

## Appendix 2 火力発電所の年間設備利用率

## Appendix A-2 火力発電所の年間設備利用率

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## Appendix A-2 火力発電所の年間設備利用率

### A-2-1 年間設備利用率の計画値

日本国内における新規火力電源の年間設備利用率は一般的に下記根拠により70%として計画されている。

- (1) 電気事業法によって義務付けられている定期点検
- (2) 日々の需要カーブに合わせた運転を行うことによる出力抑制や保守上の負荷制限
- (3) 機器の故障等による運転停止

但し、

・定期点検停止率		15~20%
・出力抑制及び負荷制限		5%
・機器の故障等による停止率	5% (初期)	2.5% (安定)

### A-2-2 火力発電所の年間設備利用率の実績

日本における主要9電力会社の燃焼方式別、年間設備利用率は Table A-2-1 の通りである。

### A-2-3 中南米地区における火力発電所の年間設備利用率の考え方

当社が手掛けた中南米地区の新規火力の年間設備利用率は Table A-2-2 の通りである。

以上

Table A-2-2 Survey of Facility Utilization Factor of Thermal Power Plants (Central and South America Plan)

Country	P/S Characteristics						Utilization Factor (%)					
	Rated Power Output (MW)	Auxiliary Power Ratio (%)	Compensation Ratio (%)	Fault Ratio (%)	Annual Generation (MW/Y)	Coal Fired	Oil Fired	Diesel	Low-speed Diesel	Steam	Gas Turbine	Geo-thermal
Costa Rica	96.5	6	8	5	449	53						
	18				134.8				85			
	12				89.9				86			
	12				89				86			
	19				134.8				81			
	10				74.9				86			
Turkey	300				1,839.6	70						
Japan	250	4.8			1,533		70					
	500	4.8			3,066		70					
Honduras	20(19)	5			120			72				
	40	5			240			72				
	60	5			360			72				
	75				432				56			
	90				508					70		
Average						61.5	70.0	72	81.7	70.0		

Table A-2-2 Survey of Facility Utilization Factor of Thermal Power Plants (Central and South America Plan)

Country	P/S Characteristics						Utilization Factor (%)					
	Rated Power Output (MW)	Auxiliary Power Ratio (%)	Compensation Ratio (%)	Fault Ratio (%)	Annual Generation (MW/Y)	Coal Fired	Oil Fired	Diesel	Low-speed Diesel	Steam	Gas Turbine	Geo-thermal
Costa Rica	96.5	6	8	5	449	53						
	18				134.8				85			
	12				89.9				86			
	12				89				86			
	19				134.8				81			
	10				74.9				86			
Turkey	300				1,839.6	70						
Japan	250	4.8			1,533		70					
	500	4.8			3,066		70					
Honduras	20(19)	5			120			72				
	40	5			240			72				
	60	5			360			72				
	75				432				66			
	90				508					70		
Average						61.5	70.0	72	81.7	70.0		

### Appendix-3 1996年系統安定度解析結果



Appendix A-3 1996年系統安定度解析結果

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## Appendix A-3 1996年系統安定度解析結果

### A-3-1 検討条件

Paute-Pascuales送電線(230kV, 2 cct)の増設及びDaule Peripa発電所が1996年時点で完成しない場合、現時点での同送電線2 cctで、Paute発電所の発電力をどこまで増加させても安定的に送電できるのかを検討した。

系統構成は、Fig. A-3-1 に示すインピーダンスマップの通り、1998年時点に比べ、Paute-Pascuales送電線が4 cctではなく2 cct、およびDaule Peripa発電所がない点が異なっている。

また、Table A-3-1 に1996年6月、12月断面の変電所ピーク負荷を示す。

### A-3-2 検討結果

Fig. A-3-2, Fig. A-3-3 に1996年6月、12月の潮流図をそれぞれ示す。

また、この潮流条件での検討安定度計算結果を Fig. A-3-4, Fig. A-3-5 にそれぞれ示す。

これによると、豊水期である6月断面では、Paute A, B, C 発電所合計 872MWで不安定な結果となっている。渇水期である12月断面でも、Daule Peripa発電所の運開が遅れると、Paute A, B, C 合計で 892MWの発電となり、不安定な結果となる。

Paute発電所を定格出力近傍にて有効に運転を行おうとする場合、Paute～Milagro～Pascuales間の4回線化が必要であり、早期にS N I Phase D<sub>2</sub> を完成させる必要がある。

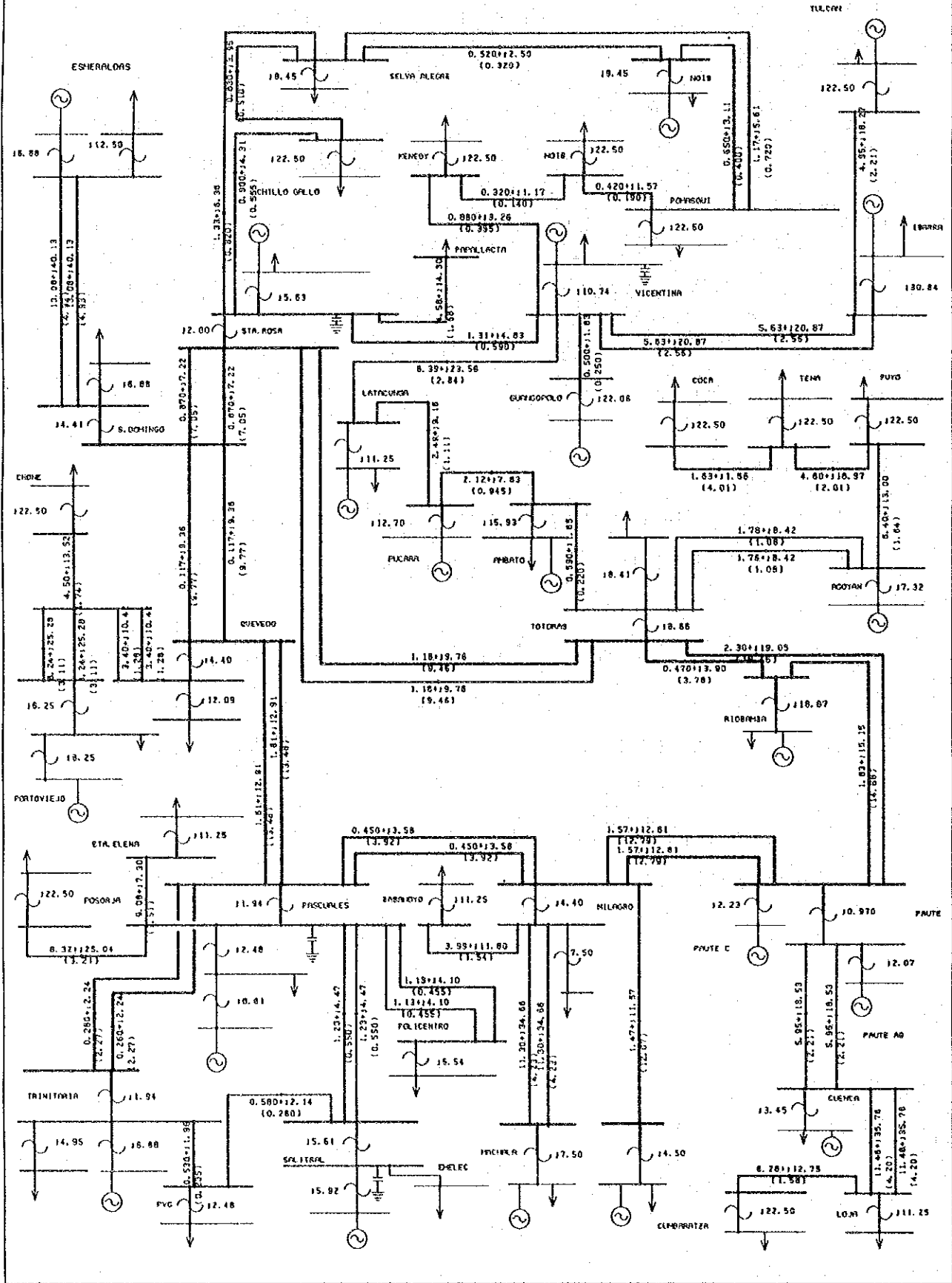


Fig. A-3-1 Impedance Map in 1996

ECUADOR 1996-06

P+JQ [% at 100 MVA Base] V∠θ [%∠deg]

TOTAL PLOSS 63.53 QLOSS 179.64

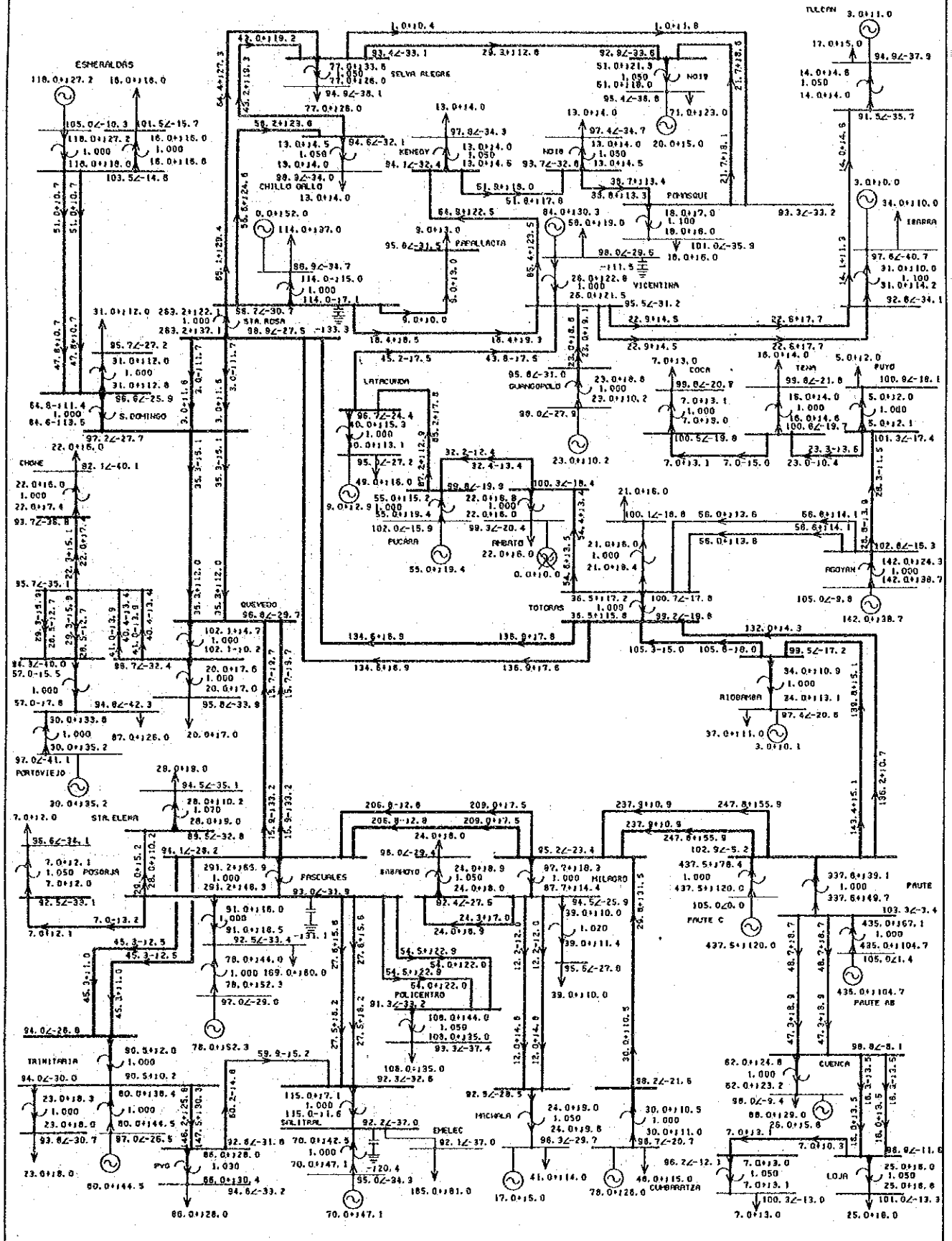


Fig. A-3-2 Power Flow In June, 1996

ECUADOR 1996-12 P+JQ [% at 100 MVA Base] V $\angle$  $\theta$  [%/deg]  
 TOTAL PLOSS 62.57 QLOSS 182.87

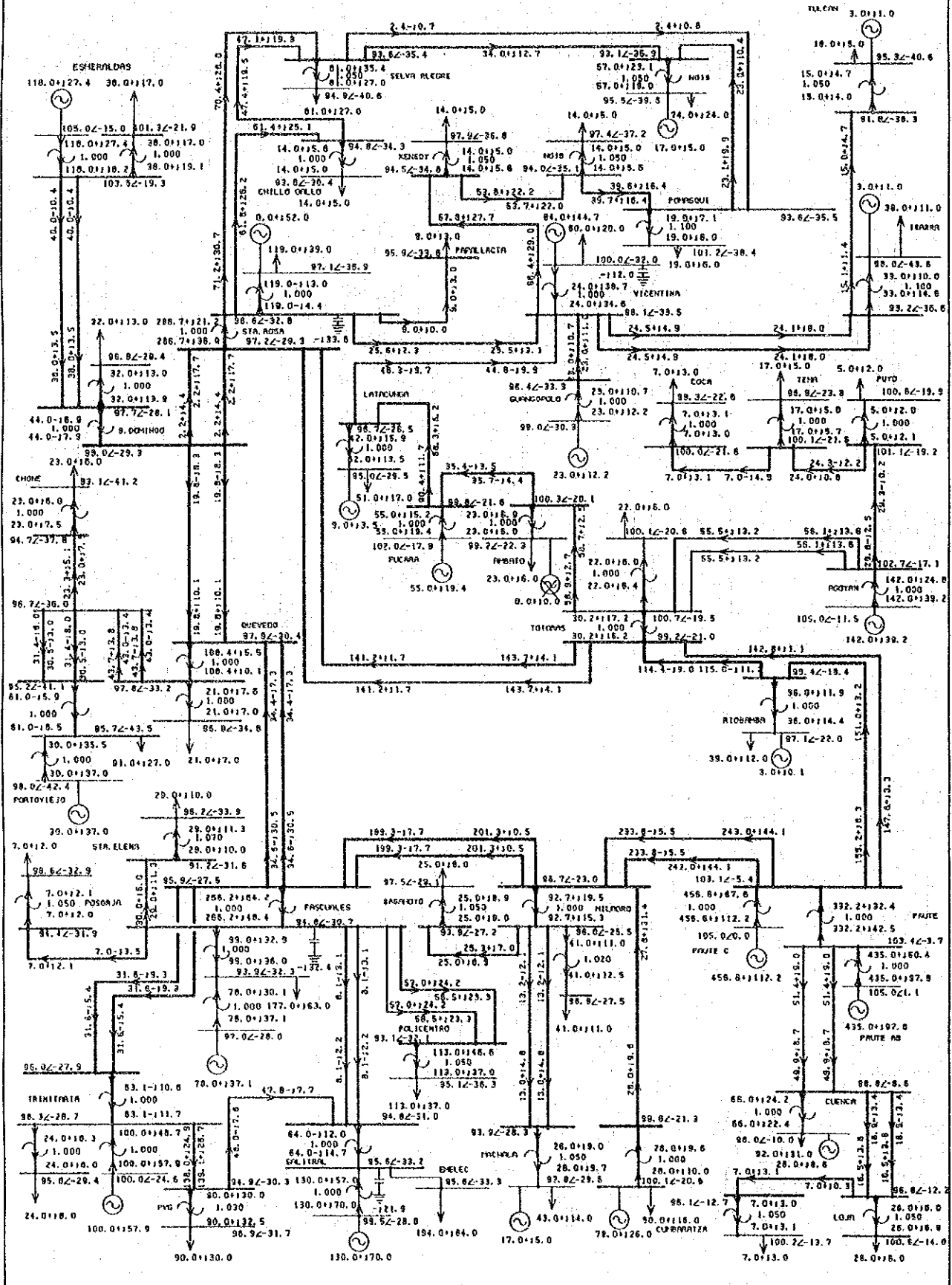
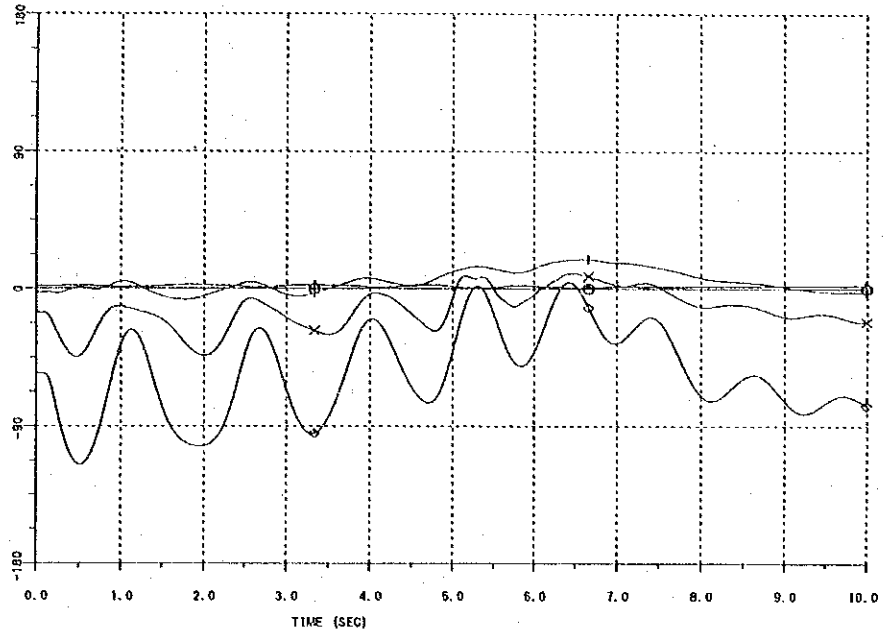


Fig. A-3-3 Power Flow in December, 1996



ECUADOR 1996-06 BR04-1 (PAUTE-MILAGRO) 3LG-0

Code	Term	Comment	Max	Min	Initial	Final
1 -○-	ANG	PAUTE-C	0.00	0.00	0.00	0.00
2 -△-	ANG	PAUTE-AB	2.76	0.32	1.76	2.20
3 -+-	ANG	CUENCA	19.42	-7.05	-2.33	-2.49
4 -X-	ANG	LATCUNGA	10.38	-44.87	-15.70	-21.84
5 -○-	ANG	IBARRA	4.19	-115.26	-55.65	-76.44



ECUADOR 1996-06 BR04-1 (PAUTE-MILAGRO) 3LG-0

Code	Term	Comment	Max	Min	Initial	Final
1 -○-	ANG	PAUTE-C	0.00	0.00	0.00	0.00
2 -△-	ANG	SALITRAL	39.72	-168.44	-36.89	-50.54
3 -+-	ANG	RIOBAMBA	-9.52	-59.60	-33.89	-39.42
4 -X-	ANG	ESMERALD	15525.59	-120.87	-2.52	15525.59
5 -○-	ANG	GUANOPL	5.80	-65.71	-32.04	-40.41

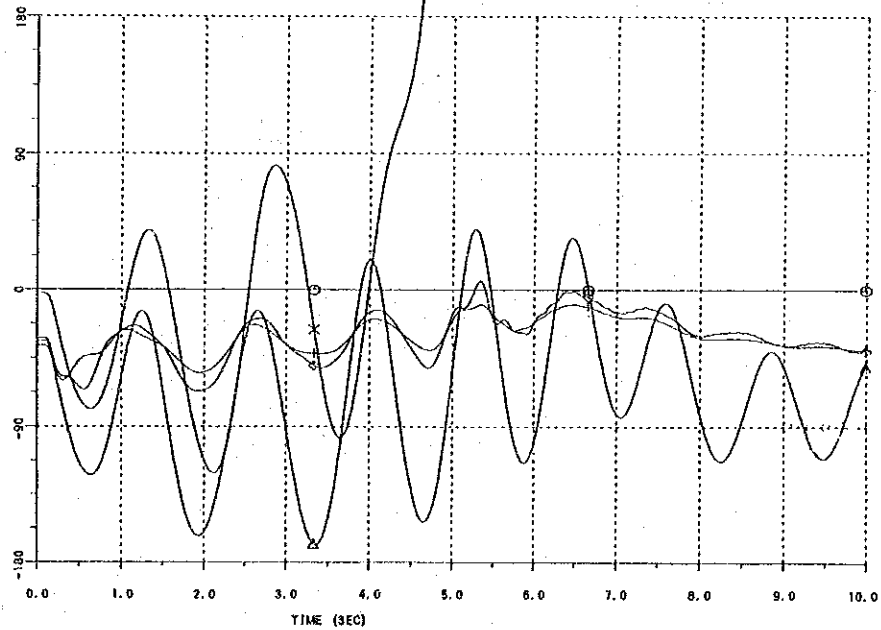
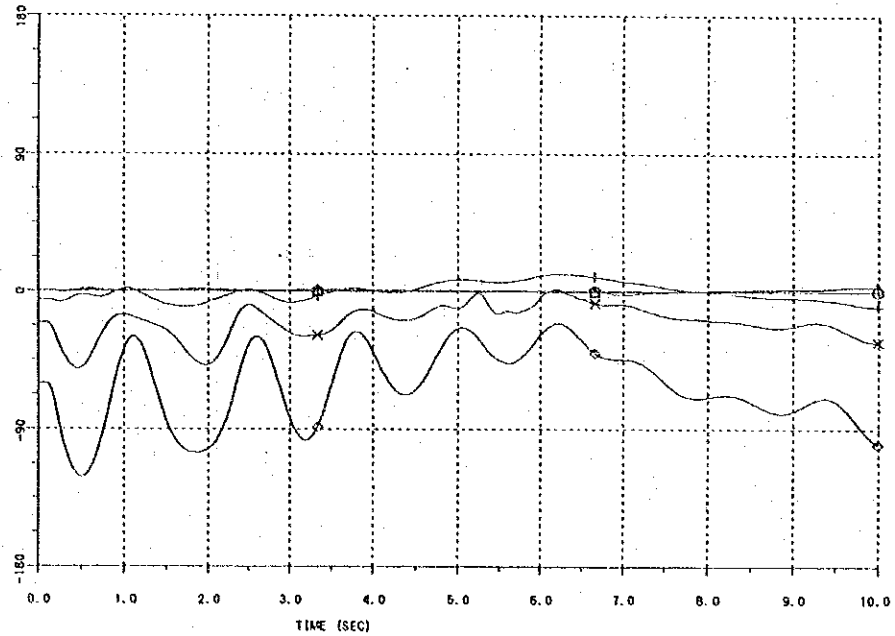


Fig. A-3-4 Power System Stability after 1 CCT Line Fault (June, 1996)



EQUADOR 1996-12 BR04-1 (PAUTE-MILAGRO) 3LG-0

	Code	Term	Comment	Max	Min	Initial	Final
1	NDG-08	ANG	PAUTE-C	0.00	0.00	0.00	0.00
2	NDG-09	ANG	PAUTE-AB	3.40	-1.91	0.55	3.22
3	NDG-11	ANG	CUENCA	11.45	-10.09	-5.67	-9.78
4	ND-60	ANG	LATCUNGA	1.43	-51.01	-20.53	-33.14
5	NDG-16	ANG	IBARRA	-20.75	-121.37	-60.25	-100.07



EQUADOR 1996-12 BR04-1 (PAUTE-MILAGRO) 3LG-0

	Code	Term	Comment	Max	Min	Initial	Final
1	NDG-08	ANG	PAUTE-C	0.00	0.00	0.00	0.00
2	NDG-05	ANG	SALITRAL	9.19	-122.48	-22.35	-74.32
3	ND-45	ANG	RIOBAMBA	-16.28	-64.06	-35.36	-47.69
4	NDG-01	ANG	ESMERALD	12838.95	-123.47	-8.44	12838.95
5	NDG-15	ANG	GUANGOPL	-11.34	-71.42	-35.45	-53.06

