



Modul 8 - Wokbuk bilong ol Sumatin

Sola Opereisen na ol Beisik Meintenens

BILONG PAPUA NIUGINI

Halivim i kam long:

KOICA
Korea International
Cooperation Agency

Wokbung wantaim:



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Dispela wokbuk bilong “**Sola na ol Beisik Meintenens**” em i modul bilong ol teknikol lain we ol i laik lainim moa long wei bilong instolim na lukautim sola.

Long pinis bilong dispela kos, yu bai kisim save long ol dispela samting:

- Mekim klia wanem ol kain Sola PV Sistem i gat
- Raitim i go daun wanem ol hap samting bilong yusim long ol Sola PV sistem
- Tokaut klia long ol samting yu nidim long yusim insait long Sola PV Sistem
- Painim aut ol samting we ol i save yusim long instalim PV system na meintenens.
- Mekim klia ol wei bilong instolim na meinteim ol sola PV System.
- Raitim i go daun ol wok lukaut bilong ol sola PV sistem.
- Panim aut na stretim ol asua we i save kamap long ol Sola PV Sistem.
- Soim klia wei bilong yusim Sola PV Sistem meintenens seklis

Lesen Plen

TEBOL 2: Lesen Plen na ol wok bilong wanwan sesen

Sapta	Ol kain Lesen
Kirapim Tingting – Stat	Skul Tingting na wok 1
2 Ol wok samting bilong Sola Pawa sistem	Skul Tingting
	Wok 2
	Wok 3
	Wok 4
3 Ol wok samting Sola PV i nidim	Skul Tingting
	Wok 5
	Wok 6
	Wok 7
4 Ol kainkain Sola PV Sistem	Wok 8
	Skul Tingting
	Wok 9
5 Ol wok samting bilong yusim long Sola PV Sistem	Wok 10
	Skul Tingting
6 Instolim ol Sola PV sistem	Wok 11
7 Ol wok lukaut bilong Sola PV Sistem	Skul Tingting
	Wok 12
8. Painim aut na luksave long ol asua bilong ol sola PV sistem insait long ol haus	Skul Tingting
	Wok 13
9 Sola PV meintenens seklis	Skul Tingting
	Wok 14

Dispela Lenas wokbuk (LW) bilong ol sumatin ol i bin kisim long treina gaid (TG). Ol samting i stap insait long dispela lenas wokbuk 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 panim aut long treina gaid.

Kava piksa: Sola demo kit ol i bin yusim long Vanuatu paillet kominiti skul. Sos: GGGI Vanuatu.

GLOSERI - Mining bilong ol Toktok i stap insait long dispela wokbuk

AC – Altaneting karent em wanpela kain pawa we i save senis olgeta taim, na i kamap long ol inveta, jenareita na ol bikpela pawa sistem.

Sas kontrola – Em i wanpela hap samting we i save kontrolim sas bilong bateri na i save stopim bateri long sas lusim mak.

Klem Mita – Em i wanpela tul we ol i save yusim long makim ron bilong pawa, tasol planti tu i ken mekim ol narapela wok.

Karent – Elektrik karent em i ron bilong pawa sas insait long seket o waia.

DC – Dairek Karent em i wanpela kain pawa we i save stap wankain na i save kamap long ol sola penel na bateri.

Elektrikol pawa – Em i mak we eneji save yusim o kamapim insait long seket, na ol i save makim long Wats.

Elektrolait – Dispela em i kemikel wara ol i painim insait long ol lead esid bateri. Dispela ol esid i save kamapim ros na bringim bagarap.

Inveta – Em i wanpela samting we i save senisim DC pawa i go long AC pawa

Lot – Ol kain samting we i save yusim pawa long mekim wok, olsem ol lait, fen na planti moa.

Mauntin – Wanpela samting we i save holim olgeta samting wantaim long wanpela hap. Tok piksa em, ol samting ol i putim wantaim long instolim na strongim ol sola penel antap long ruf o antap long graun.

Malti-mita – Em i wanpela tul we ol i save yusim long makim na testim elektrikol seket, olsem makim voltij, testim strong bilong pawa seket na planti moa.

Ovasas – Taim bateri i abrusim mak bilong em long sas long taim bateri i bin sas pinis. Dispela i ken sotim laip bilong bateri o bagarapim.

PV Arei – Em ol planti sola penel we ol i pas wantaim.

Sot seket – Taim laip waia long ol oposit sait i kam wantaim, em dispela ol i kolim long sot seket. I olsem tasol positif na nekatif sait bilong bateri i kam bung wantaim.

Sola Penel – PV modul o PV penel, em samting we i save kamapim elektrikol eneji taim i stap aut long san.

Teminol – Em ol koneksen pos bilong konektim ol waia i go long narapela samting. I olsem tasol ol bateri we i save kam wantaim ol positif na nekatif teminol long larim koneksen bilong bateri i go long ol narapela seket. Planti ol taim i gat ol lok antap long ol teminol long strongim sanap bilong ol elektrikol koneksen.

Voltij – Em i olsem tupela poin insait long seket we i save mekim karent long ron insait long seket we i pas.

1

Introdaksen/
Kirupim Tingting

WOK 1

Tok klia long yu yet long ol narapela taim tisa i askim yu. Tokaut long nem bilong yu na toktok liklik long save yu gat long sola insait long komuniti. Olsem tu, yu mas toktok long wanen samting we yu save mekim, na tok aut tu sapos you orait wantaim hap bilong skul o nogat.

2

Ol hap samting bilong
Sola PV Sistem

Ol kain kain samting we sola PV sistem i save yusim em:

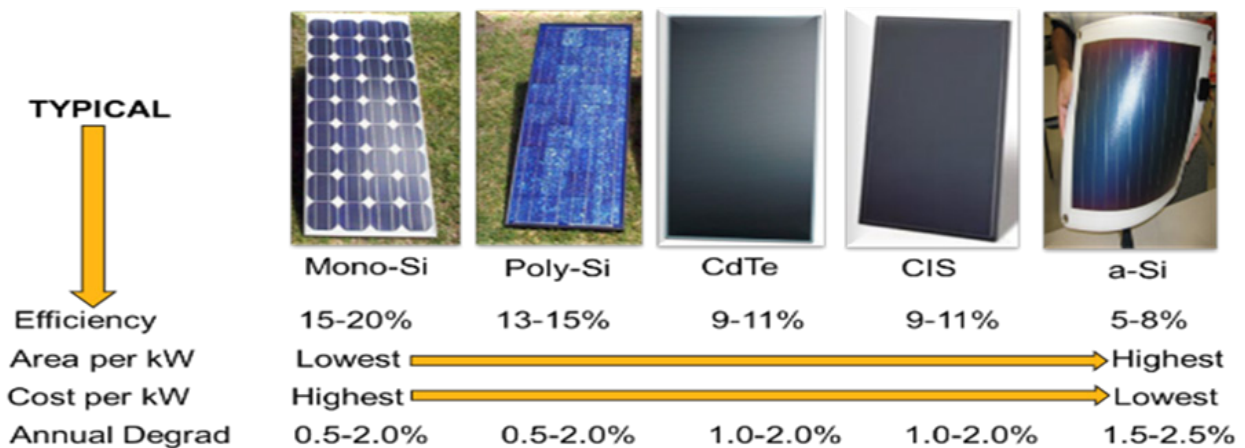
PIKSA 1: Sola Penel¹

2.1 Sola Penel (PV Modul)

Sola PV Modul i save kamapim pawa long senisim lait bilong san i go long pawa. I gat ol kain kain PV modul.



PIKSA 2: Ol kain kain Sola Penel (PV Modul)²



2.2 Sas Kontrola

Sas Kontrola em i save daunim spit bilong elektrik karent we i save putim moa o rausim long ol bateri. Em i save stopim long sas abrusim mak na lukaut tu long taim pawa i lusim mak.

PIKSA 3: Ol kain kain sas kontrola³



Morningstar ProStar controller



Morningstar TriStar controller



Xantrex C-series controller



Morningstar lighting controller



Outback MPPT controller

1 Source: Audio Digital, <http://www.audio-digital.com/tag-produk/sound/>

2 Adapted from the System Components- PV Modules, Arizona State University (VOCTEC), <http://vottec.asu.edu>

3 Adapted from System Components: Charge Controllers & Inverters, Arizona State University (VOCTEC), <http://vottec.asu.edu>

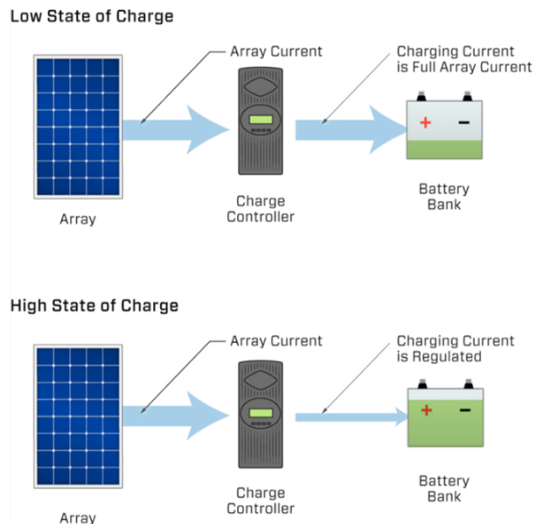
Lukaut long ova-sas

- Taim bateri voltij i go daun stret, sas kotrola em bai oltaim konektim PV modul i go long bateri bilong sas.
- Taim bateri voltij em i go antap, dispela sas kontrola hariap tru i save sepereitim PV modul long bateri long stop sas.

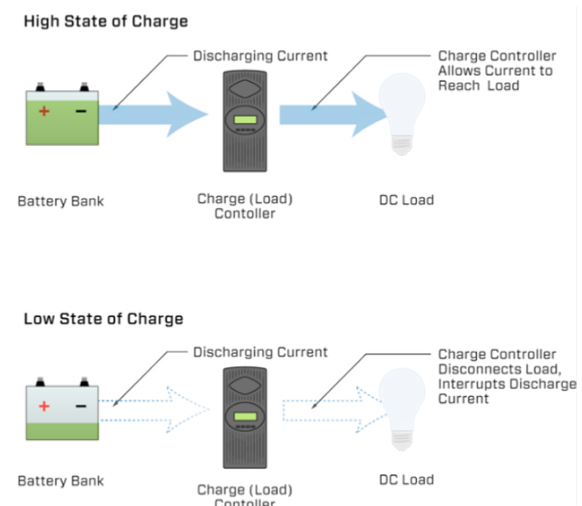
Lukautim bateri long noken sas tumas

- Taim bateri voltij i go antap stret, dispela sas kontrola i save hariap na konektim lot i go long bateri
- Taim bateri voltij i go daun olgeta, dispela sas kontrola i save hariap na konektim lot i go long bateri.

PIKSA 4: Lukaut bilong Ova-sas⁴

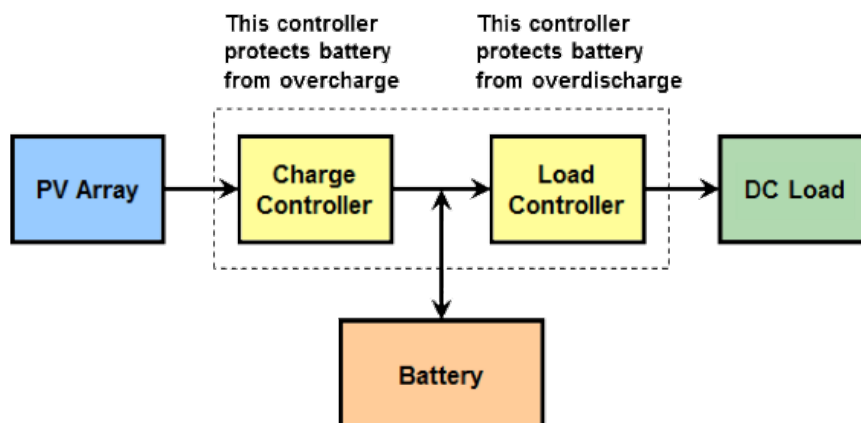


PIKSA 5: Ova-sas lukaut⁵



Dispela seket plen em bilong bihainim,

PIKSA 6: Ol rot bilong bihainim⁶



⁴ Photovoltaic Systems, Dunlop, 2nd Ed.

⁵ Photovoltaic Systems, Dunlop, 2nd Ed.

⁶ Source: Jim Dunlop Solar

2.3 Ol Bateri

Bateri em i wanpela samting bilong storim elektrikol eneji long wei bilong kemikel eneji na i save tanim eneji i go long pawa.

PIKSA 7: Bateri⁷



PIKSA 8: Kain kain ol bateri⁸

Flooded (Electrolyte – Liquid)



Flooded Lead-Acid Batteries

Sealed / Maintenance Free (Electrolyte – Fixed)



Absorbed Glass Mat

Gelled

- Ol bateri i gat esid long en.
- Insait long sola sistem, ol bateri i save sas long sola penel long de taim, na dispela bateri i save givim pawa long nait taim.
- Ol otomotif bateri i no gutpela long sola.
- Ol Sola bateri i narakain. Ol i mekim long wei we, em i save givim liklik karent long bikpela taim stret.

2.3.1 Bateri Kepesiti

- Mak bilong makim pawa sas, o eneji we i stap insait long bateri na dispela i save karim aut long ol taim nid i kamap long en.
- i save dipen long bateri tempresa long rilisim reit na katim-of voltij
 - Ol bateri em i gat bikpela asua long em na i no olsem ol narapela samting long sola.

2.3.2 Ol Fladed Bateri

Dispela em tredisinol enjin stat dip saikol-stail bateri. Usait i yusim i ken kisim long ol wanwan sel na i ken putim distil wara taim bateri em l drai.

2.3.3 Ol Sil Bateri

Insait bodi bilong dispela bateri em i wankain tasol olsem fladed bateri. Tasol em i narakain long wanem, kampani we i mekim dispela bateri i bin putim inap esid long bateri bilong karim kemikel rieksen insait long taim bilong yusim bateri.

2.3.4 Ol AGM Bateri

Planti taim dispela bateri ol i save yusim long statim ol bikpela enjin, long pawa spot, dip saikol, sola na ol bateri storij.

⁷ Source: JICA

⁸ Source: Adapted from "System Components- Batteries", Arizona State University, VOCTEC, <http://voctec.asu.edu>

2.3.5 Ol Jel Bateri

Jel Sel Bateri em i laik wankain tasol olsem AGM bateri, tasol em i narakain yet bikos AGM bateri em i wet sel.

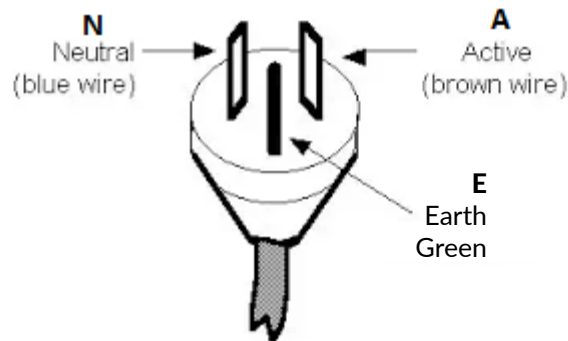
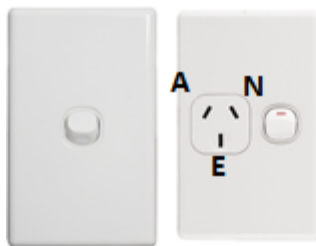
2.4 Ol Keibol

PIKSA 9: Ol Keibol⁹



Long joinim tupelo o moa masin long karim pawa long wampela masin i go long narapela ol i save usim pawa keibol.

PIKSA 11: Swis na Pawa Soket¹¹



2.7 Inveta

Inveta em i wampela pawa tul we i save senisim karent we i ron stret long i go long narapla karent. I gat ol kain kain inveta bilong ol kain kain wok. Long kisim wampela inveta bilong ol sistem we i save stap em yet, yu bai sanap long ol dispela samting:

2.5 Seket Breika/Isoleta

Wok bilong seket breika em long katim ron bilong pawa bihain long wampela bagarap i kamap.

PIKSA 10: Seket Breika na Isoleta¹⁰



2.6 Swis na Pawa Soket

Swis i save seperatim elektrisiti na pawa soket i save konektim na pasim ol masin long yusim pawa.

- Bateri input voltij (12, 24 or 48 V)
- AC output voltij (120 o 220V)
- Bikpela AC pawa ol i nidim long ol bikpela lot (insait lo wats)
- Flo bilong karent (wankain olsem, ol moto) saplai, (insait long ol amp)
- Sampela moa ol samting bilong inveta olsem bateri sasa.

⁹ Source: Global Market, http://newimg.globalmarket.com/PicLib/group0/5e/73/c477defc613ecc9a0e47b82452f4_1.jpg

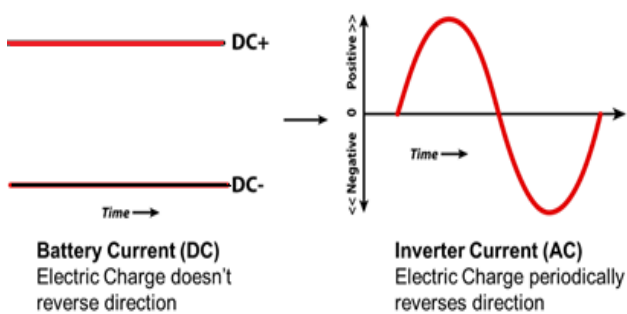
¹⁰ Source: Wave inverter.co, <https://waveinverter.co.nz/shop/solar/solar-connectors/pv-dc-isolator-switch-mc4/> and POSO.com, <http://poso.com.vn/wp-content/uploads/2020/04/1-2.png>

¹¹ Source: University of Newcastle Australia, "Electrical General-Purpose Outlets", <https://www-eng.newcastle.edu.au/eecs/ect/oh&s/Hazards/ElectricalGPOs.html>

PIKSA 12: Inveta¹²



PIKSA 13: Wok bilong Inveta¹³



PIKSA 14: Ol kain kain inveta¹⁴

	Stand-Alone Inverter	Operate from batteries and supply power independent of the utility grid
	Interactive Inverter	Operate from PV arrays and supply power in parallel with the utility grid
	Bi-Model Inverter	Transfer PV system operation to a stand-alone mode and provide backup electric power to critical loads when the utility grid is not energized

2.8 Ol Sola Penel Mautin Sistem

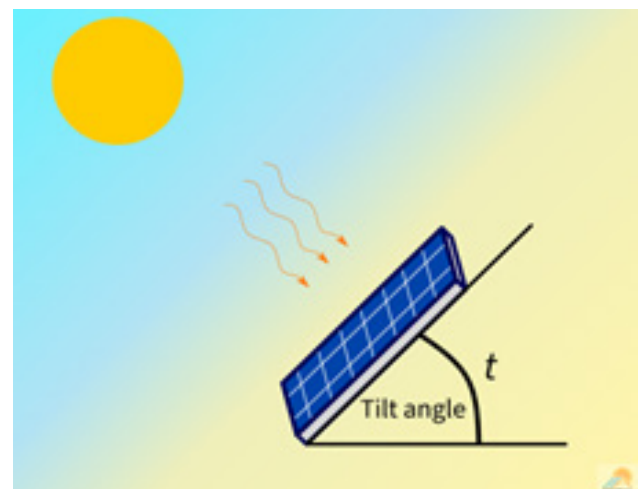
PIKSA 15: Ol Mauntin breket¹⁵



Ol mautin sistem ol i save yusim long stretim ol sola penel antap long ol haus kapa, frant bilong ol haus, o long graun. Ol Mauntin breket i impoten long wanem em i save tanim sola penel long wei em i ken kisim bikpela eneji long san, na i save abrusim seid long penel insait long wanpela de.

