◆ Chapter 7 Energy Demand and Supply Forecast ◆

Chapter 7 Energy Demand and Supply Forecast Model

7.1 Development of Energy Demand Forecast Model

7.1.1 Structure of Model

Following considerations' have been undertaken during the systemization process of this energy demand forecast model.

(1) To make the total system easy operation.
(2) To simplify systems transfer and inheritance, maintenance/enhancement and expansion work should be within the level of ordinary personal computers operations.
(3) Easy to maintain the system for data correction and updating.

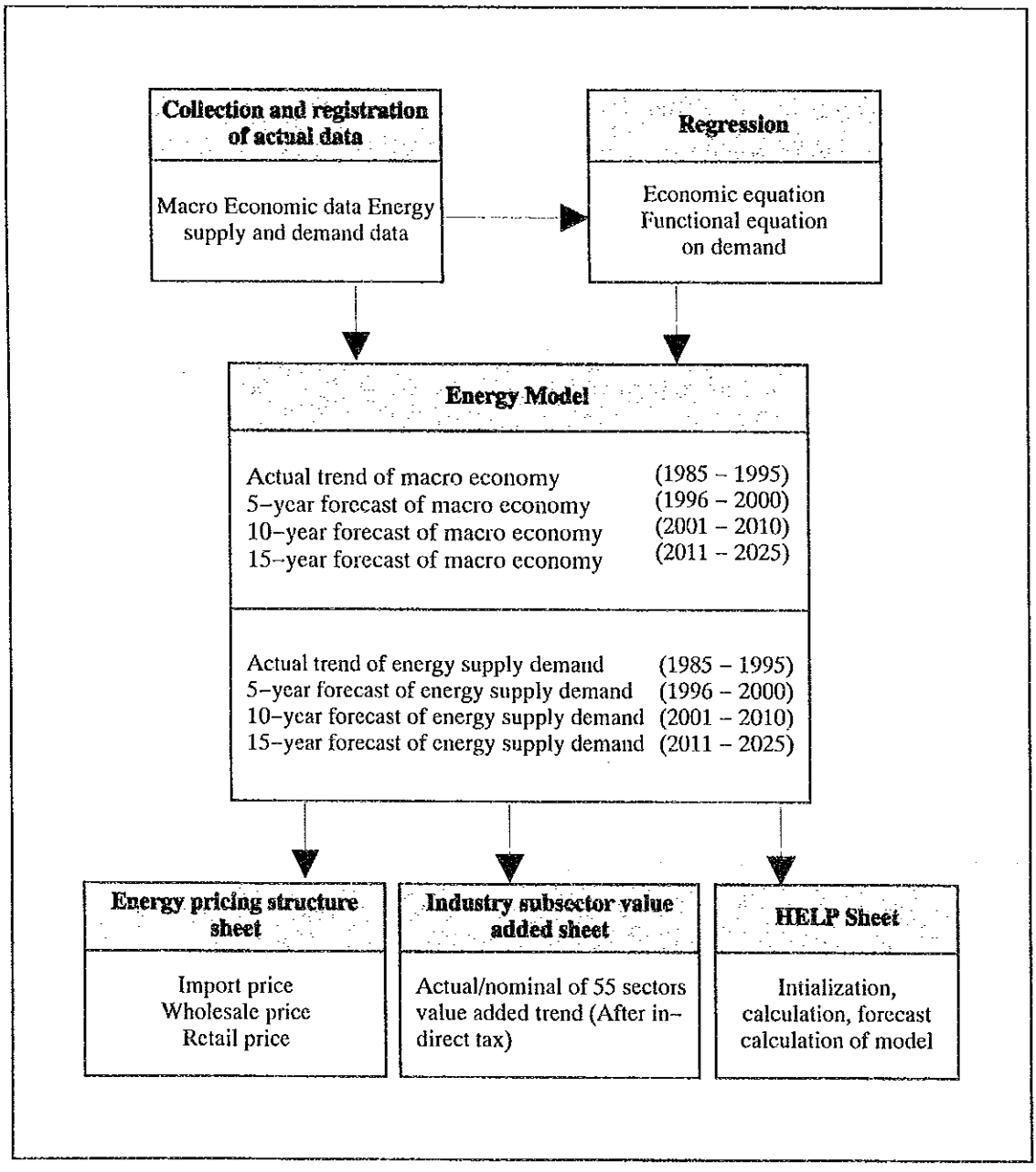
Major part of this energy demand forecast model is comprised from model portion which structures master file, however, also it is divided into sub-models for further research and experiment. Whole data are separated into 6 files which include 400 affiliated yearly data. Number of equations comprise from total 300 including 100 in macro economy data and model, and 200 in model itself respectively. Actual data (10 years data from 1985 to 1995) which are stored in the master file are based on the statistical data obtained from the Central Statistics Office (CSO). CSO is normally updating these data three to four times a year. Programs for operating these data are established to maintain whole systems without influencing re-programming effort on the whole structure of the model and equation/regression formula during each process of data correction and updating.

This model is also able to subdivide into macro economy model and energy model, and has flexible simulation function by responding to given preconditions. Information related to financial sector is very important for analysis energy demand, however, it has been limited to the minimum requirement since financial information itself has wider structure. So that growth of economic sector are reflected to the model because it responds greater to energy demand. When forecasting energy demand, simple method of calculation by taking GDP growth rate is very common, however, it is very important to clarify economic growth of each sector because price elasticity of industry sector varies sector by sector.

Also energy demand will be influenced by price, its price affiliation are considered in the model.

Energy demand forecast model in this project comprises from macro economic forecast portion and from energy demand forecast portion. Overall structure and its each portion are shown in the chart below.

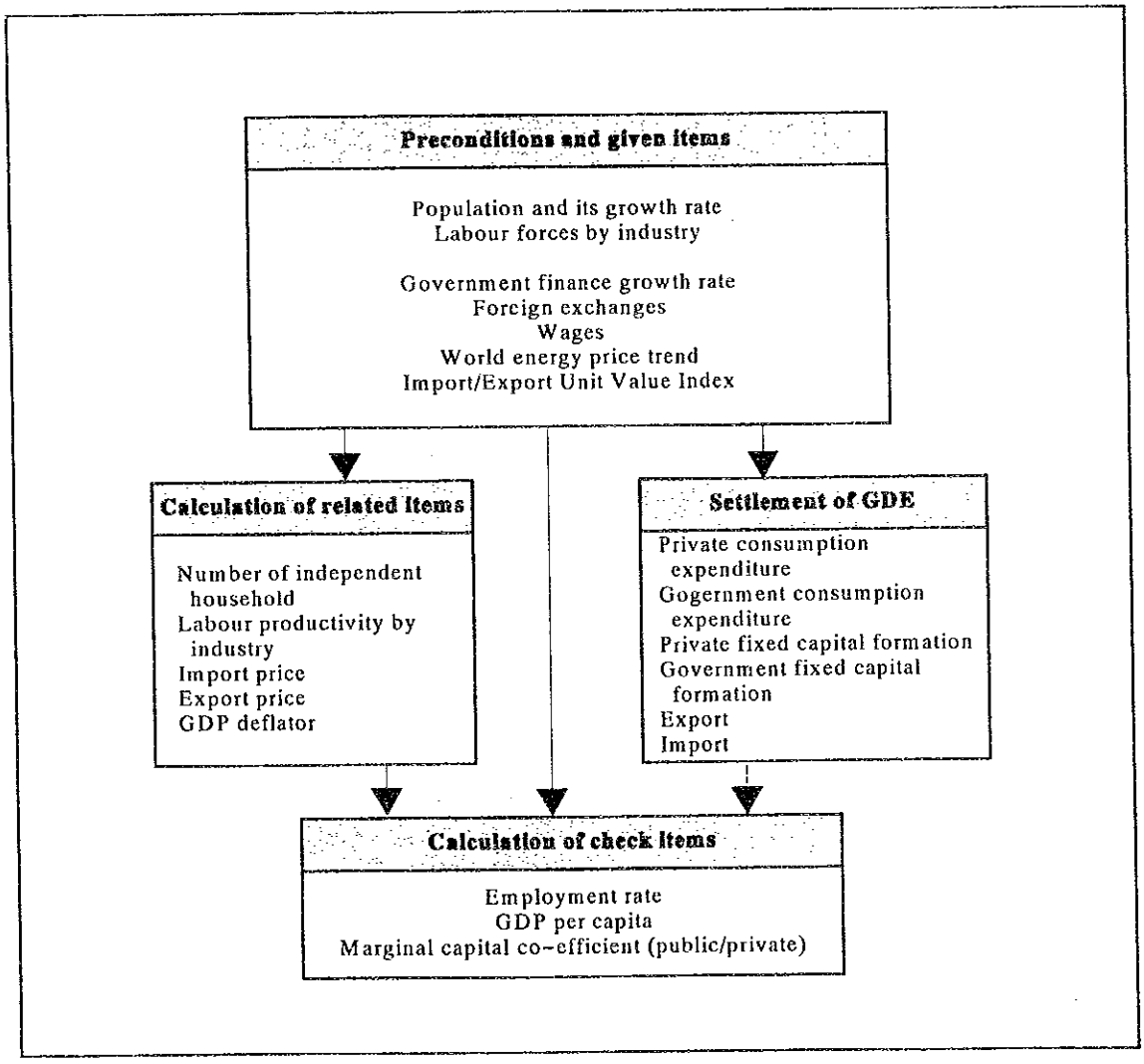
(1) Overall flow of model



As a whole, the model has been stored in a file (or a BOOK: one screen in the computer which is consisting from multiple sub-screens) of Microsoft's Excel, a software package for spreadsheet, and being created in each sheet by dividing into sub-models including energy pricing structure, value added data of industrial subsector and HELP sheet.

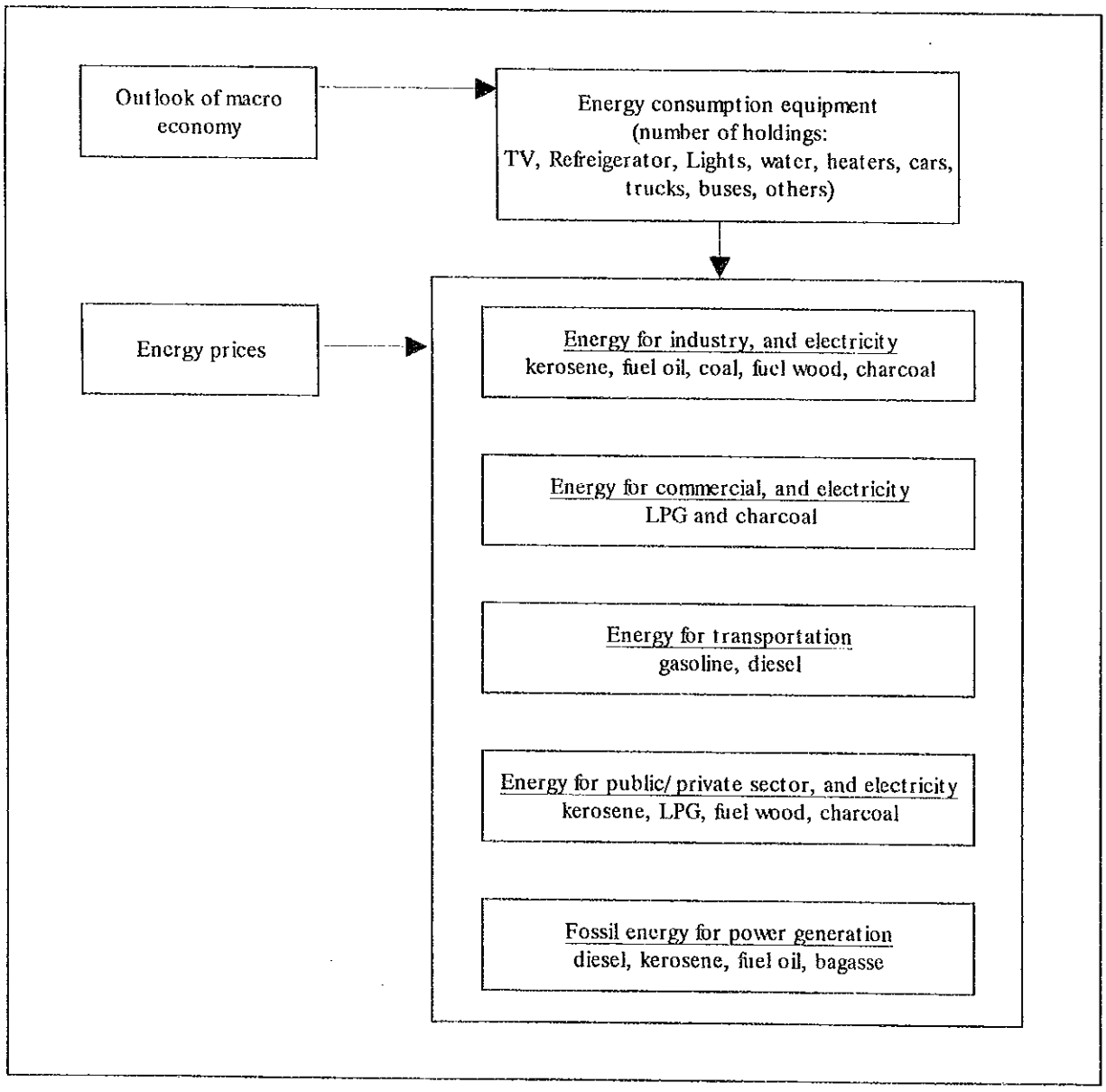
(2) Macro Economic Frame

Structure of macro economic frame is shown below. Since final objectives of this model is to forecast on demand of energy, macro economic forecast portion has been kept to a minimum frame for extraction and confirmation of internal/external variables for the use of energy demand forecast.



(3) Frame of Energy Demand Forecast

Structure of energy demand forecast frame is shown below. Final objectives in this frame are to calculate demand perspectives of fossil energy (gasoline, diesel, kerosene, fuel oil), bagasse and electricity, however, the structure of this demand forecast is also able to analyze influences to macro economy and energy policy as well as energy prices.



7.1.2 Structure of Databases

Energy database systems in this project comprises from the following components;

- Computer hardware systems
- Computer software
- Energy database

Establishment of energy database systems has been done by undertaking the process as follows:

(1) Review of available information through statistic data books, documents, and other related material obtained from the Central Statistical Office
(2) Encoding, correction, updating, matching, and revision of above obtained information and data
(3) Review of hardware and software: Price and functional comparison on hardware and software by obtaining estimates from several personal computer dealers and decided computer systems and peripherals including software to purchase
(4) Purchase and installation of the total systems
(5) Systems development
(6) Documentation of operation manual

In addition, following development environment including installation of hardware systems, software, and systems development has been established.

(1) Development of Installation Environment of Hardware and Software

System A (Master system): Personal computer (IBM compatible, one unit
System B (Backup system) : Personal computer (IBM compatible, one unit
Basic software: MS-Windows environment
Application software:
Spread sheet software for creation of database
Word processing software for documentation
Relational database software for future expansion

Computer language software for development

(2) Organization and structure of files

The datafiles established in the computer are stored in the hard disk (main drive: drive c), so that users are able to retrieve by accessing into these files.

(3) Systems Linkage Test

All systems tests, including hardware and software, network tests such as physical and logical connection test, setting test of UPS and printers are completed. Systems linkage test for each systems and total systems are also completed.

(4) Development of interface program

Tasks such as transferring existing encoded data to the new system and development of interface program between such data and user/operator are already completed. All these tasks were developed by using Visual Basic which is a computer language development software.

(5) Setting of Documentation Work

Setting of environment for documentation including operation manuals, systems maintenance and management, and program sheet for energy database systems are also complete. These documents are created in MS-WORD which is commonly used general purpose word processing software.

Computer Hardware Systems

Following preconditions were set prior to the selection of computer hardware systems.

1) To select general purpose use of computer hardware
2) To establish database in easy-to-transfer formation systems
3) To support and manage without any extra effort

Database system is comprised from the following computer hardware.

Unit 1

Personal Computer	
Central Processing Unit:	AcerMate 800
Display monitor:	AcerView 33D SVGA
Printer:	LexMark Optra R
Un-hazardous Power Supply(UPS):	Ares

Unit 2

Personal Computer	
Central Processing Unit:	AcerMate 920
Display monitor:	AcerView 33D SVGA
Printer:	LexMark Optra R
Un-hazardous Power Supply(UPS):	Ares

Among these systems, Unit 1 is assigned as a master computer and used as the exclusive system for a database establishment and interface development work . Unit 2 is assigned as a backup system for Unit 1 and has not only backup capability but functions as a simultaneous use during the operation of Unit 1 by physical connection using EtherNet cables and Peer to Peer logical connection structure.

Two sets of UPSs are adopted as an independent connection structure method in each Unit of the computers, so that the whole system including hardware, software and stored files can be protected and maintained for 5 minutes in case of power failure.

Computer Software

Following pre-conditions are set prior to the selection of software.

(1) To choose general purpose use of application software packages

(2) To establish energy database in easy-to-transfer software

(3) To support and manage without any extra effort of ordinary software operation

Following software have been selected for computer operation and for establishment of energy database systems, and settled total system operable conjunction with afore-mentioned computer units. These software have been installed in two computer hardware units (Unit 1 and Unit 2) and operable simultaneously.

Basic software and emulatorMS-Windows 95

Application softwareMS-OFFICE PROFESSIONAL

Integrated software package including below;

MS-EXCEL for Windows : Software for spread sheet

MS-WORD for Windows : Software for word processing

MS-ACCESS for Windows : Software for relational database management

MS-Visual Basic ProfessionalVersion 4.0 : Software for program development

Statistical Software : Custom-made of software by adding calculation function of Darbin-Watson to regression analysis function of Excel, and works as an add-in software to Excel.

