APPENDIX – A

PROJECT SHEET

Project Sheet SH-01: The Inle Lakeshore Rural Electrification Project in Southern Shan

1. Sector/Sub-sector:	2. Location:
Energy/Rural Electrification	Nyaung Shwe, Southern Shan

3. Implementing Agencies:

Myanma Electric Power Enterprise (MEPE)

4. Objectives:

1. To electrify the villages of Nyaung Shwe Township situated along the shore of Inle Lake and to substantially improve the present supply conditions in those villages having minimum access to electricity (8 W tube-light with small battery);
2. To demonstrate that full scale rural electrification on a 24 hour basis can be realized through development of local hydropower potential;
3. Also, the extra energy available in the rainy season may be fed into the National Main Grid, making the financial viability of the RE Project very high and attractive; and
4. To demonstrate and transfer the know-how of tunneling works, through the provision of tunneling equipment and tunneling professionals.

5. Justification:

1. Nyaung Shwe Township covers 8 Quarters and 35 Village Tracts. It has a large population of about 153,000 in 23,552 households. The households in the villages are 21,690 with population of 140,454 (92% of the total).
2. The household electrification ratio was 52% in the 8 quarters of Nyaung Shwe Township in 2001 but only 0.4% in the 35 village tracts where 92% of the population reside.
3. Assuming 100 W is to be supplied at the initial stage to all the households not electrified yet, the required capacity for power supply will be 2,700 kW including 20% as distribution losses. The demand would be doubled within a few years after the commissioning.
4. There is an idea to electrify cooking in semi-urban households in the region like Kalaw, Aungban, Heho, Shwe Nyaug, and Nyang Shwe through the introduction of strategic power tariffs. This aims to reduce the demand for firewood and charcoal in the semi-urban households which has reportedly caused denudation of the Upper Balu Chaung Basin, particularly on the west bank of Inle Lake contributing to eutrophication of the lake.

6. Project Description:

1. A run-of-river type hydropower plant with an installed capacity of some 8 MW will be constructed on the Negyiya Chaung near Heho.
2. The power generating facilities will include an intake weir, desilting basin, headrace tunnel of about 1,000 m long, head tank, penstock of about 700 m long, power house accommodating two units of turbine generators.
3. The power distribution facilities will consist of a main transformer and switching equipment, 33-66 kV distribution lines alon the shore of Inle Lake, pole-mounted distribution transformers, house-connection wiring, and connection to the 66 kV substation of the Main Grid.

7. Implementation Period:

24 months including test operation

8. Estimated Benefit and Beneficiaries:

9. Estimated Environmental Impacts:	10. Estimated Costs:
No special changes anticipated.	US$

Heho Falls, West of Inle Lake, Southern Shan State
[1st Field Assignment(Feb.2001), 2nd Field Investigation(May-Jun.2001)]

1. Discharge Measurement at the Intake Site

2. Heho Waterfall

3. Intake Site

4. Penstock Slope from Head Tank

5. Penstock Slope

6. Powerhouse Site

Heho Falls, West of Inle Lake, Southern Shan State
[2nd Field Investigation (May-Jun.2001)]

1. Heho Dam

2. Outflow from Heho Dam

3. Dried River in U/S Basin

4. Gorge of Negya Chaung

5. Inle Lake

6. Fisherman in Inle lake

Project Sheet SH-02: The Nam Lan Rural Electrification Project in Northern Shan

1. Sector/Sub-sector:	2. Location:
Energy/Rural Electrification	Nam Lan, Northern Shan

3. Implementing Agencies:

Myanma Electric Power Enterprise (MEPE)

4. Objectives:

1. To electrify the villages of Nam Lan and substantially improve the present supply conditions in the households having power supply of 3 hours a day at very low voltages, or having only an 8 W tube-light with small battery;
2. Although the power system will be the property of MEPE, its O&M and management of the electricity business may be entrusted to the Village Electrification Association or Committee, except for major inspection and overhaul of the turbines, generators, etc.;
3. The target is to achieve significant financial surplus of the electricity business before the depreciation costs of the Pilot Project, as well as to realize the O&M and management of the business without stationing MEPE staff at the site. These aims are to promote further rural electrification in the other parts of the country by mitigating the financial burden on MEPE and avoiding an increase of MEPE staff for O&M of small RE schemes.

5. Justification:

1. Nam Lan covers 11 Quarters and 5 satellite villages. There are 1,970 households including 204 in villages and the population is 10,036 with the village population being 822. Nam Lan may be called as semi-urbanized village.
2. Of the 1,970 households, only 284 were electrified with power supply by MEPE. The electrification ratio was only 16 % in 11 the Quarters and nil in the 5 villages;
3. Assuming 100 W is to be supplied at the initial stage to all 1,970 households in Nam Lan, the required capacity for power supply will be 220 kW including 10 % as distribution losses. The demand would increase to 280 kW at an assumed growth rate of 5 %/yr within several years after commissioning;
4. There would be day time demand from 18 rice-mills, 6 oil mills for ground nut, 4 mechanical repair shops existing at present; and
5. Nam Lan is accessible by 2-3 hour drive on the road from Hsipaw even in the rainy season. The road from Nam Lan to the site requires significant improvements.

6. Project Description:

1. A run-of-river type hydropower plant with an installed capacity of some 300 kW will be constructed on the Ho Sant Chaung, situated 4.5 miles from Nam Lan.
2. The power generating facilities will include 3-4 small scale diversion facilities, a desilting basin, a head tank, a penstock, and a power house.
3. The power distribution facilities will consist of a main transformer and switching equipment, 11 kV distribution lines, pole-mounted distribution transformers, and house-connection wiring. It will be an isolated power system for the time being but could be connected to the Grid in the future.

7. Implementation Period:

18 months (two dry seasons)

8. Estimated Benefit and Beneficiaries:

9. Estimated Environmental Impacts:	10. Estimated Costs:
No special changes anticipated.	US$

Nam Lan, South of Hsipaw, Northern Shan State
[1st Field Assignment(Feb.2001), 2nd Field Investigation (May-Jun.2001)]

1. Discharge Measurement in Hosang Chaung

2. Regulating Pond Site

3. Diversion Channel Route

4. Penstock Slope from P/H

5. Powerhouse Site

6. Na Pangkan Chaung

Nam Lan, South of Hsipaw, Northern Shan State
[2nd Field Investigation (May-Jun.2001)]

1. Saw Mill in Nam Lan

2. Myanmar Timber Enterprise near Nam Lan

3. Rice Mill in Nam Lan

4. Oil Mill in Nam Lan

5. Furniture Mill in Nam Lan

6. Un-electrified village in Nam Lan

Nam Lan, South of Hsipaw, Northern Shan State
[3rd Field Investigation (Sep-Oct.2001)]

Kyutaw Chaung

Na Pankan Chaung

E.P. of Head Pond

Anchor Block #1

Penstock Route

Penstock slope

Hosang Pico Hydro

Kyutaw Pico Hydro (5kW)

Project Sheet SH-03: The Parhe Rural Electrification Project in Northern Shan State

1. Sector/Sub-sector:	2. Location:
Energy/Rural Electrification	Naung Cho in Northern Shan State

3. Implementing Agencies:

Myanma Electric Power Enterprise (MEPE)

4. Objectives:

1. To electrify the villages around Parhe Falls in Naung Cho Township.
2. To improve the present poor conditions of the local people in the area.
3. To develop the local industries such as coffee plantation and agriculture.

