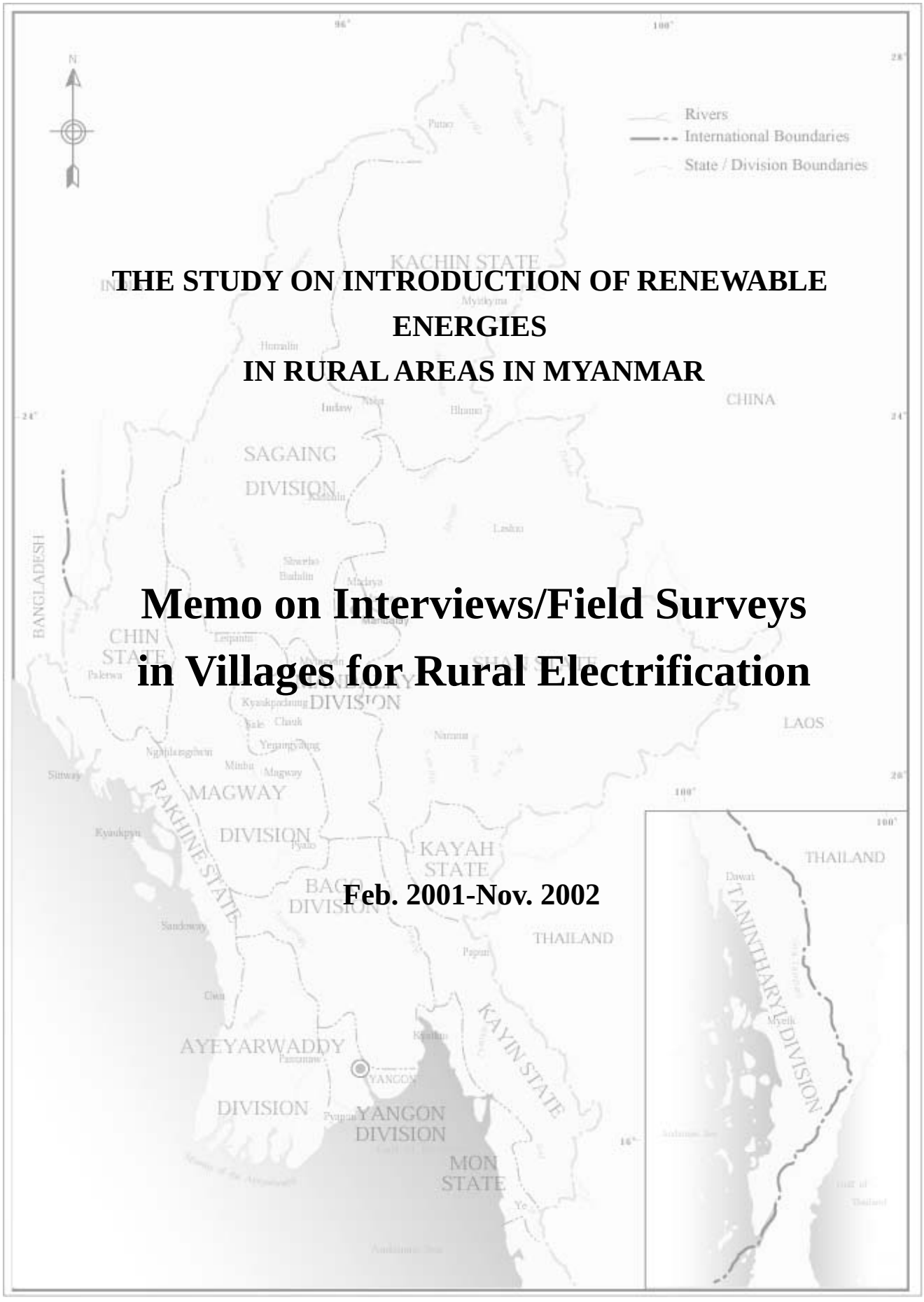

THE STUDY ON INTRODUCTION OF RENEWABLE ENERGIES IN RURAL AREAS IN MYANMAR

Memo on Interviews/Field Surveys in Villages for Rural Electrification

Feb. 2001-Nov. 2002

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Memo on Interviews/Field Surveys

Subject	**1. Reconnaissance of Parhe Falls Mini-hydro Scheme**			
Date	10-11 February 2001		Prepared by	Akio Katayama
Atten-dants	JICA team	A. Katayama, H. Kanai, and Y. Shinji		
	Myanmar side	U Win Tin, MEPE Township Engineer Nawnghkio U Thaung Tun, MEPE Wire (2), Nawnghkio		
Filename	01-02-10 Memo on Parhe Falls.doc		Ref. No.	

Note: Kindly give files to secretary.

(1) Parhe Falls Mini-hydro Scheme

- Wooden bridge upstream of the intake site: El. 557 m on GPS, WL is El. 553 m
- Headrace channel of MEPE plan is 600 m long, running on the right bank
- MEPE powerhouse site at El. 494 m
- MEPE TWL at El. 488 m
- Gross head = 553 – 488 = 65 m
- The river flow was measured on 11.2.2001 downstream of the MEPE power house site where the river splits into two streams; major one on the right side and the minor one on the left side. The total discharge was 1.38 m^3/s.
- One tributary on the right bank joins downstream of the wooden bridge site. This water should also be utilized.
- There are deposits of sand and silt in the natural water pool upstream of the bridge. However, no cobble stone size was observed. This suggests there should be certain sediment transport during flooding. A flow regulating capacity, if created on the upstream reaches by raising the water level, would be filled with these sand and silt unless provided with adequate sand flushing system.
- There are rapids downstream of the MEPE intake site. This will provide sufficient head required for hydraulic flushing of the sand to be deposited in the Sandtrap.
- The water downstream of the Falls where the river presents still water surface have emerald-green color. Water temperature is low. These suggest some or most of the river flow may originate from springs in the limestone area.

(2) Reconnaissance on the Upstream Left Bank of the Parhe Falls

- First stream encountered at El. 570 m
- Several channels are running on the left bank bordered by the mountain range.

(3) Inspection of existing micro-hydro at Oon Mathi Village

- Generator 5 kW
- Coupled with waterwheel through gear
- Built by the villagers for monastery

(4) Reconnaissance on the Left Bank of the Parhe Falls

- The stream at the wooden bridge site joins one tributary from the right bank, and runs down on the limestone terrace which presents typical limestone topography with terrace field like ponds. It branches into two major Falls.
- There were local visitors to the Falls for taking pictures at the Falls.
- The Falls has a significant view although it is situated apart from the National Road #3.

(5) Reconnaissance on the Right Bank of the Parhe Falls

- The reconnaissance on the right bank along the FSL of the intake revealed that the waterway would have to traverse the vertical cliff existing on the rear of the Guest House of the New Zealand Camp.
- Only the practical solution would be to locate a penstock upstream of this cliff, that is, just beside the right side Falls. Thereafter, the penstock should be extended to develop remaining head available in the falls and rapids existing further downstream. Gross head available would be smaller than that of the MEPE original plan by 10-20 m.
- For construction of the penstock, an inkline may be needed for excavation, concreting of anchor blocks and supports, erection of penstock pipes.
- Access road to the powerhouse site may be constructed from the downstream side on the right bank.

(6) General view

- The site would have a potential of firm power output of around 340 kW on 24 hour basis (= 9.8 x 0.7 x 1.38 m^3/s x 80 % for dry season drop x 45 m). The assumed dry season inflow at 1.10 m^3/s (= 1.38 m^3/s x 80 %) should be checked in May-June this year.
- There is an existing access road up to the intake site constructed by a New Zealand group for coffee plantation. Its camp is situated on the right bank near the Parhe Falls and the intake site. The site is about 7 km to the Southeast of the National Road #3.
- According to the Village Survey Group, there are 9 villages nearby the site, Banhwe Village being the largest. The total number of households may amount

to around 2,000 but needs confirmation.

- If the demand in these villages are too small compared with the potential output of the Parhe Falls Scheme, the scheme may be connected to the existing 11 kV line which runs from Ping Oo Lwin towards Hsipaw via Nawghkio. Any excess power could be fed to the National Grid at Ping Oo Lwin.
- Since the base power output in an order of 340 MW would be sufficient to cover the local demand, the Scheme may be developed as a base plant with a constant power output without having any regulating storage.

Memo on Interviews/Field Surveys

Subject	**2. Inspection of RHGE in Younetalin Village, Hinthada**			
Date	12 June 2001		Prepared by	Akio Katayama
Atten-dants	JICA team	A. Katayama, Harris, Yamaguchi, Kadono		
	Myanmar side	Daw Min Min Than U Khin Maung Bo, GM of Myanmar Inventors Cooperative, Tel. 666 763		
Filename	01-06-12 Memo on Younetalin.doc		Ref. No.	

Note: Kindly give files to secretary.

(1) Hinthada Township

- 1.7 MW receiving from Yangon gas turbine (6.5 MW x 3 units = 19.5 MW) by 66 kV line.
- 8,000 consumers, of which 300 are industrial.
- Population 50,000.
- Load shedding between 05:00 to 23:00 for 3 hours a day.
- MEPE Township Office has 50 staff.

(2) Younetalin Village, Hinthada Township

- 140 HP, 135 kVA, Hino 12 cylinder diesel engine
- RH-14
- Starter small DG of 4.4 kW
- 3 2 feet lights + TV, radio, Karaoke OK
- No rice cooker allowed.
- Consumer 420
- Total houseolds 1,100
- 40 streetlights
- Commissioned on 16 April 2001
- Consumption of rice husk
  1. 60 buskets of husks for 5 hour generation from 18:00 to 23:00.
  2. 1 busket reportedly 5 pounds x 0.4536 kg = 2.3 kg.
  3. 60 buskets →60 kWh divided by 5 hours →12 kW
  4.

- There are 6 ricemills, private, DG operated.
- There are 1,200 acres of paddy fields. Of these, 250 acres are cultivated by villagers and the rest by non-villagers.
- Kyat 60,000 collected at every 10 days

- Kyat 20,000-40,000 per household→installment
- Construction costs: 1.5 million for gas engine, 2.5 million for material of distribution lines with erection free of charge by MEPE.

