

**DECENTRALIZED GREEN
ENERGY DEVELOPMENT
PROJECT**



**KI JINGBATAI BNIAH SHAPHANG
KI RUKOM PYNMIH BOR DING
NAKA BOR KA UM**

**Institute of Natural Resources
Meghalaya Basin Development Authority**

“KI JINGBATAI BNIAH SHAPHANG KI RUKOM PYNMIH BORDING NAKA BOR KA UM”

DECENTRALIZED GREEN ENERGY DEVELOPMENT PROJECT

1. PICO HYDROPOWER:

Ka jingpynmih bording na ka um ka don artylli ki jingmyntoi, ka jingpynmih bording na ka bynta ban kamai bad ka jingäada äa ka jaka ba wan tuid lang ki um hajuh khnang ban pynthikna ba ka um kan don beit. Ka Meghalaya ka don ka jinglah bakhrav ban pynmih bording na ka um. Ka Meghalaya ka lah ban pynmih bording 3000 MW kaba long kumba 3% jong ka jingpynmih bording ha ka ri. Kane ka jinglah kan äarap ban weng äa ka jingeh na ka jingduna bording ha Meghalaya bad lah ban leh äa kane da ka jingäadonbynta lem ki briew ka jylla. Ka Meghalaya Institute of Natural Resource (MINR) hapoh ka MBDA ryngkat ka jingäatreilang bad ka Nagaland Empowerment of People through Energy Development (NEPED) ka la sdang äa ka projek ha Mawlyngbna (ka Pico turbine ba la tip kum ka Hydroger kaba pynmih kumba 1 kW ka bording) 1 kW ka biang na ka bynta ban pynmeh 200 tylli ki LED (5 W) bulb. Lada kawei ka äing ha ka shnong ka pyndonkam 4 tylli ki bulb, ka mut ba 50 tylli ki äing ha kata ka shnong ki lah ban äoh jingshai na kata ka bording.

Ka bor ba pynmih ka long ka dak jong ka jingroi bad ka atiar jong ka jingäaid shaphrang. Ka bording electric khamtam kaba pynmih na ki jaka pynmoh bording barit ka dei kaba lah ban pynthymmai, kaba biang ha ka liang ka ioh ka kot, kabym pynjakhlia äa ka mariang bad kaba biang na ka bynta ka sawdong sawkun. Shuh shuh, ka jaka pynmih bording barit kam donkam ban ngam hapoh ka um bad ka por ban pyntreikam äa ka naduh ba thmu nyngkong kam shim por. Kine ki jingmyntoi ka Small Hydro Power ne SHP ki dei kiba la ithuh bha mynta. Ka jingdonkam äa kane ka projek ka wan na ki jingmyntoi bad ka jinglah ban pyndonkam äa ki jingmih na ka.

Ki bynta bapher bapher jong ka SHP:

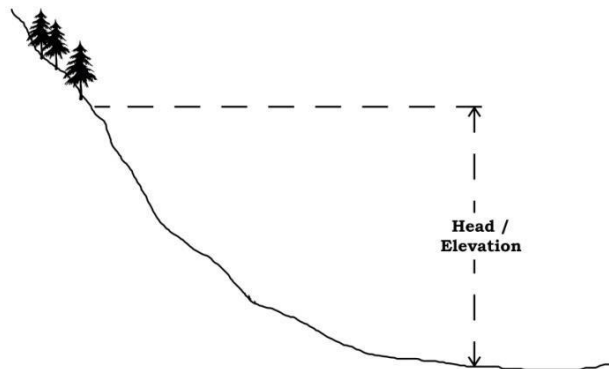
Ka jingphiah	Ka jingpynmih bording
Pico	0 kW – 5 kW
Micro	5 kW – 100 kW

Hashwa ban pyntrei äa ka prjek pynmih bording na ka jaka barit, ka long kaba kongsan ban jurip bad sorjamin shwa bad peit la ka jaka ka biang ne em ban pyntrei. Ki artylli ki daw ba kongsan

ba dei ban khmih ki long ka **jingtuid ne ka flow (discharge)** bad ka **khlieh** jong ka wahduid. Ka **jingtuid** ka dei ka jingdon jong ka um ba lah ban shim bad pyndonkam ha ka **turbine generator**, bad ka **khlieh** ka dei ka jingjngai ba ka um kan tuid ne hap sha ka generator. Katba ka jingtuid ka nang heh, kaba mut katba nang bun ka um, bad katba nang don ka khlieh um hajrong, katta ka bor kan nang bun ban pynkylla sha ka bording. La ai jingmut ba na ka bynta ka Pico ne Micro Hydro Power, ka khlieh ka dei ban long la kumno kumno 10 metre bad ka jingtuid ka um ka dei ban long la kumno kumno 20 litre ha ka shi second, kaba mut ba kan pynmih bording 1 kW.

