Annex 12 – Power Sector

I. Introduction

1. On 26 December 2004, a tsunami swept many islands of the Maldives resulting in the worst disaster ever to hit the country. It totally disrupted the power supply system in at least 95 islands (about 48% of the total islands with electricity) and left the population without electricity for days before the first technical team arrived to those islands to temporarily restore the electric power.

2. Various organizations are providing electric power in Maldives, with the State Electric Company Limited (STELCO), a government-owned enterprise, as the largest supplier. STELCO is currently responsible for supplying electricity to the capital island of Male and to 25 of the larger outer islands. In other outer islands, the electricity is being supplied by the Island Development Committees (IDCs), cooperatives, NGOs and small private companies. Each provider is responsible for both power generation and distribution to the households. Diesel-based generators are used to generate power in all islands. STELCO holds the largest share of power supply with a total installed generating capacity of 49 MW. The power supply in the resort islands is being taken care by the respective private resort operators.

3. The IDCs are community-based extensions of the Government and are the grass root institutions involved in the development of the islands. NGOs running power supply systems range from community-based formal and registered organizations to informal community clubs using the sale of electricity as a fund-raising activity. The private sector companies are operated and owned by small-scale family entrepreneurs, or by more substantial private companies. In some of the outer islands, more than one electricity provider is operating in one island. The generating capacity of the electricity providers in the outer islands is estimated at 16 MW. Distribution network from the generators comprises mainly underground low voltage cables, except in Male and a few large islands where high voltage cables are used.

4. The Maldives Electricity Bureau (MEB) is responsible for regulating generation, distribution, and utilization including tariff setting. MEB has just recently established an electricity standard by adopting the Singapore standards. However, MEB does not have sufficient resources to enforce the standards and regulations to the outer islands and therefore, in many islands the electricity installations do not meet the safety standards.

5. At the request of the Government of the Maldives, a joint Asian Development Bank, the United Nations, and the World Bank mission visited the Maldives from 5 to 17 January 2005, and from 1 to 2 February 2005. The Mission's objective is to help the Government assess the damages caused by the tsunami, identify and prioritize the emerging needs.

II. The Government's Immediate Response

6. Immediately after the disaster, the Government created a National Disaster Management Center (NMDC) that immediately collected information on the status of affected islands and regularly updates them. The NMDC is also coordinating assistance received from various groups, including government and private companies.

7. Despite of the different organizations providing the electric power, the Government has assigned STELCO to send teams to 53 most affected outer islands, including 4 STELCO's islands. STELCO has been able to quickly restore the electricity in their 4 islands and has temporarily restored electricity in many of the affected outer islands, if only to a bare minimum in terms of providing electricity in the

islands' offices and the temporary tents in the evening. STELCO's teams have been able to repair some of the damaged generators and provide temporary small generators in a few islands.

III. Methodology of Damage and Needs Assessment

8. **Consultation and Site Visit.** The Mission held discussions with staff from the Ministry of Planning and National Development (MPND), the Ministry of Finance and Treasure (MOFT), STELCO, and staff from international organizations. The Mission also visited Kolhufushi and Naalaafushi islands in the Meemu Atoll and discussed with some community members and the deputy chief of the respective islands.

9. **Methodology.** The methodology to collect the data is two-fold: (i) through questionnaires to be filled by the islands chief; and (ii) through STELCO's teams to collect the information first hand. The data on the immediate assessments carried out by STELCO's team as well as by the NDMC was analyzed by the Mission and provides the basis for this report.

IV. Damage Assessment

10. According to the data collected, the extent of damage varied from island to island. In almost all affected islands, the damage occurred to the distribution network, i.e. cables, distribution boxes, and household connections. The strong wave scoured the ground (which is mainly sand), pulled out the cables and tore them. In some islands, the powerhouses, generators and switchboards were also damaged to a varying degree; some of the generators can be repaired and others have to be replaced. Streetlights in a few islands were also damaged.