(3) Athok, Yegyi Township

- Ricemill 75 HP

(4) Thahk-Di-Aung Oilmill, Athok, Yegyi Township

- 90 kW generator for blower for drying vermicelli
- Another gasifier to generate gas for heater
- 4 years in operation
- U Tin Aung owns the vermicelli dryer, ricemill, cooking oil processor.
- Ricemill changed from husk boiler to husk gas engine.

Memo on Interviews/Field Surveys

Subject	**3. Reconnaissance of Thanlyin-Thongwa Townships for Pilot Project Site**			
Date	23 June 2001		Prepared by	Akio Katayama
Atten-dants	JICA team	A. Katayama		
	Myanmar side	Daw Min Min Than		
Filename	01-06-23 Memo on Thanlyin-Thongwa.doc		Ref. No.	

Note: Kindly give files to secretary.

(1) Tha Hkay Kong Village, Thanlyin Township

- The village name means "Rich Man".
- 320 households
- As the village for Pilot Project with rice husk gas engine, it may be too small.

(2) Kayin Seik Village, Thanlyin Township

- 575 households
- BCS using a 6 kW D/G, charging 21 batteries while 15 batteries were waiting.
- According to one villager, he use one 2 feet light, one black and white 14" TV for 18:00 to 22:00. Battery will be charged every 5 days at Kyat 80/charging.
- Battery costs: 6 V battery at Kyat 2,500, 12 V at Kyat 5,000

(3) Patauk Village, Thongwa Township

- 575 households
- Population 2,143 (family size at 3.73 → so small?)
- There are only 2 private ricemills in the village.
- Paddy fields are 500-600 acres.
- Half of the villagers are landowner and the other half landless.
- Paddy yield is 25 bags per acre.
- Two times harvesting a year.
- Water tank costs Kyat 3,500.

(4) Pale Village, Thongwa Township

- 836 households
- Good for Pilot Project but the supply of the husk may not be sufficient.
- The village name means Pearl.
- The village is selected as Model Village for improving unit paddy yields.
- There is a high school up to 10th standard.
- There are 3 ricemills.
- Many houses uses rich husk for cooking.

(5) Thongwa Township

- Load shedding is made alternately with the following two time zones:
  Morning shed: 05:00-14:00
  Afternoon shed: 14:00-22:00
  In the night from 22:00-05:00, there will be power supply everyday.

Memo on Interviews/Field Surveys

Subject	**4. Inspection of Hlegu and Hmaw-bi Townships as candidates for Model RE Villages with Rice Husk Gas Engine**			
Date	22 September 2001		Prepared by	Akio Katayama
Atten-dants	JICA team	A. Katayama		
	Myanmar side	U Aung Myint (REAM)		
Filename	01-09021 Memo on Hlegu-Mawbi.doc		Ref. No.	

Note: Kindly give files to secretary.

(1) Ohn-hne-kone Village, Hlegu Township★110

- Rain-forest reservation activity with NGO.
- JICA pilot farming with fertilizer.
- Entrance road was improved by embankment, all by villagers' contribution in 1997.
- One rice-mill exists at the entrance of the village. 2.5 ton/day, 12 hr operation per day.
- Rice husk are sold at K40/bag. 1 bag = 2 baskets. Consumption for household cooking is 8 bags per month (= 16 baskets = 80 kg = 36 kWh equivalent).
- The demand on rice husk as cooking fuel increases in the rainy season.
- There are one primary school with 70 pupils up to Grade 4.
- 110 households and 650 population.
- Village owned paddy 400 acres, Village Tract owned 1,400 acres.
- Ddayel0bo Village belongs to the Ohn-hne-kone Village Tract. It has 300 households, 4 rice-mills (2 x 15 ton/da + 2 small); located along the main road; already electrified.
- WTP at K400 per month.
- Kerosene and candle cost K700. Battery-lighting at households less than 50%.
- 6 bottles = 1 gallon.. cannot buy even one bottle of oil at once and buy by cap of oil.
- Small battery to power 8 W tube light. Charging costs K25 and lasts for 5 days. →Monthly expense K150 for cahrging.
- 12 V-20 AH-9plates big battery now costs K7,000. Price got doubled in the past few months.
- Problem of battery-lighting is inferior quality of tube light which easily gets damaged. 8W tube light set costs K500. Because of no money for this tube light, many use torchlight bulb which is cheaper but consume power at similar

level.

- Battery-lighting system has evolved since the First Oil Shock in early 1970s. Kerosene had been in use in rural areas for lighting purpose. However, kerosene disappeared from the market. The battery-lighting system has become popular from 20-25 years ago.
- Nowadays, diesel lamp is also used in complement of battery light. However, it is darker and emits more black carbon than kerosene. Diesel costs K120 per bottle = K720/gallon. Since poor farmers buy by cap, its unit cost will become higher.
- There is no VEA at present. It was formed when an electrification plan was studied about 10 years ago at a cost of K2,000,000. However, since they could not raise the capital, VEA stopped activities.
- Some family don't send children to school because of no money for buying textbooks.
- 20% can pay K40,000 for RE; 50% up to K20,000.; 75% people up to K10,000.
- Problem is people cannot pay at once. Source of cash income is paddy. The are small scale vegetable cultivation. 10 villagers are working at factory. However, many factories were closed.
- In big villages, people are using fertilizer to have more harvest.
- There are 6 TVs in the village. Battery charging for a TV costs K750. Black and white TV cost K17,000 five year ago. It now costs K45,000.
- Pupils were under meditation when visited at school. The school was built 33 years ago. It was partially damaged both roofing and flooring.

(2) 15 to/day Rice-mill, Hlegu Township

- They sell all the rice husk to a spirit maker at a price of K26 per basket.

(3) MEPE Hlegu Township Office

- Kali-htaw village is a candidate for RE with rice husk gas engine.
- There are many villages non-electrified but these are situated along creek and can be accessible only by boat (advanced arrangement is required for boat hiring and time adjustment for tide).
- RE by self-reliance. Kali-htaw village is too poor and is not on the list of electrification by MEPE. Ohn-hne-kone Village is also not on the list.
- The electrification of Kali-htaw village would cost about K4,000,000 for transformer and distribution lines.
- Hlegu Township has 29,978 households in 5 Quarters and 52 Village Tracts (176 villages). The total population is 110,084. Of the 52 52 Village Tracts, 21 have been electrified.

- MEPE standard wooden post: It will require 3 month advanced order to buy 30 feet tall poles. Round section costs K7,000 per pole.

(4) Kali-htaw Village, Hlegu Township★★★432

- Kali-htaw Village is separated into Eastern and Western Parts by a creek.
- It has 432 households and 1,977 population.
- There are 2 nos. of 2.5 ton/day rice-mills. There is another rice-mill in the neighboring village. It is also possible to buy rice husks from those situated within 5 mile distance.
- Rice-milling demand is low in the two months of September and October. The rice-mill is operating in the other 10 months.
- 75 baskets of paddy can be milled a day
- They are not interested in the Grid power since its supply is frequently interrupted. If we can control the operation hour, the rice husk gas engine is better.
- We know what are engine and generator. But we don't know what is gasifier. What is the lifetime of the gasifier?
- The two interviewees of the village showed the high demand on electricity.
- There are 5 primary schools, 1 Rural Health Center, 4 monastery, 1 community center at monastery, 2 rice-mills.
- It will be about 1,000 households if those in the surrounding areas are included.
- U Kyaw Win, Chairman, Village Peace & Development Council, Kali-htaw (East) Village, Hlae-gu Township.

(5) Payar-lan Village, Ban-bwe-gone Village Tract, Hmaw-bi Township★★★500

- MEPE Township Engineer U Kyaw Kyaw Soe.
- It has 580 households, 2,999 population in the 3 villages of the Ban-bwe-gone Village Tract. Kalar-gyi-kone Village is far by about 1 mile from this village. The Payar-lan Village has 250 households. The village opposite of the main national road and under different Village Tract has also 250 households. The total is about 500 households.
- There are 2 small rice-mills. It yields 40-50 baskets of rice husk per day. It operates for 10 hours a day. The yield falls down to half in September and October. Diesel at K850/gallon. It is powered by 16 HP D/G. It consumes 3 gallon of diesel a day.
- There are 7 small rice-mills, each having capacity of 1.5 ton/day.
- VEA once applied to MEPE.
- Rice husk is not used for cooking but firewood is used.
- Rice husk is sold to poultry farming at K25/basket.
- There was a plan for electrification. They could not raise K3.0 to 6.0 million at

that time.

- Rich has diesel generator set of 1.5-3.0 kVA. It amounts to 16 nos. It costs about K280,000. Diesel costs at K800/gallon.
- Battery
- Diesel lamp → 80%.
- Land 900 acres. 1,600 acres under the village on the opposite side of the road.
- In the Ban-bwe-gone Village Tract, there is 1 Rural Health Center, 2 primary schools, 3 monasteries.
- 12 V – 35 AH battery is used for TV. Chraging fee at K35. The battery costed K5,000.
- Candles cost K80 per bag. It is consumed in two days. K40 per day for candles.
- K900/h.h./month.
- VEA stopped activities since there was no hope to receive power.
- Farmers are willing to participate in the VEA towards electrification. VEA will provide raw materials, work force and will need help in capital installment.
- Rice husk of about 100 baskets per day will be required. This would cost K2,500 per day for 5 hour supply.
- If capital costs can be paid back by installment, VEA can introduce rice husk gas engine.
- U Soe Min, Chairman, Village Peace & Development Council, Banbwe-gone Village Tract, Hmaw-bi Township.

(6) Shew-Mya-Yar Village, Hmaw-bi Township

- VEA has been applying to MEPE for electrification.
- MEPE prepared a electrification plan with 1mile of 11 kV line, one 300 kVA transformer, and 20,000 feet Low Tension lines (concrete poles and copper wires). The cost was estimated at K12.8 million.
- Of the costs, 40% from the Government and 60% from VEA. This was a special order from late Secretary 2.
- The limit of L/T is 3,000 feet.
- Paddy from a large scale paddy cultivation goes directly to deposits and rice husk does not remain in the village. The paddy fields of the villagers are limited and rice husk too.
- One village is using rice husk for drying beans. It is difficult to collect rice husk even @35/basket.
- Main consumers of rice husk are poultry, spirit maker, and brick producers.
- There are many government factories and private big factories.
- They would manage to buy rice husk even from 50 miles away, including 110

ton/day rice-mill in Hlegu Township.

- Firewood from other villages 10 miles far.
- U Thant Sin, Chairman, Village electrification Committee, Sshew Mya Yar Village, Pu-gyi junction, Hmawe-bi Township.