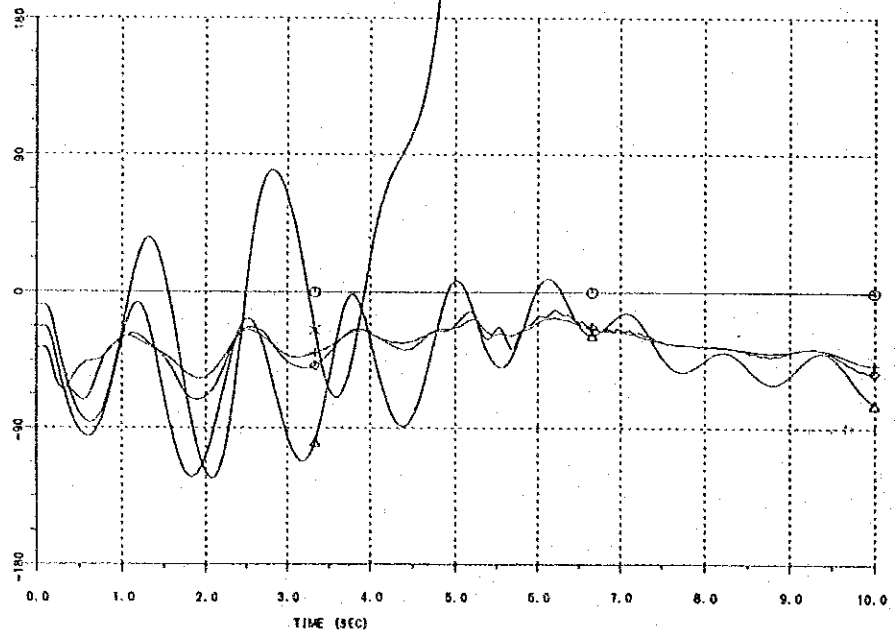


Fig. A-3-5 Power System Stability after 1 CCT Line Fault (December, 1996)



Table A-3-1 Peak Loads at Substations (MW + jMVar) (1/2)

Substation	1966	
	June	December
Santa Rosa	114+j37	119+j39
Vicentina	58+j19	60+j20
Pomasqui	18+j6	19+j6
Selva Alegre	77+j26	81+j27
S/E No. 19	71+j23	74+j24
S/E No. 18	13+j4	14+j5
Kennedy	13+j4	14+j5
Chillo Gallo	13+j4	14+j5
Papallacta	9+j3	9+j3
Ibarra	34+j10	36+j11
Tulcán	17+j5	18+j5
Santo Domingo	31+j12	32+j13
Esmeraldas	16+j16	38+j17
Quevedo	20+j7	21+j7
Portoviejo	87+j26	91+j27
Chone	22+j6	23+j6
Totoras	21+j6	22+j6
Ambato	22+j6	23+j6
Latacunga	49+j16	51+j17
Riobamba	37+j11	39+j12
Puyo	5+j2	5+j2
Tena	16+j4	17+j5
Coca	7+j3	7+j3

Table A-3-1 Peak Loads at Substations (MW + jMVar) (2/2)

Substation	1966	
	June	December
Cuenca	88+j29	92+j31
Loja	25+j6	26+j6
Cumbaratza	7+j3	7+j3
Machala (230 kV)	48+j15	50+j16
Machala (138 kV)	41+j14	43+j14
Milagro	39+j10	41+j11
Babahoyo	24+j8	25+j8
Pascuales	169+j60	177+j63
Policentro	108+j35	113+j37
Salitral	185+j61	194+j64
PVG	86+j28	90+j30
Trinitaria	23+j8	24+j8
Posorja	7+j2	7+j2
Sta. Elena	28+j9	29+j10
Total	1,648+j544	1,745+j574

## Appendix -4 SNIの信頼度解析方法

## Appendix A-4 SNIの信頼度解析方法

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Appendix A-4 S N I の信頼度解析方法

A-4-1 信頼度解析のためのデータ

(1) 需要データ

(a) 1991年12月断面

1991年12月

最大電力 北部 536.0(MW), 南部 804.0(MW)

表 A-4-1 1991年12月の需要

日付	曜日	北部需要(MW)	南部需要(MW)
○ 1	日	462.5	693.9
2	月	520.9	780.3
3	火	531.7	795.4
4	水	529.5	794.3
5	木	513.3	769.5
6	金	497.1	745.7
○ 7	土	466.8	699.3
○ 8	日	460.4	688.5
9	月	526.3	788.9
10	火	530.6	794.3
11	水	536.0	804.0
12	木	526.3	788.9
13	金	525.2	786.7
○ 14	土	475.5	711.2
○ 15	日	469.0	703.6
16	月	531.7	795.4
17	火	531.7	796.4
18	水	527.4	788.9
19	木	520.9	780.3
20	金	520.9	780.3
○ 21	土	475.5	713.3
○ 22	日	469.0	701.5
23	月	500.3	750.0
24	火	488.5	730.6
○ 25	水	440.0	659.4
26	木	513.3	769.5
27	金	504.7	756.5
○ 28	土	461.4	691.8
○ 29	日	447.4	670.2
30	月	497.1	744.6
○ 31	火	462.5	692.8

○ : 休日扱いとした日

(b) 1998年12月断面

1998年12月 最大電力 北部 753.0(MW), 南部 1,238.0(MW)

1991年12月 最大電力 北部 536.0(MW), 南部 804.0(MW)

$$\frac{753.0}{536.0} = 1.405 \quad \frac{1,238.0}{804.0} = 1.540$$

1991年12月の需要を北部は 1.405倍, 南部は 1.540倍した需要を1988年12月の需要とする。

表 A-4-2 1991年と1998年の12月の需要

日付	曜日	北部需要 (MW)		南部需要 (MW)	
		1991年	1998年	1991年	1998年
○ 1	日	462.5	649.7	693.9	1,068.5
2	月	520.9	731.9	780.3	1,201.5
3	火	531.7	747.0	795.4	1,224.8
4	水	529.5	743.9	794.3	1,223.1
5	木	513.3	721.2	769.5	1,184.9
6	金	497.1	698.4	745.7	1,148.2
○ 7	土	466.8	655.8	699.3	1,076.8
○ 8	日	460.4	646.8	688.5	1,060.2
9	月	526.3	739.5	788.9	1,214.7
10	火	530.6	745.5	794.3	1,223.1
11	水	536.0	753.0	804.0	1,238.0
12	木	526.3	739.4	788.9	1,214.7
13	金	525.2	737.8	786.7	1,211.4
○ 14	土	475.5	668.0	711.2	1,095.1
○ 15	日	469.0	658.9	703.6	1,083.4
16	月	531.7	747.0	795.4	1,224.8
17	火	531.7	747.0	796.4	1,226.3
18	水	527.4	740.9	788.9	1,214.7
19	木	520.9	731.8	780.3	1,201.5
20	金	520.9	731.8	780.3	1,201.5
○ 21	土	475.5	668.0	713.3	1,098.3
○ 22	日	469.0	658.9	701.5	1,080.2
23	月	500.3	702.8	750.0	1,154.9
24	火	488.5	686.3	730.6	1,125.0
○ 25	水	440.9	619.4	659.4	1,015.3
26	木	513.3	721.1	769.5	1,184.9
27	金	504.7	709.0	756.5	1,164.9
○ 28	土	461.4	648.2	691.8	1,065.2
○ 29	日	447.4	628.5	670.2	1,032.0
30	月	497.1	698.4	744.6	1,146.5
○ 31	火	462.5	649.7	692.8	1,066.8

○ : 休日扱いとした日  
 曜日は1991年12月の曜日である。



(c) 2003年12月断面

2003年12月 最大電力 北部 986.0(MW), 南部 1,609.0(MW)

1991年12月 最大電力 北部 536.0(MW), 南部 804.0(MW)

$$\frac{986.0}{536.0} = 1.840 \quad \frac{1,609.0}{804.0} = 2.001$$

1991年12月の需要を北部は 1.840倍, 南部は 2.001倍した需要を2003年12月の需要とする。

表 A-4-3 1991年と2003年の12月の需要

日付	曜日	北部需要 (MW)		南部需要 (MW)	
		1991年	2003年	1991年	2003年
○ 1	日	462.5	850.8	693.9	1,388.7
2	月	520.9	958.2	780.3	1,561.6
3	火	531.7	978.1	795.4	1,591.8
4	水	529.5	974.0	794.3	1,589.6
5	木	513.3	944.2	769.5	1,540.0
6	金	497.1	914.4	745.7	1,492.3
○ 7	土	466.8	858.7	699.3	1,399.5
○ 8	日	460.4	846.9	688.5	1,377.9
9	月	526.3	968.2	788.9	1,578.8
10	火	530.6	976.1	794.3	1,589.6
11	水	536.0	986.0	804.0	1,609.0
12	木	526.3	968.2	788.9	1,578.8
13	金	525.2	966.1	786.7	1,574.4
○ 14	土	475.5	874.7	711.2	1,423.3
○ 15	日	469.0	862.8	703.6	1,408.1
16	月	531.7	978.1	795.4	1,591.8
17	火	531.7	978.1	796.4	1,593.8
18	水	527.4	970.2	788.9	1,578.8
19	木	520.9	958.2	780.3	1,561.6
20	金	520.9	958.2	780.3	1,561.6
○ 21	土	475.5	874.7	713.3	1,427.5
○ 22	日	469.0	862.8	701.5	1,403.9
23	月	500.3	920.3	750.0	1,500.9
24	火	488.5	898.6	730.6	1,462.1
○ 25	水	440.9	811.0	659.4	1,319.6
26	木	513.3	944.2	769.5	1,540.0
27	金	504.7	928.4	756.5	1,513.9
○ 28	土	461.4	848.8	691.8	1,384.5
○ 29	日	447.4	823.0	670.2	1,341.2
30	月	497.1	814.4	744.6	1,490.1
○ 31	火	462.5	850.8	692.8	1,386.5

○ : 休日扱いとした日

曜日は1991年12月の曜日である。

(2) 計算条件

(a) 1991年12月断面

- ① 気温による需要変動は、考慮していない。
- ② 気温以外の要素による需要変動は、需要変動誤差率をもとに考慮し、  
北部 平均値 -13.79(MW) 標準偏差 26.83(MW)  
南部 平均値 -20.86(MW) 標準偏差 41.09(MW)  
となる、正規分布により計算した。
- ③ 出水変動分布は、考慮していない。
- ④ サンプル回数は、5,000回とした。
- ⑤ 需要の不等時量は、なし(0(MW))とした。
- ⑥ 応援ルールは、ルール4(余力率比, 不足率比, 全系率一定)を用いた。
- ⑦ 連系線容量は、  
北部 → 南部 900(MW)  
北部 ← 南部 900(MW)  
とした。

(b) 1998年12月断面

- ① 気温による需要変動は、考慮していない。
- ② 気温以外の要素による需要変動は、需要変動誤差率により考慮し、  
北部 平均値 -21.40(MW) 標準偏差 39.62(MW)  
南部 平均値 -35.40(MW) 標準偏差 66.31(MW)  
となる、正規分布により計算した。
- ③ 出水変動分布は、考慮していない。
- ④ サンプル回数は、5,000回とした。
- ⑤ 需要の不等時量は、なし(0(MW))とした。
- ⑥ 応援ルールは、ルール4(余力率比, 不足率比, 全系率一定)を用いた。
- ⑦ 連系線容量は、  
北部 → 南部 900(MW)  
北部 ← 南部 900(MW)  
とした。

(c) 2003年12月断面

- ① 気温による需要変動は、考慮していない。
- ② 気温以外の要素による需要変動は、需要変動誤差率により考慮し、  
北部 平均値 -28.02(MW) 標準偏差 51.88(MW)  
南部 平均値 -46.01(MW) 標準偏差 86.19(MW)  
となる、正規分布により計算した。
- ③ 出水変動分布は、考慮していない。
- ④ サンプルング回数は、5,000回とした。
- ⑤ 需要の不等時量は、なし(0(MW))とした。
- ⑥ 応援ルールは、ルール4(余力率比, 不足率比, 全系率一定)を用いた。
- ⑦ 連系線容量は、  
北部 → 南部 900(MW)  
北部 ← 南部 900(MW)  
とした。

AMD: 1991

Table A-4-4 DEMANDA MAXIMA (MW)  
(REAL)

EMPRESA ELECTRICA	ENE.	FEB.	MAR.	ABR.	MAY.	JUN.	JUL.	AGO.	SEP.	OCT.	NOV.	DIC.
NORTE	37.7	36.8	37.9	38.2	38.6	38.8	39.6	40.3	40.3	40.9	40.4	41.9
QUITO	284.6	282.4	287.1	286.9	289.8	287.7	287.7	282.7	282.4	302.9	305.3	310.8
STO. DOMINGO	21.0	20.5	21.0	20.8	22.0	22.0	22.3	23.0	23.8	23.8	23.7	23.9
COTOPAXI	19.7	19.7	20.5	20.8	20.9	21.0	22.0	21.9	20.6	23.0	23.0	22.7
AMBAIO-PUYO	37.3	38.5	37.8	37.5	39.1	39.4	38.6	38.9	39.3	40.1	40.4	40.8
CHIMBORAZO	25.0	25.5	25.8	26.1	27.0	27.3	27.1	27.8	26.8	28.1	28.3	28.7
BOLIVAR	5.3	5.6	5.8	5.4	5.7	5.4	6.4	6.4	6.6	6.7	6.8	7.1
CENTRO SUR	57.2	56.2	55.9	57.5	60.0	60.1	59.4	58.9	60.5	63.0	63.4	67.0
SUR	19.3	19.0	19.4	19.8	19.9	20.1	20.9	20.3	20.7	21.3	21.7	22.2
ESMERALDAS	26.9	25.7	22.2	23.6	23.0	22.0	26.0	27.5	24.6	25.0	26.0	29.8
MANABI	73.0	72.7	75.5	72.5	74.0	74.6	75.0	76.1	76.5	78.0	78.0	81.7
SALINAS SANTA ELENA	27.1	27.5	26.0	25.0	23.7	22.0	23.0	20.9	21.3	22.2	22.0	25.7
SUAYABUIL	375.8	379.5	379.4	388.5	391.6	374.2	370.3	377.0	374.5	374.5	413.0	407.4
DURAN-DAULE-BALZAR-BUEV.	49.9	48.6	49.7	50.7	51.1	50.2	51.6	52.6	54.3	55.7	57.5	60.4
BABAHYO	20.5	18.0	18.9	19.9	21.7	21.0	20.4	21.4	22.6	22.7	21.7	21.7
MILAGRO-NARANJAL	23.7	24.8	25.8	25.8	27.5	26.6	24.6	25.8	27.9	29.9	28.6	31.9
EL ORD	46.1	48.1	45.9	49.3	47.7	48.1	48.2	46.0	46.0	46.0	48.0	52.0
ZONA NORTE	450.6	442.9	446.0	451.5	462.7	463.9	463.8	460.8	458.6	483.6	493.1	491.4
ZONA SUR	682.1	677.3	678.0	696.9	712.0	697.3	684.8	687.6	695.5	703.2	752.7	749.5
TOTAL (COINC. HORARIA)	1132.7	1120.2	1124.0	1148.4	1174.7	1161.2	1148.6	1148.4	1154.1	1186.8	1235.8	1240.9
TOTAL (COINC. MENSUAL)	1150.1	1150.1	1154.6	1168.3	1183.3	1160.5	1163.1	1167.5	1168.7	1203.8	1247.8	1274.8

FORM 271

AÑO: 1991

Table A-4-5 DEMANDA MAXIMA (MW)

(PROGRAMADA)

EMPRESA ELECTRICA	ENE.	FEB.	MAR.	ABR.	MAY.	JUN.	JUL.	AGO.	SEP.	OCT.	NOV.	DIC.
NORTE	37.4	35.8	37.2	37.8	36.7	37.1	37.8	38.2	39.3	39.1	37.7	39.0
QUILO	282.6	274.8	282.2	283.8	275.3	275.1	274.6	268.1	275.7	289.6	285.0	295.7
STO. DOMINGO	20.9	19.9	20.6	20.6	20.9	21.0	21.3	21.8	23.2	22.8	22.1	22.7
COTIPALI	19.6	19.2	20.1	20.6	19.9	20.1	21.0	20.8	20.1	22.0	21.5	21.6
AMBATO-PUYO	37.0	37.5	37.2	37.1	37.1	37.7	36.8	36.9	38.4	38.3	37.7	38.8
CHIMBORAZO	24.8	24.8	25.4	25.8	25.6	26.1	25.9	26.4	26.2	26.9	26.4	27.3
BOLIVAR	5.3	5.4	5.7	5.3	5.4	5.2	6.1	6.1	6.4	6.4	6.3	6.8
CENTRO SUR	56.8	54.7	54.9	56.9	57.0	57.5	56.7	55.8	59.1	60.2	59.2	63.7
SUR	19.2	18.5	19.1	19.6	18.9	19.2	19.9	19.2	20.2	20.4	20.3	21.1
ESMERALDAS	26.7	25.0	24.8	23.3	24.8	24.0	24.8	26.1	24.0	23.9	24.3	28.4
HANABI	72.5	70.7	74.2	71.7	70.3	71.3	71.6	72.2	74.7	74.6	72.8	77.7
SALINAS SANTA ELENA	26.9	26.8	25.6	24.7	22.5	21.0	22.0	19.8	20.8	21.2	20.5	24.5
GUAYABUIL	373.1	369.2	372.9	384.3	372.0	357.8	353.4	357.5	365.6	358.1	385.5	387.6
BURAN-BAULE-BALZAR-QUEV.	49.5	42.3	48.8	50.2	48.5	48.0	49.3	49.9	53.0	53.3	53.7	57.5
BABAHYO	20.4	17.5	18.6	19.7	20.6	20.1	19.5	20.3	22.1	21.7	20.3	20.6
MILASRO-MARAHUAL	23.5	24.1	25.4	25.5	26.1	25.4	23.5	24.5	27.2	28.6	26.7	30.4
EL ORO	45.8	46.8	45.1	48.8	45.3	46.0	46.0	43.6	44.9	44.0	44.8	49.5
ZONA NORTE	447.4	430.9	438.3	446.6	439.5	443.5	442.7	437.0	447.7	462.3	460.3	467.5
ZONA SUR	677.3	659.0	666.4	689.5	676.3	666.7	653.6	651.9	679.0	672.4	702.5	713.2
TOTAL (807 MC-MENSUAL)	1124.7	1089.9	1104.7	1136.1	1115.8	1110.2	1096.3	1088.9	1126.7	1134.7	1162.9	1180.7

GENERACION HIDROTERERICA Y DEMANDAS DEL SISTEMA NACIONAL INTERCONECTADO Table A-4-6 Hydroelectric Power Generation and Demand of SNI

DIA	CENTRAL PAUTE		C. P U C A R A		C. A G O Y A N		G.ZEVALLOS		CHANGOP		S. ROSA		Gener. Inecel		D E M A N D A S								
	Cota Caudal (m3/s)	Mwh	Cota Caudal (m3/s)	Mwh	Caudal (m3/s)	Mwh	Mwh	Mwh	Mwh	Mwh	max	Gwh	Inecel	Gwh	Inecel	Mw	Mw						
1	83.64	92.34	61.67	2.71	212	70	92.00	950	156	3272	136	2856	125	8.4	58	6.1	14.5	83	17.6	973	91	1071	
2	84.23	82.53	61.71	5.71	326	70	80.00	2696	155	3294	136	2850	125	11.1	64	6.3	17.4	83	20.9	1011	84	1205	
3	84.14	68.66	61.66	2.93	494	74	75.00	2509	156	3282	136	2770	125	11.8	85	6.3	18.0	83	21.8	1021	83	1229	
4	83.68	60.91	61.61	3.59	553	70	75.00	2327	156	3178	136	2860	125	12.0	66	6.2	18.2	83	21.9	1018	83	1226	
5	83.01	57.27	61.51	2.75	709	70	87.00	2781	156	1618	68	2887	126	12.9	45	4.7	17.6	82	21.4	965	81	1188	
6	82.16	51.73	61.47	1.36	307	70	78.00	2358	156	1617	68	2895	126	11.9	72	4.6	16.6	81	20.4	949	83	1151	
7	81.81	58.40	61.35	3.28	848	74	66.00	2027	156	1618	68	2325	125	11.2	74	4.0	15.2	81	18.8	932	86	1080	
8	81.31	46.03	61.33	1.97	269	74	62.00	2023	156	1620	69	2762	121	9.5	69	4.4	14.0	80	17.5	943	89	1064	
9	79.83	40.84	61.18	1.46	823	74	57.00	1793	156	2286	136	2757	121	12.3	68	5.9	17.8	82	21.6	1032	85	1218	
10	78.76	51.03	61.06	1.90	723	74	66.00	1817	156	2849	136	2754	122	13.5	74	4.8	18.4	82	22.4	1024	83	1241	
11	77.22	47.07	60.89	2.36	993	74	62.00	1866	156	1866	136	2570	121	13.4	73	4.9	18.3	84	21.8	1016	83	1218	
12	75.26	36.82	60.69	1.14	1020	74	57.00	1841	156	3168	136	1306	120	13.9	76	4.4	18.4	83	22.0	1018	84	1215	
13	72.95	34.17	60.47	0.79	1078	74	53.00	1780	156	2327	136	1820	118	13.1	82	2.8	16.0	82	19.5	940	86	1099	
14	71.08	34.46	60.15	0.46	1502	74	68.00	2056	156	1357	106	1340	70	11.2	78	3.2	14.4	90	15.9	977	90	1066	
15	69.95	40.62	59.90	0.85	1213	70	70.00	1951	156	1324	136	1855	120	12.6	71	5.1	17.7	83	21.3	1000	81	1229	
16	68.17	34.69	59.59	1.64	1551	74	59.00	1944	156	2261	136	2720	121	11.9	66	6.2	18.1	83	21.8	1000	81	1230	
17	66.37	29.71	59.24	0.64	1636	74	57.00	1878	156	3266	136	2716	120	12.2	66	6.2	18.4	84	21.9	1003	82	1219	
18	64.20	26.33	58.89	0.67	1631	74	60.00	1838	156	3236	136	2749	126	11.7	65	6.4	18.1	84	21.7	1035	86	1205	
19	61.98	23.91	58.55	1.37	1640	74	58.00	1770	156	3227	136	2820	126	11.4	65	6.3	17.6	81	21.9	984	82	1205	
20	59.93	25.96	58.22	1.84	1630	70	58.00	1816	156	3261	136	2705	122	8.7	58	6.2	15.0	78	19.3	945	86	1101	
21	59.28	30.55	57.89	1.92	1629	70	65.00	2011	156	3256	136	2725	120	7.4	54	6.2	13.6	76	17.8	896	83	1084	
22	60.21	51.25	57.64	6.18	1648	70	59.00	1863	156	3265	136	2727	120	9.6	61	6.1	15.8	79	20.1	995	86	1158	
23	58.97	28.26	57.31	2.03	1624	70	57.00	1811	156	3266	136	2640	120	10.1	65	5.5	15.6	79	19.7	913	81	1129	
24	57.60	29.66	56.95	0.87	1643	74	57.00	1995	156	2856	136	2372	121	7.1	53	6.3	13.4	78	17.1	854	84	1019	
25	57.73	33.65	56.61	1.82	1631	70	57.00	1783	156	3284	136	2772	121	9.2	60	6.2	15.4	79	19.5	950	80	1189	
26	56.40	24.64	56.25	1.04	1638	70	59.00	1799	156	3187	136	2734	121	15.9	62	6.0	15.9	77	20.6	921	79	1168	
27	54.95	27.63	55.91	2.09	1635	70	59.00	1899	156	3065	136	2735	121	7.2	55	6.0	13.2	73	18.1	822	77	1068	
28	55.37	38.82	55.55	1.19	1630	70	61.00	1932	156	3950	136	2745	121	5.6	47	6.3	11.9	69	17.1	789	76	1035	
29	57.56	73.66	55.23	3.28	1635	70	56.00	72	78	3265	136	2737	121	7.8	55	6.2	14.0	72	19.5	895	78	1150	
30	61.50	110.49	54.90	1.47	1508	70	56.00	2327	156	3262	136	2741	120	7.1	53	6.2	13.3	72	18.4	822	77	1070	
31	63.10	63.55	54.56	1.16	1529	70	65.00	1968	156	3268	136	2716	120	328.5	171.2	499.8	621.1	1043	1241	1043	1043	1241	
TOT/FEW/MX	46.96	23237	2.02	36908	7.4	7.4	64.23	59381	84951	79971	4239	2070	328.5	65.7	34.3	80.5	630	1027	1299	1299	1299	1299	1299
PROG	72.50	62.90	56.00	3.50	32700	6.2	63.00	72032	67859	82287	2800	3600	373.8	156.5	530.4	630	1027	1299	1299	1299	1299	1299	1299
								13.6	12.8	15.5	0.5	0.7	70.5	29.5	84.2								

