



**CONTAINED
ENERGY**

**Preliminary Proposal for Installation of Hybrid Solar
PV System for Net Zero PreFab Villa in Bali, Indonesia**





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Bali, December 11, 2014

Richard John Sauter
Bali, Indonesia

Att: Mr. Richard John Sauter

Subject: Offer Letter for Installation of Hybrid Solar PV System for Net Zero PreFab Villa

Dear Mr. Richard John Sauter

Thank you for giving us the opportunity to provide a proposal for a Hybrid Solar PV system for your Net Zero PreFab Villa in Bali.

We propose a high quality system, using high-end equipment from leading manufacturers and we back our installations with first class service and support.

Our services are fully value-oriented and we always aim to provide the best service and aftercare to our clients.

We hope that the proposal meets your expectations.

Best regards,

Pieter de Vries
Managing Director
Contained Energy



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1. Introduction

Contained Energy Indonesia (CEI) is one of the leading solar system integrators in Indonesia, providing world-class PV engineering-, supply-, installation- and support services to the private sector as well as Government.

Contained Energy has a long track record of 10 years and over 100 successful projects in Indonesia, Pacific Islands and other tropical and remote areas.

Our Indonesia-based solar engineering- and project management- team is second to none and includes experienced engineers from Holland, Germany and Spain as well as Indonesian engineers.



Figure 1: Off-grid installation in Bintan



Figure 2: On-grid installation in Bali



Figure 3: On-grid installation in Jayapura



Figure 4: Off-grid installation in FSM



2. About Us

About our team

Over the years, we have assembled an excellent and experienced Engineering and Technicians team, which has no equal in Indonesia. This includes:

- **Pieter de Vries**, Managing Director, Architect, Dutch. 10 years' experience with solar and other alternative energy in Indonesia
- **Marc Ferra**, MSC, Senior PV Engineer, Spanish. 7 years PV experience in Spain and France, one year in Indonesia.
- **I Komang Adi Aswantara**, MSC, PV Engineer, Indonesian. Studied and worked in Japan and Korea.
- **Victor Samuel**, MSC, PV Engineer, Indonesian. Studied and worked in Holland and Sweden.
- **Indra Budi**, MSC, Electrical Engineer, Indonesian. 10 years electrical engineering experience for US company in Indonesia, Malaysia and Singapore.
- **Jos Frensch**, MSC, Electrical Engineering Consultant, Dutch. Ex-Heineken and Shell in Middle East, Africa and Indonesia
- **Technicians Team**: 5 electrical (degree) engineers, trained on PV installations.

About Our Experience:

Contained Energy has provided high-quality renewable energy systems and services in Indonesia and Micronesia for 10 years and are the leading system integrator for on- and off-grid PV and hybrid systems.

Relevant project includes:

- Design, supply and installation of 30 kW solar-diesel hybrid system for Nikoi Resort in Bintan Island
- Design of 20+ kWp hybrid villa system for private villa in Bali
- Design, supply and installation of 4 off-grid villa systems, including solar residential cooling for Loola Resort, Bintan
- Sanur Villa – Design, supply and installation of off-grid system for luxury villa
- **Installation of 18 on- and off-grid installations, totaling 400 kWp in 12 remote islands in Micronesia, funded by EU**

3 Proposition

In this system, we offer an off-grid hybrid system which consists of PV, battery bank, and generator set. During the normal condition, PV will cover the requirement of the energy during the day. In case of the lack of energy, the genset will be run depends on the condition.

4 Description of the PV System

The solar photovoltaic (PV) system converts sunlight into electricity. The electricity generated can be stored, used directly, fed back into grid line, or combined with one or more other electricity generators or renewable energy sources. Not using any moving parts, solar PV system yields robust and clean electricity. Consisting of a set of modules, solar PV system flexibly suits a wide range of applications such as residences, factories, hotels, and resorts.

The main equipment of this solar PV systems comprise

1. Solar/PV module : converting sunlight to electricity (DC).
2. Inverter : converting DC to AC.
3. Electrical panel : combining and distributing the power; protecting the system.

Photovoltaic Module: Canadian Solar CSP6P-250P

Our proposal is based around the polycrystalline silicon Photovoltaic module.

Crystalline silicon photovoltaic is the most widely used photovoltaic technology. Crystalline silicon photovoltaic modules are built using crystalline silicon solar cells (c-Si), developed from the microelectronics industry.

