8. Database

The Energy Database has two parts, which include the energy production, the primary energy supply and the final energy supply via conversion sectors, called supply side, and energy consumption in each sector and sub-sector, called demand side.

There are two files in this Database. One is a energy statistics file that is data input file using physical unit of each fuel, and the other is energy balance file that is converted to "ktoe", oil equivalent value. Both files are used for the model building.

8.1 Data Gathering

Several yearbooks and annual reports concerning energy are published by Central Agency for Public Mobilization and Statistics (CAPMAS), Egyptian General Petroleum Corporation (EGPC) and Egyptian Electricity Authority (EEA). The data in those books are summarized and, hence, not enough for the model building. The planned model is a short-term projection until 2005/06. Therefore, the historical data is gathered from 1981/82 to the latest year available, considering data reliability and consistency. Each data has its own unique reliability, and the regression method will need continuous historical data of 10 to 15 years to obtain reliable formulas. Each formula uses the appropriate term of the data depending on the reliability and necessity of the data for the formula.

OEP members obtained the data for the supply side through great efforts from CAPMAS, EGPC, EEA and the old documents from 1981/82 in OEP library. As a result, the data of the supply side is nearly enough for model building. The electricity Data from EEA annual report, which is thoroughly prepared with great attentions to the detail, is quite enough for the purpose as well.

On the other hand, data acquired for the consumption side is considerably rough. Although the data of the main sector is available, the data of the sub-sectors is not enough to make the model practical and useful for the analysis of the use and tendency of energy in each sub sector.

Since all data of the industry sector is usually summarized as one sector in Egypt,, the production data and the energy consumption data are not separated in each sub sector. In spite of OEP's efforts, such kind of data could not be obtained during the Study. The data source did not have such kind of detailed data but only had limited original data, which are too basic and needed much examination and evaluation to make useful data tables. Besides these data did not cover all sectors. As a result, the industry was treated as only one

category containing all industry sectors.

8.2 Energy Flow

The gathered energy data, to be applied in the model building, are verified with the energy flow in Egypt,. Egypt is a petroleum-producing country, and foreign investors are contracted to operate almost all oil and gas fields, resulting in a unique primary energy flow for Egypt. These are found in crude oil, natural gas, condensates and LPG flow.

The energy statistical data is identified in the energy flow and put into the Energy statistical file.

Figure 8.2.1 shows the general primary energy flow in Egypt. It is discussed by both OEP and JICA to get the bilateral recognition of the actual energy flow in Egypt. According to this primary energy flow diagram, every data has its definition. The indigenous production, crude oil, natural gas and condensates are shared between Egypt and "Partners" with contract. Besides, Egypt pays some amount of products to "Partners" as net expenses. Those total is defined as "Partner Share". After that, Egypt buys some amount of the primary energy from "Partners" by FOB. This is defined as "From Partner". Finally, the energy data gets TPES (Total Primary Energy Supply) subtracting import, export, international marine bunker and aviation and stock change.

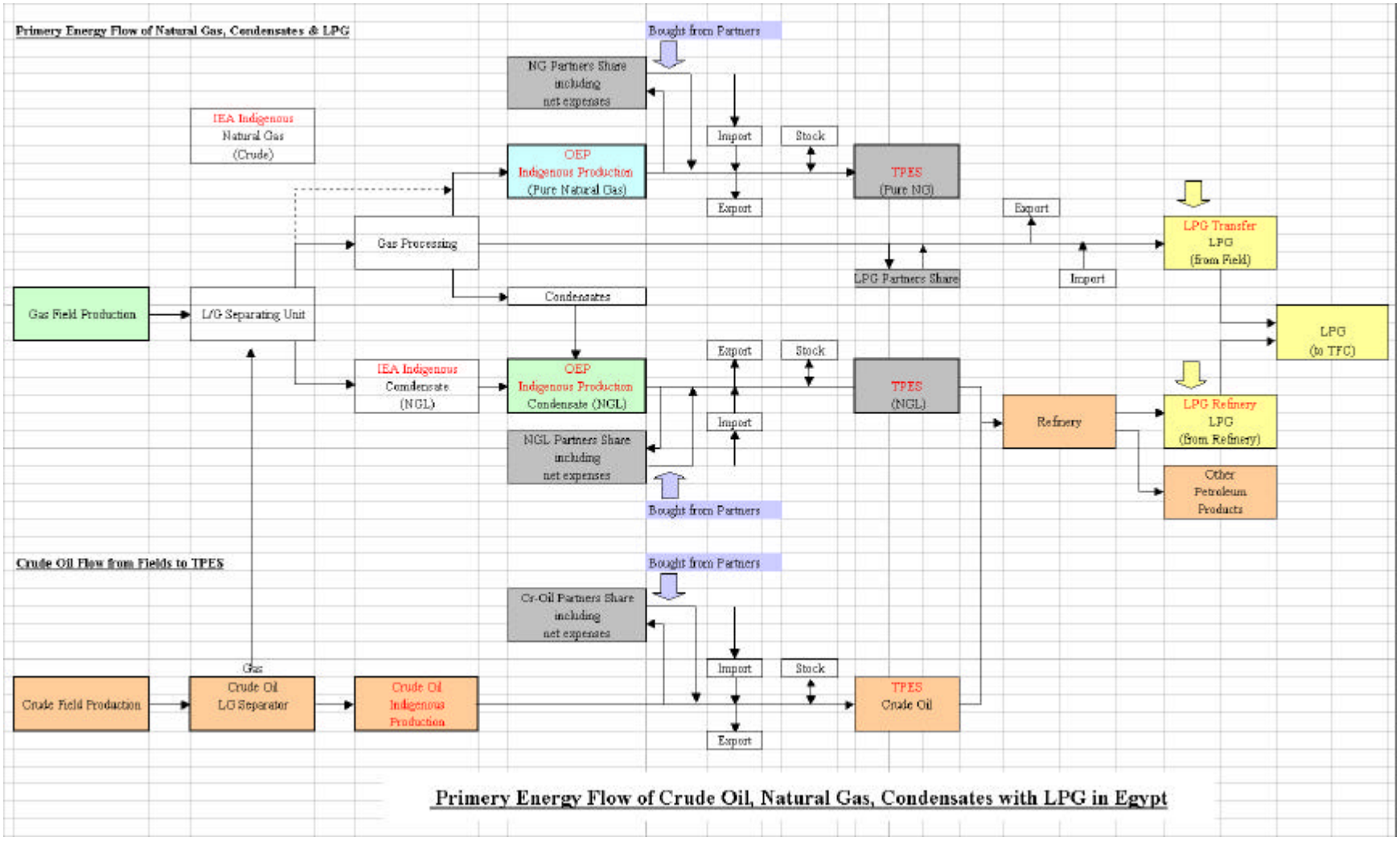
As for coal, there is a coal flow in Egypt. Coal flow data in the iron and steel industry is still missing; the data cells of coke oven or blast furnace in the iron and steel industry are remained blank in Excel sheet.

Natural gas production is increasing significantly in recent year. "Partners" are also developing gas fields and operating gas fields and gas processing facilities to get LPG. "Partner Share" and "From Partner" are also defined in this flow.

As for LPG, there are two sources of LPG supply in Egypt--one for "From Fields" defined as "Transfer" and the other for refinery product. The Database has no definition for "Partner Share" and "From Partner" for LPG because LPG is a secondary energy.

Some amount of crude oil is remained with "Partners". The energy balance does not follow the down stream, defined as minus. All of natural gas and condensates are transferred to the conversion sector and final demand sector. All crude oil of TPES also become the throughput of refineries. Small differences on energy balance table remains to be defined as statistical differences.

Figure 8.2.1 Primary Energy Flow in Egypt



A large amount of natural gas production is expected in Egypt in the near future. Utilizing natural gas for domestic fuel reduces the growth of petroleum products consumption. Also, Egypt has plans to export natural gas to neighboring countries through pipelines. Egypt recently has reached the protocol agreement with Turkey to export LNG in early 2000. The primary energy flow in Egypt will be dramatically changed in several years.

8.3 Database Configuration

The Database has one pair of Microsoft Excel files for each category. One file uses physical unit, kton/GWh, and the other file uses unified unit, kiloton oil equivalent, "ktoe". It will be easy to maintain these files since these Excel files do not use specially-defined functions or Macro but only use the originally-provided functions and formula in Excel. Also, all data sheets have the same format for an easy access to Energy balance Table and other summarized data table.

8.3.1 File List

Pair of files have five kinds of contents as below.

(1) Original actual Trend Files

Eg_OEP_DBAL_v22.xls (kton / GWh)
Eg_OEP_DBAL_u22.xls (ktoe)

Eg: Egypt
OEP: Organization of Energy Planning
DBAL: Detail Balance
v: Value, Physical unit, kton/GWh
u: Unified unit, ktoe

All files using Physical Unit (kton, GWh) are hereafter called "v" file
All files using Unified Unit (ktoe) are hereafter called "u" file

(2) Modified Actual Trend Files for the Model Building

Eg_OEP_DBAL_v30.xls (kton / GWh)
Eg_OEP_DBAL_u30.xls (ktoe)

Assumption to Coal and Coke Flow is added because of lack of data.

(3) Original Projection Data Files for Data Linkage

By Demand Forecasting Model

Eg_OEP_DBAL_vf_FMT.xls (kton / GWh)
Eg_OEP_DBAL_uf_FMT.xls (ktoe)

By LP Supply Model

Eg_OEP_DBAL_vf_LPT.xls (kton / GWh)
Eg_OEP_DBAL_uf_LPT.xls (ktoe)

(4) Future Projection Data Files by Final Model (Simple E)

Eg_OEP_DBAL_vf_FM**.xls (kton / GWh)
Eg_OEP_DBAL_uf_FM**.xls (ktoe)

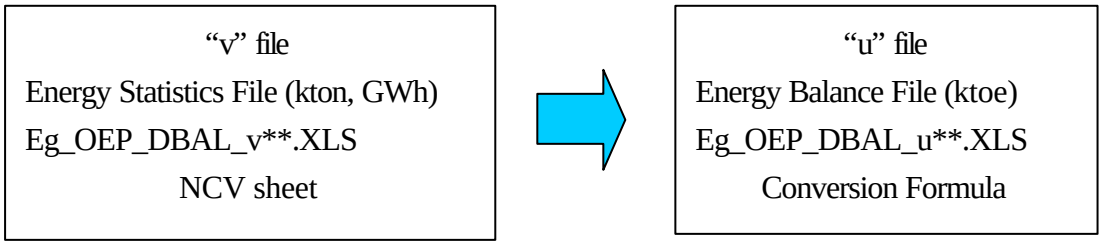
(5) Future Projection Data Files by LP Supply Model

Eg_OEP_DBAL_vf_LP**.xls (kton / GWh)
Eg_OEP_DBAL_uf_LP**.xls (ktoe)

8.3.2 Pair of Files

The Data Conversion to Physical unit to Unified unit, ktoe, is calculated by formulas in "u" file, by the flow from "v" files to "u" files, by using Net Calorific Value of Egypt in "v" file.