○ : Sunday

(3) Fault Record

INECEL

	1990	1991	1992	(unit : %) Average
Paute (Hydro)				
1	0.08	0.56	2.08	} 1.87
2	0.08	0.02	0.45	
3	2.58	0.13	0.99	
4	0.10	0.06	1.62	
5	0.21	0.31	18.75	
6			<del>44.57</del> *	
7			<del>27.96</del>	
8			<del>29.76</del>	
9			<del>18.01</del>	
10			<del>31.82</del>	
* To neglect due to initial faults				
Pisayambo (Hydro)				
1	1.86	0.54	0.55	} 0.66
2	1.02	0.00	0.01	
Agoyan (Hydro)				
1	0.07	0.25	0.15	} 0.14
2	-	0.25	0.00	
Esmeraldas (Vapor)				
1	0.04	0.13	2.24	0.80
Estero Salado (Vapor)				
Vap 2	1.27	0.60	0.25	} 0.48
Vap 3	0.24	0.02	-	
Vap 4	-	-	-	
Sta. Rosa (Gas)				
1	9.45	68.15	5.47	} 20.23
2	2.68	0.26	2.67	
3	18.61	1.44	12.67	
Guangopalo (Diesel)				
1	1.04	0.82	18.38	} 17.54
2	0.82	-	0.51	
3	0.85	-	1.12	
4	1.77	24.79	86.7	
5	0.96	8.24	69.11	
6	2.96	62.67	0.00	

EEQ

Pasochoa (Hydro)

	1984	1985	1986	1987	1988	1989	1990	Average
No. 1	2	1	0	0	0	0	0	} 0.36
No. 2	0	2	0	0	0	0	0	

Los Chillos (Hydro)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Average
No. 1	1.0	0	0	6.0	0	0	0	7.0	0	0	} 2.65
No. 2	2.1	0	0	6.0	0	0	0	3.0	0	0	

Nayon (Hydro)

	1983	1984	1985	1986	1987	1988	1989	1990	Average
No. 1	1.8	2.0	3.9	3.0	3.8	3.5	2.4	4.9	} 3.13
No. 2	1.9	1.6	3.9	3.2	4.2	3.1	2.3	4.5	

Cumbaya (Hydro)

	1983	1984	1985	1986	1987	1988	1989	1990	Average
No. 1	3.3	3.3	4.2	3.6	4.1	5.3	4.1	5.4	} 3.84
No. 2	1.9	2.2	4.5	4.3	4.7	3.4	3.2	5.9	
No. 3	2.8	2.4	4.0	3.0	3.0	3.2	3.0	5.6	
No. 4	1.9	2.6	3.9	4.9	6.2	4.0	3.6	5.3	

EMELEC

Estero Salado

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Average
Steam	0.3	6.5	0.8	1.9	0.3	1.7	19.7	14.2	0	5.6	5.10
Gas Turbine											
No. 1	32.0	0	0	-	5.7	14.3	0	0	0	30.7	} 10.73
No. 2	0.3	0	54.5	-	-	-	-	0	28.5	43.0	
No. 3	0.3	3.6	0	0	0	7.8	15.4	-	-	-	
No. 5	0.9	0	0	0	3.6	0	0	5.43	9.86	0	} 8.05
No. 6	1.9	0	0	0	0	0	0	0.16	0	0	

Guayaquil

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Average
Steam											
No. 1	62.5	53.2	18.2	29.8	24.0	37.2	22.4	36.4	36.4	37.8	} 30.30
No. 2	30.1	27.3	18.5	11.9	19.6	24.9	21.2	32.2	34.7	27.6	
No. 3	5.2	8.8	8.0	3.0	4.4	6.4	5.2	5.2	5.0	6.6	} 6.20
No. 4	7.2	5.8	6.9	5.2	7.2	4.1	7.4	6.3	7.2	8.5	
Gas Turbine											
	37.2	26.4	12.9	14.3	12.1	8.8	8.0	3.9	10.2	5.8	14.00



#### A-4-2 需要変動分布を作成するためのデータ作成

気温以外の要素による需要変動分布の作成は、連系系統信頼度解析プログラム (REPORT) で行う。

最大電力需要実績値(MW)と最大電力需要予測値(MW)を入力データとして、気温以外の要素による需要変動分布を作成するためのデータを作成する。

##### (1) 計算手順

- ① 最大電力需要実績と最大電力需要予測値より、計算する年、月について需要変動誤差率を計算する。

需要変動誤差率

$$= \frac{\text{最大電力需要実績値(MW)} - \text{最大電力需要予測値(MW)}}{\text{最大電力需要予測値(MW)}} \times 100 (\%)$$

- ② 計算された需要変動誤差率の平均値と標準偏差を計算する

$$\text{平均値} = \frac{\text{需要変動誤差率の合計}}{\text{データ数}} (\%)$$

$$\text{標準偏差} = \sqrt{\frac{(\text{需要変動誤差率} - \text{平均値})^2 \text{の合計}}{\text{データ数}}} (\%)$$

- ③ 計算された平均値、標準偏差に検討時期の最大電力(MW)をかけて、単位をMWに変換したものを、REPORTの入力データに用いる。

(2) 入力データの説明

① 入力データの説明

表 A-4-7 入力データの説明

No	変数名	型	単位	説明
1	C			No.2のデータの並びを記述
2	SYSTEM	I1		系統数。(最大4)
3	C			No.4のデータの並びを記述
4	REAL	I2		実績値データ年数。(最大50)
5	C			No.6のデータの並びを記述
6	CODE	C8		系統名称
7	C			No.8のデータの並びを記述
8	YEAR	I4		最大電力需要実績値データ年
9	C			No.10のデータの並びを記述
10	RDATA	F8	MW	最大電力需要実績値
11	C			No.12のデータの並びを記述
12	PROG	I2		予測値データ年数。(最大50)
13	C			No.14のデータの並びを記述
14	CODE	C8		系統名称
15	C			No.16のデータの並びを記述。
16	YEAR	I4		最大電力需要予測値データ年
17	C			No.18のデータの並びを記述
18	PDATA	F8	MW	最大電力需要予測値
19	C			No.20のデータの並びを記述
20	NMONTH	I2		計算に用いる月数。(最大12)
21	C			No.22のデータの並びを記述
22	MH	I2		計算に用いる月

No. : 入力データの番号。入力データ書式のNo.と一致している。

変数名 : 入力データの変数名

型 : 入力データの型と最大桁数

型 C : 文字

F : 小数点付数字

I : 整数

最大桁数 : C, F, I の後の数字が最大桁数である。

単位 : 入力データの単位

説明 : 入力データの説明

② 入力データ書式

入力データ書式の一覧表では、の部分にデータを入力する。

データの型が、C (文字) の場合には、左づめ、F (小数点付数字)、

I (整数) の場合には、右づめで入力する。

Table A-4-8 Input Data Format

No.	1	2	3	4	5	6	7
1	C	SYSTEM					
2							
3	C	REAL					
4							
5	C	CODE					
6							
7	C	YEAR	YEAR	YEAR	YEAR	YEAR	YEAR
8							
9	C	MONTH	RDATA	RDATA	RDATA	RDATA	RDATA
10							
11	C	PROC					
12							
13	C	CODE					
14							
15	C	YEAR	YEAR	YEAR	YEAR	YEAR	YEAR
16							
17	C	MONTH	PDATA	PDATA	PDATA	PDATA	PDATA
18							
19	C	NMONTH					
20							
21	C	MH	MH	MH	MH	MH	MH
22							

(3) 計算例

① 入力データ例

C	SYSTEM					
	2					
C	REAL					
	11					
C	CODE					
	NORTH					
C		YEAR	YEAR	YEAR	YEAR	YEAR
		1981	1982	1983	1984	1985
C	MONTH	RDATA	RDATA	RDATA	RDATA	RDATA
	1	241.8	257.8	273.9	294.6	317.2
	2	240.3	259.6	276.4	301.7	326.3
	3	239.2	271.5	278.9	300.8	328.4
	4	241.9	264.3	284.4	299.4	323.8
	5	241.2	262.8	287.3	303.9	326.0
	6	248.0	268.0	293.8	301.4	325.0
	7	247.3	265.0	283.0	298.9	327.6
	8	238.5	257.8	280.8	298.0	329.1
	9	246.4	263.6	277.8	305.8	321.0
	10	251.4	268.6	287.8	308.3	341.1
	11	254.3	272.9	292.7	316.9	342.7
	12	258.0	279.7	300.2	316.0	345.3
C		YEAR	YEAR	YEAR	YEAR	YEAR
		1986	1987	1988	1989	1990
C	MONTH	RDATA	RDATA	RDATA	RDATA	RDATA
	1	314.4	336.8	399.5	393.9	408.9
	2	321.3	344.0	377.9	393.3	412.1
	3	315.7	377.6	377.8	390.4	421.9
	4	314.0	344.8	382.6	400.2	413.8
	5	318.6	341.9	378.1	408.1	424.6
	6	326.8	353.7	378.4	401.1	430.5
	7	321.9	346.2	380.9	404.5	428.9
	8	313.8	347.9	370.5	389.7	416.4
	9	315.5	363.5	374.7	400.8	434.0
	10	333.0	369.2	390.6	416.7	439.5
	11	342.6	386.3	393.4	423.0	463.2
	12	340.3	385.4	396.3	422.5	464.2
C		YEAR				
		1991				
C	MONTH	RDATA				
	1	450.6				
	2	442.9				
	3	446.0				
	4	451.5				
	5	462.7				
	6	463.9				
	7	463.8				
	8	460.8				
	9	458.6				
	10	438.6				
	11	493.1				
	12	491.4				
C	CODE					
	SOUTH					
C		YEAR	YEAR	YEAR	YEAR	YEAR
		1981	1982	1983	1984	1985
C	MONTH	RDATA	RDATA	RDATA	RDATA	RDATA
	1	386.8	424.2	446.2	459.1	465.3
	2	388.1	427.6	434.7	443.3	474.6
	3	391.4	424.5	439.2	437.6	476.7
	4	391.0	437.1	435.0	451.5	475.9
	5	390.4	440.8	452.4	439.1	479.2

		6	376.5	430.0	447.3	438.0	478.7
		7	374.5	418.7	448.0	426.0	492.0
		8	390.4	423.5	438.7	426.3	492.3
		9	402.6	435.3	433.8	430.2	488.4
		10	404.2	446.9	421.0	451.8	480.3
		11	408.0	466.5	432.4	447.9	492.6
		12	444.7	477.6	442.5	472.9	505.9
C			YEAR	YEAR	YEAR	YEAR	YEAR
			1986	1987	1988	1989	1990
C	MONTH		RDATA	RDATA	RDATA	RDATA	RDATA
		1	454.9	507.4	588.8	570.9	644.0
		2	470.8	503.7	557.8	557.5	627.2
		3	468.5	500.4	556.0	568.6	650.2
		4	474.4	514.2	570.2	577.4	636.6
		5	475.3	524.6	567.3	582.4	630.4
		6	461.8	514.2	559.1	561.9	626.0
		7	461.9	512.0	542.6	559.7	623.5
		8	458.5	516.9	539.7	565.1	621.0
		9	472.6	531.9	557.2	596.0	634.8
		10	475.3	532.7	558.2	606.4	636.9
		11	491.8	554.9	562.2	608.8	658.5
		12	525.1	579.4	594.1	630.6	700.2
C			YEAR				
			1991				
C	MONTH		RDATA				
		1	682.1				
		2	677.3				
		3	678.0				
		4	696.9				
		5	712.0				
		6	697.3				
		7	684.8				
		8	687.6				
		9	695.5				
		10	703.2				
		11	752.7				
		12	749.5				
C	PROG						
		18					
C	CODE						
	NORTH						
C			YEAR	YEAR	YEAR	YEAR	YEAR
			1986	1987	1988	1989	1990
C	MONTH		PDATA	PDATA	PDATA	PDATA	PDATA
		1	370.9	365.3	385.4	396.8	400.0
		2	358.6	373.8	389.3	406.4	412.8
		3	372.4	374.1	393.7	403.9	413.7
		4	355.8	374.5	392.0	407.3	415.3
		5	372.7	367.8	391.4	411.0	425.4
		6	370.5	377.2	392.6	413.0	428.1
		7	365.0	363.6	391.7	406.1	418.1
		8	366.6	364.8	387.4	396.0	412.7
		9	355.7	377.1	386.3	393.8	421.4
		10	379.6	384.5	408.6	412.1	437.8
		11	371.5	393.7	415.8	422.0	450.5
		12	370.8	395.1	418.8	428.0	450.6
C			YEAR	YEAR	YEAR	YEAR	YEAR
			1991	1992	1993	1994	1995
C	MONTH		PDATA	PDATA	PDATA	PDATA	PDATA
		1	447.4	497.9	508.4	535.9	560.3
		2	430.9	516.5	501.4	528.5	552.6
		3	438.3	491.9	511.4	539.1	563.7

	4	446.6	470.7	511.2	538.9	563.4
	5	439.5	483.3	515.7	543.6	568.4
	6	443.5	484.3	508.8	536.3	560.7
	7	442.7	480.6	508.1	535.6	560.0
	8	437.0	487.2	502.0	529.2	553.3
	9	447.7	491.4	520.7	548.9	573.9
	10	462.3	495.7	529.5	558.2	583.7
	11	460.3	526.9	542.7	572.1	598.2
	12	467.5	535.3	558.7	588.9	615.8
C		YEAR	YEAR	YEAR	YEAR	YEAR
		1996	1997	1998	1999	2000
C	MONTH	PDATA	PDATA	PDATA	PDATA	PDATA
	1	582.9	612.7	645.1	680.2	709.1
	2	574.9	604.2	636.3	670.9	699.3
	3	586.4	616.4	649.0	684.3	713.4
	4	586.1	616.0	648.7	684.0	713.0
	5	591.3	621.5	654.5	690.1	719.3
	6	583.3	613.1	645.6	680.7	709.6
	7	582.5	612.3	644.8	679.9	708.7
	8	575.6	604.9	637.0	671.7	700.2
	9	597.0	627.5	660.8	696.7	726.3
	10	607.1	638.1	672.0	708.5	738.6
	11	622.3	654.1	688.8	726.2	757.0
	12	640.6	673.3	709.0	747.5	779.2
C		YEAR	YEAR	YEAR	YEAR	YEAR
		2001	2002	2003		
C	MONTH	PDATA	PDATA	PDATA		
	1	762.9	803.4	843.9		
	2	752.4	792.4	832.3		
	3	767.5	808.3	849.0		
	4	767.1	807.9	848.5		
	5	773.9	815.1	856.1		
	6	763.5	804.0	844.6		
	7	762.4	803.0	843.5		
	8	753.3	793.4	833.3		
	9	781.4	823.0	864.4		
	10	794.6	836.9	879.0		
	11	814.4	857.8	901.0		
	12	838.4	883.0	927.4		
C CODE						
SOUTH						
C		YEAR	YEAR	YEAR	YEAR	YEAR
		1986	1987	1988	1989	1990
C	MONTH	PDATA	PDATA	PDATA	PDATA	PDATA
	1	536.8	550.3	568.1	575.1	629.9
	2	525.5	547.4	574.6	576.1	628.4
	3	552.5	554.4	579.6	588.2	637.7
	4	537.4	558.6	584.0	587.5	638.9
	5	556.2	564.4	587.2	586.5	631.6
	6	523.6	548.5	580.2	578.6	622.7
	7	523.7	537.7	558.1	562.0	607.8
	8	535.7	541.9	564.5	574.3	615.5
	9	533.0	552.0	574.5	585.5	616.4
	10	541.7	555.0	584.1	599.8	634.5
	11	533.5	565.7	594.2	607.5	640.4
	12	572.2	593.9	627.8	638.8	679.9
C		YEAR	YEAR	YEAR	YEAR	YEAR
		1991	1992	1993	1994	1995
C	MONTH	PDATA	PDATA	PDATA	PDATA	PDATA
	1	677.3	759.4	803.6	858.0	904.0
	2	659.0	780.7	792.5	846.2	891.6
	3	666.4	759.5	808.5	863.2	909.5

	4	689.5	746.8	808.0	862.7	909.0						
	5	676.3	757.4	815.2	870.4	917.1						
	6	666.7	747.2	804.2	858.6	904.7						
	7	653.6	737.1	803.2	857.5	903.5						
	8	651.9	729.2	793.5	847.2	892.6						
	9	679.0	755.0	823.1	878.8	925.9						
	10	672.4	760.1	837.1	893.7	941.6						
	11	702.6	807.2	858.0	916.0	965.1						
	12	713.2	837.1	883.1	942.9	993.4						
C		YEAR	YEAR	YEAR	YEAR	YEAR						
		1996	1997	1998	1999	2000						
C	MONTH	PDATA	PDATA	PDATA	PDATA	PDATA						
	1	953.3	1007.3	1059.8	1114.1	1144.1						
	2	940.2	993.5	1045.1	1098.8	1128.4						
	3	959.1	1013.4	1066.2	1120.9	1151.0						
	4	958.6	1012.9	1065.6	1120.2	1150.4						
	5	967.1	1021.9	1075.0	1130.2	1160.7						
	6	954.1	1008.1	1060.6	1115.0	1145.0						
	7	952.8	1006.8	1059.2	1113.5	1143.5						
	8	941.3	994.7	1046.5	1100.1	1129.7						
	9	976.5	1031.8	1085.5	1141.2	1171.9						
	10	993.0	1049.3	1103.9	1160.5	1191.7						
	11	1017.7	1075.4	1131.4	1189.5	1221.5						
	12	1047.6	1107.0	1164.6	1224.4	1257.4						
C		YEAR	YEAR	YEAR								
		2001	2002	2003								
C	MONTH	PDATA	PDATA	PDATA								
	1	1233.5	1303.2	1377.4								
	2	1216.6	1285.2	1358.4								
	3	1241.0	1311.1	1385.7								
	4	1240.4	1310.3	1385.0								
	5	1251.4	1322.0	1397.3								
	6	1234.5	1304.2	1378.4								
	7	1232.9	1302.5	1376.6								
	8	1218.1	1286.8	1360.1								
	9	1263.5	1334.8	1410.8								
	10	1284.9	1357.4	1434.7								
	11	1317.0	1391.3	1470.5								
	12	1355.6	1432.1	1513.7								
C	NMONTH											
C	MH	MH	MH	MH	MH	MH						
	1	2	3	4	5	6	7	8	9	10	11	12

② 需要変動誤差率計算例

データNo.	最大電力需要 実績値(MW)	最大電力需要 予測値(MW)	需要予測誤差(%)
1	314.400	370.900	-15.23322
2	321.300	358.600	-10.40157
3	315.700	372.400	-15.22555
4	314.000	355.800	-11.74818
5	318.600	372.700	-14.51566
6	326.800	370.500	-11.79485
7	321.900	365.000	-11.80824
8	313.800	366.600	-14.40263
9	315.500	355.700	-11.30164
10	333.000	379.600	-12.27610
11	342.600	371.500	-7.77925
12	340.300	370.800	-8.22545
13	336.800	365.300	-7.80180
14	344.000	373.800	-7.97219
15	377.600	374.100	0.93558
16	344.800	374.500	-7.93056
17	341.900	367.800	-7.04191
18	353.700	377.200	-6.23012
19	346.200	363.600	-4.78552
20	347.900	364.800	-4.63271
21	363.500	377.100	-3.60649
22	369.200	384.500	-3.97921
23	386.300	393.700	-1.87958
24	385.400	395.100	-2.45512
25	399.500	385.400	3.65856
26	377.900	389.300	-2.92837
27	377.800	393.700	-4.03858
28	382.600	392.000	-2.39793
29	378.100	391.400	-3.39801
30	378.400	392.600	-3.61696
31	380.900	391.700	-2.75722
32	370.500	387.400	-4.36239
33	374.700	386.300	-3.00287
34	390.600	408.600	-4.40528
35	393.400	415.800	-5.38724
36	396.300	418.800	-5.37249
37	393.900	396.800	-0.73088
38	393.300	406.400	-3.22339
39	390.400	403.900	-3.34241
40	400.200	407.300	-1.74321
41	408.100	411.000	-0.70557
42	401.100	413.000	-2.88133
43	404.500	406.100	-0.39402
44	389.700	396.000	-1.59092
45	400.800	393.800	1.77753
46	416.700	412.100	1.11620
47	423.000	422.000	0.23697
48	422.500	428.000	-1.28505
49	408.900	400.000	2.22497
50	412.100	412.800	-0.16956
51	421.900	413.700	1.98210
52	413.800	415.300	-0.36118
53	424.600	425.400	-0.18801
54	430.500	428.100	0.56059
55	428.900	418.100	2.58307
56	416.400	412.700	0.89652
57	434.000	421.400	2.99006
58	439.500	437.800	0.38829
59	463.200	450.500	2.81908
60	464.200	450.600	3.01816
61	450.600	447.400	0.71529
62	442.900	430.900	2.78487
63	446.000	438.300	1.75678
64	451.500	446.600	1.09716
65	462.700	439.500	5.27871
66	463.900	443.500	4.59975
67	463.800	442.700	4.76623
68	460.800	437.000	5.44623
69	458.600	447.700	2.43470
70	438.600	462.300	-5.12653
71	493.100	460.300	7.12579
72	491.400	467.500	5.11228



データ数は、入力した最大電力需要実績値と最大電力需要予測値データの共通の年、1986～1991年の年数6 と入力データで指定した計算に用いる月数12をかけた数72 ( 6×12 )となる。

③ 出力結果例

```
SYSTEM CODE      =  NORTH
STANDARD DEVIATION =      5.40943 ( %)
AVERAGE VALUE    =     -2.77960 ( %)
```

検討年の系統の最大電力を496(MW) とすれば、REPORTに入力するデータは、

$$\text{平均値} = -2.77960/100 \times 496 = -13.79 \text{ (MW)}$$

$$\text{標準偏差} = 5.40943/100 \times 496 = 26.83 \text{ (MW)}$$

となる。

### A-4-3 出水変動分布作成

各発電所の日流入量 [m<sup>3</sup>/s] と電水比 [kW/(m<sup>3</sup>/s)] を入力データとして、出水変動分布を作成する。

#### (1) 計算手順

- ① 日流入量  $W$  [m<sup>3</sup>/s] と電水比  $R$  [kW/(m<sup>3</sup>/s)] より、各日の平均可能電力 [MW] を計算する。

$$P = \frac{W \times R}{1000}$$

- ②  $P$  を大きい順にならべかえる。

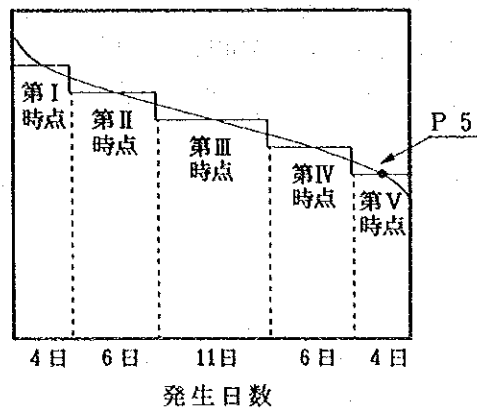


図1 代表出水時点説明図

- ③ 各日の平均可能電力  $P$  と第V時点の中間の平均可能電力  $P_5$  の差  $\Delta P$  から、 $\Delta P$  の度数を求める。そして、月の日数 (31日) で割り、確率に直す。

