



Final Report PV-Grid Connect e-BRT Charger at Sunway BRT

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PROJECT OVERVIEW

Location of Sunway BRT

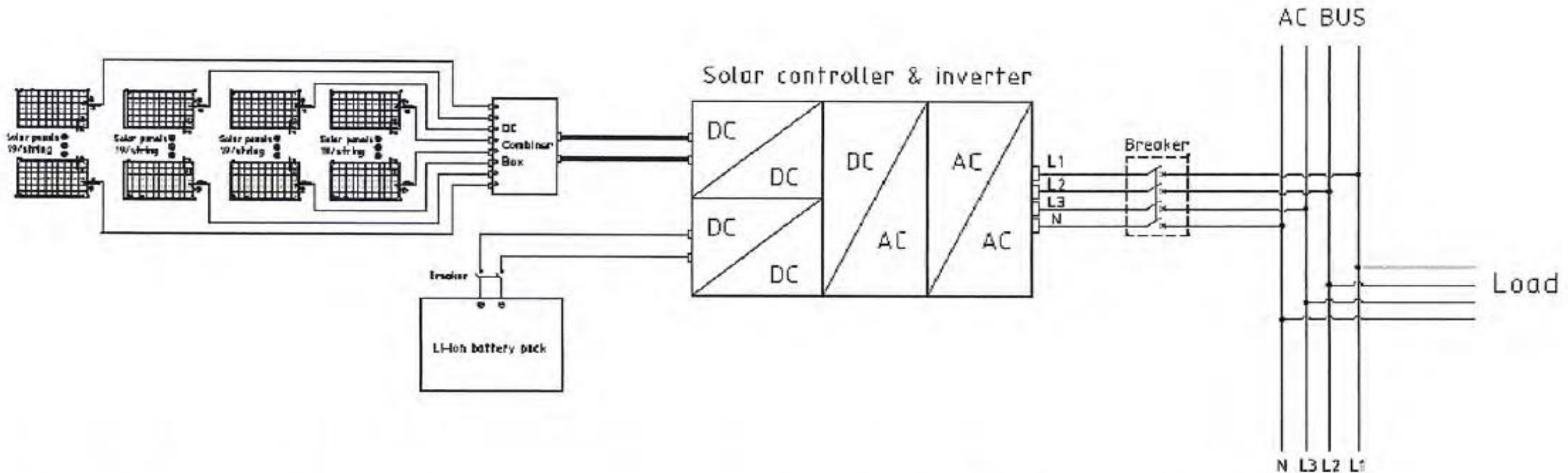


Project name	Solar PV and Energy Storage System at Malaysia BRT Station
Project location	BRT Sunway Depot latitude : N3.05° longitude : E101.6°
PV capacity	20 kW
Energy storage capacity	50kWh
LV voltage	AC 415V/240V
Operation mode	On-Grid

In this PV-Energy Storage System, the proposed PV capacity is 20kW, capacity of battery storage is 50kWh.

