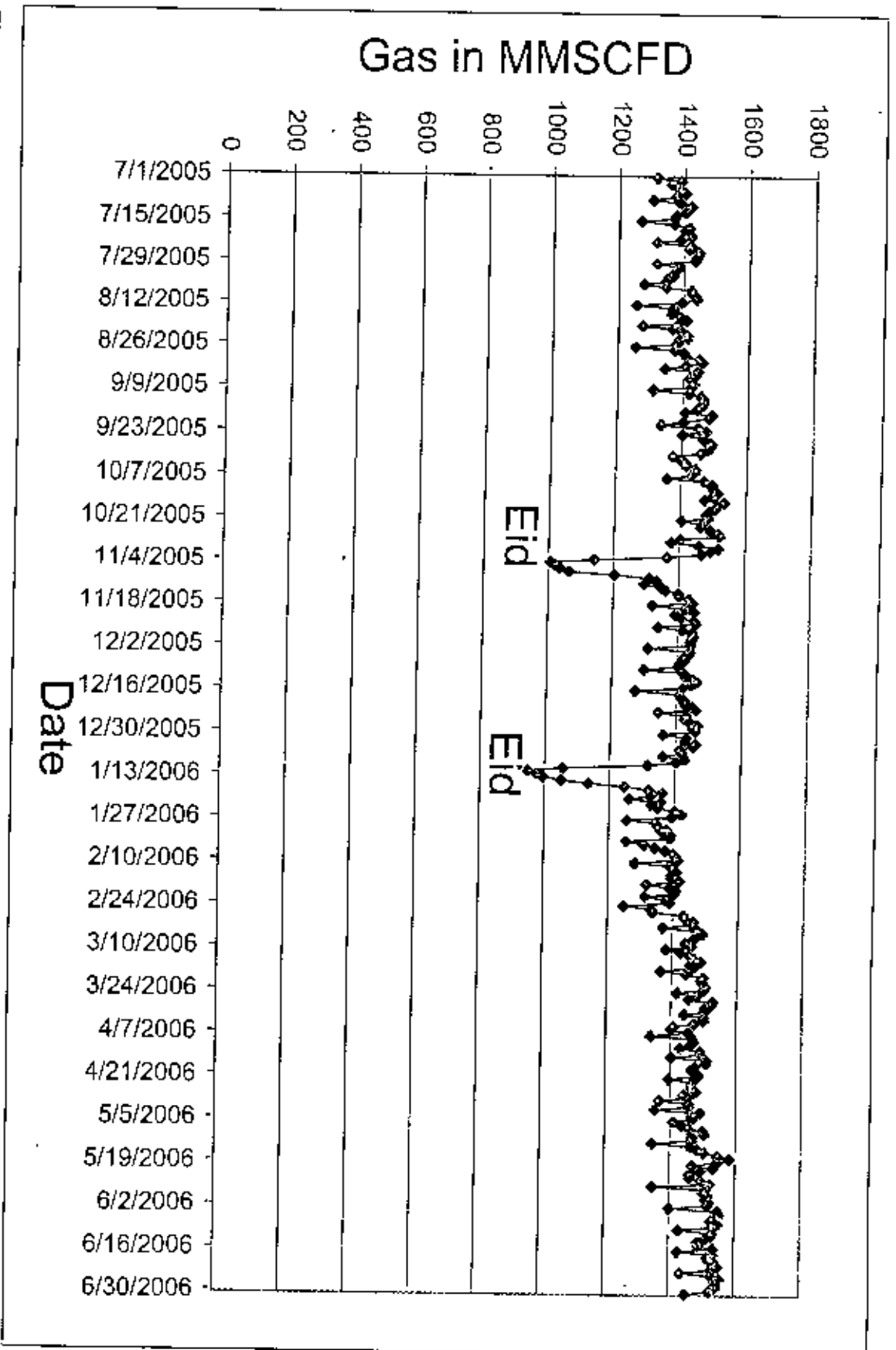
Figure 6.7.3: Seasonal Load Variation (FY2005-06)
Source: Production and Marketing Division, Petrobangla

CHAPTER 7

GAS DEMAND FORECAST FY2006-25

7.0 Introduction

In this chapter sectorwise gas demand forecasts for five distribution companies and for the whole country for the period of FY2005-06 to FY 2024-25 have been made in three scenarios viz, Base Case, High Case and Low Case. Results of the projections have been present in either graph or Tables. Power and fertilizer sectors gas demand are presented first followed by the non-bulk sector demands. Assumptions and procedures of the projections are described briefly in the relevant sections.

7.1 Power Sector Gas Demand Forecast

7.1.1 Introduction

About 85% of the power generation in Bangladesh is gas based, 10% is imported oil based while only 5% is hydro-electrical power. Power has been the single largest sector that consumes around 42% of the country's natural gas today. Therefore, it is evident that much of the development activities in the gas sector will be dictated by the gas demand in the power sector. This necessitates thorough understanding of the power sector before any forecast on the fuel requirement is made.

Although per capita electricity consumption in Bangladesh is rising at around 8% per annum, it is still about 158 KWh in FY2004-05, which is very low even in the regional standard. India, Pakistan and Srilanka have 2.5 to 4 time's higher per capita electricity consumption. It is worthwhile to mention that government of Bangladesh has declared its vision to 'Supply Electricity to All by the Year 2020'. In order to achieve this ambitious goal much has to be done in the power sector. Since the power sector is exceedingly dependent on the gas sector for fuel, the planners in the gas sector must be familiar with the dreams and realities of the power sector of the country to enable them matching those.

In this section the electrical energy demand projection based on the historical consumption and future GDP growth projections has been described briefly Gas distribution company wise gas demand in the power sector has been determined on the basis of projected energy

demand scenarios in the country. Besides, a short term realistic gas demand projection, based on the past experience and status of the power generation projects, has been made

7.1.2 Historical Electricity Sales, Consumption and Peak Generation

Electricity demand has been consistently growing at a relatively high rate. However, generation resources have been continuously inadequate to supply this increased load. As a result, every year in the last decade there has been some level of recorded capacity and corresponding energy shortage.

Table 7.1 1 presents electricity balance overview for the entire interconnected power system. It shows the customer class-wise sales as well as losses. Total sales figures for each utility are calculated by adding sales to each customer class Domestic and industrial customers account for the approximately equal share of the electricity followed by the commercial customers. Agricultural customer ranks the fourth. A large chunk of electrical energy is lost in the form of distribution and transmission loss. Average distribution losses show significant improvement (loss reduction) coming down from 30% a decade ago to around 18.3% in 2005-06 Transmission losses also show steady reduction over time.

Table 7.1.1 Historical Sales and Consumption Data

Year	Sales by Customer Class (GWh)					Total Sales (GWh)	Dist. Loss (%)	Import (GWh)	Trans Loss (%)	Net Gen (GWh)
	Res	Agri	Com	Ind	Others					
93-94	2315	268.7	558.3	2811.	195.0	6148 8	30	8787.2	4.7	9221.1
94-95	2634	434 1	565.9	3659	209 3	6934 7	28 9	9747.1	4.1	10166 3
95-96	2967.	383.2	584 6	3293.	224 9	7454 0	28 2	10375.5	4.2	10832 9
96-97	3208.	325 8	585.9	3477	223.	7821.7	27.4	10772 1	4 2	11142 9
97-98	3550.	304.8	611.3	3690.	225.6	8382 4	27 8	11657.0	4.4	12194.2
98-99	3962.	427.9	668 7	4011.	234.5	9304.7	28.4	12991.9	4.7	13637.7
99-00	4022.	351.7	711.3	4757	220 3	10082 8	28 0	14011.6	4.9	14739.1
00-01	4594.	482.8	787.9	5311	232.0	11408.9	26 7	15564 8	4 2	16254 2
01-02	5511.	454.1	876.4	5344.	261.2	12535.0	25.3	16780 4	3 8	17444.8
02-03	6036.	474.6	1018	6054.	287.7	13876.9	21.7	17724 0	3 8	18422 1
03-04	6598.	606.0	1150.	6681.	295.3	15332.4	20.8	19361.8	3.8	20062.1
04-05	7226	615 7	1239.	7282.	334.0	16698.7	21 9	20439.1	3.5	21408.2
05-06	7495.	638.6	1285.	7553.	346.4	17319.4	18.3	22187.4	3.5	22992.0

Source· PSMP 2005 and Power Cell

Table 7.1.2 shows historical net peak load values for the 1994-2006 periods. Increase in peak generation capacity is very slow although the vast majority of people does not access to the grid power. However, connected load is relentlessly increasing causing incremental load shedding across the country.

<p align="center">**Table 7.1.2 Net Peak Load**</p>

Year	Maximum Generation MW
1994	1875
1995	1970
1996	2087
1997	2114
1998	2136
1199	2449
2000	2665
2001	3033
2002	3248
2003	3458
2004	3622
2005	3671
2006	3812

Source: Power Cell

7.1.4 Distribution of Load by Region

For power system development analysis, Bangladesh is divided into five geographical regions: Central, Northern, Southern, Western and greater Dhaka region. Central region covers Sylhet division, Greater Mymensingh, Greater Faridpur and Tangail districts. Rajshahi division constitutes the Northern Region. Khulna and Barisal divisions are included in Western region while Chittagong divion excluding Brahmanbaria is in the Southern region. Dhaka region covers Dhaka, Gazipur, Narsingdi, Munshiganj, Manikganj and Brahmanbaria districts. For future transmission and distribution planning and development, it is important to accurately estimate load growth for each region. This analysis is summarized in Table 7.1.3

Table 7.1.3   Historical Electricity Requirements by Region and Distribution Factors

Region	Imported Energy (GWh)								
	1996	1997	1998	1999	2000	2001	2002	2003	2004
Central	911	909	981	1121	1172	1290	1408	1519	3642
Northern	1369	1392	1471	1635	1728	1957	2044	2136	2417
Southern	2218	2170	2302	2688	2802	3168	3449	3617	3919
Western	1315	1327	1414	1632	1746	1898	2023	2121	2306
Dhaka	4551	4962	5419	5949	6504	7241	7846	8320	7071
Total	10363	10760	11647	13024	13952	15554	16770	17714	19353
Region	Distribution by Region (%)								
Central	8.8%	8.4%	8.4%	8.6%	8.4%	8.3%	8.4%	8.6%	18.8%
Northern	13.2%	12.9%	12.6%	12.6%	12.4%	12.6%	12.2%	12.1%	12.5%
Southern	21.4%	20.2%	20.3%	20.6%	20.1%	20.4%	20.6%	20.4%	20.2%
Western	12.7%	12.3%	12.1%	12.5%	12.5%	12.2%	12.1%	12.0%	11.9%
Dhaka	43.9%	46.1%	46.5%	45.7%	46.6%	46.6%	46.8%	47.0%	36.5%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: PSMP 2005

Table 7.1.3 clearly shows minimal variations in distribution ratios over time. One anomaly is the 2004, when large portion of the REB load was transferred to Central region significantly altering distribution factors for these two regions (*PSMP 2005*).

7.1.5   Historical GDP Data

GDP was historically used as the best proxy to link electricity demand with economic activity in many developing counties. For many countries and over long periods of time, the overall electricity demand is closely linked to the growth in GDP.

During the last 10 years Bangladesh economy has gained pace and GDP grew at a consistent rate. Of course, increased economic activities, reflected in the GDP growth, are the key driver behind the increase in the electricity demand. Historical GDP values are presented in Table 7.1.4. Compound average GDP growth over the last 11 years (1994-2004 period) was 5.1%. This compares with the average electricity consumption growth of 8.1% over the same period

Table 7.1.4: Historical GDP and Growth Rates (in constant 1995-96 Taka)

Fiscal Year	GDP (million Taka)	GDP Growth (%)
1994	1,515,139	
1995	1,589,762	4.93%
1996	1,663,240	4.62%
1997	1,752,847	5.39%
1998	1,844,478	5.23%
1999	1,934,291	4.87%
2000	2,049,276	5 94%
2001	2,157,353	5.27%
2002	2,252,609	4.42%
2003	2,371,006	6 26%
2004	2,501,813	5 52%

Source: PSMP 2005

7.1.6   GDP Growth Forecast

In order to be able to use GDP as an input for future load forecasting, PSMP 2005 developed forecast for growth rates for the entire planning period, for the three different growth scenarios. In all scenarios continued robust growth in Bangladesh's economy has been assumed *(PSMP 2005)*. As the economy grows larger economic growth is more difficult to sustain. Therefore the growth rates are higher in the early years than in the later years. The Base Case assumes initial growth over the period 2005-15 slightly higher than the 1994-04 compound average growth rates. From 2016-25 the growth rates are slightly below the 1994-04 rates. Low Case rates averages about 0.7 percentage point lower than the base case. For the High Case uses current GOB forecast GDP growth rates that average about 2.7 percentage points higher than Base case.

Table 7.1.5 presents GDP forecast used in energy forecast by PSMP 2005. Base Case starts with the ADB forecasted growth rates for Bangladesh for the 2005 and 2006 of 5.3 and 6%. Going forward, PSMP consultants assumed continued growth of 6% for the first 5 years then gradually declining by 0 5% of the each 5 year period as the economy expands ending with the 4 5% growth rate for the last 5 year period 2021-25.

For the High Case the PSMP used a more optimistic initial growth rate of 6.5% for FY2004-05. The rate increases steadily to 9% in 2015 than falls steadily to 7% by 2025.

For the Low Case, it started with a growth rate for slightly lower than historical growth rate for 1994-04. Growth drops to 4 5% for the next ten years, then to 4.5% for the final year period.

Table 7.1.5: GDP Projections and Growth Rates

(Constant 1995-96 Taka)

Fiscal Year	Base Case		High Case		Low Case	
	GDP (Million Taka)	Growth Rate (%)	GDP (Million Taka)	Growth Rate (%)	GDP (Million Taka)	Growth Rate (%)
2005	2,634,409	5.3	2,664,431	6.5	2,634,409	5.3
2006	2,792,474	6.0	2,850.941	7.0	2,766,129	5.0
2007	2,960,022	6 0	3,050,507	7.0	2,904,436	5 0
2008	3,137,623	6 0	3,264,043	7.0	3,049,658	5.0
2009	3,325,881	6.0	3.508,846	7 5	3,202,141	5.0
2010	3,525,434	6.0	3,789,553	8.0	3,362,248	5.0
2011	3,719,332	5.5	4,092,718	8 0	3,513,549	4.5
2012	3,923,896	5.5	4,440,599	8.5	3.671,658	4.5
2013	4,139,710	5.5	4,818,050	8 5	3,836,883	4.5
2014	4,367,394	5.5	5.227,584	8.5	4,009,543	4.5
2015	4,607,601	5.5	5,698.066	9.0	4,189,972	4.5
2016	4,837,981	5.0	6,210.892	9.0	4,378,521	4.5
2017	5,079,880	5 0	6,738,818	8.5	4,575,554	4.5
2018	5,333,874	5.0	7,311.618	8.5	4,781,454	4.5
2019	5,600,567	5.0	7,933,105	8.5	4,996,620	4.5
2020	5,880.596	5.0	8,567,754	8.0	5,221,468	4.5
2021	6,145.222	4.5	9,253,174	8.0	5,430,326	4.0
2022	6.421,758	4.5	9,993,428	8.0	5,647,540	4.0
2023	6,710,737	4.5	10,742,935	7.5	5,873,441	4.0
2024	7,012,720	4.5	11,548.655	7.5	6,108,379	4.0
2025	7,328,292	4.5	12,357,061	7.0	6,352,714	4.0
Average		5.2%		8.0%		4.5%

7.1.7 Regression Analysis

Goal of the part of the analysis was to find historical correlation between GDP and electricity consumption. First exponential growth numbers were converted to linear values using the

natural logarithm of the original numbers (Tables 7.1 1 and 7.1.4 indicate that both GDP and load increase exponentially over time). Values were presented on Figure 7.1.1, which indicated strong correlation. Excel regression analysis package was used to conduct full regression analysis (PSMP 2005) Results further confirmed very high regression statistic value with the following key indicators.

$R^2 = 0.995$ and Standard Error = 0.018

7.1.8 Energy Forecasting

As the result of the regression analysis, the regression formula that links GDP values with electricity generation was derived in the following for which is very similar to the equation 2 6 as described in Chapter -2:

Ln Generation (n) = - 12.279 + 1.5065 Ln GDP (n)

Where n = fiscal year

Using these results forecasting future generation was proceeded using the estimated GDP values of Table 7 1.5
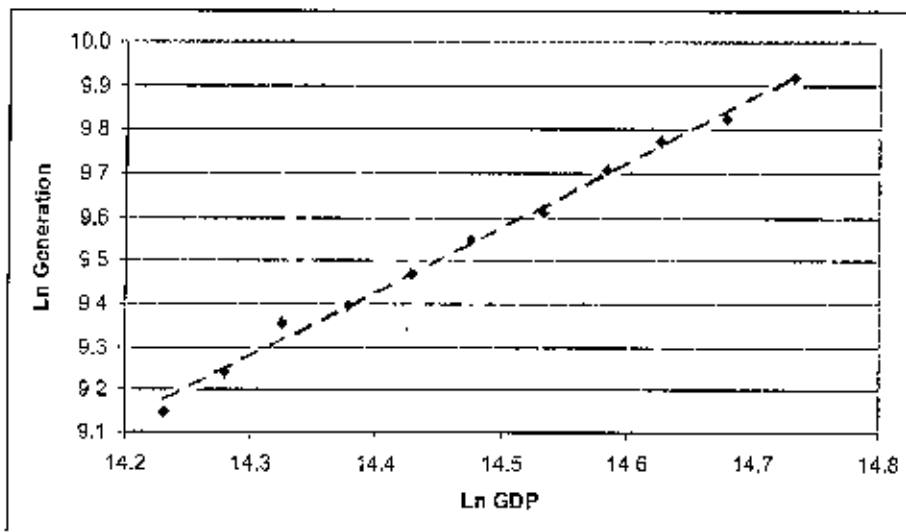
Figure 7.1.1: Historical GDP and Generation Correlation Graph

7.1.9 Daily Load Curve

Figure-7.1.2 shows a typical load curve of a summer day. Electricity load in the early morning is minimum when all night lighting is turned off and people are yet to start the day

activities. Then it slowly starts to pick up. From 10a m to 6p.m it remains more or less steady. In the evening after sunset it jumps up to the peak and remain very high until 11p.m. After mid night it again continues fall till morning. It is evident from the Figure that the difference between the maximum and minimum load is very high, maximum load is as much as 1.46 times the minimum load. This high swing in the power load makes it very difficult to maintain uninterrupted gas supply with limited infrastructures.
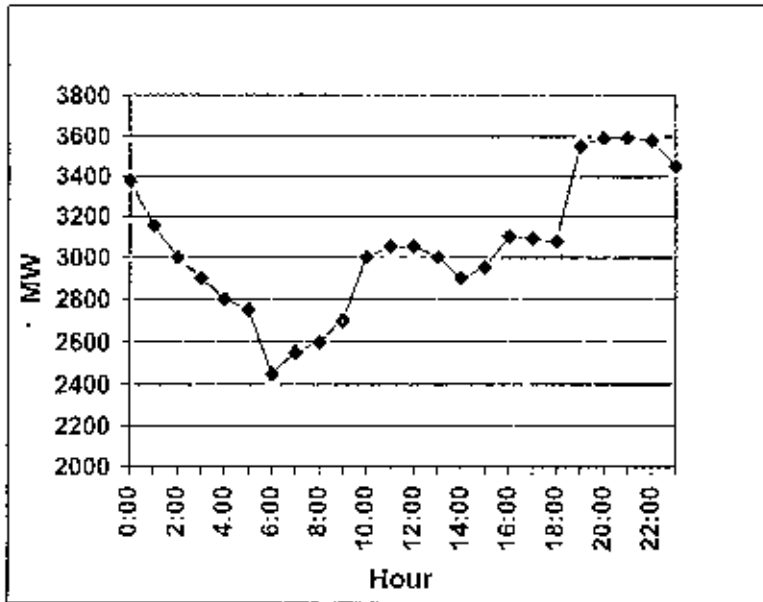
Figure 7.1 2· Daily Load Curve of Power (Date: 07-06-2006)
Source: Power Grid Company of Bangladesh

7.1.11 Peak Demand Forecasting

To forecast the peak load a projection for load factor was made first using the historical generation and peak load. Load factor is calculated using the following formula (*PSMP2005*):

Load Factor = Energy (MWh)/((Peak Demand (MW)*Time (Hours))

Where Time (Hours) for our annual analysis equals 8760 hours. Historical values were graphically presented in Figure 7.1.3. Next a trend line was added that extended 20 years in the future. This analysis provided likely scenario how load factor would on the average change during the forecasting period. Since load factor did not change much during the last 10 years, trend line shows flat curve with just the slight increase over time.
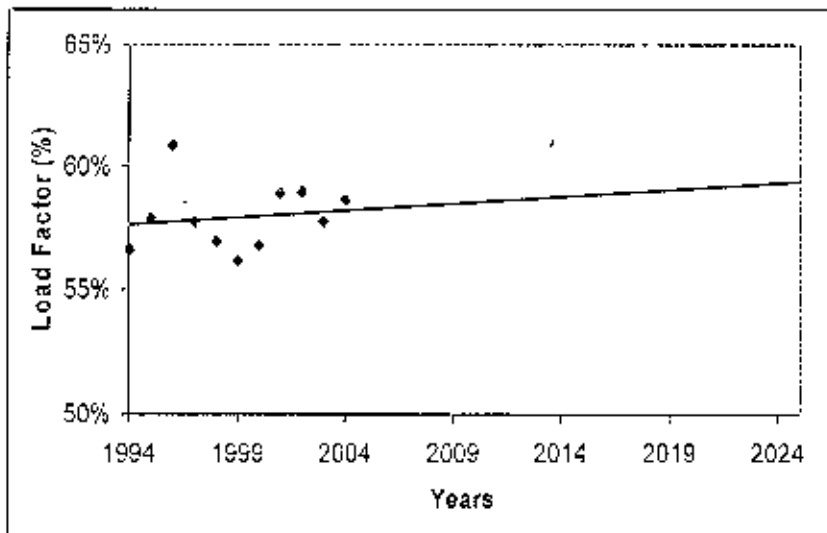
Figure 7 1.3: Load Factor Analysis

Source: PSMP 2005

Projected peak demand is forecasted using the energy forecast and future load factor projection rearranging the earlier formula into:

Peak Load (MW) = Energy (MWh)/(Load Factor*Time (Hours))

7.1.12   Forecasting Results

Using regression formulas described in section 7.1.3, and formula for peak load in the section 7.1.9 electricity load forecast was developed. Table 7 1.6 includes Net Generation and Net Peak Load forecasts corresponding to the three GDP growth scenarios. Load factor projection is the result of trending analysis, gradually increasing from 58.2% to 59.2% over the entire planning period.

Table 7.1.6   Net Generation and Net Peak Load Forecasts

Fiscal Year	Base Case Gen. (GWh)	Base Case Peak (MW)	High Case Gen. (GWh)	High Case Peak (MW)	Low Case Gen. (GWh)	Low Case Peak (MW)	Load Factor
2005	21,881	4,292	22,257	4,366	21,881	4,292	58.2%
2006	23,888	4,685	24.646	4,834	23,549	4,619	58.2%
2007	26,080	5,107	27,290	5,344	25,345	4,963	58.3%
2008	28,473	5,575	30.218	5,917	27,279	5,341	58.3%
2009	31,085	6,076	33,697	6,587	29,359	5,739	58 4%
2010	33,937	6,634	37,839	7.396	31,598	6.177	58 4%
2011	36,788	7.179	42.491	8,292	33,765	6,589	58 5%
2012	39,878	7,782	48,047	9,376	36,080	7,040	58.5%
2013	43.228	8,421	54,330	10,584	38,553	7,510	58.6%
2014	46,859	9,128	61,435	11,968	41,197	8,025	58.6%
2015	50,795	9.878	69,952	13,604	44,021	8,561	58 7%
2016	54,669	10.632	79,650	15,490	47,039	9,148	58.7%
2017	58,839	11,423	90,066	17,485	50,264	9,758	58.8%
2018	63,327	12,294	101,844	19,772	53,710	10,427	58.8%
2019	68,157	13,210	115,162	22,320	57,392	11,123	58 9%
2020	73,355	14,217	129,319	25.064	61,327	11,886	58 9%
2021	78,384	15,166	145,216	28,097	65,060	12,588	59.0%
2022	83,758	16,206	163,068	31,551	69,020	13,354	59.0%
2023	89,501	17,288	181.838	35,123	73,221	14,143	59.1%
2024	95,637	18,473	202,769	39,166	77,678	15,004	59 1%
2025	102,194	19,706	224,527	43,295	82,406	15,890	59.2%

Source: PSMP 2005

7.1.13 Power Generation Status

The sum of the installed capacity of the power plants in the country under PDB and IPP is 4995 MW Old plants cannot run at their installed capacity. The derated capacity ranges from 4174 MW to 4421 MW out of which 115 MW is Coal fired, 404 MW Oil fired and 230 MW is Hydroelectric Table 7.1.8 shows the status of the existing power plants excluding SPPs in the country

Table 7.1.7:   Status of Existing Power Plants

Dhaka Region

Name of Plants	Type	Units	Unit net Capacity (MW)	Total Net Capacity (MW)	Fuel	Max MMSCFD	Retirement Year
Ashuganj	ST	2	60	120	Gas	130	2008
Ashuganj	ST	3	141	423	Gas		2021,22,23
Ashuganj	CC	1	60	60	Gas		2010
Ashuganj	SCGT	1	40	40	Gas		2010
Ghorasal Unit2	ST	1	37	37	Gas	180	2012
Ghorasal	ST	4	197	788	Gas		2221,24
Haripur	SCGT	3	30	90	Gas	9	2010
Haripur Barge IPP	DIE	5	22	110	Gas	23	2015
CDC Haripur	CC	1	360	360	Gas	57	
CDC Meghnaghat	CC	1	450	450	Gas	75	
Siddhirganj	CC	1	28	28	Gas	55	2007
Siddhirganj	ST	1	197	197	Gas		
Tongi	ST	1	104	104	Gas	22	
Subtotal		**25**		**2807**		**551**	

Central Region

Fenchuganj	CC	3	30	88	Gas	17	2022
Shahjibazar	SCGT	3	10	30	Gas	10	2007
Shahjibazar	SCGT	2	34	68	Gas		2023
Sylhet	SCGT	1	19	19	Gas	6	2008
RPCL Mymensingh	GT	4	35	140	Gas	35	2006
Sub-total		**11**		**345**		**68**	

Southern Region

Rauzan	ST	2	164	328	Gas	90	
Sikalbaha	ST	1	47	47	Gas	20	2019
Karnafuli Hyro-1	HY	1	230	230			
Sub-total		**4**		**605**		**110**	

Northern Region

Baghabari	SCGT	1	70	70	Gas	22	2013
Baghabari	SCGT	1	100	100	Gas	42	2022
Baghabari Barge	SCGT	2	45	90	Gas		2006
Barapukuria Coal	ST	2	115	115	Gas	-	
Sub-total		**4**		**375**		**64**	

Western Region

Name of Plants	Type	Units	Unit net Capacity (MW)	Total Net Capacity (MW)	Fuel	Max MMSCFD	Retirement Year
Bheramara	SCGT	3	18	54	HSD		2008
Khulna	ST	1	47	47	HSFO		2009
Khulna	ST	1	89	89	HSFO		2019
Khulna	SCGT	2	16	32	HSD		2008
Barisal, Rangpur Syedpur	SCGT	4	18	72	HSD		2 in '08 2 in '09
Khulna	SCGT	5	22	110	HSFO		
Sub-total		**16**		**404**			
Total National		**60**		**4421**			

Source: PDB and Petrobangla

In addition to plants shown in the Table 7.1.7, there are three small power plants under REB having total capacity of 59 MW. Description of existing SPPs is given in the Table 7.1.8.

Table 7.1.8: Status of Existing Small Power Plants

Dhaka Region

Name of Plants	Type	Units	Unit net Capacity (MW)	Total Net Capacity (MW)	Fuel	Gas MMSCFD	Gas Company
Ashulia	GT	1	10	10	Gas	2	TGTDCL
Madhabdi	GT	1	35	35	Gas	7	TGTDCL
Southern Region							
Chandina	GT	1	25	25	Gas	5	BGSL
Ttotal			59			14	

Source: REB and P & M Division, Petrobangla

7.1.14 Base Case Capacity Additions

Power sector master Plan has identified plant capacities and sites for meeting the generation requirements as outlined under the Base Case scenario. At this point in time it is obvious that the future generation has been envisioned to depend on mainly gas as fuel. a list of power plants as identified in PSMP 2006 is given in the Table 7.1.9.

Table 7.1.9: List of New Power Plants
(Base Case)

Plant Location	Power Zone	Unit Type	Unit Nos	Year of Operation	Fuel	Net Capacity (MW)	Gas Company
Haripur	Dhaka	CC	1	2008	Gas	150	TGTDCL
Sikalbaha	Southern	SCGT	1	2008	Gas	150	TGTDCL
Bogra	Northern	SCGT	1	2008	Gas	150	PGCL
Bhola	Western	CC	1	2008	Gas	150	S/SW
Meghnaghat	Dhaka	CC	1	2009	Gas	450	TGTDCL
Khulna	Dhaka	SCGT	1	2009	Gas	100	S/SW
Dhaka North	Dhaka	CC	1	2010	Gas	450	TGTDCL
Meghnaghat	Dhaka	CC	2	2011	Gas	450	TGTDCL
Sylhet	Central	SCGT	1	2011	Gas	150	JGTDSL
Sirajganj	Northern	CC	1	2012	Gas	450	PGCL
Bheramara	Western	CC	1	2012	Gas	450	PGCL
Haripur	Dhaka	SCGT	1	2013	Gas	150	TGTDCL
Sikalbaha	Southern	CC	1	2013	Gas	450	BGSL
Aminbazar/Dhaka West	Dhaka	CC	1	2014	Gas	450	TGTDCL
Madanhat/New Sikalbaha	Southern	CC	1	2014	Gas	450	BGSL
Sidohirgonj	Dhaka	CC	1	2015	Gas	450	TGTDCL
Shahjibazar	Central	SCGT	1	2015	Gas	150	JGTDSL
Khulna	Western	CC	1	2015	Gas	450	S/SW
Aminbazar/Dhak West	Dhaka	CC	2	2016	Gas	450	TGTDCL
Rajshahi	Northern	CC	1	2016	Gas	450	PGCL
Ashugonj	Dhaka	SCGT	1	2017	Gas	150	TGTDCL
Aminbazar/Dhaka West	Dhaka	SCGT	1	2017	Gas	150	TGTDCL
Sylhet	Central	SCGT	2	2017	Gas	150	JGTDSL
Mymensingh New Site	Central	SCGT	1	2017	Gas	150	TGTDCL
Madanhat/New Sikalbha	Southern	SCGT	1	2017	Gas	150	BGSL
Meghnaghat New Site	Dhaka	CC	1	2018	Gas	700	TGTDCL
Madanhat/New Sikalbhaha	Southern	SCGT	2	2018	Gas	150	BGSL
Saidpur	Northern	SCGT	1	2018	Gas	150	PGCL
Mawa	Dhaka	CC	1	2019	Gas	700	TGTDCL
Fenchuganj	Central	SCGT	1	2019	Gas	150	JGTDCL
Mymensingh New Site	Central	SCGT	2	2019	Gas	150	TGTDCL
Feni	Southern	SCGT	1	2019	Gas	150	BGSL
Meghnaghat New Site	Dhaka	CC	2	2020	Gas	700	TGTDCL
Madanhat/New Sikalbaha	Southern	CC	1	2020	Gas	700	BGSL
Aminbazar /Dhaka West	Dhaka	SCGT	2	2021	Gas	150	TGTDCL
Mawa	Dhaka	CC	2	2021	Gas	700	TGTDCL
Bhaghabari	Northern	SCGT	1	2021	Gas	150	PGCL
Barisal	Western	SCGT	1	2021	Gas	150	S/SW
Mawa	Dhaka	CC	3	2022	Gas	700	TGTDCL
Madanhat/New Sikalbaha	Southern	CC	2	2022	Gas	700	BGSL
Mawa	Dhaka	CC	4	2023	Gas	700	TGTDCL

Khulna New	Western	CC	1	2023	Gas	700	S/SW
Khulna New	Western	SCGT	1	2023	Gas	150	S/SW
Ghorasal	Dhaka	CC	1	2024	Gas	700	TGDCL
Khulna New	Western	CC	2	2024	Gas	700	S/SW
Ashuganj	Dhaka	CC	1	2025	Gas	700	TGTDCL
Fenchuganj	Central	SCGT	2	2025	Gas	150	JGTDSL
Baghabari	Northern	SCGT	2	2025	Gas	150	PGCL
Rangpur	Northern	SCGT	1	2025	Gas	150	PGCL
Bheramara	Western	SCGT	1	2025	Gas	150	S/SW
Total						17650	

Source: PSMP 2005

7.1.15 Technology and Gas Demand

Fuel consumption depends on the technology selection of the power plants and their performance. Therefore it is important to have idea about the power plant technology and the comparative fuel requirement. In this section we will only discuss the power plants that use gas as fuel and their uses.

Steam Turbine

Steam turbine technology has provided base generating stations since the beginning of the industrial era. The technology has significantly improved over the past decades with respect reliability, availability and performance. The size of a single unit has progressed to about 800-1000 MW. High steam temperature and pressure are now available in the range of supercritical range of 650° C and 375 bars. Two stages steam reheat is commonplace. However, for gas fire stations steam turbine are not the best choices for their relatively lower thermal efficiency.

Simple Cycle Combustion (Gas) Turbine (SCGT)

Gas turbine technology has been used by the aerospace industry for decades to power aircraft. Use of the gas turbine technology for generation of power is relatively new compared to steam turbine technology. In a simple cycle configuration, where the exhaust gas from the turbine is released to the atmosphere without utilizing much of its energy, the technology is less efficient than steam turbine technology. The technology is the best suited for natural gas.

Gas turbine has significantly improved over the past decade with respect to reliability, availability, and performance. The size of single gas turbine has progressed to more that 300 MW. Similarly, simple cycle efficiency has improved and now can exceed 30%. The high capacity and efficiency has been possible due to the introduction of external features such as

inlet air-cooling, inter-stage air-cooling, and recuperation. Recuperation is the process of utilizing energy of the turbine exhaust gas to preheat the combustion air. High combustion temperature has contributed to high efficiency.

For application in Bangladesh, we chose a modest range for unit size and external features because of their high reliability and extensive experience throughout the world. The two common and standard, unit of 100 and 150 MW have been chosen in Bangladesh peaking duty power plants.

Combined Cycle Gas Turbine (CC)

Gas turbines are also used in a combined cycle configuration, where the exhaust gas from the turbine is used to generate steam, which in turn is used in a steam turbine to generate additional power. Thus by burning the same amount of fuel a combined cycle gas turbine (CC) system generates about 50% more power that that a simple cycle gas turbine system. As a result the efficiency of combined cycle plant is approximately 50% higher than that of a simple cycle plant.

As a result of recent improvement in technology, the capacity and efficiency of the CC have greatly improved. The highest combined cycle plant approached 1000MW combined cycle systems come in a number of configuration 1X1, 2X1, 3X1 and 3X2 The first number in the configuration designation indicated the number of gas turbine and the second number indicate the number of steam turbines. Capacity split between the gas and steam turbines is nominally two third and one third of the total capacity.

The combined cycle gas turbine system has become the technology of choice for base load generation wherever gas is available throughout the world. High fuel efficiency and relatively low capital costs make the technology attractive. The fuel consumption per megawatt-hour is the lowest of all generating technologies. Another attractive feature of the technology is that a CC plant can be installed in less time than typical steam turbine plants.

7.1.16 Thermal Efficiency

Presently the overall thermal efficiency is of gas fired plants are 30% and it will rise to 40% by the years 2025. It could be even higher, had the old plants been allowed to retire. Figure 7.1.4 shows the variation of overall thermal efficiency over the projection period.
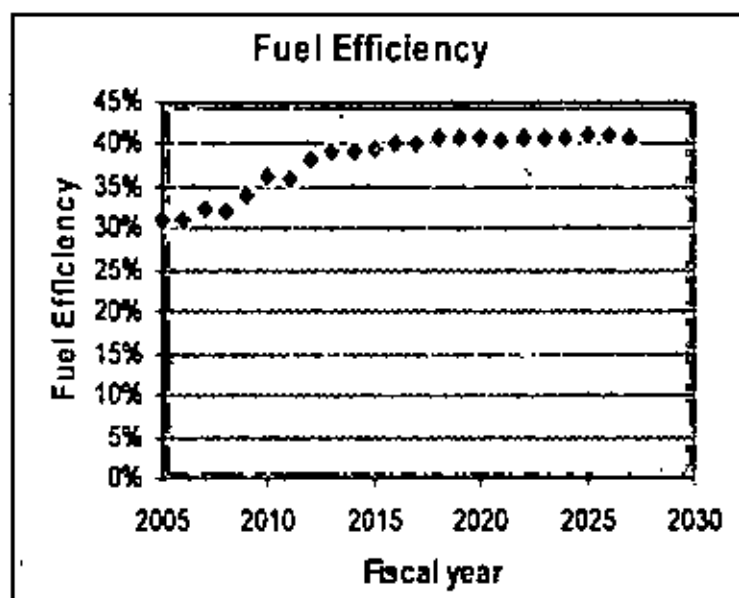
Figure 7.1.4: Variation of Overall Thermal Efficiency
Source: PSMP 2005

7.1.17 Small Power Producers (SPP)

The Government of Bangladesh has decided to allow private sector investors the establish Small Power Producers (SPP) on a fast track basis, for generation of electricity for own use and sell the surplus to other users. The plant size could be in the order of 10MW-50MW, which could be built up in stages as necessary depending on the potential market and load growth. The SPPs will be developed on Build-Own-Operate basis.