Ka khlieh

ïa ka khlieh lah ban thew da ka GPS, Altimeter ne da kano kano ka rukom ba suk.



Ka jingtuid

Ka jingtuid jong ka wahduid ka dei kaba mih na ka velocity (**v** – ka linter jong ka jingïaid ha ka shi unit ka por kum meter/second) ba la multiply bad ka jingjylliew ka um (**h** - unit of length) multiply biang bad ka jingïar (**w**). (Pynthikna ba ïa kine ki lai tylli ki bynta la pynpaw ha kajuha unit).

Ban thew ïa ka jingtuid ka um ngi donkam ïa katto katne ki tiar:

- Stopwatch/ mobile phone stopwatch app
- U pita ban thew
- Kiei kiei kiba lah ban per (U phong/bitor um ba dap shiteng /ka ball/u dieng/u soh bad kiwei)

Ki rukom ban thew ïa ka jingtuid ka um:

Ki don artylli ki rukom ba kongsan ban thew ïa ka jingtuid ka um, katkum ka jingheh jong ka wahduid.

- a. Ngin shim shwa ia ka nuksa jong ka jingtuid kaba rit:

Lada ka wahduid ka duna ka jingtuid ka um, lah ban pyndonkam ia kano kano ka borti ban khein ia ka jingwantuid ka um da kaba shim ia ka por ba ka um ka dap ha kata ka kynja borti. Nuksa, lada ka borti ka dei 20 litre bad ka shim por 5 second ban dap, ka mut ba ka jingtuid ka dei 4 litre ha ka shi second (20/5).

b. Hynrei lada ka jingtuid ka kham heh, ia kine ki lad harum lah ban shim ban khein ia ka jingwan ka um:

- Jied ia ka jaka ba ka jingtuid ka um ka long jaijai, ka beit bad ka jingiar ka wahduid ka long katjuh ha ki jaka baroh. (Kan kham suk lada ka um ka tuid lyngba ka lynti ba long beit beit) ka long kumne namar ba ka jingsted ka um ha ka wahduid ka ryngkat ha kip or baroh ka rukom tuid — ka suki ha ki pung, ka shu biang ha ki jaka ba la tip kum ki run, ka sted ha kiwei kiwei ki jaka, ka suki khyndiat ha ki jaka ba don jingwit, bad ka suki bha ha ki jaka ba don khlaw. Ka thong ka long ban jied ia ka bynta ha ka wahduid ba ka rukom tuid ka neh beit kumjuh bad kam kylla. Kane ka bynta ka dei ban lait na ki jingwit (ki dieng ba la ot, ki maw). Ban poi sha baroh ar liang jong ka um dei ban suk bad dei ban iohi shai. Kynmaw ban buh ia ka jingshngain hakhmat!
- Buh dak ha ka bynta ba shim jingsdang na ka um.
- Buh dak ha ka bynta ba shim jingkut.
- Peit bha ia ka jingjngai (**L**) hapdeng kaba sdang bad kaba kut.
- Peit bha ia ka jingiar (**w**) jong ka wahduid.
- Mynta thew ia ka jingjylliew (**h**) jong ka wahduid ha man la ki bynta bapher bapher. Ha ki katto katne ki bynta, peit bha ia ka jingjylliew $h_2, h_3, h_4, \dots, h_{n-1}$.
- Ban ioh ia ka jingjylliew ba long kyllum, khein lang ia baroh ki jingjylliew ba la shim bad sa divide da ki nombar ba la buh jingkhein. Nuksa (6 tylli ki jingshim jingkhein): $0.5 + 0.4 + 0.3 + 0.4 + 0.5 + 0.7 = 2.8$ bad $2.8 \div 6 = 0.46$ meter. Mynta ngi la ioh ia ka jingjylliew (**h**).
- Mynta ka bynta ba khot ka cross section area jong ka wahduid ka dei $A = w \times h$. Nuksa, ka jingiar ka dei 1 meter bad ka jingjylliew kyllum ka dei 0.46 meter, ka cross section area ka dei 1×0.46 meter = 0.46 meter². Mynta ngi lah ioh ia ka cross section area (**A**) jong ka wahduid.