Memo on Interviews / Field Surveys

Subject	**5. Visiting to Candidate Village of Rice Husk Gas Engine Electrification in Yangon Division**		
Date	Sep-26, 2001	Prepared by	Y.Nakagawa
Attendants (JICA ST Side)	A. Katayama K.Tamura Y. Nakagawa	Attendants (Myanmar Side)	U Aung Myint (REAM) Ma Shwe Syn
Ref. No.		Note	

Kayin-Seik (Than Lyin Township)

- Household is 277 Population is 1524。Electrified byMEPE is 0%、10 miles from Than Lyin center
- 60houses are located remote area from villege center, and are not included within the distribution line. Solar Power and BCS seem to be effective.
- There is one lamp post。

Bamar Dui Rice Mill (means Myanmar Blood) (Fig.1)

- Amount of Rice paddy is 15ton/day, 400baskets/day (equals to 300basket/day of rice husk, as rice husk is 75% volume of paddy). Four worker. 45hp power of diesel engine(Fig.2).
- No production of rice husk on Sep-Oct. Storage is needed for year round electrification.< 200baskets/day is necessary for 10h/day generation, thus 6000baskets is requisite for storage.>

- There are another 3 rice mills(10ton/day each).
- In addition to be used in cocking (Fig.3), rice husk is consumed by brick, dye-works of textile, and spirit factories. The remnant is donated to monastery.
- Price of rice husk is 5kyats at low season, and 13kyats at high season.

Meeting with monks and villagers at Mandra Monastery (Fig.4)

- Attendant : 2 monks, 15 villagers (2 women included)

- 800,000kyat of electrification fund

Information from 2 women

- Rice husk, firewood, and char coals are used for cooking. They are handed as much as easily.

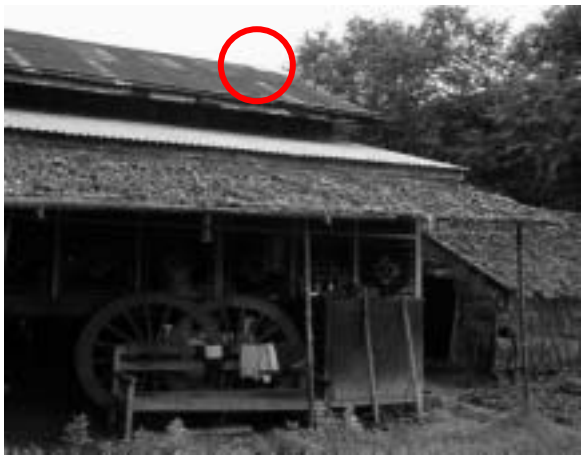
- Rice husk is consumed 1basket/day, purchased 15kyats/basket. 3viss/day(=4.9kg) for firewood, consumption is 7000kyats/yr. Char coals are seldom used because of higher price.
- Rice husk is regarded to be used by the poor, the rich people prefer firewood. Total cooking time is two to three hours a day, all day long at monastery.
- The ash of husk is used for washing and fertilizer.
- There is no electric device at home. When electrified, they want iron, cooking jar, cooker, and refrigerator.
- Entertainment for night lige is Karaoke(100 kyats per 3 songs) and video show(15 kyat), held almost every night. Bed time is 10pm, wake up at 5am。

U Kyaw Sein Rice Mill

- 360basket/day of Rice Husk is produced. 10 months/yr operation.

Solar House (Fig.5)

- 22W, Monocrystalline type of solar panel is installed. (70,000kyat(1$ =120kyat at once) of installation fee including cable, solar power unit(Fig6), and battery. Charging for 3 days use is possible so that it is available in the rainy and cloudy days.



- Dining, kitchen, storage, bedroom. Electrical equipment is 2 lights, TV, and neon for Buddha statue of home shrine.

●BCS House（Fig.7）

- Working hour is 6am-9pm., every day. 40 units/day for charging. It takes 6h for cascade charge. Usually they have to wait 2days for small battery (6V), 5-6 days for large battery(12V) for TV. Fee is 40kyats for small battery, 80kyats for large battery.
- Daily income is 2000kyats/day。
- 6hp of diesel engine for generation。1～1.5gal/day 700kyat/gal for diesel oil.

General house (Home of U Ngwe Thaw and Daw Nu)

- Ma Yii Win,Ma Sandar Lwin sisters are tailor. They have 3 manual sawing machines.
- 80kyats/3-4day of BCS fee for lighting. Light is used during 6-9pm.
- Sawing fee:50kyats for skirt, 150kyats for blouse, 300kyats for shirt。(1/2～1/3 price of Yangon City). Total income is 1500kyat/day for sister.
- They want electric iron. Char coal iron is inconvenient (Fig.8).

Kali-Htaw (Hlaegu Township)

- Household is 432, populaiton is 1977. 4 colonies are included, 50 household each. Study was held in East Kali-Htaw
- All villagers are farmers. There are no factories. 5 schools, 4 monasteries.
- 100,000-150,000kyats/yr income. It is possible to collect 1,000,000kyat for electrification fee, according to village chief.
- Paddy, watermelon, nuts, and vegetables are produced.
- Large amount of grass tree reseeds. It is used for besom. It may be used for rice husk alternative.
- There is a dam at 15 miles upstream, mainly used for irrigation, hydropower is also utilized (output uncertain)
- No entertainment for villagers

.

Rice Mill

- ・There are two rice mills of 2.5ton/day. 75baskets/day of paddy(56baskets/day of rice husk) each.
- ・Owns18hp diesel engine.
- ・Rice husk is sold as a bag(1 bag contains 2 baskets). 30kyats for 1 bag.

Primary school

- 9am-3pm, no lights。5days/week. Five teachers, 107 students.

Health Center (Additional information)

- 8 workers
- Corporation with MMCWA(Myanmar Madanao Child Welfare) and USDA (government organization)

Table. Patients in Hlegue Township **( ):Death**

Disease	Nos,of Patients,2000	**Nos. of Patients 2001,4 month**
Malaria	1260(46)	541(5)
DHF(Dengue Fever)	0	
Diahhrea	1013(1)	384(4)
Dysentery	571	253
Typhoid	10	0
Snake Bite	110(6)	0

General house (Fig.9)

- 1bag/5days of rice husk is used for cooking. 20kyats/1bag.
- 5kyats of one stick of firewood, 25kyats for one bundle. Firewood is expensive for villagers.
- 8V battery is used for lighting(Fig.10).
- 35kyats for charge, 20kyats for transportation. 1 charge for 5days.
- Some villagers are very poor, without any paddy field, just work for seeding time and harvest, according to house wife.
- She wants iron and cooking device when electrified.

Hman-Kone Village (Hlegu Township)

- Diesel lamp is used for lighting. (80Kyat/1can, 1can/2days) It is dark and with soot, odor. Worse than paraffin. Estranges mosquito. Used for 6-9p.m.(Fig.11)
- Battery is seldom used, as it is rather expensive compared to income.
- There are two thrashing diesel engines. (12hp/2000rpm and 5hp)
- ・According to old woman, there is no change in this village, which shows here is remote village.

Banbwe-Kone (Hmawbe Township)

- 585 households, 2999population. Along to Pay Road which is best paved in this country.
- Plenty of green forest. Branches are cut so that Pagoda is seen well from the village road. Cut tree would be firewood.
- Seven 2.5ton/day of Rice mills. Six Saw Mills.
- Average income is 100,000kyats, 3,000,000kyats is available for electrification.

Rice Mill

- Owned by U Chit Sui, 2.5ton/day. 30kyats/bag rice husk is produced. Working 12h/day.
- 22hp of diesel engine, consumes 4gal/day.
- Rice husk is not used for cooking fuel, but for hay of cattle, and after it will be fertilizer.
- Rise husk produced from the rice mill along the river is just throw away to the river.

U Kyaw Htou Saw Mill (Fig12)

- Owner is Daw Pan Sein, having two 50 hp of diesel engine
- ・Saw dust is produced 300bag/Month, sold to spirit factory. It could be used alternative for rise husk in the shortage season of Sept and Oct.
- ・Wood chip is used for cooking fuel, produced one- 2.5 t truck of chip,sold at 35,000kyats.

Information at village chairman's home

- As at the close vicinity of MEPE grid, there is possibility to be electrified within a few years. Considering MEPE electrification, concrete poles which can permanently used might be more suitable than cheap wood pole. (Fig.13,Fig.14)
- Village chairman has little interest to MEPE electrification.

Other informatin

U Aung Myint source, villagers can not have saving account or fund on the bases of dollar currency. Management of capital money is impossible. Saving and loan on kyat is difficult because inflation exceeds the interest.

Unit Conversion:

1gal (Imperial Gallon)	4.546l
1 basket of paddy	20.9kg
1 basket of rice husk	4.99kg
1 viss	1.63kg

Memo on Interviews/Field Surveys

Subject	**6. Inspection of Thanlyin-Hlegu and Hmaw-bi Townships as candidates for Model RE Villages with Rice Husk Gas Engine and Solar BCS**			
Date	26 September 2001		Prepared by	Akio Katayama
Atten-dants	JICA team	A. Katayama, Tamura, Y. Nakagawa		
	Myanmar side	U Aung Myint (REAM)		
Filename	01-09-26 Memo on Thanlyin-Hlegu-Mawbi.doc		Ref. No.	

Note: Kindly give files to secretary.

(1) Kayin Seik Village, Thanlyin Township ★★★277 + needs to BCS

- U Bama Thawe Min
- Rice-mill at 15 ton/day. U Aung Myint (REAM) has production records of rice.
- There are 3 rice-mills = 2 x 10 ton + 1 x 15 ton/day plus another small outside village
- The 15 ton mill can process 400 baskets of paddy a day. Of this about 75 % in volume will become husk. So, 300 baskets of husks will be discharged. → Check calculation 400 baskets of paddy weighs __ kg while 300 baskets of husks weighs about 1,500 kg. The weight ratio of husk to paddy becomes ___ which is close to a standard figure of 0.20.
- Demand for husks
  - Cooking
  - Brick
  - Textile dying
  - Spirits distillery
  - Storage room of husk equivalent to 800-1,000 baskets per 5 ton truck multiplied by 10 = 10,000 baskets = 50 ton = 100 day storage @ 100 baskets consumption per day
- Price of husk
  - K5/basket in summer
  - K15/basket in September 2001
  - Donated to monastery
- Diesel generator of the mill is 45 HP
- Village Electrification Committee was established in 1995 with the monk as chairman. It raised K800,000 but RE not realized. The fund becomes K1.2 million now.
- 277 households in the main village. There is households group of about 60

households who has no land. It is located about 1 mile to the south of the main village. In addition there are many scattered houses in the paddy field area.