Figure 8.3.1 Pair of Files

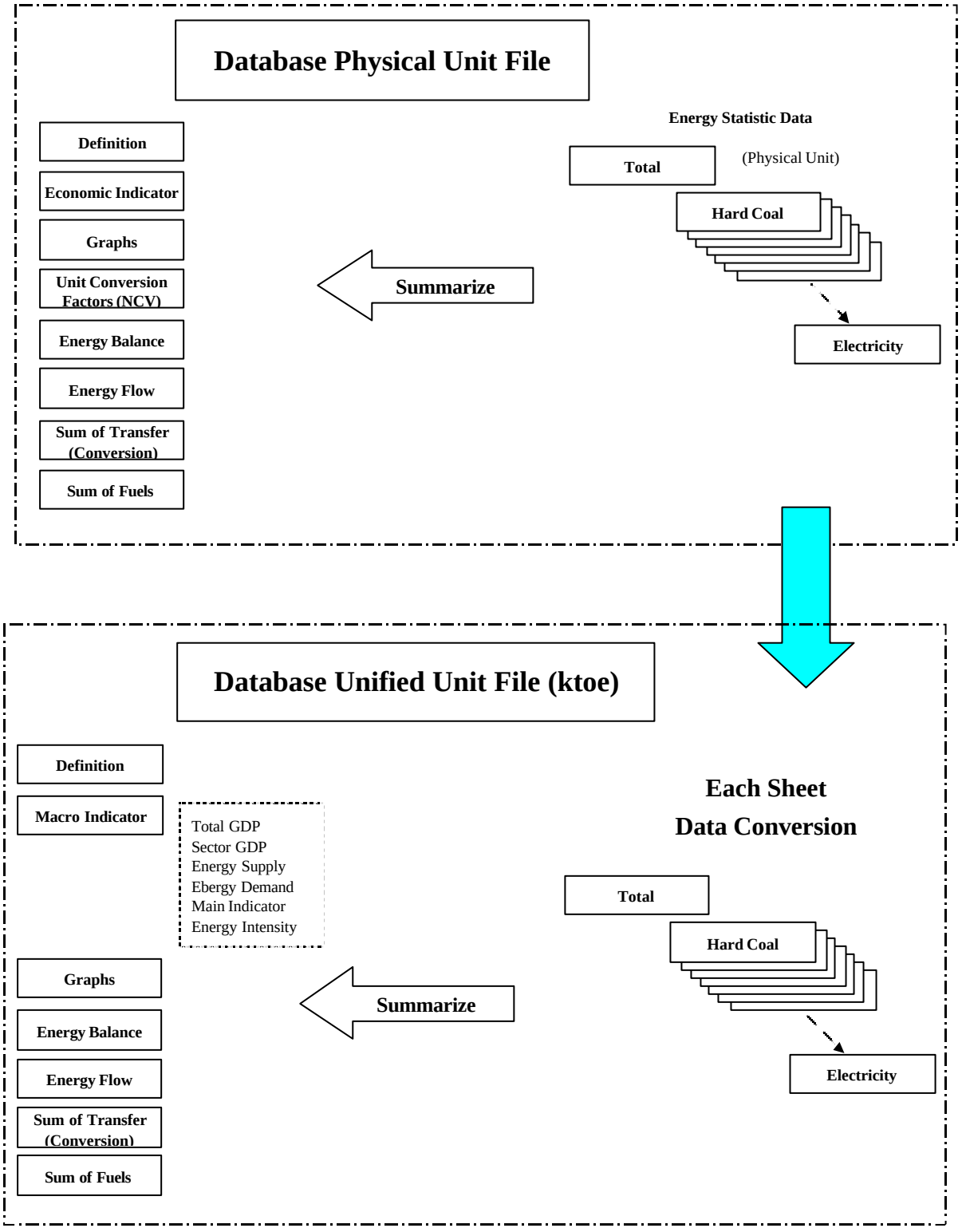


This means "Pair of Files" for one Database.

8.3.3 Configuration of the Pair of Files

The detailed configuration of the pair of files is shown in Figure 8.3.2 and explained in Chapter 8.4 in detail.

Figure 8.3.2 The Detailed Configuration of Pair of Files



8.3.4 Sheet List of Database Files

Definition of each sheet is described in the following table. Database files have these Excel sheets.

Table 8.3.1 Excel Sheet Definition in Database

Sheet Nam	Definition
Dif	Sheet and Flow Item Definition
IND	Main Economical Indicators
Graph	Graph en-bedded sheet
EB	Energy Balance Table
Flow	Energy Flow by Energy Balance sheet
Transfer	Transformation intensity, Efficiency
Fuels	Fuels of each node of Energy Flow
Total	Energy Total
Hard_C	Hard Coal for fuel
Coke_C	Coking Coal for Coke Oven
COC	Coke Oven Coke
GWG	Gas Works Gas for Town Gas
COG	Coke Oven Gas
BFG	Blust Furnace Gas
OxG	Oxygen Steel Furnace Gas
Renew	Combustible Renewable, Waste and Solar Heating
Bio	Solid Biomass and Animal Products
NG	Natural Gas
Crude Oil	Crude Oil
NGL	Natural Gas Liquids: Condensate
Ref_Gas	Refinery Gas: Top Gas from Refinery
LPG	Liquefied Petroleum Gases
Gasoline	Motor Gasoline
Jet	Kerosene type Jet Fuel
Kero	Kerosene
Diesel	Gas/Diesel Oil
Res_FO	Residual Fuel Oil: Mazut
Naphtha	Naphtha
Lub	Lubricants
Bitu	Bitumen
P_Coke	Petroleum Coke
P_Non	Non-specified Petroleum Products
Hydro	Hydro Generation
Wind	Wind Generation
Solar	Solar Generation
Elec	Electricity

8.3.5 Terms Definition of Energy Flow in Database Files

Each flow item is defined as shown in Table 8.3.2; IEA Format is basically specialized for OEP. These items are used for column items in each data sheet of the Database files.

Table 8.3.2 Items Definition of Energy Flow

Flow Definition

Item	
Indigenous Production	Energy which is produced from its own natural resources
Partners Share	Partner Share of indigenous production by contract including net expenses
From Partners	Primary energy bought from Partners
Import	Import of commodities
Export	Export of commodities
International Marine Bunkers/Aviation	Marine Bunkers and Fuels for International Aviation
Stock Changes	Difference between Initial Stock minus Final Stock
Total Primary Energy Supply	
Transfers	Transfer such as Gas Processing to produce LPG
Statistical Differences	Difference between TFC from supply side and that of demand side
Transformation Sector	Total of Transformation Sector input/output
Public Electricity Plants	Public Electricity Generation
Autoproducer Electricity Plants	Electricity Generation by Private Sector
Coke Ovens	Coke Oven
Gas Works	Civil Gas Producing
For Blast Furnace Gas	Blust Furnace in iron/steel industry
Petrochemicals for Raw Materials/Energy	Throughput to Petrochemical Industries as Raw Materials
Oil Refineries	Throughput to Refinery
Liquefaction	Liquefaction of Natural Gas
Non-specified (Transformation)	Other Category of Transformation
Energy Sector Use	Total of Energy Use in Transformation Sector
Coal Mines	Coal Mine Own Use
Oil and Gas Extraction	Injection of Oil/Gas Field
Coke Ovens use	Coke Oven Own Use
Gas Works use	Gas Works Own Use
Oil Refineries use	Oil Refinery Own Use
Own Use in Electricity	Electricity Own Use
Used for Pumped Storage	Used Electricity for Pumped Storage Hydro Generation
Nuclear Industry	Energy Use in Nuclear Industries
Non-specified (Energy)	Non-specified Own Use in Transformation Sector
Distribution Losses	Electricity Distribution Losses
Total Final Consumption (Supply)	TFC calculated from Supply Side
Total Final Consumption	TFC calculated by Demand Side
Industry Sector	Energy Consumption in Industry Sector
Iron and Steel	Energy Consumption in Iron and Steel Industry
Chemical and Petrochemical	Energy Consumption in Chemical and Petrochemical Industry
Non-Ferrous Metals	Energy Consumption in Non-Ferrous Metal Industry
Non-Metallic Minerals	Energy Consumption in Non-Metallic Minerals Industry
Transport Equipment	Energy Consumption in Transport Equipment Industry
Machinery	Energy Consumption in Machinery Industry
Mining and Quarrying	Energy Consumption in Mining and Quarrying Industry
Food and Tobacco	Energy Consumption in Food and Tobacco Industry
Paper	Energy Consumption in Paper Industry
Construction	Energy Consumption in Construction Industry
Textile and Leather	Energy Consumption in Textile and Leather Industry
Non-specified (Industry)	Energy Consumption in Non-Specified Industry
Transport Sector	Energy Consumption in Transportation Sector
Others (Transport)	Energy Consumption in Other transportation Sub-sector
Domestic Air Transport	Energy Consumption in Domestic Air Transport Sub-sector
Road	Energy Consumption in Road Transport Sub-sector
Rail	Energy Consumption in Rail Transport Sub-sector
Pipeline Transport	Energy Consumption in Pipeline Transport Sub-sector
River	Energy Consumption in River Transport Sub-sector
Internal Navigation	Energy Consumption in Internal Navigation Transport Sub-sector
Non-specified (Transport)	Energy Consumption in Non-specified Transport Sub-sector
Other Sectors	Energy Consumption in Other Sectors
Agriculture	Energy Consumption in Agriculture Sectors
Public Utility	Energy Consumption in Public Utility Sectors
Commercial	Energy Consumption in Commercial Sectors
Residential	Energy Consumption in Residential Sectors
Government	Energy Consumption in Government Sectors
Non-specified (Other)	Energy Consumption in Non-specified Sectors
Non-Energy Use	Non Energy Use

8.4 Explanation of Each Sheet

Trends of several main data are prepared as embedded graphs on "Graph" sheet.

(1) Graph List on "Graph" Sheet in "u" file

1) Macro Indicator
   - Sector GDP (bar chart)
   - Energy Intensity by Sector (line graph)
   - Energy Intensity per GDP, capita (line graph)
   - Electricity Consumption (line graph)

2) Summary of Energy Flow
   - Trend of Primary Energy Supply (line graph)
   - Trend of Primary Energy Supply with Partner's Share (line graph)
   - Trend of Domestic Primary Energy Supply (line graph)
   - Final Energy Consumption by Sector (line graph)
   - Final Energy Consumption by Sector (bar chart)
   - Final Energy Consumption by Sector (share bar chart)
   - Energy Consumption of Branch Sector in Industry (bar chart)
   - Crude Oil Production & Partner's Share (line graph)

3) Primary Energy
   - Primary Energy Production by Fuel (bar chart)
   - Import by Fuels (bar chart)
   - Export by Fuels (bar chart)
   - Primary Energy Supply by Fuel (bar chart)
   - Primary Energy Supply by Fuel (share bar chart)

4) Refinery
   - Petroleum Products from Refinery (bar chart)
   - Petroleum Products from Refinery (share bar chart)

5) Electricity
   - Fuel Use in Electricity (bar chart)
   - Fuel Use in Electricity (share bar chart)
   - Efficiency of Thermal Generation (Gross) (line graph)
   - Electricity Generation by Generator (bar chart)

6) Final Consumption

Total Final Consumption by Fuel (bar chart)

Total Final Consumption by Fuel (share bar chart)

Energy Consumption in Industry Sector by Fuel (bar chart)

Energy Consumption in Industry Sector by Fuel (share bar chart)

Energy Consumption in Transportation Sector by Fuel (bar chart)

Energy Consumption in Transportation Sector by Fuel (share bar chart)

Energy Consumption in Residential Sector by Fuel (bar chart)

Energy Consumption in Residential Sector by Fuel (share bar chart)

Energy Consumption in Agriculture Sector by Fuel (bar chart)

Energy Consumption in Agriculture Sector by Fuel (share bar chart)

(2) Graph List on "Graph" Sheet in "v" file

These graphs are only for checking miss-input of source data.

