Modul 9 – Hanbuk Bilong Sumatin

Piko-Haidro insait long Kominiti

BILONG PAPUA NIUGINI

Ol Givim Mani long wok

KOICA
Korea International Cooperation Agency

Wok Bung wantaim

PAPUA NEW GUINEA

Pacific Islands Development Forum

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"Piko—Haidro stap long Komunti" Trening modul em i wanpela indodaksen long ol fandamentol bilong Haidro pawa sistem. Taim dispel kos i pinis, yu i bai lainim pinis ol lis stap dambilo.

- Ol bai inap long stori gut long Piko-Haidro.
- Ekespelenim ol besik bilong ilektrikol paramita (V,I, P, na E, AC, DC)
- Yu bai ken tokaut lo olgeta komponen ol bin yusim insait long Haidro pawa sistem.
- Yu abi inap long tokaut lo ol wok bilong wan wan kamponen insait long Haidro pawa sistem.
- Yu bai inap long stori ol kain kain Haidro sistem.
- Yu bai ken luksa lo ol besik tes ekuipmen na showm strt na seip wail long yusm ol.
- Yu bai inap long diskas na tingting long ol kii samtin long taim yu la baim Haidro pawa sistem na ol komposisen bilong en.
- Yu bai inap long stori long gutpela bilong maintanes bilong Haidro Pawa Sistem.

Lesen Plen

Tabel 3: Lesen Pelen na ol wok bilong wan wan sesen.

Sapta	Lesen Taip
1.Kirupm Ting Ting-Intodaksen	Ol tingting na wok 1
2.Haidro Eneji em wanem samting.	Tingting
	Wok 2
	Wok 3
3.Ol Besek bilongl Ilektrisiti o pawa	TIngtin
	Wok 4
4.Ol kain kain part bilong Haidro Pawa system.	Ol tingting
	Wok 5
5. Taip na sais bilong Haidro Sistem	Tingting
	Wok 6
6. Septi insaid long Haidro Pawa Sistem	Tingting
7. Lo baim ol Haidro Pawa Sistem.	Tingting
	Wok 7
8. Mentanens bilong ol Hom Haidro Sistem.	Tingting
	Wok 8
	Wok 9

Dispela Wokbuk bilong ol sumatin ol i bin kisim long Treina Gaid (TG). Ol samtin i stap insait long dispela Lenas wok-buk (LW) i stap klia tru wantaim ol piksa na ol toktok we bai halivim ol sumatin long lainim ol samting wantaim treina long taim bilong skul. Sapos yu laikim moa infomesen long sampela seksen, plis painim aut long treina gaid.
Kava foto: Piko-haidro sistem i wok stap. Sos: Powerspout, New Zealan

1

Introdaksen/ kirupm Tingting

WOK 1

Tokim mipla liklik long yu husait long ol narapela sumatin i ken save long yu. Tokim mipla long nem bilong yu na yu bilong wanem hap. Toktok liklik long wanem samtin yu save wokim long dispela kain taim. Yu gat sampla save long Haidro Pawa

2

Wanem em haidro pawa?

2.1 Wanem em eneji?

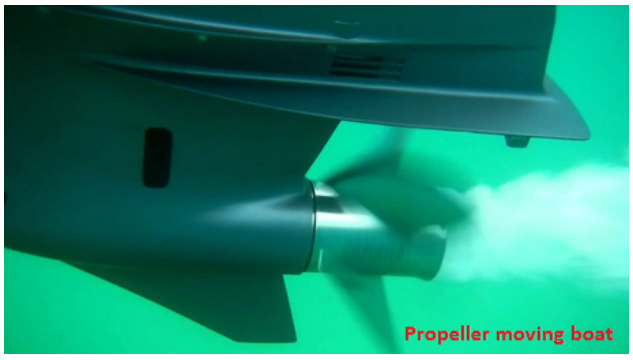
Eneji emi pawa bilong mekim wok. Dispela em ol sampela eneji:

- **Hat bilong paia –** Tingim dispela taim yu bin statim paia long hatim wara. Sikin bilong yu bai hat taim yu kam klostu long paia.

PIKSA 1: Hat bilong paia i save hatim wara[1]

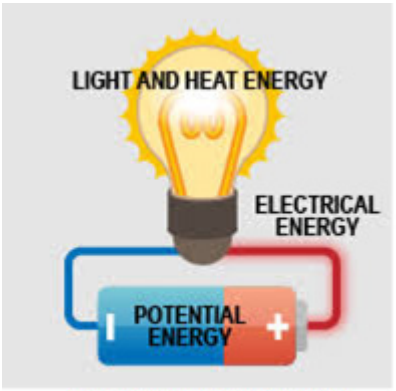
- **Mekenikol Eneji -** Dispela em pawa i kam long enjin bilong bot we i save givim pawa long tanim propela bilong bot moto long mekim emi ron. Wankain olsem enjin bilong ka i save givim pawa long tanim taia

PIKSA 2: Mekenikol eneji i kam long propela[2]



- **Kemikol Eneji –** Insait long bateri, igat igat ol kemical I stap I save holim o storim pawa long sasim on liklil masin olsem; radio, fone na ol lait
- **Elektrikol Eneji –** Dispela eneji emi save ron long waia long givim pawa long ol masin i save wok long elektrisity o pawa.

PIKSA 3: Elektrikol Eneji[3]



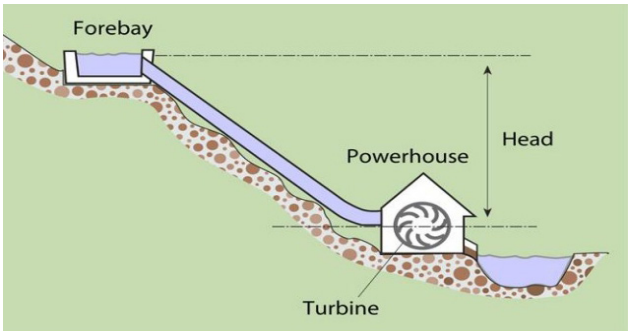
2.2 Wanem em Haidro Eneji?

Haidro eneji - emi pawa i save kamap long tupela wei, wanpela em wara i save pundaun na narapela em wara emi save ron arriup. Eneji we wara i kamapim emi gat penti wok bilong en na tu emi nogat pinis bilong en.

Storej Skims – ol I usim dem lo holim wara we wara ikam long ron wara . lo hia wara save i stap, na bihain emi save go insait long tebain na kamapim pawa.

Ron Blon Wara skim –ol I movm hap belong wara long ron long paip na bihain i go insait long tebain na kamapim pawa.

PIKSA 4: Wei bilong setim besik Haidro pawa[4]



1 Source: Pikrepo, https://p0.pikrepo.com/preview/673/890/black-cooking-pot-on-fire.jpg, accessed on 16 June 2021.

2 Source: Wonderful engineering, https://wonderfulengineering.com/wp-content/uploads/2017/02/wby-boats-have-propellers-at-the-back-1024x576.jpg, accessed 16 June 2021.