5. Justification:

1. There are 9 un-electrified villages with 2,000 households near the site, Banhwe Village being the largest.
2. The Parhe Hydropower Project could generate about 340 kW output on a 24-hour basis, even in the dry season, to supply electricity to the surrounding villages. Excess power would be supplied to the National Grid at Pying Oo Lwin by connecting to the existing 11 kV line between Pying Oo Lwin and Hsipaw via Naung Cho.
3. There is an existing road up to the site constructed by a New Zealand group for access to a coffee plantation, which is about 7 km branched from the National Road Route #3 and an 11 kV line runs along side the roadway.

6. Project Description:

1. A run-of-river type hydropower plant with an installed capacity of about 340 kW (9.8 x 1.1 m3/sec x 45 m x 0.7)
2. The Project consists of the following structures: intake weir with sediment flushing facilities, intake facilities with de-silting basin, open channel waterway, head tank, penstock, powerhouse, outdoor switchyard, and transmission line with 11 kV x 7 km long.
3. The intake can be located at the right bank of the Parhe Chaung, and the power waterway leads the water through the right bank to the powerhouse to be constructed at the downstream point of the waterfalls.

7. Implementation Period:

2 years

8. Estimated Benefit and Beneficiaries:

People of 9 villages nearby the site who receive electricity supply from the Parhe Chaung Hydropower Plant

9. Estimated Environmental Impacts:	10. Estimated Costs:
No special changes anticipated.	

Parhe Chaung, South West of Naungcho, Northern Shan State
[10 Feb. 2001 during 1st Field Investigation]

1. Existing Bridge near Intake Site

2. Intake Site (view from u/s)

3. Regulating Pond Site

4. Parhe Falls

5. Penstock Slope

6. Tailrace (view from P/H)

Project Sheet SH-04: The Nam Kone Rural Electrification Project in Northern Shan State

1. Sector/Sub-sector:	2. Location:
Energy/Rural Electrification	Manton in Northern Shan State
3. Implementing Agencies:	
Myanma Electric Power Enterprise (MEPE)	
4. Objectives:	
1. To electrify the villages in Manton Township in Northern Shan State. 2. To improve the present poor conditions of the local people in the area. 3. To develop the local industries such as pickle and brick manufacturing.	
5. Justification:	
1. There are un-electrified villages with population of 1,512 and 197 households in Manton Township. 2. The Nam Kone Chaung Hydropower Project could generate about 400 kW output on 12 peak hours operation in the dry season and on 24 hours basis in the rainy season to supply electricity to Manton Township including nearby villages.	
6. Project Description:	
1. A run-of-river type hydropower plant with an installed capacity of about 400 kW (9.8 x 0.93 m3/sec x 32 m x 0.7 x 2) 2. The Project consists of the following structures: intake, intake facilities with de-silting basin, open channel waterway (750 m long), regulating pond, penstock (74m long), powerhouse, outdoor switchyard, and transmission line with 11 kV x 3 km long.	
7. Implementation Period:	
8. Estimated Benefit and Beneficiaries:	
People of Manton Township who receive electricity supply from the Nam Kone Chaung Hydropower Plant	
9. Estimated Environmental Impacts:	10. Estimated Costs:
No special changes anticipated.	

Project Sheet SH-05: The Maing Pying Rural Electrification Project in Eastern Shan State

1. Sector/Sub-sector: Energy/Rural Electrification	2. Location: Maing Pying in Eastern Shan State
3. Implementing Agencies: Myanma Electric Power Enterprise (MEPE)	
4. Objectives: 1. To electrify the villages of Maing Pying township including surrounding villages. 2. To improve the present poor conditions of the local people in the remote area.	
5. Justification: 1. Maing Pying is an isolated township, 6 hours drive from Kyaing Ton in Eastern Shan State, with a population of 58,740 in 8,772 households. In the town (population of 5,645, in 713 households) and surrounding 343 villages (balance of population) the electricity has been in such short supply that it has only be supplied to 200 households from 18:00 to 21:00 every 2 days by diesel generators of 120 kW. 2. The Nam Uon Chaung Hydropower Project can generate about 530-800 kW output to supply electricity to Maing Pying Township including the surrounding villages. 3. There is a possibility to develop bio-gas power by the use of rice husk available in this area to supplement the hydropower. 4. Local authorities and people of Maing Pying strongly desire the electricity to improve the living standard, education and welfare amongst the lowest class since there are no alternative power sources other than the Project.	
6. Project Description: The Project is located at Nam Uon Chaung 4km northwest of Maing Pying in Eastern Shan State. 1. A run-of-river type hydropower plant with an installed capacity of about 530-800 kW (9.8 x (0.6-0.9) m^3/sec x 130 m x 0.7) 2. The Project consists of the following structures: intake weir with boulder flushing facilities, intake facilities with de-silting basin, open channel waterway, head tank, penstock, powerhouse, out door switchyard with main transformers, and transmission line with 11 kV x 4 km long. 3. The intake can be located at the left bank of the Nam Uon Chaung, and the power waterway leads the water along the mountain slope in the left bank via head tank and penstock to the powerhouse to be constructed 2 km from Wan Kawn village near Nam Ping River. 4. An existing road is available from Maing Pying along the Nam Ping River. A river crossing facility such as a causeway at Nam Ping River and access road to the intake via the powerhouse is required to be constructed.	
7. Implementation Period: 2 years	
8. Estimated Benefit and Beneficiaries: People of Maing Pying Township who receive electricity supply from the Nam Uon Chaung Hydroelectric Power Plant	
9. Estimated Environmental Impacts: No special changes anticipated.	10. Estimated Costs: US$ 4,000 x 800 kW = US$ 3,200,000

Nam Uon Chaung, Maing Pying, Eastern Shan State
[30 May 2001 during 2nd Field Investigation]