The SPPs can be located in any part of Bangladesh. The type of plant is open and the sponsor will be allowed to select plant of any configuration provided the electrical characteristics of the plant match that of the power system in Bangladesh. Where available, a subsidiary of Petrobangla may supply natural gas to the sponsor on a commercial basis. The price of gas to be charged shall be same as applicable for supply of gas for captive power generation, which may be changed from time to time by the Government or the Energy Regulatory Commission. The sponsor may be required to pay additional costs to the fuel supplier if the SPP is far from the gas supply reticulation. Alternatively, the Sponsor may arrange his own

fuel. Power cell has identified 20 locations for such small power plants. Locations of these plants along with tentative capacities are given in the Table 7 1.10.

Table 7.1.10: List of Small Power Plants

SL.	Plant Location	Capacity (MW)	Fuel	Power Purchaser	Gas Company
1	Gagalia, Comilla	50	Gas	PDB	BGSL
2.	Feni	20	Gas	PDB	BGSL
3.	Chomohini	30	Gas	PDB	BGSL
4.	Baropcundo, Cittagong	20	Gas	PDB	BGSL
5.	Cox Bazar	15	Liquid Gas	PDB	BGSL
6.	Tangail	20	Gas	PDB	TGDCL
7.	Rajshahi	30	Liquid/Gas	PDB	PGCL
8.	Bogura	50	Gas	PDB	PGCL
9.	Takurga	20	Liquid	PDB	
10	Mongla	10	Liquid	PDB	
11	Borishal	30	Liquid/Gas	PDB	S/SW
12.	Bhola	20	Gas	PDB	S/SW
13.	Noakali, Chittagong	10	Gas	REB	BGSL
14.	Mohipal, Feni	10	Gas	REB	BGSL
15.	Korotia, Tangail	10	Gas	REB	TGTDCL
16.	Habiganj	10	Gas	REB	JGTDSL
17	Ullapara, Shirajgonj	10	Gas	REB	PGCL
18.	Rupgong, Narayangonj	30	Gas	REB	TGTDCL
19.	Norshigdi	20	Gas	REB	TGTDCL
20.	Mawna, Gazipur	30	Gas	REB	TGTDCL
	Total	445			

Source: SPP Committee Report 2005, Committee formed by Power Cell

7.1.18 Regional and Countrywide Gas Demand for Power

Base Case Gas Demand for Power

Countrywide gas demand for power sector has been determined on the basis of energy demand in different franchise areas. The future power plants as shown in the Table 7.1.9 have been arranged according to franchise areas gas distribution companies and amount of maximum gas consumption rate is assigned against each plant. For the existing plants the current level of consumption has assumed to be remained unchanged over the projected period. For new combined cycle (CC) plants CDC Meghnaghat-450MW and CDC Haripur-360MW plants have been used as standard, while for SCGT plants Tongi 104 MW peaking

duty plant has been used as the standard. Gas demands for SPPs listed in Table 7.1.10 have also been taken into consideration. Dhaka being the biggest load centre, most of the power plants are located around Dhaka and in the central region. As a result TGTDCL is the largest gas supplier for power, 73% of countrywide supply for power sector in FY2005-06 In the coming years TGDCL will continue to be the largest consumer in this sector with 1,110 MMSCFD in FY2024-25 but the dominance will reduce with its share falling to 50% of power sector gas consumption. Overall countrywide average gas demand in this case in 2024-25 will be 2,202 MMSCFD while the maximum demand will be 2,678 MMSCFD. Gas distribution companywise and countrywide gas demand for power is presented in Table 7.1.11.

Table 7.1.11: Base Case: Countrywide Gas Demand in Power Sector

Unit: MMSCFD

FY	TGTDCL		BGSL		JGTDSL		PGCL		S&SW		Overall	
	Avg	Max	Avg	Max	Avg	Max	Avg	Max	AVG	Max	Avg	Max
2004-05	417	527	71	100	32	45	58	74	0	0	578	706
2005-06	454	605	75	100	40	63	60	92	0	0	629	774
2006-07	480	640	116	155	40	72	77	110	0	0	713	879
2007-08	526	751	139	198	63	90	79	110	0	0	807	1034
2008-09	587	816	143	198	77	110	77	110	0	0	884	1111
2009-10	563	866	137	198	77	110	118	182	59	90	953	1240
2010-11	586	888	137	198	98	140	153	222	85	130	1058	1331
2011-12	577	888	137	198	98	140	165	254	152	234	1129	1382
2012-13	640	985	176	270	93	132	165	254	152	234	1225	1442
2013-14	650	985	222	342	93	132	165	254	152	234	1282	1503
2014-15	687	1057	222	342	109	167	165	254	184	306	1367	1510
2015-16	722	1129	222	342	109	167	212	326	193	306	1458	1628
2016-17	796	1189	239	362	128	192	218	326	205	306	1587	1715
2017-18	860	1284	256	382	137	195	232	346	205	306	1690	1825
2018-19	867	1399	253	402	139	220	218	346	190	306	1667	1949
2019-20	896	1494	298	497	134	220	218	346	190	306	1737	2101
2020-21	949	1609	298	497	132	210	220	366	196	326	1795	2203
2021-22	988	1704	346	592	132	210	220	366	196	326	1882	2355
2022-23	1025	1799	346	592	132	210	220	366	265	441	1988	2451
2023-24	1094	1989	346	592	132	210	220	366	300	536	2092	2613
2024-25	1124	1989	346	592	143	235	244	406	345	566	2202	2678
Growth	5%	7%	8%	9%	8%	9%	7%	9%	13%	13%	7%	7%

High Case Gas Demand for Power

High case electrical energy demand is very high with respect to base case demand. PSMP 2006 has calculated only the electrical energy demand but did not show any gas requirement

either regional or countrywide. In the gas sector project has however shown the regional gas demand as well the overall countrywide demand. In this study the electrical energy distribution of the PSMP has been used and the amount of gas has been calculated on the basis of this electrical energy from the equivalent energy used in GSMP2006. In this scenario gas demand will rise at a rate of 11% over the next twenty years and reach a value of 4,779 MMSCFD on average and 6,165 MMSCFD overall maximum. It seems to be hypothetical as it will be very difficult for the gas sector to achieve. Better fuel mix over may be one way out It may be further said that power generation scenario envisioned in the high case seems to be impossible for the part of power sector too. Gas demand forecast for High Case scenario is presented in the Table 7.1.12.

Table 7.1.12 High Case: Countrywide Gas Demand for Power Sector

Unit · MMSCFD

Year	TGTDCL		BGSL		JGTDSL		PGCL		S&SW		Overall	
	Avg	Max	Avg	Max	Avg	Max	Avg	Max	AVG	Max	Avg	Max
2004-05	417	527	71	100	32	63	58	74		0	578	725
2005-06	509	641	75	100	40	63	60	72	0	0	684	832
2006-07	516	650	128	159	40	72	60	72	0	0	742	905
2007-08	552	788	146	208	66	95	83	116	0	0	847	1146
2008-09	634	881	154	214	83	119	83	119	0	0	955	1266
2009-10	625	961	152	220	86	122	131	202	65	100	1058	1477
2010-11	674	1021	157	228	113	161	176	255	97	150	1217	1633
2011-12	692	1065	164	238	118	168	198	305	183	281	1355	1748
2012-13	800	1231	219	338	116	165	206	318	190	293	1532	1922
2013-14	845	1280	289	445	120	172	215	330	198	304	1667	2025
2014-15	927	1427	300	462	147	226	223	343	248	413	1845	2239
2015-16	1048	1637	322	496	158	242	307	473	280	444	2114	2469
2016-17	1195	1783	358	543	192	288	328	489	308	459	2380	2672
2017-18	1333	1980	397	592	212	303	359	536	318	474	2619	2921
2018-19	1448	2336	423	671	232	368	364	578	317	511	2784	3348
2019-20	1560	2599	519	865	234	383	379	602	330	532	3022	3736
2020-21	1737	2944	546	910	242	385	402	670	358	597	3285	4128
2021-22	1897	3271	665	1137	254	404	422	703	376	626	3614	4605
2022-23	2051	3598	693	1184	265	420	439	732	529	882	3977	5112
2023-24	2286	4157	724	1237	277	439	459	765	627	1120	4373	5789
2024-25	2438	4316	752	1285	311	510	529	881	749	1228	4779	6165
Growth	9%	11%	12%	14%	12%	11%	12%	13%	18%	18%	11%	11%

Low Case Gas Demand for Power

If the government cannot take rigid stand with respect to power generation, situation might be worse than the present one. It may be very difficult to hold even the current level of production given the ageing and poor maintenance of the plants. In this study such a pessimistic idea has been discarded and it is believed that in the low case scenario consumption will at least maintain the present state for quite some time. For the later part of the projection period the electrical energy distribution shown in the PSMP2006 has been used as the basis for calculating gas volumes for the five gas distribution companies as well as the countrywide demand. In the scenario gas demand for power sector is likely to increase at a rate of 5% only. Gas demand forecast for High Case power generation scenario is presented in the Table 7.1.13.

Table 7.1.13 Low Case: Countrywide Gas Demand for Power Sector

Unit: MMSCFD

	TGTDCL		BGSL		JGTDSL		PGCL		S&SW		Overall	
	Avg	Max	Avg	Max	Avg	Max	Avg	Max	AVG	Max	Avg	Max
2005	417	527	71	100	32	63	58	74			578	706
2006	450	567	71	100	32	63	42	74			595	732
2007	450	567	72	100	32	63	42	74			596	733
2008	460	580	72	100	33	63	43	74			608	747
2009	460	580	75	100	33	63	45	74			613	754
2010	460	580	120	151	33	63	48	74	101	128	763	938
2011	450	567	120	151	33	63	64	81	99	125	766	943
2012	450	567	120	151	33	63	73	92	105	132	781	1015
2013	450	567	173	218	33	63	77	96	109	138	842	1095
2014	471	593	186	234	33	63	82	103	118	149	889	1156
2015	493	621	199	251	33	63	68	86	125	157	918	1194
2016	525	661	213	268	63	79	60	75	133	167	994	1292
2017	543	684	224	282	72	90	53	66	140	176	1032	1341
2018	577	727	240	302	76	95	49	61	148	187	1090	1417
2019	615	775	255	321	83	104	51	65	155	196	1159	1507
2020	664	836	274	345	86	108	56	71	167	210	1247	1621
2021	699	881	293	369	92	115	59	75	174	219	1317	1712
2022	783	987	308	388	92	116	61	77	184	231	1428	1856
2023	819	1032	326	411	92	116	73	92	195	246	1505	1957
2024	873	1100	344	433	92	116	85	106	208	262	1601	2081
2025	918	1157	364	458	92	116	90	113	218	274	1682	2186
Growth	4%	4%	8%	8%	5%	3%	2%	2%	5%	5%	5%	6%

Summary Forecast for Power

Gas demand forecast summary in three scenarios is presented in the Figure 7.1.5. High Case demand is very high compared to the Base Case demand this is due GDP because energy requirement calculation which showed wide difference between the base case and high case.
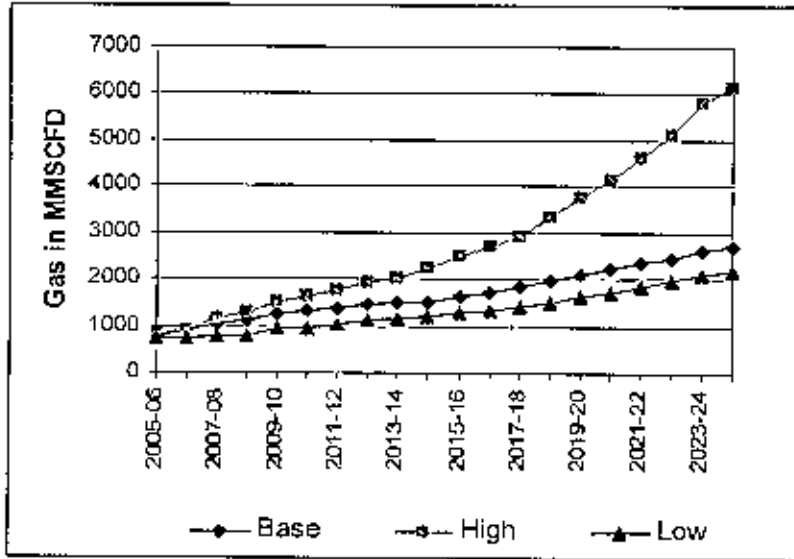
Figure 7.1.5: Countrywide Overall Maximum Gas Demand for Power

7.1.19 Projection PSMP 1995 versus Actual Gas Consumption

Projection for gas demand in the PSMP1995 and actual consumption is shown in the Figure 7.1.6. For the last three years gas consumption in the power sector has been lower than that predicted in PSMP1995. PSMP1995 predicted a 660 MMSCFD gas demand for power generation in 2005-06 but the actual consumption was only 614 This of course does not indicate that demand was not there; rather it was due to failure of the power sector to cater the demand. Sluggish pace of implementation of new generation projects as well as indecision in selecting IPPs have resulted in present crisis in the power sector. Consequently low gas consumption in this sector has been prevailing Nevertheless, in the peak hours of peak season gas supply could hardly satisfy power sector demand.

103
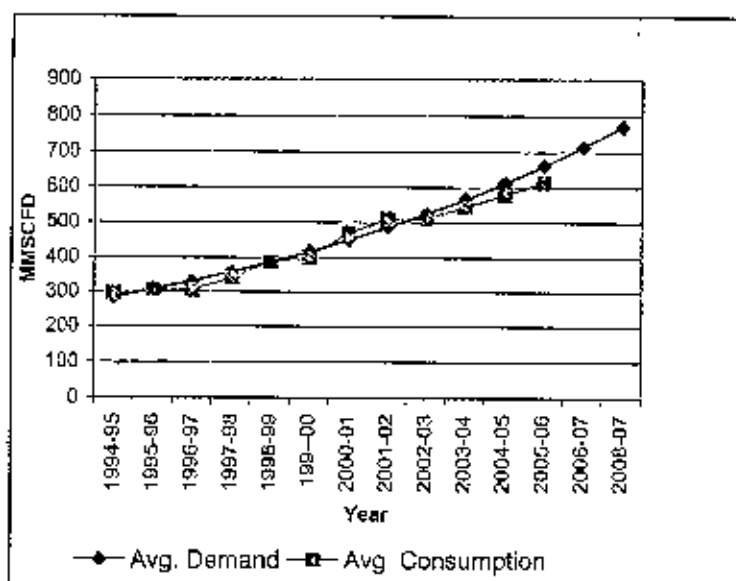
Figure 7.1.6: Forecasted Demand vs Actual Gas Consumption
Source: Petrobangla and PSMP 1995

7.1.20 Realistic Demand up to 2010

Government is trying to meet short term demand by various means in various places which does not have any relation to the plants identified in the Master Plan. Therefore distribution of power plants is going to be changed and as result the gas distribution companywise demand for power may be different from those shown in Base Case, High case and Low Case scenarios in Section 7.1.13. Although the government tried to install some small power plants under SPP and some under rental program by June 2006 but none of them have been installed so far though the contractors were selected. Those were rescheduled to be installed during June 2007 to June 2008. On 8th March 2007 government decided to retender for these plants.

Fenchuganj 90 MW power plant is under construction. Contract has been signed for construction of Siddirgonj 2x120MW, Mehgnaghat (2nd phase) 495MW and Baghabari 130MW. Contract for Chandpur 100MW is expected to be signed by March 15, 2007.

Eighteen small power plants of 10-20MW size having total capacity of 335MW will installed during FY2007-08 to FY2009-10 period.

Fresh tender has been invited for Sirjaganj 450MW power plant by IPP. Loan negotiations for loan for Siddirganj 2x150 MW, Siddirganj 210MW, Sirajganj 150MW and Sikalbaha 150MW ,

104

which are targeted to be installed in FY2009-10, is under process   Table 7 1.14 shows the summary of the gas requirement as per latest target (March 1007) by power sector upto FY 2009-10.

Table 7.1.14: Realistic Gas Demand for Power upto FY 2009-10

Unit· MMSCFD

Gas Company	Description	FY2006-07	FY2007-08	FY2008-09	FY2009-10
TGTDCL	Existing	565	565	565	565
	New	0	9	102	334
	Sum	565	574	667	899
BGSL	Existing	115	· 115	115	115
	New		10	82	94
	Sum	115	125	197	209
JGTDSL	Existing	33	33	33	33
	New	10	20	23	49
	Sum	43	53	56	82
PGCL	Existing	64	64	64	64
	New			60	133
	Sum	64	64	124	197
Countrywide	Existing	777	777	777	777
	New	10	39	267	610
	Sum	787	816	1044	1387
Overall Max		726	750	850	1040

If all these plants are installed as planned, the sum of the maximum demand for individual plants will be 1387 and overall maximum demand will be 1,040MMSCFD Possibility is very high that implementation of Siddirganj 2x150 MW, Siddirganj 210MW, Sirajganj 150MW and Sikalbaha 150MW power plant projects will over run FY2009-10. Therefore, it is much likely that the overall maximum demand will be within the range of 950 to 1000 MMSCFD in FY2009-10.

7.2   Gas Demand Forecast for Fertilizer Sector

7.2.1   Fertilizer Plants and Capacities

There are seven urea fertilizer, one Di-Amonium Phosphate (DAP) and TSP fertilizer factories in the country. State run Bangladesh Chemical Industrics Corporation used to be the owner of all fertilizer factories in the country until 1994, when the Karnaphuli Fertilizer Company (KAFCO) Limited, an export oriented state-private joint venture, came into

operation. All the six urea plants owned by BCIC are dedicated to cater the domestic need of urea fertilizer while KAFCO exports products in excess of domestic consumption.

The total production capacity of the seven gas based fertilizer units is about 3.00 million ton per annum Table 7.2.1 shows the capacities of urea fertilizer factories in the country.

Table 7.2.1: Urea Fertilizer Plant Capacity in Bangladesh

Plant	Location	Owner	Commission Year	Capacity (MMT/ YR)
Natural Gas Fertilizer Factory Limited (NGFFL)	Sylhet	BCIC	1961	0.11
Urea Fertilizer Factory Ltd (UFFL)	Ghorasal	BCIC	1970	0.47
Zia Fertilizer Company Ltd (ZFCL)	Ashugonj	BCIC	1981	0.53
Polash Fertilizer Factory Ltd (PUFFL)	Ghorasal	BCIC	1985	0.10
Chittagong urea Fertilizer Ltd (CUFL)	Chittagong	BCIC	1987	0.56
Jamuna Fertilizer Company Ltd (JFCL)	Tarakandi	BCIC	1991	0.56
BCIC sub-total				2.33
Karnaphuli Fertilizer Company (KAFCO)	Chittagong	State-private	1994	0.66
Total				2.99

It can be seen from the Table that the total annual capacity of the BCIC plants is 2.33 million metric ton. However, in practice the actual production of urea plants under BCIC has fallen to a level of 1.6-to1.9 million metric tons per year. This implies that the utilization levels range from 69% to 77%. Aging and poor maintenance of the plants have resulted in lowering the production capacity. In FY2005-06 total urea production in the country was 2.308 million metric tons of which BCIC produced 1.73 million tons and KAFCO produced 0.578 ton. BCIC purchased 0.378 million tons from KAFCO and about 0.542 million tons from abroad in FY2005-06.

7.2.2 Current Gas Consumption in Fertilizer Sector

Specific energy or the gas consumption, amount of gas required for producing one ton of urea, varies significantly by plants. It depends on the technology and the physical condition of a particular plant. In our country NGFFL, the oldest plant, has the highest gas consumption

against per ton urea production followed by PUFF. Specific gas consumptions of the existing urea plant in Bangladesh are given in Table 7.2.2.

Table 7.2.2: Specific Gas Consumption of Urea Plants

Plants	Avg. Gas Consumption (MMSCFD)	Specific Gas Consumption (MCF/Ton of urea)
ZFCL	50	35
JFCL	47	31
UFFL	50	39
PUFFL	15	58
CUFL	50	33
NGFFL	18	59
Sub-total BCIC	230	-
KAFCO	56	31

Table 7.2.2 shows that the specific consumption for urea production in Bangladesh varies from 31mcf/to to 59mcf/ton whereas a state of the art combined urea ammonia plant today would have a specific gas (energy + feed) consumption of between 20 to 25 MCF/ton of urea. This implies that in Bangladesh significantly higher quantity of gas is being used due to old technology and aging of the plants.

Replacement of the two oldest fertilizer factories by new units would result in the same amount of production with 33 MMSCFD less consumption of gas. This highlights the need to ensure efficient energy processes in gas and the potential for more economic gas prices in future - the importance of using in a more energy efficient manner will be even greater.

7.2.3 Technology

Many urea ammonia process technologies are operating around the globe invented by different process licensors with endeavour of continuous development in terms of cost energy saving, flexibility in operation and product quality assurance. The world recognized processes are:

- Ammonia Process: Haldor Topsoe A/S Denamrk; Uhde, Germany
- Urea Process: Stmicarbon by the Netherlands; Snamprogetti, Italy; ACES, Japan.

Process technologies are being updated continuously. Major energy is expensed for the production of ammonia. In early days reciprocating compressors were used in urea ammonia producing plant for compressing gases to its operating pressure. Efficiency of such reciprocating compressors was much lesser than today's centrifugal compressor Therefore,

more energy would be required for compressor against high reaction/operating pressure. Lower compressor efficiency finally restricted the plant capacity within 500-800 MT/day. An overwhelming change has also taken place in the design of reformer tube with radial flow pattern. Improvement in catalyst characteristics also put positive impact on process performance. However with the advent of centrifugal compressor and lower synthesis pressure technology, plant design capacity has been possible to achieve with single train upto 2000 MT ammonia and 3500 MT urea daily.

There has been a revolutionary change in Stamicarbon urea design in the recent years by introducing pool reactor concept thereby reducing the plant height from 60 metre to 40 metre. All these development has contributed to low cost, energy saving, high performance and high product quality .

7.2.4 Future Fertilizer Plants in Bangladesh

To meet the shortage of urea BCIC had plans to expand the urea production capacity by installing new plants viz. DAP 1& 2 in Chittagong, Shahjajlal, Sirajgonj, Chandpur and Bhola. Besides, it planned to increase ammonia capacity of the existing Chitagong Urea Fertilzer Ltd (CUFL), which included conversion of the existing prilled urea plant to a granular urea plant. But over the years most of these plans appear to have been shelved or delayed. Only the DAP plant in Chittagong has been commissioned. The plan for replacement of the NGFF by the Shahjalal Fertilzer Factory still appears to be active. Lately Sirajgonj fertilizer factory project has been revived

The Indian company TATA Group has submitted a proposal to set up a urea fertilizer plant, one of the components for their 2.5 billion dollar investment proposal. If the ongoing negotiation between the GOB and TATA succeeds, this 1 million ton per annum capacity plant in Chittagong would require 87 MMSCFD gas by FY2009-10.

7.2.5 Growth Rate in Demand for Urea

Bangladesh Economic Review 2005 data in the Table 7.2 3 indicate that over the period from FY1999-00 to FY2004-05 average growth in urea consumption has been about 1.5% per annum Assuming this rate into the future demand for urea it can be expected to increase

from current level 2.5 million metric ton per year to 3 3 million metric ton per year by FY2024-2025. Another method of estimating urea demand is to look at the current per acre use of urea and project a requirement into the future. Given Bangladesh has 33.3 million acres of cultivated land; the average domestic use of urea is about 67 kg/acre. The Econ-NPD Bangladesh Optimal Gas Utilization Study quotes a figure of 100 kg/acre is acceptable for a project *(Econ 2002)*. Taking this figure we it can be predicted that 3.3 million tones per annum will be country's requirement by FY2024-25. Some stake holders held the view that a figure of 3% per annum may be considered for the purpose of urea demand growth. Therefore it can be safely said that the demand for urea in the country by FY2024-25 would range from 3.3 to 4.5 million metric tons per annum.

Table 7.2.3 Fertilizer Consumption
(Thousand Ton)

Year	Urea	DAP
1994-95	1748.50	2
1995-96	2045.50	0
1996-97	2141.00	0
1997-98	1867.00	7
1998-99	1902.00	39
1999-00	2151.00	109
2000-01	2121.00	90
2001-02	2247.42	127
2002-03	2239.00	112
2003-04	2324.08	90
2004-05	2523.39	141

Source: Bangladesh Economic Review 2005

7.2.6 Manufacture or Import Issue/ Urea Economics *(GSMP2006)*

Bangladesh can meet the domestic urea demand by producing itself or by importing from international market. Gas Sector Master Plan project consultant has conducted a study on the economics of new urea plant in the country. They used a discounted cash flow (DCF) analysis to examine the economic case for a greenfield urea plant in Bangladesh. They made the following assumptions:

- ❏ A Middle East FOB urea price of US$135/ton with shipping cost US$20/ton from the Middle East to Chittagong and US$10/ton for internal transportation costs Thus our rational realized price is US$165 ton on an import parity basis.

□ The current gas price US$1.00 per MMBTU. A scenario was considered where the domestic gas price would reach at a more economic level which US$3.34 per MMBTU.

□ A capex assumption of US$600 per ton of the installed capacity. This Figure was arrived on the basis of discussions with technology providers and cross checked against currently under construction plant in the Middle East. Econ NPD study used a of capex US$700/ton.

□ A real discount rate 10%.

Wood Mackenzie concluded that a greenfiled urea plant would generate negative NPV even at the current gas price of US$1.00 per MMBTU for the fertilizer sector. If the gas price is to increase to more economic levels (US$3.34 per MMBTU) a higher-negative NPV is generated.

7.2.7 Gas Consumption Pattern

Once a fertilizer factory takes up full load, the gas consumption does not vary that much. Therefore the daily load curve for gas consumption in fertilizer is by and large a straight line parallel with the time axis. Figure 7.2.1 shows combined hourly consumption of four fertilizer factories (JFCL, ZFCL, PUFF and UFCL) in TGDTCL franchise area.
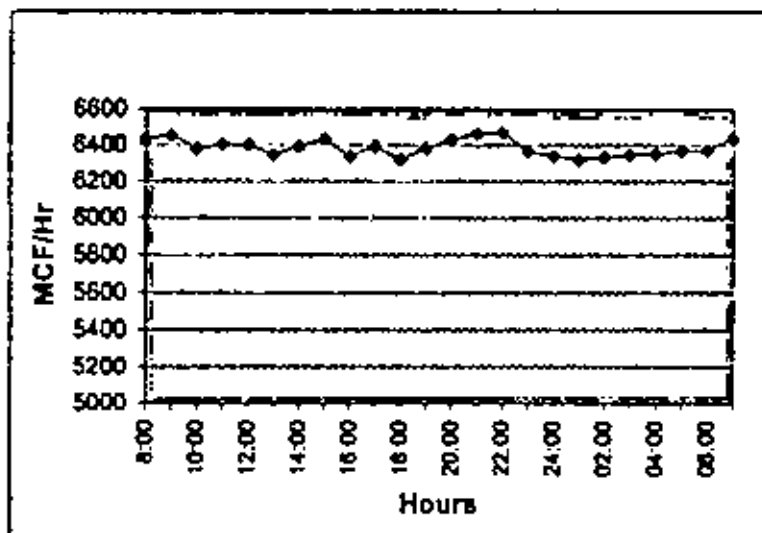
Figure 7.2.1: Daily Load Curve of four fertilizer factories

7.2.8 Gas Demand for Fertilzer

Gas demand for the fertilizer sector for the period until FY2024-25 has been forecasted in three demand scenarios A brief note on each scenario is presented in the following subsections.

Base Case Gas Demand for Fertilizer

In the base case scenario no new entrant, except Shahjalal Fertilizer factory that will replace NGFF, has been considered. It has been assumed that the gas consumption rate will remain unchanged over the projection period. Besides, extension of DAP in Chittagong has also been considered In the base case demand scenario it is found that the combined average and the maximum gas consumption rates reach 301MMSCFD and 322 MMSCFD respectively by FY2009-10, which will continue for the rest of the projection period. Overall growth in gas demand in this sector is expected be about 0.5% only.

High Case Gas Demand for Fertilizer

In addition to the plants considered in the base case Tata Fertilizer Factory by Tata Chemicals has been considered in this scenario. It is assumed that this factory will be commissioned by FY20011-12. Another fertilizer plant by BCIC will be set up in Sirajganj which, in the best case, may be commissioned by FY2010-11. Combined average and maximum gas consumption rates reach 436 MMSCFD and 474 MMSCFD respectively by FY2011-12 these will continue for the rest of the projection period. Overall growth in gas demand in this sector is expected be about 2.4 % only.

Low Case Gas Demand for Fertilizer

Low case scenario is almost same as the base case projection. Only exception is that the expansion of DAP has been eliminated in this case

7.2.9 Summary Gas Demand Forecast for Fertilizer

A graphical presentation of the countrywide gas demands for fertilizer sector in three scenarios is made in the Figure 7.2.2. Total gas requirement in the three demand Base, High and Low cases will be 2.158 TCF, 2.86 TCF and 2.10 TCF respectively.
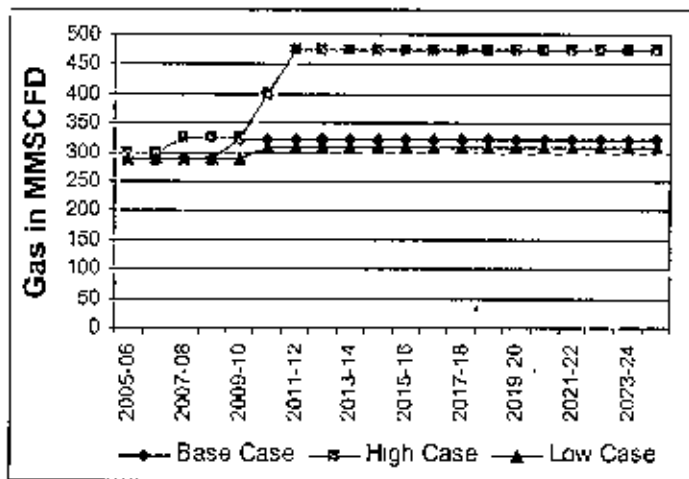
Figure 7.2.2: Countrywide Gas Demand for Fertilizer

Gas distribution company franchise area based gas demand forecast in three scenarios is presented in Table 7.2 4, Table 7.2.5 and Table 7.2.6.

Table 7.2.4: Daily Gas Demand for Fertilizer Plants
Base Case

Gas in MMSCFD

Description	TGTDCL						BGSL					JGTDSL		TOTAL	
	ZFCL	UFFL	PUFF	JFCL	Total	Max	CUFL	KAFCO	DAP	Total	Max	NGFF/SJ	Max	Avg	Max
Capacity (MT/Year)	528,000	468,600	100,650	561,000	1,658,250		561,000	561,000	2 Units	1,122,000		101,970			
Daily peak (MMCF)	53.7	46	14.2	47	160.9		53.3	61.9	5 5	120.7 - 207.7		18 - 43.4			
FY															
2004-05	48.6	41.6	12.8	42.9	145.9	160.9	48 2	56	5	109.2	120 7	16.3	18	273.1	290
2005-06	48.6	41.6	12.8	42.9	145.9	160.9	48 2	56	5	109.2	120 7	16.3	18	273.1	290
2006-07	48.6	41 6	12.8	42.9	145.9	160.9	48.2	56	5	109.2	120 7	16.3	18	273.1	290
2007-08	48.6	41 6	12.8	42.9	145.9	160.9	48.2	56	5	109.2	120.7	16.3	18	273.1	290
2008-09	48.6	41 6	12.8	42.9	145.9	160.9	48.2	56	5	109.2	120.7	16.3	18	273.1	290
2009-10	48.6	41.6	12.8	42.9	145.9	160.9	48.2	56	12	116.2	127	39.2	43 4	301.2	322
2010-11	48.6	41.6	12.8	42.9	145.9	160 9	48.2	56	12	116.2	127	39.2	43.4	301.2	322
2011-12	48.6	41.6	12.8	42.9	145.9	160 9	48 2	56	12	116.2	127	39.2	43.4	301.2	322
2012-13	48.6	41.6	12.8	42.9	145.9	160.9	48 2	56	12	116.2	127	39.2	43.4	301.2	322
2013-14	48.6	41 6	12 8	42.9	145.9	160.9	48 2	56	12	116.2	127	39.2	43.4	301.2	322
2014-15	48.6	41.6	12 8	42.9	145.9	160.9	48.2	56	12	116.2	127	39.2	43.4	301.2	322
2015-16	48.6	41.6	12 8	42.9	145.9	160.9	48.2	56	12	116.2	127	39.2	43.4	301.2	322
2016-17	48.6	41.6	12.8	42.9	145 9	160.9	48.2	56	12	116.2	127	39.2	43 4	301.2	322
2017-18	48.6	41.6	12.8	42.9	145 9	160.9	48.2	56	12	116.2	127	39.2	43 4	301.2	322
2018-19	48.6	41.6	12.8	42.9	145 9	160 9	48.2	56	12	116 2	127	39.2	43.4	301.2	322
2019-20	48.6	41.6	12.8	42.9	145.9	160.9	48.2	56	12	116.2	127	39.2	43.4	301 2	322
2020-21	48.6	41 6	12 8	42.9	145.9	160.9	48 2	56	12	116.2	127	39.2	43.4	301 2	322
2021-22	48.6	41.6	12 8	42.9	145.9	160.9	48 2	56	12	116.2	127	39.2	43.4	301 2	322
2022-23	48 6	41.6	12 8	42 9	145.9	160.9	48.2	56	12	116 2	127	39 2	43.4	301.2	322
2023-24	48.6	41.6	12.8	42 9	145 9	160.9	48.2	56	12	116.2	127	39 2	43.4	301.2	322
2024-25	48.6	41.6	12.8	42 9	145.9	160 9	48.2	56	12	116.2	127	39 2	43.4	301.2	322
Growth					0%	0%				0 3%	0.3%	4 5%	4.5%	0.49%	0.52%

Table 7.2.5: Daily Gas Demand for Fertilizer Plants
High Case

Gas in MMSCFD

Description	TGTDCL						BGSL						JGTDSL		PGCL		TOTAL	
	ZFCL	UFFL	PUFF	JFCL	Total	Max	CUFL	KAFCO	DAP	TATA	Total	Max	NGFF/SJ	Max	Sirajgon	MAx	Avg	Max
Capacity (MT/YR)	528,000	468,600	100,650	561,000	1,658,250		561,000	561,000	2 Units	2X561.0	1,122,000		101,970		561,000			
Daily peak (MMCFD)	53.7	46	14.2	47	160.9		53.3	61.9	5.5	87	120.7 - 207.7		18 - 43.4		61.9			
FY																		
2004-05	49	42	13	43	146	161	48	56	5		109	121	16	18			271	300
2005-06	49	42	13	43	146	161	48	56	5		109	121	16	18			271	300
2006-07	49	42	13	43	146	161	48	56	5		109	121	16	18			271	300
2007-08	49	42	13	43	146	161	48	56	5		109	121	16	18			271	325
2008-09	49	42	13	43	146	161	48	56	5		109	208	16	18			271	325
2009-10	49	42	13	43	146	161	48	56	12		116	208	39	43			294	325
2010-11	49	42	13	43	146	161	48	56	12		116	208	39	43	56	62	357	400
2011-12	49	42	13	43	146	161	48	56	12	79	195	208	39	43	56	62	436	474
2012-13	49	42	13	43	146	161	48	56	12	79	195	208	39	43	56	62	436	474
2013-14	49	42	13	43	146	161	48	56	12	79	195	208	39	43	56	62	436	474
2014-15	49	42	13	43	146	161	48	56	12	79	195	208	39	43	56	62	436	474
2015-16	49	42	13	43	146	161	48	56	12	79	195	208	39	43	56	62	436	474
2016-17	49	42	13	43	146	161	48	56	12	79	195	208	39	43	56	62	436	474
2017-18	49	42	13	43	146	161	48	56	12	79	195	208	39	43	56	62	436	474
2018-19	49	42	13	43	146	161	48	56	12	79	195	208	39	43	56	62	436	474
2019-20	49	42	13	43	146	161	48	56	12	79	195	208	39	43	56	62	436	474
2020-21	49	42	13	43	146	161	48	56	12	79	195	208	39	43	56	62	436	474
2021-22	49	42	13	43	146	161	48	56	12	79	195	208	39	43	56	62	436	474
2022-23	49	42	13	43	146	161	48	56	12	79	195	208	39	43	56	62	436	474
2023-24	49	42	13	43	146	161	48	56	12	79	195	208	39	43	56	62	436	474
2024-25	49	42	13	43	146	161	48	56	12	79	195	208	39	43	56	62	436	474
Growth					0	0					0	0	4%	4%			2.4%	2.3%

