

2.5 Simulation sheet

In the simulation sheet, the input actual values and the future forecasting values are shown. The all kinds of the results from the model are arranged and displayed in the simulation sheet. The contents are as follows;

(1) Regarding actual data

- The actual data are input from 1990 to 2003 or 2004, those do not have any calculation expression in the simulation sheet.
- In the model, the variable names described in data sheet appeared in the same line number position in the simulation sheet as ones in data sheet.
- The comment area in data sheet, model sheet, simulation sheet and growth rate sheet are filled out with the same comments and variable names.

(2) Regarding forecasting

- In the simulation sheet, the values with black color are the actual and exogenous values that are described in data sheet. The values with red color are ones forecasted by SimpleE.
- In the simulation sheet, the forecasting years are from 2004 or 2005 to 2025. The forecasted values are red.
- The forecasted values have the expressions that calculated the values. The expressions are described in Model sheet.
- The actual values and forecasted values are referred by the Growth sheet, Adjust sheet and Summary sheet.

Table 2-5-1 Simulation sheet(1)

F	H	I	J	TIME	1990	1995	2000	2005	2010	2015	2020	2025
5	Economic data	Exchange rate	Dn/US\$	ECXEC	5,588.0	11,000.0	14,500.0	16,077.0	17,621.0	19,313.0	21,168.0	21,168.0
6		Country number	Million persons	POPNUM	66.0	72.0	77.6	83.1	87.6	92.5	97.7	101.4
8		Growth rate	G%	POPNGR	1.7	1.4	1.1	1.4	1.1	1.1	1.1	0.8
9		Urban number	Million persons	POPUBN	12.9	14.9	18.8	21.9	24.2	26.9	29.8	32.6
10		Urban population share	S%	POPUGR	19.5	20.7	24.2	26.3	27.7	29.1	30.6	32.1
11												
12	Household	County Number	Million HH	HHNUM	13.3	15.0	16.9	18.3	19.7	21.2	22.8	24.6
13		Growth rate	G%	HHNGR	2.0	2.0	1.2	1.5	1.5	1.5	1.5	1.5
14		Urban number	Million HH	HHUBN	2.6	3.1	4.1	4.8	5.5	6.2	7.0	7.9
15		Urban HH rate	S%	HHUGR	19.5	20.7	24.2	26.3	27.7	29.1	30.6	32.1
16												
17	Labor number	Agriculture	Million persons	LABAGR	21.2	23.1	24.3	23.7	25.3	27.2	29.1	30.2
18		Manufacturing & Mining	Million persons	LABMAN	2.6	2.8	3.4	5.1	5.7	6.4	7.1	7.6
19		Services & Others	Million persons	LABOTH	5.6	7.1	9.0	13.6	15.1	16.5	18.3	19.8
20		Unemployed	Million persons	LABUNE	1.0	1.5	1.7	0.7	0.8	0.9	0.9	1.0
21		Total	Million persons	LABTOT	30.4	34.5	38.4	43.1	46.8	50.9	55.4	58.7
22												
23		Labor force share to Pop	%	LABSHP	46.0	47.9	49.5	51.9	53.5	55.1	56.7	57.9
24												
25	Labor shares	Agriculture & Forestry	S%	LASAGR	69.7	67.0	63.3	54.9	54.0	53.4	52.5	51.5
26		Manufacturing & Mining	S%	LASMAN	8.6	8.1	8.9	11.8	12.2	12.5	12.8	13.0
27		Services & Others	S%	LASOTH	18.4	20.6	23.4	31.6	32.2	32.5	33.0	33.8
28		Unemployed	S%	LASUNE	3.3	4.3	4.4	1.7	1.7	1.7	1.7	1.7
29		Total	S%	LASTOT	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
30												
33	GDP	nGDP at current price	Billion Dn	GDNOMI	41,955	228,892	441,646	793,661	1,597,030	3,213,595	6,466,498	12,715,025
34		Growth rate	G%	GDNGR	28.2	28.2	10.4	14.5	15.0	15.0	15.0	14.5
35												
36		uGDP on US \$ base	Million US\$	GDDOL	7,508	20,808	30,458	49,366	90,632	166,395	305,485	600,672
37		Growth rate	G%	GDDGR	27.8	27.8	3.1	12.4	4.9	4.9	4.9	14.5
38												
39		uGDP per capita on US\$ base	US\$ per capita	GDPDOL	113.7	289.0	392.3	594.2	1,034.4	1,798.8	3,128.2	5,925.4
40		Growth rate	G%	GDPDGR	25.7	25.7	1.7	10.8	3.8	3.8	3.8	13.6
41												
42		rGDP at 1994 price	Billion Dn	RGDP	131,968	195,567	273,666	391,898	589,279	886,074	1,332,351	1,957,661
43		Growth rate	G%	RGDPGR	9.5	9.5	6.8	8.0	8.5	8.5	8.5	8.0
44												
45		GDP deflator 1994 price	1994=100	GDFLT	31.8	117.0	161.4	202.5	271.0	362.7	485.3	649.5
46		Growth rate	G%	GDFGR	17.0	17.0	3.4	6.0	6.0	6.0	6.0	6.0
47												
48		rGross Domestic Savings	Billion Dn	GDSAV	3,834	35,594	74,230	110,515	166,177	249,873	375,723	552,060
49		Share to GDP	%	GDSHA	2.9	18.2	27.1	28.2	28.2	28.2	28.2	28.2
50		Elasticity to Private Con	%	GDEVPC	1.6	1.6	1.4	1.9	1.9	1.9	1.9	1.9
51												
52		rLabor productivity in Manufacturing	1000 Dn /persons	LAPMAN	4,489	5,926	7,457	9,238	12,795	17,694	24,470	33,939
53		Growth rate	G%	LAPMGR	5.7	5.7	4.7	5.7	6.7	6.7	6.7	6.8
54												

Table 2-5-3 Simulation sheet (3)

F	H	I	J	TIME													
				1990	1995	2000	2005	2010	2015	2020	2025						
105	Elasticity																
106	Agriculture & Forestry				0.1	0.7	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3
107	Manufacturing & Mining				1.6	1.8	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.3
108	Commercial & Trade				1.6	0.6	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
109	Transport and communications				1.4	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
110	Service & Others				1.2	0.6	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
111	Total				1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
112																	
113	GDP by Elasticity				49,416.5	68,224.2	78,502	93,420	107,688	122,744	134,911						
114	Agriculture & Forestry				59,620.5	99,032.2	164,079	277,028	453,810	735,079	1,150,075						
115	Manufacturing & Mining				34,856.7	39,530.7	53,730	79,102	117,727	173,249	247,296						
116	Commercial & Trade				8,097.6	10,607.8	14,553	21,426	31,888	46,926	66,983						
117	Transport and communications				45,280.6	56,799.6	80,838	119,013	177,124	260,659	372,967						
118	Service & Others				197,271.8	274,194.5	391,702	589,989	888,236	1,338,658	1,971,332						
119	Total																
120																	
121																	

Table 2-5-4 Simulation sheet (4)

F	H	I	J	TIME	1990	1995	2000	2005	2010	2015	2020	2025
122	Conversion factor to	Standard Oil(1000Kcal/kg)	10000	COFASCO	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
123		Coal(5600Kcal/kg)	5600	COFACOA	0.560	0.560	0.560	0.560	0.560	0.560	0.560	0.560
124		Gasoline(10500Kcal/kg)	10500	COFAGAS	1.050	1.050	1.050	1.050	1.050	1.050	1.050	1.050
125		Kerosene (10320Kcal/kg)	10320	COFAKER	1.032	1.032	1.032	1.032	1.032	1.032	1.032	1.032
126		Diesel (10150Kcal/kg)	10150	COFADIE	1.015	1.015	1.015	1.015	1.015	1.015	1.015	1.015
127		Petroleum Products	11500	COFAPET	1.050	1.050	1.050	1.050	1.050	1.050	1.050	1.050
128		Fuel oil (9910Kcal/Kg)	9910	COFAFUE	0.991	0.991	0.991	0.991	0.991	0.991	0.991	0.991
129		Natural gas (9000Kcal/m3)	9000	COFANAG	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900
130		Renewable energy (3302Kcal/Kg)	3302	COFAREW	0.330	0.330	0.330	0.330	0.330	0.330	0.330	0.330
131		Electricity (860Kcal/KWh)	860	COFAELE	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086
132												
133	Power efficiency	Power from Thermal(Coal)	35.0%	COPOCOA	2.279	2.279	2.279	2.279	2.279	2.279	2.279	2.279
134		Power from Thermal(FO)	35.0%	COPOFOT	4.033	4.033	4.033	4.033	4.033	4.033	4.033	4.033
135		Power from Gasturbine(FO)	48.0%	COPOFOE	5.531	5.531	5.531	5.762	5.762	5.762	5.762	5.762
136		Power from Gasturbine(GAS)	48.0%	COPOGAE	5.023	5.023	5.023	5.233	5.233	5.233	5.233	5.233
137		Power from Gas steam	40.0%	COPODAS	4.186	4.186	4.186	4.186	4.186	4.186	4.186	4.186
138		Power from Diesel	36.0%	COPODIE	4.249	4.249	4.249	4.249	4.249	4.249	4.249	4.249
139												
140	Energy price	WTI crude oil price	US\$/bbl	EPRCWTI	24.5	18.4	30.3	50.0	40.0	40.0	40.0	40.0
141		Crude oil Price in Vietnam	1000Dn/bbl	EPRCRD	137.0	202.5	439.4	803.9	704.8	772.5	846.7	846.7
142		NG price in Vietnam	\$/MMBTU	EPFRNG	0.0	0.0	3.8	6.5	5.8	6.4	7.0	7.8
143		Gasoline price in Vietnam	Dong/Kg	EPRGAS	840.0	4,533.3	6,400.0	10,262.0	10,400.5	12,245.4	14,417.8	15,940.5
144		Kerosene price in Vietnam	Dong/kg	EPRKER	3,312.9	3,312.9	4,662.6	7,476.2	7,577.0	8,921.1	10,503.8	11,613.1
145		Diesel price in Vietnam	Dong/kg	EPRDIE	630.0	2,940.0	3,640.0	6,524.3	6,612.3	7,785.2	9,166.4	10,134.5
146		Fuel oil price in Vietnam	Dong/kg	EPFRFO	732.4	1,082.6	2,349.1	3,870.9	3,923.1	4,619.0	5,438.5	6,012.8
147		Electricity for Agriculture use	Dn/KWh	EPRELA	450.4	535.0	570.0	934.9	1,078.0	1,354.9	1,703.1	2,064.2
148		Electricity for Residential use	Dn/KWh	EPRELR	386.8	480.0	607.0	1,201.2	1,383.2	1,736.3	2,179.7	2,638.6
149		Electricity for Industry use	Dn/KWh	EPRELI	657.0	750.0	850.0	876.2	1,007.6	1,263.3	1,584.0	1,915.0
150		Electricity for Commercial use	Dn/KWh	EPRELC	922.0	1,150.0	1,300.0	1,867.4	2,144.9	2,686.0	3,363.6	4,061.5
151												
152	G.R of Energy price	WTI crude oil price	%	GRPRWTI	7.0	7.0	57.4	25.0	0.0	0.0	0.0	0.0
153		Crude oil Price in Vietnam	%	GRPRCRD	7.3	7.3	68.6	27.3	9.6	9.6	9.6	0.0
154		NG price in Vietnam	%	GRPRNG	0.0	0.0	2.0	25.5	2.0	2.0	2.0	2.0
155		Gasoline price in Vietnam	%	GRPRGAS	24.4	24.4	11.6	20.8	8.7	8.7	8.7	2.0
156		Kerosene price in vietnam	%	GRPRKER	24.4	24.4	2.7	20.8	8.7	8.7	8.7	2.0
157		Diesel price in Vietnam	%	GRPRDIE	0.1	0.1	0.1	20.8	8.7	8.7	8.7	2.0
158		Fuel oil price in Vietnam	%	GRPRFO	7.3	7.3	68.6	20.8	8.7	8.7	8.7	2.0
159		Electricity for Agriculture use	%	GRPRAGR	2.9	2.9	3.6	14.8	7.9	7.9	7.9	3.9
160		Electricity for Residential use	%	GRPRELR	2.1	2.1	5.8	14.8	7.9	7.9	7.9	3.9
161		Electricity for Industry use	%	GRPRELI	1.4	1.4	19.4	14.7	7.9	7.9	7.9	3.9
162		Electricity for Commercial use	%	GRPRELC	4.5	4.5	4.0	14.7	7.9	7.8	7.8	3.8
163												

Table 2-5-5 Simulation sheet (5)

F	H	I	J	TIME	1990	1995	2000	2005	2010	2015	2020	2025
164	Agriculture.Forestry	Energy conservation rate	S%	PAENCOR	100.0	100.0	100.0	100.0	100.0	94.9	90.1	85.6
165		Technical Improvement	%	PAANTEC	0.0	0.0	0.0	0.0	0.0	-1.0	-1.0	-1.0
166		Elasticity to Energy price		PAENEVP	-1.9	-1.9	-0.1	0.0	0.0	0.0	0.0	0.0
167		Energy intensity to GDP		PAENEFF	1.7	1.8	1.5	1.3	1.0	0.7	0.5	0.3
168		Energy demand before E.save	KTOE	PAENDEA	225.3	346.8	400.8	503.5	575.7	644.8	716.9	774.6
169		Energy demand after E.save	KTOE	PAENDEA	225.3	346.8	400.8	503.5	575.7	612.1	646.1	663.3
170		Electricity ratio	S%	PAENELR	7.2	6.0	9.2	11.0	13.0	13.0	13.0	13.0
171		Power demand (kTOE)	KTOE	PAENELT	16.3	20.8	36.8	56.6	74.8	79.6	84.0	86.2
172		Power demand (GW/h)	GW/h	PAENELE	189.8	241.3	428.3	657.7	870.3	925.3	976.7	1,002.7
173												
174		Coal demand	KTOE	PADMCOA	64.0	76.0	24.0	27.2	30.5	32.4	34.2	35.1
175		LPG demand	KTOE	PADMLPG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
176		Gasoline demand	KTOE	PADMGAS	45.0	67.0	79.0	89.2	99.9	106.3	112.2	115.1
177		Jetfuel demand	KTOE	PADMJET	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
178		Kerosene demand	KTOE	PADMKER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
179		Diesel demand	KTOE	PADMIDIE	97.0	178.0	244.0	314.3	352.2	374.5	395.3	405.8
180		Fuel oil demand	KTOE	PADMFUL	3.0	5.0	17.0	16.3	18.3	19.4	20.5	21.1
181		Natural gas demand	KTOE	PADMGNG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
182		Renewable energy demand	KTOE	PADMREV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
183		Total	KTOE	PADMTOT	209.0	326.0	364.0	447.0	500.9	532.6	562.1	577.1
184												
185		Coal demand	S%	PASMCOA	30.6	23.3	6.6	6.1	6.1	6.1	6.1	6.1
186		LPG demand	S%	PASMLPG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
187		Gasoline demand	S%	PASMGAS	21.5	20.6	21.7	20.0	20.0	20.0	20.0	20.0
188		Jetfuel demand	S%	PASMJET	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
189		Kerosene demand	S%	PASMKER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
190		Diesel demand	S%	PASMDIE	46.4	54.6	67.0	70.3	70.3	70.3	70.3	70.3
191		Fuel oil demand	S%	PASMFUL	1.4	1.5	4.7	3.6	3.6	3.6	3.6	3.6
192		Natural gas demand	S%	PASMGNG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
193		Renewable energy demand	S%	PASMREV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
194		Total	S%	PASMTOT	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
195												

Table 2-5-6 Simulation sheet (6)

