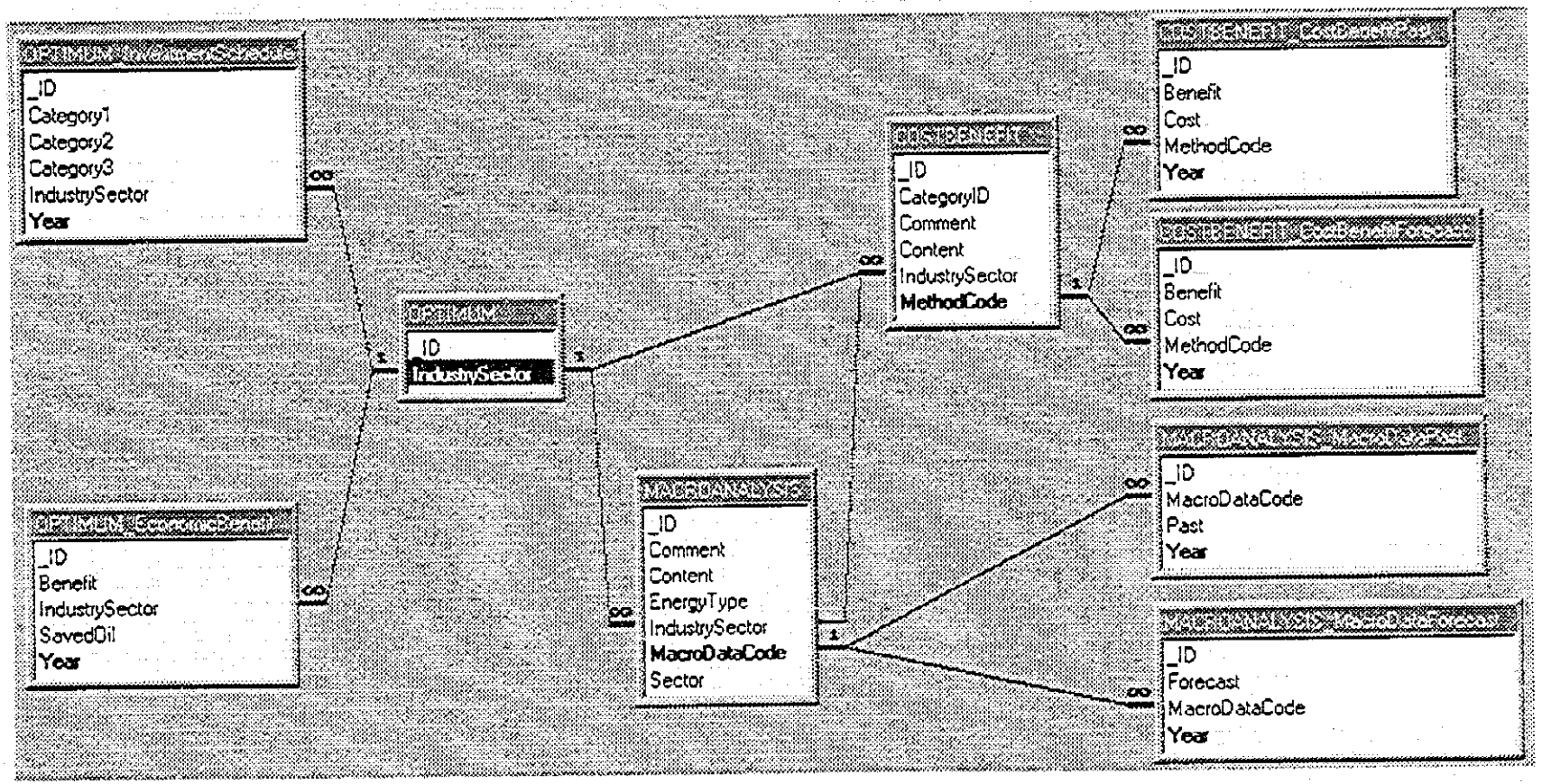
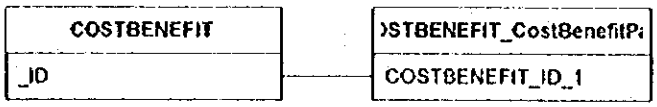
4. APPENDIX 2

DATABASE
E-R MODEL DETAIL


_ID
Category1
Category2
Category3
IndustrySector
Year
_ID
IndustrySector
_ID
CategoryID
Comment
Content
IndustrySector
MethodCode
_ID
Benefit
Cost
MethodCode
Year
_ID
Benefit
Cost
MethodCode
Year
_ID
Benefit
IndustrySector
SavedOil
Year
_ID
Comment
Content
EnergyType
IndustrySector
MacroDataCode
Sector
_ID
MacroDataCode
Past
Year
_ID
Forecast
MacroDataCode
Year

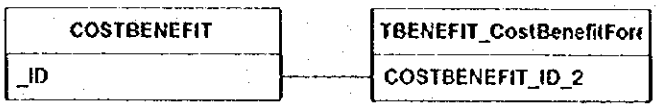
Relationships

COSTBENEFIT_FK



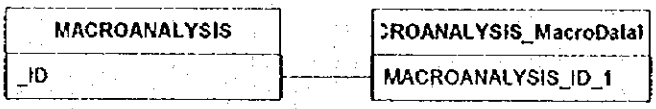
Access Key: One-To-Many
Attributes: Not Enforced

COSTBENEFIT_FK_COSTBENEFIT_CostBenefitForecast



Attributes: One-To-Many
Attributes: Not Enforced

MACROANALYSIS_FK

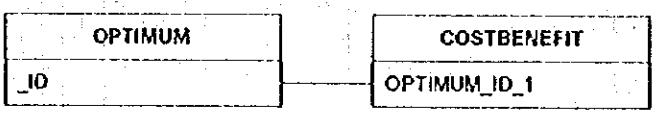


Attributes: One-To-Many
Attributes: Not Enforced

MACROANALYSIS_FK_MACROANALYSIS_MacroDataForecast

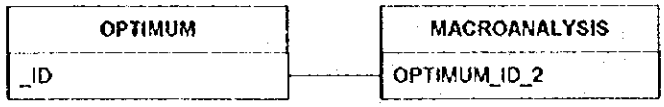
Attributes: Not Enforced
Attributes: One-To-Many

OPTIMUMCOSTBENEFIT



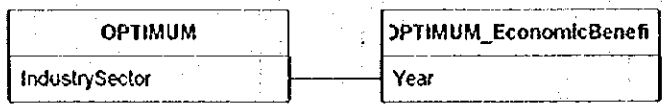
Attributes: Not Enforced
Attributes: One-To-Many

OPTIMUMMACROANALYSIS



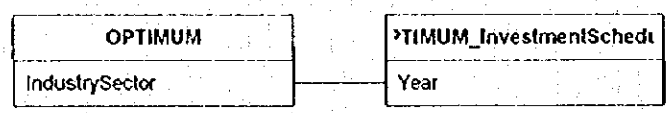
Attributes:	One-To-Many
Attributes:	Not Enforced

OPTIMUMOPTIMUM_EconomicBenefit



Attributes:	Indeterminate
Attributes:	Not Enforced

OPTIMUMOPTIMUM_InvestmentSchedule



Attributes:	Not Enforced
Attributes:	Indeterminate

Properties

Date Created:	1/7/97 3:16:25 PM	Def. Updatable:	True
Last Updated:	1/7/97 3:40:44 PM	Order By On:	False
Record Count:	0		

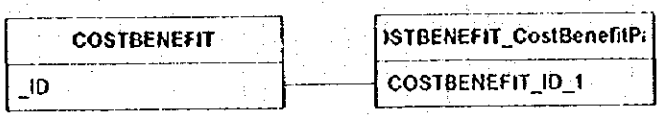
Columns

Name	Type	Size
_ID	Number (Long)	4
Allow Zero Length:	False	
Attributes:	Fixed Size, Auto-Increment	
Collating Order:	General	
Column Hidden:	False	
Column Order:	Default	
Column Width:	Default	
Ordinal Position:	0	
Required:	False	
Source Field:	_ID	
Source Table:	COSTBENEFIT	
CategoryID	Number (Byte)	1
Allow Zero Length:	False	
Attributes:	Fixed Size	
Collating Order:	General	
Column Hidden:	False	
Column Order:	Default	
Column Width:	Default	
Decimal Places:	255	
Display Control:	Text Box	
Ordinal Position:	0	
Required:	False	
Source Field:	CategoryID	
Source Table:	COSTBENEFIT	
Comment	Text	50
Allow Zero Length:	False	
Attributes:	Variable Length	
Collating Order:	General	
Column Hidden:	False	
Column Order:	Default	
Column Width:	Default	
Display Control:	Text Box	
Ordinal Position:	0	
Required:	False	
Source Field:	Comment	
Source Table:	COSTBENEFIT	
Content	Text	25
Allow Zero Length:	False	
Attributes:	Variable Length	
Collating Order:	General	
Column Hidden:	False	
Column Order:	Default	
Column Width:	Default	
Display Control:	Text Box	

	Ordinal Position:	0	
	Required:	False	
	Source Field:	Content	
	Source Table:	COSTBENEFIT	
IndustrySector		Text	10
	Allow Zero Length:	False	
	Attributes:	Variable Length	
	Collating Order:	General	
	Column Hidden:	False	
	Column Order:	Default	
	Column Width:	Default	
	Display Control:	Text Box	
	Ordinal Position:	0	
	Required:	False	
	Source Field:	IndustrySector	
	Source Table:	COSTBENEFIT	
MethodCode		Text	10
	Allow Zero Length:	False	
	Attributes:	Variable Length	
	Collating Order:	General	
	Column Hidden:	False	
	Column Order:	Default	
	Column Width:	Default	
	Display Control:	Text Box	
	Ordinal Position:	0	
	Required:	False	
	Source Field:	MethodCode	
	Source Table:	COSTBENEFIT	
OPTIMUM_ID_1		Number (Long)	4
	Allow Zero Length:	False	
	Attributes:	Fixed Size	
	Collating Order:	General	
	Column Hidden:	False	
	Column Order:	Default	
	Column Width:	Default	
	Decimal Places:	255	
	Display Control:	Text Box	
	Ordinal Position:	0	
	Required:	False	
	Source Field:	OPTIMUM_ID_1	
	Source Table:	COSTBENEFIT	

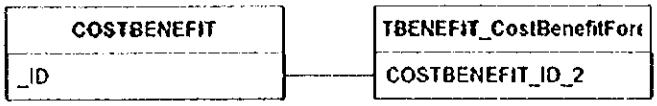
Relationships

COSTBENEFIT_FK



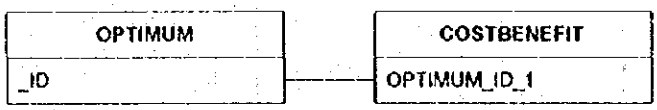
Attributes:	Not Enforced
Attributes:	One-To-Many

COSTBENEFIT_FK_COSTBENEFIT_CostBenefitForecast



Attributes:	Not Enforced
Attributes:	One-To-Many

OPTIMUMCOSTBENEFIT



Attributes:	Not Enforced
Attributes:	One-To-Many

Table Indexes

Name	Number of Fields
_ID	1
Clustered:	False
Distinct Count:	0
Foreign:	False
Ignore Nulls:	False
Name:	_ID
Primary:	True
Required:	True
Unique:	True
Fields:	_ID, Ascending
IndustrySector	1
Clustered:	False
Distinct Count:	0
Foreign:	False
Ignore Nulls:	False
Name:	IndustrySector
Primary:	False
Required:	False
Unique:	False
Fields:	IndustrySector, Ascending
MethodCode	1
Clustered:	False
Distinct Count:	0
Foreign:	False
Ignore Nulls:	False
Name:	MethodCode
Primary:	False
Required:	False
Unique:	True
Fields:	MethodCode, Ascending

User Permissions

admin	Delete, Read Permissions, Set Permissions, Change Owner, Read Definition, Write Definition, Read Data, Insert Data, Update Data, Delete Data

Group Permissions

Admins	
Users	Delete, Read Permissions, Set Permissions, Change Owner, Read Definition, Write Definition, Read Data, Insert Data, Update Data, Delete Data

Properties

Date Created:	1/7/97 3:16:30 PM	Def. Updatable:	True
Last Updated:	1/7/97 3:41:42 PM	Order By On:	False
Record Count:	0		

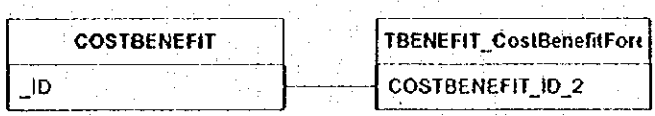
Columns

Name	Type	Size
_ID	Number (Long)	4
Allow Zero Length:	False	
Attributes:	Fixed Size, Auto-Increment	
Collating Order:	General	
Column Hidden:	False	
Column Order:	Default	
Column Width:	Default	
Ordinal Position:	0	
Required:	False	
Source Field:	_ID	
Source Table:	COSTBENEFIT_CostBenefitForecast	
Benefit	Currency	8
Allow Zero Length:	False	
Attributes:	Fixed Size	
Collating Order:	General	
Column Hidden:	False	
Column Order:	Default	
Column Width:	Default	
Decimal Places:	255	
Ordinal Position:	0	
Required:	False	
Source Field:	Benefit	
Source Table:	COSTBENEFIT_CostBenefitForecast	
Cost	Currency	8
Allow Zero Length:	False	
Attributes:	Fixed Size	
Collating Order:	General	
Column Hidden:	False	
Column Order:	Default	
Column Width:	Default	
Decimal Places:	255	
Ordinal Position:	0	
Required:	False	
Source Field:	Cost	
Source Table:	COSTBENEFIT_CostBenefitForecast	
COSTBENEFIT_ID_2	Number (Long)	4
Allow Zero Length:	False	
Attributes:	Fixed Size	
Collating Order:	General	
Column Hidden:	False	
Column Order:	Default	
Column Width:	Default	
Decimal Places:	255	
Display Control:	Text Box	

	Ordinal Position:	0	
	Required:	False	
	Source Field:	COSTBENEFIT_ID_2	
	Source Table:	COSTBENEFIT_CostBenefitForecast	
Year		Number (Integer)	2
	Allow Zero Length:	False	
	Attributes:	Fixed Size	
	Collating Order:	General	
	Column Hidden:	False	
	Column Order:	Default	
	Column Width:	Default	
	Decimal Places:	255	
	Display Control:	Text Box	
	Ordinal Position:	0	
	Required:	False	
	Source Field:	Year	
	Source Table:	COSTBENEFIT_CostBenefitForecast	

Relationships

COSTBENEFIT_FK_COSTBENEFIT_CostBenefitForecast



Attributes:	Not Enforced
Attributes:	One-To-Many

Table Indexes

Name		Number of Fields
_ID		1
	Clustered:	False
	Distinct Count:	0
	Foreign:	False
	Ignore Nulls:	False
	Name:	_ID
	Primary:	True
	Required:	True
	Unique:	True
	Fields:	_ID, Ascending
Index1		2
	Clustered:	False
	Distinct Count:	0
	Foreign:	False
	Ignore Nulls:	False
	Name:	Index1
	Primary:	False
	Required:	False
	Unique:	True
	Fields:	Year, Ascending
		COSTBENEFIT_ID_2, Ascending

User Permissions

admin	Delete, Read Permissions, Set Permissions, Change Owner, Read Definition, Write Definition, Read Data, Insert Data, Update Data, Delete Data

Group Permissions

Admins	
Users	Delete, Read Permissions, Set Permissions, Change Owner, Read Definition, Write Definition, Read Data, Insert Data, Update Data, Delete Data

Properties

Date Created:	1/7/97 3:16:28 PM	Def. Updatable:	True
Last Updated:	1/7/97 3:41:22 PM	Order By On:	False
Record Count:	0		

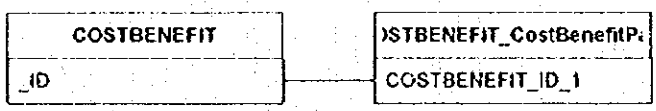
Columns

Name	Type	Size
_ID	Number (Long)	4
Allow Zero Length:	False	
Attributes:	Fixed Size, Auto-Increment	
Collating Order:	General	
Column Hidden:	False	
Column Order:	Default	
Column Width:	Default	
Ordinal Position:	0	
Required:	False	
Source Field:	_ID	
Source Table:	COSTBENEFIT_CostBenefitPast	
Benefit	Currency	8
Allow Zero Length:	False	
Attributes:	Fixed Size	
Collating Order:	General	
Column Hidden:	False	
Column Order:	Default	
Column Width:	Default	
Decimal Places:	255	
Ordinal Position:	0	
Required:	False	
Source Field:	Benefit	
Source Table:	COSTBENEFIT_CostBenefitPast	
Cost	Currency	8
Allow Zero Length:	False	
Attributes:	Fixed Size	
Collating Order:	General	
Column Hidden:	False	
Column Order:	Default	
Column Width:	Default	
Decimal Places:	255	
Ordinal Position:	0	
Required:	False	
Source Field:	Cost	
Source Table:	COSTBENEFIT_CostBenefitPast	
COSTBENEFIT_ID_1	Number (Long)	4
Allow Zero Length:	False	
Attributes:	Fixed Size	
Collating Order:	General	
Column Hidden:	False	
Column Order:	Default	
Column Width:	Default	
Decimal Places:	255	
Display Control:	Text Box	

Ordinal Position:	0	
Required:	False	
Source Field:	COSTBENEFIT_ID_1	
Source Table:	COSTBENEFIT_CostBenefitPast	
Year	Number (Integer)	2
Allow Zero Length:	False	
Attributes:	Fixed Size	
Collating Order:	General	
Column Hidden:	False	
Column Order:	Default	
Column Width:	Default	
Decimal Places:	255	
Display Control:	Text Box	
Ordinal Position:	0	
Required:	False	
Source Field:	Year	
Source Table:	COSTBENEFIT_CostBenefitPast	

Relationships

COSTBENEFIT_FK



Attributes:	Not Enforced
Attributes:	One-To-Many

Table Indexes

Name	Number of Fields
_ID	1
Clustered:	False
Distinct Count:	0
Foreign:	False
Ignore Nulls:	False
Name:	_ID
Primary:	True
Required:	True
Unique:	True
Fields:	_ID, Ascending
Index1	2
Clustered:	False
Distinct Count:	0
Foreign:	False
Ignore Nulls:	False
Name:	Index1
Primary:	False
Required:	False
Unique:	True
Fields:	Year, Ascending
	COSTBENEFIT_ID_1, Ascending

User Permissions

admin	Delete, Read Permissions, Set Permissions, Change Owner, Read Definition, Write Definition, Read Data, Insert Data, Update Data, Delete Data

Group Permissions

Admins	
Users	Delete, Read Permissions, Set Permissions, Change Owner, Read Definition, Write Definition, Read Data, Insert Data, Update Data, Delete Data

Properties

Date Created:	1/7/97 3:16:18 PM	Def. Updatable:	True
Last Updated:	1/7/97 3:40:56 PM	Order By On:	False
Record Count:	0		

Columns

Name	Type	Size
_ID	Number (Long)	4
Allow Zero Length:	False	
Attributes:	Fixed Size, Auto-Increment	
Collating Order:	General	
Column Hidden:	False	
Column Order:	Default	
Column Width:	Default	
Ordinal Position:	0	
Required:	False	
Source Field:	_ID	
Source Table:	MACROANALYSIS	
Comment	Text	50
Allow Zero Length:	False	
Attributes:	Variable Length	
Collating Order:	General	
Column Hidden:	False	
Column Order:	Default	
Column Width:	Default	
Display Control:	Text Box	
Ordinal Position:	0	
Required:	False	
Source Field:	Comment	
Source Table:	MACROANALYSIS	
Content	Text	25
Allow Zero Length:	False	
Attributes:	Variable Length	
Collating Order:	General	
Column Hidden:	False	
Column Order:	Default	
Column Width:	Default	
Display Control:	Text Box	
Ordinal Position:	0	
Required:	False	
Source Field:	Content	
Source Table:	MACROANALYSIS	
EnergyType	Text	15
Allow Zero Length:	False	
Attributes:	Variable Length	
Collating Order:	General	
Column Hidden:	False	
Column Order:	Default	
Column Width:	Default	
Display Control:	Text Box	
Ordinal Position:	0	

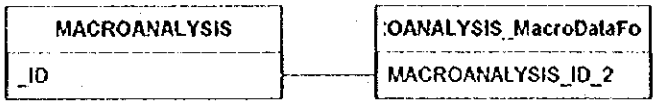
	Required:	False	
	Source Field:	EnergyType	
	Source Table:	MACROANALYSIS	
MacroDataCode		Text	10
	Allow Zero Length:	False	
	Attributes:	Variable Length	
	Collating Order:	General	
	Column Hidden:	False	
	Column Order:	Default	
	Column Width:	Default	
	Display Control:	Text Box	
	Ordinal Position:	0	
	Required:	False	
	Source Field:	MacroDataCode	
	Source Table:	MACROANALYSIS	
OPTIMUM_ID_2		Number (Long)	4
	Allow Zero Length:	False	
	Attributes:	Fixed Size	
	Collating Order:	General	
	Column Hidden:	False	
	Column Order:	Default	
	Column Width:	Default	
	Decimal Places:	255	
	Display Control:	Text Box	
	Ordinal Position:	0	
	Required:	False	
	Source Field:	OPTIMUM_ID_2	
	Source Table:	MACROANALYSIS	
Sector		Text	20
	Allow Zero Length:	False	
	Attributes:	Variable Length	
	Collating Order:	General	
	Column Hidden:	False	
	Column Order:	Default	
	Column Width:	Default	
	Display Control:	Text Box	
	Ordinal Position:	0	
	Required:	False	
	Source Field:	Sector	
	Source Table:	MACROANALYSIS	

Relationships

MACROANALYSIS_FK

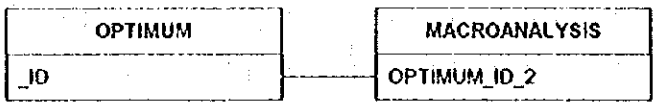
Attributes:	Not Enforced
Attributes:	One-To-Many

MACROANALYSIS_FK_MACROANALYSIS_MacroDataForecast



Attributes:	Not Enforced
Attributes:	One-To-Many

OPTIMUMMACROANALYSIS



Attributes:	Not Enforced
Attributes:	One-To-Many

Table Indexes

Name	Number of Fields
_ID	1
Clustered:	False
Distinct Count:	0
Foreign:	False
Ignore Nulls:	False
Name:	_ID
Primary:	True
Required:	True
Unique:	True
Fields:	_ID, Ascending
MacroDataCode	1
Clustered:	False
Distinct Count:	0
Foreign:	False
Ignore Nulls:	False
Name:	MacroDataCode
Primary:	False
Required:	False
Unique:	True
Fields:	MacroDataCode, Ascending

User Permissions

admin	Delete, Read Permissions, Set Permissions, Change Owner, Read Definition, Write Definition, Read Data, Insert Data, Update Data, Delete Data

Group Permissions

Admins	
Users	Delete, Read Permissions, Set Permissions, Change Owner, Read Definition, Write Definition, Read Data, Insert Data, Update Data, Delete Data

