3.3. TRANSCO 入手資料

NATIONAL TRANSMISSION CORPORATION

TRANSCO

TRANSMISSION DEVELOPMENT PROGRAM (2001-2011)

TRANSMISSION PLANNING AND SERVICES DEPARTMENT
CORPORATE PLANNING AND DEVELOPMENT
OCTOBER, 2001

TransCo

FOREWORD

The enactment of Republic Act 9136, otherwise known as the Electric Power Industry Reform Act, paves the way for segregation of functions in the electric industry. Under the new set-up, a National Transmission Company (TRANSCO) is created to take over the electrical transmission functions of the National Power Corporation (NPC). TRANSCO shall assume the responsibility of NPC in the planning, construction and centralized operation and maintenance of high voltage transmission facilities, including grid interconnections and ancillary services. In addition, TRANSCO is also mandated to formulate the Transmission Development Program (TDP).

TRANSCO's commitment to provide reliable, adequate, and stable transmission system for all electricity users in the coming years is summarized in this 2001 TDP. It outlines the important transmission infrastructure expansion and upgrading programs in support of the capacity build-up plans under the Power Development Program of the Department of Energy.

Among the infrastructures included in this year's TDP are the completion of the 500kV backbone in Southern Luzon, the upgrading of Batangas-Makban-Biñan and San Manuel-Concepcion-Mexico 230kV lines. In the Visayas, the Leyte-Cebu and Cebu-Mactan lines are scheduled for upgrading. The Cebu-Negros line is also being considered for upgrading depending on its economic viability. Also included are the following Major Interconnection of the grids: Leyte-Bohol (Stage II) and Leyte-Mindanao. The completion of these projects would ensure a substantial increase in the transfer capacity and a more economic pooling of generation resources between the island grids.

As the entire industry goes through the transition phase of the restructuring process, TRANSCO is working doubly hard, not only to ensure that its wires are ready, but also to guarantee that electricity would be transmitted reliably ---from where it is generated, to where it should be delivered.

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TRANSMISSION DEVELOPMENT PROGRAM

INTRODUCTION

This document presents the Transmission Development Program (TDP) of the National Transmission Company (TRANSCO) in line with its mandated responsibilities under Republic Act 9136, the Electric Power Industry Reform Act (EIRA).

As one of the vital strategic plans in the deregulation of electric power industry, the TDP will ensure reliable, adequate, secure, and stable transmission system for all electricity users. As part of the Philippine Energy Plan (PEP), formulated by the Department of Energy, the TDP serves as an important infrastructure program that will support the capacity build-up in the Power Development Program (PDP), provide more efficient delivery of electricity to end-users, and promote the total electrification of the country.

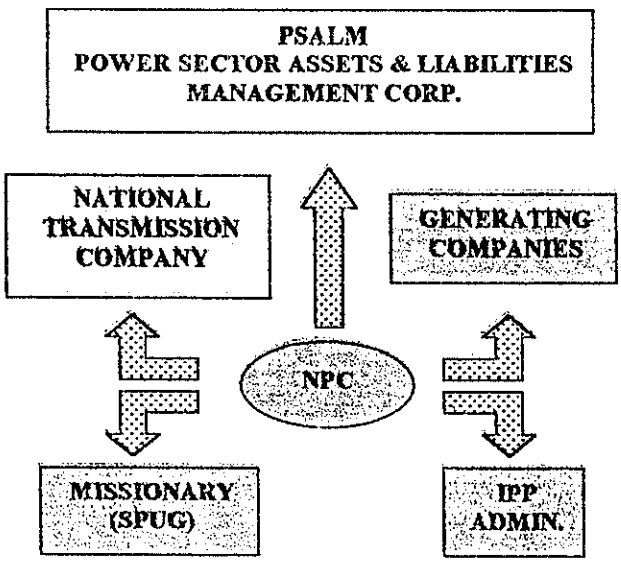
The preparation of the TDP centers on the least cost additions, expansions, reinforcements and improvements of the transmission backbone to provide stable delivery of power from generation sources to the points of consumption.

POWER INDUSTRY BACKGROUND

Industry Deregulation

NPC has been in the forefront of power generation, transmission and bulk supply of electricity throughout the country since its creation as a power corporation in 1936. Its functions were strengthened under Presidential Decree No. 40 in November 1972 and lost its monopoly in power generation under Executive Order No. 215 in July 1987. With NPC still comprises about 70% of the power industry, NPC further unbundled its generation and transmission functions through re-organization and restructuring towards privatization. This was formalized with the enactment of the EIRA last June 8, 2001. Figure 1 shows the unbundling of NPC functions.

FIGURE 1



The new law ushered in the creation of a Private Sector Assets and Liabilities Management (PSALM) Corporation. PSALM is a government owned and control corporation that will take over the ownership of NPC's assets, liabilities and other real estate properties, including its orderly sale, disposition and privatization.

The transmission assets and functions will be transferred to TRANSCO, which was created under the new law, and will be responsible for providing open and non-discriminatory access in its

transmission system all electricity users. Its privatization plan will be through open competitive bidding either through outright sale or concession contract.

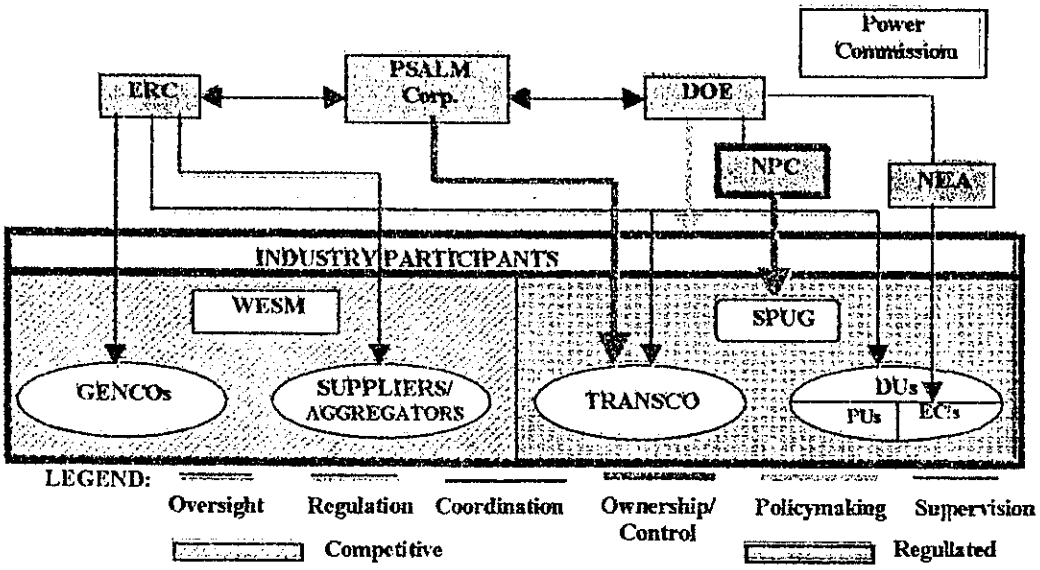
The generation assets of NPC will be grouped into an optimal number of GENCOs. It will initially be owned by PSALM and operated by NPC, but will be eventually privatized through competitive bidding, except the Agus and Pulangi hydro plants in Mindanao. The privatization of these hydro plants will be left to PSALM in consultation with the Congressional Power Commission.

NPC's IPP contracts will be placed under an IPP administrator to be appointed by PSALM. This independent entity shall administer, and manage the contracted energy output of NPC IPP contracts. An Inter-agency Committee chaired by the Secretary of Finance, with the Sec. of Justice and the NEDA Director General as members is now reviewing all IPP contracts. The Committee will recommend or initiate actions if the provisions of the contracts are found disadvantageous or onerous to the government.

The other functions of NPC in providing missionary electrification will continue to be undertaken through the Small Power Utility Group (SPUG). NPC-SPUG will provide generation and associated power delivery system in areas not connected to the transmission system.

Figure 2 presents the new structure of the electric power industry.

FIGURE 2
THE ELECTRICITY INDUSTRY STRUCTURE



Under the new structure, the industry is divided into 4-sectors: Generation, Transmission, Distribution, and Supply. Among the industry participants, the generation and supply sectors will be competitive. Within 1-year from the effectivity of the Act, DOE shall establish the Wholesale Electricity Spot Market (WESM) to provide mechanism for identifying the price of electricity not covered by bilateral contracts.

The other sub-sectors composed of transmission and distribution will be regulated. The rate of TRANSCO and Distribution Utilities will have to be approved by the ERC.

ERC is a quasi-judicial regulatory body composed of a chairman and 4 members. This agency shall promote competition, encourage market development and ensure customer choice. It will also penalize abuse of market power, harmful monopoly and anti-competitive act by any participants in the electric power industry.

PSALM will have control over TRANSCO who will provide transmission service to all transmission customers. There will be strong coordination between ERC, PSALM and DOE who will continue to be the policy making body in the power industry.

NPC, aside from operating the Agus and Pulangi hydro complexes, will continue to perform missionary functions in the small island grids through SPUG, while NEA will continue its role of administering the operation of electric cooperatives. Both NPC and NEA will be under the supervision of DOE.

The formulation of the Power Development Program (PDP) that will guide the implementation of future generation projects as part of the Philippine Energy Plan is placed under the responsibility of DOE. TRANSCO, on the other hand, will continue to prepare the TDP in support to the capacity build-up in the PDP.

Open Access Transmission Service

Apart from determining the required expansion of the transmission system through the TDP, TRANSCO will be responsible for providing open and non-discriminatory access to its transmission system through Open Access Transmission Service (OATS) to ensure competition among industry participants.

On June 11, 1997, the Energy Regulatory Board (ERB) approved the OATS, which calls for NPC's open and non-discriminatory provision of transmission service to qualified transmission customers. OATS consists of power delivery services (PDS) and associated ancillary services. PDS refer to the use of transmission facilities for the delivery of power from one point to another in the transmission grid. On the other hand, ancillary services refer to those services that are necessary to support the transmission of power while maintaining reliable operation of the transmission system in accordance with good utility practice and the Philippine Grid Code. These include load following and frequency control, spinning reserve, back-up power, energy imbalance, loss compensation, security re-dispatch, and reactive power and voltage control.

Along with OATS, the ERB also approved the Open Access Transmission Tariff (OATT) and Tariff for Ancillary Services (TAS). The imposition of OATT and TAS is part of the eventual unbundling of tariff in order to cover separately the cost of generation, power delivery services, ancillary services and other costs.

During the transition phase of the restructuring process, Transco shall manage the provision of ancillary services to maintain the reliability and security of the grid. Transco shall assure that sufficient ancillary services are arranged, provided and deployed to meet planning and operating standards. Aside from entering into transmission service agreements with transmission customers, Transco will also negotiate contracts with power generation facilities that are capable of providing ancillary services.

TRANSMISSION PLANNING CRITERIA

NPC's transmission planning process follows a set of criteria applicable to medium and long term transmission planning. These criteria refer to the system performance indices used for assessing the actual or projected reliability of the bulk power system.

