Acrel[®]

Solar PV Online Energy Vlonitoring Cloue Solution

Solar PV, Import&Export Bidirectional, Online Energy Monitoring, 4G Cloud based.

Ver. Date: July,6th 2023

Acrel Co., Ltd.

No.253 Yulv Road, Jiading District, Shanghai, China

2023/06/07 Ver.



1. Scenario Preset

(1) The scenario is based on a small on-grid Solar PV system without DC energy storage.

(2) In order to establish a complete monitoring system, we need to install a smart wireless 3-phase energy meter with bidirectional metering function on Grids Side [Need to monitor the girds' overall 3-phase incoming circuit so that we can monitor the total power consumption supplied from grids to house loads and also monitor the over-generated reflux energy from Solar PV to grids or power transformer.]

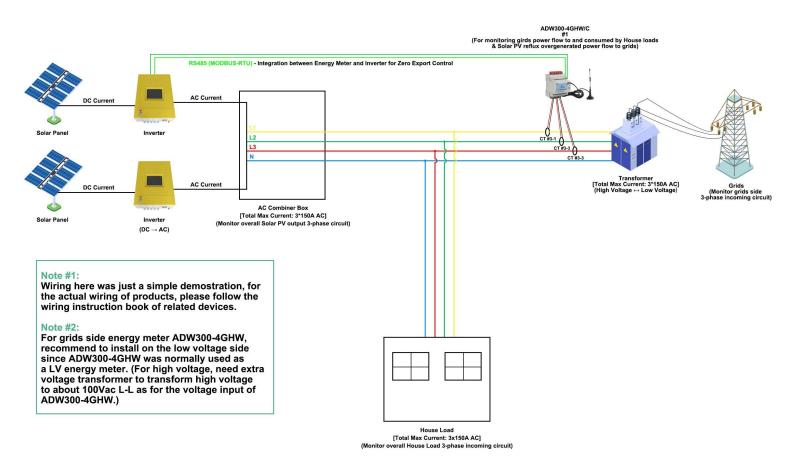
(3) The reason why to choose wireless energy meter was because it could directly send data to Acrel IoT Energy Monitoring System without using a extra IoT Gateway. For separate installation, this will be more economic.

(4) Suppose grids sides incomming circuits is with rated current of 150A AC and rated voltage of 230Vac L-N&400Vac L-N.

2. Devices Deployment Plan

Grids Side - Grids' Overall 3-phase Incoming Circuit:

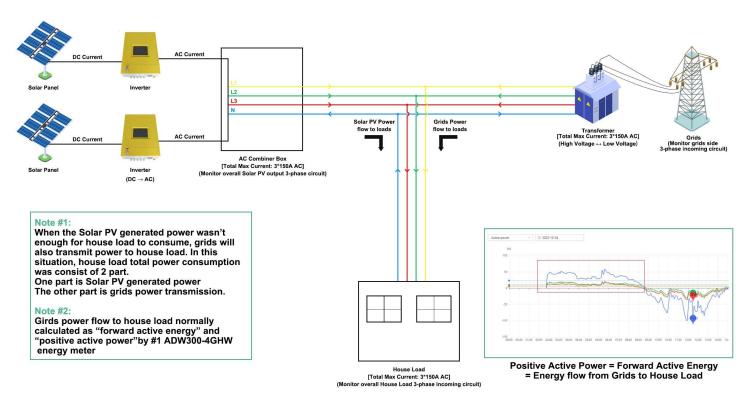
- 1* ADW300-4GHW/C Wireless 4G Energy Meter
- 3* AKH-0.66/K K- 24 150/5 Split-core Current Transformer





3. Calculation Logic - When the Solar PV Generated Power < House Load Consumed Power

When the solar PV generated power wasn't enough for house loads to consume. Grids will also distribute power to house load for consuming. So, in this situation, the house load total power consumption was consisted of 2 parts, solar PV generated power and grids distribution power.
 Girds power flow to house load for consuming was normally calculated as "forward active energy, EPI" and "postive active power, +kw" by #1 ADW300-4GHW energy meter.



Calculation logic (When Solar PV not Enough)



Diagram of "Forward Active Energy, EPI"



3. Calculation Logic - When the Solar PV Generated Power > House Load Consumed Power

 When the solar PV generated power was larger than house loads power consumption. The part of over-generated solar PV power will reflux to power transformer or grids. In this situation, solar PV power generation will be distributed to 2 part, to house loads and to power transformer or girds.
 Solar PV over-generated power which reflux to power transformer or girds was normally calculated as "backward active energy, EPE" and "negative active power, -kw" by #1 ADW300-4GHW energy meter.