F	H	I	J	TREND										
				1990	1995	2000	2005	2010	2015	2020	2025			
196	Industry	Energy conservation rate	S%	100.0	100.0	100.0	100.0	100.0	100.0	100.0	90.4	81.7	75.4	
197		Technical Improvement	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.0	-1.0	-1.0	
198		Elasticity to Energy price		0.8	0.8	0.0	0.0	0.0	0.0	0.0	-0.3	-0.3	-0.3	
199		TOE/Bil Don		34.2	30.6	28.5	28.8	28.9	28.9	26.6	24.7	23.6	23.6	
200		Energy intensity to GDP	KTOE	4,510.3	5,991.3	7,803.6	11,281.9	17,042.6	26,052.8	40,330.6	61,343.6	61,343.6	61,343.6	
201		Energy demand before E.save	KTOE	4,510.3	5,991.3	7,803.6	11,281.9	17,042.6	23,550.4	32,954.8	46,235.6	46,235.6	46,235.6	
202		Electricity ratio	S%	5.5	6.6	10.0	15.7	21.0	26.0	31.0	34.0	34.0	34.0	
203		Power demand (k·TOE)	KTOE	247.3	397.3	781.6	1,798.1	3,579.0	6,123.1	10,216.0	15,720.1	15,720.1	15,720.1	
204		Power demand (GW _h)	GWh	2,875.6	4,619.4	9,088.4	20,908.6	41,615.8	71,198.9	118,790.6	182,791.8	182,791.8	182,791.8	
205														
206		Coal demand	KTOE	1,020.0	1,938.0	2,339.0	3,698.7	5,250.8	6,796.6	8,868.1	11,901.0	11,901.0	11,901.0	
207		LPG demand	KTOE	0.0	2.0	33.0	107.9	195.4	322.9	537.7	920.9	920.9	920.9	
208		Gasoline demand	KTOE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
209		Jetfuel demand	KTOE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
210		Kerosene demand	KTOE	4.0	6.0	9.0	13.2	18.8	24.3	31.0	40.4	61.0	61.0	
211		Diesel demand	KTOE	233.0	284.0	591.0	834.6	1,184.9	1,533.7	2,001.1	2,685.5	2,685.5	2,685.5	
212		Fuel oil demand	KTOE	211.0	446.0	823.0	1,658.6	2,967.7	4,939.3	7,438.5	11,470.2	11,470.2	11,470.2	
213		Natural gas demand	KTOE	0.0	22.0	18.0	22.3	40.4	66.8	111.2	190.5	190.5	190.5	
214		Renewable energy demand	KTOE	2,795.0	2,896.0	3,209.0	3,148.6	3,810.2	3,746.9	3,683.7	3,295.7	3,295.7	3,295.7	
215		Total	KTOE	4,263.0	5,594.0	7,022.0	9,483.8	13,463.7	17,427.3	22,738.8	30,515.5	30,515.5	30,515.5	
216														
217		Coal demand	S%	23.9	34.6	33.3	39.0	39.0	39.0	39.0	39.0	39.0	39.0	
218		LPG demand	S%	0.0	0.0	0.5	1.1	1.5	1.9	2.4	3.0	3.0	3.0	
219		Gasoline demand	S%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
220		Jetfuel demand	S%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
221		Kerosene demand	S%	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
222		Diesel demand	S%	5.5	5.1	8.4	8.8	8.8	8.8	8.8	8.8	8.8	8.8	
223		Fuel oil demand	S%	4.9	8.0	11.7	17.5	22.0	28.3	32.7	37.6	37.6	37.6	
224		Natural gas demand	S%	0.0	0.4	0.3	0.2	0.3	0.4	0.5	0.6	0.6	0.6	
225		Renewable energy demand	S%	65.6	51.8	45.7	33.2	28.3	21.5	16.2	10.8	10.8	10.8	
226		Total	S%	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
227														

Table 2-5-7 Simulation sheet (7)

F	H	I	J	TIME	1990	1995	2000	2005	2010	2015	2020	2025
228	Transportation	Energy conservation rate	S%	TRENCOR	100.0	100.0	100.0	100.0	100.0	98.3	96.7	95.7
229		Technical Improvement	%	TRENTEC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
230		Elasticity to Energy price		TRENEVP		-1.4	0.0	0.0	0.0	-0.1	-0.1	-0.1
231		Energy intensity to GDP	TOE/Bil Don	TRENEFF	10.7	12.9	13.7	20.0	23.2	22.1	18.8	14.8
232		Energy demand before E.save	KTOE	TRENDEM	1,408.0	2,516.0	3,743.0	7,845.0	13,692.0	19,931.3	25,839.3	30,219.1
233		Energy demand after E.save	KTOE	TRENDEA	1,408.0	2,516.0	3,743.0	7,845.0	13,692.0	19,599.0	24,984.6	28,924.5
234		Electricity ratio	S%	TRENELR	0.4	0.4	0.6	0.6	1.0	1.3	1.7	2.0
235		Power demand (k,TOE)	KTOE	TRENELT	5.0	9.0	21.0	29.0	132.5	257.1	413.7	578.5
236		Power demand (GWh)	GWh	TREENELI	58.1	104.7	244.2	337.2	1,540.2	2,989.1	4,810.4	6,726.6
237												
238		Coal demand	KTOE	TREMCOA	14.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0
239		LPG demand	KTOE	TREMLPG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
240		Gasoline demand	KTOE	TREMGAS	601.0	884.0	1,388.0	3,262.1	5,654.3	8,230.0	10,614.6	12,429.7
241		Jetfuel demand	KTOE	TREMJET	100.0	206.0	217.0	449.1	779.1	1,004.5	1,153.5	1,202.8
242		Kerosene demand	KTOE	TREMKER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
243		Diesel demand	KTOE	TREMDIE	659.0	1,338.0	1,960.0	3,760.2	6,522.1	9,336.3	11,912.0	13,801.7
244		Fuel oil demand	KTOE	TREMFUL	34.0	86.0	178.0	344.7	588.0	771.1	885.4	923.3
245		Natural gas demand	KTOE	TREMNG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
246		Renewable energy demand	KTOE	TREMREV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
247		Total	KTOE	TREMTOT	1,408.0	2,516.0	3,743.0	7,816.0	13,559.5	19,341.9	24,570.9	28,346.0
248												
249		Coal demand	S%	TRSMCOA	1.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
250		LPG demand	S%	TRSMPLG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
251		Gasoline demand	S%	TRSMGAS	42.7	35.1	37.1	41.7	41.7	42.6	43.2	43.9
252		Jetfuel demand	S%	TRSMJET	7.1	8.2	5.8	5.7	5.7	5.2	4.7	4.2
253		Kerosene demand	S%	TRSMKER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
254		Diesel demand	S%	TRSM DIE	46.8	53.2	52.4	48.1	48.1	48.3	48.5	48.7
255		Fuel oil demand	S%	TRSMFUL	2.4	3.4	4.8	4.4	4.4	4.0	3.6	3.3
256		Natural gas demand	S%	TRSMNG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
257		Renewable energy demand	S%	TRSMREV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
258		Total	S%	TRSMTOT	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
259												

Table 2-5-8 Simulation sheet (8)

F	H	I	J	TIME	1990	1995	2000	2005	2010	2015	2020	2025
260	Commercials & Ser	Energy conservation rate	S%	COMNCOF	100.0	100.0	100.0	100.0	100.0	91.9	84.5	78.8
261		Technical Improvement	%	COMNTEC	0.0	0.0	0.0	0.0	0.0	-1.0	-1.0	-1.0
262		Elasticity to Crude oil price		COMNEVP	2.1	3.1	3.9	3.9	4.2	-0.2	3.7	-0.2
263		TOE/Bbl Don		COMNEFF	2.2	3.1	3.9	3.9	4.2	4.0	3.7	3.4
264		Energy demand before E.save	KTOE	COMNDEN	295.1	614.1	1,054.2	1,537.5	2,449.6	3,838.0	5,824.5	8,466.9
265		Energy demand after E.save	KTOE	COMNDEA	295.1	614.1	1,054.2	1,537.5	2,449.6	3,528.8	4,924.0	6,670.1
266		Electricity ratio	S%	COMNELR	3.8	7.7	8.8	12.3	15.9	20.7	26.9	35.0
267		Power demand (k-TOE)	KTOE	COMNELT	11.1	47.1	93.2	173.9	390.5	731.1	1,326.0	2,334.5
268		Power demand (GW _h)	GWh	COMNELE	128.9	547.5	1,083.7	2,022.0	4,540.7	8,501.6	15,418.3	27,145.6
269												
270		Coal demand	KTOE	COMMCOI	19.0	140.0	276.0	354.9	536.0	728.2	936.5	1,128.5
271		LPG demand	KTOE	COMMLPG	0.0	5.0	89.0	147.6	222.9	302.8	389.4	469.2
272		Gasoline demand	KTOE	COMMGAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
273		Jetfuel demand	KTOE	COMMJET	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
274		Kerosene demand	KTOE	COMMKER	147.0	205.0	228.0	301.3	454.9	618.1	794.9	957.9
275		Diesel demand	KTOE	COMMDIE	87.0	158.0	239.0	396.4	598.6	813.3	1,045.9	1,260.3
276		Fuel oil demand	KTOE	COMMFUL	31.0	59.0	129.0	163.4	246.8	335.3	431.2	519.6
277		Natural gas demand	KTOE	COMMING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
278		Renewable energy demand	KTOE	COMMREV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
279		Total	KTOE	COMMTOI	284.0	567.0	961.0	1,363.6	2,059.1	2,797.7	3,598.0	4,335.5
280												
281		Coal demand	S%	COSMCOI	6.7	24.7	28.7	26.0	26.0	26.0	26.0	26.0
282		LPG demand	S%	COSMLPG	0.0	0.9	9.3	10.8	10.8	10.8	10.8	10.8
283		Gasoline demand	S%	COSMGAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
284		Jetfuel demand	S%	COSMJET	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
285		Kerosene demand	S%	COSMKER	51.8	36.2	23.7	22.1	22.1	22.1	22.1	22.1
286		Diesel demand	S%	COSMDIE	30.6	27.9	24.9	29.1	29.1	29.1	29.1	29.1
287		Fuel oil demand	S%	COSMFUL	10.9	10.4	13.4	12.0	12.0	12.0	12.0	12.0
288		Natural gas demand	S%	COSMING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
289		Renewable energy demand	S%	COSMREV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
290		Total	S%	COSMTOT	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
291												

Table 2-5-9 Simulation sheet (9)

F	H	I	J	TIME	1990	1995	2000	2005	2010	2015	2020	2025
292	Residential	Energy conservation rate	S%	RESNCOR	100.0	100.0	100.0	100.0	100.0	93.5	87.4	82.3
293		Technical Improvement	%	RESNTEC	0.0	0.0	0.0	0.0	0.0	-1.0	-1.0	-1.0
294		Elasticity to Energy price		RESNEVP	-1.0	-1.0	-0.1	0.0	0.0	-0.1	-0.1	-0.1
295		Energy intensity to GDP	TOE/Bil Don	RESNEFF	76.9	56.4	46.9	39.3	32.4	26.0	21.6	18.7
296		Energy demand before E.save	KTOE	RESNDEA	10,146.9	11,027.8	12,846.8	15,393.0	19,068.0	24,593.8	32,902.8	44,545.0
297		Energy demand after E.save	KTOE	RESNDEA	10,146.9	11,027.8	12,846.8	15,393.0	19,068.0	22,998.4	28,772.5	36,670.0
298		Electricity ratio	S%	RESNELR		4.2	7.4	11.3	16.0	20.7	25.3	30.0
299		Power demand(k·TOE)	KTOE	RESNELT	238.9	461.8	944.8	1,734.9	3,053.1	4,754.8	7,290.1	11,001.0
300		Power demand (GWh)	GWh	RESENEL	2,778.0	5,369.4	10,985.6	20,173.5	35,501.0	55,288.2	84,769.0	127,918.7
301												
302		Coal demand	KTOE	REDMCOA	207.0	449.0	584.0	1,106.3	1,809.7	2,225.7	2,749.7	3,645.0
303		LPG demand	KTOE	REDMLPG	0.0	29.0	146.0	678.6	1,597.8	1,824.4	2,492.0	3,208.6
304		Gasoline demand	KTOE	REDMGAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
305		Jetfuel demand	KTOE	REDMJET	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
306		Kerosene demand	KTOE	REDMKER	61.0	87.0	138.0	167.3	196.2	223.5	263.2	314.5
307		Diesel demand	KTOE	REDMDIE	11.0	20.0	32.0	24.4	28.6	32.6	38.3	45.8
308		Fuel oil demand	KTOE	REDMFUL	3.0	5.0	20.0	12.2	14.3	16.3	19.2	22.9
309		Natural gas demand	KTOE	REDMING	0.0	0.0	0.0	0.0	0.0	1,824.4	4,296.5	7,700.7
310		Renewable energy demand	KTOE	REDMREV	9,626.0	9,976.0	10,982.0	11,669.3	12,368.3	12,099.2	11,616.7	10,740.6
311		Total	KTOE	REDMTOT	9,908.0	10,566.0	11,902.0	13,658.1	16,014.9	18,243.7	21,482.3	25,669.0
312												
313		Coal demand	S%	RESMCOA	2.1	4.2	4.9	8.1	11.3	12.2	12.8	14.2
314		LPG demand	S%	RESMLPG	0.0	0.3	1.2	5.0	10.0	10.0	11.6	12.5
315		Gasoline demand	S%	RESMGAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
316		Jetfuel demand	S%	RESMJET	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
317		Kerosene demand	S%	RESMKER	0.6	0.8	1.2	1.2	1.2	1.2	1.2	1.2
318		Diesel demand	S%	RESMDIE	0.1	0.2	0.3	0.2	0.2	0.2	0.2	0.2
319		Fuel oil demand	S%	RESMFUL	0.0	0.0	0.2	0.1	0.1	0.1	0.1	0.1
320		Natural gas demand	S%	RESMING	0.0	0.0	0.0	0.0	0.0	10.0	20.0	30.0
321		Renewable energy demand	S%	RESMREV	97.2	94.4	92.3	85.4	77.2	66.3	54.1	41.8
322		Total	S%	RESMTOT	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
323												

Table 2-5-10 Simulation sheet (10)

F	H	I	J	TIME	1990	1995	2000	2005	2010	2015	2020	2025
324	Others	Energy conservation rate	S%	NONCOF	100.0	100.0	100.0	100.0	100.0	93.5	87.4	82.3
325		Technical Improvement	%	NONNTEC	0.0	0.0	0.0	0.0	0.0	-1.0	-1.0	-1.0
326		Elasticity to Energy price		NONNEVP	5.1	5.1	0.0	0.0	0.0	-0.1	-0.1	-0.1
327		Energy intensity to GDP	TOE/Bil Don	NONNEFF	0.1	0.1	0.2	0.4	0.4	0.3	0.3	0.3
328		Energy demand before E.save	KTOE	NONNDEA	13.3	27.2	48.8	136.9	211.5	323.7	492.3	728.7
329		Energy demand after E.save	KTOE	NONNDEA	13.3	27.2	48.8	153.8	211.5	302.7	430.5	599.8
330		Electricity ratio	S%	NONNELR	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
331		Power demand (kTOE)	KTOE	NONNELT	13.3	27.2	48.8	136.2	211.5	302.7	430.5	599.8
332		Power demand (GW/h)	GW/h	NONNELE	154.9	315.8	567.4	1,583.3	2,459.6	3,519.6	5,006.2	6,974.8
333												
334		Coal demand	KTOE	NONMCOA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
335		LPG demand	KTOE	NONMLPG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
336		Gasoline demand	KTOE	NONMGAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
337		Jetfuel demand	KTOE	NONMJET	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
338		Kerosene demand	KTOE	NONMKER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
339		Diesel demand	KTOE	NONMDIE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
340		Fuel oil demand	KTOE	NONMFUL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
341		Natural gas demand	KTOE	NONMING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
342		Renewable energy demand	KTOE	NONMREV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
343		Total	KTOE	NONMTO1	0.0	0.0	0.0	17.6	0.0	0.0	0.0	0.0
344												
345		Coal demand	S%	NOSMCOA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
346		LPG demand	S%	NOSMLPG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
347		Gasoline demand	S%	NOSMGAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
348		Jetfuel demand	S%	NOSMJET	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
349		Kerosene demand	S%	NOSMKER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
350		Diesel demand	S%	NOSMDIE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
351		Fuel oil demand	S%	NOSMFUL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
352		Natural gas demand	S%	NOSMING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
353		Renewable energy demand	S%	NOSMREV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
354		Total	S%	NOSMTO1	0.0	0.0	0.0	100.0	100.0	100.0	100.0	100.0
355												

