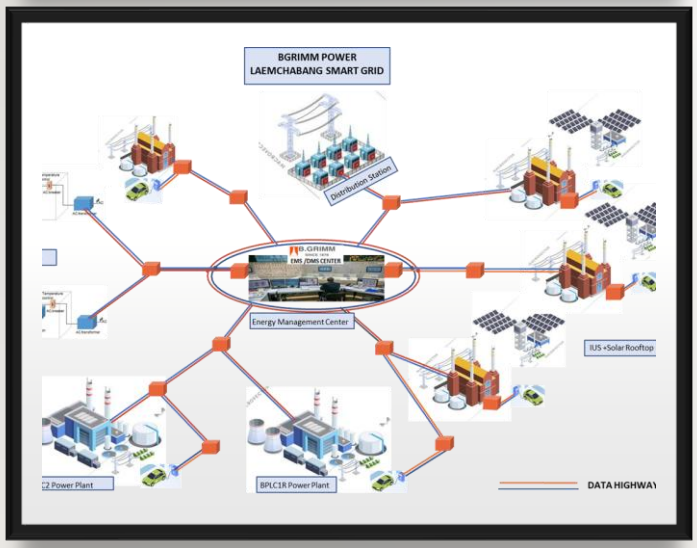
BGPLC Smart Grid & Energy Trading



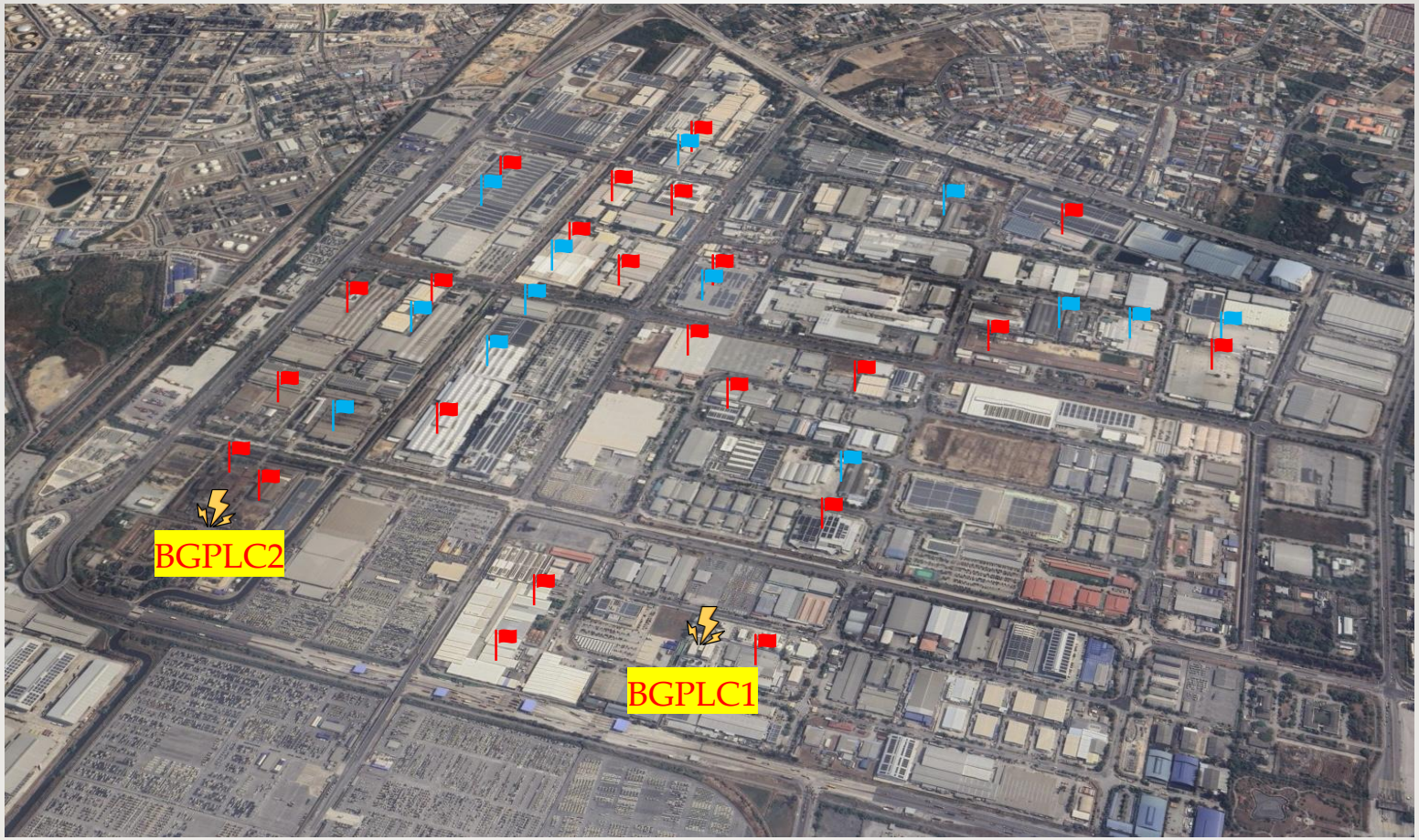
BGPLC SMART GRID & ENERGY TRADING

- RE Timeline
- Conceptual
- Smart Grid / Energy Trading
- Energy Trading
- Energy Storage System (BESS)
- Q&A

