

**DECENTRALIZED GREEN  
ENERGY DEVELOPMENT  
PROJECT**



**KAM KA'ANI KI'TAP**

**INSTITUTE OF NATURAL  
RESOURCES MEGHALAYA BASIN  
DEVELOPMENT AUTHORITY**



# KAM KA'ANI KI'TAP

## DECENTRALIZED GREEN ENERGY DEVELOPMENT PROJECT

### 1. PICO HYDROPOWER:

Hydro Power (Chioniko bikotgipa bijolini bilara) chiring-chisik ba chibimarangko tange aro naljoke rakkian baksa mandeni janggi tanganio bang-bea namgnirang gnan. Meghalaya-o mikkangchi chioniko bijoli bikotna amani cholrang bang-en donga. Meghalaya a-doko a-song gimiko chioniko bikotgipa bijoli chu-gimikoni 3 per cent mangni gita chong-motan 3000 MW bilko watna man-pile chioniko bijoli bikotna ama. Ia bijolini bilko bikotna amaniara Meghalaya-o bijoliko chu-ongge watna aro namdatna gita man-gen aro iako Meghalaya-o songdonggipa manderangan a-bachengatna gita man-gen. MBDA-ni ning-ao ga-akgipa Meghalaya Institute of Natural Resource (MINR, Nagaland Empowerment of People through Energy Development (NEPED) baksa nangrime iandakgipa project ge-sako Mawlyngbna-o a-bachengate on-aha (ua Pico turbine-ko Hydroger (chioniko bikotgipa bijoli) jean 1 kW bilko on-a man-gipa ineba agana) 1 kW bijolini bilara 200 LED (5 W) bulb-rangko ching-atna ama. Nokdang ge-sao light bulb rong 4-ko jakkalna man-ode, ua songni nokking 50-nade bijoliko chu-onga gitan so-e jakkalna man-skagen.

Uandake a-doktango bijoliko bikote jakkalna amaniara chukala gadangona tang-doani chin ong-a aro namdap-sildapani ja-pangba ong-pilskaa. Bijolini bil mongsongbate chonchonggipa chioniko bikotgipa bijoliara changni chang jakkaltaitaina man-gipa, economic-ni gita nitoatgipa, jabol ba wal-ku ong-atgijagipa aro samtangtango ong-telaigiparangko nosto ka-gijagipa bil ong-a. Uarangna agreba, chonggipa chioniko bikotgipa bijolini bil (Small Hydro Power)-ara samtangtangko chi pripatgijagipa aro ru-utgija bilsirangnasan challaienggipa ong-taia. Uandakgipa SHP-ni namgniko da-ororo chu-onga gitan ra-chakangaha. Ia project-ko nangnikaniara SHP-ni namgni aro a-doko donggipa gamjin chong-motan chiring-chisik aro chibimarangko jakkalna mangsonganiosa ong-baskaaha.

#### **Bang-gija bijolini bilko on-a amgipa hydro power-ni dingtang dingtang rokkomrang:**

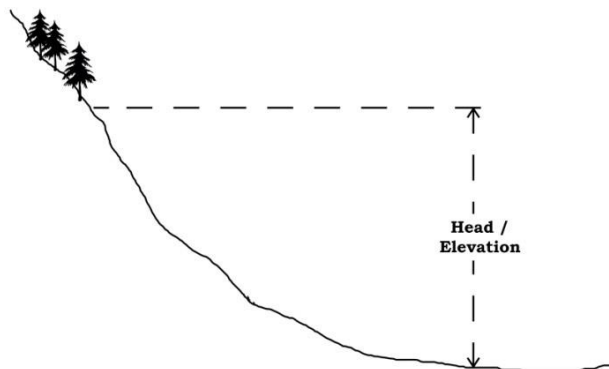
Hydro Category	Power Range
Pico	0 kW – 5 kW
Micro	5 kW – 100 kW

Jedakgipa chioniko bijoli bikotgipa (hydro power) project-rangko ra-bae a-bachengatna skang, jeo bijoli bikotna manchiengachim ua biapona re-ange iako dakna man-genma man-jawa ine niechengna nanga.

Project-ko ra-bana ama amgijanio, skanggipa aro mongsongbatgipa minggni ja-pangrangara, (flow ba discharge) jokonangenggipa chi badita dal-a aro (head) chong-motan chiara badita tu-e ga-akonangengachim uarangko nichengna nanga. Mongsongbate, generator-ni bangkako wilwilatna gita jokonangenggipa chioniko baditana kingking bang-e ra-rikna ba salrikna man-gen aro uko salrikgimin chiara generator-ona baditana kingking tu-e ga-akonengani gimin bilakgen uarangko nichengna nanga. Chiring-dare ba chibimaoni chiko baditana kingking bang-e ra-chimonge generator-ona jokonatna gita ama, ugitan bijolini bilkoba bang-bate bikote on-a man-skaa. Pico ba Micro Hydro Power project-na ku-atgimino janapani gitade generator-ona ga-akonangenggipa chidareni tu-a komibeoba meter 10 aro ra-chimonge generator-ona jokonatenggipaoni chi komibeoba second-prako liter 20 gapna nanggen. Iarangko dakna nangchongmotani ortoara komibeoba 1kW bijolini bilko bikote on-a gita man-skagen.