3 Source: APOGEE, https://www.apogee.net/, accessed 16 June 2021

4 Source: U.S Department of Energy, "Planning a Micro Hydropower System", https://www.energy.gov/energysaver/planning-microhydropower-system

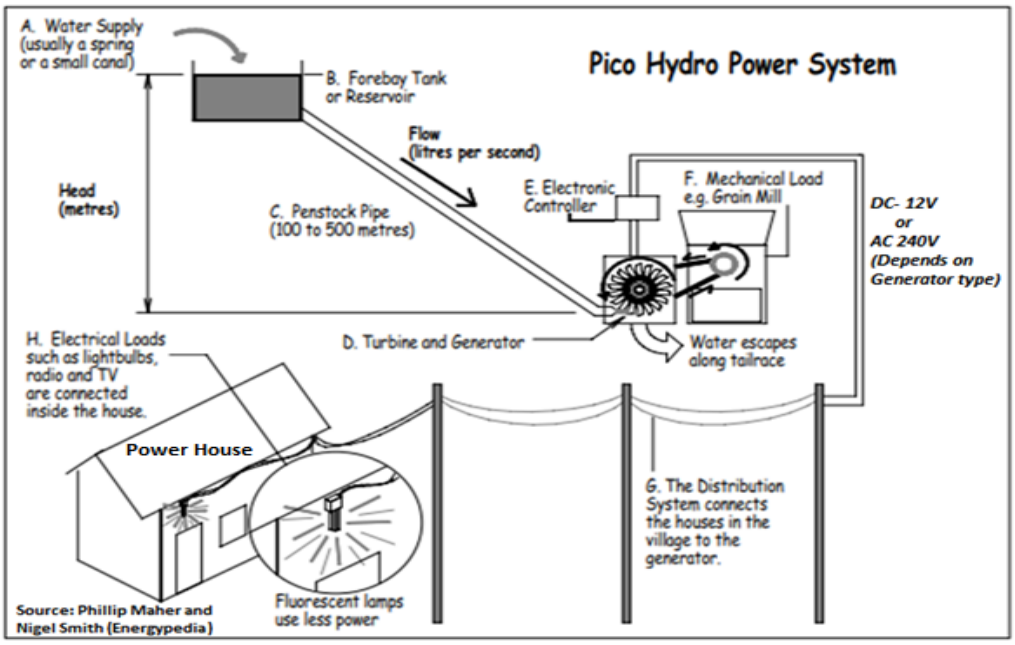
2.3 Wanem em Piko Haidropawa?

Piko Aidoropawa (PHP) em i wankain olsem ol taraipela Aidoro pawa pelent, tasol long moa liklik skel ol ibin putim, na bin disainim long ol homeona na yusim long agerikosa.

Wanpela Piko-Aidoro em i wankain long standalone Sola PV sistem. Ol i bin generetim eneji na storim long bateri na yusim long taim bilong nid.

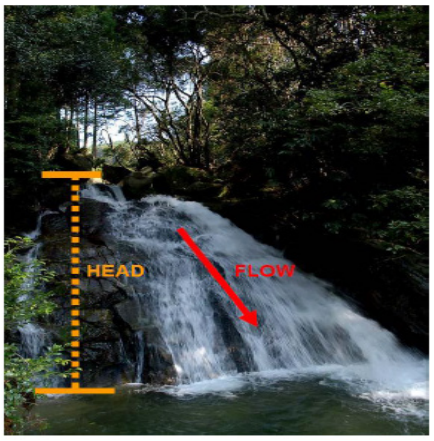
- A- Plenti taim wanpela dam ol bin poinim igo olsem Weir ol bin wokim long derekim sos insait long '' Forebay tenk (B)
- B- Resebor holim sampela wara insait long Derek wara insait long Aenstok (C)
- C- Penstock karim wara ran igo long wanpela tobain.(D)
- D- Tobain wantam potensol eneji bilong wara, tobain bai go raon
- raon, na em i bin konektim long jenereta long jeneretim elektrisiti, o konektim igo long eni mekanikol lod, olsem soim long (F)
- E- Ol kontola ol bin yusim kontol/regulet pawa autput.
- G- Taransimisin lain karim pawa igo long haushol.
- Pawa jenereta iken kamap olsem DC-12V o AC- 240V. Dispela i ken kamap losem long wanem long wanem kaina jenereta yu yusim na hamas pawa yu nidim long produsim.
- H- Haus bai ikuipim ol arapela ikuipmen. Sapos DC pawa ibin taransimitim pinis, orait bateri,na ol sasa kontola, na inveta na lod bai ol I nidim. Sapos AC pawa ii bin taransimitim pinis, orait AC lod tasol bai igat nid long en.

PIKSA 5: Tipiko setap bilong wanpela Aidoro sistem[5]



5 Adapted from the International Journal of Research in Engineering and Technology, " Design and Development of Pico Micro Hydro System by Using House Hold Water Supply, https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.672.5203&rep=rep1&type=pdf

PIKSA 6: Sikimatik na piksa bilong wanpela tipikol Piko-Aidoro sistem[6]



Hap bilong rait:

6 Source: News Sewa, June 2021, http://www.newssewa.com and DocPlayer, Manual for Renewable Energy Source, https://docplayer.net/45114164-Manual-per-burimet-e-energji-ve-te-rinovueshme.html

WOK 2

1. Yu ting olsem wanem, yus bilong ol aidoro dam bai daonim polusen?

2. Wanem fom o kain eneji bai wanpela aidoro sistem inap long produsim?

3. Ol Aidoro dam bai bagarapim nesurol wael laip?

WOK 3

1. Sapos yu bin lukim wanpela Aidoro Sistem, (olsem stap long piksa 4. Yupela I ken diskas o toktok

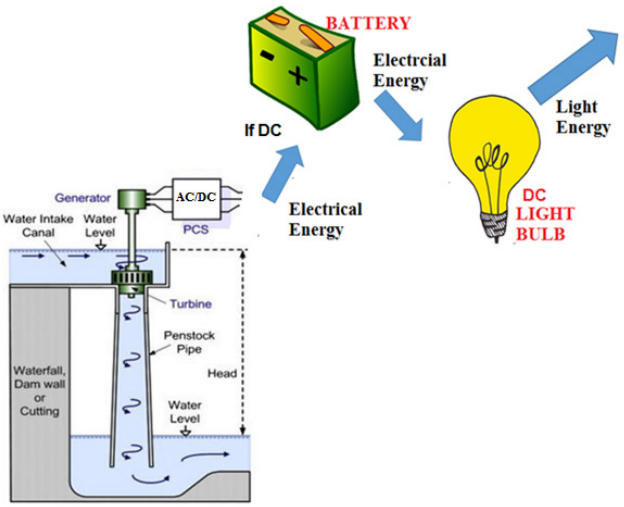
3

Sampela besik bilong eleketrisiti

3.1 Elektikol Eneji

Elektikol eneji em i olsem narapela fom bilong eneji Em ken kamap long Aidoro o win o sola o hit eneji.

PIKS 7: Hao long Aidoro eneji save sanisim ol fom long givim yumi lait[7]

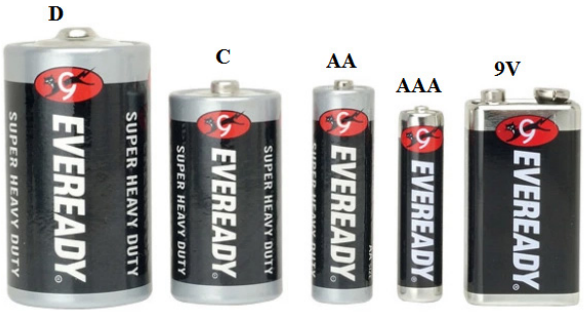


3.2 Eneji insait long wsnpela bateri

Ol i bin yusim kemikol long storim eneji insait long wanpela bateri.

PIKSA 8: Wanpela Led Asit risasebel bateri[8]

PIKSA 9: Ol narapela teip ol liklik bateri[9]



3.3 Pawa

Long ol simple tok yumi ken dipainim pawa olsem eneji I bin yus pinis long wanpela taim ol I bingivim. Yunit bilong em i wats,(W) Yumi inap sape long amas eneji yumi bai yusim long batersapose yumi sape hamas pawa wan wan apalaens nidim.

PIKSA 10: Wanpela 4W Lait bod[10]

3.4 Botes na Kuren

Botes em ii elektikol potential, o em ii wanpela peresa ii sape movim ol elekton insait long ol waeya (ol Kodakto) na bai inap long komperim peresa insait long wanpela wara paip.

Kuren em ii koleksen bilong ol dispel elekton raning olsem raning wara. Na ol bai ran ikam long antap peles igo daon long dambilo peles.long pos bilong garapiti. Na yusim pos bilong botes , kuren sape ran insait long ol waiya.