2.8.1 PV modul orienteisen

PIKSA 16: Ol Mauntin breket¹⁶



¹² MorningStar, May 2021, <https://www.morningstarcorp.com/products/suresine/>

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

¹⁴ Adapted from System Components: Charge Controllers & Inverters, Arizona State University (VOCTEC), <http://voctec.asu.edu>

¹⁵ Source: Shopping.co, <https://shopee.co.th/Utilizing%E2%9C%BF%E2%9C%B2-Solar-Panel-Mounting-Bracket-End-Mid-Clamp-Kit-Adjustable-For-19Mm-55Mm-Framed-i.188349769.7409094766>

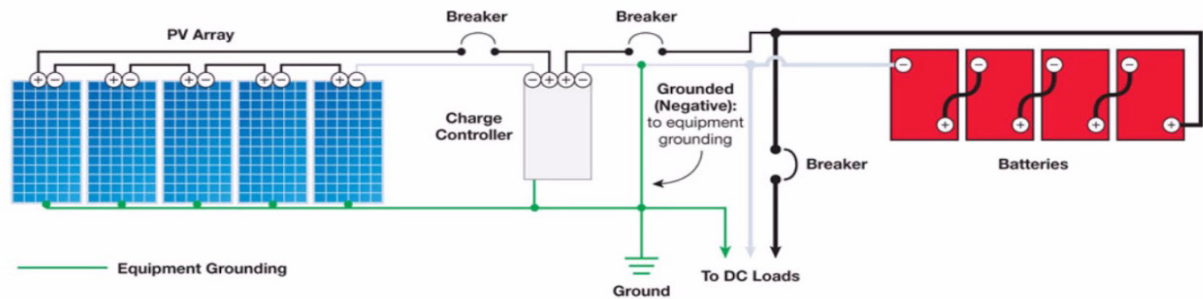
¹⁶ Solar Sena, "Optimal Solar Panel Tilt Angle Calculator", May 2021, <https://solarsena.com/solar-panel-tilt-angle-calculator>

2.8.2 Graun na ol Graunin komponen

Em i gutpela moa long graunim gut ol PV sistem, bikos sistem we ol i graunim gut bai halivim long lukautim yu long ol bagarap, o dai we i ken kamap. Em i ken halivim tu long abrusim paia insait long sistem bepo instoleisen

Long PNG, olgeta PV modul i mas tanim long mak bilong tanpela dekre na i mas feisim Not direksen,¹⁷ dispela bai halivim ol sola penel bilong yu long mekim bikpela pawa long ol yia olgeta.

PIKSA 17: Wei bilong graunim ikwipmen o sola penel koneksen¹⁸



PIKSA 18: Ol Graunin koponen¹⁹



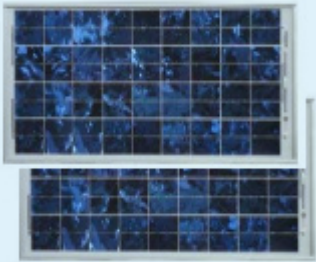
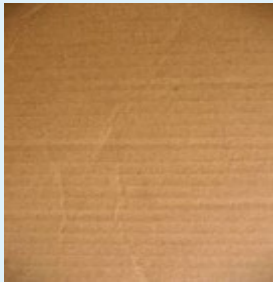
¹⁷ Adapted from the Grid- Connected PV Systems (System Installation Guidelines), by PPA and SEI/API Technical communities, 2019, <https://www.ppa.org.fj/wp-content/uploads/2019/08/Grid-Connected-PV-Systems-Installation-Guidelines-V4-250719.pdf>

¹⁸ Source: Jim Dunlop Solar

¹⁹ Source: Holt, Mike (14 November 2013), "Grounding – Safety Fundamentals", YouTube video, Mike Holt Enterprises. Retrieved 4 February 2019.

WOK 2

Soim long wanem rot seidin i save disturbim wok bilong PV Modul. Kisim voltij (Voc) na Karent (Isc) long ol kain seidin peten na konektim ol PV modul i go long ol Siris na Paralel koneksen

Tes Set-Up		
1. Ol PV Modul (2x) 	2. PV Arei Mauntin Rek 	3. Sandiel 
4. Dijitel Maltimita 	5. Kadbod bilong seidin 	6. Putim wantaim PV Arei olsem tok skul insait long MTT Quick Start Guide 
Tes Prosija: Mesamen bilong Voltij		
1. Konektim ol PV modul insait long Siris 	2. Mesa Open seket Voltij (VOC1) without shading taim i nogat seidin (VOC1) 	3. Seidim wanpela sel bilong Array PV Arei 

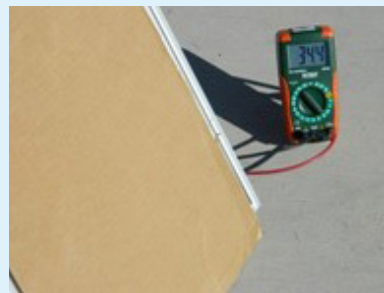
4. Mesa Open Seket Voltij (VOC2)



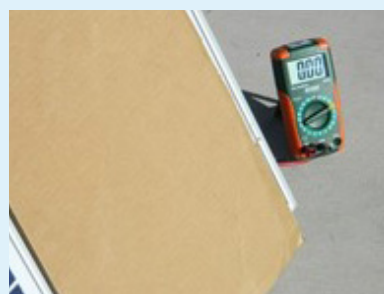
5. Seidim wanpela hap bilong PV Arei



6. Mesa Open Seket Voltij (VOC3)



Tes Prosidja: Mesamen bilong Karent

7. Ripitim Mesamen 2 - 6 bilong Sot Seket Karent (I_{SC1})8. Ripitim Mesamen 2 - 6 bilong Sot Seket Karent (I_{SC2})9. Ripitim Mesamen 2 - 6 bilong Sot Seket Karent (I_{SC3})

Rekodim na Obsevim ol Voltij na Karent: (Raitim mesamen bilong yu long spes daunbilo)

Arei i nogat seid:

Wanpela Sel i gat seid:

Wansait bilong arei i gat seid

Open Seket Voltij (VOC)

VOC1 = 41.1V

VOC2 = 41.0V

VOC3 = 34.4V

Obseveisen: VOC3 em i antap moa expected 20.5V (Voc of a single long mak 20.5V (Voc bilong wanpela module) due to partial light modul)) i go long liklik hap lait transmittance through and around the cardboard we i go insait na raunim kadbod

Short Circuit Current (ISC)

Sot Seket Karent

ISC1 = 1.88

ISC2 = 1.84

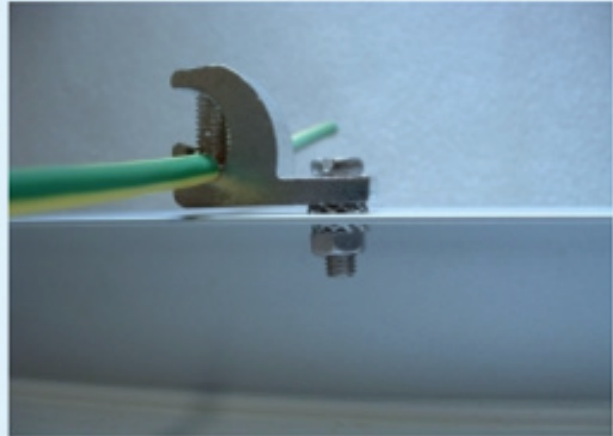
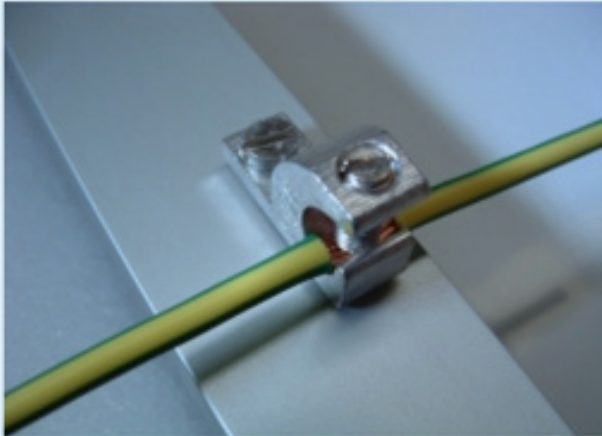
ISC3 = 0

Obseveisen: ISC3 em i 0 bikos ol dispela modules do not have by-pass diodes (the modul i nogat bai-pas diodes (Dispela modul shaded module is acting like a huge resistor i gat seid long em i olsem wanpela bikpela causing the module to operate at near open- resista, we i save mekim dispela modul long circuit condition) wok klostu long open-seket kondisen)

Prektis: Halivim na larim ol sumatin long mekim setap long tripela insait long tim na rekod/makim ol veliu.

WOK 3

Bilong wanem yumi mas graunim Sola PV sistem? Wokim wanpela graun koneksen long PV modul olsem ol i soim daunbilo.



Hap bilong rait:

WOK 4

Bilong wanem na yumi mas yusim ol gutpela mautin breket na i noken larim penel i stap nating antap long ruf?

Hap bilong rait:

3

Ol Sola PV Komponenten
Rikwaimen

3.1 PV Modul (Sola Penel)

Em i bikpela samting long save long ol wok bilong PV Modul. Sampela long ol bikpela samting long save long em:

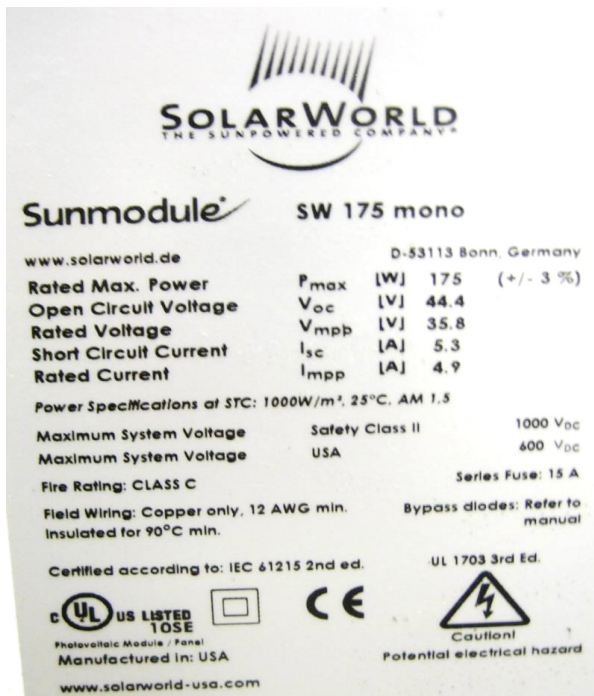
- Wanem em opereting voltij?
- Wanem em bikpela pawa?
- Wanem wok bilong karent?

Olgeta PV modul (ol sola penel) i mas makim wantaim ol dispela toksave (sapos nogat, nogut ol i kam long ol sos we ol ino luksave long en).

- Open-seket voltij
- Sot-seket karent
- Operetin voltij
- Operetin karent
- Meximem pawa
- Poleriti bilong ol teminol
- Meksimem pemisibel sistem voltij

I mas kisim tingting olsem taim eneji i go bikpela, i bai kamapim bikpela pawa na karent tu, tasol voltij bilong PV penel i klostu stap olsem namel long 200-1000 W/m²

PIKSA 19: Nemplet data antap long sola PV modul²⁰



3.2 Efek bilong Tempresa

Dispela sel tempresa i save mekim bikpela wok kamap bilong PV modul.

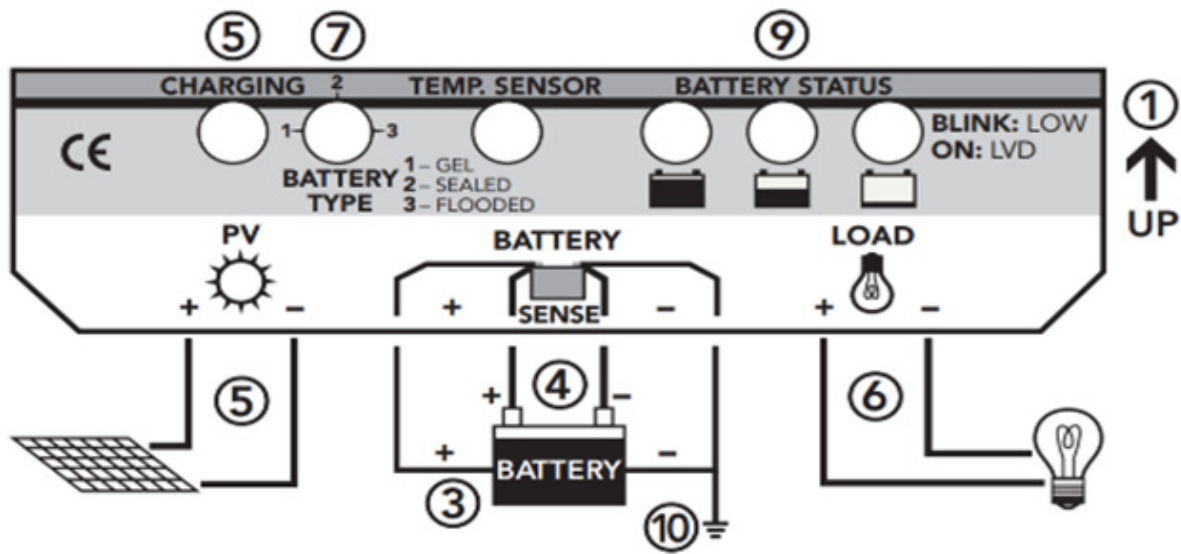
- Voltij i go daun 1% bilong tempresa i go antap 2°C
- Karent i go antap 1% bilong tempresa i go antap 12°C
- Pawa i go daun 1% bilong tempresa i go antap 2.2°C

Olsem tasol, taim sola penel i hat tumas, bai i kamapim liklik pawa tasol. Bihain yu ken lukim insait long dispela modul olsem i bikpela samting tru long i gat gutpela spes autsait long taim bilong instolim ol sola penel

3.3 Sas Kontrola

Dispela sas kontrola i mas:

- I gat inap karent kepesiti bilong sasim (amperes long sola PV) na bilong operetim ol lot (karent lot)
- Inap lo holim PV input voltij na bateri voltij
- i mas gat DC pawa we i antap tru na ken inapim bikpela lot
- i no tait na isi long wok wantaim ol kain kain bateri (fladed o sil lid-esid bateri)
- em i no save senis – ol kontrola we i isi long yusim i gutpela moa na i no olsem ol kontrola we i hat long save long en (abrusim ol hatpela ol kain lukluk long ol samting)
- olsem ol LCD skrin, mikro-prosesa program kontrol, sampela moa)

PIKSA 20: I soim stret ol hap bilong Sas kontrola²¹

Not: Yu i nap tru long yusim ol kain kain sola sas kontrola, sapos yu gat planti sola arei. Yu ken joinim ol kain kain arrei long kontrola na i go long sem bateri beng

3.4 Ol Bateri

Ol bateri i save storim tasol pawa na i no save kamapim pawa

- Unit sel em i 2V
 - 2V i min olsem liklik voltij. Voltij rens em i olsem 1.85V to 2.40V
 - 12V bateri i gat ol 6-unit sel insait wei ol i konektim
 - 6V bateri i gat ol 3-unit sel insait wei ol i konektim

PIKSA 21: Wok bilong bateri²²

SPECIFICATIONS

Nominal Voltage	12 Volts		
Amp Hour Capacity	115 (C20) 90(C5)		
Reserve Capacity Minutes	170 @ 25 Amperes		
Physical Characteristics	Length	13.13"	334 mm
	Width	6.75"	171 mm
	Height	9.38"	238 mm
	Wet Weight	58 Lbs	26.4 Kgs
Terminal Options		BCI Type M	

ELECTRICAL SPECIFICATIONS

Amp Hour Capacity	20 Hour Rate	5.75 A	115 Ah
	10 Hour Rate	10.30 A	103 Ah
	5 Hour Rate	18.00 A	90 Ah
	2 Hour Rate	33.50 A	67 Ah
Internal Resistance	80 F	27 C	7.6 mOhm
Capacity affected by Temperature (20 Ah Rate)	104 F	40 C	102%
	80 F	27 C	100%
	32 F	0 C	65%

²¹ Morning Star, June 2021, <https://www.keoghsmarine.com.au/morningstar-prostar-solar-charge-controller-30a-12-or-24v-pwm-4-stage-charging-led-charge-indicators-sr-ps-30>

²² Source: Waveinverter, co.nz, <https://waveinverter.co.nz/wp-content/uploads/2017/12/products-CR325-1.png>

PIKSA 22: Ol Bateri Koneksen²³



Sampela ol ki poins

- Parellel koneksen i save kamapim Kepesiti/karent.
- Siris koneksen i save kamapim voltij.
- Olgeta enoji o pawa storij i stap wankain
- NOKEN konektim long paralel fopela o moa bateri wantaim, dispela bai kamapim bateri long i no sas wankain, we i ken kamapim ol bagarap long bateri hariap tru.
- NOKEN putim wantaim ol kain kain model na krismas bilong ol bateri, long wanem dispela i ken kamapim ol bagarap long bateri hariap tru.
- Ol bateri i mas stap antap long wanpela gutpela ples we i gat win na i stap hait long san na rein. Noken tru putim ol bateri insait long haus.
- Ol ikwipmen bilong sasim bateri i mas strongpela waia, noken yusim ol koneksen bilong hap taim tasol.
- Ol bateri teminol i mas hait gut long abrusim ol sot seket we yu no plen long en long i kamap.
- I mas gat inap kliarens namel long ol bateri teminol na ain banis bilong haus.

3.5 Inveta

Ol inveta i save gat wanpela feis na tripela feis. Insait long dispela modul, yumi bai putim tingting tasol long wanpela feis 220-240V, 50 Hz output na 12V input.

