Solar Panel String Online Monitorting Cloud Solution

Solar Panel String Monitoring, Online Cloud Monitoring, DC Multi-circuit Solution.

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Acrel Co., Ltd.

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Solar Panel String Online Monitoring Solution (On-grid, No DC Storage)

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1. Scenario Preset

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

(2) The purpose was to online monitor all common electricity parameters for each solar panel string to check their working efficiency and status for maintanance.

(3) For site situation, suppose we have 3 inverters, 48 solar panel strings 576 solar panels in total. For each solar panel string consisted of 12 solar panels and connect to a general DC circuit for power distribution. We will target this DC circuit for monitoring. [Rated current 12A DC, rated voltage 600Vdc]. Also, each inverter connect to 16 solar panel strings.

(4) For the places that we gonna install the energy meter and IoT gateway, they are covered by stable 4G signal.

2. Devices Deployment Plan

Inverter #1 ~ Solar Panel String #1~16
- 1* AWT100-4GHW IoT 4G Gateway [for 4G data stream of AGF-M16T/L-P2 to end IoT System]
- 1* AWT100-POW Power Supply Module [for 85~265Vac/Vdc power supply of AWT100-4GHW]
- 1* AGF-M16T/L-P2 Multi-circuit DC Energy Meter [For monitor Solar Panel Sring #1~16]

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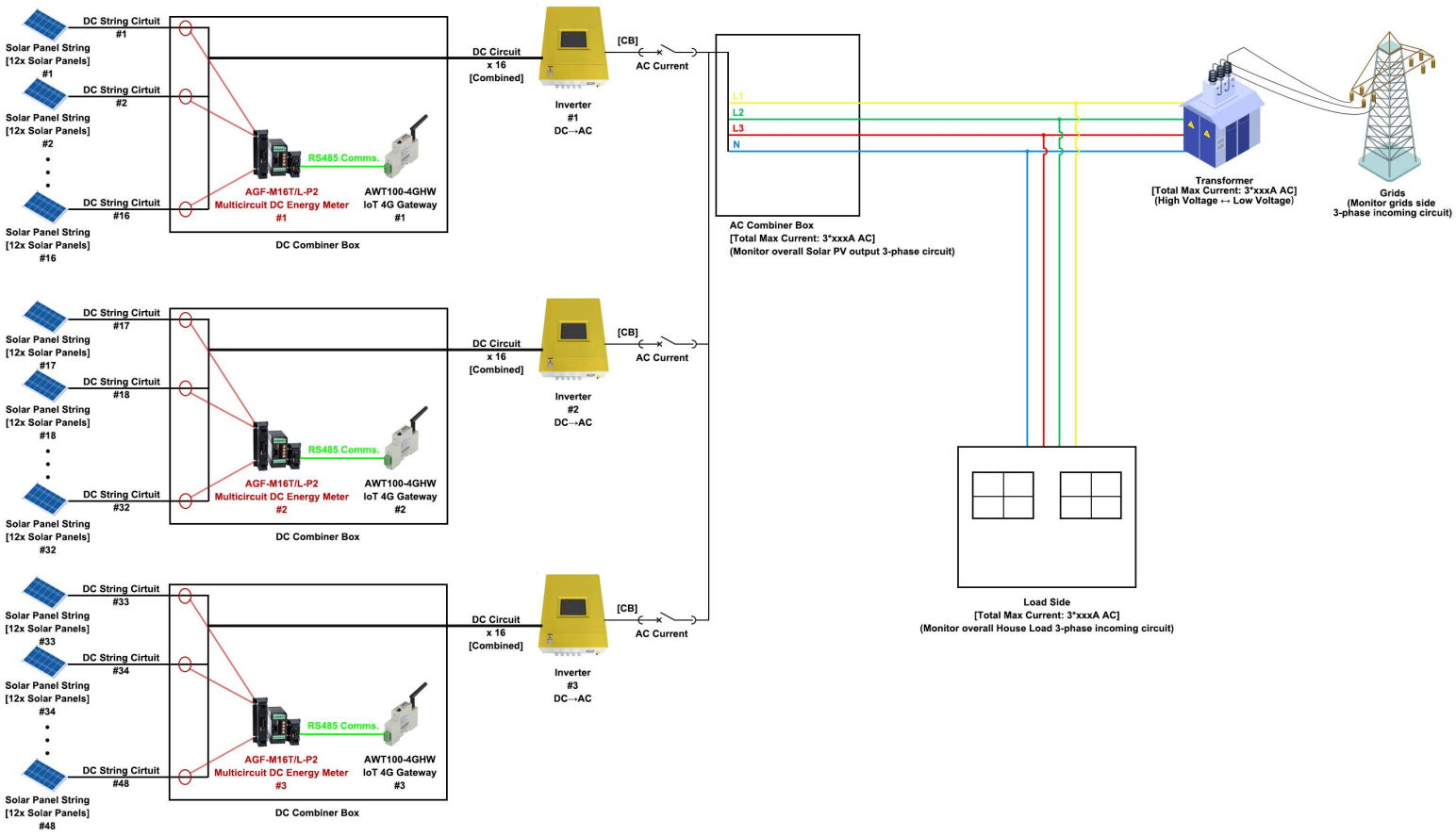
Inverter #3 ~ Solar Panel String #33~48
- 1* AWT100-4GHW IoT 4G Gateway [for 4G data stream of AGF-M16T/L-P2 to end IoT System]
- 1* AWT100-POW Power Supply Module [for 85~265Vac/Vdc power supply of AWT100-4GHW]
- 1* AGF-M16T/L-P2 Multi-circuit DC Energy Meter [For monitor Solar Panel Sring #33~48]