Customer in Laem Chabang Industrial Estate

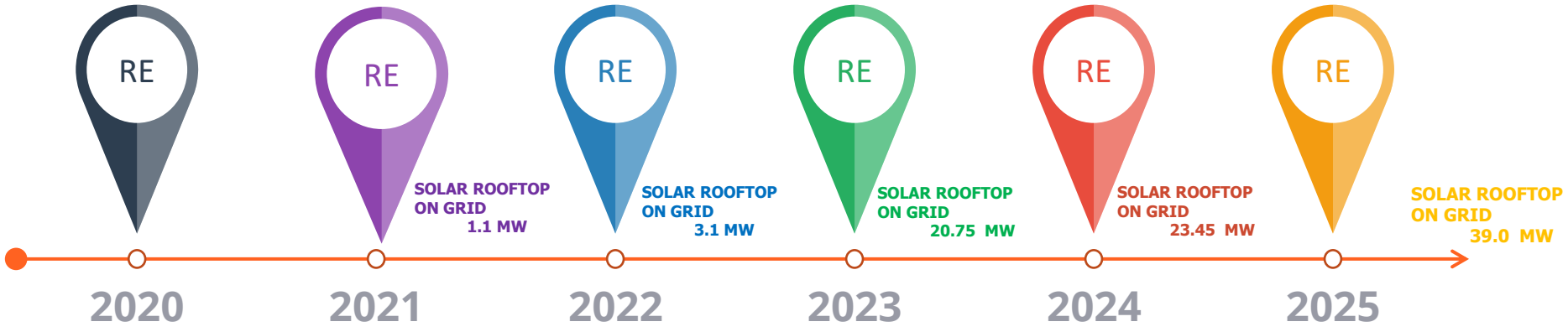
Electricity

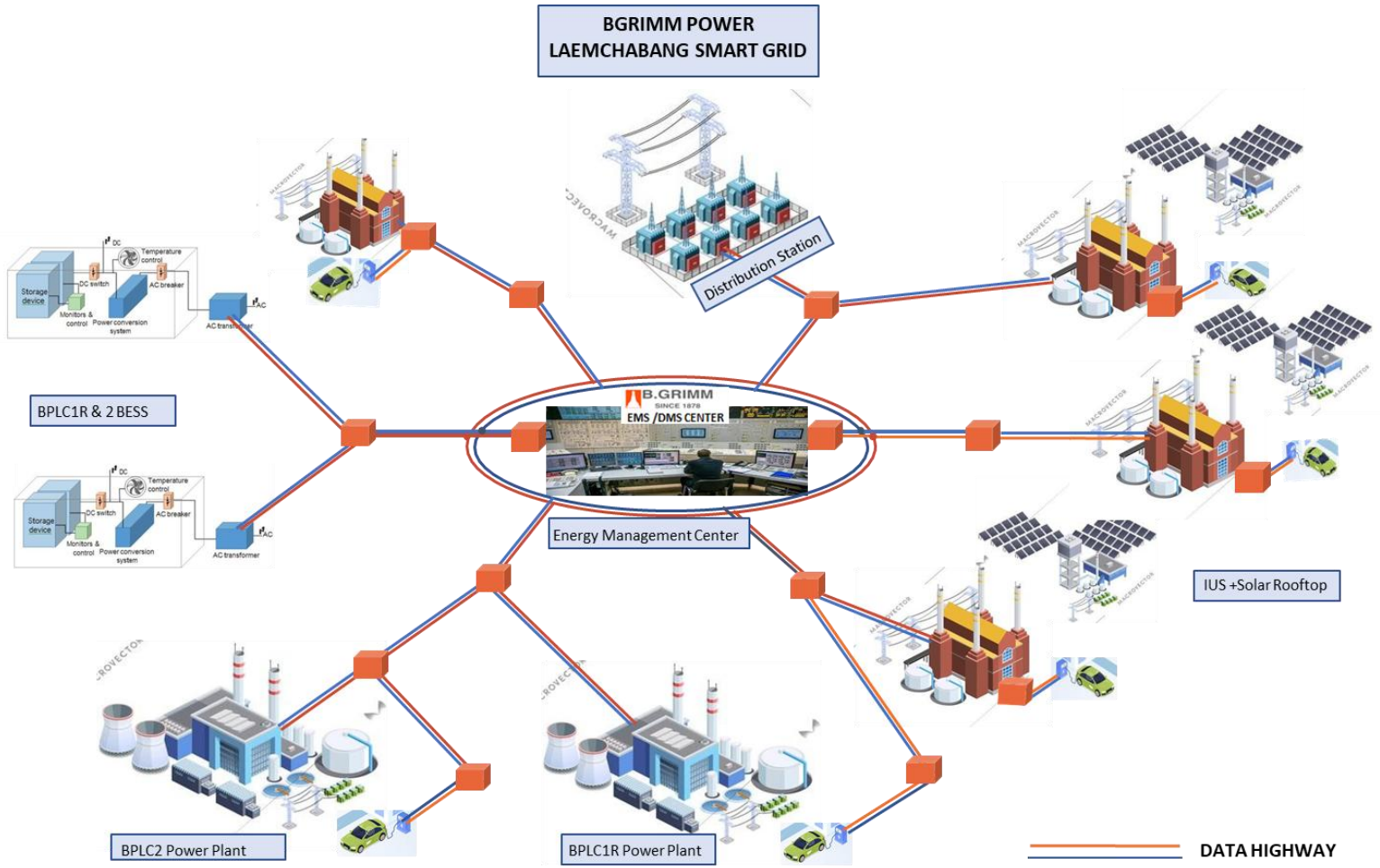
Steam



Renewable Energy Timeline

The renewable energy resources form customers solar rooftop which will be connected to BGPLC Network.




BGRIMM POWER
LAEMCHABANG SMART GRID
Distribution Station
B.GRIMM
SINCE 1878
EMS /DMS CENTER
Energy Management Center
BPLC1R & 2 BESS
IUS +Solar Rooftop
BPLC2 Power Plant
BPLC1R Power Plant
DATA HIGHWAY

Concept: BPLC Smart Grid & Energy Trading

1. **Energy Management System (EMS):** Provides real-time monitoring, demand/supply forecasting, calculation and control of energy resources to efficiently meet consumer needs

2. **BGPLC1 and BGPLC2** .

The Combined Cycle Cogeneration Power Plants,, are the main sources of electrical energy for the BGPLC Smart Grid Network

3. **Solar PV**

The customer's rooftop solar panels

The Renewable Energy Resources generated from IU customer.