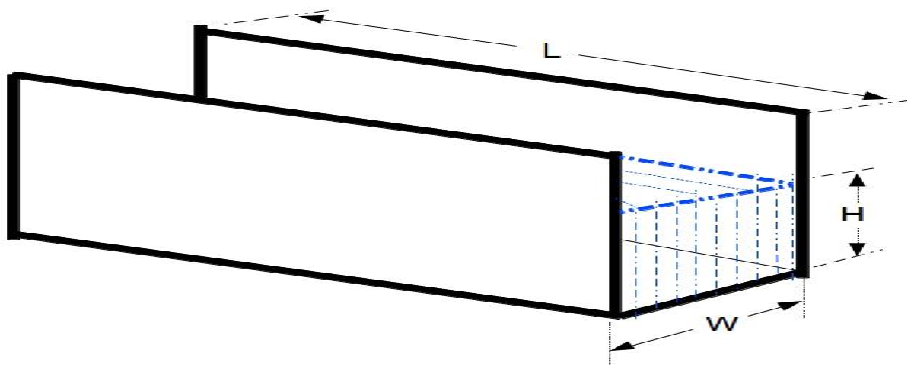


Fig: Jingkhein ia ka Volume.

Ka jingjylliew ka long mar ia katjuh ha ka jingiar baroh

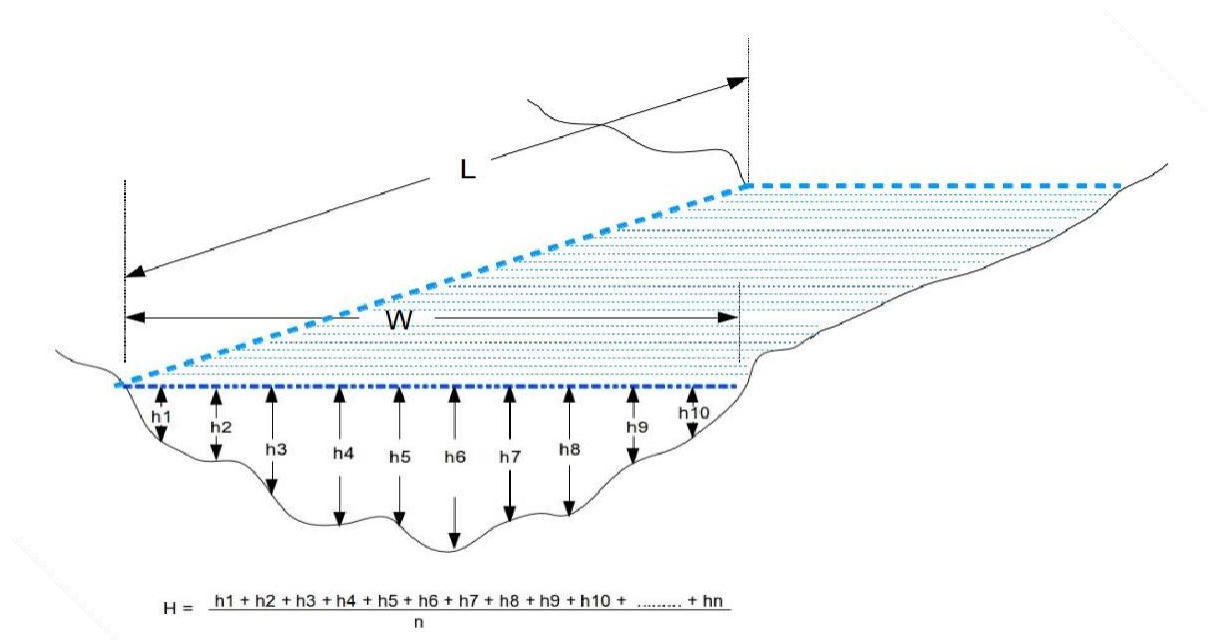


Fig: Jingkhein ia ka Volume

Ka jingjylliew ka iapher ha ka jingiar baroh.

- Mynta pynper da kaei kaei halor ka um na ka bynta ba la shim kum ka jingsdang bad sdang ia ka stopwatch ynda la poi ha u lain. Ka long kaba donkam ban buh ia ine iei iei ha ka bynta ba halor na ka bynta ba sdang ban ioh ia ka jingiaid sted ka um.
- Yn don ba ong "sangeh" haba la poi ha ka bynta ba kut bad peit ia ka por (**t**) ba la shim ban poi ha ka bynta ba kut.
- Pyrshang ia kane kumba 6 sien bad peit ia ka por (**t**) na ka bynta kawei kawei ka jingpyrshang bad ngin shem ban gin ioh ia ki jingmih bapher bapher ha kine ki 6 sien.
- Na ka bynta kawei kawei, divide **L** (jingjngai) da **t** (por) bad peit ia ka jingsted. Nuksa: lada ka jingiaid ka long 5 metre bad 10 second, kata 5 meter ÷ 10 second = 0.5 meters/second.
- Ban khein ia ka jingsted ba kyllum, khein lang ia ka velocity jong iwei pa iwei i jingiaid bad sa divide da ki sien pyrshang. Nuksa (6 sien): 1.24 + 1.29 + 1.43 + 1.37 + 1.51 + 1.62 = 8.46 bad 8.46 ÷ 6 = 1.41 meters per sec. Mynta ngi lah ioh ia ka velocity jong ka wahduid.
- Hadien ba la ioh ia kine baroh, ngi lah ban khein ia ka jingtuid ne ka discharge kumne harum:

Discharge = Cross section area(A) x velocity(v)

lane

Discharge = Jingiar ka wahduid (w) x jingjylliew kyllum ka wahduid (h) x velocity(v)

Nuksa, 0.46 meter² ka dei ka cross section, 1.41 meter per sec ka dei ka velocity, ka discharge kan dei:

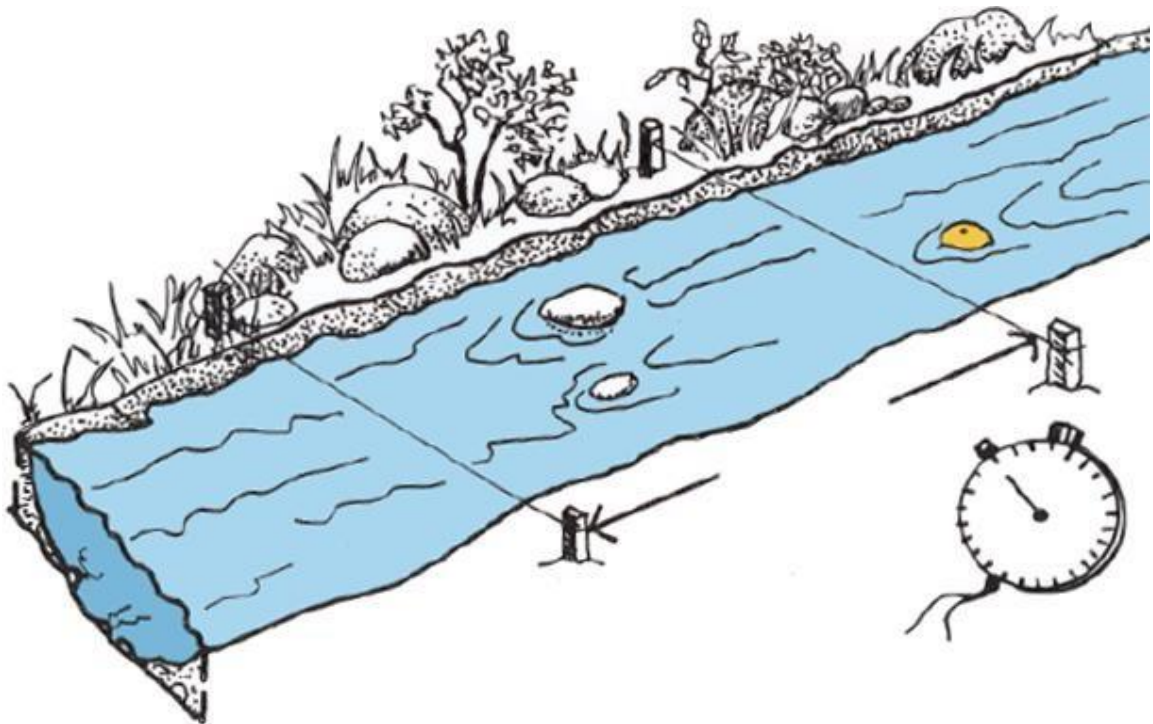
$$D = 0.46 \times 1.41 = 0.65 \text{ cubic meters per sec.}$$

- Donkam ban khmih ruh ia ka correction factor (0.85) kaba iadei bad ki jingsted bapher bapher ba la iohi. Ka um ka tuid kham sted ha ka bynta ba halor bad kham suki ha ki bynta ba sha trai namar jong ka friction ha ka wahduid. Mynta ka discharge kan long:

Discharge = Cross section area(A) x velocity(v) x correction factor

$$D = 0.46 \times 1.41 \times 0.85 = 0.55 \text{ cubic meters per sec}$$

Kum ha ka nuksa ba la ai haneng, ia ka discharge la thew ha cubic meters per sec, hynrei ia kane ka unit lah ban pynkylla sha litres per second. 1 m³ /sec ka ia ryngkat bad 1000 L/sec. So 0.55 m³ /sec = 550 L/sec.