Table 7.2.6: Daily Gas Demand for Fertilizer Plants
Low Case

Gas in MMCFD

Description	TGTDCL						BGSL					JGTDSL		TOTAL	
	ZFCL	UFFL	PUFF	JFCL	Total	Max	CUFL	KAFCO	DAP	Total	Max	NGFF/SJ	Max	Avg	Max
Capacity (MT/Year)	528,000	468,600	100,650	561,000	1,658,250		561,000	561,000	2 Units	1,122,000		101,970		271.2-372	300-412
Daily peak (MMCF)	53.7	46	14.2	47	160.9		53.3	61.9	5.5	120.7 - 207.7		18 - 43.4			
FY															
2004-05	48.6	41.6	12.8	42.9	145.9	160.9	48.2	56	5	109.2	120.7	16.3	18	271.2	290
2005-06	48.6	41.6	12.8	42.9	145.9	160.9	48.2	56	5	109.2	120.7	16.3	18	271.2	290
2006-07	48.6	41.6	12.8	42.9	145.9	160.9	48.2	56	5	109.2	120.7	16.3	18	271.2	290
2007-08	48.6	41.6	12.8	42.9	145.9	160.9	48.2	56	5	109.2	120.7	16.3	18	271.2	290
2008-09	48.6	41.6	12.8	42.9	145.9	160.9	48.2	56	5	109.2	120.7	16.3	18	271.2	290
2009-10	48.6	41.6	12.8	42.9	145.9	160.9	48.2	56	5	109.2	127	16.3	18	271.2	290
2010-11	48.6	41.6	12.8	42.9	145.9	160.9	48.2	56	5	109.2	127	39.2	43.4	294.2	310
2011-12	48.6	41.6	12.8	42.9	145.9	160.9	48.2	56	5	109.2	127	39.2	43.4	294.2	310
2012-13	48.6	41.6	12.8	42.9	145.9	160.9	48.2	56	5	109.2	127	39.2	43.4	294.2	310
2013-14	48.6	41.6	12.8	42.9	145.9	160.9	48.2	56	5	109.2	127	39.2	43.4	294.2	310
2014-15	48.6	41.6	12.8	42.9	145.9	160.9	48.2	56	5	109.2	127	39.2	43.4	294.2	310
2015-16	48.6	41.6	12.8	42.9	145.9	160.9	48.2	56	5	109.2	127	39.2	43.4	294.2	310
2016-17	48.6	41.6	12.8	42.9	145.9	160.9	48.2	56	5	109.2	127	39.2	43.4	294.2	310
2017-18	48.6	41.6	12.8	42.9	145.9	160.9	48.2	56	5	109.2	127	39.2	43.4	294.2	310
2018-19	48.6	41.6	12.8	42.9	145.9	160.9	48.2	56	5	109.2	127	39.2	43.4	294.2	310
2019-20	48.6	41.6	12.8	42.9	145.9	160.9	48.2	56	5	109.2	127	39.2	43.4	294.2	310
2020-21	48.6	41.6	12.8	42.9	145.9	160.9	48.2	56	5	109.2	127	39.2	43.4	294.2	310
2021-22	48.6	41.6	12.8	42.9	145.9	160.9	48.2	56	5	109.2	127	39.2	43.4	294.2	310
2022-23	48.6	41.6	12.8	42.9	145.9	160.9	48.2	56	5	109.2	127	39.2	43.4	294.2	310
2023-24	48.6	41.6	12.8	42.9	145.9	160.9	48.2	56	5	109.2	127	39.2	43.4	294.2	310
2024-25	48.6	41.6	12.8	42.9	145.9	160.9	48.2	56	5	109.2	127	39.2	43.4	294.2	310

7.3   Gas Demand Forecast for Non-Bulk Sectors

7.3.1   Industrial Sector Gas Demand

Industrial sector gas demand under TGTDCL

a. GDP based projection: Logarithmic equation has been used for regression analysis. The equation is $Ln\ Q = b + a\ Ln\ P$

> Q = Gas use in a year in MMCM
>
> P = GDP in million Taka in a year
>
> a and b are constants

Historical data from FY1994-95 to FY2004-05 gives the coefficients as shown in the Figure 7.3.1. Here x = logarithm of GDP, y = Logarithm of gas consumption, b= -50.69 and a = 3.9528. Regression results may be considered as close fit since R^2 value is 91.24%.
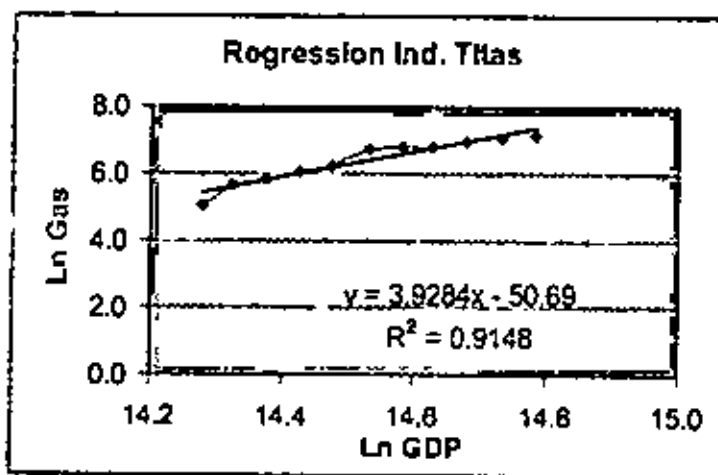
Figure 7.3.1 Regression Analysis for TGTDCL Industrial Sector

If this regression results are used for forecasting gas demand, it gives very high value towards the end of the projection period. It may be mentioned here that GDP values used here are the same that have been used calculating energy demand in the power sector in Section 7.1.6. Results of the GDP based calculations without any adjustment are presented in the Table 7.3.1. For Base, High and Low case GDP growth scenarios calculated demand by FY2024-25 are 8,718 MMSCFD, 64,939 MMSCFD and 4,974 MMSCFD respectively. This fact

indicates that GDP based calculations will not be practical for industrial sector gas demand projections.

Table 7.3.1: Industrial Sector Gas Demand under TGTDCL
(Using GDP Based Regression Analysis)

Year	GDP (Million Taka)			Demand (MMSCFD)		
	(Base)	(High)	(Low)	(Base)	(High)	(Low)
2005-06	2,793,590	2,819,944	2,767,235	197	204	190
2006-07	2,961,205	3,017,340	2,905,597	248	267	230
2007-08	3,138,878	3,228,554	3,050,877	311	348	278
2008-09	3,327,210	3,470,696	3,203,421	391	462	337
2009-10	3,526,843	3,748,352	3,363,592	492	625	408
2010-11	3,720,819	4,048,220	3,514,953	607	846	486
2011-12	3,925,464	4,392,318	3,673,126	749	1,165	577
2012-13	4,141,365	4,765,665	3,838,417	925	1,606	686
2013-14	4,369,140	5,170,747	4,011,145	1,141	2,212	816
2014-15	4,609,442	5,636,114	4,191,647	1,408	3,103	970
2015-16	4,839,915	6,143,364	4,380,271	1,706	4,354	1,153
2016-17	5,081,910	6,665,550	4,577,383	2,066	5,998	1,370
2017-18	5,336,006	7,232,122	4,783,366	2,503	8,264	1,629
2018-19	5,602,806	7,846,853	4,998,617	3,032	11,387	1,937
2019-20	5,882,946	8,474,601	5,223,555	3,672	15,406	2,302
2020-21	6,147,679	9,152,569	5,432,497·	4,366	20,845	2,686
2021-22	6,424,325	9,884,774	5,649,797	5,190	28,203	3,133
2022-23	6,713,419	10,626,132	5,875,789	6,169	37,470	3,655
2023-24	7,015,523	11,423,092	6,110,820	7,334	49,782	4,264
2024-25	7,331,222	12,222,709	6,355,253	8,718	64,939	4,974

b.   Bottom up approach (Present Study):

Base Case

Industry categorywise gas consumption from FY1999-00 to FY2004-05 has been analyzed for this purpose. It has been found that during this period industrial sector gas a CAGR 14.1%. During the FY 2005-06 the growth in his sector was about 23% while it was 13.15% in FY2004-05. The exceptional rise in gas consumption in FY2005-06 was due actual faster growth and also due to reduction of system loss/pilferage as a result of special drive by TGTDCL. During the previous year, FY2004-05, the system loss was 7.57%. If that trend continued the total loss should have been 28.805 BCF in 2005-06 but it was 6.5% i.e. 24.967BCF. This improvement of 3.838 was due to only the special drive aimed at reducing pilferage by the industrial and captive power sectors. It has been known that 80% of this improvement was in the industrial sector. Total sales in the industrial sector in FY2004-05 was 42.590 BCF and in FY2005-06 it was 53.190. Had there been no such special effort, the

sales could be (53.190-3.071) or 50.119 BCF, which was 42.589 BCF in the previous year. Therefore, it may be said with reasonable confidence that the actual growth in this sector during FY2005-06 was 17-18% in this sector.

While making the projection it is assumed that present pattern of industrial mix will continue for quite sometime in the future i.e. garments, dyeing, knitting, spinning and textile group will continue to lead the industrial sector. The reason behind such assumptions is that cheap labour and utility will be attracting the investors as it did in the recent past. It is estimated that this group will maintain a CAGR of 13.68% during the period of FY2006-07 to FY2009-10 with 17% in FY2006-07. Although this group will continue to lead beyond FY2006-07 to FY2009-10, the growth will retard as the volume increases. For the periods FY2011-2015, FY2016-2020, and FY2021-2025 will be 11.5%, 9.2% and 7.7% respectively with the gradual diminishing growth every years. Overall growth over the entire projection period for this group is 10.5%.

Steel and re-rolling sector is expected to maintain 5 to 6 percent growth as it did in the last few years. Gas consumption by bakeries grew at 15% on an average during FY2001 to FY2005. Since it is related to the population growth this is likely to maintain good growth.

The average compound growth in the industrial sector under TGTDCL has been estimated to be 9 % over the entire projection period of FY2006 to FY2025.

High Case

For higher economic growth there is no other alternative to industrial development in a densely populated country like Bangladesh. Since there is no other industrial group is seems to replace the weaving sub sector very soon, this sub-sector will have to grow at higher rates. Therefore, the gas consumption in weaving sub-sector will also be higher. Steel market has very good relation the economic growth. For this reason under high case scenario higher growth has also been assumed for gas consumption in this category.

CAGR during FY2006-2010 and overall CAGR in industrial sector under TGDCL over this period will be 13.65%. A gradual fall in growth rate as the size increases has been assumed.

Overall growth (CAGR) over the entire period is 11.1% under the high case scenario

Low Case

As in the base and high case, no change in industrial mix pattern has been assumed. Slightly lower growth than the base has been assumed. which resulted in a more or less straight line extrapolation. This gave a CAGR of 8.4% over the projection period of up to FY2024-25.

Year-wise daily gas demands in three cases are presented in the Figure 7.3.2.
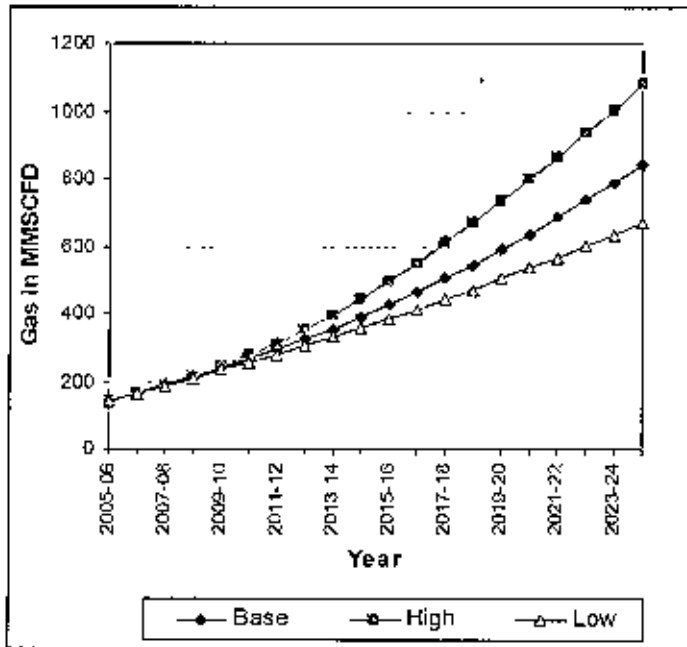
Figure 7.3.2. Industrial Sector Gas Demand under TGTDCL

Industrial Sector Gas Demand under BGSL

From the Figure 6.19 in Chapter 6 it can be seen that industrial sector gas consumption is on continuous rise since 2000. It may be said at this point in time that although this region has shown a medium range of growth during 2000 to 2005, it will continue to rise. Signs are there that this growth will be even faster in the coming years. There are two reasons for such assumption They are: increasingly scarcity of land in and round Dhaka city, and vicinity of the sea port which reduces the transport cost and time for the export oriented industries.

Industrial mix is similar to that of TGTDCL. Other assumptions as to the growth of are similar too However, slightly slower growth, compared to TGTDCL, is envisaged for BGSL. Korean Export Processing Zone (KEPZ) will be a major industrial customer who

119

claimed their demand will increase from 6 MMSCFD to 50 MMSCFD over 5 years time starting in FY2005-06. However, they have not started receiving gas yet. KEPZ might be operational from in FY2009-10. Projection results in three growth scenarios are presented in the Figure 7.3.3a and 7.3.3b.
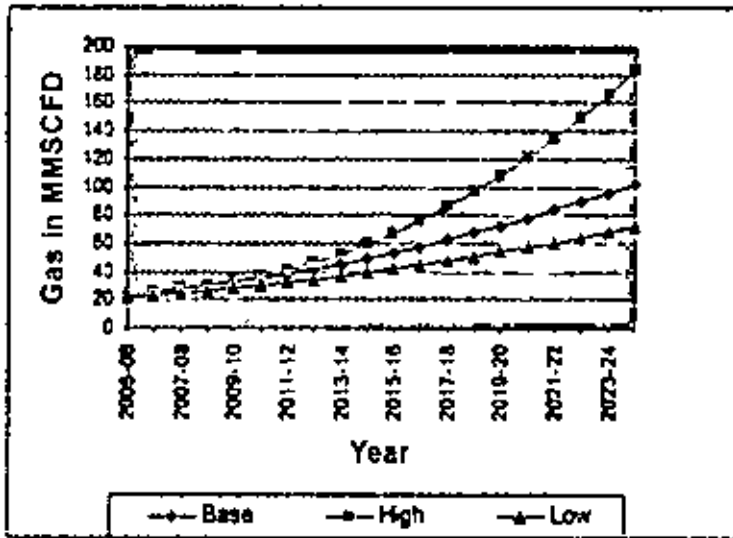
Figure-7.3.3a Industrial Sector Gas Demand under BGSL (excluding KEPZ)
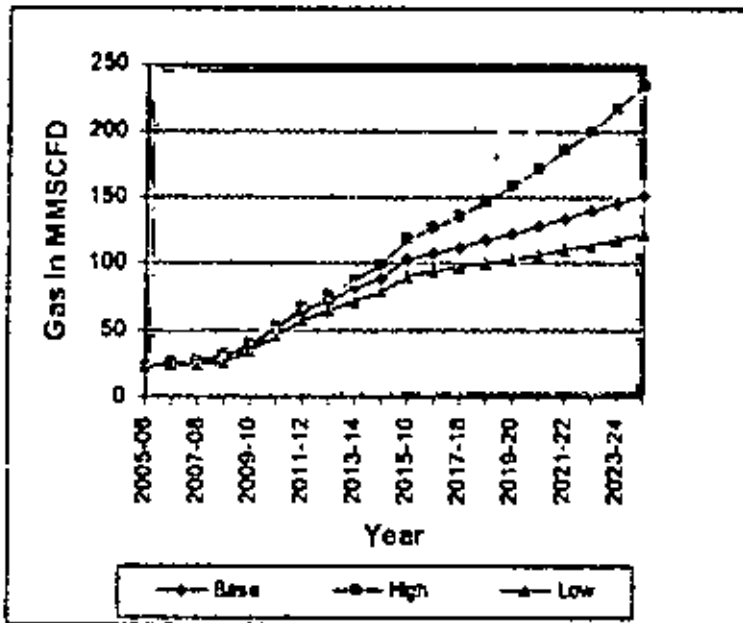
Figure 7.3.3b: Industrial Sector Gas Demand under BGSL (including KEPZ)

Growth rates (CAGR) are provided in the Table-7.3.1

120

Table 7.3.1 Growth Rates under BGSL

Scenarios	Including KEPZ	Excluding KEPZ
Base Case	10.5%	8.2%
High Case	13.0%	11.6%
Low Case	9.2%	6.5%

Industrial Sector Gas Demand under JGTDSL

Gas demand in the industrial sector in the JGTDSL area has been on continuous decline If this decline trend continues gas demand in this sector will fall to 1 MMSCFD in the JGTDSL area by the year 2025 or even before. However, Lafarge cement factory commissioned in April 2006, which will require as at rate of 16 MMSCFD gas. Keeping consumption by Lafarge at 16 MMSCFD and no normal growth until 2012, the base case demand by 2024-25 may be at 23 MMSCFD While the high and low case demand may be at 27 and 18.5 MMSCFD respectively. Figure 7.3.4 shows the gas demand forecast for the industrial sector gas demand under JGTDSL for the period of FY2006-2025
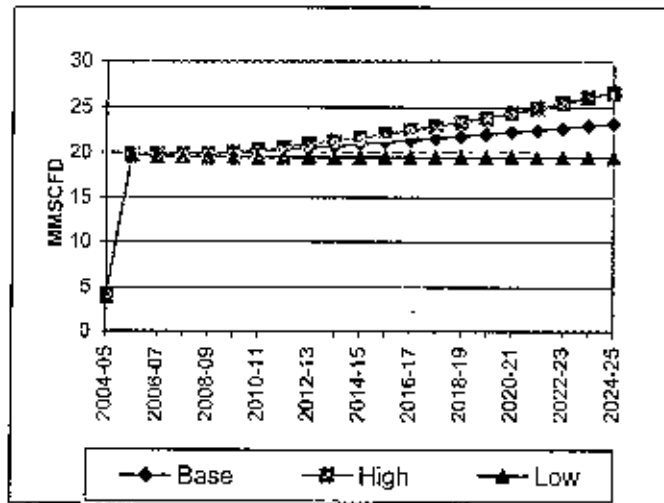
Figure 7.3 4: Industrial Sector Gas Demand under JGTDSL

Industrial Sector Gas Demand under PGCL

It is difficult to construct any model for PGCL due to lack of reliable data because it is still in the nascent stage. The average daily consumption was 0.8 MMSCFD during FY2004-05. A

flat 16% growth rate assumed for the base case while 20% and 14% growth rate for high and low case respectively If TATA Steel Mill is installed at Ishwardi the picture will be altogether different. Figure 7.3.5 shows the industrial sector gas demand in the PGCL area; gas demand for TATA still has been added to the normal high case demand. In base, high and low case scenarios the demand will be 15.3, 114 and 10.83 MMSCFD by FY2024-25,
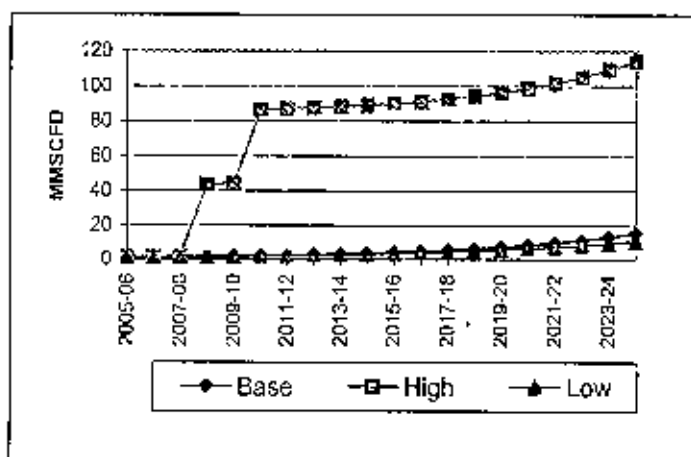
Figure 7.3.5: Industrial Sector Gas Demand under PGCL

Industrial Sector Gas Demand under S&SW

It is assumed that pipeline gas will reach South-Southwest region of the country by FY2009-10. If the practical situation relevant to pipe line is considered it may be delayed further. In the base, high and low case scenarios the gas demand by FY2024-25 may reach to 5.5, 13.3, and 3.2 MMSCFD respectively. Gas demand forecast for industrial sector under S&SW is shown in the Figure 7.3.6
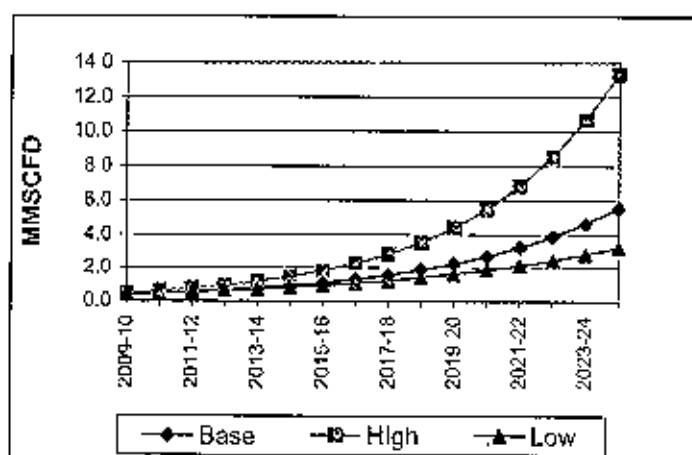
Figure 7.3.6 Industrial Sector Gas Demand under S&SW

122

Countrywide gas demand in the industrial sector is shown in the Figure 7.3.7. Demand figures are the average demand and they are algebraic summation of the demands under the four distribution companies. CAGRs in base, high and low cases over the projection period will be 8.9, 10.6 and 7.6 MMSCFD respectively.
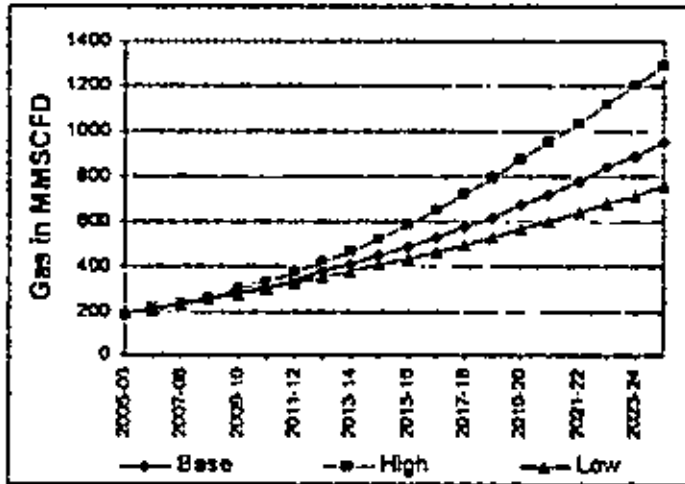
Figure 7.3.7: Countrywide Gas Demand in Industrial Sector

Industrial Sector Gas Consumption versus Export Earning

Figure 7.3.8 shows the yearly historical export total export earning of Bangladesh. This figure has resemblance to the figure of historical gas consumption in the industrial sector as shown in Figure 6.1.3 and Figure 6.3.3 in the Chapter 6. It indicates some relationship between the export value and the industrial sector gas consumption. This resemblance is more prominent in post eighties.
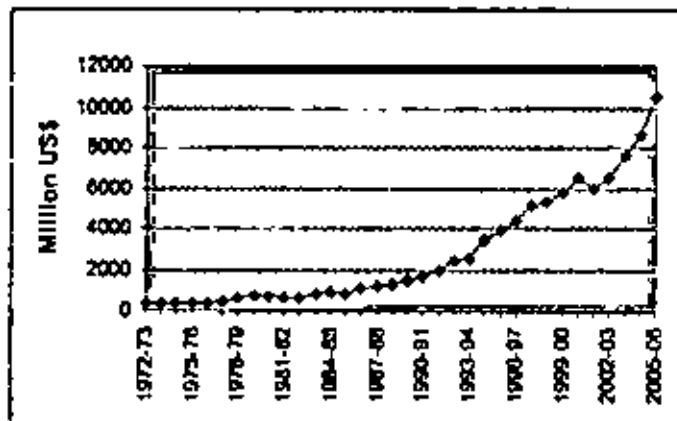
Figure 7.3.8: Historical Export Value
Source: Export Statistics 2005-2006

It would be prudent to try a relationship between export value of the manufacturing products and the gas consumption since the agricultural product export has little relation with the industrial sector gas consumption. Figure 7.3.8a and 7.3.8b show the gas consumption in the industrial sector and export earnings from manufacturing products since 1990.
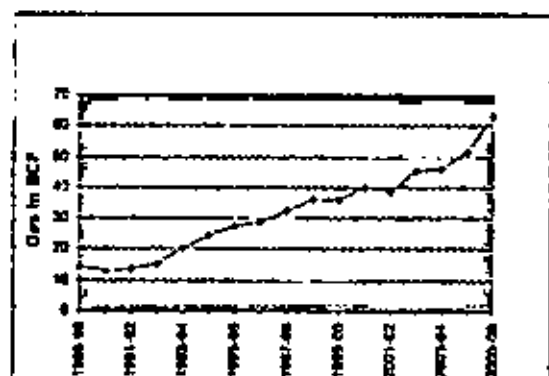
Figure 7.3.8a: Gas Consumptions in Industrial Sector
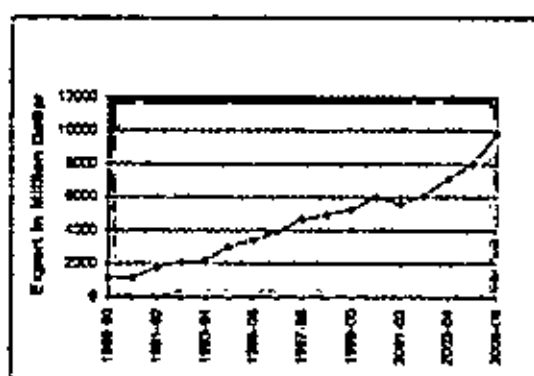
Figure 7.3.8b: Export of Manufacturing Products

Yearly export value of manufacturing products since 1992 can approximately be related with the gas consumption by the industrial sector by a linear relationship as follows:

$$EMP = C*G$$

Where,

EMP = Export of manufacturing products in billion dollars in a year;

C   = Constant ranges which varies from 0.124 to 0.154; and

G   = Gas consumption in billion cubic feet in a year.

7.3.2 Captive Power Sector Gas Demand Forecast

Captive Power Sector Gas Demand under TGDCL

Industry categorywise gas consumption data from the FY1999-00 to FY2004-05 have been used for the purpose of projection. The mix is slightly different from that of the industrial sector. Garments, dyeing, knitting, spinning and textile group with 77% consumption is the leading consuming group in this sector too. Paper manufacturing ranks the second leading industrial category, which consumes about 6%. No other industry alone occupies any significant share to mention   It is true that the gas demand in the captive power sector in the

Titas area has increased at very fast pace. But situation could have been different if national grid power supply were any better. Considering the present trend in the power supply, the relatively fast growth trend has been maintained until FY2012-13. If the power supply situation improves and presently offered incentives for captive power are withdrawn, the growth will retard. Expecting improvement of the power electricity generation and supply, retardation in the growth of gas demand in this sector has been envisioned. Gas demand projection results are shown in the Figure 7.3.9. Compound average growth rates for different period are given the Table 7.3.2.
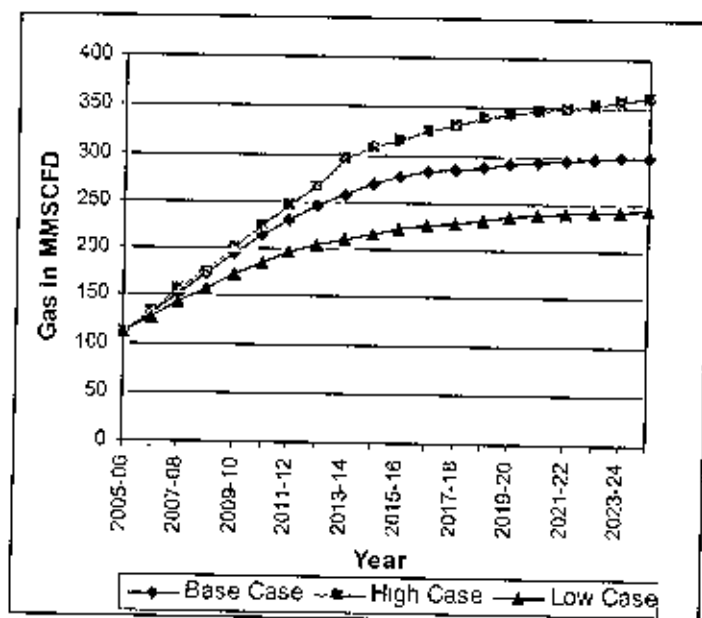
Figure 7.3.9 Captive Power Sector Gas Demand under TGTDCL

Table 7.3.2: CAGRs for Captive Power gas demand in TGTDCL

	FY2005-10	FY2010-1015	FY2016-20	FY2021-25	FY2005-25
Base Case	15.1%	6.8%	1.6%	0.6%	5.4%
High Case	16.1%	8.9%	2.2%	1.1%	6.4%
Low Case	11.7%	4.8%	1.6%	0.7%	4.3%

Captive Power Sector Gas Demand under BGSL

Industry types are similar to the captive power sector industries in TGTDCL. Steel and re-rolling is the second largest consuming industries after garments, dyeing spinning, knitting and textile group While making projection for gas demand for captive power sector under

125

BGSL, the same analogy has been used as in TGTDCL. Growth trend is likely to follow the course of TGDCL. Figure 7.3.10 shows the demand in the captive power sector in the BGFCL area.

Base Case: CAGR = 6.5%

High Case: CAGR = 8.0%

Low Case: CAGR = 5.5%
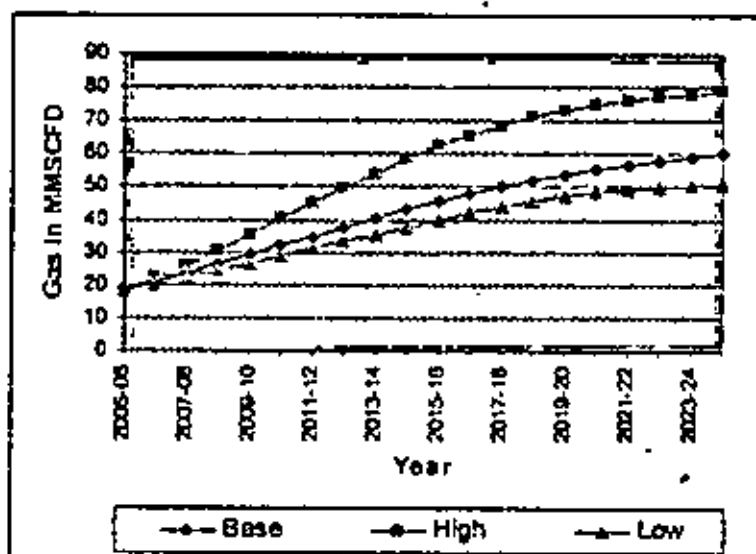
Figure 7.3.10: Captive Power Sector Gas Demand under BGSL

Captive Power Gas Demand under JGTDSL

Before commissioning of Lafarge cement factory JGTDCL had 20 tea gardens 3 spinning mills and 1 cement factory were captive power customers. Daily consumption was about 3MMSCFD and the overall trend was declining. It has been assumed that captive power growth will be minimal. Demand by Lafarge has been considered as exceptional and has been added with the normal projection without adjustment. The final CAGRs are 7.4%, 8.1 and 7.2 for base high and low cases respectively. Figure 7.3.11 shows the industrial sector demand forecast for JGTDSL franchise area.
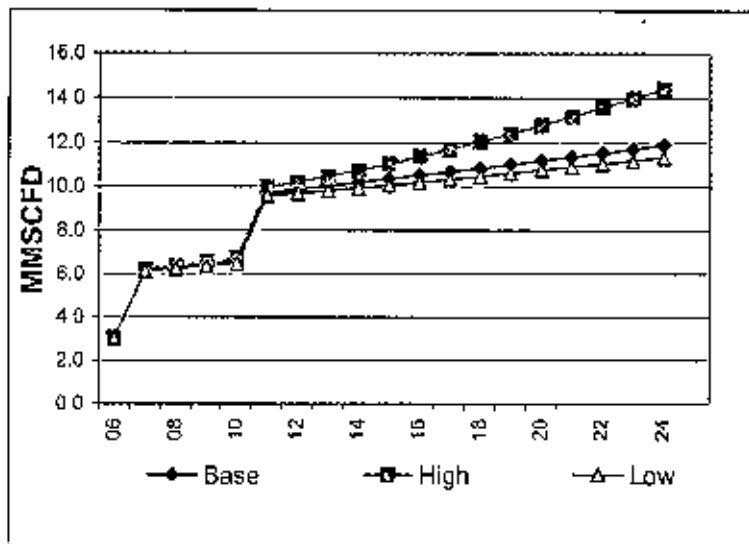
Figure7.3.11 Captive Power Gas Demand in JGTDSL A

Captive Power Sector Demand under PGCL and S&SW

No significant growth in the captive power gas demand in the PGCL franchise area is foreseen since over six year growth has been very low, present consumption in this sector is less than 0.01 MMSCFD. It has been estimated that in the base case it may rise to 0.3 MMSCFD while in the high case and low case it might be 0.5MMSCFD and 0.2 MMSCFD.

Gas network is expected to expand upto Khulna region at a time when national grid power situation is expected to improve. Hence the captive power gas demand may not grow at a pace as it has been now.

Countrywide Gas Demand in the Captive Power Sector

Gas demands in the captive power sector under the four franchise areas have been added o find the countrywide demand. Over the projection period for the captive gas demand CAGR will be 5.62%, 6.74% and 4.48% for the base, high and low cases respectively. Figure 7.3.12 shows the countrywide captive power gas demand. Captive power sector gas demand is rise at faster rate at the during the next six years and then rate will be slower, indicated by gradual flattening of curves, for the reasons described in the previous sections.

127
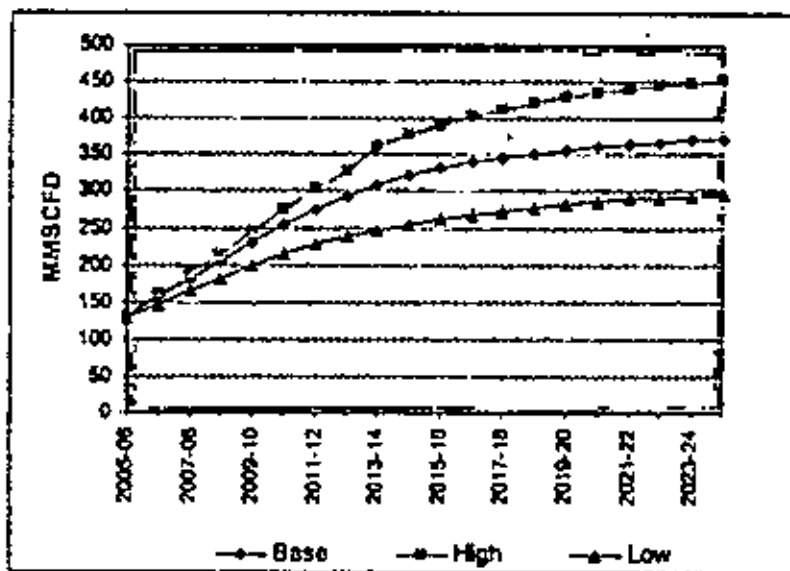
Figure 7.3.12 Countrywide Captive Power Sector Gas Demand

7.3.3 Domestic Sector Gas Demand

The rate of using the commercial fuels for the domestic use depends on the rate of urbanization. In 2005 the 25% people lived in the urban area and about 34% of population will live in the urban area by 2015 (*Toufiq 2005*). Given the advantage of gas as a fuel and lack of suitable alternative, domestic sector gas demand will increase irrespective of the area if the government does not impose any restriction on extending the pipeline gas to less viable areas. Even the stalling the expansion to new areas will not fully stop the increase in domestic sector gas demand because of the expansion of the existing areas under present network.

During the period of FY1994-95 to FY2004-05 domestic sector has shown growth of around 10% in the TGTDCL although there has been some rise and fall during this period. For the Base case it has been assumed that 10% growth rate will continue until FY2009-10 and the growth rate will gradually fall. For High case an 11 % growth has been assumed until 2009-10 followed by 10 % growth over the next five years. However for the Low case, following very recent trend, an 8% growth has been assumed until FY2009-10 followed by 7% growth for the next three years, a 5% for the rest of the projection period.

128

Domestic sector gas demand under BGSL was slightly higher than TGTDCL area. This was due smaller size of the company and extension to newer areas. Very similar approach as in the case of TGTDCL with higher rates has been followed in making projections for BGSL.