Table 2-5-11 Simulation sheet (11)

F	H	I	J	TIME	1990	1995	2000	2005	2010	2015	2020	2025
356	Power demand in fi	Agriculture..Forestry..Fishery	GWh	PWDMIPA	189.8	241.3	428.3	657.7	896.4	953.1	1,006.0	1,032.8
357	Power demand in fi	manufacturing	GWh	PWDMMIN	2,875.6	4,619.4	9,088.4	20,908.6	42,884.2	73,334.8	122,354.3	188,275.6
358	Power demand in fi	Transportation	GWh	PWDMTR	58.1	104.7	244.2	337.2	1,586.4	3,078.7	4,954.7	6,928.4
359	Power demand in fi	Commercials..Banking..Services..	GWh	PWDMCM	128.9	547.5	1,083.7	2,022.0	4,676.9	8,756.7	15,880.8	27,960.0
360	Power demand in fi	Residential	GWh	PWDMRE	2,778.0	5,369.4	10,985.6	20,173.5	36,566.0	56,946.9	87,312.1	131,756.2
361	Power demand in fi	Other	GWh	PWDMNO	154.9	315.8	567.4	1,583.3	2,533.4	3,625.2	5,156.4	7,184.1
362	Power demand in fi	Total	GWh	PWDMTO	6,185.3	11,198.1	22,397.6	45,682.3	89,123.3	146,695.5	236,664.4	363,137.1
363	Energy Demand	Coal demand	KTOE	DEDCOA	1,324.0	2,605.0	3,223.0	5,187.1	7,627.0	9,783.0	12,588.6	16,709.6
365	Energy Demand	LPG demand	KTOE	DEDLPG	0.0	36.0	268.0	934.0	2,016.2	2,450.0	3,419.0	4,598.8
366	Energy Demand	Gasoline demand	KTOE	DEDGAS	646.0	951.0	1,467.0	3,351.3	5,754.2	8,336.2	10,726.8	12,544.9
367	Energy Demand	Jetfuel demand	KTOE	DEDJET	100.0	206.0	217.0	449.1	779.1	1,004.5	1,153.5	1,202.8
368	Energy Demand	Kerosene demand	KTOE	DEDKER	212.0	298.0	375.0	481.8	669.9	865.9	1,149.1	1,333.4
369	Energy Demand	Diesel demand	KTOE	DEDDIE	1,087.0	1,978.0	3,066.0	5,329.8	8,686.4	12,090.3	15,392.7	18,199.1
370	Energy Demand	Fuel oil demand	KTOE	DEDFUE	282.0	601.0	1,167.0	2,195.2	3,845.1	6,081.4	8,794.8	12,957.1
371	Energy Demand	Petroleum total	KTOE	DEDSOT	2,327.0	4,070.0	6,560.0	12,741.2	21,750.8	30,828.4	40,635.9	50,836.1
372	Energy Demand	Natural gas demand	KTOE	DEDNNG	0.0	22.0	18.0	22.3	40.4	1,891.2	4,407.7	7,891.2
373	Energy Demand	Renewable energy demand	KTOE	DEDRW	12,659.9	13,333.8	15,135.8	14,817.9	16,178.5	15,846.0	15,300.4	14,036.2
374	Energy Demand	Power	KTOE	DEDPW	531.9	963.0	1,926.2	3,928.7	7,664.6	12,615.8	20,353.1	31,229.8
375	Energy Demand	Total(Coal+Petro+Renew+Power)	KTOE	DEDTOT	16,842.8	20,971.8	26,845.0	36,697.2	53,281.3	70,964.4	93,285.7	120,702.9
377	Power supply	Power distribution loss	S%	PWGELOF	25.4	21.7	15.0	11.5	10.3	9.3	8.5	7.5
378	Power supply	Power distribution loss (GWh)	GWh	PWLOSSG	2,204.5	3,178.6	3,727.3	5,873.8	9,667.9	13,980.7	20,236.7	27,116.0
379	Power supply	Own use in Power sector(GWh)	GWh	PWOWNG	289.4	271.2	430.3	644.1	1,090.8	1,682.9	2,608.0	3,908.6
380	Power supply	Power distribution loss (KTOE)	KTOE	PWLOSST	189.6	273.4	320.5	505.1	831.4	1,202.3	1,740.4	2,332.0
381	Power supply	Own use in Power sector(KTOE)	KTOE	PWOWNT	24.9	23.3	37.0	55.4	93.8	144.7	224.3	336.1
382	Power supply	Power from Hydro	GWh	PWGEHYD	5,368.7	10,581.8	14,550.7	20,056.0	28,281.7	45,933.1	59,270.2	59,270.2
384	Power supply	Power from Fossil	GWh	PWGEFOS	3,310.6	4,066.0	10,375.3	31,943.6	67,450.7	105,913.0	147,626.8	253,704.2
385	Power supply	Power foreign trade balance	GWh	PWGEBAL	0.0	0.0	0.0	0.0	2,452.8	7,757.0	24,528.0	28,575.1
386	Power supply	Power from Renewable energy	GWh	PWGENEV	0.0	0.0	0.0	200.6	1,696.9	2,756.0	3,556.2	3,556.2
387	Power supply	Power from Nuclear	GWh	PWGENCL	0.0	0.0	0.0	0.0	0.0	0.0	24,528.0	49,056.0
388	Power supply	Total of power generation	GWh	PWGETOT	8,679.3	14,647.7	24,926.0	52,200.2	99,882.1	162,359.0	259,509.2	394,161.7
389	Power supply	Power from Thermal(Coal)	GWh	PWGECO4	2,023.8	1,618.1	2,620.9	7,372.4	29,755.5	46,725.5	66,872.6	88,317.6
391	Power supply	Power from Thermal(FO)	GWh	PWGEFO1	988.1	1,020.4	1,302.7	2,130.0	2,411.8	2,625.0	2,415.1	3,189.6
392	Power supply	Power from Gasturbine(FO)	GWh	PWGEFOE	53.0	257.0	1,509.0	1,434.8	1,624.5	1,768.2	1,626.8	2,148.5
393	Power supply	Power from Gasturbine(GAS)	GWh	PWGEGAE	6.0	747.8	4,056.0	17,597.2	29,798.8	50,592.9	72,846.8	154,943.3
394	Power supply	Power from Gas steam	GWh	PWGEGAS	0.0	0.0	300.0	3,368.1	3,813.5	4,150.7	3,818.8	5,043.5
395	Power supply	Power from Diesel	GWh	PWGEDIE	410.8	131.7	237.5	41.2	46.6	50.7	46.7	61.6
396	Power supply	Power from Fossil	GWh	PWGEFTT	3,481.7	3,775.0	10,026.1	31,943.6	67,450.7	105,913.0	147,626.8	253,704.2
397	Power supply		GWh									

Table 2-5-12 Simulation sheet (12)

F	H	I	J	TIME	1990	1995	2000	2005	2010	2015	2020	2025
398	Power resources	Coal consumption for Thermal	KTOE	PWCCCOA	888.0	710.0	1,150.0	1,811.5	7,311.4	11,481.1	16,431.6	21,700.9
399		FO consumption for Thermal	KTOE	PWCCFOI	245.0	253.0	323.0	523.4	592.6	645.0	593.4	783.7
400		FO consumption for Gasturbine	KTOE	PWCCFOB	9.6	46.5	272.8	246.8	279.4	304.1	279.8	369.5
401		NG & AG consumption for Turbine	KTOE	PWCCGAI	1.2	148.9	807.4	3,026.7	5,125.4	8,702.0	12,529.6	26,650.3
402		NG & AG consumption for Gas steam	KTOE	PWCCGAE	0.0	0.0	71.7	724.1	819.9	892.4	821.0	1,084.3
403		Diesel consumption for Diesel engine	KTOE	PWCCDIE	96.7	31.0	55.9	9.8	11.1	12.1	11.2	14.7
404		Total	KTOE	PWCCTOI	1,240.5	1,189.3	2,680.8	6,342.3	14,139.8	22,036.8	30,666.6	50,603.5
405												
406		Power from Thermal(Coal)	% of KTOE	PWSCCOA	58.1	42.9	26.1	23.1	44.1	44.1	45.3	34.8
407		Power from Thermal(FO)	% of KTOE	PWSCFOI	28.4	27.0	13.0	6.7	3.6	2.5	1.6	1.3
408		Power from Gasturbine(FO)	% of KTOE	PWSCFOB	1.5	6.8	15.1	4.5	2.4	1.7	1.1	0.8
409		Power from Gasturbine(GAS)	% of KTOE	PWSCGAI	0.2	19.8	40.5	55.1	44.2	47.8	49.3	61.1
410		Power from Gas steam	% of KTOE	PWSCGAE	0.0	0.0	3.0	10.5	5.7	3.9	2.6	2.0
411		Power from Diesel	% of KTOE	PWSCDIE	11.8	3.5	2.4	0.1	0.1	0.0	0.0	0.0
412		Power from Fossil	% of KTOE	PWSCTOI	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
413												
414	Evaluation factors	Energy demand per capita	KOE/persons	EDPERCA	255.1	291.3	345.8	441.7	607.9	767.2	955.3	1,190.7
415		Energy demand per uGDP	KOE/US\$	EDPERGD	2.2	1.0	0.9	0.7	0.6	0.4	0.3	0.2
416		Power demand per capita	KWh/person	POPERCA	93.7	155.5	288.5	549.9	1,017.1	1,585.9	2,423.5	3,582.2
417		Power demand per uGDP	KWh/US\$	POPERGD	0.82	0.54	0.74	0.93	0.98	0.88	0.77	0.60
418												
419	LF			PINLOADF		56.5	62.7	64.200	65.800	67.400	69.000	69.000
420	Pmax	Peak demand (Total gen / (365*24)/LF	MW	PINPMAX		2796	4893	9,492	17,865	28,570	44,894	68,765
421												
422												

Table 2-5-13 Simulation sheet (13)

F	H	I	J	TIME	1990	1995	2000	2005	2010	2015	2020	2025																	
					COACDEM	COACPOW	COACDTC	LPDCDEM	LPDCPOW	LPDCTOT	GASDCDEM	GASDCPOW	GASDCTOT	JETDCDEM	JETDCPOW	JETDCTOT	KERDCDEM	KERDCPOW	KERDCTOT	DIECDDEM	DIECDPOW	DIECDTOT	FULDCDEM	FULDCPOW	FULDCTOT	NAGDCDEM	NAGDCPOW	NAGDCTOT	OTHDCDEM
423	Coal total demand	Final demand	KTOE	COACDEM	1,324.0	2,605.0	3,223.0	5,187.1	7,627.0	9,783.0	12,588.6	16,709.6																	
424		Consumption in Power sector	KTOE	COACPOW	888.0	710.0	1,150.0	1,811.5	7,311.4	11,481.1	16,431.6	21,700.9																	
425		Domestic total	KTOE	COACDTC	2,212.0	3,315.0	4,373.0	6,998.6	14,938.3	21,264.1	29,020.1	38,410.5																	
426																													
427	LPG demand	Final demand	KTOE	LPDCDEM	0.0	36.0	268.0	934.0	2,016.2	2,450.0	3,419.0	4,598.8																	
428		Consumption in Power sector	KTOE	LPDCPOW	0.0	5.0	10.0	0.0	0.0	0.0	0.0	0.0																	
429		Domestic total	KTOE	LPDCTOT	0.0	41.0	278.0	934.0	2,016.2	2,450.0	3,419.0	4,598.8																	
430																													
431	Gasoline demand	Final demand	KTOE	GASDCDEM	646.0	951.0	1,467.0	3,351.3	5,754.2	8,336.2	10,726.8	12,544.9																	
432		Consumption in Power sector	KTOE	GASDCPOW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																	
433		Domestic total	KTOE	GASDCTOT	646.0	951.0	1,467.0	3,351.3	5,754.2	8,336.2	10,726.8	12,544.9																	
434																													
435	Jetfuel demand	Final demand	KTOE	JETDCDEM	100.0	206.0	217.0	449.1	779.1	1,004.5	1,153.5	1,202.8																	
436		Consumption in Power sector	KTOE	JETDCPOW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																	
437		Domestic total	KTOE	JETDCTOT	100.0	206.0	217.0	449.1	779.1	1,004.5	1,153.5	1,202.8																	
438																													
439	Kerosene demand	Final demand	KTOE	KERDCDEM	212.0	298.0	375.0	481.8	669.9	865.9	1,149.1	1,333.4																	
440		Consumption in Power sector	KTOE	KERDCPOW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																	
441		Domestic total	KTOE	KERDCTOT	212.0	298.0	375.0	481.8	669.9	865.9	1,149.1	1,333.4																	
442																													
443	Diesel demand	Final demand	KTOE	DIECDDEM	1,087.0	1,978.0	3,066.0	5,329.8	8,686.4	12,090.3	15,392.7	18,199.1																	
444		Consumption in Power sector	KTOE	DIECDPOW	410.8	131.7	237.5	9.8	11.1	12.1	11.2	14.7																	
445		Domestic total	KTOE	DIECDTOT	1,497.8	2,109.7	3,303.5	5,339.7	8,697.5	12,102.5	15,403.8	18,213.8																	
446																													
447	Fuel oil demand	Final demand	KTOE	FULDCDEM	282.0	601.0	1,167.0	2,195.2	3,845.1	6,081.4	8,794.8	12,957.1																	
448		Consumption in Power sector	KTOE	FULDCPOW	254.6	299.5	595.8	770.2	872.0	949.1	873.2	1,153.3																	
449		Domestic total	KTOE	FULDCTOT	536.6	900.5	1,762.8	2,965.4	4,717.2	7,030.5	9,668.1	14,110.4																	
450																													
451	NG & AG demand	Final demand	KTOE	NAGDCDEM	0.0	22.0	18.0	22.3	40.4	1,891.2	4,407.7	7,891.2																	
452		Consumption in Power sector	KTOE	NAGDCPOW	0.0	0.0	71.7	3,750.8	5,945.3	9,594.4	13,350.7	27,734.6																	
453		Domestic total	KTOE	NAGDCTOT	0.0	22.0	89.7	3,773.2	5,985.7	11,485.5	17,758.4	35,625.8																	
454																													
455	Renewable & Other	Final demand	KTOE	OTHDCDEM	12,659.9	13,333.8	15,135.8	14,817.9	16,178.5	15,846.0	15,300.4	14,036.2																	
456		Consumption in Power sector	KTOE	OTHDCPOW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																	
457		Domestic total	KTOE	OTHDCTOT	12,659.9	13,333.8	15,135.8	14,817.9	16,178.5	15,846.0	15,300.4	14,036.2																	
458																													
459	Energy Demand	Domestic final demand	KTOE	EGSCDFD	16,310.9	20,030.8	24,936.8	32,768.6	45,596.7	58,348.6	72,932.5	89,473.2																	
460		Consumption in Power sector	KTOE	EGSCPOW	2,015.1	2,056.2	3,316.3	6,342.3	14,139.8	22,036.8	30,666.6	50,603.5																	
461		Domestic Energy Demand	KTOE	EGSDTOT	18,326.0	22,087.0	28,253.1	39,110.9	59,736.5	80,385.3	103,599.2	140,076.7																	
462																													

Table 2-5-14 Simulation sheet (14)