Concept: BGPLC Smart Grid & Energy Trading

4. The Energy Storage System (BESS):

Backup & Stability the Power to the Network

5. Customers

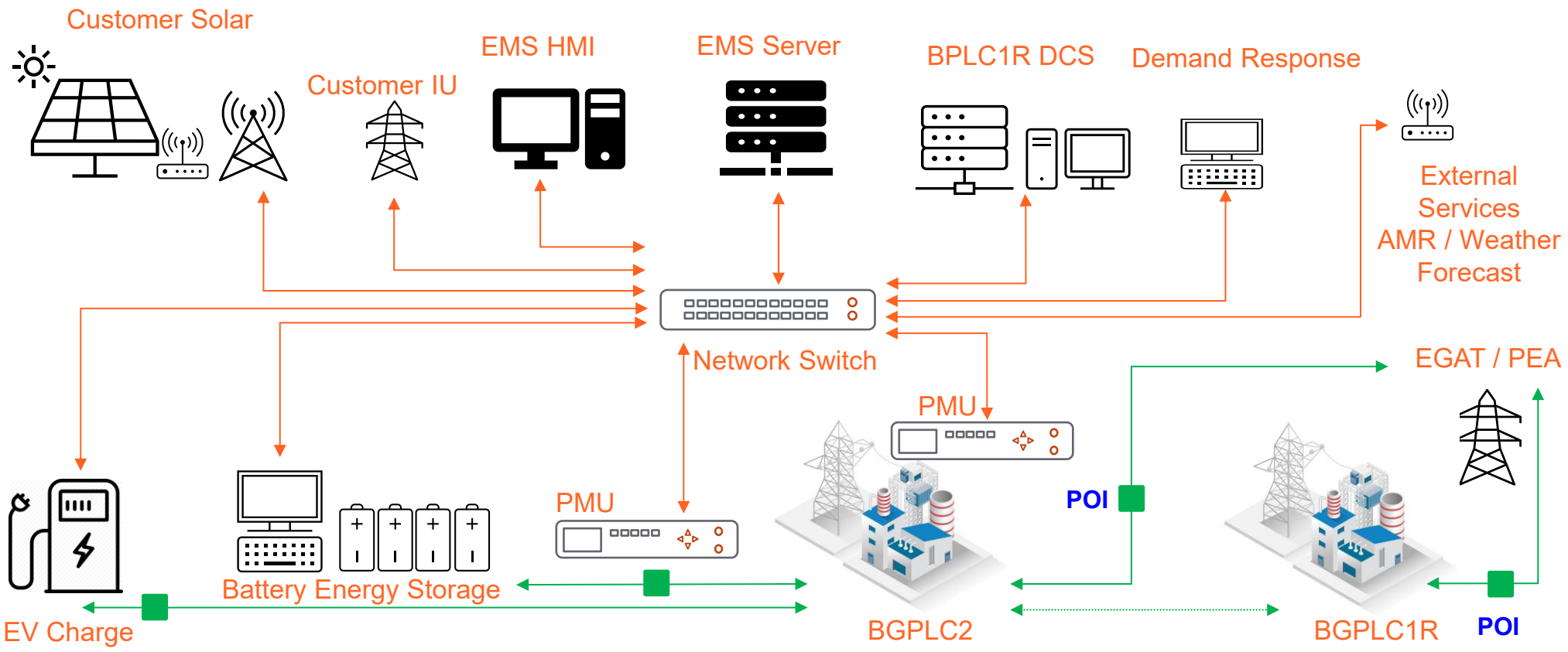
Industrial customers (e.g., factories) and EGAT will receive firming energy with high stability

6. **The EV charging station:** Our system supports future trends

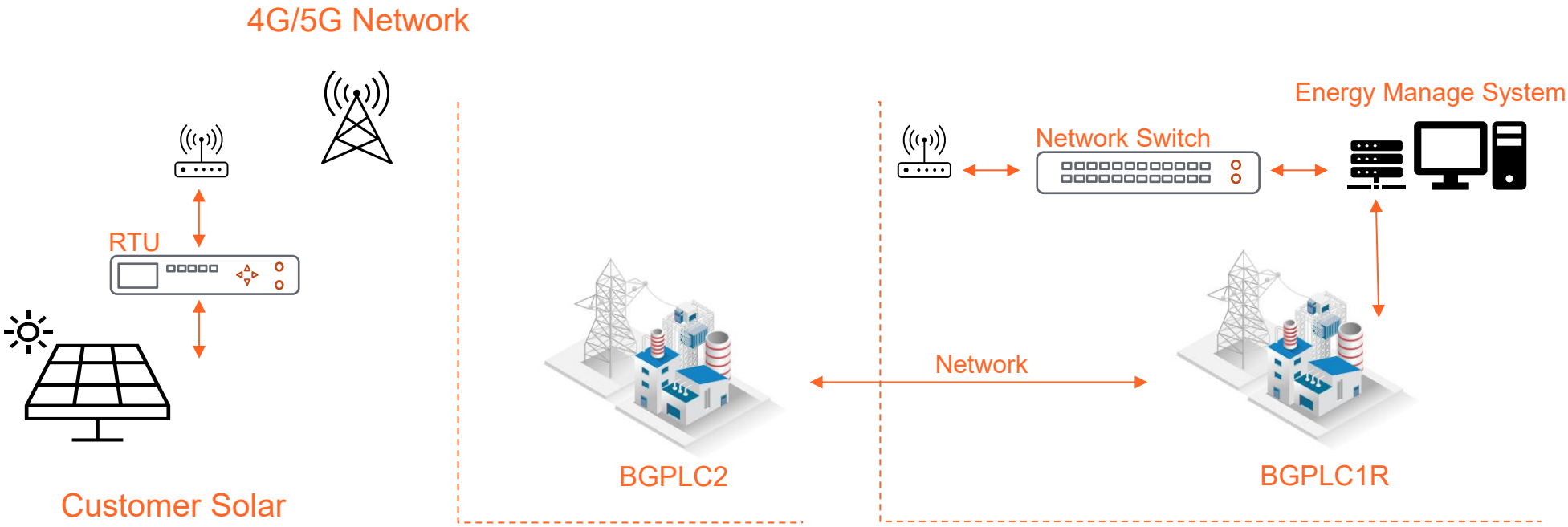
7. Demand Response & Demand Trading:

Future trend platform

BGPLC Energy Management System (EMS)