## Head

Chi ga-akonchakramba (Head)-koGPS, Altimeter ba gipin altugipa ostrorangko jakkale toe nina man-gen.



## Discharge

Chiringni chiko ra-chimonge jokonatenggipa baditana ta-rake jokata uni bil ba velocity (**v** – somoi-prako badita ta-rake jokanga, jekai meter/second) tu-ako ga-akonatna badita somoi ra-a ba depth (**h** - tong-prakni bakroa) somoini apalani ba width (**w chini apbala – tongprakni bakroa**). (Minggittamni bakroako toani apsan ong-na nanggen)

Chiringoniko ra-chimonge watonatgipako toanio adita ostrorangko nanga:

- Somoini ta-rakako nirikani/mobile phone stopwatch app
- Bakroako toe niani/measuring tape
- Balboaigipa bosturang (Thermocol /chu-gimik a-ta bottle/ robol/go-ol/ bite. etc)

### **Discharge (Chi jokangako) hisap ka-e niani chol (Method):**

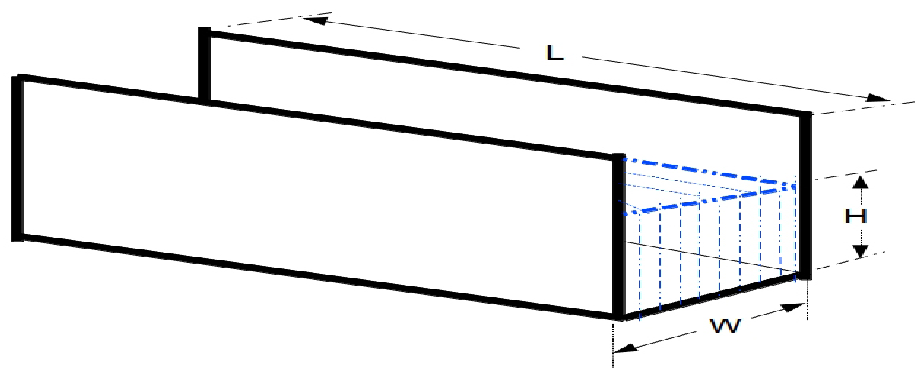
Chiringoni chiko ra-chimonge watonatenggipako hisap ka-rikna gita minggni cholrang gngang, jean, chiring dal-a-chonani kri ong-skagen.

#### **a. Skanggipa chi ka-sine jokako dakmesokate nichengna:**

Chiring ka-sinmachae ba onbeaoni jokgenchimode, balti (bucket) ba gipin chi ra-chakani bostu, jeon badita bang-e chaka uko ma-sigenchimode uandagipa ostroranko jakkale, baditana ta-rake joka uko toe nina gita man-gen: Mesokna gita, litre 20 chakgipa baltio chi gapatna second 5 nangode, Chiara second-prako litre 4 ba (20/5) jokonangenga ine ma-sina gita man-a.

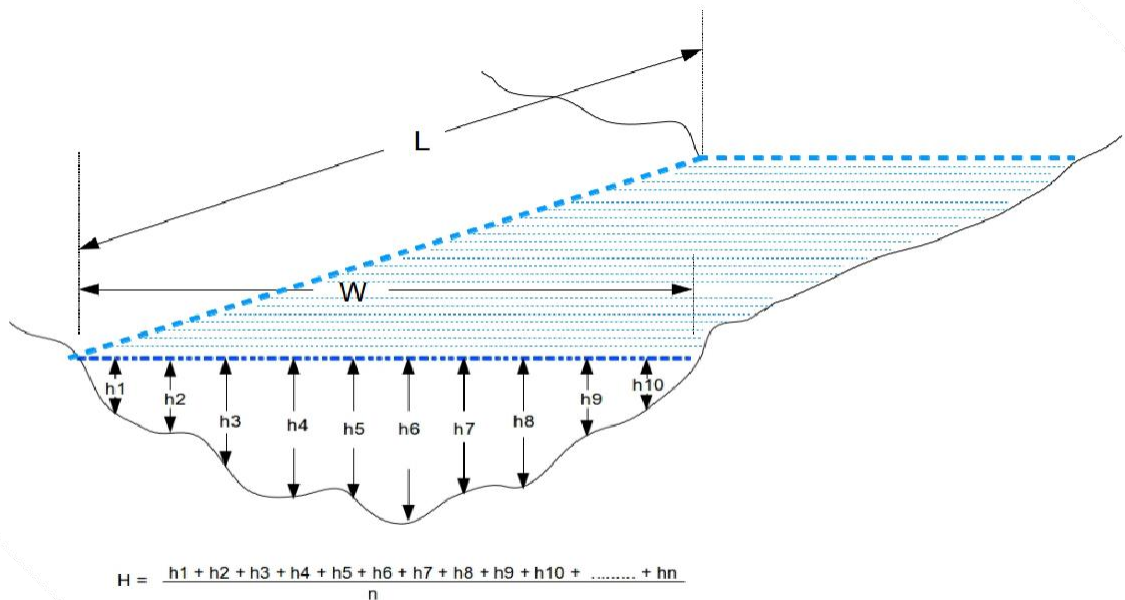
#### **b. Indiba, chiring kraa gitan ta-rake jokgenchimode, ka-mao on-sogiminko ja-rike hisap ka-e nina gita man-skagen:**