F	H	I	J	TIME														
				1990	1995	2000	2005	2010	2015	2020	2025							
512	< Central region >																	
513	(1) Census	Population	Miliom	9,632.5	11,011.2	12,280.3	13,132.7	13,850.5	14,622.0	15,436.4	16,024.0							
514		G.R. of Population	G%	2.6	1.4	1.9	1.4	1.1	1.1	1.1	0.8							
515																		
516	(3) GDP nominal	NGDP	Million Dong	3,646.2	21,004.0	42,093.1	76,355.6	154,258.8	314,614.5	650,341.6	#####							
517		Industry	Million Dong	628.5	4,476.8	10,338.1	21,330.6	50,208.6	114,147.0	266,375.8	594,068.9							
518		Commercial	Million Dong	1,467.2	8,627.0	15,578.1	29,741.5	60,090.5	126,439.0	261,051.4	550,359.4							
519		Agriculture	Million Dong	1,550.5	7,900.2	16,176.9	25,283.6	43,959.7	74,028.5	122,914.5	198,123.5							
520																		
521		Share of NGDP	%	8.7	9.2	9.5	9.6	9.7	9.8	10.1	10.6							
522		Share of Industry	%	8.0	6.5	6.6	6.7	7.0	7.4	8.0	8.9							
523		Share of Commercial	%	8.1	8.6	8.5	9.3	9.6	9.9	10.4	10.9							
524		Share of Agriculture	%	11.6	13.2	15.8	16.5	18.1	19.6	21.0	22.4							
525																		
526	(4) RGDP 1994 price	RGDP	Million Dong	11,469.0	17,946.0	26,083.0	37,703.2	56,919.1	86,747.6	133,995.8	206,705.1							
527		Industry	Million Dong	1,977.0	3,825.0	6,406.0	10,532.7	18,526.2	31,473.4	54,883.8	91,465.4							
528		Commercial	Million Dong	4,615.0	7,371.0	9,653.0	14,685.9	22,172.5	34,862.6	53,786.8	84,735.7							
529		Agriculture	Million Dong	4,877.0	6,750.0	10,024.0	12,484.6	16,220.5	20,411.6	25,325.2	30,504.0							
530																		
531		G.R. of RGDP	%		19.9	7.9	8.2	8.7	8.9	9.2	9.3							
532		G.R. of Industry	%		22.0	11.9	11.2	12.0	11.2	11.8	10.8							
533		G.R. of Commercial	%		22.3	7.2	8.0	8.6	9.5	9.1	9.5							
534		G.R. of Agriculture	%		16.3	6.1	5.7	5.4	4.7	4.4	3.8							
535																		
536		GDP E.V. to RGDP			2.1	1.2	1.0	1.0	1.1	1.1	1.2							
537		Industry E.V. to RGDP			2.3	1.8	1.4	1.4	1.3	1.4	1.4							
538		Commercial E.V. to RGDP			2.3	1.1	1.0	1.0	1.1	1.1	1.2							
539		Agriculture E.V. to RGDP			1.7	0.9	0.7	0.6	0.7	0.6	0.5							
540																		
541	(5) Power demand	C-total	GWh	434	1,010	2,272	4,601	8,713	14,123	22,939	36,609							
542		Agriculture, Forestry, Fishery	GWh	11	27	60	101	155	181	206	226							
543		Industry & Construction	GWh	179	284	669	1,709	3,495	6,045	10,450	17,161							
544		Commercials & Services	GWh	30	69	158	179	472	914	1,689	3,020							
545		Office & Residentials	GWh	207	613	1,349	2,379	4,215	6,447	9,827	15,097							
546		Others	GWh	7	18	38	233	375	535	768	1,104							
547																		
548	(6) Power demand Adjusted	C-total	GWh	434	1,010	2,272	4,609	8,899	14,544	23,715	37,879							
549		Agriculture, Forestry, Fishery	GWh	11	27	60	104	163	191	218	239							
550		Industry & Construction	GWh	179	284	669	1,713	3,521	6,113	10,605	17,473							
551		Commercials & Services	GWh	30	69	158	178	467	907	1,684	3,033							
552		Office & Residentials	GWh	207	613	1,349	2,384	4,251	6,524	9,976	15,357							
553		Others	GWh	7	18	38	230	497	809	1,233	1,776							

Table 2-5-15 Simulation sheet (15)

F	H	I	J	TIME														
				1990	1995	2000	2005	2010	2015	2020	2025							
559	< Southern region																	
560	(1) Census	Population	Milliom	24.5	23.2	28.4	30.4	32.0	33.8	35.7	37.1							
561		Population share	S%		-1.45	1.77	1.40	1.07	1.09	1.09	0.75							
562																		
563	(3) GDP nominal	NGDP	Million Dong	22,771	125,434	242,530	428,825	858,103	1,713,297	3,410,472	6,561,808							
564		Industry	Million Dong	6,621	43,468	99,458	194,350	427,207	899,029	1,896,239	3,712,732							
565		Commercial	Million Dong	9,661	53,972	96,708	163,138	317,240	639,077	1,246,533	2,451,186							
566		Agriculture	Million Dong	6,489	27,995	46,365	71,336	113,656	175,191	267,700	397,890							
567																		
568		Share of NGDP	%	54.3	54.8	54.9	54.2	54.0	53.5	52.9	52.0							
569		Share of Industry	%	62.7	63.4	63.6	60.9	59.4	58.0	56.8	55.4							
570		Share of Commercial	%	53.6	53.8	52.9	51.2	50.6	50.0	49.4	48.7							
571		Share of Agriculture	%	48.6	46.6	45.3	46.5	46.7	46.4	45.8	45.0							
572																		
573	(4) RGDP 1994 price	RGDP	Million Dong	71,625	107,172	150,284	211,747	316,627	472,402	702,690	1,010,285							
574		Industry	Million Dong	20,825	37,139	61,629	95,967	157,633	247,886	390,699	571,628							
575		Commercial	Million Dong	30,388	46,114	59,925	80,555	117,057	176,211	256,834	377,395							
576		Agriculture	Million Dong	20,412	23,919	28,730	35,225	41,937	48,305	55,157	61,261							
577																		
578		G.R. of RGDP	%		6.5	6.0	7.7	8.3	8.3	8.2	7.6							
579		G.R. of Industry	%		10.6	8.9	9.8	10.4	9.5	9.5	7.9							
580		G.R. of Commercial	%		6.5	4.3	7.3	7.8	8.5	7.8	8.0							
581		G.R. of Agriculture	%		0.5	3.6	3.9	3.6	2.9	2.7	2.1							
582																		
583		GDP E.V. to RGDP			0.7	0.9	1.0	1.0	1.0	1.0	0.9							
584		Industry E.V. to RGDP			1.1	1.3	1.2	1.2	1.1	1.1	1.0							
585		Commercial E.V. to RGDP			0.7	0.6	0.9	0.9	1.0	1.0	1.0							
586		Agriculture E.V. to RGDP			0.1	0.5	0.5	0.4	0.4	0.4	0.3							
587																		
588	(5) Power demand	S-total	GWh	2,589	5,272	11,101	23,487	45,768	74,862	120,062	181,646							
589		Agriculture, Forestry, Fishery	GWh	39	37	73	185	237	248	256	258							
590		Industry & Construction	GWh	1,228	2,452	5,193	12,076	24,589	41,397	67,934	102,142							
591		Commercials & Services	GWh	68	329	649	1,329	3,032	5,609	10,046	17,422							
592		Office & Residentials	GWh	1,128	2,259	4,797	8,974	16,461	25,571	38,972	57,932							
593		Others	GWh	127	195	390	924	1,449	2,038	2,853	3,891							
594																		
595	(6) Power demand	S-total	GWh	2,589	5,272	11,101	23,519	46,539	76,640	123,372	186,958							
596	Adjusted	Agriculture, Forestry, Fishery	GWh	39	37	73	189	249	262	271	273							
597		Industry & Construction	GWh	1,228	2,452	5,193	12,102	24,769	41,858	68,941	103,997							
598		Commercials & Services	GWh	68	329	649	1,322	3,000	5,566	10,021	17,498							
599		Office & Residentials	GWh	1,128	2,259	4,797	8,996	16,600	25,875	39,560	58,931							
600		Others	GWh	127	195	390	910	1,921	3,079	4,580	6,260							
601																		

2.6 Growth sheet

In growth sheet, the growth rates of the forecasted values and elasticity to real GDP are calculated. Annual growth rates and average growth rates are calculated and elasticity between main variables and real GDP are calculated.

(1) Annual growth rate

The annual growth rates from 2005 to 2025 are calculated for all variables. The expressions are as follows:

$$\text{The annual growth rate} = (X / X(1) - 1) * 100 \quad X(1): \text{previous value of } X$$

(2) Average growth rate

The following types of average growth rates are calculated in the Growth sheet.

Average growth rate from 1995 to 2000	Shown by 2000 / 1995
Average growth rate from 2000 to 2005	Shown by 2005 / 2000
Average growth rate from 2005 to 2010	Shown by 2010 / 2005
Average growth rate from 2010 to 2015	Shown by 2015 / 2010
Average growth rate from 2015 to 2020	Shown by 2020 / 2015
Average growth rate from 2020 to 2025	Shown by 2025 / 2020
Average growth rate from 2005 to 2025	Shown by 2025 / 2005

$$\text{The average annual growth rate} = (X / X(n))^{(1/n)} - 1 * 100 \quad n: \text{Interval years}$$

(3) Elasticity to real GDP

a. Power demand elasticity by sector

Power demand in Agriculture sector to real GDP

Power demand in Industry sector to real GDP

Power demand in Transportation sector to real GDP

Power demand in Commercial sector to real GDP

Power demand in Residential sector to real GDP

Power demand in Other sector to real GDP

b. Power and Energy demand elasticity in Whole country

Power demand in whole country to real GDP

Energy demand in whole country to real GDP

Power generation in whole country to real GDP

Power resources for thermal generators to real GDP

c. Elasticity by energy

Coal demand to real GDP

LPG demand to real GDP

Gasoline demand to real GDP

Jet-fuel demand to real GDP

Kerosene demand to real GDP

Diesel demand to real GDP

Fuel oil demand to real GDP

NG & AG demand to real GDP

Renewable & Other Energy to real GDP

d. Power demand elasticity by region

Power demand in North region to real GDP

Power demand in Center region to real GDP

Power demand in South region to real GDP

2.7 ExImport sheet

(1) Capacity, Operation load and Yields

For calculating import and export of petroleum products, the petroleum product outputs have to be calculated at first. The following table is the input area for the data of refinery plants.

Table 2-7-1 Capacity, Operation load and Yield table in ExImport sheet

			2005	2006	2007	2008	2009	2010	2024	2025
Capacity	Feed	KTON	0	0	0	0	0	6500	20500	20500
	Crude oil	KTON	0	0	0	0	0	6500	20500	20500
	NGL	KTON	0	0	0	0	0	0	0	0
Operation load		KTON	0	0	0	0	100	100	100	100
		KTON								
		KTON								
Crude oil Yields	Crude oil	KTON/KTC	-1.0000	-1.0000	-1.0000	-1.0000	-1.0000	-1.0000	-1.0000	-1.0000
	RF-LPG	KTON/KTC	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096
	Gasoline	KTON/KTC	0.0735	0.0735	0.0735	0.0735	0.0735	0.0735	0.0735	0.0735
	Jet fuel	KTON/KTC	0.0308	0.0308	0.0308	0.0308	0.0308	0.0308	0.0308	0.0308
	Kerosene	KTON/KTC	0.0331	0.0331	0.0331	0.0331	0.0331	0.0331	0.0331	0.0331
	Diesel	KTON/KTC	0.2210	0.2210	0.2210	0.2210	0.2210	0.2210	0.2210	0.2210
	Fuel oil	KTON/KTC	0.4919	0.4919	0.4919	0.4919	0.4919	0.4919	0.4919	0.4919
	Naphtha	KTON/KTC	0.0889	0.0889	0.0889	0.0889	0.0889	0.0889	0.0889	0.0889
	Lubricants & additives	KTON/KTC	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096
	Bitumen	KTON/KTC	0.0299	0.0299	0.0299	0.0299	0.0299	0.0299	0.0299	0.0299
	Petroleum Coke	KTON/KTC	0.0117	0.0117	0.0117	0.0117	0.0117	0.0117	0.0117	0.0117
NGL Yields	NGL	KTON/KTC	-1.0000	-1.0000	-1.0000	-1.0000	-1.0000	-1.0000	-1.0000	-1.0000
	RF-LPG	KTON/KTC	0.1380	0.1380	0.1380	0.1380	0.1380	0.1380	0.1380	0.1380
	Gasoline	KTON/KTC	0.1380	0.1380	0.1380	0.1380	0.1380	0.1380	0.1380	0.1380
	Jet fuel	KTON/KTC	0.0217	0.0217	0.0217	0.0217	0.0217	0.0217	0.0217	0.0217
	Kerosene	KTON/KTC	0.1771	0.1771	0.1771	0.1771	0.1771	0.1771	0.1771	0.1771
	Diesel	KTON/KTC	0.1341	0.1341	0.1341	0.1341	0.1341	0.1341	0.1341	0.1341
	Fuel oil	KTON/KTC	0.0138	0.0138	0.0138	0.0138	0.0138	0.0138	0.0138	0.0138
	Naphtha	KTON/KTC	0.3774	0.3774	0.3774	0.3774	0.3774	0.3774	0.3774	0.3774
	Lubricants & additives	KTON/KTC	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Bitumen	KTON/KTC	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Petroleum Coke	KTON/KTC	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	

a. Capacity

The refinery plant capacities are input in the starting year of the operation. In the table, one refinery plant with the capacity of 6500,000ton is installed in 2010. The second refinery plant with the capacity of 6500,000 ton is installed in 2015, The third refinery plant with the capacity of 7000,000 ton is installed in 2020.

b. Operation load

In the line, operation load of the refinery plant installed are input. In the model, operation load with 100% are input for the three plants.

c. Crude oil yields

Crude oil yields are input in the lines, the yields of the petroleum products are defined by “Output volume per unit consumption of crude oil”. In the table, minus sign means consumption of crude oil and plus sign means output of petroleum products.

d. NGL yields

NGL yields are input in the lines, the yields of the petroleum products are defined by “Output volume per unit consumption of NGL”. In the table, minus sign means consumption of NGL and plus sign means output of petroleum products.

(2) Production of petroleum products

Productions of petroleum products are calculated in the table. One of the productions made of crude oil, another made of NGL. The both productions of the petroleum products are summed up as the total production.

Table 2-7-2 Production of petroleum products table in ExImport sheet

			2005	2006	2007	2008	2009	2010	2024	2025
Production	Crude oil	KTON	0.0	0.0	0.0	0.0	0.0	-6,500.0	-20,500.0	-20,500.0
from Crude oil	RF-LPG	KTON	0.0	0.0	0.0	0.0	0.0	62.5	197.2	197.2
	Gasoline	KTON	0.0	0.0	0.0	0.0	0.0	477.7	1,506.6	1,506.6
	Jet fuel	KTON	0.0	0.0	0.0	0.0	0.0	200.3	631.8	631.8
	Kerosene	KTON	0.0	0.0	0.0	0.0	0.0	215.2	678.6	678.6
	Diesel	KTON	0.0	0.0	0.0	0.0	0.0	1,436.2	4,529.6	4,529.6
	Fuel oil	KTON	0.0	0.0	0.0	0.0	0.0	3,197.2	10,083.5	10,083.5
	Naphtha	KTON	0.0	0.0	0.0	0.0	0.0	578.1	1,823.3	1,823.3
	Lubricants & additives	KTON	0.0	0.0	0.0	0.0	0.0	62.4	196.7	196.7
	Bitumen	KTON	0.0	0.0	0.0	0.0	0.0	194.1	612.0	612.0
	Petroleum Coke	KTON	0.0	0.0	0.0	0.0	0.0	76.2	240.3	240.3
Production	NGL	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
from NGL	RF-LPG	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Gasoline	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Jet fuel	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Kerosene	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Diesel	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Fuel oil	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Naphtha	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lubricants & additives	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Bitumen	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Petroleum Coke	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Production total	RF-LPG	KTON	0.0	0.0	0.0	0.0	0.0	62.5	197.2	197.2
	Gasoline	KTON	0.0	0.0	0.0	0.0	0.0	477.7	1,506.6	1,506.6
	Jet fuel	KTON	0.0	0.0	0.0	0.0	0.0	200.3	631.8	631.8
	Kerosene	KTON	0.0	0.0	0.0	0.0	0.0	215.2	678.6	678.6
	Diesel	KTON	0.0	0.0	0.0	0.0	0.0	1,436.2	4,529.6	4,529.6
	Fuel oil	KTON	0.0	0.0	0.0	0.0	0.0	3,197.2	10,083.5	10,083.5
	Naphtha	KTON	0.0	0.0	0.0	0.0	0.0	578.1	1,823.3	1,823.3
	Lubricants & additives	KTON	0.0	0.0	0.0	0.0	0.0	62.4	196.7	196.7
	Bitumen	KTON	0.0	0.0	0.0	0.0	0.0	194.1	612.0	612.0
	Petroleum Coke	KTON	0.0	0.0	0.0	0.0	0.0	76.2	240.3	240.3
Consumption	Crude oil	KTON	0.0	0.0	0.0	0.0	0.0	6,500.0	20,500.0	20,500.0
	NGL	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		KTON								
Other supply	NG-LPG	KTON	0.0	0.0	0.0	0.0	300.0	300.0	300.0	300.0
		KTON								
		KTON								

Crude oil consumption = Capacity * Operation load * Yields.