(2) 計算例

水力発電所Aがあるとする。電水比を  $1,291 \text{ [kW/(m}^3\text{/s)]}$  とする。

日流入量データを表 A-4-9 に示す。

表 A-4-9 日流入量データ

年	1990	1991	1992
日	日流入量 [m <sup>3</sup> /s]		
1	71	92	52
2	60	80	63
3	68	75	63
4	85	75	66
5	76	87	59
6	64	78	61
7	62	66	59
8	56	62	61
9	54	57	62
10	48	66	59
11	52	62	60
12	52	57	68
13	47	53	70
14	57	68	60
15	48	70	57
16	68	59	54
17	168	57	50
18	105	60	62
19	96	58	42
20	76	58	61
21	94	65	60
22	72	59	65
23	68	57	64
24	72	57	78
25	92	57	84
26	64	59	83
27	68	59	70
28	59	61	66
29	60	56	52
30	61	56	47
31	71	65	47

日流入量と電水比より各日の平均可能電力を計算した結果を 表 A-4-10 に示す。

表 A-4-10 各日の平均可能電力計算結果

年	1990	1991	1992
日	平均可能電力 [m <sup>3</sup> /s]		
1	92	119	67
2	77	103	81
3	88	97	81
4	110	97	85
5	98	112	76
6	83	101	79
7	80	85	76
8	72	80	79
9	70	74	80
10	62	85	76
11	67	80	77
12	67	74	88
13	61	68	90
14	74	88	77
15	62	90	74
16	88	76	70
17	217	74	65
18	136	77	80
19	124	75	54
20	98	75	79
21	121	84	77
22	93	76	84
23	88	74	83
24	93	74	101
25	119	74	108
26	83	76	107
27	88	76	90
28	76	79	85
29	77	72	67
30	79	72	61
31	92	84	61

各日の平均可能電力の合計を計算し、大きい順に並べ替えた結果を  
表 A-4-11 に示す。

表 A-4-11 各日の平均可能電力

日	平均可能電力 [MW]	
	合 計	大きい順にならべかえた結果
1	278	356
2	261	301
3	266	293
4	292	292
5	286	286
6	263	282
7	241	278
8	231	268
9	224	266
10	223	266
11	224	263
12	229	261
13	219	254
14	239	253
15	226	253
16	234	252
17	356	245
18	293	241
19	253	240
20	252	239
21	282	237
22	253	234
23	245	231
24	268	229
25	301	226
26	266	224
27	254	224
28	240	223
29	216	219
30	212	216
31	237	212

表3の各日の平均可能電力の合計を大きい順に並べ替えた結果より、第V時点の中間の平均可能電力は、

$$\text{第V時点の中間の平均可能電力} = (219+216) / 2 = 217.5$$

各日の平均可能電力と第V時点の中間の平均可能電力の差を計算した結果を表A-4-12に示す。

表 A-4-12 各日の平均可能電力と第V時点の中間の平均可能電力の差

日	平均可能電力と第V時点の中間の平均可能電力の差 [MW]
1	138.5
2	83.5
3	75.5
4	74.5
5	68.5
6	64.5
7	60.5
8	50.5
9	48.5
10	48.5
11	45.5
12	43.5
13	36.5
14	35.5
15	35.5
16	34.5
17	27.5
18	23.5
19	22.5
20	21.5
21	19.5
22	16.5
23	13.5
24	11.5
25	8.5
26	6.5
27	6.5
28	5.5
29	1.5
30	- 1.5
31	- 5.5

各日の平均可能電力と第V時点の中間の平均可能電力の差の度数を計算し、月の日数31で割り、確率に直したものを出水変動分布とする。

表 A-4-13 に出水変動分布を示す。

表 A-4-13 出水変動分布

No	MW	度数	確率
1	138.5	1	0.03226
2	83.5	1	0.03226
3	75.5	1	0.03226
4	74.5	1	0.03226
5	68.5	1	0.03226
6	64.5	1	0.03226
7	60.5	1	0.03226
8	50.5	1	0.03226
9	48.5	2	0.06452
10	45.5	1	0.03226
11	43.5	1	0.03226
12	36.5	1	0.03226
13	35.5	2	0.06452
14	34.5	1	0.03226
15	27.5	1	0.03226
16	23.5	1	0.03226
17	22.5	1	0.03226
18	21.5	1	0.03226
19	19.5	1	0.03226
20	16.5	1	0.03226
21	13.5	1	0.03226
22	11.5	1	0.03226
23	8.5	1	0.03226
24	6.5	2	0.06452
25	5.5	1	0.03226
26	1.5	1	0.03226
27	- 1.5	1	0.03226
28	- 5.5	1	0.03226

(3) 入力データと出力

① 入力データ説明

表 A-4-14 入力データの説明

No.	変数名	型	単位	説明
1	C			No 2 データの並びを記述 発電所数。(最大5)
2	NPS	I2		
3	C			No 4 データの並びを記述 発電所名称
4	PSNAME	C8		
	EWR	F8	kw/(m <sup>2</sup> /s)	電水比
5	C			No 6 データの並びを記述 データ年数。(最大20)
6	NYEAR	I2		
7	C			No 8 データの並びを記述 データ年
8	YEAR	I4		
9	C			No 10 データの並びを記述 日流入量
10	VOLUME	F8	m <sup>3</sup> /s	
11	C			No 12 データの並びを記述 計算するケース数
12	NCASE	I2		
13	C			No 14 データの並びを記述 計算するケース名称
14	CASENA	C78		
15	C			No 16 データの並びを記述 合成する発電所名称 (PSNAMEの数はNo 2 のNPSの数に 一致させること。)
16	PSNAME	C8		

No. : 入力データの番号。入力データ書式のNoと一致している。

変数名 : 入力データの変数名

型 : 入力データの型と最大桁数

型 C : 文字

F : 小数点付数字

I : 整数

最大桁数 : C, F, I の後の数字が最大桁数である。

単位 : 入力データの単位

説明 : 入力データの説明

② 入力データ書式

入力データ書式の一覧表では、の部分にデータを入力する。

データの型が、C (文字) の場合には、左づめ、F (小数点付数字)、

I (整数) の場合には、右づめで入力する。



Table A-4-15 Input Data Format

No.	1	2	3	4	5	6	7
	I						
	12345678901234567890123456789012345678901234567890						
1	C	NPS					
2							
3	C	PSNAME	EWR				
4							
5	C	NYEAR					
6							
7	C	YEAR	YEAR	YEAR	YEAR	YEAR	YEAR
8							
9	C	VOLUME	VOLUME	VOLUME	VOLUME	VOLUME	VOLUME
10							
11	C	NCASE					
12							
13	C	CASENA					
14							
15	C	PSNAME	PSNAME	PSNAME	PSNAME	PSNAME	PSNAME
16							

③ 入力データ例

\* INPUT DATA \* 1 PAGE

-----10-----20-----30-----40-----50-----60-----70						
1	C	NPS				
2		2				
3	C	PSNAME	EWR			
4		PISAYAMB	352B.			
5	C	NYEAR				
6		14				
7	C		YEAR	YEAR	YEAR	YEAR
8			1979	1980	1981	1982
9	C		VOLUME	VOLUME	VOLUME	VOLUME
10	1		9.68	1.70	2.17	2.42
11	2		5.51	1.81	2.41	2.73
12	3		6.40	3.55	1.19	3.53
13	4		4.88	3.80	3.30	5.37
14	5		5.36	2.50	3.34	4.10
15	6		14.71	3.48	4.14	5.24
16	7		17.42	1.24	0.52	4.58
17	8		14.71	1.22	1.96	2.91
18	9		11.22	3.92	2.22	2.48
19	10		6.34	5.29	2.55	2.50
20	11		5.50	1.92	2.92	0.00
21	12		4.73	1.99	13.19	0.49
22	13		3.51	4.45	13.19	1.96
23	14		2.36	2.62	4.77	4.66
24	15		4.45	1.89	2.77	3.08
25	16		3.66	1.96	5.10	2.80
26	17		4.32	2.50	4.42	5.78
27	18		1.11	1.63	4.87	5.94
28	19		6.95	2.57	0.27	7.91
29	20		2.64	4.11	2.13	8.57
30	21		1.67	2.29	2.57	8.08
31	22		4.54	4.32	5.32	6.61
32	23		2.36	1.64	4.37	5.69
33	24		3.18	3.21	4.15	3.54
34	25		2.32	2.29	5.07	4.94
35	26		0.14	1.19	2.82	2.54
36	27		4.22	2.43	2.82	5.55
37	28		1.09	1.81	2.96	7.85
38	29		1.98	1.93	4.12	7.48
39	30		2.10	1.93	4.56	4.52
40	31		7.62	1.31	4.66	3.49
41	C		YEAR	YEAR	YEAR	YEAR
42			1984	1985	1986	1987
43	C		VOLUME	VOLUME	VOLUME	VOLUME
44	1		5.56	0.95	1.87	3.51
45	2		5.28	0.90	1.04	7.32
46	3		4.07	2.69	1.80	3.58
47	4		3.80	1.37	2.87	6.51
48	5		3.12	1.47	3.61	5.06
49	6		2.82	2.34	4.99	2.85
50	7		2.83	1.03	3.95	3.61
-----10-----20-----30-----40-----50-----60-----70						

		10	20	30	40	50	60	70
51	8	2.70	1.76	4.74	3.33	4.60		
52	9	2.01	6.66	14.33	2.23	1.66		
53	10	2.18	2.03	15.33	1.50	2.10		
54	11	2.54	5.72	13.78	3.81	2.45		
55	12	2.18	0.16	7.80	2.33	2.73		
56	13	2.20	1.46	5.31	3.65	2.07		
57	14	2.23	1.88	4.31	10.39	3.38		
58	15	1.78	0.57	3.16	7.29	4.75		
59	16	1.60	2.32	5.03	5.49	3.72		
60	17	1.80	1.79	3.91	2.66	5.90		
61	18	5.44	0.77	2.82	2.34	6.94		
62	19	10.83	0.59	3.50	2.42	5.70		
63	20	6.58	2.39	4.70	9.99	3.23		
64	21	7.59	1.43	20.82	25.18	3.08		
65	22	5.63	0.15	23.07	15.42	3.16		
66	23	4.71	3.78	24.14	12.35	0.83		
67	24	3.71	1.23	11.98	9.80	2.72		
68	25	3.37	1.39	7.04	6.91	1.75		
69	26	5.26	1.89	6.64	5.60	2.95		
70	27	4.90	2.54	4.25	4.17	2.84		
71	28	5.10	3.30	3.50	3.80	2.08		
72	29	5.61	5.25	4.31	3.02	3.89		
73	30	4.69	2.81	3.58	4.30	2.84		
74	31	3.55	2.43	3.33	12.46	2.84		
75	C	YEAR	YEAR	YEAR	YEAR	YEAR		
76		1989	1990	1991	1992			
77	C	VOLUME	VOLUME	VOLUME	VOLUME	VOLUME		
78	1	5.74	3.52	2.71	2.87			
79	2	1.00	0.75	5.71	4.08			
80	3	6.16	4.25	2.93	2.47			
81	4	4.16	3.63	3.59	2.51			
82	5	3.02	2.98	2.75	1.49			
83	6	2.88	2.89	1.36	1.72			
84	7	2.05	2.26	3.28	0.66			
85	8	1.35	2.62	1.97	2.04			
86	9	1.73	2.60	1.46	1.21			
87	10	2.39	1.00	1.90	1.25			
88	11	2.20	0.40	2.36	2.39			
89	12	2.29	0.55	1.14	1.87			
90	13	1.86	0.09	0.79	1.02			
91	14	1.52	3.71	0.46	1.54			
92	15	5.62	0.82	0.85	1.69			
93	16	1.25	1.97	1.64	1.23			
94	17	2.10	12.40	0.64	1.91			
95	18	0.81	9.54	0.67	1.78			
96	19	2.80	9.63	1.37	1.41			
97	20	2.91	7.79	1.84	0.72			
98	21	0.72	6.81	1.92	0.90			
99	22	1.35	5.30	6.18	1.99			
100	23	0.56	3.85	2.03	3.54			

-----+-----10-----+-----20-----+-----30-----+-----40-----+-----50-----+-----60-----+-----70						
101	24	0.56	3.82	0.87	2.60	
102	25	1.48	3.66	1.82	5.42	
103	26	2.32	4.19	1.04	4.23	
104	27	4.03	4.04	2.09	3.69	
105	28	0.34	2.29	1.19	7.47	
106	29	0.92	3.53	3.28	2.78	
107	30	4.97	3.33	1.47	1.90	
108	31	1.28	4.46	1.36	2.42	
109 C	PSNAME	EWR				
110	AGOYAN	1291.				
111 C	NYEAR					
112	3					
113 C		YEAR	YEAR	YEAR	YEAR	YEAR
114		1990	1991	1992		
115 C		VOLUME	VOLUME	VOLUME	VOLUME	VOLUME
116	1	71.00	92.00	52.00		
117	2	60.00	80.00	63.00		
118	3	68.00	75.00	63.00		
119	4	85.00	75.00	66.00		
120	5	76.00	87.00	59.00		
121	6	64.00	78.00	61.00		
122	7	62.00	66.00	59.00		
123	8	56.00	62.00	61.00		
124	9	54.00	57.00	62.00		
125	10	48.00	66.00	59.00		
126	11	52.00	62.00	60.00		
127	12	52.00	57.00	68.00		
128	13	47.00	53.00	70.00		
129	14	57.00	68.00	60.00		
130	15	48.00	70.00	57.00		
131	16	66.00	59.00	54.00		
132	17	168.00	57.00	50.00		
133	18	105.00	60.00	62.00		
134	19	96.00	58.00	42.00		
135	20	76.00	58.00	61.00		
136	21	94.00	65.00	60.00		
137	22	72.00	59.00	65.00		
138	23	68.00	57.00	64.00		
139	24	72.00	57.00	78.00		
140	25	92.00	57.00	84.00		
141	26	64.00	59.00	83.00		
142	27	68.00	59.00	70.00		
143	28	59.00	61.00	66.00		
144	29	60.00	56.00	52.00		
145	30	61.00	56.00	47.00		
146	31	71.00	65.00	47.00		
147 C	NCASE					
148	3					
149 C	CASENA					
150	CASE-1 PISAYAMBO					
-----+-----10-----+-----20-----+-----30-----+-----40-----+-----50-----+-----60-----+-----70						

```
-----+-----10-----+-----20-----+-----30-----+-----40-----+-----50-----+-----60-----+-----70
151 C  PSNAME      PSNAME      PSNAME      PSNAME      PSNAME
152  PISAYAMB
153 C  CASENA
154  CASE-2 AGOYAN
155 C  PSNAME      PSNAME      PSNAME      PSNAME      PSNAME
156  AGOYAN
157 C  CASENA
158  CASE-3 PISAYAMBO & AGOYAN
159 C  PSNAME      PSNAME      PSNAME      PSNAME      PSNAME
160  PISAYAMB AGOYAN
-----+-----10-----+-----20-----+-----30-----+-----40-----+-----50-----+-----60-----+-----70
```

④ 出力例

CASE-1 PISAYAMBO

NO.	MW	FREQUENCY	PROBABILITY
1	181.00	1	0.03226
2	156.00	1	0.03226
3	107.00	1	0.03226
4	67.00	1	0.03226
5	52.00	1	0.03226
6	51.00	1	0.03226
7	48.00	1	0.03226
8	46.00	1	0.03226
9	43.00	1	0.03226
10	40.00	1	0.03226
11	33.00	1	0.03226
12	32.00	1	0.03226
13	31.00	1	0.03226
14	29.00	1	0.03226
15	28.00	1	0.03226
16	25.00	1	0.03226
17	24.00	3	0.09677
18	21.00	2	0.06452
19	20.00	1	0.03226
20	16.00	2	0.06452
21	12.00	1	0.03226
22	10.00	1	0.03226
23	9.00	1	0.03226
24	6.00	1	0.03226
25	2.00	1	0.03226
26	-2.00	1	0.03226
27	-3.00	1	0.03226

CASE-2 AGOYAN

NO.	MW	FREQUENCY	PROBABILITY
1	138.50	1	0.03226
2	83.50	1	0.03226
3	75.50	1	0.03226
4	74.50	1	0.03226
5	68.50	1	0.03226
6	64.50	1	0.03226
7	60.50	1	0.03226
8	50.50	1	0.03226
9	48.50	2	0.06452
10	45.50	1	0.03226
11	43.50	1	0.03226
12	36.50	1	0.03226
13	35.50	2	0.06452
14	34.50	1	0.03226
15	27.50	1	0.03226
16	23.50	1	0.03226
17	22.50	1	0.03226
18	21.50	1	0.03226
19	19.50	1	0.03226
20	16.50	1	0.03226
21	13.50	1	0.03226
22	11.50	1	0.03226
23	8.50	1	0.03226
24	6.50	2	0.06452
25	5.50	1	0.03226
26	1.50	1	0.03226
27	-1.50	1	0.03226
28	-5.50	1	0.03226

CASE-3 PISAYAMBO & AGOYAN

NO.	MW	FREQUENCY	PROBABILITY
1	235.00	1	0.03226
2	181.00	1	0.03226
3	171.00	1	0.03226
4	124.00	1	0.03226
5	97.00	2	0.06452
6	91.00	1	0.03226
7	89.00	1	0.03226
8	87.00	1	0.03226
9	82.00	1	0.03226
10	80.00	1	0.03226
11	76.00	1	0.03226
12	70.00	1	0.03226
13	63.00	1	0.03226
14	57.00	1	0.03226
15	55.00	1	0.03226
16	54.00	1	0.03226
17	44.00	2	0.06452
18	40.00	1	0.03226
19	28.00	1	0.03226
20	24.00	1	0.03226
21	21.00	1	0.03226
22	17.00	1	0.03226
23	16.00	2	0.06452
24	7.00	1	0.03226
25	4.00	1	0.03226
26	0.0	2	0.06452
27	-5.00	1	0.03226

A-4-4 計算出力データ

```
*****  
*  
* RELIABILITY EVALUATION PROGRAM FOR INTERCONNECTED POWER SYSTEMS *  
*  
* ( REPORT ) *  
*  
* PRESENTED BY KCC *  
*  
*****
```

CALCULATION DATE 11/18/1993

LOLP OF SNI, AS OF DECEMBER, 1991



-----10-----20-----30-----40-----50-----60-----70

```

1 &&BEGIN CONTR
2 C DATE
3 11/18/1993
4 C TITLE
5 LOLD OF SNI, AS OF DECEMBER, 1991
6 C GRID
7
8 C ICAFCU IPSING IPMULT
9 0 0 0
10 C ANSMK ANSMK ANSMK ANSMK ANSMK ANSMK ANSMK ANSMK
11 0.5 0.4 0.3
12 * END OF "ANSMK" DATA
13 &&END
14 &&BEGIN SINGL
15 C TITLE
16 ECUADOR DECEMBER 1991
17 C CODEO KBLOCK
18 NORTH 1
19 C RANGEL HEIJIT DELTXX LTP
20 50. 20. 50. P
21 C LMWF
22 1
23 C LNMW LNMW LNMW LNMW LNMW LNMW LNMW LNMW
24 536.0 520.9 531.7 529.5 513.3 497.1 526.3
25 530.6 536.0 526.3 525.2 531.7 531.7 527.4
26 520.9 520.9 500.3 488.5 513.3 504.7 497.1
27 * END OF "LNMW" DATA
28 C INDEX1
29 1
30 C CODE TKW CN Q IPOBI
31 AGOYAN 78.00 2. 0.14 0
32 PISAYAMB 32.70 2. 0.66 0
33 CUMBAYA 4.4125 4. 3.84 0
34 NAYON 7.00 2. 3.13 0
35 PASOCHOA 1.125 2. 0.36 0
36 CHILLOS 0.430 2. 2.65 0
37 OTHERS H 1.620 18. 3.84 0
38 * END OF "CODE TKW CN Q IPOBI" DATA
39 C INDEX2
40 2
41 C CODE TKW CN Q IPOBI
42 EMERALD 125.00 1. 0.80 0
43 SANTA RO 15.00 3. 20.23 0
44 GUANGOPO 4.05 6. 17.54 0
45 S.R DIES 1.64 5. 20.23 0
46 S.R BUNK 5.00 2. 17.54 0
47 * END OF "CODE TKW CN Q IPOBI" DATA
48 C INDEX3 LOAV
49 3 26.63 -13.79
50 C INDEX4 LTAV

```

-----10-----20-----30-----40-----50-----60-----70

Line	Code	Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Field 7	Field 8	Field 9	Field 10	Field 11	Field 12	Field 13	Field 14	Field 15	Field 16	Field 17	Field 18	Field 19	Field 20	
51		4	0.0		0.0																	
52	C	INDEX5	IHD																			
53		5	H																			
54		BT	BT		BT		BT		BT		BT		BT		BT		BT		BT		BT	
55		0.0																				
56	*	END OF "DI" DATA																				
57	C	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB
58		1.00000																				
59	*	END OF "BPROB" DATA																				
60	C	CODEO	KBLOCK																			
61		SOUTH	1																			
62	C	RANGEL	HEIJIT	DELTX	LTX																	
63		50.	20.	50.	P																	
64	C	LMWF																				
65		1																				
66	C	LNMM	LNMM	LNMM	LNMM	LNMM	LNMM	LNMM	LNMM	LNMM	LNMM	LNMM	LNMM	LNMM	LNMM	LNMM	LNMM	LNMM	LNMM	LNMM	LNMM	LNMM
67		804.0	780.3	795.4	794.3	769.5	745.7	788.9														
68		794.3	804.0	788.9	786.7	795.4	796.4	788.9														
69		780.3	780.3	750.0	730.6	769.5	769.5	744.6														
70	*	END OF "LNMM" DATA																				
71	C	INDEX1																				
72		1																				
73	C	CODE	TKW	CN	Q	IPOBI																
74		PAUTE	87.70	5.	1.87	0																
75		OTHERS H	4.54	6.	3.84	0																
76	*	END OF "CODE TKW CN Q IPOBI" DATA																				
77	C	INDEX2																				
78		2																				
79	C	CODE	TKW	CN	Q	IPOBI																
80		ESTERO V	70.00	2.	0.48	0																
81		ESTERO G	20.00	1.	0.80	0																
82		GUA V #1	4.70	2.	30.30	0																
83		GUA V #2	9.50	2.	6.20	0																
84		GUA GAS	12.00	1.	14.00	0																
85		GUA VAP	31.60	1.	5.10	0																
86		ESTERO E	15.00	1.	8.05	0																
87		ESTERO E	20.00	4.	10.73	0																
88		S.R OJES	1.40	23.	20.23	0																
89		S.R BUNK	3.14	10.	17.54	0																
90	*	END OF "CODE TKW CN Q IPOBI" DATA																				
91	C	INDEX3	LOAV	LOAV																		
92		3	41.09	-20.86																		
93	C	INDEX4	LTAV	LTAV																		
94		4	0.0	0.0																		
95	C	INDEX5	IHD																			
96		5	H																			
97		BT	BT		BT		BT		BT		BT		BT		BT		BT		BT		BT	
98		0.0																				
99	*	END OF "BT" DATA																				
100	C	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB

-----10-----20-----30-----40-----50-----60-----70

```

101 1.60000
102 * END OF "BPROB" DATA
103 **END
104 **BEGIN GROUP
105 * END OF GROUP DATA
106 **END
107 **BEGIN MULTI
108 C TITLE
109 ECUADOR DECEMBER 1991
110 C ISAMPL LOLP IRULE RNTYP RNINT PFTMX PTFMX
111 5000 0.5 RATAL 1 1 900. 900.
112 C TOL1 TOL2 H RANGEM JSAMP
113 30. 3. 3.3 10. 10
114 C IRELAX NHINDO ITMAXO
115 0 1 31
116 C CODEB FROM TO CAP PFTMX PTFMX
117 LINE NORTH SOUTH 900. 900. 900.
118 * END OF "CODEB FROM TO CAP PFTMX PTFMX" DATA
119 C CODEX DIV DIV DIV DIV
120 DIV-1 0.0
121 DIV-2 0.0
122 * END OF "CODEX DIV" DATA
123 C CODES TM IRESER KDIF RANGE1 RANGE2
124 NORTH 50. 0 1 10. 1.0
125 SOUTH 120. 0 1 10. 1.0
126 * END OF "CODES TM IRESER KDIF RANGE1 RANGE2" DATA
127 **END
128 **BEGIN MULTI
129 C TITLE
130 ECUADOR DECEMBER 1991
131 C ISAMPL LOLP IRULE RNTYP RNINT
132 5000 0.5 RATAL 1 1
133 C TOL1 TOL2 H RANGEM JSAMP
134 30. 3. 3.3 10. 10
135 C IRELAX NHINDO ITMAXO
136 9 1 31
137 C CODEB FROM TO CAP PFTMX PTFMX
138 LINE NORTH SOUTH 900. 900. 900.
139 * END OF "CODEB FROM TO CAP PFTMX PTFMX" DATA
140 C CODEX DIV DIV DIV DIV
141 DIV-1 0.0
142 DIV-2 0.0
143 * END OF "CODEX DIV" DATA
144 C CODES TM IRESER KDIF RANGE1 RANGE2
145 NORTH -38.18 0 1 10. 1.0
146 SOUTH 52.34 0 1 10. 1.0
147 * END OF "CODES TM IRESER KDIF RANGE1 RANGE2" DATA
148 **END
    
```

-----10-----20-----30-----40-----50-----60-----70

\*\*\* UNIT DATA OF GRID NORTH \*\*\*

HYDRO	CODE	MW	UNIT	FOR	CODE	MW	UNIT	FOR
	AGOYAN	78.00	2.	0.1	PISAYAMB	32.70	2.	0.7
	CUMBAYA	4.41	4.	3.8	NAYON	7.00	2.	3.1
	PASOCHOA	1.13	2.	0.4	CHILLOS	0.43	2.	2.6
	OTHERS H	1.62	18.	3.8				
					TOTAL	265.32	32.	