PIKSA 23: Suresine 300W inveta sanap long em yet¹²



Ol wok samting bilong inveta	
I no save stop Pawa Reiting (300 Wats long 25°C)	Total Hamonik Distosen (< 4%)
Pawa we i antap stret long mak (600 Watts long 25°C)	Lou Voltij Diskonek (LVD) (11.5V or 10.5V)
DC Input Voltij (10.0V – 15.5V)	Lou Voltij Rikonet (10.0V – 15.5V)
Weivfom (Peiwa sine weiv)	LVD Wonin Treshol (11.8V or 10.8V)
AC Autput Voltij (220V o 115V +/-10%)	LVD Dilei Piried (4 minutes)
AC Autput Frikwensi (50 or 60 Hz +/- 10%)	Ai Voltij Diskonek (15.5V)
Pik Ifisiensi (92%)	Ai Voltij Rikonet

[illegible]

WOK 5

Long makim PV modul wanem ol sampela samting yu mas lukluk long en? Toktok wantaim ol narapela. Yu ken lukluk bek

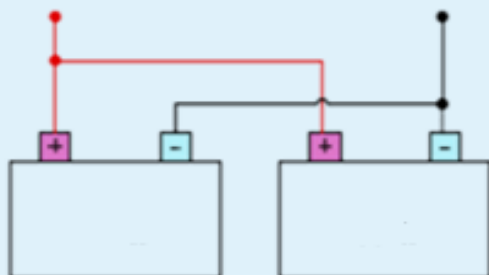
long ol samting ol i bin raitim long antap long painim aut ol Sola PV modul nemplet. Raitim ol lukluk bilong yu daunbilo.

WOK 6

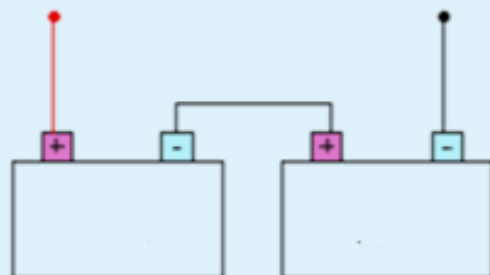
Kisim tupela bateri na taitim ol long siris na paralel. Makim olgeta voltij bilong ol wanwan setap.

Bateri (x2)	Ol Keibel	Malti-mita
		

Parallel
12V 70Ah
840Wh



Series
24V 35Ah
840Wh



WOK 7

Toktok long dispela askim: Wanem samting bai kamap long PV pawa na karent sapos tempreja bilong ol sel in go antap?

WOK 8

Treina bilong you bai providim olgeta wok samting we yupela i bin diskas long en (PV Modul. Kontrola, Inveta na 12 DC lait) wantaim pat bilong en. Ol sumatin bai painim aut nem bilong plet data (Spesifikeisen na Fitjas) bilong wanwan samting.

Rit na panim aut olgeta infomeisen we ol i raitim antap long ol dispela samting. Toktok wantaim ol tim bilong yupela na noken sem long askim treina bilong yu.

4

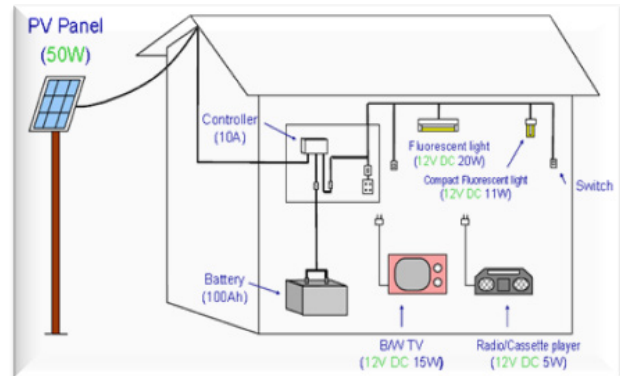
Ol kain kain Sola
PV Sistem

4.1 Sola pawa system we i sanap em yet

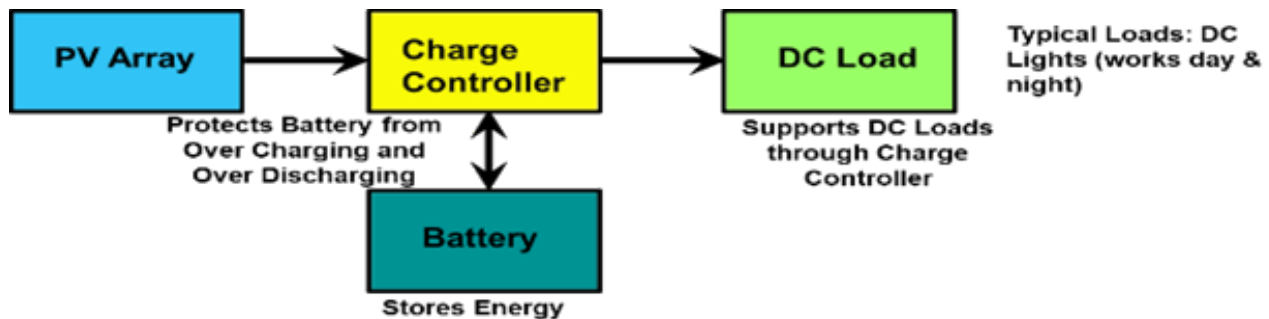
Ol sistem we i sanap em yet i no konek long pawa grit na ol i instolim long ol hap we i longwei na i gat liklik koneksen i go long grit, o ol hap we i gat bikipela nid stret long pawa.

4.1.1 Sola (DC) pawa sistem we i sanap em yet

PIKSA 24: DC pawa sistem sanap em yet²⁴



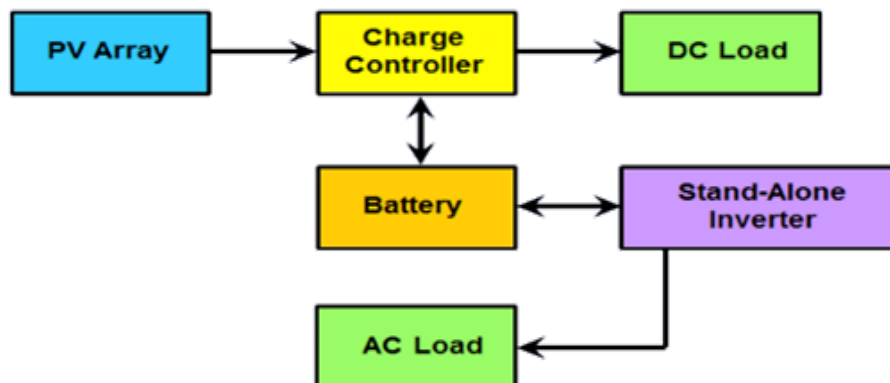
PIKSA 25: Wanpela kain DC pawa sistem wantaim bateri we i stap em yet²⁵



- I save wok long De na Nait, bilong wanem bateri i stap, we i save givim ol DC lot tasol, planti taim em ol lait
- I ken gat ol narapela DC lot olsem ol DC fen, mobail fon i save yusim USB pot long sas, na sampela moa.
- NOKEN putim sampela moa lait o lot i go long SHS sistem, long wanem dispela i ken mekim sistem i bagarap, o ino wok olgeta long wanem eneji i no inap.
- Planti, ol i save yusim long ol liklik haus we ol i save yusim bilong lait na sasim fon.

4.1.2 Sola (DC +AC) pawa sistem wantaim bateri we em i stap em yet

PIKSA 26: Koneksen bilong ol Sola (DC +AC) pawa sistem wantaim bateri we em i stap em yet²⁶



²⁴ Source: JICA

²⁵ Source: Jim Dunlop Solar

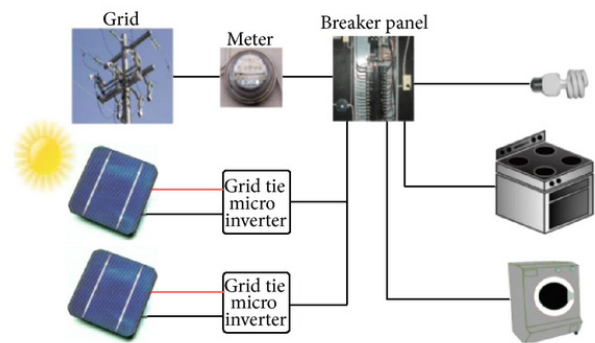
²⁶ Source: Jim Dunlop Solar

- Wankain sistem olsem “DC pawa,” tasol em i gat wanpela moa inveta long givim pawa long ol AC pawa
- NOKEN senisim ol AC na DC pawa. Ol DC pawa i mas kisim pawa long DC saplai tasol. NOKEN TURU GIVIM PAWA LONG OL DC WANTAIM AC SAPLAI. I gat bikipela sans long masin i bagarap, ol man i ken kisim bikipela bagarap o ol i ken dai.

4.2 On-grit sola pawa sistem

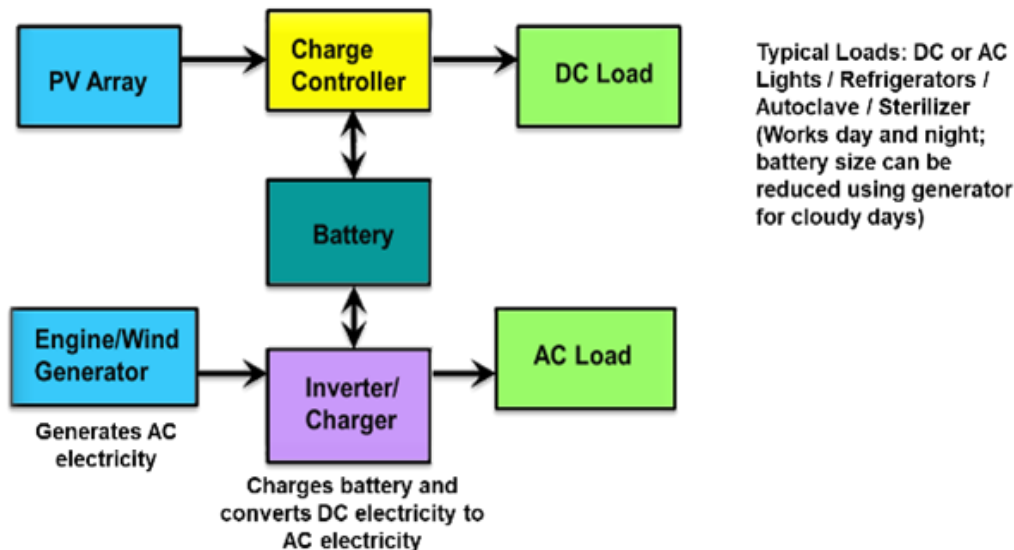
Dispela ol kain kain sistem em ol i planti long ol hap we dispela grit infrastraksa em i orait o i stap.

PIKSA 27: On-grit setup²⁷



4.3 Haibrit Sola Pawa Sistem

PIKSA 28: Haibrit Setap²⁸



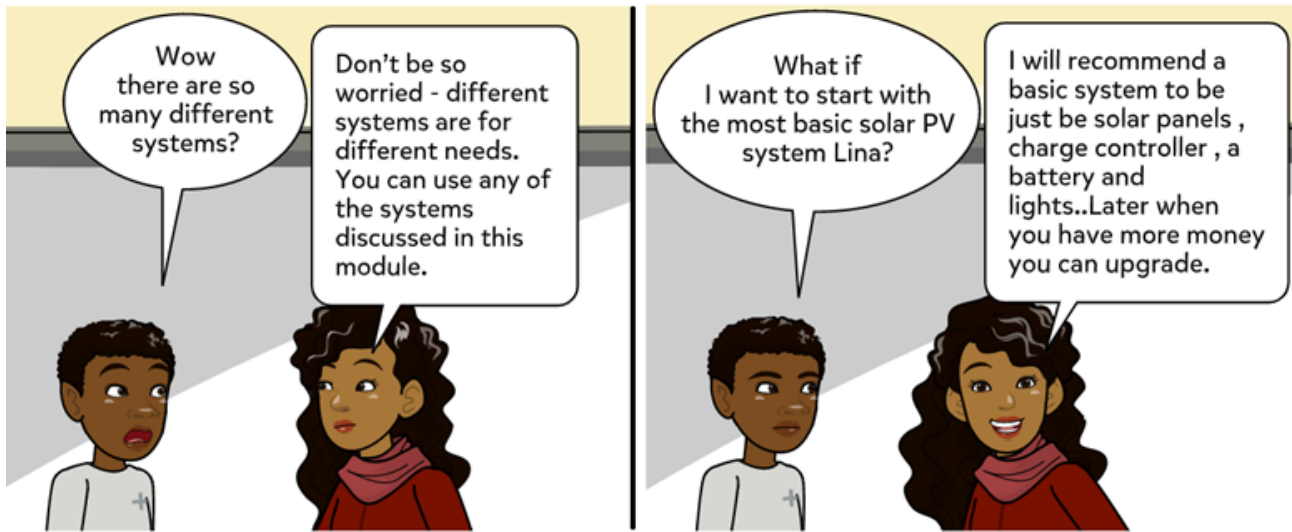
- I save wok De na Nait, bilong wanem bateri i stap
- Wankain sistem olsem “DC + AC lot” sistem, tasol i gat wanpela moa wok bilong sasa insait long inveta long larim ol bateri i sas yusim ol Diesel/Petrol Jenereita/Win tebain na sampela moa. Dispela em i allowim bekap pawa long abrusim pawa i go bikipela o eneji i sot.

Planti, ol i save yusim long ol bikipela haus we i gat lait, sasim fon na ol wok bilong AC masin (TV, masin bilong wasim kolos, ais bokis, na ol sampela moa.)

²⁷ Source: Hindawi, "Journal of Renewable Energy", June 2021, <https://www.hindawi.com/journals/ire/2013/785636/fig1/>

²⁸ Source: Jim Dunlop Solar

Katun Breik



Hap bilong Rait:

WOK 9

Droim tripela ol kain sola pawa sistem na makim wantaim ol wok bilong ol. Em i gutpela moa long toktok insait long grup bilong yu bipo you dro.

WOK 10

Diskas insait long klas wanem sistem yu laikim moa na bilong wanem?

5

Ol tul ol i yusim insait long
Sola PV Sistem —————

PIKSA 29: Ol tul bilong yusim long Sola PV Instoleisen²⁹

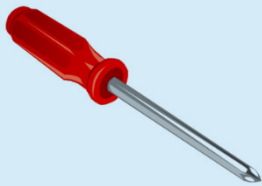
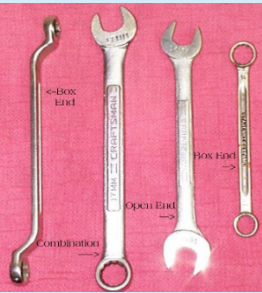
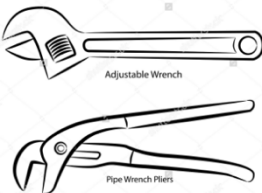
Ol sampela kain tul na ol wok bilong ol

Piksa bilong ol Tul	Nem bilong ol dispela tul	Wok bilong ol dispel tul na wei bilong yusim ol.
PIKSA 30³⁰ AC-DC 	Klamp mita	Ol Klamp mita i save makim ol dispela samting: AC karent, AC na DC voltij, strong na i mekim ol i nabawan tru long wok wantaim pawa.
PIKSA 31³⁰ 	Maltimita	Wampela multi-mita i ken makim voltij, karent, na strong Has higher resolution. Curreint can Em i gat bikipela resolusen. Karent yu i nap long makim sapos mita ol i konektim long siris (na i nogat ol spesol adepta)
PIKSA 32³¹ 	Slotet o Flet skrudriva	Ol i usim long Opim skru

²⁹ Quora, "What type of tools and fasteners are required to install a solar panel", <https://www.quora.com/What-type-of-tools-and-fasteners-are-required-to-install-a-solar-panel/#:n=12>

³⁰ Source: Jim Dunlop Solar

³¹ Source: Galco, www.galco.com

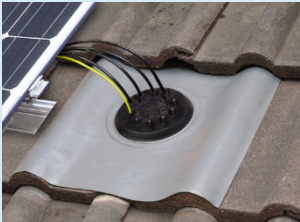
Piksa bilong ol Tul	Nem bilong ol dispela tul	Wok bilong ol dispel tul na wei bilong yusim ol.
PIKSA 33³² 	Filip Skrudriva	Openim skru
PIKSA 34³³ 	Sola Erediens Mita	Bilong makim strong o erediens bilong sola penel
PIKSA 35³⁴ 	Ofset Bokis rens Kobinesan rens Opan rens na Nomel bokis reins	Dispela ol tul i save holim gut na i gutpela long tanim ol samting- olsem ol roteri fastena, olsem ol nat na bolt o kipim ol long em i tanim
PIKSA 36³⁵ 	Edjastabel rens Paip rens plias	Dispela ol tul i save holim gut na i gutpela long tanim ol samting- olsem ol roteri fastena, olsem ol nat na bolt o kipim ol long em i tanim

32 Source: Conceptdraw.com, "Manufacturing and Maintenance", <https://www.conceptdraw.com/examples/diagram-of-screwdriver-and-its-specific-use-in-maintenance>

33 Solar Panel Store Blog, June 2021, <https://www.solarpanelstore.com/products/daystar-ds-05-solar-irradiance-meter>

34 Mechanical Engineering, <https://mechanical-engg.com/gallery/image/2209-wrench-typesjpg/>

35 Source: Pinterest.com, "Different types of wrenches", <https://www.pinterest.com/pin/147352219031480866/>

Piksa bilong ol Tul	Nem bilong ol dispela tul	Wok bilong ol dispel tul na wei bilong yusim ol.
PIKSA 37³⁶ 	Lainman Plias	Ol lainsmen plias em ol kain plias we ol elekrisen na ol narapela tredsmen oltaim save yusim long holim, benim na katim waia na keibel.
PIKSA 38³⁷ 	Nidel Nus Plias	Dispela ol plias em ol elekrisen na ol narapela tredsmen i save yusim long holim, benim, senisim o katim waia.
PIKSA 39³⁸ 	Flesing	Flesing ol i save yusim long stopim ol wara long go insait long ol hap we i op olsm long ol haus kapa.
PIKSA 40³⁹ Module connecta 	Ol Module connecta ol isave usm lo connect ol sla paneal lo series.	

36 Source: AmPro, <https://ampro.fr/en/shop/pliers/wire-cutting-pliers/71-2-high-leverage-diagonal-pliers/>

37 Source: DORNO, Rubber Grip Long-Nose Pliers, <https://www.olo-7.top/products.aspx?cname=rubber+needle+nose+pliers&cid=40>

38 Source: Alternergy Solar Pv and Storage solutions, <https://www.alternergy.co.uk/dektite-lead-multicable-solar-flashing-tiled-or-slate>

39 Source: CED Greentech, <https://www.cedgreentech.com/article/pv-connectors-what-you-need-know>

Dispela em ol kainkain ol skru driva het we ol i save yusim long taim bilong instolim sola na wanwan het i gat skrudriva bilong en stret.