- There is another rice-mill in "PAITOKAN (?)"
- Major industry
  - Stoneware
  - Sewing
  - BCS x 1 no.
  - 2 video stadio
  - 2 Karaoke, operating from 18:00 to 20:00
- There are 2 primary schools and 1 middle school with 280 pupils.
- One clinic
- Village area 60 acres, 2,500 feet on east-west direction and narrower on north-south.
- Average income level at K150,000-200,000.
- U Sein Htun, Chairman (VPDC)
- U Thaung Shein, Chairman (VEC)
- Second rice-mill, D/G 45 HP, capacity 10 ton/day, processes 360 bags of paddy a day by 12 hour operation.
- One SHS
  - Solar PV panel 22 Wp and battery 45 AH
  - 8W fluorescent lamp x 2
  - 40 W TV
  - Cassette
  - 20W illumination for Buddha image
  - Use for 5 hours a day for past 5 years
  - Can use also on cloudy day, since battery has capacity for 3 day use
  - Load management is important. If rainy day continues, save use, etc.
  - Costed K70,000 when 1$ = K120. About 600$.
  - There are about 30 users of SHS in this area. Some use larger set.
- Video stadio K15
- BCS
  - 40 batteries, charging for 6 hours
  - K50 for 20 AH battery
  - Using 6 HP-3 kVA D/G
  - Fuel consumption at 1-1.5 gallon per day
  - Diesel at K900/gallon
- Primary school up to 5^{th} grade
  - 280 pupils
- The village is not on the list for electrification by MEPE Township Office.

(2) Kali-htaw Village, Hlegu Township★53

- Rice-mill 2.5 ton/day, 18 HP
- Primary school with 107 pupils up to 4th grade, 5 teachers, school hours from 9:00 to 15:00
- The village consists of 4 house groups:

- Kali-htaw East	53 hh	236 population
- Kali-htaw Middle	68	332
- Kali-htaw Upper	54	239
- Kali-htaw Lower	59	274
Total	234	1,081

- There are 15 villages in Kali-htaw Village Tract.
- Rice husk stove
  - Husk at K20 per bag
  - Stove at K500
  - One bag lasts for 5-6 days for 5 family size
  - Use some firewood only as supplement, very costly (K20 per bundle)
  - 8V battery, charging costs K35 plus K20 for carrying
  - Battery lasts for 1-2 years
- The road in the Kali-htaw East was improved with 75% by villagers contribution and 25% from Government.
- Another village with 108 (road side) and 137 (rear side) households

(3) Payar-lan Village, Ban-bwe-gone Village Tract, Hmaw-bi Township★★★500

- There are one big and one smaller poultry farms.
- 7 rice-mills of 2.5 ton/day, using 22 HP DG consume diesel at 5 gallon/day for 12 hour operation
- Diesel at K850 per gallon
- Husk at K10/basket
- Process 200 baskets of paddy→75% husk in volume
- There is a rice-mill on the northern river bank at 7 miles. There is excess husk wasted, discharged to river. If necessary, they can get and carry from there.
- There are 2 sawmills.
  - DG 50 HP x 2 nos.
  - One month sawdust at one truck = 300 bags = 600 baskets
  - 1 bag = 3 viss
  - Being sold at K30/basket to a spirits distillery.
  - She can change supply to VEC if necessary.
  - There are 6 sawmills in this area.

- Wood tip: K35,000 for one truck volume (2.5 ton) per month.

- Income level at K100,000.
- WTP: After knowing the total capital costs, they will calculate the initial cost allocation depending on the household income. Before, they got consensus to raise K3 million to get grid power.

Memo on Interviews / Field Surveys

Subject	**7. Interview at the workshop of U Khun Kyaw, Shan Hydro Electric Engineer**		
Date	24 Nov. 2001	Prepared by	K.Kato Y.Nakagawa
Attendants (JICA ST Side)	K. Kato Y. Nakagawa	Attendants (Myanmar Side)	U Khun Kyaw (REAM)
Ref. No.		Note	

U Khun Kyaw is a specialist of pico hydropower as one of the members of REAM. He has a number of experiments of the installment of micro and pico hydro up to 100 kW in 20 years. His workshop is at Nyaun Shwe industrial area with the factory of water turbines and penstock lines.

The products of the workshop are listed below:

- Manufacturing the runner of the water turbines

Type of turbine	Capacity	Head
Pelton turbine, runner	50-70kW	Up to 300 feet
Propeller turbine runner	25kW	Up to 15 feet
Cross-flow turbine, runner	50 kW	Up tp 100 feet

Francis turbine is not produced here.

The bucket of Pelton turbine is formed by pouring melted iron into a mold and combining the bucket. The form of the bucket is made by wood which models Chinese ones.

- Stay ring:

  Stay ring is designed and flamed at the workshop, and ordered to another company for manufacturing.

- Casing:

  Casing, nozzles, and needles for Pelton turbines are imported from China. It is possible to fabricate with a design figure from China, according to him, but he has no experience at present.

  Casing for propeller turbine is produced with concrete casing. He fabricates square ones by steel plates.

  He has experiences of production of the casing of cross-flow turbines.

- Draft tube :

  There is no record for producing a draft tube.

- Inlet valve:

  No inlet valve has produced. Intake gate is opened and closed by manual operation for the existing system instead of the inlet valve.

- Penstock line:

  He is capable of manufacturing 3 to 4 feet in diameter. Units of 4 feet length are connected by flange up to 32 feet of the head. The thickness is up to 3/16 inches.

- Governor:

  Old type governers are purchased and modified by him.

- Generator:

  Generators up to 200 kW are imported from 2 Chinese companies whose blanches are located at Taung Gyi. Generators less than 30 kW are easily available at the market.

- Planning and Design:

  Planning and design is performed by him including discharge measurement, head measurement, cost estimate for the project, and drawing at the price of 5% of the capital cost. Usually it takes one week for design, one to three months for implementation depending on the scale of the projects.

- Cost for construction:

  Basically, cost is estimated about 300,000 Kyat per 1 kW.

- Transportation:

  Materials are transported only within Shan State at present. Transportation cost is from 7,500 to 10,000 Kyat for one trip of 20 miles, less than 3 tons.

Fig. Illustration of the Concept of Hydropower

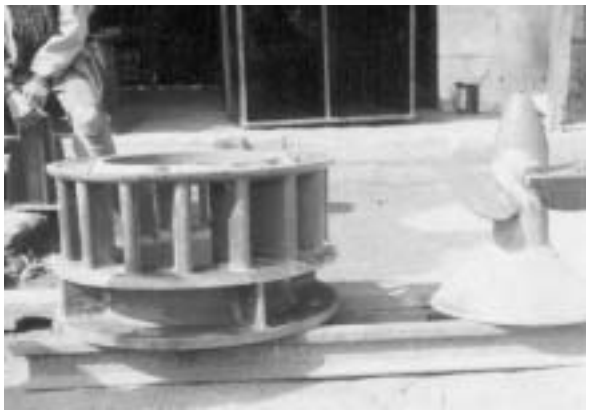


Fig. A KaplanTurbine

Fig. A Cross Flow

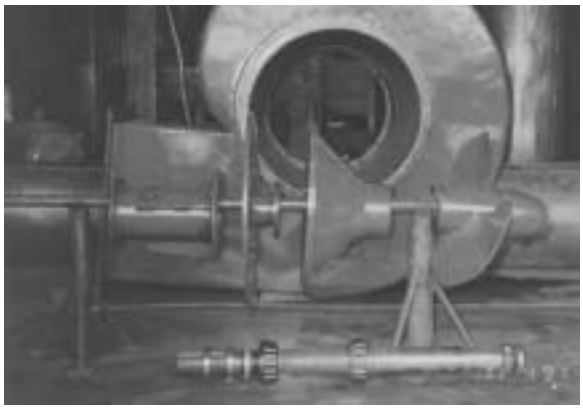


Fig. A Pelton Turbine Case

Fig. Excavation and Installment of Penstock Lines

Fig. Wiring the lines of Wooden Poles by Villagers

Fig. Installment of Materials by Cow Wheel

Fig. Penstock and Powerhouse for Micro-hydro

Memo on Interviews / Field Surveys

Subject	**8. Meeting with U Yar Sein, TPDC of Nam Lam**		
Date	Nov, 2001	Prepared by	Y.Nakagawa
Attendants (JICA ST Side)	Akio Katayama Yuka Nakagawa	Attendants (Myanmar Side)	U Yar Sein U Tun Myat (Imterpriter) U Win Zaw (MEPE MTsp. Engineer)
Ref. No.		Note	

1 Administrative division of Hshpaw and Municipal Nam Lan Township

Konghsa, near the starting point of Kyutaw Chuang, belongs to Hsipaw Township as shown below. Villagers in Konghsa said that the Konghsa village is under Nam Lan Municipal Township, but Kongsa is under a different village tract from Nam Lan according to VPDC. The recognition and sense of belonging seems to be obscure for the villagers. Nam Lan is so called Municipal Township, which is a definition for the administrative usage such as tax collection.