THERMAL	CODE	MW	UNIT	FOR	CODE	MW	UNIT	FOR
	ESMERALD	125.00	1.	0.8	SANTA RO	15.00	3.	20.2
	GUANGOPO	4.05	6.	17.5	S.R DIES	1.64	5.	20.2
	S.R BUNK	5.00	2.	17.5				
					TOTAL	212.50	17.	

HYDRO+THERMAL TOTAL 497.82 49.

\*\*\* LOAD DATA OF GRID NORTH \*\*\*

H1(MW)	WKDAYS(DAY)
536.	20.

\*\*\* RELIABILITY OF SINGLE GRID NORTH \*\*\*

LOLP (DAY/MONTH)	RESERVE MARGIN (MW)	RESERVE MARGIN (%)	DIFF. COEF. (DAY/MONTH/MW)
0.787876	141.92	26.48	-0.017279
0.400000	147.70	27.56	-0.017279
1.078846	136.32	25.43	-0.001000
*19.791108	-38.18	-7.12	

\*\*\* UNIT DATA OF GRID SOUTH \*\*\*

HYDRO CODE	MW	UNIT	FOR	CODE	MW	UNIT	FOR
PAUTE	87.70	5.	1.9	OTHERS H	4.54	6.	3.8
TOTAL					465.74	11.	
THERMAL CODE	MW	UNIT	FOR	CODE	MW	UNIT	FOR
ESTERO V	70.00	2.	0.5	ESTERO G	20.00	1.	0.8
GUA V #1	4.70	2.	30.3	GUA V #2	9.50	2.	6.2
GUA GAS	12.00	1.	14.0	GUA VAP	31.60	1.	5.1
ESTERO E	15.00	1.	8.1	ESTERO E	20.00	4.	10.7
S.R DIES	1.40	23.	20.2	S.R BUNK	3.14	10.	17.5

TOTAL 390.60 47.  
 HYDRO+THERMAL TOTAL 856.34 58.

\*\*\* LOAD DATA OF GRID SOUTH \*\*\*

H1(MW)	WKDAYS(DAY)
804.	20.

\*\*\* RELIABILITY OF SINGLE GRID SOUTH \*\*\*

LOLP (DAY/MOHTH)	RESERVE MARGIN (MW)	RESERVE MARGIN (%)	DIFF. COEF. (DAY/MONTH/MW)
0.500000	198.35	24.67	-0.009177
0.370240	215.59	26.82	-0.005501
0.300000	230.84	28.71	-0.003235
*10.132179	52.34	6.51	

E-CUADOR DECEMBER 1991 /

\*\*\* INPUT DATA OF INTERCONNECTED SYSTEM \*\*\*

\*\* MONTE CARLO DATA \*\*

SAMPLE	LOLP(D/M)	RULE	RANDOM	RINIT
5000	0.500	RATAL	1	1

\*\* GRID DATA \*\*

NO.	GRID NAME	RMINIT (MW)	BLOCK	H1 (MW)	RMIN (%)	KDIF
1	NORTH	50.0	1	536.0	0	1
2	SOUTH	120.0	1	804.0	0	1

\*\* BRANCH DATA \*\*

NB	BRANCH CODE	NF	NT	CAP (MW)	F->T (MW)	T->F (MW)
1	LINE	NORTH ( 1 )	SOUTH ( 2 )	900.0	900.0	900.0

ECUADOR DECEMBER 1991 / 7

\*\*\* RELIABILITY OF INTERCONNECTED GRID \*\*\*

IT = 8	NORTH	SOUTH
RESERVE MARGIN (MW)	46.39	125.04
(%)	8.65	15.55
IT = 500	0.47449	0.46583
IT = 1000	0.50825	0.44180
IT = 1500	0.50673	0.47721
IT = 2000	0.49392	0.46277
IT = 2500	0.51412	0.51235
IT = 3000	0.50930	0.52034
IT = 3500	0.52667	0.52073
IT = 4000	0.51501	0.51398
IT = 4500	0.51693	0.50330
IT = 5000	0.49945	0.49766
LOLP(DAY/MONTH)	0.49945	0.49766

TOTAL RESERVE MARGIN 171.43(MW) 12.79(%)

ECUADOR DECEMBER 1991

\*\*\* INPUT DATA OF INTERCONNECTED SYSTEM \*\*\*

\*\* MONTE CARLO DATA \*\*

SAMPLE	LOLP(D/M)	RULE	RANDOM	RINIT
5000	0.0	RATAL	1	1

\*\* GRID DATA \*\*

NO. GRID NAME	RMINIT (MW)	BLOCK	H1 (MW)	RMIN (%)	KDIF
1 NORTH	-38.2	1	536.0	0	1
2 SOUTH	52.3	1	804.0	0	1

\*\* BRANCH DATA \*\*

NB BRANCH CODE	NF	NT	CAP (MW)	F->T (MW)	T->F (MW)
1 LINE	NORTH ( 1)	SOUTH ( 2)	900.0	900.0	900.0



\*\*\* RELIABILITY OF INTERCONNECTED GRID \*\*\*

IT = 1	NORTH	SOUTH
RESERVE MARGIN (MW)	-38.18	52.34
RESERVE MARGIN (%)	-7.12	6.51
IT = 500	10.01636	5.13627
IT = 1000	10.22468	5.23245
IT = 1500	10.20075	5.15423
IT = 2000	10.17308	5.01941
IT = 2500	10.14246	5.00274
IT = 3000	10.12077	4.99431
IT = 3500	10.06771	4.94252
IT = 4000	10.08694	4.93148
IT = 4500	10.03529	4.92031
IT = 5000	10.06598	4.90487
LLOP(DAY/MONTH)	10.06598	4.90487

TOTAL RESERVE MARGIN 14.16(MW) 1.06(%)

\*\*\*\*\*  
\*  
\*  
\* RELIABILITY EVALUATION PROGRAM FOR INTERCONNECTED POWER SYSTEMS \*  
\* ( REPORT ) \*  
\* PRESENTED BY KCC \*  
\*  
\*  
\*\*\*\*\*

CALCULATION DATE 11/19/1993

LOLP OF SNI, AS OF DECEMBER, 1998

-----10-----20-----30-----40-----50-----60-----70

```

1 &&BEGIN CONTR
2 C DATE
3 11/19/1993
4 C TITLE
5 LOP OF SNI, AS OF DECEMBER, 1998
6 C GRID
7 2
8 C ICALCU IPSING IPMULT
9 0 0 0
10 C ANSMK ANSMK ANSMK ANSMK ANSMK ANSMK
11 0.5 0.4 0.3
12 * END OF "ANSMK" DATA
13 &&END
14 &&BEGIN SINGL
15 C TITLE
16 ECUADOR DECEMBER 1998
17 C CODEO KBLOCK
18 NORTH 1
19 C RANGEL HEIJIT DELTXX L TYP
20 50. 20. 50. P
21 C LWF
22 1
23 C LNMW LNMW LNMW LNMW LNMW LNMW
24 753.0 731.9 747.0 743.9 721.2 698.4 739.5
25 745.5 753.0 739.4 737.8 747.0 747.0 740.9
26 731.8 731.8 702.8 686.5 721.1 709.0 698.4
27 * END OF "LNMW" DATA
28 C INDEX1
29 1
30 C CODE TKW CN Q IPOBI
31 AGOYAN 78.00 2. 0.154 0
32 PISAYAMB 32.70 2. 0.726 0
33 CUMBAYA 4.4125 4. 4.221 0
34 NAYON 7.00 2. 3.437 0
35 PASOCHOA 1.125 2. 0.396 0
36 CHILLOS 0.430 2. 2.915 0
37 OTHERS H 1.620 18. 4.221 0
38 * END OF "CODE TKW CN Q IPOBI" DATA
39 C INDEX2
40 2
41 C CODE TKW CN Q IPOBI
42 EMERALD 125.00 1. 0.88 0
43 SANTA RO 15.00 3. 22.25 0
44 GUANGOPO 4.05 6. 19.29 0
45 S-R DIES 2.20 1. 22.25 0
46 S-R BUNK 1.64 5. 19.29 0
47 SR-REDIE 1.73 6. 22.25 0
48 SR-REBUN 3.76 9. 19.29 0
49 * END OF "CODE TKW CN Q IPOBI" DATA
50 C INDEX3 LOVAR LOAV

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-----10-----20-----30-----40-----50-----60-----70

-----10-----20-----30-----40-----50-----60-----70

51	3	39.62	-21.40						
52 C	INDEX4	LTVAR	LTAV						
53	4	0.0	0.0						
54 C	INDEX5	IHD							
55	5	H							
56	BT	BT	BT	BT	BT	BT	BT	BT	BT
57	0.0								
58 *	END OF "BT" DATA								
59 C	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB
60	1.00000								
61 *	END OF "BPROB" DATA								
62 C	CODE0	KBLOCK							
63	SOUTH	1							
64 C	RANGEL	HEJIT	DELTX	LTP					
65	50.	20.	50.	P					
66 C	LMWF								
67	1								
68 C	LNMW	LNMW	LNMW	LNMW	LNMW	LNMW	LNMW	LNMW	LNMW
69	1238.0	1201.5	1224.8	1223.1	1184.9	1148.2	1214.7	1214.7	1214.7
70	1223.1	1238.0	1214.7	1211.4	1224.8	1226.3	1214.7	1214.7	1214.7
71	1201.5	1201.5	1154.9	1125.0	1184.9	1164.9	1164.9	1164.9	1164.9
72 *	END OF "LNMW" DATA								
73 C	INDEX1								
74	1								
75 C	CODE	TKW	CN	Q	IPOBI				
76	PAUTEAB	87.70	5.	2.06	0				
77	PAUTE C	91.88	5.	2.06	0				
78	DAU-PERI	43.00	2.	0.50	0				
79	OTHERS H	4.54	6.	4.22	0				
80 *	END OF "CODE TKW CN Q IPOBI" DATA								
81 C	INDEX2								
82	2								
83 C	CODE	TKW	CN	Q	IPOBI				
84	ESTERO V	70.00	2.	0.53	0				
85	ESTERO G	20.00	1.	0.88	0				
86	GUA V #2	9.50	2.	6.82	0				
87	GUA VAP	31.60	1.	5.61	0				
88	ESTERO E	15.00	1.	8.85	0				
89	ESTERO E	20.00	4.	11.80	0				
90	S.R DIES	1.34	17.	22.25	0				
91	S.R BUNK	2.85	4.	19.29	0				
92	SR.REBIE	1.84	20.	22.25	0				
93	SR.REBUN	3.00	2.	19.29	0				
94	ELECCUIL	37.00	2.	14.00	0				
95	ELECCUIT	16.00	2.	14.00	0				
96	GAS-93	78.00	1.	0.80	0				
97	GAS-94	78.00	1.	0.80	0				
98	VAPOR-95	117.50	1.	0.80	0				
99	VAPOR-97	66.00	2.	0.80	0				
100 *	END OF "CODE TKW CN Q IPOBI" DATA								

-----10-----20-----30-----40-----50-----60-----70

-----10-----20-----30-----40-----50-----60-----70

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101 C INDEX3 LOVAR LOAV
102 3 66.31 -35.40
103 C INDEX4 LTVAR LTAV
104 4 0.0 0.0
105 C INDEX5 IMD
106 5 H
107 BT BT BT BT BT BT
108 0.0
109 * END OF "BT" DATA
110 C BPROB SPROB BPROB SPROB BPROB SPROB BPROB SPROB
111 1.00000
112 * END OF "BPROB" DATA
113 &END
114 &BEGIN GROUP
115 * END OF GROUP DATA
116 &END
117 &BEGIN MULTI
118 C TITLE
119 ECUADOR DECEMBER 1998
120 C ISAMPL LOLP IRULE RNTYP RNTX RNINT
121 5000 0.5 RATAL 1 1
122 C TOL1 TOL2 H RANGEM JSAMP
123 30 3 3.3 10 10
124 C IRELAX NHINDO ITMAXO
125 0 1 31
126 C CODEB FROM TO CAP PFTMX PTFMX
127 LINE NORTH SOUTH 900 900 900
128 * END OF "CODEB FROM TO CAP PFTMX PTFMX" DATA
129 C CODEX DIV DIV DIV DIV
130 DIV-1 0.0
131 DIV-2 0.0
132 * END OF "CODEX DIV" DATA
133 C CODEG TM IRESER KDIF RANGE1 RANGE2
134 NORTH 100 0 1 10 1.0
135 SOUTH 200 0 1 10 1.0
136 * END OF "CODEG TM IRESER KOIF RANGE1 RANGE2" DATA
137 &END
138 &BEGIN MULTI
139 C TITLE
140 ECUADOR DECEMBER 1998
141 C ISAMPL LOLP IRULE RNTYP RNTX RNINT
142 5000 0.5 RATAL 1 1
143 C TOL1 TOL2 H RANGEM JSAMP
144 30 3 3.3 10 10
145 C IRELAX NHINDO ITMAXO
146 9 1 1
147 C CODEB FROM TO CAP PFTMX PTFMX
148 LINE NORTH SOUTH 900 900 900
149 * END OF "CODEB FROM TO CAP PFTMX PTFMX" DATA
150 C CODEX DIV DIV DIV DIV

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-----10-----20-----30-----40-----50-----60-----70

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-----10-----20-----30-----40-----50-----60-----70
151 DIV-1 0.0
152 DIV-2 0.0
153 * END OF "CODEX DIV" DATA
154 C CODEG TM IRESER KDIF RANGE1 RANGE2
155 NORTH -218.78 0 1 10. 1.0
156 SOUTH 687.24 0 1 10. 1.0
157 * END OF "CODEG TM IRESER KOIF RANGE1 RANGE2" DATA
158 **END
-----10-----20-----30-----40-----50-----60-----70
```

\*\*\* UNIT DATA OF GRID NORTH \*\*\*

HYDRO	CODE	MW	UNIT	FOR	CODE	MW	UNIT	FOR
	AGOYAN	78.00	2.	0.2	PISAYAMB	32.70	2.	0.7
	CUMBAYA	4.41	4.	4.2	NAYON	7.00	2.	3.4
	PASOCHOA	1.13	2.	0.4	CHILLOS	0.43	2.	2.9
	OTHERS H	1.62	18.	4.2				
					TOTAL	285.32	32.	

THERMAL	CODE	MW	UNIT	FOR	CODE	MW	UNIT	FOR
	ESMERALD	125.00	1.	0.9	SANTA RO	15.00	3.	22.3
	GUANGOPO	4.05	6.	19.3	S.R.DIES	2.20	1.	22.3
	S.R.BUNK	1.64	5.	19.3	SR.REDIE	1.73	6.	22.3
	SR.REBUN	3.76	9.	19.3				
					TOTAL	248.92	31.	

HYDRO+THERMAL TOTAL 534.24 63.

\*\*\* LOAD DATA OF GRID NORTH \*\*\*

H1(MW)	WKDAYS(DAY)
753.	20.

\*\*\* RELIABILITY OF SINGLE GRID NORTH \*\*\*

LOLP (DAY/MONTH)	RESERVE MARGIN (MW)	(%)	DIFF-COEF. (DAY/MONTH/MW)
0.500871	186.40	24.75	-0.360770
0.400000	189.98	25.23	-0.012962
0.330807	193.26	25.67	-0.052489
*19.995999	-218.76	-29.05	

\*\*\* UNIT DATA OF GRID SOUTH \*\*\*

HYDRO CODE	MW	UNIT	FOR	CODE	MW	UNIT	FOR
PAUTEAB	87.70	5.	2.1	PAUTE C	91.88	5.	2.1
DAU-PERI	43.00	2.	0.5	OTHERS H	4.54	6.	4.2
TOTAL					1011.14	18.	

THERMAL CODE	MW	UNIT	FOR	CODE	MW	UNIT	FOR
ESTERO V	70.00	2.	0.5	ESTERO G	20.00	1.	0.9
GUA V #2	9.50	2.	6.8	GUA VAP	31.60	1.	5.6
ESTERO E	15.00	1.	8.9	ESTERO E	20.00	4.	11.8
S.R DIES	1.34	17.	22.3	S.R BUNK	2.85	4.	19.3
SR-REDIE	1.84	20.	22.3	SR-REBUN	3.00	2.	19.3
ELECCUIL	37.00	2.	14.0	ELECCUIT	16.00	2.	14.0
GAS-93	78.00	1.	0.8	GAS-94	79.00	1.	0.8
VAPOR-95	117.50	1.	0.8	VAPOR-97	66.00	2.	0.8
TOTAL					394.08	63.	

HYDRO+THERMAL TOTAL 1995.22 81.

\*\*\* LOAD DATA OF GRID SOUTH \*\*\*

H1(MW) WKDAYS(DAY)  
1238. 20.

\*\*\* RELIABILITY OF SINGLE GRID SOUTH \*\*\*

LOLP (DAY/MONTH)	RESERVE MARGIN (MW)	(%)	DIFF. COEF. (DAY/MONTH/MW)
0.500000	285.51	23.06	-0.020249
0.400000	289.91	23.42	-0.003729
0.300499	310.28	25.06	-0.004032
* 0.0	667.22	53.89	



ECUADOR DECEMBER 1998

P-1

\*\*\* INPUT DATA OF INTERCONNECTED SYSTEM \*\*\*

\*\* MONTE CARLO DATA \*\*

SAMPLE	LOLP(D/M)	RULE	RANDOM	RINIT
5000	0.500	RATAL	1	1

\*\* GRID DATA \*\*

NO.	GRID NAME	RINIT (MW)	BLOCK	H1 (MW)	RMIN (%)	KDIF
1	NORTH	100.0	1	753.0	0	1
2	SOUTH	200.0	1	1238.0	0	1

\*\* BRANCH DATA \*\*

NB	BRANCH CODE	NF	NT	CAP (MW)	F->T (MW)	T->F (MW)
1	LINE	NORTH ( 1)	SOUTH ( 2)	900.0	900.0	900.0

\*\*\* RELIABILITY OF INTERCONNECTED GRID \*\*\*

	NORTH	SOUTH
IT = 17		
RESERVE MARGIN (MW)	68.74	212.20
(%)	9.13	17.14
IT = 500	0.42879	0.49410
IT = 1000	0.40543	0.45802
IT = 1500	0.49104	0.48793
IT = 2000	0.48175	0.47016
IT = 2500	0.51452	0.51121
IT = 3000	0.50819	0.51852
IT = 3500	0.52432	0.51957
IT = 4000	0.51490	0.51073
IT = 4500	0.51560	0.50641
IT = 5000	0.49831	0.50046
LOLP(DAY/MONTH)	0.49831	0.50046
TOTAL RESERVE MARGIN	280.94(MW)	
		14.11(%)

ECUADOR DECEMBER 1998

P-9

\*\*\* INPUT DATA OF INTERCONNECTED SYSTEM \*\*\*

\*\* MONTE CARLO DATA \*\*

SAMPLE	LOLP(D/M)	RULE	RANDOM	RINIT
5000	0.500	RATAL	1	1

\*\* GRID DATA \*\*

NO.	GRID NAME	RMINIT (MW)	BLOCK	H1 (MW)	RMIN (%)	KDIF
1	NORTH	-218.8	1	753.0	0	1
2	SOUTH	667.2	1	1238.0	0	1

\*\* BRANCH DATA \*\*

NO	BRANCH CODE	NF	NT	CAP (MW)	F->T (MW)	T->F (MW)
1	LINE	NORTH ( 1)	SOUTH ( 2)	900.0	900.0	900.0

\*\*\* RELIABILITY OF INTERCONNECTED GRID \*\*\*

IT #	RESERVE MARGIN (MW)	NORTH	SOUTH
1		-218.78	667.24
	(%)	-29.05	53.90
IT = 500		0.07830	0.0
IT = 1000		0.04082	0.0
IT = 1500		0.02722	0.0
IT = 2000		0.02699	0.0
IT = 2500		0.03189	0.0
IT = 3000		0.03722	0.0
IT = 3500		0.05915	0.0
IT = 4000		0.05203	0.0
IT = 4500		0.05237	0.0
IT = 5000		0.04981	0.0
LOLP(DAY/MONTH)		0.04981	0.0
TOTAL RESERVE MARGIN		448.46(MW)	22.52(%)

\*\*\*\*\*  
\*  
\*  
\* RELIABILITY EVALUATION PROGRAM FOR INTERCONNECTED POWER SYSTEMS \*  
\* ( REPORT ) \*  
\* PRESENTED BY KCC \*  
\*  
\*\*\*\*\*

CALCULATION DATE 11/24/1993

LOLP OF SNI, AS OF DECEMBER, 2003

-----10-----20-----30-----40-----50-----60-----70

```

1 &&BEGIN CONTR
2 C DATE
3 11/24/1993
4 C TITLE
5 LOP OF SNI, AS OF DECEMBER, 2003
6 C GRID
7 2
8 C ICALCU IPSING IPMULT
9 0 0
10 C ANSMK ANSMK ANSMK ANSMK ANSMK ANSMK
11 0.5 0.4 0.3
12 * END OF "ANSMK" DATA
13 &&END
14 &&BEGIN SINGL
15 C TITLE
16 ECUADOR DECEMBER 2003
17 C CODEO KBLOCK
18 NORTH 1
19 C RANGEI HEIJIT DELTXX LTY P
20 50. 20. 50.
21 C LMWF
22 1
23 C LNMW LNMW LNMW LNMW LNMW LNMW
24 986.0 958.2 978.1 974.0 944.2 914.4 968.2
25 976.1 986.0 968.2 966.1 978.1 970.2
26 958.2 958.2 920.3 898.6 944.2 928.4 914.4
27 * END OF "LNMW" DATA
28 C INDEX1
29 1
30 C CODE TKW CN IPOBI
31 ACOYAN 78.00 2. 0.185 0
32 PISAYAMB 32.70 2. 0.871 0
33 CUMBAYA 4.4125 4. 5.065 0
34 NAYON 7.00 2. 4.125 0
35 PASOCHOA 1.125 2. 0.475 0
36 CHILLOS 0.430 2. 3.498 0
37 S.FRAGIS 113.0 2. 0.500 0
38 TOACHI 64.4 2. 0.500 0
39 OTHERS H 1.620 18. 5.065 0
40 * END OF "CODE TKW CN G IPOBI" DATA
41 C INDEX2
42 2
43 C CODE TKW CN IPOBI
44 EMERALD 125.00 1. 1.07 0
45 SANTA RO 15.00 3. 26.70 0
46 GUANGOPO 4.05 6. 23.15 0
47 S.R DIES 2.20 1. 26.70 0
48 S.R BUNK 1.64 5. 23.15 0
49 SR.REDIE 1.73 6. 23.36 0
50 SR.REBUN 3.76 9. 20.26 0