A basic principle of transmission planning is that all equipment connected to the system should be within normal capacity ratings and normal voltage limits during normal operating condition, i.e., when the system is operating with all scheduled elements in service and is not experiencing faults or other abnormal disturbances. Moreover, the system should be capable of operating within emergency capacity ratings and emergency voltage limits immediately after a disturbance that results in the loss of a single element (N-1). The system should be capable of such performance at all times, with various elements scheduled out-of-service (i.e. for maintenance and overhaul) and during various load conditions that range from forecasted minimum to maximum load.

With NPC's bulk power supply system still evolving, strict application of the criteria may not be suitable or practical for specific stages in transmission planning. These criteria, coupled with some basic principles, guide TRANSCO in developing the Transmission Development Program (TDP). Table 1 summarizes the transmission planning criteria.

N-1 Rule

The N-1 rule refers to the planning criterion wherein any loss of one element of the power system (i.e., a generator, a transmission line, or a transformer) should not have degrading effect on the security of the whole system. In the occurrence of this more probable failure of one element (N-1), the system should meet the following conditions:

- The generators must remain stable.
- The under-frequency load shedding must not be activated.
- The power flows must remain lower than the rating of the network equipment and must not overload the remaining element.
- The bus voltages must remain within the limits.

In compliance with the conditions defined in the (N-1) Rule, the following more detailed criterion are observed in the planning process.

Thermal Criteria

Power flows on any generator, transmission line, transformer, and or conditioning device connected to the transmission system should be maintained within the thermal capacity ratings. These thermal capacity ratings are defined as follows:

- Normal Capacity Rating represents loading limit or thermal limit that can be sustained indefinitely without increased risk of equipment failure or loss of life.

- Emergency Capacity Rating represents loading limit or thermal limit that can be tolerated for a relatively short period of time to allow time for operator's corrective action following a disturbance in the system. It must be recognized that at this

loading level, there may be a small increase in equipment's risk of faillure or loss of life. This increased risk is allowed on the basis that the events that cause such operation rarely occur and that operation within emergency limits may avoid shedding of customer load.

TABLE 1
SUMMARY OF TRANSMISSION PLANNING CRITERIA

ACCEPTABLE LIMITS	ALLOWABLE REMEDIAL ACTIONS
Normal Condition	
Transmission line loading: < 100 %	Line reinforcements
Transformer loading: < 100%	Transformers additions
Steady-state voltage range: +/- 5%	Reactive power dispatch or compensation
Single-Line Outage (N-1) Contingencies	
Transmission line loading: <110%	Line reinforcement
Transformer loading: <110%	Line reinforcement
Steady-state voltage range: +/- 10%	Reactive power dispatch or compensation
Transiently stable for 3-phase fault with normal clearing	Generator control fine tuning, reactive power dispatch, compensation or additional reinforcement
Severe Contingencies	**Automatic load dropping (ALD), generator tripping (GT), transfer tripping scheme (TTS)**
Transmission line loading: <120%	
Transformer loading:<120%	
No voltage collapse	
No cascaded outages	
Load Rejection	**Excitation system specification, reactive power compensation**
Dynamic overvoltage: 30%	
Peak Volts/Hertz ratio: 1.5 p.u./p.u.	
No self-excitation	
Line Restoration	**Reactive power compensation**
Maximum voltage difference: 15%	
Maximum open-end voltage:120%	

Voltage Criteria

Voltage control is necessary to avoid damage to connected grid and equipment from both under and over voltages. Maintaining grid voltages at or near maximum safe levels reduces system losses and reduces vulnerability to voltage collapse and steady state and transient stability problems. Voltage unbalances, voltage fluctuations and harmonics shall also be controlled to ensure quality of power service.

Voltage variations in the system shall remain within ±5% of the nominal value during normal conditions and ±10% during single outage contingency outages. Voltage may temporarily exceed ±10% during severe grid emergencies and restoration.

Stability Criteria

All generators and large machines connected to the transmission system should remain in synchronism and maintain stable operation during normal and loss of single-element (N-1) contingency events. The criteria define the appropriate generator controls, additional power conditioning devices and transmission system reinforcements that may be necessary to maintain stable operation of the system.

SUB-TRANSMISSION POLICIES

In line with the segregation of transmission functions, assets and liabilities from the sub-transmission functions and assets, as provided for in the EIRA, the implementation of various sub-transmission line projects shall be guided by the following policies:

1. All on-going projects under construction/erection should be pursued and the same should be considered as priority projects.
2. Projects, the construction of which have not started or in the pre-engineering stage, but have been earlier allocated with the necessary materials and equipment should likewise be pursued subject to the availability of funds for the projects' actual execution or construction/erection.
3. Projects with budget allocation for the conduct of engineering pre-construction activities, the outputs of which are essential in securing NEDA Investment Coordinating Council (ICC) approval, could be implemented on a case-to-case basis only.
4. All other sub-transmission projects that do not fall under the above categories will not be implemented by TRANSCO and will not be part of the TDP.

EXISTING FACILITIES

As of July 2001, the transmission system of NPC-TRANSCO has a substation capacity of 18,410 MVA: 14,572 MVA in Luzon, 2,171 MVA in the Visayas, and 1,667 MVA in Mindanao. Its transmission line of various voltages extends up to 19,632 circuit kilometers (ckt-km) in length: 9,649 ckt-km in Luzon, 4,385 ckt-km in the Visayas, and 5,598 ckt-km in Mindanao. To maintain voltages at acceptable level, a total of 315 MVAR capacitor banks have been installed in strategic locations: 142 MVAR in the Visayas, and 172.5 MVAR in Mindanao.

Of the total transmission asset, around 6,066 ckt-km of lines have voltages below the threshold transmission voltages of the respective regions. In Luzon, a total of 4,099 ckt-km can be categorized as sub-transmission, while 47 ckt-km and 2,410 ckt-km are the sub-transmission lines components for Visayas and Mindanao.

While statistically the sub-transmission lines represent around 31% of the total line length, the segregation of sub-transmission assets will depend on final verification of the functional role of these assets. Table 2 presents the summary of existing transmission line and substation capacity as of July 2001.

TABLE 2
SUMMARY OF EXISTING FACILITIES

GRID	TRANSMISSION LINES (Ckt-Km)	SUBSTATION CAPACITY (MVA)
LUZON		
500 KV	1,023.46	6,000
350 KV	358.84	516
230 KV	4,167.66	7,325
115 KV	701.75	525
69 KV	3,252.13	206
34.5 KV	73.12	
23 KV	29.70	
13.8 KV	42.50	
Sub-total	9,649.16	14,572
VISAYAS		
350 KV	564.00	516.0
230 KV	375.06	480.0
138 KV	1,126.58	1159.7
69 KV	2,271.95	15.0
34.5 KV		
23 KV		
13.8 KV	47.00	
Sub-total	4,384.59	2,170.7
MINDANAO		
138 KV	3,138.29	1,590.0
69 KV	2,385.07	77.22
34.5 KV	46.50	
23 KV		
13.8 KV	27.90	
Sub-total	5,597.76	1,667.2
PHILIPPINES		
500 KV	1,023.46	6,000.0
350 KV	922.84	1,032.0
230 KV	4,542.72	7,805.0
138 KV	4,237.87	2,749.77
115 KV	701.75	525.0
69 KV	7,909.15	298.22
34.5 KV	119.62	
23 KV	29.70	
13.8 KV	117.40	
GRAND TOTAL	19,631.51	18,409.9

POWER DEMAND PROJECTION

In general, the load projection used in the PDP is premised on the Gross Domestic Product (GDP) target of the government as provided by NEDA. This year low GDP foresee the economy to grow by 3.3% in year 2001, increasing to 4.9% in 2002, 5.4% in 2003, 5.9% in 2004, 6.1% in 2005 and 6.3% annually from 2006-2011.

Energy sales forecast were developed on a by grid basis generally using econometric modeling and trend extrapolation. NPC considered two scenarios for the load projection following NEDA's low and high growth scenarios. Most of the modeling applications were on sectoral data- residential, commercial and industrial. To account for information available in the short term, projections for the 2001-2011 NPC sales were generally based on budget levels which were obtained using a per customer approach.

The resulting system demand forecast shows a regional growth rates of 8.18% in Luzon, 10.0% in the Visayas, and 10.3% in Mindanao, indicating an average growth of 9.1% for the Philippine during the period 2001-2011. Table 3 shows the actual and projected system demand based on low GDP scenario.

TABLE 3
SYSTEM DEMAND FORECAST
(LOW GDP SCENARIO)

YEAR		ENERGY SALES (GWH)				PEAK DEMAND (MW)			
		LUZON	VISAYAS	MIND	TOTAL	LUZON	VISAYAS	MIND	TOTAL
ACTUAL	1995	23,324	3,031	4,524	30,879	3,811	564	778	5,154
	1996	25,891	3,336	4,765	33,992	4,184	658	827	5,668
	1997	28,320	3,669	5,091	37,080	4,613	692	850	6,186
	1998	30,191	3,949	5,120	39,260	4,878	745	880	6,503
	1999	30,485	4,106	5,012	39,603	5,092	766	891	6,749
	2000	32,493	4,395	5,219	42,107	5,459	800	938	7,197
%GROWTH RATE (1996-2000)		6.86	7.72	2.90	6.40	7.45	7.22	3.82	6.91
FORECAST	2001	34,960	4,692	5,469	45,120	5,765	839	929	7,533
	2002	36,913	5,089	5,915	47,917	6,087	910	1,005	8,002
	2003	40,063	5,572	6,458	52,093	6,607	996	1,097	8,700
	2004	43,744	6,130	7,105	56,979	7,214	1,096	1,207	9,517
	2005	47,763	6,836	7,861	62,460	7,876	1,222	1,335	10,434
%GROWTH RATE (2001-2005)		8.01	9.23	8.54	8.21	7.61	8.85	7.32	7.71
	2006	52,295	7,578	8,752	68,625	8,624	1,355	1,487	11,466
	2007	57,262	8,370	9,765	75,397	9,443	1,497	1,659	12,598
	2008	62,701	9,241	10,919	82,861	10,340	1,652	1,855	13,847
	2009	68,657	10,274	12,238	91,169	11,322	1,837	2,079	15,238
	2010	75,175	11,335	13,747	100,257	12,397	2,027	2,335	16,759
	2011	82,340	12,549	15,320	110,209	13,578	2,244	2,602	18,424
%GROWTH RATE (2006-2011)		9.50	10.66	11.76	9.93	9.50	10.66	11.76	9.94
(2001-2011)		8.82	10.01	10.29	9.14	8.64	9.83	9.72	8.92

Development of Bulk Substation Loading

A simple method was adopted in this transmission planning simulation to project the individual substation loading. Using the macro demand forecast for each region, the load forecast for the corresponding substations in Luzon, Visayas and Mindanao grids were developed in proportion to the current substation loading. Shown in Table 4 is the summary of coincident demand forecast per geographical area of Luzon,. Visayas and Mindanao grids.

A more elaborate methodology for substation load forecast is currently being developed. However, the large volume of data that such procedure entails for processing puts a constraint on the method that could be adopted at this time.