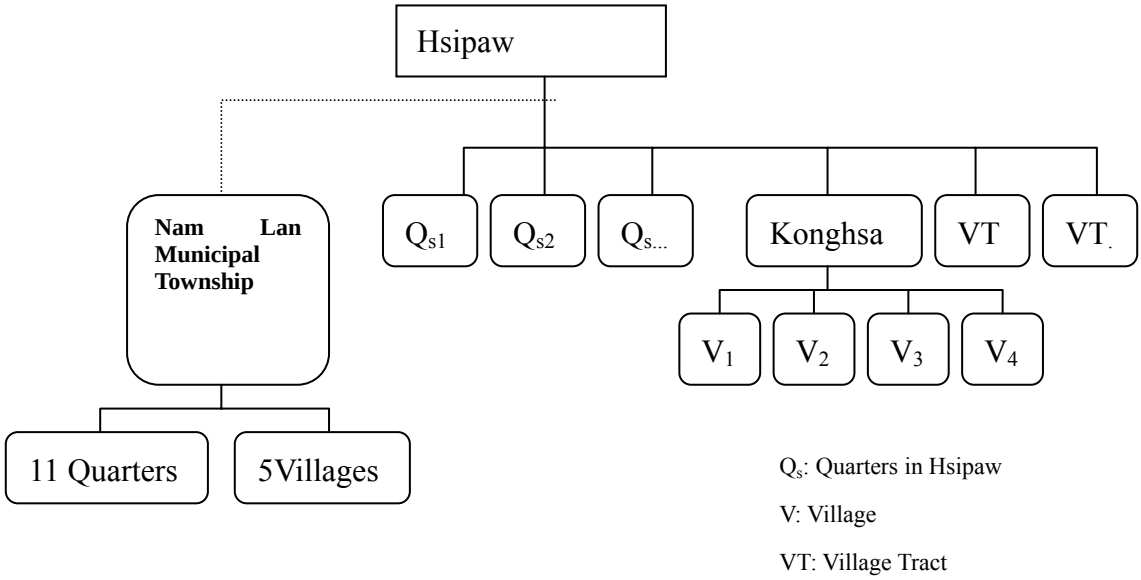


Figure Description of administrative division of Nam Lan and the neighbors

2 VEC in Nam Lan

Village Electrification Committee of Nam Lan was organized in November 2001 with U Yar Sein, Chairman fo TPDC of Nam Lan, as a chairman of VEC. They have already obtained the approval of forming VEC by PDC of Hsipaw Township. There are five members at present listed below.

Table Members of VEC in Nam Lan

No.	Name	Title	Occupation
1	U Yar Sein	Chairman	TPDC Chairman
2	Daw Nan Kin Shwe	Secretary	Secretary of USDA, teacher of chemistry and biology in Nam Lan High School
3	U Tun Pyain		Representative of farmars and pesants, owner of Kiotaw Chaung and Nam Pan Kan Chaung diversion area
4	U Shwe Thein		Organizer of transportation, heavy vehicles
5	U Nyunt Maung		Organizer of transportation, light vehicles

U Yar Sein, Chairman, Daw Nan Kin Shwe, Secretary, U Tun Pyain, and U Shwe Thein attended the meeting held in the afternoon of 27 Nov. at PDC assembly room.

Their roles are mainly to help MEPE and JICA Study Team in solving the problems concerning the implementation of the Project. Operation and Maintenance of Nam Lan Hydropower will be undertaken by MEPE at the first stage and it may be entrusted to VEC gradually in the future. Members are expected to expand in accordance with the increasing their roles during the project implementation and after the electrification. Quarter and Village Heads and those main consumers who are engaged in industry such as rice/saw mills, iron works, furniture, food processing, BCS, and commercial sectors are also expected to participate in VEC later. Rules and regulations of VEC will be drafted during the implementation.

Figure Picture of U Yar Sein

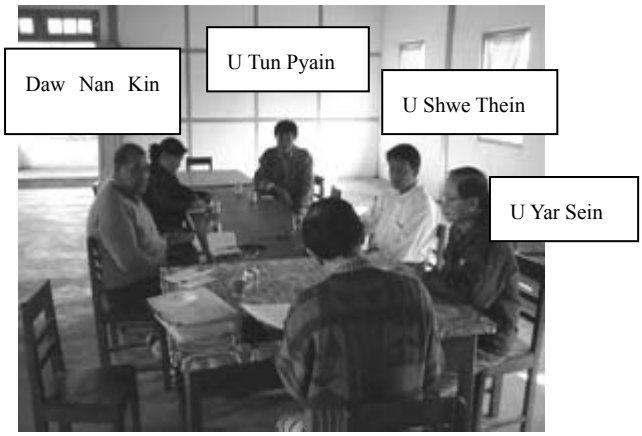


Figure Members of VEC and PDC Assembly

The following two forms were translated into Myanma and handed over to VEC Chairman to collect the information about the customers, their power demand, and type and time of the demand.

Form of Survey for Household Demand

Quarter/ Village	House No.	Name of the Family Head	Family Size	Power Demand at Night time (W)	Fluorescent light, bulb, T.V, Stove, etc. planned to be used	Will to join VEC or not

*** Remark: This form is for survey of household demand at nighttime**

Form of Survey for Public, Industrial, and Commercial Demand

Quarter/ Village	House No.	Name of the Family Head	Type of Demand: Industrial, Public, or Commercial	Type of Business: school, restaurant, rice mill, etc.	Major Usage of Electric Power	Duration of Using power from -- to --	Power Demand (kW) in Daytime/Nighttime

*** Remark: form is for survey of public, industrial, and commercial demand other than households.**

Monthly charge for the electricity cannot cover the O&M cost if current MEPE tariff is applied. It needs to be adjusted according to the actual cost before the O&M and collection of tariff are transferred to VEC. VEC members already considered about

it.

U Tun Pyain, a member of VEC is also the landowner of the area of diversion channel from Kyutaw Chaung to Nam Pan Kan Chaung and from Nam Pan Kan Chaung to Hosan. VEC members including him participated in the survey of the diversion area on 28th Nov. and agreed to use the areas.

3 Water Right Consensus

Utilization of the water between generation and irrigation was explained to VEC especially about very dry season. Generation pattern according to the discharge of the rivers was illustrated and they agreed to the power cut if required in the dry season. For the mitigation of the water shortage, farmers may sift the timing of initial watering and rice trans-planting so that the peak water use is limited to a smaller area and not to be used at once in May and June in particular. Usually vegetables in the farm land do not need irrigation. JICA requires Minutes of Meeting for the agreement of usage of the water for irrigation and generation. Explanation for the usage of water was held among villagers and Village Chief at Kyutaw village and they agreed to it as long as they can obtain enough water in the planting season.

Figure Assembly at Kyutaw

Figure Site Investigation with VEC and Villagers

VEC members, village chief of Kyutaw, and villagers who are interested in the Project participated in the site investigation on 28th Nov. covering the areas of diversion channel.

4 Distribution lines and in-house wiring

The information about distribution lines and in-house wiring is obtained in the meeting with U Win Zaw, MEPE township engineer of Nam Lan. The interview was held on 27th Nov.

- There is no contractor in Nam Lan who provide the house wiring service from the grid in Nam Lan. They come from Hsipaw. Price for the wiring is depends on the negotiation by each household and the contractor in Hsipaw.
- Information for the unit price list of the connection from the distribution lines to a house is now under inquiry from Hsipaw MEPE office to Lashio according to the request by JICA ST.
- MEPE engineer is responsible for the lead-in wiring. He checks the safety of the in-house wiring and issues permission for the contention to the Grid.
- In-house wiring system is constructed by a contractor who has a license issued by MEPE. Average wiring fee for workmanship is listed below;

Figure Wiring Materials sold in a Shop in Nam Lan

Price List of Workmanship for In-house Wiring

Standard	Price(Kyat)
High	10,000
Medium	7,500
Low	5,000

- Price of the materials for in-house wiring depends upon the scale of the house electronic devices. House owners should buy the materials by themselves. The rough cost for wiring with 10 to 15 bulbs and switches would be K50,000. Price if each material for the in-house wiring is shown below:

Price List of In-house Wiring Materials at NamLan

Item	Cost (Kyat)	Unit	Note
Cable (internal wiring)	2,500	100 yard	up to 500V
Flexible wire	1,200	300 ft	
Main switch	1,800	1 nos.	
Volt meter	400	1 nos.	
Knife switch	300	1 nos.	
Circuit breaker	350	1 nos.	
Wall wiring cover, 1inch length	50	6 feet	
Wall wiring cover, 1.5inch leng	60	6 feet	
Meter cover box	500	1 nos.	A meter is provided by MEPE
Switch	100	1 nos.	
Wall switch	200	1 nos.	
Socket (single)	150	1 nos.	
Socket (double)	80	1 nos.	
Plug	60	1 nos.	
3 pin socket	150	1 nos.	
3 pin plug	100	1 nos.	
60 W milky bulb	100	1 nos.	
2 feet fluorescent light	1,500	1 nos.	20W
4 feet fluorescent light	2,200	1 nos.	40W
Fluorescent bulb	400	1 nos.	50-100W
Lamp holder	70	1 nos.	
Ceiling type lamp holder	90	1 nos.	
Fuse holder	100	1 nos.	copper line is used for fuse

- In the present system, each customer pays the tariff to MEPE according to the meter reading. The meter is provided by MEPE at free of charge at first. Monthly charge of the meter is at 2.5 Kyat.
- Circuit breaker is used only at big consumers. It is not duty but option.
- Devices about personal electrification were also available at the market in Nam Lan. The list for price is shown below. In Hosan village, pico-hydropower was constructed by themselves at the capacity of 2kW. Some shops and houses in Nam Lan also installed pico-hydro for daily usage of electricity. The total cost including the distribution line was K130,000, which corresponds to be about 100-130$/kW.

Price List of Personal Electrification Device in Nam Lan

Item	Cost (Kyat)	Unit	Note
Throwing-type water mill, 1kw	50,000	1 nos.	
Throwing-type water mill, 1.5kv	65,000	1 nos.	
Throwing-type water mill, 2.0kv	75,000	1 nos.	
12 V battery	8,000	1 nos.	made in Thailand
12 V battery	4,400	1 nos.	made in Myanmar

Figure Generator of Pico Hydro Sold at Shop

Figure 2 kW Pico Hydro installed behind a tea shop

Memo on Interviews / Field Surveys

Subject	**9. Meeting on Capital Cost for Rice Husk Gas Engine at Kayin Seik Village Model village finding in Than lyin Tsp.**		
Date	Dec.7, 2001	Prepared by	Y.Nakagawa
Attendants (JICA ST Side)	A. Katayama Y. Nakagawa	Attendants (Myanmar Side)	U Aung Myint (REAM) Ma Shwe Syn
Ref. No.		Note	

1. The Situation of Model Villages

Discussions were held between REAM and villagers in Dec 2001 to set up VEC, to collect the information of exact beneficiaries and make a monthly payment plan, to acquire the agreement for repayment of the capital cost, and to sign MoU for the management and operation.

Banbwe Kone (Palyar-lan and Yae -tar village):

- It is difficult to acquire the consensus between the chiefs of two villages and villagers about electrification. VEC has not been formed yet.
- They have no idea of the future plans for the usage of electricity.
- People who are well off have already received electricity from MEPE Grid.