```

-----10-----20-----30-----40-----50-----60-----70

-----10-----20-----30-----40-----50-----60-----70-----

51	GAS-2001	78.00	1.	0.80	0				
52	GAS-2003	27.00	1.	0.80	0				
53	* END OF "CODE TKW CN Q IPOBI" DATA								
54	C INDEX3	LOVAR	LOAV						
55	3	51.88	-28.02						
56	C INDEX4	LTVAR	LTAV						
57	4	0.0	0.0						
58	C INDEX5	IHD							
59	5	H							
60	BT	BT	BT	BT	BT	BT	BT	BT	BT
61	0.0								
62	* END OF "BT" DATA								
63	C BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB
64	1.00000								
65	* END OF "BPROB" DATA								
66	C CODEO	KBLOCK							
67	SOUTH	1							
68	C RANGEL	HEIJIT	DELTX	LTP					
69	50.	20.	50.	P					
70	C LMWF								
71	1								
72	C LNMW	LNMW	LNMW	LNMW	LNMW	LNMW	LNMW	LNMW	LNMW
73	1609.0	1561.6	1591.8	1589.6	1540.0	1492.3	1578.8	1578.8	1578.8
74	1589.6	1609.0	1578.8	1574.4	1591.8	1593.8	1578.8	1578.8	1578.8
75	1561.6	1561.6	1500.9	1462.1	1540.0	1513.9	1490.1	1490.1	1490.1
76	* END OF "LNMW" DATA								
77	C INDEX1								
78	1								
79	C CODE	TKW	CN	Q	IPOBI				
80	PAUTEAB	87.70	5.	2.47	0				
81	PAUTE C	91.88	5.	2.47	0				
82	DAU-PERI	43.00	2.	0.52	0				
83	MAZAR	53.90	2.	0.50	0				
84	OTHERS H	4.54	6.	5.07	0				
85	* END OF "CODE TKW CN Q IPOBI" DATA								
86	C INDEX2								
87	2								
88	C CODE	TKW	CN	Q	IPOBI				
89	ESTERO V	70.00	2.	0.63	0				
90	ESTERO G	20.00	1.	1.06	0				
91	GUA V #2	9.50	2.	8.18	0				
92	GUA VAP	31.60	1.	6.73	0				
93	ESTERO E	15.00	1.	10.63	0				
94	ESTERO E	20.00	4.	14.16	0				
95	S.R DIES	1.34	17.	26.70	0				
96	S.R BUNK	2.85	4.	23.15	0				
97	SR-REDIE	1.84	20.	20.56	0				
98	SR-REBUN	3.00	2.	21.22	0				
99	ELECGUIL	37.00	2.	15.40	0				
100	ELECGUIT	16.00	2.	15.40	0				

-----10-----20-----30-----40-----50-----60-----70-----

-----10-----20-----30-----40-----50-----60-----70

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101 GAS-93      79.00      1.      0.84      0
102 GAS-94      78.00      1.      0.84      0
103 VAPOR-95   117.50     1.      0.84      0
104 VAPOR-97   66.00      2.      0.84      0
105 *          END OF "CODE TKW CN G IPOBI" DATA
106 C INDEX3   LOVAR      LOAV
107          3      86.19   -46.01
108 C INDEX4   LTVAR      LTAV
109          4      0.0      0.0
110 C INDEX5   IHD
111          5      H
112          BT      BT      BT      BT      BT
113          0.0
114 *          END OF "BT" DATA
115 C SPROB    SPROB    SPROB    SPROB    SPROB    SPROB
116          1.00000
117 *          END OF "BPROB" DATA
118 &&END
119 &&BEGIN GROUP
120 *          END OF GROUP DATA
121 &&END
122 &&BEGIN MULTI
123 C TITLE
124 ECUADOR DECEMBER 2003
125 C ISAMPL   LOLP      IRULE      RNTYP      RNINT
126          5000     0.5      RATAL      1          1
127 C TOL1     TOL2      H          RANGEM     JSAMP
128          30.      3.      3.3       10.       10
129 C IRELAX   NHINDO    ITHAXO
130          0          1          3.1
131 C CODEB    FROM      TO          CAP      PFTMX
132          NORTH    SOUTH     900.      900.
133 *          END OF "CODEB FROM TO CAP PFTMX PTFMX" DATA
134 C CODEX    DIV      DIV      DIV
135          DIV-1     0.0
136          DIV-2     0.0
137 *          END OF "CODEX DIV" DATA
138 C CODEG    TM      IRESER   KDIF      RANGE1   RANGE2
139          NORTH    100.      0          1          10.      1.0
140          SOUTH    300.      0          1          10.      1.0
141 *          END OF "CODEG TM IRESER KDIF RANGE1 RANGE2" DATA
142 &&END
143 &&BEGIN MULTI
144 C TITLE
145 ECUADOR DECEMBER 2003
146 C ISAMPL   LOLP      IRULE      RNTYP      RNINT
147          5000     0.5      RATAL      1          1
148 C TOL1     TOL2      H          RANGEM     JSAMP
149          30.      3.      3.3       10.       10
150 C IRELAX   NHINDO    ITHAXO

```

-----10-----20-----30-----40-----50-----60-----70



-----10-----20-----30-----40-----50-----60-----70

```

151 9 1 1
152 C CODEB FROM TO CAP PFTMX PTFMX
153 LINE NORTH SOUTH 900. 900. 900.
154 * END OF "CODEB FROM TO CAP PFTMX PTFMX" DATA
155 C CODEX DIV DIV DIV DIV
156 DIV-1 0.0
157 DIV-2 0.0
158 * END OF "CODEX DIV" DATA
159 C CODEG TM IRESER KOIF RANGE1 RANGE2
160 NORTH 9.10 0 1 10. 1.0
161 SOUTH 404.04 0 1 10. 1.0
162 * END OF "CODEG TM IRESER KOIF RANGE1 RANGE2" DATA
163 88END

```

-----10-----20-----30-----40-----50-----60-----70

\*\*\* UNIT DATA OF GRID NORTH \*\*\*

HYDRO CODE	MW	UNIT	FOR	CODE	MW	UNIT	FOR
AGOYAN	78.00	2.	0.2	PISAYAMB	32.70	2.	0.9
CUMBAYA	4.41	4.	5.1	NAYON	7.00	2.	4.1
PASOCHOA	1.13	2.	0.5	CHILLOS	0.43	2.	3.5
S.FRACIS	113.00	2.	0.5	TOACHI	64.60	2.	0.5
OTHERS H	1.62	18.	5.1				
				TOTAL	640.12	36.	

\*\*\* THERMAL CODE

THERMAL CODE	MW	UNIT	FOR	CODE	MW	UNIT	FOR
ESMERALD	125.00	1.	1.1	SANTA RO	15.00	3.	26.7
GUANGOPO	4.05	6.	23.1	S.R OJES	2.20	1.	26.7
S.R BUNK	1.64	5.	23.1	SR.REDIE	1.73	6.	23.4
SR.REGUN	3.76	9.	20.3	GAS-2001	78.00	1.	0.8
GAS-2003	27.00	1.	0.8				
				TOTAL	353.92	33.	
				HYDRO+THERMAL TOTAL	994.04	69.	

\*\*\* LOAD DATA OF GRID NORTH \*\*\*

H1(MW)	WKDAYS(DAY)
986.	20.

\*\*\* RELIABILITY OF SINGLE GRID NORTH \*\*\*

LOLP (DAY/MONTH)	RESERVE MARGIN (MW)	RESERVE MARGIN (%)	DIFF. COEF. (DAY/MONTH/MW)
0.504395	199.84	20.27	-0.147124
0.399699	211.65	21.47	-0.001738
0.299487	231.46	23.47	-0.008922
*15.236311	8.04	0.82	

\*\*\* UNIT DATA OF GRID SOUTH \*\*\*

HYDRO CODE	MW	UNIT	FOR	CODE	MW	UNIT	FOR
PAUTEAS	87.70	5.	2-5	PAUTE C	91.88	5.	2-5
DAU-PERI	43.00	2.	0-5	MAZAR	53.90	2.	0-5
OTHERS H	4.54	6.	5-1				
TOTAL					1118.94	20.	

THERMAL CODE	MW	UNIT	FOR	CODE	MW	UNIT	FOR
ESTERO V	70.00	2.	0-6	ESTERO G	20.00	1.	1-1
GUA V #2	9.50	2.	8-2	GUA VAP	31.60	1.	6-7
ESTERO E	15.00	1.	10-6	ESTERO E	20.00	4.	14-2
S-R DIES	1.34	17.	26-7	S-R BUNK	2.85	4.	23-1
SR.RECIE	1.84	20.	20-6	SR.REBUN	3.00	2.	21-2
ELECQUIL	37.00	2.	15-4	ELECQUIT	16.00	2.	15-4
GAS-93	78.00	1.	0-8	GAS-94	78.00	1.	0-8
VAPOR-95	117.50	1.	0-8	VAPOR-97	66.00	2.	0-8
TOTAL					894.08	63.	

HYDRO+THERMAL TOTAL 2013-02 83.

\*\*\* LOAD DATA OF GRID SOUTH \*\*\*

H1(MW) WKDAYS(DAY)  
1609. 20.

\*\*\* RELIABILITY OF SINGLE GRID SOUTH \*\*\*

LOLP (DAY/MONTH)	RESERVE MARGIN (MW)	RESERVE MARGIN (%)	DIFF.COEF. (DAY/MONTH/MW)
0.472392	322.61	20.05	-0.010883
0.400000	331.53	20.60	-0.014110
0.300038	345.45	21.47	-0.002552
* 0.085998	404.02	25.11	

\*\*\* INPUT DATA OF INTERCONNECTED SYSTEM \*\*\*

\*\* MONTE CARLO DATA \*\*

SAMPLE	LOLP(D/M)	RULE	RANDOM	RINIT
5000	0.500	RATAL	1	1

\*\* GRID DATA \*\*

NO. GRID NAME	RMINIT (MW)	BLOCK	H1 (MW)	RMMIN (%)	KDIF
1 NORTH	100.0	1	986.0	0	1
2 SOUTH	300.0	1	1609.0	0	1

\*\* BRANCH DATA \*\*

NB BRANCH CODE	NF	NT	CAP (MW)	F->T (MW)	T->F (MW)
1 LINE	NORTH ( 1)	SOUTH ( 2)	900.0	900.0	900.0

\*\*\* RELIABILITY OF INTERCONNECTED GRID \*\*\*

IT = 12	NORTH	SOUTH
RESERVE MARGIN (MW)	95.51	248.83
(%)	9.69	15.46
IT = 500	0.45888	0.48566
IT = 1000	0.51230	0.45677
IT = 1500	0.50953	0.48481
IT = 2000	0.49372	0.47094
IT = 2500	0.52317	0.51098
IT = 3000	0.51435	0.51641
IT = 3500	0.52620	0.51934
IT = 4000	0.51593	0.51101
IT = 4500	0.51812	0.50424
IT = 5000	0.50158	0.49844
LOLP(DAY/MONTH)	0.50158	0.49844
TOTAL RESERVE MARGIN	344.34(MW)	13.271%

ECUADOR DECEMBER 2003

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\*\*\* INPUT DATA OF INTERCONNECTED SYSTEM \*\*\*

\*\* MONTE CARLO DATA \*\*

SAMPLE	LOLP(D/M)	RULE	RANDOM	RINIT
5000	0.500	RATAL	1	1

\*\* GRID DATA \*\*

NO. GRID NAME	RMINIT (MW)	BLOCK	M1 (MW)	RMIN (%)	KDIF
1 NORTH	9.1	1	986.0	0	1
2 SOUTH	404.0	1	1609.0	0	1

\*\* BRANCH DATA \*\*

NS BRANCH CODE	NF	NT	CAP (MW)	F->T (MW)	T->F (MW)
1 LINE	NORTH ( 1 )	SOUTH ( 2 )	900.0	900.0	900.0

\*\*\* RELIABILITY OF INTERCONNECTED GRID \*\*\*

IT = 1	NORTH	SOUTH
RESERVE MARGIN (MW)	9.10	404.04
(%)	0.92	25.11
IT = 500	0.36606	0.05526
IT = 1000	0.33982	0.04974
IT = 1500	0.35580	0.03316
IT = 2000	0.33136	0.03343
IT = 2500	0.35536	0.04969
IT = 3000	0.36010	0.04751
IT = 3500	0.36747	0.06510
IT = 4000	0.35258	0.06239
IT = 4500	0.34189	0.06168
IT = 5000	0.32852	0.05756
LOLP(DAY/MONTH)	0.32852	0.05756
TOTAL RESERVE MARGIN	413.14(MW)	15.92(%)

\*\*\*\*\*  
\*  
\*  
\* RELIABILITY EVALUATION PROGRAM FOR INTERCONNECTED POWER SYSTEMS \*  
\* ( REPORT ) \*  
\* PRESENTED BY KCC \*  
\*  
\*  
\*\*\*\*\*

CALCULATION DATE 12/01/1993

LOLP OF SNI, AS OF DECEMBER, 1998 ALTERNATIVE



-----10-----20-----30-----40-----50-----60-----70

```

1 88BEGIN CONTR
2 C DATE
3 12/01/1993
4 C TITLE
5 LOLD OF SNI, AS OF DECEMBER, 1998 ALTERNATIVE
6 C GRID
7
8 C ICALCU IPSING IPMULT
9 . . . 0 0
10 C ANSMK ANSMK ANSMK ANSMK ANSMK ANSMK
11 0.5 0.4 0.3
12 * END OF "ANSMK" DATA
13 88END
14 88BEGIN SINGL
15 C TITLE
16 ECUADOR DECEMBER 1998
17 C CODFO KBLOCK
18 NORTH 1
19 C RANGEL HEIJIT DELTXX LTPX
20 50. 20. 50. P.
21 C LMMF
22 1
23 C LNMW LNMW LNMW LNMW LNMW LNMW
24 753.0 731.9 747.0 743.9 721.2 698.4 739.5
25 745.5 753.0 739.4 737.8 747.0 747.0 740.9
26 731.8 731.8 702.8 686.3 721.1 709.0 698.4
27 * END OF "LNMW" DATA
28 C INDEX1
29 1
30 C CODF TKW CN O IPOBI
31 AGOYAN 78.00 2. 0.154 0
32 PISAYAMB 32.70 2. 0.726 0
33 CUNHAYA 4.4125 4. 4.221 0
34 NAYON 7.00 2. 3.437 0
35 PASOCHOA 1.125 2. 0.396 0
36 CHILLOS 0.430 2. 2.915 0
37 OTHERS H 1.620 18. 4.221 0
38 * END OF "CODE TKW CN O IPOBI" DATA
39 C INDEX2
40 2
41 C CODE TKW CN O IPOBI
42 EMERALD 125.00 1. 0.88 0
43 SANTA RO 15.00 3. 22.25 0
44 GUANGOPO 4.05 6. 19.29 0
45 S-R DIES 2.20 1. 22.25 0
46 S-R BUNK 1.64 5. 19.29 0
47 SR.PEDIE 1.73 6. 22.25 0
48 SR.REBUN 3.76 9. 19.29 0
49 VAPOR-95 117.50 1. 0.80 0
50 VAPOR-97 66.00 2. 0.80 0
    
```

-----10-----20-----30-----40-----50-----60-----70

-----10-----20-----30-----40-----50-----60-----70

LINE #	DESCRIPTION	TKW	CN	IPOBI	TKW	CN	IPOBI
51	END OF "CODE TKW CN Q IPOBI" DATA						
52	INDEX3 LOVAR LOAV						
53	3 39.62 -21.40						
54	INDEX4 LTVAR LTAV						
55	4 0.0 0.0						
56	INDEX5 IHD						
57	5 H						
58	BT BT						
59	0.0						
60	END OF "BT" DATA						
61	BPROB BPROB						
62	1.00000						
63	END OF "BPROB" DATA						
64	C CODE KBLOCK						
65	SOUTH 1						
66	C RANGEL HELJIT DELTXX LTP						
67	50. 20. 50. P						
68	C LMMF						
69	1						
70	C LNMW LNMW LNMW LNMW LNMW LNMW						
71	1238.0 1201.5 1224.8 1223.1 1184.9 1148.2 1214.7						
72	1223.1 1238.0 1214.7 1211.4 1224.8 1226.3 1214.7						
73	1201.5 1201.5 1154.9 1125.0 1184.9 1164.9 1146.5						
74	END OF "LNMW" DATA						
75	C INDEX1						
76	1						
77	C CODE TKW CN IPOBI						
78	PAUTEAB 87.70 5 2.06 0						
79	PAUTE C 91.88 5 2.06 0						
80	DAU-PERI 43.00 2 0.50 0						
81	OTHERS H 4.54 6 4.22 0						
82	END OF "CODE TKW CN Q IPOBI" DATA						
83	C INDEX2						
84	2						
85	C CODE TKW CN IPOBI						
86	ESTERO V 70.00 2 0.53 0						
87	ESTERO G 20.00 1 0.88 0						
88	GUA V #2 9.50 2 6.82 0						
89	GUA VAP 31.60 1 5.61 0						
90	ESTERO E 15.00 1 8.85 0						
91	ESTERO E 20.00 4 11.80 0						
92	S.R DIES 1.34 17 22.25 0						
93	S.R BUNK 2.85 4 19.29 0						
94	SR.REIDIE 1.84 20 22.25 0						
95	SR.REBUN 3.00 2 19.29 0						
96	ELECGUIL 37.00 2 14.00 0						
97	ELECGUIT 16.00 2 14.00 0						
98	GAS-93 78.00 1 0.80 0						
99	GAS-94 78.00 1 0.80 0						
100	END OF "CODE TKW CN Q IPOBI" DATA						

-----10-----20-----30-----40-----50-----60-----70

-----10-----20-----30-----40-----50-----60-----70

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101 C INDEX3 LOVAR LOAV
102 3 66.31 -35.40
103 C INDEX4 LTAV
104 4 0.0 0.0
105 C INDEX5 IHD
106 S H
107 BY BT BT BT BT BT
108 0.0
109 * END OF "BY" DATA
110 C SPROB SPROB BPROB BPROB BPROB BPROB
111 1.00000
112 * END OF "BPROB" DATA
113 **END
114 **BEGIN GROUP
115 * END OF GROUP DATA
116 **END
117 **BEGIN MULTI
118 C TITLE
119 ECUADOR DECEMBER 1998
120 C ISAMPL LOLP IRULE RNTYP RNINT
121 5000 0.5 RATAL 1 1
122 C TOL1 TOL2 H RANGEM JSAMP
123 30. 3. 3.3 10. 10
124 C IRELAX NHINDO ITMAXO
125 0 1 31
126 C CODEB FROM TO CAP PFTMX PTFMX
127 LINE NORTH SOUTH 900. 900. 900.
128 * END OF "CODEB FROM TO CAP PFTMX PTFMX" DATA
129 C CODEX DIV DIV DIV DIV
130 DIV-1 0.0
131 DIV-2 0.0
132 * END OF "CODEX DIV" DATA
133 C CODEG TM IRESER KDIF RANGE1 RANGE2
134 NORTH 100. 0 1 10. 1.0
135 SOUTH 200. 0 1 10. 1.0
136 * END OF "CODEG TM IRESER KDIF RANGE1 RANGE2" DATA
137 **END
138 **BEGIN MULTI
139 C TITLE
140 ECUADOR DECEMBER 1998
141 C ISAMPL LOLP IRULE RNTYP RNINT
142 5000 0.5 RATAL 1 1
143 C TOL1 TOL2 H RANGEM JSAMP
144 30. 3. 3.3 10. 10
145 C IRELAX NHINDO ITMAXO
146 9 1 1
147 C CODEB FROM TO CAP PFTMX PTFMX
148 LINE NORTH SOUTH 900. 900. 900.
149 * END OF "CODEB FROM TO CAP PFTMX PTFMX" DATA
150 C CODEX DIV DIV DIV DIV

```

-----10-----20-----30-----40-----50-----60-----70

-----10-----20-----30-----40-----50-----60-----70

```
151 DIV-1 0.0
152 DIV-2 0.0
153 * END OF "CODEX DIV" DATA
154 C CODEG TM IRESER KDIF RANGE1 RANGE2
155 NORTH 30.74 0 1 10. 1.0
156 SOUTH 417.72 0 1 10. 1.0
157 * END OF "CODEG TM IRESER KDIF RANGE1 RANGE2" DATA
158 &REND
-----10-----20-----30-----40-----50-----60-----70
```

\*\*\* UNIT DATA OF GRID NORTH \*\*\*

HYDRO CODE	MW	UNIT	FOR	CODE	MW	UNIT	FOR
AGOYAN	78.00	2.	0.2	PISAYAMB	32.70	2.	0.7
CUMBAYA	4.41	4.	4.2	NAYON	7.00	2.	3.4
PASOCHOA	1.13	2.	0.4	CHILLOS	0.43	2.	2.9
OTHERS H	1.62	18.	4.2				
				TOTAL	285.32	32.	

THERMAL CODE	MW	UNIT	FOR	CODE	MW	UNIT	FOR
ESMERALD	125.00	1.	0.9	SANTA RO	15.00	3.	22.3
GUANSOPO	4.05	6.	19.3	S.R DIES	2.20	1.	22.3
S.R BUNK	1.64	5.	19.3	SR.REDIE	1.73	6.	22.3
SR.REBUN	3.76	9.	19.3	VAPOR-95	117.50	1.	0.8
VAPOR-97	66.00	2.	0.3				
				TOTAL	498.42	34.	
				HYDRO+THERMAL TOTAL	783.74	66.	

\*\*\* LOAD DATA OF GRID NORTH \*\*\*

H1(MW) WKDAYS(DAY)  
753. 20.

\*\*\* RELIABILITY OF SINGLE GRID NORTH \*\*\*

LOLP (DAY/MONTH)	RESERVE MARGIN (MW)	RESERVE MARGIN (%)	DIFF. COEF. (DAY/MONTH/MW)
0.500000	190.48	25.30	-0.014810
0.407439	194.00	25.76	-4.031279
0.300000	195.68	25.99	-0.009227
*14.035419	30.74	4.08	

ECUADOR DECEMBER 1998

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\*\*\* UNIT DATA OF GRID SOUTH \*\*\*

HYDRO CODE	MW	UNIT	FOR	CODE	MW	UNIT	FOR
PAUTEAB	87.70	5.	2.1	PAUTE C	91.88	5.	2.1
DAU-PERI	43.00	2.	0.5	OTHERS H	4.54	6.	4.2
					TOTAL	1011.14	18.

THERMAL CODE	MW	UNIT	FOR	CODE	MW	UNIT	FOR
ESTERO V	70.00	2.	0.5	ESTERO G	20.00	1.	0.9
GUA V #2	9.50	2.	6.8	GUA VAP	31.60	1.	5.6
ESTERO E	15.00	1.	8.9	ESTERO E	20.00	4.	11.8
S.R DIES	1.34	17.	22.3	S.R BUNK	2.85	4.	19.3
SR.REDIE	1.84	20.	22.3	SR.REBUN	3.00	2.	19.3
ELECOUIL	37.00	2.	14.0	ELECOUIT	16.00	2.	14.0
GAS-93	78.00	1.	0.8	GAS-94	78.00	1.	0.8
					TOTAL	644.58	60.