To establish energy database, MS-Excel is used as an application software package for creation of master file by the following reasons;

(1) Run on series of Windows operating systems environment, which has become a de facto standard among all personal computer market.

(2) Has function of general purpose use and should be the software which is familiar to those who inherit the system.

(3) Should have powerful functions of which not only for arithmetical operations

function but can be used as a tool of complicated database analytic tools including regressions with simple operation.

(4) Has superiority on Graphic User Interface (GUI) applications, so that the systems developers and operators are easily able to create and access graphics tools for further data analysis.

Energy Database

(1) Contents of Database

Major portion of information in the energy data base systems are consisting from of the following main categories. These are classified into sub-categories and stored as databases in the computer. Those details classified sub-categories are omitted from the list in this Chapter because they can be refereed by looking at actual computer files.

Macro Economic Data

1) Population including labour force
2) Gross Domestic Product: GDP (Current and constant price)
3) GDP deflator
4) Labour productivity
5) Wage at current price
6) Government finance (Current and constant price)
7) Consumer price index and exchange rate
8) GDE at current and constant price
9) Macro economic index

Energy Demand Data

1) Energy conversion factors
2) World energy price trend
3) Energy wholesale price (Physical & TOE)
4) Energy retail price (Physical & TOE)
5) Electricity price (Physical and TOE)
6) Transportation equipment
7) Energy consumption(Physical & TOE) by:

7)-1 Industry

7)-2 Commercial

7)-3 Transportation

7)-4 Domestic home appliances

Energy Supply Data

1) Electricity supply
2) Electricity generation by sources
3) Generation efficiency by sources
4) Fuel input for electricity generation (Physical and TOE)
5) Energy supply (Physical and TOE)
6) Energy for re-export
7) Bagasse supply and consumption (Physical and TOE)

(2) Structure of Database Files

Figure 7.1.1 shows the hierarchical structure of database files and size of file area for installed software and energy data. And Figure 7.1.2 shows file structure of the database. Detailed structure of installed database are already shown in 7.1.1 of this Chapter. So that to avoid overlapping of those, only structured file name and overall contents of installed data which are shown from operation side of the system are listed below.

<File 1>

File (BOOK) name : Energy_Case_01.XLS

Sheet name : EnergyModel

Outline of database : Actual data and forecast model of macro-economy and energy supply and demand data. (Case 01)

Sheet name : Subsector, Energyprices, GDP, Home.App.

Outline of database : Value-added data by industry subsector, GDP, wholesale and retail energy prices, and diffusion rate of electric home appliances.

Sheet name :HelpSheet

Outline of database : Setting of model initiation, calculation and forecasting method

Sheet name : MacRecord

Outline of database : Macro program written on the screen which retrieves all energy data base files

<File 2>

File (BOOK) name : Energy_Case_02.XLS

Sheet name : EnergyModel

Outline of database : Actual data and forecast model of macro-economy and energy supply and demand data. (Case 02)

Sheet name : HelpSheet

Outline of database : Setting of model initiation, calculation and forecasting method

Sheet name : MacRecord

Outline of database : Macro program written on the screen which retrieves all energy data base files

<File 3>

File (BOOK) name : Energy_Case_03.XLS

Sheet name : EnergyModel

Outline of database : Actual data and forecast model of macro-economy and energy supply and demand data. (Case 03)

Sheet name : HelpSheet

Outline of database : Setting of model initiation, calculation and forecasting method

Sheet name : MacRecord

Outline of database : Macro program written on the screen which retrieves all energy data base files

<File 4>

File (BOOK) name : REGM.XLS

Sheet name : ENG

Outline of database : Actual data necessary to establish variables for regression ananlysis

Sheet name : CPIMRT

Outline of database : Formula and result value of regression analysis (Consumer Price Index)

Sheet name : IMVLIX

Outline of database : Formula and result value of regression analysis (Import Price Index)

Sheet name : EXVLIX

Outline of database : Formula and result value of regression analysis (Export Price Index)

Sheet name : DFLGDP

Outline of database : Formula and result value of regression analysis (GDP deflator)

Sheet name : RPCON

Outline of database : Formula and result value of regression analysis (Actual GDE)

Sheet name : RPFIX

Outline of database : Formula and result value of regression analysis (Foreign exchange rate)

Sheet name : PASTRA

Outline of database : Formula and result value of regression analysis ()

Sheet name : REXP

Outline of database : Formula and result value of regression analysis (GDE, export)

Sheet name : RIMP

Outline of database : List of macro program code which calculate all above regression formula

Sheet name : PROM

Outline of database : List of macro program code which caiculate all above regression formula

Sheet name : MacRecord

Outline of database : Macro program written on the screen which retrieves all energy data base files

<File 5>

File (BOOK) name : REGE.XLS

Sheet name : ENG

Outline of database : Actual data necessary to establish variables for regression ananlysis

Sheet name : ARTV

Outline of database : Formula and result value of regression analysis (Diffusion of TV set)

Sheet name : ATCAR

Outline of database : Formula and result value of regression analysis (Diffusion of car)

Sheet name : ATCYC

Outline of database : Formula and result value of regression analysis (Auto and motor cycle)

Sheet name : GCIELE

Outline of database : Formula and result value of regression analysis (Consumption of electricity in industrial sector)

Sheet name : TCITOE

Outline of database : Formula and result value of regression analysis (Consumption of electricity in domestic household, TOE)

Sheet name : GCCELE

Outline of database : Formula and result value of regression analysis (Consumption of electricity in commercial sector)

Sheet name : TCCTOE

Outline of database : Formula and result value of regression analysis (Consumption of electricity in commercial sector, TOE)

Sheet name : TCTGAS

Outline of database : Formula and result value of regression analysis (Consumption of gasoline in transportation sector)

Sheet name : TCTDIE

Outline of database : Formula and result value of regression analysis (Consumption of diesel in transportation sector)

Sheet name : GCDELE

Outline of database : Formula and result value of regression analysis (Consumption of electricity in residential)

Sheet name : TCDTOE2

Outline of database : Formula and result value of regression analysis (Total consumption of electricity in residential)

Sheet name : TCDTOE

Outline of database : Formula and result value of regression analysis (Total consumption of electricity in residential)

Sheet name : PROE

Outline of database : List of macro program code which calculate all above regression formula

Sheet name : PROA

Outline of database : List of macro program code which calculate all above regression formula

Sheet name : MacRecord

Outline of database : Macro program written on the screen which retrieves all energy data base files

<File 6>

File (BOOK) name : Main_Menu.XLS

Sheet name : MainMenu

Outline of database : Initial screen setting to access all files in the database

Sheet name : MacRecord

Outline of database : Macro program written on the screen which retrieves all energy data base files

<File 7>

File (BOOK) name : Conversion_Factor.XLS

Sheet name : ConversionFactor

Outline of database : Numerical list which converts all energy sources to TOE

Sheet name : MacRecord

Outline of database : Macro program written on the screen which retrieves all

energy data base files

<File 8>

File (BOOK) name : Abbreviations_List.XLS

Sheet name : Abbrev.

Outline of database : List of variables in character used in the database

Sheet name : MacRecord

Outline of database : Macro program written on the screen which retrieves all energy data base files

<File 9>

File (BOOK) name : Base_Case.XLS

Sheet name : Energy Model

Outline of database : File which contrasts with simulation in the database

Sheet name : Help Sheet

Outline of database : Setting of model initiation, calculation and forecasting method

Sheet name : MacRecord

Outline of database : Macro program written on the screen which retrieves all energy data base files

<File 10>

File (BOOK) name : Check_Outcome.XLS

Sheet name : gdp Sector growth

Outline of database : GDP growth rate between 1985 - 1995, 1996 - 2000, 2001 - 2010, 2011 - 2015 by industry sector.

Sheet name : investment

Outline of database : Investment ratio between 1985 - 1995, 1996 - 2000, 2001 - 2010, 2011 - 2015 by public and private sector.

Sheet name : Ratio to GF

Outline of database : Government finance between 1985 - 1995, 1996 - 2000, 2001 - 2010, 2011 - 2015.

Sheet name : Trade Balance

Outline of database : Trade balance between 1985 - 1995, 1996 - 2000, 2001 - 2010, 2011 - 2015 by industry sector.

Sheet name : labour produ. sector

Outline of database : Labour productivity between 1985 - 1995, 1996 - 2000, 2001 - 2010, 2011 - 2015 by individual industry subsector.

Sheet name : cpi & deflator

Outline of database : CPI and GDP deflator between 1985 - 1995, 1996 - 2000, 2001 - 2010, 2011 - 2015.

Sheet name : Consumption total

Outline of database : Total energy demand between 1985 - 1995, 1996 - 2000, 2001 - 2010, 2011 - 2015 by sector.

Sheet name : Energy intensity

Outline of database : Energy intensity between 1985 - 1995, 1996 - 2000, 2001 - 2010, 2011 - 2015.

Sheet name : income ela. By sector

Outline of database : Income elasticity between 1985 - 1995, 1996 - 2000, 2001 - 2010, 2011 - 2015.

Sheet name : peak ele.

Outline of database : Peak electricity demand between 1985 - 1995, 1996 - 2000, 2001 - 2010, 2011 - 2015.

Sheet name : MacRecord

Outline of database : Macro program written on the screen which retrieves all energy data base files

<File 11>

File (BOOK) name : Case_Simulations.XLS

Sheet name : EnergyModel

Outline of database : Users file for simulations of the database

Sheet name : Help Sheet

Outline of database : Setting of model initiation, calculation and forecasting method

Sheet name : MacRecord

Outline of database : Macro program written on the screen which retrieves all energy data base files

<File 12>

File (BOOK) name : Outcome_Simulations.XLS

Users file for simulations of the database conjunction with Case Simulation.XLS file.

Sheet name : gdp Sector growth

Outline of database : GDP growth rate between 1985 - 1995, 1996 - 2000, 2001 - 2010, 2011 - 2015 by industry sector.

Sheet name: investment

Outline of database : Outline of database : Investment ratio between 1985 - 1995, 1996 - 2000, 2001 - 2010, 2011 - 2015 by public and private sector.

Sheet name : Ratio to GF

Outline of database : Government finance between 1985 - 1995, 1996 - 2000, 2001 - 2010, 2011 - 2015.

Sheet name : Trade Balance

Outline of database : Trade balance between 1985 - 1995, 1996 - 2000, 2001 - 2010, 2011 - 2015 by industry sector.

Sheet name : labour produ. sector

Outline of database : Labour productivity between 1985 - 1995, 1996 - 2000, 2001 - 2010, 2011 - 2015 by individual industry subsector.

Sheet name: cpi & deflator

Outline of database : CPI and GDP deflator between 1985 - 1995, 1996 - 2000, 2001 - 2010, 2011 - 2015.

Sheet name : Consumption total

Outline of database : Total energy demand between 1985 - 1995, 1996 - 2000, 2001 - 2010, 2011 - 2015 by sector.

Sheet name : Energy intensity

Outline of database : Energy intensity between 1985 - 1995, 1996 - 2000, 2001 - 2010, 2011 - 2015.

Sheet name : income ela. By sector

Outline of database : Income elasticity between 1985 - 1995, 1996 - 2000, 2001 - 2010, 2011 - 2015.

Sheet name : peak ele.

Outline of database : Peak electricity demand between 1985 - 1995, 1996 - 2000, 2001 - 2010, 2011 - 2015.

Sheet name : MacRecord

Outline of database : Macro program written on the screen which retrieves all energy data base files

<File 13>

File (BOOK) name : Balance_Table_1995.XLS

Sheet name : Balance95, Case01

Outline of database : Energy supply and demand balance table for 1995.

(Case 1)

Sheet name : MacRecord

Outline of database : Macro program written on the screen which retrieves all energy data base files

<File 14>

File (BOOK) name : Balance_Table_2000.XLS

Sheet name : Balance00, Case01

Outline of database : Energy supply and demand balance table for 2000.

(Case 1)

Sheet name : Balance00, Case02

Outline of database : Energy supply and demand balance table for 2000.

(Case 2)

Sheet name : Balance00, Case03

Outline of database : Energy supply and demand balance table for 2000.

(Case 3)

Sheet name : MacRecord

Outline of database : Macro program written on the screen which retrieves all energy data base files

<File 15>

File (BOOK) name : Balance_Table_2010.XLS

Sheet name : Balance10, Case01

Outline of database : Energy supply and demand balance table for 2010.

(Case 1)

Sheet name : Balance10, Case02

Outline of database : Energy supply and demand balance table for 2010.

(Case 2)

Sheet name : Balance10, Case03

Outline of database : Energy supply and demand balance table for 2010.

(Case 3)

Sheet name : MacRecord

Outline of database : Macro program written on the screen which retrieves all energy data base files

<File 16>

File (BOOK) name : Balance_Table_2025.XLS

Sheet name : Balance25, Case01

Outline of database : Energy supply and demand balance table for 2025.

(Case 1)

Sheet name : Balance25, Case02

Outline of database : Energy supply and demand balance table for 2025.

(Case 2)

Sheet name : Balance25, Case03

Outline of database : Energy supply and demand balance table for 2025.

(Case 3)

Sheet name : MacRecord

Outline of database : Macro program written on the screen which retrieves all energy data base files

7.1.3 Renewal and Expandability of Databases

(1) Update of master file

The macro-economic frame and energy demand forecast model that are built in the Excel permit updating and expanding existing data easily. This is made possible by the Excel's basic functions. There is no need to use any special commands or development of extra database operating functions. In addition, by modifying or updating the master file (EnergyCase01 and EnergyCase02), it is possible to automatically update all the files which constitute databases. Process of updating the master file is described below.

To modify the 1985-1995 result data on the first sheet (Energy Model) contained in the master file (filename: EnergyCase01.XLS and EnergyCase02.XLS), input the new figures directly to the associated cell. To input data for the next year, first delete the cell and line in which data for the first year of analysis (in the case of the present database, the year 1985) has been input, then insert a new cell for input of new data after the cell in which data for the last year of analysis (in the case of the present database, the year 1995) has been input.

(2) Renewal of regression analysis file

To modify the 1985-1995 result data on the first sheet (ENG) contained in the regression analysis file (filename: REGM.XLS and REGE.XLS), input the new figures directly to the associated cell, and the other sheets are automatically modified together with the ENG sheet. Subsequent regression analyses can be performed by manipulating the Excel's regression analysis macro.

(3) Expansion of Database

The databases can be expanded either by using the Excel's function or by downloading the data in the Excel to the MS-Access--software for relational database (RDB)--to make the data an RDB. Since the macro economy and energy database were to be stored in the Excel at the early stages of the present survey project, the expansion by the MS-Access shall not

be effected during the project execution. However, in order to enable Mauritius side to use the MS-Access for expansion of databases in the future, the software has been loaded into the personal computers.

If Mauritius side wants to study the expandability of databases using the Excel functions, it is possible, for example, to add statistical analysis using the Excel's function command and automatic calculation and analysis of original data using the Excel's macro, though these functions depend upon the items and functions to be expanded. In addition, by incorporating the Visual Basic in the Excel, it is possible to provide additional macro functions and thereby enhance the analytical function.

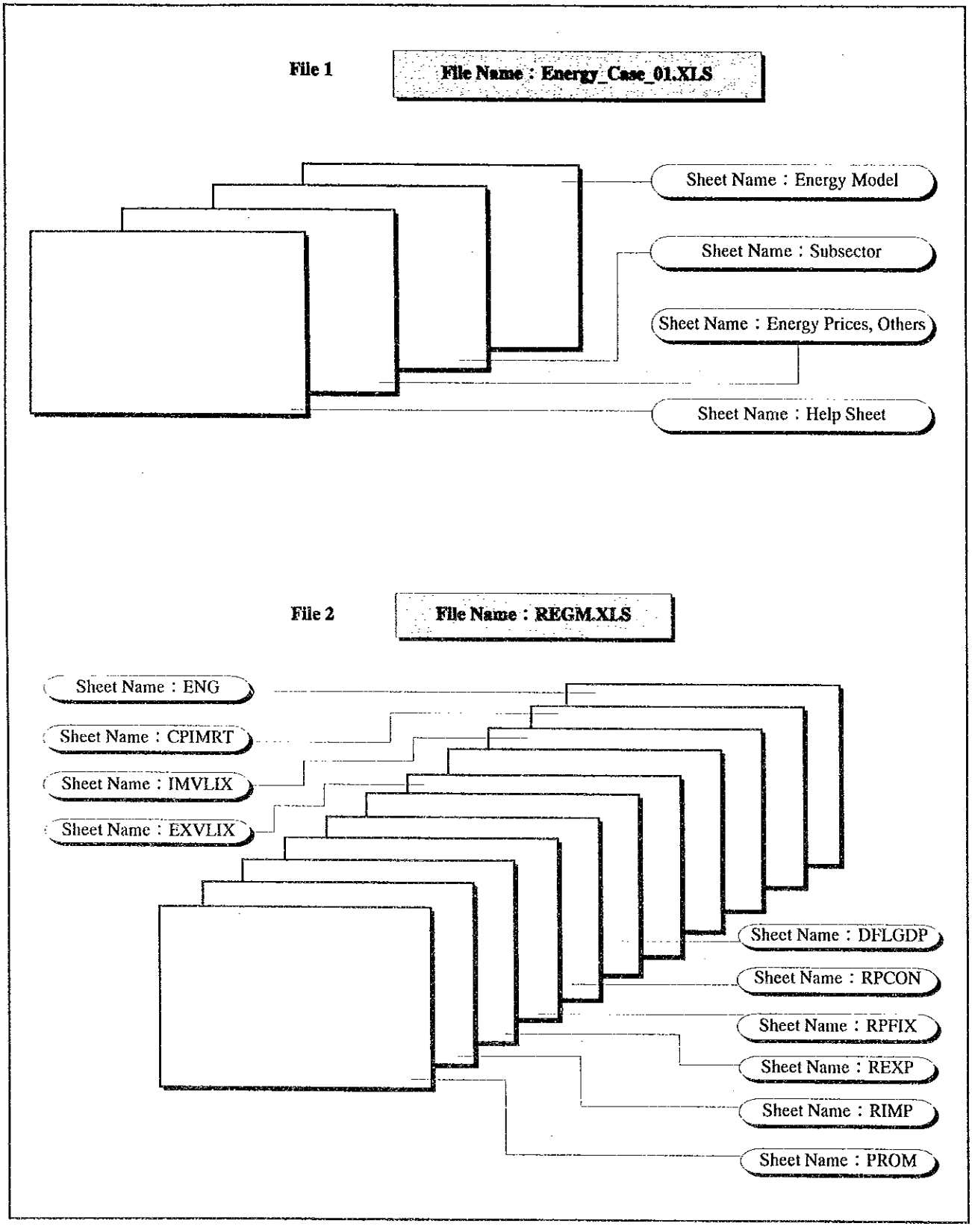


Figure 7.1.1 STRUCTURE OF DATABASE FILE (1)