In 2005-06 countrywide domestic sector average gas consumption was 145 MMSCFD (TGTDCL-102, BGSL-33, JGTDSL-9 and PGCL-0.66 MMSCFD). By the FY2024-25 this figure will rise to 565, 1058 and 463 MMSCFD in the base, high and low cases respectively. Countrywide overall gas demand in the domestic sector is presented in the Figure 7.3.13 and companywise demand is given in the Figure 7.3.14.
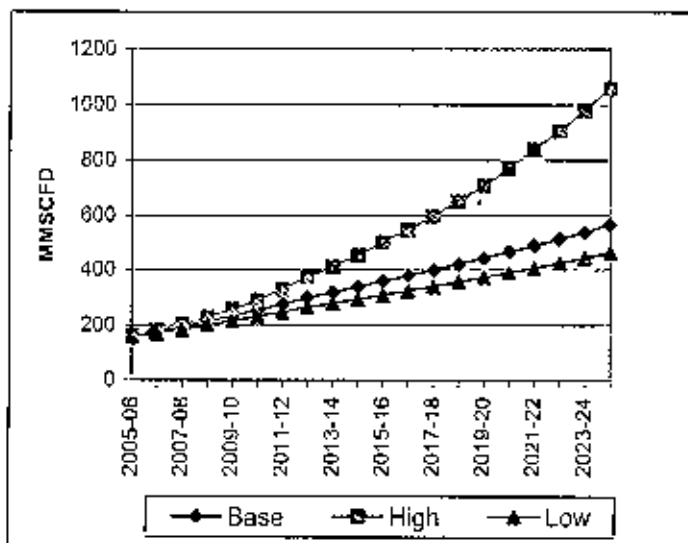
Figure 7.3.13: Countrywide Domestic Sector Gas Demand
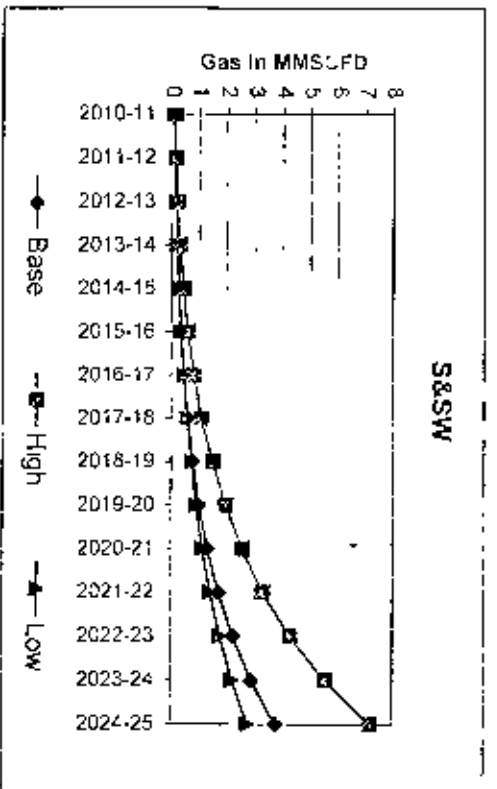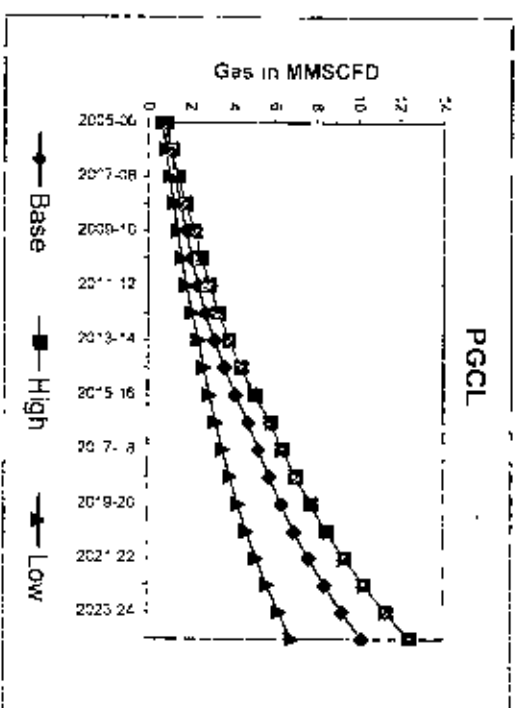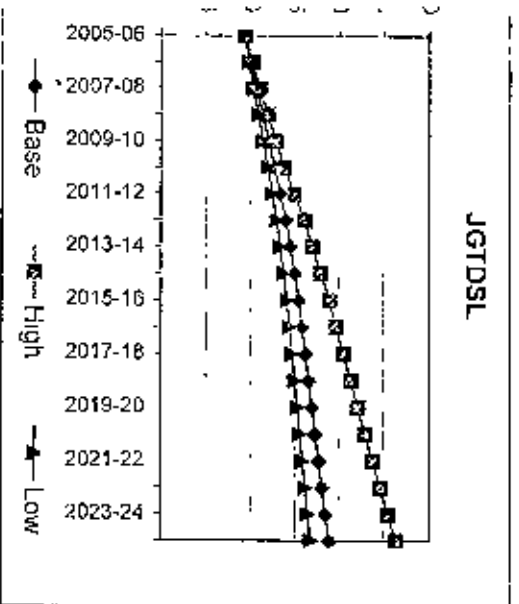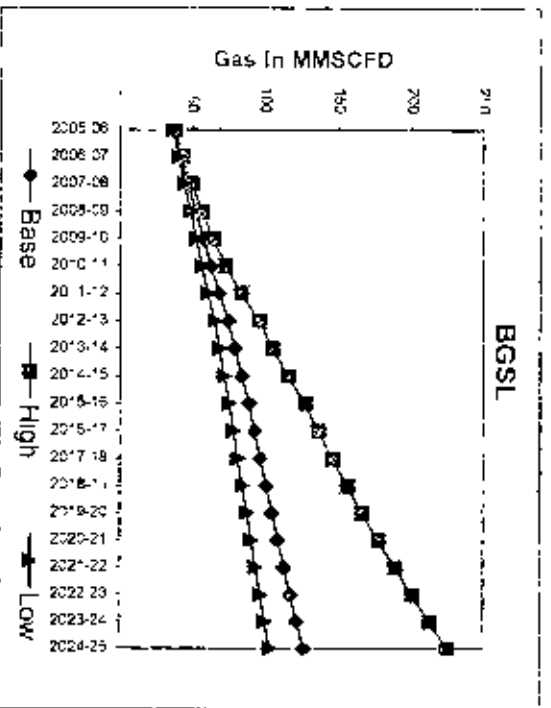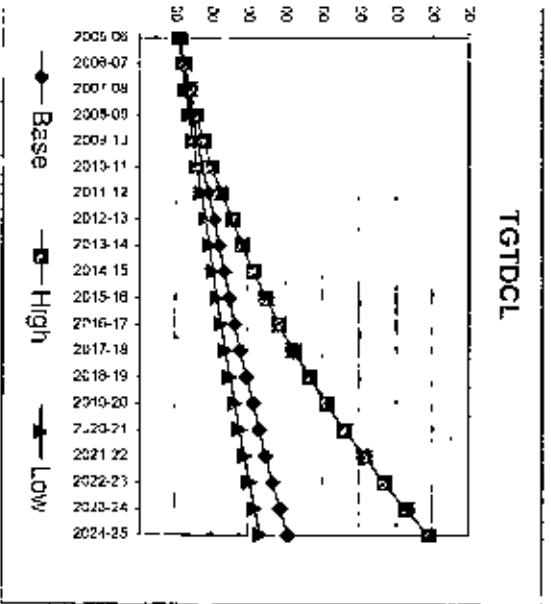
Figure 7.3.14: Domestic Sector Gas Demand under five companies

130

7.3.4 Commercial Sector Gas Demand

Countrywide commercial sector gas consumption was 13.7 MMSCFD in FY2004-2005. It may rise to 38, 59 and 33 MMSCFD in the base, high and low case demand scenarios respectively by 2024-25. Countrywide commercial sector gas demands in three demand scenarios are presented in Figure 7.3.15.
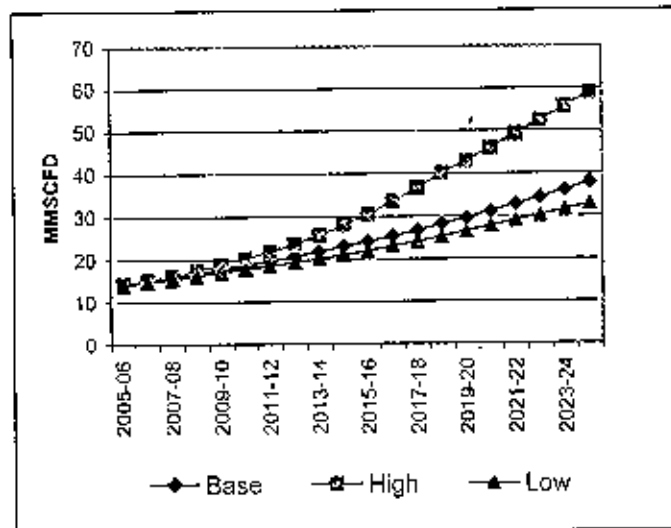
Figure 7.3.15: Countrywide Commercial Sector Gas Demand

7.3.5 Gas Demand in Tea Estate

Gas demand in the Tea estate sector is likely to remain unchanged to its present level of 2.31 MMSCFD over the entire projection period.

7.3.6   CNG Sector Gas Demand

CNG sector demand has shown very steep rise over the two years. Figure 7.1.16 shows the country wide gas demand for the forecasting period. Since it is the just beginning in real sense of word, the rate of rise is very high. Some sort of saturation will eventually reach which will cause slower growth. By the year 2004-25 it will reach 49, 67 and 35 MMSCFD in base case, high case and low case demand scenarios respectively
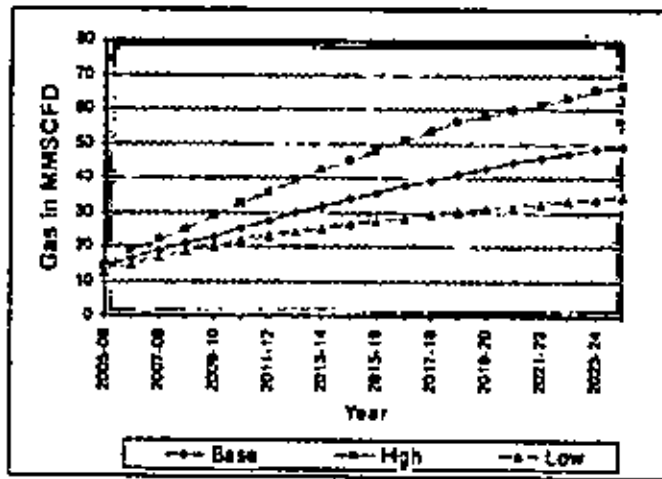
Figure 7.3.16: Countrywide CNG Sector Gas Demand

7.3.7   Forecast for System Loss

System loss has attained a monstrous shape, which has marred much of the success of the gas sector. Non-technical system loss must be prevented at any cost. Measures like splitting TGTDCL into several smaller companies, increasing the accountability of employees and regional managers, intensive surveillance, stopping political patronization of trade unionism etc can contribute positively in reducing system loss. In forecasting system loss an optimistic approach has been pursued. It has been assumed that BGSL and PGCL will be able to maintain system loss at current level and proportion of system loss in TGTDCL area will reduce gradually to 2%. If same approach is perused for three cases high case system loss may rise as high as 149 MMSCFD. Measures must be taken to keep the system loss to acceptable level. Concerted effort by all tires of the administration will be required to achieve the desired goal.
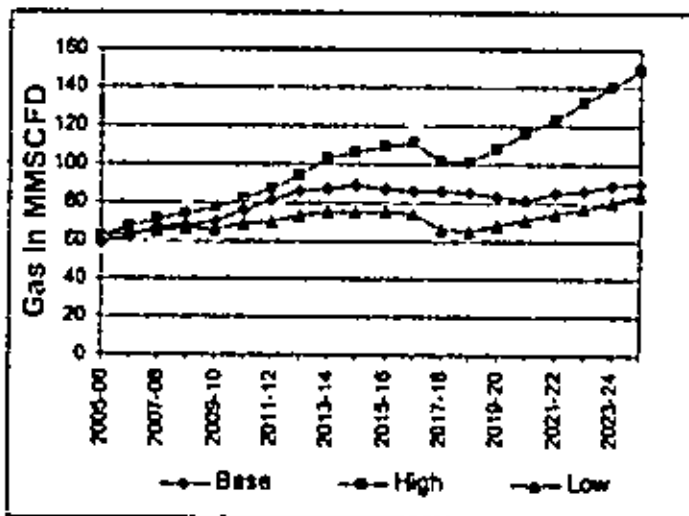
Figure 7.3.17: Countrywide System Loss

7.4   Regional/Companywise Gas Demand

Regional or companywide overall gas demand forecasts for four existing and S&SW company have been presented in this section. Overall average demand under a company is just the sum of the sectorwise average demand under respective companies. The maximum daily demand is the sum of the maximum demands in the bulk sector and non-bulk sector multiplied by a diversity factor. Diversity factors have been used on the assumption that the all the sectors will not simultaneously consume its maximum in any particular year.

7.4.1   Overall Gas Demand under TGTDCL.

This company will continue to sale the major portion of the gas in the country unless the government decides to split it into multiple distribution companies. The daily maximum demand under this company is likely to grow at 5.9%, 8.9% and 4.3% in base, high and low cases respectively. Figure 7.4.1 shows the overall maximum gas demand under TGTDCL in three scenarios.
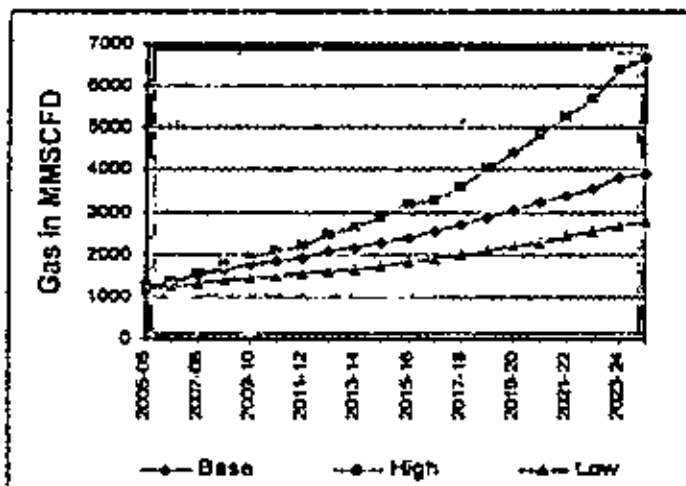
Figure 7.4.1 Overall Gas Demand under TGTDCL

7.4.2   Overall Gas Demand under BGSL

Being the second largest distribution company, BGSL has fair chance to continue the increasing trend provided the gas supply can be ensured. Because of the decline of the production from Sangu, Feni, Meghna and Bakhrabad along with the limitation of the

133

Bakhrabad-Chittagong 24 inch diameter transmission pipeline BGSL seems to be in a very difficult position to cope with the growing demand until FY2009-2010. The forecast is made on the ample gas scenario. In base, high and low Case scenarios growths over the entire period of forecast will be 6.7%, 10.2% and 5.6% respectively. Figure 7.4.2 shows the maximum demand under BGSL in three demand scenarios.
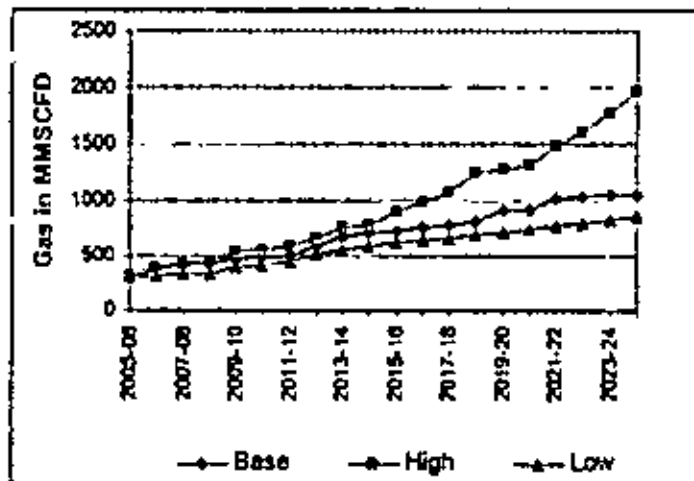
Figure 7.4.2 Overall Gas Demand under BGSL

7.4.3   Overall Demand under JGTDSL

The shows that the overall maximum gas demand in the JGTDSL franchise area will incase at 5%, 9% and 3% in the base, high and low case scenarios respectively. The main contributor to the increase in the gas demand will be power sector. Overall maximum gas demand is shown in the Figure 7.4.3.
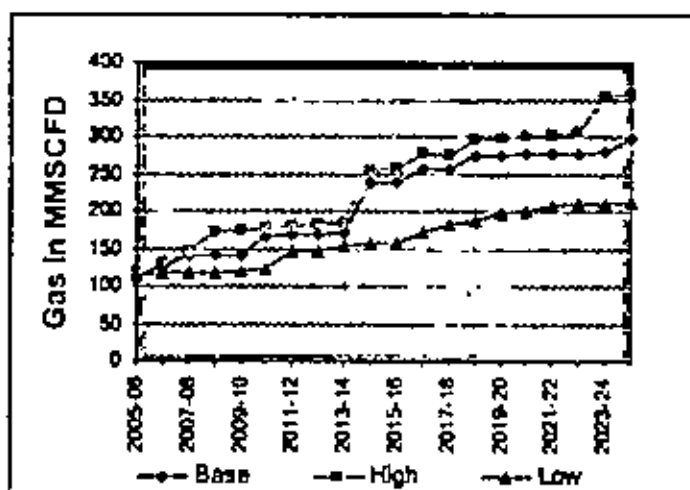
Figure 7.4.3 Overall Gas demand under JGTDSL

7.4.4 Overall Demand under PGCL

Figure 7.4.4 shows overall maximum gas demand under in this company in three different scenarios. Growth rates are 10% 15% and 3% in base, high and low cases respectively. The wide difference between these growths rates are due to very low generation scenario under low case of power generation. Gas demand for the proposed steel mill by Tata in Ishwardi and another fertilizer has been considered in the high case scenario. These have also widened the gap.
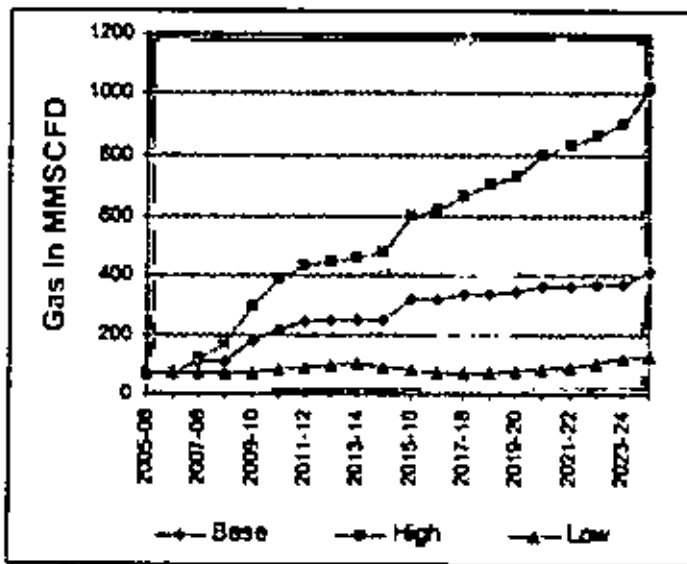
Figure 7.4.4: Overall Gas Demand under PGCL

7.4.5 Gas Demand under S& SW Company

Gas supply to region under the proposed S &SW may start in FY2010-11 depending upon the completion of transmission pipeline. Considering the best performance in the implementation of transmission pipeline project, the demand forecast has been made starting from the FY2009-10. Since the non bulk sector demand is expected to be low the power sector gas demand will highly dominate. Figure 7.4.5 show the summary of the forecast in the scenarios.
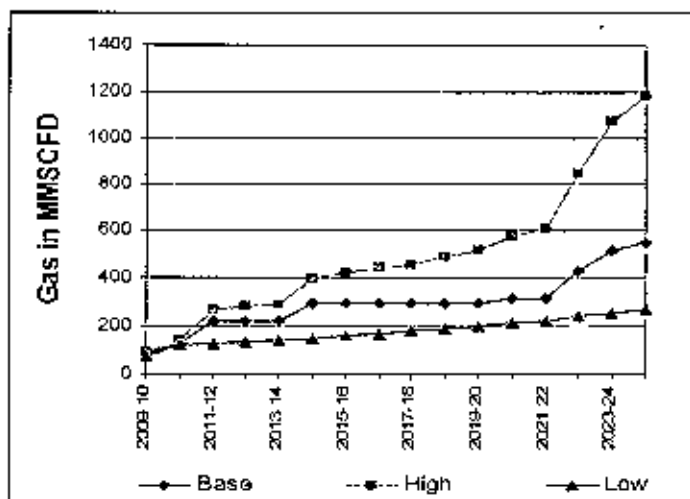
Figure 7.4.5: Overall Gas Demand under S&SW Company

7.5   Sub-regional Gas Demand for Non Bulk Sectors

As it has already said how sub-regional gas demand will influence the future planning, it was one of the objectives of the study to estimate the sub-regional gas demand. Under these considerations the sub-regional gas demand for the non-bulk sectors demand for different sales centres under the TGDCL has been presented in the Table 7.5.1. Demands shown in this table are the average demand. Sub-regional forecast for other companies are not made for they would be insignificant.

Table 7.5.1: Sub-regional Demand Forecast for TGTDTCL.

Sub-Region	Gas Demand				
	FY 05-06	FY 06-07	FY 07-08	FY 08-09	FY 09-10
Sonargoan	48.00	51.11	53.96	61.97	66.21
Narayanganj	58.49	69 01	70.91	78.34	83.79
Munshiganj	0.94	1.07	1.05	1.08	1.10
Tongi	15.48	17 75	18.66	19.36	21.71
Manikganj	5.22	5.82	5.66	5.75	5.75
Tangail	8.71	10.84	11.65	15.12	18.45
Savar	55.00	60.17	64 66	72.82	79 68
Joydevpur	85.00	105.13	128.83	150.00	170.33
Norsingdi	24.00	28.67	30.41	36.04	40.24
Ghorasal	3.01	3 42	3.39	3.52	3.58
B.Baria	2.49	2 90	2.94	3.11	3.21
Ashuganj	0.49	0.55	0.54	0.59	0.59
Vairab	1.09	1.18	1.15	1.13	1.13
Mymensingh	1 99	2.28	2.28	2.39	2.46
Jamalpur	0.55	0 62	0 61	0.62	0.63
Sherpur	0.24	0.27	0 27	0.29	0.30
Netrakona	0.33	0 36	0 35	0.36	0.36
Kishoreganj	0.62	0.76	0.81	0.91	0.99
Valuka	8.71	11.78	13.88	18.46	22.17
Gafargaon	0.11	0.13	0.13	0.14	0.14
Trisal	0 03	0.04	0.04	0.05	0.05
Dhaka Metro	133.97	156.61	158.69	168 51	175 05
Total	**454.49**	**530.51**	**569.87**	**640.60**	**697.92**

7.6   Countrywide Overall Gas Demand

Countrywide overall maximum daily gas demands in three scenarios are presented in Figure 7.6.1. The countrywide average gas demand is the sum of the individual sectorwise average demand. However, the overall maximum or peak demand is not the sum maximum demand in the individual sectors. Because, it is not expected that all the sectors will consume at maximum rates on the same day of a particular year. A diversity factor of 0.94 has been used in each demand scenario or calculating overall maximum demand

Countrywide overall and sectorwise demands projections in three scenarios are presented in Table 7.6.1, Table 7.6.2 and Table 7.6.3.

It is found that total 22.114 TCF, 32.170 TCF and 17.890 TCF gas will be required from July 2005 to July 2025 period in base, high and low cases demand scenarios respectively.

Growth rates (CAGR) for maximum demand over this period are:

Base Case = 6%

High Case = 9%

Low Case = 5%

Proportion of power sector gas demand to the total countrywide demand will increase. In the base case scenario, this will rise to 48% of the countrywide average gas demand by FY2024-25. While in the high case scenario and low case scenarios this proportion will be 56% and 45% respectively. The proportion of the fertilizer in the base case sector will decrease to 6.5% by the same period. In the high case and low case demand scenarios proportion of fertilizer sector gas demand will fall to 5% and 8% respectively.

In the base case in is found that the maximum daily demand will reach 5,117 MMSCF while maximum demand in the high and low case scenarios will be 9,762 MMSCF and 4,112 MMSCF respectively. The difference between the high case and base case demand appears to be very large. It is due the electricity demand in the high case scenario. If the electricity demand grows according to the high case scenario as envisaged in the PSMP 2005 and the trend to set them on gas based, the overall gas demand in the country will be very high as

shown in the high case demand scenario in this study. Apart from that the high case gas demand scenarios it is assumed that all the sector will grow at high rates, which may not be the case in reality. In fact one sector may grow at high while other at that time may not show that trend However, for simplicity there is no the alternative to such assumptions
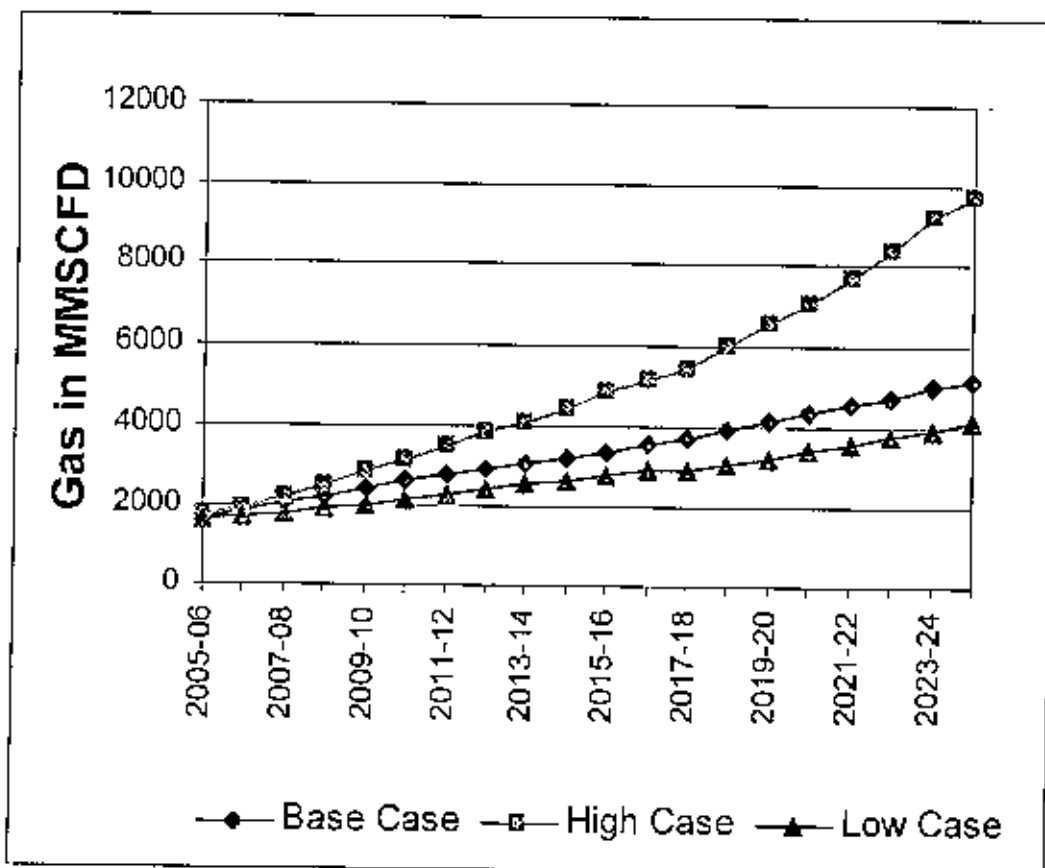
Figure 7.6.1: Countrywide Maximum Gas Demand

Table 7.6 1: Countrywide Gas Demand
(Base Case)

Unit: MMSCFD

Year	Power		Fertilizer		Industry	Captive	Commercial	Domestic	Seasonal	Tea	CNG	System	Non Bulk		Sum		Overall
	Avg	Max.	Avg.	Max								Loss	Avg	Max	Avg	Max	Max
1	2	3	4	5	7	8	9	10	11	12	13	14	15	16	16	17	18
2005-06	629	774	273	290	189	132	14.1	158	0.3	2.3	13	59	568	705	1470	1769	1663
2006-07	713	879	273	290	213	157	14.9	174	0.3	2.3	17	62	640	794	1626	1963	1845
2007-08	807	1034	273	290	236	181	15.7	192	0.3	2.3	19	67	712	883	1792	2208	2075
2008-09	884	1111	273	290	257	205	16.7	211	0.3	2.3	21	68	781	961	1939	2362	2220
2009-10	953	1240	273	290	290	230	17.8	232	0.3	2.3	23	70	865	1055	2091	2584	2429
2010-11	1058	1331	301	322	328	255	18.7	252	0.3	2.3	25	76	958	1149	2317	2802	2634
2011-12	1129	1382	301	322	368	275	19.6	274	0.3	2.3	27	81	1048	1258	2479	2962	2784
2012-13	1225	1442	301	322	407	294	20.7	299	0.3	2.3	30	86	1139	1366	2665	3130	2943
2013-14	1282	1503	301	322	444	310	21.8	318	0.3	2.3	32	87	1214	1457	2798	3282	3085
2014-15	1367	1510	301	322	488	323	23.0	338	0.3	2.3	34	89	1297	1544	2965	3375	3173
2015-16	1458	1628	301	322	539	334	24.1	358	0.3	2.3	36	87	1379	1628	3139	3577	3363
2016-17	1587	1715	301	322	580	342	25.4	377	0.3	2.3	38	86	1451	1713	3339	3750	3525
2017-18	1690	1825	301	322	626	347	26.7	398	0.3	2.3	39	86	1525	1800	3516	3948	3711
2018-19	1667	1949	301	322	672	352	28.1	419	0.3	2.3	41	85	1600	1904	3568	4175	3924
2019-20	1737	2101	301	322	722	357	29.7	442	0.3	2.3	43	83	1680	1982	3718	4406	4141
2020-21	1795	2203	301	322	774	362	31.2	464	0.3	2.3	44	81	1759	2093	3855	4618	4341
2021-22	1882	2355	301	322	830	365	32.8	487	0.3	2.3	46	85	1846	2126	4032	4802	4514
2022-23	1988	2451	301	322	889	368	34.4	512	0.3	2.3	47	86	1938	2229	4228	5002	4702
2023-24	2092	2613	301	322	943	371	36.1	538	0.3	2.3	48	89	2028	2332	4422	5268	4952
2024-25	2202	2678	301	322	1005	374	37.9	565	0.3	2.3	49	90	2124	2443	4628	5443	5117
Growth	7%	7%	1%	1%	9%	6%	5%	7%	0%	0%	7%	2%	7%	7%	6%	6%	6%

Table 7.6.2: Countrywide Gas Demand
(High Case)

Unit: MMSCFD

Year	Power Avg	Power Max	Fertilizer Avg	Fertilizer Max	Industry	Captive	Commercial	Domestic	Seasonal	Tea	CNG	System Loss	Non Bulk Avg	Non Bulk Max	Sum Avg	Sum Max	Overall Max
1	2	3	4	5	7	8	9	10	11	12	13	14	15	16	16	17	18
2005-06	684	832	271	300	190	131	14.3	161	0.3	2.3	14.31	62	575	713	1530	1845	1734
2006-07	742	905	271	300	213	160	15.2	180	0.3	2.3	18.30	67	656	814	1669	2019	1897
2007-08	847	1146	271	300	238	188	16.2	201	0.3	2.3	21.82	71	739	917	1857	2362	2221
2008-09	955	1266	271	325	310	211	17.4	227	0.3	2.3	25.04	74	866	1074	2092	2665	2505
2009-10	1058	1477	271	325	348	242	18.8	256	0.3	2.3	28.83	77	973	1207	2302	3008	2828
2010-11	1217	1633	294	325	436	275	20.2	289	0.3	2.3	32.31	82	1137	1364	2648	3323	3123
2011-12	1355	1748	357	400	487	302	21.8	328	0.3	2.3	35.72	87	1265	1519	2978	3667	3447
2012-13	1532	1922	436	474	539	327	23.6	373	0.3	2.3	38.93	94	1399	1678	3366	4074	3830
2013-14	1667	2025	436	474	592	360	25.6	410	0.3	2.3	42.06	103	1535	1842	3638	4341	4080
2014-15	1845	2239	436	474	654	376	27.9	453	0.3	2.3	44.80	106	1663	1996	3944	4709	4426
2015-16	2114	2469	436	474	725	389	30.6	500	0.3	2.3	47.61	109	1804	2165	4354	5107	4801
2016-17	2380	2672	436	474	791	402	33.5	546	0.3	2.3	50.62	111	1936	2324	4752	5470	5141
2017-18	2619	2921	436	474	865	412	36.6	596	0.3	2.3	53.35	101	2067	2377	5121	5772	5426
2018-19	2784	3348	436	474	939	422	40.1	651	0.3	2.3	56.35	101	2212	2544	5432	6366	5984
2019-20	3022	3736	436	474	1019	429	42.9	708	0.3	2.3	57.97	108	2367	2722	5825	6932	6516
2020-21	3285	4128	436	474	1099	434	45.9	770	0.3	2.3	59.62	116	2527	2906	6248	7508	7058
2021-22	3614	4605	436	474	1184	439	49.2	837	0.3	2.3	61.35	123	2697	3101	6747	8180	7690
2022-23	3977	5112	436	474	1277	444	52.3	906	0.3	2.3	63.28	132	2878	3309	7290	8895	8362
2023-24	4373	5789	436	474	1367	449	55.6	982	0.3	2.3	65.19	140	3061	3521	7870	9783	9196
2024-25	4779	6165	436	474	1468	454	59.0	1058	0.3	2.3	66.67	149	3258	3746	8473	10385	9762
Growth	11%	11%	3%	2%	11%	7%	8%	10%	0%	0%	8%	5%	10%	9%	9%	9.5%	9.5%

Table 7.6.3 : Countrywide Gas Demand
(Low Case)

Unit: MMSCFD

Year	Power		Fertilizer		Industry	Captive	Commercial	Domestic	Seasonal	Tea	CNG	System Loss	Non Bulk		Sum		Overall
	Avg	Max.	Avg.	Max									Avg	Max	Avg.	Max	Max
1	2	3	4	5	7	8	9	10	11	12	13	14	15	16	16	17	18
2005-06	595	706	271.2	299.6	189	128	14.0	156	0.3	2.3	12.55	61	564	699	1430	1704	1602
2006-07	596	732	271.2	299.6	210	147	14.7	169	0.3	2.3	14.84	64	622	771	1488	1802	1694
2007-08	608	733	294.2	318	228	165	15.3	183	0.3	2.3	16.92	65	676	838	1577	1888	1775
2008-09	613	796	294.2	318	251	182	16.1	198	0.3	2.3	18.56	66	734	911	1641	2025	1904
2009-10	763	840	294.2	318	282	198	17.0	214	0.3	2.3	19.92	66	800	992	1857	2150	2021
2010-11	766	938	294.2	318	317	214	17.7	230	0.3	2.3	21.83	69	871	1045	1932	2302	2163
2011-12	781	943	294.2	318	351	227	18.5	246	0.3	2.3	23.09	70	939	1126	2014	2387	2244
2012-13	842	1015	294.2	318	383	237	19.3	264	0.3	2.3	24.51	73	1004	1204	2140	2537	2385
2013-14	889	1095	294.2	318	412	246	20.1	278	0.3	2.3	25.47	75	1059	1270	2242	2683	2522
2014-15	918	1156	294.2	318	447	254	21.0	292	0.3	2.3	26.57	75	1119	1343	2332	2817	2648
2015-16	994	1194	294.2	318	486	261	22.0	307	0.3	2.3	27.61	75	1181	1418	2469	2929	2754
2016-17	1032	1292	294.2	319	517	267	23.0	322	0.3	2.3	28.45	74	1235	1491	2560	3091	2906
2017-18	1090	1341	294.2	318	550	273	24.1	338	0.3	2.3	29.33	66	1283	1475	2667	3134	2946
2018-19	1159	1417	294.2	318	581	278	25.2	355	0.3	2.3	30.33	65	1337	1538	2790	3272	3076
2019-20	1247	1507	294.2	318	618	282	26.5	372	0.3	2.3	31.00	68	1401	1611	2942	3436	3230
2020-21	1317	1621	294.2	319	654	286	27.7	389	0.3	2.3	31.69	71	1461	1681	3072	3619	3402
2021-22	1428	1712	294.2	318	687	289	29.0	406	0.3	2.3	32.39	74	1520	1749	3242	3778	3551
2022-23	1505	1856	294.2	318	727	291	30.2	424	0.3	2.3	33.22	77	1585	1823	3385	3997	3757
2023-24	1601	1957	294.2	318	762	293	31.5	443	0.3	2.3	33.97	80	1646	1893	3541	4168	3918
2024-25	1682	2081	294.2	318	806	295	32.9	463	0.3	2.3	34.73	84	1717	1975	3693	4374	4112
Growth	6%	6%	0%	0%	8%	4%	5%	6%	0%	0%	6%	2%	6%	6%	5%	5%	5%

7.7   Comparison of Forecast under This Study with Others

Figure 7.7.1 shows results of countrywide gas demand forecast made by different agencies since 2001 including this study. Average daily demands during each year at five year intervals have been shown in this figure. From the first look, it can be said, general trend is that the forecast performed in earlier showed smaller values than those performed later. It might had happened due to fact that forecast done later had been able to accommodate changes took place in this dynamic sector. GSMP 2006 is, however, an exception In the Case B of GSMP2006 showed slow growth at the early stage of the forecasting period but at the later stage growth rate is very high compared to others. At the final five years interval GSMP2006 showed steepest rise and the average daily demand rose to 5,606 MMSCFD. GSMP 2006 predicted that gas demand in the power sector in the base case will reach 3,171 MMSCFD by the FY2024-25 while PDB calculated this demand as 2,632 MMSCFD as the system total or over all maximum Calculation of PDB was based on the energy calculation done in the PSMP2005. In this GDP based projection of GSPMP2006, consultants also came up with smaller values at the beginning and higher figures at the later stages for the no-bulk sectors too. These made their projection curve having increasingly steeper slope. But the general perception for normal growth scenario is that when the size of economy becomes larger growth rate will be slower. In this study the base case gas demand for power is based on the projection by PDB in line with master plan update 2006 and subsequent changes in view of projects taken recently. Non bulk sector gas demand projection based on the bottom up approach. In the GSMP2006, the consultants first tried to link the GDP with the gas demand in the non-bulk sectors. Upon finding these results to be unrealistic they made arbitrary adjustments.