11. Much of data were collected in the period immediately after disaster where the attention was more on the relief effort. This situation was aggravated by the non-functioning communication systems, which made the transmission of data difficult. Table 1 summarizes the damage assessment (for details see Attachment 1).

Table 1: Summary of the Damaged Power Supply Facilities

Damaged Facilities	Number
Power House	24 nos.
Generator	104 nos.
Streetlights	652 nos.
Switchboards	34 nos.
Cables	>121 km
Distribution boxes	632 nos.

12. This data has to be interpreted carefully to come up with the reasonable cost estimates. The number of generators damaged is 104; however, it does not necessarily imply that all 104 generators have to be replaced. There are some that can be repaired, and not all those generators were used in the first place. On the other hand, the length of damaged cable is estimated at 121 km, but based on the Mission's observation during field visit, it is believed that the actual requirement is much higher.

13. The direct cost of the damage will be the replacement cost of the damaged equipment, including the installation cost which is estimated at about $4.6 million (see reconstruction cost in para. 15 below). No indirect cost of the damage is envisaged.

V. Needs Assessment

14. **Immediate Needs.** To restore the power supply system on a more permanent basis within the shortest possible time, repairing the damaged generators, replacing the damaged cables and distribution boxes, are considered a priority. STELCO has prepared cost estimates for immediate rehabilitation of the power supply within 6 months amounting to about $1.9 million. These estimates do not include the cost for repair in 4 STELCO islands, which is considered minor and for which STELCO has assumed full responsibility (STELCO has submitted a claim to the insurance company on the damage of their generators and switch boards).

15. **Medium-Term Needs.** To bring back the system to the pre-disaster level, more time, resources and detailed survey will be needed. It is estimated that such a reconstruction program will cost an additional $2.7 million and will be completed within 1.5 to 2.0 years. This will bring the total cost to $4.6 million. A summary of the cost estimates is presented in Table 2 below, while the details are in Attachment 2.

Table 2: Summary of Cost Estimates

No.	Description	Phase 1		Phase 2		Total
		MRf ('000)	$ ('000)	MRf ('000)	$ ('000)	$ ('000)
1.	**Equipment**					
a.	Generators	0.00	0.00	7,096.88	555.44	554.44
b.	Switchboard	6,120.00	478.13	0.00	0.00	478.13
c.	Cables	7,650.00	597.66	0.00	0.00	597.66
d.	Distribution boxes	2,875.60	224.66	0.00	0.00	224.66
e.	Streetlights	0.00	0.00	1,773.44	138.55	138.55
f.	Tools	0.00	0.00	1,035.00	80.86	80.84
g.	Accessories	525.28	41.12	88.67	6.93	48.04
h.	Fuel tanks	0.00	0.00	6,900.00	539.06	539.06
i.	Meters and consumer panel	0.00	0.00	4,876.00	380.94	380.94
	Subtotal (1)	**17,171.88**	**1,341.55**	**21,769.99**	**1,700.78**	**3,042.33**
2.	**Works**					
a.	Transport of equipment	1,717.19	134.16	1,487.00	116.17	250.33
b.1.	Installation of generators	0.00	0.00	580.00	45.31	45.31
b.2.	Installation of cables	4,500.00	351.56	0.00	0.00	351.56
b.3.	Installation of distr. Boxes	442.40	34.56	0.00	0.00	34.56
b.4.	Installation of streetlights	0.00	0.00	326.00	25.47	25.47
c.	Construction of powerhouse	0.00	0.00	11,500.00	898.44	898.44
	Subtotal (2)	**6,659.59**	**520.28**	**13,893.00**	**1,085.39**	**1,605.67**
	Total	**23,831.47**	**1,861.83**	**35,662.99**	**2,786.17**	**4,648.00**

16. The reconstruction of power supply system will be a considerable challenge because the limited number of experts available in the country. While community members can participate in certain labor-intensive works such as constructing the powerhouses and laying the underground cables to help provide

jobs that are badly needed, most of the experience electrical technicians and engineers are working with STELCO. The number of qualified local contractors is also limited. Given the large amount of reconstruction works to be immediately carried out, assistance from international and local organizations will be needed and should be well coordinated. A summary of priority steps is presented in Attachment 3.