Indigenous Production (line graph)

Import (line graph)

Export (line graph)

TPES: Total Primary Energy Supply (line graph)

TFC: Total Final Energy Consumption (line graph)

Energy Consumption in Industry Sector (line graph)

Energy Consumption in Transportation Sector (line graph)

Energy Consumption in Agriculture Sector (line graph)

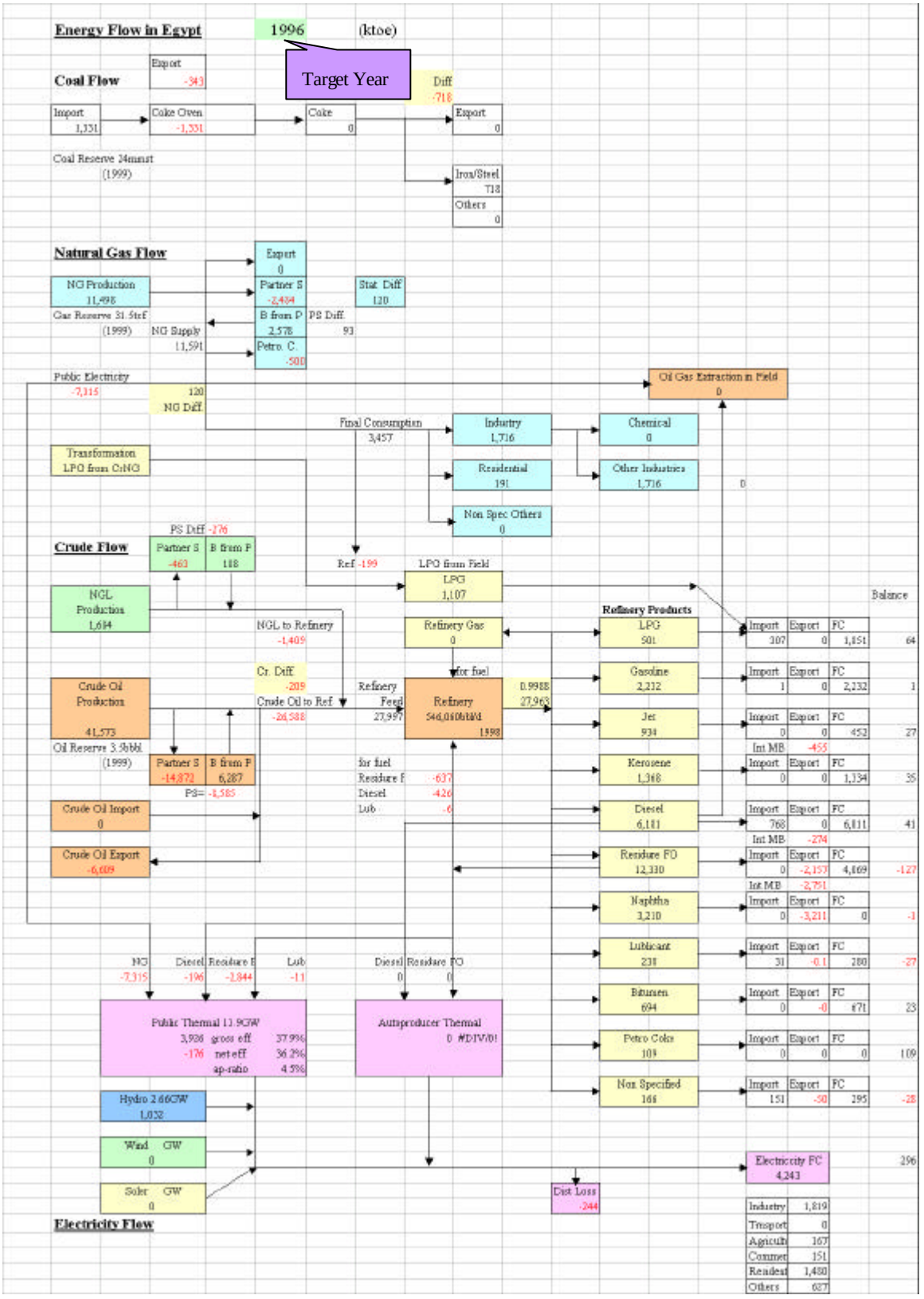
Energy Consumption in Residential Sector (line graph)

(3) "Flow" Sheet

Energy Flow of the specified year is prepared on this sheet as the following example of "u" file.

These data are referred from "EB" sheet by inputting a target year in cell C3 on "EB" sheet.

Figure 8.4.1 Example of Energy Flow



(4) "IND" Sheet

1) "v" file

There are Macro Indicators from IEA Database (1999) for reference in "v" file on this sheet.

2) "u" file

This sheet is the data table of GDP, population and some typically-calculated indicators. The table items are as follows;

Table 8.4.1 Macro Indicator Items in "u" File

Items
Macro Economic Data (million LE)
TOTAL GDP (FACTOR COST)
GDP Adjusted agriculture GDP
GDP Adjusted industry GDP
GDP Adjusted petroleum GDP
GDP Adjusted electricity GDP
GDP Adjusted construction GDP
GDP Adjusted transportation GDP
GDP Adjusted commercial GDP
GDP Adjusted government GDP
GDP Adjusted others GDP
Population (1,000persons)
Energy Supply
Energy Indigenous Production (ktoe)
TPES (ktoe)
Crude Oil Domestic Supply (ktoe)
Electricity Generation (GWh)
Electricity Consumption (GWh)
Energy Consumption (ktoe)
Industry
Agriculture
Transportation
Commercial
Public Utility
Goverbment Use
Non-Energy Use
Main Indicator
TPES/GDP (ktoe/million LE)
TPES/Population (toe per capita)
Energy production/TPES
Oil Supply/GDP (toe per thousand LE)
Oil Supply/Population (toe per capita)
Electricity Consumption/GDP (kWh per LE)
Electricity Consumption/Population (kWh per capita)
Sectoral Energy Intensity (ktoe/million LE)
Industry
Agriculture
Transportation
Commercial
Government

(5) "NCV" Sheet in "v" file

The Net Calorific Values of Egypt are defined in this sheet. These are used to obtain unified unit, "ktoe", from physical unit, "kton, GWh". Examples of Net Calorific Value is listed in the following table. This sheet is prepared only in "v" files.

Table 8.4.2 Example of "NCV" Sheet

Average Net Calorific Value
toe/ton

	1997	1998	1999	2000	2001	2002	2003	2004	2005
Hard Coal	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
Brown Coal	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Coking Coal	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
Other Bituminous Coal and Anthracite	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
Sub-Bituminous Coal	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Lignite	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Coke Oven Coke	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Natural Gas	1.111	1.111	1.111	1.111	1.111	1.111	1.111	1.111	1.111
Crude Oil	0.995	0.995	0.995	0.995	0.995	0.995	0.995	0.995	0.995
Natural Gas Liquids	1.103	1.103	1.103	1.103	1.103	1.103	1.103	1.103	1.103
Refinery Feedstocks	1.103	1.103	1.103	1.103	1.103	1.103	1.103	1.103	1.103
Additives/Blending Components	0	0	0	0	0	0	0	0	0
Input of Origin not Crude or NGL	0	0	0	0	0	0	0	0	0
Refinery Gas	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125
Ethane	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125
Liquefied Petroleum Gases	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125
Motor Gasoline	1.103	1.103	1.103	1.103	1.103	1.103	1.103	1.103	1.103
Aviation Gasoline	1.103	1.103	1.103	1.103	1.103	1.103	1.103	1.103	1.103
Gasoline type Jet Fuel	1.103	1.103	1.103	1.103	1.103	1.103	1.103	1.103	1.103
Kerosene type Jet Fuel	1.086	1.086	1.086	1.086	1.086	1.086	1.086	1.086	1.086
Kerosene	1.086	1.086	1.086	1.086	1.086	1.086	1.086	1.086	1.086
Gas/Diesel Oil	1.066	1.066	1.066	1.066	1.066	1.066	1.066	1.066	1.066
Residual Fuel Oil	0.972	0.972	0.972	0.972	0.972	0.972	0.972	0.972	0.972
Naphtha	1.103	1.103	1.103	1.103	1.103	1.103	1.103	1.103	1.103
White Spirit	1.086	1.086	1.086	1.086	1.086	1.086	1.086	1.086	1.086
Lubricants	0.972	0.972	0.972	0.972	0.972	0.972	0.972	0.972	0.972
Bitumen	0.972	0.972	0.972	0.972	0.972	0.972	0.972	0.972	0.972
Paraffin Waxes	0.972	0.972	0.972	0.972	0.972	0.972	0.972	0.972	0.972
Petroleum Coke	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74
Non-specified Petroleum Products	0.972	0.972	0.972	0.972	0.972	0.972	0.972	0.972	0.972
kcal/ton_oil_equivalent	10000	10000	10000	10000	10000	10000	10000	10000	10000
Elec	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086

(6) "EB" sheet

The Energy Balance Table is prepared as illustrated in the following example. The Table is automatically calculated from each fuel sheet of Database file by using "HLOOKUP" Excel function.

Table 8.4.3 Example of Energy Balance Table

Egypt Energy Balance (KTOE)	2004												
Item	Hard_C	NG	Crude	Crude_Oil	NGL	Ref_Gas	LPG	Gasoline	Jet	Kero	Diesel	Res_FO	Naphtha
Indigenous Production	32	20,884	43,733	41,656	2,077	0	0	0	0	0	0	0	0
Partners Share	0	-8,682	-17,166	-15,125	-2,040	0	0	0	0	0	0	0	0
From Partners	0	8,682	10,598	8,557	2,040	0	0	0	0	0	0	0	0
Import	0	0	0	0	0	0	1,450	165	0	0	3,011	0	0
Export	-32	0	-1,033	-1,033	0	0	0	0	-368	-835	0	-2,966	-4,081
International Marine Bunkers/Aviation	0	0	0	0	0	0	0	0	-394	0	-259	-2,284	0
Stock Changes	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Primary Energy Supply	0	20,884	36,132	34,055	2,077	0	1,450	165	-762	-835	2,752	-5,250	-4,081
Transfers	0	0	0	0	0	0	1,612	0	0	0	0	0	0
Statistical Differences	0	0	0	0	0	0	0	0	0	0	0	0	0
Transformation Sector	0	-13,904	-36,132	-34,055	-2,077	0	610	3,023	1,267	1,447	7,939	10,100	4,081
Public Electricity Plants	0	-12,908	0	0	0	0	0	0	0	0	-86	-5,330	0
Autoproducer Electricity Plants	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works	0	0	0	0	0	0	0	0	0	0	0	0	0
For Blast Furnace Gas	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemicals for Raw Materials/Energy	0	-996	0	0	0	0	0	0	0	0	0	0	0
Oil Refineries	0	0	-36,132	-34,055	-2,077	0	610	3,023	1,267	1,447	8,024	15,431	4,081
Liquefaction	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0
Energy Sector Use	0	-656	0	0	0	0	0	0	0	0	-610	-407	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens use	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works use	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil Refineries use	0	-656	0	0	0	0	0	0	0	0	-610	-407	0
Own Use in Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0
Used for Pumped Storage	0	0	0	0	0	0	0	0	0	0	0	0	0
Nuclear Industry	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Final Consumption (Supply)	0	6,324	0	0	0	0	3,671	3,188	506	612	10,081	4,444	0
Total Final Consumption	0	6,324	0	0	0	0	3,671	3,188	506	612	10,081	4,444	0
Industry Sector	0	3,602	0	0	0	0	322	0	0	3	3,054	3,646	0
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical and Petrochemical	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-Ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-Metallic Minerals	0	0	0	0	0	0	0	0	0	0	0	0	0
Transport Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0
Food and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0	0
Paper	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0
Textile and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-specified (Industry)	0	3,602	0	0	0	0	322	0	0	3	3,054	3,646	0
Transport Sector	0	0	0	0	0	0	0	3,188	506	0	7,018	798	0
Others (Transportation)	0	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	506	0	0	0	0
Road	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0	0
River	0	0	0	0	0	0	0	0	0	0	0	0	0
Internal Navigation	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-specified (Transport)	0	0	0	0	0	0	0	3,188	0	0	7,018	798	0
Other Sectors	0	615	0	0	0	0	3,350	0	0	609	9	0	0
Agriculture	0	0	0	0	0	0	0	0	0	61	9	0	0
Public Utility	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	615	0	0	0	0	3,350	0	0	548	0	0	0
Government	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-specified (Other)	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-Energy Use	0	2,107	0	0	0	0	0	0	0	0	0	0	0

(7) "Fuel" Sheet

"Fuel" sheet is a table summarized by fuel at each energy flow for utilizing these data.