Properties

Date Created:	1/7/97 3:16:21 PM	Def. Updatable:	True
Last Updated:	1/7/97 3:42:32 PM	Order By On:	False
Record Count:	0		

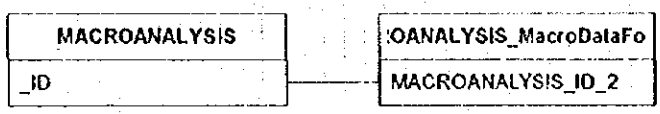
Columns

Name	Type	Size
_ID	Number (Long)	4
Allow Zero Length:	False	
Attributes:	Fixed Size, Auto-Increment	
Collating Order:	General	
Column Hidden:	False	
Column Order:	Default	
Column Width:	Default	
Ordinal Position:	0	
Required:	False	
Source Field:	_ID	
Source Table:	MACROANALYSIS_MacroDataForecast	
Forecast	Number (Integer)	2
Allow Zero Length:	False	
Attributes:	Fixed Size	
Collating Order:	General	
Column Hidden:	False	
Column Order:	Default	
Column Width:	Default	
Decimal Places:	255	
Display Control:	Text Box	
Ordinal Position:	0	
Required:	False	
Source Field:	Forecast	
Source Table:	MACROANALYSIS_MacroDataForecast	
MACROANALYSIS_ID_2	Number (Long)	4
Allow Zero Length:	False	
Attributes:	Fixed Size	
Collating Order:	General	
Column Hidden:	False	
Column Order:	Default	
Column Width:	Default	
Decimal Places:	255	
Display Control:	Text Box	
Ordinal Position:	0	
Required:	False	
Source Field:	MACROANALYSIS_ID_2	
Source Table:	MACROANALYSIS_MacroDataForecast	
Year	Number (Integer)	2
Allow Zero Length:	False	
Attributes:	Fixed Size	
Collating Order:	General	
Column Hidden:	False	
Column Order:	Default	
Column Width:	Default	

Decimal Places:	255
Display Control:	Text Box
Ordinal Position:	0
Required:	False
Source Field:	Year
Source Table:	MACROANALYSIS_MacroDataForecast

Relationships

MACROANALYSIS_FK_MACROANALYSIS_MacroDataForecast



Attributes:	Not Enforced
Attributes:	One-To-Many

Table Indexes

Name	Number of Fields
_ID	1

Clustered:	False
Distinct Count:	0
Foreign:	False
Ignore Nulls:	False
Name:	_ID
Primary:	True
Required:	True
Unique:	True
Fields:	_ID, Ascending

Index1	2
Clustered:	False
Distinct Count:	0
Foreign:	False
Ignore Nulls:	False
Name:	Index1
Primary:	False
Required:	False
Unique:	True
Fields:	Year, Ascending
	MACROANALYSIS_ID_2, Ascending

User Permissions

admin	Delete, Read Permissions, Set Permissions, Change Owner, Read Definition, Write Definition, Read Data, Insert Data, Update Data, Delete Data

Group Permissions

Admins	
Users	Delete, Read Permissions, Set Permissions, Change Owner, Read Definition, Write Definition, Read Data, Insert Data, Update Data, Delete Data

Properties

Date Created:	1/7/97 3:16:19 PM	Def. Updatable:	True
Last Updated:	1/7/97 3:42:20 PM	Order By On:	False
Record Count:	0		

Columns

Name	Type	Size
_ID	Number (Long)	4
Allow Zero Length:	False	
Attributes:	Fixed Size, Auto-Increment	
Collating Order:	General	
Column Hidden:	False	
Column Order:	Default	
Column Width:	Default	
Ordinal Position:	0	
Required:	False	
Source Field:	_ID	
Source Table:	MACROANALYSIS_MacroDataPast	
MACROANALYSIS_ID_1	Number (Long)	4
Allow Zero Length:	False	
Attributes:	Fixed Size	
Collating Order:	General	
Column Hidden:	False	
Column Order:	Default	
Column Width:	Default	
Decimal Places:	255	
Display Control:	Text Box	
Ordinal Position:	0	
Required:	False	
Source Field:	MACROANALYSIS_ID_1	
Source Table:	MACROANALYSIS_MacroDataPast	
Past	Number (Integer)	2
Allow Zero Length:	False	
Attributes:	Fixed Size	
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Column Hidden:	False	
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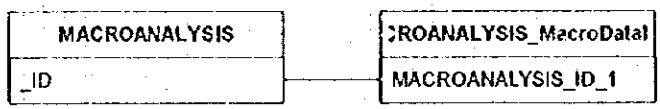

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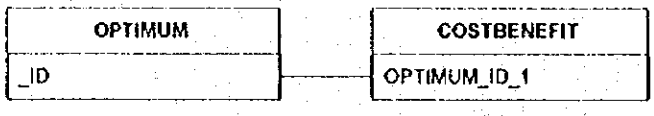

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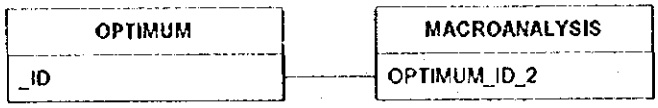

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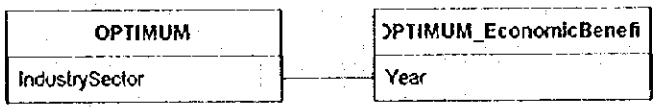

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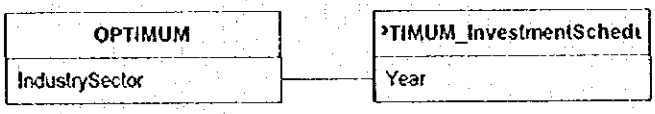

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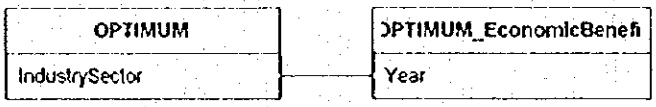

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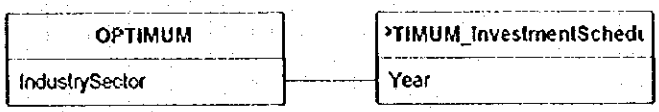

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5. DEMAND FORECAST

5. DEMAND FORECAST

This chapter describes the energy demand forecast in I. R. Iran the JICA team performed in collaboration with the PBO team. For this task, we developed a forecasting model combined with a macro-economic model and an energy supply and demand model, taking into account the current Iranian economic situation. We call this model the "Macro-Energy Model; MEM."

The model, which was developed in the previous JICA study, has been substantially revised in this study. All of the formulas were re-estimated with new data, and the macro-economic model was modified from the viewpoint of the present Iranian economic situation. Concretely, the model assumes, (1) stagnation of private and public investment due to the deficit in the balance of payment and (2) high inflation caused by the budget deficit of the government.

The composition of this chapter is as follows. The current situation of the economy and energy supply/demand in I. R. Iran are described in the first section and the second section explains MEM in detail. Moreover, the third section introduces a simulation using MEM and the last section, section four, presents policy implications based on the simulation results.

5.1 Present Situation of the Energy Supply and Demand

5.1.1 Economic Trend

The real GDP (at constant 1982 prices) in I. R. Iran in 1994 is 13 trillion Rials, with private final consumption expenditure making up 69.2% of the total and exports of goods and services 25.8%. Public demand such as government expenditure and public capital formation contributed 20.5% of GDP in the same year.

The role of oil and service has remained critical in the Iranian economic structure. In 1994, oil and services accounted for 55.5% of total GDP and agriculture and industry accounted for 23.9% and 20.6%, respectively.

The growth rate of nominal GDP from 1990 to 1994 averaged 37.2%. However, the wholesale price index and the consumer price index rose by 25.7% and 31.8%, respectively, in the same period, so real GDP grew at 4.6% annually.

GDP growth has been fluctuating. The average rate of annual growth in the 1970s was 11.4%,but in the 1980s, it dropped to 1.4% because economic activity stagnated due to the War. (Figure 5.1,Table 5.1)

Figure 5.1 Trends of GDE

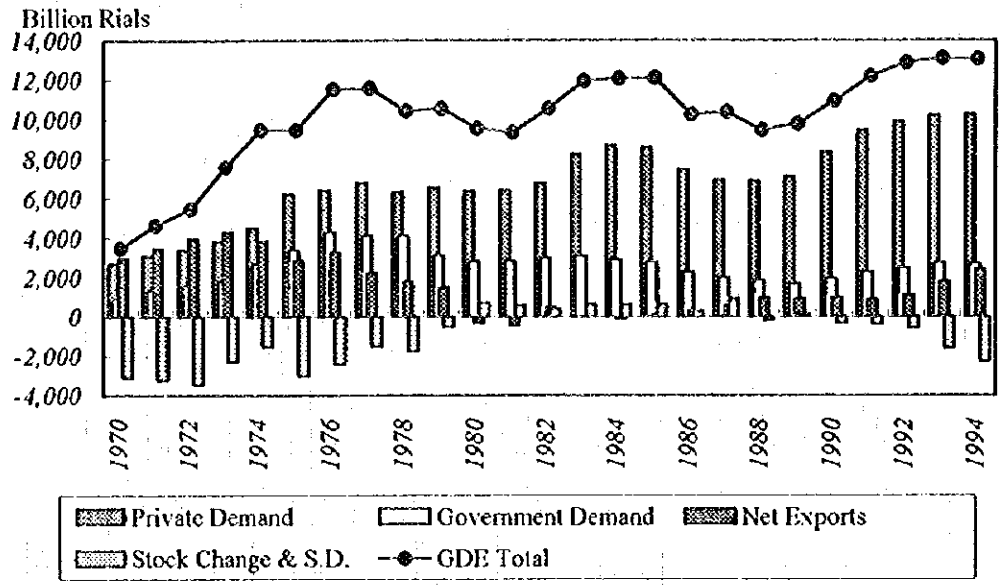


Table 5.1 GDE and Economic Indicators

(Unit:Billion Rials, 1982 prices)

	1970	1980	1990	1994	80/70	90/80	94/90	94/70
Gross Domestic Expenditure	3,468	9,556	10,930	13,066	*11.4*	*1.4*	*4.6*	*5.7*
Domestic Demand	3,625	9,177	10,279	12,930	*10.3*	*1.1*	*5.9*	*5.4*
Private Demand	2,682	6,347	8,329	10,251	*10.7*	*2.8*	*5.3*	*5.7*
Private Consumption Expenditure	2,248	5,360	7,561	9,038	*11.3*	*3.5*	*4.6*	*6.0*
Private Investment	434	987	766	1,213	*7.4*	*-2.5*	*12.2*	*4.4*
Pubric Demand	943	2,830	1,950	2,679	*9.2*	*-3.7*	*8.3*	*4.4*
Government Consumption Expenditure	590	1,968	1,337	1,953	*9.8*	*-3.8*	*9.9*	*5.1*
Pubric Fixed Capital Formation	353	861	613	726	*8.0*	*-3.3*	*4.3*	*3.1*
Net Foreign Demand	2,955	-306	978	2,425	*-21.2*		*25.5*	*-0.8*
Exports of Goods & Services	3,505	869	2,253	3,372	*-10.0*	*10.0*	*10.6*	*-0.2*
Oil & Gas	3,355	799	2,098	2,992	*-10.0*	*10.1*	*9.3*	*-0.5*
Others	151	70	154	380	*-11.1*	*8.2*	*25.3*	*3.9*
Imports of Goods & Services	550	1,175	1,274	947	*5.6*	*0.8*	*-7.1*	*2.3*
Norminal GDE	661	6,632	36,645	129,777	*37.7*	*18.6*	*37.2*	*24.6*
Wholesale Price Index(1990=100)	5.5	19.4	100.0	249.3	*24.1*	*17.8*	*25.7*	*17.2*
Consumer Price Index(1990=100)	5.8	20.4	100.0	301.4	*22.2*	*17.2*	*31.8*	*17.9*
Exchange Rate for Export(Rials/US$)	99.2	70.7	300.9	1646.0	*-2.5*	*15.6*	*52.9*	*12.4*
Active Labor Population(1,000 persons)	7,339	10,899	14,167	15,367	*5.8*	*2.7*	*2.1*	*3.1*
Unemployment Rate(%)	3.8	11.8	14.0	9.8	*14.0*	*1.7*	*-8.5*	*4.0*

5.1.2 Primary Energy Supply

The primary energy supply in 1994 was 767.8 MBOE (million barrels crude oil equivalent). Oil accounted for 56.7% of total supply and natural gas 40.4%, hydro electric power 1.5%, solid fuel 0.9%, and others 0.4%.

The greater dependence on oil and natural gas in the primary energy requirement is due to huge energy reserve of natural resources. I. R. Iran was ranked the fifth largest country for proven crude oil reserves and second in the world for proven natural gas reserves at the end of 1994. (Table 5.2)

Table 5.2 Domestic Primary Energy Supply

(Units:MBOE,%)

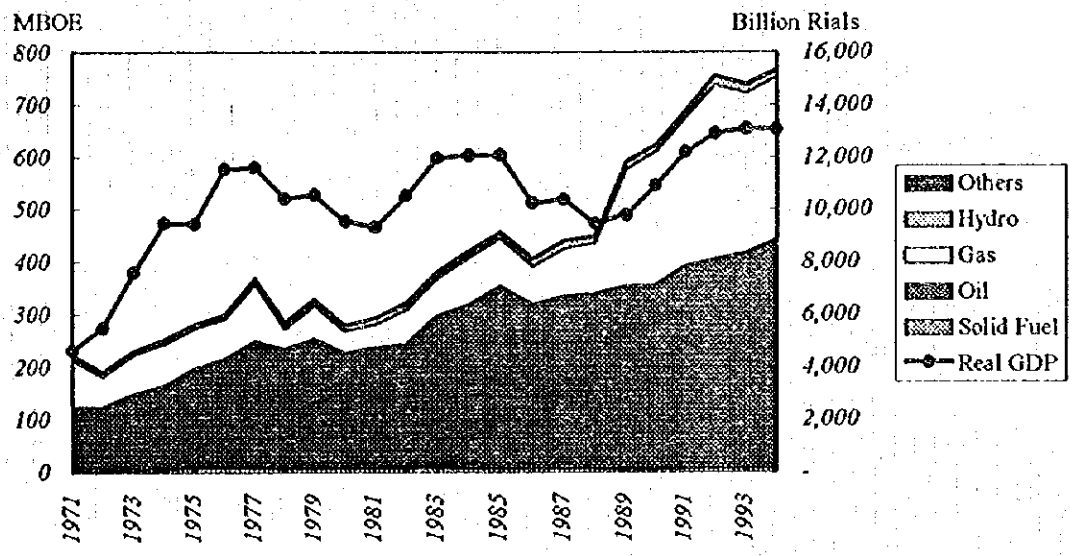
	1971	1980	1990	1994	1971	1980	1990	1994	80/71	90/80	94/90	94/71
Total	222.2	280.4	624.4	767.8	(100)	(100)	(100)	(100)	2.6	8.3	5.3	5.5
Solid Fuel	1.6	7.9	4.7	7.0	(0.7)	(2.8)	(0.8)	(0.9)	19.4	-5.1	10.5	6.6
Petroleum	122.1	218.7	352.1	435.6	(55.0)	(78.0)	(56.4)	(56.7)	6.7	4.9	5.5	5.7
Gas	90.4	41.6	254.9	310.2	(40.7)	(14.9)	(40.8)	(40.4)	-8.3	19.9	5.0	5.5
Hydro	4.2	8.8	9.5	11.6	(1.9)	(3.1)	(1.5)	(1.5)	8.6	0.8	5.1	4.5
Others	3.8	3.4	3.2	3.4	(1.7)	(1.2)	(0.5)	(0.4)	-1.2	-0.6	1.5	-0.5
GDP(1982 Billion Rials)	4,622	9,556	10,930	13,181					8.4	1.4	4.8	4.7
Intensity(1971=100)	100.0	61.1	118.9	121.2					-5.3	6.9	0.5	0.8
Elastisity									0.3	6.2	1.1	1.2

[Note]Figures in parentheses show percentage share of total

From former trends in energy supply and economy, the primary energy supply increased steadily whereas real GDP increased or decreased in 1971-1994. The Primary energy supply increased about 3.5 times in the same periods (annual growth rate 5.5%). In the 1980s the annual growth rate it was 8.3%.

Until the first half of the 1980s, the increase in oil accounted for the largest part of the increment in total primary energy supply. However, in the second half of the 1980s, natural gas took the place of petroleum in the increment. (Figure 5.2)

Figure 5.2 Primary Energy Supply



Energy intensity against GDP shows energy consumed to produce one unit of additional value. Although it decreased from 100 in 1970 to 61 in 1980, after the economic stagnation of the 1980s, it

doubled to 119 in 1990.

5.1.3 Final Energy Consumption

About 75% of the primary energy supply was demanded by the consumer as the final energy consumption in 1994. Final energy consumption during the year was 573.7 MBOE, with petroleum products accounting for 64.2% of the total, gas 27.5%, and electricity a mere 6.5%.
An analysis of energy consumption by sector shows that the residential sector accounted for 34.1% of the total final consumption and the industrial sector 30.1%, the transportation sector 24.6%, the non-energy and the agriculture sectors 8.6% and 5.0%, respectively. (Table 5.3)

Table 5.3 Final Energy Demand

(Units:MBOE,%)

	1971	1980	1990	1994	1971	1980	1990	1994	80/71	90/80	94/90	94/71
Total	182.8	230.8	425.3	573.7	(100)	(100)	(100)	(100)	2.6	6.3	7.8	5.1
Solid Fuel	1.6	7.9	4.7	7.0	(0.9)	(3.4)	(1.1)	(1.2)	19.4	-5.1	10.5	6.6
Petroleum	86.6	185.6	288.1	368.3	(47.4)	(80.4)	(67.7)	(64.2)	8.8	4.5	6.3	6.5
Gas	88.2	24.2	102.7	157.6	(48.2)	(10.5)	(24.1)	(27.5)	-13.4	15.6	11.3	2.6
Electricity	2.7	9.6	26.5	37.4	(1.5)	(4.2)	(6.2)	(6.5)	15.3	10.7	9.0	12.2
Others	3.8	3.4	3.3	3.4	(2.1)	(1.5)	(0.8)	(0.6)	-1.2	-0.3	0.7	-0.5
Industrial Sector	104.3	61.8	149.8	172.5	(57.0)	(26.8)	(35.2)	(30.1)	-5.6	9.3	3.6	2.2
Transportation Sector	19.1	52.7	96.8	141.0	(10.5)	(22.8)	(22.8)	(24.6)	11.9	6.3	9.9	9.1
Agricultural Sector	4.7	12.1	27.7	28.6	(2.6)	(5.2)	(6.5)	(5.0)	11.0	8.6	0.9	8.1
Residential Sector	31.8	77.6	128.0	195.8	(17.4)	(33.6)	(30.1)	(34.1)	10.4	5.1	11.2	8.2
Household Sector	22.1	50.4	101.1	146.5	(12.1)	(21.9)	(23.8)	(25.5)	9.6	7.2	9.7	8.6
Commercial Sector	9.7	27.1	26.9	49.3	(5.3)	(11.8)	(6.3)	(8.6)	12.1	-0.1	16.3	7.3
Non-energy Use Total	22.9	26.6	23.0	35.6	(12.5)	(11.5)	(5.4)	(6.2)	1.7	-1.4	11.5	1.9
Population(1,000 persons)	28,727	37,991	54,504	62,150					3.2	3.7	3.3	3.4
Per Capita(BOE/Person)	6.4	6.1	7.8	9.2					-0.5	2.5	4.3	1.6

[Note]Figures in parentheses show percentage share of total

The annual growth rate in the period 1971-1980 was 2.6%, which rose to 6.3% in 1980-1990, and 7.8% in 1990-1994. The increase in the final energy consumption in 1971-1977 was largely due to petroleum(accounting for 80%). However, after 1981 the contribution of petroleum dropped to 50% and the increase of gas consumption accounted 40% of the increment in total final energy consumption.
Changes in final energy consumption can also be broken down for the following sectors in each period. Until 1977, in each demand sector, such as the industrial sector, the transportation sector, and the residential sector accounted for 30% of the increment in final energy consumption, but in 1981-1990, the industrial sector accounted for more than 40%.

Since 1990, the contribution of the industrial sector has fallen to 20% and the increase in the residential sector accounts for 50% of the increment in total final energy consumption. (Figure 5.3, Figure 5.4)

Figure 5.3 Final Energy Demand by Source

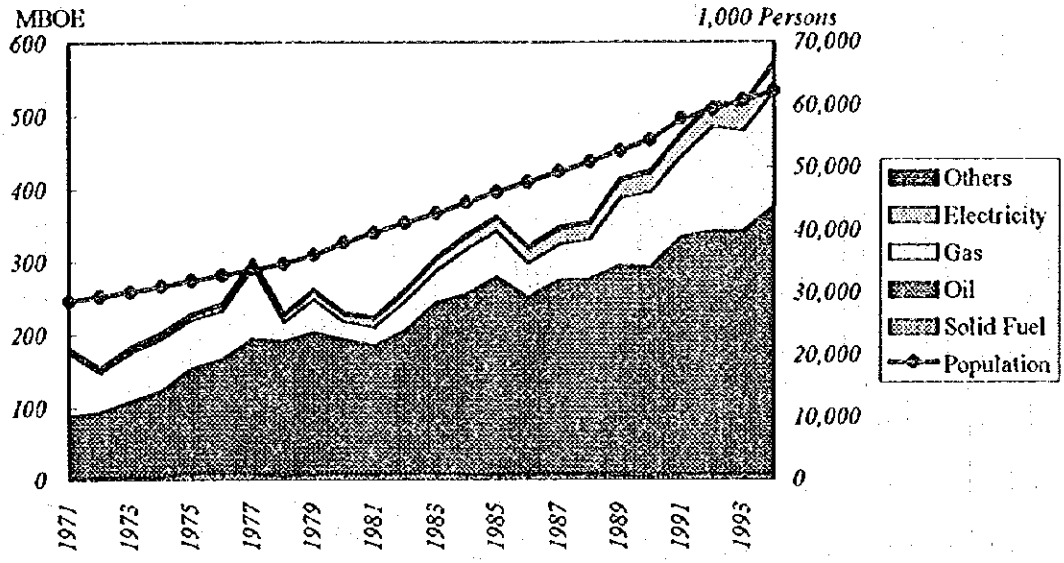
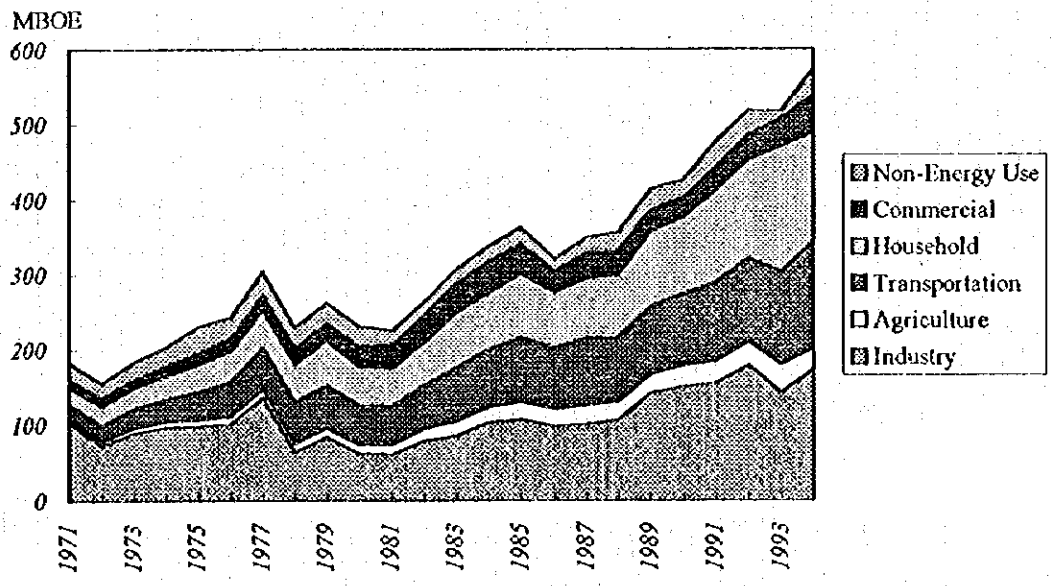


Figure 5.4 Final Energy Demand by Sector



Final energy consumption per capita fell to 5.7 BOE in 1981 from 6.4 BOE in 1971. However, it then increased up to 7.8 BOE in 1990. Since 1990, it has grown at an annual rate of 4.3% and was 9.2 BOE in 1994. Incidentally, the growth rate of the population in the same period was 3.3%.