17. The next stage would be to further improve the power supply system in the affected islands. However, this stage is considered beyond the scope of the emergency reconstruction efforts and should be handled in an annual development planning and programming.

18. It should be emphasized that the power supply facilities are not the Government's asset, as they mostly belong to the IDCs as the electric power provider. However, because of the natural disaster, the Government may decide to finance the reconstruction works, including replacement of the damaged facilities. It is understood that the Government would do this on a grant basis to the IDCs.

VI. Response from International Agencies

19. The International Federation of Red Cross and Red Crescent Societies (IFRC) had immediately provided generators, cables and distribution boxes. A total of 22 generators of 20 to 150 kW capacity have been delivered and installed in 22 affected islands. Those generators have been operating since 29 January 2005. The grant from IFRC was valued at $0.6 million. It is recommended that IFRC also provide spare-parts for at least 2 years of operation of the generators.

20. The British Royal Navy teams assisted STELCO in installing the new generators from IFRC and repairing some of the damaged generators in January 2005.

21. The United Nation Development Program (UNDP) will provide cables and distribution boxes to compliment the equipment provided by IFRC. The total fund available is $0.3 million, granted by the United Nation Foundation.

22. It is recommended that the Government coordinate the relief efforts to avoid duplication and to know exactly if there is a funding gap. A summary of input that may be provided by different parties is in Attachment 4.

VII. The Long Term

23. **Long-Term Strategy.** The Government recognizes that providing reliable and efficient power supply in the outer islands will contribute to the national development objectives by reducing the disparities in services among the islands and the vulnerability of the outer islands populations. The Government has therefore given high priority to improved electrification in the outer islands, and prepared a Sector Policy on Outer Islands Electrification in June 2001. The aim is to establish the financial viability of the outer islands power providers and place them on a sound footing. The sector policy also highlights the importance of strengthening sector entities including implementing agencies, island power providers, and sector regulators to build their capacity in long-term development planning and management of power supply systems in the outer islands.

24. Based on the policy, the Government has established investment strategies and priorities to improve power supply in the outer islands on an affordable and sustainable basis. Of the 97 focus islands, 75 were identified for improvement of electricity supply.

25. **Issues for Long-Term Planning.** While the tsunami disaster may have no impact to the sector policy, the investment strategy may need to be slightly modified in terms of islands targeted for the improvement of power supply system. As some of the focus islands were badly affected by tsunami and the populations of those islands were evacuated to other islands, the Government is currently considering to permanently relocate those people in selected "host islands". While taking account of the possible change of the target islands, the outer islands electrification improvement program clearly remains a priority and should be continued in an accelerated pace to achieve the objectives of the sector policy.

VIII. Next Steps

26. To complement the Government's efforts to reestablish the power supply in the shortest possible time, the Mission recommends to the Government the following to be considered as next steps:

(i) Assign STELCO to carry out detailed survey to all affected islands to come up with more reliable data and more accurate cost estimates.

(ii) Coordinate the repair and reconstruction program to be implemented by STELCO with assistance from international agencies and local organizations to avoid duplication.

(iii) Continue the outer island electrification improvement program, specifically by expediting the implementation of the ongoing Outer Islands Electrification (Sector) Project.