- Chiring kraa gita ta-rakkale, sronge aro chini apala apsandake jokonangna a-bachenggipa biapko basee ra-bo (siltong gita chi jokangenggipani ta-raka apsanaigenchimode uan hisap ka-na gita altubata) maina chiring joka ta-rakanio bang-a dingtangrikani gngang, chi wario ka-sina, jokonangenggipao kraa gita ta-rakkala, chiring dareo ta-rakbata, chi jokangenggipa biap ga-nanga ga-nanggijani krisan ong-aia. Basakobade, samsi, bol-wa-arang aro rong-grimrang aro uandagipa biaprangode chi jokanirang ka-sinbata. Iako hisap ka-e niani miksonganiara badia biapo chiring kraa gita ta-rake joka uandagipakosa base ra-na gita nanga. Chiring jokgipao ro-ong, boltong aro uandagiparang champengna nangjawa. Chiring ku-chot samgnion indakgipa chijolko man-genchimode, uan altugipa aro mande niktengra nambatgipa chol ong-skagen. Uan pangnan naljokani ine gisik ra-na nanga!
- Chiring kosakchiko a-bachenge siltong ku-choto chin dake donbo
- Chiring ka-machikoba siltong ku-choto chin donskabo.
- Kosak aro ka-magipa ku-choto dongimin chirangona bakroa (**L**)-ko toe niskabo.
- Chiringni apala ba width (**w**)-ko see ra-kibo
- Da-o apsan ta-rake chiring jokonangenggipani tu-ako (depth) toe niskabo (**h**). Uandake adita chel-grike toktok dake chiring onchokangengani tu-ako  $h_2, h_3, h_4, \dots, h_{n-1}$  dake toenba serike ra-skabo.
- Gimikko ra-dime tokprako badita tu-a uko ma-sie ra-na gita kosako toktok dake toe ra-giminko chandime badita tong dongachim una sualskabo. Jekai, (serikani gita changdok donggenchimode):  $0.5 + 0.4 + 0.3 + 0.4 + 0.5 + 0.7 = 2.8$  aro  $2.8 \div 6 = 0.46$  meter. Da-o an-ching chiring jokonanggipa baditana tu-a ba depth (**h**) uko ma-siaha.
- Da-o chiring badita apala aro tu-ako  $A = w \times h$  ine ma-sina man-a. Mesokatna gita, apalani ba width miter 1 aro gimikko ra-chimonge sualgimin tu-a ba depth-ara miter 0.46 ong-genchimode, uni chu-gimik apalara  $1 \times 0.46$  meter = 0.46 meter<sup>2</sup> ong-skagen. Da-o an-ching chiringni bakroa aro apala (**A**)-ko ma-sina man-aha.



**Fig: Volume (Apalako hisapani)**

Tu-ani ba (depth) pangnan uni apala ba(width) baksa apsan ong-ako gisik ra-na nanga.



**Fig: Volume (Apalako hisapani)**

Tu-ani ba (depth) pangnan uni apala ba(width) gimik dingtangrikako gisik ra-na nanga

- Da-o balbogipa bostuko da-sio chin dakgimin siltong ku-chotoni chi kosakkalachi goate, uni balbaa ku-chot tiktakona soko baditana ta-rake balboangachim uni somoiko nirikna stopwatch-ko done nibo. Chiringni chi baditana kingking ta-rake jokonanga, uni somoiko ma-sirikna gita balbogipa bostuko siltong ku-paoni on-tisa kosakkalachi goatna nangchongmota.
- Saksa bostuni balboangako nirike, jensalo ua ka-machipakna ku-chotona sokahaon "dondipatchina" agantimna nanggen aro a-bachengaoni bon-kamaona badita somoi (t) nangako serike ra-bo
- Ia apsan kamkon changdokna kingkingba daktaitaibo aro changprakprako badita somoi (t) ra-a uarangko seriktokbo, uan dingtang dingtang somoirangko man-gnok.