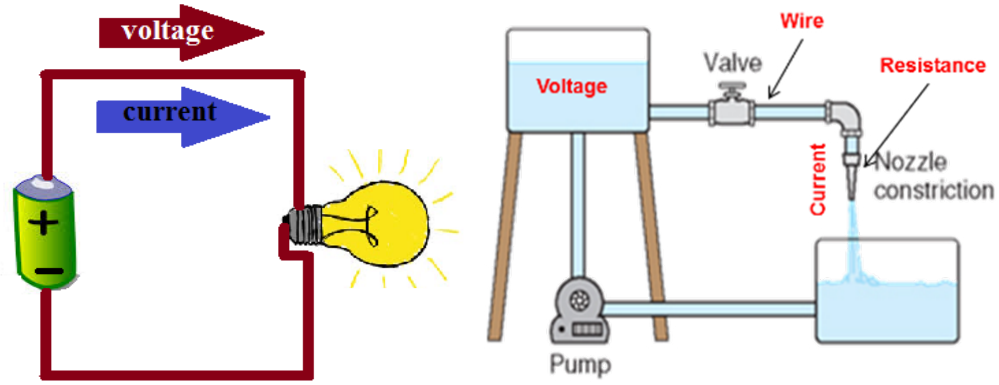
7 Source: TDM Electricity, http://www.tdmelec.fr/wp-content/uploads/uploadpeel/minikaplan4.jpg, accessed 21 June 2021

8 Source: JICA

9 Source: Lazada, "Eveready battery", https://ph-live-01.slatic.net/p/6abf377c3bd40ff76088f4764c8624cb.jpg_2200x2200q80.jpg_.webp, accessed 25 June 2021

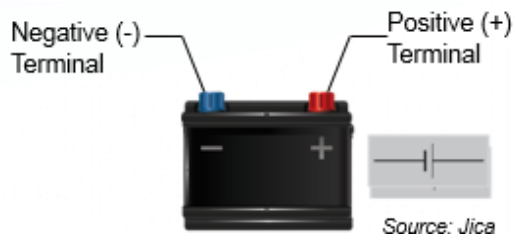
10 Source: Shopee.com, Philips Led Lights 4 Watt Yellow and White Colour, https://shopee.com.my/PHILIPS-4-WATT-LED-LIGHT-yellow-and-white-i.267756065.3536838685

PIKSA 11: Botes wantai Kuren kamapim pawa, na botes em i olsem presa insait long wara tenk[11]



Botes, Ol i bin mesarim botes insait long unit botes, na mesarim kuren Amperes o Amps. Yumi olgera taim laik sape hamas kuren na botes stap long ol waeya. Yumi ken tok olsem botes em ii olsem wanpela dip raning wara, na kuren em i olsem pors bilong raning wara. Strim wara ii no dip tasol pors bilong en is strong tumas, bai em inap daonim yumi. Em I wankain olsem botes ken stap dambilo tasol sapos kuren igo antap, bai em ken kilim yumi.

PIKSA 12: Pllariti bilong Bateri[12]

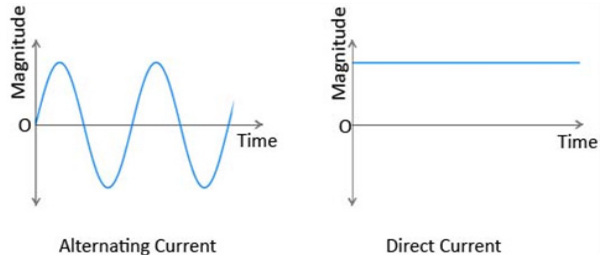


3.5 AC na DC sistem

SAFTI TOKSAVE: Bigpela kren na voltes I sa kamupim bigpla bagarup na ken killm yu sapos ol I kism bodi bilong yu. Olsm na oltime mas abrusim ol waiah natin na nogen wok lo liv konection.. Olgeta taim yu mas behin safti pasin o kism sa mahn o meri lo pawa lo makm wok.

Kuren yumi sape kisim long bateri ,em yumi sape kolim Derek kuren,o DC long wanem, em ino sape sanis.. Long DC kuren sape ran ikam Derek long positip na igo long neketip terminal na igat wanpela terminal tasol. Long ol bikpela dipais , yumi igat AC kuren o ateneting kuren na em igat weiping pom o pasin.

PIKSA 13: AC na DC igat narapel narapela botes na kuren magnitude over time[13]



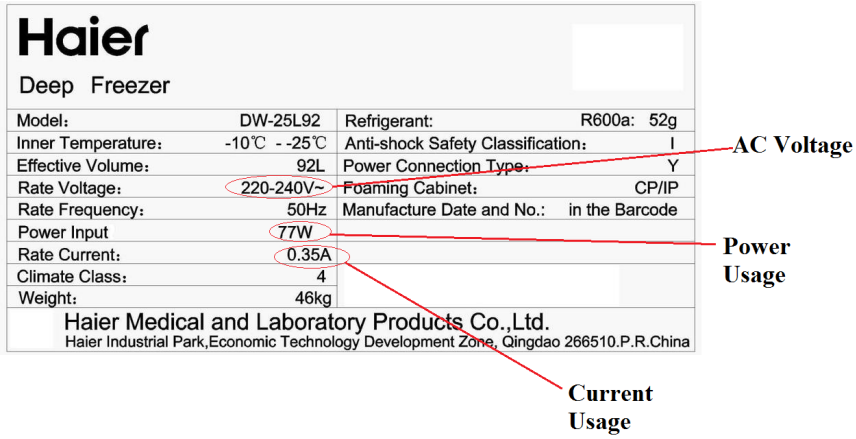
Dispela em I wanpela sampel bilong nem pellet bilong wanpela AC ol I bin givim pawa ses firija.

11 Adapted from the Electricity Basics, Arizona State University (VOCTEC), http://voctec.asu.edu

12 Source: JICA

13 Adapted from System Components: Charge Controllers &Inverters, Arizona State University (VOCTEC), http://voctec.asu.edu

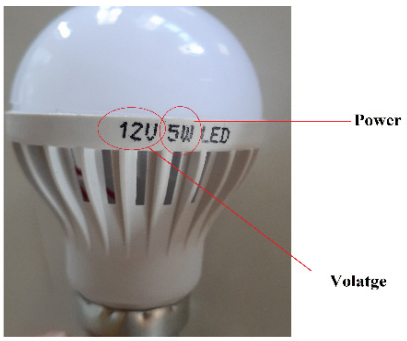
PIKSA 14: Sampela peletebel bilong ses frija[14]



Yu ken painim pawa long taim yu motipalaim votes wantaim kuren. Sapos olsem long piksa 14, yumi lukim 22oV motipalaim wantaim 35A kuren raiting na em givim pawa olsem 77W em ii rait stap long Pawa input lebel .Sapos ol ino givim pawa Derek ;orait yumi yusim votes na kuren ;long kakulet pawa.

Dispela em ekesampel bilong wanpela DC lait nempelet o lebel

PIKSA 15: DC Bob na ol lebel ditel[15]



Hap bilong rait:

14 Source: DocPlayer, "Deep Freezer-upright: HMRSM Haier Medical & Laboratory Products Co., Ltd.

15 Source: Amazon.com, "Led bulbs", https://m.media-amazon.com/images/I/31kJoFKty+L._AC_SY100_.jpg, accessed 21 June,2021

WOK 4

Givim ol sumatin wantaim 2pela AC apalaens nempelet olsem AC lait bob na AC fen. Na tu givim ol 2pela DC apalaens nempelet olsem wanpela DC bob na DC frija. Yu mas lukaut gut bai yu no helpim ol long separetim ol divais. Ol tim bilong ol yet mas mekim olsem.

Painim aut wanem dipais i AC na wanem em i DC.

- Long ranim ol dispel dipais,ol mas save long ridim botes na kuren.
- Na tu ol mas save long amas pawa wan wan dipais bai yusim.

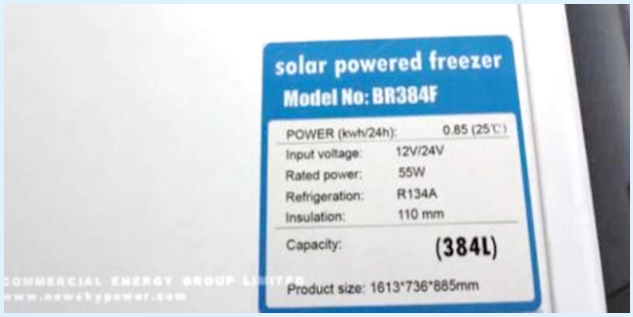
Sapos ol ino givim kuren raiting, olsem na yu ken kakuletim em long pawa na votes, na soim sumatin long sampela besik apalaens ino soim long kuren stap long lebel.

