



Leveraging Performance Evaluation Through Special Maintenance of Photo Voltaic Power Plant in Nusa Tenggara Region to Achieve Photovoltaic Reliability Excellence

6 - 1 0 A u g u s t 2 0 2 3 Prama Sanur Beach, Denpasar, Bali, Indonesia oleh

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CURRICULUM VITAE Ir. KHARISMA UTOMO M., ST., M.T, QRMO

PENDIDIKAN

2004 - 2006

SMA Negeri 8 Yogyakarta

2006 - 2010

Teknik Elektro UGM

2016 - 2018

Institut Teknologi Bandung (MT)

Joint Research Curtin University, Australia

2022

Sertifikasi QRMO (Qualified Risk Management Officer) dengan Predikat Kompeten

2023

Lulus Sertifikasi Data Science dengan Predikat Kompeten

2024

-Lulus Pendidikan Profesi Insinyur Universitas Indonesia (UI) dengan Predikat Summa Cumlaude -Lulus Sertifikasi Penyuluh Anti Korupsi (PAKSI)

Activity

2016, Pegawai Penerima Kesempatan Magang PLN2020, Co-Founder PLN Ignition



PT PLN (Persero)
Kantor Pusat
kharisma.utomo@pln.co.id

PENGALAMAN

2010 – 2011, PT PLN Disjaya

On Job Training (OJT)

2011 – 2015, PT PLN Disjaya

AE Pemeliharaan Distribusi TM

2015 – 2016, PT PLN Disbanten

SPV OPDIST PLN Kampung Melayu PLN Area

Teluk Naga

2016 – 2018, DIVTLN PLNPusat

Pegawai Tugas Belajar S2 Penghargaan

Direksi PLN-ITB

2018 - 2021, PT PLN Pusat

AE Manajemen Aset Transmisi dan Distribusi

2021 – 2023, PT PLN Pusat

Engineer Pengelolaan Aset Distribusi

2023 – 2024, PT PLN Pusat

Senior Officer Implementasi Investasi Bisnis

2024 - present, PT PLN Pusat

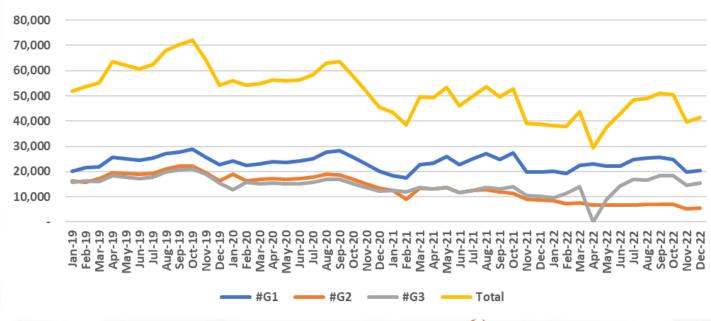
Senior Officer Inovasi Teknologi

(Divisi Pengembangan Bisnis)



Problem Formulation









17% to 19% every year

Specification of PV Module Gili Terawangan Solar Power Plant



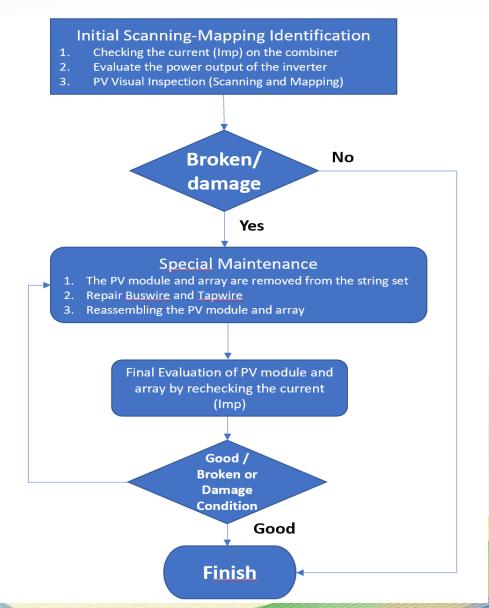
PV MODULE SPECIFICATION	GILI TERAWANGAN SOLAR POWER PLANT						
PV WIODULE SPECIFICATION		G2	G3				
Brand	SUNTECH	SKYTECH	LEN	SOLPOWER	LEN	LEN	
Output Power (Pmax)	220	220	245	220	180	180	
Maximum Power Voltage (Vpm)	29.5	29.82	29.88	30	35.6	35.6	
Maximum Power Current (Ipm)	7.46	7.39	8.2	7.35	5.06	5.06	
Open Circuit Voltage (Voc)	36.6	36.24	37.34	36.2	44.1	44.1	
Short Circuit Current (Isc)	8.05	7.93	8.63	7.95	5.52	5.52	
Efficiency					14 - 15	14 - 15	