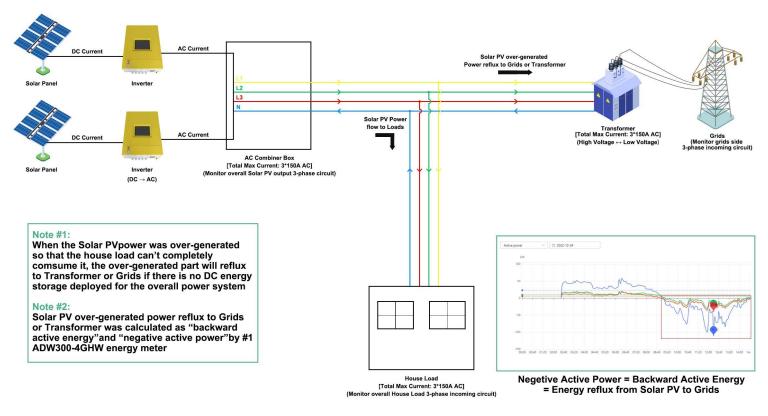






Diagram of "Backward Active Energy, EPE"



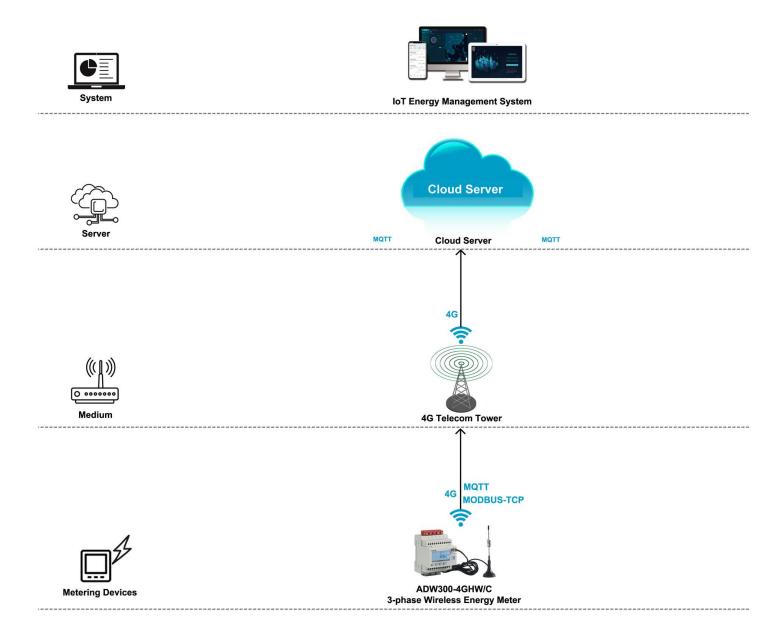
4. Communication Structure&Logic - To IoT System

(1) 4G Communication could be served as one of the final data upstream methods by sending the data to cloud server deployed in Internet so that Acrel IoT System could be interact with these data collected by bottom metering devices like Energy Meter

(2) ADW300-4GHW/C Wireless 4G 3-phase Energy Meter has a built-in 4G communication module which allow it to directly send data to local 4G telecom tower through 4G signal based on MQTT and MODBUS-TCP protocol without using a extra 4G IoT Gateway.

(3) Each ADW300-4GHW/C has a 4G card tray for installing the 4G sim card which could be bought from your local 4G service provider.

(4) ADW300-4GHW/C also have a RS485 communication normally used for devices adjustment with Acrel ADW300 adjustment softare.

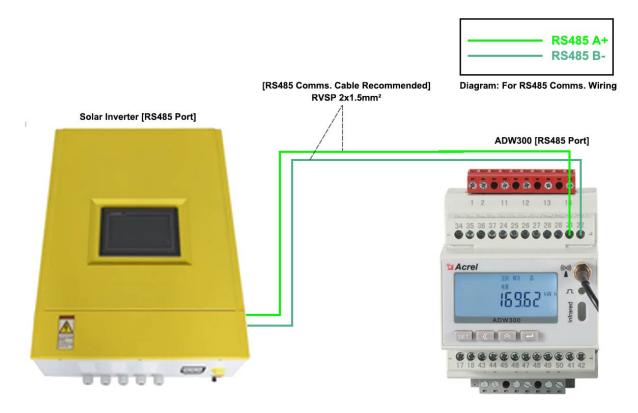




4. Communication Structure&Logic - To Solar Inverter

(1) ADW300-4GHW energy meter also has a RS485 port [MODBUS-RTU protocol] which could be connected to Solar PV Inverter so that inverter could get the reading from ADW300 based on MODBUS-RTU protocol.