Data Flow points are:

Indigenous Production

Partner's Share

From Partners

Import

Export

International Marine Bunkers/Aviation Jet

Total Primary Energy Supply

Transfer, Public Electricity, Coke Oven, Petrochemicals

Total Final Consumption

Industry Sector

Transport Sector, Agriculture Sector, Residential Sector, Commercial Sector

Table 8.4.4 Example of "Fuel" Sheet

	1997	1998	1999	2000	2001	2002	2003	2004	2005
TPES									
Hard_C	0	0	0	0	0	0	0	0	0
Coke_C	1,321	0	1,110	1,363	1,361	1,359	1,358	1,358	1,358
COC	-325	0	-325	-325	-325	-325	-325	-325	-325
GWG	0	0	0	0	0	0	0	0	0
COG	0	0	0	0	0	0	0	0	0
BFG	0	0	0	0	0	0	0	0	0
OxG	0	0	0	0	0	0	0	0	0
Renew	93	93	93	94	294	294	295	295	0
Bio	13	13	17	18	18	20	20	21	0
NG	11,719	13,189	13,258	13,669	14,126	14,638	15,205	15,830	16,588
Crude	28,782	29,071	30,135	30,110	30,092	30,083	30,079	30,082	30,091
Crude_Oil	27,236	27,400	27,227	27,458	27,617	27,708	27,738	27,709	27,626
NGL	1,546	1,671	2,908	2,652	2,475	2,375	2,342	2,374	2,465
Ref_Gas	0	0	0	0	0	0	0	0	0
LPG	599	825	800	978	1,154	1,335	1,523	1,724	1,939
Gasoline	126	133	-66	3	68	130	188	240	291
Jet	-510	-559	-515	-507	-498	-491	-483	-475	-467
Kero	-35	-13	-244	-352	-452	-544	-628	-704	-771
Diesel	780	1,449	1,367	1,953	2,609	3,346	4,163	5,067	6,069
Res_FO	-3,898	-3,533	-4,024	-3,524	-2,979	-2,383	-2,271	-2,284	-2,287
Naphtha	-3,245	-3,358	-3,392	-3,392	-3,392	-3,392	-3,392	-3,392	-3,392
Lub	48	35	83	107	134	165	201	241	286
Bitu	0	-3	116	142	167	191	213	233	252
P_Coke	0	0	0	0	0	0	0	0	0
P_Non	152	145	179	185	191	197	203	210	218
Hydro	1,051	1,290	1,314	1,337	1,359	1,380	1,400	1,419	1,437
Elec	0	0	0	0	0	0	0	0	0
Total	36,672	38,779	39,911	41,897	44,005	46,114	47,925	49,835	51,287

LP Model and Environmental Model utilize this table.

(8) "Transfer" Sheet

"Transfer" sheet is the data table, summarizing transformation (energy conversion) sector to obtain producing intensity in refinery and thermal efficiency in power generation.

Table 8.4.5 Example of "Transfer" Sheet

TRANS FORMATION SECTOR										
COUNTRY: EGYPT										
Units: KTOE										
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Transfer										
Natural Gas Liquids	0	0	0	0	0	0	0	0	0	0
Liquefied Petroleum Gases	1,107	1,106	1,130	1,192	1,275	1,359	1,444	1,530	1,618	1,707
Refineries										
In let										
Crude	27,997	28,782	29,071	30,970	32,380	33,766	35,351	37,132	39,116	41,322
Crude Oil	26,588	27,236	27,400	29,190	30,519	31,825	33,319	34,998	36,868	38,947
Natural Gas Liquids	1,409	1,546	1,671	1,780	1,861	1,941	2,032	2,134	2,248	2,375
Petroleum Products										
Refinery Gas	0	0	0	0	0	0	0	0	0	0
Liquefied Petroleum Gases	501	519	491	523	546	570	596	626	660	697
Motor Gasoline	2,335	2,335	2,432	2,591	2,709	2,825	2,958	3,106	3,272	3,457
Kerosene type Jet Fuel	934	951	1,020	1,086	1,136	1,184	1,240	1,302	1,372	1,449
Kerosene	1,368	1,250	1,164	1,240	1,297	1,352	1,416	1,487	1,566	1,655
Gas/Diesel Oil	6,181	6,561	6,456	6,878	7,191	7,499	7,851	8,246	8,687	9,177
Residual Fuel Oil	12,330	12,912	12,415	13,226	13,828	14,420	15,097	15,858	16,705	17,647
Naphtha	3,210	3,423	3,284	3,498	3,657	3,814	3,993	4,194	4,418	4,667
Lubricants	238	249	259	275	288	300	314	330	348	368
Bitumen	694	784	927	988	1,033	1,077	1,128	1,184	1,248	1,318
Petroleum Coke	109	116	121	129	135	141	148	155	163	173
Non-specified Petroleum Prod	166	165	176	188	196	205	215	225	237	251
Products Total	28,066	29,265	28,745	30,623	32,017	33,388	34,955	36,716	38,678	40,859
Material Balance Differences	-69	-482	326	347	363	379	396	416	439	463
Intensity of Refinery										
Refinery Gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Liquefied Petroleum Gases	0.018	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
Motor Gasoline	0.083	0.081	0.084	0.084	0.084	0.084	0.084	0.084	0.084	0.084
Kerosene type Jet Fuel	0.033	0.033	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035
Kerosene	0.049	0.043	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
Gas/Diesel Oil	0.221	0.228	0.222	0.222	0.222	0.222	0.222	0.222	0.222	0.222
Residual Fuel Oil	0.440	0.449	0.427	0.427	0.427	0.427	0.427	0.427	0.427	0.427
Naphtha	0.115	0.119	0.113	0.113	0.113	0.113	0.113	0.113	0.113	0.113
Lubricants	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009
Bitumen	0.025	0.027	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032
Petroleum Coke	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
Non-specified Petroleum Prod	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
	1.002	1.017	0.989	0.989	0.989	0.989	0.989	0.989	0.989	0.989
Own Use in Refinery										
Refinery Gas	0	0	0	0	0	0	0	0	0	0
Residual Fuel Oil	-637	-577	-543	-538	-521	-502	-483	-464	-444	-424
Own Use Total	-637	-577	-543	-538	-521	-502	-483	-464	-444	-424
Electricity										
Natural Gas	7,315	7,228	7,675	8,953	9,768	10,750	11,887	13,185	14,649	16,291
Gas/Diesel Oil	196	222	129	120	112	105	98	91	86	81
Residual Fuel Oil	2,844	3,986	4,208	3,997	4,288	4,644	5,059	5,531	6,061	6,652
Fuel Total	10,355	11,436	12,012	13,070	14,167	15,498	17,044	18,807	20,796	23,023
Thermal Generation (Gross)	3,926	4,310	4,558	4,960	5,376	5,881	6,467	7,137	7,891	8,736
Efficiency (Gross)	37.9%	37.7%	37.9%	37.9%	37.9%	37.9%	37.9%	37.9%	37.9%	37.9%
Hydro	1,032	1,051	1,290	1,314	1,337	1,359	1,380	1,400	1,419	1,437
Wind	0	0	0	0	0	0	0	0	0	0
Solar	0	0	0	0	0	0	0	7	7	0
Total Electricity (Gross)	4,958	5,361	5,848	6,274	6,713	7,240	7,847	8,537	9,310	10,174
Own Use in Electricity	-176	-193	-215	-226	-237	-250	-266	-283	-302	-322
Distribution Loss	-540	-612	-765	-813	-861	-919	-986	-1,062	-1,146	-1,239
Total Loss in Electricity	-716	-805	-980	-1,039	-1,098	-1,170	-1,252	-1,344	-1,447	-1,561
Ap Ratio	3.54%	3.60%	3.68%	3.60%	3.53%	3.46%	3.38%	3.31%	3.24%	3.17%
Distribution Loss Ratio	10.89%	11.41%	13.09%	12.96%	12.83%	12.70%	12.57%	12.44%	12.31%	12.18%
Total Loss Ratio	14.43%	15.01%	16.76%	16.56%	16.36%	16.16%	15.95%	15.75%	15.55%	15.34%

8.4.1 “Total” Sheet

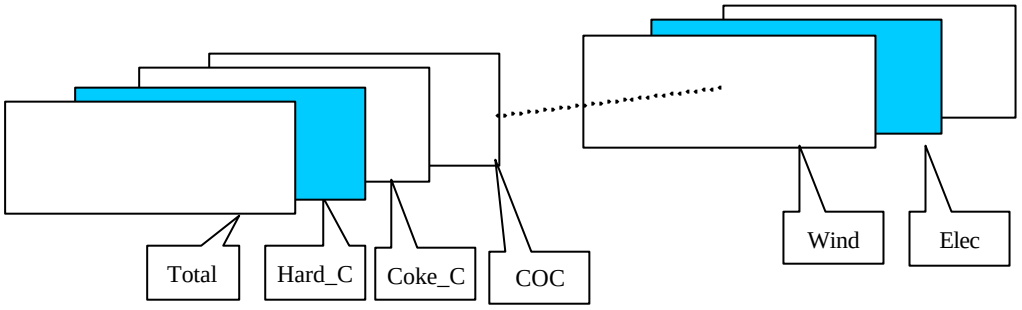
“Total” sheet is summation of each fuel by yearly series that has the same format as each fuel sheet.

To make summation of each cell in each sheet on Total sheet, with an example of cell Q6.

Q6 = SUM(Hard_C:Elec!Q6)
This formula is equal to
=Hard_C!Q6+Coak_C!Q6+COC!Q6+……+Wind!Q6+Elec!Q6

Summation of Cell Q6 in all sheets between “Hard_C” sheet (colored) and “Elec” sheet (colored).

Figure 8.4.2 Summation in “Total” sheet



8.4.2 Each Fuel Sheet

There are 28 sheets of fuel in Database files. These sheets have absolutely the same format to make getting Energy Balance Table and adding new fuel sheets easy.
Sheet list is shown in 8.3.4, and Item definition is explained in 8.3.5. The time series for each sheet is between FY 1981 and FY 2005.

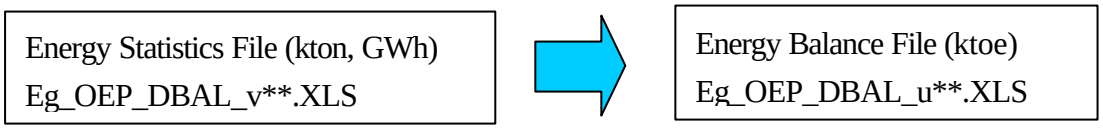
8.5 Data Calculation Method in Database Files

This section explains Data calculation method to get unified unit, ktoe, and Energy Balance table.

8.5.1 Conversion from Physical Unit (kton, GWh) to Unified Unit (ktoe)

This data conversion is calculated by the flow from "v" files to "u" files by using Net Calorific Value of Egypt.

Figure 8.5.1 Unit Conversion



Crude Oil Export at 1996FY on "Crude_Oil" sheet in Eg_OEP_DBAL_v30.xls.

Figure 8.5.2 Target Cell on Crude Oil Sheet in "v" File

PRODUCT: Crude Oil
COUNTRY: EGYPT
Units: KTON

Item	1990	1991	1992	1993	1994	1995	1996	1997	1998
Indigenous Production	44375	43821	44967	45186	44292	43994	41782	40293	39516
Partners Share	-16082	-15842	-16401	-16346	-15898	-15602	-14947		14705
From Partners	2954	3485	5176	5100	4975	5318	6319	R10	6060
Import									
Export	-7883	-8424	-10261	-9460	-7973	-7864	-6642	-3968	-2934
International Marine Bunkers/Avia	0	0	0	0	0	0	0	0	0
Stock Changes	-140	-251	-251	-321.608	184.9246	49.24623	210.0503	-415.075	-398.995
Total Primary Energy Supply	23224	22789	23230	24158.39	25580.92	25895.25	26722.05	27372.92	27538.01
Transfers									
Statistical Differences	0	0	0	0	0	0	0	0	0
Transformation Sector	-23224	-22789	-23230	-24158.4	-25580.9	-25895.2	-26722.1	-27372.9	-27538
Public Electricity Plants									
Autoproducer Electricity Plants									
Coke Ovens									
Gas Works									
For Blast Furnace Gas									
Petrochemical Industry									
Oil Refineries	-23224	-22789	-23230	-24158.4	-25580.9	-25895.2	-26722.1	-27372.9	-27538
Liquefaction									
Non-specified (Transformation)									
Energy Sector Use	0	0	0	0	0	0	0	0	0

In this case, the target data, in Cell R10, on this sheet is "-6642 kton".