TABLE 4
SUMMARY OF DEMAND FORECAST PER AREA

GRID	2001	2005	2008	2011
LUZON				
NLR	1,268	1,733	2,275	2,987
MM	3,257	4,450	5,842	7,672
SLR	1,239	1,693	2,223	2,919
Sub-total	5,764	7,876	10,340	13,578
VISAYAS				
CEBU	339	479	636	857
NEGROS	168	250	343	477
PANAY	156	224	310	434
LEYTE	119	162	209	253
SAMAR	25	33	44	53
BOHOL	31	74	110	171
Sub-total	839	1,222	1,652	2,244
MINDANAO				
NWMA	130	187	259	364
LANAO	125	180	250	351
NCMA	142	204	284	399
NEMA	125	180	249	350
SEMA	255	366	509	714
SWMA	152	218	301	425
Sub-total	929	1,335	1,855	2,602
PHILIPPINES	7,532	10,433	13,847	18,424

GENERATION PLANT ADDITIONS

As mandated under R.A. 9136, the Department of Energy (DOE) is responsible for the development of Power Development Program (PDP) as part of the Philippine Energy Plan (PEP).

The 2001 PDP calls for a new capacity addition of 12,610 MW during the period 2001-2011. A total of 9,720 MW will be added in Luzon, 1,690 MW in the Visayas and 1,200 MW in Mindanao. During the same period, around 1,024 MW will be retired, indicating a net capacity addition of 11,618 MW.

Of the new capacity requirement, NPC is committed to implement around 2,605 MW and Meralco is required to add 565 MW. The PDP also indicated the additions of around 9,440 MW of merchant plants to meet the projected demand during the planning period. Table 5 presents the 2001 Power Development Program.

Considering that some future generation projects are indicative in nature and that the plant location depends on the suitability of the site on specific project, planning for adequacy of transmission lines was undertaken by distributing the indicative baseload, mid-range and peaking plants to areas where the plants are most needed.

TABLE 5
2001 POWER DEVELOPMENT PROGRAM 1/
SYSTEM MW CAPACITY

YEAR	LUZON GRID				VISAYAS GRID				MINDANAO GRID				PHIL. CUM. TOTAL
	MO	PLANT ADDITION	M CAP	CUM. MW	MO	PLANT ADDITION	M CAP	CUM. MW	MO	PLANT ADDITION	M CAP	CUM. MW	
2001	Feb	BAKUN AC HYDRO	70	210	-			0	-			0	210
		GASECNAN HYDRO	140										
2002	Jan	ILIJAN NAT GAS	1,200	1,535	Jan	NEGROS FP 102	32	32	-			0	1,567
		FIRST GAS POWER B	525			(transferred from Mindanao)							
		(SUCAT 2-3 -- RET)	*-400*		Jan	PANAY FP 104							
						(transferred from Cebu)							
2003	Jan	MALAYA/SAN ROQUE	500	1,815	Jan	UPRATING LEYTE-CEBU TL		152	-			0	1,967
		(HOPEWELL GT3 -- OUT)	*-70*		Jan	LEYTE-BOHOL INTER.II							
					Jan	*NEGROS PEAKING*	60						
					Jan	*PANAY PEAKING*	60						
2004				1,815	Jan	*NEGROS PEAKING*	30	355	Jan	HOPEWELL GT3 -- IN	70	70	2,240
					Jan	*PANAY MIDRANGE*	50			(transferred from Luzon)			
					Jan	*BOHOL MIDRANGE*	30						
					Jan	*CEBU MIDRANGE*	100						
					Jan	*PANAY PEAKING*	30						
						(PANAY DPP I) -- RET.)	*-37*						
2005	Jan	SAN PASCUAL COGEN	500	2,500	Jan	*PANAY MIDRANGE*	50	317	Jan	LEYTE-MIND. INTER.		70	2,687
	Jan	SAN ROQUE HYDRO	345		Jan	*BOHOL MIDRANGE*	40						
		BULACAN BIOMASS	40			*(P. BARGE DSL -- RET.)*	*-128*						
2006	Jan	*BASELOAD PLANT*	300	2,800	Jan	*CEBU PEAKING*	50	507	Jan	*MINDANAO COAL*	200	270	3,577
					Jan	*BOHOL MIDRANGE*	20						
					Jan	*PANAY PEAKING*	30						
					Jan	*NEGROS PEAKING*	30						
					Jan	*CEBU MIDRANGE*	50						
2007	Jan	*BASELOAD PLANT*	300	3,550	Jan	*CEBU PEAKING*	60	677	Jan	*MINDANAO MIDRANGE*	150	420	4,647
	Jan	*PEAKING PLANT*	450		Jan	*NEGROS MIDRANGE*	50						
					Jan	*PANAY MIDRANGE*	50						
					Jan	*BOHOL MIDRANGE*	10						
2008	Jan	*BASELOAD PLANT*	900	4,600	Jan	*CEBU PEAKING*	60	747	Jan	*MINDANAO MIDRANGE*	150	600	5,947
	Jan	*PEAKING PLANT*	150		Jan	*BOHOL MIDRANGE*	10		Jan	*MINDANAO PEAKING*	30		
2009	Jan	*BASELOAD PLANT*	900	5,060	Jan	*CEBU PEAKING*	60	937	Jan	*MINDANAO MIDRANGE*	150	710	7,307
	Jan	*PEAKING PLANT*	300		Jan	*PANAY MIDRANGE*	50		Jan	*MINDANAO PEAKING*	30		
		(HOPEWELL GT1&2--RET)	*-140*		Jan	*NEGROS MIDRANGE*	50						
					Jan	*BOHOL MIDRANGE*	30						
2010	Jan	*BASELOAD PLANT*	900	7,010	Jan	*CEBU PEAKING*	60	1,187	Jan	*MINDANAO MIDRANGE*	300	1,010	9,207
	Jan	*PEAKING PLANT*	450		Jan	*PANAY PEAKING*	60						
					Jan	*BOHOL MIDRANGE*	20						
					Jan	*NEGROS PEAKING*	60						
					Jan	*CEBU MIDRANGE*	50						
2011	Jan	*BASELOAD PLANT*	1,200	9,010	Jan	*CEBU BASELOAD*	100	1,408	Jan	*MIND. BASELOAD*	100	1,200	11,618
	Jan	*PEAKING PLANT*	300		Jan	*CEBU PEAKING*	60		Jan	*MINDANAO PEAKING*	90		
		(HOPEWELL GT4 --RET)	*-100*		Jan	*CEBU MIDRANGE*	100						
					Jan	*NEGROS PEAKING*	60						
					Jan	*PANAY PEAKING*	30						
					Jan	*BOHOL MIDRANGE*	20						
						(NAGA COAL 1&2) -- RET.	*-105*						
						(CEBU DPP I) -- RET.	*-44*						

● With PSA w/ NPC = 2405 MW ● Committed NPC Project = 200 MW ● For Transfer = 102 MW:
● With PSA w/ distributor = 565 MW ● Merchant Plants = 9,440 MW ● *For Retirement = 1,204 MW*

1/ For main Grids only; Excludes Small Islands

TRANSMISSION EXPANSION PROGRAM

Complementary to the generation additions is the transmission expansion program to ensure stable delivery of power through least cost integration of the proposed generation projects into the existing system and the reinforcement of the network to accommodate higher demand. This year transmission program highlights the interconnection of the major island grids, the enhancement of substation capacities and the strengthening of transmission backbone in the major islands of Luzon, Visayas and Mindanao.

MAJOR INTERCONNECTION PROJECTS

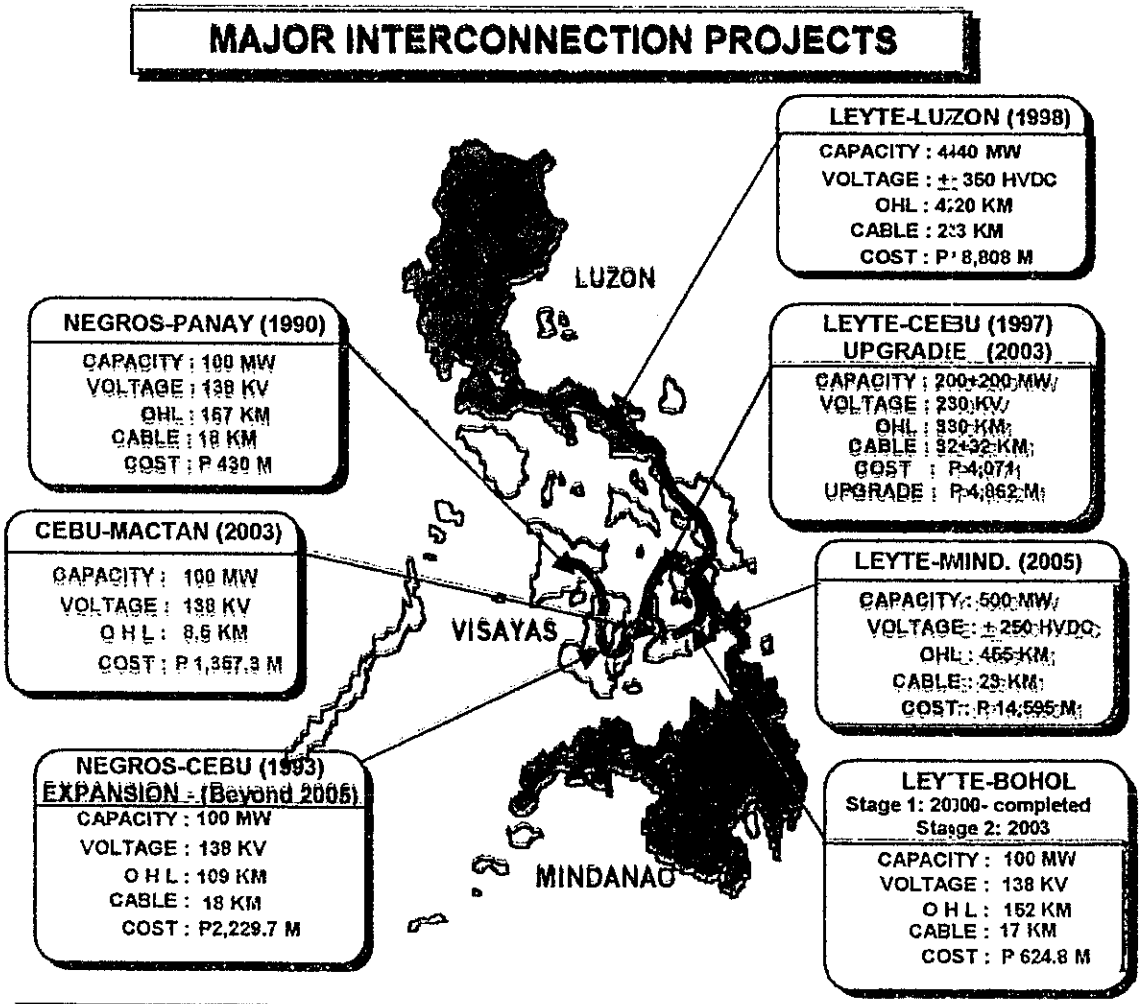
A dominant feature of the Transmission Development Program is the attainment of a unified Philippine grid for effective sharing of reserves. Last December 2000, the initial stage of the Leyte-Bohol Interconnection project was completed thereby unifying the

major islands of Visayas into one grid. As a continuing effort towards interconnecting the major grids, the interconnection of Mindanao Island with the presently interconnected islands of Luzon, Leyte-Samar, Cebu, Negros, Panay and Bohol will be pursued. The existing interconnection links will also be reinforced to accommodate higher transfer capacity. It is expected that by 2005, a unified Philippine grid will be realized. Figure 3 shows the major interconnection projects.