5.1.4 Energy Demand in the Industrial Sector

Energy consumption in the industrial sector was 172.5 BOE in 1994 accounting for about 30% of final energy consumption. Gas accounted for 55.9% of total energy consumption in the industrial sector, petroleum 33.0%, electric power 7.0%, and solid fuels 4.1%. (Table 5.4)

Table 5.4 Energy Demand in the Industrial Sector

(Units:MBOE,%)

	1971	1980	1990	1994	1971	1980	1990	1994	80/71	90/80	94/90	94/71
Industrial Sector Total	104.25	61.81	149.8	172.55	(100)	(100)	(100)	(100)	-5.6	9.3	3.6	2.2
Solid Fuel	1.6	7.9	4.7	7.01	(1.5)	(12.8)	(3.1)	(4.1)	19.4	-5.1	10.5	6.6
Petrolium Total	13.3	31.66	58.34	56.99	(12.8)	(51.2)	(38.9)	(33.0)	10.1	6.3	-0.6	6.5
Gas	88.15	18.79	80.75	96.513	(84.6)	(30.4)	(53.9)	(55.9)	-15.8	15.7	4.6	0.4
Electricity	1.2	3.46	6.01	12.036	(1.2)	(5.6)	(4.0)	(7.0)	12.5	5.7	19.0	10.5
Food	2.5148	7.9842	21.63	32.401	(2.4)	(12.9)	(14.4)	(18.8)	13.7	10.5	10.6	11.8
Textile	1.6222	5.1503	8.1014	12.135	(1.6)	(8.3)	(5.4)	(7.0)	13.7	4.6	10.6	9.1
Wood & Products	0.1339	0.4251	1.3709	2.0536	(0.1)	(0.7)	(0.9)	(1.2)	13.7	12.4	10.6	12.6
Paper & Pulp	0.2805	0.8906	1.6994	2.5456	(0.3)	(1.4)	(1.1)	(1.5)	13.7	6.7	10.6	10.1
Chemical	89.172	13.94	56.392	32.629	(85.5)	(22.6)	(37.6)	(18.9)	-18.6	15.0	-12.8	-4.3
Ceramics & Non-metal	9.5488	30.316	45.155	67.64	(9.2)	(49.0)	(30.1)	(39.2)	13.7	4.1	10.6	8.9
Primary Metal	0.3192	1.0134	8.6296	12.927	(0.3)	(1.6)	(5.8)	(7.5)	13.7	23.9	10.6	17.5
Machinery	0.6561	2.083	6.6657	9.9849	(0.6)	(3.4)	(4.4)	(5.8)	13.7	12.3	10.6	12.6
Other Manufacturing	0.0023	0.0074	0.1556	0.2331	(0.0)	(0.0)	(0.1)	(0.1)	13.7	35.6	10.6	22.2
Value Added(Billion Rials)		688.6	1163.9							5.4		
Intensity(BOE/M Rials)		89.8	128.7									

[Note]Figures in parentheses show percentage share of total

During the period from 1971 to 1980, with the decrease of natural gas as a raw material for the petrochemical industry, energy consumption in the industrial sector showed a decrease of 5.6% per year. However, the annual growth rate in 1980-1990 increased to 9.3% and 3.6 % in 1990-1994. An analysis of energy consumption by energy source showed that consumption of gas and electricity has increased substantially in recent years.

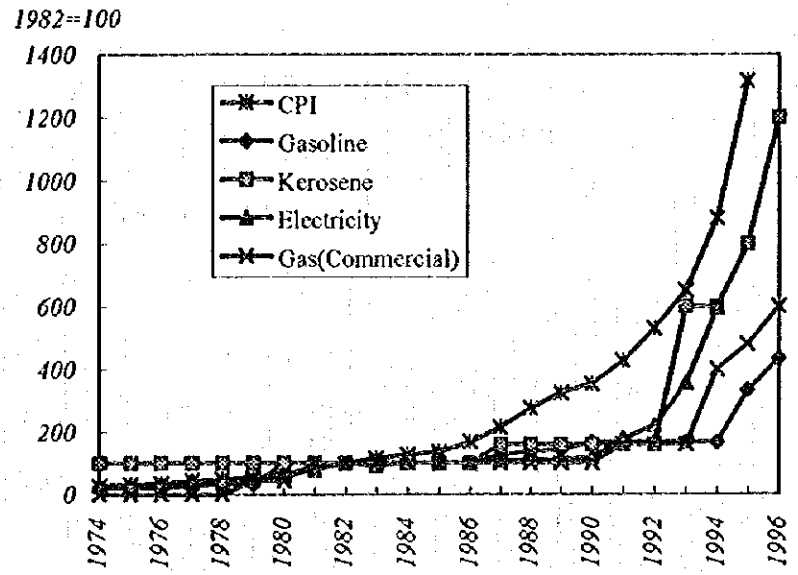
Trends in the energy intensity per a unit of value added show a rapid decrease from 184 BOE/million Rials in 1974 to 75 BOE/million Rials in 1981. If then increased to 149 BOE/million Rials in 1989 and fell to 103 BOE/million Rials, which accounted for 60% of the figure in 1974. It is considered that the reason for the upward tendency of intensity from 1981 to 1989 depended on the fall of the operation rate, because of the slowdown of industrial activity, which was caused by the War.

The contribution of energy-intensive industries to the total energy consumption in this sector fell to 67% in 1994 from 95% in 1971. However, if we exclude natural gas as a raw material for the petrochemical industry, energy consumption by the energy-intensive industries contributed 48% in 1994 against 37% in 1990.

5.1.5 Domestic Energy Prices

Until recent years, domestic energy prices were kept down by subsidies from the government. However, some domestic energy prices were raised to reduce the budget deficit. For instance, the price of regular gasoline was raised from 50 Rials per liter in 1994 to 100 Rials in 1995, 130 Rials in 1996. Prices of other petroleum products, electricity, city gas, were also raised in the same way. In the future, pricing policy will be adopted to promote energy conservation. (Figure 5.5)

Figure 5.5 Domestic Energy Prices



5.2 Development of Model

In this section, we describe the Macro-Energy Model; MEM, which was developed by the JICA team for this project.

5.2.1 Macro-energy Model; MEM

(1) Fundamental Concept and Structure of the Model

a. Fundamental Concept

The basic design concept and the targets of the MEM are as follows. First, the variables in the macro-economic model and the energy supply/demand model are solved simultaneously. Second, it should be possible to evaluate the effects of energy policy on the macro-economy. Third, the model should be easy to use on a personal computer. Forth, the model is based on econometrics with time series data. Fifth, the model is composed of two sub-models: macro-economic model and energy supply/demand model.

The macro-economic model considers the issues and the difficulties in the current Iranian economy in developing the model structure. These issues are as follows.
First is the constraint on imports which is caused by the balance of payments deficit. The

accumulation of foreign debt and the repayment plan make it difficult to import not only consumers goods but also capital goods. Second is the constraint on fixed capital formation due to scarcity of imported capital goods mentioned above. Third is the financial deficit of the government, which causes high inflation through the expansion of money supply.

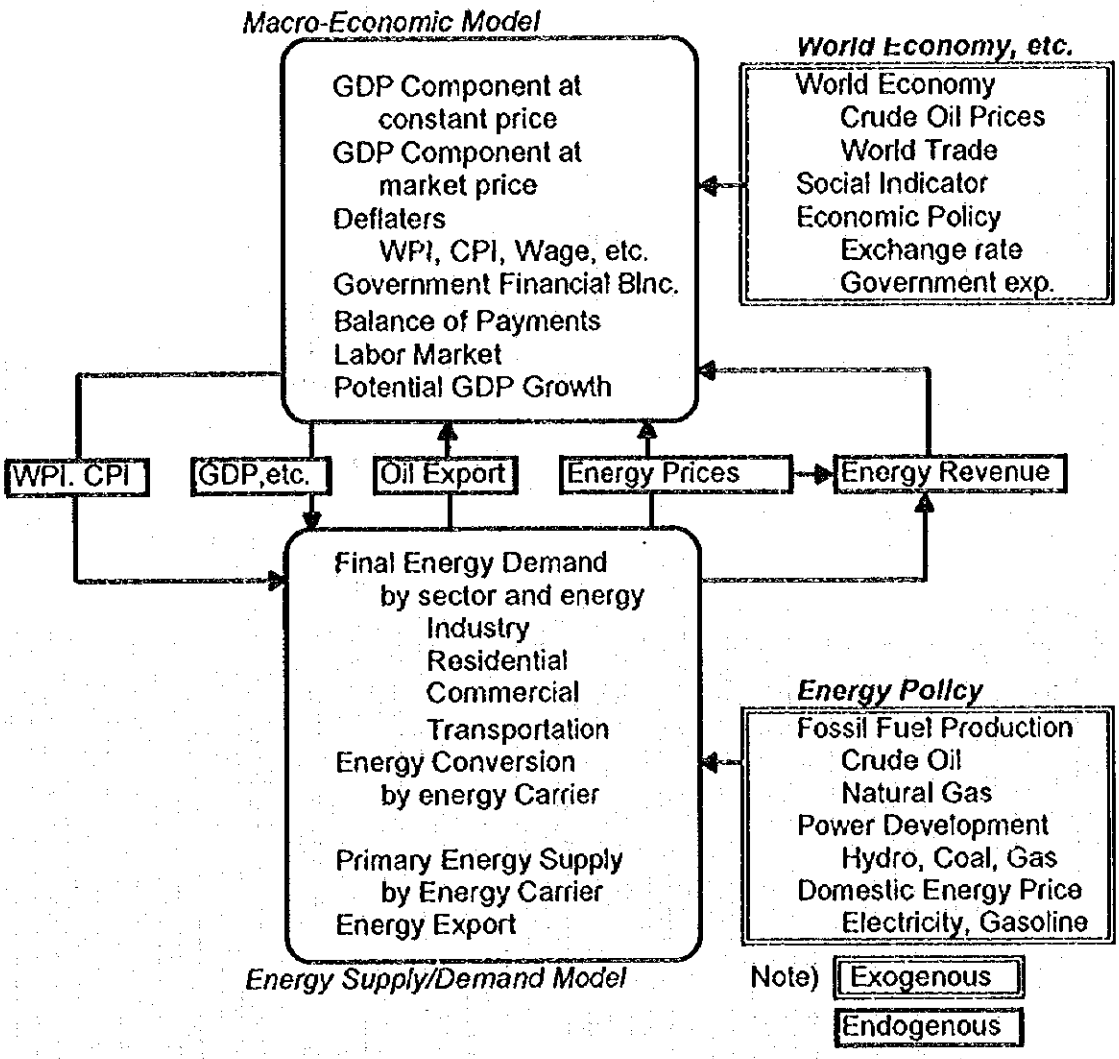
Conversely, the energy supply and demand model includes the following items. These are: (1) the model is designed to grasp energy flows from primary energy supply to final energy consumption by sector and energy carrier, (2) energy demand responds to energy prices which is one of the energy policy measures, (3) in the demand sector of the industry, energy intensity denominated by the physical output is taken into account.

There are the following five paths linking the sub-models: the macro-economic model and the energy supply and demand model. They are,

1) general price indices (explanation variable in energy demand functions)
2) macro-economic variables (explanation variable in the energy demand functions and production indices for manufacturing industries)
3) quantity of energy exports (oil exportation in GDE component)
4) domestic energy prices (explanation variable for consumer price index and energy demand function)
5) revenue from domestic energy sales (part of financial income of the government)

1) and 2) are endogenous variables, which are calculated in the macro-economic model and are handled as exogenous variables in the energy supply and demand model. On the other hand, the variables 3), 4), and 5) are endogenous variables in the energy supply and demand model and exogenous ones in the macro-economic model. (Figure 5.6)

Figure 5.6 Flow Chart of Macro-energy Model(MEM)



b. Characteristics

MEM was constructed with the fundamental design shown above and has the following characteristics. First, the model is composed of demand equations estimated by the OLS (ordinary least square) method with time series data and definitional equations. Second, it is possible to examine the models performance using several tests, since the model is based on historical data. Third, because the variables in the model are solved simultaneously, the influence of energy policy on the economic activity can be easily estimated by the model. Fourth, because the model is compact, we can use it on a personal computer.

c. Endogenous and Exogenous Variables

The number of endogenous variables is 171 and the number of exogenous ones is 63 in the MEM and the number of definitional equations and structural equations is 171. There are 63 exogenous variables, but many of them are dummy variables and statistically insignificant variables.

When we use the model, there are the following 20 major exogenous variables.
Those are,

1) world economy
   1)-1 crude oil prices (OPEC basket)
   1)-2 price index of the world exportation goods
2) social variable
   2)-1 population
3) domestic economic policy
   3)-1 exchange rate
   3)-2 balance of payments (current account, service account, transfer account, etc.)
   3)-3 government expenditure (current expenditure and development expenditure)
   3)-4 inventory change and the statistical difference
4) energy supply
   4)-1 production (crude oil, natural gas, and coal)
   4)-2 exportation (natural gas)
   4)-3 stock change and the statistical difference
   4)-4 electric power development
5) domestic energy prices
   5)-1 gasoline price
   5)-2 electric power price
6) time trend

(2) Outline of Macro-economic Model

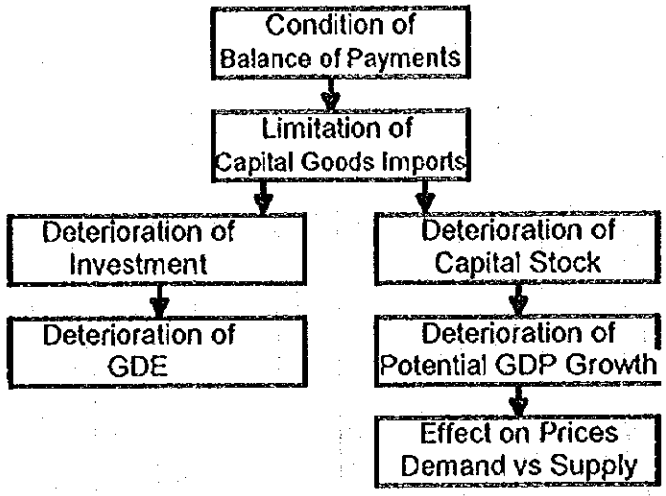
The macro-economic model was designed to reflect the present status of the Iranian economy. Following three key aspects are included in the model. They are: 1) foreign debt, 2) government financial deficit, and 3) domestic energy price changes. To reflect the above key issues in the model concretely, following mechanism are incorporated into the model.

a. Influence of Foreign Debt on the Domestic Economy

The capability of importing goods depends on the availability of foreign currency. This foreign payment ability depends on foreign currency preparations and balance of payments. I. R. Iran has a foreign debt and a balance of payments deficit. Therefore, the limited foreign payment ability brings about import constraints and purchases of capital goods, such as machines and equipment for factories. In other words, the constraint on imports due to the balance of payments adversely affects fixed capital formation.

Moreover, in the long term, fixed capital formation determines the capital stock through the accumulation of historical investment, and capital stock decides the production ability of the country. Consequently, the constraint on capital investment adversely affects the potential economic growth of the country. If production cannot meet demand, the result is rising prices. This relationship is illustrated in the following chart. (Figure 5.7)

Figure 5.7 Flow Chart on Impact on Economy of Balance of Payments

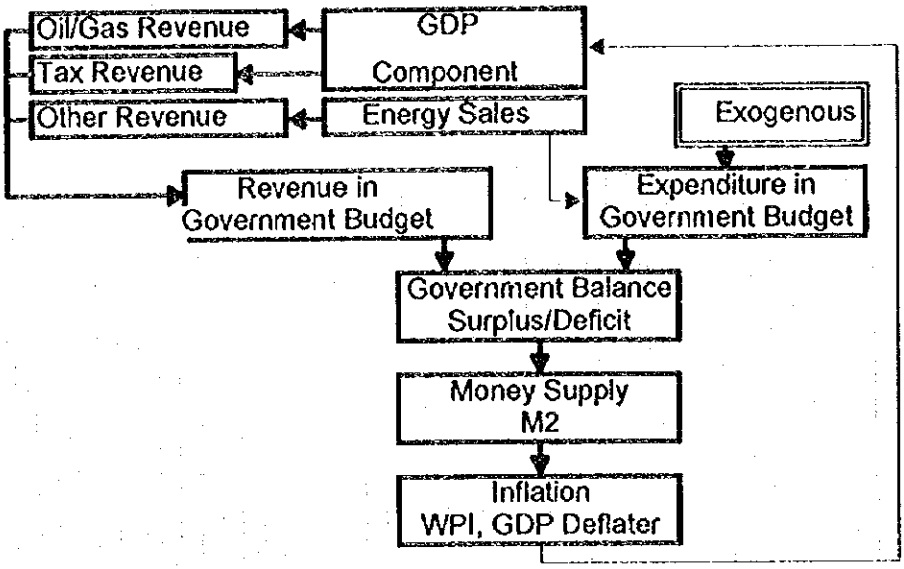


b. Influence of the Government Financial Balance on the Domestic Economy

In I. R. Iran, because the energy industry, including electric power utilities, gas utilities, and petroleum industry, is state-operated, the revenue from domestic energy sales becomes part of the government budget income. Hence, raising energy prices as an energy policy increases government income.

On the other hand, when the government has a deficit, it responds as follows. The central bank increases the money supply. Therefore, the financial deficit of the government increases the money supply and leads to inflationary trends in the domestic market . The relation mentioned above is illustrated as a following chart.
(Figure 5.8)

Figure 5.8 Flow Chart of Impact on Economy of Government Financial Balance



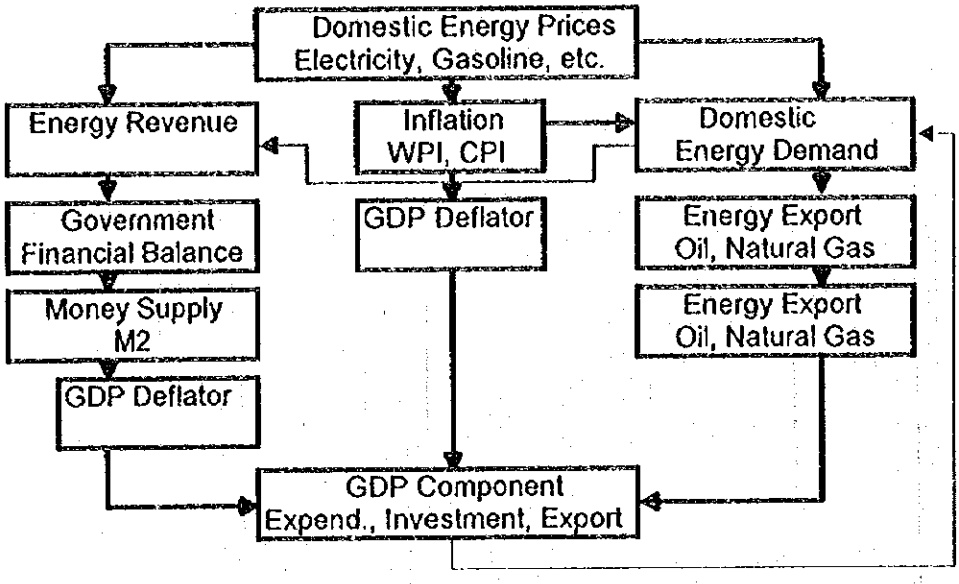
c. Influence of Energy Price Change on the Domestic Economy

Domestic energy prices influences the domestic economy, through the following three paths.

The first path is the reflection of revenue changes in the energy industry on the financial situation of the government. The second path is the change of commodity prices due to the change of energy prices. The third path is domestic energy demand changes and its impacts on the quantity of crude oil exports.

For example, increasing domestic energy prices brings the following changes through each path. In the first path, which is government revenue, the rise of energy prices reduces the financial deficit of the government due to increasing government income. The improvement of the financial balance reduces the volume of the incremental money supply holds down inflation. In the second path with commodities prices, a rise of domestic energy prices impacts all commodity prices through wholesale prices and consumer prices. The price rise makes the purchasing power of the consumer decline in real terms and acts on the real GDP growth as a negative factor. As for the third path, the quantity of saved energy demand due to the rise of energy prices is converted into exports. In the international market, Iranian crude oil is traded at the international price. Then, an increase of crude oil export. increases GDE(GDP). These three paths are summarized in the following chart. (Figure 5.9)

Figure 5.9 Flow Chart of Impact on Economy of Domestic Energy Prices



(3) Outline of Energy Supply and Demand Model

The energy supply and demand model computes end-use energy demand in each of the final energy demand sectors, using economic indices obtained from the macro-economic model. Then it takes account of fuel inputs and conversion losses in the conversion sector, such as electric power generation, oil refining, city gas production, and primary energy requirement is calculated.