PIKSA 16: AC Bob 220—240V, 3W, 0.010A[16]

PIKSA 17: AC Fen, 220V, 55W, 0.25A[17]

PIKSA 18: DC Lait 12V, 6W, 0.5A[18]

PIKSA 19: DC Freezer, 12V/24V, 55W, 4.58A/2.29A[19]



16 Amazon.com, "Led bulbs", https://m.media-amazon.com/images/I/31kJoFKty+L._AC_SY100_.jpg, accessed 21 June,2021

17 Source: Khind.com, https://www.khind.com.my/index.php?route=product/search&search=AC%20Fan%2C%20220V%2C%2055W%2C%200.25A%20, accessed 25 June 2021.

18 Source: AliExpress.com, https://www.aliexpress.com/item/1316122622.html, accessed 25 June 2021.

19 Source: Made in China.com, "Solar Freezer", https://m.made-in-china.com/company-commercial-energy/ , accessed 25 June 2021

1. Wanem wok bilong ol inveta?

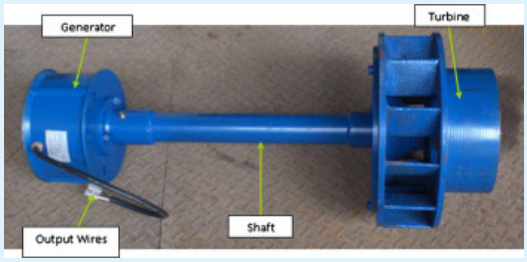
2. Wanem as tru yumi save nidim bateri?

4

OI samting i save kamapim Piko Haidro Pawa sistem

Ol samting we i save kamapim ol Haidro Pawa sistem na wok bilong ol i stap long tebol daun bilo

WOK 5

PIKSA 20: Tebine na Genereta i stap wantaim[20]  	Tebine em i wanpela samting we i save usim eneji bilong wara long kamapim mekenikol eneji (em i save tanim tanim) dispela tebine i konect lo genereta na genereta i save kamapim pawa
PIKSA 21: Penstok (PVC Paip)[21] 	PVC paip em i save karim wara long ples bilong wara go long ol tebine
PIKSA 22: Bateri[22]  	Bateri em i save lukautim eneji bilon elektriciti long fom bilong kemikol eneji na behain em i save kamapim elektriciti o pawa. Ol batri is save kamapim 12V. Batri i save konect lo sas kontrola

20 Source: Researchgate.net, "Typical low head Pico hydro turbine", https://www.researchgate.net/figure/Typical-low-head-pico-hydro-turbine-courtesy-of-Hydrotec-Vietnam_fig1_257414899, accessed 25 June 2021

21 Source: Creative Commons, adapted from Energypedia, https://energypedia.info/wiki/File:Penstock_La_Laguna.JPG

22 Source: JICA

PIKSA 23: Sas Kontrola[23] 	Sas Kontrola em i save kontolim taim bilong bateri em bai sas long generata. Em i save skelim hamas pawa i save ron i go long bateri na hamas pawa i raus long bateri. Em i save putim mak long taim bateri em i pulap long pawa na em save toksave long taim bateri i gat liklik pawa long en, ol dispela ol i save wokim bateri i no wok gut na save sotim laif bilong bateri na tu em i ken bagrapim laif bilong man.
PIKSA 24: Inveta[24] 	Inveta em bilong senim Direct Current (DC) igo long Alatnetin Current (AC)
PIKSA 25: Pawa Rop[25] 	Ol rop i save karim pawa i go long ol masin na tu em save kisim signol bilong elecrtriciti i go kam namel long twopela o moa masin
PIKSA 26: Breika/Isoleta[26] 	Wok bilong en em long burukim karent i ron sapos em i luksave olsem sampela samting ino stret. Wok bilong isoleta em long stopim sos bilong pawa long ron. Isoleta em wanpela swits, taim em i Op stap em i save larim pawa i ron go insait or go arasait.

23 Source: Solar4rvs.com, "Victron SmartSolar MPPT Charge controller, https://www.solar4rvs.com.au/assets/full/VIC-SCC110020160R.jpg?20210204030925, accessed 25 June 2021

24 MorningStar, May 2021, https://www.morningstarcorp.com/products/suresine/

25 Source: Global Market, http://newimg.globalmarket.com/PicLib/group0/5e/73/c477defc613ecc9a0e47b82452f4_1.jpg

26 Source: Wave inverter.co, https://waveinverter.co.nz/shop/solar/solar-connectors/pv-dc-isolator-switch-mc4/ and POSO.com, http://poso.com.vn/wp-content/uploads/2020/04/1-2.png

PIKSA 27: **Swits bilong elektriciti**[27] 	Swits em i save stap long rot bilong pawa we i save larim pawa i ron na pasim pawa long ron.
PIKSA 28: **Pawa Autlet**[27] 	Dispela em save stap long ol bildin long plugim ol masin long kisim pawa long altanetin current (AC) i ron insait.

27 Source: EuroTech NZ, "PDL 600 Series Power Points", https://www.kiwisparks.co.nz/collections/pdl-600-series-power-points/products/pdl-691, accessed 25 June 2021.

5

Ol kainkain Haidro sistem na sise bilong ol

5.1 Ol sise bilong ol Haidro pawa

I gat sixpela kain ol haidro sistem. Tebol 3 em i givim dispela. Olgeta ol sistem ol i gat wankain wok bilong ol

TEBOL 4: Ol sise bilong Haidro sistem

Nem bilong Haidro	Sise bilong pawa em i save givim
Piko - haidro	Long mak bilong 10kW
Mikro – haidro (MH)	10kW-100kW
Mini Haidro	100kW – 1 MW
Liklik Haidro	1MW – 10MW
Midium Haidro	10MW –100MW
Bikpela Haidro	100MW na i igo antap

TEBOL 5: Tebine wantaim sise bilong ol na sise bilong wara em i save kisim

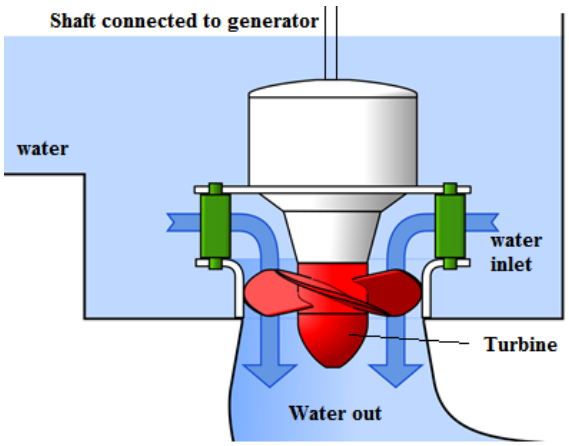
Tebine	Het bilong wara (m)	Ron bilong Wara (lita/sec)
Tebine gat propela	1 - 5	14 - 55
Tebine i gat tego	2 - 30	8 - 16
Tebine i gat Pelton	3 - 130	0.5 - 8

5.2 Piko - Haidro

Piko-haidro em i wanpela liklik sistem. Em i no nidim bikpela wara long ron na tu sotpla hap tasol wara i ken pundaun.

PIKSA 29: Piko Haidro system

28



29

28 Source: Baylor University, adapted from Wikipedia, "Pico Hydro", https://en.wikipedia.org/wiki/Pico_hydro

29 Source: Mechanical E- Notes, https://mechanicalenotes.com/wp-content/uploads/2019/08/kaplan-turbine-diagram-1000x550.png,accessed 16 June 2021.

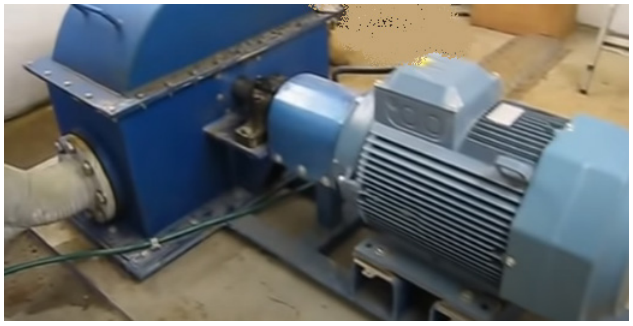
5.3 Mikro - Haidro

Mikro Haidro em wanpela sistem we em i wankain olsem Piko haidro tasol tebine bilong em i bikpela liklik na tu genereta bilong em sa givimg bikpela pawa liklik winim piko haidro.