Kayin Seik:

- An willingness to pay for the capital cost from each household is 5,000 Kyat per year, which is much smaller than it is required even considering three-year repayment.

Banbwe Kone is not supposed to be suitable for the model village in this stage and Kayin Seik needs further discussion about the payment of capital cost.

2. Cost Estimation and Loan Plan for Kayin Seik village

The capital cost of the rice husk gas engine for Kayin Seik, assuming the household 300, is shown in the right table according to the estimation by MIC and REAM;

Table Total Capital Cost Estimation (Kayin Seik, 100HP/50kVA)

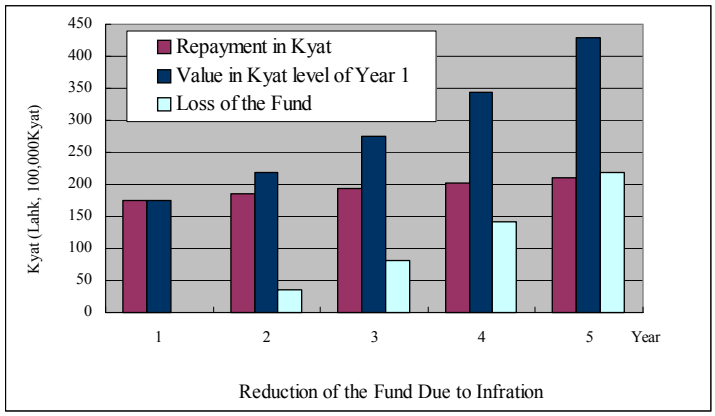
Item	Kyat	USD
Engine and Generators	5,500,000	$8,462
Installation	1,100,000	$1,692
Basement & Building	1,200,000	$1,846
Husk Storage	500,000	$769
Distribution Line	7,060,000	$10,862
Street Light	60,000	$92
Fencing	150,000	$231
BCS Facilities	1,700,000	$2,615
Battery Workshop	300,000	$462
TOTAL	**17,570,000**	**$27,031**

(676$/kW)

1.00$=K650 in Dec 2001

As it is not affordable for Kayin Seik villagers to repay the initial capital cost at once, the installment plan and concept of interest are needed to be introduced. The inflation rate is said to be about 25% in Myanmar and would be a problem for the loan plan as the decrease of the value of currency. The real value would be half in about three years.

If the interest of the loan set zero in the first year, 10 % in the second year, and 20 % in the third year in order to encourage the earlier repayment, the decrease would be illustrated in the figure shown in the right.



This interest won't be enough to catch up with the assumed inflation rate and the shortage needs to be covered by the Grant. The reduction in the value of repaid Kyats would be more than 50 %. The earlier is the better for the sustainable operation of the RE Fund.

The repayment schedule with above interest plan for five years of repayment period is shown below;

Table Payment for Kayin Seik Village in Kyat

		Repayment Period				
Year	Interest Rate	1	2	3	4	5
1	10%	17,570,000	8,785,000	5,856,667	4,392,500	3,514,000
2	20%		9,663,500	6,442,333	4,831,750	3,865,400
3	30%			7,028,000	5,271,000	4,216,800
4	40%				5,710,250	4,919,600
5	50%					4,919,600
TOTAL		17,570,000	18,448,500	19,327,000	20,205,500	21,435,400

Table Payment per household in Kyat

		Repayment Period				
Year	Interest Rate	1	2	3	4	5
1	10%	58,567	29,283	19,522	14,642	11,713
2	20%		32,212	21,474	16,106	12,885
3	30%			23,427	17,570	14,056
4	40%				19,034	16,399
5	50%					16,399
TOTAL		58,567	61,495	64,423	67,352	71,451

The repayment would be 19,327,000 Kyat with 1/3 payment of the capital cost at the end of the first year, 1/3 at the second year with 10 % interest for the rest of the amount, and the remaining 1/3 with 20% interest in the third year.

VEC members of Kayin Seik village understood about this matter.

3. Meeting with VEC menbers in Kayin Seik

3.1 Meeting on Dec 7,2001

A meeting with VEC members were held on Dec 7th at a monastery in Kayin Seik to explain the financial plan for rice husk gas engine. According to the former study by U Aung Myint,

REAM, their willingness and ability to pay for capital fee was 5,000 Kyat per household that is too small for electrification. The attendants were below;

No.	Name	Title
	VEC Side	
1	Monk	
2	U Sein Tun	Chairman
3	U Tin Oo	
4	U Tin Hla	
5	U Tun Sa	
6	U Swe Thein	
7	U Sein Myint	Rice mill owner
8	U Tin Nyunt	
9	U Myint Kyi	
10	U Bu Aye	
11	U Aye Thein	
12	U Than win	
	JICA ST side	
1	A. Katayaya	Team Leader, JICA ST
2	Y. Nakagawa	JICA ST
3	U Aung Myint	REAM
4	Ma Shwe Syn	

Their comment were as belows:

- There is no problem for husk supply. The only problem is for the repayment for the capital costs.
- Many people who are well to do are living in surrounding area of the village in paddy areas and they will not be electrified by the project due to the limit in the distribution line length. Landless people living in the center of the village are not much interested in the electrification, as their income is low (300 Kyat per day even in the harvest season).
- 100 household is affordable for the payment of 20,000 Kyat per year for the capital payment. While 200 households are landowners, 90 households are landless.

They agreed to see the Younethaline village, where rice husk engine was installed in March 2001 to see if they are satisfied with the electrification. Their final decision will be made after the investigation.

3.2 Meeting on Dec 12, 2001

After the investigation of Yonethalin and discussion among the villagers, they have confirmed their will to install the rice husk gas engine, but the problem is in the financial matter. They

understood the concept of inflation and the contribution portion from the Grant according to the reduction of the value of the money repaid for the capital cost. The summary of their comment is below:

- Maximum financial capacity is 6,600,000 Kyat.
- Beneficiaries are 112 households at the most.
- They requested the scale-down of the project area to reduce the area of distribution line and engine size.

Reduction about the capital is discussed to meet their request. The plans and the calculations of capital costs are shown in the table below:

Table Plan for the Payment of Capital Cost in Kayin Seik

Item	Initial Plan	Degraded Plan I	Degraded Plan II	Note
Engine and Generators	5,500,000	3,500,000	5,500,000	Decreasing engine size
Installation	1,100,000	1,100,000	1,100,000	
Basement & Building	1,200,000	1,200,000	1,200,000	
Husk Storage	500,000	500,000	500,000	
Distribution Line	7,060,000	4,759,000	4,759,000	Adopting wooden poles
Street Light	60,000	60,000	60,000	
Fencing	150,000	150,000	150,000	
BCS Facilities	1,700,000	0	0	Using existing facilities
Battery Workshop	300,000	0	0	
Total Capital Cost	17,570,000	11,269,000	13,269,000	
Total Payment with Interest	**19,327,000**	**12,395,900**	**14,595,900**	
Complement from Monthly Charge	0	2,301,180	2,301,180	
Complement from Rice Mill Owner	0	0	4,461,180	
Total Amount of Complement	0	2,301,180	6,762,360	
Total Net Repayment	**19,327,000**	**10,094,720**	**7,833,540**	

The Initial Plan was the estimate shown to villagers on that meeting. Degraded Plan I was considered for the scale-down of the engine and generator at the meeting. Wooden poles instead of concrete poles are used for this estimation to reduce the cost of distribution line. Monthly fee for the beneficiaries is suggested to complement for the capital cost. In the Degraded Plan II, the engine and generator scale is remaining at the same level as more customers are expected to participate later. A power tariff should be collected from a rice mill owner if the electricity from the rice husk gas engine is supplied to power the rice mill to save the fuel costs of the existing diesel engine. The half amount of the oil expense to be saved is assumed here to be charged as the power tariff. Tariff for BCS is also considerable to add in the similar way.

Income from monthly charge from users

Usage	nos.	Charge (Kyat)	Total fee (Kyat)
In-house	100	800	80,000
Street Light	100	100	10,000
BCS	1,200	40	48,000
Commercial Use	2	5,000	10,000
Total Income/month			148,000
Total Income/year			1776000

Expense for O&M

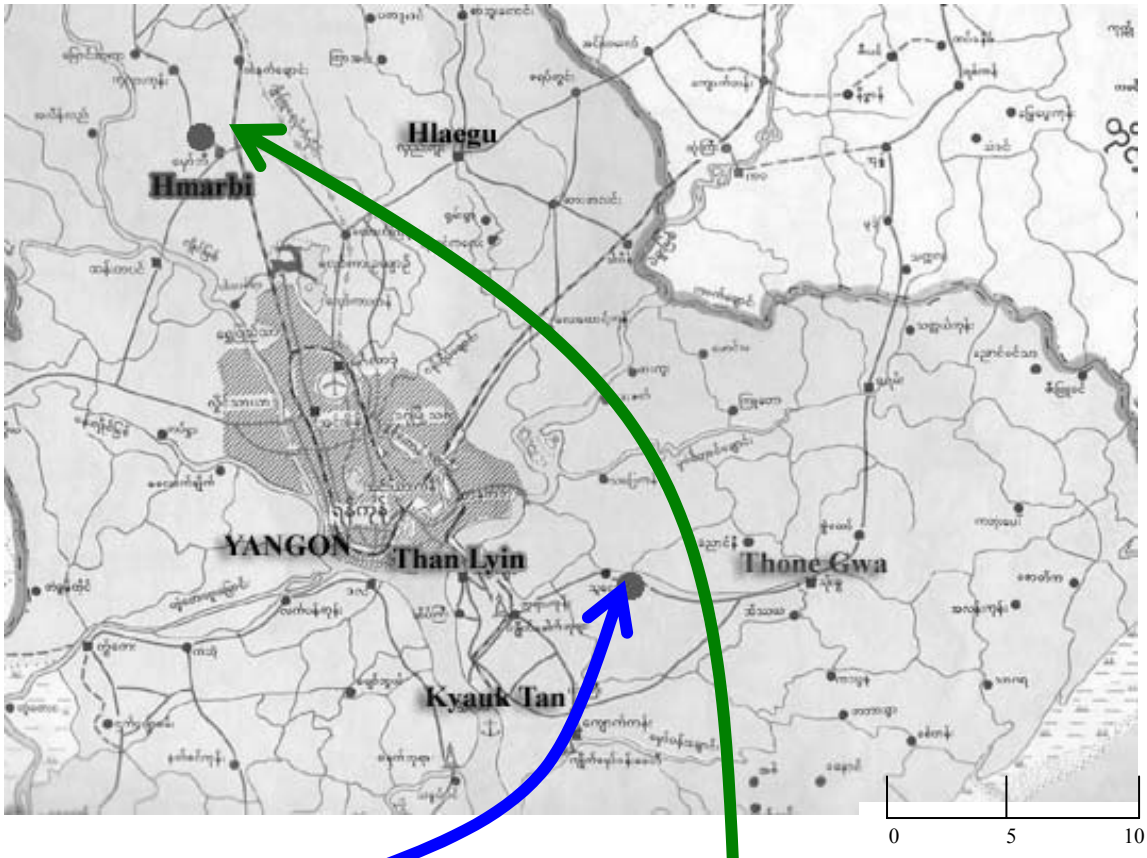
Operators Cost	540,000
Gasifier Maintenance	39,540
Engine Maintenance	429,400
TOTAL Expense/year	1,008,940