Energy demand is basically determined by real income, real prices, and technical innovation. Domestic energy prices and levels of production in each industry are also projected in this model corresponding to GDE components and general price index, which are obtained from the macro-economic model. The total flow of energy from final demand to the primary energy supply is determined in the energy balance table between supply and demand of energy sources consistently. However, in this model policy factors such as production of crude oil, exportation of natural gas, and electricity power development are handled as exogenous variables.

a. Domestic Energy Price

The future domestic prices for each secondary energy classified by users are estimated in the model. All of these are regulated by the government. In this model, all energy prices are correlated with gasoline prices or electricity prices.

b. Industrial Production

Presupposing the GDE (Gross Domestic Expenditure) components obtained from the macro-economic model, we can estimate the levels of economic activities for various industries. The indices of total industrial production are estimated by the weighted average

on the index of each industry. The production index and the domestic energy price here are used as the premise for the energy demand forecast.

c. Energy Consumption of Industry

The industrial sector consists of nine industries: food, textile, wood & products, paper & pulp, chemical, ceramics & non-metal, primary metal, machinery, and other manufacturing. Each industry has a demand function reflecting its characteristics. Production index and real energy price are explanatory variables for estimating energy demand. Furthermore, the model has the different demand functions to estimate demand for energy by energy carrier, such as electric power, petroleum products, natural gas, and city gas. We define consumption of solid fuel as the residual amount, which is the total minus electricity, petroleum products, and gas.

d. Energy Consumption for Transportation

The transportation sector consists of land (the road transportation and the railway) and aviation transport. The energy source in this sector is only petroleum products. Energy demand for each use is determined by the GDE components and real energy price.

e. Energy Consumption for Agriculture

In the agricultural sector there are two energy carriers: electricity and petroleum products, and demand for each is determined by private final consumption expenditure, value added of the agriculture, real energy price, etc.

f. Energy Consumption for Residential Sector

The residential sector consists of household sector and commercial sector. Energy sources are classified into electric power, petroleum products, city gas, and others. Demand for electric power is estimated by the ratio of electrification and the number of customers, real income, and real energy price.

(4) List of Equations in the Model

The equations adopted in the model are listed at the end of this chapter. The figures in parentheses are t value, R^2 shows the coefficient of determination adjusted for degrees of freedom, SD means standard difference, and DW is the value of the Durbin-Watson statistic. The meanings and contents of each variable in the equations listed hereafter are explained in the attached sheets at the end of this chapter.

5.2.2 Data

(1) Data Collection

When we developed the model, we employed data which was principally published in I. R. Iran. For data collection, the PBO team provided most of the data needed from a data base they developed. However, we made efforts to obtain data missing from their database from different statistic sources with the cooperation of the PBO team.

Moreover, for the mission data, we used data sources of international organization such as the World Bank, OECD/IEA, OPEC, and the British Petroleum.
To keep data consistent and to complete the data base for the model, while using the above data source, the JICA team added the several estimations.

(2) Descriptions and Quantity

The of data we set in the data base for the model numbered 364. The descriptions and quantities are listed at the end of this chapter.

(3) Data Processing

We sometimes faced the following difficulties with data. (1)The case in which it was impossible to obtain data required for building the model and (2)the case when it seems to us that figures are unreliable compared to other data. At these cases, the JICA team modified and estimated the data. These data are shown hereinafter.

a. Current Balance of Payments
According to the statistics of I. R. Iran, the balance of payments figures are provided by the World Bank provides those date. Therefore, we estimated the data on balance of payments based on World Bank data from the years 1970 to 1994. Also, the estimations of transfer balance and service balance, were made I the same way.

b. Crude Oil Production, Export and Price
Using OPEC statistics, we estimated three variables: crude oil production, exports and prices, from 1960 to 1994.

c. Capital Stock
Data on capital stock does not exist in I. R. Iran, although such data are a key variable of the investment function. Therefore, we estimated these data from private investment and the government fixed capital formation for every year, assuming a deprecation ratio of 5%.

d. Interest
In the Islamic economy, specified rent interest does not exist. However, the interest rate is important to estimate the investment function. Because the deposit rate is available in the statistics, it is possible to interpret this rate as interest rate for rent. But, unfortunately, it was possible to use only data from and after 1985, although we needed time series data for a longer.
In case of the estimation for data on past period years, we adopted a regression formula with three exploration variables for deposit interest (INT). These variables are wholesale price index (WPI), money supply (MLM2), and deposit interest for the previous year. The concrete formula is as follows.

$$INT = -13.31 + 2.83 * (WPI/WPI(-1)) + 9.05 * (MLM2/MLM2(-1)) + 0.89 * INT(-1)$$
$$(-4.25) \quad (1.09) \qquad (2.07) \qquad (2.3)$$

estimation period : 1995-1993 R^2=0.87 SD=0.39 DW=2.33

e. Potential GDP

The potential economic capability of a country is determined by the size and the operation of the factors of production, which are labor and capital. Concretely, the available labor force, the capital stock, and rates of those factors utilization produces actual GDP.

Therefore, we can estimate potential GDP and potential economic production capability using the following formula.

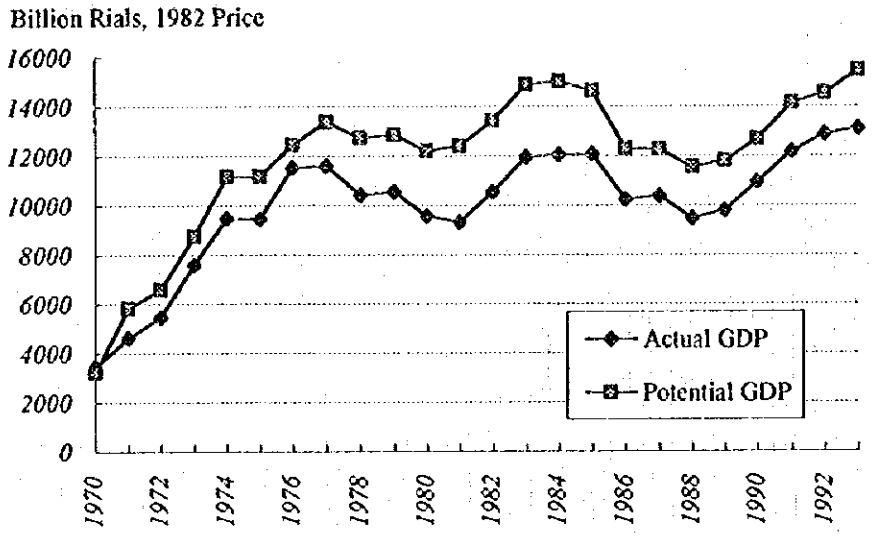
GDP/((1-URATE/100)*LN)=1.75+0.0000006*(KIP*ORELE) - 0.004*(VAG/GDP)*100
(57.62) (8.17) (-19.74)
estimation period : 1976-1993 R^2=0.97 SD=0.02 DW=1.396

The left side of the equation is labor productivity per person employed. We adopted the following three variables as the explanatory variable on the right side: 1) capital stock (KIP) with operation ratio (ORELE), and 2) ratio of agricultural value added to value added total (VAG/GDP). The utilization ratio of the electric power facilities is adopted as the operation ratio for capital stock, because of data availability.

By substituting the minimum value for the actual unemployment rate (URATE), a maximum value for the actual operation ratio (ORELE) in the estimation formula above, the potential economic production capability in the past can be estimated.

A comparison between the potential production capability estimated, which is the potential GDP and the actual GDP is shown in the following chart. (Figure 5.10)

Figure 5.10 Comparison of Actual GDP and Potential GDP



It is quite natural that some gap between potential GDP and actual GDP exists, and that gap lets us know the situation of the market, (demand and supply), in the whole country. If demand (the actual GDP) approaches possible supply (potential GDP), the market becomes tight and prices tend to rise.

f. Energy Data in the Industrial Sector

For the energy supply and demand data, we basically used the energy balance table estimated by the PBO team. However, in this balance table, demand for energy in the industrial sector is not classified into several sub-industrial sectors. Also, gas consumption as raw material for the petrochemical industry is counted as non-energy consumption and is not contained in the demand of the industrial sector.

Different statistics are available for energy demand of sub-industrial sectors. However, they cover only data series from 1981 to 1989. The total energy demand obtained from this series accounted for 75% (1989) of that in the balance table.

Therefore, we calculated the share of each industry from the latter data source and distributed the total energy demand in the balance table. The process of the estimation is as follows.

1) It is assumed that total energy demand in the industrial sector is the sum of gas demand for the petrochemical industry as raw material and the total in the balance table.
2) We distribute the total energy demand in the balance table to the individual industries by the ratio of compositions.
3) The composition ratio of each industry before 1980 is same as the figure in 1981.
4) The composition ratio of each industry after 1990 is same as the figure in 1989.
5) City gas consumption, which was counted with non-energy use in the balance table, is recognized as part of demand for the chemical industry.

g. Energy Data in the Residential/Commercial Sector

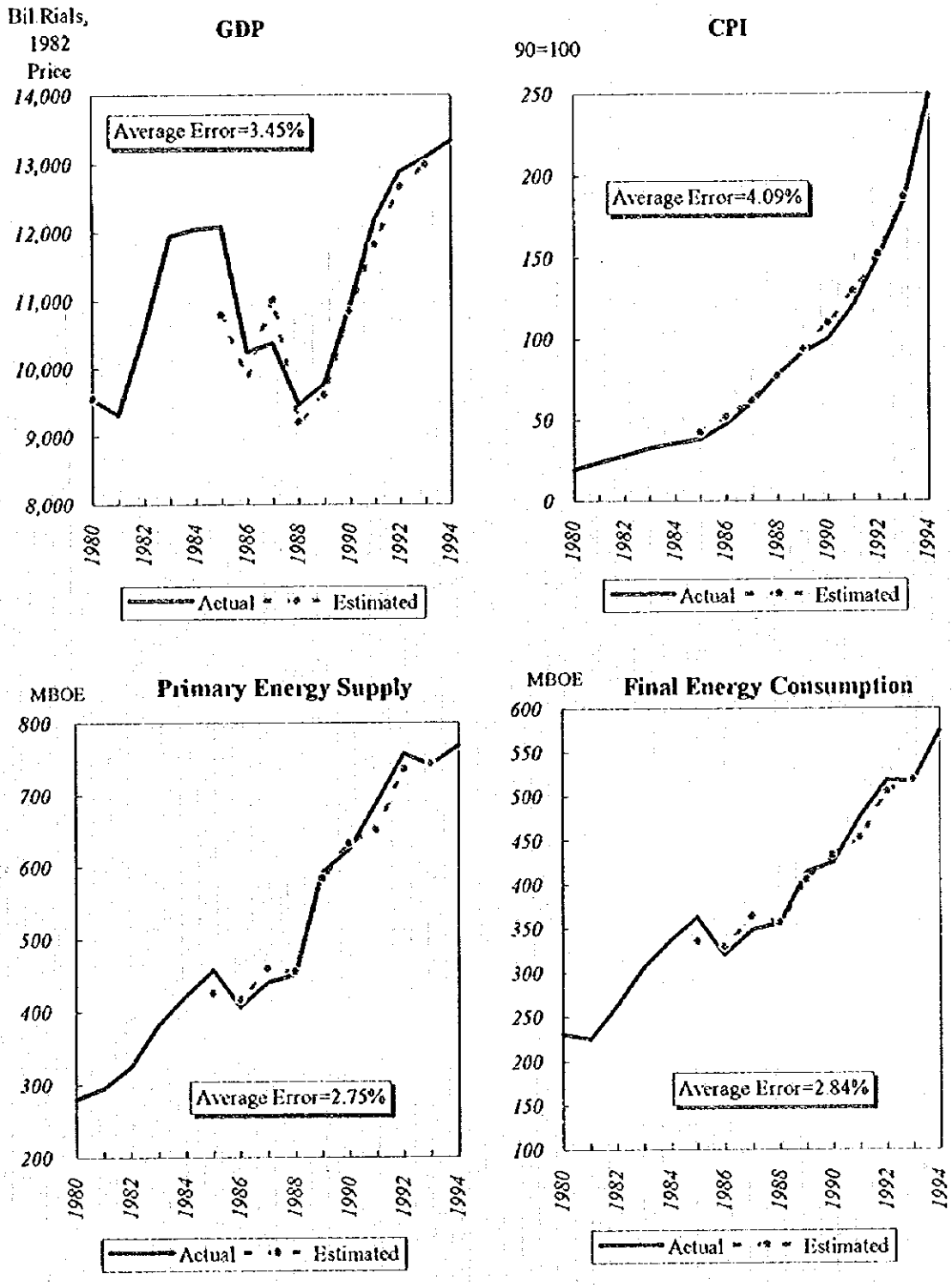
Energy demand data in the residential/commercial sector used basically was extracted from the energy balance table. However, in this balance table, all of the gas consumption in the commercial sector before 1992 is counted as demand in the household sector. Also, electric power consumption in the commercial sector such as for street is counted as non-energy use. Therefore, using gas consumption data in the household sector in the energy balance table of JICA 's previous study, we corrected the data in the balance table. The estimation process is as follows.

1) We count all of electric power consumption which was classified as non-energy use in the balance table as a part of electric power demand in the commercial sector.
2) Gas consumption in the commercial sector is determined as the residual amount which drew gas consumption in the household sector from the total gas consumption in the residential/commercial sector in the balance table.
3) The ratio of gas consumption of the household sector to the commercial sector from 1990 to 1992 is the same as the figure 1989.
4) For gas consumption in the residential/commercial sector in 1993 and 1994, we adopted the original time series data in the balance table because the trend of original series data in the both years follows the trend of the previous year's data, which are estimated by this study.

5.2.3 Model Performance

We attempted to check the performance of the whole model by the most severe test, the so-called a "Final test." The" Final test" is a verification test which shows how much endogenous variables in the model can successfully trace past actual figures while adopting past exogenous variables.
Looking at the test result from 1985 to 1993, we identified that the performance of the model was good. The average error percentages for major variables, such as GDP, consumer price index, primary energy supply, final energy consumption through the testing period, are 3.5%, 4.1%, 2.8%, 2.8% respectively. The comparison between the actual figures and the model results is shown in the following chart. (Figure 5.11)

Figure 5.11 Model Performance According to the "Final Test"



5.3 Simulation

5.3.1 Viewpoint of Simulation

In this section we introduce simulation results using MEM. We prepared two cases. The first simulation is so called the "Reference Case" and the second one is the "Energy Conservation Case." The Energy Conservation Case takes account of energy conservation potential through a micro-study of individual industries in the second Chapter of this report, with consideration of the effects of higher domestic energy prices. The purpose of the simulations is to get knowledge about the impacts on the macro-economy and the energy supply and demand of energy policy measures, which are energy pricing and institutional energy conservation framework. Through the comparison of simulation results for the two cases, we evaluate energy policy. The simulation period is from 1994 to 2005, and base year is 1994.

5.3.2 Reference Case

(1) Major Assumption

In the Reference Case, the major assumptions of the simulation are as follows. (Table 5.5)

Table 5.5 Assumptions of Simulation for the Reference Case

	Unit	1990 1369	90/80	1994 1373	94/90	2000 1379	00/94	2005 1384	05/00	05/94
1.World Economy										
a. World Oil Price	$/bbl	23.2	-1.5	16.5	-8.2	20.6	3.8	23.9	3.0	3.4
b. Price Deflator Export Goods	1980=100	133.8	2.9	133.5	-0.1	159.4	3.0	184.8	3.0	3.0
2.Economic Policy										
a. Interest	%	9.0	-1.2	11.5	6.3	11.5	0.0	11.5	0.0	0.0
b.Government										
Current Expenditure	Bil. Rials	4,285	9.8	18,841	44.8	71,873	25.0	150,958	16.0	20.8
Development Expnd.	Bil. Rials	1,766	12.0	9,071	50.5	27,087	20.0	56,891	16.0	18.2
c.Exchange Rate										
for Oil Exports	Rials/US$	211	11.6	1,646	67.2	4,500	18.2	5,000	2.1	10.6
for Other Exports	Rials/US$	1,445	34.0	1,646	3.3	4,500	18.2	5,000	2.1	10.6
for Imports	Rials/US$	371	13.9	1,829	49.1	4,500	16.2	5,000	2.1	9.6
d. Balance of Payment										
Service net	Bil. US$	-3.15	-2.6	-2.99	-1.3	-2.99	0.0	-2.99	0.0	0.0
Transfer	Bil. US$	2.50		1.20	-16.8	1.20	0.0	1.20	0.0	0.0
Capital Balance	Bil. US$	0.30	138.3	-2.23		0.00	-100	0.00		-100
Errors	Bil. US$	-0.92		-1.13	5.1	-1.13	0.0	-1.13	0.0	0.0
Over All Balance	Bil. US$	-0.30		1.23		1.23	0.0	1.23	0.0	0.0
e. Others										
Inventory and Stts Dif	Bil. Rials	-327		-2,288	62.6	-2,288	0.0	-2,288	0.0	0.0
same as abv. in nominal	Bil. Rials	4,254	24.3	1,948	-17.7	1,948	0.0	1,948	0.0	0.0
3.Energy Policy										
a Resource Development(Production)										
Crude Oil	Mil. BOE	1,192	8.4	1,382	3.7618	1,460	0.9	1,643	2.4	1.6
Solid Fuel	Mil. BOE	4	-1.0	4	3.5	6	5.0	7	5.0	5.0
Natural Gas	Mil. BOE	351	13.2	458	6.9	687	7.0	964	7.0	7.0
b.Energy Plices										
Gasoline	Rials/l	50	5.2	50	0.0	200	26.0	300	8.4	17.7
Electricity	Rials/kWh	5.7	7.3	28.5	49.7	38.2	5.0	48.7	5.0	5.0
c.Power Development										
Hydro	Mil. BOE	-9.5	0.8	-11.6	5.1196	-14.7	4.0	-17.9	4.0	4.0
Petro.Products	Mil. BOE	-38.4	9.4	-45.4	4.3149	-45.4	0.0	-45.4	0.0	0.0
Solid Fuel	Mil. BOE	0		0		0		0		
Nuclear	Mil. BOE	0		0		0		0		
d Energy Export										
Lean Gas	Mil.BOE	-13.1		-0.84	-49.68	-0.84	0.0	-0.84	0.0	-
e.Efficiency										
Rate of Effic., ELE	%	32.5	0.7	34.6	1.6	35.0	0.2	36.0	0.6	0.4
Rate of Own Use, ELE	%	5.3	4.7	4.6	-3.6	4.0	-2.2	4.0	0.0	-1.2
Rate of Loss, ELE	%	14.4	-0.6	14.8	0.6	14.5	-0.3	14.5	0.0	-0.2
Rate of Effic., Petro.	%	4.4	4.3	2.2	-15.8	4.0	10.1	4.0	0.0	5.4
Rate of Own Use, Petro.	%	3.8	-0.1	3.3	-3.2	3.0	-1.7	3.0	0.0	-0.9
Rate of Effic., LG	%	8.5	-0.6	11.4	7.5	9.0	-3.8	9.0	0.0	-2.1
Rate of Own Use, LG	%	37.9		16.1	-19.2	35.0	13.8	35.0	0.0	7.3
4. Others										
a. Population	1000 P.	54,504	3.7	62,150	3.3	72,075	2.5	81,546	2.5	2.5
b. Time Trend	1959=1	32	3.8	36	3.0	42	2.6	47	2.3	2.5
c. Dummy	1 or 0	0		1		1	0.0	1	0.0	0.0
	1 or 0	1		1	0.0	1	0.0	1	0.0	0.0

a. World Economy and Exchange Rate

First, we assumed that the annual inflation ratio in the world with the price index of world export goods is 3.0%.

Crude oil prices is rise gently in the future. Concretely, its annual increase in the 1990s is 3.8% and 3.0% after 2000. As a result, crude oil price in 2000 is 20.6 US dollars/barrel

and is 23.9 dollars/barrel in 2005 as a nominal base.
The assumption about exchange rate is as follows. The exchange rate in 1996 is 3000 Rials for one US dollar. The exchange rate will be gradually fall to 4500 Rials for one US dollar in 2000, and 5000 Rials in 2005.

According to a projection of the Economic Intelligence Unit, the exchange rate in 2000 will be 6000 Rials for one US dollar. Comparing this, our assumption might be seemed relatively conservative.
As to the presupposition about the balance of payments, we respect the present foreign debt repayment plan.
Equilibrium of the capital balance in 2000 will be realized and the deficit will be canceled. The future status of service balance, transfer balance, and overall balance are assumed to be the same as the 1994 figures.

b. Social Index
According to the statistics, the annual growth rate of the population in I. R. Iran has been 3.5% and more in recent years. This statistic is judged to be unreliable by the PBO team. Following the recommendation of the PBO team, we presumed that annual population growth rate in the future will be 2.5%.

c. Energy Policy
The important energy policies include 1) energy production, 2) domestic energy price, 3) power supply development plan.

1) Primary Energy Production
The contents of primary energy production are mainly crude oil and natural gas. Because crude oil production depends on the will of the government and OPEC, it is a very political value and is difficult to assumed. But for crude oil production in the Reference Case, we adopted, 4 million barrels /day in 2000 and 4.5 million barrels/day in 2005.

For natural gas production, we assumed it would expand at an annual rate of 7%. According to official plans in I.R. Iran, there is a natural gas export project to Turkey and India, but there is still uncertainty about feasibility. Therefore, for natural gas production, we think the increase trend in recent years will continue in the coming decade.

2) Domestic Energy Price
The forecast to domestic energy price is as follows. The electric power price is expected to have 5% annual increase rate. The Iranian government is examining raising the energy price. Comparing the government examination plan, our assumption might be very moderate, that is, an annual price rise of about 5%. Above all, under inflation which reached double digits in recent years, the electric power price in real terms.
On the other hand, the gasoline price, which was taken as representative of all petroleum

products, is assumed to be 130 Rials per a liter in 1996, 200 Rials in 2000, and 300 Rials in 2005. Comparing the price in 1994, the annual increase is 26% up to the year 2000 and 8.4% thereafter.

3) Power Supply Development

The incremental capacity of the electric power supply that corresponds to the demand increase in the future depends mainly on the natural gas fired power plants. This is the basic concept which is the logic of power supply composition in future. Based on this idea, the generation capacity of petroleum, coal, and nuclear in future are adopt the same figures as in 1994.

But, for the hydraulic electric power generation, we premise that it increases at about 4% annually.

Moreover, for the ratio of the conversion loss at the generation and the loss in the transmission and distribution which accompanies electric power supply, we expect these will be gradually improved. Concretely, we assume the efficiency of generation, 34.6% in 1994, reaching 35% in 2000 and 36% in 2005.

(2) Simulation Result

The simulation result computed on the assumption described above with MEM is as follows.

a. Macro economy

1) GDP

The annual growth rate of GDP in real terms from 1994 to 2000 is projected to be 2.3% and 3.2% from 2000 to 2005. The growth rate until 2000 is lower than that thereafter, because high inflation in recent years decreases GDP growth. Looking at the GDP deflator for example, the annual escalation ratio until 2000 is 22.1%, whereas it becomes 11.2% after 2000.

As a result, the GDP in 2000 and in 2005 was estimated to be 15 trillion Rials and 17 trillion Rials in real terms. These are 1.14 times and 1.33 times respectively that in 1994.

GDP per capita in 1982 prices is estimated to be 207 thousand Rials in 2000 and 214 thousand Rials in 2005, while it was 210 thousand Rials in 1994.

2) Prices

Reflecting the current high rate of inflation, the consumer price index is projected to increase at an annual rate of 27% from 1994 to 2000. However, it is increasing at 13% annually after 2000, which is more stable than before 2000. The reason for the difference is that the improvement of the international balance of payments and the relative stability of the exchange rate which accompanies the former leads to mild inflation.