Crystalline silicon solar cells have high efficiency, making crystalline silicon photovoltaic an interesting technology where space is at premium.

For this project we propose photovoltaic module with efficiency of 16.16%.



Canadian Solar 250Wp Polycrystalline

Rolls Surette Battery



Rolls Surette battery

Rolls premium deep cycle batteries have earned a reputation of reliability and dependability in the railroad, marine, motive power and renewable energy markets.

Dual container construction, high-density polyethylene materials and unique "resistox" plate design provide a life expectancy that is among the longest in the battery industry.

For this project we propose 96Rolls Surette batteries with current capacity of 2400Ah @2V@C20 each.



SMA Inverter: Sunny Tripower 20000TL

The new Sunny Tripower TL High Efficiency offers 99 percent, best-in-class efficiency, which results in a short payback period. This efficiency breakthrough reduces conversion losses by half and further improves the unit's specific price—making it the ideal inverter for medium and large decentralized PV plants. This model optimizes efficiency while retaining all necessary integration requirements such as reactive power control, network support and grid management.





SMA Inverter Sunny Island SI 8.0



The Sunny Island 8.0 supports a wide range of on-grid and off-grid applications, and both systems have a number of compelling product features. Users benefit from SMA's over 25 years of experience with battery inverter technology. Its high protection class, wide temperature range and overload capacity provides the kind of reliability needed for off-grid use. Intelligent load and energy management keeps the system running even in critical situations. And being a core element in the SMA Flexible Storage System for new and existing PV systems, the Sunny Island system stores generated solar power and works with the Sunny Home Manager to intelligently manage home energy consumption. The quick configuration guide and intuitive user interface help ensure quick and convenient commissioning in any both cases.

The PVSyst simulation result is shown as follows.

		PVSYST V5.73	PT Contained Energy Indonesia	11/12/14	Page 1/3
Grid-Connected System: Simulation parameters					
Project :	Carribean Bali Villa				
Geographical Site	Bali		Country	Indonesia	
Situation	Latitude	8.3°S	Longitude	115.1°E	
Time defined as	Legal Time	Time zone UT+8	Altitude	10 m	
	Albedo	0.20			
Meteo data :	Bali 1, Synthetic Hourly data				
Simulation variant :	Caribbean Villa				
	Simulation date	11/12/14 09h29			
Simulation parameters					
Collector Plane Orientation	Tilt	10°	Azimuth	0°	
Horizon	Free Horizon				
Near Shadings	No Shadings				
PV Array Characteristics					
PV module	Si-poly	Model	CS6P - 250P		
		Manufacturer	Canadian Solar Inc.		
Number of PV modules		In series	24 modules	In parallel	10 strings
Total number of PV modules		Nb. modules	240	Unit Nom. Power	250 Wp
Array global power		Nominal (STC)	60.0 kWp	At operating cond.	53.3 kWp (50°C)
Array operating characteristics (50°C)		U mpp	639 V	I mpp	83 A
Total area		Module area	386 m²	Cell area	350 m²
Inverter					
		Model	Sunny Tripower 20000 TL30		
		Manufacturer	SMA		
Characteristics		Operating Voltage	320-800 V	Unit Nom. Power	20.0 kW AC
Inverter pack		Number of Inverter	3 units	Total Power	60.0 kW AC
PV Array loss factors					
Thermal Loss factor		Uc (const)	29.0 W/m²K	Uv (wind)	0.0 W/m²K / m/s
=> Nominal Oper. Coll. Temp. (G=800 W/m², Tamb=20°C, Wind=1 m/s.)				NOCT	45 °C
Wiring Ohmic Loss		Global array res.	131 mOhm	Loss Fraction	1.5 % at STC
Module Quality Loss				Loss Fraction	0.1 %
Module Mismatch Losses				Loss Fraction	2.0 % at MPP
Incidence effect, ASHRAE parametrization		IAM =	1 - bo (1/cos i - 1)	bo Parameter	0.05
User's needs :	Unlimited load (grid)				

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Grid-Connected System: Main results