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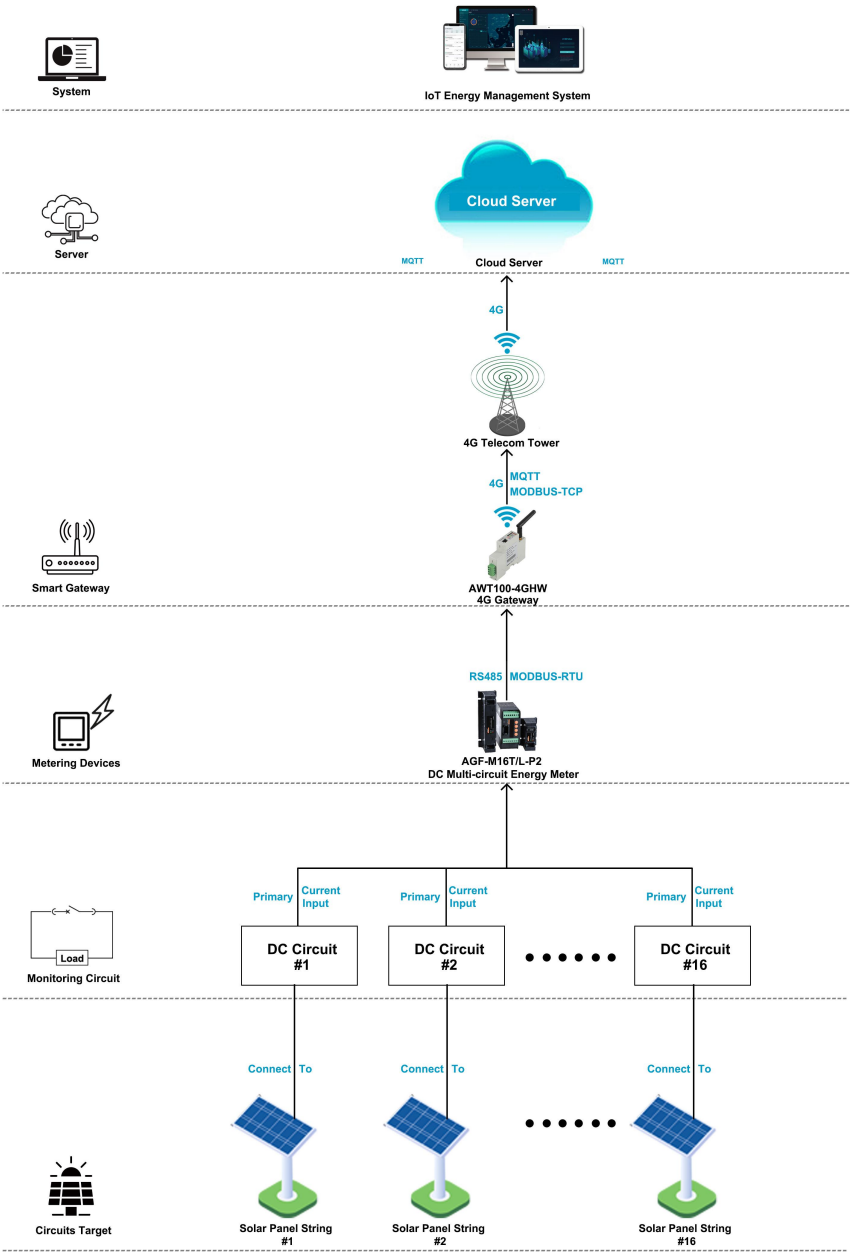
2. Communication Structure&Logic

(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) AWT100-4GHW gateway support upstream of 4G communication with MQTT and MODBUS-protocol and downstream of RS485 communication based on MODBUS-RTU protocol. AGF-M16T support upstream communication of RS485 communication based on MODBUS-RTU protocol.