Similar to the consumer price index, the annual escalation of the wholesale price index is expected to be 24% until 2000 and then 9% until 2005. (Table 5.6)

Table 5.6 Simulation Result of Macro Economy ('Reference Case')

(Unit:Billion Rials, 1982 prices)

	1990	1994	2000	2005	94/90	00/94	05/00	05/94
Gross Domestic Expenditure	10,930	13,066	14,944	17,482	*4.6*	*2.3*	*3.2*	*2.7*
Domestic Demand	10,279	12,929	14,624	16,847	*5.9*	*2.1*	*2.9*	*2.4*
Private Demand	8,329	10,251	11,627	12,982	*5.3*	*2.1*	*2.2*	*2.2*
Private Consumption Expenditure	7,564	9,038	9,524	9,957	*4.6*	*0.9*	*0.9*	*0.9*
Private Investment	766	1,213	2,102	3,025	*12.2*	*9.6*	*7.5*	*8.7*
Pubric Demand	1,950	2,678	2,997	3,864	*8.3*	*1.9*	*5.2*	*3.4*
Government Consumption Expenditure	1,337	1,953	2,231	2,666	*9.9*	*2.2*	*3.6*	*2.9*
Pubric Fixed Capital Formation	613	726	766	1,199	*4.3*	*0.9*	*9.4*	*4.7*
Net Foreign Demand	978	2,425	2,607	2,923	*25.5*	*1.2*	*2.3*	*1.7*
Exports of Goods & Services	2,253	3,372	4,046	5,191	*10.6*	*3.1*	*5.1*	*4.0*
Oil & Gas	2,098	2,992	3,330	4,148	*9.3*	*1.8*	*4.5*	*3.0*
Others	154	380	716	1,043	*25.3*	*11.2*	*7.8*	*9.6*
Imports of Goods & Services	1,274	947	1,438	2,268	*-7.2*	*7.2*	*9.5*	*8.3*
Norminal GDE	36,645	125,789	476,712	950,323	*36.1*	*24.9*	*14.8*	*20.2*
Wholesale Price Index(1990=100)	100	304	1,076	1,633	*32.0*	*23.5*	*8.7*	*16.5*
Consumer Price Index(1990=100)	100	249	1,052	1,963	*25.6*	*27.2*	*13.3*	*20.6*
Exchange Rate for Export(Rials:US$)	301	1,646	4,500	5,000	*52.9*	*18.2*	*2.1*	*10.6*
Active Labor Population(1,000 persons)	14,167	17,898	22,097	24,331	*6.0*	*3.6*	*1.9*	*2.8*
Unemployment Rate(%)	13.96	8.33	4.85	3.16	*-12.1*	*-8.6*	*-8.2*	*-8.4*

3) Government Financial Balance

Due to the increase of government expenditure with the pace of nominal GDP growth, the financial deficit will expand further in the future. Concretely, the deficit is forecast to be 7 trillion Rials (in nominal base) in 2000 and to be 47 trillion Rials (same) in 2005. These are 1.5% in 2000 and 4.9% in 2005 respectively for nominal GDP.

b. Primary Energy Supply

1) Primary Energy Total

The simulation result for the primary energy supply is as follows. In recent years, domestic energy consumption has been increasing steadily, although economic activity is stagnant. Reflecting this tendency, the primary energy requirement until 2000 is projected to increase at 4% annually, and at 3.7% after 2000. Consequently, the primary energy requirement in 2000 is estimated to expand to 950 MBOE and to become 1,140 MBOE in 2005, while it was 751 MBOE in 1994. These figures are 1.26 times and 1.51 times the 1994 figure, respectively.

As for the energy-GDP elasticity (increasing energy requirement against GDP), 1.8 is calculated until 2000 and 1.2 after 2000. Comparing these elasticity values until 2000 and after, we notice that the figure in the first half is larger than the later one. The reason is that the energy price will decline through the simulation period at the constant price base, but degree is much larger in the first half than the latter half, as it excludes gasoline.

Also, the ratio of energy per GDP (energy intensity per GDP) shows a constant upward tendency through the simulation period.

2) Composition by Energy Source

Looking at composition by energy carriers in the primary energy requirement, the share of oil, which was 57% in 1994, is expected to decline to 52% in 2000 and 47% in 2005. There are two dominant reasons for this. One is that the demand expansion of natural gas and electricity in the final energy consumption, especially in residential/commercial sector. The other is the growth of natural gas in the power generation sector. (Table 5.7)

Table 5.7 Simulation Result of Primary Energy Requirement ('Reference Case')

(Units:MBOE,%)

	1990	1994	2000	2005	1990	1994	2000	2005	94/90	00/94	05/00	05/94
Total	624	751	950	1,140	(100)	(100)	(100)	(100)	*4.7*	*4.0*	*3.7*	*3.9*
Solid Fuel	5	8	8	9	(1)	(1)	(1)	(1)	*13.5*	*0.4*	*2.0*	*1.1*
Oil	352	431	495	535	(56)	(57)	(52)	(47)	*5.2*	*2.3*	*1.6*	*2.0*
Crude Oil	318	427	489	529	(51)	(57)	(52)	(46)	*7.6*	*2.3*	*1.6*	*2.0*
Petroleum Products	34	5	6	5	(6)	(1)	(1)	(0)	*-39.1*	*2.7*	*-0.5*	*1.2*
Gas	255	297	429	576	(41)	(40)	(45)	(50)	*3.9*	*6.3*	*6.0*	*6.2*
Hydro	10	12	15	18	(2)	(2)	(2)	(2)	*5.1*	*4.0*	*4.0*	*4.0*
Others	3	4	4	4	(1)	(0)	(0)	(0)	*2.3*	*0.1*	*-0.1*	*0.0*
GDP(1982 Billion Rials)	10930	13066	14944	17482					*4.563*	*2.263*	*3.188*	*2.682*
Intensity(1990=100)	100	100.7	111.3	114.2					*0.168*	*1.689*	*0.511*	*1.152*
Elastisity									1.038	1.763	1.165	1.441

[Note]Figures in parentheses show percentage share of total

c. Final Energy Consumption

1) Composition by energy Source

The final energy consumption total is projected to increase at an annual rate of 3.8% from 1994 to 2000 and 3.6% after 2000.

It is in the order of gas, electric power, petroleum, when viewed by energy source and with higher increasing rates. Gas increases are mainly in the residential/commercial sector and an annual growth rate with 7% is expected. Next, electric power is expected to experiences increasing demand in all of the demand sectors with a 4.0% annual growth rate until 2000 and 3.1% thereafter. Then, petroleum will increase at 2.3% annually until 2000 and at 1.7% after 2000. Because demand in the transportation sector is projected to be relatively stagnant, growth rate of petroleum demand is relatively weak compared to other energy sources.

2) Composition by Sector

Looking at final energy consumption by the demand sector, the biggest growth is expected in the residential/commercial sector. The annual increase of demand for energy in this sector is about 7% through the simulation period. The second highest increase is shown in the agricultural sector, followed by the transportation sector and the industrial sector.

The reason why the residential/commercial sector and the agricultural sector show relatively larger demand increases than other sectors are (1) conversion into commercial

energy from non-commercial energy, which is not expressed in the statistics so far and (2) the diffusion of energy consuming equipment among households. (Table 5.8)

Table 5.8 Simulation Result of Final Energy Demand ('Reference Case')

(Units:MBOE,%)

	1990	1994	2000	2005	1990	1994	2000	2005	94/90	00/94	05/00	05/94
Total	425.3	564.8	705.3	843.2	(100)	(100)	(100)	(100)	*7.3*	*3.8*	*3.6*	*3.7*
Solid Fuel	4.7	7.798	7.964	8.79	(1)	(1)	(1)	(1)	*13.5*	*0.4*	*2.0*	*1.1*
Petroleum	288.1	365.3	418.9	455.8	(68)	(65)	(59)	(54)	*6.1*	*2.3*	*1.7*	*2.0*
Gas	102.7	151.9	228.9	321.4	(24)	(27)	(32)	(38)	*10.3*	*7.1*	*7.0*	*7.1*
Electricity	26.53	36.29	46.02	53.68	(6)	(6)	(7)	(6)	*8.1*	*4.0*	*3.1*	*3.6*
Others	3.3	3.51	3.541	3.524	(1)	(1)	(1)	(0)	*1.6*	*0.1*	*-0.1*	*0.0*
Industrial Sector	149.8	170.8	190.8	199.7	(35)	(30)	(27)	(24)	*3.3*	*1.9*	*0.9*	*1.4*
Transportation Sector	96.8	140.4	156.3	168.8	(23)	(25)	(22)	(20)	*9.7*	*1.8*	*1.5*	*1.7*
Agricultural Sector	27.67	27.94	31.84	34.74	(7)	(5)	(5)	(4)	*0.2*	*2.2*	*1.8*	*2.0*
Residential Sector	128	190.2	288.1	397.8	(30)	(34)	(41)	(47)	*10.4*	*7.2*	*6.7*	*6.9*
Household Sector	101.1	139.9	212.6	299.6	(24)	(25)	(30)	(36)	*8.5*	*7.2*	*7.1*	*7.2*
Commercial Sector	26.94	50.36	75.45	98.07	(6)	(9)	(11)	(12)	*16.9*	*7.0*	*5.4*	*6.2*
Non-Energy Use Total	23	35.37	38.25	42.15	(5)	(6)	(5)	(5)	*11.4*	*1.3*	*2.0*	*1.6*
Population(1,000 persons)	54,504	62,150	72,075	81,546					*3.3*	*2.5*	*2.5*	*2.5*
Per Capita(BOE/Person)	7.8	9.1	9.8	10.3					*3.9*	*1.2*	*1.1*	*1.2*

[Note]Figures in parentheses show percentage share of total

d. Energy Consumption in the Industrial Sector

The annual growth rate of energy consumption in the industrial sector is projected to be 1.9% until 2000 and then 0.9%.

The important factors which determine energy consumption in this sector are described below. They are (1) production level of manufacturing industries, (2)industrial structure, such as scale of heavy chemical industry, which is an energy intensive industry in terms of all industries, and (3) the introduction speed of energy-saving processes in the factory.

As for the first factor, production levels, we estimated that the index of the whole manufacturing industry, IIP, would expand at 2.2% annually until 2000 and 2.8% thereafter.

The assumptions of the Reference Case do not have a political development pattern for the second factor: industrial structure. Therefore, by creating an industrial structure which promotes export industries and more industrialization in the domestic economy, energy demand in the industrial sector would increase further.

For the third factor, energy saving, we did not take into account any specific measures to accelerate energy conservation in the Reference Case. The case of development of energy saving depends on demand elasticity to price and autonomous progress of technological innovation, which the demand function includes in the model.

In the assumptions of the Reference Case, because energy prices stand to decline in real terms, progress with energy savings cannot be expected. (Table 5.9)

Table 5.9 Simulation Result of Energy Demand in the Industrial Sector ('Reference Case')

(Units:MBOE,%)

	1990	1994	2000	2005	1990	1994	2000	2005	94/90	00/94	05/00	05/94
Industrial Sector Total	149.8	170.8	190.8	199.7	(100)	(100)	(100)	(100)	*3.3*	*1.9*	*0.9*	*1.4*
Solid Fuel	4.7	7.798	7.964	8.79	(3)	(5)	(4)	(4)	*13.5*	*0.4*	*2.0*	*1.1*
Petrolium Total	58.34	56.65	65.14	66.96	(39)	(33)	(34)	(34)	*-0.7*	*2.4*	*0.6*	*1.5*
Gas	80.75	94.49	105.4	111.3	(54)	(55)	(55)	(56)	*4.0*	*1.8*	*1.1*	*1.5*
Electricity	6.01	11.9	12.3	12.66	(4)	(7)	(6)	(6)	*18.6*	*0.6*	*0.6*	*0.6*
Food	21.63	32.17	38.48	41.33	(14)	(19)	(20)	(21)	*10.4*	*3.0*	*1.4*	*2.3*
Textile	8.1	12.12	13.23	13.42	(5)	(7)	(7)	(7)	*10.6*	*1.5*	*0.3*	*0.9*
Wood & Products	1.37	2.018	2.261	2.356	(1)	(1)	(1)	(1)	*10.2*	*1.9*	*0.8*	*1.4*
Paper & Pulp	1.7	2.538	2.887	3.077	(1)	(1)	(2)	(2)	*10.5*	*2.2*	*1.3*	*1.8*
Chemical	56.39	32	33.6	35.32	(38)	(19)	(18)	(18)	*-13.2*	*0.8*	*1.0*	*0.9*
Ceramics & Non-metal	45.15	67.05	72.17	74.13	(30)	(39)	(38)	(37)	*10.4*	*1.2*	*0.5*	*0.9*
Primary Metal	8.63	12.84	15.16	15.65	(6)	(8)	(8)	(8)	*10.4*	*2.8*	*0.6*	*1.8*
Machinery	6.67	9.886	12.74	14.1	(4)	(6)	(7)	(7)	*10.3*	*4.3*	*2.1*	*3.3*
Other Manufacturing	0.16	0.232	0.294	0.318	(0)	(0)	(0)	(0)	*9.8*	*4.0*	*1.5*	*2.9*
Value Added(Billion Rials)	1163.9	1375.6	1997.8	3057.3					*4.3*	*6.4*	*8.9*	*7.5*
Intensity(BOE/M Rials)	128.71	124.19	95.514	65.318					*-0.9*	*-4.3*	*-7.3*	*-5.7*

[Note]Figures in parentheses show percentage share of total

5.3.3 Energy Conservation Case

(1) Assumption

To evaluate the effects of energy Conservation measures, including higher domestic energy prices, we prepared a different case: the "Energy Conservation Case." In this case domestic energy prices are set much higher than those of the Reference Case and the energy conservation potential by the individual industries studied in the Chapter Second is also taken account. Concretely, domestic energy prices rise at an 8% annual rate with a constant price base.

If domestic energy prices rise, consequently, the prices of all commodities also rise due to the increase of intermediate goods costs. Therefore, when we want to realize an increase of energy prices in real terms, we cannot avoid quite a big rise in the nominal base. As for the upsurge rate of energy prices, in nominal base, we set a level of 33% annually for the period from 1994 to 2000 and 26% for the period from 2000 to 2005. Using these rates, the price of electricity in 2000 is 171 Rials/kWh (in nominal base), which is six times the 1994 figures; 29 Rials/kWh, and that in 2005 is 539 Rials/kWh, means 19 times of 1994 level.

As for demand for energy in the industrial sector, higher energy prices reduce demand by improving energy intensities due to price elasticity in several industries. These improvements of energy intensities are not guaranteed to be equal to those of the studies in the Chapter Second based on the bottom up approach. To sustain the consistency between the MEM analysis in this chapter and the micro-analysis in the Second Chapter, we took the following process to set the assumptions for the Energy Conservation Case.

Initially, we obtain information about the effects on improving energy intensities of higher energy prices in the industrial sector using MEM. Then, we compare these results to the figures produced by the-micro analysis in Chapter 2. The differences between former and

latter results are recognized as the effects of non-price factors for the energy conservation promotion. Then we treat this non-price factor as an exogenous variable in MEM. In addition, we assume that the improvements of energy intensities in several industries, which are not examined in the micro-analysis in Chapter 2, are the same as the average of the industries examined. (Table 5.10,Table 5.11)

Table 5.10 Assumption of Simulation for the Energy Conservation Case

	Unit	1990		1994		2000		2005		
		1369	90/80	1373	94/90	1379	00/94	1384	05/00	05/94
b.Energy Prices										
Gasoline	Rials/l	50	5.2	50	0.0	297.6	34.6	930.1	25.6	30.4
Electricity	Rials/kWh	5.68	7.3	28.5	49.7	171.00	34.8	538.80	25.8	30.6

[Note]Other exogenous variables are the same as the reference case.

Table 5.11 Comparison of Energy Intensities between MEM Results and Micro Analysis

(Unit: 1994=10

Industry	1994 Index	2000 (a)High-Price	2000 (b)Energy Conservation	2000 (a)/(b)	2005 (a)High-Price	2005 (b)Energy Conservation	2005 (a)/(b)	Note Source
Food	100	94	***89***	***0.95***	82	***77***	***0.94***	Micro-analysis[1]
Textile	100	99	***86***	***0.87***	93	***78***	***0.84***	Average[2]
Wood & Products	100	99	***86***	***0.87***	94	***78***	***0.83***	Average[2]
Paper/pulp	100	92	92	1.00	81	81	1.00	High-price[3]
Chemical	100	99	***86***	***0.87***	96	***78***	***0.81***	Average[2]
Ceramics & Non-materia	100	99	***82***	***0.83***	95	***77***	***0.81***	Micro-analysis[1]
Primary Metal	100	94	***88***	***0.94***	81	81	1.00	Micro-analysis[1]
Machinery	100	84	84	1.00	63	63	1.00	High-price[3]
Other Manufacturing	100	94	***86***	***0.92***	79	***78***	***0.99***	Average[2]

Note) 1)Micro-analysis means the results in the Chapter 2 and 6, 2)Average means the average results among the industries analyzed in the Chapters 2 and 6, and 3)High-Price means the results by MEM with higher domestic energy prices

The figures in bold and italics are adopted as exogenous in the Energy Conservation Case

(2) Simulation Result

Comparing the simulation results in the Energy Conservation Case with those in the Reference Case, the following several differences can be pointed out.

a. Macro-economy

1)GDP

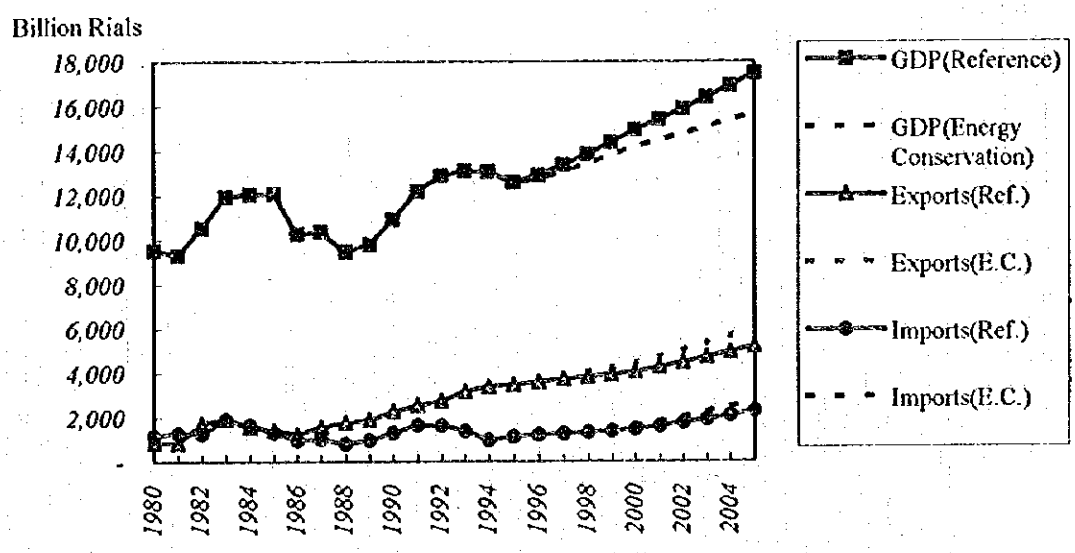
Annual GDP growth rate of the Energy Conservation Case in real terms is lower than that of the Reference Case by about one point. Concretely, growth rate is projected to be 1.4% from 1994 to 2000 and 2.0% thereafter in this case. This decline is mainly due to the decrease of purchased power, which is accompanied by the rise of energy prices. Because the annual increasing ratio of the population is 2.5%, GDP per capita in real terms follows a downward trend.

Comparing the level of GDP in real terms in 2005 for both cases, GDP in the Energy

Conservation Case is 90% of the Reference Case.

On the other hand, however, the rise of energy prices reduces domestic energy consumption , consequently, it expands energy exports which contributes to GDP growth. The amount of energy export of the Energy Conservation Case in 2000 is about 12% larger than that of the Reference Case, and for the year 2005 it is 21% bigger than the Reference Case. (Figure 5.12)

Figure 5.12 Simulation Results of GDP ('Reference Case' and 'Energy Conservation Case')



2) Prices

Comparing the escalation ratio of the consumer price index between two cases, it is noted that the increased energy price contributes to increasing the consumer price index about six points annually. In the same way, the influence over the wholesale price index shows a rise of nine points annually. The increase and the influence over the GDP deflator is an about five points annually

3) Government Financial Balance

The rise of energy prices would improve the financial balance of the government be expanding energy revenues. The financial surplus in 2000 is 11 trillion Rials (market price base) and 28 trillion Rials in 2005 (same). These values for the surplus are equal to almost 2% of the nominal base GDP in both 2000 and 2005.