Project : Carribean Bali Villa

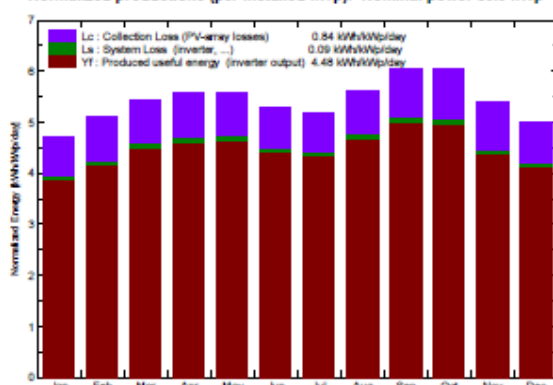
Simulation variant : Caribbean Villa

Main system parameters	System type	Grid-Connected	
PV Field Orientation	tilt	10°	azimuth 0°
PV modules	Model	CS6P - 250P	Pnom 250 Wp
PV Array	Nb. of modules	240	Pnom total 60.0 kWp
Inverter	Model	Sunny Tripower 20000	TL30 Pnom 20.00 kW ac
Inverter pack	Nb. of units	3.0	Pnom total 60.0 kW ac
User's needs	Unlimited load (grid)		

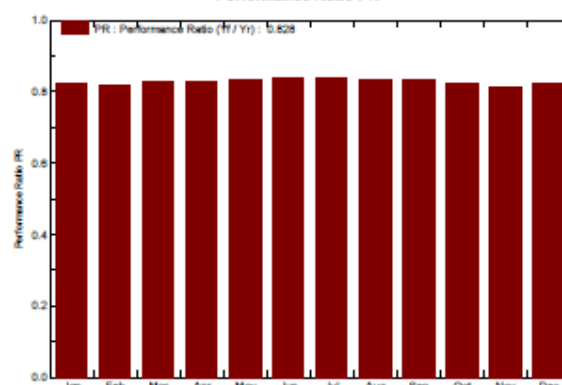
Main simulation results

System Production	Produced Energy	98.1 MWh/year	Specific prod.	1636 kWh/kWp/year
	Performance Ratio PR	82.8 %		