PIKSA 41: Ol Skru wantaim ol kain kain het bilong ol. Yu bin lukim pinis bipo?⁴⁰



Lukaut bilong yu long ol tul em i bikpela samting tru long sola PV sistem. Dispela piksa i soim sef wei bilong karim ol tul.

I gat tripela ol kain lata

- Step Lata (A-fram)

PIKSA 42: Wei bilong karim ol tul⁴¹



PIKSA 43: A-frem lata⁴²



40 Source: UU-99, <https://www.hindawi.com/journals/jre/2013/785636/fig1/>

41 Source: Pinterest.com, <https://www.pinterest.com/bambulancemania/work-apparel/>

42 Source: Total Tools, <https://www.totaltools.com.au/2-4-4-0m-extension-ladder>

- Pletfom Lata

PIKSA 44: Pletfom Lata⁴³



SEIFTI TIP: Taim yu makim stretpela extensen lata, kisim lata we i longpela long mak bilong 3 ft antap long hap yu ken sanap na wok long en. Wanem taim yu yusim extensen na ol stret lata, namba foa step long antap bilong lata em i hap we yu ken kalap i go long em na wok.

- Streit Extensen lata

PIKSA 45: Extensen lata⁴⁴



SEIFTI TIP: Noken turu yusim ain lata klostu long ol elektrikol lain o lkwapmen. Olgeta taim yu mas lukluk i go antap bipo yu apim lata, nogut i gat ol pawalain i stap antap.

Long kisim gutpela lata longpela bilong em i bikpela samting stret. Kisim lata we longpela bilong em i tatsim ruf lain o wol.

Hap bilong Rait:

⁴³ Source: Total Tools, <https://www.totaltools.com.au/2-4-4-0m-extension-ladder>

⁴⁴ Source: Swallow Tail Inn, <http://www.swallowtailinn.com/when-should-replace-your-siding/>

WOK 11

1. Wanem em i bikpela lukluk namel long klamp mita na malti-mita?

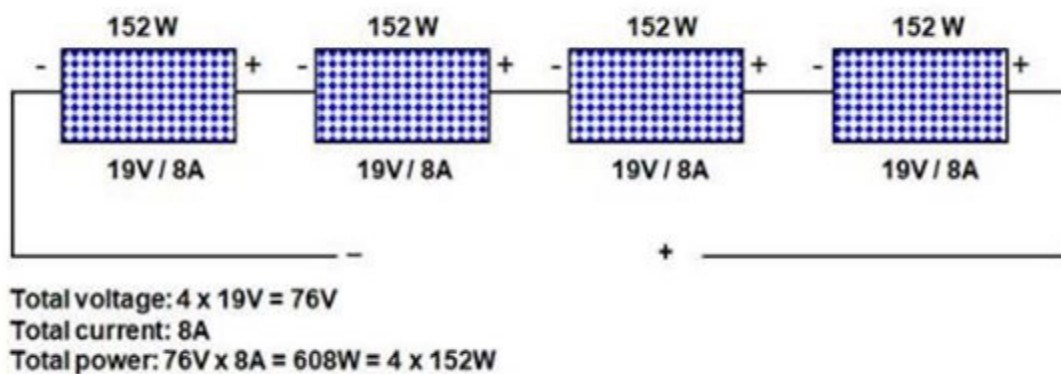
6

Instolim ol Sola
PV sistem

6.1 Ol Siris Koneksen

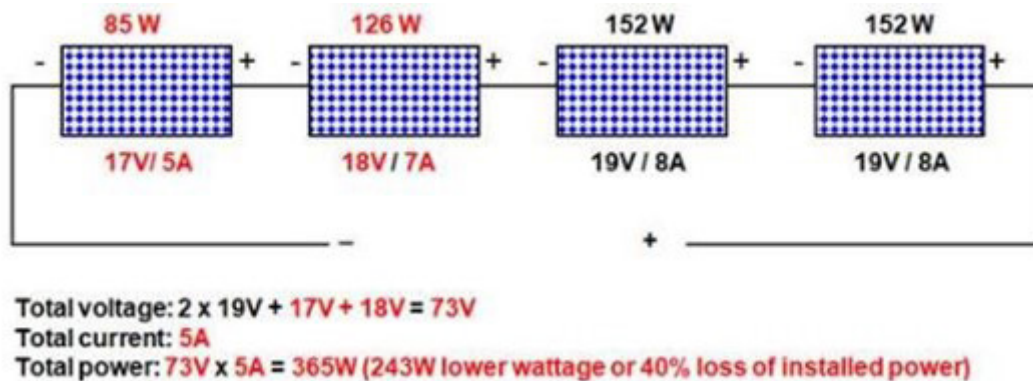
Ol PV modul ol i konektim wantaim pawa long ol siris long mekim voltij igo output (karent i stap wankain). Ol koneksen ol i mekim i positif teminol long wanpela penel na nekatif teminol long ol narapela penel.

PIKSA 46: Ol Siris Koneksen⁴⁵



Taim ol kain PV penel ol i konektim na i paralel, karent i save go antap, tasol voltij i no inap long wanen karent output penel long paralel koneksen i go daun stret.

PIKSA 47: Ol Siris wantaim ol kain sies⁴⁵

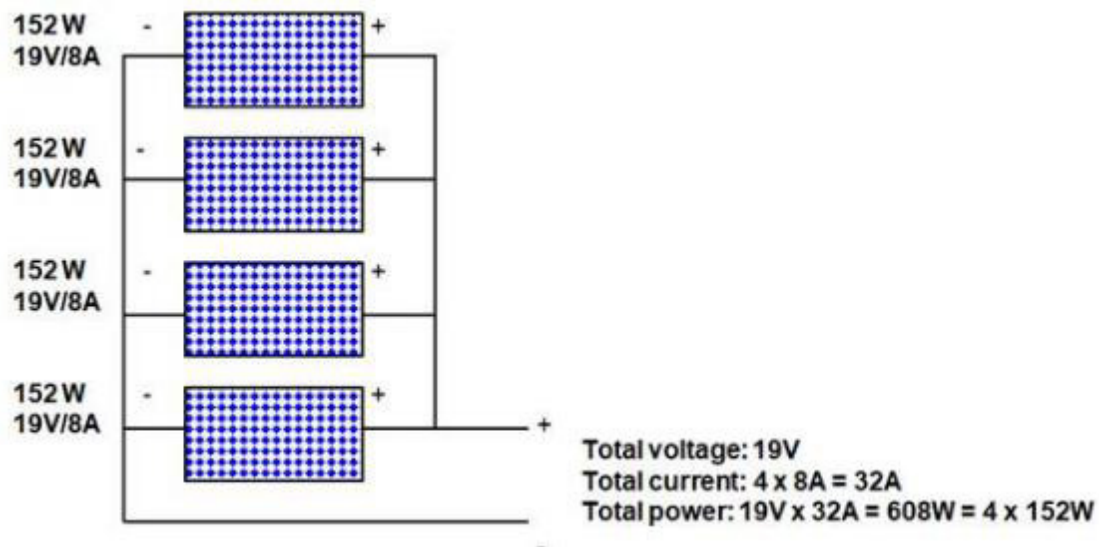


⁴⁵ Photo credit: solarpanelsvenue.com

6.2 Paralel Koneksen

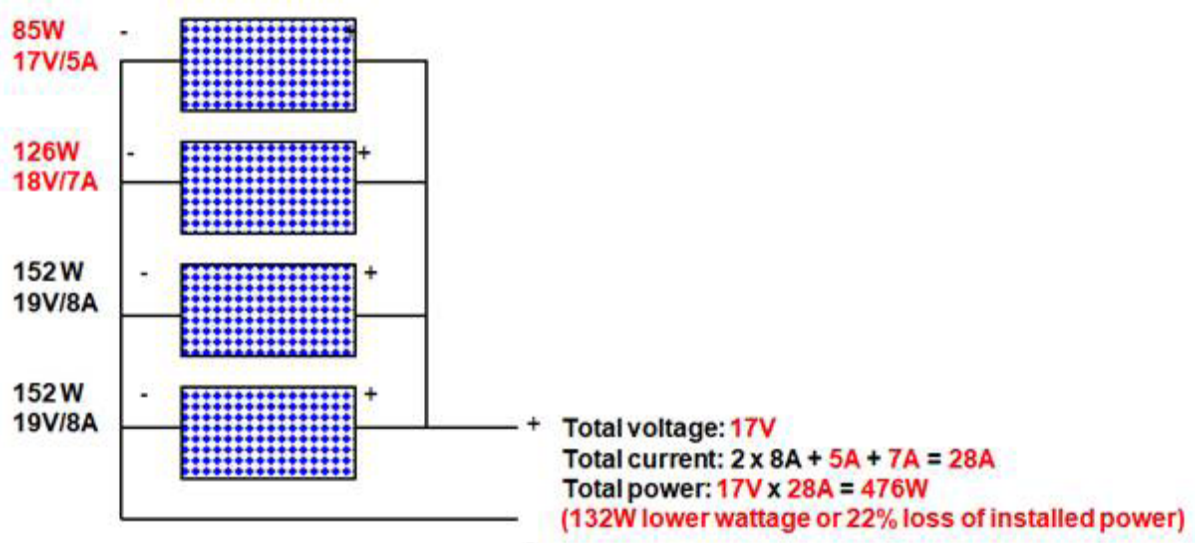
Ol PV modul ol i konektim wantaim pawa na i paralel i bildim karent output (Voltij output i stap sem). Ol koneksen ol i mekim i positif teminol long wanpela penel na positif teminol long ol narapela penel, na nekatif teminol long wanpela modul i go long nekatif teminol bilong narapela penel.

PIKSA 48: Ol Paralel Koneksen⁴⁵



Taim ol kain PV penel ol i konektim lo paralel, karent i save go antap, tasol voltij em i save kism lo penel i save givim liklik karent taim ol i konektim lo parelel.

PIKSA 49: Paralel wantaim ol miks seis⁴⁵



6.3 Redi long instoleisen

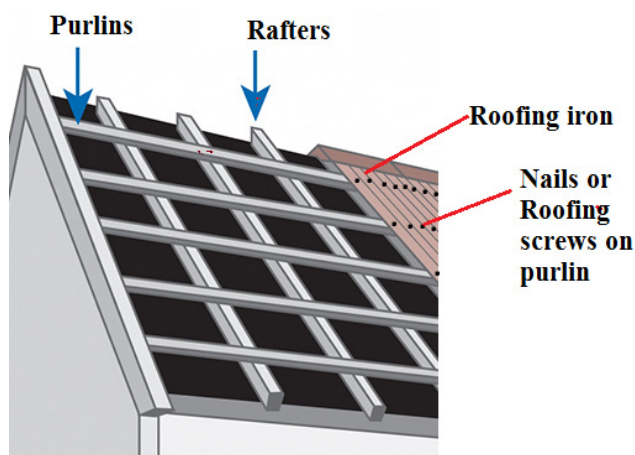
Bipo yu statim instoleisen, yu mas plenim instoleisen na bungim olgeta material we yu nidim na pikim sapos em siris o paralel koneksen we yu laikim na tu tingim long ol kain seifti hevi we bai ken kamap. Olsem na redim ol PPE bipo yu statim ol sola instoleisen. Na yu bai laik long mekim sure olsem ol rait seis na namba long ol koponent yu kisim i go long hap bilong instoleisen.

6.3.1 Sola PV Modul mauntin

Bipo long mauntim ol penel, yu mas mauntim ol reil i go antap long ruf. Na long tilt ankle bilong penel, planti ol ruf i save stap long slop antap olsem na yumi ken mauntim ol penel antap long ruf long ankle bilong em yet.

6.3.2 Ol Ruf Mauntin PV modul

PIKSA 50: Timba straksa bilong ol ruf⁴⁶

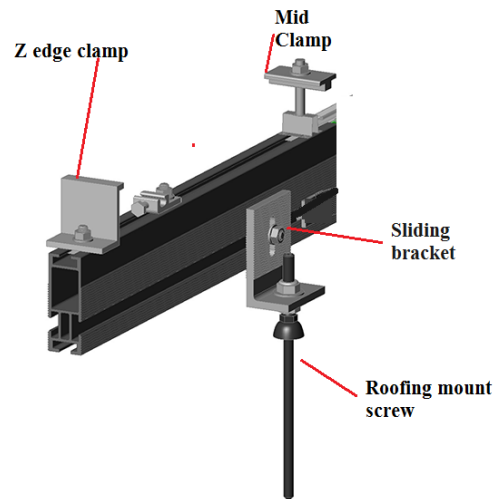


PIKSA 51: Ol Sola Reil antap long ain⁴⁷



Long wok gut insait long PNG, sola penel i mas sidaun sait liklik i go long tenpela dikri na lukluk i go long Not daireksen long mekim na larim bikpela pawa i stap olgeta taim long ol modul insait long ron long yia olgeta.

PIKSA 52: Arere na namel klam bilong sola mauntin⁴⁸



PIKSA 53: Ol sola penel ol i mauntim antap long ol reil⁴⁹



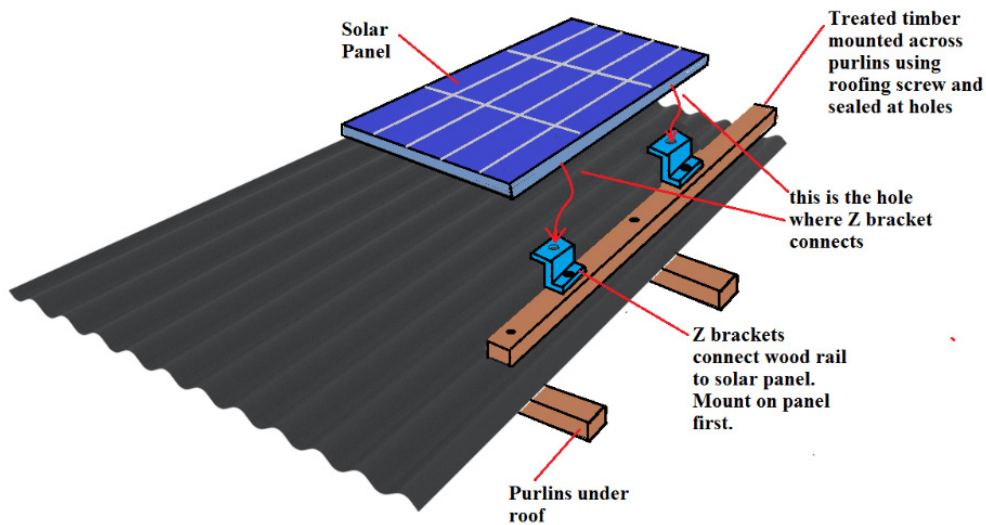
Long sampela taim, ol wankain reil ba i nonap stap. Olsem tasol, bai yu nid long kamapim niupela wei long yusim Z breket.

⁴⁶ Source: Pinterest.com, March 2021, <https://www.pinterest.co.uk/pin/539446861598727570/>

⁴⁷ Source: Sun for Son, <http://www.solar-mount.com/solar-mounts/high-quality-tile-roof-aluminum-alloy-pv.html>

⁴⁸ Source: Solar Gain, June 2021, <https://www.solargain.ca/product/fast-rack-10-panel-mounting-kit/>

⁴⁹ Source: ClayEnergy, Fiji.

PIKSA 54: Pasin bilong yusim ol z klem na timba long mekim sola mauntin long ol ruf insait long Pasifik ailan⁵⁰

Dispela wei ol i soim antap, i save yusim ol metiriel ol i stretim pinis na liklik ol hap ain tasol. Noken yusim stil ain long wanem em i save ros hariap tru.

PIKSA 55: Sola we ol i putim long pol em i gutpela long wanem ruf straksa i no gutpela⁵¹**PIKSA 56:** Tok piksa bilong maunted sola PV mauntin system⁵²

Ol gutpela samting i save kamap long ol pol maunt bilong wanpela o tupela penel sistem em i:

- i stap longwei long seid
- saitim gut na mekim lukluk bilong en i kamap long mak
- mekim penel i kol, long wanem, aninit bilong penel em i klia long kisim win,
- nogat wari long ol lip na pipia i pas namel long ol penel na long ruf,
- gutpela rot bilong kisim wok halivim,
- nogat ol hevi wantaim ol ruf i lik long wanem long ol mauntin penel i stap antap long ain ruf.

I mas i gat gutpela hap bilong pol long sanap, long givim strong long pol. Dispela wok em ol i save yusim simen long mekim.

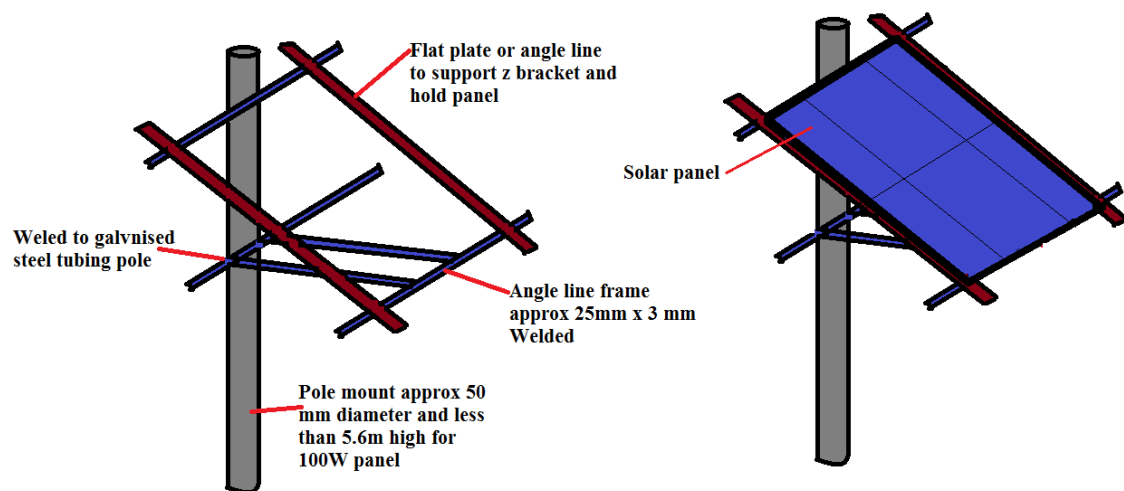
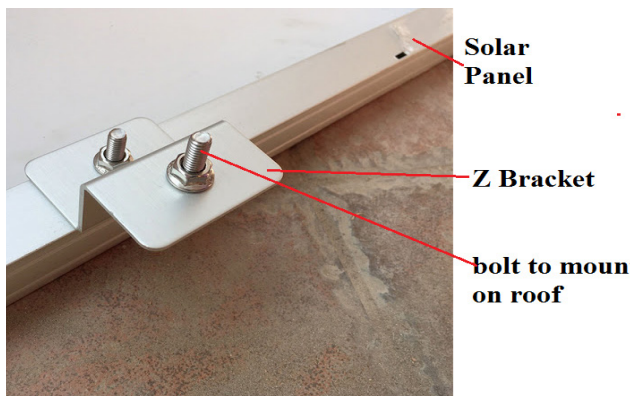
6.4 Graun/pol maunted PV Modul

Sapos ruf mauntin bilong ol sola penel i no kamap gut, ol graun maunted sistem ken givim narapela wei long wokim samting, insait long ol kominiti we i stap insait tru long ples.