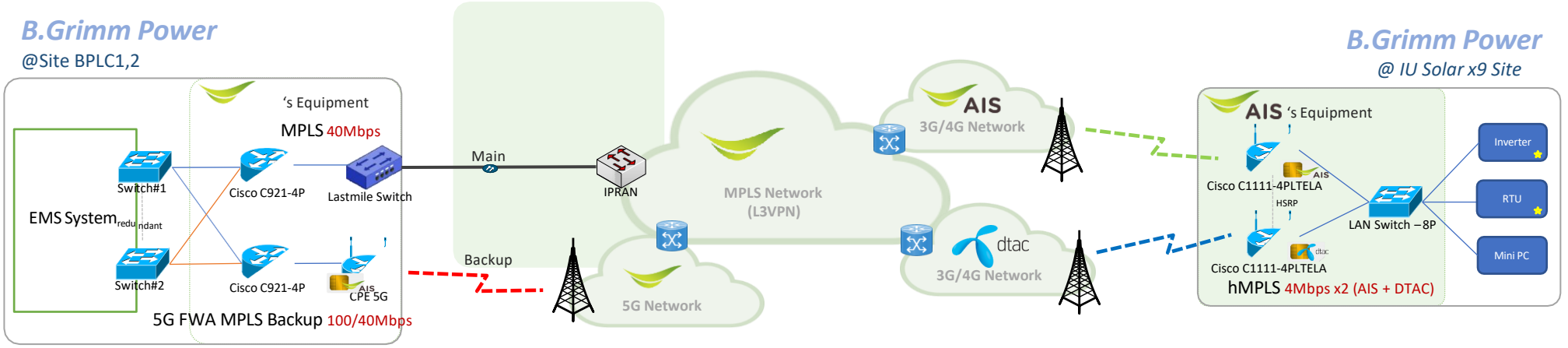


Customer Solar PV System : 9 Systems

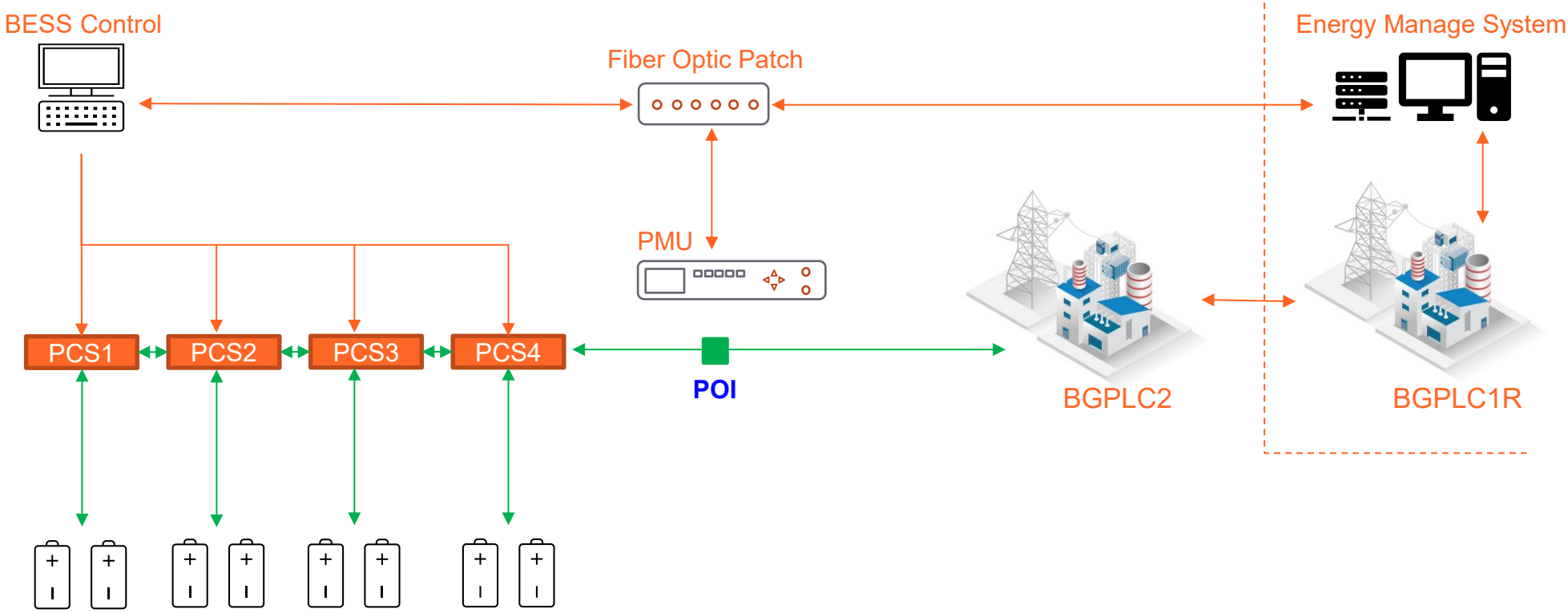


* RTU : Remote Terminal Unit

Network Diagram – B.Grimm Power _ hMPLS for Smart Grid project

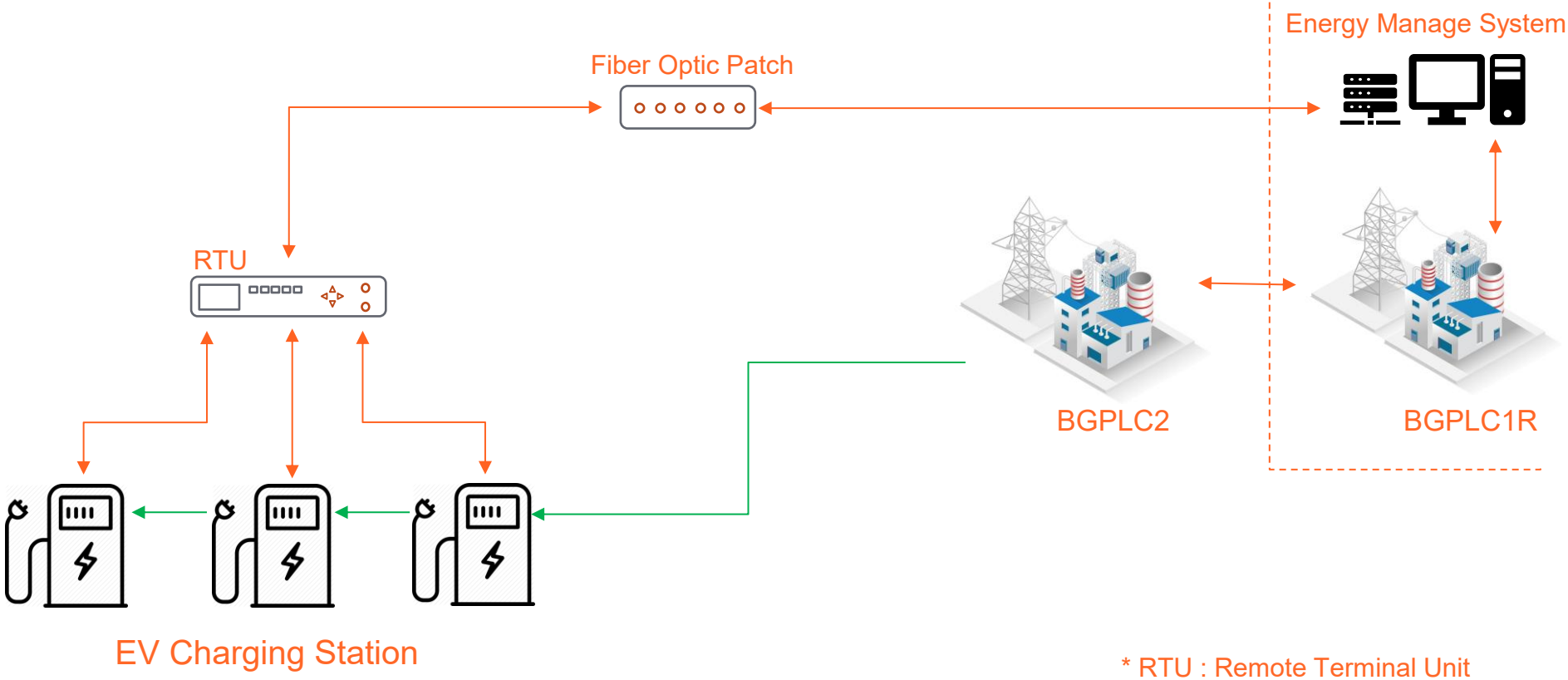


Battery Energy Storage System (BESS), 3MW/3.35MWH