Normalized productions (per installed kWp): Nominal power 60.0 kWp



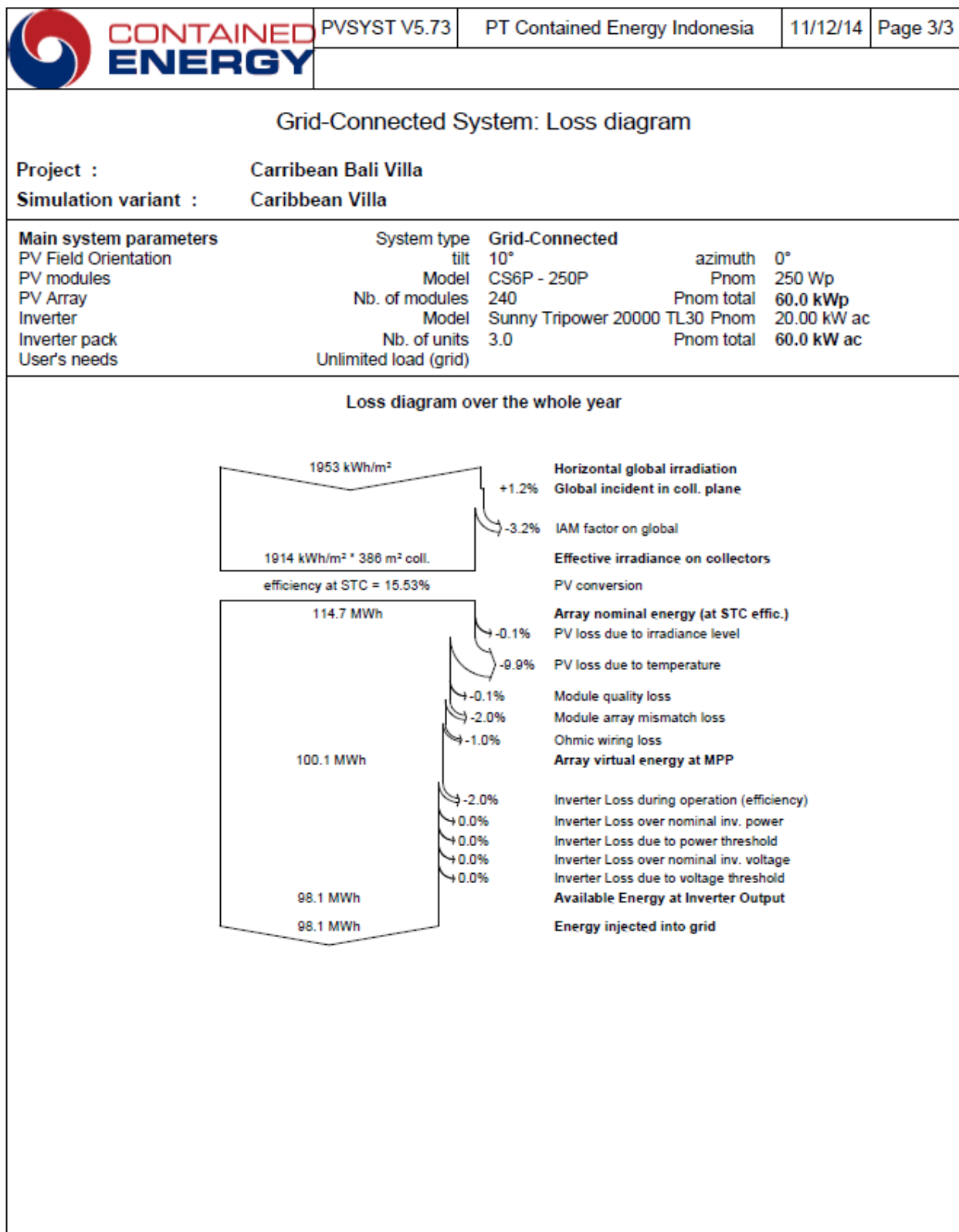
Performance Ratio PR



Caribbean Villa
Balances and main results

	GlobHor kWh/m²	T Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray MWh	E_Grid MWh	EffArr %	EffSysR %
January	152.8	26.66	146.2	140.8	7.365	7.213	13.05	12.78
February	146.2	26.72	142.5	137.6	7.134	6.992	12.97	12.71
March	168.3	26.62	168.4	163.2	8.548	8.384	13.15	12.89
April	161.7	26.85	167.5	162.7	8.480	8.314	13.11	12.86
May	160.9	26.83	172.7	167.6	8.809	8.639	13.21	12.96
June	145.2	26.42	158.4	153.5	8.114	7.956	13.27	13.01
July	148.5	25.75	160.7	155.8	8.253	8.092	13.31	13.04
August	165.2	25.41	174.3	169.4	8.895	8.720	13.22	12.96
September	178.5	25.52	181.2	175.9	9.206	9.023	13.16	12.90
October	191.9	26.02	187.6	181.7	9.444	9.259	13.04	12.79
November	170.1	26.43	161.5	156.0	8.047	7.890	12.90	12.65
December	163.7	26.56	155.1	149.4	7.822	7.668	13.06	12.80
Year	1953.0	26.31	1976.1	1913.7	100.120	98.150	13.12	12.87

Legends: GlobHor Horizontal global irradiation EArray Effective energy at the output of the array
T Amb Ambient Temperature E_Grid Energy injected into grid
GlobInc Global incident in coll. plane EffArr Effc. Eout array / rough area
GlobEff Effective Global, corr. for IAM and shadings EffSysR Effc. Eout system / rough area



5. Summary for PV System

No	On-grid System for Villa
1	Photovoltaic Modules - Canadian Solar CSP6P-250P <ul style="list-style-type: none"> Units : 240 units Rated Power : 250 Wp Total Power : 60,000 Wp Solar Cell Type: Polycrystalline Silicon Dimension : 1640 x 990 x 40 mm
2	Inverter Sunny Island 8.0 <ul style="list-style-type: none"> Units : 3 unit Maximum AC power output : 6,000 W Voltage / frequency : 230V / 50Hz Efficiency : 95 % Dimension : 612 mm x 467 mm x 242 mm Warranty 5 years
3	Inverter Sunny Tripower 2000TL <ul style="list-style-type: none"> Units : 3 unit Maximum AC power output : 20,000 W Voltage / frequency : 380V / 50Hz Efficiency : 99 % Dimension : 665 mm x 690 mm x 265 mm Warranty 5 years
4	Rolls Surette Batteries <ul style="list-style-type: none"> Units : 96 unit Capacity : 2400Ah Voltage : 2V
5	Generator Set (Biodiesel/LPG)
6	System DC/AC Electrical Distribution Board <p><i>Specifications:</i></p> <ul style="list-style-type: none"> DC/AC protection complete with MCBs and Surge Arrester Non corrosive enclosure



