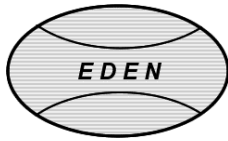


MICRO HYDRO ELECTRICAL POWER GENERATOR

LPM – SDA EDEN

LEMBAGA PENGAJIAN DAN MANAJEMEN

SUMBER DAYA ALAM EDEN



**Institute of Research and Management
Natural Energy Resources “ Eden ”
Kupang – East Nusa Tenggara**

Lalamentik Street, Oepoi Kupang - East Nusa Tenggara

Phone: (0380) 820275

Hand Phone: 08124662547

E-Mail: odh_eden@yahoo.com

URL: www.geocities.com/lpmeden

PROJECT PROPOSAL

MICRO HYDRO ELECTRICAL POWER GENERATOR

IN EAST NUSA TENGGARA PROVINCE

● **Contents:** General information's MHEPG Locations, Total Cost Estimation for Construction

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Mulawatu – Detupera



1. GENERAL INFORMATION

Province	: East Nusa Tenggara
Regency	: Ende
District	: Lio Timur (Wolowaru)
Village	: Detupera
Site / Sub-village	: Mulawatu
River	: Lowolise
Gross Head	: 30m
Estimate Design Discharge:	120 l/s
Hydraulic Potential Power	: 35.32 kW
Estimate Electrical Power	: 19.07 kW

2. SITE DESCRIPTION

2.1. Location

Mulawatu sub-villages is one of the potential site for a Micro Hydropower (MHP) implementation. Mulawatu Sub-villages is a part of Detupera, Lio Timur (Wolowaru) district, Ende regency, East Nusa Tenggara province. It is located geographically at S 08⁰ 45 18" and E 121⁰ 56 15". Mulawatu village north border is Bu Utara village, Wolosambi village at the southern side, Wololelea village at the western side and Bu Selatan village at the eastern side.

2.3. Topographic and Geological Condition

The MHP scheme will use water from Lowolise River. The river located on the South of Mulawatu sub-villages. From the MHP scheme (power house location) the river goes to the north direction. Topographic conditions along the river are moderate slope, while the soil condition in waterway is loose. And the materials around the river are gravel and loose soil. There is a separate channel (waterway) in the middle part of head race, and also a splitted

Table 1.
Route of Access Line

Route	Distance	Duration	Available Transportation	Layer (road) Type
Ende – Watuneso	90.5 km	180 minutes	Bus	Asphalt
Watuneso – Detupera	6 km	20 minutes	Bus	Asphalt, Grave
Detupera - Mulawatu (MHP scheme location)	1 km	10 minutes	-	Grave

2.2. Accessibility

Mulawatu sub-villages located about 97.5 km to the south east of Ende, Ende regency, East Nusa Tenggara province. The location could be reach by four wheel vehicle such Kijang or motorcycle for about 4 hour from Ende, or by a public transportation (buses, rented car) which service route among Ende and Wewaria - Mulawatu village. From Mulawatu, Mulawatu the MHP scheme location (power house) could be reached by walk in \pm 10 minutes. (see Table 1.)

stream on the intake scheme (it is recommended to make a further measurement here, to adapts this condition).

3. SOCIO – ECONOMIC CONDITION

Village settlements in Mulawatu village are spread not concentrated. There is an adequate distance between every small group from one to another. Almost the villagers are farmers. Their main crops are coffee, chocolate. They still cultivate their land in traditional way, without any modern agriculture know-how.

According to the agriculture potential in the area, Mulawatu sub-village is quite prospective to develop further. There are existing public facilities such as elementary school, church, public health center, and village government office. There are also community organization such as LKMD, Farmer groups, and religious groups.

4. POTENTIAL ENERGY SOURCES AND ELECTRIFICATION CONDITION =====

The villages around MHP scheme has not been electrified and will not get electricity from PLN grid, at least in the recent PLN plan. The nearest PLN electricity grid is about 7 km. Existing main energy sources for villagers there are kerosene, and oil for lighting.

The village around MHP scheme economically has many potential, especially in agriculture, horticulture, and forestry sectors. However, related production facilities are still insufficient, there are some possibilities such as; sawmill, rice mill, and coffee grinding. MHP development is expected giving valuable support to increase community economics quality apart from lighting need.

The numbers of household that will electrify by MHP scheme at Mulawatu village are ±138 household. Based on empiric data of electrification project using MHP, the estimate electricity need or electrical power need assumption is about 100 watt per house. Including the electricity need to several public facilities, than total MHP Capacity expected for Mulawatu villages is about 19.57 kW.



Table 2.
Sub-Villages which will electrified by the MHP Scheme

Sub-Village	Village	Number of Household	Latitude Line	Longitude Line
Mulawatu	Detupera	43	8 ⁰ 45' 25"	121 ⁰ 56' 15"
Wolonio	Detupera	37	8 ⁰ 44' 50"	121 ⁰ 56' 30"
Deturao	Detupera	24	8 ⁰ 45' 40"	121 ⁰ 56' 15"
Aemalu	Detupera	34	8 ⁰ 45' 50"	121 ⁰ 56' 40"
Total		138		

**Table 3.
Estimate Energy Demand in the Catchment Area**

Item	Amount	Capacity per Unit	Capacity	Remark
Households	138	100 W	13,8 kW	-
School	1	100 W	0,1 kW	Elementary School
Church	2	150 W	0,3 kW	
Public Health Center	1	100 W	0,1 kW	
Village Office	1	100 W	0,1 kW	Meeting Facility
Public Facility (Streed Lighting)				
Total			14,4 kW	

5. HYDRO – POWER POTENTIAL

According to topographic measurement, water from Lowolise River will be flow through intake and had 300 m headrace. For this MHP scheme, measured gross head is about 30 m and estimate penstock length is about 130 m. Detail penstock profile is shown.

Estimate minimum power electricity need in Mulawatu village and it is surrounding is about 19.57 kW. To fulfill this requirement, the future MHP discharge have to be about 120 l/s with the estimate net head 27 m, with this calculation the MHP scheme could generate electricity power about 19,07 kW and still have reserved power about 3,72 kW (see detail calculation at Table 4.).

Lowolise River is \pm 200 liter/second. Recorded discharge data or annual discharge are not available and discharge measurement done not in the driest month, therefore maximum discharge in the dry season estimate about 120 l/s.

However, design discharge has to be determined in detail and more accurate, considering all factor, and catchment area when a further feasibility study for this MHP done.

6. TRANSMISSION LINE

The village settlement surrounding the MHP scheme is spread and in small group which have significant distance from each other. Main transmission line to house sub-villages is about 4 km length.

Table 4.
Estimate Power Capacity of The MHP Scheme

Item	Symbol	Amount
Estimate Gross Head	Hg	30 m
Measured Discharge (when survey)	Qm	200.00 l/s
Design Discharge (max 60 % frm Qm)	Qd	120.00 l/s
Hydrolic Power Potential	Ph	35.32 kW
Estmate Net Head	Hnet	27 m
Estimate Turbine Efficiency	η_T	0.6
Estimate Generator Efficiency	η_G	0.85
Estimate mechanical transmission line efficiency	η_M	0.97
Estimate Electrical Power Generated at the power house	P _{el1}	19.07 kW
Estimate transmission Losses	P _{loss}	0.95 kW
Estmate Electrical Power delivered to the village	P _{el2}	18.12 kW
Expected MHP Capacity (refers table 3)	P _{exp}	14.40 kW
Reserved Power (Pel2 - Pel1)	P _{res}	3.72 kW