PV Module parts	1st year degradati on	Degradati on Between 1st and 3rd year	Degradati on after 3rd year
PV Panels	25%	15%	15%
Mounting Structure	3%	1%	1%
Cables, Protection, electrical connection	10%	20%	30%
Inverters	55%	60%	50%
Less voltage equipment	5%	3%	3%
Energy meters	2%	1%	1%

UNIT	INVERTER	Number of PV	COMBINER	Number of String	Number PV per String	Total number of PV	Nominal Voltage
GILI TERAWANGAN SOLAR POWER PLANT	G1	920	G1 COMBINER 1	12	20	240	590.0
			G1 COMBINER 2	12	20	240	590.0
			G1 COMBINER 3	12	20	240	590.0
			G1 COMBINER 4	10	20	200	590.0
			G2 COMBINER 1	14	16	224	569.6
			G2 COMBINER 2	14	16	224	569.6
	G2	1120	G2 COMBINER 3	14	16	224	569.6
			G2 COMBINER 4	14	16	224	569.6
			G2 COMBINER 5	14	16	224	569.6
	G3	1120	G3 COMBINER 6	14	16	224	569.6
			G3 COMBINER 7	14	16	224	569.6
			G3 COMBINER 8	14	16	224	569.6
			G3 COMBINER 9	14	16	224	569.6
			G3 COMBINER 10	14	16	224	569.6

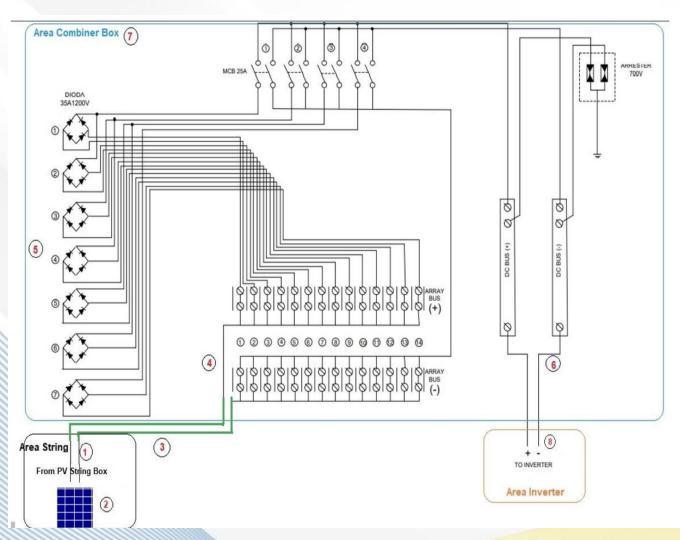
Flowchart of the Performance Evaluation of PV module and array through special maintenance program in PT. PLN (Persero)