The average demand under this study is slightly higher than those in the projection by Petrobangla in 2005 for the most of the projection period. By the end of the projection they are about the same. But the maximum demand is higher than those done by Petrobangla in 2005. In that projection Petrobangla used gas demand by the Power Sector Master Plan 1995 for until FY2014-15 and then extrapolated for the next 10 years. They considered relatively low growth compared to the prevailing ones in the non-bulk sectors, especially the industrial, captive power and CNG sectors. According to Petrobangla 2005 projection average demand

143

FY2009-10 will be 1954 MMSCFD while this study shows that average demand in FY2009-10 will be 2,125 MMSCFD. Maximum demand is also lower in Petrobangla 2005 projection than this study This study shows that in the FY2024-25 the maximum demand will be 5,177 MMSCFD while Petrobangla 2005 projection predicted it to be 4, 773 MMSCFD. In 2005 Petrobangla adjusted its forecast made in 2001 in view of the current trend of the sectors under distribution companies. But it did not study the sub-regional growth pattern at all. There was no effort to look into the non-bulk sectors in detail.
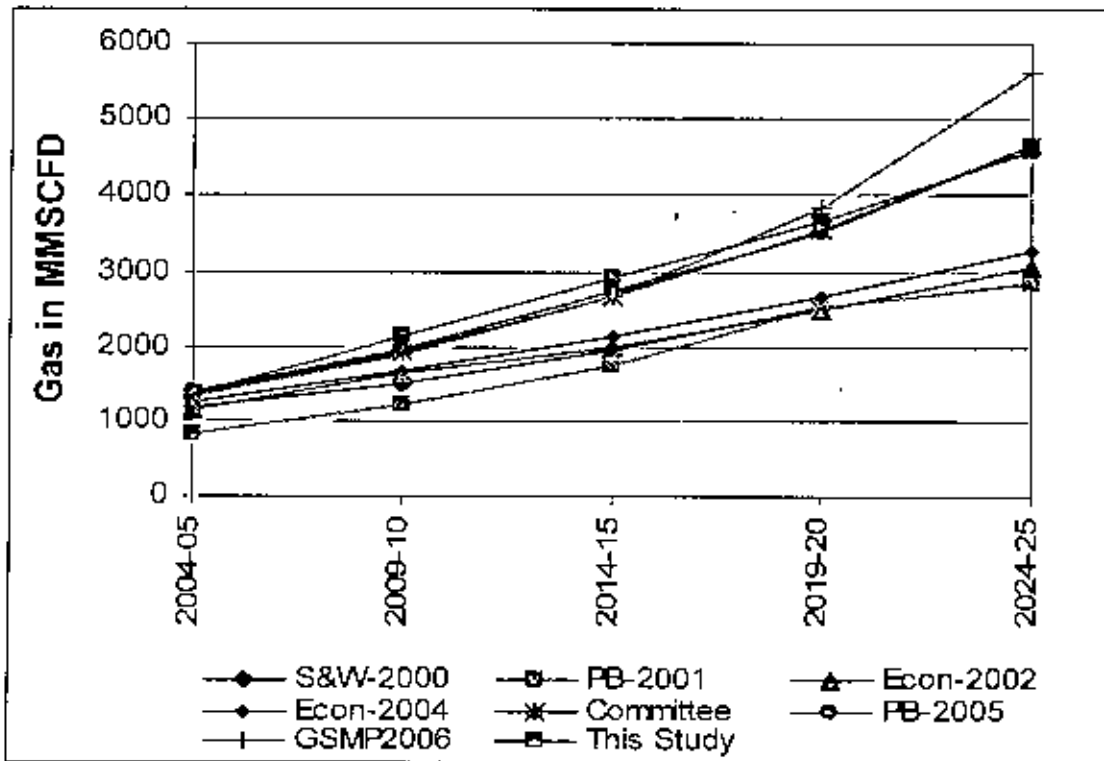
Figure 7.7.1· Comparison of Forecast under This Study with Others

Forecasts made by S& SW Consultants and Econ are far below the present trend. These projections were made on the basis of GDP growth projections. They made sectorwise projections for the whole country. They did not find the demand for any region. Their effort was more focused on the comparison of gas demand and the reserve in order to investigate the possibility of gas export. It may be worthwhile to mention that GDP growth does not completely relate with the gas demand in this country because agricultural sector, which has virtually no link with gas consumption apart from fertilizer production, has a great influence on the GDP growth of this country. Since the S & W Consultant and Econ did not have the

144

regional distribution of demand they could be indicative of national demand but these types of projections could not contribute to the infrastructural development of the sector

National Committee 2002 (Reserve Committee) made the gas demand forecast for the country for period of 2005 to 2050. As mentioned in the Chapter 2 that the committee found yearly total gas demand in nine different scenarios. The average demand calculated in 6% GDP and with EI Model-IV (shown in Figure 7.7.1) has striking similarity Petrobangla 2005 projection. The projection under this study shows slightly higher values until 2020 and for the next five years both are very close. The forecast made by the Committee in the caption 'Business as Usual' (4.55% GDP growth) appears to be very low. The committee found the total gas demand in different scenarios but did not say anything sectorwise or regional gas demand. They did not show maximum daily demand either.

This study made forecast for both countrywide and regional gas demand and presented. This Study examined the sectors in detail. This is based on the latest information. Non-bulk sectors gas consumption data from different sales centers were collected for this study and tried show the growth pattern of different areas under companies especially under TGTDCL. This study also tried find reasons behind wide variation of gas consumption growth among different areas. Besides, this study gave special emphasis on growth pattern on the industrial and captive power sector gas consumption. Industry categorywise gas consumption data from different sales centre were collected and made gas demand forecasts based on their growth trend. This study has been able to make the understanding about the non-bulk sectors growth pattern especially of industrial and captive power sectors both regional and countrywide basis much more comprehensive than the previous ones

Since this study has been able to accommodate the latest scenarios of the bulk sectors and it is based on the comprehensive study of non-bulk sectors, it can be said that the forecast made under this study is more dependable than others.

145

CHAPTER 8
DISCUSSION AND CONCLUSION

8.1 Discussion

This study shows that proportion of power sector gas demand to the overall countrywide demand will increase indicating further dependence on a single fuel. The share of the fertilizer sector gas demand will decline with time Industrial and captive power sector gas demand is growing very fast. The gas demand in the domestic sector will continue to increase in this country because of population growth and migration of people to the urban areas. Rapid urbanization is causing the extension of cities and townships both laterally and vertically Therefore, gas consumption in the domestic sector will continue to increase even expansion of network for domestic sector to new areas is stopped.

Gas consumption in the CNG sector has surpassed all estimations of the past. Increasing number of CNG stations are being installed in different regions with the increase in demand by the automobiles. It has appeared as a significant gas consuming sector within very shot span of time. Rise of the price of liquid fuel such as petrol and diesel, promotional policy by the government like duty free import of kits for conversion, and above all the throw away price of the gas in this sector are believed to be the main reasons for such rapid expansion of CNG sector.

Growth of gas demand is very prominent in the area around the Dhaka city and it is extending along the main highways projecting away from the city. Due to higher price of land and high rental for housing the industries in the city areas, entrepreneurs are choosing sites for new industries in the affordable areas Some of them are shifting existing ones to the outskirt areas like Sonargoan, Savar, Joydevpur and Narsingdi etc. There has been very rapid growth in gas demand in these areas in industrial and captive power sectors.

Although it cannot be compared with Dhaka region, Chittagong has emerged another growth centre for gas demand. A large number of gas based industries have been set up around this

city especially from the Barabkunda to the city-gate along the Dhaka-Chittagong highway. It can be said that if smooth supply of gas can be ensured the growth trend will continue.

On the other hand, there are some areas where gas networks had been extended long before, but development activities did not get any momentum. Sylhet region is an example where gas distribution is as old as the history of the gas marketing in the country. But industrial growth has been discouraging in this region Jamalpur, Sherpur, Netrokana, Kishoreganj, Mymensingh (north) under TGTDCL franchise area have been connected with network 10-12 years ago. Growth of gas demand in these towns has been limited to the domestic sectors and with very small amount in commercial sectors. Brahmanbaria is adjacent to the biggest gas field Titas and there has been gas distribution network for quite a long time, communication is also very good, even though there has been no virtual growth in the industrial sector here. Hence it can be said that only availability of utilities cannot intensify growth of industries in a particular area. Therefore, expansion of gas network should be based on economic consideration. Indiscriminate extension of gas infrastructure will be wastage of scarce national resource. Infrastructure development should be very much based on clear understanding of the sub-regional growth pattern

The study of gas consumption in different types of industrial and captive power sector customers of different sales centers have revealed that garments, dyeing, knitting, spinning and textile together as a group, weaving sector, leads in the industrial and captive power sectors by a very high margin with the second leading one: steel and re-rolling. The recent trend in the industries is to set up composite industries i.e garments, dyeing, spinning and textile in the same premises by same investor. Ceramic, Food and Beverage, Paper and Packaging are some other types industries that have some shares to the gas consumption to be mentioned. Contributions by other industries are not very significant. Since the industrial sector of the country is not diversified at all, gas demand in the industries both in industrial and captive power sectors will very much depend on the progress of the weaving sector. Any setback to the weaving sector may cause the gas demand in industrial and captive power sectors to be plummet.

This study has further revealed that gas consumption in the industrial sector is dependent on the export of manufacturing products which is largely garments, knitting and textile products. The consumption in this sector can be approximated by a linear relationship.

147

April and May is the peak season of gas demand in the country. Demand for electricity in the residential, commercial sectors increases due to hot weather. Demand of electricity for irrigation reaches to the peak during this period. High demand for electricity causes rise in gas demand. This is further accentuated by rise in gas demand in fertilizer sector because in this period they try to operate the fertilizer factories in the full swing. Since the difference between the evening peak demand and average daily demand in the power is very high. Evening peak demand in the electricity compounded by the peak demand by the residential sector for cooking, evening peak gas demand necessitates the gas sector some extra capacity in both production and transmission over the daily overall demand. Alternatively, like many other countries, the difference between daily peak and low demand may be reduced by using liquid fuel or LPG for the peaking duty power plants.

Gas requirement from 2006 to 2025 will vary from 17.89 TCF to 32.17 TCF for low to high growth scenarios with 22.11 TCF in base case (moderate) scenario. With these huge demand figures in the view it is not difficult for anybody to surmise that it will be an uphill task for the country's gas sector to meet this demand with the indigenous resources. Urgent actions are needed for the augmentation of the production and transmission capacity.

8.2   Conclusion

1. Demand for natural gas is ever increasing in the country. Meeting long-term demand will be the great challenge for the gas sector.

2. Major share of the industrial sector consists of consumption by weaving sector which is the major source of export from the country. Gas consumption has approximately linear relationship with export in the manufacturing sector.

3. Industrial sector growth is predominantly limited within Dhaka and its surrounding areas. Chittagong region could be another growth centre if dependable gas supply could be established.

4. Availability of gas supply and other utilities does not necessarily guarantee industrial growth in a particular area. People have general tendency to stay close to the administrative centre of the country

References

Azad 2006: System Loss Reduction Plan of Titas Gas Transmission and Distribution Co. Ltd by Md. Shamsuddin Al Azad, PMRED, BUET Dhaka, January 2006

BGSL 2000: Annual Report 2000, Bakhrabad Gas Systems Limited, Chapapur Comilla, November 14, 2000.

Committee 2002: Report of the Committee for Gas Demand Projections and Determination of Recoverable Reserve & Gas Resource Potential in Bangladesh, Prepared for the Ministry of Energy and Mineral Resources, Government of The People's Republic of Bangladesh, June 2002.

Econ 2002: Bangladesh Optimal Gas Utilization by Econ Centre for Economic Analysis, P.O. Box. No 6823, St. Olva Plass, Oslo, Norway for Norwegian Petroleum Directorate and Hydrocarbon Unit, Ministry of energy and Mineral resources of Bangladesh in 2002.

Econ 2004: Bangladesh Optimal Gas Utilization (Phase II) by Econ Centre for Economic Analysis, P O. Box. No 6823, St. Olva Plass, Oslo, Norway for Norwegian Petroleum Directorate and Hydrocarbon Unit of Ministry of energy and Mineral resources, Bangladesh in 2004.

Economic Review 2005: Bangladesh Economic Review 2005, Economic Consultancy Cell, Finance Division, Ministry of finance, People's Republic of Bangladesh.

Energy Policy 2006: Bangladesh National Energy Policy, Ministry of Power Energy & Mineral Resources, October 2006.

Export Statistics 2005-2006: Bangladesh Export Statistics 2005-2006, Export Promotion Bureau TCB Bhahan. 1 Kawranbazar, Dhaka 1215, Web: www.epb.gov.bd.

GSMP 2006: Bangladesh Gas Sector Master Plan 2006 by Wood Mackenzie Limited, Kintore House 74-77, Queen Street, Edinburgh, EH2 4NS, UK.

JGTDSL 1997: Annual Report 1997, Jalalabad Gas Transmission and Distribution Systems Limited, Mandibagh, Sylhet, March 31, 1998.

MIS June 2006: Management Information Services Report for the Month of June 2006, Report No.288, Management Information Services Department, Petrobangla.

Petrobangla 2001: Natural Gas Demand and Supply forecast: FY 2001 to 2050 by Md. Abdul Aziz Khan, General Manager, Production & Marketing Division, Petrobangla, March 2001.

Petrobangla 2005: 'Natural Gas Demand Forecast' by Production and Marketing Division, Petrobangla, January 2005.

PSMP 1995: Power System Master Plan Bangladesh by Acres International Limited, Collaborating with Directorate of System Planning, BPDB, August 1995.

PSMP 2005: Component B: Power System Master Plan Update, Nexant, Collaborating with Bangladesh Power Development Board and Power Grid Company of Bangladesh Limited, February 2006.

Peterson 2000: Managerial Economics by H. Craig Peterson, Third Edition, Published by Prentice hall of India, New Delhi-110 001 in 2000.

S & W 2000: Natural Gas Demand forecast for Bangladesh (2000-2020) by S & W Consultants, 1430 Enclave Parkway, Houston, TX 77077, in August 2000.

TGTDCL June 2006: Monthly Progress Report for the Months of June 2006, Titas Gas Transmission and Distribution Company Limited, 105 Kazi Nazrul Isalm Avenue, Dhaka-1215.

Toufiq 2005 : Article titled 'The Growth & Potential of Real Estate Sector in Bangladesh' by Dr. Toufiq M. Siraj, President of REHAB, Published in REHAB Housing Fair NY 2005, May 2005.

WDI 2005: World Development Indicators 2005, Development Data Center, The World Bank, 18 P8 H Street. NW, Room MC2-812, Washington DC 20433, USA; Web. www. worldbank.org/data.

Appendix - A

Contents

Table A1 : Gas Consumption and Production History
Period: 1961-2006

Unit: BCF

Year	Power	Fertilizer	Industry	Captive	Domestic	Comm.	CNG	Tea	Production
1960-61		0.161	0.847		0				1.0
1961-62		2.626	0.844		0				3.5
1962-63		4.520	0.912		0				5.4
1963-64		5.812	0.962		0				6.8
1964-65		4.756	0.918		0				5.7
1965-66		5 672	0.845		0				6.3
1966-67		5.530	1.027		0				6.6
1967-68	0.225	6.480	0.917		0				7.6
1968-69	2.764	5.554	1.943		0				10.3
1969-70	6.017	7.644	0.736		0.005	0.0			14.4
1970-71	7.154	8.148	1.346		0.028	0.1			16.7
1971-72	5.480	4.978	0.946		0.056	0.1			11.5
1972-73	7.960	14.075	1.380		0.093	0.7			23.6
1973-74	10.136	15.558	2.380		0.164	0.1			28.3
1974-75	8.445	7.109	2.857		0.290	0.2			18.9
1975-76	8.704	15.787	3.566		0.495	0.3			28.8
1976-77	10.785	15.919	4.371		0.785	0.3			32.2
1977-78	13.161	13.958	5.443		1.149	0.4		0.016	34.3
1978-79	14.806	15.444	6.399		1.827	0.8		0.151	39.3
1979-80	15.855	18.587	7.297		2.839	1.1		0.205	45.7
1980-81	18.855	17.609	8.482		3.929	1.4		0.259	48.9
1981-82	18.000	26.600	9.100		4.200	1.7		0.270	64.8
1982-83	22.000	25.800	9.800		5.200	1.9		0.259	72.2
1983-84	22.800	29.400	10.400		5.800	2.1		0.267	83.3
1984-85	38.300	27.200	12.600		6.300	2.2		0.241	94.6
1985-86	39.800	33.700	16.400		6.800	2.7		0.304	105.1
1986-87	51.800	34.900	18.700		6.800	3.4		0.576	120.9
1987-88	62.100	51.000	16.700		7.600	3.6		0.641	147.4
1988-89	65.500	53.400	15.000		9.300	3.2		0.628	162.0
1989-90	75.600	55.900	14.300		10.200	3.1		0.677	167.7
1990-91	82.600	54.200	13.200		10.500	2.9		0.750	172.7
1991-92	88.100	61.600	13.400		11.600	2.9		0.677	188.4
1992-93	93.300	69.200	15.200		13 500	2.4		0.660	210.9
1993-94	97.300	74.500	20.260		15.400	2.87		0.689	223.8
1994-95	107.400	80.500	24.240		18.860	2.88		0.624	247.2
1995-96	110.900	90.980	27.310		20.710	3.00		0.727	265.7
1996-97	110.630	77.830	28.620		22.840	4.49		0.712	260.9
1997-98	123.550	80.070	32.320		24.890	4.61		0.743	281.9
1998-99	140.820	82.710	35.790		27.020	4.71		0.710	307.9
1999-00	147.620	93.310	35.970	15.097	29.560	3.85		0.671	331.2
2000-01	175.270	88.430	39.800	18.162	31.850	4.06		0.669	372.2
2001-02	185.950	78.780	38.600	21.605	36.740	4.25	0.003	0.728	391.5
2002-03	186.260	95.850	45.380	26.176	44.900	4.56	1.357	0.742	427.3
2003-04	199.000	92.820	46.367	32.062	49.370	4.85	1.937	0.816	453.0
2004-05	211.023	93.394	51.675	37.857	52.491	4.85	3.633	0.796	486.6
2005-06	224.390	89.086	63.261	48.862	56.747	5.21	6.832	0.756	526.9
Total	2,810.680	1,827.087	708.621	199.823	540.839	91.667	13.762	15.963	6,563

Source: Petrobangla 2001, MIS June 2006

154

Table A1.1 : Sectorwise Gas Consumption
Titas Gas T & D Company Ltd

Unit : BCF

Year	Power	Fertilizer	Industrial	Commercial	Domestic	Brick field	Captive Power	CNG	Total Sales	Purchase	UFG (%)
1967-68	0.225	-	-	-	-				0.225	0.225	0.00
1968-69	1.019		0.005	0.009	0.001				1.034	1.034	0.00
1969-70	1.140	1.828	0.145	0.026	0.004				3.143	3.190	1.48
1970-71	3.419	4.225	0.253	0.041	0.022				7.962	8.023	0.76
1971-72	3.103	0.602	0.322	0.033	0.036				4.096	4.188	2.25
1972-73	4.113	9.669	0.843	0.066	0.087				14.778	14.858	0.54
1973-74	7.419	10.559	1.462	0.115	0.146				19.701	19.734	0.17
1974-75	6.063	2.098	1.784	0.181	0.277				10.403	10.321	-0.79
1975-76	6.535	11.018	2.334	0.768	0.489				20.642	20.464	-0.86
1976-77	8.200	10.027	3.047	0.370	0.766				22.410	22.289	-0.54
1977-78	9.327	8.311	3.726	0.548	1.116				23.028	22.940	-0.38
1978-79	9.209	11.146	4.406	0.805	1.609				27.375	27.260	-0.42
1979-80	11.016	11.975	4.823	1.021	2.472				31.409	31.645	0.75
1980-81	13.321	11.210	5.669	1.289	3.265				34.754	35.421	1.92
1981-82	18.010	19.836	6.993	1.591	4.050				50.480	51.469	1.96
1982-83	21.999	19.140	7.457	1.810	5.049				55.451	57.119	2.99
1983-84	22.688	25.805	5.294	1.965	5.611				61.561	63.900	3.80
1984-85	34.656	24.298	7.977	2.130	6.131	1.461			76.671	79.677	3.92
1985-86	27.947	30.002	4.704	2.277	6.466	2.030			73.506	77.916	6.00
1986-87	40.688	30.866	9.050	2.418	6.220	1.928			91.168	96.679	5.99
1987-88	49.005	33.076	8.855	2.482	6.781	1.827			102.026	107.178	5.05
1988-89	53.458	33.401	6.851	2.521	8.009	-			104.240	111.474	0.94
1989-90	64.802	31.538	7.240	2.401	8.264				114.243	122.103	0.88
1990-91	71.512	31.924	7.204	2.260	8.511	0.003			121.415	129.003	6.25
1991-92	76.399	37.928	7.640	2.280	9.005	0.406			135.838	144.382	6.29
1992-93	63.376	47.357	9.323	1.695	10.453	0.586			152.792	167.078	9.35
1993-94	75.079	51.242	12.619	1.907	11.760	0.900			153.707	165.081	7.40
1994-95	78.409	45.381	15.786	1.842	14.091	0.968			159.035	172.230	7.89
1995-96	63.590	53.502	18.646	2.013	15.574	0.642			173.987	186.249	7.06
1996-97	68.534	47.004	21.883	2.190	16.986	0.235			178.632	191.169	6.23
1997-98	68.267	45.909	25.744	2.260	18.717	0.362			181.279	194.730	7.42
1998-99	102.942	44.391	26.887	2.331	19.953	0.300			198.604	214.549	7.92
1999-00	112.407	44.461	22.574	2.452	21.542	0.304	11.377		215.117	233.402	8.50
2000-01	119.390	46.737	26.465	2.562	22.903	0.346	14.110	0.422	232.533	254.972	9.05
2001-02	132.712	37.243	28.471	2.672	26.215	0.361	17.537	0.097	245.230	267.939	9.26
2002-03	132.444	52.327	33.610	2.891	31.684	0.367	21.893	0.422	275.416	298.414	8.35
2003-04	145.969	49.442	37.818	3.074	34.766	0.093	26.802	1.771	299.535	320.822	7.14
2004-05	152.122	51.296	42.550	3.082	36.873	-	31.544	3.085	320.532	344.798	7.57
2005-06	167.911	48.700	53.190	3.294	39.696	-	40.837	5.438	359.072	384.065	0.50
Total	1,962,797	1,029,760	432.643	59.944	368.322	13.155	123.263	5.797	3,092,748	4,273.975	

Table A1.2 : Sectorwise Gas Consumtption
Bakhrabad Gas Systems Ltd.

Unit : BCF

Year	Power	Fertilizer	Industry	Captive Power	Comm.	Domestic	Seasonal	Tea	CNG	Total Sales	UFG (%)	Purchase
1984-85	3.637	0.000	3.096		0.017	0.004	0.000			6.754	4.120	7 032
1985-86	5.306	0.068	5.270		0.078	0.086	0.156			10.965	1.470	11.126
1986-87	5.794	0.509	7.043		0 196	0.280	0 468			14.290	1 870	14.557
1987-88	8.187	11.943	4.781		0 306	0.420	0.453			26.090	2 080	26.633
1988-89	7 314	13.637	5.364		0.442	0.833	0.000			27.589	3.420	28.533
1989-90	7.570	18.240	5.049		0.524	1.133	0.000			32.516	-0.950	32.207
1990-91	8.487	16.020	4.657		0.495	1.270	0.000			30 929	-0.490	30.778
1991-92	7.758	17.917	4.540		0.496	1 848	0.159			32.718	0.180	32.776
1992-93	5.350	16.270	4.713		0.508	2 118	0.110			29.069	1.080	29.383
1993-94	16.916	17.335	5.138		0 600	2.562	0.099			42.651	0.370	42.809
1994-95	19 243	26.308	5.580		0 678	3.281	0 105			55.195	-1.070	54.604
1995-96	15.884	31 916	5.598		0.740	3.768	0 097			58.003	-2.000	56 843
1996-97	8.538	24.833	5.274	2.084	0.827	4.214	0.000			45.770	0.500	45.999
1997-98	17.977	28.555	5.131	1.467	0.902	4.787	0.000			58.819	2.520	60.301
1998-99	22.803	32.439	5.239	2.634	0.958	5.364	0.000			69.437	0 860	70.034
1999-00	22.859	34.566	5.380	2 774	1.025	6.112	0.000			72.716	2.810	74.760
2000-01	24.893	35.942	5.856	3.111	1.098	6.899	0.073			77 872	2.330	79.686
2001-02	23.543	35.880	6.126	3.176	1.171	8 176	0.073			78.144	4.080	81.333
2002-03	26 718	37.661	6.591	3.468	1 237	10.220	0.110		0 028	86.033	1.010	86.902
2003-04	23.387	37 808	7.247	4.319	1.318	11.346	0.037		0.166	85 627	1.030	86.509
2004-05	26.082	36.745	7.464	5.205	1.357	12.195	0.000		0.535	89.585	2.150	91 511
2005-06	28 109	34 605	8.450	6.697	1.406	13.090	0.000	0.001	1.226	93.584	2.250	95.740
Total	336.356	509.198	123.587	34.935	16.379	100.004	1.939	0.001	1.956	1,124.356		1,140.055

Source. BGSL 2000, MIS June 2006

Table A1.3 : Sectorwise Gas Consumption
Jalalabad T & D Systems Ltd.

Unit :BCF

Year	Power	Fertilizer	Industrial	Comm.	Domestic	Bricks	Tea	Captive	CNG	Sales	UFG (%)	Purchase
1977-78			0.000	0.023	0.009		0.016			0.049		0.049
1978-79			0.000	0.050	0 064		0.151			0.265		0.265
1979-80			0.055	0.057	0.090		0.205			0.407		0 407
1980-81			0.050	0.053	0.125		0.259			0 488		0 488
1981-82			0.128	0.090	0.164		0.270			0 652		0.652
1982-83			0 082	0.102	0.168		0.259			0.611		0.611
1983-84			0.127	0 093	0.174		0.267			0.661		0.661
1984-85			0.133	0.085	0.184		0.241			0.644		0.644
1985-86	6.525		2.014	0.101	0.225		0.304			9.168		9.168
1986-87	5.340	0.243	2.038	0.116	0.341	0.217	0.576	0.033		8.904		8.904
1987-88	4.880	6.313	2 400	0.142	0.388	0.221	0.641	1.012		15.996		15.996
1988-89	5.334	6.379	1.541	0.164	0.431	0.000	0.628	1.062		15.538		15.538
1989-90	3 186	6.133	1.318	0 173	0.775	0.000	0 677	1.069		13.331		13.331
1990-91	2.521	6.229	1.300	0 175	0.748	0.000	0 750	0.996		12.720	3.310	13 141
1991-92	1.948	5 797	1.031	0.182	0.793	0.039	0.677	0.870		11.337	1.890	11 551
1992-93	4.484	5.575	1.105	0.192	0.925	0.044	0.660	0.711		13.694	3.520	14.177
1993-94	5.532	5.858	1.602	0.203	1.281	0.044	0.689	0.652		15.861	4.430	16.563
1994-95	9.726	5.775	1.904	0 210	1.410	0.067	0.624	0.671		20.387	2.000	20.795
1995-96	11.353	5.563	2 008	0.227	1.515	0.045	0.727	0.786		22.223	1.500	22.557
1996-97	13.792	6.011	1.870	0.271	1.569	0.091	0.712	0.790		25.106	0.190	25.153
1997-98	15.720	5.538	1.600	0 300	1.697	0.030	0 743	0.704		26.333	0 880	26.565
1998-99	12.841	5.909	1.382	0.332	1.828	0.047	0.710	0.707		23 755	0.430	23.857
1999-00	10.212	5.867	1.445	0.367	1 964	0 030	0.671	0 946		21.503	0.000	21.503
2000-01	9.271	5 804	1.629	0.402	2.044	0.037	0.669	0.930		20.785	0.060	20.797
2001-02	13.359	5.694	1 169	0.402	2.336	0.073	0.726	0.860		24.619	0.940	24 850
2002-03	9.782	5.986	1.003	0.402	2.592	0.073	0.742	0.812		21.391	0.180	21.429
2003-04	10 907	5.673	1.408	0 403	2.965	0.000	0.816	0.942		23.113	-0.300	23.043
2004-05	11.611	5.874	1.373	0.410	3.183	0.000	0.796	1.092	0 018	24.357	-0.160	24.318
2005-06	11.642	5.775	1.283	0.426	3.472	0.000	0.755	1.151	0.146	24.649	1.140	24.932
Total	179.964	111.994	32.423	5.599	32.480	1.056	14.293	16.796	0.163	394.768		398.168

Table A1.4 :Sectorwise Gas Consumption
Pashcimanchal Gas Company Ltd.

Year	Power	Fertilizer	Industry	Commercial	Domestic	Birck fields	Captive	Total	Purchase	UFG
1999-00	0.596	0.000	0.002	0.000	0.004		0.000	0.602	0.536	-12.46%
2000-01	13.505	0.000	0.037	0.008	0.037		0.011	13.595	13.137	-3.49%
2001-02	16.097	0.000	0.073	0.012	0.037		0.033	16.251	15.867	-2.42%
2002-03	17.265	0.000	0.110	0.015	0.110		0.004	17.502	17.204	-1.74%
2003-04	19.288	0.000	0.256	0.018	0.183		0.003	19.749	19.595	-0.79%
2004-05	21.225	0.000	0.288	0.022	0.241	0.000	0.028	21.805	21.718	-0.40%
2005-06	16.732	0.000	0.325	0.063	0.490	0.000	0.177	17.804	17.804	0.00%
Total	104.708	0.000	1.090	0.136	1.101	0.000	0.255	107.307	105.859	

Table A1.1.1 : Sub-Regional Gas Consumption
Titas Gas Transmission and Distribution Company Ltd

Unit: MMSCM

Region	Customer	FY 94-95		FY 95-96		FY 96-97		FY 97-98		FY 98-99		FY 99-00		FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05		Growth
		N	v	N	v	N	v	N	v	N	v	N	v	N	v	N	v	N	v	N	v	
Sonargaon	Industry									119	57.91			142	105.290	147	119	157	135	170	151	157	160.000	11%
	Cap. Power									23	36.68			33	76.070	36	96.54	41	110.3	48	133	60	157.000	20%
	Comm.									21	0.27			27	0.470	25	0.53	29	0.63	30	0.73	33	0.567	10%
	Domestic									6320	4.72			6092	7.866	17658	8.807	19708	8.80	21120	10.254	24955	11.831	11%
	Total									6483	99.58			7159	149.504	17860	215.877	19935	255.62	21368	294.984	25205	329.518	15%
Narayangonj	Industry													223	170	277	200	260	210	363	237	317	230.000	10%
	Cap. Power													17	40.31	17	54.47	23	70.3	31	80.4	35	93.284	23%
	Comm.													235	4.59	235	4.91	238	7.43	260	8.13	270	9.765	21%
	Domestic													44000	53.77	48000	60.98	53000	83.00	61330	111.19	64450	125.104	24%
	Total													44475	268.675	48480	319.473	53521	370.73	61924	435.716	65072	476.153	16%
Munshigonj	Industry	11	1.97	12	2.3	14	3.47	15	4.16	15	2.8	16	2.436	18	24.178	20	3.25	21	3.294	15	3.387	9%
	Cap. Power														0.41	2	0.51	3	0.61	4	0.447	
	Comm.	16	0.16	16	0.18	19	1.05	21	0.24	25	0.27	28	0.73	30	0.37	31	0.51	31	0.54	22	0.462	10%
	Domestic	1319	1.05	1549	1.25	1833	1.48	2005	1.57	2336	1.83	2336	1.86	2609	2.32	7915	2.69	5248	3.19	3901	3.877	17%
	Total	1346	3.18	1577	3.73	1866	6.79	2041	6.01	2376	4.898	2378	4.624	2658	5.520	2968	6.96	3301	7.598	4022	7.974	15%
Tongi	Industry	96	37.8	94	37.32	97	37.87	105	36.04	112	35.16	112	42.408	109	45.000	129	56	144	58.000	153	63.965	11%
	Cap. Power			1	0.07	2	1.14	6	6.04	7	13	9	24.440	13	34.040	19	34.16	19	34.180	28	34.916	11%
	Comm.	82	1.51	81	1.56	78	1.52	82	1.63	85	1.64	90	1.820	92	1.810	94	2.12	97	2.070	98	2.100	4%
	Domestic	8548	6.94	9154	7.37	11893	9.36	12916	10.38	15373	11.64	16373	13.618	17136	17.161	19708	21.08	21120	29.379	24955	28.098	18%
	CNG																	1	0.550		1.000	
	Total	8726	46.25	9370	46.29	12070	49.89	13109	54.09	16584	61.44	16584	82.255	17870	96.111	19950	113.36	21381	119.103	25232	130.079	12%
Manikgonj	Industry									18	11.896	18	11.896	15	11.982	13	13	15	12.128	18	13.390	3%
	Cap. Power									5	16.590	18.590	5	17.430	5	10.40	5	27.030	5	24.530	7%
	Comm.									37	0.500	0.540	39	0.500	40	0.57	39	0.820	40	0.910	14%
	Domestic									4539	5.474	5.352	4942	5.520	5405	6.21	5863	6.310	7032	6.358	4%
	Total									4598	33.251	36.319	5061	33.432	5463	39.24	5722	46.288	7093	45.195	6%
Tangail	Industry	10	5.31	10	5.58	17	8.46	17	10.14	17	11.32	21	4.759	24	5.139	27	5.65	26	6.682	27	10.563	22%
	Cap. Power											8.804		18.320		33.071	11	41.991	11	44.941	60%
	Comm.	19	0.31	21	0.32	24	0.4	26	0.41	34	0.4	36	0.560	37	0.680	35	0.6	39	0.610	36	0.644	3%
	Domestic	3729	3.27	4354	3.68	5417	4.59	5749	4.8	6560	5.27	7149	6.008	7846	7.380	8018	9.12	9725	10.223	10521	11.316	17%
	Total	3758	8.89	4391	9.58	5458	13.47	5792	15.35	6605	16.99	7200	16.150	7907	31.529	9102	44.441	9798	58.906	10595	67.466	39%

Table A1.1.1 : Sub-Regional Gas Consumption
Titas Gas Transmission and Distribution Company Ltd

Table A1.1: Sub-Regional Gas Consumption
Titas Gas Transmission and Distribution Company Ltd.