RF-LPG production = Capacity * Operation load * Yields

The expressions of Gasoline, Jet fuel, Kerosene, Diesel, Fuel oil, Naphtha, Lubricants & additives, Bitumen and Petroleum Coke are the same way to RF-LPG.

NG-LPG in Other supply is LPG from natural gas fields. The values are the input as exogenous.

(3) Hydro cracking process

It is considered that hydro cracking plant is installed in future. In the model, the procedures are setup as following table.

Table 2-7-3 Hydro cracking process table in ExImport sheet

			2005	2006	2007	2008	2009	2010	2024	2025
Capacity	Fuel oil	KTON	0	0	0	0	0	0	0	0
		KTON								
		KTON								
Operation load		KTON	0	0	0	0	0	0	0	0
		KTON								
		KTON								
Fuel oil Yields	Fuel oil	KTON/KTC	-1.0000	-1.0000	-1.0000	-1.0000	-1.0000	-1.0000	-1.0000	-1.0000
	LPG	KTON/KTC	0.0110	0.0110	0.0110	0.0110	0.0110	0.0110	0.0110	0.0110
	Gasoline	KTON/KTC	0.0890	0.0890	0.0890	0.0890	0.0890	0.0890	0.0890	0.0890
	Jet fuel	KTON/KTC	0.1400	0.1400	0.1400	0.1400	0.1400	0.1400	0.1400	0.1400
	Diesel	KTON/KTC	0.4120	0.4120	0.4120	0.4120	0.4120	0.4120	0.4120	0.4120
	Fuel oil	KTON/KTC	0.2660	0.2660	0.2660	0.2660	0.2660	0.2660	0.2660	0.2660
	Petroleum coke	KTON/KTC	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090
Production from Fuel oil	Fuel oil	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	LPG	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Gasoline	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Jet fuel	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Diesel	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Fuel oil	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Petroleum coke	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Consumption	Fuel oil	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		KTON								
		KTON								

a. Capacity

The Hydro cracking plant capacities are input in the starting year of the operation. In the table, the capacity is set with zero as current assumption.

b. Operation load

In the line, operation load of the hydro cracking plant installed are input. In the model, operation load with 0% are input.

c. Fuel oil yields

Fuel oil yields are input in the lines, the yields of the petroleum products are defined “Output volume per unit consumption of fuel oil”. In the table, minus sign means consumption of fuel oil and plus sign means output of petroleum products.

d. Production

Productions of petroleum products are calculated in the table.

Fuel oil consumption = Capacity * Operation load * Yields.

LPG production = Capacity * Operation load * Yields

The expressions of Gasoline, Jet fuel, Kerosene, Diesel and Petroleum Coke are the same way to LPG.

(4) Supply and Consumption

The petroleum product supply from refinery and hydro cracking plants is shown in the following table. And also consumption of crude oil, NGL and fuel oil as feed stocks to refinery and hydro cracking plants are shown.

Table 2-7-4 Supply and Consumption balance in ExImport sheet

			2005	2006	2007	2008	2009	2010	2024	2025
Supply	Crude oil	KTON								
	NGL	KTON								
	LPG	KTON	0.0	0.0	0.0	0.0	300.0	362.5	497.2	497.2
	Gasoline	KTON	0.0	0.0	0.0	0.0	0.0	477.7	1,506.6	1,506.6
	Jet fuel	KTON	0.0	0.0	0.0	0.0	0.0	200.3	631.8	631.8
	Kerosene	KTON	0.0	0.0	0.0	0.0	0.0	215.2	678.6	678.6
	Diesel	KTON	0.0	0.0	0.0	0.0	0.0	1,436.2	4,529.6	4,529.6
	Fuel oil	KTON	0.0	0.0	0.0	0.0	0.0	3,197.2	10,083.5	10,083.5
	Naphtha	KTON	0.0	0.0	0.0	0.0	0.0	578.1	1,823.3	1,823.3
	Lubricants & additives	KTON	0.0	0.0	0.0	0.0	0.0	62.4	196.7	196.7
Consumption	Bitumen	KTON	0.0	0.0	0.0	0.0	0.0	194.1	612.0	612.0
	Petroleum Coke	KTON	0.0	0.0	0.0	0.0	0.0	76.2	240.3	240.3
	Crude oil	KTON	0.0	0.0	0.0	0.0	0.0	6,500.0	20,500.0	20,500.0
	NGL	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	LPG	KTON								
	Gasoline	KTON								
	Jet fuel	KTON								
	Kerosene	KTON								
	Diesel	KTON								
	Fuel oil	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Naphtha	KTON									
Lubricants & additives	KTON									
Bitumen	KTON									
Petroleum Coke	KTON									

(4) Export and Import balance

Domestic demand, export and import of petroleum products are shown in the following table.

Table 2-7-5 Export and Import balance in ExImport sheet

			2005	2006	2007	2008	2009	2004	2007	2008
Demand	LPG	KTON	858.5	1,029.9	1,210.8	1,414.0	1,627.6	1,853.1	4,171.3	4,226.8
	Gasoline	KTON	3,191.7	3,650.5	4,115.7	4,576.8	5,032.6	5,477.6	11,602.0	11,924.8
	Jet fuel	KTON	435.1	499.4	564.3	628.6	692.2	754.9	1,160.2	1,165.6
	Kerosene	KTON	466.9	496.5	531.5	568.5	607.7	649.1	1,247.6	1,292.0
	Diesel	KTON	5,260.8	5,901.1	6,565.7	7,231.4	7,900.1	8,569.0	17,386.5	17,944.7
	Fuel oil	KTON	2,992.3	3,373.6	3,758.0	4,054.7	4,409.9	4,760.0	13,185.3	14,238.5
	Naphtha	KTON	0.0	0.0	0.0	0.0	0.0	578.1	1,823.3	1,823.3
	Lubricants & additives	KTON	0.0	0.0	0.0	0.0	0.0	62.4	196.7	196.7
	Bitumen	KTON	0.0	0.0	0.0	0.0	0.0	194.1	612.0	612.0
	Petroleum Coke	KTON	0.0	0.0	0.0	0.0	0.0	76.2	240.3	240.3
		KTON								
Export	LPG	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Gasoline	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Jet fuel	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Kerosene	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Diesel	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Fuel oil	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Naphtha	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lubricants & additives	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Bitumen	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Petroleum Coke	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		KTON								
Import	LPG	KTON	858.5	1,029.9	1,210.8	1,414.0	1,327.6	1,490.5	3,674.1	3,729.6
	Gasoline	KTON	3,191.7	3,650.5	4,115.7	4,576.8	5,032.6	4,999.9	10,095.4	10,418.2
	Jet fuel	KTON	435.1	499.4	564.3	628.6	692.2	554.6	528.4	533.7
	Kerosene	KTON	466.9	496.5	531.5	568.5	607.7	433.9	568.9	613.4
	Diesel	KTON	5,260.8	5,901.1	6,565.7	7,231.4	7,900.1	7,132.7	12,856.9	13,415.1
	Fuel oil	KTON	2,992.3	3,373.6	3,758.0	4,054.7	4,409.9	1,562.8	3,101.7	4,155.0
	Naphtha	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lubricants & additives	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Bitumen	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Petroleum Coke	KTON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		KTON								

a. Domestic demand

The values of the domestic demand come from Simulation sheet.

b. Export

When the petroleum product balance is “Supply is greater than Domestic demand” ,

The balance of “ Supply – Domestic demand” is set to “Export”.

c. Import

When the petroleum products balance is “ Supply is less than Domestic demand”,

The balance of “ Domestic demand – Supply” is set to “Import”.

2.8 Summary sheet

(1) Power demand by sector

The power demands by sector are brought from Simulation sheet. The trends of the actual and forecasting values by Agriculture, Manufacturing, Transportation, Commercials & Service, Residential and other sector are displayed in the following table and graph..

Table 2-8-1 The Summary of Power demand by sector for PDP6th

High		1990	1995	2000	2005	2010	2015	2020	2025
Power	(1)Agriculture	190	241	428	658	896	953	1,006	1,033
Demand	(2)Manufacturing	2,876	4,619	9,088	20,909	42,864	73,335	122,354	188,276
	(3)Transportation	58	105	244	337	1,586	3,079	4,955	6,928
	(4)Commercials & Serv	129	548	1,084	2,022	4,677	8,757	15,881	27,960
	(5)Residentials	2,778	5,369	10,986	20,174	36,566	56,947	87,312	131,756
	(6)Others	155	316	567	1,583	2,533	3,625	5,156	7,184
	Total	6,185	11,198	22,398	45,682	89,123	146,695	236,664	363,137

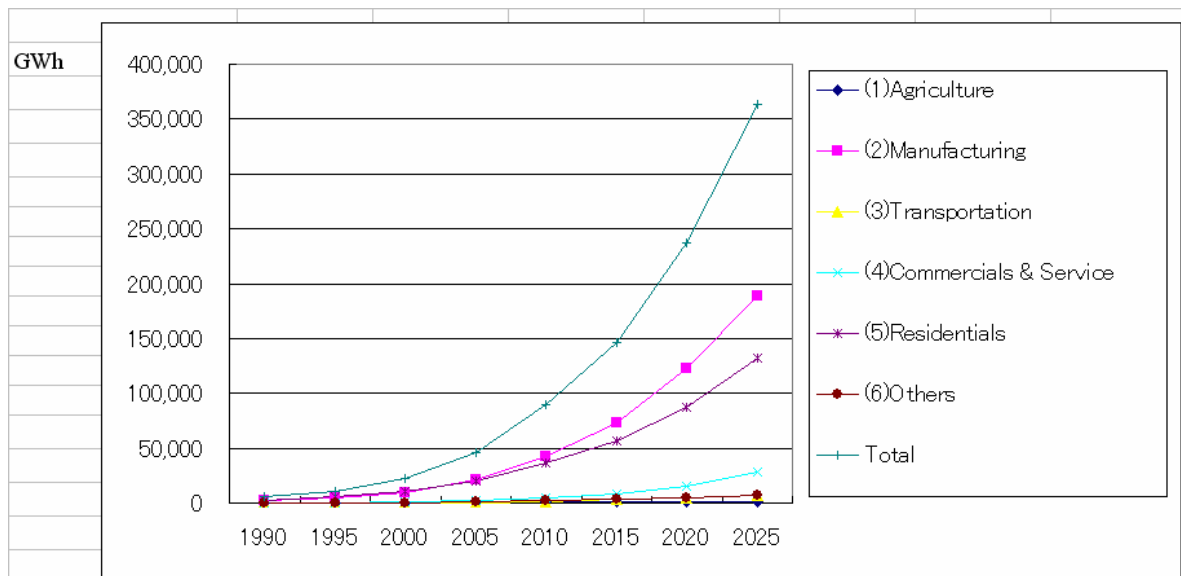


Figure 2-8-1 Power demand by sector for PDP6th

(2) Comparison of the power demand forecasting

Several kinds of power demand forecasting are compared in the following table. The forecasting made by JICA, Institute of Energy, PDP5th and PDP5th revised. The forecasting years of JICA and IE are from 2005 to 2025. PDP5th and PDP5th revised are from 2002 to 2020.

Table 2-8-2 Comparison of the power demand forecasting of PDP6th

BASE		1990	1995	2000	2005	2010	2015	2020	2025
Power Demand	PDP6	6,185	11,198	22,398	45,682	91,949	146,899	216,433	308,511
	PDP5	6,185	11,198	22,398	37,116	61,572	95,747	146,555	
	Revised PDP 5th	6,185	11,198	22,398	44,944	80,486	124,203	178,568	

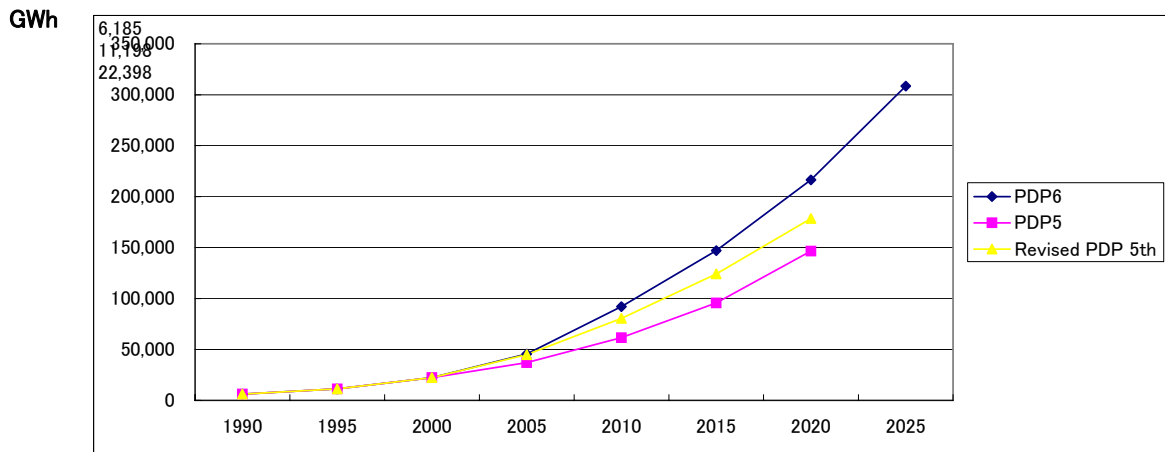


Figure 2-8-2 Comparison of the power demand forecasting

Chapter 3. Functions and operation of daily load curve forecasting model

3.1 The function of the sheets

Daily load curve forecasting model consists of 8 sheets including SimpleE sheets. The functions and its roles are as the following table.

Table 3-1-1 The functions of the Model

Sheet	Functions and roles
Data sheet	Input actual values on Economy, Daily load data Input Social and Economic data in future Describe variable names and comments.
Model sheet	Build regression equations for daily load by region by hour Evaluate regression equations Build regression equations for load factor by region
Simulation sheet	Show the data used in the model by region by hour Show the future daily load by region by hour Show the load factors by region
Data Analysis	Calculate daily load by region by type by hour Calculate yearly daily load Calculate load factor
Whole	Draw daily load curve by type by year in whole country
North	Draw daily load curve by type by year in North
South	Draw daily load curve by type by year in South
Load Factor	Compare the daily load curve and peak demand among organizations

3.2 Data sheet

“Data sheet” is created by SimpleE. The actual values in all kinds of variables and future values in exogenous variables are set in the sheet. There are two kinds of actual data in Data sheet, one is an input data, another is calculation data.

In the model, the actual data for forecasting daily load curve are input in the following table:

Table 3-2-1 Actual data for forecasting daily load curve

Thailand (1-9)	Malaysia (10-14)	Philippines (15-17)	Indonesia (18-25)	Japan (26-43)	Vietnam (44-151)
1988/04	1993/07	1999/03	1990/04	1967/12	1996/01
1989/04	1994/09	2000/04	1991/04	1968/07	1996/02
1990/04	1995/05	2001/04	1992/07	1969/08	1996/03
1991/04	1996/03		1993/07	1970/09	-
1992/07	1997/03		1994/09	1971/08	-
1993/07			1995/05	1972/08	-
1994/09			1996/03	1973/08	-
1995/05			1997/03	1974/08	-
1996/03				1975/07	-
				1976/08	-
				1978/07	-
				1979/08	-
				1980/07	-
				1981/07	-
				1982/08	-
				1983/08	2004/10
				1984/08	2004/11
				1985/08	2004/12

The data by region, North, Center and South are input. And the social and economic data are classified into the three regions.