Research Methodology







Documentation of Data Retrieval Process







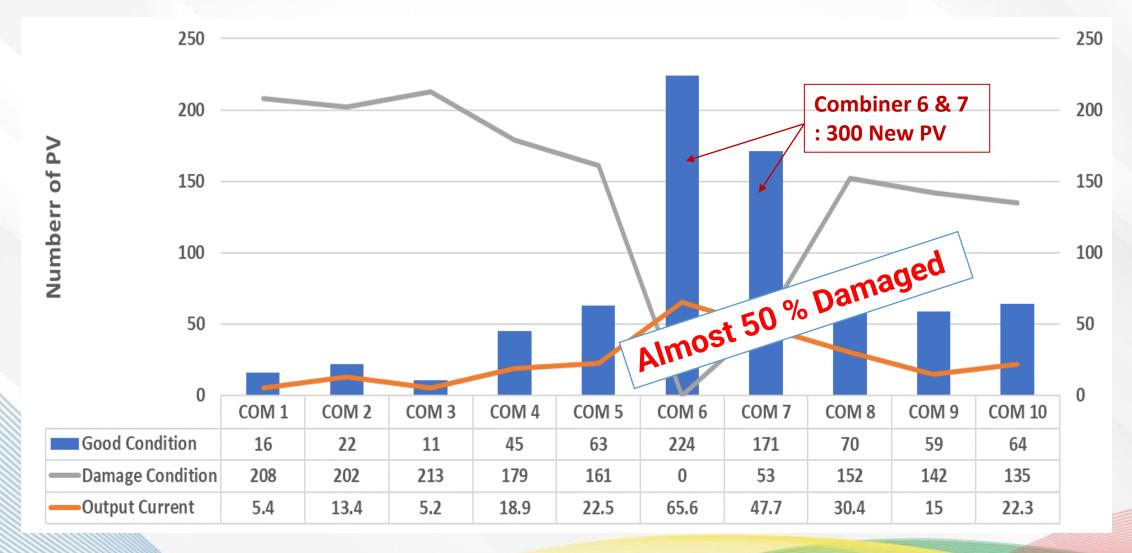






CONDITION COMPOSITION OF PV MODULE PLTS TERAWANGAN





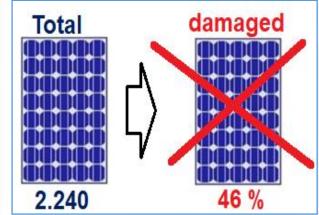
COMPARISON VALUE OF CURRENT AND VOLTAGE OF COMBINER G2 AND G3 INVERTER





Layout of the PV Module Conditions for PLTS Gili Trawangan (G2 and G3 Inverter)









Results of Assessment of the PV Condition of the Gili Terawangan PV Power Plant (Inverter G2 & G3)

G2 Data	Number	Percentage	G3 Data	Number	Percentage
NORMAL	125	11%	NORMAL	140	13%
OXIDATION	736	66%	OXIDATION	430	38%
CRACKING	24	2%	CRACKING	5	0%
BREAKDOWN	203	18%	BREAKDOWN	47	4%
NEW PV PANELS (JULY 2018)	32	3%	NEW PV PANELS (JULY 2018)	48	4%
NEW PV PANELS (JANUARY	_	0%	NEW PV PANELS (JANUARY	100	9%
2021)	0		2021)		
NEW PV PANELS (JANUARY	_	0%	NEW PV PANELS (JANUARY	300	27%
2022)	0		2022)		
BREAKDOWN PV PANEL THAT	0	0%	BREAKDOWN PV PANEL THAT	35	3%
HAD BEEN REPAIRED	0		HAD BEEN REPAIRED		
CRACKING PV PANELS THAT	0	00/	CRACKING PV PANELS THAT	15	1%
HAD BEEN REPLACED	U	0%	HAD BEEN REPLACED	15	
Total	1120	100%	Total	1120	100%