Leyte-Samar Interconnection Project

The Leyte-Samar Interconnection Project was commissioned in 1987. The project aims to provide bulk power supply to the island of Samar from the indigenous geothermal resource in Leyte. The interconnection covers 130 kilometers of single circuit wood pole 138 kV lines that emanates from Tongonan geothermal switchyard to Babatngon substation in Leyte and then to Wright substation in Western Samar. Special towers were utilized for the line crossing the bridge from Leyte to Samar. The link has around 200 MW transfer capacity and very vulnerable to typhoon. At present, the upgrading of this circuit into a double circuit steel tower transmission line is under construction for completion in year 2002. The reinforcement aims to increase the reliability and sufficiency of bulk power supply in Samar Island at an estimated cost of around P 1,085.99 million.

FIGURE 3



Negros–Panay Interconnection Project

The Negros–Panay Interconnection Project, commissioned in 1990, aims to interconnect the islands of Negros and Panay via a 138 kV single circuit submarine cables with a length of 18 kilometers and 100 MW transfer capacity. The submarine cable route has a maximum depth of about 60 meters below sea level. This interconnection, which cost around P 430 million in 1990, enables the transfer of power between Negros and Panay and maximizes the utilization of geothermal resource in Palinpinon, Negros. The interconnection is complemented with an overhead line with a total length of 167 kilometers. The whole interconnection emanates from Amlan substation in Negros Oriental, via Bacolod substation in Negros Occidental, to Dingle substation in Panay. At present, no expansion plan is identified in the 2001 TDP for the uprating of the submarine cable capacity.

Negros-Cebu Interconnection Project

The Negros-Cebu Interconnection Project was commissioned in 1993.. It aims to interconnect the islands of Negros and Cebu, thereby enabling the pooling of reserve capacity of Cebu, Negros and Panay grids. This interconnection consists of 118 kilometers of 138 kV single circuit submarine cables, with a transfer capacity of 100 MW, and 109 km. of single circuit 138 kV overhead line. The submarine cable route has a maximum depth of about 60 meters below sea level. The interconnection terminates in Amlan substation in Negros and Naga substation in Cebu. The whole project has a total cost of about P 408.05 million pesos in 1993. A second circuit expansion of the submarine cable is being considered beyond 2006 depending on the economic viability of the project with a cost of about P 2,229.7 million. This uprating is intended to maximize the transfer of power from the Leyte geothermal plants to the load center in Cebu and towards the island of Negros.

Leyte-Cebu Interconnection Project

The Leyte-Cebu Interconnection Project was commissioned in 1997. The project is intended to unite the whole Visayas grid and maximize the utilization of the indigenous power from the Leyte geothermal fields. The interconnection is a 230 kV single circuit submarine cable with a transfer capacity of 200 MW. The submarine cable is 32 kilometers long with a complement of 330 circuit-kilometer of double-circuit 230 kV overhead line. The submarine cable has a depth of about 360 meters below sea level. The interconnection emanates from the Central Station in Ormoc, Leyte and terminates at Compostela substation in Cebu. The whole project has a total cost of about P 4,071 million pesos in 1997. In 2002, a second circuit submarine cable with a capacity of 200 MW and at a cost of P 4,862.22 million will be installed to reinforce the existing cable. A total of 400 MW capacity will then be transferred from Leyte geothermal fields to the load center in Cebu.

Leyte – Luzon Interconnection Project

The Leyte-Luzon Interconnection Project was commissioned in 1998. It is part of the overall plan to connect the existing Luzon, Visayas, and Mindanao grids into a single national grid. It aims to transmit geothermal energy from Leyte to the load center in

Metro Manila. The interconnection is a ± 350kV HVDC monopolar link, comprising of 420 kilometers of bipolar designed overhead lines and 23 kilometers of two submarine cables. The maximum depth of the cable is about 150 meters below sea level. At present, the capacity of the link is 440 MW and upgradable to 880 MW bipolar operation. The interconnection emanates from the Naga Converter Station in the Bicoll Region and terminates at the Ormoc Central Station in Leyte. The whole project has a total cost of about P 8,808 million pesos.

Leyte – Bohol Interconnection Project

The Leyte-Bohol Interconnection Project aims to provide reliable bulk power supply to Bohol Island from the indigenous geothermal power from Leyte. This link is the final phase in uniting all the major islands in the Visayas, thus creating the Cebu-Negros-Panay-Leyte-Samar-Bohol (CNPLSB) grid. With a capacity of 100 MW, this link was implemented in two stages. Stage I involves the installation of 17 kilometers of 138 kV submarine cables, initially energized at 69 kV. Stage II covers the uprating of the link to its ultimate voltage of 138 kV and involves the construction of 152 kilometers of 138 kV overhead lines. The submarine cable route has a depth of about 60 meters bellow sea level. Stage I was commissioned in 2000 while Stage II is programmed for commissioning in 2002. The link emanates from the Ormoc Central Station to Ubay Substation in Northeastern Bohol via Maasin Substation in Southern Leyte. The project is estimated to cost around P2,913 million: P 2,288.28 million for Stage I and P 624.77 for Stage II.

Cebu-Mactan Interconnection Project

The Cebu-Mactan Interconnection Project aims to uprate the existing 69 kV link between Mactan and mainland Cebu and provide a more reliable bulk power supply to Mactan Island. With a capacity of 100 MW, this link involves the installation of 1.5 kilometers of 138 kV cross-linked polyethylene power cable (XLPE), under the new bridge linking Mactan with mainland Cebu, and 7 kilometers of 138 kV overhead lines. The link is programmed for commissioning in 2002. It emanates from the Banilad substation to Mactan substation via Mandaue substation. The project is estimated to cost around P1,357.33 million.

Leyte – Mindanao Interconnection Project

The Leyte-Mindanao Interconnection Project is the final phase in the unification of Luzon, Visayas and Mindanao grids. It will enable the deferment of additional baseload plants in the region and lower the system production cost as a result of overall pooling of resources. The interconnection project, which is programmed for commissioning in 2005, is designed for a ± 250 kV HVDC bipolar link with a total transfer capacity of 500 MW.

The project, which is estimated to cost around $ 342 million, includes 455 kilometers long overhead line and 23 kilometers submarine cable with a maximum depth of around 1,000 meters below sea level. It emanates from the existing Ormoc Converter Station in Leyte and terminates at Kirahon Converter Station in Northcentral Mindanao via Southern Leyte and Northeastern Mindanao. Pre-construction activities for the project are in progress, including the preparation of definite design and tender documents.

TRANSMISSION ADDITIONS AND REINFORCEMENTS

Aside from the interconnection projects, the TDP also emphasizes on the reinforcement of the transmission backbone to establish a more reliable delivery system. Such reinforcement is mainly dictated by the configuration of the system, the profile of the loads and the power resources available. The assessment of these system characteristics is necessary in determining the weaknesses of the transmission system that need to be improved in the future.

System Characteristics of Luzon Transmission System

A large portion of the load in the Luzon grid is located in the Metro-Manila area while the generation sources are located in the northern and southern parts of the Luzon Island. The current load in Luzon is geographically distributed as follows: 56.5% (3,270 MW) in Metro-Manila, 22% (1,260 MW) in northern Luzon and 21.5% (1,235 MW) in southern Luzon. Because of this system configuration, it is vital that the transmission backbone be adequate to transfer large amount of power from both north and south areas to Metro-Manila.

The installed generation capacity in the northern Luzon is 3,757 MW, while southern Luzon has 4,534 MW. In comparison, the transmission corridors to Metro-Manila are limited to power transfer capabilities of 2,500 MW and 3,000 MW for the northern and southern corridors, respectively. The generation capacity in the northern corridor is just enough to sustain its local load and allow transfer of remaining capacity to Metro-Manila within its transfer capability limit. On the other hand, about 750 MW generation capacity from the southern Luzon cannot be dispatched because of line limitations.

Strengthening of the transmission corridors is necessary to accommodate the entry of new generation sources and development of new load centers.

System Characteristics of Visayas Transmission System

The Visayas grid, in terms of system reliability and security compared to Luzon, is still under developed. Internal generation sources in the different islands are mostly oil-based plants with the exception of Leyte and Negros islands, which have geothermal plants with capacity of 752.5 MW and 192.5 MW, respectively.

The island grids are connected through AC submarine cable links to fully utilize the geothermal power source and optimize reserve sharing. The different islands internally distribute bulk power through radial backbone lines rated at 230 kV and 138 kV for Cebu, 138 kV for Negros, Panay and Leyte-Samar and 69kV for Bohol island. Bulk of the load is in Cebu (40%), while the rest are divided to Negros, Panay, Leyte-Samar and Bohol at 20%, 18%, 17% and 4%, respectively.

The power normally flows from the Leyte geothermal fields to Cebu. Excess power from Cebu is then transmitted to Negros and Panay. The same is true for the power flow in Samar and Bohol islands. Power transfer between the islands is inherently limited by the capacity of the submarine cables linking the islands. At present the transfer capability from Leyte to Cebu is 200 MW. In 2003, this will be uprated to 400 MW with the

completion of a second Leyte-Cebu submarine cable link. The transfer capability from Cebu to Negros and from Negros to Panay is 100 MW. Additional 100 MW submarine link between Negros and Cebu will depend on the economic viability of the project. Samar Island solely relies on the Leyte geothermal for its power requirements. On the other hand, Bohol, although interconnected to Leyte, still relies on internal generation due to the existing limitation on the transfer capability of the submarine cable link. This limitation will be rectified in 2003, with the completion of 138 kV lines from the Leyte geothermal fields and the uprating of the link from 69 kV to 138 kV.

The Visayas system is inherently low in system stiffness due to long radial lines from supply source to power consumers and overall system reliability. Low voltages are still experienced particularly during peak loading condition at the far end of the lines. However, in due time and completion of programmed system reinforcements, the Visayas grid is expected to attain the desired system reliability and security levels.

System Characteristics of Mindanao Transmission System

The transmission system of Mindanao grid is divided into six areas: namely, North Central, North Western, Lanao, North Eastern, South Eastern and South Western Area. Inter area ties and backbone transmission are at 138 kV level with 69 kV radial lines emanating from the bulk substations to load-end substations. Generation sources in the island consist of the Agus Hydro plants (45%) in Lanao area and Pulangi Hydro plant (16%) in North Central Mindanao. Mt. Apo Geo (6%) in South Eastern Mindanao and oil-based plants (34%) in NEMA, SEMA, NWMA and SWMA. The Agus plants have a total installed capacity of 727 MW, Pulangi plant has 255 MW, Mt. Apo has 95 MW and the Diesel plants have a combined capacity of 551 MW.