- Changprakkon, L (bakroa)-kot (somoj)-na sualgrikbo aro balboangani somoiko serikbo. Mesokna gita: balboangani chel-a miter 5 aro somoiara second 10 nangode, miter  $5 \div \text{second } 10 = 0.5 \text{ meter/second}$  ong-skagen.
- Gimikko chandime sualeming ta-rakaniko ma-sie ra-na gita, changprak balboatgipani ta-raka gimikko chandime badita changna daktaitaie nia, una sualskabo. Mesokna gita (changdok balboatode):  $1.24 + 1.29 + 1.43 + 1.37 + 1.51 + 1.62 = 8.46$  aro  $8.46 \div 6 = 1.41 \text{ mete/sec}$ . Da-o an-ching chiring badita ta-rake jokako ma-siaha.
- Da-o chong-motgipako ma-siani ja-mano, ka-mao on-sogiminko ja-rike ra-chimonge jokonatenggipa chiringni ta-rakako hisapna man-a

$$\text{Discharge} = \text{Cross section area}(A) \times \text{velocity}(v)$$

**BA**

$$\text{Discharge} = \text{Chiring apala}(w) \times \text{chiring chuani average } (h) \times \text{ta-rake joka ba velocity}(v)$$

Mesokna gita:  $0.46 \text{ meter}^2$ —ara chiring ta-rakako toe nigimin,  $1.41 \text{ meter/sec}$  skara uni ta-rake jokani, aro on-sogimin jokonangenggipa chiring:

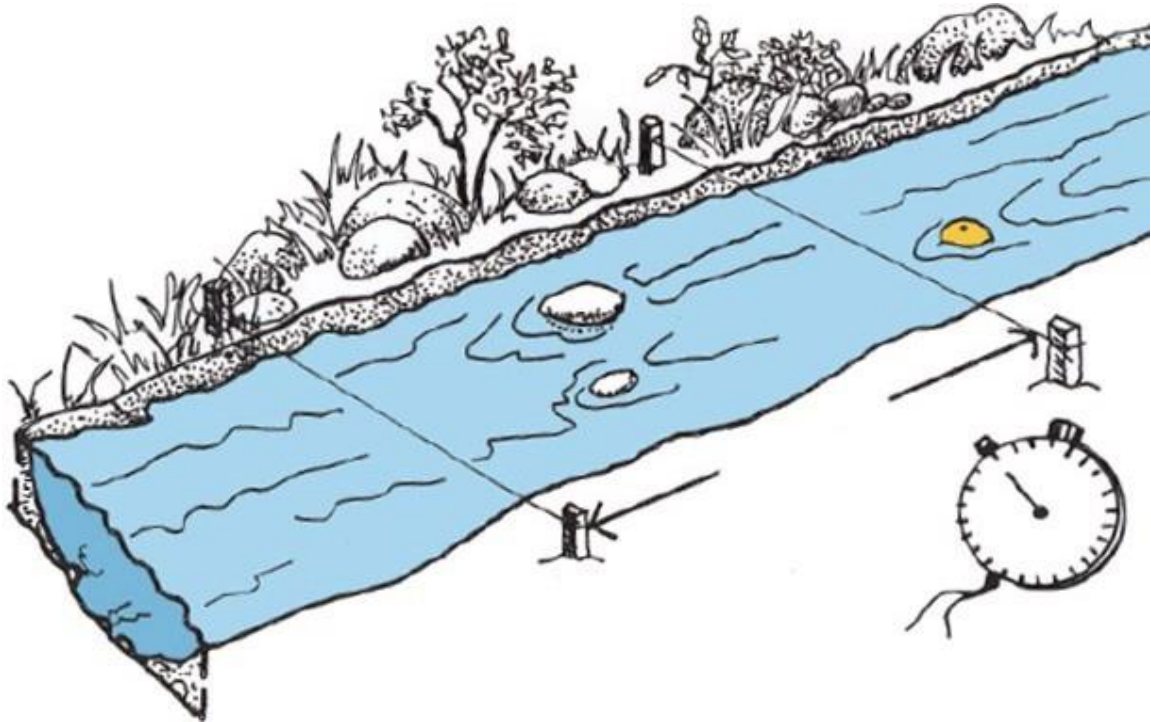
$$D = 0.46 \times 1.41 = 0.65 \text{ cubic meter/second.}$$

- Indiba nipiltaigimin (0.85)-koba chiringni dingtang dingtang ta-rake jokani kri nigrike hisapna nangskaa. Chiringara kosakgilgilde ta-rakkale joka aro siltong ba channel ka-machipakde ning-ao maiba champengani donganichi ka-sinkale jokangskaa. Unigimin da-o chimonggimin chiringni jokanio dingtanggrikako on-soskaenga.

$$\text{Discharge} = \text{Cross section area}(A) \times \text{velocity}(v) \times \text{correction factor}$$

$$D = 0.46 \times 1.41 \times 0.85 = 0.55 \text{ cubic meter/second}$$

Kosako mesokatgimin gita, siltongona chimonge watatgimin chiringni cubic meters/second-chi hisap ka-a, indiba uni tokprakko litres/second-prakona bodolatskana nanggen. Jean  $1 \text{ m}^3 / \text{sec}$  —ara  $1000 \text{ L/sec}$ -ming apsanai. Unigimin,  $0.55 \text{ m}^3 / \text{sec} = 550 \text{ L/sec}$ .



Chising jokaniara bilsa gimikde apsan ong-e dongkamja, uni a-selsa bilsigimikan jao changprak chiring jokonangenggipako toe ba hisap ka-e nijringna nanga (baditana kingking nirokjringa ugitan bijoliko name, tik ong-e on-a man-skaa), maina ian bilsigimiko sal-ja, somoi ba bilsa-karini kri chising baditana kingking ta-rake jokkama uaranko namedake ma-sie ra-na gita namen dakchakskaa.