Region	Customer	FY 94-95 N	FY 94-95 V	FY 95-96 N	FY 95-96 V	FY 96-97 N	FY 96-97 V	FY 97-98 N	FY 97-98 V	FY 98-99 N	FY 98-99 V	FY 99-00 N	FY 99-00 V	FY 00-01 N	FY 00-01 V	FY 01-02 N	FY 01-02 V	FY 02-03 N	FY 02-03 V	FY 03-04 N	FY 03-04 V	FY 04-05 N	FY 04-05 V	Growth %
Mymensingh	Industry	1	0.31	1	0.19	1	0.38	1	0.28	1	0.20	2	0.33	3	0.420	3	0.370	2	0.12	5	0.1	8	0.322	-0%
	Comm.	11	0.05	19	0.28	27	0.39	30	0.43	45	0.59	47	1.16	54	0.860	58	1.020	68	1.1	76	1.37	72	0.37	-33%
	Domestic	4079	2.47	6060	4.96	7571	6.37	9000	7.36	10497	7.30	11753	9.936	11753	9.936	12056	11.235	14014	15.17	15000	15.17	16769	16.217	13%
	Total	4091	2.67	6080	5.61	7599	7.14	9127	8.06	10538	8.06	11802	11.428	11810	11.216	12918	12.625	14082	16.39	15086	16.64	16847	16.7087	10%
Jamalpur	Comm.			9	0.08	14	0.18	18	0.22	18	0.27	17	0.24	17	0.26	18	0.26	16	0.3	15	0.27	14	0.284	0%
	Domestic	1136	0.26	1751	1.2	2229	1.73	2360	2.06	3295	2.51	3685	2.8	3933	3.10	8442	3.23	4380	3.84	4485	4.28	4673	4.441	9%
	Total	1136	0.26	1760	1.28	2243	1.91	2387	2.3	3313	2.78	3702	3.04	3950	3.42	8460	3.51	4376	4.14	4500	4.55	4687	4.705	6%
Sherpur	Comm.	270	0.07	3	0.02	7	0.07	12	0.14	13	0.17	14	0.19	17	0.25	15	0.26	15	0.25	15	0.24	15	0.231	-2%
	Domestic	270	0.07	450	0.22	588	0.44	840	0.57	958	0.75	1061	0.85	1267	0.97	1453	1.11	1517	1.41	1711	1.61	1807	1.762	18%
	Total	270	0.07	453	0.24	595	0.51	852	0.71	971	0.92	1075	1.04	1284	1.22	1480	1.37	1532	1.65	1726	1.95	1902	1.993	13%
Netrokona	Comm.			8	0.07	10	0.14	11	0.16	14	0.20	17	0.22	14	0.2	18	0.24	18	0.27	16	0.28	17	0.287	9%
	Domestic	205	0.07	592	0.4	856	0.63	1153	0.84	1638	1.02	1760	1.31	1998	1.59	2153	2.14	2343	2.7	2724	2.547	13%
	Total	268	0.07	600	0.47	866	0.77	1164	1	1650	1.22	1777	1.53	2012	1.73	2171	2.41	2361	2.93	2741	2.834	12%
Kishoreganj	Comm.	4		4	0.04	5	0.06	8	0.09	11	0.14	14	0.16	17	0.17	21	0.23	23	0.23	24	0.31	23	0.371	22%
	Domestic	586	0.21	1090	0.71	1587	1.13	1910	1.43	2206	1.02	2561	2.04	2993	2.07	3375	2.41	3690	3.41	4285	3.79	4505	4.385	21%
	Total	595	0.21	1094	0.75	1602	1.19	1918	1.52	2216	1.96	2575	2.22	3010	2.24	3396	2.64	3631	3.64	4079	4.1	4528	4.756	21%
Vairab	Industry	2	0.36	3	2.4	3	0.3	6	0.5	13	1.10	9	1.301	5	1.618	8	2.741	8	4.29	8	2.520	6	10.784	61%
	Captive			3	1.83	3	5.27	4	5.87	7	8.43	6	14.460	8	16.310	17	21.690	16	31.79	16	34.91	25	50.164	32%
	Comm.																	2	0.01	4	0.03	6	0.054	
	Domestic	37	0.01	103	0.1	124	0.15	214	0.21	321	0.44	406	0.400	428	0.470	456	0.560	585	0.86	630	0.77	749	1.069	28%
	Total	39	0.37	109	4.33	130	5.72	224	6.58	341	10.05	417	16.161	439	18.348	474	24.991	609	36.75	659	40.230	780	62.05	56%
Gafargaon	Industry									1	0.001	1	0.000	3	0.03	3	0.05	3	0.07	3	0.08	34%
	Comm.	13	0.003	91	0.05	131	0.08	211	0.12	267	0.2	329	0.24	476	0.37	529	0.44	700	0.58	796	0.77	856	0.842	23%
	Total	13	0.003	91	0.05	131	0.08	211	0.12	268	0.201	327	0.249	479	0.39	532	0.49	704	0.64	800	0.84	859	0.907	23%
Tangi	Industry							2	0.009	2	0.04	2	0.03	4	0.04	5	0.03	6	0.06	3	0.04	3	0.054	12%
	Comm. Domestic	16	0.005	28	0.02	47	0.04	75	0.05	107	0.07	118	0.09	138	0.09	164	0.13	159	0.16	214	0.21	225	0.213	16%
	Total	16	0.005	28	0.02	47	0.04	77	0.059	109	0.1	118	0.12	142	0.15	168	0.16	174	0.22	220	0.75	228	0.277	17%
Dhaka Metro	Industry Cap.Power			858	121.83	92	123.31	907	149.50	900	142.23	150	150					152	188.00	195.000	211	211	9%
	Comm.			4	2.923	4	4.257	7	4.401	9	8.123	11	11.101	14	13.31	29	20.994	38	30.459	44	41.218	30%
	Domestic	4193	43.541	4573	46.611	4757	48.054	4926	50.684	5133	51.378	5327	54.714	5558	57.619	5887	61.581	6271	695.90	64.973	4%
	CNG	4	0.193	5	0.611	5	1.242	5	1.573	7	1.740	7	3.355	19	11.948	51	46.785	62	82.936	163%
	Total	399297	535.101	436720	625.79	469162	652.41	532144	687.65	532385	704.49	565867	741.43	606830	948.62	655735	1009.27	719456	1105.26	12%

Source: R&O and Marketing Division, TGTDCL

Table A1.2.1: Sub-Regional Gas Consumption
Bakhrabad Gas Systems Limited

Table A2a : Countrywide Industry Categoryywise Gas Consumption
Industrial Sector

Gas in MMSCM

Type	FY 00-01 N	FY 00-01 V	FY 01-02 N	FY 01-02 V	FY 02-03 N	FY 02-03 V	FY 03-04 N	FY 03-04 V	FY 04-05 N	FY 04-05 V
Garments										
Knitting	1103	556.458	1226	592.107	1320	714.017	1507	829.250	1647	940.331
Dyeing										
Textile										
Jute	2	1.333	2	1.672	2	1.621	2	1.817	3	2.401
Steel	247	104.471	259	113.200	281	132.361	300	135.998	301	140.246
Metal										
Molding	1	0.006	1	0.006	1	0.007	1	0.007	1	0.007
Wire	1	0.155	1	0.564	1	0.564	1	0.456	1	0.228
Aluminium	10	0.987	13	1.232	13	1.586	13	1.062	14	1.496
Ceramics	26	27.892	29	28.676	30	35.853	31	36.574	31	38.878
Cement	1	42.063	1	28.715	1	24.058	1	34.811	2	34.568
Glass	4	2.156	4	2.211	1	2.300	4	2.374	5	2.827
Chemical	59	30.330	58	31.707	64	37.618	67	38.919	72	41.130
Sillicate	10	4.860	10	4.649	12	4.675	11	4.432	13	5.063
Soap	44	6.664	45	6.164	45	6.276	44	5.027	44	5.705
Mos. Coil	0	0.000	1	0.199	1	0.226	1	0.215	1	0.215
Pharmaceutical	17	4.720	17	5.053	20	5.076	23	5.509	28	7.022
Plastic	4	0.892	4	0.883	4	0.911	6	1.128	6	1.286
Paper	6	8.375	6	8.392	6	7.791	8	8.014	9	9.857
Packaging	2	0.641	2	0.752	3	0.918	3	0.977	4	1.016
Board	2	2.741	2	2.856	2	2.250	2	1.425	2	3.023
Food & Bev.	97	16.914	102	15.693	105	16.336	118	13.059	128	18.710
Backery	91	16.638	93	17.927	97	24.695	105	27.040	101	29.228
Dairy	0	0.000	0	0.000	0	0.000	1	0.521	1	0.521
Pattry	0	0.000	0	0.000	0	0.000	2	0.560	2	0.590
Battery	1	0.031	1	0.029	1	0.030	1	0.032	2	0.355
Electronics	2	1.370	2	0.730	1	0.710	1	0.750	1	0.740
Lime	13	9.408	12	9.844	15	11.456	13	9.361	14	9.674
Agro	1	1.728	1	1.661	1	1.356	1	2.051	1	2.155
Salt	8	5.581	8	6.126	11	8.447	18	13.213	21	14.940
Sugar	1	0.007	1	0.007	1	0.007	1	0.007	1	0.007
Edible Oil	7	4.064	8	5.725	7	5.724	8	6.550	8	6.475
Footwear	3	0.704	3	0.809	3	0.942	3	0.988	3	1.028
Tobacco	2	2.068	2	1.922	2	2.043	2	1.167	2	2.163
Tenary	45	4.250	45	4.355	44	4.852	44	5.172	44	5.164
Autobrick	1	0.020	1	1.320	1	1.300	1	1.420	2	1.980
Pottory	1	0.050	1	0.050	1	0.040	1	0.040	1	0.050
Gov. Industries		52.710	28	51.480	28	49.750	26	47.330	25	42.600
Others	398	59.369	487	67.144	452	73.601	483	74.372	490	85.974
Total	2210	969.66	2476	1013.87	2577	1179.4	2854	1312.61	3031	1457.45

Table A2b : Countrywide Industry Catergorywise Gas Consumption
Captive Power

Gas In MMSCM

Name	FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V
Garments										
Spinning										
Knitting										
Dyeing										
Textile										
~~	120	325.23	140	407.18	167	533	211	623.11	254	733.047
Ceramics	6	5.2101	7	10.576	7	12.934	11	17.511	11	21.857
Steel	7	5.96	7	5.965	9	12.04	10	20.252	10	31.991
Metal	1	1.542	1	1.744	1	1.626	1	1.626	1	1.626
Aluminium										
Cement	2	20.505	3	14.775	4	18.785	4	22.238	6	24.484
Glass	2	2.181	2	2.299	2	2.379	2	2.315	2	2.404
Jute	2	5.877	2	5.903	2	5.656	2	6.245	3	6.318
Chemical	5	4.94	5	4.2132	6	4.294	7	2.589	7	2.3106
Pharmaceutical	6	7.462	6	7.553	7	9.088	8	10.1	13	10.498
Paper	9	30.432	9	35.353	10	39.908	15	42.236	15	57.5169
Packaging	2	0.948	3	1.457	4	1.412	5	1.912	8	3.777
Hardboard	2	2.552	3	2.661	6	4.476	6	4.588	6	4.661
Paltry Feed	0	0	1	0.61	1	0.59	3	1.172	3	1.274
Agri	1	2.223	1	2.223	1	1.932	1	2.231	1	2.231
Melamine	1	0.85	2	1.85	2	1.82	2	1.8	2	1.944
Leather	0	0	0	0	1	0.91	1	0.88	1	0.929
Polythene	0	0	0	0	1	0.425	1	0.603	1	0.603
Plastic	0	0	2	1.24	3	4.61	4	8.009	4	9.583
Rubber	1	1	1	1.281	2	1.281	2	1.221	2	1.281
Polymer	0	0	1	0.371	1	0.371	1	0.371	1	0.371
Food & Beverag	9	4.295	10	6.215	12	12.09	16	13.05	19	14.784
Bakery	3	1.543	4	1.717	4	2.517	4	2.917	4	3.383
V. Oil	6	5.126	7	5.255	7	5.025	7	5.268	8	8.0614
Dairy	0	0	0	0	0	0	2	3.79	2	3.856
Battery	2	1.75	2	1.919	3	2.019	3	2.119	3	2.159
Soap	1	0.48	1	0.85	1	0.32	2	0.8	2	1
Electrical	2	1.37	2	0.75	1	0.71	1	0.75	1	0.74
Sugar Mill	0	0	0	0	0	0	1	1.5	1	1.67
Cable	1	0.043	1	0.043	1	0.043	1	0.043	1	0.043
Tobacco	2	4.316	2	4.585	2	4.565	2	4.2515	2	4.432
Seed						1.5	1	1.554	1	1.567
Oxygen	1	0.515	1	0.75	1	0.75	1	0.9	1	1.112
Others	32	59.04	40	64.724	40	64.889	57	67.77	64	74.988
Total	226	495.4	266	594.04	309	751.95	395	875.72	460	1036.5

Table A 2.1.1: Industry Categorywise Gas Consumption
Dhaka Metro, TGTDCL

a. Industrial Sector

Gas in MMSCM

Type	FY 99-00		FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Garments												
Knitting	370	65.352	350	70.125	390	71.606	400	88.503	425	91.636	457	99 358
Dyeing												
Textile												
Sub-total	370	65	350	70	390	72	400	89	425	92	457	99
Tenary	45	4.350	45	4.250	45	4.3554	44	4.852	44	5 1717	44	5 1642
Ceramics	8	3.516	8	3.516	8	3 6945	8	4.167	8	4.655	8	4.839
Chemical	32	13.015	32	13.250	32	14.067	32	17.288	32	17.927	32	19.356
Steel & Metal	115	35.500	119	35.500	123	35.167	125	43 220	130	44.818	130	48.39
Bakery	55	12.950	59	12.950	63	14.067	64	17.288	70	16.758	70	19.356
Others	125	7.345	134	10.824	144	10.673	156	12 964	164	12.354	164	16 425
Total	750	142.03	747	150.42	805	153.63	829	188.28	873	193.32	905	212.89

b. Captive Power Sector

Type	FY 99-00		FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Garments							1		1	1.92	1	1.924
Knitting	2	0.136	2	0.1	2	0.136	2	0.146	2	0.146	2	1.207
Dyeing	2	0.56	2	0 5	2	1.1	2	1.1	2	1.3	2	1.38
Textile	5	4.129	5	4.355	5	5.4	5	4.5	6	12.20	6	12.365
Steel	2	0.3	2	0.35	2	0.3	2	0.65	2	0.65	2	0.654
Glass	1	1.1	1	1.3	1	1 42	1	1.5	1	1 4	1	1.47
Chemical	1	0.5	1	0.5	1	0.5	1	0.5	1	0.942	1	0.942
Pharmaceutical	1	0.88	1	0 9	1	0.9	1	1	1	1	2	1.061
Packaging					1	0 125	1	0.1	1	0.1	1	0 065
Plastic			*		1	1.00	2	3	2	4.5	2	4.56
Bakery	1	0 88	2	1 1	2	1.2	2	2	2	2.4	2	2.866
Leather												
Paper	1	0.1	1	0.01	1	0.1	0.01	0.01	1	0 01	1	0.0149
Food & Bev.	2	0.801	2	0.655	2	0.895	4	3.2	4	3.5	5	4.506
V, Oil	1	1	1	1	1	1.025	1	1	1	1.5	1	3.43
Oxygen	1	0.505	1	0.515	1	0.75	1	0.75	1	0.9	1	1.112
Tenary							1	0.4	1	1	1	1 171
Others			1	0.194	1	0.189	2	0.568	9	1.5	13	2.491
Total	20	10 89	22	11 48	24	14.101	29	20.424	38	34.968	44	41.219

Table A2.1.2 : Industry Catergorywise Gas Consumption
Sonargoan, TGTDCL

a. Industrial Sector

Gas in MMSCM

Name	FY 99-00		FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Garments	20	26	38	26	50	26	50	37.000	55	42	60	32
Knitting	30	29	30	29	35	29.892	35	33.000	40	40	45	40.258
Dyeing	9	5.5	10	5.5	19	5	19	6 000	19	10	20	10
Textile		15	16	15	20	15	20	18.000	29	19	30	33
Subtotal	59	75 5	94	75.5	124	75.892	124	94	143	111	155	115.258
Ceramics	1	1.302	1	0.92853	2	1.0944	2	1.592	2	1.3602	2	1.18441
Steel	5	12.558	11	9.95695	11	9.8949	12	9.554	13	10	15	11.2889
Salt	2	2.000	3	2.433	3	2.542	4	3.514	6	4.523	9	5.447
Pharmaceutical	3	1 435	3	1.423	3	1 553	3	1.554	4	1.75	5	2.113
Cement	1	0.010	1	0.01	1	0.01	1	0.010	1	0.012	2	0.0125
Paper	5	4.550	5	5.44	5	5.512	5	5.554	7	6.458	8	6 556
Board	1	1.240	1	1.25	1	1.35	1	1.500	1	1.425	1	1.523
Soap	4	1.796	4	1.59561	4	1.3817	4	1.482	4	1.0232	4	1.11038
Silicate	1	0.995	1	1.001	1	1	1	0.996	1	1.02	1	1.125
Plastic Molding	1	0.307	1	0.28173	1	0 2777	1	0.299	1	0.2686	1	0 23836
V. Oil	5	6.012	5	3.564	6	5.325	6	5 324	7	6 12	7	6 125
Food	4	0.455	4	0.502	5	0.711	5	0.701	5	0.754	5	0.755
Bakery	2	0.071	5	0.08733	3	0.067	4	0.972	4	1.0784	4	0.92532
Others			30	2	94	2	30	4 000	40	4	40	9
Total	94	108.23	169	105.973	264	108.61	203	131.052	239	150.79	259	162.662

b. Captive Power Sector

Name	FY 99-00		FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Garments						0		0	1	0.645	1	0.65
Knitting			1	1 6	2	3.456	2	3.333	2	3.422	2	3.428
Dyeing			1	2.5	1	2.54	1	2.5	2	4 6	4	9 338
Spinning			4	9.75	4	9.91	4	9 615	5	11.62	5	12.664
Textile			4	18 251	4	21.512	6	25.631	7	33.345	8	41.087
Subtotal			10	32.101	11	37.418	13	41.079	17	53.632	20	67.167
Ceramics					1	2 39	1	2.405	1	2.04	1	2.062
Steel			1	2.285	1	2.29	2	2.31	2	2.3	2	2.3
Cement					1	0.501	1	0.546	1	0.513	2	0.545
Glass			1	0.881	1	0.879	1	0.879	1	0.915	1	0.934
Jute			1	3.254	1	3 28	1	3.3	1	3.332	1	3.274
Chemical			1	2.356	1	2.3	1	2.39	2	0.243	2	0.244
Pharmaceutical										0.867	1	0.888
Paultry Feed					1	0.61	1	0 59	1	0.612	1	0.684
Salt												
Malamine			1	0.85	2	1.85	2	1.82	2	1 8	2	1.944
Leather							1	0.91	1	0.88	1	0 929

b. Captive Power Sector

Name	FY 99-00		FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Paper			5	24.256	5	28.981	7	34.456	8	34.251	8	49.487
Hardboard				0.801	1	0.82	1	1.289	1	1 356	1	1 389
Polythene							1	0.425	1	0.603	1	0.603
Food & Bervarge	4											
V, Oil			4	3.256	5	3.5	5	3.425	5	3.456	6	4.3114
Seed								1.5	1	1.554	1	1.567
Others			7	6.562	8	11.25	9	13.25	10	17.125	10	19.114
Total	4	0	31	76.602	39	96.069	47	110.574	55	125.48	61	157.442

Source: RSD, TGTDCL

Table A2.1.3 : Industry Catergorywise Gas Consumption
Narayangonj, TGTDCL

a. Industrial Sector

Gas in MMSCM

Type	FY 99-00		FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Garments												
Textile												
Knitting	130	83.156	128	98.184	132	116.252	146	118.17	177	138.624	193	152.001
Dyeing												
Steel	47	30.06	40	30.766	41	36.1116	53	42.899	62	46.9892	66	49.1929
Salt	4	2.469	4	3.0826	4	3.51869	6	4.85832	11	8.6211	11	9.41012
Glass	1	0.6197	1	0.7737	1	0.87967	1	0.80873	1	0 7826	1	0 72068
Chemical	14	8 6168	14	10.831	13	11.447	17	13.764	19	14.8819	19	13.9819
Bakery	1	0.2459	1	0.7737	1	0.87967	2	1.62192	5	3.92553	3	3 06332
Limes	14	8.6168	12	9.2841	11	9.68766	14	11 3311	11	8.6211	12	8.90186
Others	25	15.994	23	17.794	24	21.1347	21	17.0004	19	14.8819	21	13.4722
Total	236	145.41	223	171.490	227	199.911	260	210.453	305	237.327	326	250.744

b. Captive Power Sector

Type	FY 99-00		FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Garments	1	0 356	1	0.356	1	0.394	1	0.394	1	0.395	2	0.874
Knitting	1	2.647	1	2.647	1	4.574	3	11.541	5	14.294	6	16.571
Dyeing									1	1.250	2	2.359
Spinning	1	2.581	1	2.581	1	6.547	4	16.95	4	17.445	6	25.875
Textile	6	27.704	6	27.704	6	33.568	6	32.804	7	36.664	7	37.2645
Sub-total	9	33.288	9	33.288	9	45.083	14	61.689	18	70.048	23	82.9435
Paper	2	2.345	2	2.345	2	2.451	2	2.103	4	3.988	4	3.988
Pharmacetical	1	1 002	1	1.002	1	1.002	1	1.002	4	3.988	4	3.988
Board	1	1.451	1	1.451	1	1.541	3	2.812	1	1.002	1	1.002
Polymer					1	0.371	1	0.371	3	2.812	3	2.812
Cable	1	0.043	1	0.043	1	0.043	1	0.043	1	0 371	1	0.371
Metal	1	1.542	1	1 542	1	1.744	1	1.626	1	0.043	1	0.043
Others			1	0.634	1	0.657		0.657	2	0.512	1	0.479
Total	15	39.671	16	40.305	17	52.892	23	70.303	31	80.402	35	93.2645

Source RSD, TGTDCL

Table A2.1.4: Industry Categorywise Gas Consumption
Savar, TGTDCL

a. Industrial Sector

Gas in MMSCM

Type	FY 99-00		FY00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Garments	20	27.240	26	33.545	32	32.240	45	43.824	68	51.9694	83	64.9604
Knitting	30	38.634	30	35.236	30	37.253	30	36.503	35	46.7563	38	57.641
Dyeing	9	23.125	10	21.128	12	22.646	12	23.811	15	25.4745	15	28.0876
Subtotal	59	88.999	66	89.909	74	92.1389	87	104.138	118	124.2	136	150.689
Ceramics	5	12.558	5	11.002	6	11.043	6	13.690	6	12.9716	6	14.515
Steel	5	1.302	5	1.026	6	1.221	6	1.592	6	1.41457	6	1.52288
Soap	4	1.796	4	1.763	4	1.542	4	1.482	4	1.06407	4	1.4277
Plastic	1	0.307	1	0.311	1	0.310	1	0.299	1	0.27931	1	0.30648
Backery	2	0.071	3	0.097	3	0.075	4	0.972	4	1.12158	4	1.18975
Others			83	13.125	94	13.000	90	13.500	100	14.9	102	17.0372
Total	76	105.033	167	117.233	188	119.331	198	135.673	239	155.951	259	186.688

b. Captive Power Sector

Type	FY 99-00		FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Garments	5	5.2439	5	5.2469	5	8.5439	6	10.6912	8	9.8946	12	14.568
Knitting	3	28.045	5	29.794	5	31.97	5	35.4254	6	35.073	6	41
Spining	1	1.4	1	1.51	1	1.5	2	2.214	3	3	3	3.1
Textile	13	48.391	13	50.891	14	55.555	15	61.515	19	65.515	22	70.624
Dyeing	3	1.21	3	1.22	3	4.5671	3	7.1335	4	7.5103	5	7.615
Subtotal	25	84.2899	27	88.6619	28	102.136	31	116.979	40	120.993	48	136.907
Ceramics	2	1.7258	3	1.8601	3	4.2562	3	6.3391	3	6.8811	3	6.895
Phama.	1	0.422	1	0.425	1	0.455	2	1.4	2	1.421	2	1.422
Plastic									1	0.75	1	1.773
Hardborad							1	0.075	1	0.12	1	0.13
Bttery	1	1.1	1	1.1	1	1.2	1	1.3	1	1.4	1	1.44
Others					5	3.445	5	7.675	9	9.509	10	11.889
Total	29	87.5377	32	92.047	38	111.492	43	133.768	57	141.074	66	160.456

Source: RSD, TGTDCL

Table A2.1.5 : Industry Categorywise Gas Consumption
Joydevpur, TGTDCL

a. Industrial Sector

Gas in MMSCM

Type	FY 99-00		FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Garments	20	25.132	26	27.9661	32	26.237	45	39.661	68	51.303	90	81.72
Knitting	30	28.075	30	29.2588	30	30.316	30	33.035	35	46.157	45	56.079
Dyeing	9	15.057	10	17.8804	12	18.429	12	21.549	15	25.148	20	27.326
Textile												
Subtotal	59	68.264	66	75.1053	74	74.983	87	94.245	118	122.61	155	165.12
Ceramics	5	8.6625	5	8.93375	6	8.9871	6	12.389	6	12.805	7	14.122
Steel	5	0.8423	5	0.83311	6	0.994	6	1.4408	6	1.3964	6	1.4816
Salt												
Glass												
Soap	4	1.3943	4	1.43164	4	1.255	4	1.3415	4	1.0504	4	1.389
Plastic	1	0.2531	1	0.25278	1	0.2522	1	0.2701	1	0.2757	1	0.2982
Molding		0		0		0		0		0		0
Bakery	2	0.0585	5	0.07836	3	0.0609	4	0.8797	4	1.1072	4	1.1575
Others	48	3.531	83	8.323	94	13.46	94	15.086	100	15.744	102	16.575
Total	124	83.005	169	94.958	188	99.992	202	125.65	239	154.99	279	200.147

b. Captive Power Sector

Type	FY 99-00		FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Garments	1	0.001	2	0.630	1	0.995	3	4.240	5	5.718	7	5.938
Knitting	3	3.779	4	2.629	4	3.189	5	5.289	6	7.139	6	7.369
Dyeing							1		2	0.290	3	6.500
Spinning	9	27.190	12	50.505	18	72.150	22	115.000	23	120.705	25	133.000
Textile	5	4.319	5	6.045	8	11.500	12	24.000	18	36.500	20	42.000
Subtotal	18	35.289	23	59.809	31	87.834	43	148.529	54	170.352	61	194.807
Ceramics	1	1.080	3	3.350	3	3.930	3	4.190	7	8.590	7	12.900
Steel	1	0.570	1	0.950	1	0.970	1	1.310	1	1.300	1	1.300
Paultry									2	0.560	2	0.590
Electronics	1	0.590	2	1.370	2	0.750	1	0.710	1	0.750	1	0.740
Soap	1	0.530	1	0.480	1	0.850	1	0.320	2	0.800	2	1.000
Plastic					1	0.240	1	1.610	1	2.759	1	3.250
Paper									1	0.180	1	0.200
Food & Bervarge	2	0.260	3	1.250	3	2.090	3	3.430	4	3.430	4	3.950
Others	2	0.861	3	0.861	4	1.101	3	0.571	5	1.723	8	6.773
Total	26	39.180	59	68.070	46	97.765	56	160.670	78	190.444	88	225.510

Source. RSD, TGTDCL

Tabel A2.1.6 : Industrywise Gas Consumption
Tongi, TGTDCL

a. Industrial Sector

Gas in MMSCM

Type	FY 99-00		FY00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Garments	8	2.617	9	3 094	10	3.624	10	3.717	14	4.823	17	5.251
Dyeing	6	3 480	7	4.361	7	4.266	8	7.222	8	7.708	11	7.759
Spinning	1	0.212	1	0.233	1	0.215	1	0.221	1	0.236	2	2.625
Knitting	5	3 079	6	3.669	7	4.389	7	4.519	12	4.823	13	5.237
Textile	13	7.787	13	8.570	14	9.885	16	12.513	16	12.622	16	12.569
Sub-total	33	17.176	36	19.927	39	22.379	42	28.192	51	30.211	59	33.44
Chemical	7	4 443	7	4.889	7	5.223	7	5.511	9	5.322	10	5.895
Ceramic	4	2 607	4	2.869	4	3.114	5	3.385	5	3.612	5	3.580
Steel	5	1.235	5	1.358	6	1.392	6	1.608	7	1.716	7	1.684
Pharmaceutical	9	2.260	9	2.487	9	2.464	9	2.528	9	2.698	9	2.858
Glass	3	1.256	3	1.382	3	1.331		1.491	3	1.592	3	1.666
Tobacco	1	0.879	1	0.966	1	0 972	1	1.093	1	1.167	1	1.213
Packaging	2	0.583	2	0.641	2	0 752	3	0.916	3	0.977	4	1.016
Battery	1	0.029	1	0.031	1	0.029	1	0.030	1	0.032	1	0.033
Plastic	1	0.042	1	0.046	1	0.043	1	0.044	1	0.047	1	0.049
Food	2	0.195	2	0.214	2	0.282	2	0.289	4	0.309	4	0.321
Footwear	2	0.440	2	0.484	2	0.549	2	0 682	2	0.728	2	0.766
Others	46	6.455	39	7 103	32	6.470	50	10.228	48	11.000	47	11.415
Total	116	37.599	112	42.397	109	45.000	129	55.996	144	59.409	153	63.937

b. Captive Power Sector

Type	FY 99-00		FY00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Garments			1	0.250	1	0.421	1	0.421	3	0.661	3	0.829
Dyeing						0 000		0.000	1	0.340	2	0 846
Spinning					1	3 329	1	3.329	1	3.216	1	3.328
Textile	5		5	14.260	7	19 100	7	19.110	9	19.126	9	22.573
Sub-total	5		6	14.51	9	22.85	9	22.86	14	23.343	15	27.576
Chemical			1	0.604	1	1.103	3	1.124	3	1.124	4	1.125
Steel										0.000	0	0.000
Pharmaceutical	1		1	2.915	1	2.916	1	2.916	1	2.890	2	2.966
Tobacco	1		1	3.566	1	3.815	1	3.815	1	3.502	1	3.659
Packaging	1		1	0.758	1	0.842	2	0.842	2	0.842	2	0.842
Battery	1		1	0.650	1	0.719	1	0.719	1	0 719	1	0.719
Bakery	1		1	0.443	2	0 517	2	0.517	2	0.517	2	0.517
Rubber			1	1.000	1	1.281	2	1 281	2	1.221	2	1.281
Total	10		13	24.446	17	34.043	21	34.074	26	34.158	29	38.685

Source. RSD, TGTDCL

Table A2.1.7: Industry Categorywise Gas Consumption
Narsingdi, TGTDCL

a. Industrial Sector

Gas in MMSCM

Type	FY 99-00		FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Garments												
Knitting	120	42.00	123	43.20	122	48	141	84	145	91.2	152	80.743
Dyeing												
Ceramic	1	0.48							1	0.48		
Steel	1	2.30	1	2.40	1	2.4	1	2.5	1	2.6	1	2.586
Glass	1	0.45										
Soap	3	0.18	3	0.19	3	0.19	3	0.2	3	0.2	3	0.208
Molding	1	0.01	1	0.01	1	0.006	1	0.007	1	0.007	1	0.007
Total	127	45.42	128	45.80	127	50.60	146	86.71	151	94.49	157	83.544

b. Captive Power Sector

Type	FY 99-00		FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Dyeing	1	1.340	1	1.355	1	1.355	1	1.516	1	2.187	1	2.187
Spinning	1	0.689	2	3.055	2	3.055	2	3.455	3	5.23	5	13.8246
Textile	3	1.405	3	1.455	3	1.455	4	1.955	5	2.7	6	2.77
	5	3.434	6	5.865	6	5.865	7	6.926	9	10.117	12	18.7816
Jute											1	0.131
Steel	1	1.25	1	1.345	1	1.345	1	1.5	1	1.787	1	1.787
Pharmaceutical									1	0.03	1	0.03
Dairy									1	1.9	1	1.928
Total	6	4.684	7	7.21	7	7.21	8	8.426	12	13.834	16	22.6576

Source: RSD, TGTDCL

Table A2.1.8 : Industry Categorywise Gas Consumption
Valuka, TGTDCL

a. Industrial Sector

Gas in MMSCM

Type	FY 99-00		FY00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Garments	4	1.50	4	1.600	4	2.350	5	3.870	5	4.510	5	5.91789
Dyeing	6	0.50	7	0.620	7	0.960	8	1.150	10	1.400	11	4.80557
Sub-total	10	2	11	2.22	11	3.31	13	5.02	15	5.91	16	10.7235
Ceramic	1		1		1		1		1		1	
Food	2	0.09	2	0.080	2	0.082	2	0.072	2	0.079	2	0.07213
Others	3	0.07	5	0.090	3	0.080	5	0.083	5	0.085	5	0.07821
Total	16	2.16	19	2.39	17	3.472	21	5.175	23	6.074	24	10.8738

b. Captive Power Sector

Type	FY 99-00		FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Spinning	5	9.25	5	11.25	6	14.95	7	24.94	8	29.06	14	37.66
Dyeing	3	5.21	3	5.06	5	6.65	5	6.85	8	7.85	11	12.5
Total	8	14.46	8	16.31	11	21.6	12	31.79	16	36.91	25	50.16

Table A2.1.9 : Industry Categorywise Gas Consumption
Mymensigh, TGTDCL

a. Industrial Sector

Gas in MMSCM

Type	FY 99-00		FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Spinning												
Biscuit & Food	2	0.33	3	0.42	3	0.37	2	0.12	5	0.1	6	0.322
Total	2	0.33	3	0.42	3	0.37	2	0.12	5	0.1	6	0.322

Source: RSD, TGTDCL

Table A2.1.10: Industrywise Gas Consumption
Manikgonj, TGTDCL

a. Industrial Sector

Gas in MMSCM

Type	FY 99-00		FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Spinning											-	
Textile	3	5.800	3	6.615	3	6.415	3	5.720	3		3	6.500
Hardboard	1	1.332	1	1.491	1	1.506	1	0.750	1		1	1.500
Toabco	1	0.950	1	1.102	1	0.950	1	0.950	1		1	0.950
Food	13	3.551	12	7.150	12	4.140	8	3.552	10		10	4.550
Total	18	11.633	17	16.358	17	13.011	13	10.972	15	-	15	13.500

b. Captive Power Sector

Type	FY 99-00		FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Spinning												0.00
Textile	3	15.42	3	17.48	3	16.38	3	18.41	3	25.95	3	24.39
Food/Bev.										0.03	1	0.038
Hardboard	1	0.30	1	0.3	1	0 3	1	0.3	1	0.3	1	0.33
Toabco	1	0.70	1	0.75	1	0.75	1	0.75	1	0.75	1	0.773
Total	5	16.42	5	18.53	5	17.43	5	19.46	5	27.03	6	25.531

Table A2.1.11: Industrywise Gas Consumption
Munshigonj, TGTDCL

a. Industrial Sector

Gas in MMSCM

Type	FY 99-00		FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Textile			3	1.92	3	1.2	3	1.25	3	1.337	3	1.725
Dyeing			1	0.01	1	0.653	1	0 654	1	0 643	1	0.659
Subtotal	0	0	4	1.93	4	1.853	4	1.904	4	1.98	4	2.384
Steel			2	0	2	0.307	2	0.487	2	0.546	2	0.519
Aluminum											1	
Food		0 065		0 066	6	0.066	6	0.067	6	0.064	6	0.066
Metal							1	0.08	1	0.08	1	0.08
Tobaco							1	0 094	1	0.111	1	0.094
Harboard							1	0.235	1	0.235	1	0.235
Battery							1	0 08	1	0.08	1	0.08
Total	0	0.065	6	1.996	12	2.226	16	2.947	16	3.096	17	3.458

b Captive Power Sector

Type	FY 99-00		FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Textile							1	0.05	1	0.205	1	0.226
Fishing Net	1	0.4	1	0.4	1	0.41	2	0.401	2	0.401	2	0.225
Total	1	0.4	1	0.4	1	0.41	3	0.451	3	0.606	3	0.451

Source: RSD, TGTDCL

Table A2.1.12 :Industry Categorywise wise Gas Consumption
B.Baria, TGTDCL

a. Industrial Sector

Gas in MMSCM

Type	FY 99-00		FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Sodium Silicate	2	1.567	2	1.501	2	1 624	2	1.524	2	1.524	2	1 524
Food	2	0.644	2	0.566	3	0.614	3	0 614	3	0.614	3	0.614
Aluminium	1	0.315	1	0.315	1	0.325	1	0.315	1	0.321	1	0.315
Soap	1	0.345	1	0.345	1	0 564	1	0 564	1	0.443	1	0.564
Other					1	0.206	2	0.206	3	0.221	2	0.206
Total	6	2.871	6	2.727	8	3.333	9	3.223	10	3.123	9	3.223

b. Captive Power Sector

Office									1	0.441	1	0.478

Table A2.1.13 : Industry Categorywise Gas Consumption
Vairab, TGTDCL
a. Industrial Sector

Gas in MMSCM

Type	FY 99-00		FY 00-01		FY 01-02		FY 02-03		FY 03-04		FY 04-05	
	N	V	N	V	N	V	N	V	N	V	N	V
Sodium Silicate	1	0.956	1	0.998	1	1.055	1	1.1	1	1.1	1	0.8
Food	1	0.256	2	0.402	2	0.614	2	0 614	2	0.538	2	0.425
Plastic									1	0.112	1	0.1
Wire			1	0.155	1	0.564	1	0.564	1	0.456	1	0.228
Soap	1	0 20	1	0.20	2	0.211	2	0.206	2	0.216	2	0.216
Coil					1	0.199	1	0.226	1	0.215	1	0.215
Total	3	1.411	5	1.754	7	2.643	7	2.71	8	2.637	8	1.984

Source: RSD, TGTDCL

Appendix - B

Contents

Table B1.1: Gas Demand Forecast
For
Titas Gas Transmission and Distribution Company Ltd.
(Base Case)