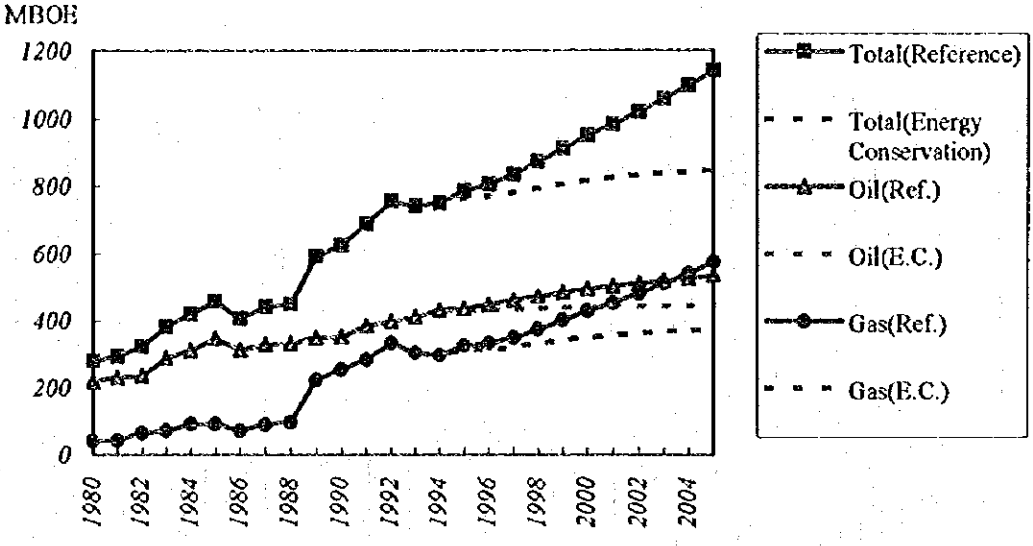
b. Energy Supply and Demand

1) Primary Energy Supply

The annual growth rate of the primary energy supply in the Energy Conservation Case is 1.1% in the simulation period from 1994 to 2005. Comparing this and that of the Reference Case, the former is smaller than the latter by around 2.8-points annually. The primary energy requirement of the Energy Conservation Case in the year of 2005 is

847MBOE and it stands 74% of the Reference Case. (Figure 5.13)

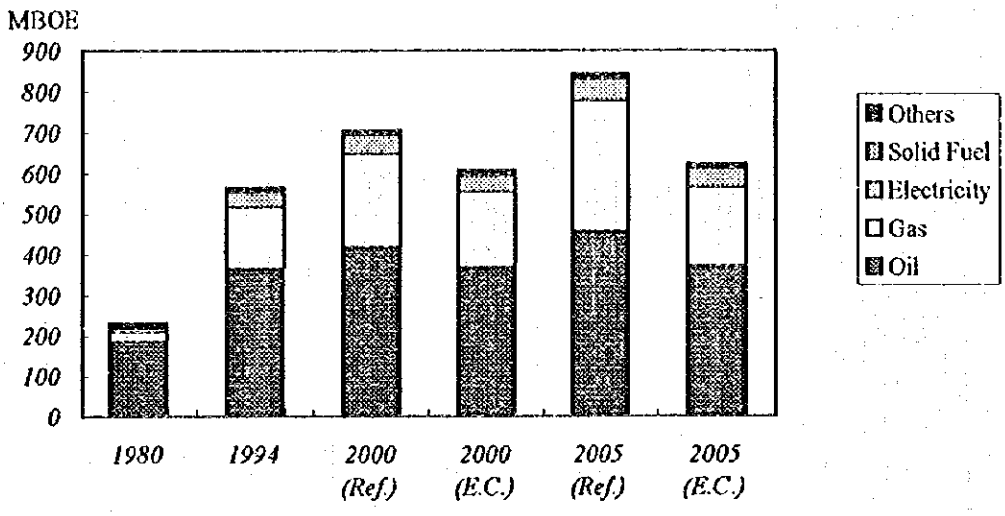
Figure 5.13 Simulation Results of Primary Energy Supply ('Reference Case' and 'Energy Conservation Case')

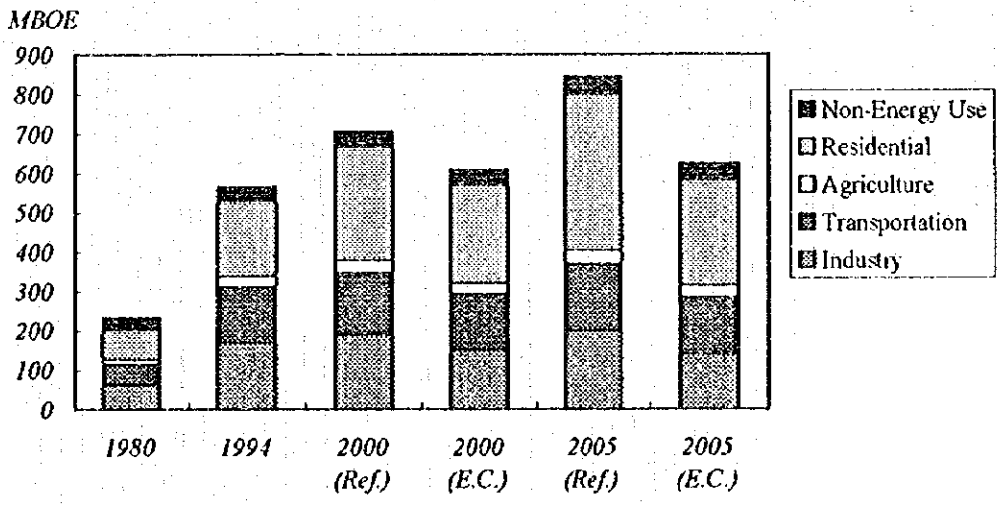


c. Final Energy Consumption

Similar to the primary energy supply, the annual growth rate of final energy consumption in the Energy Conservation Case is smaller than the Reference Case. by an about 2.8-points When viewing the impact of the price rise by energy source, gas has the biggest, followed by petroleum, electricity. Dull demand in the residential/commercial sector is mainly due to stagnant demand for gas. Demand for electricity is sensitive to income but it insensitive to price. (Figure 5.14)

Figure 5.14 Simulation Results of Final Energy Demand ('Reference Case' and 'Energy Conservation Case')

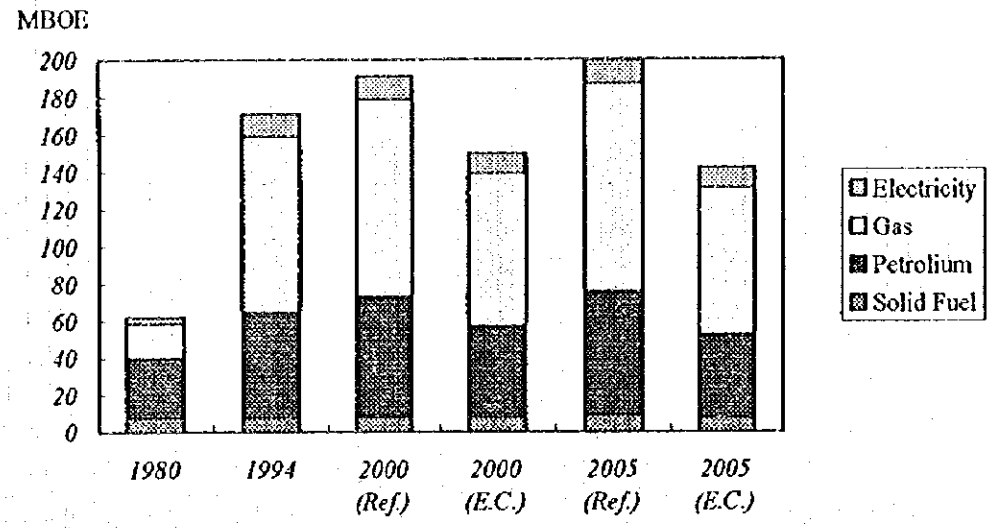




d. Energy Consumption in the Industrial Sector

Energy demand in the industrial sector is estimated to have negative growth. The annual rate of decrease is -2.2% from 1994 to 2000 and -1.1% after 2000. Throughout the entire simulation period, the Energy Conservation Case has a 3.1-point lower annual growth rate than the Reference Case. Of the figure of 3.1-points, 1.8-points is contributed by the effects of higher energy prices and the residual amount, 1.3-points, is due to the effects of other energy conservation approaches. (Figure 5.15)

Figure 5.15 Simulation Results of Energy Demand in the Industrial Sector ('Reference Case' and 'Energy Conservation Case')



5.4 Policy Implication

5.4.1 Energy Price Policy

According to the simulation results, it is clear that the substantial domestic energy price rise will reduce GDP growth. This is caused by the following mechanism; "the rise of domestic energy prices → commodity price increase → decline of purchasing power → reducing GDP growth".
On the other hand, however, the positive effects of higher energy prices also work on GDP; for example, "rise of domestic energy prices → acceleration of energy saving due to higher energy cost → expansion of crude oil exports → increase of GDP". In addition, another positive path to amplify GDP growth also exists, that is "rise of domestic energy prices → expansion of government income → expansion of public fixed capital formation and reduction of incremental money supply → increase of GDP growth and abatement of inflation."
Judging from the simulation results, the rise of energy price in real terms exerts a negative effect on the macro-economy, with a decline of purchasing power which, is bigger than the other two positive effects pointed earlier. This is because, in the case of energy, the demand elasticity to price is very small, so the curtailing effect of the demand for energy of the price raise is slight. Therefore, the policy of increasing energy prices which is adopted to save saving energy and increase oil exports is linked to the decline of GDP growth.
However, the Iranian government cannot afford not to cut the subsidy in the energy price, because it is one of the origins for the substantial deficit in the government finance and is the major reason for inflation. The actual policy will be concluded by balancing political and economic needs.

5.4.2 Promotion of Energy Conservation

In the industrial sector, the effects of non-price measures on the energy conservation policy are estimated to have a similar impact as the pricing policy. Through a comparison of pricing impacts calculated by the MEM and the energy conservation potential studied in the Chapter Second, we can estimate the price effect and non-price effects separately for conservation, which is shown in the Table 5.12.
Would be better that if we could promote energy conservation without any negative impacts on the macro-economy. Concretely, enhancement and improvement of energy management represent such procedures. However we will face the next issue. That is what kind of incentives is more effective and it is practical for the energy consumers to promote adoption of such procedures. Institutional arrangements are required for the promoting energy conservation. (Table 5.12)

Table 5.12 Factors of Energy Conservation in the Industrial Sector

(Units: MBOE, %)

Cases and Factors	1994	2000	2005	'00/'94	'05/'00	'05/'94
(a)Reference Case	170.8	190.8	199.7	1.9	0.9	1.4
(b)High-Price Case	170.8	169.4	163.8	-0.1	-0.7	-0.4
(c)Ene. Consrv Case	170.8	149.7	141.6	-2.2	-1.1	-1.7
Factor by Price(a)-(b)	-	-21.4	-35.9	*-2.0*	*-1.6*	*-1.8*
Factor by Others(b)-(c)	-	-19.6	-22.2	*-2.0*	*-0.4*	*-1.3*
Total factors	-	-41.1	-58.1	*-4.0*	*-2.0*	*-3.1*

5.4.3 Improvement of Energy Data

The biggest barrier to building the forecasting model in this study was the data. Sometimes, key data are not available and sometimes available data are unreliable. We needed to estimate much of the data series to develop the model, because the system and institutional framework for data collection and arrangement, even for fundamental data on the macro-economy and energy supply and demand, is not sufficient. In particular, energy data based on the end users is very poor, including the industrial sector. Nobody knows exactly how much each sub-sector in the industrial sector consumes energy.

Although data is not sophisticated improving the institutional arrangement of the data system is important duty to estimate more potential energy conservation more precisely and to create forecasting models.

Note) The simulation results explained in this Chapter are calculated using MEM which was developed through collaborative work and the model is based on an econometric methodology with time series data. Because we know that the simulation results and sensitivity depend on the model, we have no intention to say that the figures shown are the only answer for the evaluation of energy policy.

5. APPENDIX 1
LIST OF EQUATIONS
IN THE MODEL

APPENDIX 2
DATA LIST FOR MODEL BUILDING

APPENDIX 3
TIME SERIES DATA
FOR MODEL BUILDING

APPENDIX 4
ENERGY BALANCE TABLE

Appendix 1

Iranian Oil Price

POILIR=-.511765+.87219*(POILW)

(-0.26) (10.16)

OLS (1982-1993) R^2= .902846 SD= 1.90993 DW= 2.81831

GDP Component, Constant Price

Consumer's Expenditure

CP=5025.33+22.245*((GDP.N-GRTAX)/PC)-2136.67*(PC/PC(-1))+.284115*(CP(-1))+794.821*(DUM9093)

(4.16) (3.24) (-2.10) (2.17) (4.42)

OLS (1983-1993) R^2= .966514 SD= 183.905 DW= 2.12651

Private Investment

IP=-99.79+17.959*((GDP.N-GRTAX)/PIP)-38.22*(INT/(WPI/WPI(-1)))-.0690359*(KIP(-1))+33.7243*(DM)

(-0.12) (4.48) (-0.78) (-1.32) (5.01)

-264.354*(DUM90)

(-2.72)

OLS (1983-1993) R^2= .902748 SD= 89.2588 DW= 2.96442

Oil Export

LOG(EXOL)=1.115+.973*(LOG(-CREX-PTEX-PTIM-LGEX-GEX))+.1242*(DUM92)+.198712*(DUM93)

(2.52) (14.08) (1.76) (2.76)

OLS (1981-1993) R^2= .963267 SD= .0635133 DW= 2.03809

Other Export

EXOT=-152.703-2132.71*(PEXOT/(PEW*EXROT))+.0815497*(VAG)+.782205*(EXOT(-1))

(-1.57) (-2.94) (1.90) (3.32)

OLS (1983-1993) R^2= .971638 SD= 17.2275 DW= 2.49327

Export Total

EX=EXOL+EXOT

Import

M=M.N/PM*100

Government Consumption

CG=CG.N/PCG*100

Government Investment

IG=IG.N/PIG*100

Gross Domestic Expenditure (GDP) Total

GDP=CP+CG+IP+IG+JSD+EX-M

Net Factor Income Abroad

NFA=47.9406+184282*(((DSERV+DTRANS)/EXRM)/PM)+145.196*(DUM91)+239.377*(DUM93)

(2.90) (2.45) (3.98) (6.68)

OLS (1982-1993) R^2= .891983 SD= 31.8615 DW= 1.74239

Gross National Product

GNP=GDP+NFA

GDP Component t, Current Price

Private Expenditure

CP.N=CP*PC/100

Private Investment

IP.N=IP*PIP/100

Oil Export

EXOL.N=EXOL*PEXOL/100

Other Export

EXOT.N=EXOT*PEXOT/100

Export Total

EX.N=EXOL.N+EXOT.N

Government Consumption

CG.N=-238.9+1.01395*(GPCE)-726.614*(DUM92)

(-6.57) (116.15) (-6.35)

OLS (1975-1993) R^2= .998795 SD= 104.014 DW= .785338

Government Investment

IG.N=-320.15+1.14734*(GPDE)+.807904*(RENE)+1127.24*(DUM92)

(-4.5) (18.5) (5.72) (5.57)

OLS (1975-1993) R^2= .994069 SD= 182.381 DW= 2.22356

Import

M.N=DM*EXRM

Gross Domestic Expenditure (GDP) Total

GDP.N=CP.N+CG.N+IP.N+IG.N+J.N+EX.N-M.N+SD.N

Net Factor Income Abroad

NFA.N= 14.8137+1916*((DSERV+DTRANS)/EXRM)-2494.92*(DUM93)

(0.30) (1.17) (-16.11)

OLS (1975-1993) R^2= .935593 SD= 147.882 DW= 2.29718

Gross National Product

GNP.N=GDP.N+NFA.N

Prices

WPI(Wholesale Price Index)

WPI=-38.84+.0795226*(PM)+42.7552*(GDP/GDPP)+2.51486*(MLM2/MLM2(-1))+4.48374*(PGASI)
(-4.59) (6.25) (4.17) (1.59) (8.95)
+.134*(WI/(GDP/L))+7.35*(DUM87)-8.41802*(DUM89)-3.42738*(DUM90)+1.49797*(DUM91)
(10.10) (0.92) (-0.13) (2.51) (2.77)
OLS (1975-1993) R^2= .999507 SD= 1.27372 DW= 2.80495

CPI(Consumers Price Index)

CPI=-12.8051+.670567*(PELE)+.101214*(WPI(-1))+.30206*(WI)
(-3.09) (0.92) (0.55) (7.06)
OLS (1983-1993) R^2= .999012 SD= 1.57353 DW= 1.73164

Wage Index

WI= 97.6098+1.02422*(PC(-1))-75.6535*(GDP/L)+.103422*(WI(-1))
(2.01) (2.46) (-1.89) (0.24)
OLS (1983-1993) R^2= .995457 SD= 9.62685 DW= 2.28044

Deflator for CP

PC/PC(-1)=1.01026+.937954*(LOG(CPI/CPI(-1)))+.0402036*(LOG(PELE/PELE(-1)))
(50.61) (8.15) (0.96)
OLS (1983-1993) R^2= .884759 SD= .0225104 DW= 2.89143

Deflator for IP

PIP/PIP(-1) = 1.04228+.859164*(LOG(WPI/WPI(-1)))+.21603*(DUM91))*PIP(-1)
(21.21) (3.42) (3.31)
OLS (1983-1993) R^2= .728812 SD= .0607225 DW= 1.73941

Deflator or CG

PCG= 22.4591+2.6853*(CPI)+.0281355*(PM)+187.661*(DUM93)
(3.80) (15.26) (1.01) (10.24)
OLS (1983-1993) R^2= .999212 SD= 5.31695 DW= 2.11586

Deflator for IG

PIG= 2.39438+2.12*(WPI)+.416019*(PM)
(0.57) (12.23) (15.24)
OLS (1970-1993) R^2= .996912 SD= 14.3612 DW= 2.0345

Deflator for EXOL

PEXOL= 7.51763+.035156*(POILIR*EXROL)
(2.34) (44.08)
OLS (1970-1993) R^2= .988296 SD= 12.6426 DW= 1.80646

Deflator for EXOT

PEXOT=-4806.4+1156.27*(LOG(CPI))+103.862*(LOG(EXROT))+328.976*(DUM91)

(-9.1) (6.46) (1.78) (2.83)
OLS (1986-1993) R^2= .976904 SD= 105.383 DW= 2.85651

Deflator for EX

PEX=EX.N/EX*100

Deflator for M

PM/PM(-1)=-.145202+1.09364*((PEW*EXRM)/(PEW(-1)*EXRM(-1)))+.420384*(DUM89)

(-0.13) (8.47) (2.42)
OLS (1982-1993) R^2= .964954 SD= .0888295 DW= 3.07028

Dflator for JSD

PJSD=JSD.N/JSD*100

Deflator for NFA

PNFA=NFA.N/NFA*100

Deflator for GDP

P=GDP.N/GDP*100

Labor and Production

Un-emproyment

U= 826.932-.0410835*(LN)+806.328*(LN/GDPP)+.410282*(U(-1))-202.798*(DUM87)

(3.51) (-2.05) (3.19) (2.25) (-2.77)
OLS (1983-1993) R^2= .803694 SD= 66.2479 DW= 2.83063

Active Population

LN= 957.189+.0526455*(POP)+.750431*(LN(-1))+1144.42*(DUM93)

(1.87) (1.88) (5.13) (10.13)
OLS (1975-1993) R^2= .9976 SD= 96.3007 DW= 1.30663

Employment Population

L=LN-U

Unemployment Ratio

URATE=U/LN*100

Value added for Agriculture

VAG/GDP = .151551-1.69933E-05*(GDP)+5.58256E-06*(POP)+.01434*(DUM86)

(11.72) (-12.99) (33.35) (2.33)
OLS (1975-1993) R^2= .984804 SD= 5.87347E-03 DW= 1.77428

Value Added for Manufacturing Industry

VALIN/GDP=-.0173+4.038E-06*(KIP)+3.25E06*((IP+IG+CP+EXOT))+.387*(VALIN(-1)/GDP(-1))

(-1.08) (11.75) (1.17) (1.48)

OLS (1970-1993) R^2= .875606 SD= .0124006 DW= 1.6746

Capital Stock in Private Sector

KIP= 701.252+.873912*(KIP(-1))+.92454*(IP)

(2.31) (38.11) (14.98)

OLS (1983-1993) R^2= .993946 SD= 41.7246 DW= .471379

Potential GDP

GDPP/(LN*(1-2.838/100))=1.75445+5.86412E-07*(KIP*50.56)-.0434087*((VAG/GDP*100))

(57.62) (8.17) (-19.74)

OLS (1976-1993) R^2= .972902 SD= .0236271 DW= 1.3959

Government Account Balance

Revenue by Oil

GROIL= 60.049+.904299*(EXOL.N)

(1.38) (88.99)

OLS (1975-1993) R^2= .997732 SD= 152.65 DW= 1.53475

Revenue by Tax

GRTAX= 163.055+.0501497*((GDP.N-EXOL.N))+550.327*(DUM92)

(3.54) (27.82) (3.34)

OLS (1975-1993) R^2= .984254 SD= 141.228 DW= 1.19019

Revenue by Other Sources

GROTR= 58.5259+.433807*(RENE)+450.635*(DUM93)

(2.10) (12.80) (3.46)

OLS (1975-1993) R^2= .962257 SD= 71.808 DW= 1.89148

Revenue Total

GRT=GROIL+GRTAX+GROTR

Current Expenditure, Total

GPT=GPCE+GPDE

Government Balance

GRPD=GRT-GPT

Money Supply

MLM2= 2501.05+.51882*(GDP.N)-331.084*(INT)-2.23206*(GRPD)+3501.91*(DUM90)

(0.87) (51.88) (-1.26) (-3.36) (3.37)

OLS (1980-1993) R^2= .995583 SD= 864.446 DW= 1.8776

Balance of Payment

Current Balance

DBLCR=DBLTT-DBLCA-DBLER

Trade Balance

DBLTR=DBLCR-DSERV-DTRANS

Export of Oil

DEXOL=EXOLN/EXROL

Export of Other Goods

DEXOT=EXOTN/EXROT

Import

DM=(DBLTR-DEX)*(-1)

Domestic Energy Price

Gas Price for Household

PGASH= .5814+.151032*(PGASO(-1))-1.29045*(DUM88)-1.74355*(DUM89)

(2.40) (21.73) (-3.90) (-5.22)
OLS (1979-1993) R^2= .971272 SD= .316929 DW= 2.00637

Gas Price for Commercial

PGASC=1.66399+.599862*(PGASH)+1.53711*(DUM91)+1.53711*(DUM92)+1.53711*(DUM93)

(2.47) (4.45) (1.89) (1.89) (1.89)
OLS (1979-1993) R^2= .853394 SD= .66247 DW= 1.51158

Gas Price for Industry

PGASI=-.654121+.56825*(PELE)+3.6875*(DUM92)

(-3.16) (18.23) (8.39)
OLS (1979-1993) R^2= .976087 SD= .399026 DW= 1.74714

Gas Price for Power Plant

PGASE= .18247+.357567*(PGASH)-1.04301*(DUM90)

(4.88) (52.79) (-21.26)
OLS (1979-1993) R^2= .995001 SD= .043817 DW= .542346

Electricity Price for Household

PELEH= 1.01875+.749604*(PELE)

(3.22) (17.57)
OLS (1981-1993) R^2= .962472 SD= .536038 DW= 1.4708

Electricity Price for Commercial

PELEC=-1.73029+1.57285*(PELE)

(-2.06) (13.88)
OLS (1981-1993) R^2= .941055 SD= 1.42416 DW= .692844

Electricity Price for Industry

PELEI=-3.56749+1.26415*(PELE)+1.9222*(DUM91)

(-8.59) (22.29) (2.59)
OLS (1981-1993) R^2= .978033 SD= .703236 DW= 1.60746

Electricity Price for Agriculture

PELEA=1.63276+.0517119*(PELE)-.575288*(DUM8385)+1.07352*(DUM90)

(12.08) (3.20) (-4.43) (5.63)

+.92769*(DUM91)+.824266*(DUM92)+.670735*(DUM81)

(4.86) (4.18) (3.41)
OLS (1981-1993) R^2= .927185 SD= .175384 DW= 1.76097

Kerosene Price

PKERO= .594271+.812853*(PELE)-3.50352*(DUM91)-5.12923*(DUM92)-1.79522*(WDUM)

(2.29) (19.11) (-5.31) (-7.45) (-5.74)
OLS (1974-1993) R^2= .952369 SD= .606303 DW= 1.10619

Heavy Fuel Oil Price

PHO= .51186+.309254*(PKERO)+3.25112*(DUM92)

(8.62) (23.48) (19.87)
OLS (1974-1993) R^2= .980958 SD= .159398 DW= .460122

Gas Oil Price

PGOIL= .405921+1.95153*(PHO)+5.69101*(DUM91)

(2.89) (29.36) (16.57)
OLS (1974-1993) R^2= .98416 SD= .334367 DW= .217848

Production index of Industries

Industry Total

IIP=(13.85*IIPFO+26.83*IIPTX+1.22*IIPWO+2.4*IIPPA+12.23*IIPCH+12.36*IIPNM+5.75*IIPPM

+25.36*IIPMN)/100.00

Foodstuff, Beverages, Tobacco

IIPFO= 13.5782+8.40082E-03*(GDP)+5.06368*(DUM8586)

(1.80) (12.26) (2.05)
OLS (1978-1993) R^2= .912439 SD= 3.26652 DW= 1.48231

Textile, Cloth, Leather

IIPTX= 21.6293+9.05635E-03*(CP)+27.4705*(WDUM)

(2.05) (6.08) (7.62)

OLS (1978-1993) R^2= .841394 SD= 6.58241 DW= 1.24192

Wood, Wooden Products

IIPWO=-15.7423+.0150635*(CP)+19.8782*(WDUM)+34.6339*(DUM89)+14.0094*(DUM90)