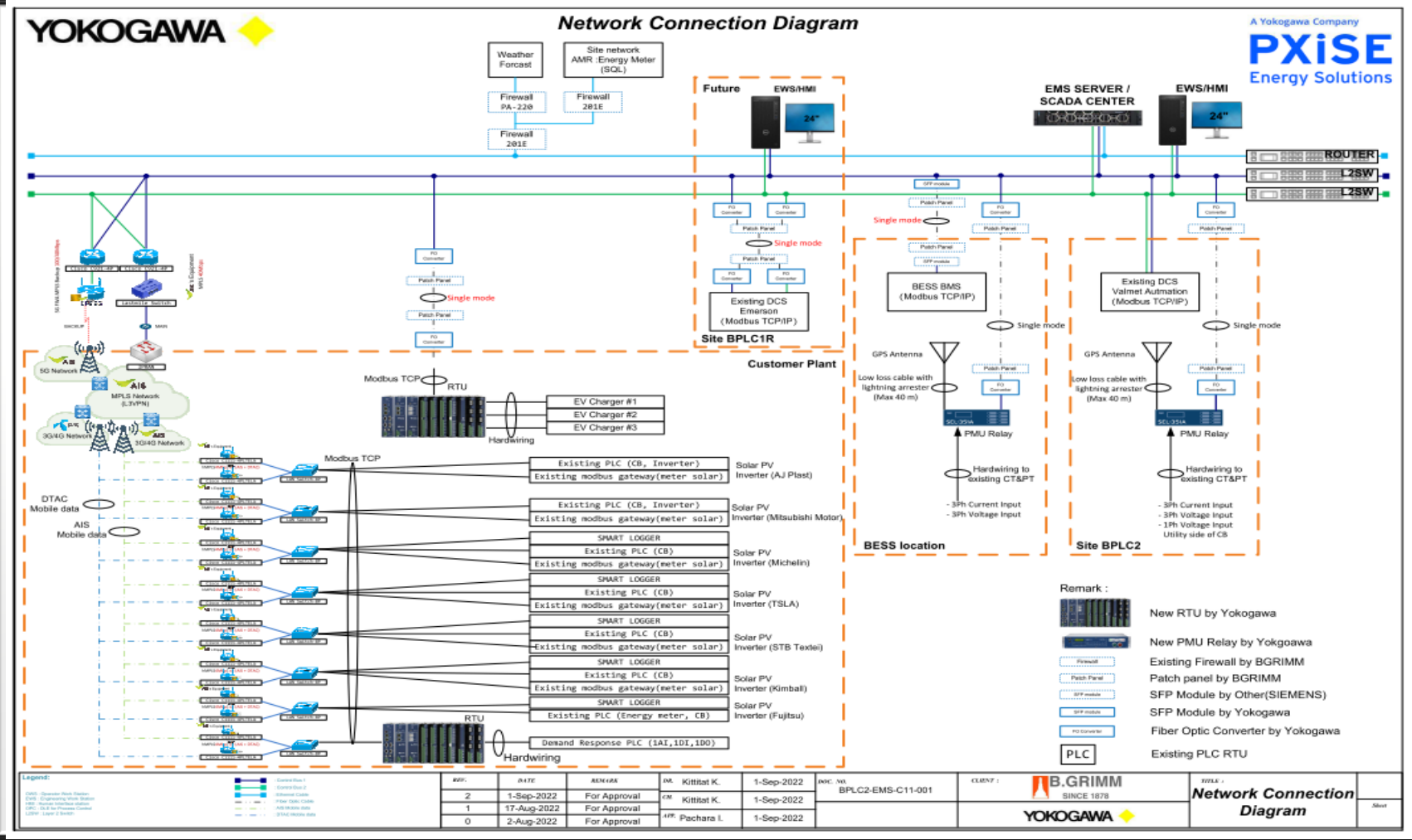


* BMS : Battery Management System
PCS : Power Conversion System
POI : Point Of Interconnection
PMU : Phasor Measurement Unit

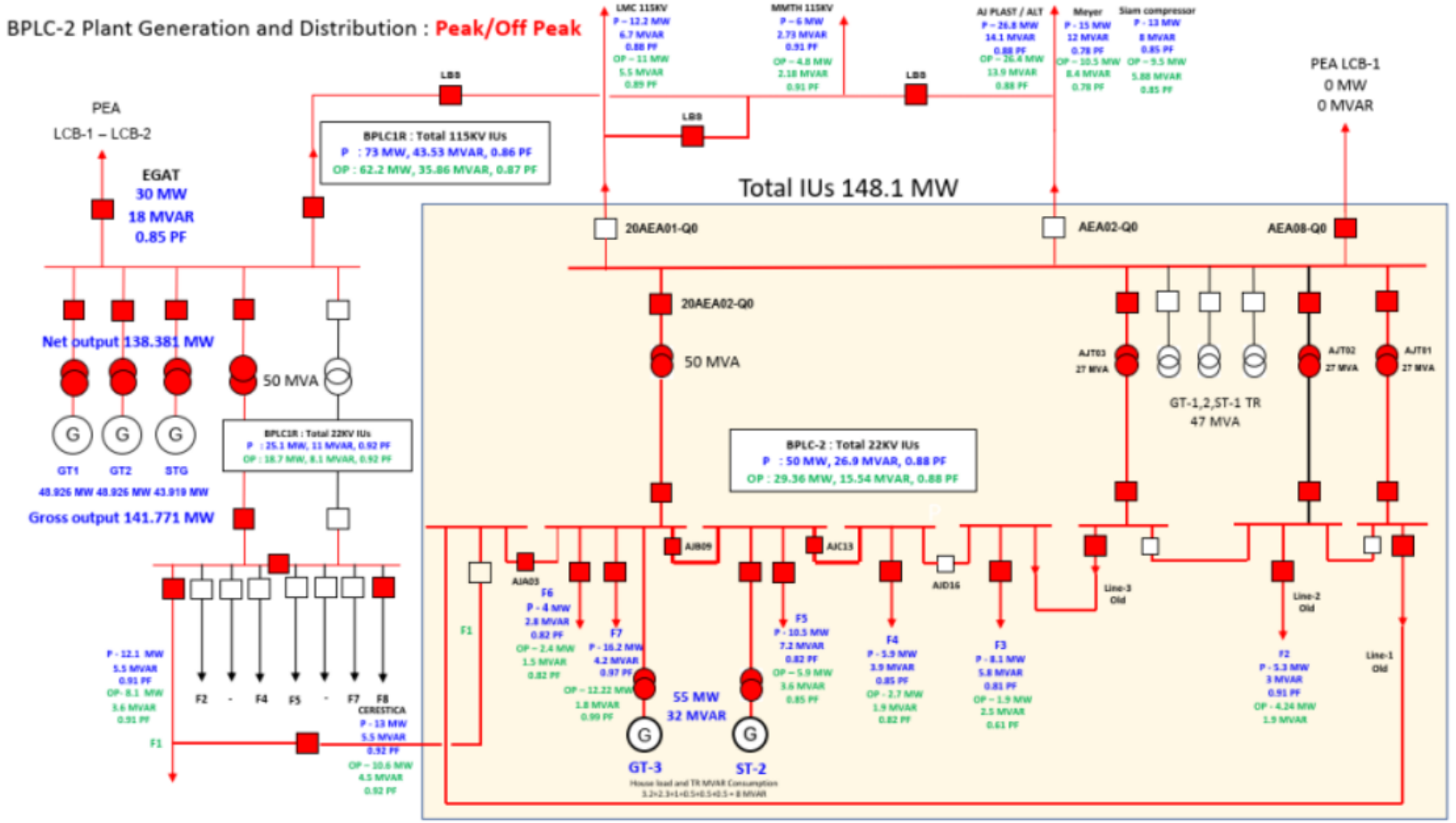
Electric Vehicle Charging Station (EV Charging Station)