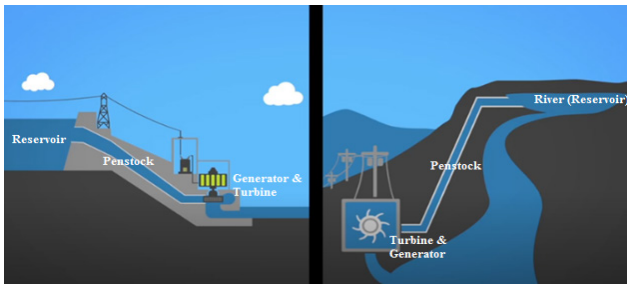
PIKSA 30: Micro Hydro system[30]

5.4 Mini haidro

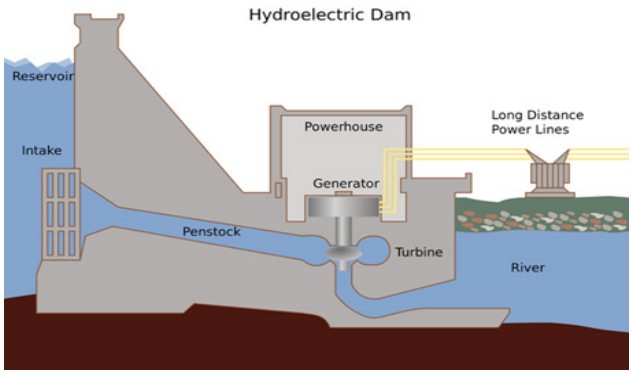
PIKSA 31: Mini Haidro system[31]



PIKSA 32: Han Kais -Haidro Dem na Han Sut – Run-of Riva[32]



PIKSA 33: Haidro Dem[33]



5.5 Mini igo long Bikpela Haidro Sistem

Mini igo long Bikpela Haidro sistem ol igat wankain ol samtin tasol i gat tupela kain sistem olsem i stap long piksa 10 (long Han sut em run off riva na han kais em dem) Dem haidro sistem (Lukim long han kais lon piksa 11) em i bilong ol bikpela pawa sistem we i gat moa kontol long en

30 SUNECO Hydro Turbines, June 2021, https://www.micro-hydro-power.com/

31 Source: Pinterest.com, "Mini hydroelectric Pelton Turbine, https://www.pinterest.com/pin/431360470538243882/

32 Earth & Science Space, "Hydroelectric power generation, https://grade8science.com/7-3-1-what-existing-technologies-could-solve-the-problem-of-global-warming/ or watch YouTube video: Student Energy, "Hydropower 101", 18 May 2015, https://www.youtube.com/watch?v=q8HmRLCgDAI

33 Source: Wikimedia Commons, Hydroelectric Plant, September 2015, https://upload.wikimedia.org/wikipedia/commons/thumb/5/57/Hydroelectric_dam.svg/2000px-Hydroelectric_dam.svg.png

WOK 6

1. Tingim wanpela sos bilong wara long ples blong yu. Drawim wanpela Piko Haidro sistem na long wanem rot bai yu ken kamapim pawa. Wanem nem bilong ol samting i save kamapim Piko Haidro sistem.

2. Long Haidro pawa sistem, painim aut sampela ol bagarap em i ken kamap

3. Painim aut wanem ol kain kain haidro pawa sistem i stap

6

Seifti insait long ol pawa Sistem

Igat sampela ol impotent toktok long seifti yu mas bihainim dispela ol toktok i stap daun bilow long stap seif taim yu wok long ol Haidro Sistem.

1. Mas putim of pawa taim yu laik wok long ol seket bilong pawa long wanem elektrisiti i ron insait i stap.

PIKSA 38: Sain bilong Lukaut[34]

2. Mas kisim wanpela elektrisen long stretim pawa long haus bilong yu. Noken traim long wokim yu yet

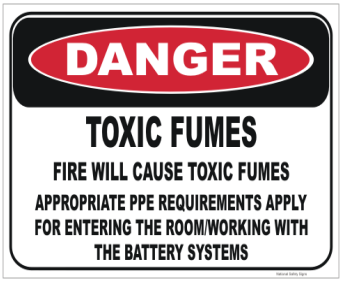
PIKSA 39: Wearim gutpla hanglov[35]

3. Mas werim PPE(personal protective equipment) kain olsem glav bilong han, ol galas bilong ai na ol seifti su
4. Yu yet mas noken traim long stretim ol bateri i bagarap pinis long en. Ol i gat ol kemikol we i ken kamapim bikpela bagarap long yu

PIKSA 40: Lukaut long Esid[36]

5. Noken tru putim ol bateri klostu long paia o insait long ol rum – sampela ol bateri i save givim aut ol nogut ges we yumi no save lukim.

PIKSA 41: Tok Lukaut bilong ol Simuk[37]



6. Noken tru putim ol bateri insait long ol hap we em i liklik o klostu long ol fiul long wanem em i ken statim paia. Olgeta taim yu i mas putim ol bateri long hap we yu sekim gut.

PIKSA 42: Tok Lukaut bilong Bateri[38]

34 Source: AviationPros, https://www.aviationpros.com/tools-equipment/safety-equipment/article/11148860/ground-handling-safety-signs
35 Source: Safety workblog.com, https://safetyworkblog.com/assets/understanding-the-2015-edition-of-nfpa-70e-the-arc-flash-hazard.jpg
36 MSDS online, https://www.msdsonline.com/2014/07/22/sulfuric-acid-safety-tips-sulfuric-acid-msds-information/
37 Source: National Safety Signs, https://nationalsafetysigns.com.au/wp-content/uploads/2020/02/D10332-Toxic-Fumes-sign.png
38 We Need Signs.com, "Ansi Battery Charging Safety Signs", http://www.weneedsigns.com/home.php?cat=403

7

Baim ol Piko-Haidro Pawa Sistem

7.1 Baim wanpela Sistem bilong haus

Haidro Sistem em i hat liklik, inap long taim yu painim aut wanem kain sais sistem yu i laikim. Yumi kisim sampela taim long toktok moa long baim dispela ol samting olsem wanem.

7.2 Sampela ol askim bilong askim man husait i salim dispela samting

1. I gat tok orait na waranti bilong dispela prodak?

PIKSA 44: Tok Orait o waranti Lebol[39]

2. Wanem kain tebain em i stap insait long dispela sistem? Wanem kain pawa i save kam aut long dispela jenereita? Dispela sistem em i DC o AC.S apos em i AC,askim sapos otometik volteg reguleita em i stap wantaim. Kisim ol liklik toktok bilong ol wok bilong dispela sistem.

PIKSA 44: Ol kain kain tebain[40]

PIKSA 45: Bikpela lukluk bilong ol wok bilong tebain[41]

GENERAL CHARACTERISTICS

Certifications:	2006\42\CE (Machinery Directive); 2014\35\UE (LVD); 2014\30\UE (EMC)
Power range:	3 – 750 kW
Head range:	30-550m
Flow range:	2-400 l/s
Number of nozzles:	6
Flow regulation:	on/off valves by electrical drive for flow regulation
Generator:	asynchronous squirrel-cage motors, high efficiency
Generator class insulation/temp. rise:	F/B
Bearings of generator:	lifetime lubricated / with grease-gun
Temperature sensor generator windings:	N°3 PTC in series
Frequency:	50-60 Hz
Voltage:	230/400V - 277/480V, three-phase
Protection grade:	IP23 (protection grade of generator IP55)
Rotational speed sensor:	proximity 1 signal/revolution

The mechanical components in contact with water are in stainless steel

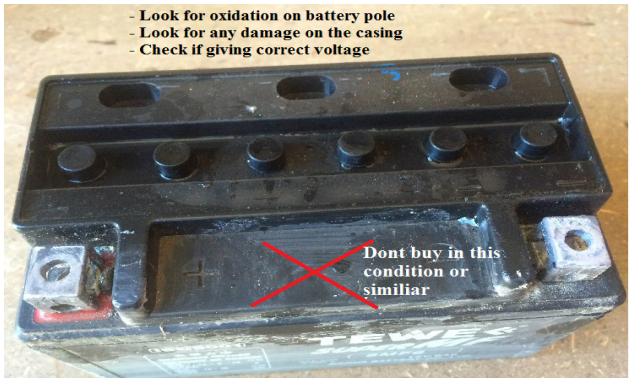
39 Source: PNGWING, https://www.pngwing.com/en/free-png-kfvth

40 Source: Power Spout, June 2021, www.powerspout.com

41 Source: Direct Industry.com, "Hydraulic turbine", https://www.directindustry.com/prod/irem-spa/product-16995-2302864.html, accessed 25 June 2021.