"Crude_Oil" sheet in "u" file (ktoe), (in this case, Eg_OEP_DBAL_u30.xls)

Figure 8.5.3 Target Cell on Crude Oil Sheet in "u" File

PRODUCT: Crude Oil
COUNTRY: EGYPT
Units: KTOE

Item	1990	1991	1992	1993	1994	1995	1996	1997	1998
Indigenous Production	44153.13	43601.9	44742.17	44960.07	44070.54	43774.03	41573.09	40091.54	39318.42
Partners Share	-16001.6	-15762.8	-16319	-16264.3	-15818.5	-15524	-14872.3	[illegible]	-14631.5
From Partners	2939.23	3467.575	5150.12	5074.5	4950.125	5291.41	6287.405	[illegible]	6029.7
Import	0	0	0	0	0	0	0	[illegible]	0
Export	-7843.59	-8381.88	-10209.7	-9412.7	-7933.14	-7824.68	-6608.79	-3948.16	-2919.33
International Marine Bunkers/Avi	0	0	0	0	0	0	0	0	0
Stock Changes	-139.3	-249.745	-249.745	-320	184	49	209	-413	-397
Total Primary Energy Supply	23107.88	22675.06	23113.85	24037.6	25453.02	25765.77	26588.44	27236.06	27400.32
Transfers	0	0	0	0	0	0	0	0	0
Statistical Differences	0	0	0	0	0	0	0	0	0
Transformation Sector	-23107.9	-22675.1	-23113.9	-24037.6	-25453	-25765.8	-26588.4	-27236.1	-27400.3
Public Electricity Plants	0	0	0	0	0	0	0	0	0
Autoproducer Electricity Plants	0	0	0	0	0	0	0	0	0
Coke Ovens	0	0	0	0	0	0	0	0	0
Gas Works	0	0	0	0	0	0	0	0	0
For Blast Furnace Gas	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0
Oil Refineries	-23107.9	-22675.1	-23113.9	-24037.6	-25453	-25765.8	-26588.4	-27236.1	-27400.3
Liquefaction	0	0	0	0	0	0	0	0	0
Non-specified (Transformation)	0	0	0	0	0	0	0	0	0
Energy Sector Use	0	0	0	0	0	0	0	0	0

R10

Crude Oil Export, which was "-6608.79ktoe" in FY 1996, is calculated with the following formula.

Cell R10 on "Crude_Oil" sheet of Eg_OEP_DBAL_u30.xls

R10 = [Eg_OEP_DBAL_v30.xls]NCV!R$14*[Eg_OEP_DBAL_v30.xls]Crude_Oil!R10

[Eg_OEP_DBAL_v30.xls] : Referred "v" File Name (physical unit)

NCV! : Sheet name (Net Calorific Value) of the reference "v" file

R$14 : Cell data reference (Crude Oil NCV at 1996FY), "0.995ktoe/kton"

R column means 1996FY, 14 row means Crude Oil NCV on "NCV" sheet and "$" means not to change the reference "Row" during formula copy to other cells on the "Crude_Oil" sheet of this "u" file (Eg_OEP_DBAL_u30.xls)

Crude Oil! : Sheet name ("Crude_Oil" sheet) of the reference "v" file

R10 : Referred Cell (Crude Oil Export at 1996FY)

The R10 without any "$" means inter-reference cell is changeable during copying this formula to other cells in this sheet ("Crude_Oil" sheet)

8.5.2 Energy Balance Table of each Year

Data of each fuel sheet are picked up to Energy Balance table, "EB" sheet, by using Excel function, "HLOOKUP".

"EB" sheet in Eg_OEP_DBAL_u30.xls

Figure 8.5.4 Explanation of "EB" Sheet in "u" File

Egypt Energy Balance (KTOE) 1996

C3

Target item

N10

Item	Hard_C	Coke_C	Crude_Oil	NGL	Ref_Gas	LPG	Gasoline	Jet	Kero	Diesel
Indigenous Production	22.78	0	41573.09	1684.281	0	0	0	0	0	0
Partners Share	0	0	-14872.3	-463.26	0	0	0	0	0	0
From Partners	0	0	6287.405	18	0	0	0	0	0	0
Import	0	1330.62	0		0	306.5625	1.103	0	0	767.52
Export	-22.78	0	-6608.79		0	0	0	0	0	0
International Marine Bunkers/Aviation	0	0	0	0	0	0	-0.08824	-455.034	0	-273.962
Stock Changes	0	0	209	0	0	-7.875	-19.854	0	13.032	-13.858
Total Primary Energy Supply	0	1330.62	26588.44	1408.531	0	298.6875	-18.8392	-455.034	13.032	479.7
Transfers	0	0	0	0	0	1107	0	0	0	0
Statistical Differences	0	0	0	0	0	-55.6875	18.83924	-27.15	-47.784	-27.2896
Transformation Sector	0	-1330.62	-26588.4	-1408.53	0	500.625	2232.472	933.96	1368.36	5985.164
Public Electricity Plants	0	0	0	0	0	0	0	0	0	-196.144
Autoproducer Electricity Plants	0	0	0	0	0	0	0	0	0	0
Coke Ovens	0	-1330.62	0	0	0	0	0	0	0	0
Gas Works	0	0	0	0	0	0	0	0	0	0
For Blast Furnace Gas	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0
Oil Refineries	0	0	-26588.4	-1408.53	0	500.625	2232.472	933.96	1368.36	6181.308
Liquefaction	0	0	0	0	0	0	0	0	0	0
Non-specified (Transformation)	0	0	0	0	0	0	0	0	0	0
Energy Sector Use	0	0	0	0	0	0	0	0	0	-426.4

Export of Crude Oil at 1996FY.

N10=HLOOKUP($C$3,Crude_Oil!$B$5:$AG$68,MATCH($B10,Crude_Oil!$B$5:$B$68,0),FALSE)

HLOOKUP: data picking up from reference data area

$C$3: refers to the year of energy balance. it is also referred by "Flow" sheet Cell "H2"

Crude_Oil!$B$5:$AG$68: data area of "Crude_Oil" sheet. For other columns, it must be changed to the same area in other sheets, such as NGL!$B$5:$AG$68. "$" means this area should not be changed during formula copy to other cells on this column.

MATCH($B10,Crude_Oil!$B$5:$B$68,0):

Finding as same target item on "Crude_Oil" sheet

$B10: Target item to find ("Export" in this case)

"$" means absolute reference should not be changed during formula copy to other cells

Crude_Oil!$B$5:$B$68: items area on "Crude_Oil" sheet

0 : Parameter of this function finding exactly the same or equal

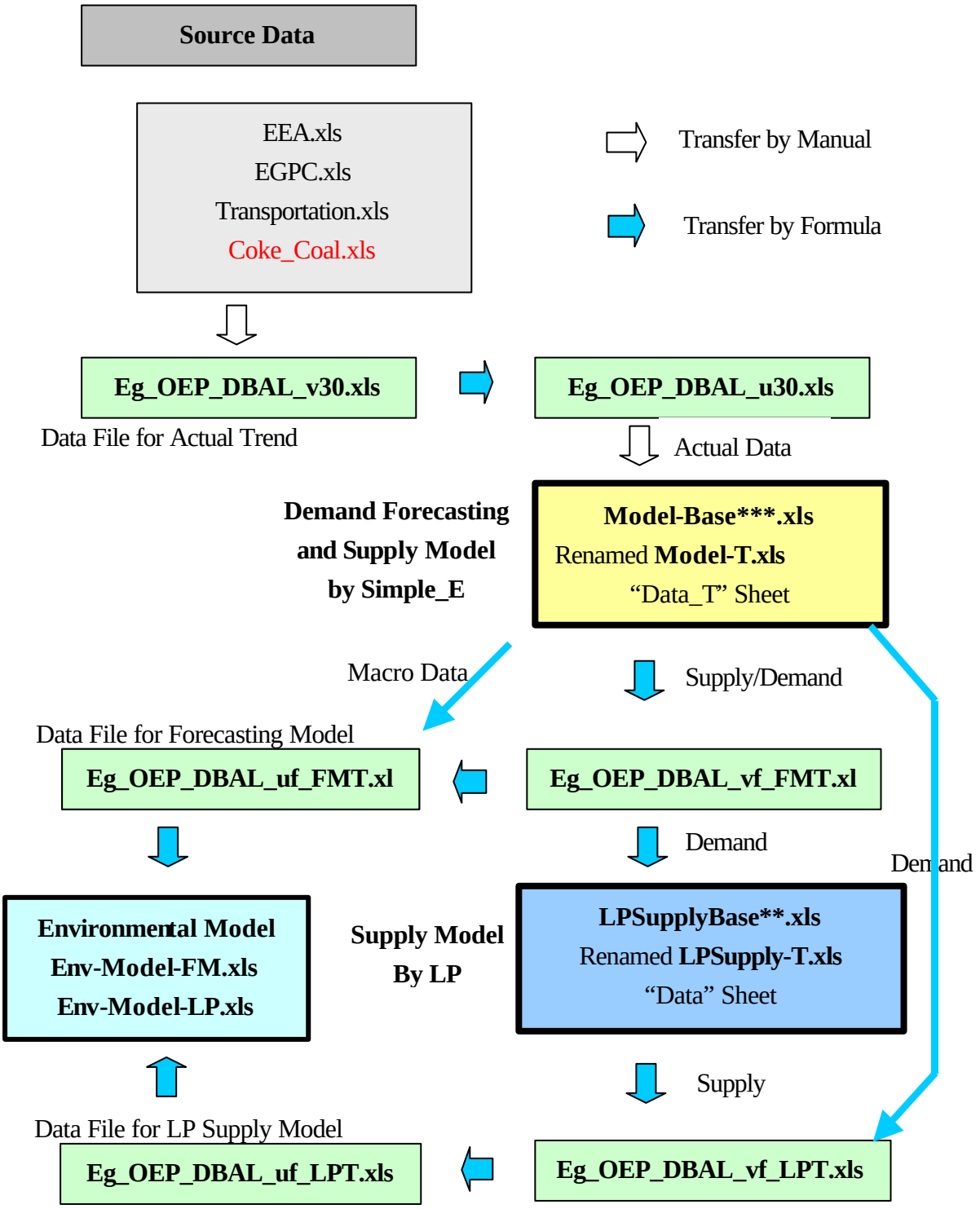
False : If not be found, error value will show as "#N/A"

8.6 Data Linkage

All Data are basically transferred with this Flow. White arrow means Data transfer by manual, and Colored arrow means Automatic Data transfer by several formulas.

8.6.1 Data Transfer Flow

Figure 8.6.1 Data Linkage between each File



8.6.2 The Inter-reference of each File

(1) Eg_OEP_DBAL_vf_FMT.xls refers Model-T.xls

This file has direct linkage formulas to **Data_T** sheet in **Model-T.xls** that gives Demand side data and Supply side data to this "v" file.

(2) Eg_OEP_DBAL_uf_FMT.xls refers Eg_OEP_DBAL_vf_FMT.xls and Model-T.xls

This file has direct linkage formulas to each energy sheet in **Eg_OEP_DBAL_vf_FMT.xls** to make data conversion from physical unit to kiloton oil equivalent unit, "ktoe", and has direct linkage formula to **Data_T** sheet in **Model-T.xls** to obtain the Macro Economic data.

(3) Eg_OEP_DBAL_vf_LPT.xls refers Model-T.xls and LPSupply-T.xls

This file has direct linkage formulas to **Data_T** sheet in **Model-T.xls** to obtain Demand side data and has direct linkage formulas to **Data** sheet in **LPSupply-T.xls** to get Supply side data.

(4) Eg_OEP_DBAL_uf_LPT.xls refers Eg_OEP_DBAL_vf_LPT.xls

This file has direct linkage formula to each energy sheet in **Eg_OEP_DBAL_vf_FMT.xls** to make data conversion from physical unit to "ktoe".