The variables are arranged in line with the processing orders. Then calculation of the model is basically performed from the upper variables to below variables. But it is possible that the upper variables are calculated by using the results of the below variables. And if the model contains the simultaneous equations, the SimpleE can solve the equations.

The model has the following blocks as model structures.

Table 3-2-2 Structures of daily load curve forecasting model

CONTENTS	Line number
<North region >	
Dummy in North	5 ~ 10
Economic & Climate Indicators in North	11 ~ 25
Weekday Data in North	26 ~ 51
Holiday Data in North	52 ~ 77
Peak Data in North	78 ~ 103
<Center region >	
Dummy in North	106 ~ 110
Economic & Climate Indicators in North	111 ~ 123
Weekday Data in North	126 ~ 151
Holiday Data in North	152 ~ 177
Peak Data in North	178 ~ 204
<South region >	
Dummy in North	206 ~ 211
Economic & Climate Indicators in North	212 ~ 224
Weekday Data in North	227 ~ 252
Holiday Data in North	253 ~ 278
Peak Data in North	279 ~ 305
<Load factor >	
Load factor	307 ~ 310
Monthly Consumption	312 ~ 316
Peak demand	317 ~ 321

(1) Dummy, Social and Economic variables in North

a. Dummy variable

The Thailand dummy variable has “1” at the time of Thailand’s data. In the data number from 1 to 9, the Dummy variable is “1” and other terms are “0”.

Table 3-2-3 Variables for Dummy and Economic data

	North				VNI99601	VNI99602	VNI99603	VNI99604	VNI99605
5	Dummy	Thailand Dummy			NTHADUM	0	0	0	0
6		Malaysia Dummy			NMAYDUM	0	0	0	0
7		Philippines Dummy			NPHIDUM	0	0	0	0
8		Indonesia Dummy			NINDDUM	0	0	0	0
9		Japan Dummy			NJAPDUM	0	0	0	0
10									
11	Economic & Climate Indicators								
12		Real GDP (1995 constant)							
13		(1) G.R. Agriculture	%		NRAGR	2.5	2.5	2.5	2.5
14		(2) G.R. Industry	%		NRIND	12.8	12.8	12.8	12.8
15		(3) G.R. Service	%		NRSER	7.8	7.8	7.8	7.8
16		(1) Agriculture	Bill US\$		NGAGR	2.3	2.3	2.3	2.3
17		(2) Industry	Bill US\$		NGIND	2.1	2.1	2.1	2.2
18		(3) Service	Bill US\$		NGSER	3.7	3.7	3.8	3.8
19		(4) GDP Total	Bill US\$		NGDP	8.1	8.2	8.2	8.3
20		Population	Mill		NPOP	33.3	33.3	33.3	33.4
21		Humidity	%		NHUM	81.0	73.0	84.0	80.0
22		Electrified Population	Mill		NELPOP	25.1	25.2	25.3	25.4
23		Temperature	Deg		NDEG	17.9	18.0	21.1	24.8
24	Elastic value to GDP sector								
25		GDP Total	Bill US\$		NEGDP	2.0	2.0	2.0	2.0

The Malaysia dummy variable has “1” at the time of Malaysia’s data. In the data number from 10 to 15, the Dummy variable is “1” and other terms are “0”.

The Philippines’ dummy variable has “1” at the time of Philippines’ data. In the data number from 16 to 19, the Dummy variable is “1” and other terms are “0”.

The Indonesia’s dummy variable has “1” at the time of Indonesia’s data. In the data number from 20 to 28, the Dummy variable is “1” and other terms are “0”.

The Japan’s dummy variable has “1” at the time of Japan’s data. In the data number from 29 to 57, the Dummy variable is “1” and other terms are “0”.

b. Economic and Climate Indicators in North

Real GDP and sector GDP are used as exogenous variables, the future values are given by the growth rate. The sector GDP of Agriculture, Industry and Services are calculated by the growth rate.

The data of Population, Electrified population, Humidity and temperature in North are given

and used for forecasting daily load curve.

(2) Weekday data in North

The weekday data are hourly average vales in week day, The weekday data do not include the values of Sundays, National holidays and three Peak days in a month. The average hourly data from 1st to 24th clock are prepared not only from Vietnam, but also from Thailand, Malaysia, Philippines, Indonesia and Japan.

Table 3-2-4 Weekday data in North

North					VN199601	VN199602	VN199603	VN199604	VN199605	
26	Weekday Data									
27	<1st Hour>	Electricity Consumption	Hourly	MW	NWELEC1	518.0	515.0	492.0	483.0	577.0
28	<2nd Hour>	Electricity Consumption	Hourly	MW	NWELEC2	506.0	513.0	482.0	475.0	562.0
29	<3rd Hour>	Electricity Consumption	Hourly	MW	NWELEC3	502.0	511.0	485.0	476.0	555.0
30	<4th Hour>	Electricity Consumption	Hourly	MW	NWELEC4	503.0	518.0	499.0	487.0	558.0
31	<5th Hour>	Electricity Consumption	Hourly	MW	NWELEC5	583.0	569.0	541.0	554.0	636.0
32	<6th Hour>	Electricity Consumption	Hourly	MW	NWELEC6	709.0	742.0	731.0	695.0	695.0
33	<7th Hour>	Electricity Consumption	Hourly	MW	NWELEC7	799.0	790.0	755.0	707.0	728.0
34	<8th Hour>	Electricity Consumption	Hourly	MW	NWELEC8	771.0	777.0	776.0	736.0	768.0
35	<9th Hour>	Electricity Consumption	Hourly	MW	NWELEC9	801.0	815.0	806.0	769.0	832.0
36	<10th Hour>	Electricity Consumption	Hourly	MW	NWELEC1	817.0	808.0	810.0	797.0	897.0
37	<11th Hour>	Electricity Consumption	Hourly	MW	NWELEC1	841.0	820.0	848.0	823.0	959.0
38	<12th Hour>	Electricity Consumption	Hourly	MW	NWELEC1	718.0	737.0	735.0	736.0	856.0
39	<13th Hour>	Electricity Consumption	Hourly	MW	NWELEC1	682.0	669.0	682.0	656.0	827.0
40	<14th Hour>	Electricity Consumption	Hourly	MW	NWELEC1	715.0	712.0	716.0	718.0	851.0
41	<15th Hour>	Electricity Consumption	Hourly	MW	NWELEC1	739.0	721.0	727.0	721.0	841.0
42	<16th Hour>	Electricity Consumption	Hourly	MW	NWELEC1	766.0	760.0	767.0	744.0	837.0
43	<17th Hour>	Electricity Consumption	Hourly	MW	NWELEC1	969.0	912.0	952.0	906.0	917.0
44	<18th Hour>	Electricity Consumption	Hourly	MW	NWELEC1	1,272.0	1,155.0	1,116.0	1,069.0	1,025.0
45	<19th Hour>	Electricity Consumption	Hourly	MW	NWELEC1	1,291.0	1,338.0	1,309.0	1,271.0	1,289.0
46	<20th Hour>	Electricity Consumption	Hourly	MW	NWELEC2	1,180.0	1,223.0	1,193.0	1,156.0	1,263.0
47	<21st Hour>	Electricity Consumption	Hourly	MW	NWELEC2	1,026.0	1,099.0	1,037.0	1,012.0	1,137.0
48	<22rd Hour>	Electricity Consumption	Hourly	MW	NWELEC2	878.0	902.0	875.0	855.0	984.0
49	<23rd Hour>	Electricity Consumption	Hourly	MW	NWELEC2	642.0	688.0	630.0	589.0	725.0
50	<24th Hour>	Electricity Consumption	Hourly	MW	NWELEC2	559.0	598.0	538.0	532.0	644.0
51										

$$1^{st} \text{ hour load} = f(\text{Industry GDP} + \text{Service GDP}) / \text{GDP}, \text{ GDP per capita}, \\ \text{Electrified pop} * (\text{Humidity} + \text{Temperature})$$

$$2nd \text{ hour load} = f(\text{Industry GDP} + \text{Service GDP}) / \text{GDP}, \text{ GDP per capita}, \\ \text{Electrified pop} * (\text{Humidity} + \text{Temperature})$$

$$23rd \text{ hour load} = f(\text{Industry GDP} + \text{Service GDP}) / \text{GDP}, \text{ GDP per capita}, \\ \text{Electrified pop} * (\text{Humidity} + \text{Temperature})$$

$$24th \text{ hour load} = f(\text{Industry GDP} + \text{Service GDP}) / \text{GDP}, \text{ GDP per capita}, \\ \text{Electrified pop} * (\text{Humidity} + \text{Temperature})$$

(3) Holiday data in North

The Holiday data are hourly average values in Holidays. The Holiday data include the data of Sundays and National holidays. The average hourly data from 1st to 24th clock are prepared not only from Vietnam, but also from Thailand, Malaysia, Philippines, Indonesia and Japan.

Table 3-2-5 Holiday data in North

	North					VN199601	VN199602	VN199603	VN199604	VN199605
52	Holiday Data									
53	<1st Hour>	Electricity Consumption	Hourly	MW	NHELEC1	509.0	551.0	504.0	499.0	550.0
54	<2nd Hour>	Electricity Consumption	Hourly	MW	NHELEC2	477.0	515.0	498.0	492.0	534.0
55	<3rd Hour>	Electricity Consumption	Hourly	MW	NHELEC3	483.0	497.0	509.0	492.0	541.0
56	<4th Hour>	Electricity Consumption	Hourly	MW	NHELEC4	515.0	505.0	511.0	499.0	545.0
57	<5th Hour>	Electricity Consumption	Hourly	MW	NHELEC5	581.0	522.0	552.0	573.0	619.0
58	<6th Hour>	Electricity Consumption	Hourly	MW	NHELEC6	630.0	629.0	660.0	635.0	649.0
59	<7th Hour>	Electricity Consumption	Hourly	MW	NHELEC7	711.0	696.0	689.0	670.0	669.0
60	<8th Hour>	Electricity Consumption	Hourly	MW	NHELEC8	762.0	795.0	673.0	678.0	714.0
61	<9th Hour>	Electricity Consumption	Hourly	MW	NHELEC9	796.0	839.0	780.0	763.0	804.0
62	<10th Hour>	Electricity Consumption	Hourly	MW	NHELEC1	790.0	820.0	792.0	772.0	854.0
63	<11th Hour>	Electricity Consumption	Hourly	MW	NHELEC1	773.0	775.0	779.0	820.0	872.0
64	<12th Hour>	Electricity Consumption	Hourly	MW	NHELEC1	691.0	711.0	683.0	688.0	829.0
65	<13th Hour>	Electricity Consumption	Hourly	MW	NHELEC1	633.0	621.0	642.0	641.0	744.0
66	<14th Hour>	Electricity Consumption	Hourly	MW	NHELEC1	647.0	627.0	666.0	681.0	766.0
67	<15th Hour>	Electricity Consumption	Hourly	MW	NHELEC1	700.0	718.0	728.0	708.0	783.0
68	<16th Hour>	Electricity Consumption	Hourly	MW	NHELEC1	751.0	739.0	777.0	708.0	788.0
69	<17th Hour>	Electricity Consumption	Hourly	MW	NHELEC1	830.0	875.0	851.0	872.0	884.0
70	<18th Hour>	Electricity Consumption	Hourly	MW	NHELEC1	1,246.0	1,132.0	1,041.0	982.0	962.0
71	<19th Hour>	Electricity Consumption	Hourly	MW	NHELEC1	1,239.0	1,263.0	1,322.0	1,261.0	1,285.0
72	<20th Hour>	Electricity Consumption	Hourly	MW	NHELEC2	1,126.0	1,158.0	1,172.0	1,144.0	1,260.0
73	<21st Hour>	Electricity Consumption	Hourly	MW	NHELEC2	973.0	1,047.0	1,028.0	975.0	1,130.0
74	<22nd Hour>	Electricity Consumption	Hourly	MW	NHELEC2	847.0	901.0	869.0	818.0	983.0
75	<23rd Hour>	Electricity Consumption	Hourly	MW	NHELEC2	575.0	730.0	610.0	594.0	718.0
76	<24th Hour>	Electricity Consumption	Hourly	MW	NHELEC2	512.0	634.0	530.0	547.0	649.0
77	Total Electricity Consumption									

$$1^{\text{st}} \text{ hour load} = f(\text{Industry GDP} + \text{Service GDP}) / \text{GDP}, \text{ GDP per capita}, \\ \text{Electrified pop} * (\text{Humidity} + \text{Temperature})$$

$$2^{\text{nd}} \text{ hour load} = f(\text{Industry GDP} + \text{Service GDP}) / \text{GDP}, \text{ GDP per capita}, \\ \text{Electrified pop} * (\text{Humidity} + \text{Temperature})$$

$$23^{\text{rd}} \text{ hour load} = f(\text{Industry GDP} + \text{Service GDP}) / \text{GDP}, \text{ GDP per capita}, \\ \text{Electrified pop} * (\text{Humidity} + \text{Temperature})$$

$$24^{\text{th}} \text{ hour load} = f(\text{Industry GDP} + \text{Service GDP}) / \text{GDP}, \text{ GDP per capita}, \\ \text{Electrified pop} * (\text{Humidity} + \text{Temperature})$$

(4) Peak day data in North

The Peak day data are average of three peak demand days in a month. The average hourly data from 1st to 24th clock are prepared from Thailand, Malaysia, Philippines, Indonesia, Japan and Vietnam

Table 3-2-6 Peak day data in North

	North					VNI99601	VNI99602	VNI99603	VNI99604
78	Peak day								
79	<1st Hour>	Peak electricity Consumption	Hourly	MW	NPELEC1	530.0	517.0	540.0	535.0
80	<2nd Hour>	Peak electricity Consumption	Hourly	MW	NPELEC2	507.0	517.0	475.0	487.0
81	<3rd Hour>	Peak electricity Consumption	Hourly	MW	NPELEC3	501.0	515.0	487.0	507.0
82	<4th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC4	490.0	535.0	499.0	495.0
83	<5th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC5	545.0	667.0	582.0	536.0
84	<6th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC6	669.0	756.0	744.0	725.0
85	<7th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC7	838.0	822.0	716.0	729.0
86	<8th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC8	779.0	813.0	758.0	740.0
87	<9th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC9	881.0	841.0	782.0	770.0
88	<10th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC10	847.0	852.0	719.0	786.0
89	<11th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC11	894.0	870.0	824.0	784.0
90	<12th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC12	804.0	753.0	717.0	781.0
91	<13th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC13	740.0	695.0	648.0	687.0
92	<14th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC14	742.0	727.0	694.0	702.0
93	<15th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC15	796.0	778.0	741.0	700.0
94	<16th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC16	818.0	772.0	732.0	743.0
95	<17th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC17	943.0	915.0	848.0	929.0
96	<18th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC18	1,294.0	1,150.0	1,022.0	1,058.0
97	<19th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC19	1,346.0	1,406.0	1,387.0	1,377.0
98	<20th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC20	1,270.0	1,255.0	1,245.0	1,243.0
99	<21st Hour>	Peak electricity Consumption	Hourly	MW	NPELEC21	1,125.0	1,095.0	1,131.0	1,121.0
100	<22nd Hour>	Peak electricity Consumption	Hourly	MW	NPELEC22	866.0	923.0	923.0	915.0
101	<23rd Hour>	Peak electricity Consumption	Hourly	MW	NPELEC23	630.0	678.0	735.0	642.0
102	<24th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC24	597.0	582.0	574.0	600.0
103									

1st hour load in Peak day = f (1st hour load in weekday)

2nd hour load in Peak day = f (2nd hour load in weekday)

23rd hour load in Peak day = f (23rd hour load in weekday)

24th hour load in Peak day = f (24th hour load in weekday)

(5) Dummy, Social and Economic variable in Center

The actual data for Center are set with Thailand (19-27), Malaysia (28-32), Philippines (33-35), Indonesia (36-43), Vietnam (44-151). Japan data are not included in the independent variables.

a. Dummy variable

The Thailand dummy variable has “1” at the time of Thailand’s data. In the data number from 19 to 27, the Dummy variable is “1” and other terms are “0”.