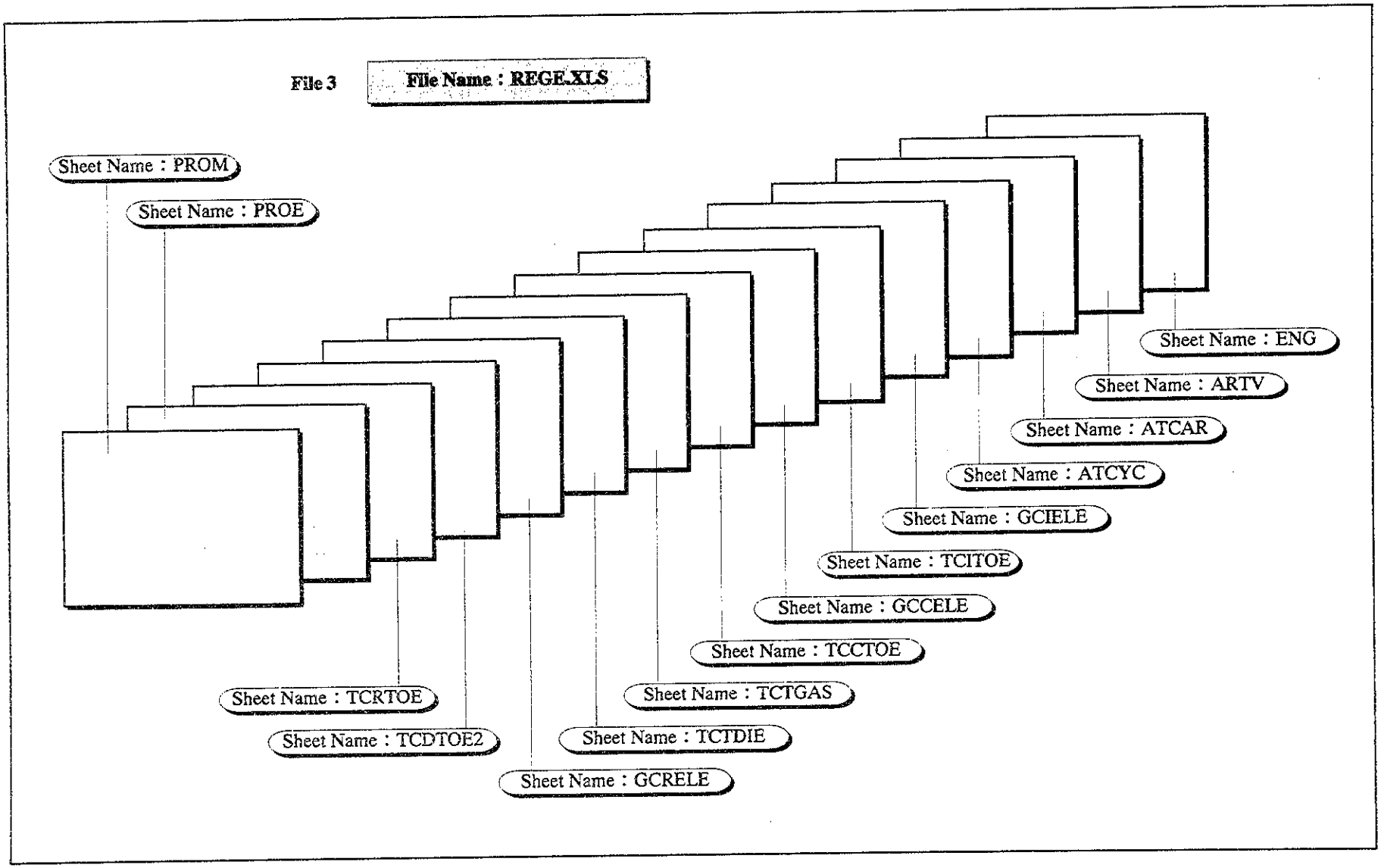


Figure 7.1.2 STRUCTURE OF DATABASE FILE (2)

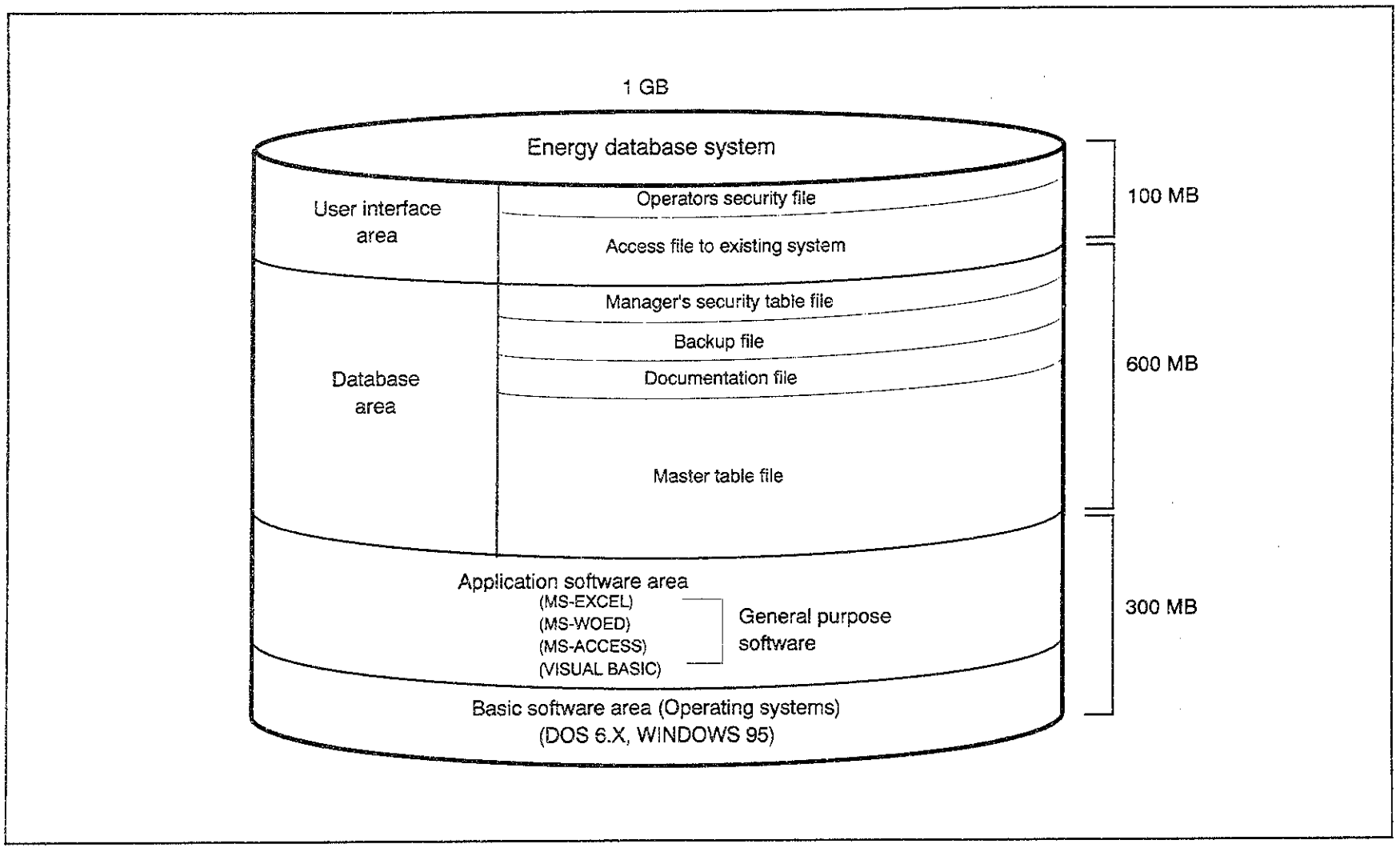


Figure 7.1.3 LAYER STRUCTURE OF FILE AND SIZE

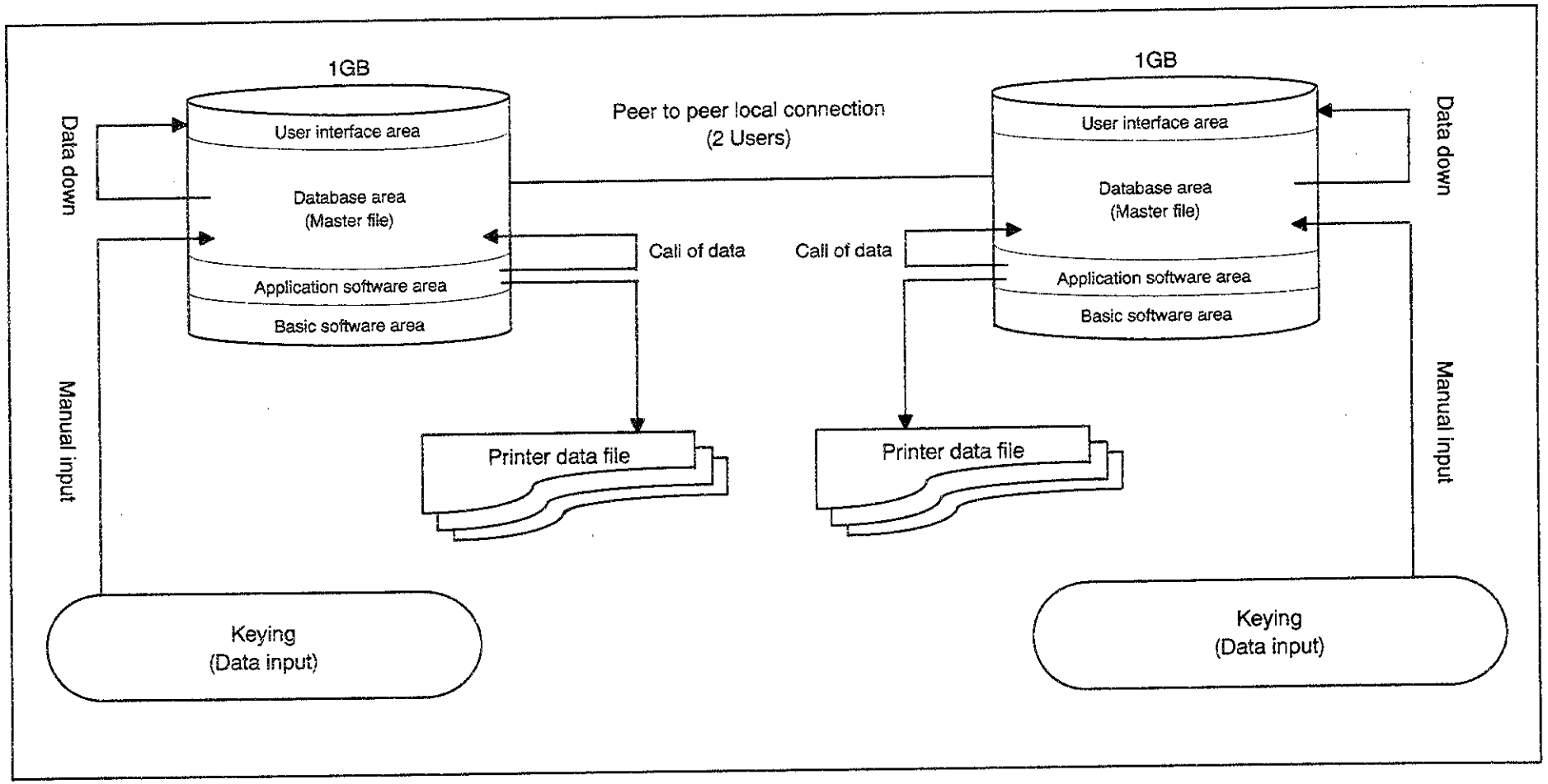


Figure 7.1.4 INTERFACE AND STRUCTURE OF ENERGY DATABASE SYSTEM

7.2 Main Assumptions for Long-term Energy Demand Forecast

7.2.1 Case Scenario

(1) Base Case

Economic Assumptions

1) The sugar sector stagnates its development beyond 2000.
2) It takes EPZ's restructuring for two decades up to 2010 and revitalizes again since then.
3) New businesses of free port and offshore banking, and established tourism grow steadily.
4) Actual working hours are extended by 6 hours a weak during 2010 and 2025.
5) Wage increases by 5% a year.
6) Taking into consideration that industrial goods' prices in the developed countries increases 2.2-2.3% a year, inflation in the Republic of South Africa for an indicator of Mauritius import price is 10% a year, by 3% less than past 10 years.
7) Exchange rate of Mauricia rupees and South Africa's Rand is depreciated by 2% a year against US dollar.
8) Budget revenue and expenditure are neutral to the economy, which means that the component ratios of them and its deficit over the GDP do not change.

Energy Assumptions

1) Current crude oil price and coal price in a world market increase 3% and 1.8% respectively until 2010; 4% and 2.4% beyond 2010.
2) Taxes on imported energy sources do not change.
3) Electricity tariff is adjusted by price changes of local fuel and coal.
4) Energy conservation is materialized in industry, transportation and domestic sectors.
5) Current tendency of electricity shift of energy sources continues in each sector.
6) Load factor in the power generation improves to 63.0% since 2006 from 57.0% in 1995. Loss ratio in the generators and power transmission improves to 13.0% since 2010 from 15.4% in 1995.

(2) High Case

1) Economic growth will be higher owing to shorter period for EPZ' restructuring, considerable success of free port & offshore services, tourism boom and rapid increase of foreign workers.
2) Inflation in the Republic of South Africa increases by 13% a year due to revived world inflation.
3) Wage increases by 6% a year.
4) Current crude oil price and coal price in a world market increase 2%, 1.2% up to 2010, and increase 3% and 1.8% respectively beyond 2010.
5) Energy conservation is not materialized in each sector.
6) Electricity shift of energy sources is accelerated in each sector excluding transportation.

(3) Low Case

1) Economic growth is lower due to fruitless restructuring of EPZ, poor activities of free port & offshore services and slow-down of tourism.
2) Inflation in the Republic of South Africa increases by 7% a year owing to lower world inflation.
3) Wage increases by 4% a year.
4) Actual working hours do not change.
5) Due to a low profitability of oil businesses, crude oil price and coal price in a world market increases 4% and 2.4% a year respectively until 2010; 5% and 3.0% a year beyond 2010.
6) Electricity tariff increases by 30% equivalent of inflation adding to normal adjustment.
7) Energy conservation is accelerated in industry and transportation sectors.

(4) Other Cases

Many variations can be conceivable by different assumptions and their combinations. Some simulations were executed at the workshop during the third staying in Mauritius.

7.2.2 Back-ground Explanation of Main Exogenous Valuables in Each Case

(1) Sectoral Output

1) According to the "Prospects of Sectoral Development " in Appendix 3 , sectoral growth of output is assumed as follows, up to 2025.

Table 7.2.1 GDP Growth Rate by Sector (Base Case)

(%)

GDP at Constant Price (1990)	1995/1985	2000/1995	2010/2000	2025/2010	2025/1995
Agriculture, Hunting, Forestry, Mining, and Quarrying	-0.1	4.0	1.0	1.0	1.5
Manufacturing	8.1	5.2	5.5	7.8	6.6
Sugar	-1.7	4.0	0.0	0.0	0.7
EPZ	10.4	5.0	5.5	8.0	6.7
Domestic Manufacturing	8.1	5.5	6.0	8.0	6.9
Electricity, Gas, and Water	6.7	8.0	8.0	8.0	8.0
Construction	9.0	5.0	5.0	5.0	5.0
Wholesale, Retail, Restaurants, and Hotels	8.5	6.5	6.0	5.0	5.6
Transportation, Storage, and Communication	7.6	6.5	6.5	6.0	6.2
Banking, Insurance, Real Estate, Business service	7.0	6.5	6.5	6.0	6.2
Other service	7.7	5.	5.0	5.0	5.0
Imputed Bank Service Charge	.	11.0	12.0	12.0	11.8
GDP at Factor cost	6.5	5.4	5.1	5.1	5.1
Net Indirect Taxes	3.7	5.0	5.0	5.0	5.0
GDP at constant (1990)	6.1	5.4	5.1	5.1	5.1

2) First five years in 1995 - 2000, are the same assumption in each cases. Beyond 2000, two elements are setted in high case and low case. Labour productivity will increase by 10 % in a higher case and decrease by 10% in a low case in the two sectors of EPZ and domestic manufacturing and construction. Output of electricity, gas and water sector is also adjusted by the GDP in high case and low case.

(2) Labour Input

1) Labour Activity Rate and Foreign Workers

Mauritius falls into labour shortage owing to steady increase of jobs in the service sector, although labour is decreasing in EPZ. The unemployment ratio is extremely low at 1.7% in 1995. The population will increase only by 1% a year from now on. They need the capital intensive investment, but it is restricted by financial capacity. Mauritius labour cost is still comparatively low excluding EPZ. Labour supply is the most fundamental conditions for the future development.