HYDRO+THERMAL TOTAL 1655.72 78.

\*\*\* LOAD DATA OF GRID SOUTH \*\*\*

H1(MW) WKDAYS(DAY)  
1238. 20.

\*\*\* RELIABILITY OF SINGLE GRID SOUTH \*\*\*

LOLP (DAY/MONTH)	RESERVE MARGIN (MW)	(%)	DIFF. COEF. (DAY/MONTH/MW)
0.500000	283.72	22.92	-0.004336
0.392397	287.11	23.19	-0.075217
0.281054	301.07	24.32	-0.010432
* 0.020822	417.72	33.74	

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ECUADOR DECEMBER 1998

\*\*\* INPUT DATA OF INTERCONNECTED SYSTEM \*\*\*

\*\* MONTE CARLO DATA \*\*

SAMPLE	LOLP(D/M)	RULE	RANDOM	RINIT
5000	0.500	RATAL	1	1

\*\* GRID DATA \*\*

NO.	GRID NAME	RINIT (MW)	BLOCK	H1 (MW)	RMIN (%)	KDIF
1	NORTH	100.0	1	753.0	0	1
2	SOUTH	200.0	1	1238.0	0	1

\*\* BRANCH DATA \*\*

NB	BRANCH CODE	NF	NT	CAP (MW)	F->T (MW)	T->F (MW)
1	LINE	NORTH ( 1 )	SOUTH ( 2 )	900.0	900.0	900.0

ECUADOR DECEMBER 1998

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\*\*\* RELIABILITY OF INTERCONNECTED GRID \*\*\*

IT = 14	NORTH	SOUTH
RESERVE MARGIN (MW)	76.91	203.73
RESERVE MARGIN (%)	10.21	16.46
IT = 500	0.45792	0.49187
IT = 1000	0.50733	0.45707
IT = 1500	0.50436	0.46638
IT = 2000	0.49387	0.47173
IT = 2500	0.52451	0.51379
IT = 3000	0.51556	0.52009
IT = 3500	0.53142	0.52169
IT = 4000	0.52011	0.51281
IT = 4500	0.51986	0.50594
IT = 5000	0.50143	0.50051
LOLP(DAY/MONTH)	0.50143	0.50051
TOTAL RESERVE MARGIN	280.64(MW)	14.10(%)



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\*\*\* INPUT DATA OF INTERCONNECTED SYSTEM \*\*\*

\*\* MONTE CARLO DATA \*\*

SAMPLE	LOLP(D/M)	RULE	RANDOM	RINIT
5000	0.500	RATAL	1	1

\*\* GRID DATA \*\*

NO.	GRID NAME	RMINIT (MW)	BLOCK	H1 (MW)	RMMIN (%)	KDIF
1	NORTH	30.7	1	753.0	0	1
2	SOUTH	417.7	1	1238.0	0	1

\*\* BRANCH DATA \*\*

NB	BRANCH CODE	NF	NT	CAP (MW)	F->T (MW)	T->F (MW)
1	LINE	NORTH ( 1)	SOUTH ( 2)	900.0	900.0	900.0

\*\*\* RELIABILITY OF INTERCONNECTED GRID \*\*\*

IT = 1	NORTH	SOUTH
RESERVE MARGIN (MW)	30.74	417.72
(%)	4.08	33.74
IT = 500	0.10453	0.02169
IT = 1000	0.05391	0.01084
IT = 1500	0.03665	0.00723
IT = 2000	0.03406	0.00542
IT = 2500	0.03205	0.00497
IT = 3000	0.03872	0.00414
IT = 3500	0.05934	0.00914
IT = 4000	0.05228	0.00800
IT = 4500	0.05382	0.00711
IT = 5000	0.05112	0.00640
LOLR(DAY/MONTH)	0.05112	0.00640
TOTAL RESERVE MARGIN	448.46(MW)	22.52(%)

\*\*\*\*\*  
\*  
\*  
\* RELIABILITY EVALUATION PROGRAM FOR INTERCONNECTED POWER SYSTEMS \*  
\* ( REPORT ) \*  
\* PRESENTED BY KCC \*  
\*  
\*\*\*\*\*

CALCULATION DATE 12/01/1993

LOLP OF SNI, AS OF DECEMBER, 2003 ALTERNATIVE

-----10-----20-----30-----40-----50-----60-----70

```

1 ##BEGIN CONTR
2 C DATE
3 12/01/1993
4 C TITLE
5 LOLF OF SNI, AS OF DECEMBER, 2003 ALTERNATIVE
6 C GRID
7
8 C ICALCU IPSING IPMULT
9 0 0 0
10 C ANSMK ANSMK ANSMK ANSMK ANSMK ANSMK ANSMK ANSMK
11 0.5 0.4 0.3
12 * END OF "ANSMK" DATA
13 ##END
14 ##BEGIN SINGL
15 C TITLE
16 ECUADOR DECEMBER 2003
17 C CODEO KBLOCK
18 NORTH 1
19 C RANGEL HEIJIT DELTXX LTY P
20 50. 20. 50.
21 C LMWF
22 1
23 C LNMW LNMW LNMW LNMW LNMW LNMW LNMW LNMW
24 986.0 958.2 978.1 974.0 944.2 914.4 968.2
25 976.1 986.0 968.2 956.1 978.1 970.2
26 958.2 958.2 920.3 898.6 944.2 928.4 914.4
27 * END OF "LNMW" DATA
28 C INDEX1
29 1
30 C CODE TKW CN Q IPOBI
31 AGOYAN 78.00 2. 0.185 0
32 PISAYAMB 32.70 2. 0.871 0
33 CUMBAYA 4.4125 4. 5.065 0
34 NAYON 7.00 2. 4.125 0
35 PASOCHOA 1.125 2. 0.475 0
36 CHILLOS 0.430 2. 3.498 0
37 S.FRACIS 113.0 2. 0.500 0
38 TOACHI 64.4 2. 0.500 0
39 OTHERS H 1.620 18. 5.065 0
40 * END OF "CODE TKW CN Q IPOBI" DATA
41 C INDEX2
42 2
43 C CODE TKW CN Q IPOBI
44 ESERALD 125.00 1. 1.07 0
45 SANTA RO 15.00 3. 26.70 0
46 GUANGOPO 4.05 6. 23.15 0
47 S.R DIES 2.20 1. 26.70 0
48 S.R BUNK 1.64 5. 23.15 0
49 SR.REDIE 1.73 6. 23.36 0
50 SR.REBUN 3.76 9. 20.26 0
    
```

-----10-----20-----30-----40-----50-----60-----70

-----10-----20-----30-----40-----50-----60-----70

51	GAS-2003	27.00	1.	0.80	0				
52	VAPOR-95	117.50	1.	0.84	0				
53	VAPOR-97	66.00	2.	0.84	0				
54 *	END OF "CODE TKW CN Q IPOBI" DATA								
55 C	INDEX3	LOVAR	LOAV						
56	3	51.88	-28.02						
57 C	INDEX4	LTAV	LTAV						
58	4	0.0	0.0						
59 C	INDEX5	IHD							
60	5	H							
61	BT	BT	BT	BT	BT	BT	BT	BT	BT
62	0.0								
63 *	END OF "BT" DATA								
64 C	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB
65	1.00000								
66 *	END OF "BPROB" DATA								
67 C	CODE0	KBLOCK							
68	SOUTH	1							
69 C	RANGEL	HEIJIT	DELTX	LTP					
70	50.	20.	50.	P					
71 C	LMWF								
72	1								
73 C	LNMW	LNMW	LNMW	LNMW	LNMW	LNMW	LNMW	LNMW	LNMW
74	1609.0	1561.6	1591.8	1589.6	1540.0	1492.3	1578.8	1578.8	1490.1
75	1589.6	1609.0	1578.8	1574.4	1591.8	1593.8	1578.8	1578.8	1490.1
76	1561.6	1561.6	1500.9	1462.1	1540.0	1513.9	1540.0	1513.9	1490.1
77 *	END OF "LNMW" DATA								
78 C	INDEX1								
79	1								
80 C	CODE	TKW	CN	Q	IPOBI				
81	PAUTEAB	87.70	5.	2.47	0				
82	PAUTE C	91.88	5.	2.47	0				
83	DAU-PERI	43.00	2.	0.52	0				
84	MAZAR	53.90	2.	0.50	0				
85	OTHERS H	4.54	6.	5.07	0				
86 *	END OF "CODE TKW CN Q IPOBI" DATA								
87 C	INDEX2								
88	2								
89 C	CODE	TKW	CN	Q	IPOBI				
90	ESTERO V	70.00	2.	0.63	0				
91	ESTERO G	20.00	1.	1.06	0				
92	GUA V #2	9.50	2.	8.18	0				
93	GUA VAP	31.60	1.	6.73	0				
94	ESTERO E	15.00	1.	10.63	0				
95	ESTERO E	20.00	4.	14.16	0				
96	S.R DIES	1.34	17.	26.70	0				
97	S.R BUNK	2.85	4.	23.15	0				
98	SR-REDIE	1.84	20.	20.56	0				
99	SR-REBUN	3.00	2.	21.22	0				
100	ELECGUIL	37.00	2.	15.40	0				

-----10-----20-----30-----40-----50-----60-----70

-----10-----20-----30-----40-----50-----60-----70

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101 ELECQUIT 16.00 2. 15.40 0
102 GAS-93 78.00 1. 0.84 0
103 GAS-94 78.00 1. 0.84 0
104 GAS-2001 78.00 1. 0.80 0
105 * END OF "CODE TKW CN G IPOBI" DATA
106 C INDEX3 LOVAR LOAV
107 3 86.19 -46.01
100 C INDEX4 LIVAR LTAV
109 4 0.0 0.0
110 C INDEX5 IHD
111 5 H
112 BT BT BT BT BT BT BT BT
113 0.0
114 * END OF "BT" DATA
115 C SPROB BPROB BPROB BPROB BPROB BPROB BPROB BPROB
116 1.00000
117 * END OF "BPROB" DATA
118 &&END
119 &&BEGIN GROUP
120 + END OF GROUP DATA
121 &&END
122 &&BEGIN MULTI
123 C TITLE
124 ECUADOR DECEMBER 2003
125 C ISAMPL LOLP IRULE RNTYP RNINT
126 5000 0.5 RATAL 1 1
127 C TOL1 TOL2 H RANGEM JSAMP
128 30. 3. 3.3 10. 10
129 C IRELAX NHINDO ITMAXO
130 0 1 31
131 C CODEB FROM TO CAP PTFMX PTFMX
132 LINE NORTH SOUTH 900. 900. 900.
133 * END OF "CODEB FROM TO CAP PTFMX PTFMX" DATA
134 C CODEX DIV DIV DIV DIV
135 DIV-1 0.0
136 DIV-2 0.0
137 * END OF "CODEX DIV" DATA
138 C CODEG TM IRESER KDIF RANGE1 RANGE2
139 NORTH 100. 0 1 10. 1.0
140 SOUTH 300. 0 1 10. 1.0
141 * END OF "CODEG TM IRESER KDIF RANGE1 RANGE2" DATA
142 &&END
143 &&BEGIN MULTI
144 C TITLE
145 ECUADOR DECEMBER 2003
146 C ISAMPL LOLP IRULE RNTYP RNINT
147 5000 0.5 RATAL 1 1
148 C TOL1 TOL2 H RANGEM JSAMP
149 30. 3. 3.3 10. 10
150 C IRELAX NHINDO ITMAXO

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-----10-----20-----30-----40-----50-----60-----70

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-----10-----20-----30-----40-----50-----60-----70
151          9          1          1
152 C CODEB FROM TO CAP PFTMX PTFMX
153 LINE NORTH SOUTH 900. 900. 900.
154 * END OF "CODEB FROM TO CAP PFTMX PTFMX" DATA
155 C CODEX DIV DIV DIV DIV
156 DIV-1 0.0
157 DIV-2 0.0
158 * END OF "CODEX DIV" DATA
159 C CODEG TM IRESER KDIF RANGE1 RANGE2
160 NORTH 179.54 0 1 10. 1.0
161 SOUTH 232.52 0 1 10. 1.0
162 * END OF "CODEG TM IRESER KDIF RANGE1 RANGE2" DATA
163 &&END
-----10-----20-----30-----40-----50-----60-----70

```

\*\*\* UNIT DATA OF GRID NORTH \*\*\*

HYDRO	CODE	MW	UNIT	FOR	CODE	MW	UNIT	FOR
	AGYAN	78.00	2.	0.2	PISAYAMB	32.70	2.	0.9
	CUMBAYA	4.41	4.	5.1	NAYON	7.00	2.	4.1
	PASOCHOA	1.13	2.	0.5	CHILLOS	0.43	2.	3.5
	S.FRACIS	113.00	2.	0.5	TOACHI	64.40	2.	0.5
	OTHERS H	1.62	18.	5.1				
					TOTAL	640.12	36.	

THERMAL	CODE	MW	UNIT	FOR	CODE	MW	UNIT	FOR
	ESMERALD	125.00	1.	1.1	SANTA RO	15.00	3.	26.7
	GUANGOPO	4.05	6.	23.1	S.R DIES	2.20	1.	26.7
	S.R BUNK	1.64	5.	23.1	SR.REDIE	1.73	6.	23.4
	SR.REBUN	3.76	9.	20.3	GAS-2003	27.00	1.	0.8
	VAPOR-95	117.50	1.	0.8	VAPOR-97	66.00	2.	0.8
					TOTAL	525.42	35.	

HYDRO+THERMAL TOTAL 1165.54 71.

\*\*\* LOAD DATA OF GRID NORTH \*\*\*

H1(MW)	WKDAYS(DAY)
986.	20.

\*\*\* RELIABILITY OF SINGLE GRID NORTH \*\*\*

LOLP (DAY/MONTH)	RESERVE MARGIN (MW)	RESERVE MARGIN (%)	DIFF. COEF. (DAY/MONTH/MW)
0.498322	200.46	20.33	-0.064507
0.442476	220.79	22.39	-0.003171
0.299418	233.68	23.70	-0.010961
* 1.262555	179.54	18.21	



\*\*\* UNIT DATA OF GRID SOUTH \*\*\*

HYDRO CODE	MW	UNIT	FOR CODE	MW	UNIT	FOR
PAUTEAB	87.70	5.	2.5 PAUTE C	91.88	5.	2.5
DAU-PERI	43.00	2.	0.5 MAZAR	53.90	2.	0.5
OTHERS H	4.54	6.	5.1			
TOTAL				118.94	20.	

THERMAL CODE	MW	UNIT	FOR CODE	MW	UNIT	FOR
ESTERO V	70.00	2.	0.6 ESTERO G	20.00	1.	1.1
GUA V #2	9.50	2.	8.2 GUA VAP	31.60	1.	6.7
ESTERO E	15.00	1.	10.6 ESTERO E	20.00	4.	14.2
S.R DIES	1.34	17.	26.7 S.R BUNK	2.85	4.	23.1
SR-RFDIE	1.84	20.	20.6 SR-REBUN	3.00	2.	21.2
ELECCUIL	37.00	2.	15.4 ELECCUIT	16.00	2.	15.4
GAS-93	78.00	1.	0.8 GAS-94	78.00	1.	0.8
GAS-2001	78.00	1.				
TOTAL				722.58	61.	

HYDRO+THERMAL TOTAL 1841.52 81.

\*\*\* LOAD DATA OF GRID SOUTH \*\*\*

H1(MW)	WKDAYS(DAY)
1609.	20.

\*\*\* RELIABILITY OF SINGLE GRID SOUTH \*\*\*

LOLP (DAY/MONTH)	RESERVE MARGIN (MW)	RESERVE MARGIN (%)	DIFF-COEF. (DAY/MONTH/MW)
0.560113	303.44	18.86	-0.002826
0.423419	330.53	20.54	-0.020102
0.299462	337.89	21.00	-0.002000
* 1.861536	232.52	14.45	

ECUADOR DECEMBER 2003

P-7

\*\*\* INPUT DATA OF INTERCONNECTED SYSTEM \*\*\*

\*\* MONTE CARLO DATA \*\*

SAMPLE	LOLP(D/M)	RULE	RANDOM	RINIT
5000	0.500	RATAL	1	1

\*\* GRID DATA \*\*

NO.	GRID NAME	RMINIT (MW)	BLOCK (MW)	H1 (MW)	RMIN (%)	KDIF
1	NORTH	100.0	1	986.0	0	1
2	SOUTH	300.0	1	1609.0	0	1

\*\* BRANCH DATA \*\*

NB	BRANCH CODE	NF	NT	CAP (MW)	F->T (MW)	T->F (MW)
1	LINE	NORTH ( 1 )	SOUTH ( 2 )	900.0	900.0	900.0

\*\*\* RELIABILITY OF INTERCONNECTED GRID \*\*\*

IT =	RESERVE MARGIN (MW)	NORTH	SOUTH
9	100.00	244.40	
	(%)	10.14	15.19
IT = 500	0.46049	0.48598	
IT = 1000	0.51722	0.45600	
IT = 1500	0.51177	0.48488	
IT = 2000	0.49741	0.47246	
IT = 2500	0.52587	0.51420	
IT = 3000	0.51682	0.51952	
IT = 3500	0.53052	0.52227	
IT = 4000	0.51904	0.51383	
IT = 4500	0.51977	0.50542	
IT = 5000	0.50276	0.49921	
LOLP(DAY/MONTH)	0.50276	0.49921	
TOTAL RESERVE MARGIN	344.40(MW)		13.27(%)

\*\*\* INPUT DATA OF INTERCONNECTED SYSTEM \*\*\*

\*\* MONTE CARLO DATA \*\*

SAMPLE	LOLP(D/M)	RULE	RANDOM	RINIT
5000	0.500	RATAL	1	1

\*\* GRID DATA \*\*

NO.	GRID NAME	RINIT (MW)	BLOCK	H1 (MW)	RMIN (%)	KDIF
1	NORTH	179.5	1	986.0	0	1
2	SOUTH	232.5	1	1609.0	0	1

\*\* BRANCH DATA \*\*

NB	BRANCH CODE	NF	NT	CAP (MW)	F->T (MW)	T->F (MW)
1	LINE	NORTH ( 1)	SOUTH ( 2)	900.0	900.0	900.0

\*\*\* RELIABILITY OF INTERCONNECTED GRID \*\*\*

IT = 1	NORTH	SOUTH
RESERVE MARGIN (MW)	179.54	232.52
(%)	18.21	14.45
IT = 500	0.15093	0.22681
IT = 1000	0.12394	0.23131
IT = 1500	0.13894	0.23961
IT = 2000	0.12697	0.22489
IT = 2500	0.11071	0.26455
IT = 3000	0.11388	0.26141
IT = 3500	0.11642	0.27380
IT = 4000	0.11562	0.26105
IT = 4500	0.11679	0.25103
IT = 5000	0.11305	0.23832
LOLP(DAY/MONTH)	0.11305	0.23832
TOTAL RESERVE MARGIN	412.06(MW)	15.88(%)

\*\*\*\*\*  
\*  
\* RELIABILITY EVALUATION PROGRAM FOR INTERCONNECTED POWER SYSTEMS \*  
\* ( REPORT ) \*  
\* PRESENTED BY KCC \*  
\*  
\*\*\*\*\*

CALCULATION DATE 12/15/1993

LOLP OF SNI, AS OF DECEMBER, 1998 RECOMMENDATION

-----10-----20-----30-----40-----50-----60-----70

```

1 &&BEGIN CONTR
2 C DATE
3 12/15/1993
4 C TITLE
5 LOP. OF SNI, AS OF DECEMBER, 1998 RECOMMENDATION
6 C GRID
7
8 C ICALCU IPSING IPMULT
9 0 0 0
10 C ANSMK ANSMK ANSMK ANSMK ANSMK ANSMK ANSMK ANSMK
11 0.5 0.4 0.3
12 * END OF "ANSMK" DATA
13 &&END
14 &&BEGIN SINGL
15 C TITLE
16 ECUADOR DECEMBER 1998
17 C CODEO KBLOCK
18 NORTH 1
19 C RANGEL HEIJIT DELTXX LTYL
20 50. 20. 50. P
21 C LMF 1
22
23 C LNMW LNMW LNMW LNMW LNMW LNMW LNMW LNMW
24 753.0 731.9 747.0 743.9 721.2 698.4 739.5
25 745.5 753.0 739.4 737.8 747.0 747.0 740.9
26 731.8 731.8 702.8 686.3 721.1 709.0 698.4
27 * END OF "LNMW" DATA
28 C INDEX1
29 1
30 C CODE CN G IPOBI
31 AGOYAN 78.00 2. 0.154 0
32 PISAYAMB 32.70 2. 0.726 0
33 CUMBAYA 4.4125 4. 4.221 0
34 NAYON 7.00 2. 3.437 0
35 PASOCHOA 1.125 2. 0.396 0
36 CHILLOS 0.430 2. 2.915 0
37 OTHERS H 1.620 18. 4.221 0
38 DAU-PERI 43.00 2. 0.50 0
39 * END OF "CODE TKW CN G IPOBI" DATA
40 C INDEX2
41 2
42 C CODE CN G IPOBI
43 EMERALD 125.00 1. 0.88 0
44 SANTA RO 15.00 3. 22.25 0
45 GUANGOPO 4.05 6. 19.29 0
46 S.R DIES 2.20 1. 22.25 0
47 S.R BUNK 1.64 5. 19.29 0
48 SR-REDIE 1.73 6. 22.25 0
49 SR-REBUN 3.76 9. 19.29 0
50 VAPOR-97 66.00 2. 0.80 0
    
```

-----10-----20-----30-----40-----50-----60-----70

-----10-----20-----30-----40-----50-----60-----70

LINE	CODE	DESCRIPTION	TKW	CN	Q	IPOBI	DATA
51	*	END OF "CODE TKW CN Q IPOBI" DATA					
52	C	LOVAR	LOAV				
53			39.62	-21.40			
54	C	LTAV	LTAV				
55			0.0	0.0			
56	C	IHD					
57							
58	BT	BT	BT	BT	BT	BT	BT
59			0.0				
60	*	END OF "BT" DATA					
61	C	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB
62			1.00000				
63	*	END OF "BPROB" DATA					
64	C	KBLOCK					
65							
66	C	RANGEL	HEIJT	DELTX	LTP		
67			50.	20.	50.	P	
68	C	LMWF					
69							
70	C	LNHW	LNHW	LNHW	LNHW	LNHW	LNHW
71			1238.0	1201.5	1224.8	1223.1	1184.9
72			1238.0	1238.0	1214.7	1211.4	1224.8
73			1201.5	1201.5	1154.9	1125.0	1184.9
74	*	END OF "LNHW" DATA					
75	C	INDEX1					
76							
77	C	TKW	CN	Q	IPOBI		
78			87.70	5.	2.06	0	
79			91.88	5.	2.06	0	
80			4.54	6.	4.22	0	
81	*	END OF "CODE TKW CN Q IPOBI" DATA					
82	C	INDEX2					
83							
84	C	TKW	CN	Q	IPOBI		
85			70.00	2.	0.53	0	
86			20.00	1.	0.88	0	
87			9.50	2.	6.82	0	
88			31.60	1.	5.61	0	
89			15.00	1.	8.85	0	
90			20.00	4.	11.80	0	
91			1.34	17.	22.25	0	
92			2.85	4.	19.29	0	
93			1.84	20.	22.25	0	
94			3.00	2.	19.29	0	
95			37.00	2.	14.00	0	
96			16.00	2.	14.00	0	
97			78.00	1.	0.80	0	
98			78.00	1.	0.80	0	
99			117.50	1.	0.80	0	
100	*	END OF "CODE TKW CN Q IPOBI" DATA					

-----10-----20-----30-----40-----50-----60-----70



-----10-----20-----30-----40-----50-----60-----70-----

```

101 C INDEX3 LOVAR LOAV
102 3 66.31 -35.60
103 C INDEX4 LTVAR LTAV
104 4 0.0 0.0
105 C INDEX5 IHD
106 5 H
107 BT BT BT BT BT
108 0.0
109 * END OF "BT" DATA
110 C BPROB BPROB BPROB BPROB BPROB BPROB
111 1.00000
112 * END OF "BPROB" DATA
113 &&END
114 &&BEGIN GROUP
115 * END OF GROUP DATA
116 &&END
117 &&BEGIN MULTI
118 C TITLE
119 ECUADOR DECEMBER 1998
120 C ISAMPL LOLP IRULE RNTYP RNINT
121 5000 0.5 RATAL 1 1
122 C TOL1 TOL2 H RANGEM JSAMP
123 30. 3. 3.3 10. 10
124 C IRELAX NHINDO ITMAXO
125 0 1 31
126 C CODEB FROM TO CAP PFTMX PFTMX
127 LINE NORTH SOUTH 900. 900.
128 * END OF "CODES FROM TO CAP PFTMX PFTMX" DATA
129 C CODEX DIV DIV DIV DIV
130 DIV-1 0.0
131 DIV-2 0.0
132 * END OF "CODEX DIV" DATA
133 C CODEG TM IRESER KDIF RANGE1 RANGE2
134 NORTH 100. 0 1 10. 1.0
135 SOUTH 200. 0 1 10. 1.0
136 * END OF "CODEG TM IRESER KDIF RANGE1 RANGE2" DATA
137 &&END
138 &&BEGIN MULTI
139 C TITLE
140 ECUADOR DECEMBER 1998
141 C ISAMPL LOLP IRULE RNTYP RNINT
142 5000 0.5 RATAL 1 1
143 C TOL1 TOL2 H RANGEM JSAMP
144 30. 3. 3.3 10. 10
145 C IRELAX NHINDO ITMAXO
146 9 1 1
147 C CODEB FROM TO CAP PFTMX PFTMX
148 LINE NORTH SOUTH 900. 900.
149 * END OF "CODES FROM TO CAP PFTMX PFTMX" DATA
150 C CODEX DIV DIV DIV DIV

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-----10-----20-----30-----40-----50-----60-----70-----

-----10-----20-----30-----40-----50-----60-----70

```
151 DIV-1 0.0
152 DIV-2 0.0
153 * END OF "CODEX DIV" DATA
154 C CODEG TM IRESER KDIF RANGE1 RANGE2
155 NORTH -0.76 0 1 10. 1.0
156 SOUTH 449.22 0 1 10. 1.0
157 * END OF "CODEG TM IRESER KDIF RANGE1 RANGE2" DATA
158 **END
```

-----10-----20-----30-----40-----50-----60-----70

\*\*\* UNIT DATA OF GRID NORTH \*\*\*

HYDRO CODE	MW	UNIT	FOR	CODE	MW	UNIT	FOR
AGYAN	78.00	2.	0.2	PISAYAMB	32.70	2.	0.7
CUMBAYA	4.41	4.	4.2	NAYON	7.00	2.	3.4
PASOCHOA	1.13	2.	0.4	CHILLOS	0.43	2.	2.9
OTHERS H	1.62	18.	4.2	DAU-PERI	43.00	2.	0.5
				TOTAL	371.32	34.	