Unit: MMSCFD

| Year | Power | | Fertilizer | | Industry | Captive Power | Comm. | Domestic | Seasonal | Tea | CNG | System Loss | Non Bulk | | Sum | | Overall Max |
| | Avg. | Max. | Avg. | Max | | | | | | | | | Avg | Max | Avg. | Max | |
1	2	3	4	5	7	8	9	10	11	12	13		14	15	16	17	18
2005-06	454	605	146	161	146	110	9	111	0.2	0	11.8	56	444	515	1043	1280	1216
2006-07	480	640	146	161	167	130	9	121	0.2	0	14.8	59	502	582	1127	1383	1314
2007-08	526	751	146	161	187	151	10	133	0.1	0	17.0	63	562	652	1234	1564	1486
2008-09	587	816	146	161	206	172	11	146	0.1	0	18.7	65	618	717	1352	1694	1609
2009-10	563	866	146	161	230	194	11	160	0.1	0	20.6	67	682	792	1391	1818	1727
2010-11	586	888	146	161	255	213	12	174	0.1	0	22.2	73	749	869	1481	1917	1821
2011-12	577	888	146	161	281	230	12	190	0.1	0	24.0	78	815	945	1538	1994	1894
2012-13	640	985	146	161	312	246	13	206	0.1	0	25.7	83	886	1028	1672	2173	2065
2013-14	650	985	146	161	339	259	14	220	0.1	0	27.5	83	942	1093	1738	2238	2127
2014-15	687	1057	146	161	373	269	15	234	0.1	0	29.1	86	1007	1168	1839	2385	2266
2015-16	722	1129	146	161	409	277	15	248	0.1	0	30.9	84	1064	1235	1933	2524	2398
2016-17	796	1189	146	161	445	283	16	263	0.1	0	32.7	83	1123	1302	2065	2652	2519
2017-18	860	1284	146	161	485	285	17	279	0.1	0	34.0	82	1183	1372	2189	2817	2676
2018-19	867	1399	146	161	525	288	18	295	0.1	0	35.4	81	1243	1441	2256	3001	2851
2019-20	896	1494	146	161	568	291	18	313	0.1	0	36.8	80	1307	1517	2350	3171	3013
2020-21	949	1609	146	161	612	294	19	330	0.1	0	37.9	78	1371	1591	2466	3360	3192
2021-22	988	1704	146	161	661	296	20	347	0.1	0	39.1	81	1444	1675	2578	3540	3363
2022-23	1025	1799	146	161	711	297	21	366	0.1	0	39.8	82	1517	1760	2688	3720	3534
2023-24	1094	1989	146	161	757	298	22	386	0.1	0	40.6	86	1589	1844	2829	3993	3794
2024-25	1124	1989	146	161	810	300	23	406	0.1	0	41.0	87	1667	1934	2937	4083	3879
CAGR	4.6%	6.1%	0.0%	0.0%	9.0%	5.1%	4.8%	6.7%	-3.4%		6.4%	2.3%	6.8%	6.8%	5.3%	6.0%	6.0%

Table B1.2: Gas Demand Forecast
For
Titas Gas Transmission and Distribution Company Ltd.
(High Case)

Unit: MMSCFD

Year	Power		Fertilizer		Industry	Captive Power	Comm.	Domestic	Seasonal	CNG	System Loss	Non Bulk		Sum		Overall
	Avg.	Max.	Avg.	Max								Avg	Max	Avg.	Max	Max.
1	2	3	4	5	7	8	9	10	11	13		14	15	16	17	18
2005-06	509	641	145.9	160.9	146	110	9	112	0.2	12.7	59	449	521	1104	1323	1257
2006-07	516	650	145.9	160.9	167	132	10	125	0.2	16.5	63	513	595	1175	1406	1336
2007-08	552	788	145.9	160.9	189	156	10	139	0.1	19.8	67	581	674	1279	1623	1542
2008-09	634	881	145.9	160.9	214	174	11	156	0.1	22.7	69	647	751	1427	1793	1703
2009-10	625	961	145.9	160.9	244	200	12	176	0.1	26.1	72	730	847	1501	1969	1871
2010-11	674	1021	145.9	160.9	277	224	13	199	0.1	28.8	78	819	950	1639	2132	2025
2011-12	692	1065	145.9	160.9	312	246	14	227	0.1	31.6	83	913	1060	1752	2286	2172
2012-13	800	1231	145.9	160.9	353	266	15	258	0.1	34.2	90	1016	1179	1962	2571	2442
2013-14	845	1280	145.9	160.9	393	294	16	284	0.1	36.9	97	1122	1302	2113	2743	2606
2014-15	927	1427	145.9	160.9	442	306	18	314	0.1	39.1	101	1221	1416	2294	3004	2853
2015-16	1048	1637	145.9	160.9	494	315	19	348	0.1	41.5	104	1322	1534	2516	3331	3165
2016-17	1195	1783	145.9	160.9	549	325	21	384	0.1	44.0	106	1428	1657	2769	3601	3241
2017-18	1333	1990	145.9	160.9	611	331	22	423	0.1	46.2	96	1530	1775	3009	3925	3533
2018-19	1448	2336	145.9	160.9	672	338	24	466	0.1	48.5	98	1646	1910	3240	4406	3966
2019-20	1560	2599	145.9	160.9	737	342	26	510	0.1	49.4	105	1770	2053	3476	4813	4332
2020-21	1737	2944	145.9	160.9	801	346	28	559	0.1	50.4	112	1896	2199	3779	5304	4774
2021-22	1897	3271	145.9	160.9	866	349	30	612	0.1	51.4	120	2030	2354	4073	5787	5208
2022-23	2051	3598	145.9	160.9	938	353	32	667	0.1	52.5	129	2172	2519	4368	6278	5650
2023-24	2286	4157	145.9	160.9	1005	356	35	727	0.1	53.5	137	2313	2683	4745	7001	6301
2024-25	2438	4316	145.9	160.9	1080	360	37	787	0.1	54.0	146	2465	2859	5049	7335	6602
CAGR	8%	10.0%	0.0%	0.0%	10.5%	6.1%	7.3%	10.2%	-3.4%	7.5%	4.7%	8.9%	8.9%	7.9%	8.9%	8.6%

Table A1.3: Gas Demand Forecast
For
Titas Gas Transmission and Distribution Company Ltd.
(Low Case)

Unit: MMSCFD

Year	Power		Fertilizer		Industry	Captive Power	Comm.	Domestic	Seasonal	CNG	System Loss	Non Bulk		Sum		Overall
	Avg.	Max.	Avg.	Max								Avg	Max	Avg.	Max	Max.
1	2	3	4	5	7	8	9	10	11	13	14	15	16	17	18	19
2005-06	450	567	146	161	146	110	9	109	0.2	11.0	56	441	511	1036	1239	1177
2006-07	450	567	146	161	165	127	9	118	0.2	13.2	59	491	569	1087	1297	1232
2007-08	460	580	146	161	182	143	10	127	0.1	15.2	63	541	627	1147	1368	1299
2008-09	460	580	146	161	203	157	10	138	0 1	16.7	65	590	684	1196	1425	1353
2009-10	460	580	146	161	227	171	11	149	0.1	17 8	67	642	745	1248	1486	1411
2010-11	450	567	146	161	249	185	11	159	0.1	19 1	73	697	808	1292	1536	1459
2011-12	450	567	146	161	271	196	12	171	0.1	20 0	78	747	867	1343	1595	1515
2012-13	450	567	146	161	297	204	12	183	0.1	21.0	83	800	927	1395	1655	1573
2013-14	471	593	146	161	317	210	13	193	0.1	21.9	83	839	973	1455	1727	1640
2014-15	493	621	146	161	345	216	13	203	0.1	22.8	86	887	1029	1526	1811	1720
2015-16	525	661	146	161	371	221	14	214	0.1	23.7	84	928	1076	1598	1898	1803
2016-17	543	684	146	161	398	225	14	226	0 1	24.4	83	971	1126	1660	1971	1873
2017-18	577	727	146	161	428	229	15	238	0 1	25.1	82	1017	1180	1740	2068	1964
2018-19	615	775	146	161	456	232	16	250	0.1	25.9	81	1061	1231	1822	2166	2058
2019-20	664	836	146	161	488	235	16	264	0.1	26.4	80	1110	1287	1919	2284	2170
2020-21	699	881	146	161	519	238	17	276	0.1	26.9	78	1155	1340	2000	2381	2262
2021-22	783	987	146	161	549	240	18	290	0.1	27.5	81	1204	1397	2133	2545	2417
2022-23	819	1032	146	161	583	241	18	303	0.1	28.0	82	1256	1457	2221	2650	2517
2023-24	873	1100	146	161	612	242	19	318	0.1	28.6	86	1306	1515	2325	2776	2637
2024-25	918	1157	146	161	651	244	20	333	0.1	29.1	87	1363	1581	2427	2899	2754
CAGR	4%	4%	0%	0%	8%	4%	4%	6%	-3%	5%	2%	6%	6%	4%	4%	4%

Table B.2.1: Gas Demand Forecast
For
Bakhrabad Gas Systems Ltd.
(Base Case)

Unit: MMSCFD

Year	Power Avg	Power Max.	Fertilizer Avg.	Fertilizer Max	Industry	Captive Power	Comm.	Domestic	Seasonal	Tea	CNG	System Loss	Non Bulk Avg	Non Bulk Max	Sum Avg.	Sum Max	Overall Max
1	2	3	4	5	7	8	9	10	11	12	13	14	15	16	16	17	18
2005-06	75	100	109	121	23	18	3.9	37	0.1	0.01	1.6	3	87	108	271	329	309
2006-07	126	168	109	121	25	21	4.1	42	0.1	0.01	1.7	3	97	120	332	409	384
2007-08	139	198	109	121	27	23	4.3	47	0	0.01	1.8	3	107	132	354	451	424
2008-09	143	198	109	121	30	26	4.6	52	0	0.01	1.9	3	118	146	389	465	437
2009-10	137	198	116	127	38	29	4.8	58	0	0.01	2.1	3	135	167	388	492	463
2010-11	137	198	116	127	51	32	5.0	63	0	0.01	2.2	3	156	187	409	512	482
2011-12	137	198	116	127	64	35	5.2	69	0	0.01	2.4	3	178	214	431	539	507
2012-13	176	270	116	127	72	37	5.4	75	0	0.01	2.5	3	195	234	487	631	593
2013-14	222	342	116	127	81	40	5.6	80	0	0.01	2.7	3	213	255	551	724	681
2014-15	222	342	116	127	89	43	5.8	85	0	0.01	2.9	3	229	274	567	743	699
2015-16	222	342	116	127	103	46	6.0	89	0	0.01	3.1	3	250	300	589	769	723
2016-17	239	362	116	127	108	48	6.2	93	0	0.01	3.3	3	261	314	616	803	754
2017-18	256	382	116	127	112	50	6.5	97	0	0.01	3.5	3	272	313	644	822	773
2018-19	253	402	116	127	117	52	6.7	101	0	0.01	3.8	3	284	326	653	855	804
2019-20	298	497	116	127	123	54	6.9	105	0	0.01	4.0	3	295	340	710	964	906
2020-21	298	497	116	127	128	55	7.2	109	0	0.01	4.3	3	307	353	721	977	918
2021-22	346	592	116	127	134	57	7.4	113	0	0.01	4.6	3	319	366	781	1085	1020
2022-23	346	592	116	127	140	58	7.6	117	0	0.01	5.0	3	330	380	793	1099	1033
2023-24	346	592	116	127	146	59	7.9	122	0	0.01	5.3	3	343	394	805	1113	1046
2024-25	346	592	116	127	151	60	8.1	126	0	0.01	5.7	3	355	408	817	1127	1059
Growth	8%	9.8%	0.3%	0.3%	10.5%	6.5%	3.9%	6.6%	-		0.0%	7.0%	0.0%	7.7%	7.2%	8.0%	6.7%	6.7%

Table B2.2: Gas Demand Forecast
For
Bakhrabad Gas Systems Ltd.
(High Case)

Unit: MMSCFD

Year	Power		Fertilizer		Industry	Captive Power	Comm.	Domestic	Seasonal	Tea	CNG	System Loss	Non Bulk		Sum		Overall
	Avg	Max.	Avg	Max									Avg	Max	Avg	Max	Max
1	2	3	4	5	7	8	9	10	11	12	13	14	15	16	16	17	18
2005-06	75	100	109	121	23	18	3.9	38	0.1	0.01	1.5	3	88	109	272	330	310
2006-07	126	159	109	121	26	22	4.2	43	0.1	0.01	1.6	3	100	124	335	403	379
2007-08	146	208	109	121	28	26	4.4	49	0	0.01	1.7	3	113	140	367	468	440
2008-09	154	214	109	121	32	30	4.7	57	0	0.01	1.8	3	129	160	392	494	464
2009-10	152	220	109	208	40	35	5.1	65	0	0.01	1.9	3	150	186	411	613	576
2010-11	157	228	116	208	53	40	5.3	73	0	0.01	2.0	3	176	212	450	647	608
2011-12	164	238	116	208	67	45	5.7	84	0	0.01	2.1	3	207	248	487	693	652
2012-13	219	338	195	208	76	49	6.0	96	0	0.01	2.2	3	233	280	647	825	775
2013-14	289	445	195	208	88	54	6.4	105	0	0.01	2.3	3	259	311	743	963	905
2014-15	300	462	195	208	99	58	6.8	116	0	0.01	2.4	3	285	342	780	1012	951
2015-16	322	496	195	208	117	62	7.2	127	0	0.01	2.5	3	319	383	837	1087	1022
2016-17	358	543	195	208	126	65	7.7	136	0	0.01	2.6	3	341	409	894	1159	1090
2017-18	397	592	195	208	135	68	8.1	146	0	0.01	2.8	3	363	418	955	1217	1144
2018-19	423	671	195	208	146	71	8.6	156	0	0.01	2.9	3	387	446	1005	1325	1245
2019-20	519	865	195	208	158	73	9.1	166	0	0.01	3.0	3	412	474	1126	1546	1453
2020-21	546	910	195	208	170	75	9.6	177	0	0.01	3.2	3	438	503	1178	1621	1523
2021-22	665	1137	195	208	185	76	10.2	188	0	0.01	3.4	3	466	535	1325	1880	1767
2022-23	693	1184	195	208	200	77	10.7	200	0	0.01	3.5	3	494	568	1382	1960	1842
2023-24	724	1237	195	208	217	78	11.3	212	0	0.01	3.7	3	525	603	1443	2048	1925
2024-25	752	1285	195	208	234	79	11.9	225	0	0.01	3.9	3	556	640	1503	2132	2004
Growth	12.9%	14.4%	3.1%	2.9%	13.0%	8.0%	6.0%	9.8%	-100.0%	0.0%	5.0%	0.0%	10.2%	9.8%	9.4%	10.3%	10.3%

Table B2.3: Gas Demand Forecast
For
Bakhrabad Gas Systems Ltd.
(Low Case)

Year	Power		Fertilizer		Industry	Captive Power	Comm	Domestic	Seasonal	Tea	CNG	System Loss	Non Bulk		Sum		Overall Max
	Avg	Max.	Avg.	Max									Avg	Max	Avg	Max	Max
1	2	3	4	5	7	8	9	10	11	12	13	14	15	16	16	17	18
2005-06	71	100	109	121	23	18	3.9	37	0.1	0.01	1.5	3	87	107	267	328	308
2006-07	72	100	109	121	24	20	4.0	40	0.1	0.01	1.6	3	93	116	274	336	316
2007-08	72	100	109	121	25	22	4.2	44	0	0.01	1.7	3	100	124	281	345	324
2008-09	75	100	109	121	26	24	4.4	49	0	0.01	1.8	3	109	135	293	355	334
2009-10	120	151	109	127	34	26	4.6	53	0	0.01	1.9	3	123	152	352	431	405
2010-11	120	151	109	127	46	29	4.7	57	0	0.01	2.0	3	141	169	370	448	421
2011-12	120	151	109	127	58	31	4.9	61	0	0.01	2.1	3	160	192	389	470	442
2012-13	173	218	109	127	64	33	5.1	66	0	0.01	2.2	3	173	208	456	553	520
2013-14	186	234	109	127	72	35	5.2	69	0	0.01	2.3	3	187	224	482	585	550
2014-15	199	251	109	127	79	37	5.4	72	0	0.01	2.4	3	200	239	508	617	580
2015-16	213	268	109	127	91	40	5.6	76	0	0.01	2.5	3	218	261	540	657	617
2016-17	224	282	109	127	94	42	5.7	79	0	0.01	2.6	3	226	272	560	681	640
2017-18	240	302	109	127	97	44	5.9	82	0	0.01	2.8	3	234	270	584	699	657
2018-19	255	321	109	127	100	46	6.1	85	0	0.01	2.9	3	243	279	606	727	683
2019-20	274	345	109	127	104	47	6.3	88	0	0.01	3.0	3	251	289	634	761	715
2020-21	293	369	109	127	107	48	6.5	91	0	0.01	3.2	3	259	297	661	793	746
2021-22	308	368	109	127	110	49	6.7	94	0	0.01	3.4	3	266	306	683	821	771
2022-23	326	411	109	127	114	50	6.9	97	0	0.01	3.5	3	274	315	709	853	802
2023-24	344	433	109	127	118	50	7.1	100	0	0.01	3.7	3	282	324	735	884	831
2024-25	364	458	109	127	122	51	7.3	103	0	0.01	3.9	3	290	334	763	919	864
Growth	9.0%	8.3%	0.0%	0.3%	9.2%	5.5%	3.4%	5.6%	-100.0%	0.0%	5.0%	0.0%	6.6%	6.2%	5.7%	5.6%	5.6%

Table B3.1: Gas Demand Forecast
For
Jalalabad Gas T & D Systems Ltd.
(Base Case)

Unit MMSCFD

Year	Power		Fertilizer		Industry	Captive Power	Comm	Domestic	Seasonal	Tea	CNG	System Loss	Non Bulk		Sum		Overall
	Avg	Max.	Avg.	Max									Avg	Max	Avg.	Max	Max
1	2	3	4	5	7	8	9	10	11	12	13	14	15	16	16	17	18
2005-06	40	63	16.3	18	20	3	1.2	9	0.3	2.3	0 02	0.1	36	45	92	126	113
2006-07	40	72	16.3	18	20	6	1.2	10	0.3	2 3	0 03	0.1	40	49	96	140	126
2007-08	63	90	16 3	18	20	6	1.2	11	0 3	2.3	0.05	0 1	41	50	120	159	143
2008-09	77	110	16 3	18	20	6	1.3	11	0 3	2.3	0.07	0 1	42	52	135	180	162
2009-10	77	110	16 3	18	20	7	1 3	12	0 3	2.3	0.10	0 1	43	53	136	181	163
2010-11	98	140	39 2	43	20	10	1 4	13	0 3	2.3	0.14	0 1	47	56	184	240	216
2011-12	98	140	39.2	43	20	10	1 4	13	0 3	2 3	0.18	0 1	48	57	185	241	217
2012-13	93	132	39.2	43	21	10	1 5	14	0 3	2 3	0 23	0.1	49	59	181	234	211
2013-14	93	132	39 2	43	21	10	1.5	14	0.3	2 3	0 28	0.1	50	60	182	235	212
2014-15	109	167	39.2	43	21	10	1.6	15	0.3	2 3	0 33	0.1	51	61	199	272	244
2015-16	109	167	39.2	43	21	11	1.6	15	0 3	2.3	0 37	0 1	52	62	200	273	245
2016-17	128	192	39 2	43	21	11	1.7	16	0 3	2.3	0.40	0 1	53	63	220	299	269
2017-18	137	195	39 2	43	22	11	1.7	16	0 3	2.3	0.44	0 1	53	61	229	300	270
2018-19	139	220	39.2	43	22	11	1 7	17	0.3	2.3	0 49	0.1	54	62	232	326	293
2019-20	134	220	39 2	43	22	11	1 8	17	0 3	2 3	0.54	0 1	55	63	229	327	294
2020-21	132	210	39 2	43	22	11	1.8	17	0 3	2 3	0 59	0.1	56	64	228	318	286
2021-22	132	210	39 2	43	22	12	1 9	18	0.3	2.3	0 65	0.1	57	65	229	319	287
2022-23	132	210	39.2	43	23	12	1 9	18	0.3	2 3	0.72	0.1	58	66	229	320	288
2023-24	132	210	39.2	43	23	12	2.0	18	0.3	2 3	0 79	0 1	59	68	230	321	289
2024-25	143	235	39.2	43	23	12	2.0	19	0.3	2.3	0 87	0.1	60	69	242	347	313
Growth	7%	7%	5%	5%	1%	8%	3%	4%	0%	0%	21%	0%	3%	2%	5%	5%	5%

Table B3.2: Gas Demand Forecast
For
Jalalabad Gas T & D Systems Ltd.
(High Case)

Unit: MMSCFD

Year	Power		Fertilizer		Industry	Captive Power	Comm	Domestic	Seasonal	Tea	CNG	System Loss	Non Bulk		Sum		Overall
	Avg	Max.	Avg.	Max									Avg	Max	Avg.	Max	Max
1	2	3	4	5	7	8	9	10	11	12	13	14	15	16	16	17	18
2005-06	40	63	16	18	20	3	1.2	9	0 3	2 3	0 03	0.1	36	45	92	126	118
2006-07	40	72	16	18	20	6	1.2	10	0.3	2.3	0 04	0 1	40	50	96	140	132
2007-08	66	95	16	18	20	6	1.3	11	0 3	2.3	0 07	0.1	41	51	124	164	154
2008-09	83	119	16	18	20	7	1.3	12	0 3	2.3	0 11	0.1	42	52	142	189	178
2009-10	86	122	16	18	20	7	1 4	13	0 3	2.3	0 16	0 1	44	54	145	195	183
2010-11	113	161	39	43	20	10	1 4	14	0 3	2 3	0.25	0 1	48	58	200	263	247
2011-12	118	168	39	43	21	10	1 5	15	0.3	2 3	0.32	0 1	50	60	207	272	256
2012-13	116	165	39	43	21	10	1 6	16	0.3	2.3	0.42	0.1	52	63	207	271	255
2013-14	120	172	39	43	21	11	1.7	17	0.3	2.3	0.50	0.1	54	65	213	280	263
2014-15	147	226	39	43	22	11	1 8	18	0.3	2 3	0.57	0.1	56	67	241	336	316
2015-16	158	242	39	43	22	11	1.8	19	0 3	2 3	0.66	0.1	57	69	254	355	334
2016-17	192	288	39	43	22	12	1.9	20	0.3	2 3	0.76	0 1	59	71	290	403	379
2017-18	212	303	39	43	23	12	2 0	20	0.3	2.3	0 84	0 1	61	70	312	416	391
2018-19	232	368	39	43	23	12	2.1	21	0.3	2.3	0.92	0.1	63	72	334	483	454
2019-20	234	383	39	43	24	13	2.2	22	0 3	2 3	1 01	0.1	65	74	338	501	471
2020-21	242	385	39	43	24	13	2 3	23	0 3	2.3	1.06	0 1	66	76	348	505	474
2021-22	254	404	39	43	25	14	2 4	24	0.3	2 3	1.12	0 1	68	79	362	526	494
2022-23	265	420	39	43	25	14	2.5	25	0.3	2 3	1 17	0.1	70	81	374	545	512
2023-24	277	439	39	43	26	14	2 6	25	0 3	2.3	1 22	0.1	72	83	388	566	532
2024-25	311	510	39	43	27	15	2.8	26	0.3	2 3	1 27	0.1	74	86	425	639	601
Growth	11%	12%	5%	5%	2%	9%	5%	6%	0%	0%	23%	0%	4%	3%	8%	9%	9%

Table B3.3: Gas Demand Forecast
For
Jalalabad Gas T & D Systems Ltd.
(Low Case)

Unit: MMSCFD

Year	Power		Fertilizer		Industry	Captive Power	Comm.	Domestic	Seasonal	Tea	CNG	System Loss	Non Bulk		Sum		Overall Max
	Avg	Max.	Avg	Max									Avg	Max	Avg	Max	Max
1	2	3	4	5	7	8	9	10	11	12	13	14	15	16	16	17	18
2005-06	32	63	16	18	20	3	1.2	9	0.3	2.3	0.03	0.1	36	44	84	125	113
2006-07	32	63	16	18	20	6	1.2	10	0.3	2.3	0.04	0.1	39	49	88	130	117
2007-08	32	63	16	18	20	6	1.2	10	0.3	2.3	0.07	0.1	40	50	88	131	118
2008-09	33	63	16	18	20	6	1.3	11	0.3	2.3	0.11	0.1	41	51	90	132	119
2009-10	33	63	16	18	20	6	1.3	11	0.3	2.3	0.16	0.1	42	52	91	133	119
2010-11	33	63	16	18	20	10	1.3	12	0.3	2.3	0.25	0.1	45	54	95	135	122
2011-12	33	63	39	43	20	10	1.4	12	0.3	2.3	0.32	0.1	46	55	118	162	146
2012-13	33	63	39	43	20	10	1.4	13	0.3	2.3	0.42	0.1	47	56	119	163	146
2013-14	33	63	39	43	20	10	1.4	13	0.3	2.3	0.50	0.1	48	57	120	163	152
2014-15	33	63	39	43	20	10	1.5	14	0.3	2.3	0.57	0.1	48	58	120	164	154
2015-16	33	63	39	43	20	10	1.5	14	0.3	2.3	0.66	0.1	49	59	121	165	155
2016-17	63	79	39	43	20	10	1.6	14	0.3	2.3	0.76	0.1	49	59	152	182	171
2017-18	72	90	39	43	20	10	1.6	15	0.3	2.3	0.84	0.1	50	57	161	191	180
2018-19	76	95	39	43	20	11	1.6	15	0.3	2.3	0.92	0.1	51	58	166	197	185
2019-20	83	104	39	43	20	11	1.7	15	0.3	2.3	1.01	0.1	51	59	173	206	194
2020-21	86	108	39	43	20	11	1.7	16	0.3	2.3	1.06	0.1	52	59	177	211	198
2021-22	92	115	39	43	20	11	1.8	16	0.3	2.3	1.12	0.1	52	60	183	219	206
2022-23	92	116	39	43	20	11	1.8	16	0.3	2.3	1.17	0.1	53	61	184	220	207
2023-24	92	116	39	43	20	11	1.8	16	0.3	2.3	1.22	0.1	53	61	184	221	207
2024-25	92	116	39	43	20	11	1.9	17	0.3	2.3	1.27	0.1	54	62	185	221	208
Growth	6%	3%	5%	5%	0%	7%	3%	3%	0%	0%	23%	0%	2%	2%	4%	3%	3%

TableB4.1: Gas Demand Forecast
For
Pashchimancahl Gas Company Ltd.
(Base Case)

Unit: MMSCFD

Year	Power		Fertilizer		Industry	Captive Power	Comm	Domestic	Seasonal	Tea	CNG	System Loss	Non Bulk		Sum		Overall
	Avg	Max	Avg.	Max									Avg	Max	Avg.	Max	Max
1	2	3	4	5	7	8	9	10	11	12	13	14	15	16	16	17	18
2005-06	60	72	0	0	0.91	0 1	0.1	1	0	0	0 00	0.1	2	2	62	74	70
2006-07	65	72	0	0	1 06	0 1	0.1	1	0	0	0 01	0.1	2	3	67	75	70
2007-08	79	110	0	0	1.23	0 1	0 1	1	0	0	0 02	0.1	3	3	82	113	107
2008-09	77	110	0	0	1.43	0 1	0 2	1	0	0	0 03	0.1	3	4	80	114	107
2009-10	118	182	0	0	1 65	0 1	0 2	2	0	0	0 1	0.1	4	5	122	187	176
2010-11	153	222	0	0	1.92	0.1	0 2	2	0	0	0.6	0.1	5	6	158	228	214
2011-12	165	254	0	0	2 23	0.1	0 3	2	0	0	0.8	0.1	6	7	171	261	245
2012-13	165	254	0	0	2 58	0.1	0 4	3	0	0	1.0	0.1	7	8	172	262	247
2013-14	165	254	0	0	3.00	0.1	0 5	3	0	0	1.0	0.1	8	9	173	263	248
2014-15	165	254	0	0	3.48	0 1	0.6	4	0	0	1 0	0.1	9	11	174	265	249
2015-16	212	326	0	0	4 03	0 2	0.7	4	0	0	1 0	0 1	10	12	222	338	318
2016-17	218	326	0	0	4 68	0.2	0 8	5	0	0	1 0	0 1	12	14	230	340	319
2017-18	232	346	0	0	5 42	0 2	1 0	5	0	0	1.0	0.1	13	15	245	361	339
2018-19	218	346	0	0	6.29	0 2	1.1	6	0	0	1 0	0.1	14	17	232	363	341
2019-20	218	346	0	0	7 30	0 2	1 3	6	0	0	1 0	0.1	16	19	234	365	343
2020-21	220	366	0	0	8 47	0.2	1 6	7	0	0	1.0	0.1	18	21	238	387	364
2021-22	220	366	0	0	9.82	0 2	1 7	8	0	0	1.0	0 1	21	24	240	390	366
2022-23	220	366	0	0	11 39	0.3	2 0	8	0	0	1.0	0.1	23	27	243	393	369
2023-24	220	366	0	0	13.22	0.3	2 3	9	0	0	1.0	0 1	26	30	246	396	372
2024-25	244	406	0	0	15.33	0.3	2 7	10	0	0	1.0	0 1	30	34	273	440	414
Growth	8%	10%			16.00%	7%	20%	14%				0%	15%	15%	8%	10%	10%

Table B4.3: Gas Demand Forecast
For
Pashchimanchal Gas Company Ltd.
(Low Case)

Unit MMSCFD

Year	Power		Fertilizer		Industry	Captive power	Comm.	Domestic	Seasonal	Tea	CNG	System Loss	Non Bulk		Sum		Overall
	Avg	Max	Avg	Max									Avg	Max	Avg	Max	Max
1	2	3	4	5	7	8	9	10	11	12	13	14	15	16	16	17	18
2005-06	42	74	0	0	0 90	0.1	0.1	0.7	0	0	0.00	0 1	2	2	44	76	70
2006-07	42	74	0	0	1 02	0 1	0.1	0.8	0	0	0.01	0.1	2	3	44	76	71
2007-08	43	74	0	0	1 17	0.1	0 1	1.0	0	0	0.02	0.1	2	3	45	77	72
2008-09	45	74	0	0	1 33	0.1	0 1	1 2	0	0	0.03	0.1	3	4	48	77	72
2009-10	48	74	0	0	1.52	0 1	0 2	1.4	0	0	0.05	0.1	3	4	52	78	73
2010-11	64	81	0	0	1 73	0 1	0.2	1.6	0	0	0 60	0 1	4	5	69	86	81
2011-12	73	92	0	0	1 97	0 1	0 2	1.8	0	0	0.80	0.1	5	6	78	98	92
2012-13	77	96	0	0	2 25	0 1	0 3	2.1	0	0	1.00	0.1	6	7	82	103	97
2013-14	82	103	0	0	2 56	0 1	0 3	2 4	0	0	1 00	0.1	7	8	88	111	104
2014-15	68	86	0	0	2.92	0.1	0 4	2 6	0	0	1 00	0.1	7	9	76	95	89
2015-16	60	75	0	0	3 33	0.1	0 5	2 9	0	0	1 00	0 1	8	10	68	85	80
2016-17	53	66	0	0	3 80	0.1	0.6	3 2	0	0	1 00	0.1	9	11	61	77	72
2017-18	49	61	0	0	4 33	0 1	0.6	3 5	0	0	1.00	0 1	10	11	58	73	68
2018-19	51	65	0	0	4.93	0 1	0 7	3 9	0	0	1 00	0.1	11	12	62	77	73
2019-20	56	71	0	0	5 62	0 2	0 8	4 2	0	0	1 00	0 1	12	14	68	85	79
2020-21	59	75	0	0	6 41	0 2	0.9	4 7	0	0	1 00	0 1	13	15	73	90	85
2021-22	61	77	0	0	7 31	0.2	1 1	5.1	0	0	1.00	0 1	15	17	76	94	88
2022-23	73	92	0	0	8.33	0 2	1 2	5 6	0	0	1 00	0.1	16	19	89	111	104
2023-24	85	106	0	0	9 50	0.2	1.4	6 2	0	0	1.00	0.1	18	21	103	128	120
2024-25	90	113	0	0	10 83	0.2	1 6	6.8	0	0	1.00	0 1	21	24	111	137	129
Growth	4%	2%	0	0	14%	5%	17%	13%				0%	14%	13%	5%	3%	3%

Table B5.1: Gas Demand Forecast
For
South South-West Region
(Base Case)

Unit: MMSCFD

Year	Power		Fertilizer		Industry	Captive	Commercial	Domestic	Seasonal	Tea	CNG	System Loss/Gain	Non Bulk		Sum		Overall
	Avg	Max.	Avg	Max									Avg	Max	Avg	Max	Max
1	2	3	4	5	7	8	9	10	11	12	13	14	15	16	16	17	18
2005-06																	
2006-07																	
2007-08																	
2008-09																	
2009-10	59	90	0	0	0.4	0.03	0.2	0.07	0	0	0.1	0.05	1	1	59	91	86
2010-11	85	130	0	0	0.4	0.04	0.3	0.09	0	0	0.1	0.06	1	1	86	131	123
2011-12	152	234	0	0	0.5	0.04	0.3	0.12	0	0	0.1	0.1	1	1	153	235	221
2012-13	152	234	0	0	0.6	0.04	0.4	0.16	0	0	0.2	0.1	2	2	154	236	222
2013-14	152	234	0	0	0.7	0.05	0.5	0.21	0	0	0.2	0.1	2	2	154	236	222
2014-15	184	306	0	0	0.9	0.05	0.6	0.27	0	0	0.3	0.1	2	3	186	309	290
2015-16	183	306	0	0	1.1	0.06	0.7	0.35	0	0	0.3	0.1	3	3	195	309	291
2016-17	205	306	0	0	1.3	0.06	0.9	0.46	0	0	0.3	0.1	3	4	208	310	291
2017-18	205	306	0	0	1.5	0.07	1.0	0.59	0	0	0.3	0.1	4	4	209	310	292
2018-19	190	306	0	0	1.9	0.08	1.2	0.77	0	0	0.4	0.1	4	5	194	311	292
2019-20	190	306	0	0	2.2	0.08	1.5	1.01	0	0	0.4	0.1	5	6	195	312	293
2020-21	186	328	0	0	2.7	0.09	1.8	1.31	0	0	0.4	0.1	6	7	202	333	313
2021-22	196	326	0	0	3.2	0.10	2.0	1.70	0	0	0.4	0.1	7	9	203	335	315
2022-23	265	441	0	0	3.9	0.11	2.2	2.21	0	0	0.5	0.1	9	10	274	451	424
2023-24	300	536	0	0	4.6	0.12	2.4	2.87	0	0	0.5	0.1	11	12	311	548	515
2024-25	345	566	0	0	5.5	0.13	2.6	3.73	0	0	0.5	0.1	13	15	358	581	546
Growth	13%	13%	0%	0%	20%	10%	17%	31%			11%	5%	20%	19%	13%	13%	13%

Table B5.2: Gas Demand Forecast
For
South South-West Region
(High Case)

Unit. MMSCFD

Year	Power Avg	Power Max	Fertilizer Avg	Fertilizer Max	Industry	Captive	Commercial	Domestic	Seasonal	Tea	CNG	System Loss	Non Bulk Avg	Non Bulk Max	Sum Avg	Sum Max	Overall Max
1	2	3	4	5	7	8	9	10	11	12	13	14	15	16	16	17	18
2009-10	65	100	0	0	0.5	0.50	0.3	0.07	0	0	0.10	0 05	1 4	2	66	102	96
2010-11	97	150	0	0	0.6	0.60	0.3	0.11	0	0	0.10	0.06	1 8	2	99	152	143
2011-12	183	281	0	0	0.7	0.80	0 4	0.15	0	0	0.10	0.1	2 3	3	185	284	267
2012-13	190	293	0	0	0 9	0.90	0 5	0 21	0	0	0.20	0.1	2.8	3	193	296	278
2013-14	198	304	0	0	1 1	1.00	0 6	0.30	0	0	0.20	0.1	3.4	4	201	308	290
2014-15	248	413	0	0	1 4	0.07	0 8	0.42	0	0	0.30	0.1	3.1	4	251	417	392
2015-16	280	444	0	0	1 8	0 08	1.0	0 59	0	0	0.30	0.1	3 8	5	283	448	421
2016-17	308	459	0	0	2.2	0.09	1.2	0.82	0	0	0.30	0.1	4 7	6	312	465	437
2017-18	318	474	0	0	2.8	0.10	1 5	1.07	0	0	0.30	0 1	5 9	7	324	481	452
2018-19	317	511	0	0	3 5	0 12	1.9	1 49	0	0	0 40	0 1	7 5	9	324	520	488
2019-20	330	532	0	0	4 4	0.14	2.3	1.94	0	0	0.40	0 1	9.3	11	339	543	511
2020-21	358	597	0	0	5.5	0 16	2 9	2 52	0	0	0 40	0.1	11 5	13	369	610	573
2021-22	376	626	0	0	6 8	0 18	3 3	3 28	0	0	0 40	0.1	14 1	16	390	642	604
2022-23	529	882	0	0	8 5	0.21	3.8	4 26	0	0	0 50	0.1	17.4	20	547	902	848
2023-24	627	1120	0	0	10.7	0.24	4.4	5.54	0	0	0.50	0 1	21 5	25	649	1145	1076
2024-25	749	1228	0	0	13.3	0.27	5.1	7 20			0.50	0.1	26 5	30	776	1259	1183
Growth	18%	18%	0%	0%	25%	-4%	22%	36%	0%	0%	11%	5%	21%	21%	18%	18%	18%