⁵⁰ Image adopted online, <https://lh3.googleusercontent.com/NMvliGIRQsn4c6lts7B5o2gAQCOJYhJX49a0Dsh1iN5NjuHdlwiDN4aP2ax6mZfMnWUL=s159>

⁵¹ Source: Fiji Department of Energy

⁵² Source: Mibet Energy, May 2021, <https://www.mibetsolar.com/>.

PIKSA 57: Pol mauntin ol i ken mekim tu insait long kantri yet⁵³**PIKSA 58: Ol toksave bilong Z Klam maunt⁵⁴****6.5 Putim ol Bateri**

Ol bateri ol i save yusim long lukautim eneji bilong yusim long bihain taim.

PIKSA 59: Ol kainkain Bateri⁵⁵

⁵³ Image adopted online, https://lh3.googleusercontent.com/27bgQvgahMcC14Z0r74LIBUyQsbGdJiNIHCs6JRB8Q1HqHkaftLwN_-GBujlZ31dJmJg=s170

⁵⁴ Source: Engineer Solar, June 2021, <http://engineer-solar.com/Products/solar-panel-z-bracket.html>

⁵⁵ Source: Adapted from "System Components- Batteries", Arizona State University, VOCTEC, <http://voctec.asu.edu>

Sampela ki poin lo tingim taim i kam long putim gut bateri em⁵⁶

- Ol i mas putim ol bateri insait long wanpela bateri rum yet o hap we wanpela ples hait.
- Ol ples we ol i makim i mas gat mekanikal lukaut na wei i go long ol bateri i mas pas long ol man usat i nogat tok orait long go insait.
- I mas gat inap hap ples insait long rum long mekim isi long putim bateri na wok bilong mekim gut bateri. I mas nogat ol ain samting i mas stap long dispela hap we man bai pudaun antap long ol bateri teminol na kamapim sot seket.
- Sapos hap bilong bateri em i rum bilong em yet na hap bilong wanepla haus we ol man na samting i stap tu, wei bilong kam insait mas long outsait na ol bateri i save rausim ol bagarap smuk (e.g., ol open-sel led-esid bateri) ol wol insait mas nogat hul long go insait long haus na i mas gat hul bilong win long go outsait.
- Noken putim elektrikol masin antap long ol bateri we i save rausim ol ges we i save kamapim bikpela bagarap.
- Dispela ples we ol bateri ol i putim i mas drai.
- Ol bateri mas stap antap longwe long graun o simen flo.
- Hap we bateri i stap mas noken stap long ples we lait bilong san i kisim na em mas stap long ples we bai mekim bateri stap kol.
- I mas gat inap gutpela hap bilong win long ron lo halivim long lukluk long temprasa na sapos em i nid, long abryusim bild-ap long haidrojen o ol narapela ges i save go wantaim sas.
- Ol bateri i save hevi na ples daunbilo long ol bateri i mas inap long karim hevi bilong ol bateri na noken buruk.

6.6 Putim Sas Kontrola na ol narapela komponen.

Ol hap samting we i stap bek bilong Sola Hom Sistem, olsem sas kontrola, ol lot, pawa rop na seifti ikwipmen, ol i save putim long mauntin bod na putim antap long wol olsem piksa daunbilo i soim.

PIKSA 60: Enjinia i soim SHS sistem we ol i putim long wol⁵⁷



Ol toktok bilong bihainim long putim ol hap samting bilong Sas Kontrola em:

- Ol hap samting mas putim bihainim ol toktok bilong kampani i bin mekim.
- Olgeta hap nid bilong wanwan hap samting bai mas bihainim long larim gutpela rot na wei bilong win long ron bilong ol dispela hap samting.
- Putim sas kontrola na inveta (sapos em i stap) i mas stap klostu long bateri long daunim ol longpela waia na daunim ol voltij we i pudaun.
- Noken putim ol hap samting long rot bilong lait bilong san na putim long hap we i nogat das.
- Long wanem ol hap samting, kain olsem inveta, em i ken hevi, em i bikpela tru long mekim mauntin bod i strong inap long karim hevi.
- Ol DC (na AC waia sapos inveta em i stap) mas putim na lukautim gut. Ol AC waia mas stap ol yet long ol DC waia.
- Olgeta waia we yusim mas gat bikpela voltij na karent reiting i moa long meksimam voltij na karent we i nid insait long seket.
- Olgeta lukaut na senis bilong ol hap samting i mas gat gutpela mak long ol i bai ken wok gut olsem long wei ol i sapos long wok.

⁵⁶ Off Grid PV Power Systems – System Installation Guidelines, SEIAP, 2019

⁵⁷ CBS Power Solutions, May 2021, <https://www.worldbank.org/>

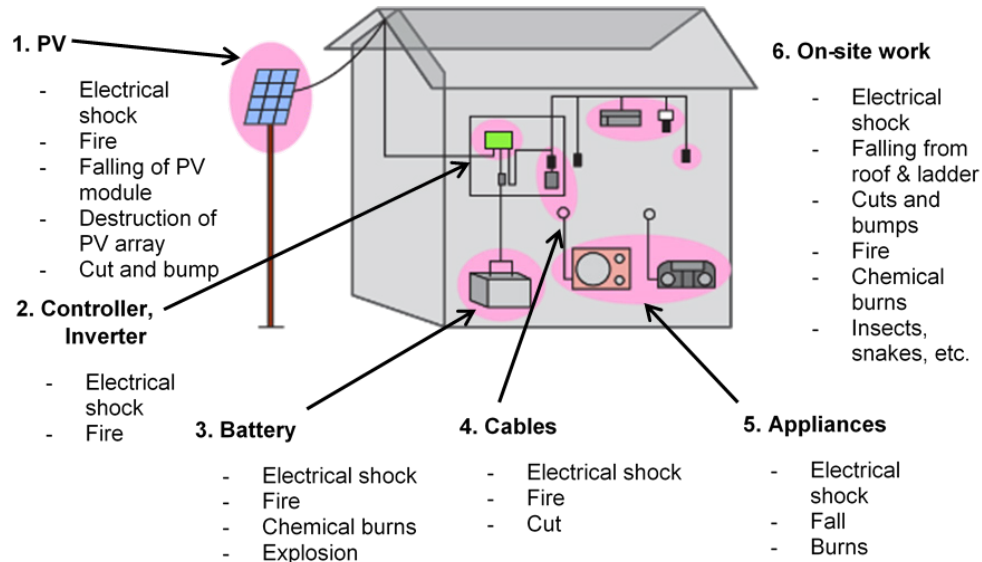
Hap bilong Rait:

7

Seifti wok bilong ol Sola
PV Sistem

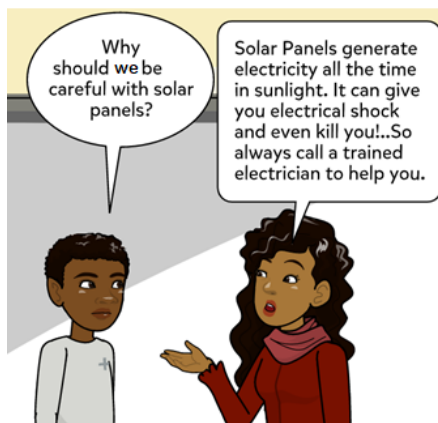
Seifti em i wanpela bikpela samting insait long putim na lukautim Sola PV. Sampela ol seifti risk em ol i makim insait long piksa daunbilo.

PIKSA 61: Seifti risk insait long Sola PV Sistem⁵⁸



7.1 Ol Seifti Rul bilong bihainim

PIKSA 62: Mas olgeta taim kisim halivim long wanpela eletrisen o sola teknisen⁵⁹



1. Olgeta taim mas putim pawa of bipo long mekim ol sampela moa koneksen o senis. Yusim ol rait tul na abryusim ol sot seket we i ken kamapim paia.

PIKSA 63: Tok Lukaut Sian⁶⁰



2. Olgeta taim yu mas putim o mekim wok long ol seket we yu bin kisim skul long en. Noken traim long wok long ol Sola PV sistem sapos yu no save gut long wok bilong sistem.

PIKSA 64: Werim ol glav i gat sil⁶¹



⁵⁸ Source: JICA

⁵⁹ GGGI, Fiji.

⁶⁰ Source: AviationPros, <https://www.aviationpros.com/tools-equipment/safety-equipment/article/11148860/ground-handling-safety-signs>

⁶¹ Source: Safety workblog.com, <https://safetyworkblog.com/assets/understanding-the-2015-edition-of-nfpa-70e-the-arc-flash-hazard.jpg>

3. Mas olgeta taim werim PPE (pesanel protektiv ikwipmen) olsem ol glav we i gat sil, ai galas na seifti su. Noken turu holim laip waia we em i stap ples klia wantem glav we ol i gat sil long en.
4. Noken turu traim long mekim wok long ol bateri we i no wok gut. Ol bateri i gat ol marasin we i ken kamapim bikpela bagarap.

PIKSA 65: Esid Tok Lukaut⁶²



5. Noken turu putim ol bateri arere long paia o insait long rum bilong silip – ol sampela bateri i save givim ol nogut ges we yumi no save lukim.

PIKSA 66: Tok Lukaut long ol Simuk⁶³



6. Noken turu putim ol bateri insait long ol liklik hap ples or klostu long ol fiul bilong wanem ol i ken kamapim paia. Olgeta taim putim ol bateri insait long hap we win i save go lo em.

PIKSA 67: Tok Lukaut bilong Bateri⁶⁴



7. Olgeta taim mas werim rop we ol i pasim i go long het bilong haus bilong yu, long taim yu wok long putim ol sola PV penel antap long het bilong haus. Olgeta taim tupela man mas wok wantem taim wok antap long het bilong haus.

PIKSA 68: Pasim rop long het bilong haus olgeta taim⁶⁵



8. Mas save olsem sola penel bai stat mekim pawa wantiam wanem lait bilong san i stap. Olsem na noken holim ol waia long ol taim or traim long putim waia wantem.

PIKSA 69: Mas lukaut taim karim penel long taim san i hat⁶⁶



9. Ol sola penel na ol mauntin bilong ol na het bilong haus tu i ken go hat nogut tru long san olsem na lukaut gut na werim ol glav na ol narapela PPE taim holim ol hap antap i hat.

⁶² MSDS online, <https://www.msds-online.com/2014/07/22/sulfuric-acid-safety-tips-sulfuric-acid-msds-information/>

⁶³ Source: National Safety Signs, <https://nationalsafety-signs.com.au/wp-content/uploads/2020/02/D10332-Toxic-Fumes-sign.png>

⁶⁴ We Need Signs.com, "Ansi Battery Charging Safety Signs", <http://www.weneedsigns.com/home.php?cat=403>

⁶⁵ Source: Solar Power World, <https://www.solarpowerworldonline.com/2016/01/how-to-stay-safe-on-top-of-metal-roofs-when-installing-solar/>

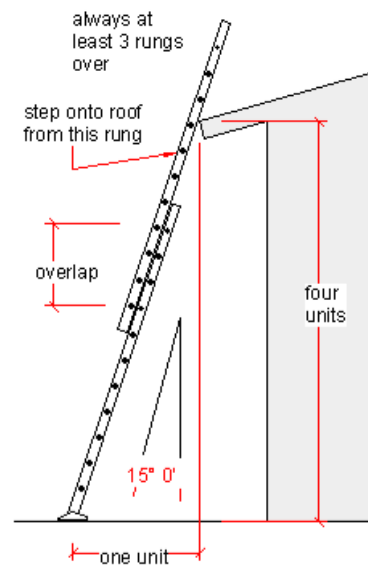
⁶⁶ Adapted from Barefoot college Annual Report (2016-2017), https://www.barefootcollege.org/wp-content/uploads/2018/10/Barefoot_annualreport_2016-17_v7_online.pdf

PIKSA 70: Werim PPE na pasim rop long het bilong haus⁶⁷



10. Olgeta taim yu mas bihainim ol lata seifti rul taim yusim lata long go long het bilong haus long wok long ol sola PV sistem.

PIKSA 71: Lata i mas mekim klostu long 75 dikri engol wantaim graun⁶⁸



⁶⁷ Source: Pacific Prime Singapore, <https://www.pacificprime.sg/blog/covid-19-lockdown-singapores-quarantine-measures-for-foreign-workers/>

⁶⁸ Source: Builder Bill, <https://builder-bill.com/diy-help>

WOK 12 - MENDATORI

Hap A:

Mekim ol grup na tingim olsem yu bai putim 2 x 50-wat penel wantem 3 x 30Ah bateri wantem wangepa 20A sas kontrola, 2 x Dc lait na 1 x 100W inveta wantem wangepa singal AC lait balb olsem wangepa lot.

Yu mas nambawan tru toktok long olgeta seifti we yu nid lo bihainim taim yu mekim dispela instoleisen. Toktok o raitim i go daun. Instolim wangepa DC na AC Standalone sistem yusim Sola Treining Kit we i stap.

Pat B: Instoleisen (Yusim VOTEC Kit bilong DC na AC Setap)

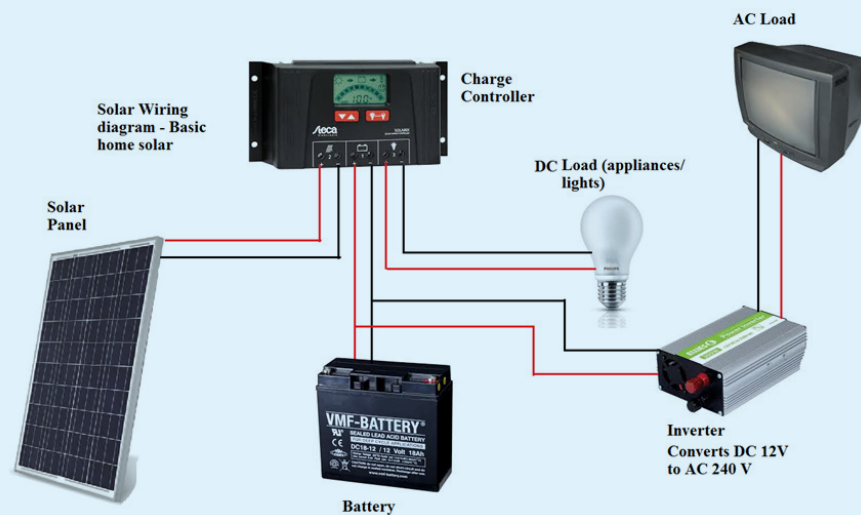
Givim ol sumatin wantaim wangepa solar PV sistem we igat ol dispela samting:

- Ol Sola penel
- Bateri
- Sas kontrola
- Inveta
- Ol DC lait balb (olsem 10W) wantaim wangepa swis olsem AC lot

- AC lait balb (olsem 10 W) wantaim swis
- Sola Penel mauntin kit
- Elektrikol waia
- Ol Plias, skru driva, multi-mita
- Ol PPE – insuleitet glav, ol gogols, ol insuleited tul, helmat, ruf hanes
- Ol waia konekta na DC seket breika

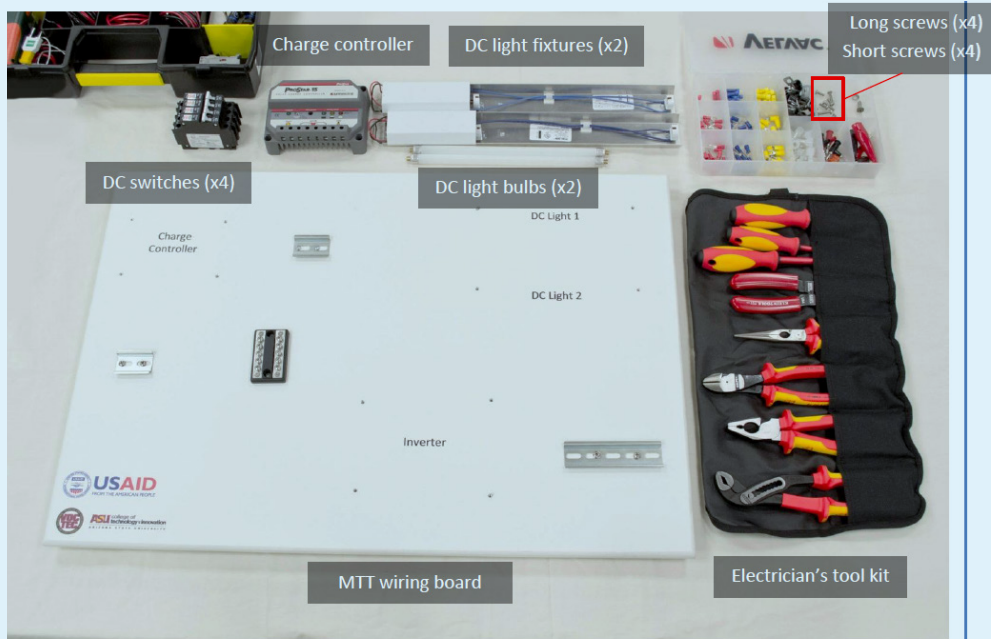
Insait long dispela wok ol sumatin bai traim long instolim stret sola PV sistem wantaim ol seket mak olsem piska i soim

PIKSA 72: AC/DC Sola PV Sistem⁶⁹

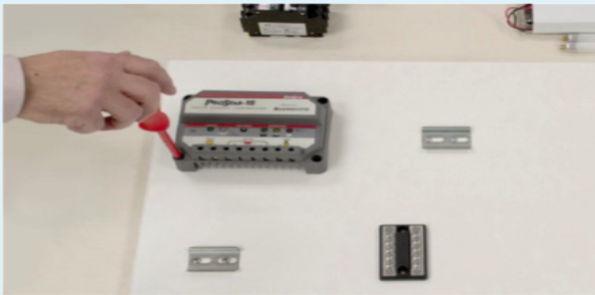


Ol sumatin i mas tok klia long we bilong mekim instoleisen. Sapos i gat ol grup, ol i mas wan wan kisim taim long wokim dispela wok.