### Power (Biljolini Bil)

Da-o ka-mao mongsonggipa on-sogiminko jakkale hisapna gisik ra-na nanggen:

$$\text{Power (Bil)} = \text{Head (Chi onchokram)} \times \text{Flow (Chising)} \times \text{Gravity (Ga-akonenggipa chi)}$$

Jedake, bijolini bil (**power**)-ko Watts-chi tona ba hisapna man-a, Chi onchakani (**head**)-ko metre-chi, Jokonenggipa chising ba (**flow/discharge**)-ko litre/second-chi, aro gravity-ni a-sel chisingni an-tangari ga-akontelaigipako metres/second<sup>2</sup>-chi hisape ba toe nina gita man-a

Gravity-ni a-sel chisingni ga-akonengani ta-raka 9.81 metres/second<sup>2</sup>mang, uan- i.e. second-prako bostuni ga-akangenggipa, uni ta-rakaniko 9.81 metres/second-ona (uni ta-raka gimik apsan apsan ong-jaskal) bariatskabo.

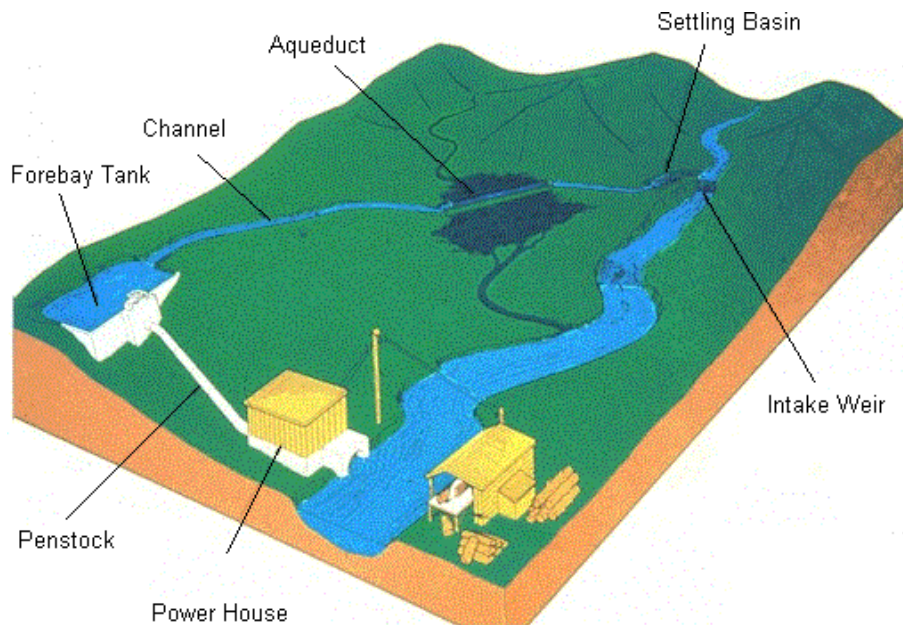
Mesokna gita: Jekai, chising second-prako litre 10, aro uni onchokramni chua ba tu-ara miter 10 ine chanchibo. Ia on-sogiminko hisap ka-e niskabo.