8.6.3 Data Linkage

(1) File Allocation

Two Models and Energy Balance Data files are put in the "Original" folder in "Model" folder.
File allocation is shown in the following box.

```
/Model
        /Original
                Eg_OEP_DBAL_vf_FMT.xls    (kton/GWh)
                Eg_OEP_DBAL_uf_FMT.xls    (ktoe)
                Eg_OEP_DBAL_vf_LPT.xls    (kton/GWh)
                Eg_OEP_DBAL_uf_LPT.xls    (ktoe)
                Model-T.xls
                LPSupply-T.xls
```

(2) Method of Data Linkage

Make new folder with the following way. The new folder name should be a suitable case study code--for example, " Scenario-1".

/Model
    /Original
    /Base Case (New Folder)

Open the folder, "/Model/Original" and select four files shown in red in the following box.

/Model
    /Original
        Eg_OEP_DBAL_vf_FMT.xls (kton/GWh)
        Eg_OEP_DBAL_uf_FMT.xls (ktoe)
        Eg_OEP_DBAL_vf_LPT.xls (kton/GWh)
        Eg_OEP_DBAL_uf_LPT.xls (ktoe)
        Model-T.xls
        LPSupply-T.xls

Copy, not move, those four files to the new folder--"Base Case", for example.

/Model
    /Original
    /Base Case (New Folder)
        Eg_OEP_DBAL_vf_FMT.xls
        Eg_OEP_DBAL_uf_FMT.xls
        Eg_OEP_DBAL_vf_LPT.xls
        Eg_OEP_DBAL_uf_LPT.xls

Copy two files of Models--"Forecasting Model" and "LP Supply Model", in this case. Forecasting Model version is "Base****", and LP Supply Model version is "Base****".

/Model
- /Original
- /Base Case
  - Eg_OEP_DBAL_vf_FMT.xls
  - Eg_OEP_DBAL_uf_FMT.xls
  - Eg_OEP_DBAL_vf_LPT.xls
  - Eg_OEP_DBAL_uf_LPT.xls
  - Model-Base****.xls
  - LPSupplyBase**.xls

Rename these two model files as follows;

/Model
- /Original
- /Base Case
  - Eg_OEP_DBAL_vf_FMT.xls
  - Eg_OEP_DBAL_uf_FMT.xls
  - Eg_OEP_DBAL_vf_LPT.xls
  - Eg_OEP_DBAL_uf_LPT.xls
  - Model-T.xls
  - LPSupply-T.xls

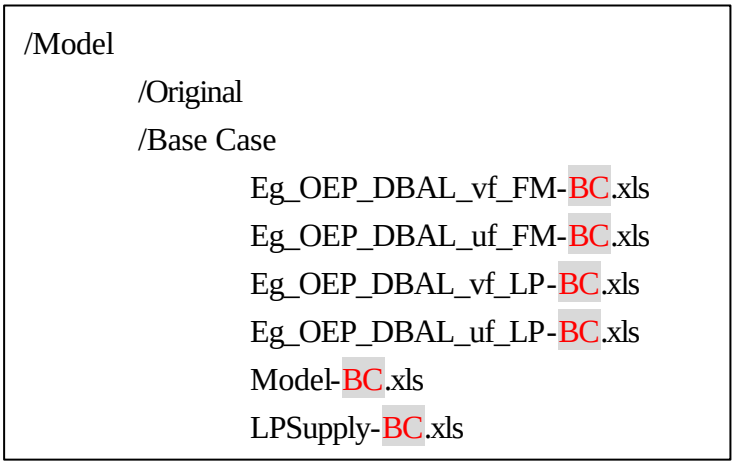
Open all files according the following statements. Then, the inter-relation between all files will be accurately calculated automatically.

1. Eg_OEP_DBAL_vf_FMT.xls
2. Eg_OEP_DBAL_uf_FMT.xls
3. Eg_OEP_DBAL_vf_LPT.xls
4. Eg_OEP_DBAL_uf_LPT.xls
5. LPSupply-T.xls
6. Model-T.xls

This opening order of files is important in making opening these files quickly. When some recalculation message appears, select "No", which means no recalculation at this moment.

In case of saving this Case Study data as specified filename, save all files as new name such

as the following block while all files are opened according to the Data Flow--the first from Model file, the second from "v" file and the third from "u" file. All the interrelation between these files will be automatically changed. "BC" means Base Case in this case. After that, you can delete old name files with "T" suffix in this folder. When overwriting message appears during closing of those new named files, select "Yes". Do not rename any file while it is not opened to avoid destroying inter-relation between these files.



Original files are kept in "Original" folder.

8.7 Method of Data Linkage to Database

8.7.1 Macroeconomic Energy Demand Forecasting Model

Electricity use in Agriculture in 2000 in this case is 215ktoe.

"Simulation" Sheet in the Model-T.xls (Simple E) (ktoe)

Figure 8.7.1 Explanation on Simulation Sheet in the Model

TREND	17	18	19	20	21	22	23	24	25
TIME	1997	1998	1999	2000	2001	2002	2003	2004	2005
AGEL	2,131	2,200	2,339	2,4[illegible]	2,656	2,824	3,002	3,192	3,395
AGELU	183	189	201	215	228	243	258	275	292
AGDO	5	6	7	7	[illegible]	8	9	9	10
AGKE	88	81	76	72	[illegible]	[illegible]	63	61	59
AGLB	41	43	45	47	[illegible]	[illegible]	54	56	59
AGPT	134	131	128	126	125	125	125	126	128
AGFU	93	88	83	79	76	73	72	70	69
AGTL	317	320	329	340	353	367	383	401	420
SAGEL	1	1	1	1	1	1	1	1	1
INELU	1,899	1,969	2,051	2,144	2,247	2,361	2,485	2,619	2,764
INEL	22,079	22,900	23,848	24,926	26,128	27,451	28,894	30,458	32,145
INNP	0	0	0	0	0	0	0	0	0
INDO	2,215	1,800	1,984	2,180	2,378	2,581	2,792	3,011	3,240
INFO	3,682	3,511	3,533	3,555	3,578	3,600	3,623	3,646	3,669
INLP	77	119	142	169	199	233	271	313	361
INKE	3	3	3	3	3	3	3	3	3
INNS	243	274	278	283	287	290	294	297	301
INLB	90	94	98	102	106	110	115	119	124
INBT	753	883	902	922	946	974	1,005	1,039	1,076
INPC	0	0	0	0	0	0	0	0	0
INPT	7,064	6,685	6,941	7,214	7,497	7,792	8,102	8,428	8,774
INNG	1,970	2,121	2,307	2,522	2,758	3,011	3,279	3,561	3,857
STEEL	968	1,048	1,134	1,226	1,325	1,432	1,546	1,669	1,802
INCK	594	625	646	669	695	722	752	784	818

Target Code

Target Year

Target Data

"Data_T" Sheet (Electricity) in the Model-T.xls (Simple E) (ktoe)

Figure 8.7.2 Explanation on "Data-T" Sheet in the Model

COUNTRY: EGYPT
Units: KTON/GWh

Item		1998	1999	2000	2001	2002	2003	2004	2005
PRODUCT: Electricity									
Transport Sector		0	0	0	0	0	0	0	0
Others (Transport)									
Domestic Air Transport									
Road									
Rail									
Pipeline Transport									
River									
Internal Navigation									
Non-specified (Transport)									
Other Sectors		2,898	3,105	3,3[illegible]	3,561	3,806	4,068	4,347	4,646
Agriculture	AGELU	189	201	215	228	243	258	275	292
Public Utillity									
Commercial	CMELU	184	200	219	239	260	282	306	332
Residential	REELU	1,812	1,943	2,086	2,228	2,374	2,525	2,683	2,850
Government	GVTL		760	808	865	930	1,003	1,083	1,172
Non-specified (Other)		714							
Non-Energy Use									

F4

C1449

F1449

Electricity consumption in Agriculture sector in 2000: AGELU(2000)

Picking up the target data, "215ktoe" on "Simulation" sheet, transfer to F1449 on this sheet.

F1449 = HLOOKUP(F$4,Simout,MATCH($C1449,Simitems,0),FALSE)

"Simout" is output area of the "Simulation" sheet, and the top row must be year row.

"Simitems" is the column of variable code name on "Simulation" sheet.

"Elec Sheet" in Eg_OEP_DBAL_vf_FMT.xls (GWh)

Figure 8.7.3 Explanation on "Elec" Sheet in Database

PRODUCT: Electricity
COUNTRY: EGYPT
Units: GWh

Item	1997	1998	1999	2000	2001	2002	2003	2004	2005
Transport Sector	0	0	0	0	0	0	0	0	0
Others (Transport)									
Domestic Air Transport									
Road									
Rail									
Pipeline Transport									
River									
Internal Navigation									
Non-specified (Transport)									
Other Sectors	30,898	33,700	36,101	38,699	41,402	44,261	47,301	50,546	54,023
Agriculture	2,131	2,200	2,339	2,496	2,656	2,824	3,002	3,192	3,395
Public Utility									
Commercial	1,883	2,134	2,321	2,551	2,780	3,020	3,277	3,558	3,866
Residential	18,588	21,066	22,598	24,254	25,909	27,604	29,362	31,200	33,135
Government			8,843	9,399	10,057	10,813	11,659	12,596	13,627
Non-specified (Other)	8,296	8,300	0	0	0	0	0	0	0
Non-Energy Use									

V62

Electricity consumption in Agriculture sector in 2000 on "Elec" sheet, V62 = 2,496GWh

V62 = '[Model-T.xls]Data_T'!F$1449/NCV!V$37

[Model-T.xls]Data_T'!F$1449 means Target cell F1449, "215ktoe", "Data_T" sheet in "Model-T.xls" file.

NCV!V$37 means conversion to physical unit of Electricity, "0.086ktoe/GWh", because all data in "v" file must be physical unit and data from the Model is using "ktoe".

There is "Net Calorific Value" table defined by OEP on the "NCV" sheet of "v" file.

For V37, "V" column means year 2000, "37" row means NCV of Electricity on the "NCV" sheet of "v" file.

"NCV" Sheet in Eg_OEP_DBAL_vf_FMT.xls (ktoe/kton, kton/GWh)

Figure 8.7.4 Explanation on "NCV" Sheet in "v" File of Database

	1998	1999	2000	2001	2002	2003	2004	2005	2006
Refinery Gas	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125
Ethane	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125
Liquefied Petroleum Gases	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125
Motor Gasoline	1.103	1.103	1.103	1.103	1.103	1.103	1.103	1.103	1.103
Aviation Gasoline	1.103	1.103	1.103	1.103	1.103	1.103	1.103	1.103	1.103
Gasoline type Jet Fuel	1.103	1.103	1.103	1.103	1.103	1.103	1.103	1.103	1.103
Kerosene type Jet Fuel	1.086	1.086	1.086	1.086	1.086	1.086	1.086	1.086	1.086
Kerosene	1.086	1.086	1.086	1.086	1.086	1.086	1.086	1.086	1.086
Gas/Diesel Oil	1.066	1.066	1.066	1.066	1.066	1.066	1.066	1.066	1.066
Residual Fuel Oil	0.972	0.972	0.972	0.972	0.972	0.972	0.972	0.972	0.972
Naphtha	1.103	1.103	1.103	1.103	1.103	1.103	1.103	1.103	1.103
White Spirit	1.086	1.086	1.086	1.086	1.086	1.086	1.086	1.086	1.086
Lubricants	0.972	0.972	0.972	0.972	0.972	0.972	0.972	0.972	0.972
Bitumen	0.972	0.972	0.972	0.972	0.972	0.972	0.972	0.972	0.972
Paraffin Waxes	0.972	0.972	0.972	0.972	0.972	0.972	0.972	0.972	0.972
Petroleum Coke	0.74	0.74	0.74		0.74	0.74	0.74	0.74	0.74
Non-specified Petroleum Products	0.972	0.972	0.972		0.972	0.972	0.972	0.972	0.972
kcal/ton_oil_equivalent	10000	10000	10000	10000	10000	10000	10000	10000	10000
Elec	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086

V37

After transferring Agriculture electricity consumption in 2000, "2,496GWh", to "v" file, the data is transferred to "u" file with the next formula.