The first remarkable change of labour supply is rapid increase of female activity rate from 25.9% in 1983 to 41.0% in 1995. The Central Statistical Office (CSO) estimates 48.0% of its activity rate in 2010 which is 7% point higher during 15 years since 1995 to 2010 compared with 11% point in the past 15 years. On the other hand the male activity rate is already saturated at 76-77%. As 48.0% of female activity rate is quite high, its rate will relax the increase tempo further: 3.5% higher during next 15 years since 2010 to 2025. Increase rate of labour forces cannot help slowing down from now on due to two factors; slower growth of population and slower increase of female activity rate. Labour forces will increase 1.5% a year in 1995-2000, 1.4% in 2000-2010 and 0.7% in 2010-2025.

The second is foreign workers, who have increased in a scare field of skills and know-how, mainly in manufacturing and construction. Foreigners are working also in a trade or service sector. They need foreign workers for restructuring of EPZ, construction for infrastructure, new business activities relating to free port and offshore services, or for management function in many sectors. Foreign workers will increase by one thousand a year from now on.

Table 7.2.2 LOCAL LABOUR FORCES AND ACTIVITY RATE

	Male		Female		Total		
	thousand	activity rate (%)	thousand	activity rate (%)	thousand	activity rate (%)	Annual increase rate (%)
1983	269	73.7	96	25.9	365	49.6	
1986	289	77.9	129	34.4	418	56.0	4.5
1987	295	79.1	136	35.7	431	57.2	3.1
1988	300	78.9	142	36.5	442	57.6	2.6
1989	303	78.5	147	37.0	450	57.5	1.8
1990	307	76.1	151	37.1	458	53.5	1.8
1991	312	76.1	156	37.8	468	56.6	2.2
1992	320	75.8	162	38.4	482	56.8	3.0
1993	328	75.8	169	39.2	497	57.4	3.1
1994	334	76.0	177	40.0	511	57.9	2.8
1995	340	76.4	184	41.0	524	58.6	1.5
2000	356	77.8	209	44.9	565	61.1	1.5
2010	395	77.6	253	48.0	648	62.5	1.4
2025	423	77.6	298	51.5	721	64.1	0.7

Source: Central Statistical Office "Digest of Labour Statistics 1995"
"1990 Housing and Population Census of Mauritius, volume vii, and vi"

Table 7.2.3 FOREIGN WORKERS

	Male	Female	Total
1990	-	-	1,000
1991	-	-	2,200
1992	3,850	750	4,100
1993	4,850	2,050	6,900
1994	5,100	3,100	8,275
1995	5,575	4,220	9,795
2000	-	-	15,000
2010	-	-	25,000
2025	-	-	40,000

Source: Central Statistical Office

2) Working Hours

Working hours are regulated at 33 ¼~40 hours a week in the public sector by the recommendation of the Pay Research Bureau, while 45 hours average in the private

sector by the National Remuneration Board. If employers want employees work more longer, they have to pay 50% more the regular hourly wage in week days, 100% more for the first eight hours on holiday and 200 % more for afterward on holiday. This punishable overtime charge is popular in Europe from the view point of their graceful lifestyle and pragmatic safety network of work sharing against higher unemployment. But it is a prohibitive additional cost for employers to use them. Most of the Maurice labours go back punctually to take care for their family. As such a lifestyle is so popular, most of the shops and restaurants in Port Louice close during 4:00 and 5:00 pm. The buses, only public transportation except costly taxis also stop operation after six o'clock.

Such practices will be changed near future. US$ 3,000 per capita and continuous inflation motivate the people to earn more by work rather than to enjoy plenty of time at home. This tendency will be stimulated by increase of foreign workers who work more longer. Mass transit system between Port Louice and Cuirpipe will benefit labours to go back late. These factors will push to amend the current employment regulation to reduce the over-time charge. If they decreases this 50% to 20% or 30%, which encourage employers to use their employees more longer for their profitable activities.

At the base case, working hours are assumed to extend by 6 hours a week during 2010 and 2025. In this assumption, local employees work roughly one hour more a week in 2025, which will contribute to increase labour input by 1% a year since 2010 to 2025. Otherwise, Maurice economy will suffer from stagflation with continuous wage push inflation and low economic growth, or from rapid increase of foreign workers.

3) Labour Input Assumption

Sectoral labour input is assumed as follows referring to the actual results and sectoral development analysis in Appendix 1.

Table 7.2.4 SECTORAL LABOUR INPUT

(Base Case, Annual increase rate %)

	Actual		Assumptions		
	1985/90	1990/95	1995/2000	2000/2010	2010/2015
Agriculture, fishery, mining	-4.8	-0.5	-3.0	-4.0	-2.0
Manufacturing	15.9	0.6	-1.2	-2.0	1.2
Sugar	-0.8	-3.7	-4.0	-2.1	-4.0
EPZ	15.7	-1.8	-3.5	}-2.0	}1.3
Others	21.8	5.7	2.0		
Electricity, gas and water	-2.7	0.6	-1.0	-1.0	-1.0
Construction	19.2	3.0	3.0	3.0	3.0
Wholesale, retail, restaurant & hotels	12.9	8.9	7.0	5.0	1.3
Transportation, storage & communication	8.6	5.0	6.0	4.5	1.2
Banking, insurance, real estate, & business services	13.2	6.8	5.0	4.0	3.0
Government and other services	2.0	4.6	2.0	1.0	1.0
Total Labour Forces	6.4	2.9	1.8	1.5	1.3

Note: Labour input is extended labour numbers adjusted by current working hours since 2010.

In the high case, foreign labours increase by one thousand a year more than the base case since 2001. In the low case, those decrease by one thousand a year less than the base case since 2001. Foreign labours work 20 hours more a week. This is equivalent to 1.5 times current local workers. Real effect to the labour input becomes one thousand five hundred labours a year on the current local labour base. Foreign labours are allocated mainly into manufacturing and construction, however there are some sectors where foreign labours works.

Table 7.2.5 SECTORAL CHANGE OF LABOUR INPUT VOLUME

(2001-2025, Thousand)

	1995	Assumed component Ratio (%)	Annual Change of Foreign Labour Input	
			High Case	Low Case
EPZ and domestic manufacturing	6.0	61.0	0.9	0.9
Construction	2.8	29.0	0.4	0.4
Wholesale, retail, restaurant & hotels	0.4	4.0	0.1	0.1
Transport, storage & communication	0.4	4.0	0.1	0.1
Banking, insurance, real estate & business services	0.2	2.0	every two years 0.1	every two years 0.1
Total	9.8	100.0	1.5	1.5

4) Structure of Employment

According to the above assumption, the employment structure will change dramatically. Component of agriculture will drop sharply, which in 2025 is nearly the current level in the developed country. That of manufacturing in 2025 will be roughly a half of 1990. Construction will establish its own importance. Employees in the physical production will fall into 34.0% in 2025 from 49.4% in 1995, though the value added is still considerable owing to their high productivity.

On the contrary, service sector will swell. Wholesale, retail, restaurants and hotels will become the main sector in Mauritius owing to free port and tourism. This sector is still labour intensive with low-tech jobs. Transportation, storage and communication will grow rapidly, but this sector with wholesale, retail, restaurants & hotels may face restructuring after 2010. Banking, insurance, real estate and business services will grow steadly, but it will still stay at a small component due to high productivity by advanced communication technology. Government and other services will reduce their weight due to restructuring of the public sector, though personal and education services will grow steadily. Service sector will occupy 66.0% of the total employment in 2025 from 50.6% in 1995. The problem is how to bring up young generation for potential jobs under such a drastic change of market needs.

Table 7.2.6 SECTORAL COMPONENT RATIO OF EMPLOYMENT

(Base Case, %)

	Actual			Assumption		
	1985	1990	1995	2000	2010	2025
Agriculture	28.5	16.4	13.8	10.8	6.2	4.3
Manufacturing	20.2	31.1	27.9	23.9	16.7	16.9
Electricity, Construction	5.1	7.7	7.7	8.0	9.0	12.8
Sub total of physical production	**53.8**	**55.2**	**49.4**	**42.7**	**31.9**	**34.0**
Wholesale, retail, rest. & hotels	8.7	11.7	15.6	19.9	28.0	27.3
Transportation, storage & communication	5.8	6.4	7.1	8.7	11.7	11.0
Banking, business services	1.9	2.6	3.1	3.6	4.6	5.7
Government and other services	29.7	24.0	24.8	25.0	23.8	22.1
Sub total of service sector	**46.2**	**44.8**	**50.6**	**57.3**	**68.1**	**66.0**
Total Employees (%)	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total number (thou.)	**327**	**446**	**515**	**564**	**654**	**697**

5) Labour Market

Two problems will appear in the labour market. One is the balance of the foreign workers and local labours. The component ratio of foreign workers will be three times from 1.9% in 1995 to 5.3% in 2025. 5.3% itself is not so large, but attention should be paid to job contents. The other problem is unemployment rate, which is easily changeable by job offered, because unemployees are the small margin between labour forces and employed workers. This unemployment rate is not so important in the long-term forecast. Main problem will be miss-match between labours and job offered. If they lack in adequate reform of education system & curriculum, and job training & retraining, this miss-match problem will be serious in the challenging future to cause increase of local unemployees under a considerable increase of foreign workers.

Table 7.2.7 LABOUR MARKET

(Base Case)

Labour Market	Actual		Assumption		
	1990	1995	2000	2010	2025
Local labour forces (thou.)			565	648	721
Local employees (thou.)	458	524	549	629	657
Foreign workers (thou.)	1	10	15	25	40
Total employees (thou.)	459	534	564	654	697
Foreign workers/Total employees(%)	0.2	1.9	2.6	3.7	5.3
Local unemployees			16	19	64
Local unemployment rate (%)	8.5	1.7	2.8	2.9	8.9

(2) Inflation in the World

There is an important forecast of commodities up to 2005 by the World Bank. They use the unit value index in US dollar terms of manufactures exported from the Group 5 countries, that is France, Germany, Japan, UK and USA, weighted proportionally to the countries' exports to the developing countries. The World Bank forecasts comparatively low inflation in the developed countries in the coming 10 years, 2.3% in 1995-2000 and 2.2% in 2000-2005.

Table 7.2.8 G5 INFLATION

(Annual increase rate, %)

	Export prices of manufactures	US GDP deflator
1980-1985	1.0	5.4
1986-1990	7.8	3.6
1991-1995	2.9	2.8
1996-2000	2.3	2.7
2001-2005	2.2	3.2

Source: World Bank "Commodity Market and the Developing Countries" (August 1996)

This model uses consumer price in the Republic of South Africa, main trading partner for Mauritius. Her per capita GDP in 1993 is US$ 2,980, nearly the same level of Mauritius.

Her GDP in 1993 is US bill. $ 105.6, which is roughly four times total GDP of SADC nine countries. Though she is an economic giant in the eastern and southern Africa, there is still instability in the economic development due to a serious social & political problem on racial discrimination. New cabinet led by President Mandera was so welcomed in the world, that US bill $6 has flowed into South Africa, a hopeful emerging economy since May 1994, however the National Party left the coalition cabinet in June 1996. Due to such an incompatibility, her currency has been devalued by 20 percent in 1996, which will aggravate her inflation. Though above uncertainties will exist in the future, we'll use the forecast of The University of Wastern Cape for the assumption.

Table 7.2.9 ECONOMIC FORECAST OF SOUTH AFRICA

(Annual increase rate, %)

	1993-1998	1999-2004
GDP	3.3	4.5
Fixed capital investment	9.6	8.7
Export of goods & non-factor services	2.9	4.1
Import of goods & non-factor services	5.3	8.1
CPI	10.0	10.0
Budget Revenue/GDP	(1993) 26.8	(2003) 32.5
Budge Expenditure/GDP	(1993) 38.4	(2003) 34.7
Labour forces (mil.)	(1993) 14.5	(2000) 17.6 (2011) 23.1

Source: The University of Wastern Cape "Making Democracy Work - A Framework for Macroeconomic Policy in South Africa" (December 1993).

Table 7.2.10 INFLATION ASSUMPTION IN SOUTH AFRICA

(1996-2025, Annual increase rate of CPI)

Base Case	High Case	Low Case
10%	7%	13%

(3) Energy Price

There are two credible forecasts for energy price in the future. The World Bank provides

price forecasts of many commodities, whose figures are reflecting recent movements, but they are easily changeable. According to the latest publication, energy prices will increase by 1-2% a year, but they will decline in a 1990 price.

Table 7.2.11 ENERGY PRICE FORECAST BY THE WORLD BANK

		Actual				Projections					Annual increase
		1980	1985	1990	1995	1996	1997	1998	2000	2005	rate (1996-2005)
(Current price)											%
Petroleum	$/bbl	36.87	27.18	22.88	17.18	18.25	16.50	16.00	17.00	19.00	1.0
Coal	$/mt	43.10	46.60	41.80	39.17	39.00	40.00	41.00	43.00	48.00	2.1
Natural gas, Europe	$/mmbtu	3.40	3.70	2.55	2.73	2.75	2.70	2.70	2.70	2.90	0.6
(1990 US dollar price)											
Petroleum	$/bbl	51.23	39.62	22.88	14.92	15.40	13.65	12.96	13.14	13.17	1.2
Coal	$/mt	59.89	67.93	41.80	34.01	32.91	33.09	33.21	33.27	33..26	0.2
Natural gas, Europe	$/mmbtu	4.72	5.39	2.55	2.37	2.32	2.23	2.19	2.09	2.01	1.6

Source: The World Bank "Commodity Markets and the Developing Countries" (August 1996)

International Energy Agency (IEA), established in November 1974 in the OECD works for international energy plan. IEA published "World Energy Outlook 1993 in 2010" in 1993. They revised it and published "World Energy Outlook 1994 in 2010" in October 1995. Before they forecast energy demand and prices, they assumed the world economic development. Economic growth in the developing countries will be enhanced by 1.5 times than the past 20 years, while that in OECD will slow down. Population growth will decrease considerably in the developing countries as well as OECD.

Table 7.2.12 FORECASTS OF THE WORLD ECONOMY BY IEA

	GDP		Population (annual increase rate %)	
	1971-1991	1991-2010	1971-1991	1991-2010
OECD	2.9	2.3	0.8	0.4
FSU/Central & Eastern Europe	0.7	1.5	0.8	0.5
Developing Countries	3.6	5.3	2.2	1.4
World Total	2.7	2.9	1.8	1.4

Source: IEA "World Energy Outlook 1994" (October 1995)

World energy demand will increase moderately in 1991-2000 by 1.7% a year, but will

enhance increase rate to 2.4% in 2000-2010. Cheaper energy sources of natural gas and coal will increase higher than petroleum. Petroleum's share of total primary energy will fall steadily at 37.2% in 2010 from 39.2% in 1991, 47.8% in 1971. Per capita energy consumption will increase, though energy intensity will improve steadily.

Table 7.2.13 WORLD ENERGY DEMAND FORECASTS BY IEA

(Primary energy)

	Mtoe				Annual Growth Rate (%)		
	1971	1991	2000	2010	1971/91	1991/2000	2000/2010
Solid fuel	1,502	2,275	2,627	3,363	2.1	1.6	2.5
Petroleum	2,325	3,072	3,531	4,299	1.4	1.6	2.0
Natural gas	895	1,727	2,020	2,718	3.3	1.8	3.0
Nuclear	29	549	631	706	15.9	1.5	1.1
Hydro	104	190	251	330	3.1	3.1	2.8
Geothermal & others	4	32	84	145	11.0	11.7	5.6
Total	4,859	7,845	9,144	11,560	2.4	1.7	2.4
Per capita energy consumption (toe)	-	1.53	1.56	1.73	-	0.2	1.1
Energy intensity (toe/US$ thousand)	-	0.43	0.40	0.37	-	0.9	0.7

Source: IEA "World Energy Outlook 1994" (October 1995)

Electricity demand will grow faster than the total energy consumption but this difference will become smaller in the future. Coal, natural gas and hydro will occupies the main energy sources for power 79.0% in 2010, which used to be 70.4% in 1971, while petroleum's share will fall to 6.9% in 2010 from 11.4% in 1991, 20.7% in 1971. Costly petroleum already gave way to nuclear power in the electricity.

Table 7.2.14 WORLD ELECTRICITY FORECAST BY IEA

	Twh				Annual Growth Rate (%)			Component Ratio (%)			
	1971	1991	2000	2010	1971/91	1991/2000	2000/2010	1971	1991	2000	2010
Solid fuel	2,165	4,708	6,094	8,260	4.0	2.9	3.1	40.8	39.1	40.7	40.4
Petroleum	1,100	1,366	1,307	1,405	1.1	0.5	0.7	20.7	11.4	8.7	6.9
Natural gas	717	1,594	2,121	4,047	4.1	3.2	6.7	13.5	13.3	14.2	19.8
Nuclear	111	2,108	2,420	2,707	15.9	1.5	1.1	2.1	17.5	16.2	13.2
Hydro	1,209	2,213	2,922	3,840	3.1	3.1	2.8	22.8	18.4	19.5	18.8
Geothermal & others	5	41	111	191	11.0	11.7	5.6	0.1	0.3	0.7	0.9
Total	5,308	12,030	14,976	20,450	4.2	2.5	3.2	100.0	100.0	100.0	100.0

Source: IEA "World Energy Outlook 1994" (October 1995)

IEA assume the energy price more positive than the World Bank, but the energy price forecasted will stay at the same level after 2005. Coal price will also go up, but the increase rate will be than petroleum. In a short-term crude oil price jumped by 6% in 1996 due to Iraqi political tension and low level of inventories, however energy price will be stable in the long run owing to increase of non-OPEC oil supply by new technology or potential development of oil, and policy change of OPEC countries to own export volume rather than price stability of crude oil. However there are still many uncertainties in the oil price, because OPEC's share of oil production is 35.7% in 1995, still considerably high and FSU's energy policy does not clear yet.