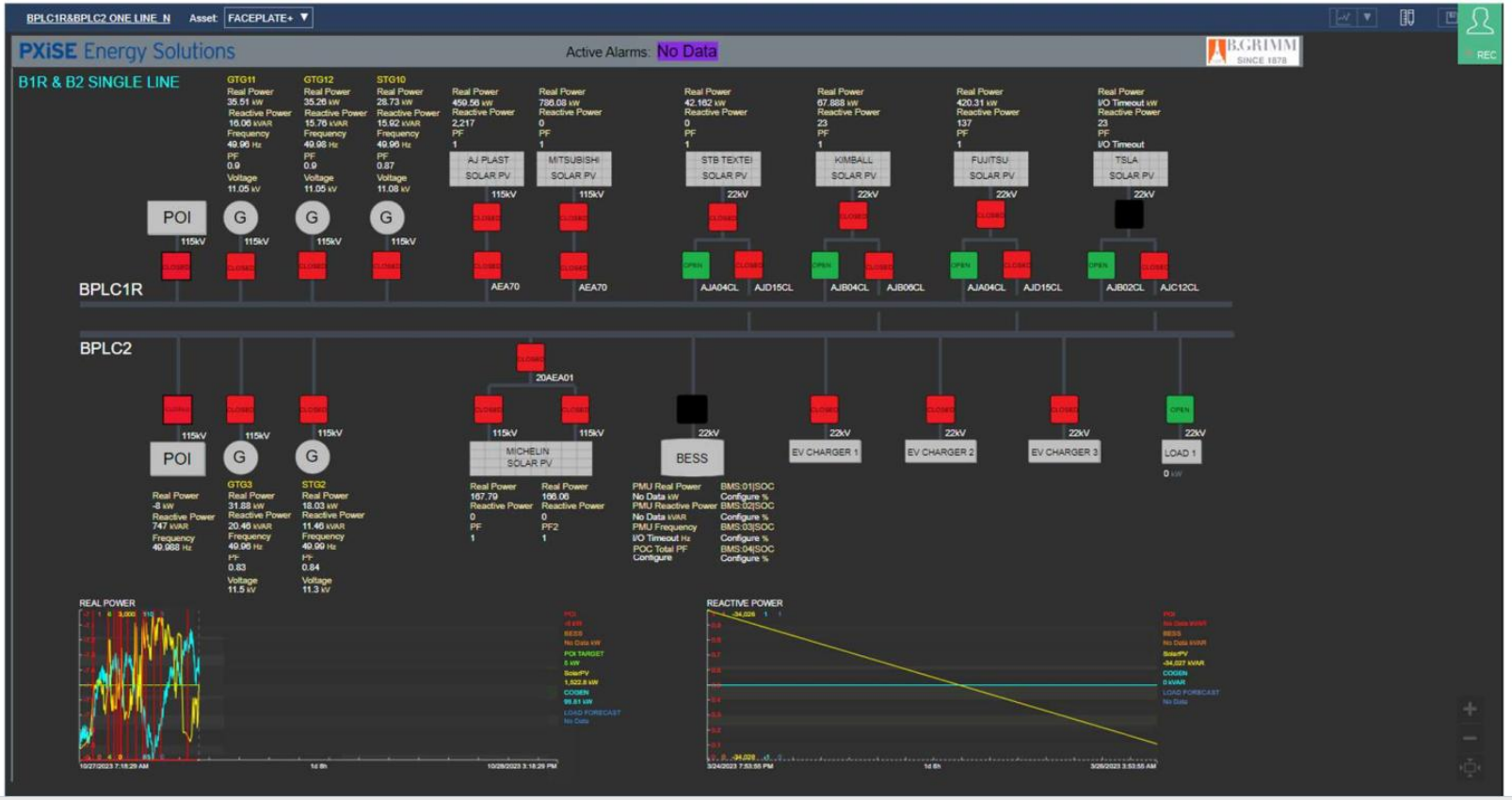


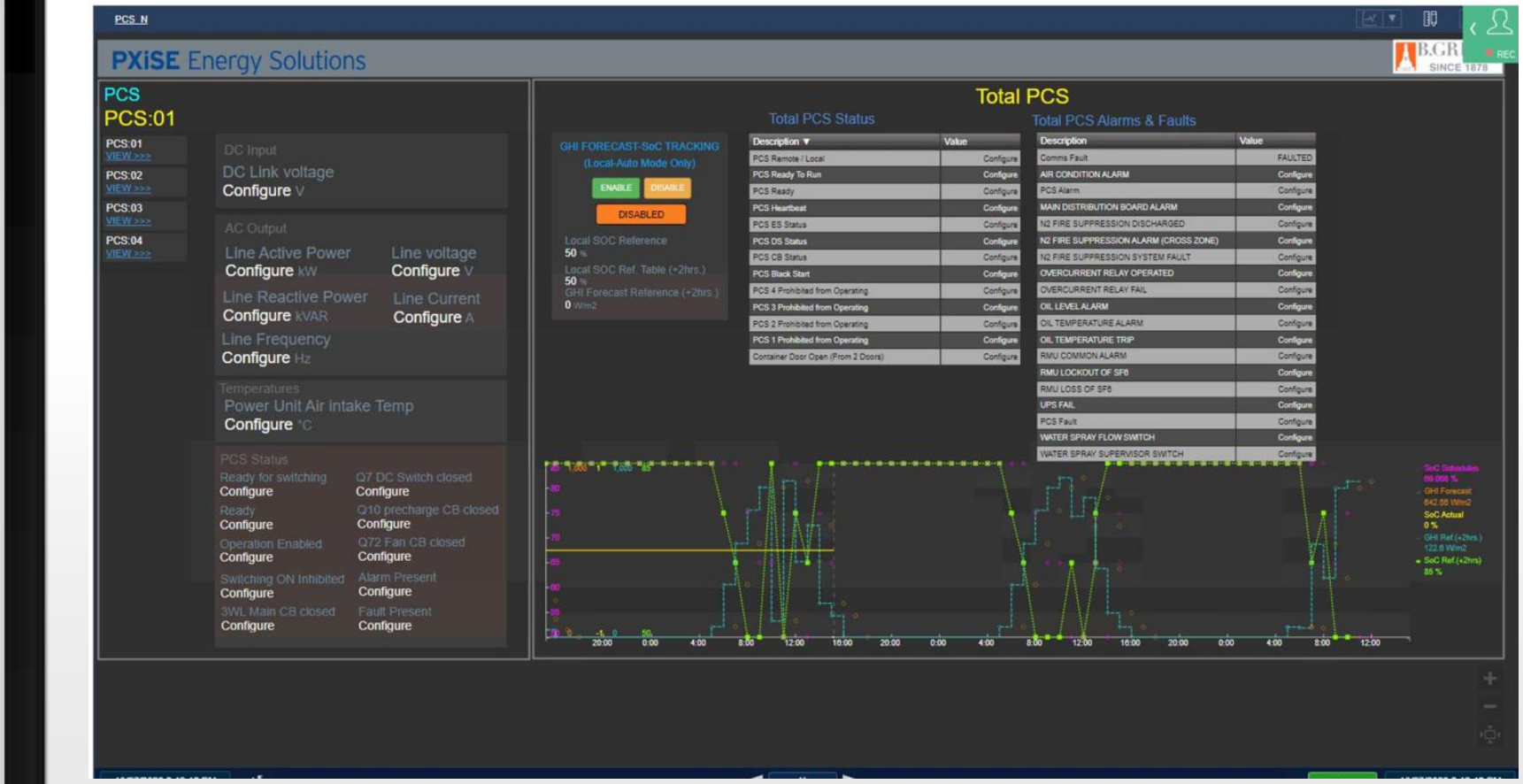
* RTU : Remote Terminal Unit

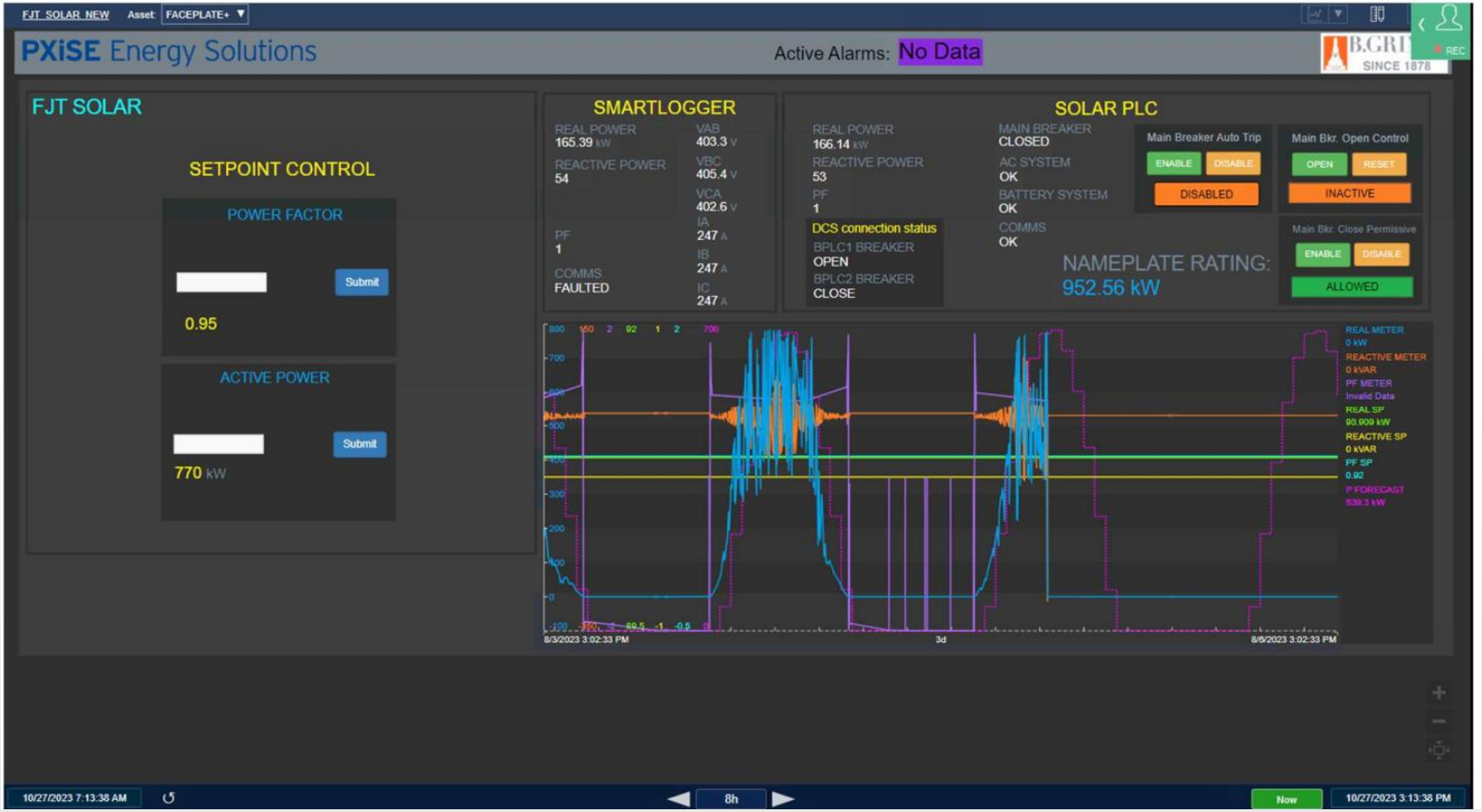

YOKOGAWA
Network Connection Diagram
A Yokogawa Company
PXiSE
Energy Solutions
Weather Forcast
Site network AMR :Energy Meter (SQL)
Firewall PA-220
Firewall 201E
Firewall 201E
Future
EWS/HMI
24"
EMS SERVER / SCADA CENTER
EWS/HMI
24"
ROUTER
L2SW
L2SW
Single mode
Existing DCS Emerson (Modbus TCP/IP)
Site BPLC1R
Customer Plant
BESS BMS (Modbus TCP/IP)
Existing DCS Valmet Autmation (Modbus TCP/IP)
GPS Antenna
Low loss cable with lightning arrester (Max 40 m)
PMU Relay
Hardwiring to existing CT&PT
- 3Ph Current Input
- 3Ph Voltage Input
- 1Ph Voltage Input
Utility side of CB
BESS location
Site BPLC2
5G Network
MPLS Network (L3VPN)
3G/4G Network
3G/4G Network
DTAC Mobile data
AIS Mobile data
Modbus TCP
RTU
Hardwiring
EV Charger #1
EV Charger #2
EV Charger #3
Existing PLC (CB, Inverter)
Existing modbus gateway(meter solar)
Solar PV Inverter (AJ Plast)
Solar PV Inverter (Mitsubishi Motor)
SMART LOGGER
Existing PLC (CB)
Existing modbus gateway(meter solar)
Solar PV Inverter (Michelin)