"**Elec Sheet" in Eg_OEP_DBAL_uf_FMT.xls (GWh)**

Figure 8.7.5 Explanation on "Elec" Sheet in "u" File of Database

PRODUCT: Electricity
COUNTRY: EGYPT
Units: KTOE

Item	1997	1998	1999	2000	2001	2002	2003	2004	2005
Transport Sector	0	0	0	0	0	0	0	0	0
Others (Transportation)	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0
Road	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0
River	0	0	0	0	0	0	0	0	0
Internal Navigation	0	0	0	0	0	0	0	0	0
Non-specified (Transport)	0	0	0	0	0	0	0	0	0
Other Sectors	2,657	2,898	3,105	3,328	3,561	3,806	4,068	4,347	4,646
Agriculture	183	189	201	215	228	243	258	275	292
Public Utility	0	0	0	0	0	0	0	0	0
Commercial	162	184	200	219	239	260	282	306	332
Residential	1,599	1,812	1,943	2,086	2,228	2,374	2,525	2,683	2,850
Government	0	0	760	808	865	930	1,003	1,083	1,172
Non-specified (Other)	713	714	0	0	0	0	0	0	0
Non-Energy Use	0	0	0	0	0	0	0	0	0

V62

Electricity consumption in Agriculture sector in 2000 on "Elec" sheet

V62 = [Eg_OEP_DBAL_vf_FMT.xls]NCV!V$37*[Eg_OEP_DBAL_vf_FMT.xls]Elec!V62

This formula converts the data from physical unit to unified unit, "ktoe", using "u" file--Eg_OEP_DBAL_uf_FMT.xls in this case. The source data of physical unit is in the "v" fileEg_OEP_DBAL_vf_FMT.xls in this case.

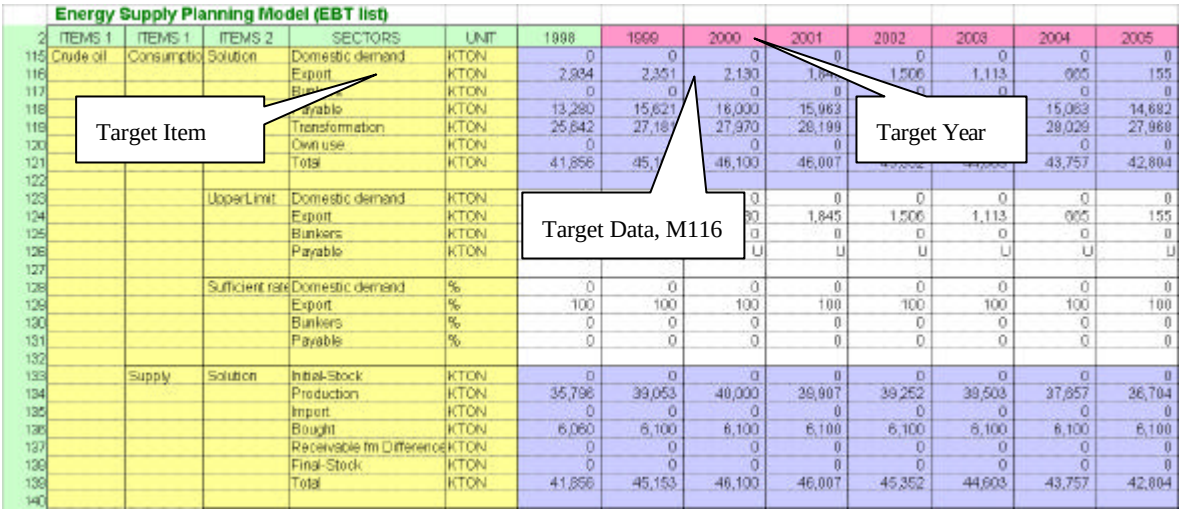
And "215ktoe" from "Simulation" sheet in Model is transferred to Cell V62 on "Elec" sheet in "u" file.

8.7.2 Energy Supply Planning Model

Crude Oil Export in 2000 in this case is 2,130kton.

"EBT" Sheet in LPSupply-T.xls

Figure 8.7.6 Explanation on "EBT" Sheet in LP Model



	ITEMS 1	ITEMS 1	ITEMS 2	SECTORS	UNIT	1998	1999	2000	2001	2002	2003	2004	2005
115	Crude oil	Consumptio	Solution	Domestic demand	KTON	0	0	0	0	0	0	0	0
116				Export	KTON	2,934	2,351	2,130	1,845	1,506	1,113	665	155
117				Bunkers	KTON	0	0	0	0	0	0	0	0
118				Payable	KTON	13,280	15,621	16,000	15,963			15,063	14,682
119				Transformation	KTON	25,642	27,18	27,970	28,199			28,029	27,968
120				Own use	KTON	0		0	0			0	0
121				Total	KTON	41,856	45,1	46,100	46,007			43,757	42,804
122													
123			UpperLimit	Domestic demand	KTON			0	0	0	0	0	0
124				Export	KTON			30	1,845	1,506	1,113	665	155
125				Bunkers	KTON			0	0	0	0	0	0
126				Payable	KTON			U	U	U	U	U	U
127													
128			Sufficient rate	Domestic demand	%	0	0	0	0	0	0	0	0
129				Export	%	100	100	100	100	100	100	100	100
130				Bunkers	%	0	0	0	0	0	0	0	0
131				Payable	%	0	0	0	0	0	0	0	0
132													
133		Supply	Solution	Initial-Stock	KTON	0	0	0	0	0	0	0	0
134				Production	KTON	35,796	39,053	40,000	39,907	39,252	38,503	37,657	36,704
135				Import	KTON	0	0	0	0	0	0	0	0
136				Bought	KTON	6,060	6,100	6,100	6,100	6,100	6,100	6,100	6,100
137				Receivable fm Difference	KTON	0	0	0	0	0	0	0	0
138				Final-Stock	KTON	0	0	0	0	0	0	0	0
139				Total	KTON	41,856	45,153	46,100	46,007	45,352	44,603	43,757	42,804
140													

"Data" Sheet in LPSupply-T.xls (kton)

Figure 8.7.7 Explanation on Data Sheet in LP Model

COUNTRY: EGYPT
Units: KTON/GWh

Item	1998	1999	2000	2001	2002	2003	2004	2005
PRODUCT: Crude Oil								
Indigenous Production	35,796	39,053	40,000	39,907	39,252	38,503	37,657	36,704
Partener Share	-13,280	-15,621	-16,000		-15,701	-15,401	-15,063	-14,682
From Partners	6,060	6,100	6,100	E147	6,100	6,100	6,100	6,100
Import	0	0	0	0	0	0	0	0
Export	-2,934	-2,351	-2,130	-1,845	-1,506	-1,113	-665	-155
International Marine Bunkers/A	0	0	0	0	0	0	0	0
Stock Changes	0	0	0	0	0	0	0	0
Total Primary Energy Supply	25,642	27,181	27,970	28,199	28,145	28,089	28,029	27,968
Transfers								
Statistical Differences								
Transformation Sector	-25,642	-27,181	-27,970	-28,199	-28,145	-28,089	-28,029	-27,968
Public Electricity Plants								
Autoproducer Electricity Plants								
Coke Ovens								
Gas Works								
For Blast Furnace Gas								
Petrochemical Industry								
Oil Refineries	-25,642	-27,181	-27,970	-28,199	-28,145	-28,089	-28,029	-27,968
Liquefaction								
Non-specified (Transformation)								
Energy Sector Use	0	0	0	0	0	0	0	0

Export of Crude Oil in 2000, E147 = -2,130kton

Transferring the target data, "2,130kton" on "EBT" sheet in LP Supply Model.

E147 = -EBT!M116

This formula refers directly to Cell M116 on EBT Sheet, and "-" means the direction of energy--minus direction, in this case.

"Crude_Oil" Sheet in Eg_OEP_DBAL_vf_LPT.xls (kton)

Figure 8.7.8 Explanation on "Crude Oil" Sheet in "v" File of Database

Item	1997	1998	1999	2000	2001	2002	2003	2004	2005
Indigenous Production	40,293	39,516	39,053	40,000	39,907	39,252	38,503	37,657	36,704
Partners Share	-14,763	-14,705	-15,621	-16,000		-15,701	-15,401	-15,063	-14,682
From Partners	6,226	6,060	6,100	6,100	V10	6,100	6,100	6,100	6,100
Import			0	0	0	0	0	0	0
Export	-3,968	-2,934	-2,351	-2,130	-1,845	-1,506	-1,113	-665	-155
International Marine Bunkers/Avi	0	0	0	0	0	0	0	0	0
Stock Changes	-415	-399	0	0	0	0	0	0	0
Total Primary Energy Supply	27,373	27,538	27,181	27,970	28,199	28,145	28,089	28,029	27,968
Transfers									
Statistical Differences	0	0	0	0	0	0	0	0	0
Transformation Sector	-27,373	-27,538	-27,181	-27,970	-28,199	-28,145	-28,089	-28,029	-27,968
Public Electricity Plants									
Autoproducer Electricity Plants									
Coke Ovens									
Gas Works									
For Blast Furnace Gas									
Petrochemicals for Raw Materials/Energy									
Oil Refineries	-27,373	-27,538	-27,181	-27,970	-28,199	-28,145	-28,089	-28,029	-27,968
Liquefaction									
Non-specified (Transformation)									
Energy Sector Use	0	0	0	0	0	0	0	0	0

Crude Oil export at 2000 on "Crude_Oil" sheet in "v" file, V10 = -2,130kton

V10 = '[LPSupply-T.xls]Data'!E147

This formula directly refers to Cell E147 on "Data" sheet of LPSupply-T.xls file.

"Crude_Oil" Sheet in Eg_OEP_DBAL_uf_LPT.xls (ktoe)

Figure 8.7.9 Explanation on "Crude Oil" Sheet in "u" File of Database

Item	1997	1998	1999	2000	2001	2002	2003	2004	2005
Indigenous Production	40,092	39,318	38,858	39,800	39,707	39,056	38,310	37,469	36,521
Partener Share	-14,689	-14,631	-15,543	-15,920		-15,622	-15,324	-14,988	-14,608
From Partners	6,195	6,030	6,070	6,070	V10	6,070	6,070	6,070	6,070
Import	0	0	0	0	0	0	0	0	0
Export	-3,948	-2,919	-2,339	-2,119	-1,836	-1,498	-1,107	-662	-154
International Marine Bunkers/Avi	0	0	0	0	0	0	0	0	0
Stock Changes	-413	-397	0	0	0	0	0	0	0
Total Primary Energy Supply	27,236	27,400	27,045	27,830	28,058	28,004	27,948	27,889	27,828
Transfers	0	0	0	0	0	0	0	0	0
Statistical Differences	0	0	0	0	0	0	0	0	0
Transformation Sector	-27,236	-27,400	-27,045	-27,830	-28,058	-28,004	-27,948	-27,889	-27,828
Public Electricity Plants	0	0	0	0	0	0	0	0	0
Autoproducer Electricity Plants	0	0	0	0	0	0	0	0	0
Coke Ovens	0	0	0	0	0	0	0	0	0
Gas Works	0	0	0	0	0	0	0	0	0
For Blast Furnace Gas	0	0	0	0	0	0	0	0	0
Petrochemicals for Raw Materials	0	0	0	0	0	0	0	0	0
Oil Refineries	-27,236	-27,400	-27,045	-27,830	-28,058	-28,004	-27,948	-27,889	-27,828
Liquefaction	0	0	0	0	0	0	0	0	0
Non-specified (Transformation)	0	0	0	0	0	0	0	0	0
Energy Sector Use	0	0	0	0	0	0	0	0	0

Crude Oil export in 2000 in "Crude_Oil" sheet of "u" file, V10 = -2,119ktoe

V10=[Eg_OEP_DBAL_vf_LPT.xls]NCV!V$14*[Eg_OEP_DBAL_vf_LPT.xls]Crude_Oil!V10

This formula converts the data from physical unit to unified unit, ktoe.