Table 7.2.15 ENERGY PRICE FORECASTS BY IEA

(in 1993 US$, %)

		Actual	Forecasts		Annual increase rate (%)
		1995	2005	2010	1995-2000
Petroleum	$/bbl	17	28	28	3.4
Coal	$mt	37	55	55	2.7
Natural gas	$/thou.f^3	-	3.3	3.3	-

Source: IEA "World Energy Outlook 1994" (October 1995)

Table 7.2.16 OIL CONSUMPTION

	Millions of barrels per day				Percentage change			
	OECD	FSU and Eastern Europe	Developing countries	Total	OECD	FSU and Eastern Europe	Developing countries	Total
1990	38.1	10.1	18.3	66.4	0.3	-5.0	4.3	0.5
1991	38.2	9.6	19.1	66.9	0.3	-4.8	4.5	0.7
1992	38.9	8.4	20.3	67.5	1.8	-12.5	6.3	1.0
1993	39.1	7.0	21.7	67.7	0.5	-16.7	6.4	0.2
1994	40.0	6.1	22.7	68.7	2.3	-12.1	4.2	1.3
1995	40.3	6.2	23.5	70.0	1.1	-0.8	4.4	2.0

Source: World bank "Commodity Markets and the Developing Countries (August 1996)

Table 7.2.17 OPEC CRUDE OIL PRODUCTION AND QUOTAS

(millions of barrels per day)

	1993	1994	1996	Quotas
Algeria	0.75	0.76	0.80	0.750
Indonesia	1.32	1.34	1.40	1.330
Iran	3.61	3.65	3.68	3.600
Iraq	0.53	0.55	0.55	1.200
Kuwait	1.84	1.84	1.79	2.000[a]
Libya	1.38	1.41	1.39	1.390
Neutral Zone	0.39	0.43	0.47	
Nigeria	1.90	1.93	2.13	1.865
Qatar	0.41	0.45	0.48	0.378
Saudi Arabia	7.90	7.94	7.88	8.000[a]
UAE	2.22	2.19	2.18	2.161
Venezuela	2.44	2.58	2.94	2.359
Total Crude	24.67	25.06	25.68	25.033
NGLs[b]	2.38	2.42	2.56	
Total OPEC	27.05	27.48	28.23	

Note: a. Quota includes share of Neutral Zone.
b. Natural gas liquids (NGL).

Source: World bank "Commodity Markets and the Developing Countries" (August 1996)

Table 7.2.18 NON-OPEC OIL SUPPLY

(millions of barrels per day)

	1993	1994	1996
United States	8.64	8.61	8.48
Canada	2.28	2.39	2.35
United Kingdom	2.71	2.79	2.70
Norway	2.69	2.91	3.26
Other OECD	1.32	1.28	1.41
Latin America	5.94	6.09	6.56
Africa	2.39	2.59	2.68
Middle East	1.79	1.90	1.91
China	2.84	2.99	3.12
Other Asia	1.94	2.04	2.06
FSU	7.22	7.15	7.09
East Europe	0.28	0.27	0.28
Processing Gain	1.43	1.48	1.51
Total non-OPEC	41.47	42.51	43.40

Note: Included NGLs, nonconventional, and other supply sources.
Source: World bank "Commodity Markets and the Developing Countries" (August 1996).

As a result, we assumes the energy prices as follows in this model.

Table 7.2.19 ENERGY PRICE ASSUMPTION

(current price, annual increase rate %)

	Base Case		High Case		Low Case	
	1996-2010	2011-2025	1996-2010	2011-2025	1996-2010	2011-2025
Petroleum	3.0	4.0	2.0	3.0	4.0	5.0
Coal	1.8	2.4	1.2	1.8	2.4	3.0

(4) Energy Conservation

Assumption of energy conservation for base case comes from the analysis in 8.4. High case is assumed no improvement in each sector. Low case is assumed the same improvement in OECD countries in industry, and 1.5 times improvement in transportation.

Table 7.2.20 ASSUMPTION OF ENERGY INTENSITY

(1996-2025, annual improvement rate %)

	Base Case	High Case	Low Case
Industry	0.50	0.00	1.00
Commerce	0.00	0.00	0.00
Transportation	0.46	0.00	0.69
Domestic	0.33	0.00	0.33

(5) Load Factor & Loss Ratio in the Power

Load factor is an actual power generation ratio over the peak power production. The electricity demand is fluctuated so much at each hour and the power company shall have the sufficient generation facilities to meet the peak load. If the power consumption is almost flat whole the day, the power company can provide power with a smallest facility. However the company has to equip redundant facilities, if the consumption curve is largely fluctuated.

Loss ratio is an ratio of electricity difference between the power generation and payable consumption over the sold electricity. This loss is composed of generator's self consumption, transmission & distribution loss and stolen electricity from their network. Stolen electricity is very small in Mauritius less than 1%. Main loss factor is the smaller voltage transmission lines and self consumption of generators. They need investment to efficient generators and transmission & distribution system to improve this loss ratio.

Above load factor and loss ratio are assumed as follows in any cases of this forecast.

Table 7.2.21 EFFECTIVENESS OF ELECTRICITY

	Load Factor	Loss Ratio
1996	60.0	15.2
1997	60.3	15.5
1998	60.6	15.0
1999	60.9	14.5
2000	61.2	14.8
2001	61.5	15.1
2002	61.8	15.4
2003	62.1	15.7
2004	62.4	16.0
2005	62.7	15.5
2006	63.0	15.0
2007	"	14.5
2008	"	14.0
2009	"	13.5
2010	"	13.0
2011	"	"
2012	"	"
2013	"	"
2014	"	"
2015	"	"
2016	"	"
2017	"	"
2018	"	"
2019	"	"
2020	"	"
2021	"	"
2022	"	"
2023	"	"
2024	"	"
2025	"	"

Note: Load Factor $= \frac{\text{Total Production (MWH)}}{\text{Peak Production (MW) x 8760 H}} \times 100$

$$\text{Loss Ratio} = \frac{\text{Transmission loss (MWH) + Self Consumption}}{\text{Electricity Sold (MWH)}} \times 100$$

7.3 Outcomes of Economic and Energy Demand Forecast up to the Year 2025

Table 7.3.1 shows that expected average growth rates of each economic sector from 1985 to 2025 are depicted according to the three scenarios provided on the previous chapter. These growth rates by economic sector, as explained in detail on the previous chapter, are assumed based upon the JICA team survey. This is the very basis for the energy demand forecast model. The 30 years period is, for a simplicity sake, divided into three periods, i.e., 5 years from 1996 to 2000, 10 years from 2001 to 2010, 15 years from 2011 to 2025.

As shown the average annual growth rate of GDP for the last 10 years between 1985 and 1995 was 6.1%. Likewise, the growth rates in forecast for the first 5 years from 1996 to 2000 will be 5.4 %, the next 10 years 5.3 % and the last 15 years 5.1%. The average growth rate during the entire 30 years is 5.2 %. The second table of Table 7.3.1 indicates the high growth case, which marks 5.7 % for the 30 years period, and the last table indicating the low growth case at 4.9 % on average.

As depicted on the related chapter on the present situation and future of the macro economy, it would be not easy, however, to make investment, private and public, as much as expected to incur anticipated economic growth toward the next century. The high growth case bases the realization of the high investment anticipated, resulting in high energy consumption, and the low case bases the low level of investment and resulting low energy consumption. Thus, the likelihood of the high case is less than that of the low case. The economic growth rate for the entire period in forecast, the next 30 years, will be around 5 %, as common sense suggests.

Table 7.3.2 to Table 7.3.4 show various macro economic indicators for the references of the user of the energy demand model, such as GDP investment ratio(Table 7.3.2), public finance balance(Table 7.3.3) and trade balance(Table 7.3.4), which are not directly related to the forecast outcomes of the energy demand model.

Table 7.3.5 shows the trend of labor productivity and their average annual growth rates. The labor productivity is derived by the product value for a particular sector being divided by the number of labor employed for that sector.

The labor productivity is known to grow steadily as the economy is at the growing stage.

The total labor productivity for the base case has increased about 3 times in the 3 decades. Or the average annual growth is 3.7 % for the base case, 4.0 % for the high case and 3.5 % for the low case.

Table 7.3.6 indicates the past and future forecast for the Consumer Price Index(CPI) and GDP deflator between the year 1985 and 2025, which have been obtained through the regression analysis. The present CPI is 7 % on average, which will slow down to near 4 % in the 30 years. And the figure of the base case is surrounded by that of the high case, 4.7 % and that of the low case, 4.3 %, consequently.

Table 7.3.7 to Table 7.3.11 summarize the major outcomes of the energy demand forecast model.

Table 7.3.7 describes the energy demand forecast by sector, i.e., manufacturing, commercial and transport and household and its total on final energy demand base.
The present demand for the base case is 0.4 million TOE, will change to 0.5 million TOE in 2000, 0.9 million TOE in 2010, and 2 million TOE in the year 2025 eventually. On the other hand, the high case records 2.8 million TOE and the low case 1.7 million TOE in 2025.
The per capita energy consumption is 0.4 TOE in 1995, will rise to 0.5 TOE in 2000, 0.9 TOE in 2010 and 2.1 TOE in 2025 for the base case. The energy consumption will increase as income rises, no doubt. The high case marks 2.8 TOE and the low case 1.7 TOE in 2025.

Table 7.3.8 shows energy demand by type of energy sources on primary energy supply basis, including the energy inputs for electricity generation. The country is now at a period of steady economic growth. As well known, the economic growth corresponds with electrification ratio. The energy inputs for electricity is 40 % in 1995 on the base case, will rise to over 60 % in the year 2025. The high growth case, on the contrary, marks 63 % in 2025, less than that of the base case, perhaps because the manufacturing sector requires more non-electricity energy as economy marks higher growth. The low case makes the inputs for electricity relatively higher since the economy, that is, the manufacturing sector, is not growing as anticipated.

After the year 2010 to the year 2025, a number of the coal fired electricity generations will be introduced on the plan(please refer to the related chapter), the coal demand during the corresponding period will increase significantly, simultaneously reduce the fuel oil and kerosene demand for electricity generation. Also it indicates a large reduction in charcoal and firewood being substituted by LPG for household energy. The per capita energy demand in terms of primary energy basis is 0.5 TOE in 1995, reaching 2.9 TOE in 2025. Likewise, the high case records 3.5 TOE and the low case 2.5 TOE in the final year of forecast.

Table 7.3.9 indicates the trend of so-called energy unit, which can be obtained by dividing energy demand with the product value. The base case of the electricity demand shows the energy unit of 2025 is up to 1.75 times that of 1995, implying the electricity energy unit will be rising at a rate of 2 % for the next 3 decades. In contrast the energy unit for non-electricity will not rise as much as that of electricity. On the whole, the energy unit will shift from 11.4 TOE/million Rupee in 1995 to 19.3 TOE/ million Rupee at an average annual rate of 1 % plus.

In contrast with the base case, the trend of the high case shows higher, and the low case lower than the base case. This implies that for the high case the incremental energy demand to produce incremental amount of product tend to be higher than the incremental GDP due to higher economic and industrial activities in the high case. The low case shows the contrary.

In considering the present economic stage of the country and the given natural condition, i.e., the island country, the energy unit will inevitably increase slowly as the economy grows, just as an energy unit increased slowly in a country like Singapore at a similar economic stage.

The last two rows on the Table show the electricity and energy consumption(on primary energy supply basis) per capita. The rapid electrification is reflected on the increase of electricity from 0.8 MWh in 1995 to 4.7 MWh in 2025 at a rate of 6 % annual growth.

Table 7.3.10 indicates so called the income elasticity of energy by sector, manufacturing, commercial, transport and household. The income elasticity is a major and useful indicator when discussing energy policy. The energy growth rate during a particular period being divided by the income or GDP growth rate during the same periods results in the income elasticity of energy. Generally, the indicator exceeds one at economic growth stage, and converges to one when economy stabilizes. At the base case, that of manufacturing sector changes from 1.5 to 1.2, that of the commercial sector unchanged at the level of 1.5, that of the transport changes from 1.2 to 0.6, and that of the household from 0.7 to 0.8. As a whole, that of the electricity in total shifts from 1.8 to 1.2, that of the energy from 1.3 to 1.1. The similar trend can be observed for the high and low cases as well.

Table 7.3.11 summarizes then key electricity data in the master file. The electricity demand in 1995 is 0.9 TWh, moves up to 8 TWh in 2025. The average annual growth rate is 7.2 % for the base case, 8.0 % for the high case and 6.6 % for the low case, respectively.

Combining the total electricity demand, and the load factor and self consumption and loss anticipated in the future, one can derive the peak electricity demand, implying the supply capacity of the electricity generation for a particular year. The peak electricity is 200 MW in 1995, exceeds 1600 MW in 2025 for the base case. At the high case, the total demand in 2025 is 10 TWh and the peak 2100 MW, and the low case, 7 TWh and 1400 MW, respectively. The non-synmetricity of the high and low cases centering on the base case may reflect that of the three economic growth rates for the 3 decades, that is, the economic growth, 5.2 % for the base, 5.7 % for the high and 4.9 % for the low case.

Table 7.3.12 comprises a series of the energy balance tables starting from 1995(current), 2000, 2010 to 2025. These figures are taken from the energy data base of the past and the future in forecast . 1995 table shows the present energy balance by sources of energy and the three tables in the other years are made based upon the three cases in forecast after the year 2000.

Table 7.3.1 GDP GROWTH RATE BY SECTOR (Base Case)

(%)

GDP at Constant Price (1990)	1995/1985	2000/1995	2010/2000	2025/2010	2025/1995
Agriculture, Hunting, Forestry, Mining, and Quarrying	-0.1	4.0	4.0	4.0	4.0
Manufacturing	8.1	5.2	5.5	7.8	6.6
Sugar	-1.7	4.0	0.0	0.0	0.7
EPZ	10.4	5.0	5.5	8.0	6.7
Domestic Manufacturing	8.1	5.5	6.0	8.0	6.9
Electricity, Gas, and Water	6.7	8.0	8.0	8.0	8.0
Construction	9.0	5.0	5.0	5.0	5.0
Wholesale, Retail, Restaurants, and Hotels	8.5	6.5	6.0	5.0	5.6
Transportation, Storage, and Communication	7.6	6.5	6.5	6.0	6.2
Banking, Insurance, Real Estate, Business service	7.0	6.5	6.5	6.0	6.2
Other service	7.7	5.0	5.0	5.0	5.0
Imputed Bank Service Charge	0.0	11.0	12.0	12.0	11.8
GDP at Factor cost	6.5	5.4	5.3	5.2	5.3
Net Indirect Taxes	3.7	5.0	5.0	5.0	5.0
GDP at constant (1990)	6.1	5.4	5.3	5.1	5.2

GDP GROWTH RATE BY SECTOR (High Case)

(%)

GDP at Constant Price (1990)	1995/1985	2000/1995	2010/2000	2025/2010	2025/1995
Agriculture, Hunting, Forestry, Mining, and Quarrying	-0.1	4.0	4.0	4.0	4.0
Manufacturing	8.1	5.2	8.9	8.1	7.9
Sugar	-1.7	4.0	0.0	0.0	0.7
EPZ	10.4	5.0	9.4	8.3	8.1
Domestic Manufacturing	8.1	5.5	9.1	8.2	8.0
Electricity, Gas, and Water	6.7	8.0	8.5	8.5	8.4
Construction	9.0	5.0	6.3	6.3	6.1
Wholesale, Retail, Restaurants, and Hotels	8.5	6.5	6.0	5.0	5.6
Transportation, Storage, and Communication	7.6	6.5	6.5	6.0	6.2
Banking, Insurance, Real Estate, Business service	7.0	6.5	6.5	6.0	6.2
Other service	7.7	5.4	5.0	5.0	5.1
Imputed Bank Service Charge	0.0	11.	12.0	12	11.8
GDP at Factor cost	6.5	5.5	6.3	5.7	5.8
Net Indirect Taxes	3.7	5.0	5.0	5.0	5.0
GDP at constant (1990)	6.1	5.4	6.1	5.6	5.7

GDP GROWTH RATE BY SECTOR (Low Case)

GDP at Constant Price (1990)	1995/1985	2000/1995	2010/2000	2025/2010	2025/1995
Agriculture, Hunting, Forestry, Mining, and Quarrying	-0.1	4.0	4.0	4.0	4.0
Manufacturing	8.1	5.2	4.2	6.5	5.5
Sugar	-1.7	4.0	0.0	0.0	0.7
EPZ	10.4	5.0	4.2	6.7	5.6
Domestic Manufacturing	8.1	5.5	4.6	6.6	5.7
Electricity, Gas, and Water	6.7	8.0	7.5	7.5	7.6
Construction	9.0	5.0	3.6	3.6	3.8
Wholesale, Retail, Restaurants, and Hotels	8.5	6.5	6.0	5.0	5.6
Transportation, Storage, and Communication	7.6	6.5	6.5	6.0	6.2
Banking, Insurance, Real Estate, Business service	7.0	6.5	6.5	6.0	6.2
Other service	7.7	5.4	5.0	5.0	5.1
Imputed Bank Service Charge	0.0	11.0	12.0	12.0	11.8
GDP at Factor cost	6.5	5.5	4.9	4.6	4.8
Net Indirect Taxes	3.7	5.0	5.0	5.0	5.0
GDP at constant (1990)	6.1	5.4	4.9	4.6	4.9

(Source: CSO and JICA Study Team)

Table 7.3.2 INVESTMENT RATIO BY PUBLIC AND PRIVATE SECTOR (Base Case)