1. Intake Site : View from D/S

2. Existing Irrigation Intake

3. Waterway Route along Existing Irrigation Channel

4. Waterway Route along Mountain Slope

5. Penstock Slope

6. Powerhouse Site

Project Sheet SH-06: The Gangaw Rural Electrification Project in Magway Division

1. Sector/Sub-sector: Energy/Rural Electrification	2. Location: Gangaw in Northern Magway Division
3. Implementing Agencies: Myanma Electric Power Enterprise (MEPE)	
4. Objectives: 1. To electrify the villages of Gangaw Township including surrounding villages. 2. To improve the present poor conditions of the local people in the remote area. 3. To develop the local industries with a high potential.	
5. Justification: 1. Gangaw is an isolated township, 11 hours drive from Mandalay, 9 hours from Monywa, with a population of 23,976 and 4,289 households in the town and surrounding 4 villages. Electricity has only been supplied from 18:00 to 21:00 every 2 days by diesel generators of 424 kW to 660 households. 2. The Zhaw Chaung Hydropower Project can generate about 1,200 kW output to supply electricity to Gangaw Township including some villages. 3. There exists a high potential for local industries requiring power supply for development, such as sawmill, furniture, weaving, oil manufacturing, municipal water supply, and irrigation water supply for paddy and bean fields. 4. A hydroelectric committee has been established for promoting Zahaw Chaung Hydropower Project, since there are no alternative power sources other than the Project to improve the living standard in the lowest class and to develop the local industries.	
6. Project Description: The Project is located at Zahaw Chaung 10 km upstream from the confluence with the Myittha River in Northern Magway Division. 1. A run-of-river type hydropower plant with an installed capacity of about 1,200 kW (9.8 x 12m3/sec x 15m x 0.7) 2. 24 hours operation in rainy season from June to October with 1,200 kW, and 400 kW~600 kW peak operation in the dry season, although discharge measurements throughout the year are required finalize details of the scheme. 3. The Project consists of the following structures: intake weir with sediment flushing facilities, intake facilities with de-silting basin, open channel waterway, head tank, penstock, powerhouse, outdoor switchyard with main transformers, and transmission line with 11 kV x 10km long. 4. The intake can be located at the left bank of the Zahaw Chaung, and the power waterway leads the water through the left bank to the powerhouse to be constructed at the downstream section of the waterfalls of Zahaw Chaung. 5. An existing road is available from Gangaw to the site for access.	
7. Implementation Period: 2 ~ 3 years	
8. Estimated Benefit and Beneficiaries: People of Gangaw Township who receive electricity supply from the Zahaw Hydroelectric Power Plant	
9. Estimated Environmental Impacts: No special changes anticipated.	10. Estimated Costs: US$ 4,000 x 1,200 kW = US$ 4,800,000

Zahaw Chaung, Gangaw, Northern Magway Division
[7-8 Jun. 2001 during 2nd Field Assignment]

1. Intake Site : View from D/S

2. Water Fall of Zahaw Chaung

3. Zahaw Chaung

4. Penstock at Left Bank Slope

5. Powerhouse Site : View from D/S

6. Saw Mill in Gangaw

Project Sheet SH-07: The Dawai Rural Electrification Project in Tanin Tharyi State

1. Sector/Sub-sector:	2. Location:
Energy/Rural Electrification	Dawai Township in Tanin Tharyi State

3. Implementing Agencies:

Myanma Electric Power Enterprise (MEPE)

4. Objectives:

1. To electrify Dawai Township including villages.
2. To supply irrigation water to farm land of 1,300 ha in Dawai Township.
3. To supply drinking water to Dawai Township.

5. Justification:

1. Anyapya power plant will supply electricity to Dawi Township, which is facing severe electricity shortage for domestic, industrial, agricultural and public demands.
2. Anyapya dam will supply irrigation water to the paddy fields of 1,300 ha to enable a second rice crop during the dry season.
3. Anyapya dam will supply drinking water to Dawai Township

6. Project Description:

1. A dam type hydropower plant with an installed capacity of about 9,300 kW :

Catchment area	111km^2
Annual mean discharge	18.93m^3/sec
Dam	Rockfill dam of center core type with 48m high and 450,000m^3 in volume
Reservoir	270 x 10^6 m^3
Headrace tunnel	6.0 m x 197m + 3.2 m x 41m
Penstock	3.2 m x 31m
Head (max)	41.5m
Discharge (max)	32.96m^3/sec
Turbine	Kaplan type, 9.3 MW (3.1 MW x 3 units)
Transformer	12 MVA (4 MVA x 3 units), 6.3 kV/33 kV
Transmission line	33 kV x 14.5 km

7. Implementation Period:

8. Estimated Benefit and Beneficiaries:

People in Dawai Township

9. Estimated Environmental Impacts:	10. Estimated Costs:
No special changes anticipated.	

Project Sheet BM-01: The Model Villages for Rural Electrification with Rice Husk Gas Engine and Solar BCS

1. Sector/Sub-sector:	2. Location:
Energy/Rural Electrification	Than Lyin and Hmaw bi Townships, Yangon Division

3. Implementing Agencies:

VEC of each village with NGO

4. Objectives:

1. To implement the Model Villages for Rural Electrification with Rice Husk Gas Engine and Solar BCS that are to be managed by the Village Electrification Committee (VEC);
2. To test the proposed implementation of Village Electrification by VEC on a self reliance basis with support from an NGO and RE Fund.
3. To test and monitor the performance, O&M, and management of the Project by the VEC in order to identify ways to best-adapt the model to the paddy cultivating villages in Myanmar.

5. Justification:

1. The Rice Husk Gas Engine has been installed at more than 100 locations in Myanmar to prove its technologyicaly soundness. It is appreciated that the Rice Husk Gas Engine has prospects to become Star in the rural electrification of the paddy-cultivating villages;
2. Its fuel is rice husk or sawdust waste from rice-mills or sawmills. These are renewable, clean, indigenous to the country, and available at almost at no cost;
3. The power output could range from 20 kW to over 100 kW which corresponds to a village scale of 200 to 1,000 households if 100 W is to be supplied to each household. The output is good enough to cover most of the village sizes in Myanmar.
4. The power has been used also for operating rice-mills, ice-plants, cooking oil processor, drying vermicelli, etc.
5. Solar and/or wind powered BCS can electrify those small villages located in remote and poorly accessible areas in the shortest time among the alternative energy sources;
6. Solar power is maintenance-free while wind power is available even in the rainy season;
7. If the initial costs are supported and borne by external resources, those villages can enjoy the minimum lighting for the expense of buying battery and lights.

6. Project Description:

While the Rice Husk Gas Engine will electrify those households located in the central part of the village within 1,000 m cable distance from the engine, the households in the peripheral zones around the village may be electrified by the line-fed BCS and small satellite villages scattered further outside by the solar powered BCS.

1. To install one set of rice husk gas engines to each village, with 400/230 V distribution lines to each consumer;
2. To install one solar BCS with one 500 W; and to execute improvement tests (introduction of new battery charging controller); and
3. To monitor the implementation, test operation, and management of the Model Villages by VEC for one year and to achieve best adaptation.

7. Implementation Period:

18 months including test operation

8. Estimated Benefit and Beneficiaries:

People of Myanmar who receive electricity supply from the Model Villages in the short-term, and the people living in the non-electrified rural area in the medium to long-term.