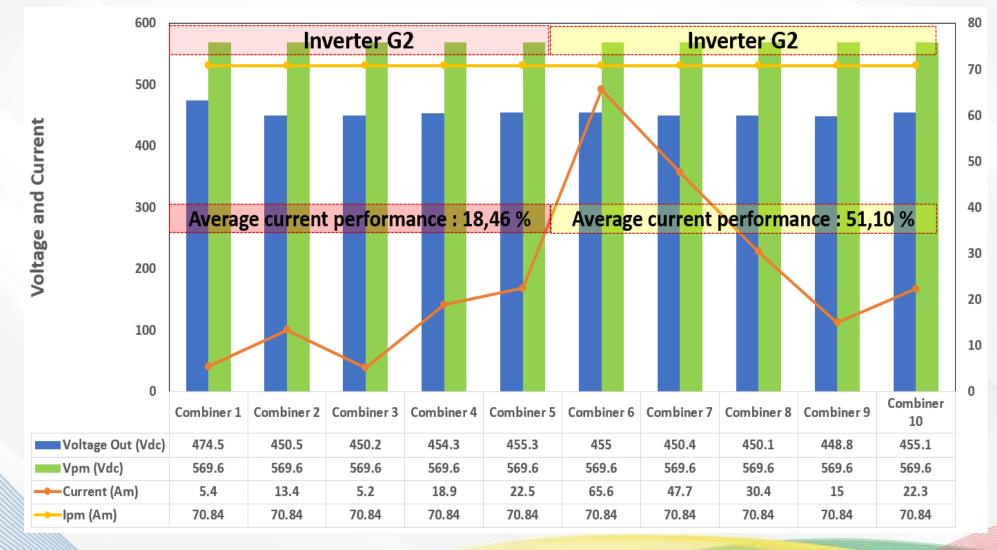
TYPES OF PV MODULE DAMAGED





MEASUREMENT RESULTS OF COMBINERS



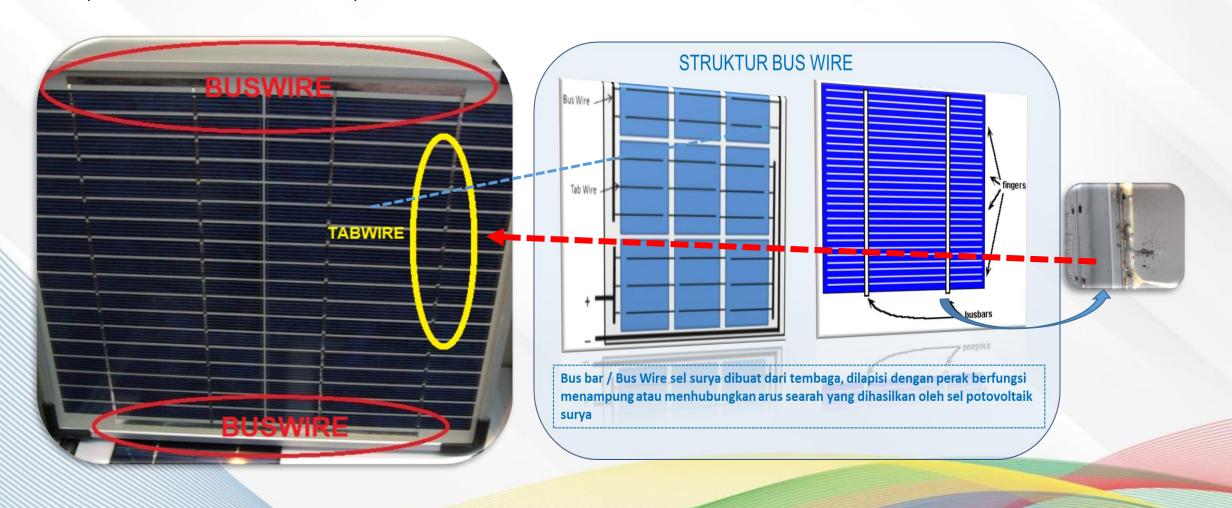






STRUCTURE OF PV MODULE

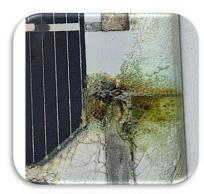
A solar cell is a device or component that can convert sunlight energy into electrical energy using the principle of the photovoltaic effect, also called photovoltaic (PV) cells.