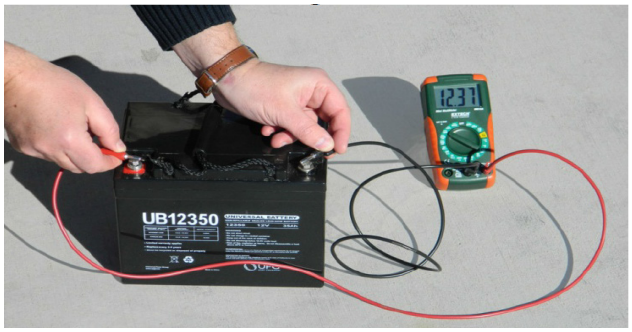
3. Sekim sapos igat ol sain bilong bagarap – Noken baim ol prodak we i bagarap. Olgeta taim yu i mas askim man husait i save salim prodak long soim yu sapos em i wok. Sapos ol hap bilong en i buruk liklik o doti o i bagarap, noken baim ol.Sapos ol bateri ol i lik o solap – noken baim ol.

PIKSA 46: Sek bilong painim sapos i gat bagarap[42]



4. Long sait bilong ol bateri, yu i mas askim man husait i save salim prodak, long soim yu pawa bilong bateri. Na long wanpela 12V bateri – dispela pawa i mas noken go daunbilo long 12V.

PIKSA 47: Kisim halivim long man husait i salim dispela samting[43]



5. Tanim dispela tebain igo ikam long lukim sapos em i stap nating. Askim man husait i salim dispela samting sapos em i ken soim yu long pawa bilong jenereita (sapos em i ken traim statim).

6. Lukluk long ol prodak we ol i gat pepa bilong ol – painim ol prodak i gat ol gutpela bren na logo na ol toktok i stap bilong bihainim. Noken baim ol prodak we i nogat bren bilong ol, ol i no raitim gut o i nogat ol toktok i stap bilong bihainim.

7. Taim yu makim ol inveta, askim man husait i salim dispela samting sapos dispela inveta em i save kamapim sine weif. Ol i mas soim antap long inveta olsem em i wanpela sine weif inveta. Sekim pawa bilong en antap long ol lebel o nem long ol plet.

8. Sekim gut tru ol nem i stap long plet. Sampela taim, prodak ol i ken pekim long ol rong bokis – olgeta taim ridim nem i stap long plet long painim raitpela pawa bilong ol samting.

42 Source: The DIY Life, Tech &Electronics, https://www.the-diy-life.com/wp-content/uploads/2016/05/battery-opened.jpg, accessed 25 June 2021.

43 Amazon.com, "Electric Measuring instrument", https://www.amazon.com/Electric-Measuring-Instrument/s?k=Electric+Measuring+Instrument, accessed 25 June 2021.

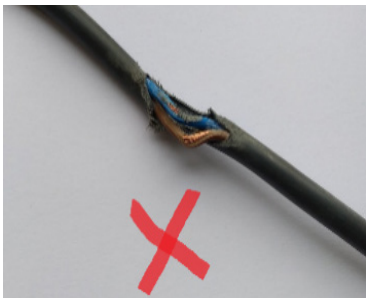
PIKSA 48: Pawa Inveta[44]

3000W INVERTER

Model	YX-3000W-S					
Continuous Power	3000W					
Peak Power	6000W					
DC Voltage	DC12V	DC24V	DC48V	DC12V	DC24V	DC48V
AC Voltage	100VAC or 110VAC or 120VAC ± 5%			220VAC or 230VAC or 240VAC ± 5%		
No Load Current Draws	1.4A	0.7A	0.3A	1.4A	0.7A	0.3A
Frequency	50HZ ± 0.5HZ or 60HZ ± 0.5HZ					
Output Waveform	Pure Sine Wave					
AC Regulation	THD<3% (Linear load)					
Output Efficiency	up to 92%					
DC Voltage Range	10-15.5V	20-31V	40-62V	10-15.5V	20-31V	40-62V
Low Voltage Alarm	10.5V±0.5V	21.5V±0.5V	43V±1V	10.5V±0.5V	21.5V±0.5V	43V±1V
Low Voltage Shut Down	10V±0.5V	20.5V±0.5V	40V±1V	10V±0.5V	20.5V±0.5V	40V±1V
Over Voltage Shut Down	15.5V±0.5V	31.5V±0.5V	62V±1V	15.5V±0.5V	31.5V±0.5V	62V±1V
Low Voltage Recovery	12.7V±0.5V	25V±0.5V	49V±1V	12.7V±0.5V	25V±0.5V	49V±1V
Over Voltage Recovery	14.7V±0.5V	29.5V±0.5V	59V±1V	14.7V±0.5V	29.5V±0.5V	59V±1V
Protection Function	Low voltage shutdown		Buzzer sounds 3 times interruptedly and fault light turns red			
	Over input voltage protection		Buzzer sounds 4 times interruptedly and fault light turns red			
	Over temperature protection		Buzzer sounds 5 times uninterruptedly and fault light turns red			
	Over load protection		Buzzer sounds 3 times uninterruptedly and fault light turns red			
	Short circuit protection		Recover automatically			
	Reverse polarity protection		Built-in fuse or Built-out fuse			
Working Temperature	-10°C--+50°C		Production Size		12V:465x220x80mm; 24V: 445x220x80mm	
Storage Temperature	-30°C--+70°C		Packing Size		45x28x14.3cm	
Warranty	12 months		N.W. / G.W. (KG)		12V: 7.3KG/9.0KG; 24V: 6.9KG/8.0KG	
Start	Bipolar soft-start		Quantity / Carton		2pcs	
Cooling Way	Intelligent cooling fan		Carton Size		56.5x28.5x32.5CM	
Certification	CE		Carton Weight		12V: 18KG; 24V:17KG	

9. Lukim olsem ol prodak ol seif bilong usim. Noken baim sapos yu pilim olsem i gat ol waia i stap ples klia, o dispela prodak em i luk olsem ol i no mekim gut na em i ken kamapim bagarap.

PIKSA 49: Ol Waia i stap ples klia[45]



10. Olgeta taim yu mas lukluk raun long ol stoa na skelim gut ol prais,gutpela bilong ol, ol sais, ol bren, seifti na sapos igat tok orait pepa istap bilong dispela ol prodak yu i laik long baim.Askim ol narapela husait ol i gat sistem, long wanem hap ol i baim long en na askim ol long rot igo long dispela ol stoa.
11. Askim man husait i save salim dispela samting long amas moni ol bai sasim sapos wanpela wokman bilong ol i kam na setim sistem bilong yu. Long wanem, wanpela sistem em i hat tru long setim (i no olsem wanpela sola sistem),em bai i gutpela moa long wanpela man i gat save long dispela wok, long kam na setim bilong yu.Bihain long ol i setim, man husait i mekim dispela wok em bai i traim sistem, na givim skul long bai ol i yusim na lukautim dispela sistem gut olsem wanem.

44 Source: Goteborgsaventyr, https://goteborgsaventyrscenter.se/product/z59qoeznno47/mexxsun-3000-watt-12-v-24-v-220-v-pure-sine-wave-inverter

45 Source: IOL, "How to fix frayed cables", https://www.iol.co.za/technology/how-to-fix-frayed-cables-49412981

Hap bilong rait:

WOK 7

Tisa bilong yu bai givim na soim yu wanpela kit, we i gat planti long ol samting bilong dispela sistem i stap.Traim tingim olsem tisa bilong yu, em i man husait i salim dispela ol piko Haidro-prodak, insait long ol tim bilong yupela, toktok pastaim na bihain mekim ol askim i go long tisa olsem tru yupela i laik baim na setim sistem bilong yupela. Dispela bilong halivim yu yet long mekim rait sois taim yu i laik sistem.