At present, bulk of the Mindanao load are distributed in the six areas as follows: NWMA (14%), LANAO (13%), NCMA (15%), NEMA (13%), SEMA (27%) and SWMA (16%). With the baseload power plants located in Lanao, power tends to flow from the north to south towards the Davao area through North Central Mindanao and westward towards North Western Mindanao and eastward towards North Eastern Mindanao. Inter area ties are mostly composed of double circuit transmission lines enabling the ties to have n-1 contingency.

However, portion of the power corridor from Lanao to North Central and South Eastern Mindanao are subject to constant sabotage, thus reducing the overall transfer reliability from Lanao area to South Eastern Mindanao. However, this is expected to be mitigated with the completion of reinforcing AC lines associated with the 500 MW Leyte-Mindanao HVDC Interconnection Project, which is expected to be commissioned in 2005. To further increase the transmission system reliability and security, a 230 kV transmission line backbone has been lined-up for implementation and will be installed from Lanao area towards South Eastern Mindanao Area.

At present the Mindanao system is relatively stiff with the exception of North Eastern Mindanao area, which has long single circuit 138 kV lines and limited local generation. On the other hand, low voltages are also experienced at far-flung load-end substations. The installation of capacitor banks in the near future will mitigate such problems.

On-going Transmission Projects

The on-going projects include those that are already under construction and with financing source. These projects are immediately needed to relieve the bottlenecks on the transmission system, and increase the transfer capability of the transmission corridors in order to accommodate the entry of the generation projects in the pipeline. Table 6 summarizes the on-going transmission projects.

In the Luzon grid, the major projects include the completion of the Damarinas-Tayabas 500 kV backbone and the upgrading of Batangas-Makban-Biñan in the southern Luzon transmission corridor and San Manuel-Conception-Mexico 230 kV lines in the northern corridor. Other projects are lines associated with incoming plants and extension of sub-transmission line to remote areas. All these projects will involve the construction of 1,168 ckt-km of lines and installation of 5,300 MVA of substation capacity.

In Visayas region several projects should be implemented immediately to maintain the adequacy of the transmission network. These projects are the upgrading of Leyte-Cebu interconnection to 400 MW that will allow higher geothermal power transfer to Cebu from Tongonan Leyte, the completion of Stage II Leyte-Bohol interconnection, the commissioning of Leyte-Samar reinforcement project and the reinforcement of Mactan-Cebu link via 138 kV XLPE cable. Other projects consist of the reinforcement of transmission backbone in Panay, extension of 138 kV lines to Western and Northern Negros and installation of capacitor devices to regulate the voltages in the system. The on-going projects in the Visayas cover the construction of 904 ckt-km of lines and 1,380 MVA of substation capacity.

In Mindanao the on-going projects cover the construction of 495 ckt-km of lines and 850 MVA of substation capacity, including installation of around 343 MVAR of capacitor devices for voltage support. These projects include the reinforcement of 138 kV line from Gen. Santos to Tacurong up to Nuling and the Sangali-Potogo 138 kV line, covering 324 ckt-km of overhead lines, and extension of 69 kV lines totaling 171 km to connect the load-end substations of the cooperatives. Expansion of major substations in Tagoloan, Tindalo, Butuan, Anislagan, Tacurong, Aurora, Maria Cristina, Sangali, and Nuling, including installation of new substations in Bunawan and Maco, will also be implemented to ensure supply reliability and accommodate higher demand.

Transmission Projects For Implementation

Projects for implementation are those projects identified to accommodate the entry of new generation projects and increase in bulk substation loading to further maintain the security and reliability of power delivery.

In Luzon, these projects consist of additional transmission line upgrading and reinforcement projects. These are the Kalayaan-Makban Upgrading Project, the San Esteban-Bantay-Laoag 230 kV transmission line project, and the 230 kV T/L upgrading projects II to improve the transfer capability of the northern and southern transmission corridors. Also included are sub-transmission projects under NEA requirements that involve the construction of several 69 kV lines to supply additional customers load-end substations. The projects under this category involve the implementation of 981 ckt-km of lines.

TABLE 6
SUMMARY OF ON-GOING TRANSMISSION PROJECTS

PROJECT	CONSTRUCTION COST			FINANCING		COMM DATE
	FOREX (MP)	LOCAL (MP)	TOTAL (MP)	SOURCE	LOAN I.D.	
LUZON	231.50	2083.46	11900.20			
1. PAGBILAO CFTPP ASSO.T/L	19.72	246.80	1035.86	ADB 1288-PHI / Miyazawa	a	Dec-99
2. CONCEPCION-CAT-LIPCO 69 kV	0.38	8.00	25.10	LIPC		Dec-98
3. CLUSTER C S/S EXP. PROJECTS	6.38	29.96	285.60	OECF PH-P161(20thYen)		Mar-99
4. T/L & S/S PROJ.	4.58	34.07	262.82	EDCF PHL-3/ICG		Dec-99
5. WB-TGRL SUBSTATION	13.93	65.22	634.40	IBRD 3996/3997-PH		Dec-99
6. CASECNAN HYDRO ASSO T/L	9.33	156.35	529.55	OECF / Miyazawa / ICG		Jan-00
7. BATANGAS T/L	49.40	346.78	2322.73	ADB 1590-		Dec-00
8. NGAS GEN ASSOCIATED T/L PROJ.	79.10	425.12	3549.04	OECF PH-P178 / Miyazawa		Jan-01
9. LUZON SUB-TRANS. PROJ. I & II	7.43	164.56	536.01	Miyazawa		Dec-04
10. BAUANG-SN ESTEBAN L2 STRING'G	3.29	13.80	178.30	Miyazawa		Dec-01
11. SAN ROQUE HYDRO ASSO. T/L	3.33	24.24	190.74	ADB / Miyazawa		Jun-02
12. BINGA-SAN MANUEL T/L	7.10	87.18	442.18	Miyazawa		Dec-02
13. LUZON TRANS. LINE	25.79	459.29	1748.79	Miyazawa		Apr-04
14. LUZON PCB REPLACEMENT	2.74	22.08	159.08	RP-Swiss Mixed Credit		Dec-02
VISAYAS	247.29	1292.84	11673.82			
1. LEYTE-SAMAR TRANS.	0.65	15.00	40.88	JGODA		Oct-02
2. PANAY IV	15.45	144.11	792.04	IBR 3996/3997-		Feb-03
3. NEGROS III	10.77	68.59	519.97	J. EXIMBANK		Jan-03
4. NEGROS IV	5.30	72.00	293.23	IBR 3996/3997-PH		Feb-03
5. CEBU III	3.61	25.74	176.23			Sep-03
6. VISAYAS CAPACITOR PROJECT	12.06	54.20	560.64	MIYAZAWA		Dec-04
7. VISAYAS CAPACITOR PROJECT	4.82	37.18	239.76	MIYAZAWA		Dec-04
8. CEBU IV	2.58	13.14	121.50	IBR 3700-PH		Jul-03
9. LEYTE-SAMAR	20.17	238.85	1085.99	MIYAZAWA		Dec-02
10. LEYTE BOHOL INTER. (STAGE	11.24	152.24	624.77	OEC PH-P177		Apr-03
11. VISAYAS SUBSTATION EXP.	4.71	31.75	229.57	MIYAZAWA		Apr-03
12. LEYTE-CEBU INTERCON.	113.91	77.80	4862.22	ADB 1590-PHI		Feb-03
13. CEBU -MACTAN	27.72	193.06	1357.33	MIYAZAWA		May-
14. NEGROS V	3.49	60.26	206.98	MIYAZAWA		Mar-05
15. ORMOC 230/138 KV S/S	3.14	24.04	155.71	MIYAZAWA		Apr-03
16. CEBU	7.67	84.87	407.00	MIYAZAWA		Dec-03
MINDANAO	72.50	853.83	3902.95			
1. MINDANAO CAPACITOR PROJ. I &	3.66	31.56	196.14	ICG		Dec-02
2. MINDANAO SUBSTATION EXP.	9.66	78.38	464.77	OPE OPEC/62		Sep-02
3. 69 KV LINE PROJECTS	3.55	58.90	200.90	J.EXIMBANK IBRD		Mar-03
4. MINDANAO EXPANSION -	5.70	42.76	270.76	J.EXIMBANKJ.EXIM		Sep-02
5. BUNAWAN S/S	6.68	59.71	326.91	MIYAZAWA		Feb-02
6. MACO SUBSTATION	5.13	32.49	237.69	MIYAZAWA		Jul-03
7. NULING	1.89	14.40	89.88	MIYAZAWA		Sep-02
8. MINDANAO CAPACITOR	8.96	69.05	472.14	MIYAZAWA		Oct-03
9. GEN. SAN-TACURONG T/L REINFORCE.	11.40	169.01	682.20	MIYAZAWA		Dec-03
10. TACURONG - NULING	7.95	140.62	498.22	MIYAZAWA		Dec-03
11. ZAMBOANGA CITY AREA 138 KV	7.93	156.96	553.34	MIYAZAWA		Dec-03
GRAND TOTAL	551.29	4230.12	27568.98			

In the Visayas, the projects for implementation involve the construction of 793 ckt-km of lines and 400 MVA of substation capacity. These consist of several 69 kV lines to connect the load-end substations of the cooperatives and looping of cooperatives substations to ensure reliability of power supply in Panay, Leyte and Negros areas. The projects also include the strengthening of the northern and southern Panay backbone.

In Mindanao, the projects for implementation total 2,923 ckt-km of lines and 2,070 MVA of substation capacity. This includes the Leyte–Mindanao interconnection that will provide a transmission highway and make available low cost power for the three region of the country. Reinforcement of transmission link between Agus plants and the major substations in Tagoloan and Davao will also be implemented for reliability of power supply to northern and southern part of Mindanao. Other projects for implementation are several 69 kV lines to supply the load-end substations of the cooperatives, including looping of the existing radial lines to ensure reliability of power service in the cooperative's franchise areas.

To meet the increase in power demand, additional transformers will be added, including the installation of new substations in Pitogo, Prosperidad, and Pulanco. Reliability of power supply will also be ensured in eastern part of Mindanao through extension of 138 kV transmission lines in Surigao and Caraga Region. Other projects for implementation are lines associated with incoming generation projects and power circuit breakers replacement projects for the existing substations of NPC. Table 7 shows the projects for implementation.