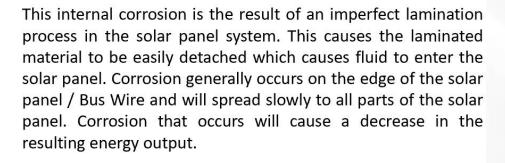




SPECIAL MAINTENANCE BY REPAIRING THE OXIDIZED BUSSWIRE











Repair of oxidized <u>buswire</u> by soldering using the appropriate material (tin). This <u>buswire</u> soldering aims to restore the function of the <u>buswire</u> as a conducting medium which previously experienced a short circuit or resistance.





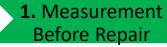
Doing soldering using <u>buswire</u> and tin materials. This method can save costs because there is no need to install the new PV Modules



Buswire Repair Process Special Maintenance Program









2. Remove the bolt



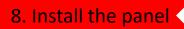
3. Put down The **Panel**



4. Remove Silicone & corrosion cleaning



9. Measurement After Repair





6. Silicon Proses



5. Soldering









Special Maintenance Program







Advantages:

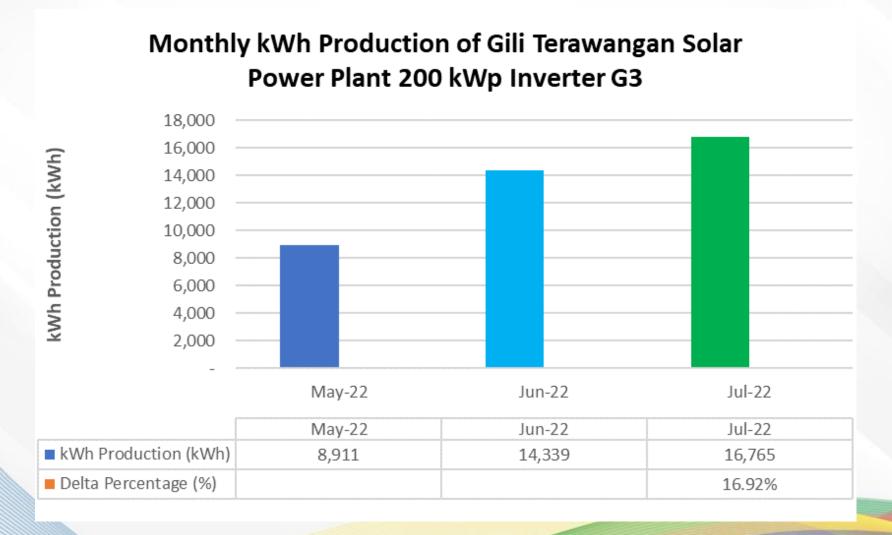
- 1. Low Cost
- 2. Simple
- 3. No Procurement

Disadvantages:

- 1. Susceptible
- 2. Unpredictable Condition



RESULT AND IMPACT AFTER SPECIAL MAINTENANCE PROGRAM (BUSSWIRE REPAIR)



Conclusion



- 1. The declining of Gili Trawangan Solar Power Plant's reliability is due to the PV Module cracking, oxidation (corrosion), snail track, short circuit, breakdown, damaged lamination (air bubbles), and discolored cells, resulting decreasing in kWh production of PV module from year to year, approximately from 17% to 19% per year.
- 2. The performance of kWh production in the last three years of Gili Trawangan Solar Power Plant on inverter G1 reached 44% compared to achievements on inverters G2 & G3, which reached 29% and 28% respectively.
- 3. Conducting the PV Solar Power Plant special maintenance program using the buswire repair method (period May 2022 to July 2022) can improve the performance and reliability of the PV Module, with an increase in kWh production of up to 16-17%.
- 4. From the analysis above, it can also be concluded that for tropical areas such as Indonesia, especially in the Nusa Tenggara Region, the reliability of the PV Module on the G1 inverter with the Polycrystalline type is still superior to the PV Module on the G2 & G3 inverter with the Monocrystalline type, based on a study case in Gili Trawangan Solar Power Plant.





Thank You