Table B5.3: Gas Demand Forecast
For
South South-West Region
(Low Case)

Unit: MMSCFD

Year	Power		Fertilizer		Industry	Captive	Commercial	Domestic	Seasonal	Tea	CNG	System Loss	Non Bulk		Sum		Overall
	Avg	Max	Avg	Max									Avg	Max	Avg	Max	Max
1	2	3	4	5	7	8	9	10	11	12	13	14	15	16	16	17	18
2005-06																	
2006-07																	
2007-08																	
2008-09																	
2009-10	75	80	0	0	0.4	0.03	0.2	0.05	0	0	0.10	0.05	0.9	1	76	81	76
2010-11	99	125	0	0	0.5	0.03	0.3	0.07	0	0	0.10	0.06	1.0	1	100	126	118
2011-12	105	132	0	0	0.5	0.04	0.3	0.09	0	0	0.10	0.1	1.2	1	106	134	126
2012-13	109	138	0	0	0.6	0.04	0.3	0.11	0	0	0.20	0.1	1.4	2	111	140	131
2013-14	118	149	0	0	0.7	0.04	0.4	0.15	0	0	0.20	0.1	1.6	2	120	151	142
2014-15	125	157	0	0	0.8	0.05	0.5	0.19	0	0	0.30	0.1	1.9	2	127	160	150
2015-16	133	167	0	0	0.9	0.05	0.5	0.25	0	0	0.30	0.1	2.2	3	135	170	160
2016-17	140	176	0	0	1.1	0.05	0.6	0.33	0	0	0.30	0.1	2.4	3	142	179	168
2017-18	148	187	0	0	1.2	0.06	0.7	0.43	0	0	0.30	0.1	2.8	3	151	190	178
2018-19	155	196	0	0	1.4	0.06	0.8	0.53	0	0	0.40	0.1	3.3	4	158	199	187
2019-20	167	210	0	0	1.6	0.07	0.9	0.66	0	0	0.40	0.1	3.8	4	171	215	202
2020-21	174	219	0	0	1.8	0.07	1.1	0.83	0	0	0.40	0.1	4.3	5	178	224	210
2021-22	184	231	0	0	2.1	0.08	1.2	1.04	0	0	0.40	0.1	4.9	6	188	237	223
2022-23	195	246	0	0	2.4	0.09	1.2	1.30	0	0	0.50	0.1	5.7	7	201	253	238
2023-24	208	262	0	0	2.8	0.09	1.3	1.62	0	0	0.50	0.1	6.5	7	214	269	253
2024-25	218	274	0	0	3.2	0.10	1.5	2.03	0	0	0.50	0.1	7.4	9	225	283	266
Growth	7%	9%			15%	8%	13%	28%			11%	5%	15%	15%	8%	9%	9%

Appendix-B

Table B6.1a. Industry Categorywise Gas Demand
Industrial Sector
Titas Gas T&D Company LTD

Gas in MMSCFD

Type	FY 05-06	FY 06-07	FY 07-08	FY 08-09	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16
Total	146	167	187	206	230	255	281	312	339	373	409
Others	10 50	12.19	14 02	16.12	18.54	20.95	23 46	25.81	25 58	28.13	30 66
V.Oil	0.820	0 919	0.919	0.968	1.064	1.107	1.151	1 197	1.245	1 295	1.347
Tenary	0.726	0.766	0.799	0.799	0.839	0.856	0.873	0 690	0.908	0.926	0.945
Tobacco	0 277	0 285	0.223	0.232	0.232	0 235	0.237	0 239	0.242	0.244	0.246
Footwear	0.104	0.116	0 106	0.106	0.116	0.121	0.030	0.126	0.031	0.131	0 136
Sugar	0.001	0 001	0.001	0 010	0.001	0 012	0.012	0.014	0.015	0 018	0.012
Salt	2.495	2 683	2.709	2.709	2 806	3.086	3 395	3.667	3 923	4.159	4.575
Agro	0 259	0.274	0 291	0 308	0.327	0.343	0.360	0 378	0.397	0.417	0.438
Lime	1.161	1 258	1.355	1.355	1.451	1 524	1.600	1 680	1.764	1.852	1.945
Electronics	0.104	0.104	0 104	0.104	0.104	0.106	0.110	0 115	0.119	0 124	0.128
Battery	0 058	0.058	0 063	0.068	0.058	0.060	0.060	0.060	0 065	0.065	0.060
Paltry	0 062	0 066	0 070	0.074	0 078	0.100	0.010	0 015	0.016	0 200	0.100
Dairy	0 078	0.069	0.069	0.077	0 097	0.100	0.097	0.100	0 100	0.100	0 100
Backery	3.516	4.043	4.650	5 347	6 149	6 680	7.041	7.653	8.061	8 626	9 229
Food & Bev.	1 242	1.234	1 268	1 306	1.355	1.409	1 023	1.465	0.024	1 524	1.695
Board	0.311	0.311	0.320	0 329	0 339	0.344	0 348	0.353	0 357	0.362	0.367
Packaging	0 129	0.106	0 106	0.116	0 121	0.122	1.125	0.125	1 250	0.130	0 122
Paper	1 200	1.258	1 296	1.334	1 374	1.416	1.468	1 502	1.547	1.593	1.641
Plastic	0.111	0 169	0.137	0 143	0.147	0.157	0.168	0.180	0.193	0 206	0.221
Pharmaceutical	0.611	0.648	0.687	0 728	0.771	0.818	0 867	0.919	0 974	1 032	1.094
M/os Coil	0.021	0.021	0.021	0 022	0 022	0 023	0.023	0 024	0 024	0 025	0.023
Soap	0 725	0.726	0 726	0.726	0 726	0.740	0.755	0.770	0 785	0.801	0 817
Silicate	0.271	0.271	0.293	0 316	0 341	0.355	0.062	0.369	0.064	0 384	0.399
Chemical	4.659	4 845	5.039	5 240	5 450	5.668	5 896	6.130	6 376	6.631	6.896
Glass	0 248	0.248	0 256	0.264	0 271	0.278	0 023	0.285	0 024	0.292	0 300
Ceramics	4 275	5.321	5 612	5.805	5 806	6.037	6.279	6.530	6 791	7.063	7 345
Aluminium	0.031	0 031	0.031	0 031	0.031	0 032	0.033	0 033	0.040	0.050	0 032
Wire	0.052	0.052	0.052	0 052	0.062	0 050	0.055	0 055	0.080	0.065	0 050
Molding	0 051	0 001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002
Metal	0 000	0.000	0.000	0.000	0.000	0 000	0.000	0 000	0.000	0.000	0 000
Steel	13 066	13.849	14.680	15 561	16.496	17 485	18.358	19 277	20.241	21.253	22.529
Jute	0 255	0.255	0 255	0.255	0 255	0 300	0.330	0.350	0.400	0.400	0 300
Textile / Dyeing / Knitting / Garments	98.280	114.987	131.085	145 898	164.135	184.242	184.135	206 811	231.629	257 108	285.390	315.356

Table B6.1a. Industry Categorywise Gas Demand
Industrial Sector
Titas Gas T& D Company LTD

Gas In MMSCFD

Type	FY 16-17	FY 17-18	FY18-19	FY19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	FY24-25
Garments Knitting Dyeing Textile	346.891	379.846	414.032	449.225	488.286	529.079	569.818	612.555	655.433
Jute	0.330	0.350	0.400	0.400	0.300	0.330	0.350	0.400	0.400
Steel	23.654	24.837	26.079	27.353	29.025	30.477	32.001	33.601	35.281
Metal	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Molding	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Wire	0.055	0.055	0.060	0.065	0.050	0.055	0.055	0.060	0.065
Aluminium	0.033	0.033	0.040	0.050	0.032	0.033	0.033	0.040	0.050
Ceramics	7.639	7.945	8.263	8.593	8.937	9.294	9.666	10.053	10.455
Glass	0.013	0.307	0.013	0.315	0.323	0.013	0.331	0.013	0.339
Chemical	7.172	7.459	7.757	8.067	8.390	8.726	9.075	9.438	9.815
Silicate	0.021	0.415	0.021	0.432	0.449	0.021	0.467	0.021	0.486
Soap	0.834	0.850	0.867	0.885	0.902	0.920	0.939	0.957	0.977
Mos. Coil	0.023	0.024	0.024	0.025	0.023	0.023	0.024	0.024	0.025
Pharmaceutical	1.160	1.230	1.303	1.381	1.464	1.552	1.645	1.744	1.849
Plastic	0.236	0.253	0.270	0.289	0.310	0.331	0.354	0.379	0.406
Paper	1.690	1.741	1.793	1.847	1.903	1.960	2.018	2.079	2.141
Packaging	1.125	0.125	1.250	0.130	0.122	1.125	0.125	1.250	0.130
Board	0.371	0.376	0.381	0.386	0.391	0.396	0.401	0.407	0.412
Food & Bev.	0.021	1.648	0.021	1.714	1.782	0.021	1.854	0.021	1.928
Backery	9.875	10.556	11.306	12.097	12.944	13.850	14.819	15.857	16.967
Dairy	0.097	0.100	0.100	0.100	0.100	0.097	0.100	0.100	0.100
Petry	0.010	0.015	0.015	0.200	0.100	0.010	0.015	0.015	0.200
Battery	0.060	0.060	0.065	0.065	0.060	0.060	0.060	0.065	0.065
Electronics	0.132	0.134	0.137	0.140	0.142	0.144	0.145	0.147	0.148
Lime	2.042	2.144	2.251	2.364	2.482	2.606	2.737	2.873	3.017
Agro	0.460	0.483	0.507	0.532	0.559	0.587	0.616	0.647	0.679
Salt	5.032	5.435	5.815	6.164	6.760	7.458	8.055	8.619	9.136
Sugar	0.012	0.014	0.015	0.016	0.012	0.012	0.014	0.015	0.016
Footwear	0.021	0.141	0.021	0.147	0.153	0.021	0.159	0.021	0.165
Tobacco	0.249	0.251	0.254	0.257	0.259	0.262	0.264	0.267	0.270
Tenary	0.964	0.983	1.002	1.023	1.043	1.064	1.085	1.107	1.129
V. Oil	1.401	1.457	1.515	1.575	1.638	1.704	1.772	1.843	1.917
Others	33.27	36.10	38.99	42.11	45.26	48.88	52.07	52.07	55.71
Total	445	485	525	568	612	661	711	757	810

Table B6.1b: Industrywise Gas Demand Forecast
Captive Power Sector
Titas Gas T& D Company LTD

Gas in MMSCFD

Type	FY 05-06	FY 06-07	FY 07-08	FY 08-09	FY 09-10	FY10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16
Garments											
Spinning											
Knitting	84.175	99.326	115.2	131.349	148.424	165.493	178.733	190.350	200.820	207.848	214.084
Dyeing											
Textile											
Ceramics	2.821	3.526	5.289	6.082	6.994	7.623	8.233	8.727	9.076	9.394	9.676
Steel	0.826	0.892	0.928	1.113	1.161	1.242	1.329	1.409	1.479	1.524	1.570
Metal	0.175	0.179	0.179	0.184	0.194	0.197	0.201	0.205	0.209	0.214	0.218
Aluminium	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cement	0.068	0.078	0.089	0.099	0.110	0.120	0.150	0.200	0.250	0.250	0.120
Glass	0.258	0.268	0.279	0.290	0.302	0.350	0.364	0.379	0.394	0.406	0.350
Jute	0.650	0.629	0.629	0.677	0.774	0.774	0.774	0.774	1.774	2.774	0.774
Chemical	0.258	0.290	0.290	0.339	0.339	0.400	0.428	0.458	0.490	0.524	0.400
Pharmaceutical	1.084	1.138	1.275	1.306	1.355	1.422	1.508	1.598	1.694	1.762	1.850
Paper	7.007	8.128	9.103	10.013	11.015	12.116	13.206	14.395	15.115	15.568	16.035
Packaging	0.112	0.129	0.147	0.165	0.183	0.204	0.210	0.210	0.210	0.210	0.233
Hardboard	0.577	0.664	0.757	0.848	0.943	1.037	1.000	1.000	1.000	1.100	1.037
Paltry Feed	0.158	0.181	0.207	0.232	0.258	0.283	0.290	0.290	0.290	0.290	0.319
Agri	0.276	0.318	0.362	0.406	0.451	0.496	0.500	0.500	0.600	0.600	0.660
Melamine	0.241	0.277	0.316	0.354	0.393	0.433	0.455	0.455	0.500	0.500	0.550
Leather	0.115	0.132	0.151	0.169	0.188	0.207	0.225	0.241	0.256	0.271	0.298
Polythene	0.075	0.086	0.098	0.110	0.122	0.134	0.122	0.122	0.122	0.150	0.165
Plastic	1.187	1.365	1.556	1.743	1.938	2.132	2.324	2.533	2.711	2.873	2.939
Rubber	0.159	0.182	0.208	0.233	0.259	0.269	0.260	0.260	0.260	0.260	0.270
Polymer	0.046	0.053	0.060	0.067	0.075	0.075	0.080	0.080	0.080	0.080	0.080
Food & Beverage	1.052	1.242	1.440	1.671	1.888	1.900	2.128	2.256	2.391	2.511	2.586
Bakery	0.419	0.486	0.559	0.626	0.714	0.778	0.871	0.976	1.074	1.127	1.172
V. Oil	0.959	1.103	1.279	1.458	1.742	1.850	2.035	2.137	2.222	2.267	2.230
Dairy	0.478	0.445	0.484	0.542	0.602	0.639	0.677	0.718	0.761	0.806	0.855
Battery	0.227	0.232	0.213	0.242	0.252	0.258	0.265	0.271	0.278	0.286	0.293
Soap	0.124	0.142	0.162	0.182	0.202	0.222	0.245	0.264	0.286	0.308	0.335
Electrical	0.092	0.105	0.097	0.097	0.106	0.110	0.110	0.110	0.110	0.110	0.110
Sugar Mill	0.175	0.175	0.175	0.178	0.180	0.198	0.200	0.200	0.200	0.200	0.198
Cable	0.005	0.006	0.007	0.008	0.009	0.010	0.200	0.200	0.200	0.200	0.200
Tobacco	0.480	0.504	0.530	0.556	0.584	0.584	0.580	0.580	0.580	0.610	0.584
Seed	0.165	0.155	0.155	0.164	0.174	0.175	0.175	0.175	0.175	0.175	0.175
Oxygen	0.155	0.155	0.155	0.155	0.155	0.160	0.160	0.160	0.160	0.160	0.165
Others	5.830	7.288	8.746	10.159	11.683	12.734	13.880	14.852	15.595	15.985	16.304
Total	110	130	151	172	194	213	230	246	259	269	277

Table B6.1b: Industrywise Gas Demand Forecast
Captive Power Sector
Titas Gas T& D Company LTD

Type	FY 16-17	FY 17-18	FY18-19	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY23-24	Gas in MMSCFD FY 24-25
Garments									
Spinning									
Knitting									
Dyeing	219.436	220 533	221.636	222.633	223 523	229.112	230.257	231.408	232.103
Textile									
Ceramic									
Steel	9 966	10.066	10 116	10.162	10.207	10.514	10.619	10 672	10 704
Metal	1 617	1.633	1.641	1 648	1.656	1.705	1 723	1.731	1.736
Aluminium	0 222	0.224	0 225	0 227	0.228	0 232	0.235	0.236	0.236
Cement	0.000	0.000	0.000	0 000	0.000	0 000	0.000	0.000	0 000
Glass	0 150	1.150	1 156	1.161	1.166	0.150	1.150	1.156	1 159
Jute	0.364	0.379	0.380	0 382	0.384	0.399	0 415	0.417	0.419
Chemical	0 774	1.774	1 783	1 791	1.799	0 774	1.774	1.783	1 788
Pharmaceutical	0 428	0 437	0.439	0.441	0.443	0.474	0.483	0.486	0 487
Paper	1.905	1.962	1.972	1 981	1.990	2.050	2 111	2.122	2.128
Packaging	16 196	16 358	16.439	16 513	16.588	16.753	16.921	17.006	17.057
Hardboard	0 210	0.210	0.211	0.212	0 213	0 210	0.210	0 211	0.212
Paltry Feed	1.000	1.000	1 005	1.010	1.014	1.000	1 000	1.005	1.008
Agri	0 290	0 290	0.291	0 293	0.294	0.290	0 290	0 291	0.292
Melamine	0.500	0 500	0.503	0.505	0 507	0 500	0.500	0.503	0 504
Leather	0.455	0 455	0.457	0.459	0.461	0.455	0 455	0.457	0.459
Polythene	0 325	0.354	0 356	0.357	0.359	0.391	0.427	0 429	0.430
Plastic	0.122	1 122	1.128	1.133	1 138	0 122	1.122	1.128	1.131
Rubber	2.998	3.028	3.043	3.057	3.071	3 132	3.163	3.179	3 189
Polymer	0.260	0.260	0 261	0.262	0 264	0.260	0.260	0 261	0.262
Food & Beverage	0 080	0 080	0.080	0.081	0.081	0 080	0 080	0.080	0.081
Bakery	2.644	2 704	2.717	2.729	2 742	2.803	2.866	2 881	2.889
V, Oil	1.208	1.220	1.226	1.231	1 237	1.274	1.287	1 293	1.297
Dairy	2.279	2.302	2 313	2 324	2.334	2.386	2 409	2 421	2.429
Battery	0 880	0.889	0.894	0 898	0.902	0 929	0.938	0.943	0 945
Soap	0.300	0.303	0 305	0.306	0.308	0.316	0 319	0.321	0 321
Electrical	0.369	0 405	0.407	0.409	0.411	0 452	0 497	0.500	0.501
Sugar Mill	0.110	0.110	0.111	0 111	0 112	0.110	0.110	0.111	0.111
Cable	0 200	0.200	0.201	0.202	0 203	0 200	0.200	0.201	0 202
Tobacco	0.200	0.200	0 201	0.202	0 203	0.200	0 200	0 201	0.202
Seed	0 584	0 584	0.587	0.590	0.592	0.584	0 584	0.587	0.589
Oxygen	0.175	0.175	0.176	0 177	0.177	0.175	0 175	0.176	0.176
Others	0.165	0.165	0.165	0.165	0 170	0 170	0.170	0.170	0.170
Total	16.630	16.797	16 881	16.957	17.033	17 374	17.547	17.635	17 688
	283	285	288	291	294	296	297	298	300

Table A6.2a : Industrywise Demand Forecast
Industrial Sector
Bakhrabad Gas Systems Ltd

Gas in MMSCFD

Type	FY 05-06	FY 06-07	FY 07-08	FY 08-09	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15
Garments										
Dyeing & Knitting										
Textile										
Subtotal	13 244	14.966	16.837	18.857	21.120	23 549	26.140	28 754	31.341	34 162
Ceramic	0 009	0.010	0.010	0 012	0.012	0 015	0.250	0 250	0.300	0 350
Steel & Re-rolling	3.580	4.064	4.160	4 160	4.160	4.306	4.457	4.613	4.797	4 989
Aluminium	0 103	0.106	0.111	0.116	0 116	0.118	0 220	0.280	0.300	0 300
Engineering	0.023	0 024	0 026	0.027	0 029	0 035	0.040	0.045	0 045	0.050
Pharmaceuticals	0.097	0 116	0.116	0.126	0.135	0 200	0.220	0 300	0 350	0.400
Bakery/Food	0 629	0 677	0.822	0 919	1.016	1 128	1.252	1 377	1.515	1.666
Beverage	0.077	0.082	0 097	0 092	0.097	0.102	0.107	0 112	0.118	0 123
Edible Oil	0.039	0 044	0.048	0 058	0.068	0.076	0.080	0.084	0.088	0 092
Silicate/Chemicals	0.145	0.145	0.150	0.150	0.155	0.210	0.300	0.350	0 350	0 400
Soap	0.077	0.082	0.082	0 087	0 092	0 100	0.100	0 150	0.150	0.200
Footwears	0.025	0.025	0.034	0.039	0 044	0.055	0.060	0.065	0.100	0 150
Pottery	0 005	0.005	0 005	0.005	0 005	0.008	0.008	0.085	0 085	0.090
Autobricks	0 194	0.215	0 218	0.232	0.242	0.300	0 400	0.400	0 450	0.600
Salt	0.629	0.726	0.726	0 726	0.774	0 900	1.000	1 100	1.150	1 300
Glass	0.048	0 053	0.053	0.058	0 068	0.080	0 090	0.200	0.220	0 280
Plastic	0.019	0 019	0.019	0.019	0 024	0.030	0.035	0.040	0 045	0.045
Gov. Industries	3.882	3.882	3.882	3.882	3.882	3.800	3.800	3.800	3 800	3.800
Sub-total	22.825	25.241	27.387	29 565	32.038	35.082	38.239	41 585	45.223	49.158
KEPZ	0				6.0000	16 000	26.000	30 000	36.000	40.000
Total	22.825	25.241	27.387	29.565	38.038	51.082	64.239	71.585	81.223	89.158

Table A6.2a : Industrywise Demand Forecast
Industrial Sector
Bakhrabad Gas Systems Ltd

Type	FY 15-16	FY 16-17	FY 17-18	FY18-19	FY19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	FY24-25
Garments										
Dyeing & Knitting										
Textile										
Subtotal Textile	37.237	40.588	44.038	47.781	51.843	55.731	59.911	64.404	69.234	74.081
Ceramic	0.400	0.450	0.500	0.500	0.800	0.900	0.900	1.000	1.100	1.200
Steel & Re-rolling	5.184	5.370	5.585	5.884	6.158	6.500	6.825	7.166	7.525	7.901
Aluminium	0.350	0.500	0.550	0.600	0.600	0.650	0.650	0.700	0.700	0.750
Engineering	0.055	0.060	0.080	0.100	0.150	0.200	0.200	0.250	0.300	0.300
Pharmaceuticals	0.500	0.550	0.600	0.700	0.800	0.900	0.900	1.000	1.100	1.100
Bakery/Food	1.816	1.979	2.158	2.352	2.563	2.794	3.046	3.320	3.618	3.944
Beverage	0.130	0.138	0.143	0.156	0.170	0.200	0.212	0.225	0.238	0.252
Edible Oil	0.097	0.102	0.200	0.250	0.263	0.280	0.300	0.400	0.450	0.600
Silicate/Chemicals	0.500	0.500	0.600	0.650	0.700	0.700	0.700	0.750	0.900	1.000
Soap	0.300	0.350	0.400	0.400	0.450	0.500	0.550	0.700	0.800	0.900
Footwears	0.180	0.200	0.400	0.450	0.500	0.550	0.600	0.650	0.750	0.800
Pottery	0.100	0.150	0.150	0.200	0.200	0.250	0.300	0.300	0.350	0.400
Autobricks	0.650	0.700	0.750	0.800	0.850	0.900	0.950	1.100	1.100	1.200
Salt	1.400	1.500	1.800	1.900	1.900	2.000	2.100	2.200	2.200	2.300
Glass	0.300	0.500	0.600	0.700	0.800	0.900	0.900	1.000	1.100	1.200
Plastic	0.050	0.100	0.200	0.300	0.350	0.350	0.400	0.500	0.550	0.600
Gov. Industries	3.800	3.800	3.800	3.800	3.800	3.800	3.700	3.800	3.500	3.400
Sub-toal	53.33629	57.81654	62.44187	67.374775	72.63	78.077	83.777	89.641	95.737	101.481
KEPZ	50	50	50	50	50	50	50	50	50	50
Total	103.336	107.817	112.442	117.375	122.630	128.077	133.777	139.641	145.737	151.481

Table B6.2b: Industrywise Demand Forecast
Captive Power Sector
Bakhrabad Gas Systems Ltd

Type	FY 15-16	FY 19-17	FY 17-18	FY18-19	FY19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	FY24-25
Garments										
Dyeing & Knitting										
Textile										
Sub-total	17.864	19.228	20.478	21.400	22.362	23.257	23.955	24.673	25.414	26.176
Steel & Re-rolling	12.315	13.300	14.165	14.802	15.468	16.087	16.569	17.067	17.578	18.106
Pharmaceuticals	0.180	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
Bakery/Food	1.854	1.900	1.900	1.900	1.900	2.000	2.000	2.000	2.000	2.000
Beverage	0.820	0.894	0.966	1.004	1.045	1.081	1.113	1.147	1.181	1.217
Edible Oil	0.090	0.098	0.105	0.110	0.116	0.120	0.123	0.127	0.131	0.135
Silicate/Chemicals	0.450	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
Salt	0.550	0.600	0.600	0.600	0.600	0.600	0.600	0.600	0.600	0.600
Paper & packaging	1.300	1.405	1.450	1.450	1.450	1.500	1.500	1.500	1.500	1.500
Jute	0.700	0.700	0.700	0.700	0.700	0.700	0.700	0.700	0.700	0.700
Eastern Refinery	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Cement	1.550	1.700	1.700	1.700	1.700	1.700	1.700	1.700	1.700	1.700
Oxygen	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.450
PHP Power	2.400	2.400	2.400	2.400	2.400	2.400	2.000	2.000	2.000	2.000
Gov. Industires	3.100	3.000	2.800	2.800	2.600	2.500	2.400	2.200	2.200	2.200
Others	0.280	0.350	0.350	0.350	0.350	0.400	0.400	0.400	0.400	0.400
Total	45.543	47.820	49.972	51.971	53.790	55.403	56.789	57.924	59.083	60.264

Table B6.2b: Industrywise Demand Forecast
Captive Power Sector
Bakhrabad Gas Systems Ltd

Gas in MMCFD

Type	FY 05-06	FY 06-07	FY 07-08	FY 08-09	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15
Garments										
Dyeing & Knitting										
Textile										
Sub-total	4.311	5.389	6.575	7.890	9.310	10.427	11.678	13.021	14.584	16.334
Steel & Re-rolling	3.386	4.064	4.876	5.705	6.561	7.348	8.083	9.296	10.318	11.350
Pharmaceuticals	0.048	0.054	0.060	0.066	0.072	0.081	0.085	0.085	0.090	0.180
Bakery/Food	0.677	0.759	0.834	0.918	1.010	1.131	1.255	1.393	1.546	1.717
Beverage	0.313	0.351	0.388	0.425	0.467	0.514	0.565	0.622	0.684	0.753
Edible Oil	0.039	0.043	0.048	0.052	0.058	0.065	0.071	0.077	0.084	0.092
Silicate/Chemicals	0.024	0.027	0.030	0.033	0.036	0.041	0.450	0.450	0.450	0.450
Salt	0.271	0.303	0.334	0.367	0.404	0.456	0.550	0.550	0.550	0.550
Paper & packaging	0.484	0.542	0.596	0.656	0.721	0.815	0.896	0.986	1.085	1.193
Jute	0.387	0.433	0.477	0.524	0.577	0.652	0.700	0.700	0.700	0.700
Eastern Refinery	0.581	0.650	0.715	0.787	0.865	0.865	0.865	0.865	0.865	0.865
Cement	0.774	0.867	0.954	1.049	1.154	1.500	1.500	1.500	1.500	1.500
Oxygen	0.968	1.084	1.192	1.311	1.442	1.440	1.450	1.450	1.450	1.450
PHP Power	2.322	2.400	2.400	2.400	2.400	2.400	2.400	2.400	2.400	2.400
Gov. Industires	3.096	3.090	3.100	3.100	3.100	3.503	3.100	3.100	3.100	3.100
Others	0.145	0.160	0.176	0.193	0.212	0.240	0.250	0.250	0.250	0.270
Total	18.310	20.758	23.348	26.131	29.111	31.876	34.586	37.353	40.154	42.965

Table B6.3 : Industry Categorywise Demand Forecast
a . Industrial Sector
Jalalabad Gas T & D systems Ltd

Gas in MMSCFD

Type	FY 05-06	FY 06-07	FY 07-08	FY 08-09	FY 09-10
Ceramic	0.058	0.058	0.058	0.058	0.058
Cement	3.385	13.056	16.925	16.925	16.925
Food	0.222	0.227	0.227	0.227	0.227
Aliminium	0.012	0.012	0.012	0.012	0.012
Bakery	0.073	0.073	0.077	0.077	0.082
Lime	0.012	0.012	0.012	0.012	0.012
Board	0.029	0.029	0.034	0.058	0.058
Other	0.021	0.029	0.048	0.053	0.058
Total	3.812	13.496	17.393	17.422	17.432

b. Captive Power Sector

Type	FY 05-06	FY 06-07	FY 07-08	FY 08-09	FY 09-10
Spinning	1.064	1.064	1.112	1.161	1.257
Cement	1.838	3.868	4.642	4.836	4.836
Tea	0.387	0.435	0.435	0.435	0.435
Total	3.288	5.368	6.190	6.431	6.528

TableB6. 4 : Industr Categoryywise Demand Forecast
Pashchimanchal Gas Company Limited

a . Industrial Sector

Gas in MMSCFD

Type	FY 05-06	FY 06-07	FY 07-08	FY 08-09	FY 09-10
Dyeing					
Textile	0.399	0 581	0.668	0 768	0.883
Sub-total *⸗ - i ⸗⸗	0.019	0.018	0.019	0.018	0.019
Jute	0.007	0.039	0.048	0.068	0 068
Steel	0.027	0.027	0.028	0.029	0 039
Chemical	0.097	0.097	0.097	0.097	0.097
Silicate	0.092	0.097	0.121	0.145	0.145
Pharamaceutical	0.063	0.145	0.145	0 145	0.194
Lime	0.000	0.004	0.005	0.005	0.006
Electrical	0.048	0.058	0.063	0 068	0.087
Food	0.017	0.018	0.019	0.021	0.022
Backery	0.009	0.008	0.009	0.009	0.009
Salt	0.106	0.116	0.126	0 135	0.145
Others	0.884	1.207	1.348	1.508	1.713
Total	1.768	2.415	2.696	3.015	3.425

b. Captive Power Sector

Type	FY 05-06	FY 06-07	FY 07-08	FY 08-09	FY 09-10
Spinning	0.000	0.145	0.194	0 387	0.387
Textile	0.135	0.135	0.194	0.242	0 242
Cement	0.194	0.194	0.194	0 203	0.203
Pharmaceutical	0.019	0.048	0.077	0.077	0 077
Total	0.348	0.522	0.658	0.909	0.909

Table 17 Gas Requirements for New & Old Power Plants
Period March 2007 - June 2010

Gas Distribution Company	New & Old Power Plants	2006-07 Capacity MW	Type	Period	Gas Req Max Hrly	Max Daily	2007-08 Capacity MW	Type	Period	Gas Req Max Hrly	Max Daily	2008-09 Capacity MW	Type	Period	Gas Req Max Hrly	Max Daily	2009-10 Capacity MW	Type	Period	Gas Req Max Hrly	Max Daily	Remarks
PDB	Siddirganj																240			3.7	65	Contract signed
	Siddirganj																	GT	Dec'09	3.9	80	Loan Negotiation expected to be completed by '07
	Siddiganj						2x120	GT	Oct'09	3.2	65	2x120	GT	Oct'09	3.2	65	2x150	GT	Aug'09	2.2	48	Loan Negotiation expected to be completed by '07
	Ashuganj	724			6.5	120	724			6.5	120	724			6.5	120	1x210			6.5	120	
	Gharatsal	950			8.5	160	950			8.5	160	950			8.5	160	950			6.5	160	
	Siddiganj	240			2.5	55	240			2.5	55	240			2.5	55	240			2.5	55	
	Tongi	105			1.2	22	105			1.2	72	105			1.7	22	105			1.2	22	
	Haripur	99			0.4	9	99			0.4	9	99			0.4	9	99			0.4	9	
	Subtotal	2118			19.1	366	2118			19.1	366	2356			22.3	431	2868			28.4	559	
IPP	Meghnaghat (Phase 2)																					
	NEPC	110			1	23	110			1	23	110			1	23	1x495	CC	Nov'09	4	90	Contract Signed
	Haripur	380			2.4	57	380			2.4	57	380			2.4	57	110			1	23	
	Meghnaghat	450			3.3	75	450			3.3	75	450			3.3	75	380			2.4	57	
	RPCL	140			1.8	35	140			1.8	35	140			1.8	35	450			3.3	75	
																	140			1.8	35	
	Subtotal	1060			8.5	190	1060			8.5	190	1060			8.5	190	1555			12.5	280	
SPP-PDB	Tangail																					
	Subtotal											20	GT	Jul'08	0.76	6	20	CC	Nov'09	0.75	5	Contract to be signed by May 2007
SPP, R=B												20			0.26	5	20			0.26	5	Contract to be signed by May 2007
	Ashulia (Ext)						33.75			0.37	8.75	33.75			0.37	8.75	33.75			0.37	8.75	
	Narsingdi 2											20		Jul'08	0.25	6	20		Dec'09	0.25	6	
	Fulzari (Hypen)											20		Jul'08	0.30	9	30			0.38	9	
	Maona (Hypup)											40		Jul'08	0.33	9	33			0.33	9	
	Tarbail																12	GE	July'09	0.13	3	
	Nawabganj (Chaka FBS 2)																10	GE	July'09	0.13	3	
	Munsiganj																20	GE	Jul'09	0.25	6	
	Achiia	10			0.095	2	10			0.095	2	10			0.095	2	10			0.095	2	
	Madbersb	35			0.296	7	35			0.296	7	35			0.296	7	35			0.296	7	
	Subtotal	45			0.39	9	76.75			0.755	17.75	156.75			1.76	41.75	198.75			2.26	53.75	
	Total	3223			27.99	565	3256.75			28.355	573.75	3596.75			32.82	607.75	4641.75			43.42	897.75	
PDB	Chandpur											100	GT	July'08	1.3	24	100			1.3	24	Contract to be signed by March 2007
	Shitalbaha											150	GT	May'09	1.9	38	150			1.9	38	Contract to be signed by 2007
	Shitalbaha																			1.7	36	ERD is taking action for loan agreement with Kuwait
	Rauzan	420			4	90	420			4	90	420			4	90	225	CC	Dec'09			
	Shitulbaha	88			1	20	88			1	20	88			1	20	420			4	80	
	Subtotal	508			5	110	508			5	110	758			8.2	172	88			1	20	
																	983			9.9	208	
SPP-PDB	Dasankundu											20	GT	July'08	0.26	5	20			0.26	5	Contract to be signed by May 2007

																Remarks
BPDL	Feni	4259		38366	767		437775		39 10		52 50		1001		73 50	
	Zeshla - Comilla														0.20	5	Contract to be signed by May 2007
	Subtotal										0.9		30	7	0.30	7	Contract to be signed by May 2007
RFR													70	17	0.9	17	
	Feni-Haitipal														0.13	1	
	Chandpur PBS										0.13	3	10	GE July'09	0.13	1	
	Comilla PBS 2												10	GE July'09	0.13	3	
	Chittagong PBS 1												10	GC July'09	0.13	0	
	Chittagong PBS-2												10	GC July'09	0.13	3	
	Chandina	25		0.206	5	25		0.206	5	0.206		25		0.206	5	
	Subtotal	25		0.206	5	25		0.206		0.331	8	75		0.831	20	
	Total	533	115	521	115	863	17	1128		9.43	197	11.63	245	
JGTDSL	Feni-chugani	25	GT April'07	0.42	10	35	GT July'07	34		0.42	10	35	0.42	10	Construction going on
	Feni-chugani					35		35	10	0.43	10	35	GT July'09	0.43	10	Construction going on
	Sylhe-CC											100		1.2	33	GOB Fund Expected
	Shahibazar	97		0.46	10	97		97		0.45	10	97		0.45	10	
	Kumargson	20		0.3	8	20		20		0.3	6	20		0.3	6	
	Fenchugani	50		0.4	17	50		50		0.8	17	50		0.8	17	
	Subtotal	242		1.57	43	277		277		1.24	53	377		3.6	76	
AEB	Habiganj PBS																
	M Bazar PBS										0.13	3	10	GE July'09	0.13	3	
	Subtotal												10	GE	0.13	1	
	Total	242		1.97	43	277		277		0.13	55	20		0.25	62	
										2.63		397		3.65		
PGCL	Srajganj												150	GT July'09	1.9	35	Signing of Loan agreement with ADB is under process
	Baghabari	171		22	42	171		171		22	42	150		22	42	
	Subtotal	171		22	42	171		171		22	42	321		41	77	
IPP	Srabgan								150	GT Jan'09	33	35	150	GT July'09	33	35	
	Srabganj												150	ST Jan'10	33	35	
	Srabganj	90		1	22	90			130	GT Nov'08	1.1	22	130		1.1	22	
	Westport	90		1	22	90			90		1	72	90		1	22	Contract signed
	Subtotal								370		5.4	79	670		8.7	114	
REB	Ulahpara SPBS								10	GT July'08	0.125	3	10	CC July'09	0.13	3	
	Bocra PBS	261		1.2	64	261			10		0.125	3	10		0.13	3	
	Subtotal												30		0.25	6	Fund expected from IDB
PDB	Total	261		1.2	64	261			551		7.73	124	1001		13.05	197	
	Bhola								10				150		1.9	33	
	Total								150				150		1.9	35	
Grand Total		4259		38366	767	437775			529275		52 50	101175	73175		73 851	1456 13	