(3) Based on the communication described in item (2), Acrel AWT100-4GHW gateway could receive the data from ADL200/C energy meter using RS485 communication while sending the data further to cloud server using 4G upstream communication. Thus accomplish a complete communication from bottom metering devices to top system software.



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3. Hardware Devices Overview [Energy Meter & Paired IoT Gateway]

IoT Gateway | 4G Upstream
MQTT&MODBUS | RS485 Downstream

Model 1: AWT100-4GHW IoT 4G Smart Gateway

- Upstream Comms.: 4G LTE [MQTT, MODBUS Protocol]
- Downstream Comms.: RS485 [MODBUS-RTU Protocol]
- Support: Up to 25 Downstream Devices via RS485.
- Auxiliary Power Supply: 85~265Vac [via AWT100-POW]
- Certificate&Standard: CE; CE-RED; IEC
- More Introduciton: https://www.acrel-electric.fr/product/awt100_4ghw_iot_smart_4g_gateway

Rated Input | Rated Output
85~265Vac | 12Vdc

Model 2: AWT100-POW Power Supply Module

- Input: 85~265Vac
- Output: 12Vdc
- Application: Paired with AWT100-4GHW for 85~265Vac Power Supply Input [via PIN L & PIN N]
- Certificate&Standard: CE

DC Multi-circuit | Solar Panel
Up to 24 circuits | Combiner Box

Model 2: AGF-MxxT Multi-circuit DC Energy Meter

- Monitoring: Up 24 DC circuits.
- Rated Current: 20A DC (via paired Hall Sensor)
- Accuracy: 0.5S
- Wired Comms: RS485 Interface, MODBUS-RTU Protocol
- Certificate&Standard: CE
- More Introduction: https://www.acrel-electric.fr/product/agf_mxxt_multi_circuits_monitoring_device_for_pv_junction_box

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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 (Choose Host Service or Buy-out Service after 3-month Free Trial of **Cloud IoT System**)
 **Acrel Cloud IoT Energy Management System**	1.System support all the meters across the country whose data has been sent to cloud server through **4G,WiFi or Ethernet**. 2.Remote meter reading and data collection. 3.Provide **IoT APP** for **mobile phone** side and **IoT WEB** for **PC** side. 4.Generate energy data report of daily, monthly and annually period with year-on-yeay and period-on-period energy analysis. 5.Provide various alarm function to ensure a stable operation of the system and protect your property. 6.Offer 3-month free trial of system with full technical support as for a test phase or pilot project.	$0 (recommended in pilot projtect)	3-month Free Trail (Users don't need to rent a cloud server))
		$xxx/Year (For 48 Points) (Price for Host Service Only, recommended in pilot projtect)	$xxx to buy Hosting Service for 1 monitoring points connected to the system 1 year (Users don't need to rent a cloud server)
		$xxxx/Permanent (Limitless Points) (Price for Buy-out Service Only,recommended in late projtect)	1-time charging of $xxxx for Buy-out Service of permanent use (Support OEM and a cloud server need to be rent by users)

Cloud Server

Name	Description	Server Renting Price (For Reference Only)	Remark
 Cloud Server	1.Cloud Server could be rent on the cloud server provider like Amazon Cloud. 2.Users of **Cloud IoT Energy Management System** only need to rent cloud server when they choose **buy-out** service of our **Cloud IoT System**. And if they are using **hosting service** or **3-month free trial** of our Cloud IoT System, we will use our own cloud server which has been rent on Amazon so that users don't need to rent a cloud server. 3.The quotation of Cloud Server is only a reference price that we have rent on Amazon Cloud.	According to Specs of Rented Cloud Server	Below cloud server specs could support 1000~2000 monitoings points connected to the system (Server：8 core 16G Operation System：windows server 2016)

IoT Smart Gateway

Overview Picture	USAGE&MODULE NAME	DESCRIPTION & SPECIFICATION	QUANTITY	FOB UNIT PRICE (USD)	AMOUNT (USD)
	4G Smart Gateway **AWT100-4GHW**	**Upstream:** 4G (MQTT&MODBUS-TCP) **Downstream:** RS485 (MODBUS-RTU) **Support:** up to **20~25** Energy Meters within 400m using RS485 Wired Communication **Power Supply:** 85~265Vac/Vdc (via AWT100-POW Module); 24Vdc (Default) **HS Code:** 8517629900	3 pcs	/	/
	Power Supply Module **AWT100-POW**	**Input:** 85~265Vac/Vdc **Output:** 24Vdc **Application:** paired with AWT100 Series gateway for 85~265Vac/Vdc power supply input **HS Code:** 8504409999	3 pcs	/	/