Attachment 1

Damage Assessment Report of Power Supply Facilities

No.	Name of Islands	Number of Main Equipment Damage				
		Power House	Generator		Cables (m)	Distribution Boxes (No)
			No.	Capacity (kW)		
	Haa Alif Atoll					
1	Vashafaru		1	40		4
2	Filadhoo				330	4
3	Hathifushi		1	10		
4	Baarah				670	6
	Haa Dhaal					
5	Naivaadhoo				160	1
6	Nolhivaranfaru				1,020	
7	Nellaidho		1	60		
8	Kulhudhuffushi					1
9	Vaikaradhoo				3,840	1
10	Maavaidhoo				100	1
	Shaviyani Atoll					
11	Kaditheemu				7,521	5
12	Feidhoo					Damaged
13	Feevah	1	1	50		25
14	Maakandhoodhoo	1	2		240	15
15	Maroshi	1	3	40	8,000	31
16	Komandoo				2,600	13
17	Narudhoo					6
18	Noomara					8
19	Maaugoodhoo		1		Damaged	2
	Noonu Atoll					
20	Maafaru	1	4	106	12,000	50
21	Kudafari	1	3	40	1,400	3
22	Holdhudhoo					4
	Raa Atoll					
23	Kandholhudhoo		2	300	14,000	10
24	Maduvvari				Damaged	4
25	Meedhoo					1
	Baa Atoll					
26	Kendhoo		2	80	200	2
27	Kihadhoo		1	40		1
28	Dhonfaru					2
29	Dharavandhoo					Damaged
30	Eydhafushi					2
31	Fehendhoo		2	10		

No.	Name of Islands	Number of Main Equipment Damage	No.	Name of Islands	Number of Main Equipment Damage	No.
32	Goidhoo		5	40	1,372	20
	Lhaviyani Atoll					
33	Olhuvelifhushi	1				10
34	Maafilaafushi				1,400	
	Kaafu Atoll					
35	Kaasidhoo (STELCO Island)		2	200		1
36	Gaafaru				200	1
37	Dhiffushi		1	60		1
38	Thulusdhoo				500	2
39	Gulhi					2
40	Huraa					8
41	Himmafushi (STELCO Island)		3			2
42	Maafushi (STELCO Island)	1				27
43	Guraidhoo (STELCO Island)				Damaged	Damaged
	Alif Alif Atoll					
44	Mathiveri		2	96	1,600	
45	Bodufolhudhoo					2
	Alif Dhaal					
46	Mandhoo					Damaged
47	Dhagethi		1	100		Damaged
48	Fenfushi				Damaged	
	Vaavu Atoll					
49	Fulidhoo		2	68	800	5
50	Felidhoo	1			Damaged	Damaged
51	Keyodhoo				650	20
52	Rakeedhoo		2	20	500	3
53	Thinadhoo					5
	Meemu Atoll					
54	Madifushi	1	2	16		Damaged
55	Veyvah		1	55		
56	Muli	1	3	244	1,750	34
57	Naalaafushi		1	50	300	3
58	Kolhufushi	1	4	184	2,100	5
59	Dhiggaru		1	80	1,600	Damaged
60	Maduvvari		1	40	1,300	6
	Faafu Atoll					
61	Magoodhoo				Damaged	1
	Dhaalu Atoll					

No.	Name of Islands	Number of Main Equipment Damage	No.	Name of Islands	Number of Main Equipment Damage	No.
62	Meedhoo	1	3	168	3,600	22
63	Ribudhoo				800	
64	Hulhudheli				500	
65	Gemendhoo	1	4	22	Damaged	22
66	Vaane	1	3	71		
67	Maaeboodhoo		2	40	4,800	13
	Thaa Atoll					
68	Buruni		1	14	2,132	6
69	Vilufushi	1	3	180	2,500	21
70	Madifushi	1	3	50	3,500	15
71	Dhiyamigili	1	3	31	3,500	44
72	Guraidhoo	1	1	100	8,000	21
73	Hirilandhoo				500	
74	Omadhoo				2,500	10
75	Vandhoo	1	1	28	2,400	
76	Gaadhiffushi	1	2	32	3,000	26
77	Thimarafushi				3,200	6
78	Kinbidhoo		2	80	3,000	39
	Laamu Atoll					
79	Isdhoo		1	80	296	3
80	Dhabidhoo		4		Damaged	Damaged
81	Maabaidhoo		2		1,000	20
82	Mundhoo	1	3	65	800	23
83	Kalhaidhoo	1				Damaged
84	Gamu	1			5,000	28
85	Fonadhoo		3			39
86	Gaadhoo		3	31		
87	Kunahandhoo		4	63		7
	Gaaf Alif Atoll					
88	Viligili		1	200		18
89	Maamendhoo	1				2
90	Dhaandhoo					1
91	Kodey				1,000	
92	Dhiyadhoo				1,322	1
	Gaaf Dhaal Atoll					
93	Hoadedhoo					Damaged
94	Gadhdhoo					11
95	Thinadhoo				1,240	