9. Estimated Environmental Impacts:	10. Estimated Costs:
No special changes anticipated.	wtihin US$ 80,000

Kayin Seik, Yangon Division
[Field Investigation(Sep.2001)]

1.Meeting at Monastery with VEC

2. Cooking using Rice Husk

3. Video House in Kayin Seik

4. Rice Mill in Kayin Seik

5. P Road in Banbwe Kone

6. Saw Mill in Banbwe Kone

Project Sheet BM-02: The Project for Promotion of Rural Electrification with Rice Husk Gas Engine in Ayeyawady Division

1. Sector/Sub-sector:	2. Location:
Energy/Rural Electrification	Ayeyawady Division

3. Implementing Agencies:

Village Electrification Association (VEC) to be established in each village

4. Objectives:

1. To improve household electrification ratio by 30 % in 5 years in Ayeyawady Division through strategic promotion of rice husk gas engine, as a model of Rural Electrification in paddy cultivating regions in Myanmar.

5. Justification:

1. Ayeyawady Division has 26 Townships, population of 6.44 million in about 1 million households, and paddy production of about 5.9 million ton;
2. If only 20 % of the rice husks in the Division is used for power generation with husk gas engine, it will generate electric energy of 107 GWh which can supply electricity to 300,000 households at a rate of 200 W for 5 hours a day throughout the year. It is not a dream but within a reach in view of technology, fuel resources, and fund requirement;
3. Since there is only one cooperative that can manufacture the rice husk gas engine and a great demand on the rural electrification with gas engine is forecast, there will be issues:
   - Manufacturing capacity of the rice husk gas engine systems may be limited;
   - Experienced staff for installation, commissioning test, and initial training of O&M personnel may be limited;
   - Post-installation services for the systems already installed will be important.

6. Project Description:

1. To establish Husk Division in the Rural Electrification Center which will provide information and technical support for introducing rice husk gas engine;
2. To establish Rural Electrification Fund which will provide no-interest loans for up to one year to help arrange the initial capital costs for procurement;
3. The objective of household electrification ratio of 30 % corresponds to new electrification of about 300,000 households. The beneficiary will be about 1.8 million. Assuming one power system can supply 500 households on an average, 600 power supply systems will be needed in 5 years, that is, new installation of 120 systems a year. (52 systems will be installed in 2001);
4. The RE Fund would need annual lending in an order of US$ 1.5 million (= US$12,000 x 120 systems/yr). The financial costs of the Fund would be about US$0.15 million a year as 10% of the revolving fund.
5. In addition to the Fund above, the administration costs of the Implementing Agency and costs for information and technical supports by Husk Division of REC will be needed.

7. Implementation Period:

Five years

8. Estimated Benefit and Beneficiaries:

1.8 million people in Ayeyawady Division

9. Estimated Environmental Impacts:	10. Estimated Costs:
No special changes anticipated.	Revolving fund at US$ 1.5 million plus running fund at US$ 0.15 million plus running costs of Husk Division of REC at US$ 0.2 million

Younethalin, Ayeyawady Division
[1st Field Assignment(Feb.2001), 2nd Field Invewstigation(May-Jun.2001)]


1.Power House


2. Generation System Beside Rice Mill


3. Generator


4. Input Rice Husk to Gasifier


5. Rice Husk Storage


6. Factory of Husk Generation System

Project Sheet BM-03: The Project for Promotion of Rural Electrification with Rice Husk Gas Engine and Solar-Wind BCS in Kachin State

1. Sector/Sub-sector:	2. Location:
Energy/Rural Electrification	Northern Kachin State

3. Implementing Agencies:

Village Electrification Association (VEC) to be established in each village

4. Objectives:

1. To electrify the villages in Putao, Machan Baw, Chi-Pwi, Hsaw-Olaw, Kyaung Ianfu, Naung Monn, and Tanai Townships with rice husk gas engines and solar BCS.

5. Justification:

1. The villages in Upper Kachin have poor access even in the dry season. It is a 2-day drive to reach Putao from Myitkyina in the dry season. Diesel oil is air-transported before the rainy season. The number of vehicles/trucks in the District Center Putao was less than 20 even in 2001.
2. There is one mini-hydro station in Putao, supplying only the central part of the Putao Township. There is one rice husk gas engine to power the rice mill in Putao.
3. The other source of electricity is small diesel generators and batteries.
4. It is reported that batteries are rarely transported to the Putao area since they cannot be air-cargoed due to safety restrictions. These should be road-transported during the dry season.
5. The villages in the Upper Kachin would remain unelectrified even after tens of years unless strategic support is given to achieve electrification with a rice husk gas engine and solar BCS, whichever best suits the village conditions.
6. The only resources in the Region may be human resources. In order to further develop the human resources, it is essential to provide modern education including the latest information from the world. Electricity supply to the schools and clinics are basic needs of the Region.

6. Project Description:

Two villages each of the seven townships will be electrified using rice husk gas engine where enough husk is available and the village scale is large, and using solar BCS where not enough husk is available or the village scale is too small.

In view of the scattered villages in the remote and poorly accessible areas, the Project is planned for implementation in 4 phases:

- Phase 1: Putao and Machan Baw Townships
- Phase 2: Chi-Pwi and Hsaw-Plaw Townships
- Phase 3: Kyaung Ianfu and Naung Monn Townships
- Phase 4: Tanai Township

The rural electrification systems will be managed by a Village Electrification Committee that is yet to be established.

7. Implementation Period:

18 months including test operation

8. Estimated Benefit and Beneficiaries:

9. Estimated Environmental Impacts:	10. Estimated Costs:
No special changes anticipated.	US$ 80,000 per phase

Project Sheet BM-04: The Pilot Project for Diesel Substitute of MEPE Power Plants for Rural Electrification

1. Sector/Sub-sector:	2. Location:
Energy/Rural Electrification	to be selected from MEPE Township Office
3. Implementing Agencies:	
MEPE	
4. Objectives:	
1. To test and prove the performance of the proposed substitution of diesel oil of the MEPE diesel power plants with biomass gas; 2. To test and prove the synchronized operation of multiple gas engine generators. 3. To test and prove the performance using the 11 kV distribution.	
5. Justification:	
1. MEPE operates 456 sets of diesel generators in the local Township Offices, with an additional 69 units on standby. The total capacity is 65 MW. 2. Because of limited budget for diesel oil, these diesel generators are operated only 3 hours a day. 3. A total generation of 44 GWh by diesel generators in 2000 needed fuel costs of about US$1.4 million (K700 million) at an official fuel price of K160/gallon, assuming one gallon of diesel can generate 10 kWh. On the other hand, a total operating revenue of MEPE was US$45 million (K22.4 billion) in 2000. A 3.1 % of the gross revenue was spent for purchasing diesel for RE. If it is valued at market price K600/gallon, the diesel cost would amount to US$5.3 million (K2.6 billion) or 12 % of the total budget of MEPE. Saving and substitute of fuel oil are of the prime issue of not only from financial aspects of MEPE but also from the Nation's economy.	
6. Project Description:	
1. To install one set of gasifier and engine; 2. To implement a few Model Projects; 3. To execute performance tests for 3 years;	
7. Implementation Period:	
4-5 years	
8. Estimated Benefit and Beneficiaries:	
MEPE	
9. Estimated Environmental Impacts:	10. Estimated Costs:
No special changes anticipated.	