DC Multi-circuit Energy Meter

Overview Picture	USAGE&MODULE NAME	DESCRIPTION & SPECIFICATION	QUANTITY	FOB UNIT PRICE (USD)	AMOUNT (USD)
	Energy Meter **AGF-M16T/L-P2**	**Monitoring:** Up to **16** DC circuits **Communication:** RS485 (MODBUS-RTU) **Rated Current:** 20A DC [via paired Hall sensor] **Auxiliary Power Supply:** 1000Vdc [adapted to 600Vdc] **Accuracy:** 0.5S **HS Code:** 9028309000	3 pcs	/	/

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7. Acrel IoT Energy Monitoring System (Partail Introduction)

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

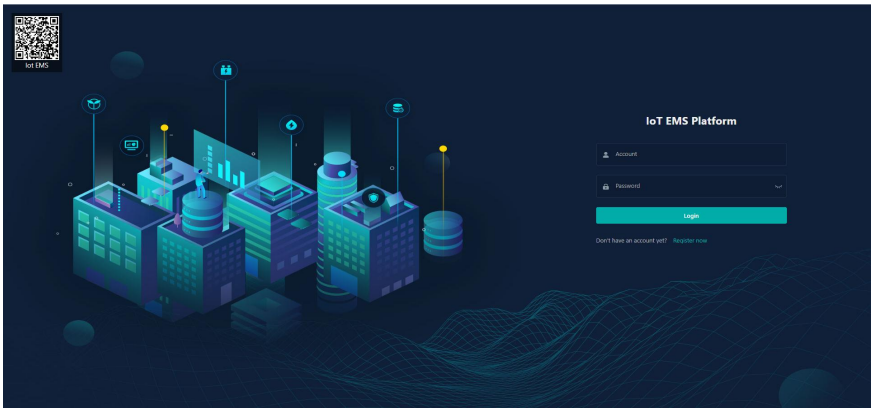
Download Link: https://play.google.com/store/apps/details?id=com.acrel.iotems

(1) WEB Accesss (Computer):

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

Test Account Name: acrel

Test Account Password: 123456

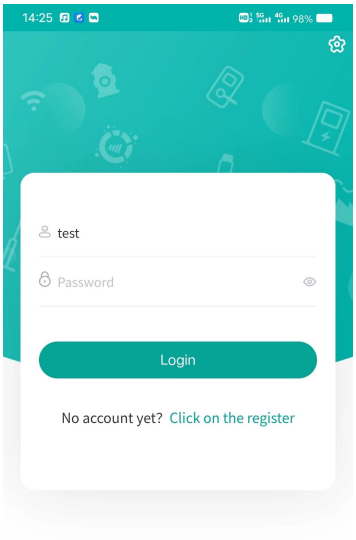


(2) APP Accesss (Mobile):

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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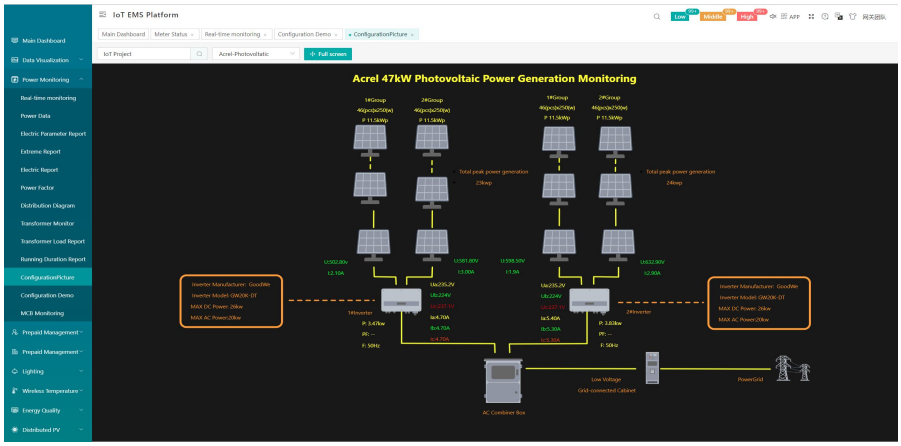
7. Acrel IoT Energy Monitoring System (Partail Introduction)