Attachment 2

DETAILED COST ESTIMATES FOR RECONSTRUCTION

No.	Description	Total					Phase 1			Phase 2		
		Quantity	Unit	Unit Price MRf	MRf	US$	Quantity	MRf	US$	Quantity	MRf	US$
1.	**Equipment**											
a.	Generator	29	no.	244,720	7,096,880	554,444	0	0	0	29	7,096,880	554,444
b.	Switchboard	34	no.	180,000	6,120,000	478,125	34	6,120,000	478,125	0	0	0
c.	Cables	150,000	m	51	7,650,000	597,656	150,000	7,650,000	597,656	0	0	0
d.	Distribution boxes	632	no.	4,550	2,875,600	224,656	632	2,875,600	224,656	0	0	0
e.	Street lights	652	no.	2,720	1,773,440	138,550		0	0	652	1,773,440	138,550
f.	Tools	23	no.	45,000	1,035,000	80,859	0	0	0	23	1,035,000	80,859
g.	Accessories		LS		614,952	48,043		526,280	41,116	0	88,672	6,928
h.	Fuel Tanks	23	no.	300,000	6,900,000	539,063	0	0	0	23	6,900,000	539,063
i.	Meters and consumer meter panel	2,000	hh	2,438	4,876,000	380,938	0	0	0	2,000	4,876,000	380,938
	Subtotal (1)				**38,941,872**	**3,042,334**		**17,171,880**	**1,341,553**		**21,769,992**	**1,700,781**
2.	**Works**											
a.	Transport of equipment		LS		3,204,187	250,327		1,717,188	134,155	0	1,486,999	116,172
b.1.	Installation of generators	29	no.	20,000	580,000	45,313	0	0	0	29	580,000	45,313
b.2.	Installation of cables	150,000	m	30	4,500,000	351,563	150,000	4,500,000	351,563	0	0	0
b.3.	Installation of distribution boxes	632	no.	700	442,400	34,563	632	442,400	34,563	0	0	0
b.4	Installation of streetlights	652	no.	500	326,000	25,469	0	0	0	652	326,000	25,469
c.	Reconstruction of Power House	23	no.	500,000	11,500,000	898,438	0	0	0	23	11,500,000	898,438
	Subtotal (2)				**20,552,587**	**1,605,671**		**6,659,588**	**520,280**		**13,892,999**	**1,085,391**
	Total				**59,494,459**	**4,648,005**		**23,831,468**	**1,861,833**		**35,662,991**	**2,786,171**

Attachment 3

Assessed Needs and Commitments

Priority	Issue	Resource Needs	Commitments
Ensuring power supply in the tsunami-affected islands.	Power supply has to be restored up to the pre-disaster level in a shortest possible time.	Reliable data and costs estimates are needed for: a. Electrical equipment and materials b. Installation of equipment, including distribution system, and connection to the households.	a. Part of the equipment and materials have been committed by the IFRC. b. Some of the damaged generators will be repaired by a team from the British Royal Navy. c. STELCO has started considerable works in temporarily restoring the power supply and will continue to install the equipment, although its resources are limited. d. UNDP will procure and install cables and distribution boxes using funds from the UN Foundation.

Attachment 4

Summary of Inputs by International and Local Agencies and Communities

IFRC	British Royal Navy	UNDP	STELCO
• Provide part of the required equipment, including generators, cables, distribution boxes, accessories and spare-parts.	• Together with STELCO, repair some of the damaged generators.	• Provide and install part of the required equipment, mainly cables.	• Carry out emergency repair of power systems in all affected islands. • Conduct survey of the requirement of equipment. • Together with the British Royal Navy, repair some of the damaged generators. • Install the new equipment to be provided by the IFRC in some of the islands.