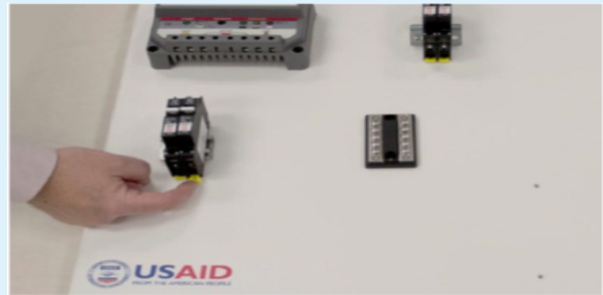
OL METIREIL BILONG DC SETAP



STEP 1



STEP 2



STEP 3

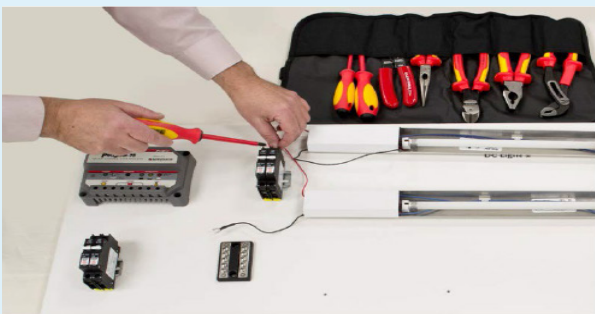


STEP 4



PUTIM WAIA LONG OL KOPONENT BILONG DC SISTEM

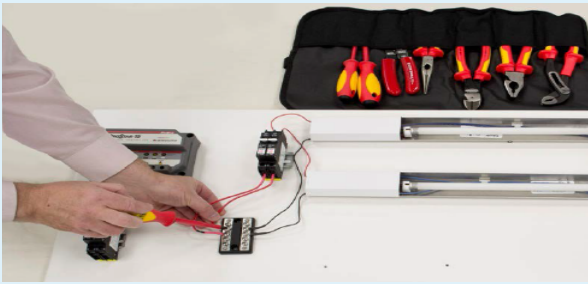
STEP 1



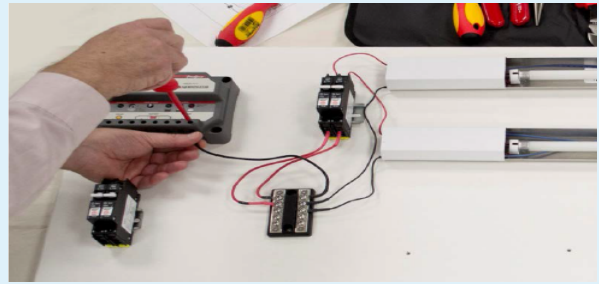
STEP 2



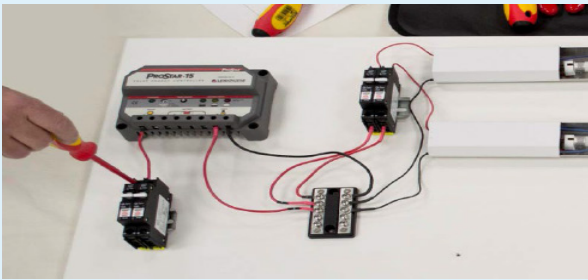
STEP 3



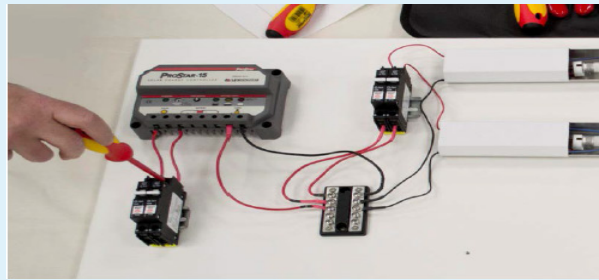
STEP 4



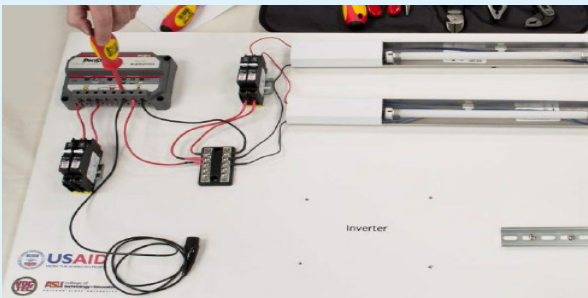
STEP 5



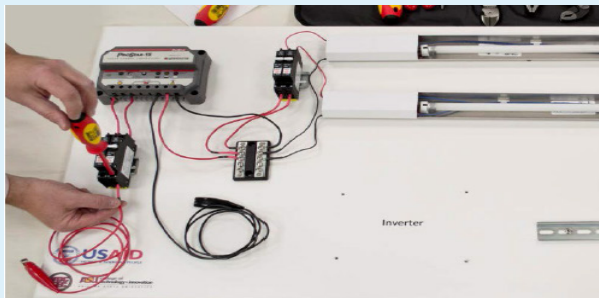
STEP 6



STEP 7

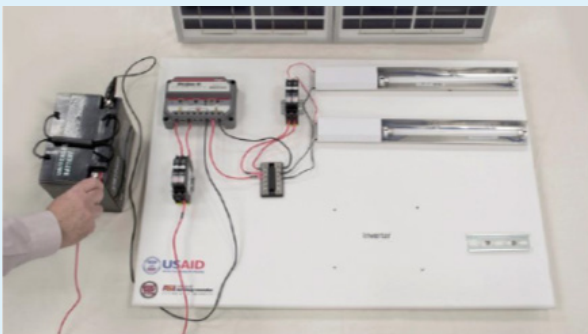


STEP 8

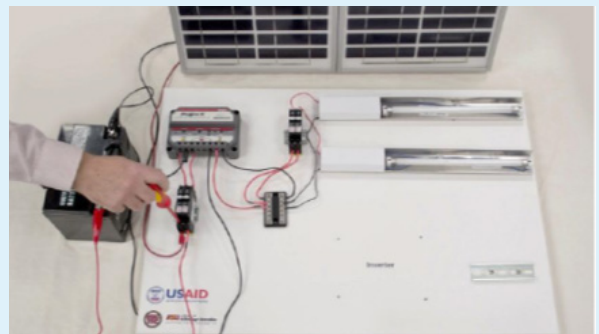


LONG DISPELA STEP YUMI BAI KONEKTIM BATERI NA PENEL

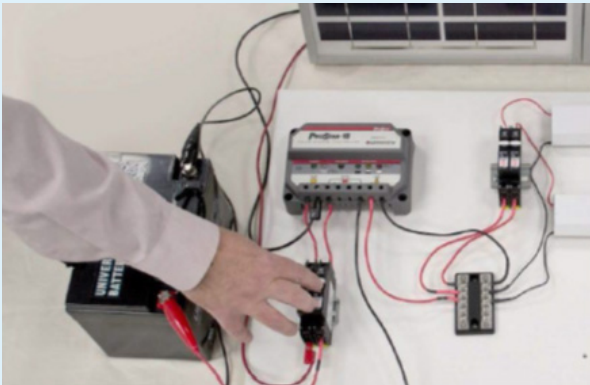
STEP 1



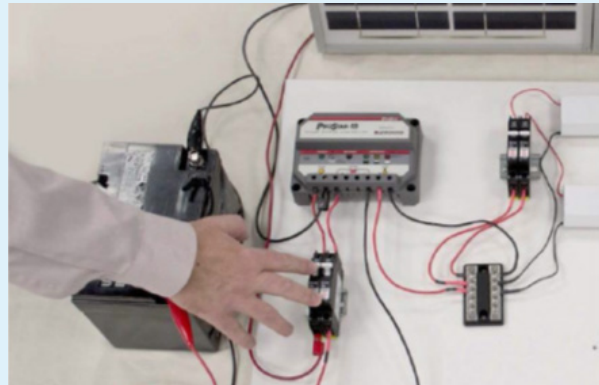
STEP 2



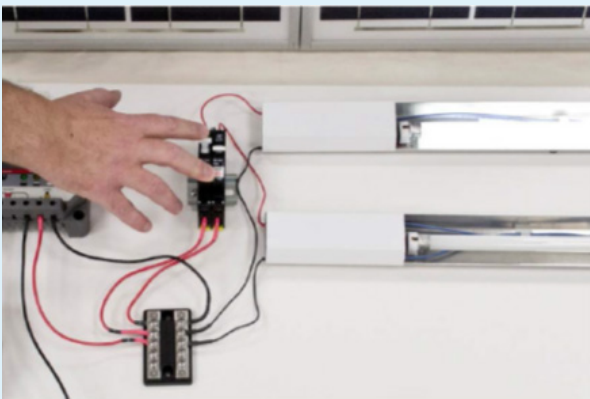
STEP 3



STEP 4



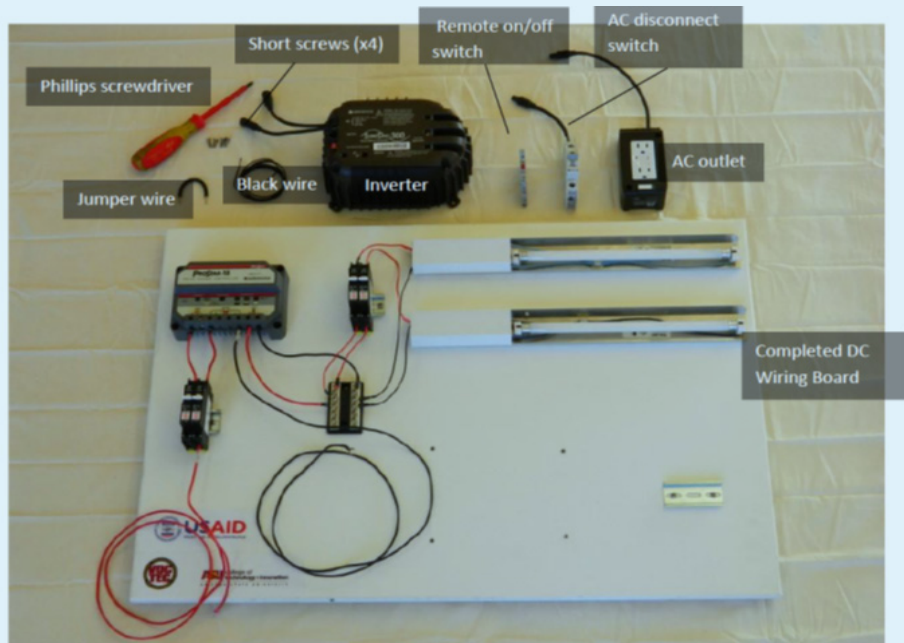
STEP 5



STEP 6

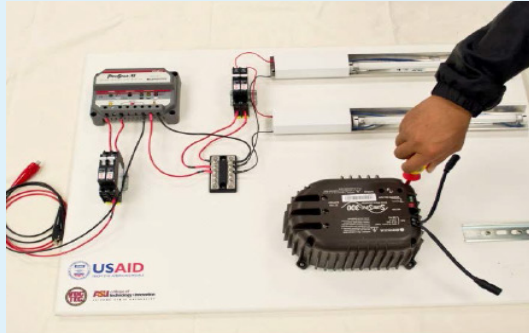


Nau olsem yumi wokim pinis DC sistem yumi bai muv i go long AC sistem. Hia em ol sampela komponent yu bai nidim.