6. Quote

	Amount	Unit	Total price
Solar arrays			
Canadian Solar CS6P-250P	60000	Wp	\$ 100,800
Inverters			
Sunny Tripower 20000TL	3	pcs	\$ 47,350
Sunny Island 8.0	3	pcs	
Monitoring System	1	set	
Storage			
Rolls Surette 2400Ah 2V	96	unit	\$ 120,000
Mounting System			
Rooftop rails and mounting structure	60000	Wp	\$ 15,000
Generator			
20kW Genset (Biodiesel or LPG)	1	set	\$ 10,000
Cables & Conduits			
Cabling to DC Board + connectors	500	meter	\$ 2,780
AC cabling from inverter to dist. panel	50	meter	
Lightning and grounding	2	set	
Conduits and tray	10	set	
Distribution Board			
DC board/combiner panel	1	set	\$ 2,200
AC board	1	set	
Installation			
Installers	80	man.days	\$ 6,400
Food and Local Transportation	80	man.days	
Engineering and test-commissioning			
Engineering design	5	eng.days	\$ 3,200
Project management & site supervision	10	eng.days	
Commissioning	2.00	eng.days	
Miscellaneous			
Equipment delivery to site	1	set	\$ 1,600
Total			\$ 309,330
Total/Wp			\$ 5.16



Terms & Conditions

- Payment term:
 - 70% on purchase order
 - 20% prior to delivery
 - 10% on commissioning
- Quote valid for 2 weeks from date
- Not including 10% PPN
- Installation included
- Lead time: 10-12 weeks from PO

Associated Services:

<u>Service</u>	<u>Description</u>
<i>Engineering</i>	<ul style="list-style-type: none">- System design- Cabling calculations
<i>Project Management</i>	<ul style="list-style-type: none">- Organizing installation- Managing
<i>Installation Labor</i>	<ul style="list-style-type: none">- All labor for all works

Warranties:

<u>Equipment</u>	<u>Warranty</u>
<i>PV Modules</i>	<ul style="list-style-type: none">- 10 year manufacturer warranty
<i>Inverter</i>	<ul style="list-style-type: none">- 5 years SMA warranty
<i>Installation</i>	5 years



7. Saving Scenario

The proposal entails the design, sourcing, installation and aftercare of hybrid **60kWp** photovoltaic (PV) power system for your Villa in Bali, Indonesia.

Due to a dramatic fall in panel prices, **grid-tied PV systems** have become much more economic than even two years ago, and are now very much accepted as an economically feasible investment.

Produced electricity is fed directly into the buildings where it is used to provide energy to electrical appliances together with electricity from the grid. Where currently all electricity is provided by your PLN connection, after installation the system will provide part of the required power. This results in a **direct monthly cost saving** on the electricity bill.

Energy Offset PV system

No	Description	Units
1	System Peak Power (Wp)	60,000.00
2	Projected Daily Generated Power (kWh)	268.77
3	Projected Annual Generated Power (kWh)	98,100.00
4	Energy cost offset/year base on genset generation based on IDR 12,500/liter fuel price	USD 31,410.09

Estimated Payback Period

No	Description	Units
1	Total cost of PV System (US\$)	USD 309,330.00
2	Payback period (years) - base on 1587Rp/kWh	9.8 years

CO2 Emission reduction

No	Description	Units
1	Life span of PV system	25 Years
2	Total Energy Generated per year (kWh)	98,100.00
3	Total CO2 Emission reduction (ton) per year	73.58
4	Total CO2 Emission reduction (ton) for 25 years	1,839.38
5	The Number of tree saved for installing the system for 25 years	8,628

The equipment is designed to operate **trouble-free for 25 years** or more. The PV modules come with a **25 year performance warranty** and on inverters a **5 year product warranty** is offered (10 year optional).

Operating costs and maintenance are negligible (consisting mainly of 'washing the PV modules' now and again in the dry season) for PV System and several changes on the batteries for some period.



8. In Conclusion

The above described proposal and budget provides an excellent opportunity to invest in reduced operating costs and raising your green profile. We believe it has quality and value.

Providing systems which are economically feasible for our customers is our top priority.

Should you decide to purchase the offered systems and services you will be sure to get many years of value from them, that you will save energy and carbon emissions, and that you will help fight climate change.

Please do not hesitate to contact me anytime on +62-8961-9494-199 or by email on komang@containedenergy.com should you have any questions or if I can be of service in any other way.

Best Regards,

I Komang Adi Aswantara

Solution Engineer