Solar PV Inverter (TSLA)
Solar PV Inverter (STB Texlei)
Solar PV Inverter (Kimball)
Solar PV Inverter (Fujitsu)
Existing PLC (Energy meter, CB)
Demand Response PLC (1AI,1DI,1DO)
Remark :
New RTU by Yokogawa
New PMU Relay by Yokgoawa
Existing Firewall by BGRIMM
Patch panel by BGRIMM
SFP Module by Other(SIEMENS)
SFP Module by Yokogawa
Fiber Optic Converter by Yokogawa
PLC
Existing PLC RTU
Legend:
REV. DATE REMARK
2 1-Sep-2022 For Approval
1 17-Aug-2022 For Approval
0 2-Aug-2022 For Approval
DR. Kittitat K. 1-Sep-2022
CH. Kittitat K. 1-Sep-2022
APP. Pachara I. 1-Sep-2022
DOC. NO. BPLC2-EMS-C11-001
CLIENT : B.GRIMM SINCE 1878
YOKOGAWA
TITLE : Network Connection Diagram
Sheet

Simplified overall single line diagram



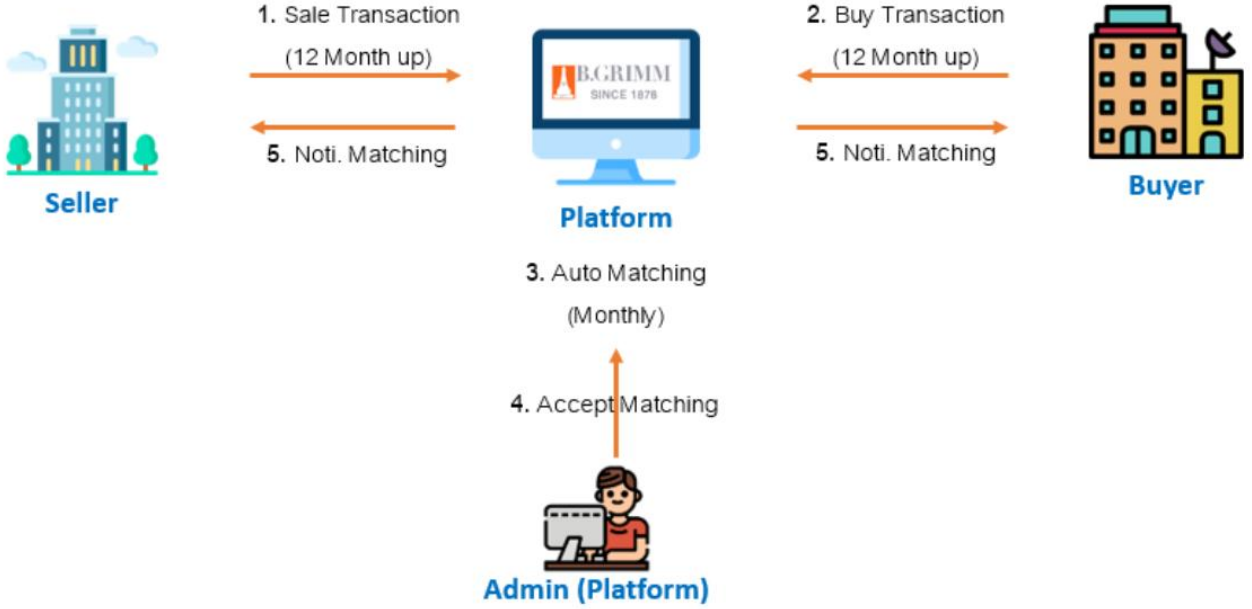

BPLC1R&BPLC2 ONE LINE_N
Asset: FACEPLATE+
PXiSE Energy Solutions
Active Alarms: No Data
B.GRIMM SINCE 1878
REC
B1R & B2 SINGLE LINE
GTG11
Real Power 35.51 kW
Reactive Power 16.06 kVAR
Frequency 49.96 Hz
PF 0.9
Voltage 11.05 kV
GTG12
Real Power 35.26 kW
Reactive Power 15.76 kVAR
Frequency 49.96 Hz
PF 0.9
Voltage 11.05 kV
STG10
Real Power 28.73 kW
Reactive Power 15.92 kVAR
Frequency 49.96 Hz