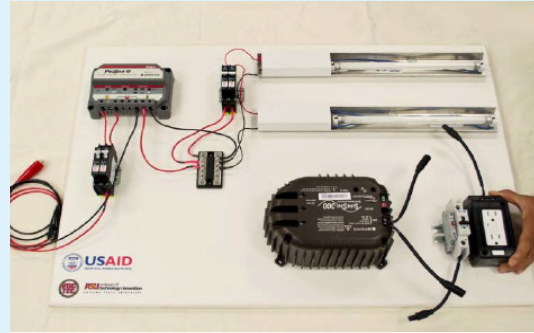


NAU YUMI INSTOLIM INVETA

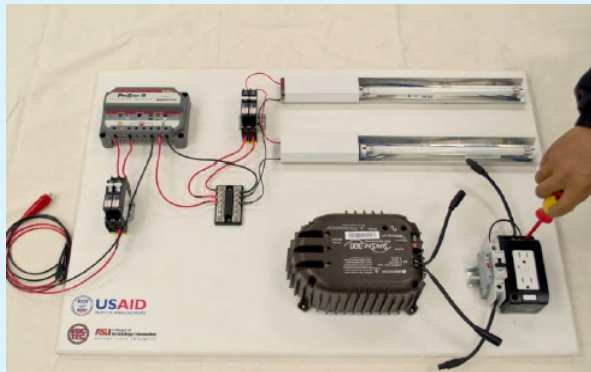
STEP 1



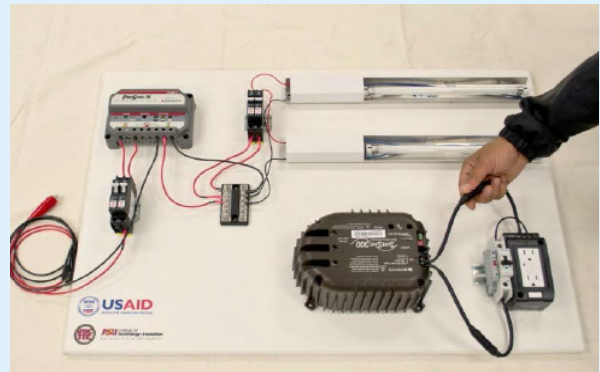
STEP 2



STEP 3



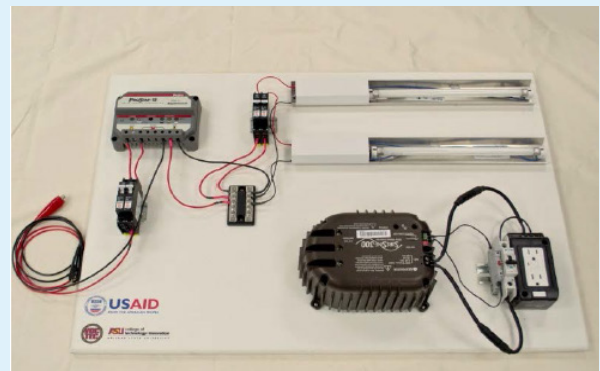
STEP 4



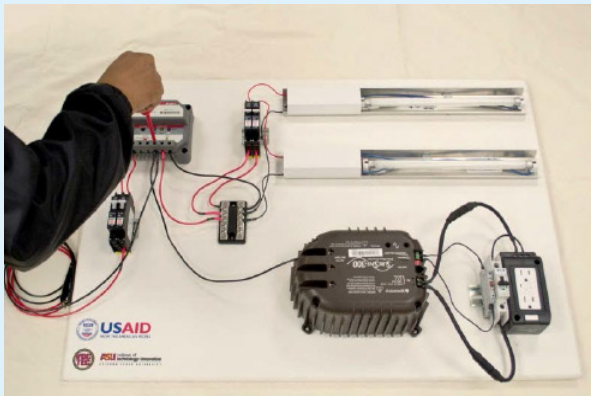
STEP 5



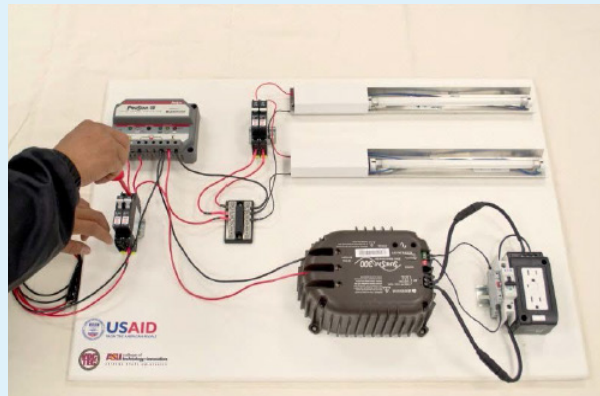
STEP 6



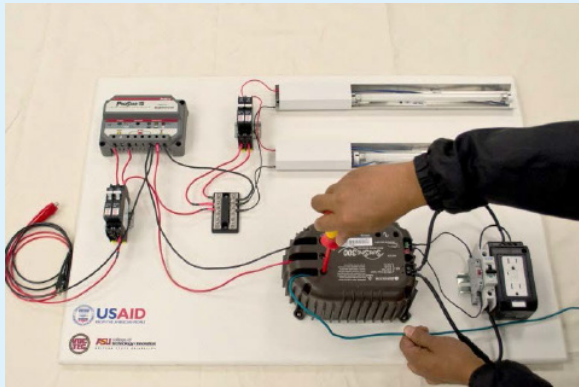
STEP 7



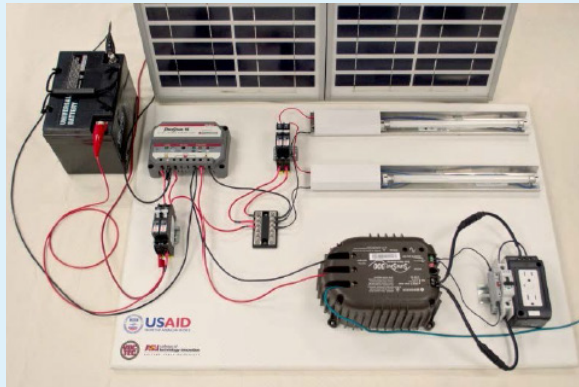
STEP 8



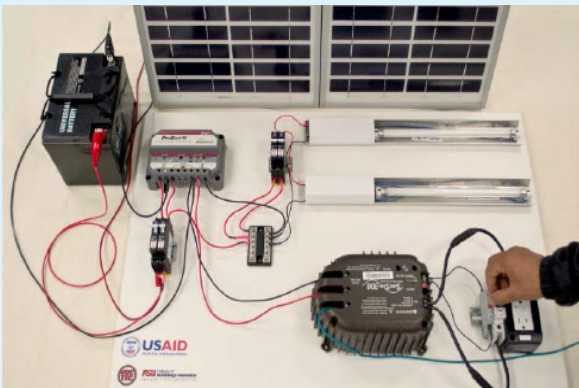
STEP 9



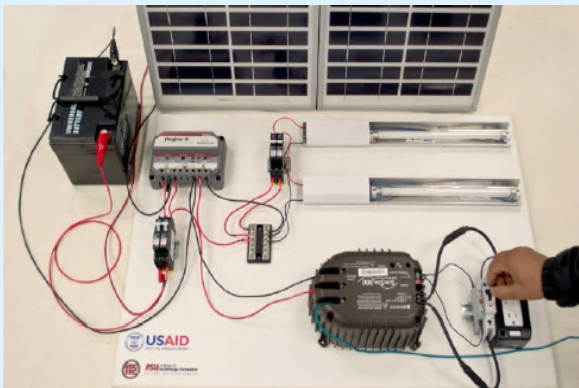
STEP 10



STEP 11



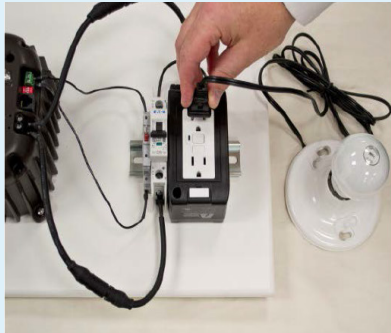
STEP 12



STEP 1



STEP 2



STEP 3

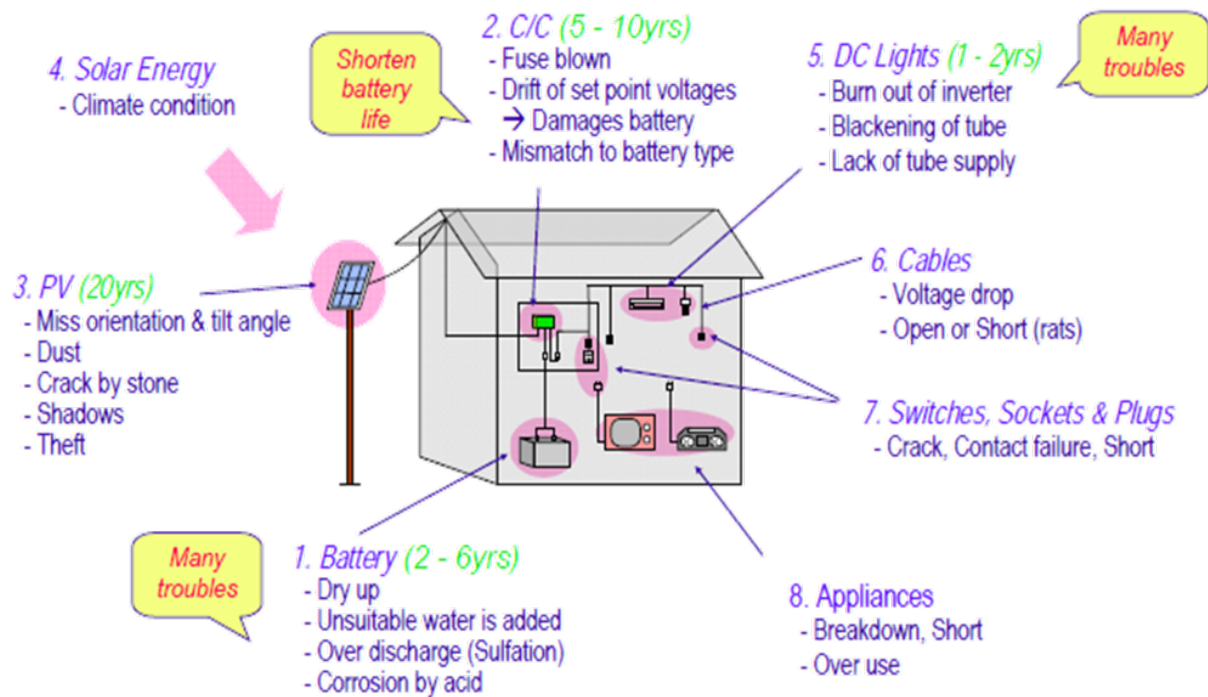


8

Panim aut na mekim
orait ol hevi long ol sola
haus PV sistem _____

Dispela piksa i soim ol kain ol hevi we i ken kamap long sola haus sistem.

PIKSA 73: Ol hevi we i save kamap long koponent⁷⁰



8.1 Ol hevi bilong Sas Kontrola

Dispela em ol sampela hevi bilong sas kontrola

Hevi 1: Sas Kontrola i no save soim olsem em i sas gut long de taim

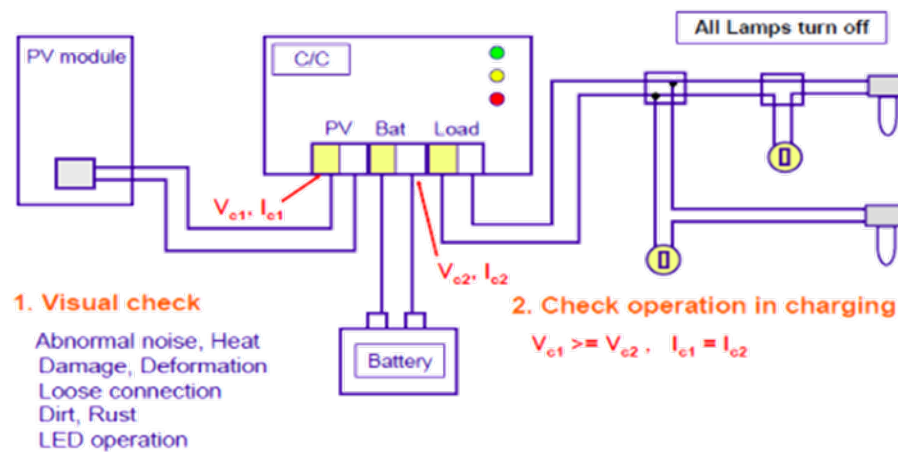
Risen: Yusim nating abryusim mak (klaut em i karampim skai, rein, spesol TV program)

Remedi: Katim daun taim bilong yusim lot i go long hap de long larim ol bateri long sas gut

Hevi 2: Sas Kontrola i save katim of lot na ol lait

Risen: Olgeta taim yu yusim (bateri em i empty o plat)

Remedi: Katim daun taim bilong yusim lot i go long hap inap C/C i soim mak bilong en i pulap (olsem wan wik) long larim ol bateri long sas gut.

PIKSA 74: Panim aut hevi bilong Kontrola⁷¹

Hevi 3: Nogat karent i ron i go long bateri, o i soim olsem bateri i sas olgeta o bateri i stat sas o i wok long sasim bateri we i sas pinis.

Risen: Fius i blou, koneksen bilong ol waia i lus o bagarap bilong insait long kontrola seket.

Remedi: Tiatim ol lus koneksen, senisim ol fuis we i blou na stretim seting bilong ol LVD na HVD.

Risen: I nogat gutpela sindaun (ankel i no stap long mak or position), das i pulap, krek insait long glas, seid antap long panel, i nogat gutpela sanlait, sot seket long of baipas diode, waia koneksen i lus or buruk, o oli stilim ol panel.

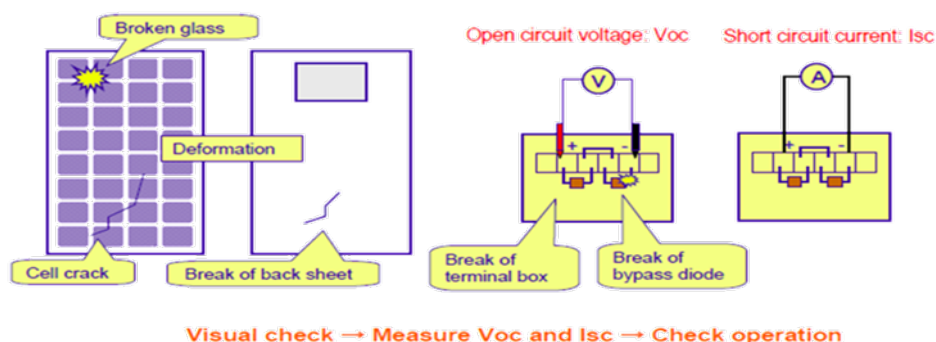
Remedi:

- Stretim hap na saitim ankel (tilt ankel i mas no osem $<10^\circ$ pesim not)
- Sekim sapos i gat ol das na ol krek o buruk long glas bilong sola panel
- Klinim PV wantaim wara, no nidim ol ditejen
- Taitim ol lus koneksen long teminol bokis
- Rausim ol hap i blok na stopim sedouing long PV modul namel long 9am – 3pm
- Senisim Baipas diode

8.2 Ol hevi bilong Sola Panel

Yu ken painim ol hevi bling sola panel taim pawa i lus o taim yu mekim ol mesamen.

Hevi 4: Pawa i tamblo o nogat pawa output long sola panel

PIKSA 75: Penel Falt⁷²

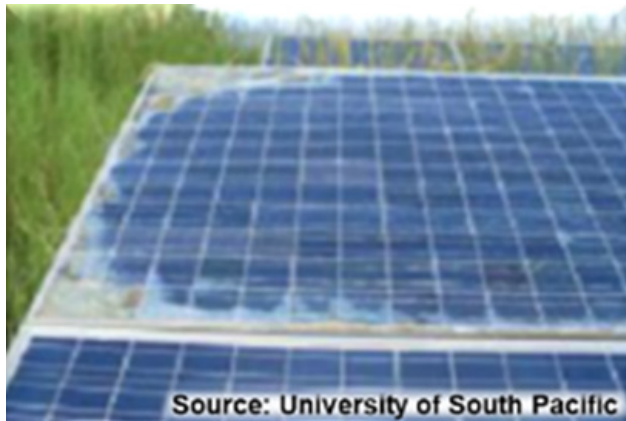
⁷¹ Source: JICA

⁷² Source: JICA

Ol sampela risen bilong pawa i lus:

Dilemineisen: Dispela em taim ol karamap long metiriel antap long ol sola penel i diskonek. Dilemineisen i save kamapim elektrikol sok, na i ken kamapim bikpela pawa long lus

PIKSA 76: Bagarap long antap long penel



Sistem Brauning: Dispela em taim lait bilong san na kemikel senis long antap long penel i senis kala i go long yelo o braun. Brauning bai no inap kamapim elektrikol sok, tasol bai kamapim pawa long lus.

8.3 Ol kain hevi bilong bateri

Hevi 5: Bateri em i isi long sas o i no inap sas gut sapos ol sel i nogat ol wankain voltij

Risen: Salfeisen, bateri i drai, stretifikeisen (taim ol elektrolait insait long solusen i go stap daunbilo) ol teminol koneksen i lus, bateri tempresa i go antap o elekrisiti i kapsait long wanem esit i stap antap name long ol bateri teminol.

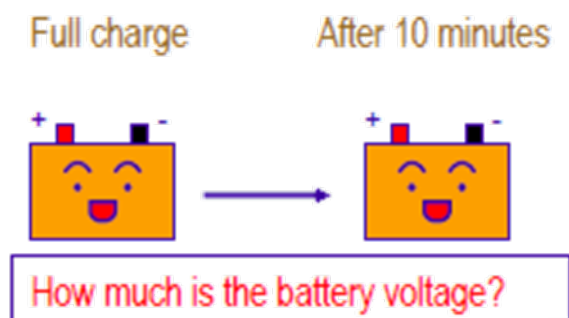
Remedi:

- Koneksen long ol teminol i lus
- Klinim ol teminol wantaim ain bras na putim gris (tok piksa, Veselin o litium gris)
- Topim ap mak bilong bateri elektrolait, taim i gat nid
- Yusim ol rait teminol lag/klam tasol
- Rausim ros long ol teminol
- Sekim liklik bateri (ino bikpela long tenpela dikri long sait bilong flo lain) long abryusim stratifikeisen
- Senisim ples bilong instoleisen sapos i gat nid

8.4 Sekim bateri voltij

Bihain long sasim bateri, stopim sas bihain tasol long lilik taim long tenpela minit tasol planti taim olsem tupela hawa voltage. makim bateri voltij. Sapos voltij i aninit long 12.5V, dispela em i soim bateri em i klostu kamamp long pinis bilong en.

PIKSA 77: Bateri sas – olgeta taim was long voltij⁷³



8.5 Ol Hevi bilong Balens long Ekuipmen

Ol Hevi

- BOS (ol keibel, swis, lait, na planti moa)
- I nogat lait long taim bateri i sas olgeta
- Aninit-voltij long pinis bilong lot
- I nogat pawa long pinis bilong lot

Ol risen:

- open o sot seket o grauning
- I no rait sies bilong ol keibel (bikpela pundaun bilong voltij)
- Ban-aut DC lait tub/inveta
- Koneksen i lus long ol teminol
- Bikpela resistens long ol swis kontek

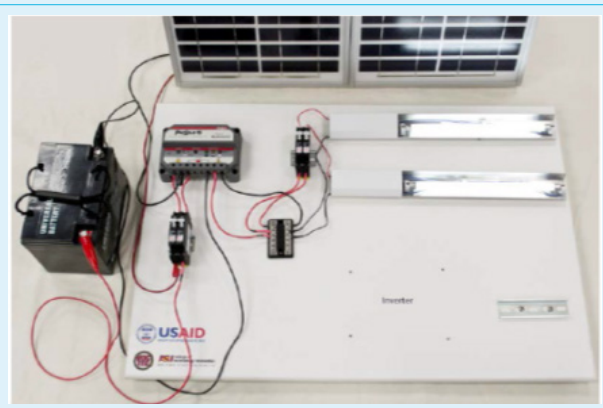
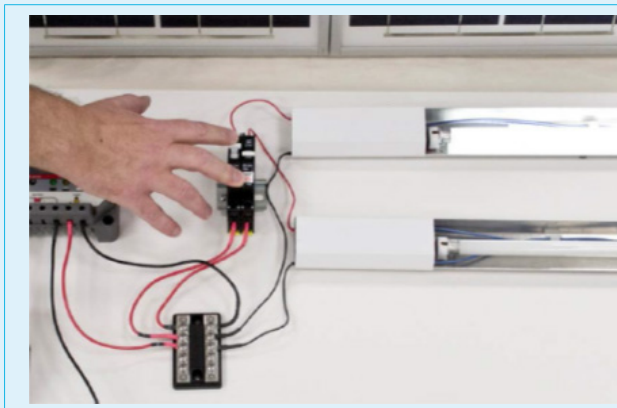
Remedi:

- Sekim voltij mak long pinis bilong lot na pundaun bilong voltij
- Taitim ol lus koneksen long teminol
- Sekim sias bilong keibel sapos keibel we ol i instolim i rait sias o i gat nid long senisim
- Sekim strong bilong ol keibel, taim seket i op, treisim lain na konektim open seket
- Sekim na stretim sot seket we i ken kamap na graunim insait long lain, na karamapim sot seket/lain i stap long graun
- Sekim wok bilong swis na pundaun bilong voltij namel long wok we i kam insait na wok i kamap a utsailong swis taim putim on swis

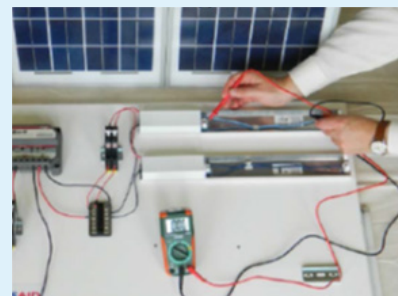
WOK 13 – KONTINUETI TES

Long dispela wok bilong mekim, konektim waia we i gat bagarap long en namel long bateri na sas kontrola na ol sumatin bai painim aut na stretim yusim kontinuiti tes.

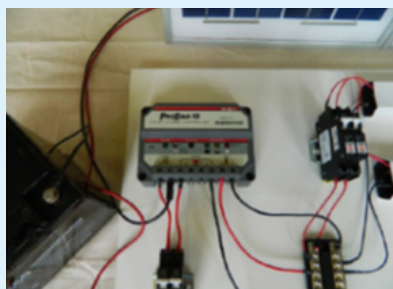
Makim dispela DC Sola Sistem na soim osem em i wok



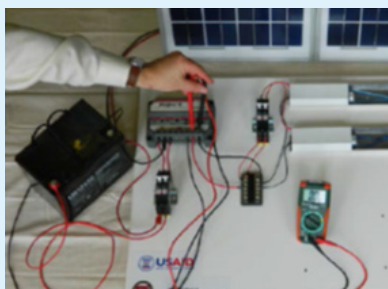
Taim ol sumatin i lukim olsem em i wok – senisim wanpela gutpela waia wantaim waia i bagarap na ol sumatin i ken panim aut hevi.

STEP 1**STEP 2****STEP 3**

STEP 4



STEP 5



STEP 6



STEP 7



STEP 8



STEP 1



STEP 2



STEP 3



9

Sola PV
Meintenens seklis —————

9.1 Plening Meintenens

Rutin meintenens em i gutpela wei long mekim laif bilong sola PV sistem na ol komponen bilong en i stap gut. Rutin meintenens i olsem wanpela sekis i gat lis bilong ol samting long wanwan komponen we ol i nid long tikim of.

9.2 Sola Penel Meintenens

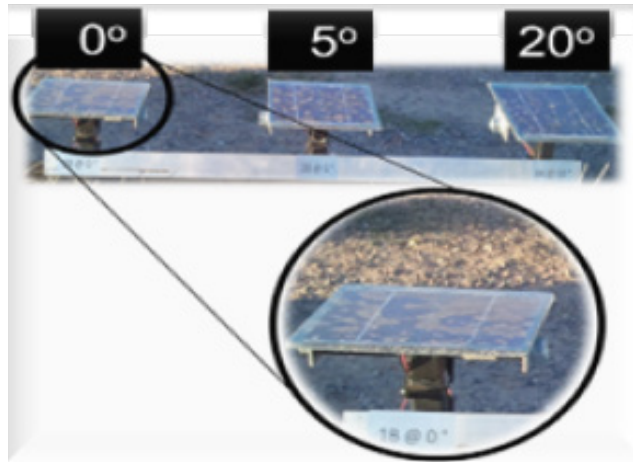
- Sekim ol PV arei long sampela sian ol kain bagarap i kamap olsem samting i buruk
- Antap i mas stap kiln, na i no bagarap, klinim ol kain doti o pipia long antap na aninit long penel sapos ol i mautim antap long ruf.

PIKSA 78: Ol penel i bagarap⁷⁴



- Mekim napim olsem ol penel i no flet na i gat sampela tilt.

PIKSA 79: Bagarap long ol doti penel⁷⁵



9.3 Bateri Meintenens

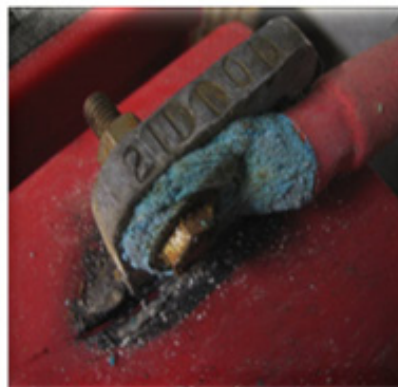
Bateri meintenens i gat ol kain ol wok bilong en na i save dipen long ol kain kain bateri na ol kampani rikwaimen olsem:

- Inspektim na klinim ol bateri rek, keisas trei na pinis bilong en
- Inspektim ol bateri diskonek, ovakarent samting na we bilong ol waia sistem
- Mesarim voltij
- Bateri lot tes i save putim bikpela dissas reit long liklik seken, taim yu mesarim pundaun long bateri voltij
- Long testim level bilong bateri i save olsem, lyusim bateri long liklik dissas reit i go long mak ol i setim long dep-long-dissas.
- Senisim ol bateri we i no gutpela long siris string. Dispela ya i soim olsem siris string bateri beng, em ol bateri i no wok gut bai gat kontrol long en.
- Tok nogat long olgeta taim Ova-dissas long sistem – Ova yusim na ova-dissasing i save daunim laif bilong bateri i go bikpela dep of dissas (DOD)
- Mesarim spesifik greviti na addim wara (bilong ol fladed led-esit bateri tasol)
- Piriotic bateri meintenens i mas gat ol sek bilong olgeta teminol long ros na gutpela taitening
- Yusim ain bras long klinim oxides long ol koneksen. Olgeta taim wearim insuleisen glaf.