Ka Discharge ne ka jingtuid ka um kam long kumjuh ha baroh shi snem, namarkata donkam ban thew ia ka discharge la kumno kumno shisien shi bnai ha baroh shi snem (katba nang bunsien, katta kan nang bha), kane kan ai ka jingsngewthuh ba shai halor ka jingtuid ka um ha ki aiom bapher bapher ha baroh shi snem.

Ka bor ne Power

Mynta donkam ban kynmaw:

$$\text{Power} = \text{Head} \times \text{Flow} \times \text{Gravity}$$

Ia ka **power** la thew da ka Watts, ia ka **head** ha ka metre, ia ka **flow/discharge** ha litres per second, bad **acceleration due to gravity** ha metres per second².

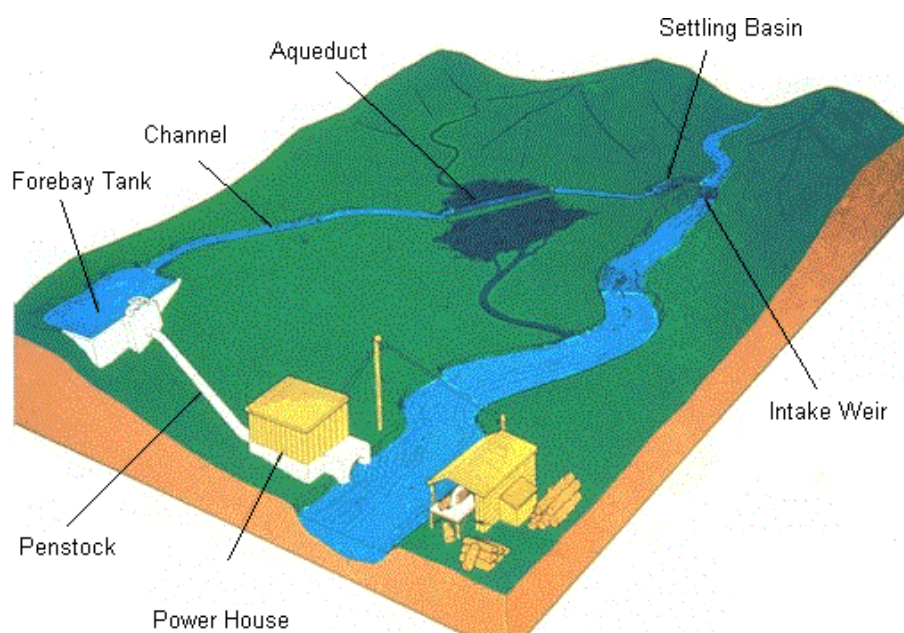
Ka acceleration due to gravity ka long kumba 9.81 metres per second² – kata ka mut ba man ka second ba hap kaei kaei, ka jingsted jong ka ka kiew da 9.81 metres ha ka shi second (haduh ba kan da poi ha ka velocity ba kut).

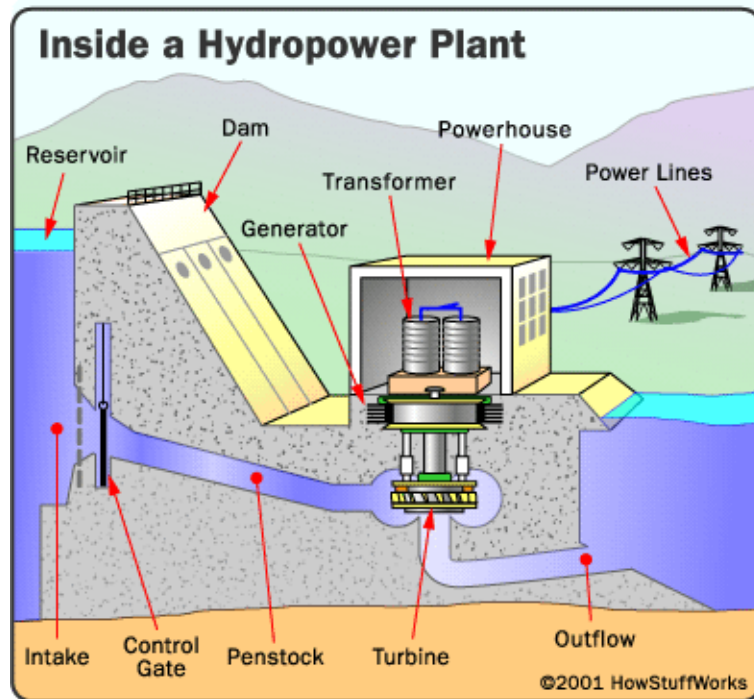
Nuksa: Lada ngi ioh ia ka jingtuid ba 10 litres per second ha ka head ba 10 metres. Khein ha kane ka rukom:

$$10 \times 10 \times 9.81 = 981 \text{ Watts}$$

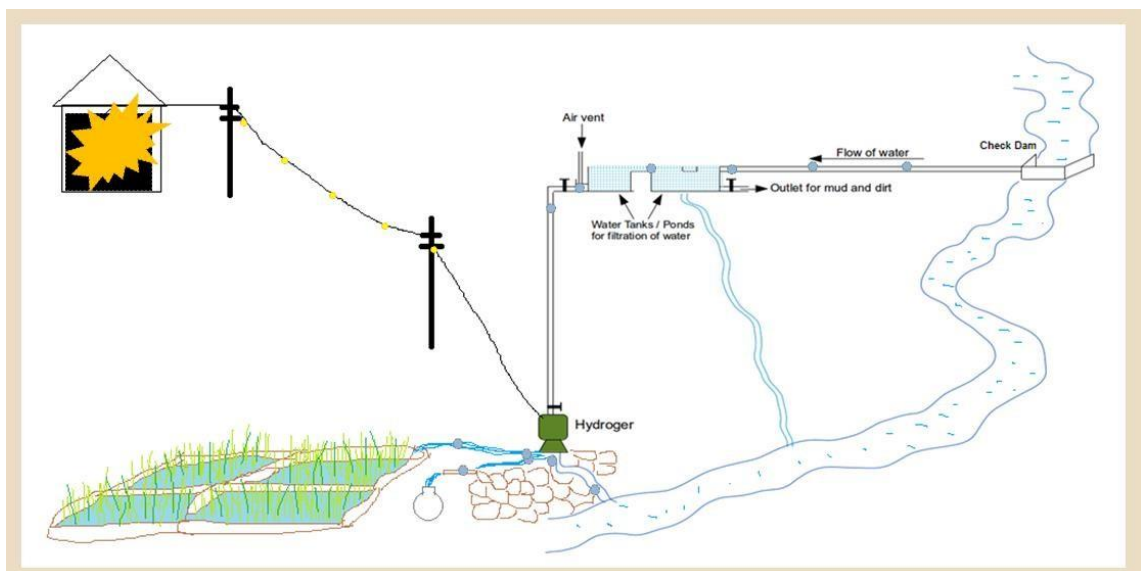
Ha kane ka nuksa halor, ka bor ka long 981 Watts. Kaba sngewsih ka long ba ynm lah ban ioh ia kata ka bor – ym don kaba 100%. hynrei, ki **hydro power turbine generator** ki long kiba treikam bha haba ianujor bad ki **wind turbine generator** bad ki **solar panel**.

Lah ban khmihlynti ba 70% kan treikam bad ia 70% ka bor jong ka um lah ban pynkylla sha ka bor ban pynshad ia ka **turbine generator**. Kaba 30% kaba sah la shu duh ei. Kumba 10% ka bor la duh biang haba pynkylla ia ka *mechanical energy* sha ka bording electric, te kumta la khmihlynti ba lah ban ioh tang kumba 50% haduh 60%. Ha ka nuksa ba la dep ai ha kaba 981 W ka bor la ioh – ngi lah ban khmihlynti ban ioh kumba 589 W ka bording electric.





Hydroger: Ym donkam than shibun ka um bad ki wahduid kiba rit kin long ki tyllong ban pynmih bording. Ia ka um na ka wahduid la buh ha ka jaka pyllang bad la pyllait 10 m sha trai jong ka hydroger ba kynthup ia ka cylindrical cast iron casing housing ba don jingpyniasoh bad u turbine. Ia ka bording ba ioh na ka um la pyndonkam ban pynkhih ia u turbine ban pynmih ia ka bor. Ki don ar jait ki turbine, impulse bad reaction. Ka hydroger unit barit ba 3kW ka lah ban pynbiang bording ia i shnong iba rit.



Nuksa jong ka jingbuh ia u Hydroger

Ka jingiashimbynta ki briew

Ka long kaba donkam ban don ka jingiashimbynta ki briew ha ka projek pico ne micro hydro power projek, ka jingjop jong ka projek ka shong ha ka jingiashimbynta shitrhem ki briew. Ka jingkhmih ba man ka sngi, ka jingpynbiang bad ki jingmaramot barit ki dei ki bynta jong ka projek. Yn thaw ia ka Village level committee ban long trai bad khmih ia u Turbine Generator. Ki kam ban leh ka Committee ki long:-

- i. Ban lum khajna
- ii. Ka rukom ban sam bording
- iii. Ban khmih ia u Hydro Turbine Generator

Ha ka jingiashimbynta ki briew, ki briew ki lah ban khmih ia ka rukom tuid ka um, ka khlieh jong ka um bad ka jaka buh ia ka power house.