Table 3-2-7 Dummy variable, economic data and Climate data in Center region

Central					VNI99601	VNI99602	VNI99603	VNI99604	VNI99605
Dummy	Thailand Dummy			CTHADUM	0	0	0	0	0
	Malaysia Dummy			CMAYDUM	0	0	0	0	0
	Philippines Dummy			CPHIDUM	0	0	0	0	0
	Indonesia Dummy			CINDDUM	0	0	0	0	0
Economic & Climate Indicators									
	Real GDP (1995 constant)								
	(1) G.R. Agriculture	%		CRAGR	8.1	8.1	8.1	8.1	8.1
	(2) G.R. Industry	%		CRIND	13.5	13.5	13.5	13.5	13.5
	(3) G.R. Service	%		CRSER	7.6	7.6	7.6	7.6	7.6
	(1) Agriculture	Bill US\$		CGAGR	0.8	0.8	0.8	0.8	0.8
	(2) Industry	Bill US\$		CGIND	0.5	0.5	0.5	0.5	0.5
	(3) Service	Bill US\$		CGSER	0.9	0.9	0.9	0.9	0.9
	(4) GDP Total	Bill US\$		CGDP	2.1	2.1	2.1	2.1	2.2
	Population	Mill		CPOP	11.3	11.3	11.4	11.4	11.4
	Humidity	%		CHUM	81.0	73.0	84.0	84.0	80.0
	Electrified Population	Mill		CELPOP	6.7	6.7	6.7	6.7	6.7
	Temperature	Deg		CDEG	21.2	21.4	23.5	25.4	26.4
Elastic value to GDP sector									
	GDP Total	Bill US\$		CEGDP	2.0	2.0	2.0	2.0	2.0

The Malaysia dummy variable has “1” at the time of Malaysia’s data. In the data number from 28 to 32, the Dummy variable is “1” and other terms are “0”.

The Philippines’ dummy variable has “1” at the time of Philippines’ data. In the data number from 33 to 35, the Dummy variable is “1” and other terms are “0”.

The Indonesia’s dummy variable has “1” at the time of Indonesia’s data, In the data number from 36 to 57, the Dummy variable is “1” and other terms are “0”.

b. Economic and Climate Indicators in North

Real GDP and sector GDP are used as exogenous variables, the future values are given by the growth rate. The sector GDP of Agriculture, Industry and Services are calculated by the growth rate.

The data of Population, Electrified population, Humidity and temperature in North are given and used for forecasting daily load curve.

(6) Weekday data in Center

The weekday data are average hourly values in weekday. The weekday data do not include the data of Sundays, National holidays and three Peak days in a month. The average hourly data from 1st to 24th clock are prepared from Thailand, Malaysia, Philippines, Indonesia and Vietnam.

Table 3-2-8 Weekday data in Center

105	Central						VN199601	VN199602	VN199603	VN199604	VN199605
126	Weekday Data										
127	<1st Hour>	Electricity Consumption	Hourly	MW	CWELEC1	89.0	92.0	109.0	111.0	128.0	
128	<2nd Hour>	Electricity Consumption	Hourly	MW	CWELEC2	87.0	90.0	106.0	109.0	125.0	
129	<3rd Hour>	Electricity Consumption	Hourly	MW	CWELEC3	89.0	89.0	106.0	108.0	124.0	
130	<4th Hour>	Electricity Consumption	Hourly	MW	CWELEC4	91.0	93.0	109.0	112.0	126.0	
131	<5th Hour>	Electricity Consumption	Hourly	MW	CWELEC5	107.0	107.0	122.0	132.0	141.0	
132	<6th Hour>	Electricity Consumption	Hourly	MW	CWELEC6	144.0	144.0	143.0	142.0	140.0	
133	<7th Hour>	Electricity Consumption	Hourly	MW	CWELEC7	138.0	141.0	140.0	143.0	146.0	
134	<8th Hour>	Electricity Consumption	Hourly	MW	CWELEC8	137.0	141.0	150.0	153.0	162.0	
135	<9th Hour>	Electricity Consumption	Hourly	MW	CWELEC9	138.0	139.0	152.0	153.0	169.0	
136	<10th Hour>	Electricity Consumption	Hourly	MW	CWELEC1	146.0	145.0	159.0	169.0	182.0	
137	<11th Hour>	Electricity Consumption	Hourly	MW	CWELEC1	144.0	145.0	161.0	171.0	183.0	
138	<12th Hour>	Electricity Consumption	Hourly	MW	CWELEC1	123.0	124.0	135.0	147.0	166.0	
139	<13th Hour>	Electricity Consumption	Hourly	MW	CWELEC1	117.0	119.0	136.0	143.0	162.0	
140	<14th Hour>	Electricity Consumption	Hourly	MW	CWELEC1	127.0	126.0	144.0	156.0	169.0	
141	<15th Hour>	Electricity Consumption	Hourly	MW	CWELEC1	133.0	133.0	150.0	161.0	172.0	
142	<16th Hour>	Electricity Consumption	Hourly	MW	CWELEC1	142.0	140.0	158.0	166.0	176.0	
143	<17th Hour>	Electricity Consumption	Hourly	MW	CWELEC1	166.0	169.0	183.0	179.0	190.0	
144	<18th Hour>	Electricity Consumption	Hourly	MW	CWELEC1	246.0	225.0	232.0	224.0	221.0	
145	<19th Hour>	Electricity Consumption	Hourly	MW	CWELEC1	259.0	262.0	277.0	285.0	293.0	
146	<20th Hour>	Electricity Consumption	Hourly	MW	CWELEC2	241.0	248.0	272.0	270.0	282.0	
147	<21st Hour>	Electricity Consumption	Hourly	MW	CWELEC2	210.0	222.0	245.0	242.0	260.0	
148	<22rd Hour>	Electricity Consumption	Hourly	MW	CWELEC2	178.0	182.0	213.0	204.0	220.0	
149	<23rd Hour>	Electricity Consumption	Hourly	MW	CWELEC2	115.0	121.0	147.0	140.0	164.0	
150	<24th Hour>	Electricity Consumption	Hourly	MW	CWELEC2	98.0	97.0	115.0	124.0	142.0	
151											

$$1^{st} \text{ hour load} = f(\text{Industry GDP} + \text{Service GDP}) / \text{GDP}, \text{ GDP per capita}, \\ \text{Electrified pop} * (\text{Humidity} + \text{Temperature})$$

$$2^{nd} \text{ hour load} = f(\text{Industry GDP} + \text{Service GDP}) / \text{GDP}, \text{ GDP per capita}, \\ \text{Electrified pop} * (\text{Humidity} + \text{Temperature})$$

$$23^{rd} \text{ hour load} = f(\text{Industry GDP} + \text{Service GDP}) / \text{GDP}, \text{ GDP per capita}, \\ \text{Electrified pop} * (\text{Humidity} + \text{Temperature})$$

$$24^{th} \text{ hour load} = f(\text{Industry GDP} + \text{Service GDP}) / \text{GDP}, \text{ GDP per capita}, \\ \text{Electrified pop} * (\text{Humidity} + \text{Temperature})$$

(7) Holiday data in Center

The Holiday data are average hourly values in Holidays. The Holiday data include the data of Sundays and national holidays. The average hourly data from 1st to 24th clock are prepared from Thailand, Malaysia, Philippines, Indonesia and Vietnam.

Table 3-2-9 Holiday data in Center

105	Central					VN199601	VN199602	VN199603	VN199604	VN199605
152	Holiday Data									
153	<1st Hour>	Electricity Consumption	Hourly	MW	CHELEC1	82.0	119.0	109.0	108.0	125.0
154	<2nd Hour>	Electricity Consumption	Hourly	MW	CHELEC2	84.0	95.0	108.0	110.0	119.0
155	<3rd Hour>	Electricity Consumption	Hourly	MW	CHELEC3	86.0	94.0	107.0	105.0	115.0
156	<4th Hour>	Electricity Consumption	Hourly	MW	CHELEC4	87.0	98.0	110.0	112.0	118.0
157	<5th Hour>	Electricity Consumption	Hourly	MW	CHELEC5	98.0	106.0	122.0	124.0	126.0
158	<6th Hour>	Electricity Consumption	Hourly	MW	CHELEC6	130.0	131.0	129.0	128.0	132.0
159	<7th Hour>	Electricity Consumption	Hourly	MW	CHELEC7	133.0	142.0	137.0	138.0	139.0
160	<8th Hour>	Electricity Consumption	Hourly	MW	CHELEC8	137.0	146.0	146.0	147.0	152.0
161	<9th Hour>	Electricity Consumption	Hourly	MW	CHELEC9	138.0	142.0	154.0	156.0	152.0
162	<10th Hour>	Electricity Consumption	Hourly	MW	CHELEC1	143.0	135.0	164.0	165.0	169.0
163	<11th Hour>	Electricity Consumption	Hourly	MW	CHELEC1	139.0	128.0	160.0	166.0	171.0
164	<12th Hour>	Electricity Consumption	Hourly	MW	CHELEC1	123.0	117.0	137.0	142.0	154.0
165	<13th Hour>	Electricity Consumption	Hourly	MW	CHELEC1	109.0	118.0	135.0	144.0	151.0
166	<14th Hour>	Electricity Consumption	Hourly	MW	CHELEC1	121.0	123.0	145.0	150.0	155.0
167	<15th Hour>	Electricity Consumption	Hourly	MW	CHELEC1	133.0	133.0	154.0	153.0	160.0
168	<16th Hour>	Electricity Consumption	Hourly	MW	CHELEC1	144.0	142.0	165.0	162.0	168.0
169	<17th Hour>	Electricity Consumption	Hourly	MW	CHELEC1	154.0	162.0	177.0	178.0	177.0
170	<18th Hour>	Electricity Consumption	Hourly	MW	CHELEC1	244.0	210.0	224.0	218.0	197.0
171	<19th Hour>	Electricity Consumption	Hourly	MW	CHELEC1	252.0	268.0	286.0	276.0	282.0
172	<20th Hour>	Electricity Consumption	Hourly	MW	CHELEC2	236.0	255.0	269.0	268.0	267.0
173	<21st Hour>	Electricity Consumption	Hourly	MW	CHELEC2	201.0	228.0	240.0	241.0	243.0
174	<22nd Hour>	Electricity Consumption	Hourly	MW	CHELEC2	172.0	194.0	207.0	185.0	206.0
175	<23rd Hour>	Electricity Consumption	Hourly	MW	CHELEC2	107.0	145.0	133.0	140.0	148.0
176	<24th Hour>	Electricity Consumption	Hourly	MW	CHELEC2	91.0	124.0	116.0	121.0	130.0
177	Total Electricity Consumption									

$$1^{st} \text{ hour load} = f(\text{Industry GDP} + \text{Service GDP}) / \text{GDP}, \text{ GDP per capita}, \\ \text{Electrified pop} * (\text{Humidity} + \text{Temperature})$$

$$2^{nd} \text{ hour load} = f(\text{Industry GDP} + \text{Service GDP}) / \text{GDP}, \text{ GDP per capita}, \\ \text{Electrified pop} * (\text{Humidity} + \text{Temperature})$$

$$23^{rd} \text{ hour load} = f(\text{Industry GDP} + \text{Service GDP}) / \text{GDP}, \text{ GDP per capita}, \\ \text{Electrified pop} * (\text{Humidity} + \text{Temperature})$$

$$24^{th} \text{ hour load} = f(\text{Industry GDP} + \text{Service GDP}) / \text{GDP}, \text{ GDP per capita}, \\ \text{Electrified pop} * (\text{Humidity} + \text{Temperature})$$

(8) Peak day data in Center

The Peak day data are average hourly values of three peak demand days in a month. The average hourly data from 1st to 24th clock are prepared from Thailand, Malaysia, Philippines, Indonesia and Vietnam

Table3-2-10 Peak day data in Center

North						VN199601	VN199602	VN199603	VN199604
78	Peak day								
79	<1st Hour>	Peak electricity Consumption	Hourly	MW	NPELEC1	530.0	517.0	540.0	535.0
80	<2nd Hour>	Peak electricity Consumption	Hourly	MW	NPELEC2	507.0	517.0	475.0	487.0
81	<3rd Hour>	Peak electricity Consumption	Hourly	MW	NPELEC3	501.0	515.0	487.0	507.0
82	<4th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC4	490.0	535.0	499.0	495.0
83	<5th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC5	545.0	667.0	582.0	536.0
84	<6th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC6	669.0	756.0	744.0	725.0
85	<7th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC7	838.0	822.0	716.0	729.0
86	<8th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC8	779.0	813.0	758.0	740.0
87	<9th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC9	881.0	841.0	782.0	770.0
88	<10th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC1	847.0	852.0	719.0	786.0
89	<11th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC1	894.0	870.0	824.0	784.0
90	<12th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC1	804.0	753.0	717.0	781.0
91	<13th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC1	740.0	695.0	648.0	687.0
92	<14th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC1	742.0	727.0	694.0	702.0
93	<15th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC1	796.0	778.0	741.0	700.0
94	<16th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC1	818.0	772.0	732.0	743.0
95	<17th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC1	943.0	915.0	848.0	929.0
96	<18th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC1	1,294.0	1,150.0	1,022.0	1,058.0
97	<19th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC1	1,346.0	1,406.0	1,387.0	1,377.0
98	<20th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC2	1,270.0	1,255.0	1,245.0	1,243.0
99	<21st Hour>	Peak electricity Consumption	Hourly	MW	NPELEC2	1,125.0	1,095.0	1,131.0	1,121.0
100	<22rd Hour>	Peak electricity Consumption	Hourly	MW	NPELEC2	866.0	923.0	923.0	915.0
101	<23rd Hour>	Peak electricity Consumption	Hourly	MW	NPELEC2	630.0	678.0	735.0	642.0
102	<24th Hour>	Peak electricity Consumption	Hourly	MW	NPELEC2	597.0	582.0	574.0	600.0
103									

1st hour load in Peak day = f(1st hour load in weekday)

2nd hour load in Peak day = f(2nd hour load in weekday)

23rd hour load in Peak day = f(23rd hour load in weekday)

24th hour load in Peak day = f(24th hour load in weekday)

(9) Dummy, Social and Economic variable in South

a. Dummy variable

The Thailand dummy variable has “1” at the time of Thailand’s data. In the data number from 1 to 9, the Dummy is “1” and other terms are “0”.

Table 3-2-11 Dummy, Economic data and Climate data in South region

	South				VN199601	VN199602	VN199603	VN199604	VN199605
206	Dummy	Thailand Dummy		STHADUM	0	0	0	0	0
207		Malaysia Dummy		SMAYDUM	0	0	0	0	0
208		Philippines Dummy		SPHIDUM	0	0	0	0	0
209		Indonesia Dummy		SINDDUM	0	0	0	0	0
210		Japan Dummy		SJAPDUM	0	0	0	0	0
211									
212	Economic & Climate Indicators								
213		Real GDP (1995 constant)							
214		(1) G.R. Agriculture	%	SRAGR	5.0	5.0	5.0	5.0	5.0
215		(2) G.R. Industry	%	SRIND	15.3	15.3	15.3	15.3	15.3
216		(3) G.R. Service	%	SRSER	9.7	9.7	9.7	9.7	9.7
217		(1) Agriculture	Bill US\$	SGAGR	2.7	2.7	2.7	2.8	2.8
218		(2) Industry	Bill US\$	SGIND	4.5	4.5	4.6	4.6	4.7
219		(3) Service	Bill US\$	SGSER	5.4	5.4	5.5	5.5	5.6
220		(4) GDP Total	Bill US\$	SGDP	12.6	12.7	12.8	12.9	13.0
221		Population	Mill	SPOP	27.2	27.3	27.3	27.4	27.4
222		Humidity	%	SHUM	80.0	79.0	71.0	77.0	85.0
223		Electrified Population	Mill	SELPOP	13.4	13.4	13.5	13.5	13.6
224		Temperature	Deg	SDEG	22.2	22.8	24.3	25.1	24.9

The Malaysia dummy variable has “1” at the time of Malaysia’s data. In the data number from 10 to 15, the Dummy variable is “1” and other terms are “0”.