(-1.30) (8.85) (4.61) (4.34) (1.75)
OLS (1978-1993) R^2= .863816 SD= 7.37446 DW= 1.79677

Paper, Card Board & Products

IIPPA=-6.49+.0116591*(CP)+.0148*(IP+IG)-19.0599*(DUM80)+16.6703*(DUM84)+32.3009*(DUM90)

(-0.42) (5.64) (2.73) (-2.09) (1.77) (3.46)
OLS (1978-1993) R^2= .861596 SD= 8.36212 DW= 2.06707

Chemical Material & Products

IIPCH=-29.951+.021992*(CP)+25.2145*(DUM90)+24.0243*(DUM91)

(-2.65) (12.97) (3.42) (3.11)
OLS (1978-1993) R^2= .948284 SD= 6.92818 DW= 2.40106

Non-Metallic Mineral Products, exclude. Oil, Coal

IIPNM=-1.6834+.0173045*(CP)-20.533*(RDUM)

(-0.10) (7.48) (-2.75)
OLS (1978-1993) R^2= .9011 SD= 8.28602 DW= 1.0281

Basic Metals

IIPPM=-235.75+.0571098*(CP)-64.5146*(DUM85)-18.7555*(DUM81)-46.9262*(DUM93)

(-13.77) (22.34) (-6.54) (-1.88) (-4.13)
OLS (1978-1993) R^2= .977759 SD= 9.36123 DW= 1.15666

Machinery, Metallic Products & Appliances

IIPMN=-135.02+.0269404*(CP+IP)+.0384182*(IG)-45.1905*(DUM93)

(-6.61) (11.24) (4.36) (-3.61)
OLS (1978-1993) R^2= .904063 SD= 10.5191 DW= 1.03482

Final Energy Demand of Industrial Sector

Foodstuff, Beverages, Tobacco

TLFO= 15.6388+.111753*(IIPFO)-278.389*(PHO/WPI)-6.17163*(WDUM)+6.71099*(DUM92)

(2.82) (2.33) (-9.80) (-6.20) (3.25)
OLS (1979-1993) R^2= .936833 SD= 1.72461 DW= 2.30992

Textile, Cloth, Leather

TLTX= 7.60616+.0223483*(IIPTX)-62.2029*(PHO/WPI)-1.72615*(WDUM)+2.51371*(DUM92)

(4.53) (1.34) (-5.73) (-3.49) (4.01)
OLS (1979-1993) R^2= .894249 SD= .544868 DW= 2.05232

Wood, Wooden Products

TLWO= .247967+.0121597*(IIPWO) -9.40251*(PHO/WPI)-.299461*(WDUM)+.289201*(DUM92)

(0.49) (3.14) (-2.34) (-4.03) (1.82)

OLS (1979-1993) R^2= .919772 SD= .119935 DW= 1.70834

Paper, Card Board & Products

TLPA= 1.25596+6.71498E-03*(IIPPA)-13.3372*(PHO/WPI)-.40531*(WDUM)+.502103*(DUM92)

(4.62) (3.38) (-4.80) (-4.90) (3.14)

OLS (1979-1993) R^2= .902145 SD= .143249 DW= 2.78813

Chemical Material & Products

TLCH=19.05+.177*(IIPCH)-13.75*(PGASO/WPI)+23.26*(DUM89)+15.59*(DUM90)+12.7819*(DUM92)

(1.23) (1.97) (-1.84) (3.38) (2.18) (1.74)

OLS (1979-1993) R^2= .826661 SD= 6.26795 DW= 1.51349

Non-Metallic Mineral Products, exclude. Oil, Coal

TLNM= 21.13+.219655*(IIPNM)-43.8319*((PHO+PELE)/WPI)+7.59385*(DUM92)

(3.41) (5.91) (-2.85) (3.67)

OLS (1979-1993) R^2= .958126 SD= 1.7404 DW= 2.06567

Basic Metals

TLPM= 9.944+.01217*(IIPPM)-62.9*(PGASI/WPI)-5.487*(DUM7982)-2.71*(DUM83)-2.00194*(DUM89)

(6.22) (2.02) (-2.17) (-4.82) (-2.12) (-1.57)

-2.52121*(DUM90)

(-1.85)

OLS (1979-1993) R^2= .924824 SD= 1.03936 DW= 2.33751

Machinery, Metallic Products & Appliances

TLMN= 6.73983+.0219464*(IIPMN)-26.8256*((PHO+PELE)/WPI)

(12.88) (5.85) (-9.58)

-.814026*(DUM8081)-.514826*(WDUM)+.90784*(DUM92)

(-2.05) (-1.74) (1.78)

OLS (1979-1993) R^2= .960173 SD= .419979 DW= 1.89769

Other Manufacturing Industries

TLOT= .117846+8.64743E-04*(IIP)-.563443*((PGOIL+PKERO)/WPI)

(4.36) (4.72) (-8.69)

-.0393542*(DUM80)-.10606*(WDUM)+.0436547*(DUM87)

(-2.77) (-14.34) (3.26)

OLS (1979-1993) R^2= .974594 SD= .0117973 DW= 2.02011

Industrial Sector Total

TLIN=TLFO+TLTX+TLWO+TLPA+TLCH+TLNM+TLPM+TLMN+TLOT

Electricity Demand

ELIN= 1.14364+.0481333*(IIPNM)-1.24295*(PELE/(PHO+PGASI))

(2.07) (16.87) (-3.95)

+.664923*(DUM86)-.476905*(DUM87)+2.36341*(DUM93)

(2.61) (-1.97) (8.95)

OLS (1979-1993) R^2= .978375 SD= .232646 DW= 1.90807

Petroleum Product Demand

PTIN= 47.4977+.145089*(IIPNM)-443.942*(PHO/WPI)+8.14704*(DUM87)

(3.11) (1.56) (-3.16) (1.75)

OLS (1979-1993) R^2= .837238 SD= 4.50079 DW= 1.41405

Total Gas Demand

GAIN=-9.937+.5687*(IIPCH)-153.4*(PGASI/WPI)-12.46*(WDUM)+25.293*(DUM92)+21.48*(DUM89)

(-0.80) (8.33) (-1.34) (-3.15) (3.41) (2.93)

OLS (1979-1993) R^2= .94433 SD= 6.19447 DW= 2.52143

Lean Gas Demand

LGIN=-3.73703+.476346*(IIP)-230.366*(PGASI/WPI)-23.1074*(WDUM)+24.8995*(DUM92)

(-0.37) (5.90) (-2.43) (-6.06) (3.39)

OLS (1979-1993) R^2= .921105 SD= 6.00793 DW= 1.94096

Natural Gas Demand

NGIN=GAIN-LGIN

Solid Fuel Demand

SOIN=TLIN-ELIN-PTIN-GAIN

Final Energy demand of Transportation Sector

Petroleum Products Demand for Road & Train

PTTRR= 88.1783+3.56971E-03*(GDP)-37.3919*(PGASO/CPI)-266.024*(PGOIL/WPI)+16.3207*(DUM80)

(6.56) (3.45) (-7.55) (-16.62) (2.59)

OLS (1974-1993) R^2= .967191 SD= 4.64261 DW= 2.01152

Petroleum Products Demand for Air

PTTRA= 2.534+.00253*(IG)-1.17*(PGASO/CPI)-.742234*(WDUM)-1.40426*(DUM81)+1.148*(DUM87)

(6.36) (8.67) (-2.72) (-2.67) (-2.52) (2.10)

OLS (1974-1993) R^2= .868965 SD= .487044 DW= 2.59779

Total Petroleum Products Demand

PTTR=PTTRR+PTTRA

Transportation Sector Total

TLTR=PTTR

Final Energy Demand of Agriculture Sector

Petroleum Product Demand

PTAG=-5.797+3.987E-03*(CP)-16.34*(PKERO/WPI)-1.982*(RDUM)+6.1197*(DUM87)+5.42*(DUM88)
(-5.21) (23.56) (-4.99) (-2.21) (4.72) (4.16)
+5.56954*(DUM89)+6.94773*(DUM93)
(4.27) (4.96)
OLS (1971-1993) R^2= .97863 SD= 1.25278 DW= 1.77833

Electricity Demand

ELAG=-1.29211+1.15447E-03*(VAG)-2.40378*(PELE/WPI)-.327775*(DUM92)
(-9.75) (22.70) (-4.30) (-1.92)
OLS (1971-1993) R^2= .964713 SD= .153697 DW= 1.29847

Agriculture Sector Total

TLAG=PTAG+ELAG

Final Energy Demand of Household Sector

Electricity Demand

ELHO =(-6.431E-04+2.64E-04*(GDP/NHO)-9.71E-04*(PELE/CPI)+1.794E-03*(NHOELE/NHO))*NHO
(-3.78) (3.71) (-1.87) (13.40)
OLS (1974-1993) R^2= .984778 SD= 3.86579E-05 DW= 1.1233

Petroleum Product Demand

PTHO= 27.6245+4.50882E-03*(GDP)-157.812*(PKERO/CPI)-9.49613*(WDUM)+23.2002*(DUM93)
(1.96) (3.69) (-9.20) (-3.10) (3.64)
OLS (1974-1993) R^2= .909901 SD= 5.46106 DW= 1.29229

Lean Gas Demand

LOG(LGHO)=-29.171+3.18374*(LOG(CP))-1.35701*(LOG(PGASH/CPI))+.48361*(DUM86)
(-11.25) (10.71) (-15.69) (4.21)
+.267794*(DUM90)-.151518*(DUM92)
(2.36) (-1.17)
OLS (1983-1993) R^2= .983021 SD= .105296 DW= 2.74145

Other Demand

OTHO =(6.78095E-04-4.7425E-04*(NHOELE/NHO))*NHO
(55.06) (-23.35)
OLS (1974-1993) R^2= .966271 SD= 1.59507E-05 DW= 1.12481

Household Sector Total

TLHO=ELHO+PTHO+LGHO+OTHO

Final Energy Demand of Commercial Sector

Electricity Demand

ELCM=-3.36778-12.4239*(PELEC/WPI)+7.72062E-03*(NCMELE)

(-3.18) (-2.51) (15.04)

+1.86352E-04*(GDP)-.6026*(DUM92)+.797*(DUM93)

(1.93) (-1.51) (2.13)

OLS (1981-1993) R^2= .984813 SD= .282476 DW= 1.83338

Petroleum Product Demand

PTCM= 15.1166+4.14648E-03*(IP)-50.0422*(PHO/WPI)

(9.14) (2.85) (-4.79)

+6.92497*(WDUM)-6.33872*(DUM86)-5.23057*(DUM87)+3.88121*(RDUM)

(6.95) (-3.53) (-2.86) (3.27)

OLS (1974-1993) R^2= .85745 SD= 1.58197 DW= 2.14761

Lean Gas Demand

LGCM=LGRE-LGHO

Commercial Sector Total

TLCM=ELCM+PTCM+LGCM

Final Energy Demand of Residential/Commercial Sector

Electricity Demand

ELRE=ELHO+ELCM

Petroleum Product Demand

PTRE=PTHO+PTCM

Lean Gas Demand

LOG(LGRE)=-21.5231+2.42871*(LOG(GDP))-.75561*(LOG(PGASH/CPI))+.242562*(DUM93)

(-9.07) (9.76) (-11.17) (2.29)

OLS (1983-1993) R^2= .974253 SD= .0758347 DW= 2.7768

Other Demand

OTRE=OTHO

Residential/Commercial Sector Total

TLRE=ELRE+PTRE+LGRE+OTRE

Final Energy Demand of Non-energy Sector

Petroleum Product Demand

PTNE= 13.222+.0015338*(GDP)-11.0772*(WDUM)-6.98679*(DUM90)-24.19*(DUM93)

(1.96) (2.43) (-7.15) (-2.24) (-6.93)

OLS (1974-1993) R^2= .80336 SD= 2.97668 DW= 2.29599

Non-energy Sector Total

TLNE=PTNE

Final Energy Demand Total

Petroleum Product Demand

PTFN=PTIN+PTTR+PTAG+PTRE+PTNE

Solid Fuel Demand

SOFN=SOIN

Electricity Demand

ELFN=ELIN+ELAG+ELRE

Total Gas Demand

GAFN=LGFN+NGFN

Lean Gas Demand

LGFN=LGIN+LGRE

Natural Gas Demand

NGFN=NGIN

Other Demand

OTFN=OTRE

Total Final Energy Demand

TLFN=PTFN+SOFN+ELFN+GAFN+OTFN

Electric Power(Energy Conversion)

Own Use

ELOU = ELEL * RLOSELOU/100*(-1)

Distribution & Transportation Loss

ELLO = ELEL * RLOSELLO/100*(-1)

Own Use & Loss

ELOW = ELOU + ELLO

Electricity Generation

ELEL = ELFN - ELOW - ELSD

Total Input

INPELE = (ELEL/RCONVEL*100)*(-1)

Electric Generation Loss

TLEL = INPELE + ELEL

Lean Gas Input

LGEL = INPELE - (PTEL+HYEL+SOEL+NUEL)

Oil Refinery(Energy Conversion)

Own Use

PTOW = PTPT * RLOSPTOW/100*(-1)

Petroleum Products Output

PTPT = (PTFN - PTEL - PTOW - PTSD) - PTPR

Oil Refinery Loss

TLPT = (-PTPT*RCONVLPT/100)/(1-RCONVLPT/100)

Crude Oil Input

CRPT = -PTPT + TLPT

Gas Refinery(Energy Conversion)

Own Use

LGOW = LGLG * RLOSLGOW/100*(-1)

Lean Gas Output

LGLG = (LGFN-LGEL-LGOW-LGSD) -LGPR

Gas Refinery Loss

TLLG = (-LGLG*RCONVLLG/100)/(1-RCONVLLG/100)

Natural Gas Input

NGLG = -LGLG + TLLG

Primary Energy Requirement

Own Use Total

TLOW = ELOW + PTOW + LGOW

Crude Oil

CRPR = CRPT*(-1)

Petroleum Products

PTPR = PTEX - PTIM*(-1) - PTSC*(-1)

Solid Fuel

SOPR = SOFN - SOEL - SOSD

Natural Gas

NGPR = NGFN - NGLG - NGSD

Lean Gas

LGPR = LGEX

Hydro

HYPR = HYEL*(-1)

Others

OTPR = OTFN - OTSD

Primary Energy Requirement Total

TLPR = SOPR + CRPR + PTPR + NGPR + LGPR + HYPR + OTPR

Export & Import

Petroleum Products Export

PTEX=-45.9829+286.693*((PTIN+(-PTEL))/(PTFN-PTEL))
(-1.62) (2.62)
-.164074*(PTFN)+11.3085*(DUM85)-9.02192*(DUM86)-27.845*(DUM93)
(-5.05) (2.32) (-1.27) (-4.32)
OLS (1981-1993) R^2= .913651 SD= 4.64315 DW= 1.61239

Petroleum Products Import

PTIM=-27.243+.793048*(PTTR)+41.1777*(WDUM)-16.8668*(DUM93)
(-3.94) (7.50) (6.41) (-1.15)
OLS (1971-1993) R^2= .866204 SD= 12.5508 DW= 1.06041

Crude Oil Export

CREX = (CRPD - CRPR - CRSC*(-1))*(-1)

Lean Gas Export

NGEX = (NGPD - NGPR - NGSC*(-1))*(-1)

Solid Fuel Import

SOIM = SOPR - SOPD

Export Total

TLEX = CREX + PTEX +LGEX + NGEX

Import Total

TLIM = PTIM + SOIM

Primary Energy Production

Production Total

TLPD = SOPD + CRPD + NGPD + HYPD + OTPD

Hydro

HYPD = HYPR

Other

OTPD = OTPR

Stock Change & Some Loss

Stock Change Total

TLSC = CRSC + NGSC

Environmental Matters

CO2 = 0.1645*(SOPR+OTPR) + 0.1328*(CRPR+PTPR) + 0.0948*(NGPR-NGIN+LGPR)

SOX = 6.60828*(PTFN +(PTEL+PTOW)*(-1))+0.00135*(GAFN+(-LGEL))+7.12644*SOFN

NOX=1.1961*(PTEL)*(-1)+0.84091*(PTFN+(-PTOW))

+0.64327*LGEL*(-1)+0.32749*GAFN+1.72176*SOFN

Revenue of Energy Sales by Government

Petroleum Products Sale

RPT = ((PGASO*PTTR)+PKERO*(PTRE+PTAG)+PHO*(-PTEL+PTIN))*159/1000

Electricity Sale

RELE = (PELE*(ELEL)*10*159)/1000

Gas Sale

RGAS = (PGASI*GAIN+PGASH*LGHO+PGASC*LGCM+PGASE*(-LGEL))*159/1000

Revenue Total

RENE = RPT+RELE+RGAS

Appendix 2

Name	Unit	Contents
CAP	1000 C/D	REFINERY CAPACITY
CG	10^9 Rials	GOVERNMENT CONSUMPTION (REAL)
CG.N	10^9 Rials	GOVERNMENT CONSUMPTION (NOMINAL)
CO2	MT-C	CO2 Emission
COFN	MBOE	FINAL ENERGY DEMAND: COAL
CP	10^9 Rials	TOTAL PRIVATE CONSUMPTION (REAL)
CP.N	10^9 Rials	PRIVATE CONSUMPTION (NOMINAL)
CPI	1982=100	Consumer PRICE INDEX: AVERAGE
CREX	MBOE	TOTAL EXPORT OF CRUDE OIL
CREX.BD	1000 B/D	Crude Oil Export, B/D OPEC Statistics.
CRPD	MBOE	TOTAL PRODUCTION OF CRUDE OIL
CRPD.BD	1000 B/D	Crude Oil Production, b/d OPEC Statistic.
CRPR	MBOE	PRIMARY ENERGY REQUIREMENT: CRUDE OIL
CRPT	MBOE	REFINERY: CRUDE OIL INPUT
CRSC	MBOE	STOCK CHANGE & SOME LOSS: CRUDE OIL
D.N	10^9 Rilas	DEPRECIATION FOR NATIONAL INCOME
DBLCA	10^9 US$	BALANCE OF PAYMENT, CAPITAL ACCOUNT
DBLCR	10^9 US$	BALANCE OF PAYMENT, CURRENT ACCOUNT
DBLER	10^9 US$	DBLTT-DBLCR-DBLCA, BoP, ERRORS AND OMISSION
DBLTR	10^9 US$	BALANCE OF PAYMENT, TRADE BALANCE
DBLTT	10^9 US$	BALANCE OF PAYMENT, OVER ALL BALANCE
DEX	10^9 US$	BALANCE OF PAYMENT, EXPORT TOTAL
DEXOL	10^9 US$	BALANCE OF PAYMENT, OIL EXPORT
DEXOT	10^9 US$	BALANCE OF PAYMENT, OTHER EXPORT
DM	10^9 US$	BALANCE OF PAYMENT, IMPORT TOTAL
DMC	10^9 US$	IMPORT FOR CONSUMER'S GOODS
DMI	10^9 US$	CAPITAL GOODS TOTAL(DMIC+DMII)
DMIC	10^9 US$	IMPORT FOR CAPITAL GOODS
DMII	10^9 US$	IMPORT FOR INTER-MIDIATE GOODS
DSERV	10^9 US$	DBLCR-DBLTR-DTRANS
DSETR	10^9 US$	DBLCR-DBLTR
DTRANS	10^9 US$	BALANCE OF PAYMENT, TRANSFER ACCOUNT
DUM78	1 OR 0	Dummy 1978
DUM7879	1 OR 0	Dummy 1978-79
DUM79	1 OR 0	Dummy 1979
DUM7982	1 OR 0	Dummy 1979-1982
DUM80	1 OR 0	Dummy 1980
DUM8081	1 OR 0	Dummy 1980-81
DUM81	1 OR 0	Dummy 1981
DUM82	1 OR 0	Dummy 1982
DUM83	1 OR 0	Dummy 1983
DUM8385	1 OR 0	Dummy 1983-85
DUM84	1 OR 0	Dummy 1984
DUM85	1 OR 0	Dummy 1985
DUM8586	1 OR 0	Dummy 1985-86
DUM86	1 OR 0	Dummy 1986
DUM87	1 OR 0	1987 DUMMY
DUM88	1 OR 0	Dummy 1988
DUM8889	1 OR 0	Dummy 1988-1989

Name	Unit	Contents
DUM89	1 OR 0	Dummy 1989
DUM90	1 OR 0	Dummy 1990
DUM9091	1 OR 0	Dummy 1990-1991
DUM9092	1 OR 0	Dummy 1990-1992
DUM9093	1 OR 0	Dummy 1990-1993
DUM91	1 OR 0	Dummy 1991
DUM9192	1 OR 0	Dummy 1991-1992
DUM92	1 OR 0	Dummy 1992
DUM93	1 OR 0	Dummy 1993
EFR	%	(ELEL)/(ELEL-TLEL)*100: GENERATION EFFICIENCY
ELAG	MBOE	FINAL ENERGY DEMAND: AGRICULTURE: ELECTRICITY
ELAU	MBOE	AUTO GENERATION: AUTO OUTPUT
ELCM	MBOE	FINAL ENERGY DEMAND: COMMERCIAL: ELECTRICITY
ELEL	MBOE	POWER PLANT: GENERATION
ELFN	MBOE	FINAL ENERGY DEMAND TOTAL: ELECTRICITY
ELHO	MBOE	FINAL ENERGY DEMAND: HOUSEHOLD: ELECTRICITY
ELIN	MBOE	FINAL ENERGY DEMAND: INDUSTRY: ELECTRICITY
ELLO	MBOE	POWER PLANT: DISTRIBUTION LOSS
ELOU	MBOE	POWER PLANT: OWN USE
ELOW	MBOE	POWER PLANT: OWN USE & DIST. TRANS. LOSSES
ELRE	BOE	FINAL ENERGY DEMAND: RES. & COMM.: ELECTRICITY
ELSD	MBOE	STATISTICAL DIFFERENCE: ELECTRICITY
EX	10^9 Rials	TOTAL EXPORT (REAL)
EX.N	10^9 Rilas	TOTAL EXPORT (Nominal)
EXOL	10^9 Rials	OIL EXPORT (REAL)
EXOL.BD	1000 B/D	Export Crude and Oil Products, OPEC Slts.
EXOL.N	10^9 Rials	OIL EXPORT (NOMINAL)
EXOT	10^9 Rials	OTHER EXPORT (REAL)
EXOT.N	10^9 Rials	OTHER EXPORT (NOMINAL)
EXREX	Rilas/US$	EXCHANGE RATE FOR EXPORT TOTAL(EX.N/DEX)
EXRM	Rilas/US$	EXCHANGE RATE FOR IMPORT (M.N/DM)
EXROL	Rilas/US$	EXCHANGE RATE FOR OIL (EXOL.N/DEXOL)
EXROT	Rilas/US$	EXCHANGE RATE FOR OTHER EXP. (EXOT.N/DEXOT)
FWPD	MBOE	PRODUCTION OF FUEL WOOD
FWPR	MBOE	FUEL WOOD: PRIMARY ENERGY SUPPLY
GAFN	MBOE	FINAL ENERGY DEMAND TOTAL: GAS(NATURAL+LEAN)
GAIN	MBOE	FINAL ENERGY DEMAND: INDUSTRY: GAS(NAT.+LEAN)
GANE	MBOE	FINAL ENERGY DEMAND: NON-ENERGY: GAS
GDP	10^9 Rials	GDE (REAL)
GDP.N	10^9 Rials	GDE, CURRENT PRICE
GDPP	10^9 Rials	GDP POTENTIAL, ESTIMATED BU JICA
GNP	10^9 Rials	GDP+NFA
GNP.N	10^9 Rilas	GDP.N+NFA.N , GRPSS NATIONAL PRODUCTS
GPCE	10^9 Rials	GOVERNMENT PAYMENT FOR CURRENT EXPENSE
GPDE	10^9 Rials	GOVERNMENT PAYMENT FOR DEVELOPMENT EXPENDITURE
GPT	10^9 Rials	GOVERNMENT PAYMENT TOTAL
GROIL	10^9 Rials	GOVERNMENT REVENUE BY OIL
GROTR	10^9 Rials	GOVERNMENT REVENUE BY OTHERS
GRPD	10^9 Rials	GRT-GPT(GOVERNMENT BALANCE, + SURPLUS, -DEFICIT
GRPSP	10^9 Rials	GOVERNMENT REVENUE & EXPENDITURE FOR SPECIAL
GRSTT	10^9 Rials	GRT+GRPSP (GENERAL ACCOUNT REV. + SPECIAL ACC)