TOTAL Net Income /Year from Operation	767,060
Rice Mill Oil Compensation*	720,000
TOTAL Contribution for Capital cost for 3 years	4,461,180

Half of the diesel oil cost for milling power
0.9gal/h x 8h x 800 Kyat/gal x 25 day/month x 10month
=1,440,000 Kyat

There may be another way of cost recovery from the rice mill, that is, both capital costs and O&M costs will be shared between the night time users and the rice mill in proportion to the usage of hours (or kWh consumed) like 5 hour for lighting versus 10 hr for rice milling. If there is a large difference between the nighttime load and daytime load, the cost sharing needs adjustment for the capital costs share by the capacity actually needed.

The consensus among the village is not consolidated. The another key for implementation is to increase the households of the beneficiary who are still doubtful about the electrification in this village.



Village	Kayin Seik	Banbwe Kone (Village Tract)
Township	Than Lyin	Hmawbi
Accessibility	10 miles from Than Lyin 15 miles from center of Yangon	Along Pay Road 18 miles from center of Yangon
Household	277	527
Population	1524	2472
Electrification	0%	Grid comes to only pagoda and monastery
Rice husk production	3 Rice mills 15 ton/day x 1, 10 ton/day x 2 Total 700 baskets/day	7 Rice mills, 2.5 ton/day each. Total 350 baskets/ day Needs collection.
Price of Rice Husk per 1 basket	5 Kyats, low season 13 Kyats, High Season	15 Kyats
Public Institution	2 Primary and 1 middle schools 1 Clinic	Details unknown
Industry	1 BCS 2 Shoe house, 7 Tailor 1 Stone Grinder	2 Saw mills. One produces saw dust at 600 baskets/month. 1 Spirit industry
VEC	Established in 1995	Once applied to MEPE
ks	60 households are apart from village center, which distribution lines hard to be reached. Thus, solar BCS would be preferred for them..	Concrete pole for distribution lines would be preferable for the future electrification by Grid.

(Ref. Oct-1.2001, 1$=680Kyats)

Memo on Interviews / Field Surveys

Subject	**10. Village Interview at Pyin Ma Kan, Ton Gwa Tsp.**		
Date	Dec 7 2001	Prepared by	Y.Nakagawa
Attendants (JICA ST Side)	A.Katayama Y.Nakagawa	Attendants (Myanmar Side)	U Aung Myint (REAM) Ma Shwe Syn
Ref. No.		Note	

Pyin Ma Kan is located 4 miles from the high way road from Yangon to Tongwa Tsp. The details are as follows;

Household	400	According to VPDC, the number of families is 795. It is said more than 800.
Population	About 4000	
Nos. of rice mill	4	one 15ton/day and three small size mill
Price of rice husk	10 Kyat/basket	
Public facility	3 schools	Up to ten graders
Industry	4 rice mills	
	Brick making	Only in summer time
Commerce	1 Kalaoke	50 Kyat per 1 song
	1 shop	There are also many small shops.
	16 in-house tailors	
Transportation	Boat for Kyauk Tan	Once a day
Contact	247006 (Phone)	

A meeting was held at a monastery with two monks and VPDC chairman.

- Electrification from MEPE Grid planned to apply three years ago but failed because of the supply deficit of MEPE electricity.
- They have a footpath connection between the village and highway and paved road by brick for walking in the village. Those are constructed under the order of VPDC with the workforce of villagers. There is a organization of 10 households as one group with one leader elected in each group. The activity of the group is held in special events such as festival and donation. This situation seems to be an advantage for the public activity such as electrification.
- The access road is difficult for cars to arrive to the center of the village especially in the rainy reason.

- There are four diesel engines for electricity and they provide 200 households at the charge of 700 Kyat. The business is not doing well because of high price of diesel oil. The price of fuel is at 850 Kyat/gal, total consumption is 400,000 to 500,000 Kyat per year. One 60 hp-7.5kW diesel engine now stopped because of the increasing fuel cost. One barrel (= 34.3 gal) of diesel oil was 6,000 Kyat six years ago.
- Regular boat transportation is available for Kyauk Tan once a day. It is also possible to go directly to Yangon.
- Rice husk is already consumed as cooking fuel at the price of 10 Kyat per basket. There is no forest for firewood as alternative of cooking fuels in this village. There is 15 ton/day capacity of rice mill but the situation is that they have the rice paddy for their personal consumption milled in outside of the village. They can mill the paddy in the village if necessary. In addition, they can purchase rice husk from Thai Tu Kan, which is located 6 miles from that village. It has 50 ton/day capacity of rice mill.
- The village owns 735 acres of paddy field.
- Average household saving per year is 50,000 Kyat.

Pyin Ma Kan seems to have a good motivation and funding capacity for rice husk electrification. Since the road condition is not convenient for the Model Village however, it is suggested that Pyin Ma Kan is the candidate that is electrified by RE Fund in the coming year.

Fig.1 View of Pyin MaKan Village with a Paved Foot Road

Fig.2 Meeting with Monks and PDC Chairman at a Monastery

Fig.3 A Diesel Engine and Generator Which is Not Used at Present Due to Increase of the Oil Cost

Fig.4 A Boat Transportation to Kyauk Than

Memo on Interviews / Field Surveys

Subject	**11. Interview in Yone tha lin village**		
Date	Dec 8, 2001	Prepared by	Y.Nakagawa
Attendants (JICA ST Side)	A.Katayama Y.Nakagawa	Attendants (Myanmar Side)	U Aung Myint (REAM) Ma Shwe Syn
		Kayin Seik Villegers	U Sein Tun (Chairman of VEC), U Sein Myint (Rice mill owner), U Than Win, U Tun Hla
Ref. No.		File Name	Yonethalin011208

Investigation and Interview in Yone tha lin Village, Ayeyarwaddy Division

4 members of Kayin Seik VEC participated in the investigation of Yone tha lin, where the electrification by rice husk gas engine is performed at the order of area commander.
The basic data of Yone tha lin is shown below;

Location	Hinthada Tsp., Ayeyarwaddi Division	
Household	1100	
Population		
Commerce	One fruit powdering manufacture	
Industry	None	
Monthly payment for the work of the rice husk gas engine	Operator	9,000 Kyat/month
	Distribution line coordinator	8,000 Kyat/month
Tariff for home electronic devises	20 W fluorescent light	15 Kyat/day
	40 W fluorescent light	20 Kyat/day
	TV	30 Kyat/day
	5W Neon for home shrine	Free
Tariff for commercial electronic devises	Karaoke	150 Kyat/day
	Video shop	200 Kyat/day
	BCS	250 Kyat/day

- The rice husk gas engine, the capacity of 140 HP-135kVA, installed in April 2001.
- The consumption of husk is 15 to 20 baskets per hour. They operate the engine 5 hours from 5:15 p.m. to 10:30 p.m., which is flexible dependent on a season. Electricity for State high school is provided at free of charge, three days a week.

- There are six private rice mills powered by diesel engine and rice husk is collected at free. It is distributed at the cost of 9 Kyat per 1.5 basket in Yone tha lin and sold at 12 Kyat in Yangon.
- 250 acres of paddy field belongs to villagers, out of 1200 acres which is owned by outside villagers.
- The system belongs to the area Commander. Tariff is collected regularly per ten days and subjected to the commander. Kayin seik villager said they would be in good condition than Yone tha lin people when VEC manages the tariff correction.
- Capital cost for the rice husk gas engine was 9,600,000 Kyat. 5,800,000 Kyat was for engine and generator, and 3,800,000 Kyat was for the distribution lines. Fund for the repayment was collected from 500 Kyat up to 40,000 Kyat according to the financial condition of each house. The starter engine was a donation from the operator, which would cost 150,000 Kyat. Simple interest, 2% of the capital cost per month, is applied. The schedule for the installment was late for one week and the difference of capital cost was not negligible due to inflation in their case.
- A part of the cogwheel had been damaged and need to have repaired in Yangon three days ago. It recovered in the next day.
- Ash is collected at free of charge and provided farmers as fertilizer. Ash is also used as the material of repairing roads here.
- There is no particular business other than Kalaoke, video shop, BCS, or small shops in Yone tha lin.

Samples below were collected for analysis possibly held in the future.

- rice husk
- rice husk ash
- water containing the ash from an ash drain
- water contai
- ning tar from a cyclone
- tar from secondary tower
- tar from primary filter

Fig.1 A Building of Rice Husk Gas Engine and Poles for Distribution Lines.

Fig.2 Mixing Husks for the Ignition of the Engine

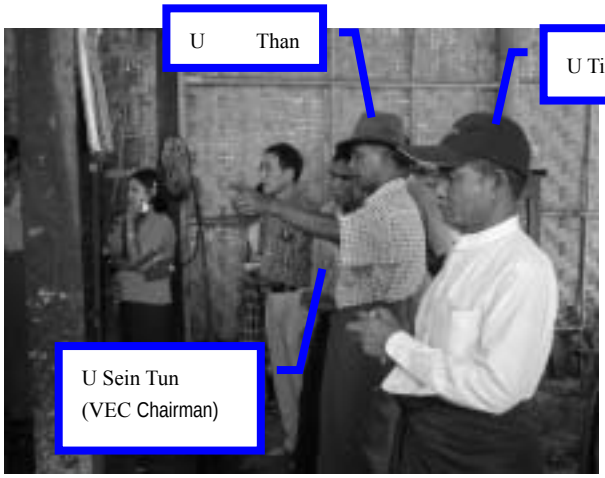


Fig.3 Kayin Seik Villagers Interviewing to Rice Husk Gas Engine Operator

Fig.4 Rice Mill Owner in Kayin Seik Checking the Gasifier.