Project Sheet SW-01: The Project for Promotion of Rural Electrification with Solar-Wind BCS in Kachin State

1. Sector/Sub-sector:	2. Location:
Energy/Rural Electrification	Kaungmu-lonvillage, Machan Baw Township, Putao District, Kachin State

3. Implementing Agencies:

Kaungmu-lon Village Electrification Committee (VEC) has to be established under VPDC together with REAM official participation by sharing specific responsibilities in the implementation process.

REAM will co-operate in various implementation phases of the project to do necessary technical supports in project preparation, installation, operation and training, and also monitoring the data logging system of the project.

4. Objectives:

1. To electrify the villages in Putao District, Machan Baw Township, Kaungmu-long village with PV and Wind BCS.

5. Justification:

1. This village in Upper Kachin is poorly accessible even in the dry season. It needs 2-days driving to reach Putao from Myitkyina in the dry season. Diesel oil is air-transported before the rainy season. The number of vehicles/trucks in the District Center Putao was less than 20 even in 2001.
2. There is no regular power supplying system to that village. There is one diesel generator set (7 kVA) which is provided by the government for a pagoda construction site. Fuel transportation, even from Putao to the village is very difficult. There is no regular transportation and the cost of car hire is very expensive. The other source of electricity is small batteries charged from the nearest village of Tran-dan (two miles foot by road) where one small engine (3 kVA) is provided to facilitate crop grinding.
3. It is reported that availability of batteries, even at Putao, is low due to difficulty of transportation from the main regional center (Myitkyina). Batteries cannot be transported by air due to safety restrictions and have to be road-transported during the dry season only.
4. The villages in the Upper Kachin would remain un-electrified even after tens of years unless strategic support is given to achieve electrification with renewable energy sources such as solar and/or wind powered BCS, whichever best suits the village conditions.
5. The only resources in the Region may be human resources. In order to further develop the human resources, it is essential to provide the modern education including latest information from the world. Electricity supply to the schools and clinics are basic needs of the Region.
6. Kaungmu-lon village is a government rehabilitation model village which was established in late 2000, by organizing the surrounding moving families who practicing slash & burn farming and seriously degrading the forest areas. The government supports the model village along with houses and farm-land for each family. The families that have started establishing here are, Kachin, Lee-su, Shan and La-wan.
7. Recently, villagers have Village Electrification Committee (VEC), to operate and manage the available power source.
8. The village area has enough space and buildings to establish and install a solar/wind hybrid system. The VEC agree to contribute the necessary buildings and other raw construction materials as much as possible, together with labor force from their side.

9. There are another three villages (Ngwar-zar, Salun-dun and Kan-cho) near by – with 80, 40 and 60 households each within a 1-mile radius. The primary school children from those villages have no regular power source for nighttime lighting.
10. Electrical energy is urgently required in the rehabilitation area to organize and rise the people's awareness of the importance of protecting their unique environment with rich biodiversity and to enable their development by taking a key role in providing themselves with a renewable energy source.

6. Project Description:

Kaungmu-lon village will be electrified using PV and wind powered hybrid renewable energy systems for which solar radiation and seasonal wind sources are available and by using solar BCS where battery-powered electrification practices are familiar to the villagers.

In view of the urgent need to fulfill basic energy needs and for long term project scheme improvement and propagation in surrounding areas, it is necessary to immediately install a wind and solar power supply system together with a system for wind and solar power resources and energy output .

Particular specifications and performance descriptions for PV and Wind generators are attached in a separate sheet.

Detailed facts and figures for cost estimation and load particulars are also attached in separate sheet.

The project is planned for implementation in the following phases:

- Phase 1: Site preparation and planning for material handling, transportation and installation processes between Local authorities, VEC and REAM through the guideline of JICA Renewable Energy Study Team for Myanmar.
- Phase 2: System establishment and performance testing.
- Phase 3: education and training on system operation, administration, maintenance and data logging system monitoring procedures between VEC and REAM.

The rural electrification systems will be managed by VEC to be reformed and established to meet with the official requirements for activities under the VPDC.

REAM will carry out the necessary technical support for system installation, training & education and further monitoring for system establishment and for one year of system operation (based on JICA/RE Team arrangement).

VEC has to do all the necessary data recording along with the set procedures, and REAM will compile the necessary documentation for JICA and other necessary official reports required.

7. Implementation Period:

18 months including test operation

8. Estimated Benefit and Beneficiaries:

Three villages of 382 households and population of 2282 will beneft from the Project.

Local people around the area will have an improved awareness of RET application and environmental situation of RET through practical implementation of the project.

Data of the project will support the propagation and development of such kinds of projects in surrounding areas.

The achievement of the project will form an incentive for local shifting-cultivators to settle and farm in one place and systematically upgrade their living standard and knowledge. This will protect and improve the forest and soil environment of the area in a sustainable measure.

9. Estimated Environmental Impacts:	10. Estimated Costs:
No special changes anticipated.	US$

Project Sheet SH-02: The Project for Promotion of Rural Electrification with Wind BCS in Magwe Division

1. Sector/Sub-sector:	2. Location:
Energy/Rural Electrification	Ahlae-thaung village, Yasakyo Township, Pakokekku District, Magwe Division

3. Implementing Agencies:

Ahlae-thaung Village Electrification Committee (VEC) has to be established under VPDC together with REAM official participation by sharing specific responsibilities in implementation process.

REAM will co-operate in respective implementation phases of the project to do necessary technical support in project preparation, installation, operation and training, and also monitoring the data logging system of the project.

4. Objectives:

1. To electrify the villages with Wind BCS.

5. Justification:

1. This village is situated on an island in Ayeyarwady - near the junction with the Chindwin river and windy without wind-break surrounding the island.
2. There is no regular power supplying system to the village. The most common source of electricity is small batteries. Transportation of batteries is difficult, because of the route to the nearest charging station is only accessible by small boat and foot path-way.
3. It is reported that there is no proper battery repair facilities and most old batteries used by the villagers are partially damaged due to hard transportation .
4. For villages in the middle of a big river it is always hard to transport fuel and also grid line extension. Renewable energy sources like PV and/or wind power systems are best choice to suit the village conditions.
5. Villagers are interested to form a Village Electrification Committee (VEC), to operate and manage the available power source.
6. The village area has enough space and buildings to establish and install a PV/wind hybrid system.
7. Electrical energy is urgently required in this kind of isolated area to promote the living standard of the people.

6. Project Description:

Ahlae-thaund village will be electrified using wind powered renewable energy system because a better wind source is available than at inland areas.

Battery powered electrification is already familiar to the villagers, and the BCS will be used not only for the village, but also the surrounding villages.

This power supply system and systems for logging power output performance and available wind power have to be installed.

The particular specifications and performance descriptions for PV and wind generators are attached in separate sheet.