(2) Once the inverter get a reading of "backward active power [minus value]", the invert could automatically lower its power generation rates so that the over all Solar PV generated power won't be more than house load consumption. Thus Solar PV side won't have export to grids side and eventually realize zero export.



Note:

1. Solar PV inverter get reading of bidirectional active power of grids side from ADW300 based on RS485 [MODBUS-RTU]

2. Once inverter get the reading of backward active power [export], inverter will lower its power generation rates so that no more Solar PV over-generated power flow to grids side. [no more export power]

3.All the generation power control logic was decided by inverter, energy meter ADW300 only provide the reading of bidirectional active power. So the integration between ADW300 and inverter based on RS485 interface [MODBUS-RTU] protocol for get the reading of bidirectional active power must be done and inverter side must have this type of control logic. [When inverter get the reading of backward active power, it will lower its power generate rate]



5. Overall Model Selection&Quoation

(1) This Quotation doesn't include freight charge. To gain a complete quotation, please refer the actual quantity that you want to request for the actual order, once we receiving it. We will issue a Official Proforma Invoice with Acrel Stamps on it for later procedure.

			System Software					
Name			Description	System Price			Remark ice or Buy-out Service after 3- ial of Cloud IoT System)	
		been sent to cloud s	I the meters across the country whose data has erver through 4G,WiFi or Ethernet . Iding and data collection.	\$0 (recommended in pilot pro	ojtect)	3-month Free Trail (Users don't need to rent a cloud se		
		3.Provide IoT APP 4.Generate energy of	for mobile phone side and IoT WEB for PC side. data report of daily, monthly and annually yeay and period-on-period energy analysis.	\$xx/Year (For 1 Points (Price for Host Service 0 recommended in pilot pro	Only,	connected	Service for 1 monitoring points to the system 1 year ed to rent a cloud server)	
Acrel Cloud IoT Energy Manager	ment System	5.Provide various al of the system and p	arm function to ensure a stable operation rotect your property. e trial of system with full technical support	\$xxxx/Permanent (Limitless (Price for Buy-out Serv Only,recommended in late p	Points) rice	1-time charging of \$xxxx for Buy-out Serv permanent use (A cloud server need to be users)		
			Cloud Server					
Name			Description	Server Renting Price (For Reference Only			Remark	
Cloud Server Cloud Server	Cloud. 2. Users of Cloud IoT Energy M cloud server when they choose I System. And if they are using h our Cloud IoT System, we will us rent on Amazon so that users do		d be rent on the cloud server provider like Amazon T Energy Management System only need to rent ley choose buy-out service of our Cloud IoT are using hosting service or 3-month free trial of m, we will use our own cloud server which has been that users don't need to rent a cloud server. Cloud Server is only a reference price that we have ud.	According to Specs of Rente Server	ed Cloud	1000~2000 monito (Serv	erver specs could support bings points connected to the system rer: 8 core 16G rm: windows server 2016)	
		1	4G Wireless Energy Mete	er				
Overview Picture	USAGE&MO	DULE NAME	DESCRIPTION & SPECIFICATION	QUANTITY	FOB U	NIT PRICE (USD)	AMOUNT (USD)	
		less Energy Meter -4GHW/C	Communication: 4G Wireless Communication (with 4G SIM card)&RS485 (MODBUS-RTU) Rated Voltage: 3x380~456Vac L-L or 3x660Vac L-L (45~65Hz) Rated Current: 3x1(6)A AC (via CTs) Auxiliary Power Supply: 85~265Vac	1 pcs		1	1	
			Paired Split-core CT					
Overview Picture	USAGE&MO	DULE NAME	DESCRIPTION & SPECIFICATION	QUANTITY	FOB U	NIT PRICE (USD)	AMOUNT (USD)	
		ent Trasnformer K-φ24 150/5	Current Ratio: 150/5A AC Aperture: ¢24mm (diameter) Accuracy: Class 1.0 Application: Paired with ADW300-4GHW/C for current input	3 pcs	T		1	



Acrel IoT Energy Monitoring System could be access in 2 different ways:

(1) Access through WEB on your computer.