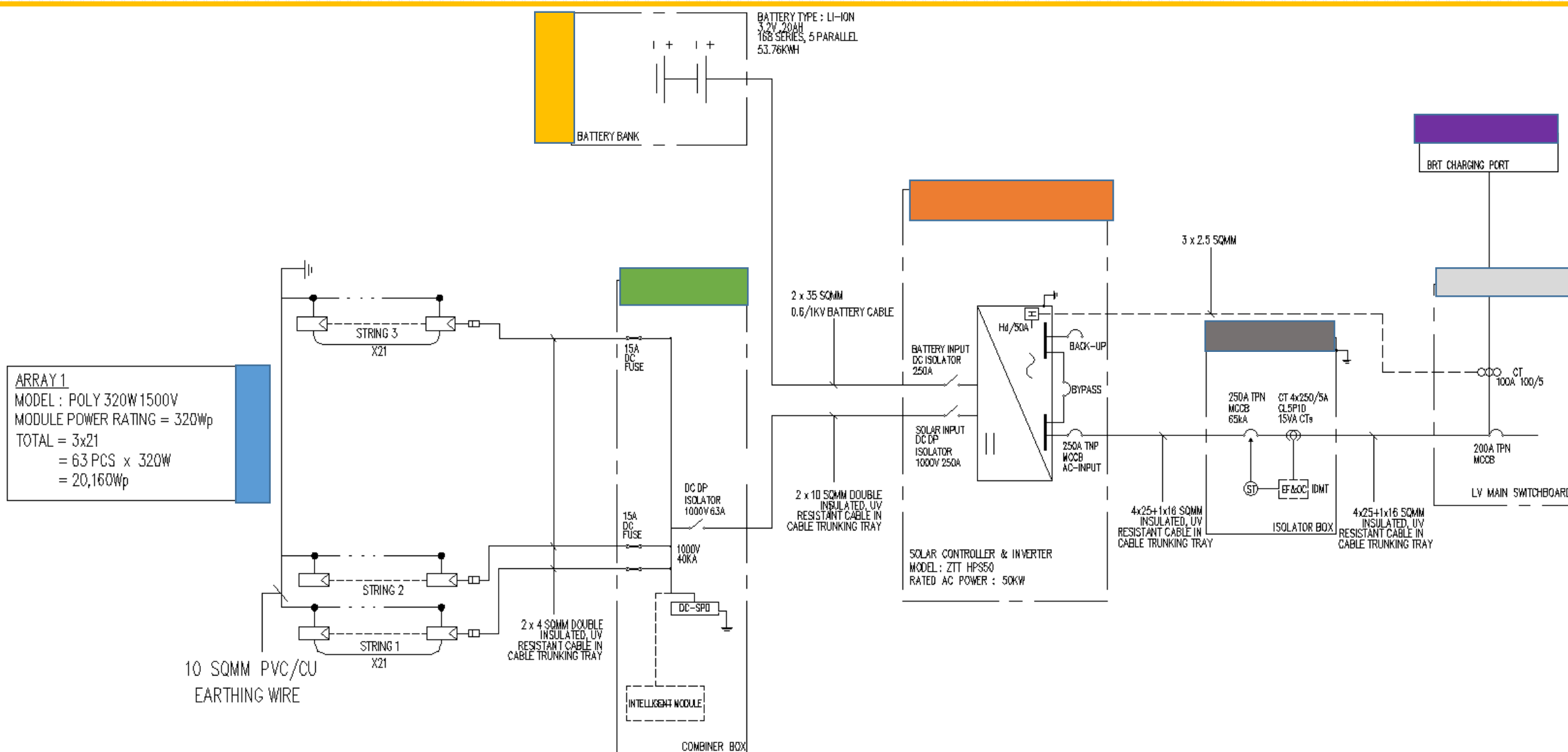
The energy generated is mainly supplied to the charging pile. In the day time the PV power is used in priority, the battery and grid will supply power when solar power is insufficient. The whole system will be customized and smart.

SYSTEM DESIGN



1. Total 63 pcs of PV modules are installed, with 320Wp/module, 21 in one string, total 3 strings
2. Battery Bank Configuration: 216 pcs 3.2V battery cells, 3 strings parallel, nominal voltage 691.2V, nominal capacity 75Ah. Total Energy Storage System (ESS) Capacity, 50kWh

DETAIL SINGLE LINE DIAGRAM (SLD)