The Philippines’ dummy variable has “1” at the time of Philippines’ data. In the data number from 16 to 19, the Dummy variable is “1” and other terms are “0”.

The Indonesia’s dummy variable has “1” at the time of Indonesia’s data, In the data number from 20 to 28, the Dummy variable is “1” and other terms are “0”.

The Japan’s dummy variable has “1” at the time of Japan’s data, In the data number from 29 to 57, the Dummy variable is “1” and other terms are “0”.

b. Economic and Climate Indicators in Center

Real GDP and sector GDP are used as exogenous variables, the future values are given by the growth rate. The sector GDP of Agriculture, Industry and Services are calculated by the growth rate.

The data of Population, Electrified population, Humidity and temperature in South are given and used for forecasting daily load curve.

(10) Weekday data in South

The weekday data are average hourly values in weekdays. The weekday data do not include the data of Sundays, National holidays and three Peak days in a month. The average hourly data from 1st to 24th clock are prepared from Thailand, Malaysia, Philippines, Indonesia, Japan and Vietnam.

Table 3-2-12 Weekday data in South

205	South					VNI99601	VNI99602	VNI99603	VNI99604	VNI99605
227	Weekday Data									
228	<1st Hour>	Electricity Consumption	Hourly	MW	SWELEC1	601.0	605.0	698.0	770.0	738.0
229	<2nd Hour>	Electricity Consumption	Hourly	MW	SWELEC2	592.0	596.0	676.0	749.0	718.0
230	<3rd Hour>	Electricity Consumption	Hourly	MW	SWELEC3	579.0	599.0	668.0	741.0	707.0
231	<4th Hour>	Electricity Consumption	Hourly	MW	SWELEC4	595.0	609.0	680.0	740.0	709.0
232	<5th Hour>	Electricity Consumption	Hourly	MW	SWELEC5	634.0	638.0	709.0	770.0	751.0
233	<6th Hour>	Electricity Consumption	Hourly	MW	SWELEC6	726.0	716.0	787.0	829.0	787.0
234	<7th Hour>	Electricity Consumption	Hourly	MW	SWELEC7	731.0	710.0	777.0	807.0	802.0
235	<8th Hour>	Electricity Consumption	Hourly	MW	SWELEC8	810.0	766.0	878.0	935.0	946.0
236	<9th Hour>	Electricity Consumption	Hourly	MW	SWELEC9	849.0	806.0	929.0	1,007.0	1,011.0
237	<10th Hour>	Electricity Consumption	Hourly	MW	SWELEC1	905.0	848.0	998.0	1,061.0	1,069.0
238	<11th Hour>	Electricity Consumption	Hourly	MW	SWELEC1	887.0	833.0	973.0	1,048.0	1,059.0
239	<12th Hour>	Electricity Consumption	Hourly	MW	SWELEC1	764.0	745.0	848.0	917.0	929.0
240	<13th Hour>	Electricity Consumption	Hourly	MW	SWELEC1	755.0	745.0	867.0	947.0	941.0
241	<14th Hour>	Electricity Consumption	Hourly	MW	SWELEC1	839.0	777.0	935.0	1,001.0	1,002.0
242	<15th Hour>	Electricity Consumption	Hourly	MW	SWELEC1	877.0	808.0	962.0	1,023.0	1,014.0
243	<16th Hour>	Electricity Consumption	Hourly	MW	SWELEC1	904.0	837.0	984.0	1,039.0	1,039.0
244	<17th Hour>	Electricity Consumption	Hourly	MW	SWELEC1	945.0	860.0	989.0	1,037.0	1,064.0
245	<18th Hour>	Electricity Consumption	Hourly	MW	SWELEC1	1,058.0	947.0	1,017.0	1,085.0	1,086.0
246	<19th Hour>	Electricity Consumption	Hourly	MW	SWELEC1	1,112.0	1,097.0	1,185.0	1,209.0	1,203.0
247	<20th Hour>	Electricity Consumption	Hourly	MW	SWELEC2	1,063.0	1,070.0	1,158.0	1,186.0	1,171.0
248	<21st Hour>	Electricity Consumption	Hourly	MW	SWELEC2	1,027.0	1,018.0	1,120.0	1,170.0	1,144.0
249	<22nd Hour>	Electricity Consumption	Hourly	MW	SWELEC2	918.0	939.0	1,026.0	1,101.0	1,065.0
250	<23rd Hour>	Electricity Consumption	Hourly	MW	SWELEC2	749.0	776.0	870.0	944.0	885.0
251	<24th Hour>	Electricity Consumption	Hourly	MW	SWELEC2	638.0	654.0	764.0	830.0	787.0
252										

$$1^{st} \text{ hour load} = f(\text{Industry GDP} + \text{Service GDP}) / \text{GDP}, \text{ GDP per capita}, \\ \text{Electrified pop} * (\text{Humidity} + \text{Temperature})$$

$$2^{nd} \text{ hour load} = f(\text{Industry GDP} + \text{Service GDP}) / \text{GDP}, \text{ GDP per capita}, \\ \text{Electrified pop} * (\text{Humidity} + \text{Temperature})$$

$$23^{rd} \text{ hour load} = f(\text{Industry GDP} + \text{Service GDP}) / \text{GDP}, \text{ GDP per capita}, \\ \text{Electrified pop} * (\text{Humidity} + \text{Temperature})$$

$$24^{th} \text{ hour load} = f(\text{Industry GDP} + \text{Service GDP}) / \text{GDP}, \text{ GDP per capita}, \\ \text{Electrified pop} * (\text{Humidity} + \text{Temperature})$$

(12) Holiday data in South

The Holiday data are average hourly values in holidays. The Holiday data include the data of Sundays, national holidays. The average hourly data from 1st to 24th clock are prepared from Thailand, Malaysia, Philippines, Indonesia, Japan and Vietnam.

Table 3-2-13 Holiday data in South

205	South					VNI99601	VNI99602	VNI99603	VNI99604	VNI99605
253	Holiday Data									
254	<1st Hour>	Electricity Consumption	Hourly	MW	SHELEC1	578.0	607.0	702.0	757.0	752.0
255	<2nd Hour>	Electricity Consumption	Hourly	MW	SHELEC2	565.0	555.0	682.0	746.0	740.0
256	<3rd Hour>	Electricity Consumption	Hourly	MW	SHELEC3	560.0	553.0	675.0	731.0	724.0
257	<4th Hour>	Electricity Consumption	Hourly	MW	SHELEC4	558.0	557.0	673.0	737.0	723.0
258	<5th Hour>	Electricity Consumption	Hourly	MW	SHELEC5	601.0	575.0	692.0	749.0	761.0
259	<6th Hour>	Electricity Consumption	Hourly	MW	SHELEC6	650.0	640.0	736.0	772.0	759.0
260	<7th Hour>	Electricity Consumption	Hourly	MW	SHELEC7	664.0	649.0	741.0	763.0	759.0
261	<8th Hour>	Electricity Consumption	Hourly	MW	SHELEC8	721.0	668.0	823.0	828.0	838.0
262	<9th Hour>	Electricity Consumption	Hourly	MW	SHELEC9	739.0	677.0	914.0	883.0	920.0
263	<10th Hour>	Electricity Consumption	Hourly	MW	SHELEC10	811.0	688.0	962.0	964.0	980.0
264	<11th Hour>	Electricity Consumption	Hourly	MW	SHELEC11	807.0	680.0	928.0	937.0	970.0
265	<12th Hour>	Electricity Consumption	Hourly	MW	SHELEC12	703.0	637.0	827.0	859.0	857.0
266	<13th Hour>	Electricity Consumption	Hourly	MW	SHELEC13	681.0	636.0	818.0	874.0	868.0
267	<14th Hour>	Electricity Consumption	Hourly	MW	SHELEC14	726.0	655.0	856.0	899.0	881.0
268	<15th Hour>	Electricity Consumption	Hourly	MW	SHELEC15	756.0	686.0	893.0	910.0	881.0
269	<16th Hour>	Electricity Consumption	Hourly	MW	SHELEC16	801.0	719.0	914.0	928.0	941.0
270	<17th Hour>	Electricity Consumption	Hourly	MW	SHELEC17	823.0	754.0	928.0	944.0	946.0
271	<18th Hour>	Electricity Consumption	Hourly	MW	SHELEC18	985.0	847.0	979.0	1,015.0	999.0
272	<19th Hour>	Electricity Consumption	Hourly	MW	SHELEC19	1,015.0	1,049.0	1,157.0	1,117.0	1,138.0
273	<20th Hour>	Electricity Consumption	Hourly	MW	SHELEC20	1,003.0	1,006.0	1,126.0	1,101.0	1,120.0
274	<21st Hour>	Electricity Consumption	Hourly	MW	SHELEC21	957.0	953.0	1,101.0	1,092.0	1,091.0
275	<22nd Hour>	Electricity Consumption	Hourly	MW	SHELEC22	819.0	884.0	1,017.0	1,031.0	1,002.0
276	<23rd Hour>	Electricity Consumption	Hourly	MW	SHELEC23	700.0	770.0	841.0	858.0	864.0
277	<24th Hour>	Electricity Consumption	Hourly	MW	SHELEC24	595.0	655.0	715.0	780.0	738.0
278										

$$1^{st} \text{ hour load} = f(\text{Industry GDP} + \text{Service GDP}) / \text{GDP}, \text{ GDP per capita}, \\ \text{Electrified pop} * (\text{Humidity} + \text{Temperature})$$

$$2^{nd} \text{ hour load} = f(\text{Industry GDP} + \text{Service GDP}) / \text{GDP}, \text{ GDP per capita}, \\ \text{Electrified pop} * (\text{Humidity} + \text{Temperature})$$

$$23^{rd} \text{ hour load} = f(\text{Industry GDP} + \text{Service GDP}) / \text{GDP}, \text{ GDP per capita}, \\ \text{Electrified pop} * (\text{Humidity} + \text{Temperature})$$

$$24^{th} \text{ hour load} = f(\text{Industry GDP} + \text{Service GDP}) / \text{GDP}, \text{ GDP per capita}, \\ \text{Electrified pop} * (\text{Humidity} + \text{Temperature})$$

(13) Peak day data in South

The Peak day data are average hourly values of three peak demand days in a month. The average hourly data from 1st to 24th clock are prepared from Thailand, Malaysia, Philippines, Indonesia, Japan and Vietnam

Table 3-2-14 Peak day data in South

205	South					VN199601	VN199602	VN199603	VN199604	VN199605
279	Peak day									
280	<1st Hour>	Peak electricity Consumption	Hourly	MW	SPELEC1	612.0	605.0	766.0	755.0	795.0
281	<2nd Hour>	Peak electricity Consumption	Hourly	MW	SPELEC2	599.0	593.0	732.0	741.0	793.0
282	<3rd Hour>	Peak electricity Consumption	Hourly	MW	SPELEC3	607.0	598.0	731.0	728.0	771.0
283	<4th Hour>	Peak electricity Consumption	Hourly	MW	SPELEC4	628.0	607.0	738.0	741.0	773.0
284	<5th Hour>	Peak electricity Consumption	Hourly	MW	SPELEC5	669.0	658.0	793.0	756.0	795.0
285	<6th Hour>	Peak electricity Consumption	Hourly	MW	SPELEC6	762.0	735.0	843.0	828.0	839.0
286	<7th Hour>	Peak electricity Consumption	Hourly	MW	SPELEC7	762.0	716.0	808.0	789.0	833.0
287	<8th Hour>	Peak electricity Consumption	Hourly	MW	SPELEC8	819.0	793.0	948.0	958.0	951.0
288	<9th Hour>	Peak electricity Consumption	Hourly	MW	SPELEC9	864.0	879.0	1,018.0	1,012.0	1,085.0
289	<10th Hour>	Peak electricity Consumption	Hourly	MW	SPELEC10	938.0	943.0	1,042.0	1,101.0	1,112.0
290	<11th Hour>	Peak electricity Consumption	Hourly	MW	SPELEC11	907.0	905.0	1,039.0	1,065.0	1,104.0
291	<12th Hour>	Peak electricity Consumption	Hourly	MW	SPELEC12	748.0	787.0	919.0	885.0	960.0
292	<13th Hour>	Peak electricity Consumption	Hourly	MW	SPELEC13	783.0	787.0	960.0	933.0	973.0
293	<14th Hour>	Peak electricity Consumption	Hourly	MW	SPELEC14	873.0	864.0	1,000.0	1,011.0	1,021.0
294	<15th Hour>	Peak electricity Consumption	Hourly	MW	SPELEC15	898.0	886.0	1,011.0	1,028.0	1,032.0
295	<16th Hour>	Peak electricity Consumption	Hourly	MW	SPELEC16	942.0	935.0	1,044.0	1,057.0	1,047.0
296	<17th Hour>	Peak electricity Consumption	Hourly	MW	SPELEC17	968.0	960.0	1,031.0	1,045.0	1,048.0
297	<18th Hour>	Peak electricity Consumption	Hourly	MW	SPELEC18	1,041.0	1,018.0	1,077.0	1,102.0	1,137.0
298	<19th Hour>	Peak electricity Consumption	Hourly	MW	SPELEC19	1,146.0	1,154.0	1,264.0	1,259.0	1,280.0
299	<20th Hour>	Peak electricity Consumption	Hourly	MW	SPELEC20	1,100.0	1,120.0	1,213.0	1,212.0	1,229.0
300	<21st Hour>	Peak electricity Consumption	Hourly	MW	SPELEC21	1,056.0	1,038.0	1,180.0	1,203.0	1,212.0
301	<22nd Hour>	Peak electricity Consumption	Hourly	MW	SPELEC22	962.0	941.0	1,110.0	1,149.0	1,178.0
302	<23rd Hour>	Peak electricity Consumption	Hourly	MW	SPELEC23	809.0	753.0	950.0	946.0	958.0
303	<24th Hour>	Peak electricity Consumption	Hourly	MW	SPELEC24	681.0	680.0	807.0	830.0	865.0
304										

1st hour load in Peak day = f(1st hour load in weekday)

2nd hour load in Peak day = f(2nd hour load in weekday)

23rd hour load in Peak day = f(23rd hour load in weekday)

24th hour load in Peak day = f(24th hour load in weekday)

(14) Load factor forecasting

In Data analysis sheet, load factor, peak demand and monthly power consumption are calculated. The load factors in Data analysis sheet are calculated from peak demand and monthly consumption. In the SimpleE sheets, the load factors in future are estimated by regression equations by using actual peak demand and monthly power consumption, and load factor data calculated in the actual terms.

Table 3-2-15 Load factor forecasting in Data sheet

E	F	G	H	I	J	TIME	VNI99601	VNI99602	VNI99603	VNI99604	VNI99605
307		Load factor		North		DLNRTH	0.58	0.56	0.55	0.54	0.59
308				Central		DLCENT	0.53	0.53	0.54	0.54	0.57
309				South		DLSOUT	0.70	0.67	0.71	0.75	0.73
310				Total		DLTOTL	0.62	0.60	0.62	0.63	0.65
311											
312		Monthly Consumption		North	MWh	PKNRTH	564,213	511,810	557,053	525,384	604,130
313				Central	MWh	PKCENT	111,571	103,344	125,673	123,498	135,957
314				South	MWh	PKSOUT	595,279	513,754	665,099	677,827	693,869
315				Total	MWh	PKTOTL	1,271,063	1,128,908	1,347,824	1,326,710	1,433,955
316											
317		Peak demand		North	MW	PLNRTH	1,312	1,371	1,353	1,343	1,383
318				Central	MW	PLCENT	281	292	315	317	319
319				South	MW	PLSOUT	1,141	1,150	1,259	1,254	1,274
320				Total	MW	PLTOTL	2,735	2,812	2,928	2,914	2,976
321											

a. Load factor forecasting

Future load factors are estimated by the following regression equations.

Load factor in North = f(Monthly power demand in North / (Peak demand in North 30*24))

Load factor in Center = f(Monthly power demand in Center / (Peak demand in North 30*24))

Load factor in South = f(Monthly power demand in South / (Peak demand in North 30*24))

Load factor in Whole = f(Monthly power demand in Whole / (Peak demand in North 30*24))