		1985	Ratio to GDP(%)	1995	Ratio to GDP(%)	2000	Ratio to GDP(%)	2010	Ratio to GDP(%)	2025	Ratio to GDP(%)
Gross Domestic Fixed Capital Formation	Rs million	3,100	18.7	18,325	26.7	35,810	28.5	92,916	29.2	368,931	29.5
Private Fixed Capital Formation	Rs million	2,100	12.6	12,460	18.1	25,622	20.4	70,917	22.3	299,648	23.9
Govern. Fixed Capital Formation	Rs million	1,000	6.0	5,865	8.5	10,188	8.1	21,999	6.9	69,283	5.5
GDP at Current Price	Rs million	16,618		68,760		125,780		318,332		1,252,170	

INVESTMENT RATIO BY PUBLIC AND PRIVATE SECTOR (High Case)

		1985	Ratio to GDP(%)	1995	Ratio to GDP(%)	2000	Ratio to GDP(%)	2010	Ratio to GDP(%)	2025	Ratio to GDP(%)
Gross Domestic Fixed Capital Formation	Rs million	3,100	18.7	18,325	26.7	36,232	28.4	102,923	29.1	434,160	28.5
Private Fixed Capital Formation	Rs million	2,100	12.6	12,460	18.1	25,930	20.3	80,497	22.8	361,385	23.7
Govern. Fixed Capital Formation	Rs million	1,000	6.0	5,865	8.5	10,303	8.1	22,426	6.3	72,775	4.8
GDP at Current Price	Rs million	16,618		68,760		127,542		353,459		1,524,039	

INVESTMENT RATIO BY PUBLIC AND PRIVATE SECTOR (Low Case)

		1985	Ratio to GDP(%)	1995	Ratio to GDP(%)	2000	Ratio to GDP(%)	2010	Ratio to GDP(%)	2025	Ratio to GDP(%)
Gross Domestic Fixed Capital Formation	Rs million	3,100	18.7	18,325	26.7	35,381	28.4	87,717	29.2	323,144	30.2
Private Fixed Capital Formation	Rs million	2,100	12.6	12,460	18.1	25,321	20.3	66,319	22.1	257,471	24.1
Govern. Fixed Capital Formation	Rs million	1,000	6.0	5,865	8.5	10,061	8.1	21,398	7.1	65,673	6.1
GDP at Current Price	Rs million	16,618		68,760		124,546		300,380		1,069,819	

(Source: CSO and JICA Study Team)

Table 7.3.3 GOVERNMENT FINANCE (Base Case)

Government Finance at Current Price		1985	1995	2000	2010	2025
Revenue	Rs million	3,593	14,295	25,599	55,275	174,077
Grants Received	Rs million	166	240	300	300	300
Expenditure	Rs million	4,229	15,868	28,281	59,320	188,174
Lending - Repayment	Rs million	110	-380	-500	-800	-1,500
Deficit and Surplus	Rs million	-580	-953	-1,882	-2,945	-12,297
Deficit Ratio to GDP	(%)	3.5	1.4	1.5	0.9	1.0

GOVERNMENT FINANCE (High Case)

Government Finance at Current Price		1985	1995	2000	2010	2025
Revenue	Rs million	3,593	14,295	25,886	56,347	182,851
Grants Received	Rs million	166	240	300	300	300
Expenditure	Rs million	4,229	15,868	28,598	60,471	197,658
Lending - Repayment	Rs million	110	-380	-500	-800	-1,500
Deficit and Surplus	Rs million	-580	-953	-1,912	-3,024	-13,007
Deficit Ratio to GDP	(%)	3.5	1.4	1.5	0.9	0.9

GOVERNMENT FINANCE (Low Case)

Government Finance at Current Price		1985	1995	2000	2010	2025
Revenue	Rs million	3,593	14,295	25,278	53,765	165,007
Grants Received	Rs million	166	240	300	300	300
Expenditure	Rs million	4,229	15,868	27,926	57,700	178,369
Lending - Repayment	Rs million	110	-380	-500	-800	-1,500
Deficit and Surplus	Rs million	-580	-953	-1,848	-2,835	-11,562
Deficit Ratio to GDP	(%)	3.5	1.4	1.5	0.9	1.1

(Source: CSO and JICA Study Team)

Table 7.3.4 TRADE BALANCE (Base Case)

		1985	1995	2000	2010	2025
Export of Goods and Services	Rs million	8,895	40,115	78,827	217,382	905,071
Import of Goods and Services	Rs million	9,210	43,100	84,365	231,883	969,697
Balance	Rs million	-315	-2985	-5,538	-14,501	-64,626
Ratio to GDP(%)		1.9	4.3	4.4	4.6	5.2

TRADE BALANCE (High Case)

		1985	1995	2000	2010	2025
Export of Goods and Services	Rs million	8,895	40,115	80,177	241,370	1,068,322
Import of Goods and Services	Rs million	9,210	43,100	85,580	253,511	1,139,617
Balance	Rs million	-315	-2985	-5,402	-12,141	-71,295
Ratio to GDP(%)		1.9	4.3	4.2	3.4	4.7

TRADE BALANCE (Low Case)

		1985	1995	2000	2010	2025
Export of Goods and Services	Rs million	8,895	40,115	78,294	207,759	807,162
Import of Goods and Services	Rs million	9,210	43,100	83,506	221,070	857,950
Balance	Rs million	-315	-2985	-5,213	-13,311	-50,788
Ratio to GDP(%)		1.9	4.3	4.2	4.4	4.7

(Source: CSO and JICA Study Team)

Table 7.3.5 LABOUR PRODUCTIVITY BY INDUSTRIAL SECTOR (Base Case)

Labour Productivity (1990)	1985*1	1995	2000	2010	2025	1995/1985*2	2000/1995	2010/2000	2025/2010	2025/1995
Agriculture, Hunting, Forestry, Mining, and Quarrying	42	55	78	156	380	2.7	7.2	7.2	6.1	6.7
Manufacturing	70	70	96	201	517	0.0	6.4	7.7	6.5	6.9
Sugar	-	102	152	229	279	-	8.3	4.2	1.3	3.4
EPZ	-	63	96	201	526	-	8.8	7.7	6.6	7.3
Domestic Manufacturing	-	76	90	198	517	-	3.4	8.2	6.6	6.6
Electricity, Gas, and Water	96	204	315	751	2,772	7.8	9.1	9.1	9.1	9.1
Construction	103	86	95	115	153	-1.7	1.9	1.9	1.9	1.9
Wholesale, Retail, Restaurants, Hotels	116	93	91	100	171	-2.2	-0.5	1.0	3.7	2.1
Transportation, Storage, and Communication	127	137	140	170	345	0.7	0.5	1.9	4.8	3.1
Banking, Insurance, Real Estate, Business service	559	428	459	582	896	-2.6	1.4	2.4	2.9	2.5
Other service	35	56	65	96	172	4.8	2.9	4.0	4.0	3.8
Total Labor Productivity at Constant Price (1990)	83	95	113	161	284	1.3	3.5	3.6	3.8	3.7

LABOUR PRODUCTIVITY BY INDUSTRIAL SECTOR (High Case)

Labour Productivity (1990)	1985*1	1995	2000	2010	2025	1995/1985*2	2000/1995	2010/2000	2025/2010	2025/1995
Agriculture, Hunting, Forestry, Mining, and Quarrying	42	55	78	156	380	2.7	7.2	7.2	6.1	6.7
Manufacturing	70	70	96	259	633	0.0	6.4	10.5	6.1	7.6
Sugar	-	102	152	229	279	-	8.3	4.2	1.3	3.4
EPZ	-	63	96	275	696	-	8.8	11.1	6.4	8.3
Domestic Manufacturing	-	76	90	243	581	-	3.4	10.4	6.0	7.0
Electricity, Gas, and Water	96	204	315	787	3,111	7.8	9.1	9.6	9.6	9.5
Construction	103	86	95	117	160	-1.7	1.9	2.1	2.1	2.1
Wholesale, Retail, Restaurants, Hotels	116	93	91	100	171	-2.2	-0.5	1.0	3.7	2.1
Transportation, Storage, and Communication	127	137	140	170	345	0.7	0.5	1.9	4.8	3.1
Banking, Insurance, Real Estate, Business service	559	428	459	582	896	-2.6	1.4	2.4	2.9	2.5
Other service	35	56	66	98	175	4.8	3.3	4.0	4.0	3.9
Total Labor Productivity at Constant Price (1990)	83	95	113	172	310	1.3	3.5	4.3	4.0	4.

LABOUR PRODUCTIVITY BY INDUSTRIAL SECTOR (Low Case)

Labour Productivity (1990)	1985*1	1995	2000	2010	2025	1995/1985*2	2000/1995	2010/2000	2025/2010	2025/1995
Agriculture, Hunting, Forestry, Mining, and Quarrying	42	55	78	156	380	2.7	7.2	7.2	6.1	6.7
Manufacturing	70	70	96	166	390	0.0	6.4	5.7	5.8	5.9
Sugar	-	102	152	229	279	-	8.3	4.2	1.3	3.4
EPZ	-	63	96	169	397	-	8.8	5.8	5.9	6.3
Domestic Manufacturing	-	76	90	160	387	-	3.4	5.9	6.1	5.6
Electricity, Gas, and Water	96	204	315	717	2,468	7.8	9.1	8.6	8.6	8.7
Construction	103	86	95	112	143	-1.7	1.9	1.7	1.7	1.7
Wholesale, Retail, Restaurants, Hotels	116	93	91	100	171	-2.2	-0.5	1.0	3.7	2.1
Transportation, Storage, and Communication	127	137	140	170	345	0.7	0.5	1.9	4.8	3.1
Banking, Insurance, Real Estate, Business service	559	428	459	582	896	-2.6	1.4	2.4	2.9	2.5
Other service	35	56	66	98	175	4.8	3.3	4.0	4.0	3.9
Total Labor Productivity at Constant Price (1990)	83	95	113	156	264	1.3	3.5	3.3	3.6	3.5

(Notes *1: Labour productivity in 1000 Rs/person)
(Notes *2: Annual average growth rate of labour productivity in %)
(Source: CSO and JICA Study Team)

Table 7.3.6 CPI AND GDP DEFLATOR (Base Case)

	1985*1	1995	2000	2010	2025	1995/1985*2	2000/1995	2010/2000	2025/2010	2025/1995
Consumer Price Index	70.1	141.0	195.2	291.3	527.0	7.2	6.7	4.1	4.0	4.5
GDP Deflator	63.2	140.9	197.7	299.7	555.3	8.3	7.0	4.2	4.2	4.7

CPI AND GDP DEFLATOR (High Case)

	1985*1	1995	2000	2010	2025	1995/1985*2	2000/1995	2010/2000	2025/2010	2025/1995
Consumer Price Index	70.1	141.0	197.3	296.7	552.6	7.2	7.0	4.2	4.2	4.7
GDP Deflator	63.2	140.9	199.9	305.5	583.3	8.3	7.2	4.3	4.4	4.8

CPI AND GDP DEFLATOR (Low Case)

	1985*1	1995	2000	2010	2025	1995/1985*2	2000/1995	2010/2000	2025/2010	2025/1995
Consumer Price Index	70.1	141.0	192.9	283.6	500.6	7.2	6.5	3.9	3.9	4.3
GDP Deflator	63.2	140.9	195.2	291.5	526.4	8.3	6.7	4.1	4.	4.5

(Notes *1: Index figure assuming 1990 equal to 100))
(Notes *2: Annual average growth rate in %)
(Source: CSO and JICA Study Team)

Table 7.3.7 TOTAL ENERGY DEMAND BY SECTOR (Base Case)

	Unit	1985	1995	2000	2010	2025
Non-electricity Consumption by Industry	TOE	38,127	80,263	114,034	222,652	694,029
Electricity Consumption by Industry	MWh	103,900	322,476	502,898	1,177,432	3,672,913
Conversion to TOE	TOE	8935.4	27,733	43,249	101,259	315,871
Total Consumption by Industry	TOE	47,062	107,996	157,283	323,911	1,009,899
Non-Electricity Consumption by Commercial	TOE	1,543	3,994	6,921	20,303	89,239
Electricity Consumption by Commercial	MWh	73,000	227,327	325,408	659,303	1,741,575
Conversion to TOE	TOE	6,278	19,550	27,985	56,700	149,775
Total Consumption by Commercial	TOE	7,821	23,544	34,906	77,003	239,014
Total Consumption by Transport	TOE	79,202	192,132	248,376	352,958	588,753
Non-Electricity Consumption by Residential	TOE	35,561	45,082	51,004	62,488	88,553
Electricity Consumption by Residential	MWh	138,200	330,792	478,302	943,667	1,664,980
Conversion to TOE	TOE	11,885	28,448	41,134	81,155	143,188
Total Consumption by Residential	TOE	47,447	73,530	92,138	143,644	231,742
Electricity Consumption by Others	MWh	5,800	14,490	20,906	44,486	113,271
Total Electricity Consumption by all Sectors	MWh	320,900	895,085	1,327,514	2,824,889	7,192,740
Total Energy Consumption by all Sectors	TOE	181,531	397,202	532,703	897,516	2,069,409
Final Energy Consumption per Capita	TOE	0.2	0.4	0.5	0.9	2.1

TOTAL ENERGY DEMAND BY SECTOR (High Case)

	Unit	1985	1995	2000	2010	2025
Non-electricity Consumption by Industry	TOE	38,127	80,263	115,451	344,887	1,082,331
Electricity Consumption by Industry	MWh	103,900	322,476	506,285	1,861,206	5,448,416
Conversion to TOE	TOE	8,935	27,733	43,541	160,064	468,564
Total Consumption by Industry	TOE	47,062	107,996	158,992	504,951	1,550,894
Non-Electricity Consumption by Commercial	TOE	1,543	3,994	7,001	20,520	90,145
Electricity Consumption by Commercial	MWh	73,000	227,327	327,881	663,921	1,753,160
Conversion to TOE	TOE	6,278	19,550	28,198	57,097	150,772
Total Consumption by Commercial	TOE	7,821	23,544	35,199	77,617	240,917
Total Consumption by Transport	TOE	79,202	192,132	252,011	389,675	710,111
Non-Electricity Consumption by Residential	TOE	35,561	45,082	51,056	63,092	88,769
Electricity Consumption by Residential	MWh	138,200	330,792	478,752	976,446	1,779,699
Conversion to TOE	TOE	11,885	28,448	41,173	83,974	153,054
Total Consumption by Residential	TOE	47,447	73,530	92,229	147,066	241,823
Electricity Consumption by Others	MWh	5,800	14,490	21,007	56,025	143,700
Total Electricity Consumption by all Sectors	MWh	320,900	895,085	1,333,925	3,557,598	9,124,976
Total Energy Consumption by all Sectors	TOE	181,531	397,202	538,430	1,119,310	2,743,746
Final Energy Consumption per Capita	TOE	0.2	0.4	0.5	1.1	2.8

TOTAL ENERGY DEMAND BY SECTOR (Low Case)

	Unit	1985	1995	2000	2010	2025
Non-electricity Consumption by Industry	TOE	38,127	80,263	112,604	183,533	466,945
Electricity Consumption by Industry	MWh	103,900	322,476	499,278	973,954	2,593,714
Conversion to TOE	TOE	8,935	27,733	42,938	83,760	223,059
Total Consumption by Industry	TOE	47,062	107,996	155,542	267,293	690,004
Non-Electricity Consumption by Commercial	TOE	1,543	3,994	7,001	20,520	90,145
Electricity Consumption by Commercial	MWh	73,000	227,327	327,881	663,921	1,753,160
Conversion to TOE	TOE	6,278	19,550	28,198	57,097	150,772
Total Consumption by Commercial	TOE	7,821	23,544	35,199	77,617	240,917
Total Consumption by Transport	TOE	79,202	192,132	246,189	332,372	506,994
Non-Electricity Consumption by Residential	TOE	35,561	45,082	50,990	62,228	88,403
Electricity Consumption by Residential	MWh	138,200	330,792	478,089	929,751	1,588,415
Conversion to TOE	TOE	11,885	28,448	41,116	79,959	136,604
Total Consumption by Residential	TOE	47,447	73,530	92,105	142,187	225,006
Electricity Consumption by Others	MWh	5,800	14,490	20,884	41,082	94,965
Total Electricity Consumption by all Sectors	MWh	320,900	895,085	1,326,131	2,608,708	6,030,253
Total Energy Consumption by all Sectors	TOE	181,531	397,202	529,035	819,470	1,662,922
Final Energy Consumption per Capita	TOE	0.2	0.4	0.5	0.8	1.7

(Source: CSO and JICA Study Team)

Table 7.3.8 INLAND ENERGY DEMAND BY SOURCES (Base Case)

(TOE)

	1985	1995	2000	2010	2025
Gasoline	37,579	90,675	115,210	197,233	352,393
Diesel	56,851	121,510	158,796	191,754	264,991
Kerosene	18,056	44,639	38,743	32,938	32,265
Fuel Oil	53,684	175,436	286,027	668,793	1,049,930
LPG	2,741	36,396	53,395	90,911	227,410
Coal	22,358	39,113	59,133	109,734	2,252,877
Fuel Wood	19,457	4,940	1,792	192	7
Charcoal	1,850	962	421	313	300
Bagasse (For National Grid)	22,734	31,582	61,384	78,137	162,440
Total Primary Energy Consumption	235,311	545,253	774,900	1,370,005	4,342,613
Of which Inputs for Electricity	80,878	223,782	353,715	710,929	2,881,408
Inputs for Electricity/Total Consumption (%)	34.4	41.	45.6	51.9	66.4
Primary Energy Consumuption per Capita	0.2	0.5	0.7	1.1	2.9

INLAND ENERGY DEMAND BY SOURCES (High Case)

(TOE)