Fig.5 Children Who Carried Bags of Rice Husk from Rice Mill

Fig.6 Rice Husk Storage

Memo on Interviews / Field Surveys

Subject	**12. Interview at Sa Ma Lauk Village**		
Date	Dec 10, 2001	Prepared by	Y.Nakagawa
Attendants (JICA ST Side)	A.Katayama Y.Nakagawa	Attendants (Myanmar Side)	U Aung Myint (REAM) Ma Shwe Syn
Ref. No.		Note	

Sar Ma Lauk means “not having enough salt for preservation of fish”, as it has plenty amount of snake fish production. Sar Ma Lauk village is located beside the road of Yangon-Pathein High Way in Nyaundon township at the border of Ayeyawaddi Division and Yangon Division. They already have installed a rice husk gas engine for the power of a rice mill and an ice mill. They intend to utilize the rice husk gas engine to the village electrification.

The existing rice husk gas engine and inside of the village are investigated with the owner of the mill, and discussion was held about the electrification with MEPE township engineer at MEPE Nyaundon office and with VPDC Chairman. at village restaurant owned by him.

The location map is shown below;

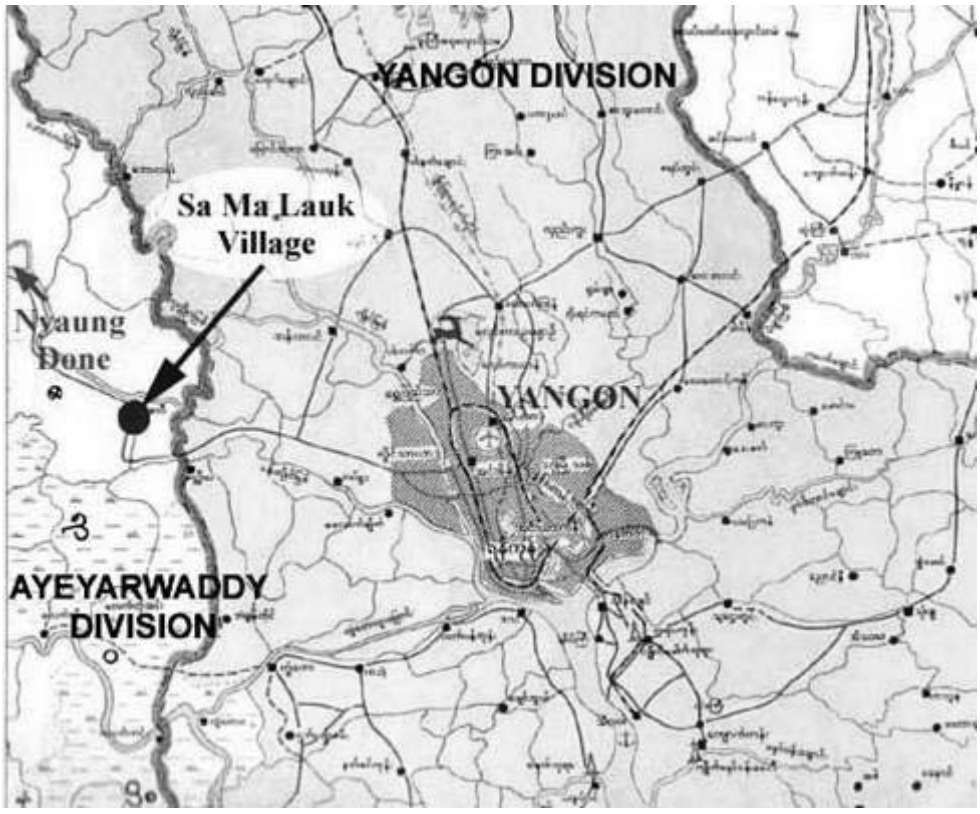
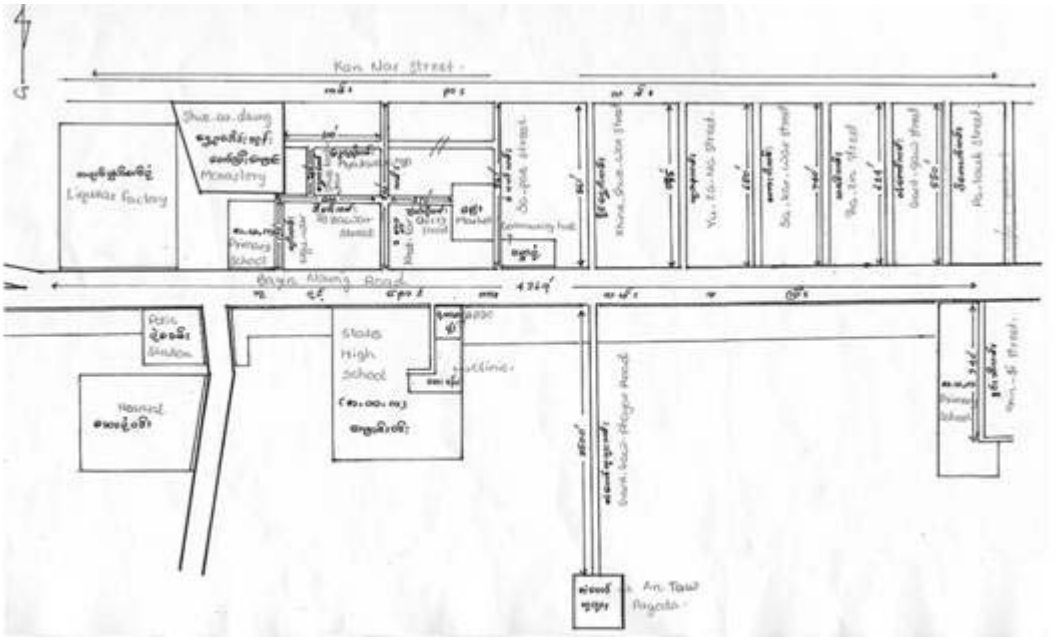


Fig.1 Location Map of Sa Ma Lauk



Basic Data of Sar Ma Lauk Village

Fig.2 Village Figure of Sa Ma Lauk

Household	About 800	
Population	About 4,000	
Industry	1 ice plant Rice mills 1 oil mill 1 liquor industry Banana industry	 25 ton/day :2, 1.5 ton/day :4
Public facility	Hospital 3 primary schools 4 monasteries VPDC office Community Center Police Station Library	Aided by Korean Embassy
Commerce	Fishery Many restaurants Machine workshop for boats and cars 4 BCS's	
Contact	Phone:045-21643 "Myanmar Restaurant", Yangon-Pathein High Way Rd., ma-qu-pin junction, Sar ma lauk village, Nyaung Done Tsp.	U Tun Thein, a member of VPDC

<Rice Husk Gas Engine>

- Rice husk gas engine is used to power a rice mill, an ice mill, and water pomp. Total capital cost was 1,800,000 Kyat. The owner is U Win Myint. The system was installed in March 2001, the period for installment was 1 week.
- 15 operators are working at the mills under the payment of 30,000 Kyat per day when they process 500 basket.
- They also have a small rice mill that is powered from 25-hp-diesel engine when the amount of milling is small such as 5 to 10 baskets.
- When the amount of the paddy is more than 20, they use rice husk gas engine. 500 basket of paddy can be processed per day by the rice husk gas engine. The milling capacity is 25 ton/day, powered by 100-hp engine. It is operated at 12 hours per day and is possible to work at 24 hours/day. 1.5 bottle (=1/4 gal) of diesel oil is used for starting engine.
- The cyclone is cleaned once a week, the cleaning window for the cyclone and primary filter is at once a day. The secondary filter is cleaned at every two days.
- They used 1.5 gal/h of diesel oil at 950 Kyat/gal before the introduction of rice husk gas engine to process 8-10 basket of rice paddy.
- The price for milling had reduced from 80 Kyat/basket to 40 Kyat/basket while other rice mill charges 60-100 Kyat per basket.
- The husk is sold at 10 Kyat per basket to a liquor factory in an industrial zone near the village. The cost of transportation is at 20,000 Kyat per one track.
- Ash is produced at half amount of input of the rice husk. It is used as a fertilizer in a rainy season, and is thrown away to a river in other seasons.
- Ice is produced for the reservation of fish. Ice candy is sold at 2.5 to 10 Kyat per each. Income of the ice mill is 7000 Kyat/day. Ice mill is operated eight months per year. The initial capital cost for ice mill was 500,000 Kyat.

<Public facilities>

- VEC has not formed yet but some group exists under VPDC. They are supposed to take a role of VEC.
- A hospital is already electrified by MEPE Grid. A high school is also planned to be electrified in Nov 2000, but the plan was terminated due to the cost of distribution line which was charged 3,000,000 Kyat to villagers.

<Industries and Commerce>

- A BCS charges 100 Kyat for a 12 V battery, 50 Kyat for 8V battery. Its capacity is 20 batteries per day for 12 V and 8 V respectively. They consume 2 gal/day of diesel oil at 8-900 Kyat/gal at present.
- Dried snake head fish is sold at 2300 Kyat per viss.
- A liquor factory applied for MEPE electricity but it has not come true at present.

<Life of Villagers>

- They spend 1,500 Kyat to 2,000 Kyat for the lighting per month. A family who has two 8 W fluorescent lights spends 1,000 Kyat per month.
- Charcoal is used for cooking fuel at 600 Kyat/bag and one bag is consumed in one month.
- Some are using rice husk for cooking fuel at 10 Kyat per basket.
- According to housewife, lighting is more expensive than cooking fuel.
- The average income for 10-acre landowner is 400,000 to 500,000 Kyat.

Fig.1 Rice Mill Engine Powered with Husk Gas

Fig.2 Tower, Filter, and Belt Connecting the Engine and Mill

Fig.3 Heat Exchanger of Ice Mill

Fig. 4 Ice Candy Seller

Fig.5 Drying the Snake Head Fish

Fig.6 Meeting with VPDC and MEPE Township Engineer at Sar Ma Lahk