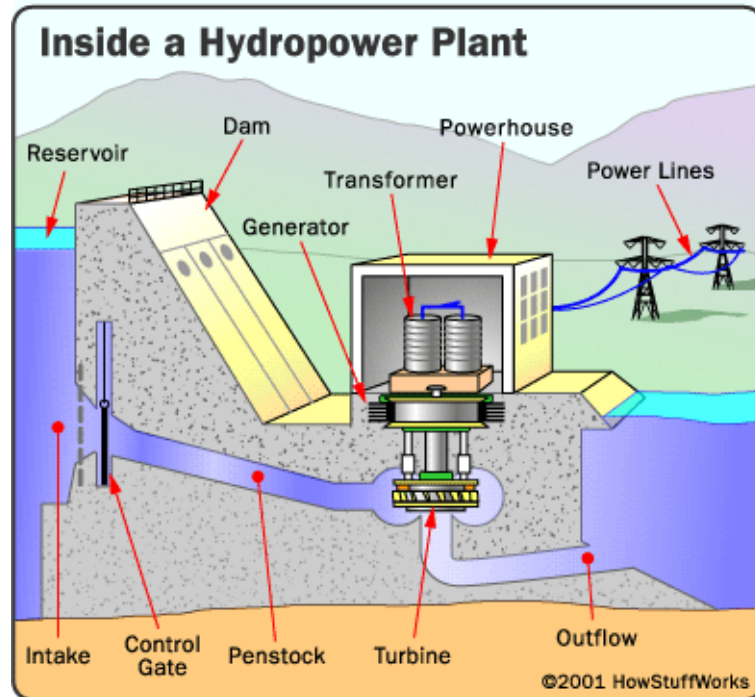


**Uan:  $10 \times 10 \times 9.81 = 981 \text{ Watts}$**

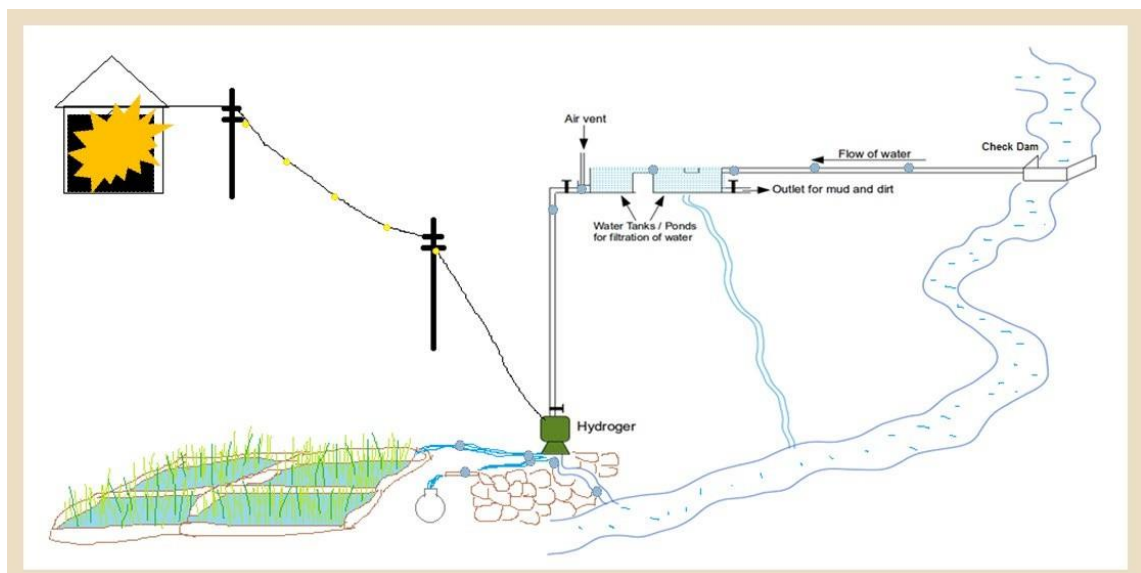
Unigimin, kosako mesokatgimin gita, Bijolini bilakara 981 Watts donga. Indiba rasong gribee, ua bil chu-gimikkode 100% ra-gopna man-skaja. Je ong-oba, Chioniko bikotgipa bijoli (**hydro power**) gipin bijoliko bikotani jekai, balwani bangka (**wind turbine**) aro salni ja-dri (**solar panels**)-rangchi bikotgipa biljolirangna bateba chu-gimik bilko jakkalna man-bata.

Chioniko bijoli bikotgipa chu-gimikoni batbeoba 70%-ni gitasan jakkalna man-gen, chong-motan *hydraulic energy*-oni 70%-kode chising jokenggipaoniko **turbine generator**gita *mechanical energy* pil-atskana man-a. Bang-ki dongrikkuenggipa 30%-de gimarika. *Mechanical energy*-oni *electrical energy* (bijoli ba electricity) pil-atani somoi 10%-de gimarikaia aro uandakegimik daka matchote jakkalna man-agipa chu-gimik 50%-oni 60% mang gitasan bijoli jakkalna man-gen inesan ka-dongsona man-a. A-bachengo mesokatgimin gita bijolini bil 981 W ong-ode, uoniko 589 W bijolini bil ba (electricity)-ko jakkalna man-gen ine ka-dongani gnan.





**Hydroger:** Chi bang-e nangja aro chiring chongipan bijoli bikote on-ani ja-pang dakna cholia. Chiringni chiko kachange chimonga aro ukon miter 10 chuaoni hydroger-ona watonata, je chian cylindrical ba pipe-ni a-kol ning-a gita jokonange turbine ba bangkako wilwilata aro bijolini bilko nokrangona watatna man-a. Chi ba (Hydro)-ni bilko generator-ni bangkako wilwilate bijoliko bikotna jakkala. Mongsongbate Bangka ba (turbine)-ni rokkomrang minggni donga, impulse aro reaction. Chonbegipa 3kW hydroger unit-chin songsana chu-onga gitan bijoli on-a man-a.



**Hydroger-ko rikako mesokatgimin**

## Manderangni bak ra-paani

Pico ba Micro Power project-o manderangni bakko ra-paaniba namen nangchongmotgipa bak ong-a, project-ni chu-sokanio namgniko man-enggipa manderangni bimchipe jak on-paaniosa ong-gen. Saksani salanti nirok-simsakani, tiktak ong-e donatani aro taridapaniba project-na nangchongmotgipa kam ong-a. Iani nokgipa ong-e aro Turbine Generator chu-gimikko challaina aro nirok-simsakna gita songni committee songna nanga. Ka-maoon-sogiminrangan Committee-ko seokani mongsongbatgipa kam ong-a.

- i. Kajina ra-gilna
- ii. Bijoliko nigrike suale watna ba (Power Distribution Methodology)
- iii. Hydro Turbine Generatorchu-gimikko challaina.

Manderangni bakko ra-paanichi uko name challaina gita man-a, jeon manderang chiring jokonangengako, chi ga-akonengako aro bijoli bikotchakram nok ba biapko nirokna man-skaa.