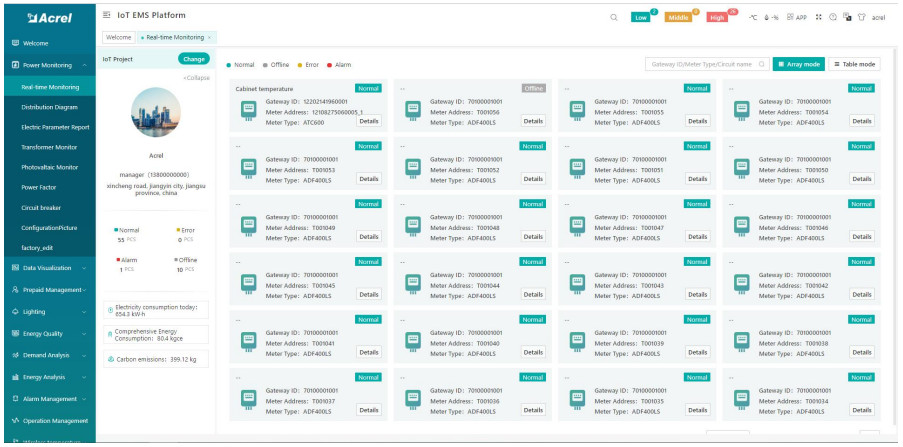
Main Function of WEB side System:

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

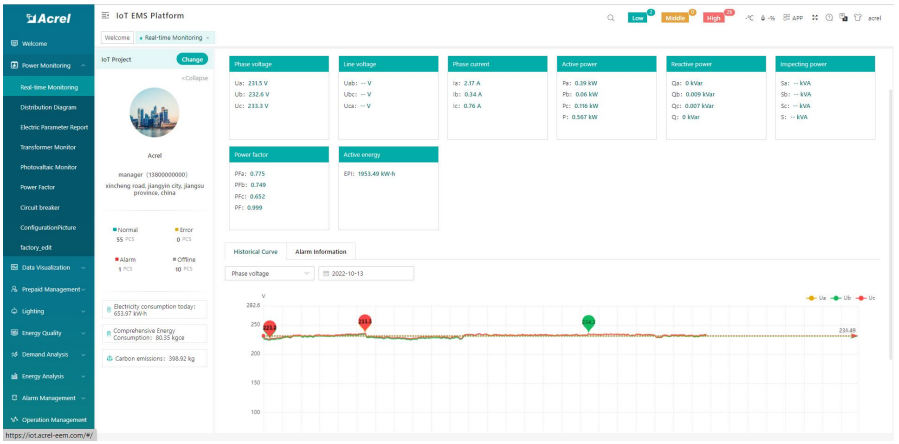
(1) Solar Panel String Monitoring: A visualization configuration mapping could be customized and bind the data with the site's monitoring devices. Realize a visualization and digitalization of solar panel working status and efficiency.