Access port: https://iot.acrel-eem.com/

(2) Access through APP on your mobile phone

Download Link: https://play.google.com/store/apps/details?id=com.acrel.iotems

(1) WEB Accesss (Computer):Access Port: https://iot.acrel-eem.com/Test Account Name: acrelTest Account Password: 123456



(2) APP Accesss (Mobile):
Download Link: https://play.google.
com/store/apps/details?id=com.acrel.
iotems
Test Account Name: acrel
Test Account Password: 123456



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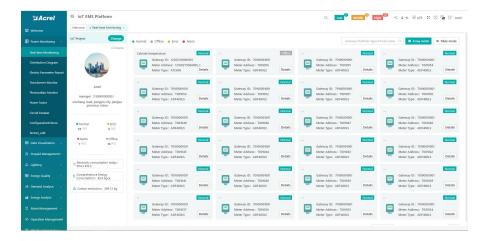
Main Function of WEB side System:

(1) Solar PV Monitoring (2) Devices List (3) History Curve (4) Electricity Parameters Report (5) Energy Consumption Report (Daily, Monthly, Yearly) (6) User Report

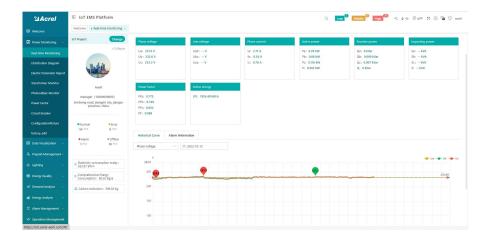
(1) Solar PV Monitoring: Overview of overall loads' power consumption,
Solar PV total power generation, energy supplied by grids that consumed by loads, over-generated
Solar PV power flux to grids or power transformer.



(2) Devices List: Showing the overall devices connected to Acrel System and were bond to certain project. SN code, Online-Offline status, devices model and other necessary information will be shown here.



(3) History Curve: Showing the daily history data curve of all the data that could be collected and uploaded by energy meter or other basic metering devices.





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(3) History Curve: By selecting the items of "date" and "electricity parameter", platform can show the history curve of different data and date.



(4) Electricity Parameters Report: All the electricity parameters that could be collected by certain energy meter will showed as a report here.

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ormer Monitor	ROOM002	24	9.84	8.46	8.46	26.76	-8.34	-5.82	-6.84	21	12.9	10.26	10.86	34.02					13942
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	5/F	58	9.9	8.82	8.34	27.06	-8.46	-6.12	-6.84	21.42	13.08	10.74	10.8	34.62					13943
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(4) Electricity Parameters Report: Report on platform could be exported in "Excel" format to your computer for a brief storage when accessing the IoT EMS WEB platform.

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7. Acrel IoT Energy Monitoring System (Partail Introduction)

Main Function of WEB side System:

(1) Solar PV Monitoring (2) Devices List (3) History Curve (4) Electricity Parameters Report (5) Energy Consumption Report (Daily, Monthly, Yearly) (6) User Report

E IoT EMS Platform

(5) Energy Report (Daily): This Interface show the daily energy consumtion report (calculated by forward active energy)

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(5) Energy Report (Daily): This daily
energy report could be also export
to computer in "Excel" format