8.8 Data Definition

The Database strictly defines the Primary Energy and the Secondary Energy so that all the energy that are used in the Transformation (Energy Conversion) sector, such as the Electricity sector and the Refinery sector, are defined as the Energy sector own use, not in the Industry sector energy use. The definitions of each energy data are follows;

(1) Electricity
* Gross generation is the sum of thermal and hydro except for generating electricity by Wind and Solar because this electricity is not currently included in the EEA annual report.
* Energy own use in electricity sector = Gross generation - Net generation.
* Distribution losses = Net generation - Total Sales or Consumption.

(2) Naphtha
* The Naphtha production is separated from Gasoline production data
* The Naphtha production = Gasoline and Naphtha production - Gasoline final consumption.
* Gasoline production = Gasoline & Naphtha production - Naphtha production.

(3) Non Specified Petroleum Product:
* Non Specified Petroleum Products are Refinery Products not for Energy use, such as Wax, Chemical Products, Solvent and so on, except for NaOH.

(4) Petroleum Coke
* Petroleum-Coke data are production, export and import, but the consumption data was not available during the Study.

(5) LPG
* LPG from field is defined as the Second energy and the production from "Transfer", which is the Gas processing unit in Gas field.
* LPG partner share is not defined because it is not a Primary energy.

(6) NGL & Crude Oil
* The data of Oil refinery throughput is simply the total of Crude Oil and NGL (Condensates). The total primary energy supply of Crude Oil and NGL are assumed as Oil Refinery throughput.

(7) EGPC data of Natural Gas
* Natural Gas from field = Oil Refinery Own use.
* Natural Gas consumption in Petroleum = Petrochemical throughput + Refinery Own Use

* Natural Gas consumption in Industry and Housing = Industry Non-specified
* Natural Gas consumption in Fertilizer = Non Energy Use

(8) EGPC data of Residue Fuel Oil

* Petroleum sector consumption is defined as final consumption in petrochemical industry in the Industry sector.

(9) Coking Coal and Coke Oven Coke

* These data are not complete source data so that some data is assumed to be suitable input data for the Models in "v30" file.

(10) Jet Fuel for International Aviation

Jet Fuel for International Aviation is treated as the same as International Marine Bunker

9. Conclusion

The objectives of the Study are to develop Energy-Economic models (short-term forecasting-simulation models) for Egypt in order to evaluate the impact of public energy policies on its economy and to transfer the technology for building and operating of these models. The Study is for both model building and technology transfer.

9.1 Model Building

(1) Function of Model

The major policy issues to be analyzed are summarized in Table 1.1.1. These policy issues are the targets of our outputs by the energy economic model. The base year and target year of the models are 1998/99 and 2005/06 respectively.

(2) Configuration of Models

Models are comprised of a series of Macroeconomic energy demand forecasting model (Macroeconomic-energy model), Energy supply planning model, Environmental impact analysis model and Database. And models are categorized into models to be developed by econometric tool (Macroeconomic model and Energy supply/demand model) and a model (Energy supply planning model) by linear programming tool (See Figure 1.3.1).

Development of each model was carried out separately. Macroeconomic model and Energy demand forecasting model were linked as one model system, which covers from final energy consumption to primary energy requirement. Energy supply planning model is an optimization model to evaluate maximum benefit of the total energy supply system. As Energy supply planning model involves objective functions and constraints, the model is yet another model system of Macroeconomic energy demand forecasting model. Environment impact analysis model can link both Macroeconomic energy demand and Energy supply planning model through Database as an interface.

Macroeconomic energy demand forecasting model can simulate macroeconomic activities and energy demand by scenario. Energy supply planning model receives the forecast energy demand and can simulate the best mix of energy to be the maximum benefit under the constraints of facilities' capacity. Both models can be used separately or simultaneously through Database.

9.2 Technology Transfer

Workshop for technology transfer was held in each work-in-Egypt. Especially, the long-running workshop in the third work-in-Egypt was carried out concentratively. The contents of the technology transfer include: 1) the theories and concepts underlying individual models, 2) the tools and methods for model building, 3) the technique of building the Energy-Economic model, 4) the energy database and the database development tool, and 5) the model itself and model maintenance.

Lecture and practice were given to counterparts of OEP (macroeconomic group, energy demand forecasting group, energy supply planning group and database group) during the first half of the seven-week workshop in the third work-in-Egypt.

In general, model building for macroeconomic and energy demand forecasting models is based on the econometric method, and model building for energy supply model are based on the optimization method with the knowledge of linear programming and energy sector. Considering these two different methods, two teams were organized. The first was the team of econometrics, whose principal tool was "Simple-E." The team was comprised of macroeconomics and energy demand forecasting groups. The other team was the engineering team, whose principal tool was LP. The team was comprised of energy supply planning and database groups.

9.3 Main Outputs

(1) Macro-economic/Energy Demand Forecastiong Model

Three price scenarios are used to see the impacts of domestic energy price. The scenarios are; 1) Nominal price constant (low price scenario); 2) Real price constant (base price scenario) and 3) Real price increase 10 % annually (high price scenario). Energy price scenarios described above can say in other words, that is, low price scenario is demand high case and high price scenario is demand low case from the standpoint of the demand side. Base case is real price constant case.

Table 9.3.1 Main Forecasted Results by Price Scenario

(unit：annual average growth rate %)

	1998/99 value (ktoe)	High price	Base price	Low price
Total Energy Requirement	44,064	5.44	5.64	6.01

Primary Energy Requirement				
Natural Gas	12,799	8.38	8.47	8.64
Crude Oil	27,400	3.79	4.10	4.70
Secondary Energy Requirement				
Petroleum Products	24,057	36.3	3.91	4.46
Power Generation	5,848	6.23	6.33	6.53
Final Energy Demand				
Agriculture	320	3.77	4.39	5.34
Industry	10,775	5.96	6.06	6.21
Transportation	9,113	4.08	4.49	5.37
Residential/Commercial	5,652	4.87	5.16	5.66
Electricity	4,868	6.48	6.59	6.79
GDP		5.77	5.74	5.68
Elasticity to GDP				
Electricity		1.12	1.15	1.20
Total Energy Requirement		0.94	0.98	1.06

In addition, the impact to GDP of 1) structural reform, 2) increase of international crude oil price 3) increase of electricity prices 4) increase of petroleum products prices, 5) advancement of energy saving technology, and 6) price control for energy substitution are examined as sensitivity analyses.

Table 9.3.2 Examples of Sensitivity Analyses

Issues	Simulation Summary
1) Impacts of ERSAP	- Increase in investment (increase in savings and relative decrease in consumption) - Decrease in government consumption (shrink of public sector with privatization) - Impact of energy sector: contribute to the growth, however the magnitude is smaller than other sectors
2) Increase of International Crude Oil Price	- Increase in export revenue - Positive direct impacts on petroleum sector - Positive indirect impacts on non-petroleum sectors - Accompany time lag of several years
3) Increase of Electricity prices	- Increase of growth in energy sector in short term - However, slightly negative impacts on most sectors in mid-term
4) Increase of petroleum products prices	- Negative impacts on electricity and transportation sector - Positive impacts on non-petroleum sectors in mid-term - Increase of revenue of petroleum sector is short-term only
5) Advancement of energy saving technology	- Large increase in investment - Negative direct impact on petroleum sector - In mid-term, positive impacts on all sectors especially industry and transportation - The benefit increase with time
6) Price control for energy substitution	- Cross price elasticity is negligible, implies supply policy will be more effective at current price level

(2) Energy Supply Planning Model

For the simulation of energy supply policy, several scenarios are examined using the Energy Supply Planning Model. The two indicators of indigenous energy supply and CO2 emission are prepared as the energy strategy. Policy variables are technical changes, crude oil bought, natural gas production, refinery capacity and GCC capacity.

Table 9.3.3 Scenario and Results (LP Model)

Scenario	Contents
Base case	For forecasting future energy balance (2005) including the current energy policies, the Base case should be prepared. The current capacities and forecasting demand are set as the Base case. **(Results)** LPG, Gasoline and Diesel oil balances are short. The energies are imported to meet their demand.
Scenario 1	For resolving Gasoline, Diesel and LPG shortage, the yields of LPG, Gasoline, Diesel are 10% up, the yields of Fuel oil (7%) and Naphtha (11%) are down in 2001 **(Results)** Gasoline and Diesel shortage are mostly not resolved.
Scenario 2	For decreasing import of petroleum products, this scenario is assumed to increase crude oil from partners at 20% to 2000. **(Results)** LPG, Gasoline and Diesel still have the supply shortage.
Scenario 3	For decreasing import of petroleum products, this scenario is assumed to increase crude oil from partner at 20% to 2000 and yields at 10% up. **(Results)** Diesel still have the supply shortage. But Gasoline shortage is resolved.
Scenario 4	This scenario makes a plan to install a LNG plant consumed Natural gas and makes foreign trade surplus increase. **(Results)** By exporting LNG, Egypt can increase the profit at level of 9% to the Base case.
Scenario 5	Renewable energies is supplied with 285 kton in 2005, and the renewable energies substitute LPG domestic demand. As the results, it is expected that LPG import decreases. **(Results)** Renewable energies is supplied with 285 kton in 2005 and is consumed in residential sector. LPG demand is decreased as much as the supply of renewable energy

(3) Environment Impact Analysis Model

The environment model is based on engineering method. It uses "Energy Balance Table" and "Emission Factors of GHGs," which are prepared based on the Egyptian original data as much as possible. The model is linked with macroeconomic energy demand forecasting model and energy supply planning model. The model receives related results from these models and calculates the GHG emission automatically.

Table 9.3.4 Scenario and the Results (Environmental Model)

Scenario	Simulation Results
Base Case (GHG emission)	1) CO_2 emission by sector: electricity (34%), transportation (26%), industry (26%) Taking into consideration of CH_4 emitted from wastewater / sludge and solid waste, maximum emission source is the industrial sector which account for 32 % in CO_2 equivalent. 2) Emission of NOx, CO, N_2O, CH_4 and NMNOC: Transportation sector is responsible for the greater part of emissions. 3) Industrial policy and transportation policy are the key for improving environmental issue.

(4) Database

Database was constructed and the energy flow of Egypt was examined based on IEA format. The purpose of Database is to offer the energy data to other models and to consolidate the result of the model. In Database, the Microsoft Excel is used as a basic tool to be used transparently with other models.

The formulas used in Database uses general functions prepared in Microsoft Excel, does not use any special defined functions and Macro commands. Therefore, the flow of the calculation was not especially controlled in Database, and all formulas are calculated simultaneously by default of Microsoft Excel to realize a high-speed data link.

9.4 Recommendations

(1) Establishment of Data Gathering System

The model requires data to cover a wide range of characteristics. In order to improve the accuracy of model outputs, it is necessary to steadily collect a wide range of data related to industrial activities and energy supply/demand. It requires much time and fund to establish classified statistics, of which the public sector is expected to play an important role for the establishment and maintenance. The arrangement of organization/constitutions including laws and regulations is highly recommended.

(2) Maintenance of Model

The model does not consist of "Black Box" system and differs from models distributed by international organizations and institutions. The model structure is flexible and transparent.

The model can be modified or added if necessary. On the other hand, it is imperative to familiarize model treatment and maintenance. When new data is added periodically, it is necessary to fully evaluate the consistency of the data concerning historical trends and energy flow as well as the external and internal variables.

(3) Application to Medium/Long Term Issues

The model is built for short- to medium-term simulation model, and many explainable variables are endogenously treated. If the model is requested to be used as a medium- to long-term model, it is desirable to input the long-term development plan of energy facilities as external variables.

(4) Application to Energy Policy

When the model is applied to certain energy policies, the step-by-step method is recommendable. The application method should be reliable and reasonable for applying model block and function by turns. For instance, energy demand forecasting part should be applied firs, followed by price part and energy supply planning part.