Detailed facts and figures for cost estimation and load particulars are also attached in separate sheet.

The Project is planned for implementation in the following phases:

- Phase 1: Site preparation and planning for material handling, transportation and installation processes between Local authorities, VEC and REAM through the guide line of JICA Renewable Energy Study Team for Myanmar.

- Phase 2: System establishment and performance testing by VEC and REAM.
- Phase 3: Education and training on system operation, administration, maintenance and data logging system monitoring procedures between VEC and REAM.
- Phase 4: One year monitoring process of Wind Resources and System Performance data collection and power generating System Maintenance task by REAM

VEC has to do all necessary daily data recording along with the procedure and Ream will compile and make necessary systematic documentation for JICA and other official reports required.

7. Implementation Period:

18 months including test operation

8. Estimated Benefit and Beneficiaries:

The villages of Ahlae-thaung with 637 households and population of 3725 will become beneficiaries.

Local people around the area (altogether 9 villages on the same island) will be improved in awareness of RET application and environmental situation of RET through existence of the project on their island.

Data of the project will effectively support propagation and development of projects in surrounding areas

9. Estimated Environmental Impacts:	10. Estimated Costs:
No special changes anticipated.	US$

Project Sheet RH-01: The Rehabilitation of Small Hydropower Stations in Myanmar

1. Sector/Sub-sector:	2. Location:
Energy/Rural Electrification	Whole Myanmar

3. Implementing Agencies:

Myanma Electric Power Enterprise (MEPE)

4. Objectives:

1. To rehabilitate existing small and mini-hydropower plants in order to fully utilize the hydropower potential and improve the present supply conditions through checking, rehabilitation, and upgrading of intakes, de-sanding facilities, and waterway structures as well as generating equipment.

5. Justification:

8. The existing hydropower plants constructed in mountainous areas have been contributing to the rural electrification in Myanmar.
9. The rehabilitation of such existing plants will increase the station output significantly, since many facilities including hydro-mechanical equipment and controls have been damaged or deteriorated since commissioning.
10. It appears that the issues related to the existing hydropower plants may be attributed mainly to the severe conditions of sediment transport in the rivers and the durability of generating equipment and controllers in particular.
11. The review of design and operation of the civil structures in relation to sediment transport will contribute to utilization of hydropower potential to the possible maximum possible extent.
12. The rehabilitation of existing hydropower plants will contribute not only to the rural electrification but also to saving the fuel consumption of diesel generators, that is, reducing the emission of carbon dioxide.

6. Project Description:

MEPE has constructed 39 small and mini-hydropower plants with the total capacity of 40 MW, and 4 power plants are being constructed at present. However, most of them have some probllems, and many units are not available for operation or are operated at a very low efficiency.

1. To rehabilitate the existing hydropower plants in 4 phases according to the magnitude of damages/troubles and urgency for rehabilitation:

   Phase 1: 7 plants of Priority A including Zawgyi I with top priority given to those in Kachine and Chin States followed by Shan State;

   Phase 2: remaining 7 plants of Priority A;

   Phase 3: 9 plants of Priority B; and

   Phase 4: 8 plants with Priority C.

7. Implementation Period:

6 months for rehabilitation of one plant, and about 2 years for each phase (2 dry seasons).

8. Estimated Benefit and Beneficiaries:

Local people who receive electricity supply from the existing hydropower plants

9. Estimated Environmental Impacts:	10. Estimated Costs:
No special changes anticipated.	

Nam Hkam Hka (Kachin) Mar. 2001

Nam Hkam Hka (Kachin) Mar. 2001

Nam Lat (Eastern Shan) May. 2001

Nam Lat (Eastern Shan) May. 2001

Kyaukme (Northern Shan) Feb. 2001

Kyaukme (Northern Shan) Feb. 2001

KyangHkrang Hka (Kachin) Mar. 2001

Putao (Kachin) Mar. 2001

List of Small and Mini-hydro Power Stations Existing and Under Construction in Myanmar (<10,000 kW) (1/3)

No.	State/Division	Plant Name	Commissioned in	C. Area	P_i		Q_d	H_g	Location	Priority (A to C)	Remarks
				km^2	kW	Unit	m^3/s	m			
1	Kachin State	Putao (Nam Htun)	March 1987	134	160	100+60	4.8	7.3	7 miles from Putao	A	Inspected on 12/3/2001. Hyd. controller needs rehabilitation. The 100 kW machine was procured for the other site and is over-sized to the site head. It could be shifted for full output.
2	Kachin State	Kampaiti	commissioned	-	150	-	-	28.1	0.5 miles from North of Kampaiti		not known.
3	Kachin State	Panwa		-	160	-	0.5	36.3	1.5 miles North of Panwa		not known.
4	Kachin State	Hopin (Glaing Chaung)	Sept. 1991	23	1,260	630 x 2	0.8	190.5	8 miles northeast of Hopin	C	1st YMEC project in Myanmar. Installed capacity may be increased in view of hydrology. Waterway & penstock design be reviewed.
5	Kachin State	Chinghkrang Hka	April 1993	61	2,520	630 x 4	2.3	164.0	21 miles from Myitkyina	C	Inspected on 9/3/2001. Chinese machines. Design flood 2,645 cusec.
6	Kachin State	Namhkam Hka	Sept. 1996	36	5,000	1,250 x 4	5.4	128.0	14 miles east of Magaung	A for governor B for others	Inspected on 10/3/2001. 3 governors out of order. Waterway may be improved and 3 tributaries could be tapped. Design flood 1,500 cusec.
7	Kachin State	Tumpang Chaung	under const.	621	6,000		-	45.7	24 miles northeast of Waingmaw		
8	Kachin State	Nan Dabak	under const., planned in 2002	134	24,000	8,000 x 3	38.2	75.3	17 miles S.E. of Maingmaw.		under construction on IPP basis. Design flood 49,045 cusec.
9	Kayah State	Hpa Saung (Hwe Kabu Chaung)	Jan. 1988	12	108	54 x 2	-	58.5	Hpa Saung, to the east of Loikaw.	B	Local machines, probably out of order, need rehabilitation. Good location for rehabilitation. Waterway also may need rehabili.
10	Kayin State	Papun (Lekapaw Chaung)	March 1987	3	37	2 units	-	24.4	1.5 miles from Papun	B	Installed capacity may be increased by more efficient machines. It may not be operable in the dry season. A convoy required to reach the site.
11	Chin State	Dhobi Chaung	1975	-	60		-	-	2 miles from Falam		First hydropower in Chin State. No longer exists.
12	Chin State	Zalui	Feb. 1984	24	400	200 x 2	-	148.7	4 miles from Tiddim	B	VoestAlpine, Germany. Diversion of water from nearby stream, Haicin Chaung, possible.
13	Chin State	Daung Va	Sept. 1984	64	400	200 x 2	-	79.2	8 miles from Haka	B	VoestAlpine, Germany. One machine out of order.
14	Chin State	Paletwa	Aug. 1988	3	50	25 x 2	-	42.7	0.5 miles from Paletwo	C	Not in operation anymore. Local authority has interest to reconstruct the plant.
15	Chin State	Matupi (Namlaung Chaung)	May 1992	41	200	100 x 2	-	43.6	8 miles east of Matupi	A	Local cross-flow machines. Needs new machines.
16	Chin State	Laiva	April 1994	8	600	300 x 2	0.5	193.9	110 miles southeast of Falam	B	Chinese machines. Initially Laiva multi-purpose dam with priority for irrigation by ID. No irrigation now and all the water can be used for power –> Hydrology to be restudied.
17	Chin State	Tui Saung Chaung	July 1997	52	200	100 x 2	0.9	45.7	2 miles northeast of Tonzang	A	Locally made cross-flow turbines. Upgrading possible by new machines.