TABLE 7

SUMMARY OF TRANSMISSION PROJECTS FOR IMPLEMENTATION

PROJECT	CONSTRUCTION COST			FINANCING SOURCE	COMM. DATE
	FOREX ($M)	LOCAL (PM)	TOTAL (PM)		
LUZON	**95.31**	**1,885.25**	**6,636.60**		
1. SLRC SUBTRANSMISSION	0.7	6.9	43.4		Dec-
2. SLRC SUBTRANSMISSION	0.1	1.0	7.5	ICG-Area	Dec-
3. LIMA CUT-IN TO BATANGAS-MAKBAN L1	2.8	25.7	153.1	Lima	Jan-
4. LUZON SUBTRANS PROJ. (NEA REQMT.)	9.9	516.4	1,013.95		Jan-
5. KALAYAAN-MAKBAN UPGRADING PROJ.	17.3	238.2	1,104.79		Dec-
6. SN ESTEBAN-BANTAY-LAOAG 230 kV PROJ.	12.57	449.6	1,078.15		Dec-
7. 230 kV T/L UPGRADING PROJECTS -	17.2	522.4	1,382.97		Apr-06
8. SMALL ISLAND INTERCON. PROJ.	34.56	124.7	1,852.7		Dec-06
VISAYAS	**69.41**	**714.91**	**4,186.63**		
1. BORACAY ELECTRIFICATION PROJECT	4.01	40.36	240.6	IC	Jun-
2. VISAYAS SUBTRANSMISSION PROJECTS	21.74	254.4	1,341.35		Dec-
3. SMALL ISLAND INTERCONNECTION PROJ.	12.2	49.0	660.9		Dec-
4. NORTHERN PANAY BACKBONE	13.1	181.0	838.2		Jan-
5. WESTERN PANAY 69 KV EXP.	4.6	54.2	285.6		Jun-
6. SOUTHERN PANAY BACKBONE	6.5	74.7	402.3		Jun-
7. SUBTATION EXPANSION PROJECT -2005	7.11	60.9	416.4		Jun-
MINDANAO	**393.05**	**4,841.16**	**24,493.64**		
1. DAMILAG S/S PROJECT (NEW)	0.6	4.8	38.5		Dec-
2. KABACAN SWITCHING AND 138 KV T/L	8.7	116.3	553.9	PROPOSED TO	Jul-
3. REGION 9 SUB-TRANSMISSION PROJECT	7.5	88.2	464.0	PROPOSED TO	Jan-
4. CARAGA & REGION 10 SUBTRANS. PROJ.	10.9	129.8	676.6	PROPOSED TO	Jan-
5. REGION 11 SUB-TRANSMISSION	11.4	134.4	704.1	PROPOSED TO	Jan-
6. ARMM & REGION 12 SUBTRANS. PROJ.	5.1	56.9	313.3	PROPOSED TO	Jan-
7. ABAGA - KIRAHON 230 KV T/L	31.0	279.2	1,833.39	PROPOSED TO	Jun-
8. AURORA-DIPOLOG 138 KV T/L	12.3	179.1	795.3	PROPOSED TO	Jan-
9. MINDANAO SUBSTATION EXP. 2004	10.2	77.0	591.1	PROPOSED TO	Jan-
10. LEYTE-MINDANAO INTERCON. (500 MW)	222.4	3,121.50	14,594.50	ADB/MIYAZAWA	Jan-
11. PCBs REPLACEMENT PROGRAM 1	2.4	17.7	141.7		Jan-
12. SMALL ISLAND GRIDS INTERCON.	33.3	152.8	1,818.20	DANIDA/TBD	Dec-06
13. PROSPERIDAD SUBSTATION (NEW)	27.96	463.95	1,861.82	PROPOSED TO AADB	Jan-
14. MINDANAO COAL ASSO. T/L (2x100 MW)	1.75	19.10	106.79	PROPOSED TO WB	Jul-
GRAND TOTAL	**557.77**	**7,441.33**	**35,315.87**		

Indicative Transmission Projects

Indicative projects include those that have been identified as necessary in the latter half of the program period (2007-2011), but require further study. It includes lines associated with generating plants whose sites have not yet been identified but are included in the generation program.

In Luzon, these projects include various substation expansion projects, Mexico-Hermosa-Olongapo and San Manuel Upgrading Projects, the Northern Luzon 230 kV T/L Loop and numerous generation associated transmission line projects. These willl involve the construction of around 2,659 ckt-km of lines and installation of 6,470 MVA of substation capacity. Table 8 presents the summary of indicative projects in Luzon.

TABLE 8

SUMMARY OF LUZON INDICATIVE PROJECTS

	PROJECT	CONSTRUCTION COST			FINANCING SOURCE	COMM. DATE
		FOREX ($M)	LOCAL (PM)	TOTAL (PM)		
	LUZON	347.76	3,648.86	21,036.93		
1.	40-MW PNOC WIND FARM ASSO. T/L PROJ.	4.14	48.38	255.48	PNOC	Dec-04
2.	LUZON SUBSTATION EXP. PROJECTS - 1	5.00	40.01	290.11		Dec-05
3.	NEW MUÑOZ 230 kV SUBSTATION PROJECT	1.44	11.51	83.51		Dec-06
4.	300-MW BASE PLANT @ ISABELA ASSO. T/L.	51.13	506.28	3,062.78		Dec-06
5.	LUZON SUBSTATION EXPANSION PROJ. - 2	7.90	63.17	458.02		Dec-07
6.	360-MW AGBULU HYDRO ASSO. T/L PROJ.	25.42	331.11	1,602.01		Dec-07
7.	60-MW ABUAN HYDRO ASSO. T/L PROJECT	1.80	22.09	112.29		Dec-07
8.	88-MW ILAGUEN HYDRO ASSO. T/L PROJECT	4.07	57.05	260.75		Dec-07
9.	46-MW ADDALAM HYDRO ASSO. T/L PROJ.	2.62	34.81	166.01		Dec-07
10.	113-MW KANAN HYDRO ASSO. T/L PROJECT	4.48	51.12	275.32	PROPONENT	Dec-07
11.	TUGUEGARAO-SOLANA 69 kV LINE	0.96	11.60	59.60		Dec-08
12.	MEXICO-HERMOSA-OLONGAPO UPGRADING	9.92	124.16	620.03		Dec-08
13.	320-MW BATANGAS PRIV. POWER ASSO. T/L	2.86	35.38	178.18	MUDC	Dec-08
14.	600-MW @ PNPP ASSO. T/L PROJECT	19.45	176.15	1,148.75		Dec-08
15.	175-MW BINONGAN HYDRO ASSO. T/L PROJ.	7.57	111.08	489.68		Dec-08
16.	LUZON SUBSTATION EXPANSION PROJ. - 3	13.87	110.97	804.67		Dec-09
17.	BTPP REPOWERING (600 MW)	7.42	91.07	461.97		Dec-09
18.	600-MW @ SAN MANUEL UPGRADING PROJ.	24.05	368.97	1,571.67		Dec-09
19.	3x460-MW LNG @ BATANGAS ASSO. T/L	56.81	457.21	3,297.71	PROPONENT	Dec-10
20.	1200-MW @ MASINLOC T/L PROJECT	30.21	236.52	1,747.07		Dec-11
21.	750-MW @ TAYABAS UPGRADING PROJ.	16.80	134.40	974.30		Dec-11
22.	332-MW DIDUYON HYDRO ASSO. T/L PROJ.	5.62	80.89	361.64		Dec-11
23.	NORTHERN LUZON 230 kV T/L LOOP PROJ.	29.92	430.52	1,926.52		Dec-11
24.	LUZON SUBSTATION EXPANSION PROJ. - 4	14.29	114.31	828.86		Dec-11

In the Visayas, the indicative projects cover the construction of 654 ckt-km of lines and 1,250 MVA of substation capacity. These consist of generation associated transmission lines and several 69 kV lines to connect the load-end substations of the cooperatives and looping of cooperatives substations to ensure reliability of power supply in the Visayas grid. The projects also include the Ubay-Hernandez 138 kV transmission lines that will strengthen the transmission backbone of Bohol grid. Table 9 shows the indicative transmission line projects in the Visayas.

In Mindanao, the indicative projects involve the construction of 1,183 ckt-km of lines and 3,075 MVA of substation capacity. Most of these projects are generation associated lines and the completion of 230 kV backbone of Mindanao by installing of 230/138 kV, 2x300 MVA, in each substation of Abaga, Tagoloan, Pulangi 4 and Bunawan. Table 10 summarizes the indicative projects in Mindanao.

TABLE 9
SUMMARY OF VISAYAS INDICATIVE PROJECTS

PROJECT	CONSTRUCTION COST			FINANCING SOURCE	COMM. DATE
	FOREX ($M)	LOCAL (PM)	TOTAL (PM)		
VISAYAS	**133.58**	**1,181.78**	**7,856.02**		
1. 69 KV LINE PROJECTS	0.62	9.10	35.26		
2. PANAY PEAKING ASSO. T/L (60 MW)	2.04	25.48	127.67	PROPONENT	JUL/2003
3. NEGROS PEAKING ASSO. T/L (60 MW)	2.04	25.48	127.67	PROPONENT	JUL/2003
4. NEGROS PEAKING ASSO. T/L (30 MW)	2.04	25.48	127.67	PROPONENT	JUL/2004
5. BOHOL MIDRANGE ASSO. T/L (30 MW)	2.04	25.48	127.67	PROPONENT	JUL/2004
6. PANAY MIDRANGE ASSO. T/L (50 MW)	2.04	25.48	127.67	PROPONENT	JUL/2004
7. CEBU MIDRANGE ASSO. T/L (100 MW)	2.04	25.48	127.67	PROPONENT	JUL/2004
8. PANAY PEAKING ASSO. T/L (2X30 MW) 2004-2008	2.04	25.48	127.67	PROPONENT	JUL/2004
9. PANAY MIDRANGE ASSO. T/L (2X50 MW) 2005-2007	2.04	25.48	127.67	PROPONENT	JUL/2005
10. BOHOL MIDRANGE ASSO. T/L (2X40 MW) 2005-2011	2.04	25.48	127.67	PROPONENT	JUL/2005
11. PCBs REPLACEMENT PROGRAM (CLUSTER 1)	0.38	2.34	21.34		JAN-2006
12. PCBs REPLACEMENT PROGRAM (CLUSTER 2)	0.51	18.27	43.77		AUG/2006
13. GINATILAN PROJECT (NEW)	3.54	32.87	209.85		JAN/2006
14. BOHOL BACKBONE PROJECT	8.34	110.63	527.75		JAN/2006
15. VISAYAS S/S EXPANSION PROJECTS (2006)	10.60	91.02	621.26		JAN/2006
16. CEBU PEAKING ASSO. T/L (2X60 MW)2006-2007	2.04	25.48	127.67	PROPONENT	JUL/2006
17. BOHOL DIESEL ASSO. T/L (20 MW)	2.04	25.48	127.67	PROPONENT	JUL/2006
18. NEGROS PEAKING ASSO. T/L (30 MW)	2.04	25.48	127.67	PROPONENT	JUL/2006
19. CEBU MIDRANGE ASSO. T/L (2X50 MW)2006-2010	2.04	25.48	127.67	PROPONENT	JUL/2006
20. VISAYAS S/S EXPANSION PROJECTS (2007)	8.39	72.08	491.46		JAN/2007
21. BOHOL MIDRANGE ASSO. T/L (3X20 MW) 2007-2010	2.04	25.48	127.67	PROPONENT	JUL/2007
22. VISAYAS S/S EXPANSION PROJECTS (2008)	10.47	89.97	613.34		JAN/2008
23. CEBU PEAKING ASSO. T/L (2X60 MW)2008-2009	2.04	25.48	127.67	PROPONENT	JUL/2008
24. NEGROS-CEBU INTERCONNECTION EXP.	41.57	150.98	2229.66		DEC/2008
25. VISAYAS S/S EXPANSION PROJECTS (2009)	2.15	18.41	125.83		JAN/2009
26. PANAY MIDRANGE ASSO. T/L (50 MW)	2.04	25.48	127.67	PROPONENT	JUL/2009
27. BOHOL MIDRANGE ASSO. T/L (30 MW)	2.04	25.48	127.67	PROPONENT	JUL/2009
28. CEBU PEAKING ASSO. T/L (2X60 MW)2010-2011	2.04	25.48	127.67	PROPONENT	JUL/2010
29. PANAY PEAKING ASSO. T/L (60 MW)	2.04	25.48	127.67	PROPONENT	JUL/2010
30. NEGROS PEAKING ASSO. T/L (2X60 MW)2010-2011	2.04	25.48	127.67	PROPONENT	JUL/2010
31. CEBU BASELOAD ASSO. T/L (100 MW)	2.04	25.48	127.67	PROPONENT	JUL/2011
32. CEBU MIDRANGE ASSO. T/L (100 MW)	2.04	25.48	127.67	PROPONENT	JUL/2011
33. PANAY PEAKING ASSO. T/L (30 MW)	2.04	25.48	127.67	PROPONENT	JUL/2011