8

Wok na Lukaut bilong ol Haus Sistem

Taim yumi pinis long setim wanpela Piko-Haidro sistem, yumi i mas lukautim gut dispela sistem. Em i olsem tasol wanpela gaden, bus bai i pulap tru long en sapos ol i no lukautim – dispela sistem nau em i strongpela, bai i bagarap sapos ol i no lukautim gut.

8.1 Bilong wanem ol pawa sistem i no save wok?

I gat ol planti wei we ol piko-haidro sistem bilong yumi i gen stat lo givim ol hevi. Sampela taim yumi i save luksave, na sampela taim yumi i no save luksave inap dispela sistem em i bagarap.

8.1.1 Wok na Lukaut bilong Tebain

- Lukluk gut long pipia insait long tebain

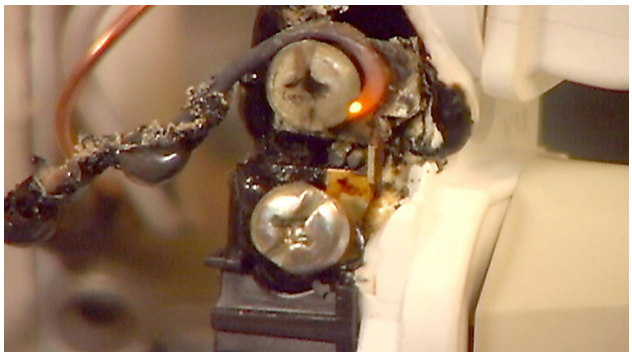
PIKSA 50: Pipia[46]

- Sek olsem olgeta paip insait long tebain ol i stap klia
- Sekim pipia long hap bilong kisim wara

8.1.2 Wok na Lukaut bilong Jenereita

- I mas stap kiln na rot bilong win i mas klia. Usim bloa bilong rausim das long insait bilong jenereita
- Lukim olsem wara em i no kam klostu long jenereita
- Noken brukim daun jenereta long klinim das
- Lukluk gut long ol teminal

PIKSA 51: Showm teminal Konection Figure 51: Terminal Connection[47]



- Long piksa antup onepela teminal hat na sensim kala. Taim yu lukm kala senis quik tim yu mas sekim na strtm. Stronim nut bai nonap helpm ba yu mas sampla tim cutm rausim nogut pat lo kable na makm konectio gen.
- Sekim mol berings – ofim jenerator o tubin na tunim wantm han lo harim ani nois na sapos yu harim nois senism ol berings.
- Redim ol jenerator intracton buk na behinm.

SAFTI TOKSAVE: Nogen holim ol teminal na movim ol hap bilong jenerator taim m wok stap.

8.1.3 Panstok na Strtm bilong Chanel

- Sekim Panstok pip lo ani buruk na stretm arriup tasol.
- Sekim ol rot bilong wara mas nogat pipia.

46 Source: Walczak, N. (2018). Operational Evaluation of a Small Hydropower Plant in the Context of Sustainable Development. Pages 7-8. https://www.mdpi.com/2073-4441/10/9/1114/htm

47 Source: EC&M, https://www.ecmweb.com/maintenance-repair-operations/article/20890352/the-basics-of-electrical-overheating

PIKSA 52: Sekim olsm ol wal nogen buruk[48]

- Sekim ol igat gutpela wara ron igo lo tubin. Rausim ol pipia.
- Behin lo ren yu mas sekim penstock.
- Kinim ol gras kamup klostu lo panstok.

8.1.4 Strtm bilong Batri

Lo strtm batri igat kainkain wok behinm dispela batri typ na hau ol makm. Ol sampela strtm bilong batri istap daunbilo;

- Sekim na kinim ol batri train na teminal.
- Maisarim batri voltes sapos yu igat multi meta o redim batri voltes lo chargs kontrolla. Sapos 12V batri em mas nogen go daun abrusim mak bilong 12V longpela tim. Sapos dispela kamup yu mas save olsm batri em I kam klostu lo pinis bilong em.
- Lo Ol taim batri strtm yu mas sekim ol batri teminal lo rus na titim ol teminal. Sekim batri wara na sensim wantim distil wara lo ol flad led asid batri sapos mak I go tamblo. Trim lo makm olsm long 2-3pela wik.
- Usim stil bras lo kinim pipia lo teminal. Long makim dispela yu mas oltime wearim glov.
- Sekim lo lus o bagarup wia na strtim arriup tasol.

PIKSA 53: LED Lite showim batri Sas Mak[49]

PIKSA 54: Sas kontrola shoim batri voltes[50]

48 Source: Wisions of Sustainability, "Demonstration of Sustainable Low Head Pico-Hydro to Deliver Enhanced Rural Energy Services to the Terai Region Of Nepal", https://www.wisions.net/projects/demonstration-of-sustainable-low-head-pico-hydro-to-deliver-enhanced-rural-

49 Source: Sundaya Apple, "Sundaya Apple Regulator, Quick Start Manual", https://assets.website-files.com/5a2fb65f5701c800018e826f/603e4f42254a71b39b6e33a9_Sundaya%20apple%20-%20English.pdf

50 Source: Amazon, "iSunergy MPPT Solar Charge Controller", https://www.amazon.com/iSunergy-Controller-Intelligent-Regulator-Batteries/dp/B081GSFDKC, accessed 25 June 2021.

PIKSA 55: Wai blo kinim rus lo batri teminal[51]

SAFTI TOKSAVE: Usim safti galas na raba glov taim yu wok lo batri na wearim ol olpela clos nogut ba batri asid igo lo yu.

Yu mas igat wanpela bokis blo baking soda na wara stap clostu lo taim yu wok lo batri lo wanem sapos asid igo lo yu ba quik taim putm na Wasim lo protectim yu yet.

Lo voltes ino ba makim yu guria tasol bigpla curran ba shockim yu Ol bagarup batri teminal ken kukim han blo yu na ken kamupm bigpela birup na paia olsm na yu mas oltime kism was.

Em gutpela lo makim seklist lo helivim yu lo sekim na strtm sistem bilong yu. Sapos yu pinim wanpela hevi quik taim tasol tokm wanpela mahn o meri I sa gut lo pawa. Sampel bilong wanpela seklis is stap daun below;

8.1.5 Basik Strtm seklis

TABOL 6: Basik Haus Haidro strtm wik – Mun Seklis

Namba	Wikly Seklis -Basik	Pinis or Nogat (tick/ X)
1	Sekim rot bilong Wara	
2	Sekim tebine ron gut na nogat pipia	
3	Klinim Tebin na jenerata	
4	Sekim ol teminal na pawa rob	
5	Sekim system mount na taitim ol nat sapos lus.	
6	Sekim batri voltes lo sas kontrolla	
7	Sekim na klinim batri rus	
8	Sekim na taitm ol lus teminal konecton	
9	Sekim batri wara lo ol flad batri na pull mapim wantim distil wara sapos pinis.	
10	Sekim batri ples em I kol na win em ron gut	
11	Sekim ol lit na appliens ol wok gut.	

51 Source; Jim Dunlop Solar

WOK 8

Makim wanpela seklis lo showim ol rutin sek yu ned lo makim lo makim ba haidro sistem bilong yu I wok longepla taim. Traim na tingim ol wai bai yu behinm long makm ol sek na kamup wantm seklis bilong yu.

WOK 9

Ass tintin bilong dispela wok em lo kism ol comuniti mahn na meri lo save lo ol wok bilong ol meri save playim lo makim disison na lo managmen na use bilong ol teknologi. Redim dispela kase stadi na ansarim ol qestan. Yu bai mas ned lo animatim ol toktok lo makm moa klea.