List of Small and Mini-hydro Power Stations Existing and Under Construction in Myanmar (<10,000 kW) (2/3)

No.	State/Division	Plant Name	Commissioned in	C. Area	P_i		Q_d	H_g	Location	Priority (A to C)	Remarks
				km^2	kW	Unit	m^3/s	m			
18	Chin State	Che Chaung (Mindat)	Sept. 1997	292	400	100 x 4 (only 2 installed)	2.5	28.0	7.5 miles southwest of Mindat	A	Water abundant. Upgrading possible. It needs new machines.
19	Chin State	Mgalsip Va	Dec. 1986	116	1,000	500 x 2	-	117.0	12 miles from Falam	A	VoestAlpine. Needs new machines. Others all right.
20	Sagaing Div.	Lahe (Hwe Hngwin Chaung)	Feb. 1997	7	50	50 x 1	0.1	59.4	1.5 miles southeast of Lahe	A	Local machines. Rehabilitation will be greatly beneficial.
21	Sagaing Div.	Zi Chaung	July 1996	297	1,260	630 x 2	4.0	41.0	12 miles from Kalemyo	A	Chinese machines. Intake improvement may be required.
22	Tanintharyi Div	Kattalu Chaung	July 1991	18	150	50 x 3	-	52.4	Kyunsu Township Katan Island	C	Civil structures may remain there but no longer in operation.
23	Tanintharyi Div	Mali Kyun	July 1992	2	192	64 x 3	-	107.0	Mali Kyun		Built with local partners. Working all right. Pondage improvement may be required for its leakage. Use for port authority.
24	Mandalay Div.	Wet Wun	1933	189	450	225 x 2	-	212.8	13 miles from Maymyo	A	Very oldd since 1933. Waterway (wooden flume) & machine improvement may increase output.
25	Mandalay Div.	Mogok	Sept. 1989	68	4,000	2,000 x 2	-	120.4	Mogok Township	**AA**	VoestAlpine. Very high siliting problem due to mining operation upstream. Turbine repaired every 2-3 months.
26	Mon State	Zingyaik	Oct. 1984	3	198	64 x 3 and 6 x 1	0.3	109.3	6 miles northeast of Paung, on the way to Mawlamyine	A	Very low flow during the dry season. May be possiblee to have another regulating pond upstream. Design flood 3,000 cusec.
27	Shan State	Namhsan	1936 (existing)	17	30		0.1	27.4	1.5 miles from Namhsan		not known.
28	Shan State	Muse (Namkhun Chaung)	April 1988	26	192		0.1	47.1	4 miles east of Muse		Renovated with new Chinese machines, needs confirmation.
29	Shan State	NamKham (Nammahla Chaung)	March 1988	29	300		0.1	42.7	6 miles south of Namkham		Renovated with new Chinese machines, needs confirmation.
30	Shan State	Kunhing (Namsham Chaung)	Sept. 1991	67	150	Turbine 75 x 3 Generator 50 x 3	-	25.9	2 miles east of Kunhing	A	Chinese machines. Needs rehabilitation very much.
31	Shan State	Kyaington-2 (Nam Lat Chaung)	Nov. 1991	109	480	160 x 3	1.7	39.9	8 miles southeast of Kyaington	A	Chinese machines. 2 units out of order. Needs rehabilitation very much. Design flood 6,360 cusec.
32	Shan State	Chinshwehaw (Pachethaw Chaung)	Feb. 1992	7	300	100 x 1 VoestAlpine 200 x 1 Chinese	8.9	4.3	13 miles north of Kunlong	B	Kokan Area (Special Region 1). Chinese machine has more down time.

List of Small and Mini-hydro Power Stations Existing and Under Construction in Myanmar (<10,000 kW) (3/3)

No.	State/Division	Plant Name	Commissioned in	C. Area	P_i		Q_d	H_g	Location	Priority (A to C)	Remarks
				km^2	kW	Unit	m^3/s	m			
33	Shan State	Maing Lar	March 1992	32	60	30 x 2	0.3	19.8	56 miles from Kyaington		Kokan Area (Special Region 1). Not in operation any more, needss confirmation.
34	Shan State	Selu (Nam Lat Chaung)	March 1992	12	24	12 x 2	-	20.1	7 miles east of Mongyang		Not in operation any more.
35	Shan State	Kunlong (Nam Hsawn Chaung)	Jan. 1996	71	500	250 x 2	1.7	40.8	15 miles east of kunlong, 3 miles east of Hopan	B	Chinese machines.
36	Shan State	Pon Hsan (Namnga Chaung)	commissioned	-	80		-	79.9	Southwest of Pan Hsan (Pan Hkam)		not known.
37	Shan State	Kyukok (Nam Hkan Chaung)	under const.	78	320		-	59.7	4 miles from Kyukok, near the border with China.	B	Civil works completed. Penstock & machines are not installed. Needs rehabilitation.
38	Shan State	Kong Nyaung (1)	1985	1,306	6,800		-	45.7	24 miles from Lashio	C	Belongs to a Mine, not of MEPE.
39	Shan State	Tatkyi Falls	July 1987	1,293	1,200	600 x 2	-	9.0	7 miles east of Yat Sauk	C	Finish machines. Renovated for its gear problem. Design flood 250 m^3/s.
40	Shan State	Namyao (Kong Nyaung 2)	April 1994	1,357	4,000	2,000 x 2	17.0	32.0	14 miles southwest of Lashio	C	Chinese machines.
41	Shan State	Kyaington-1 (Nam Wap Chaung)	July 1994	26	3,000	1,000 x 3	1.1	338.0	10 miles south of Kyaington	C	Chinese machines. 2 units out of order
42	Shan State	Kyaukme (Nam Saung Ngau Chaung)	Sept. 1996	180	4,000	2,000 x 2	3.4	148.0	6 miles east of Kyaukme	B	Inspected on 9/2/2001. Sediment issue. Water shortage during the dry season. Design flood 200 m^3/s.
43	Shan State	Mepan	under const.	16	2,000	1,500 only	-	335.3	6 miles northeast of Mong Hsat		YMEC machines. MEPE will now install machines.
Total					72,441						
Total excluding those under construction					40,121						
Total of only Priority A projects					13,548						
	Shan State	Zawgyi I	July 1995	1,368	18,000	6,000 x 3	18.6	121.9	13 miles north of Yat Sauk	A	YMEC machines. 2 machines OK. Rotor of 1 unit needs replacement, turbine OK.
	Shan State	Zawgyi II	Oct. 1998	315	12,000	6,000 x 2	49.2	Hmax 40.53 Hmin 23.78			

Note: The priority is judged on the basis of the machine damages and urgency of the rehabilitation works.