TABLE 10
SUMMARY OF MINDANAO INDICATIVE PROJECTS

PROJECT	CONSTRUCTION COST			FINANCING SOURCE	COMM. DATE
	FOREX ($M)	LOCAL (PM)	TOTAL (PM)		
MINDANAO	**189.98**	**1,808.59**	**10,868.59**		
1. 69 KV LINE PROJECTS 1	0.62	13.39	44.39	WB-3163	Deferred
2. KIRAHON - BUNAWAN 230 KV T/L	54.53	489.95	3,216.25		Jan-2006
3. PCBs REPLACEMENT PROG. 2	1.14	6.82	63.82		Jan-2006
4. MC SWITCHYARD REHAB PROGRAM	3.60	38.59	218.70		Jan-2007
5. MAASIM SUBSTATION (NEW)	9.81	128.77	619.27		Jul-2007
6. MINDANAO MIDRANGE ASSO. T/L (150 MW)	2.04	25.48	127.67	PROPONENT	Jul-2007
7. MINDANAO SUBSTATION EXPANSION (2007)	7.66	58.38	441.19		Jul-2007
8. AURORA - ABAGA REINFORCEMENT PROJ.	7.92	125.92	522.02		Oct-2007
9. MINDANAO MIDRANGE ASSO. T/L (150 MW)	2.04	25.48	127.67	PROPONENT	Jul-2008
10. MINDANAO SUBSTATION EXPANSION (2008)	3.84	28.93	220.80		Jul-2008
11. MIND. PEAK.ASSO. T/L (2X30 MW) 2008-2009	2.04	25.48	127.67	PROPONENT	Jul-2008
12. MATANAO-KLINAN REINFORCEMENT	7.86	124.80	517.66		Jan-2008
13. PCBs REPLACEMENT PROG. 3	2.00	12.06	112.06		Aug-2008
14. MINDANAO MIDRANGE ASSO. T/L (150 MW)	2.04	25.48	127.67	PROPONENT	Jul-2009
15. ABAGA-KIRAHON-BUNAWAN 230 KV T/L	41.98	260.86	2,380.05		Jan-2010
16. MINDANAO SUBSTATION EXPANSION - 2010	5.69	43.39	327.93		Jan-2010
17. MALAYBALAY S/S (NEW)	4.41	49.76	270.14		Jan-2010
18. AURORA - NULING T/L	15.21	226.13	986.77		Jan-2010
19. MINDANAO MIDRANGE ASSO. T/L (300 MW)	2.43	27.94	149.50	PROPONENT	Jul-2010
20. MINDANAO BASELOAD ASSO. T/L (100 MW)	2.04	25.48	127.67	PROPONENT	Jul-2011
21. MINDANAO PEAKING ASSO. T/L (90 MW)	2.04	25.48	127.67	PROPONENT	Jul-2011

Small Island Grids Interconnection

Through a Danish government grant, NPC hired a consultant that conducted a feasibility study for several small islands interconnection, indicating the economic viability of the following Cluster I projects: interconnection of Catanduanes and Marinduque to Luzon, Bantayan to Visayas, and the islands of Basilan, Camiguin, Dinagat, Samall, and Talicud to Mindanao. Table 11 summarizes the Cluster I small islands interconnection projects.

TABLE 11
SUMMARY OF SMALL ISLAND INTERCONNECTION PROJECT

PROJECT	LENGTH (KM)	FOREX ($M)	LOCAL (PM)	TOTAL (PM)
LUZON-CATANDUANES	40	16.43	69.16	800.47
LUZON-MARINDUQUE	25	18.13	55.56	862.23
CEBU-BANTAYAN	18	12.74	35.59	672.55
MINDANAO-BASILAN	24	12.87	15.17	658.52
MINDANAO-CAMIGUIN	11	5.50	15.21	290.24
MINDANAO-DINAGAT	11	9.17	83.95	542.35
MINDANAO-SAMAL-TALICUD	11	5.77	38.48	327.09
TOTAL	140	80.61	313.13	4,153.45

Transmission Expansion Summary

Overall, the transmission expansion program identified in this 2001 TDP, covering the period 2001-2011, will reach 11,760 ckt-km of transmission and sub-transmission lines and 20,800 MVA of substation capacity. Addition of reactive and capacitive equipment, totaling 1,155 MVAR will also be implemented for voltage support in the different outlying areas. Table 12 presents the summary of the transmission line length for ongoing, projects for implementation and indicative projects under the 2001 TDP. Figures 4 to 6 plot the major projects for Luzon, Visayas and Mindanao.

TABLE 12
SUMMARY OF TRANSMISSION AND SUBSTATION ADDITION
(2001-2011)

Grid	Transmission (Circuit kms.)	Substation (MVA)	Capacitor (Mvar)
Ongoing	1,168	5,300	0
For Implementation	981	5	0
Indicative	2,659	6,470	0
LUZON	**4,808**	**11,775**	**0**
Ongoing	904	1,380	617
For Implementation	793	400	0
Indicative	654	1,250	40
VISAYAS	**2,351**	**3,030**	**657**
Ongoing	495	850	343
For Implementation	2,923	2,070	35
Indicative	1,183	3,075	120
MINDANAO	**4,601**	**5,995**	**498**
Ongoing	2,567	7,530	960
For Implementation	4,698	2,475	35
Indicative	4,496	10,795	160
TOTAL PHILIPPINES	**11,760**	**20,800**	**1,155**

Rehabilitation Projects

Aside from the new transmission projects, the TPD incorporates the rehabilitation works defined in the medium-term work plans of each regional Power Transmission Groups (PTG). Table 13 summarizes the transmission and substation projects for rehabilitation.

Table 13
SUMMARY OF REHABILITATION PROJECTS (2001-2005)

Grid	Description of Rehabilitation Projects	Cost (PM)
Northern LUZON	T/L Slope Protection T/L Rerouting and By-pass Installation Replacement of Wood pole, Collapse/Toppled Steel Towers, Wooden Cross-arms Substation Equipment Retirement and Replacement program Acquisition of On-line monitoring Equipment	147
Southern LUZON	230 and 69 kV Slope Protection Installation of Power Transformer Rehabilitation of 500, 230 and 69 kV T/L Construction of Transposition Towers Installation and Erection of Steel Towers Replacement of Temporary/By-Pass Wood Pole Structures PCB Replacement 69 kV Line Re-routing and Extension Installation of Mid-span support HVDC Line slope protection 69 kV Bus Modification and Construction of New 69	122
VISAYAS	Rehabilitation of 69 kV T/L Acquisition of Spare parts Upgrading of radial connection to 1 ½ Breaker Scheme Replacement of rotten wood poles to steel pole	985
MINDANAO	Rehabilitation of system protection Acquisition of Spare parts Construction of PSMD laboratory & Warehouse	98
	TOTAL PHILIPPINES	1,352

In Luzon, these projects include various 69 and 230 kV transmission lines rehabilitation works, 69 kV line rerouting and transmission line slope projects. The capital expenditure of this rehabilitation will cost of around P 269 million and will be implemented between years 2002 to 2004.

In Visayas, most of the projects are 69 kV transmission lines rehabilitation works, line rerouting and replacing of rotten wood poles to steel pole. It also includes the replacement of defective 69 kV breakers and its accessories. These projects will cost of around P 985 million and scheduled for implementation in year 2002 to 2004.

In Mindanao, the rehabilitation projects during the period 2002 to 2005 consist of upgrading of billing meters, rehabilitation of system protection and establishment of high voltage equipment repair facility. It also includes the acquisition of spare parts for the defective substation equipment. A total of P 98 million is needed to implement this project.

INVESTMENT REQUIREMENT:

The 2001 Transmission Development Program (TDP), covering the period 2001-2011, will entail an estimated total investment requirement of around P 103.98 billion or $2.08 billion, excluding interest during construction. Foreign portion accounts for $ 1.77 billion, while local counterpart totals P 19.88 billion. The local cost component includes rehabilitation projects amounting to P 1.35 billion.

The transmission projects in Luzon represent 38 percent (P 39.84 billion) of the total investment, while the Visayas and Mindanao grids account for 24 percent (P 24.70 billion) and 38 percent (P 39.44 billion), respectively. Table 14 presents the estimated capital expenditures of the 2001 TPD.

TABLE 14
SUMMARY OF INVESTMENT REQUIREMENT
(2001-2011)

GRID	FOREX ($ MILLION)	LOCAL (P MILLION)	TOTAL (P MILLION)
On Going	231.50	2,083.46	11,,900.20
For Implementation	95.31	1,885.25	6,,636.60
Indicative	347.76	3,648.86	21,,036.93
Rehabilitation	0.00	269.00	269.00
LUZON	**674.57**	**7,886.57**	**39,,842.73**
On Going	247.29	1,292.84	11,,673.82
For Implementation	69.41	714.91	4,,185.63
Indicative	133.58	1,181.78	7,,856.02
Rehabilitation	0.00	985.00	985.00
VISAYAS	**450.28**	**4,174.53**	**24,,700.47**
On Going	72.50	853.83	3,,992.95
For Implementation	393.05	4,841.16	24,,493.64
Indicative	180.96	1,808.59	10,,856.59
Rehabilitation	0.00	98.00	98.00
MINDANAO	**646.51**	**7,601.58**	**39,,441.18**
On Going	551.29	4,230.13	27,,566.97
For Implementation	557.77	7,441.32	35,,315.87
Indicative	662.30	6,639.23	39,,749.54
Rehabilitation	0.00	1,352.00	1,,352.00
GRAND TOTAL	**1,771.36**	**19,662.68**	**103,984.38**