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Energy	Node Consumption				Y Consumption(kW .									17
	0.32	0.00	0.32	0.00	0.32	0.00	0.32	0.00	0.32	0.00	0.32	0.00	0.30	
	(31.20	0.00	19.20	0.00	36.00	0.00	15.20	0.00	22.40	0.00	32.00	0.00	30.40	c
) 46.40	0.00	30.40	0.00	44.80	0.00	28.00	0.00	39.20	0.00	40.00	0.00	40.80	
	- 8.80	0.00	9.60	0.00	9.60	0.00	9.60	0.00	9.60	0.00	9.60	0.00	9.60	6
	- 12.00	0.00	11.20	0.00	12.00	0.00	11.20	0.00	11.20	0.00	12.00	0.00	12.00	
34	- 39. 20	0.00	39.20	0.00	40.80	0.00	32.80	0.00	47.20	0.00	40.00	0.00	39.20	(
M-) 32.80	0.00	32.80	0.00	33.60	0.00	32.80	0.00	12.80	0.00	32.80	0.00	32.80	
M	- 29.60	0.00	29.60	0.00	29.60	0.00	29.60	0.00	29.60	0.00	29.60	0.00	28.80	
M	- 17.60	0.00	21.60	0.00	20.80	0.00	21.60	0.00	20.80	0.00	21.60	0.00	20.80	
. W	- 30. 40	0.00	30.40	0.00	30.40	0.00	30.40	0.00	30.40	0.00	30.40	0.00	29.60	
W	24.80	0.00	21.60	0.00	20.80	0.00	21.60	0.00	20.80	0.00	20.80	0.00	20.80	
м	- 40.00	0.00	40.80	0.00	40.80	0.00	40.80	0.00	40.80	0.00	40.00	0.00	40.80	
	- 0.00	0.00	0.80	0.00	0.80	0.00	0.80	0.00	0.00	0.00	0.80	0.00	0.80	
1	2(42, 40	0.00	26.40	0,00	47.20	0.00	47.20	0.00	46.40	0.00	45.60	0.00	47.20	
	32.00	0.00	34.40	0.00	34.40	0.00	34.40	0.00	34.40	0.00	34.40	0.00	33.60	
Total	387.52	0.00	348, 32	0.00	401.92	0.00	356.32	0.00	365.92	0.00	389, 92	0.00	387.50	
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(5) Energy Report (Monthly& Yearly): Same as daily energy report, monthly and yearly energy report could be also checked on platform and exported in "Excel" format.

≌Acrel	IoT EMS Platform							Q	Low Niddl	e High	-1C & -16 SP	APP 11 (1) (1	a 😗 acrai
I Welcome	Welcome Real-time Monitoring × User Report ×	Electric	Parameter Report ×	Energy Report ×									
Rower Monitoring	IoT Project Change	Energy	Consumption Con	rprehensive Energ	Consumption	Carbon Dicoide Emi	ssions						
🖽 Data Visualization 🖂	Enter search content here	Energy	Consumption: Elec	tric	U Date:	Month 🔿 🖽 2	022-10	Q Sea	ch < Chart	# Export			
℅ Prepaid Management ~	All Cascading			01		Day		03		04		05	
¢ tighting ∽	ROOM001			Cost(\$)	Consumption	Month	Consumption(k	Cost(\$)	Consumption(k	Cost(\$)	Consumption(k	Cost(\$)	Consumptio
Energy Quality	ROOM002					Yaar	W(h)		W-b)		W-b)		W/h)
	> 🗆 1/F		G/F	0.00	2.76	0.00	2.92	0.00	2.01	0.00	2.17	0.00	1.72
sé Demand Analysis 🗸	> _ 2/F		RDOM001								-		
📫 Energy Analysis 🔷	• 🗆 3/F		RDOM002										
YoY Analysis	• 🗌 4/F		Total	0.00	2.76	0.00	2.92	0.00	2.81	0.00	2.17	0.00	1.72
	5.F												
MoM Analysis	 12203162030001_12203162030001_1 11 												
Energy Trend	232												
Energy Report	70100001001 7001002												
Collecting Report	70100001001_7001003												
	70100001001_T001004												
Multiple Rate Report	70100001001_T001005												
Energy Rank	70100001001_T001008												
Loss Analysis	70100001001_7001007												
	70100001001_T001003												
Energy Flow	70100001001_T001009												
S Alarm Management ~	70100001001_T001010												
VA Operation Management	70100001001_0001011												
	70100001001_0001012												
Erresgy Rank Loss Arallysis Erresgy Flow	7010001001,700100 70100001001,700100 70100001001,700100 70100001001,700100 70100001001,00010 70100001001,70010												



widdie ⁰ High ⁶⁰ - C à - M (21 APP 12 () 🖫

7. Acrel IoT Energy Monitoring System (Partail Introduction)

Main Function of WEB side System:

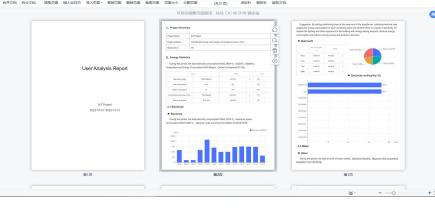
(1) Solar PV Monitoring (2) Devices List (3) History Curve (4) Electricity Parameters Report (5) Energy Consumption Report (Daily, Monthly, Yearly) (6) User Report

INT EMS Platfe

(6) User Report: A comprehensive
 user report including project
 overview, energy report, energy
 analysis and etc could be check on
 platform



(6) User Report: User report could be exported in "PDF" format into your PC for convenient check and storage.