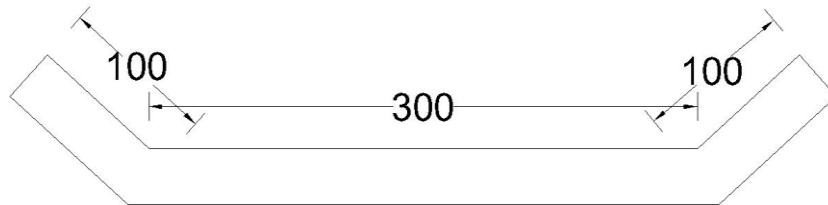
### Uiatani (Approach):

Day	Steps
1	Chiring jokonangengako ma-sie ra-na (Discharge)
	Chi onchakramko ma-sie ra-na (Head)
	Chi watonatengako uie ra-na (Penstock Area)
	Bijoli bikotchakram nokni biapko ma-sina (Identify the Power House Area)
	Pipe Line baditana bakroako ma-sina
	Light ching-atani ku-chotko ma-sina nanggen
	Badita rong light bulb-rangko dongen uko hisapna nanga
	Bijoli budu badita ro-e nanga uko ma-sie ra-na nanggen
2	Koros badita nanga uko hisape tarina nanga
3	Tariani bosturang (Equipment)-ko man-a nanggen
4	Bosturangko songona salangna nanga
5	Chi watonatchakani pipe ba (Penstock / Mini dam)-ko rikbo
6	Pipeline-ko a-ao nangchatpatbo ba a-ning gita ra-angbo
7	Bijoli bikotchakram nok ba (Power House)-ko rikbo
8	Light ba Lamp Poles-ko bijoli ching-atna gita taribo
9	Bijoli budoko sringangbo
10	Chioniko bikotgimin bijolini setup ba (Hydro-Power Setup)-ona bijoli watbo

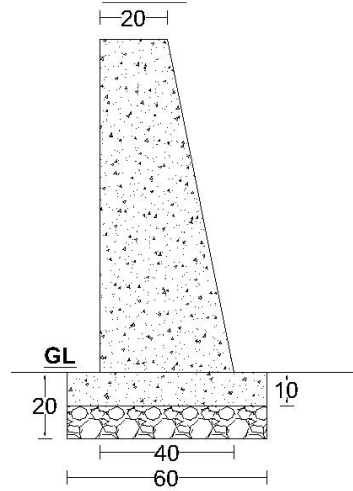


Hydroger

a. Cement-ko itta tarigipachi rikgimin pakma (dam)



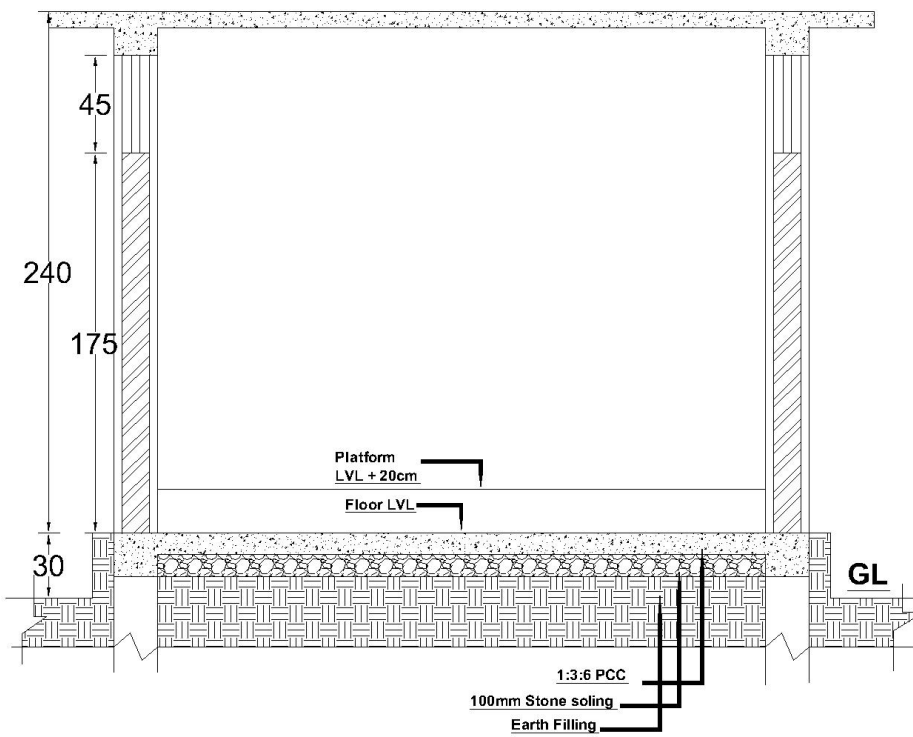
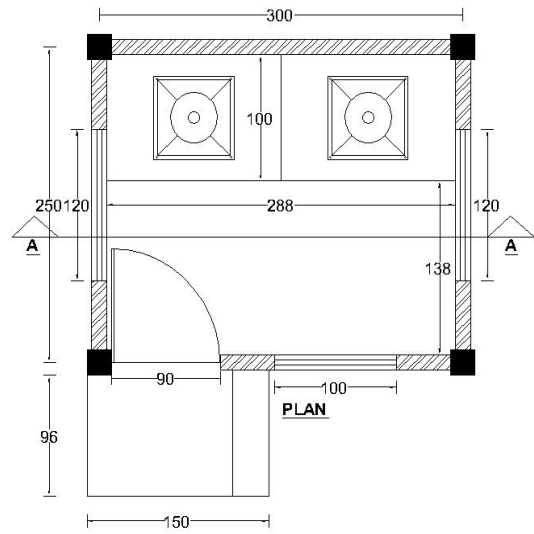
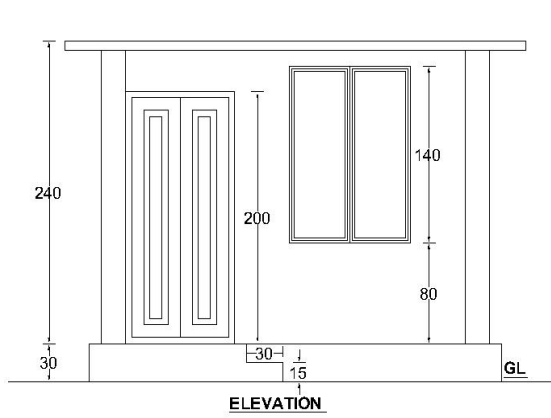
**PLAN**