SYSTEM CONFIGURATION LIST

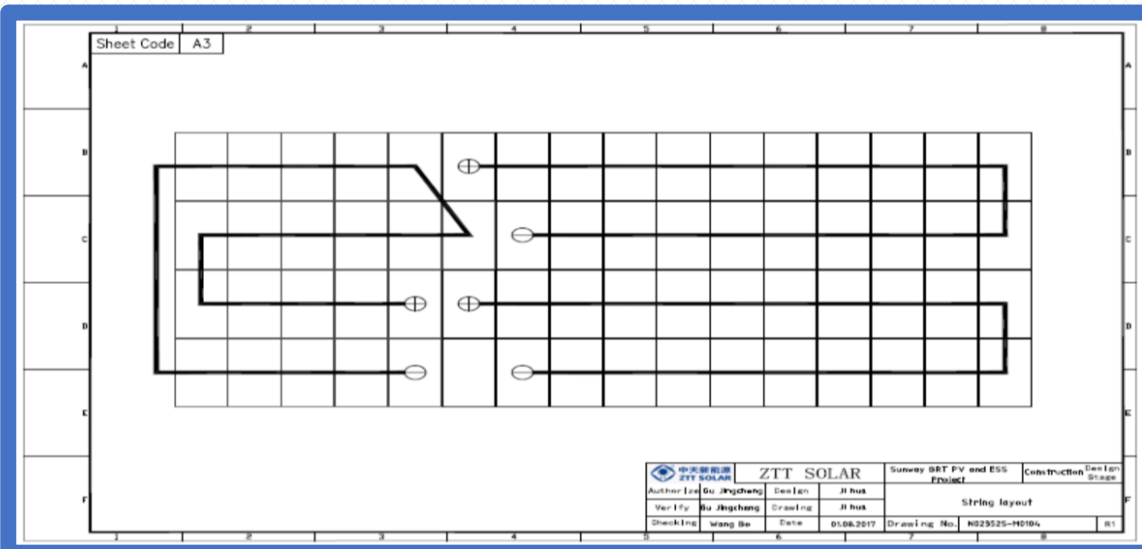


Name		Model	Qty	Unit
PV system	PV module	320 Wp	63	Pcs
	DC combiner box	3 in1out	1	Set
	Mounting system	20 kWp	1	Set
Energy Storage System	Lithium battery	3.2V 25Ah	648	Pcs
	Battery pack	/	18	Set
	Battery cabinet	/	1	Set
	BMS	BMS	1	Set
PV&ESS Hybrid PCS		50kW	1	Set
EMS		EMS	1	Set
AC&DC cable		/	1	Set
Auxiliary material		/	1	Set

PV MODULE LAYOUT ON THE ROOF

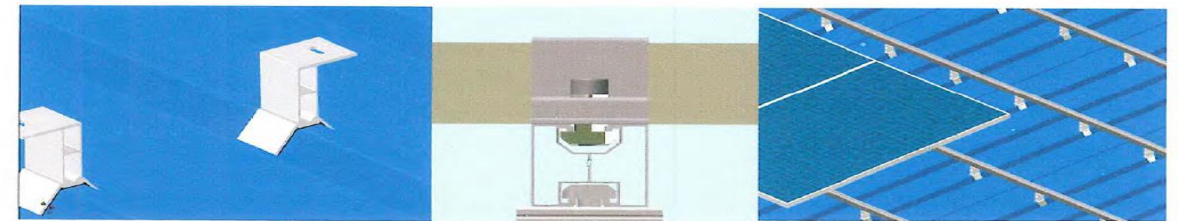


1. Installed PV capacity: 20.16kWp, 320Wp/pcs,
2. Total 63 pcs.
3. The PV Module is installed on the rooftop, tilt angle follow the angle of rooftop.
4. Location of the Solar PV Array is highlighted in blue in the picture.



Based on survey, the rooftop is color steel type
Installation step:

1. The structural adhesive is used to fix the clamp on the color steel rooftop.
For the design we propose, ZTT has successfully applied in many demonstrative project and gained national patent (ZL 2012 2 0694619.3).
2. Track installation, fix the track and module on the clamp.



Installation features:

- Do not destroy the original waterproof layer, no need water treatment;
- Applies to any specification of crystalline silicon module and part of CIS module;
- Installation fast, simple.

HPS SPECIFICATION

Hybrid Power System



ZTT HPS50

Model	ZTT HPS50
Rating	50kW
DC input quantities	
VMAX DC (absolute maximum)	1000V
PV input operating voltage range	480-800V
Maximum operating PV input current	125A
ISC DC (absolute maximum)	125A
BAT input operating voltage range	350V-600V (MPP voltage-100V)
BAT Maximum operating DC input current	180A
AC output quantities	
Voltage (nominal or range)	400Vac
Current (maximum continuous)	80A
Frequency (nominal or range)	50Hz/60Hz
Power (maximum continuous)	55kW
Power factor range	0.9lagging-0.9leading
Weight unit	600 kg
Ingress Protection	IP20
Environmental category	indoor
Suitability for wet locations	not
Pollution degree	II
Elect.protection class	Class I
Overvoltage category	Category I for AC output category II
Mains connection	Permanent connection
Transformer info	With isolating Transformer
Insulation class	Class H

BATTERY SPECIFICATION



BATTERY MODULE SPECIFICATION

Considering the charging /discharging performance of single cell and current limitation, the whole battery system will be divided into 18 battery modules and every module is 38.4V/75Ah. The size of each module is 19 inches and 2.6U with 36 pieces of 25Ah cells.