	1985	1995	2000	2010	2025
Gasoline	37,579	90,675	116,908	219,780	430,175
Diesel	56,851	121,510	160,900	206,421	196,204
Kerosene	18,056	44,639	38,743	32,938	32,265
Fuel Oil	53,684	175,436	288,377	923,466	1,843,658
LPG	2,741	36,396	53,589	98,034	256,479
Coal	22,358	39,113	59,492	140,785	2,380,935
Fuel Wood	19,457	4,940	1,792	192	7
Charcoal	1,850	962	421	313	300
Bagasse (For National Grid)	22,734	31,582	61,384	78,137	162,440
Total Primary Energy Consumption	235,311	545,253	781,606	1,700,066	5,302,463
Of which Inputs for Electricity	80,878	223,782	355,237	881,312	3,330,725
Inputs for Electricity/Total Consumption (%)	34.4	41.	45.4	51.8	62.8
Primary Energy Consumuption per Capita	0.2	0.5	0.7	1.3	3.5

INLAND ENERGY DEMAND BY SOURCES (Low Case)

(TOE)

	1985	1995	2000	2010	2025
Gasoline	37,579	90,675	114,144	185,646	302,701
Diesel	56,851	121,510	157,526	181,079	248,683
Kerosene	18,056	44,639	38,743	32,938	32,265
Fuel Oil	53,684	175,436	284,842	592,955	620,611
LPG	2,741	36,396	53,399	88,958	211,823
Coal	22,358	39,113	58,770	99,797	2,185,525
Fuel Wood	19,457	4,940	1,792	192	7
Charcoal	1,850	962	421	313	300
Bagasse (For National Grid)	22,734	31,582	61,384	78,137	162,440
Total Primary Energy Consumption	235,311	545,253	771,022	1,260,015	3,764,355
Of which Inputs for Electricity	80,878	223,782	353,386	660,659	2,611,086
Inputs for Electricity/Total Consumption	34.4	41.	45.8	52.4	69.4
Primary Energy Consumuption per Capita	0.2	0.5	0.7	1.0	2.5

(Source: CSO and JICA Study Team)

Table 7.3.9 ENERGY INTENSITY AND PER CAPITA CONSUMPTION (Base Case)

		1985	1995	2000	2010	2025
Total Electricity Consumption(PHY)	MWh	320,900	895,085	1,327,514	2,824,889	7,192,740
Total Energy Consumption (TOE)	TOE	245,192	556,812	786,080	1,381,185	4,353,793
GDP at constant (1990)	Rs million	27,183	48,932	63,622	106,211	225,494
Energy Intensity of Electricity	(MWh/Rs mil.)	11.8	18.3	20.9	26.6	31.9
Energy Intensity of Total Energy	(TOE/Rs mil.)	9.0	11.4	12.4	13.	19.3
Electricity Consumption per capita	MWh	0.3	0.8	1.1	2.1	4.7
Energy Consumption per capita	TOE	0.2	0.5	0.7	1.1	2.9

ENERGY INTENSITY AND PER CAPITA CONSUMPTION (High Case)

		1985	1995	2000	2010	2025
Total Electricity Consumption(PHY)	MWh	320,900	895,085	1,333,925	3,557,598	9,124,976
Total Energy Consumption (TOE)	TOE	245,192	556,812	792,786	1,711,246	5,313,643
GDP at constant (1990)	Rs million	27,183	48,932	63,798	115,687	261,284
Energy Intensity of Electricity	(MWh/Rs mil.)	11.8	18.3	20.9	30.8	34.9
Energy Intensity of Total Energy	(TOE/Rs mil.)	9.0	11.4	12.4	14.8	20.3
Electricity Consumption per capita	MWh	0.3	0.8	1.1	2.7	6.
Energy Consumption per capita	TOE	0.2	0.5	0.7	1.3	3.5

ENERGY INTENSITY AND PER CAPITA CONSUMPTION (Low Case)

		1985	1995	2000	2010	2025
Total Electricity Consumption(PHY)	MWh	320,900	895,085	1,326,131	2,608,708	6,030,253
Total Energy Consumption (TOE)	TOE	245,192	556,812	782,202	1,271,195	3,775,535
GDP at constant (1990)	Rs million	27,183	48,932	63,798	103,036	203,246
Energy Intensity of Electricity	(MWh/Rs mil.)	11.8	18.3	20.8	25.3	29.7
Energy Intensity of Total Energy	(TOE/Rs mil.)	9.0	11.4	12.3	12.3	18.6
Electricity Consumption per capita	MWh	0.3	0.8	1.1	2.0	3.9
Energy Consumption per capita	TOE	0.2	0.5	0.7	1.0	2.5

(Source: CSO and JICA Study Team)

Table 7.3.10 INCOME ELASTICITY BY SECTOR (Base Case)

	Unit	1985	1995	2000	2010	2025
Non-Electricity consumption by industry	TOE	38,127	80,263	114,034	222,652	694,029
Electricity including irrigation	MWh	103,900	322,476	502,898	1,177,432	3,672,913
Conversion to TOE	TOE	8,935	27,733	43,249	101,259	315,871
Total Consumption by Industry	TOE	47,062	107,996	157,283	323,911	1,009,899
Average Annual Growth Rate	(%)	-	8.7	7.8	7.5	7.9
Real GDP by Industry	Rs. million	10,244	17756.1	22660.4	37702.	101244.3
Average Annual Growth Rate by industry	(%)	-	5.7	5.0	5.2	6.8
Income Elasticity		-	1.5	1.6	1.4	1.2
Non-Electricity Consumption by Commercial	TOE	1,543	3,994	6,921	20,303	89,239
Electricity Consumption by Commercial	MWh	73,000	227,327	325,408	659,303	1,741,575
Conversion to TOE	TOE	6,278	19,550	27,985	56,700	149,775
Total Consumption by Commercial	TOE	7820.76	23,544	34,906	77,003	239,014
Average Annual Growth Rate	(%)	-	11.7	8.2	8.2	7.8
Real GDP by Commercial	Rs. million	10,201	21511.2	28796.9	50892.	111392.7
Average Annual Growth Rate by Commercial	(%)	-	7.7	6.0	5.9	5.4
Income Elasticity		-	1.5	1.4	1.4	1.5
Total Consumption by Transport	TOE	79,202	192,132	248,376	352,958	588,753
Average Annual Growth Rate	(%)	-	9.3	5.3	3.6	3.5
Real GDP by Transport, etc.	Rs. million	2,406	5016.3	6872.7	12901.	30918.
Average Annual Growth Rate by Transport	(%)	-	7.6	6.5	6.5	6.0
Income Elasticity		-	1.2	0.8	0.6	0.6
Non-Electricity Consumption by Residential	TOE	35,561	45,082	51,004	62,488	88,553
Electricity Consumption by Residential	MWh	138,200	330,792	478,302	943,667	1,664,980
Conversion to TOE	TOE	11885.2	28,448	41,134	81,155	143,188
Total Consumption by Residential	TOE	47,447	73,530	92,138	143,644	231,742
Average Annual Growth Rate	(%)	-	4.5	4.6	4.5	3.2
Real Private Consumption Expenditure	Rs. million	17591.77	31745.92	40795.85	65809.50	122565.58
Average Annual Growth Rate by RPCON	(%)	-	6.1	5.1	4.9	4.2
Income Elasticity		-	0.7	0.9	0.9	0.8
Total Electricity Consumption by all sectors	TOE	27,099	75,731	112,368	239,115	608,834
Average Annual Growth Rate	(%)	-	10.8	8.2	7.8	6.4
Income Elasticity		-	1.8	1.5	1.5	1.2
Total Energy Consumption by all sectors	TOE	181,531	397,202	532,703	897,516	2,069,409
Average Annual Growth Rate	(%)	-	8.1	6.0	5.4	5.7
Income Elasticity		-	1.3	1.1	1.0	1.1
GDP at constant (1990)	Rs million	27,183	48,932	63,622	106,211	225,494
Average Annual Growth Rate	(%)	-	6.1	5.4	5.3	5.1

INCOME ELASTICITY BY SECTOR (High Case)

	Unit	1985	1995	2000	2010	2025
Non-Electricity consumption by industry	TOE	38,127	80,263	115,451	344,887	1,082,331
Electricity including irrigation	MWh	103,900	322,476	506,285	1,861,206	5,448,416
Conversion to TOE	TOE	8,935	27,733	43,541	160,064	468,564
Total Consumption by Industry	TOE	47,062	107,996	158,992	504,951	1,550,894
Average Annual Growth Rate	(%)	-	8.7	8.	12.3	7.8
Real GDP by Industry	Rs. million	10,244	17756.1	22660.4	46890.8	136436.8
Average Annual Growth Rate by industry	(%)	-	5.7	5.0	7.5	7.4
Income Elasticity		-	1.5	1.6	1.6	1.1
Non-Electricity Consumption by Commercial	TOE	1,543	3,994	7,001	20,520	90,145
Electricity Consumption by Commercial	MWh	73,000	227,327	327,881	663,921	1,753,160
Conversion to TOE	TOE	6,278	19,550	28,198	57,097	150,772
Total Consumption by Commercial	TOE	7820.76	23,544	35,199	77,617	240,917
Average Annual Growth Rate	(%)	-	11.7	8.4	8.2	7.8
Real GDP by Commercial	Rs. million	10,201	21511.2	28973.2	51179.3	111989.9
Average Annual Growth Rate by Commercial	(%)	-	7.7	6.1	5.9	5.4
Income Elasticity		-	1.5	1.4	1.4	1.5
Total Consumption by Transport	TOE	79,202	192,132	252,011	389,675	710,111
Average Annual Growth Rate	(%)	-	9.3	5.6	4.5	4.1
Real GDP by Transport, etc.	Rs. million	2,406	5016.3	6872.7	12901.	30918.
Average Annual Growth Rate by Transport	(%)	-	7.6	6.5	6.5	6.0
Income Elasticity		-	1.2	0.9	0.7	0.7

Non-Electricity Consumption by Residential	TOE	35,561	45,082	51,056	63,092	88,769
Electricity Consumption by Residential	MWh	138,200	330,792	478,752	976,446	1,779,699
Conversion to TOE	TOE	11885.2	28,448	41,173	83,974	153,054
Total Consumption by Residential	TOE	47,447	73,530	92,229	147,066	241,823
Average Annual Growth Rate	(%)	-	4.5	4.6	4.8	3.4
Real Private Consumption Expenditure	Rs. million	17591.77	31745.92	40849.87	68177.65	133150.13
Average Annual Growth Rate by RPCON	(%)	-	6.1	5.2	5.3	4.6
Income Elasticity		-	0.7	0.9	0.9	0.7
Total Electricity Consumption by all sectors	TOE	27,099	75,731	112,911	301,135	772,390
Average Annual Growth Rate	(%)	-	10.8	8.3	10.3	6.5
Income Elasticity		-	1.8	1.5	1.7	1.2
Total Energy Consumption by all sectors	TOE	181,531	397,202	538,430	1,119,310	2,743,746
Average Annual Growth Rate	(%)	-	8.1	6.3	7.6	6.2
Income Elasticity		-	1.3	1.2	1.2	1.1
GDP at constant (1990)	Rs. million	27,183	48,932	63,798	115,687	261,284
Average Annual Growth Rate	(%)	-	6.1	5.4	6.1	5.6

INCOME ELASTICITY BY SECTORr (Low Case)

	Unit	1985	1995	2000	2010	2025
Non-Electricity consumption by industry	TOE	38,127	80,263	112,604	183,533	466,945
Electricity including irrigation	MWh	103,900	322,476	499,278	973,954	2,593,714
Conversion to TOE	TOE	8,935	27,733	42,938	83,760	223,059
Total Consumption by Industry	TOE	47,062	107,996	155,542	267,293	690,004
Average Annual Growth Rate	(%)	-	8.7	7.6	5.6	6.5
Real GDP by Industry	Rs. million	10,244	17756.1	22660.4	34239.6	78399.1
Average Annual Growth Rate by industry	(%)	-	5.7	5.0	4.2	5.7
Income Elasticity		-	1.0	1.0	1.0	1.0
Non-Electricity Consumption by Commercial	TOE	1,543	3,994	7,001	20,520	90,145
Electricity Consumption by Commercial	MWh	73,000	227,327	327,881	663,921	1,753,160
Conversion to TOE	TOE	6,278	19,550	28,198	57,097	150,772
Total Consumption by Commercial	TOE	7820.76	23,544	35,199	77,617	240,917
Average Annual Growth Rate	(%)	-	11.7	8.4	8.2	7.8
Real GDP by Commercial	Rs. million	10,201	21511.2	28973.2	51179.3	111989.9
Average Annual Growth Rate by Commercial	(%)	-	7.7	6.1	5.9	5.4
Income Elasticity		-	1.5	1.4	1.4	1.5
Total Consumption by Transport	TOE	79,202	192,132	246,189	332,372	506,994
Average Annual Growth Rate	(%)	-	9.3	5.1	3.0	2.9
Real GDP by Transport, etc.	Rs. million	2,406	5016.3	6872.7	12901.	30918.
Average Annual Growth Rate by Transport	(%)	-	7.6	6.5	6.5	6.0
Income Elasticity		-	1.2	0.8	0.5	0.5
Non-Electricity Consumption by Residential	TOE	35,561	45,082	50,990	62,228	88,403
Electricity Consumption by Residential	MWh	138,200	330,792	478,089	929,751	1,588,415
Conversion to TOE	TOE	11885.2	28,448	41,116	79,959	136,604
Total Consumption by Residential	TOE	47,447	73,530	92,105	142,187	225,006
Average Annual Growth Rate	(%)	-	4.5	4.6	4.4	3.1
Real Private Consumption Expenditure	Rs. million	17591.77	31745.92	40778.97	64811.45	115308.66
Average Annual Growth Rate by RPCON	(%)	-	6.1	5.1	4.7	3.9
Income Elasticity		-	0.7	0.9	0.9	0.8
Total Electricity Consumption by all sectors	TOE	27,099	75,731	112,251	220,816	510,435
Average Annual Growth Rate	(%)	-	10.8	8.2	7.0	5.7
Income Elasticity		-	1.8	1.5	1.4	1.2
Total Energy Consumption by all sectors	TOE	181,531	397,202	529,035	819,470	1,662,922
Average Annual Growth Rate	(%)	-	8.1	5.9	4.5	4.8
Income Elasticity		-	1.3	1.1	0.9	1.0
GDP at constant (1990)	Rs. million	27,183	48,932	63,798	103,036	203,246
Average Annual Growth Rate	(%)	-	6.1	5.4	4.9	4.6

Table 7.3.11 PEAK ELECTRICITY DEMAND (Base Case)

	1985	1995	2000	2010	2025	1995/1985	2000/1995	2010/2000	2025/2010	2025/1995
Total electricity consumption	320,900	895,085	1,327,514	2,824,889	7,192,740	10.8	8.2	7.8	6.4	7.2
Electricity consumption per hour	36	101	152	322	821	10.8	8.6	7.8	6.4	7.3
Load factor (%)	51.1	57.9	61.2	63.0	63.0	1.3	1.1	0.3	0.0	0.3
Peak Electricity Demand	85	200	286	579	1474	8.9	7.4	7.3	6.4	6.9
Self consumption and loss (%)	22.4	16.9	14.8	13.0	13.0	-2.8	-2.6	-1.3	0.0	-0.9

PEAK ELECTRICITY DEMAND (High Case)

	1985	1995	2000	2010	2025	1995/1985	2000/1995	2010/2000	2025/2010	2025/1995
Total electricity consumption	320,900	895,085	1,333,925	3,557,598	9,124,976	10.8	8.3	10.3	6.5	8.0
Electricity consumption per hour	36	101	152	406	1,042	10.8	8.7	10.3	6.5	8.1
Load factor (%)	51.1	57.9	61.2	63.0	63.0	1.3	1.1	0.3	0.0	0.3
Peak Electricity Demand	85	200	287	729	1,871	8.9	7.5	9.8	6.5	7.7
Self consumption and loss (%)	22.4	16.9	14.8	13.0	13.0	-2.8	-2.6	-1.3	0.0	-0.9

PEAK ELECTRICITY DEMAND (Low Case)

	1985	1995	2000	2010	2025	1995/1985	2000/1995	2010/2000	2025/2010	2025/1995
Total electricity consumption	320,900	895,085	1,326,131	2,608,708	6,030,253	10.8	8.2	7.	5.7	6.6
Electricity consumption per hour	36	101	151	298	688	10.8	8.5	7.	5.7	6.6
Load factor (%)	51.1	57.9	61.2	63.0	63.0	1.3	1.1	0.3	0.0	0.3
Peak Electricity Demand	85	200	286	535	1236	8.9	7.4	6.5	5.7	6.3
Self consumption and loss (%)	22.4	16.9	14.8	13.0	13.0	-2.8	-2.6	-1.3	0.0	-0.9

(Source: CSO and JICA Study Team)

Table 7.3.12 (a) ENERGY BALANCE TABLE IN TOE (Case01)

1995	Coal	Gasoline	Diesel	Jet Fuel	Kerosene	Fuel Oil	LPG	Fuel Wood	Charcoal	Hydro	Bagasse	Electricity	Total
Indigenous Production								4,940	962	11,558	31,582		49,043
Import	39,113	90,675	255,470	125,041	44,639	195,998	36,396						787,333
Export (Bunkering)			-133,960	-125,041		-20,562							-279,564
TPES	39,113	90,675	121,510	0	44,639	175,436	36,396	4,940	962	11,558	31,582	0	556,812
Electricity Generation	-18,779		-2,625		-33,625	-137,171				-11,558	-31,582	76,977	-158,363
TFC (Inland)	20,334	90,675	118,885	0	11,014	38,266	36,396	4,940	962	0	0	76,977	398,448
Industry Sector	20,334		17,428			38,266	2,754	1,482				27,733	107,996
Transport Sector		90,675	101,458										192,132
Commercial Sector							3,402		592			19,550	23,544
Domestic Sector					11,014		30,240	3,458	370			28,448	73,530
Statistical error	0	0	0	0	0	0	0	0	0	0	0	1,246	1,246

Notes:

TPES: Total Primary Energy Supply

TFC: Total Final Consumption

Table 7.3.12 (b) ENERGY BALANCE TABLE IN TOE (Case01)