(6) User Report: User report support template customization in buy-out service of Acrel IoT Energy Monitoirng System.

Sa Acrel	IoT EMS Platform	Q 🛛 🗤 💷 💷 🖉 🖓 🖓 🖓 🖓 🖓 🖓 🖓 🖓 🖓 🖓 🖓 🖓 🖓
	Welcome Real-time Monitoring - User report template -	
	Project Name Q	Report Template
		â Save
	ioT Project xincheng road, jiangyin city, jiangsu province, china	□ A1
		projectOverview i ewerg/statistics
Energy Quality		Intergy/dialance
		• 🗆 transformer
	338	IncomaAnalysis
		eventionalysis inspection
	(m	
	m	
Financial v		
	333	
	Weigleer masseres Sdn Bhd	
User Report		
	440	
	C	



Main Function of APP side System:

(1) Devices List (2) History Curve (3) Electricity Parameters Report (4) Energy Trend (5) Energy Consumption Report (Daily, Monthly, Yearly)

Noted: Since APP side and WEB side of Acrel IoT Energy Monitoring System share the same data, normally recommend our user to add the devices to their account using APP and check the data using WEB platform.

13:23 🛙 🖬 🛸	🖽 🖏 🖏 77% 🔲
Q Gateway ID/Meter Type	
📮 Cabinet temperature 🛛 💷	
Gateway ID:12202141960001	>
Meter address:12108275060005_1	/
Meter Type:ATC600	
Coline	
Gateway ID:70100001001	
Meter address:T001055	>
Meter Type:ADF400LS	
Conine)	
Gateway ID:70100001001	
Meter address:T001054	>
Meter Type:ADF400LS	
Coline	
Gateway ID:70100001001	
Meter address:T001053	>
Meter Type:ADF400LS	
Online	
Gateway ID:70100001001	
Meter address:T001052	>
Meter Type:ADF400LS	
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= ^	÷
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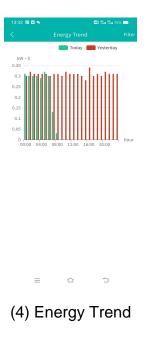
(1) Device List

13:32 😰 🖾 🛸		🖽 🖓 🖬 🖓 a 75% 💶)						
<	Electrical p	ara…	Filter					
Acquisition time	Ua(V)	Ub(V)	Uc(V)					
00:00	220.9	220.6	221.4					
00:05	221.4	220.8	221.5					
00:10	221.9	221.7	222.1					
00:15	221.6	221.2	222					
00:20	222	221.5	221.9					
00:25	221.5	221.2	221.8					
00:30	221.9	221.3	221.6					
00:35	220.6	220.4	220.9					
00:40	221.6	220.7	221.7					
00:45	222.3	221.4	222.2					
00:50	221.5	221	221.7					
00:55	221.9	221.7	221.7					
01:00	221.4	220.8	221.6					

(3) Parameter Report

13:28 😰 🖬 🛸		🕮 🕮 Ka 76% 🚍
Device Status: <mark>Onlin</mark>	e	2022-10-13 13:25:00
Ua	Ub	Uc
218.8V	217.5V	218.6V
Uab	Ubc	Uca
V	V	V
la	Ib	lc
0.8A	0.8A	0.8A
Pa	Pb	Pc
0.08kW	0.16kW	0.16kW
Р	Qa	Qb
0.48kW	-0.08kVar	0kVar
Qc	Q	PFa
0kVar	-0.16kVar	0.666
EPI	EPE	EQL
15258.4kW • h	5790.4kW • h	16692kW • h
EQC		
7143.2kW • h		
Phase voltage		2022-10-13 🔍
	- O- Ua - O -	Ub -O- Uc
V		

(2) History Curve





(2) History Curve

13:34 🕅 🖼 🛸		🕮 Sa Sa 74% 💶
<	Data report	Filte
energy	comEnergy	CO2
Circuit name	17:00	
	Cost(¥)	Consumpti on(kW · h)
z	- 0.00	0.80
)-	- 0.00	22.40
	0.00	38.40
	0.00	17.60
	0.00	18.40
Total	0.00	97.60
=	\bigcirc	1

(5) Energy Report