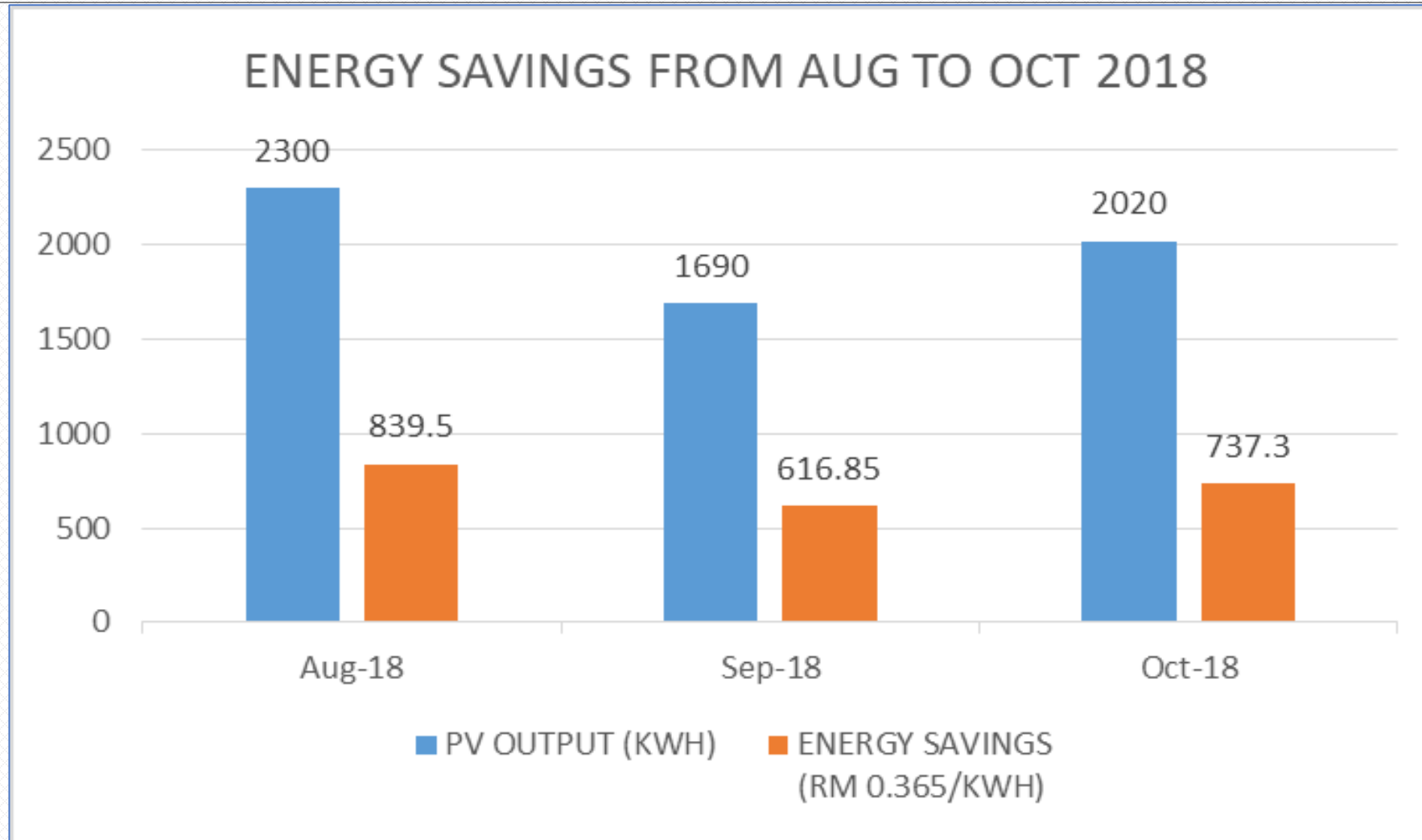
50kWh battery module parameters table

No.	Item	Parameter	Note
1	Nominal voltage(V)	38.4	
2	Nominal capacity(Ah)	75	
3	Nominal energy (Wh)	2880	
4	Charging terminal voltage (V)	3.7 (Single cell)	
5	Charging terminal voltage(V)	2.5V(Single cell)	
6	Combination	3P12S	
7	Single cell amount(PCS)	36	
8	Size	482mm*550mm*117mm	2.6U