⁷⁴ Jim Dunlop Solar

⁷⁵ Source: ASU PV/ Reliability Laboratory

PIKSA 80: Lukaut bilong bateri⁷⁶



SEFTI TIP: Usim ol seifti gogel na raba glaf long taim bilong sevisim batri. Werim olupela kolos, wanem yu ken kisim esit long en (olsem ol fladed batri) Kipim bakin soda bokis op na wantaim plastik wara klostu taim you sevisim ol batri-nogud i gat lik long en, yu ken putim baking soda insait long wara, tanim, na usim dispela miksa na hariap stopim ol kain esid i lik Lo voltij em i no samting nogud i kamap, tasol karent em i antap. Wampela rens i pundaun antap Long ol teminel i ken hariap tru kukim han bilong yu na batri tu i ken pairap. Lukaut!

9.4 Mesarim bateri long stet bilong sas

I gat tupela we long mesarim dispela – long open seket voltij na long mesarim ol spesifik greviti (SG) bilong elektrolait.

9.4.1 Voltij we

Mesarim Open-seket voltij bihain long bateri i malolo long sampela awa. Teibel aninit i givim mak bilong sas:

PIKSA 81: Stet bilong Sas⁷⁷

State-of-Charge	Specific Gravity	Open-Circuit Voltage (V)
100%	1.265	12.6
75%	1.225	12.4
50%	1.190	12.2
25%	1.155	12.0
0	1.120	11.8

For typical lead-acid battery at 25°C

9.4.2 Hidromita we (bilong ol fladed bateri tasol)

Hidromita mesa elektrolait spesifik greviti (SG) we bilong rausim ol elektrolait long bateri sel i go long wampela hap.

⁷⁶ Source: Jim Dunlop Solar

⁷⁷ Source, Pinterest.com, <https://www.pinterest.com/bambulancemania/work-apparal/>

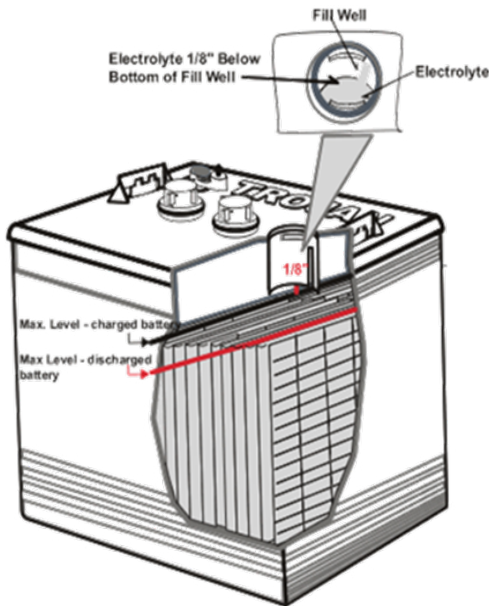
PIKSA 82: Pasin long yusim Hidromita⁷⁸



9.4.3 Adim Distil Wara long Bateri (fladed bateri tasol)

- Ol open vent fladed bateri, i save lyusim wara bikos long elektrolaises na gasing long taim i sas
- Wara i lus i apim wantaim tempresa, ol sas reit na laif bilong bateri
- Yusim distil wara long pasim bagarap long bateri na noken pulap kapsait

PIKSA 83: Bateri struksa⁷⁹



Yu ken yusim wanpela bateri meintenens seklis ol i givim aninit long karim aut ol rutin sek long ol bateri.

Ol bateri (ating pat bilong wapela bekap sistem)	
Sekim elektrikol koneksen	Long wik
Sekim long ros na klinpela teminol	Long wik
Sekim wara lewal na top ap long ol led esid bateri	Long wik
Inapim olsem bateri i sas gut long planti taim	Long wik
Senisim ol bateri beng	Long olgeta 3-5 yia (led-esid) na 5-10 yia (sel jel) sapos lukautim gut
We long lukautim ol nogut metiriel, storis na rausim: resikelim ol bateri we yusim pinis, lukautim ol elektroliat lik long ol led-esid bateri	Osem yu nidim

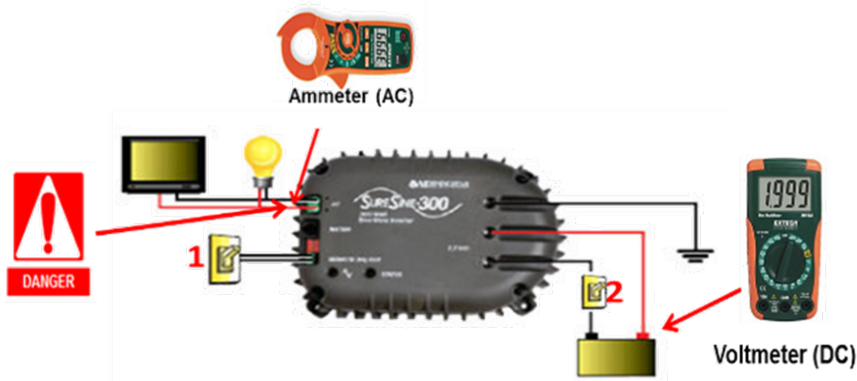
9.5 Inveta Meintenens

- Sekim gut sapos inveta i wok long kisim DC voltij long bateri yusim voltij mita set long DC voltij mesamen
- Sekim gut sapos inveta i wok long kamapim AC voltij long AC lot yusim voltij mita set long AC voltij mesamen



SEFTI TIP: Inveta i save kamapim ol bikpela AC voltij olsem 220-240V. Werim ol eletrikal insuleisen glav na bihainim ol sefti wei.

⁷⁸ Source: Jim Dunlop Solar
⁷⁹ Source: Jim Dunlop Solar

PIKSA 84: Inveta waiaring⁸⁰

Noken rausim ol waia, mekim lukluk sek insait long dispela wei:

- Tanim of ol diskonekt swis 1 na 2 (lukim piksa)
- Yusim klemp-on amita (AC) antap long sait bilong AC
- Konektim voltmita (Ino amita) i go long ol bateri teminol (tingim: Amita i save sot seketim bateri na fuis i save pairap)
- Tanim on ol diskonekt swis 1 na 2
- Lukluk na skelim sapos voltij na karent i ron i go long lot. Sapos yes, inveta bai wok

PIKSA 85: Sas kontrola³**9.6 Sas Kontrola Meintenens**

Ol sas kontrola em ol i gutpela na bai i nonap givim planti wari sapos ol i no pulap tumas.

- Sekim ol lus koneksen
- Sekim ol displei voltij na sek long ol era mesij
- Sekim fuis i no blou
- Sekim ol mauntin bilong kontrola

9.7 Kamapim na yusim seklis

Wanpela wankain lukluk bilong masta seklis bilong wanwan mun ol i givim aninit, na yu i ken putim sampela moa o rausim sampela we ol i no nid.

⁸⁰ Adapted from "Operations & Maintenance of Stand-Alone PV Systems, Arizona State University, VOTEC, <http://votec.asu.edu>

TEBOL 4: Meintenens Seklis

Ol samting bilong sekim	Ok	Koment
Instoleisen Siat Sek		
mekim ruf penetreisen i gat waratait, sapos i nap		
mekim drain long ruf i seif, ol drein long ruf i no blok, na i nogat ol sain bilong wara i bung insait long hap bilong arei		
sekim ol plents i grow o narapela niupela seid samting olsem setalait dis		
sekim graun erosen klostu long beis bilong graun mauntin sistem		
sekim olsem i gat gupela sistem sianaj i stap insait long hap		
sekim ol rait expensen join ol i yusim we ol i nidim lo longpela hap ol drein i ron		
taitim wantaim ol lok o bungim ol lok, na i gat sain bilong tambu long go insait		
Sekim ros long autsait bilong ol samting na reking sistem		
sekim olsem ples i stap kiln – i mas nogat ol pipia insait long hap bilong inveta ped o narapela hap		
sekim ol lus waia i hangamap insait long arei; na		
sekim ol sian long ol enimal		
Oltaim lukim ol dispela samting		
Lukim gut ol inveta na Elektrikol ped long olsem em i no soim tumas krek o ol sian bilong bagarap. Dispela inveta i mas taitim i go long ped long olgeta mauntin poin olsem long ol Kampani instoleisen rikwaiment. Long ol saís, hap na mekim isi we long sistem long man i nogat save long dispela wok, ol inveta, kombaina bokis, na putim of swis i mas nidim ol tul o kisim ol lok long stopim. kisim nating ol ikwipmen.		
Lukluk long ol tok lukaut sain i gat arc flash o ol PPE samting yu mas lukluk long en bilong kisim ikwipmen. Yu mas klia tru long bihainim olgeta tok lukaut sain. Sapos nogat sain i stap, o sapos sampela sain i lus, mekim not long en na instoilim ol sain i lus long taim bilong meintenens lukluk raun.		
Lukluk gut long ol PV modul long ol bagarap we i ken kamap, olsem ol paia mak, lyusim kala na karap bilong en, na bruk bruk glas.		
Sekim ol modul long ol bikpela doti we i kamap long graun, o long ol pipia bilong enimal.		
Inapim tru olsem ol modul waia i stap tait na i no malolo antap long ruf, hangamap lus na i stap klia long bagarap, i krungut na i no stap stret long mak, o pulim long antap long ol hap I sap o raf.		

Ol samting bilong sekim	Ok	Koment
Lukluk gut long reking sistem long ol bagarap olsem ros, bagarapi kamap long ain, krungut, na klip o lok i lus o i bruk.		
Sapos ol sprinkle ol i save yusim long spreim ol arei, sekim olsem wara i fri long ol minerel (demineralized) long wanem ol dispela minerel i ken kamapim wok long go isi isi na bagarap.		
Sekim ol pipe long gutpela sapot na mekim bikpela ol join sapos i gat nid.		
Insait long ol ruf-maunted sistem, sekim gut tru ol samting we ol i putim i go insait.		
Insait long ol graun-maunted sistem, lukluk long ol sain bilong ros klostu long ol sapot.		
Opim ol kombaina boks na sekim ol torque mak antap long ol koneksen. Ol torque mak i save kamap taim ol i taitim gut ol lags i go long raitpela reit bilong torque. Kain olsem, ol i save putim long taim we ol i putim instoleisen, sapos nogat, teknisen i ken makim lag bihain long mekim torque long taim em i mekim meintenense visit. Raitpela torque mak bai i kamap wantaim pen yet bilong mekim torque mak. Dispela mak em i stretpela lain namel long lag na haus. Long ol taim i kam, sapos dispela lain i lus namel long lag na haus, em i soim olsem lag em i bin suruk na em i nid long torque ken. Lukluk long ol pipia insait long ol boks na ol sain bilong bagarap wara i kam insait. Lukluk long ol kala em i senis antap long ol teminol, ol bod na ol fuis holda.		
Opim kabinet dua long ol diskonekt na lukluk long ol sain bilong ros o bagarap.		
Sek long inapim tru olsem ol kabinet penatreisen ol i passim gut na i nogat sain bilong wara long go tru. Sekim ol torque mak antap long ol teminol.		
Mekim wanpela piksa sek long insait na autsait bilong inveta. Lukluk long ol sain bilong wara, rat, o das i go insait long inveta. Sek long ol torque mak antap long ol fil temineisen.		
Sapos wanpela weda steisen em i stap, i mas mekim inap olsem ol sensa i stap long raitpela hap na i silip gut. Global horizontal irediens sensa i mas flet, na wanpela plen bilong erei irediens sensa i mas putim long wankain pits na orienteisen olsem erei. Ol irediens sensa mas kiln long rausim pipia na ol pekpek bilong pisin.		
Inveta sek		
Raitim na givim tok orait long ol voltij na ol prodaksen veliu bilong human-masin intafas (HMI) ol soim.		
Raitim laspela rong i rekot long system.		
Klinim ol filta.		
Klinim insait bilong kabot.		
Givim tes long ol fen long wok gut.		
Sekim ol fuis.		
Sekim torque long ol temineisen.		
Sekim gasket sil.		
Em mas mekim inap ol tok lukaut long ol mak i mas stap gut.		

Ol samting bilong sekim	Ok	Koment
Lukluk long ol kala i pinis long wanem hat bilong san i go bikpela.		
Sekim intagriti bilong ol laitning aresta.		
Sekim kontinuiti bilong sistem graun na ikwipmen grauning.		
Sekim mekenikal koneksen bilong inveta long wall o graun.		
Sekim intenal diskonekt opereisen.		
I mas mekim inap olsem karent softwe em i instol.		
Kontekim instola na/o menufeksara taim painim ol hevi.		
Putim ol wok painim bilong ol wok i bin kamap.		
Sekim ol insuleited geit bi-pola treinsista na ol inveta bod long kala i pinis.		
Yusim inspeksen mira sapos i nid.		
Sekim ol input dc na auput ac kepisita long ol mak bilong bagarap long i go hat tumas.		
Rekodim olgeta karent ridin long frant piksa penel.		
Sekim lukluk/klin bilong kabot, rot bilong win sistem, na antap bilong ol insuleited samting.		
Sekim ol teminol na ol keibel long ros na sapos hat tumas.		
Ol torque teminol, ol konekta, na ol lok olsem i nid.		
Raitim ol weda kondisen, wantaim tempresa na sapos de em i san o klaud i karpim long wanpela hap.		
Sekim lukluk bilong ol ac na dc saj sapresa long ol bagarap o mak bilong paia.		
Sekim ol opereisen long ol seifti samting (ol emejensi stop devis, dua swis, graun falt detekta intarupta).		
Sekim (klinim o senisim) ol win filta element.		
Stretim ol kain painim aut long ol samting we i sot.		
Pinisim meintenens skeduel kad.		
Pinis raitim inspeksen ripot.		
Sapos ol kampani-trein man i stap long hap bilong wok, instolim na soim ol kain tok orait enginaring fil modifikeisen, wantaim ol softwe apgred.		
Bateri Sek		
Sekim ol sain bilong ol kain elektrolait insait long ol seifti trei (sapos i gat) o antap long floa, i soim wanpela bateri i lik o i pulap kapsait;		
sekim kondisen bilong ol bateri konteina		
Sekim bateri voltij levul – rekodim ol voltij levul		
Sekim ol kondisen bilong ol bateri teminol – i nogat ros na rausim ros sapos i gat.		
Sekim ol bateri elektrolait levul (I no gutpela long ol bateri we i gat jel antap long en)		
Waia na koneksen sek		

Ol samting bilong sekim	Ok	Koment
Sekim ol kain bruk insait long ol waia na waia i nogat karamap long en – ripotim ol kain bruk long waia.		
Sekim olsem olgeta koneksan i gat gutpela karamap long en		
Sekim ol lus o waia i hangamap		
Sekim ol uninsuleited waia we i paia klostu long yu.		

9.8 Menismen long ol pipia

I bikpela samting tru long luksave long pasin bilong yusim sola we i save kamapim pipia long taim sola penel, ol bateri o waia we konek wantaim na i save kisim bagarap, long planti taim ol komuniti i no save na i save tromoi. Dispela ol metiriel i bagarap na i gat ol kemikel we i ken bagarapim envairemen na ol samting i kamap nating long graun, olsem na i bikpela samting tru olsem sampela stretpela pasin i mas kamap na bihainim long taim tromoi ol dispela ol metiriel. [Sampela ol isi wei em i:](#)

Putim ol keibel we i bagarap wantaim na salim long ain faktori we ol bai wokim i kamap gut.

Kisim ol bateri we i bagarap i go bek long hap yu bin baim long en long ol i ken tromoi.

Yu ken planim ol sola penel we i bagarap na was gut long ol bruk glas.

Planim ol pipia longwe stret long ples na ol gaden na wara sos long wanem em i ken kamapim bagarap.

Em i bikpela samting tru olsem em wok bilong yumi long lukautim gut ol pipia bilong yumi na i no long ol pipia we i save kamap tasol long sola tasol long ol wanwan hauslain tu.

WOK 14

Putim PPE na karim aut ol rutin sek long ol sola sistem we yu bin setim insait long laspela wok.

Yusim dispela seklis we ol i givim antap. Wok insait long grup na kisim halivim long treina bilong yu.

Wanpela moa Rol Plei: (opsenel)

Tupela bubu meri bilong wanpela ples ol i kam bek long wanpela treinin long Sola O&M Beisik na tupela stori

Tima: Mi hamamas stret olsem mi bin kisim dispela treinin – Mi ting olsem long dispela kain kristmas, mi nogat samting long lainim – tasol mi rong stret

Anna: Ya, mi pilim wankain tu – i bin gat planti samting tru long lainim, na mi kirap nogut long wanem mi bin i nap long bihainim wantaim klia tingting long ol teknikol infomesan.

Tima: Tingting em i narapela kain samting – taim yumi opim tingting long lainim niupela samting – yumi bai wokim yet. Mi wok long tokim mi yet olsem mi ken mekim, na ol pikinini bilong mi na ol bubu bilong mi bin givim mi gutpela tok tu.

Anna: Mi save olsem mi bai no i nap long mekim sapos i nogat gutpela sapot long ol femili bilong mi – nau yumi kamap ol sola teknisen .hahaha

Tima: Long mekim yumi tingim olgeta samting; yumi mas bung wanpela taim long wanpela wik long toktok long ol wanem samting yumi bin lainim. Yu ting wanem?

Anna: Ya, mi wanbel. Maski yumi gat dispela mani pawa sistem bilong EFL, planti ol femili insait long ples i yusim sola na olsem yumi ken halivim.

Tima: Na wantaim ol dispela ol pawa blek aut we i wok long kamap, mi ting planti moa femili bai laikim ol sola sistem.

Anna: Ya, yu tok stret. Dispela ol bateri pawa sola sistem bai mekim na ol haus i ken savim elekrisiti i kam long san long de taim, na yusim long nait long pawaim ol haus na ol narapela samting we i save yusim pawa.

Tima: Mi hamamas olsem yumi mekim dispela wantaim long sapotim ol pikinini, ol bubu bilong yumi na olgeta insait long ples na tu yumi sapotim envairemen.



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