Name	Unit	Contents
GRT	10^9 Rials	GOVERNMENT REVENUE , TOTAL
GRTAX	10^9 Rials	GOVERNMENT REVENUE BY TAX
HDD	DegreeDay	Heating DEGREE DAYS
HYEL	MBOE	DELIVERY TO POWER GENERATION
HYPD	MBOE	PRODUCTION OF HYDRO
HYPR	MBOE	PRIMARY ENERGY REQUIREMENT: HYDRO POWER
I	10^9 Rilas	INVESTMENT TOTAL(PRIVATE + GOVERNMENT)
I.N	10^9 Rilas	INVESTMENT TOTAL
IG	10^9 Rilas	IGM+IGC(GOVERNMENT INVESTMENT) TOTAL,1992 PRICE
IG.N	10^9 Rilas	IGM.N+IGC.N (GOVERNMENT INV.) TOTAL, CURRENT
IGC	10^9 Rilas	GOVERNMENT INV. FOR CONSTRUCTION. 1982 PRICE
IGC.N	10^9 Rilas	GOVERNMENT INVESTMENT FOR CONSTRUCTION
IGM	10^9 Rilas	GOVERNMENT INV.FOR MACHINE. 1982 PRICE
IGM.N	10^9 Rilas	GOVERNMENT INVESTMENT FOR MACHINERY
IIP	1982=100	IIP FOR GENERAL INDEX
IIPCH	1982=100	IIP FOR CHEMICAL
IIPFO	1982=100	IIP FOOD
IIPMN	1982=100	IIP FOR MACHINERY
IIPNM	1982=100	IIP FOR NON-METAL
IIPPA	1982=100	IIP FOR PAPER
IIPPM	1982=100	IIP FOR PRIME-METAL
IIPTX	1982=100	IIP FOR TEXTILE
IIPWO	1982=100	IIP FOR WOOD
INPELE	MBOE	Input Energy for Power Generation
INT	%	INTEREST RATE 1 YEAR DEPOSIT
IP	10^9 Rials	IPM+IPC(PRIVATE INVESTMENT) TOTAL
IP.N	10^9 Rials	IPN+IPC.N
IPC	10^9 Rilas	PRIVATE INV. FOR CONSTRUCTION
IPC.N	10^9 Rilas	PRIVATE INVESTMENT FOR CONSTRUCTION
IPM	10^9 Rilas	PRIVATE INV. FOR MACHINE. 1982 PRICE
IPM.N	10^9 Rilas	PRIVATE INVESTMENT FOR MACHINERY
ISDUM	1 OR 0	ISLAM DUMMY
J	10^9 Rilas	INVENTORY STOCK CHANGE
J.N	10^9 Rilas	STOCK CHANGE
JSD	10^9 Rials	J+SD
JSD.N	10^9 Rials	J.N+SD.N
KIG	10^9 Rials	CAPITAL STOCK FOR IG
KIGC	10^9 Rials	CAPITAL STOCK FOR IBC, IN 1982 PRICE
KIGM	10^9 Rials	CAPITAL STOCK FOR I'M
KIP	10^9 Rials	CAPITAL STOCK FOR IP
KIPC	10^9 Rials	CAPITAL STOCK FOR IPC, 1982
KIPM	10^9 Rials	CAPITAL STOCK FOR IPM 1982 PRICE
L	10^3	PERSON LABOR: TOTAL
LGCM	MBOE	FINAL ENERGY DEMAND: COMMERCIAL: LEAN GAS
LGEL	MBOE	LEAN GAS FOR ELECTRIC POWER PLANT
LGEX	MBOE	TOTAL EXPORT OF LEAN GAS
LGFN	MBOE	FINAL ENERGY DEMAND TOTAL: LEAN GAS
LGHO	MBOE	FINAL ENERGY DEMAND: HOUSEHOLD: LEAN GAS
LGIN	MBOE	FINAL ENERGY DEMAND: INDUSTRY: LEAN GAS
LGLG	MBOE	GAS REFINERY: LEAN GAS OUTPUT
LGOW	MBOE	GAS REFINERY: INJECTED GAS

Name	Unit	Contents
LGPR	MBOE	PRIMARY ENERGY REQUIREMENT: LEAN GAS
LGRE	MBOE	FINAL ENERGY DEMAND: RES. & COMM.: LEAN GAS
LGSD	MBOE	STATISTICAL DIFFERENCE: LEAN GAS
LN	10^3	PERSON ACTIVE LABOR POPULATION
M	10^9 Rials	TOTAL IMPORT (REAL)
M.N	10^9 Rilas	TOTAL IMPORT (NOMINAL)
MACPR	10^9 Rilas	MONETARY ASSETS, CLAIMS BY PRIVATE
MACPU	10^9 Rilas	MONEY ASSETS, CLAIMS AND PUBLIC
MAFA	10^9 Rilas	MONEY, ASSET, FOREIGN ASSETS
MALC	10^9 Rilas	MONETARY, ASSETS , LC(LETTER OF CREDIT)
MAOTR	10^9 Rilas	MONETARY ASSETS, OTHERS
MASUTL	10^9 Rilas	MONETARY ASSETS, SUB TOTAL
MATL	10^9 Rilas	MONETARY ASSETS, TOTAL
MC	10^9 Rials	IMPORT FOR CONSUMMER'S GDs(MC.N/PM*100) 1982 Price
MC.N	10^9 Rials	IMPORT FOR CONSUMER'S GOODS (DMC*EXRM) SNA BASE
MI	10^9 Rials	IMPORT FOR CAPITAL GOODS (MI.N/PM*100) 1982 Price
MI.N	10^9 Rials	IMPORT FOR CAPITAL GOODS (DMI*EXRM) SNA BASE
MLADLC	10^9 Rilas	MONETARY LIABILITY, ADVANCED LC BY PUBLIC
MLCP	10^9 Rilas	MONETARY LIABILITY, CAPITAL ACCOUNT
MLDF	10^9 Rilas	MONETARY, LIABILITY, DEPOSIT AND FOUND
MLFL	10^9 Rilas	MONETARY LIABILITY, FOREIGN LOAN & CREDIT
MLIMDP	10^9 Rilas	MONETARY LIABILITY, IMPORT DEPOSIT BY PRIVATE
MLLC	10^9 Rilas	MONETARY LIABILITY, LETTER OF CREDIT
MLM2	10^9 Rilas	MONETARY LIABILITY, M2
MLOTR	10^9 Rilas	MONETARY LIABILITY, OTHERS
MLSUTL	10^9 Rilas	MONETARY LIABILITY, SUB TOTAL
MLTL	10^9 Rilas	MONETARY LIABILITY, TOTAL
NAGELE	10^3	NO. OF CUSTOMERS OF ELE.: AGRICULTURE
NBUS	10^3	BUSES NO. OF VEHICLES: BUS: DIESEL
NBUSM	10^3	BUSES NO. OF VEHICLES: MINI BUS: DIESEL
NCAR	10^3	CARS NO. OF VEHICLES: CAR :GASOLINE
NCMELE	10^3	NO. OF CUSTOMERS OF ELE.: COMMERCIAL
NCYC	10^3	VEHICLES NO. OF VEHICLES: MOTOR CYCLE :GASOLINE
NFA	10^9 Rials	NET FACTOR INCOME FROM ABROAD
NFA.N	10^9 Rilas	NET INCOME FACTOR INCOME ABROAD
NGEX	MBOE	EXPORT: NATURAL GAS
NGFN	MBOE	FINAL ENERGY DEMAND TOTAL: NATURAL GAS
NGIN	MBOE	FINAL ENERGY DEMAND: INDUSTRY: NATURAL GAS
NGLG	MBOE	GAS REFINERY: NATURAL GAS INPUT
NGPD	MBOE	PRODUCTION: NATURAL GAS
NGPR	MBOE	PRIMARY ENERGY REQUIREMENT: NATURAL GAS
NGSC	MBOE	STOCK CHANGE & SOME LOSS: NATURAL GAS
NGSD	MBOE	STATISTICAL DIFFERENCE: NATURAL GAS
NHO	1000 Unit	NUMBER OF HOUSEHOLDS
NHOELE	10^3	HOUSES NO. OF CUSTOMERS OF ELE.: HOUSEHOLD
NI.N	10^9 Rilas	NATIONAL INCOME, NOMINAL
NINELE	10^3	NO. OF CUSTOMERS OF ELE.: INDUSTRY
NITAX.N	10^9 Rilas	NET INDIRECT TAX
NOFN	MBOE	FINAL ENERGY DEMAND TOTAL: NON-COMMERCIAL
NOPD	MBOE	PRODUCTION OF NON-COMMERCIAL FUEL
NOPR	MBOE	NON-COMMERCIAL FUEL: PRIMARY ENERGY SUPPLY

Name	Unit	Contents
NORE	MBOE	FINAL ENERGY DEMAND:RES/COMM:NON-COMM,FUELWOOD
NOX	MT-C	NOx Emission
NTRKL	10^3	TRUCKS NO. OF VEHICLES: LARGE TRUCK: DIESEL
NTRKS	10^3	TRUCKS NO. OF VEHICLES: SMALL TRUCK :GASOLINE
NUEL	MBOE	NUCLEAR ENERGY FOR POWER PLANT
OR1	%	OPERATION RATIO OF REFINERY BY OPEC STATISTIC
OR2	%	OPERATION RATION OF REFINERY BY ENERGY BALANCE
ORELE	%	OPERATION RATIO FOR THERMAL ELECTRICITY
OTCM	MBOE	FINAL ENERGY DEMAND: COMMERCIAL: OTHERS
OTFN	MBOE	FINAL ENERGY DEMAND TOTAL: OTHERS
OTHO	MBOE	FINAL ENERGY DEMAND: HOUSEHOLD: OTHER FUEL
OTHOOLD	MBOE	FINAL ENERGY DEMAND: HOUSEHOLD: OTHER FUEL
OTIN	MBOE	FINAL ENERGY DEMAND: INDUSTRY: FUELWOOD
OTPD	MBOE	PRODUCTION: OTHER = OTPR
OTPR	MBOE	PRIMARY ENERGY REQUIREMENT: OTHERS
OTRE	MBOE	FINAL ENERGY DEMAND: RES. & COMM.: OTHER FUEL
OTSD	MBOE	STATISTICAL DIFFERENCE: OTHERS
P	1982=100	GDP.N/GDP*100
PC	1982=100	CP.N/CP*100
PCG	1982=100	CG.N/CG*100
PE	1982=100	EX.N/EX*100
PELE	RIAL	/kWh PRICE: ELECTRICITY
PELEA	Rials/kWh	PRICE: ELECTRICITY: AGRICULTURE
PELEC	Rials/kWh	PRICE: ELECTRICITY: COMMERCIAL
PELEH	Rials/kWh	PRICE: ELECTRICITY: HOUSEHOLD
PELEI	Rials/kWh	PRICE: ELECTRICITY: INDUSTRY
PEW	1980=100	Deflator for World Exporting Goods
PEX	1982=100	EX.N/EX*100, PRICE DEFLATOR
PEXOL	1982=100	EXOL.N/EXOL*100
PEXOT	1982=100	EXOT.N/EXOT*100
PG	1982=100	(CG.N+IG.N)/(CG+IG)*100
PGAS	Rials/m3	Price: Gas
PGASC	RIAL	/M^3 PRICE: GAS-COMMERCE
PGASE	RIAL	/M^3 PRICE: GAS-ELECTRICITY
PGASH	RIAL	/M^3 PRICE: GAS-HOUSE HOLD
PGASI	RIAL	/M^3 PRICE: GAS-INDUSTRY
PGASO	RIAL	/LITTER PRICE: GASOLINE
PGC	1982=100	CG.N/CG*100
PGNP	1982=100	GNP.N/GNP*100
PGOIL	MBOE	PRICE: GAS OIL
PHO	RIAL	/LITTER PRICE: HEAVY FUEL OIL
PI	1982=100	I.N/I*100
PIG	1982=100	IG.N/IG*100
PIGC	1982=100	IGC.N/IGC*100
PIGM	1982=100	IG.N/IGM*100
PIP	1982=100	IP.N/IP*100
PIPC	1982=100	IPC.N/IPC*100
PIPM	1982=100	IPM.N/IPM*100
PJ	1982=100	J.N/J*100
PJSD	1982=100	JSD.N/JSD*100
PKERO	RIAL	/LITTER PRICE: KEROSENE

Name	Unit	Contents
PM	1982=100	M.N/M*100
PNFA	1982=100	NFA.N/NFA*100
POIL	US$/bbl	OIL PRICE
POILIR	US$/bbl	Iranian Oil Price, by OPEC Sttis.
POILJ	US$/bbl	Crude Oil Price CIF Japan
POILW	US$/bbl	WORLD OIL PRICE BY BP STATISTICS
POILW93	US$/bbl	PRICE OF OIL PER BARREL IN 1993 PRICE
POP	100	PEOPLE POPU + POPR (POPULATION TOTAL)
POP.H	Person/house	Number of persons per House
PPOILW	1993=100	POILW/POILW93*100, PRICE DEFLATOR FOR WLD OIL
PSD	1982=100	SD.N/SD*100
PTAG	MBOE	FINAL ENERGY DEMAND: AGRICULTURE: GAS OIL
PTAU	MBOE	AUTO GENERATION: PETROLEUM INPUT
PTCM	MBOE	FINAL ENERGY DEMAND: COMMERCIAL: PETROLEUM
PTEL	MBOE	OIL PRODUCTS DELIVERED TO POWER PLANT
PTEX	MBOE	EXPORT: PETROLEUM PRODUCTS & BUNKER
PTFN	MBOE	FINAL ENERGY DEMAND TOTAL: PETROLEUM
PTHO	MBOE	FINAL ENERGY DEMAND: HOUSEHOLD: PETROLEUM
PTIM	MBOE	IMPORT OF OIL PRODUCTS: TOTAL
PTIN	MBOE	FINAL ENERGY DEMAND: INDUSTRY: PETROLEUM TOTAL
PTNE	MBOE	FINAL ENERGY DEMAND: NON-ENERGY: PETROLEUM
PTOW	MBOE	REFINERY: OWN USE
PTPR	MBOE	PRIMARY ENERGY REQUIREMENT: PETROLEUM PRODUCTS
PTPT	MBOE	PRODUCTION: TOTAL (PETROLEUM PRODUCT OUTPUT)
PTPT.BD	1000 B/d	B/D PETROLEUM PROD. PRODUCTION BY Energy Balance Table B/D
PTPTO.BD	1000 B/d	PETROLEUM PROD. PRODUCTION B/D BY OPEC STATISTIC
PTRE	MBOE	FINAL ENERGY DEMAND: RES. & COMM.: PETROLEUM
PTSC	MBOE	STOCK CHANGE & SOME LOSS: PETROLEUM PRODUCTS
PTSD	MBOE	STATISTICAL DIFFERENCE: PETROLEUM
PTTR	MBOE	FINAL ENERGY DEMAND:TRANSPORT: PETROLEUM TOTA
PTTRA	MBOE	FINAL ENERGY DEMAND: TRANSPORTATION: JET FUEL
PTTRR	MBOE	FINAL ENERGY DEMAND: TRANSPORTATION: RD & TRAIN
PTW	1980=100	Deflator of World Trade(year average)
RCONVEL	%	ELEL/INPELE*(-1)*100, Efficiency of Generation
RCONVLLG	%	TLLG/NGLG*100, Efficiency of Gas Works
RCONVLPT	%	TLPT/CRPT*100, Efficiency of Refinery
RDUM	1 OR 0	REVOLUTION DUMMY
REFCAP	1000 C/D	REFINERY CAPACITY BY OPEC STATISTICS
RELE	10^6 Rials	Revenue of Electricity Sales
RENE	10^6 Rials	Revenue of Energy Sales(Petroleum+Electricity+gas)
RGAS	10^6 Rials	Revenue of Gas Sales
RLOSELLO	%	(-1)*ELLO/ELEL*100, Ratio of Loss of Electricity
RLOSELOU	%	(-1)*ELOU/ELEL*100, Ratio of Own Use at Power Generation
RLOSLGOW	%	(-1)*LGOW/LGLG*100, Own use ar Gas Work
RLOSPTOW	%	(-1)*PTOW/PTPT*100, Own use at Refinery
RPT	10^6 Rials	Revenue of Petroleum sales
SD	10^9 Rials	Statistical Difference
SD.N	10^9 Rilas	STATISTICAL DIFFERENCE
SOCM	MOBE	FINAL ENERGY DEMAND: COMMERCIAL: SOLID FUEL
SOEL	MBOE	ELECTRIC UTILITY: SOLID FUEL FOR POWER
SOEX	MBOE	EXPORT: SOLID FUEL

Name	Unit	Contents
SOFN	MBOE	FINAL ENERGY DEMAND TOTAL: SOLID FUEL
SOHO	MBOE	FINAL ENERGY DEMAND: HOUSEHOLD: SOLID FUEL
SOIM	MBOE	IMPORT: SOLID FUEL
SOIN	MBOE	FINAL ENERGY DEMAND: INDUSTRY: SOLID FUEL
SOPD	MBOE	PRODUCTION: SOLID FUEL
SOPR	MBOE	PRIMARY ENERGY REQUIREMENT: SOLID FUEL
SORE	MBOE	FINAL ENERGY DEMAND: RES. & COMM.: SOLID FUEL
SOSC	MBOE	STOCK CHANGE & SOME LOSS: SOLID FUEL
SOSD	MBOE	STATISTICAL DIFFERENCE: SOLID FUEL
SOX	MT-C	SOx Emission
TIME	1 to ...	Time Trend
TLAG	MBOE	FINAL ENERGY DEMAND: AGRICULTURE: TOTAL
TLAU	MBOE	AUTO GENERATION: LOSS OF AUTO GENERATION
TLCH	MBOE	FINAL ENERGY DEMAND: INDUSTRY: CHEMICAL
TLCM	MBOE	FINAL ENERGY DEMAND: COMMERCIAL: TOTAL
TLEL	MBOE	PRODUCTION OF HYD:CONVERSION LOSS OF POWER GENERATION
TLEX	MBOE	EXPORT: TOTAL
TLFN	MBOE	FINAL ENERGY DEMAND: TOTAL
TLFO	MBOE	FINAL ENERGY DEMAND: INDUSTRY: FOOD
TLHO	MBOE	FINAL ENERGY DEMAND: HOUSEHOLD: TOTAL
TLIM	MBOE	PRODUCTION: TOTAL = SOIM+PTIM
TLIN	MBOE	FINAL ENERGY DEMAND: INDUSTRY: TOTAL
TLLG	MBOE	GAS REFINERY: CONVERSION LOSS
TLMN	MBOE	FINAL ENERGY DEMAND: INDUSTRY: MACHINERY
TLNE	MBOE	FINAL ENERGY DEMAND: NON-ENERGY USE: TOTAL
TLNM	MBOE	FINAL ENERGY DEMAND: IND: CERAMICS & NON-METAL
TLOT	MBOE	FINAL ENERGY DEMAND: INDUSTRY: OTHER MANUFACTURING.
TLOW	MBOE	OWN USE & LOSSES: TOTAL
TLPA	MBOE	FINAL ENERGY DEMAND: INDUSTRY: PAPER & PULP
TLPD	MBOE	PRODUCTION: TOTAL
TLPM	MBOE	FINAL ENERGY DEMAND: INDUSTRY: PRIMARY METAL
TLPR	MBOE	PRIMARY ENERGY REQUIREMENT: TOTAL
TLPT	MBOE	FUEL & LOSSES (CONVERSION LOSS)
TLRE	MBOE	FINAL ENERGY DEMAND: RES. & COMM.: TOTAL
TLSC	MBOE	STOCK CHANGE & SOME LOSS: TOTAL
TLSD	MBOE	STATISTICAL DIFFERENCE: TOTAL
TLTR	MBOE	FINAL ENERGY DEMAND: TRANSPORTATION: TOTAL
TLTX	MBOE	FINAL ENERGY DEMAND: INDUSTRY: TEXTILE
TLWO	MBOE	FINAL ENERGY DEMAND: INDUSTRY: WOOD & PRO.
TWM	10^9 US$	World Trade(1980 price, year average)
TWM.N	10^9 US$	World Trade(market price, year average)
U	10^3	PERSON UNEMPLOYMENT
URATE	%	(U/LN)*100 UNEMPLOYMENT RATIO
VAG	10^9 Rilas	@Agricultural VALUE ADDED
VALCH	10^9 Rilas	VALUE ADDED IN MANUFACTURING: CHEMICAL
VALFM	10^9 Rilas	VALUE ADDED FOR FABRIC-METAL IN 1982 PRICE
VALFO	10^9 Rilas	VALUE ADDED IN MANUFACTURING: FOOD (1982PRICE)
VALIN	10^9 Rilas	VALUE ADDED IN MANUFACTURING: TOTAL
VALNM	10^9 Rilas	VALUE ADDED IN MANUFACTURING: NON-METAL
VALOT	10^9 Rilas	VALUE ADDED IN MANUFACTURING: OTHERS
VALPA	10^9 Rilas	VALUE ADDED IN MANUFACTURING: PAPER & PULP

Name	Unit	Contents
VALPM	10^9 Rilas	VALUE ADDED IN MANUFACTURING: PRIMARY MATTEL
VALTX	10^9 Rilas	VALUE ADDED IN MANUFACTURING: TEXTILE(1982PR.)
VALWO	10^9 Rilas	VALUE ADDED IN MANUFACTURING: WOOD PRO(1982PR)
VSER	10^9 Rials	VALUE ADDED BY SERVICE INDUSTRY
WDUM	1 OR 0	War DUMMY
WI	1982=100	WAGE INDEX: CONSTRUCTION SECTOR
WODM	MMTO	NS WORLD OIL CONSUMPTION
WPER	MTOE	WORLD PRIMARY ENERGY SUPPLY (BP STATISTICS)
WPI	1982=100	Wholesale PRICE INDEX