ENERGY SAVINGS: 3 MONTHS RESULT



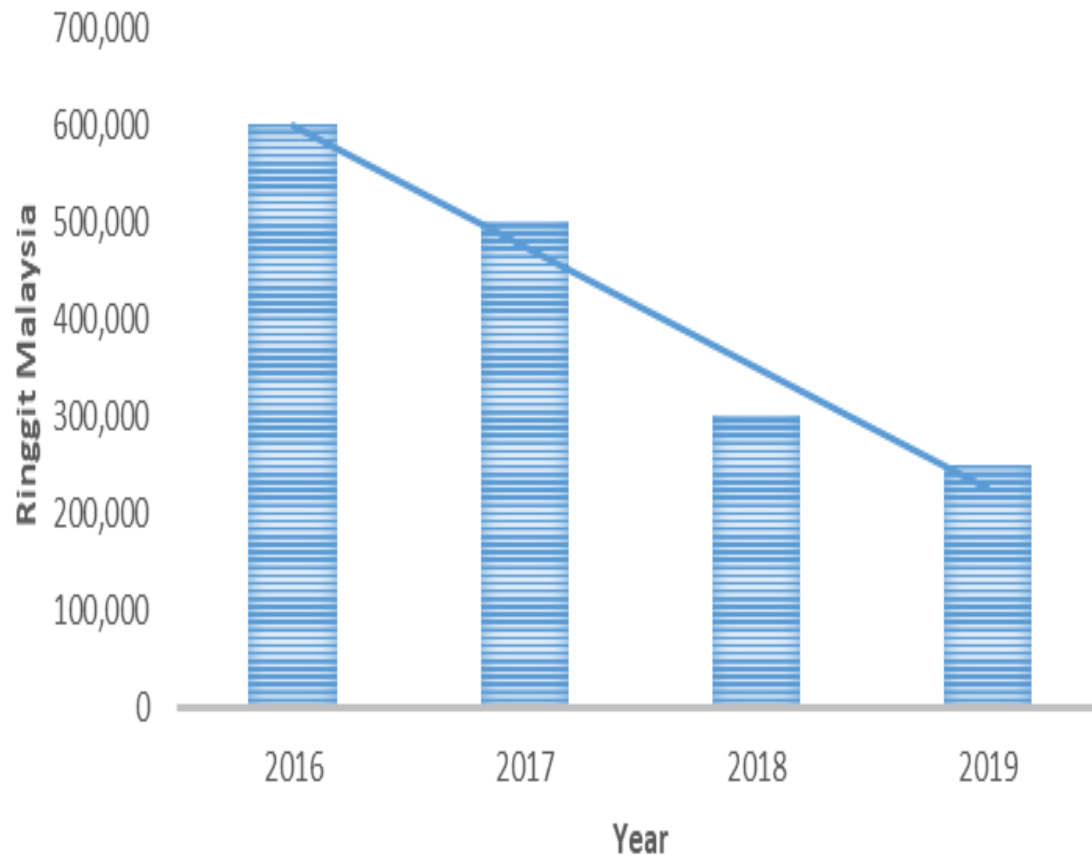
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ITEMS	Aug-18	Sep-18	Oct-18
PV OUTPUT (KWH)	2300	1690	2020
ENERGY SAVINGS (RM 0.365/KWH)	839.5	616.85	737.3

SYSTEM EXPANSION PROPOSAL

SYSTEM COST (RM) TRENDLINE



1. Assume HPS system to be expanded from 50 kW to 250kW AC
2. Energy Storage System to be able to support load consumption from 8pm to 12am everyday
3. Total Investment estimation: RM 1.2 million

PROJECT ECONOMIC IMPACT

1. Total Energy Savings will be $RM3,500 \times 12 = RM 42,000$ per year
2. Maximum Demand Reduction: 250kW AC
3. Maximum Demand Savings per month:
 $250kW \times RM30.3 = RM 7,575$ per month
4. Maximum Demand Savings per year:
 $RM 7,575 \times 12 = RM 90,900$
5. Total Savings per year = RM 132,900
6. Return of Investment = 9 years

Conclusion

- The contract has successfully delivered in the design, development and deployment of an integrated solar photovoltaic and energy storage charging system for electric buses aimed at demonstrating the feasibility of operating EVs that run on renewable energy.
- On a scale-up application, the project benefit will be three-prongs:
 - i. Reduction of grid energy used in charging the buses
 - ii. Reduction of overall maximum demand to BRT Sunway electricity supply
 - iii. Higher reduction of GHG emissions from fossil fuel