2000	Coal	Gasoline	Diesel	Jet Fuel	Kerosene	Fuel Oil	LPG	Fuel Wood	Charcoal	Hydro	Bagasse	Electricity	Total
Indigenous Production								1,792	421	11,180	61,384		74,777
Import	59,133	115,210	311,048	138,056	38,743	308,729	53,395						1,024,314
Export (Bunkering)			-152,253	-138,056		-22,702							-313,011
TPES	59,133	115,210	158,796	0	38,743	286,027	53,395	1,792	421	11,180	61,384	0	786,080
Electricity Generation	-30,235		-4,480		-29,760	-227,855				-11,180	-61,384	114,166	-250,729
TFC	28,898	115,210	154,315	0	8,983	58,171	53,395	1,792	421	0	0	114,166	535,352
Industry Sector	28,898		21,278			58,171	4,187	1,500				43,249	157,283
Transport Sector		115,210	133,166										248,376
Commercial Sector							6,621		300			27,985	34,906
Domestic Sector					6,503		42,587	1,792	121			41,134	92,138
Statistical error	0	0	(129.24)	0	2,480	0	0	-1,500	0	0	0	1,798	2,649

Notes:

TPES: Total Primary Energy Supply

TFC: Total Final Consumption

Table 7.3.12 (c) ENERGY BALANCE TABLE IN TOE (Case01)

2010	Coal	Gasoline	Diesel	Jet Fuel	Kerosene	Fuel Oil	LPG	Fuel Wood	Charcoal	Hydro	Bagasse	Electricity	Total
Indigenous Production								192	313	11,180	78,137		89,822
Import	109,734	197,233	377,349	168,289	32,938	696,467	90,911						1,672,922
Export (Bunkering)			-185,595	-168,289		-27,674							-381,558
TPES	109,734	197,233	191,754	0	32,938	668,793	90,911	192	313	11,180	78,137	0	1,381,185
Electricity Generation	-53,175		-10,603		-29,760	-539,255				-11,180	-78,137	242,940	-479,169
TFC (Inland)	56,559	197,233	181,150	0	3,178	129,539	90,911	192	313	0	0	242,940	902,016
Industry Sector	56,559		25,731			129,539	9,323	1,500				101,259	323,911
Transport Sector		197,233	155,725										352,958
Commercial Sector							20,003		300			56,700	77,003
Domestic Sector					698		61,585	192	13			81,155	143,644
Statistical error	0	0	(305.87)	0	2,480	0	0	-1,500	0	0	0	3,826	4,500

Notes:

TPES: Total Primary Energy Supply

TFC: Total Final Consumption

Table 7.3.12 (d) ENERGY BALANCE TABLE IN TOE (Case01)

2025	Coal	Gasoline	Diesel	Jet Fuel	Kerosene	Fuel Oil	LPG	Fuel Wood	Charcoal	Hydro	Bagasse	Electricity	Total
Indigenous Production								7	300	11,180	162,440		173,927
Import	2,252,877	352,393	514,778	226,495	32,265	1,087,176	227,410						4,693,393
Export (Bunkering)			-249,787	-226,495		-37,246							-513,527
TPES	2,252,877	352,393	264,991	0	32,265	1,049,930	227,410	7	300	11,180	162,440	0	4,353,793
Electricity Generation	-2,062,719		-12,081		-29,760	-614,407				-11,180	-162,440	618,576	-2,274,012
TFC (Inland)	190,158	352,393	252,910	0	2,505	435,523	227,410	7	300	0	0	618,576	2,079,781
Industry Sector	190,158		16,898			435,523	49,950	1,500				315,871	1,009,899
Transport Sector		352,393	236,360										588,753
Commercial Sector							88,939		300			149,775	239,014
Domestic Sector					25		88,522	7	0			143,188	231,742
Statistical error	0	0	(348.49)	0	2,480	0	0	-1,500	0	0	0	9,741	10,373

Notes:

TPES: Total Primary Energy Supply

TFC: Total Final Consumption

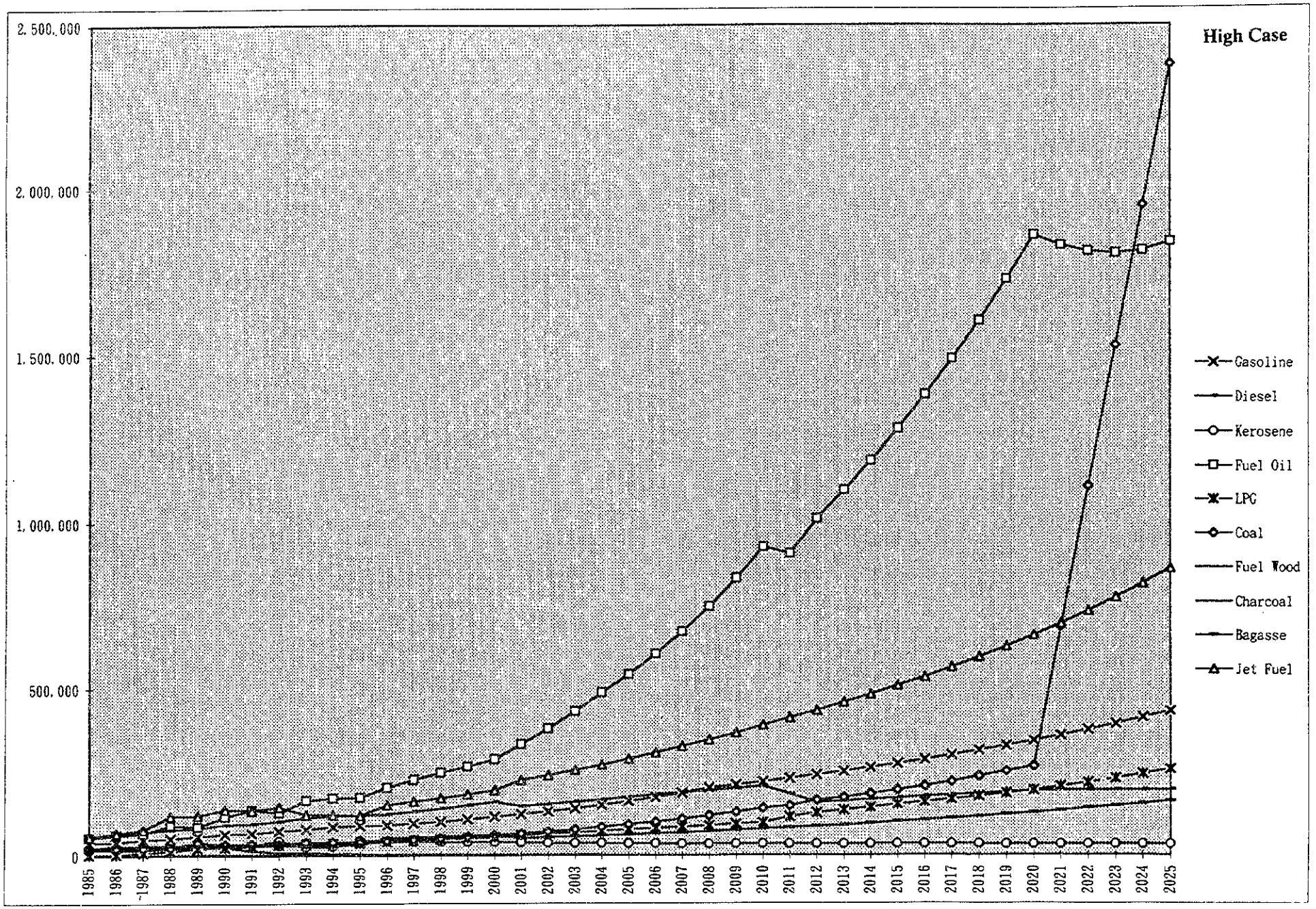
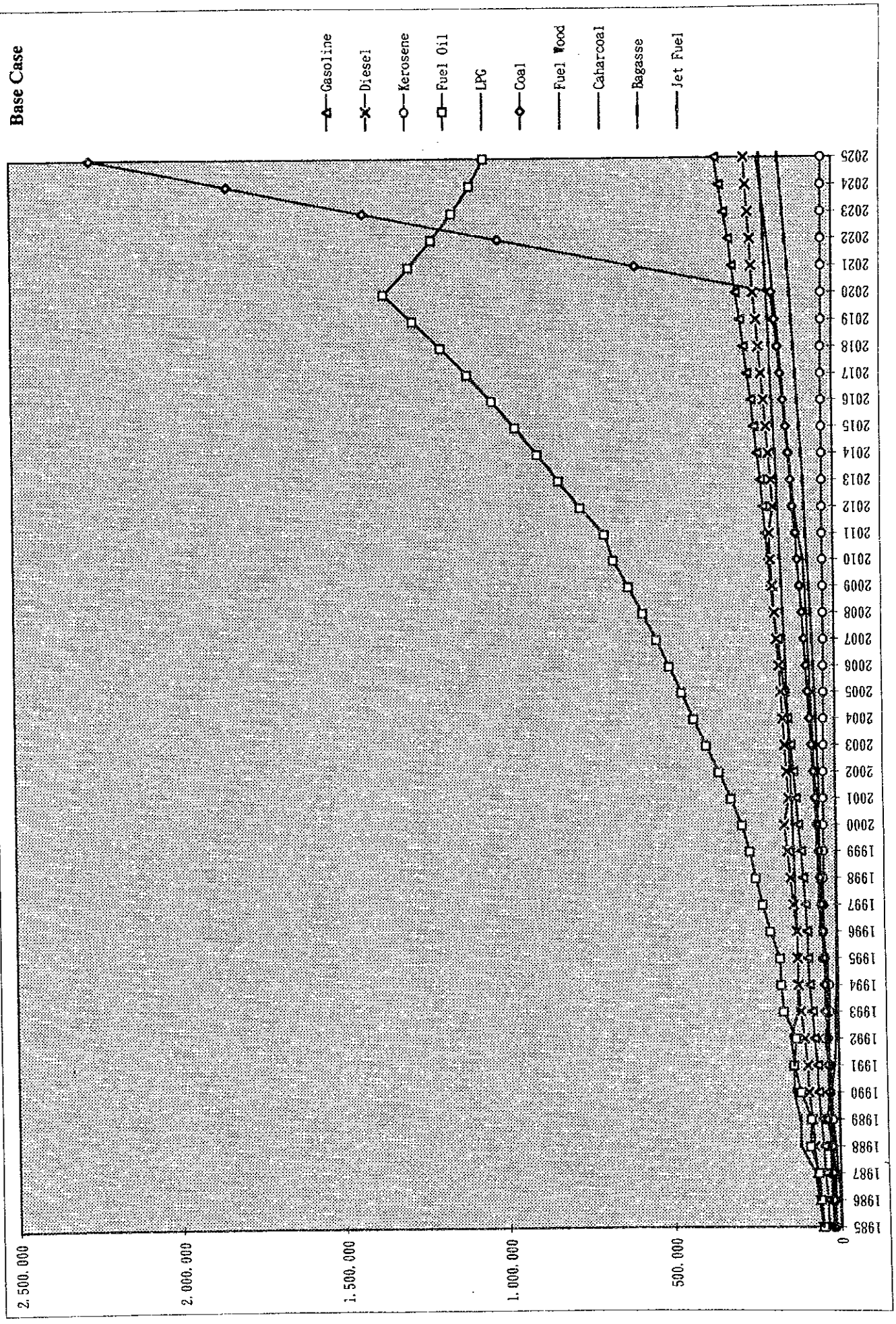


Figure 7.3.1 ENERGY DEMAND BY TYPE OF ENERGY


Base Case
Gasoline
Diesel
Kerosene
Fuel Oil
LPG
Coal
Fuel Wood
Caharcoal
Bagasse
Jet Fuel
2.500.000
2.000.000
1.500.000
1.000.000
500.000
0
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
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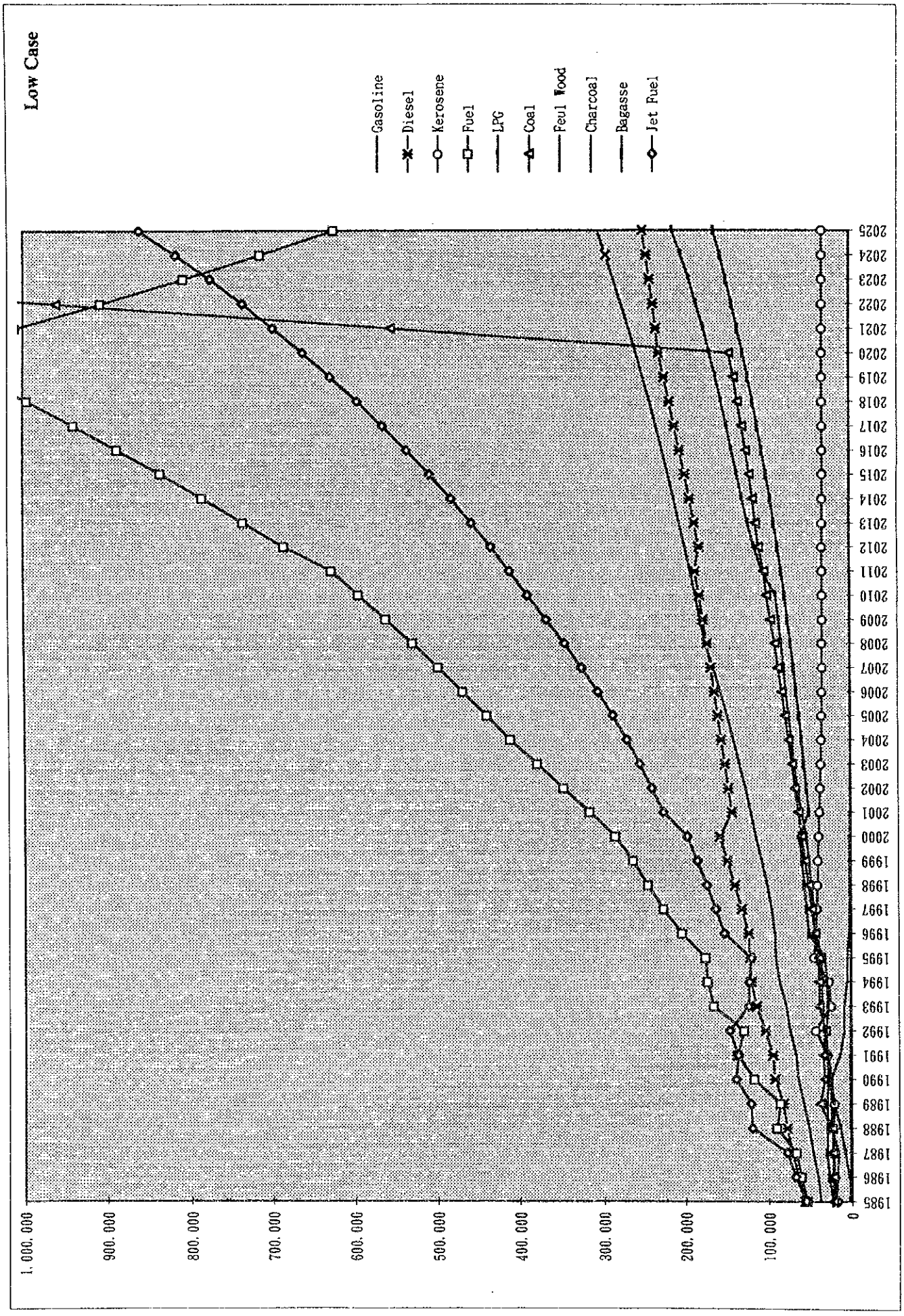
2017
2018
2019
2020
2021
2022
2023
2024
2025


Low Case
Gasoline
Diesel
Kerosene
Fuel
LPG
Coal
Feul Wood
Charcoal
Bagasse
Jet Fuel
1,000,000
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
1985
1986
1987
1988
1989
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2023
2024
2025

7.4 Prospect of New Energy Development (Potential of New Energy to be commercially applicable by AD2025)

Presently, in Mauritius, the new energy, which is being used in the commercial scale, is only solar energy for the water heaters, which are installed in the households, hotels, restaurants etc. The number of the water heaters installed in Mauritius have reached to 18,000 (7.5% of total household). In addition, the wind power generation was introduced on semi-commercial scale in the past (180kW one and 40 kW four). However, except one unit in Rodrigues island most of the units mechanically failed by the cyclone, and operation are interrupted. At present, no positive activities for development of new energy utilization in the country are not existing, and therefore the significant increase of new energy supply in the country in near future seems unlikely. However, in the long term the development of use of new energy will be promoted under the condition of rise of electricity tariff and/or the cost of petroleum fuel. The cooperation between the Government and the private sector to develop new energy technology to improve the design of wind mill or solar heater to withstand the natural conditions of the country and to provide soft loans required for installation of such new energy facilities is very much desirable. In general, energy efficient new plant require significant initial investment, which may be the obstade for the individual parties to provide for the implementation without adequate assistance from the Government. In any case, there is the potential to develop the energy supply from new energy sources up to 1-3% of total energy requirement in future.

In addition to the solar heat and the wind energy, the utilization of photovoltiac energy has good possibility to be adopted as a new energy supply in the country. At this moment, the cost of photovotiac power supply is still costly than the traditional fossil fuel power generation. (Ref. 6.2.1)

However, the progress of the technology improvement is very rapid and the cost will be competitive to the traditional energy within 5-10 years. The sun shine in the country is adequate for this technology. The solar power generation by the large office buildings or the power supply in the isolated island will be the most probable application in future, but the quantitative assessment for the future application is not possible at this stage.

Further, the technology of co-generation of electricity and heat for large office building, hotel, hospital etc. have already developed in the industrially developed countries. This scheme may be implemented near future in the country.

However, the technical fundamental, which is required to develop the application of such sophisticated technology must be established at the first place.