Hau ol Meri sa bringim senis

Susi na Mahn bilong em Mario sa stap lo Braun River Komuniti wantm 3 pela pikinni bilong ol. Ol nogat pawa lo peles bilong ol. Mario em wapela bigmahn lo peles na mahn bilong pinm pis na mas go aut lo solwara bik monin lo katsim ol gutpela pis na putim lo pis stasion wer igat ice lo dispela island. Sampela taim Mario save bringim ol liklik pis golo haus lo kuk. Ol gat 3pela piknini, lily chrimas 9, Andrew chrimas 10 na Meri chrismas 13, olgeta isave go skul 4 km longwei lon haus bilong ol. Ol save wokabt 1 Awah igo long skul. Ol gat bigepla garten lo haus wer ol planim kaukau, yam, kabis na tomato lo kaikai dai to dai. Papa na Mama bilong Mario I stap wantm ol na Mario save wok hat tru na gat ol narapela wok olsm strtim ol boat, go kism ice, karim ol pasenga go lo ol naraplea ailan lo boat bilong em long avinun. Susie wankain too em I save wok hat lo lukautm papa mama bilong Mario, lukautm haus, lukautim ol pikinini na save makim tu ol narapela komuniti wok.

Onepela avinun 13 chrismas pikinini meri bilong tuplea Meri woklo makim skul wok bilong em lo Karasin lam. Simel bilong Karasin pulmupim haus lo ol igat 3pela lam lit lo onepela taim. Mario inno kam bak lo haus yet lo ples em igo lukm ol poro bilong em. 9 pela chrimas pikinini bilong ol lilly koros lo simel bilong Karasin bilong wanem em I makm em pillim sik. Ol pikinini koros namel lo ol yet lo wanm Andrew na Meri lik usim Karasin lam. Lilly la pilai na upim lam na ron raunim ol lo pilai. Ol narapela kirup na ronim em raunim haus, lam mistak na kam lus lo han bilong lilly na pundaun lo mat na paia kirup arriup tru. Meri singaut lo halivim na ol lain stap clostu ron kam lo helivim putm op paia tasol ol buk bilong Meri paia kukim pinis. Lilly poret moa long usim karain lam behin. Behin lo nait Susie tokim Mario long wanpela tingting.

Mario: Stap isi- nogat lain kuk, ba mi baim nupela buks lo pinis bilong wik. Nogen wari.

Susie: Mi tin em taim umi no moa usim Karasin lam lo haus bilong umi.

Mario: Wanm? Yu mas lonlon – ba umi usim Wanm?

Susie: Mi harim olsm sapos umi gat gutpela wara ron umi ken kamupim pawa. Umi gat wara ron clostu innap umi toktok lo chief bilong peles na pinim aut sapos ol tu likim pawa na lait lon haus bilong ol. Ples bilong mama bilong me igat Piko-Haidro na ol pikinini lo dispela peles save makim gut lo skul lo wan mol save usim lait lo studi gut.

Mario: Wow, yu sa toktok planti. Yupela ol meri olgeta taim olsm (Susie Cutim tok quik taim)

Susie: Em u laik tok wanm? 'mipla ol Meri'

Mario: Umm

Susie: Mipela ol meri mas bringim senis lo wanm mipela pillim pen lo life nogat pawa. Me mas kirup lo bik monin hap tutak yet na laitim simel Karasin lem na kukim kaikai. Mi mas lukautim wai mi putim ol kaikai ba nonap bagarup arriup na ba makim umi sik. Mi mas makim gut so ol pikinni tu I ken skul lo liklik lait na mi mas savim moni gen lo baim Karasin.

Mario: Ok mi wanbel umi mas kism pawa. Mi too likm tru wapela fris lo putim ol pis bilong umi. Tasol John woklo tokim me olsm umi ken baim na sanupim piko-hidro system lo wok insait lo wanpela wik. Tasol taim m bagarup ba olsm wanm nau?Na tu disla sistem ba bigepla moni na sapos ol narapela lain lo peles inno likim dispela tintin ba olsm wanm nau?

Susie: Oiyo. Umi traim tasol pastm. Umi toktok lo ol narapela peles lain na lukim sapos ol wanbel umi olgeta ken bun wantm lo bungim moni na sapos umi olgeta bunim lo wanpela wik lo nau go nap lo chrimas umi bai gat innap moni lo baim dispela sistem. Umi gen toktok wantm departmen bilong eneji lo helivim umi tu. Na nogen wari lo strtim umi bai kism helivim lo ol lain whosait igat pinis displea sistem na mi save ol lokal gavaman bai helivim na me tu ken go kism sampela training lo operatim.

Mario: Em gutpela tintin tru Susie. Me hamamas turu umi kamup wantim wanpela tintin lo dispela na me hamamas lo lukautim ol piknini na papa mama bilong mi taim yu ned lo go kism training lo piko-haidro sistem. Ba mi toktok wantm ol peles lain bilong umi tumoro.

Pinis bilong rol Pilaind

Lon pinis bilong pilai kisim ol partisipen lo group na halivim ol tintin lo olgeta samtin ol lainim na askim ol helivim Susie ansarim 2 pela askim:

- Wanm ol sampela samtin Susie, Mario na ol Peles lain bilong ol lukluk long em taim ol ilaik baim piko-haidro sistem?
- Hau ba Susie na ol Meri long peles lukautim Piko-haidro sistem bilong ol bai stap longpela taim?

9

Estimatim sais bilong Hydropower Sistem

Igat mak bilong pawa ol masin olsem lait balb, ais bokis na televisen i save usim embai givim

Liklik Piko-hydropower bai givim liklik pawa tasol long ol masin, olsem na usas i mas save long mak/level bilong sistem.

Dispela ol samting em bai helpim kamapim strong bilong hydropower sistem:

1. Het – Dispela em distens wara i save pundaun we ol i save makim long mita
2. Flow – dispela em mak bilong wara i save go insait long turbine na ol i save makim long cubic meters long wanwan seken (m3/s). Note: wanpela kubik mita/seken em bai kamap long 1000 litas botol wara rong bihain wanpela seken.
3. Gravity – Dispela em i save stap wankain na em 9.81m/s (metres / second)
4. Gudpela wok bilong tebain na elektrikol masin/ekwipmen. 50 emi gudpela mak bilong wok bilong sistem. (0.50)

Kominiti i kenl painim aut sais bilong Piko hydropower sistem antap long dispela ol samting sapos kominiti kisim sampela helpim. Wei bilong painim aut em olsem:

Elekrikol Pawa Autput (Kw) =Het (m) x flow (m^3/s) x Graviti (m/s) x ipisensi

Yu ken usim tep mesa na spirit level long mekim sevei long kisim mak bilong het.

Ron bilong wara emi depend long weda bilong dispela dei. Gudpela wei long kisim strong bilong ron bilong wara em long tupela o tripela taim long wanpela krismas. Tasol dispela wei, em bai kisim mak bilong liklik ron bilong wara na pawa we i ken kamap

Yu ken usim baket, ol paip, spid na ron bilong sol long makim ron bilong wara. Dispela emi no pat long dispela wekshop tasol emi gudpela long kominiti i kisim skull long dipatmen bilong envaironmen long ol impotent samting.

Wok

Wanpela sait emi gat tupela mita het na wara em i ron long oslem 5l/s long seken (wankain olsem yu pulapim wara long baket). Wanem sais Piko-hydropower sistem sapos i usim olgeta wara?

Ansa:

Wara em i ron long litas seken na Long senisim i go long kubik mita long wanpela seken, yu devaidim wantaim 1000 olsem.

Elektrisiti Pawa (Kw) = het (2m) x flow (0.005 m3/s) x 9.81 m/s x 0.5

Elektrisiti Pawa (Kilowat) = 0,04905 kw

Elektrikol Pawa (Watts) = 0.04905Kw x 1000 = 49 Watts

Askim: Fivepela watts em bai i nap long laitim hau mas pela lait balb?

Ansa = 49 /5=9.8 em bai nainpela balb

Hau mas pela watt bai stap long hydro sistem sapos igat tupela het olsem fopela mita?

Elektrikol Pawa (kW) = het (fopela mita x ron bilong wara (0.005 m3/s) x 9.81 m/s x 0.5

Elektrikol Pawa (Kilowatts = 0.0981 kW

Elektrikol Pawa (Watts) = 0.0981 Kw x 1000 = 98 Watts

Emi bikpela samting long toksave olsem, wara i mas ron gud olgeta taim wantaim gutpela het. Dispela em bai inapim bikpela sistem long sanap

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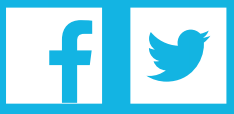

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