**C/S ELEVATION**

b.

b. Bijoli bikotchakram nok (Power House)



**SECTION AT AA**

## 5. Bijoli Bikote watgimin

### A. Sohrarim, Laitkroh Khatarshnong, East Khasi Hills-o bijoli bikote watgimin.

MINR, MBDA staff-ni memberrang East Khasi Hills-ni Green Volunteers aro Field Engineer-rang aro VEC-ni memberrangni dakchakachi Pico Turbine-ko 15/06/2020 bilsini gisepon East Khasi Hills district, Laitkroh Khatarshnong Block-ni ning-ao ga-akgipa Sohrarimsongo a-bachengate chioniko bijoli bikote on-angaha. Pico Turbine, 3kW mang gita bijolini bilko on-a gita ama. Ua Project-ni bakrangara pipeline (penstock)-rang gimikko man-chape Sohrarim songo da-o dongenggipa dam-o pangchake rikjolaha, jeon Pico Turbine-koba bijoli bikotchakram nokningon donataha. Uko a-bachengatani miksonganide songgimikna Street Lightingko aro chi saldoe on-a gita namen dakchakani ong-beaha.



**Noksao chioniko bijoli bikote on-giminko biapko mesokatenga**

## B. Upper Bolsaldam, Kharkutta, North Garo Hills-o bikote on-gimin

NorthGaroHills-ni ning-ao ga-akgipa Kharkutta Block-ni Upper Bolsaldam songoba batanggimin 18/06/2020 tariko Pico Turbine, chong-motan 3kW mang gita watna man-gipa bijoliko chioniko bikote on-aha. Ua Project-ni bakrango skangni wachi-a-rak tipchanggija dongkamsogipa chiring-dareo pangchake Upper Bolsaldam songo check damko kae, bijoli bikotchakram noko Pico Turbine-koba done bijoli wataha. Uko rikani miksonganide songni manderangna a-tila aro rama-sorok jolrango, songni skul, Angawadi centre, songni tom-chakram nok, gilja nok aro Mandeni nokrango 10%-ni gita light ba bijoli ching-atna gita miksonga.

Uarangna agreba, bijoli bikotna jakkalgipa apan Pico Turbine –ni chikon songni skul nokrang aro manderangni nokrangonaba namgipa ringani chirangko sale on-a gita cholba ong-jolaha.



**C.South Garo Hills, Baghmara Block-ni Rongtra songo bijoli bikote on-gipa:**

South Garo Hills District a-jani ning-ao ga-akgipa Baghmara Block-ni Rongtra songoba ua apsan project-ni ning-on re-anggipa 20/08/2020 tariko MINR,MBDA staff, South Garo Hills District-ni Deputy Commissioner, Baghmara block-ni Block Development Officer, DRDA–ni Project Director aro songni manderangni dongpaanio Pico Turbine-ko a-bachengate on-aha. Jean, pico turbine-ni gita 3kW mang bijoliko watna man-aha. Apsan Project-ni bakochonggipa check dam-ko wachi-a-rak tipchanggijagipa chiring-dareoni chiko jakkalna man-a gita Rongtra songo donggipa chiringon chonggipa damko rikan baksana, Pico Turbine-ko donchakani bijoli bikotchakram nok-ona pipelines(penstock)-koba rikjolaha. Ua chonggipa damoniko 3KW mang gitan bijoli jakkalna man-enga aro uko miksonge rikani namgniara, songni manderang nokdangprako bijoli ching-atna, rama-sorok ba a-tilarango aro songni skulrango bijoli ching-atna gita namen dakchakbea.



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