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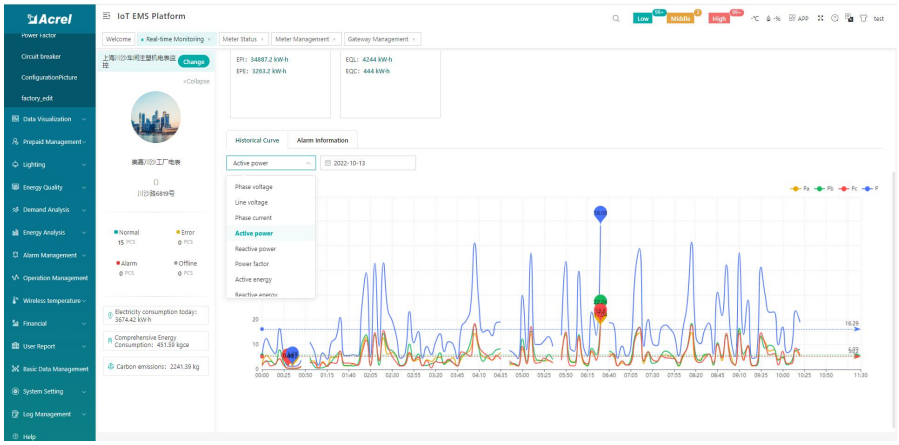
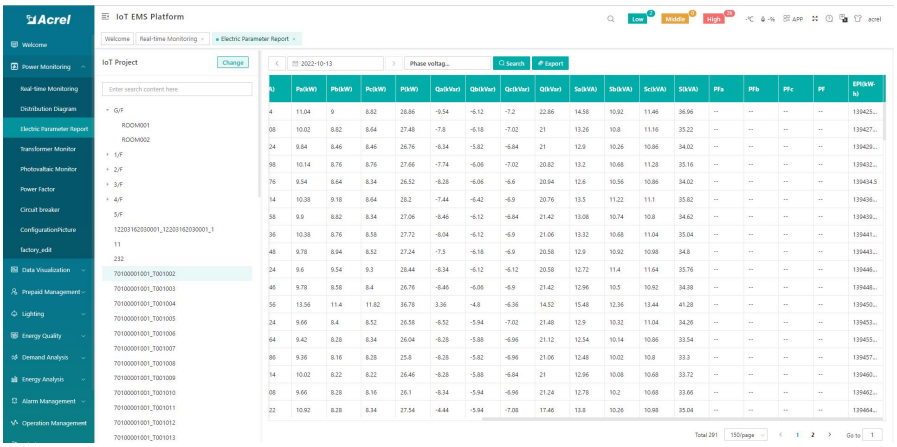
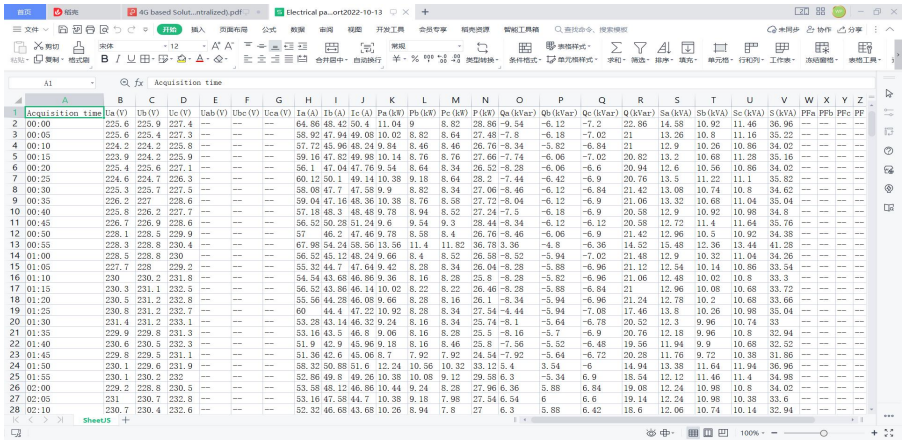
(3) History Curve: By selecting the items of "date" and "electricity parameter", platform can show the history curve of different data and date.



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



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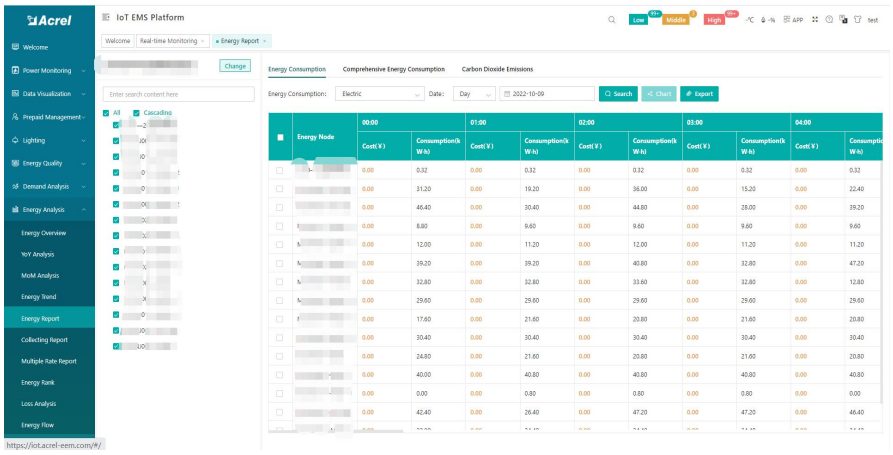
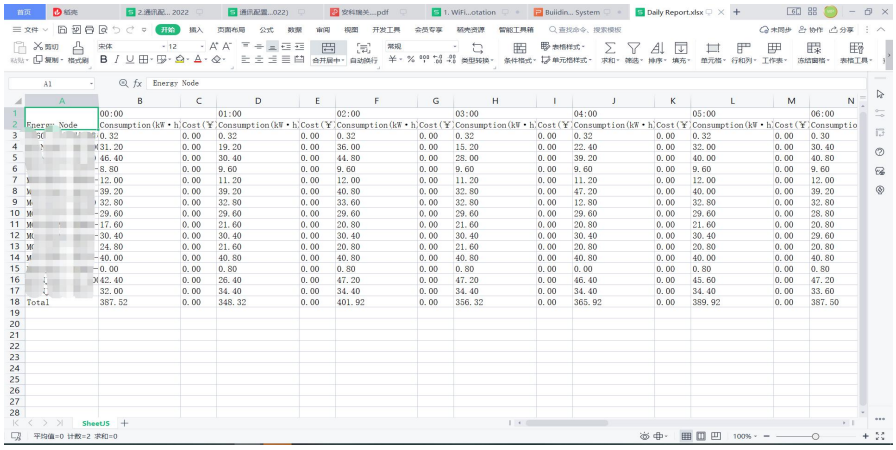
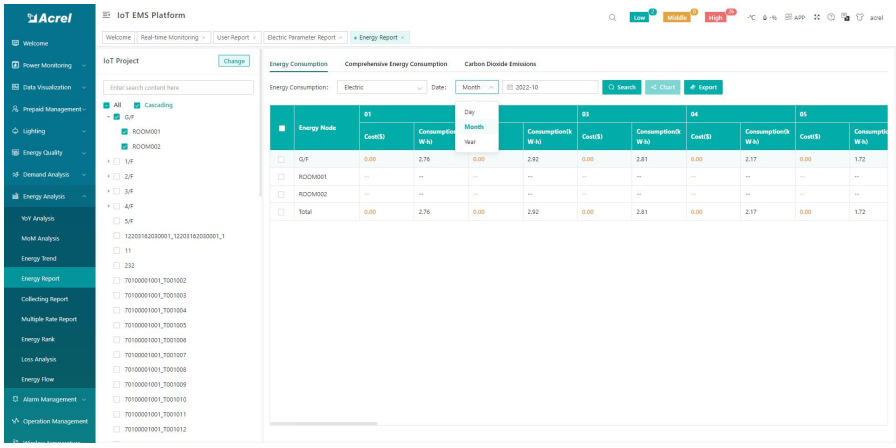
(5) Energy Report (Daily): This Interface show the daily energy consumtion report (calculated by forward active energy)