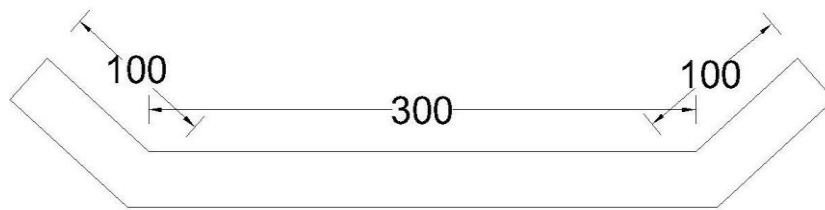
Ka rukom treikam:

Sngi	Ki sienjam
1	Khmih ia ka jingtuid
	Khmih ia ka khlieh
	Ithuh ia ka Penstock Area
	Ithuh ia ka jaka ban buh Power House
	Khmih ia ka jingjingai ban pun pipe
	Ithuh ia ki bynta ban buh ia ki jingpynshai
	Khmih katno tylli ki jaka buh light ban buh
	Ithuh ia ka jingjingai ki wire
2	Pynkhreh ia ka jinglut
3	Thied ia ki tiar
4	Jingpynpoi ia ki tiar sha ka shnong
5	Jingshna ia ka Penstock / Dam barit
6	Jingsiang ia ki lynti pun Pipe
7	Jingshna ia ka Power House
8	Jingbuh ia ki Light / Dieng pynieng ia ka light
9	Jingbuh wire
10	Jingbuh ia ka Hydro-Power Setup

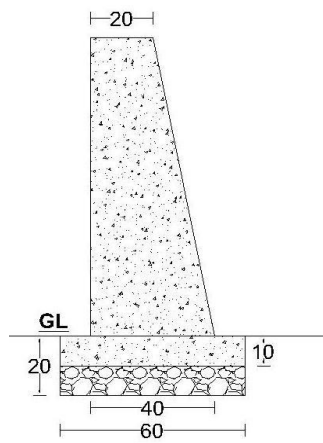


Hydroger

a. Cement Concrete Weir

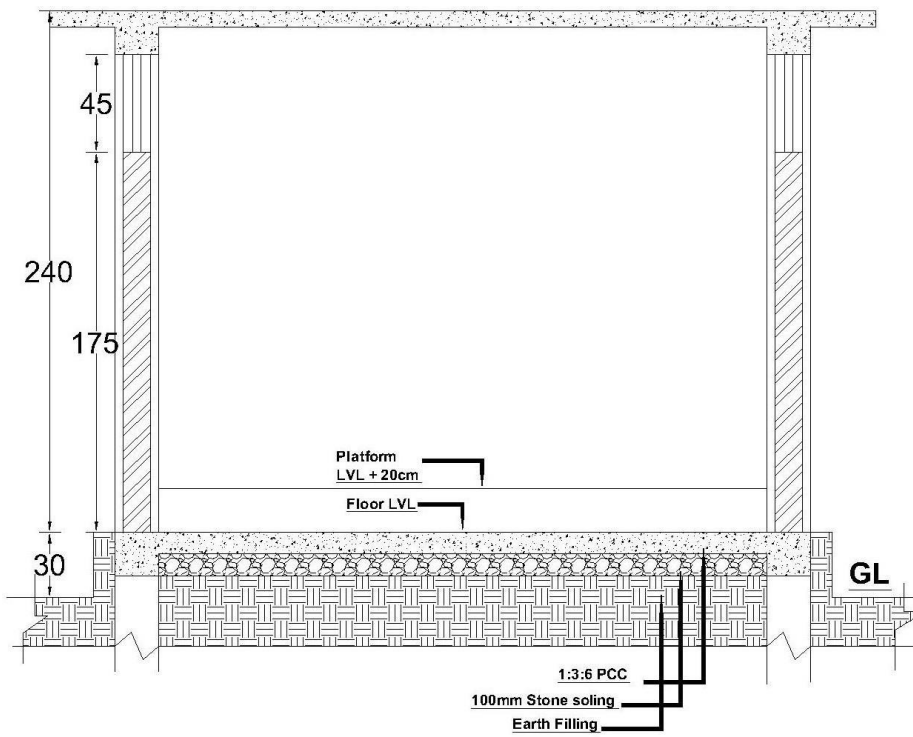
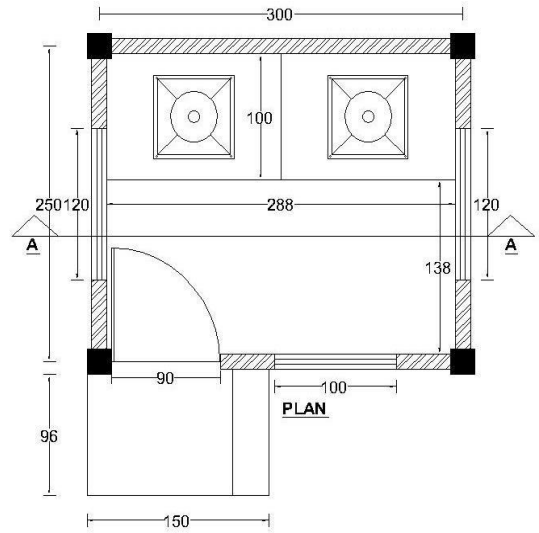
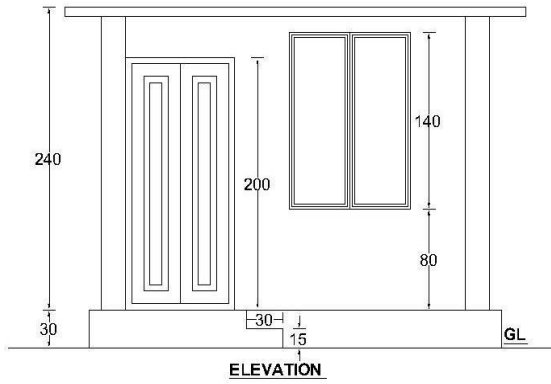