Project Sheet CB-01: MOEP Capacity Building Project

1. Sector/Sub-sector:	2. Location:
Energy/Rural Electrification	Yangon or Mandalay

3. Implementing Agencies:

Myanma Electric Power Enterprise (MOEP)

4. Objectives:

1. To establish MOEP Technology Center and train young engineers and technicians from MOEP, local governments, and NGOs who will be engaged in promotion and O&M of power supply and rural electrification in Myanmar.

5. Justification:

13. To meet the policy of the Government to implement 2,000 MW in the short-term and more in the long-term, capacity building of the staff for implementation and O&M of hydropower projects is essential together with rural electrification with hydro;

14. High quality works will contribute to the realization of a long lifetime of the hydro projects, which will result in the best interests of the Nation;

15. Past experience proves that OJT through participation in the actual construction works with guidance from experts, or in the manufacturing and repair works in the power stations and workshops are the most effective ways of training young engineers and technicians.

16. Penstock pipes, small gates and trashracks, transformers, concrete poles for distribution lines, etc. can be manufactured in Myanmar. However, there has been little experience and know-how on manufacturing and repairing turbines-generators. These technology and know-how are much needed in Myanmar.

6. Project Description:

2. To establish MOEP Technology Center with the following divisions:
   - Laboratory and Field Investigation Division;
   - Planning and Design Division;
   - Construction Technology and Management Division; and
   - Workshop for O&M of Electro-Mechanical Works.

3. The training will cover:
   - Investigation stage: field reconnaissance, topo-survey, discharge measurement, geological investigations, material testing, environmental survey, and social survey;
   - Planning and design stage: hydro-meteorology, demand forecasting, formulation of development plans, analyses and planning of Power Grid, basic and detailed design, technical specifications, construction planning and cost estimates, economic aspects, power tariff, environmental aspects, organization for O&M and management of electricity business;
   - Implementation stage: Civil construction works including tunneling, hydro-mechanical works, electro-mechanical works, and distribution lines works; and
   - O&M and monitoring stage: O&M of the generation and distribution facilities, meter reading, tariff collection, accounting, management of staff, vehicles, spare parts, and fund raised and accumulated, reporting to relevant agency.

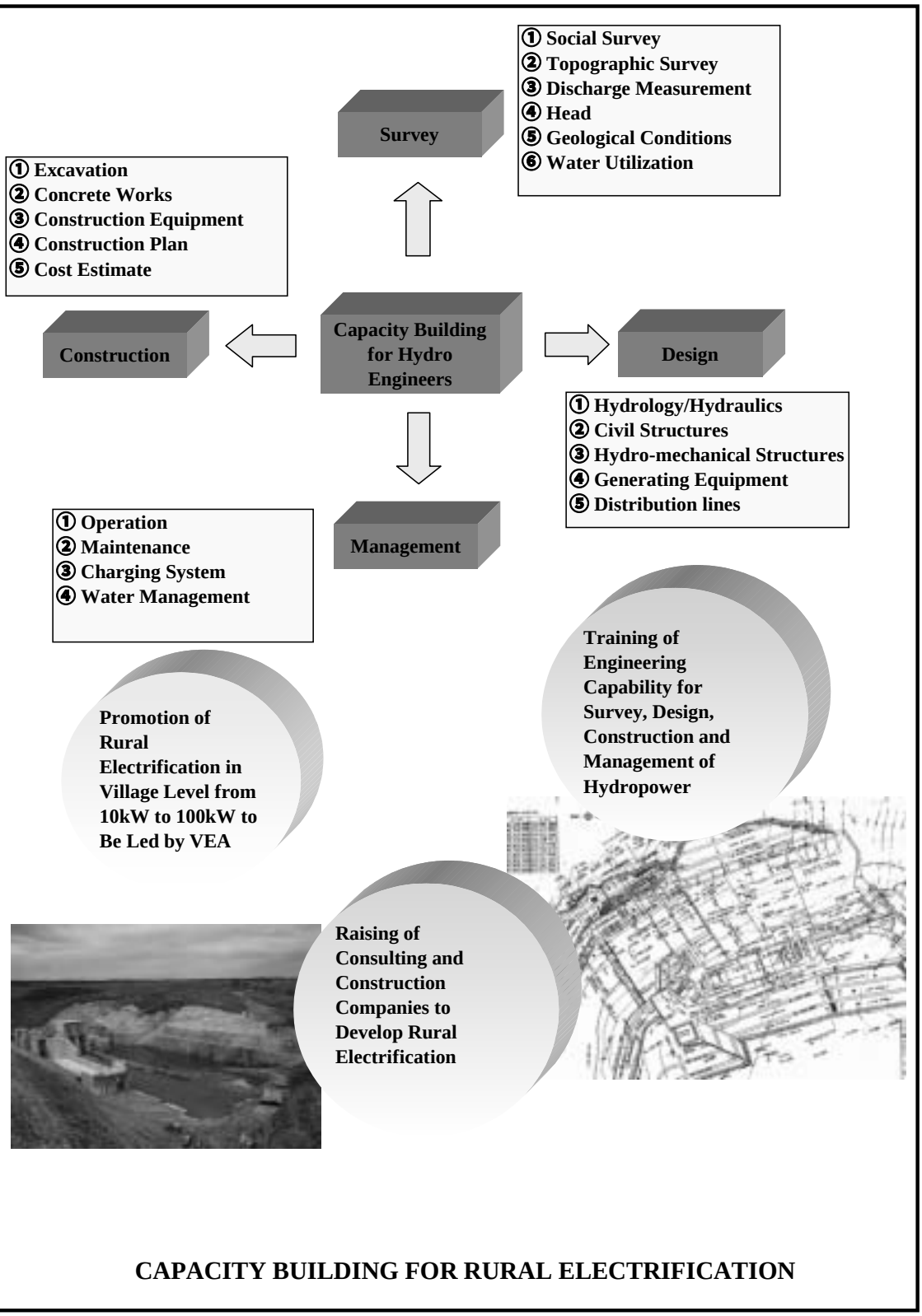
7. Implementation Period:

2 years for establishment of the Center, to be followed by training activities

8. Estimated Benefit and Beneficiaries:

Trainees directly and customers of MEPE and rural electrification systems indirectly

9. Estimated Environmental Impacts:	10. Estimated Costs:
No special changes anticipated.	US$



CAPACITY BUILDING FOR RURAL ELECTRIFICATION