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



(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.



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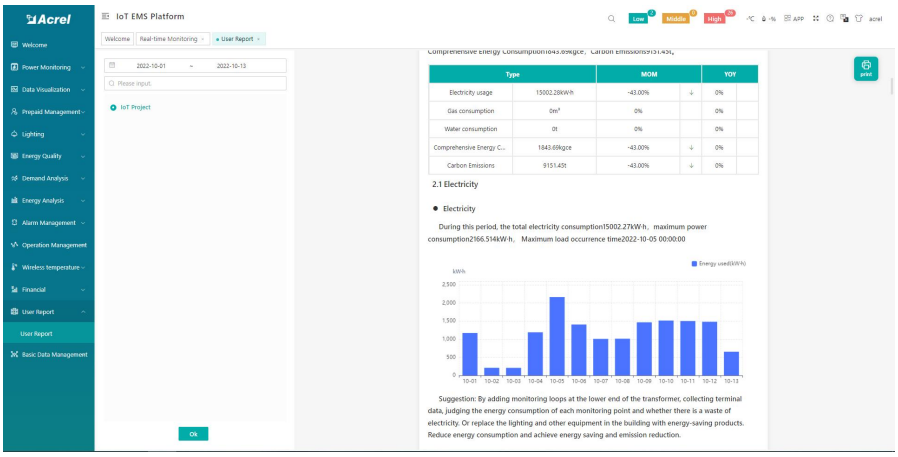
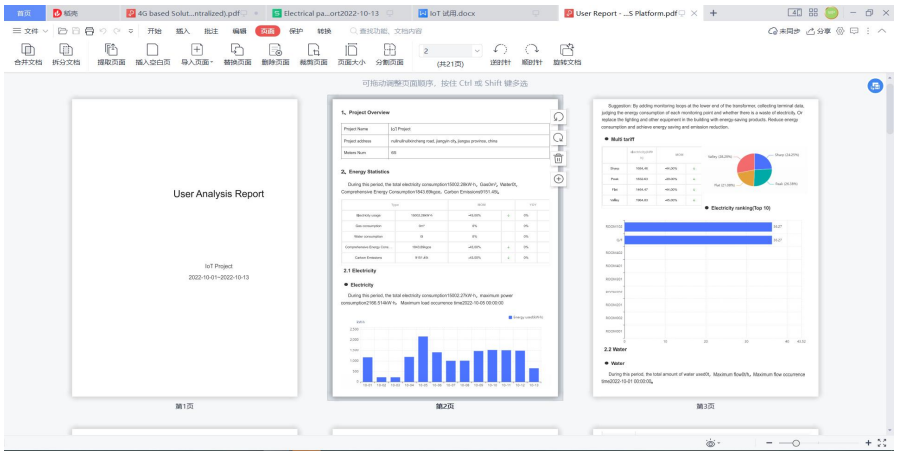
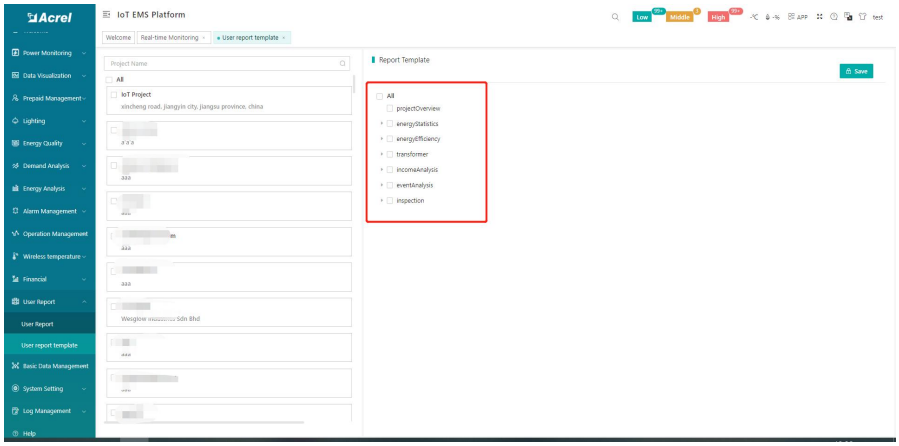
(6) User Report: A comprehensive user report including project overview, energy report, energy analysis and etc could be check on platform