FUGURE 4

LUZON GRID
POWER SYSTEM DEVELOPMENT MAP – 2001 TDP

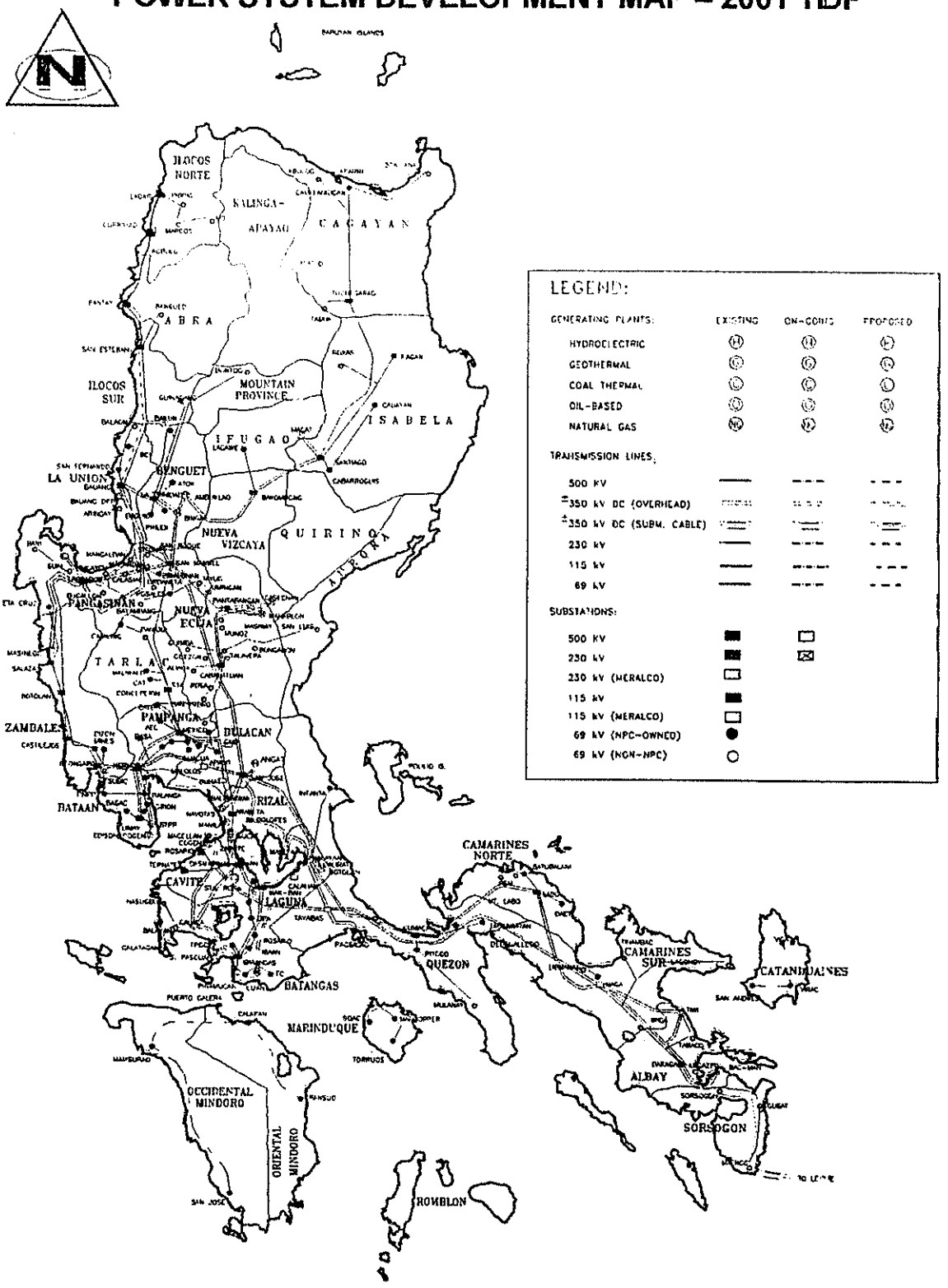
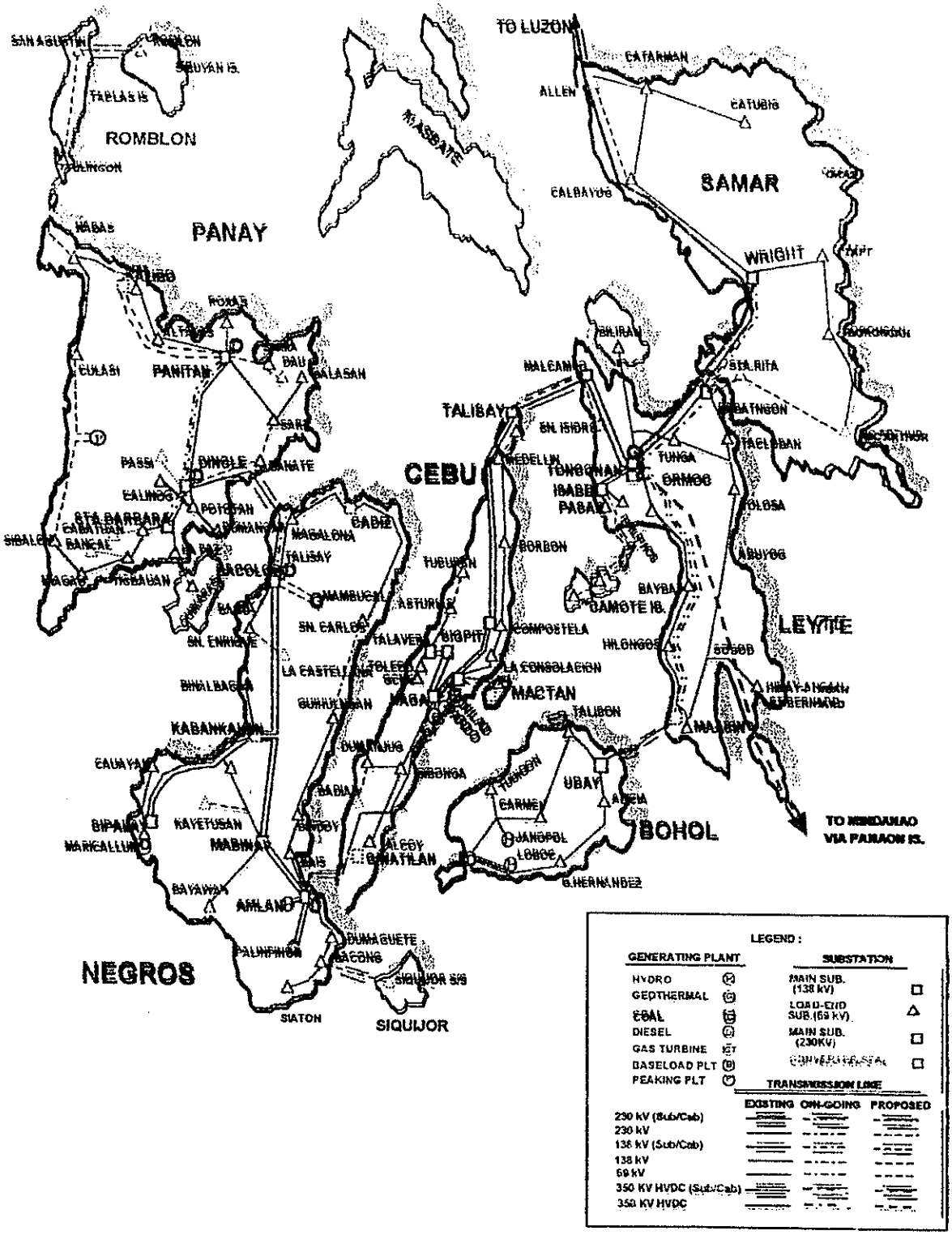


FIGURE 5

VISAYAS GRIDS

POWER SYSTEM DEVELOPMENT MAP- 2001 TDP



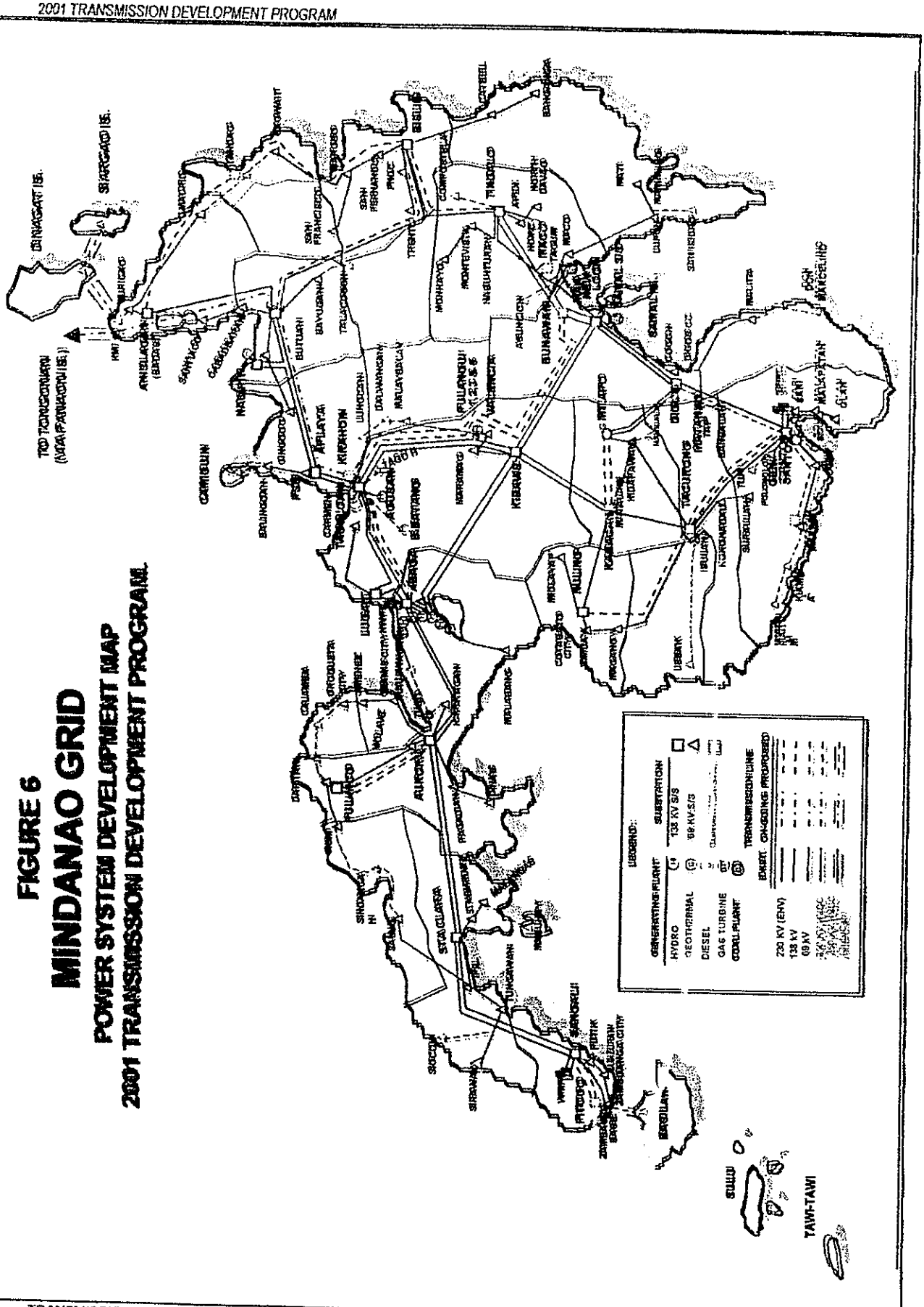


FIGURE 6

MINDANAO GRID

POWER SYSTEM DEVELOPMENT MAP

2001 TRANSMISSION DEVELOPMENT PROGRAM

National Transmission Corporation- Table of Organization