PLAN



C/S ELEVATION

b. Power House



5. KI JINGTREIKAM BA LA BUH

A. Jingbuh ha Sohrarim, Laitkroh Khatarshnong, East Khasi Hills.

Ia ka jingbuh ia ka Pico Turbine la leh ha ka shnong Sohrarim ha Laitkroh Khatarshnong Block ha East Khasi Hills District ha ka 15/06/2020 da ki nongtrei ka MINR,MBDA da ka jingiarap ki Green Volunteer bad ki Field Engineer ka East Khasi Hills bad ki dkhot ka VEC. Kane ka Pico Turbine ba la buh ka pynmih kumba 3kW ka bording. Ha kane ka Projek la buh ia ki pipe (penstock) na ka check dam ba la don lypa ha Sohrarim ia kiba la ai sha ka Pico Turbine ha kane ka Power House. Ka jingthmu ka long ban shakri ia ka shnong da kaba ia Street Light bad Water Lifting.



SITE INSTALLATION PICTURES

B. Jingbuh ha Upper Bolsaldam, Kharkutta, North Garo Hills

Ia ka jingbuh la leh ha ka shnong Upper Bolsaldam ha Kharkutta Block ha North Garo Hills District ha ka 18/06/2020 ha kaba ia ka Pico Turbine la buh bad ka lah ban pynmih bording kumba 3kW. Ha ka Projek la kynthup ia ka jingpun pipe na ka check dam barim ba la don ha kshaid Aiar ha Upper Bolsaldam ba la pynpoi sha ka Pico Turbine ha ka Power House.

Ka jingthmu ka long ban shakri ia ki nongshong shnong da ki street light, jingpynshai ia ki skul shnong, ki community centre, ki Angawadi centre bad 10% sha ki iing bym pat ioh bording.

Nalor kine, ka um ba la pyllait na ka Pico Turbine la phah kylla sha ka phyllaw skul ban pynbiang ia ka jingdonkam um ha kane ka skul.



A.Jingbuh ha ka shnong Rongtra, Baghmara Block, South Garo Hills :

Ia ka jingbuh ia ka Pico Turbine la leh ha ka shnong Rongtra ha Baghmara Block ha South Garo Hills District ha ka 20/08/2020 da ki nongtrei na ka MINR,MBDA ha ka jingiadon ryngkat u Deputy Commissioner South Garo Hills District, u Block Development officer ka Baghmara Block, u Project Director DRDA bad ki nongshong shnong. Kane ka pico turbine ka pynmih kumba 3kW ka bording. Ha ka Projek la kynthup ia ka check dam barit, ki pipe (penstock) na ka check dam barit na Rongtra chi ha ka shnong Rongtra kiba la pynpoi sha ka Pico Turbine ha ka Power House. Ka bording ba 3KW ba la pynmih na ka Pico Turbine la pyndonkam ha ka jingpynshai ia ki iing briew, ki surok bad ki skul shnong.