(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.



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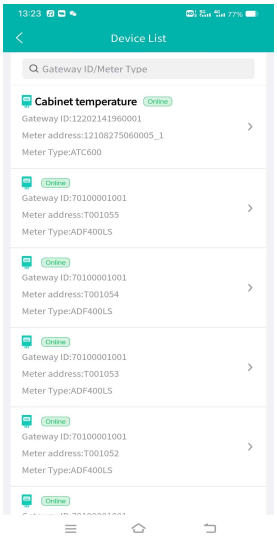
7. Acrel IoT Energy Monitoring System (Partail Introduction)

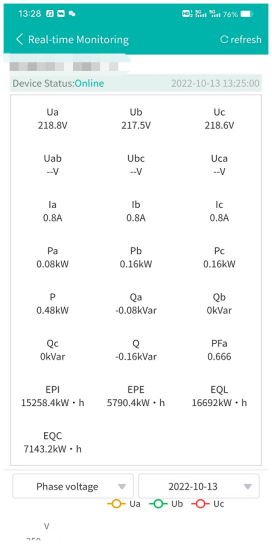
Main Function of APP side System:

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

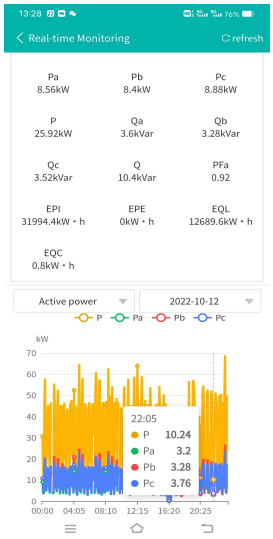
Noted: Since APP side and WEB side of Acrel IoT Energy Monitoring System share the same data, normally recommend our user to add the devices to their account using APP and check the data using WEB platform.



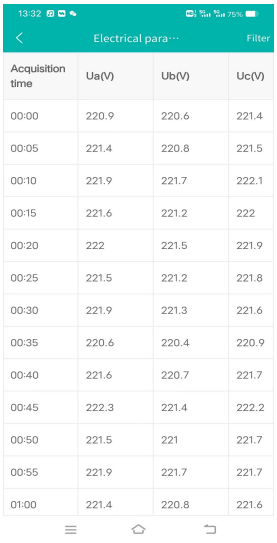
(1) Device List



(2) History Curve

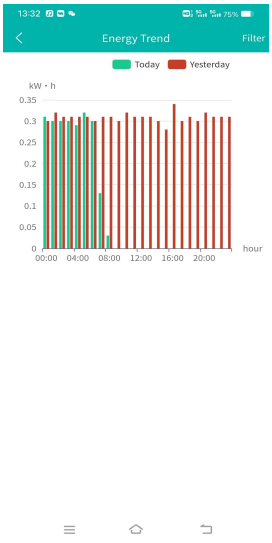


(2) History Curve



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



(4) Energy Trend

(5) Energy Report