THERMAL CODE	MW	UNIT	FOR	CODE	MW	UNIT	FOR
ESMERALD	125.00	1.	0.9	SANTA RO	15.00	3.	22.3
GUANGOPO	4.05	6.	19.3	S.R DIES	2.20	1.	22.3
S.R BUNK	1.64	5.	19.3	SR.REDIE	1.73	6.	22.3
SR.REBUN	3.76	9.	19.3	VAPOR-97	66.00	2.	0.8
				TOTAL	380.92	33.	

HYDRO+THERMAL TOTAL 752.24 67.

\*\*\* LOAD DATA OF GRID NORTH \*\*\*

H1(MW) WKDAYS(DAY)  
753. 20.

\*\*\* RELIABILITY OF SINGLE GRID NORTH \*\*\*

LOLP (DAY/MONTH)	RESERVE MARGIN (MW)	RESERVE MARGIN (%)	DIFF. COEF. (DAY/MONTH/MW)
0.499277	187.39	24.89	-0.024185
0.400000	192.50	25.56	-0.026022
0.251498	196.19	26.05	-0.026791
*16.392649	-0.76	-0.10	

ECUADOR DECEMBER 1998

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\*\*\* UNIT DATA OF GRID SOUTH \*\*\*

HYDRO CODE	MW	UNIT	FOR	CODE	MW	UNIT	FOR
PAUTEAB	87.70	5.	2.1	PAUTE C	91.88	5.	2.1
OTHERS H	4.54	6.	4.2				
TOTAL					925.14	16.	

THERMAL CODE

MW	UNIT	FOR	CODE	MW	UNIT	FOR
ESTERO V	70.00	2.	0.5	ESTERO G	20.00	1.
GUA V #2	9.50	2.	6.8	GUA VAP	31.60	1.
ESTERO E	15.00	1.	8.9	ESTERO E	20.00	4.
S-R DIES	1.34	17.	22.3	S-R BUNK	2.85	4.
SR.REDIE	1.84	20.	22.3	SR.REBUN	3.00	2.
ELECCUIL	37.00	2.	14.0	ELECCUIT	16.00	2.
GAS-93	78.00	1.	0.8	GAS-94	78.00	1.
VAPOR-95	117.50	1.	0.8			
TOTAL					762.08	61.

HYDRO+THERMAL TOTAL 1687.22 77.

\*\*\* LOAD DATA OF GRID SOUTH \*\*\*

H1(MW)	WKDAYS(DAY)
1238.	20.

\*\*\* RELIABILITY OF SINGLE GRID SOUTH \*\*\*

LOLP (DAY/MONTH)	RESERVE MARGIN (MW)	RESERVE MARGIN (%)	DIFF. COEF. (DAY/MONTH/MW)
0.516102	284.59	22.99	-0.031453
0.400000	287.57	23.23	-0.022101
0.339292	297.29	24.01	-0.000964
* 0.008981	449.22	36.29	

ECUADOR DECEMBER 1998

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\*\*\* INPUT DATA OF INTERCONNECTED SYSTEM \*\*\*

\*\* MONTE CARLO DATA \*\*

SAMPLE	LOLP(D/M)	RULE	RANDOM	RINIT
5000	0.500	RATAL	1	1

\*\* GRID DATA \*\*

NO.	GRID NAME	RMINIT (MW)	BLOCK	H1 (MW)	RMIN (%)	KDIF
1	NORTH	100.0	1	753.0	0	1
2	SOUTH	200.0	1	1238.0	0	1

\*\* BRANCH DATA \*\*

NB	BRANCH CODE	NF	NT	CAP (MW)	F-3T (MW)	T-3F (MW)
1	LINE	NORTH ( 1 )	SOUTH ( 2 )	900.0	900.0	900.0

\*\*\* RELIABILITY OF INTERCONNECTED GRID \*\*\*

IT = 13	NORTH	SOUTH
RESERVE MARGIN (MW)	73.27	207.35
(%)	9.73	16.75
IT = 500	0.44119	0.49643
IT = 1000	0.50241	0.46149
IT = 1500	0.50309	0.49054
IT = 2000	0.49193	0.47307
IT = 2500	0.52300	0.51502
IT = 3000	0.51426	0.52080
IT = 3500	0.52695	0.52153
IT = 4000	0.51895	0.51311
IT = 4500	0.51869	0.50828
IT = 5000	0.50029	0.50248
LOLP(DAY/MONTH)	0.50029	0.50248
TOTAL RESERVE MARGIN	280.62(MW)	14.09(%)

ECUADOR DECEMBER 1998

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\*\*\* INPUT DATA OF INTERCONNECTED SYSTEM \*\*\*

\*\* MONTE CARLO DATA \*\*

SAMPLE	LOLP(D/M)	RULE	RANDOM	RINIT
5000	0.500	RATAL	1	1

\*\* GRID DATA \*\*

NO.	GRID NAME	RMINIT (MW)	BLOCK	H1 (MW)	RMIN (%)	KDIF
1	NORTH	-0.8	1	753.0	0	1
2	SOUTH	449.2	1	1238.0	0	1

\*\* BRANCH DATA \*\*

NB	BRANCH CODE	NF	NT	CAP (MW)	F->T (MW)	T->F (MW)
1	LINE	NORTH ( 1)	SOUTH ( 2)	900.0	900.0	900.0

\*\*\* RELIABILITY OF INTERCONNECTED GRID \*\*\*

IT = 1	NORTH	SOUTH
RESERVE MARGIN (MW)	-0.76	449.22
(%)	-0.10	36.29
IT = 500	0.07887	0.00411
IT = 1000	0.04179	0.00205
IT = 1500	0.02786	0.00137
IT = 2000	0.02747	0.00103
IT = 2500	0.03059	0.00082
IT = 3000	0.03659	0.00068
IT = 3500	0.05856	0.00431
IT = 4000	0.05155	0.00377
IT = 4500	0.05265	0.00335
IT = 5000	0.05025	0.00301
LOLP(DAY/MONTH)	0.05025	0.00301

TOTAL RESERVE MARGIN 448.46(MW) 22.52(%)



\*\*\*\*\*  
\*  
\*  
\* RELIABILITY EVALUATION PROGRAM FOR INTERCONNECTED POWER SYSTEMS \*  
\* ( REPORT ) \*  
\* PRESENTED BY KCC \*  
\*  
\*  
\*\*\*\*\*

CALCULATION DATE 12/15/1993

LOLP OF SNI, AS OF DECEMBER, 2003 RECOMMENDATION

-----10-----20-----30-----40-----50-----60-----70

```

1 &&BEGIN CONTR
2 C DATE
3 12/15/1993
4 C TITLE
5 LOP OF SNI, AS OF DECEMBER, 2003 RECOMMENDATION
6 C GRID
7 2
8 C ICALCU IPSING IPMULT
9 0 0 0
10 C ANSMK ANSMK ANSMK ANSMK ANSMK ANSMK
11 0.5 0.4 0.3
12 * END OF "ANSMK" DATA
13 &&END
14 &&BEGIN SINGL
15 C TITLE
16 ECUADOR DECEMBER 2003
17 C CODEO KBLOCK
18 NORTH 1
19 C RANGEL HEIJIT DELTXX LTY
20 50. 20. 50. P
21 C LMWF
22 1
23 C LNMW LNMW LNMW LNMW LNMW LNMW
24 986.0 958.2 978.1 974.0 944.2 914.4 968.2
25 976.1 986.0 968.2 986.1 978.1 978.1 970.2
26 958.2 958.2 920.3 898.6 944.2 928.4 914.4
27 * END OF "LNMW" DATA
28 C INDEX1
29 1
30 C CODE TKW CN IPOBI
31 AGOYAN 78.00 2. 0.185 0
32 PISAYAMB 32.70 2. 0.871 0
33 CUMBAYA 4.4125 4. 5.065 0
34 NAYON 7.00 2. 4.125 0
35 PASOCHOA 1.125 2. 0.475 0
36 CHILLOS 0.430 2. 3.498 0
37 S.FRACIS 113.0 2. 0.500 0
38 TOACHI 64.4 2. 0.500 0
39 OTHERS H 1.620 18. 5.065 0
40 DAU-PERI 43.00 2. 0.52 0
41 * END OF "CODE TKW CN Q IPOBI" DATA
42 C INDEX2
43 2
44 C CODE TKW CN IPOBI
45 ESERALD 125.00 1. 1.07 0
46 SANTA RO 15.00 3. 26.70 0
47 GUANGOPO 4.05 6. 23.15 0
48 S.R DIES 2.20 1. 26.70 0
49 S.R BUNK 1.64 5. 23.15 0
50 SR.REDIE 1.73 6. 23.36 0

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-----10-----20-----30-----40-----50-----60-----70

	10	20	30	40	50	60	70
51	SR.REBUN	3.76	9.	20.26	0		
52	GAS-2001	78.00	1.	0.80	0		
53	GAS-2003	27.00	1.	0.80	0		
54	VAPOR-97	66.00	2.	0.84	0		
55	* END OF "CODE TKW CN Q IPOBI" DATA						
56	C INDEX3	LOVAR	LOAV				
57	3	51.88	-28.02				
58	C INDEX4	LTAV	LTAV				
59	4	0.0	0.0				
60	C INDEX5	IHD					
61	5	H					
62	BT	BT	BT	BT	BT	BT	BT
63	0.0						
64	* END OF "BT" DATA						
65	C BPROB	BPROB	BPROB	BPROB	BPROB	BPROB	BPROB
66	1.00000						
67	* END OF "BPROB" DATA						
68	C CODE	KBLOCK					
69	SOUTH	1					
70	C RANGEL	HEIJIT	DELTXX	LTP			
71	50.	20.	50.	P			
72	C LMWF						
73	1						
74	C LNMW	LNMW	LNMW	LNMW	LNMW	LNMW	LNMW
75	1609.0	1561.6	1591.8	1589.6	1540.0	1492.3	1578.8
76	1589.6	1609.0	1578.8	1574.4	1591.8	1593.8	1578.8
77	1561.6	1561.6	1500.9	1462.1	1540.0	1513.9	1490.1
78	* END OF "LNMW" DATA						
79	C INDEX1						
80	1						
81	C CODE	TKW	CN	Q	IPOBI		
82	PAUTEAB	87.70	5.	2.47	0		
83	PAUTE C	91.88	5.	2.47	0		
84	MAZAR	53.90	2.	0.50	0		
85	OTHERS H	4.54	6.	5.07	0		
86	* END OF "CODE TKW CN Q IPOBI" DATA						
87	C INDEX2						
88	2						
89	C CODE	TKW	CN	Q	IPOBI		
90	ESTERO V	70.00	2.	0.63	0		
91	ESTERO G	20.00	1.	1.06	0		
92	GUA V #2	9.50	2.	8.18	0		
93	GUA VAP	31.60	1.	6.73	0		
94	ESTERO E	15.00	1.	10.63	0		
95	ESTERO E	20.00	4.	14.16	0		
96	S.R DIES	1.34	17.	26.70	0		
97	S.R BUNK	2.85	4.	23.15	0		
98	SR.REDIE	1.84	20.	20.55	0		
99	SR.REBUN	3.00	2.	21.22	0		
100	ELECOUIL	37.00	2.	15.40	0		

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-----10-----20-----30-----40-----50-----60-----70
101 ELEGUIT 16.00 2. 15.40 0
102 GAS-93 78.00 1. 0.84 0
103 GAS-94 78.00 1. 0.84 0
104 VAPOR-95 117.50 1. 0.84 0
105 * END OF "CODE TKW CN Q IPOBI" DATA
106 C INDEX3 LOVAR LCVA
107 3 86.19 -46.01
108 C INDEX4 LTVAR LTAV
109 4 0.0 0.0
110 C INDEX5 IMD
111 5 H
112 BT BT
113 0.0
114 * END OF "BT" DATA
115 C BPROB BPROB SPROB BPROB BPROB BPROB BPROB
116 1.00000
117 * END OF "BPROB" DATA
118 &&END
119 &&BEGIN GROUP
120 * END OF GROUP DATA
121 &&END
122 &&BEGIN MULTI
123 C TITLE
124 ECUADOR DECEMBER 2003
125 C ISAMPL LOLP IRULE RNTYP RNTYP RNINT
126 5000 0.5 RATAL 1 1
127 C TOL1 TOL2 H RANGEM JSAMP
128 30. 3. 3.3 10. 10
129 C IRELAX NHINDO ITMAXO
130 0 1 31
131 C CODEB FROM TO CAP PFTMX PFTMX
132 LINE NORTH SOUTH 900. 900. 900.
133 * END OF "CODEB FROM TO CAP PFTMX PFTMX" DATA
134 C CODEX DIV DIV DIV DIV
135 DIV-1 0.0
136 DIV-2 0.0
137 * END OF "CODEX DIV" DATA
138 C CODEG TM IRESER KDIF RANGE1 RANGE2
139 NORTH 100. 0 1 10. 1.0
140 SOUTH 300. 0 1 10. 1.0
141 * END OF "CODEG TM IRESER KDIF RANGE1 RANGE2" DATA
142 &&END
143 &&BEGIN MULTI
144 C TITLE
145 ECUADOR DECEMBER 2003
146 C ISAMPL LOLP IRULE RNTYP RNTYP RNINT
147 5000 0.5 RATAL 1 1
148 C TOL1 TOL2 H RANGEM JSAMP
149 30. 3. 3.3 10. 10
150 C IRELAX NHINDO ITMAXO

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-----10-----20-----30-----40-----50-----60-----70

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151 9 1 1
152 C CODES FROM TO CAP PFTMX PTFMX
153 LINE NORTH SOUTH 900. 900. 900.
154 * END OF "CODES FROM TO CAP PFTMX PTFMX" DATA
155 C CODEX DIV DIV DIV DIV
156 DIV-1 0.0
157 DIV-2 0.0
158 * END OF "CODEX DIV" DATA
159 C CODES TM IRESER KDIF RANGE1 RANGE2
160 NORTH 226.04 0 1 10. 1.0
161 SOUTH 186.02 0 1 10. 1.0
162 * END OF "CODEX TM IRESER KDIF RANGE1 RANGE2" DATA
163 88END
    
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-----10-----20-----30-----40-----50-----60-----70

\*\*\* UNIT DATA OF GRID NORTH \*\*\*

HYDRO	CODE	MW	UNIT	FOR	CODE	MW	UNIT	FOR
	AGOYAN	78.00	2.	0.2	PISAYAMB	32.70	2.	0.9
	CUMBAYA	4.41	4.	5.1	NAYON	7.00	2.	4.1
	PASOCHOA	1.13	2.	0.5	CHILLOS	0.43	2.	3.5
	S-FRACIS	113.00	2.	0.5	TOACHI	64.40	2.	0.5
	OTHERS H	1.62	18.	5.1	DAU-PERI	43.00	2.	0.5
					TOTAL	726.12	38.	

THERMAL	CODE	MW	UNIT	FOR	CODE	MW	UNIT	FOR
	ESMERALD	125.00	1.	1.1	SANTA RO	15.00	3.	26.7
	GUANGOPO	4.05	6.	23.1	S.R DIES	2.20	1.	26.7
	S-R BUNK	1.64	5.	23.1	SR.REDIE	1.73	6.	23.4
	SR.REBUN	3.76	9.	20.3	GAS-2001	78.00	1.	0.8
	GAS-2003	27.00	1.	0.8	VAPOR-97	66.00	2.	0.8
					TOTAL	485.92	35.	
					HYDRO+THERMAL TOTAL	1212.04	73.	

\*\*\* LOAD DATA OF GRID NORTH \*\*\*

H1(MW) WKDAYS(DAY)  
986. 20.

\*\*\* RELIABILITY OF SINGLE GRID NORTH \*\*\*

LOLP (DAY/MONTH)	RESERVE MARGIN (MW)	RESERVE MARGIN (%)	DIFF. COEF. (DAY/MONTH/MW)
0.949369	187.18	18.98	-0.001380
0.425442	221.44	22.46	-0.009293
0.300000	232.50	23.58	-0.011849
* 0.368442	226.04	22.92	

ECUADOR DECEMBER 2003

\*\*\* UNIT DATA OF GRID SOUTH \*\*\*

HYDRO	CODE	MW	UNIT	FOR	CODE	MW	UNIT	FOR
PAUTEAS		87.70	5.	2.5	PAUTE C	91.88	5.	2.5
MAZAR		53.90	2.	0.5	OTHERS H	4.54	6.	5.1
						TOTAL	1032.94	18.

THERMAL	CODE	MW	UNIT	FOR	CODE	MW	UNIT	FOR
ESTERO V		70.00	2.	0.6	ESTERO G	20.00	1.	1.1
GUA V #2		9.50	2.	8.2	GUA VAP	31.60	1.	6.7
ESTERO E		15.00	1.	10.6	ESTERO E	20.00	4.	14.2
S.R DIES		1.34	17.	26.7	S.R BUNK	2.85	4.	23.1
SR.REDIE		1.84	20.	20.6	SR.REBUN	3.00	2.	21.2
ELECCUIL		37.00	2.	15.4	ELECCUIT	16.00	2.	15.4
GAS-93		78.00	1.	0.8	GAS-94	78.00	1.	0.8
VAPOR-95		117.50	1.	0.8				
						TOTAL	762.08	61.

HYDRO+THERMAL TOTAL 1795.02 79.

\*\*\* LOAD DATA OF GRID SOUTH \*\*\*

H1(MW)	WKDAYS(DAY)
1609.	20.

\*\*\* RELIABILITY OF SINGLE GRID SOUTH \*\*\*

LOLP (DAY/MONTH)	RESERVE MARGIN (MW)	RESERVE MARGIN (%)	DIFF. COEF. (DAY/MONTH/MW)
0.459443	319.84	19.88	-0.008866
0.400725	330.89	20.56	-0.015401
0.300000	339.58	21.10	-0.002597
# 3.231045	186.02	11.56	

ECUADOR DECEMBER 2003

\*\*\* INPUT DATA OF INTERCONNECTED SYSTEM \*\*\*

\*\* MONTE CARLO DATA \*\*

SAMPLE	LOLP(D/M)	RULE	RANDOM	RINIT
5000	0.500	RATAL	1	1

\*\* GRID DATA \*\*

NO. GRID NAME	RINIT (MM)	BLOCK	H1 (MM)	RMIN (%)	KDIF
1 NORTH	100.0	1	986.0	0	1
2 SOUTH	300.0	1	1609.0	0	1

\*\* BRANCH DATA \*\*

NB BRANCH CODE	NF	NT	CAP (MW)	F->T (MW)	T->F (MW)
1 LINE	NORTH ( 1 )	SOUTH ( 2 )	900.0	900.0	900.0



ECUADOR DECEMBER 2003

\*\*\* RELIABILITY OF INTERCONNECTED GRID \*\*\*

IT = 10	NORTH	SOUTH
RESERVE MARGIN (MW)	99.13	245.44
RESERVE MARGIN (%)	10.05	15.25
IT = 500	0.45232	0.48451
IT = 1000	0.51148	0.45554
IT = 1500	0.50860	0.48625
IT = 2000	0.49537	0.47237
IT = 2500	0.52492	0.51234
IT = 3000	0.51522	0.51790
IT = 3500	0.52652	0.52121
IT = 4000	0.51538	0.51255
IT = 4500	0.51645	0.50543
IT = 5000	0.49990	0.49946
LOLP(DAY/MONTH)	0.49990	0.49946

TOTAL RESERVE MARGIN 344.57(MW) 13.28(%)

ECUADOR DECEMBER 2003

\*\*\* INPUT DATA OF INTERCONNECTED SYSTEM \*\*\*

\*\* MONTE CARLO DATA \*\*

SAMPLE	LOLP(D/M)	RULE	RANDOM	RINIT
5000	0.500	RATAL	1	1

\*\* GRID DATA \*\*

NO.	GRID NAME	RMINIT (MW)	BLOCK	H1 (MW)	RMIN (%)	KDIF
1	NORTH	226.0	1	986.0	0	1
2	SOUTH	186.0	1	1609.0	0	1

\*\* BRANCH DATA \*\*

NB BRANCH CODE	NF	NT	CAP (MW)	F->T (MW)	T->F (MW)
1	LINE	NORTH ( 1 ) SOUTH ( 2 )	900.0	900.0	900.0

ECUADOR DECEMBER 2003

\*\*\* RELIABILITY OF INTERCONNECTED GRID \*\*\*

IT = 1	NORTH	SOUTH
RESERVE MARGIN (MW)	226.04	186.02
(%)	22.92	11.56
IT = 500	0.12283	0.26075
IT = 1000	0.07701	0.26595
IT = 1500	0.06299	0.27412
IT = 2000	0.05751	0.25704
IT = 2500	0.04601	0.29228
IT = 3000	0.04838	0.29082
IT = 3500	0.04202	0.30634
IT = 4000	0.04357	0.29341
IT = 4500	0.04246	0.28225
IT = 5000	0.04123	0.26887
LOLP(DAY/MONTH)	0.04123	0.26887

TOTAL RESERVE MARGIN 412.06(MW) 15.88(%)

JICA