PF 0.87
Voltage 11.08 kV
Real Power 459.56 kW
Reactive Power 2,217
PF 1
AJ PLAST SOLAR PV
Real Power 788.08 kW
Reactive Power 0
PF 1
MITSUBISHI SOLAR PV
Real Power 42.162 kW
Reactive Power 0
PF 1
STB TEXTEI SOLAR PV
Real Power 67.888 kW
Reactive Power 23
PF 1
KIMBALL SOLAR PV
Real Power 420.31 kW
Reactive Power 137
PF 1
FUJITSU SOLAR PV
Real Power I/O Timeout kW
Reactive Power 23
PF I/O Timeout
TSLA SOLAR PV
POI
G
115kV
22kV
BPLC1R
AEA70
AJA04CL
AJD15CL
AJB04CL
AJB06CL
AJA04CL
AJD15CL
AJB02CL
AJC12CL
BPLC2
20AEA01
MICHELIN SOLAR PV
BESS
EV CHARGER 1
EV CHARGER 2
EV CHARGER 3
LOAD 1
Real Power -8 kW
Reactive Power 747 kVAR
Frequency 49.988 Hz
GTG3
Real Power 31.88 kW
Reactive Power 20.46 kVAR
Frequency 49.96 Hz
PF 0.83
Voltage 11.5 kV
STG2
Real Power 18.03 kW
Reactive Power 11.46 kVAR
Frequency 49.99 Hz
PF 0.84
Voltage 11.3 kV
Real Power 167.79
Reactive Power 0
PF 1
Real Power 190.00
Reactive Power 0
PF2 1
PMU Real Power
No Data kW
PMU Reactive Power
No Data kVAR
PMU Frequency
I/O Timeout Hz
POC Total PF
Configure
BMS:01|SOC
Configure %
BMS:02|SOC
Configure %
BMS:03|SOC
Configure %
BMS:04|SOC
Configure %
REAL POWER
REACTIVE POWER

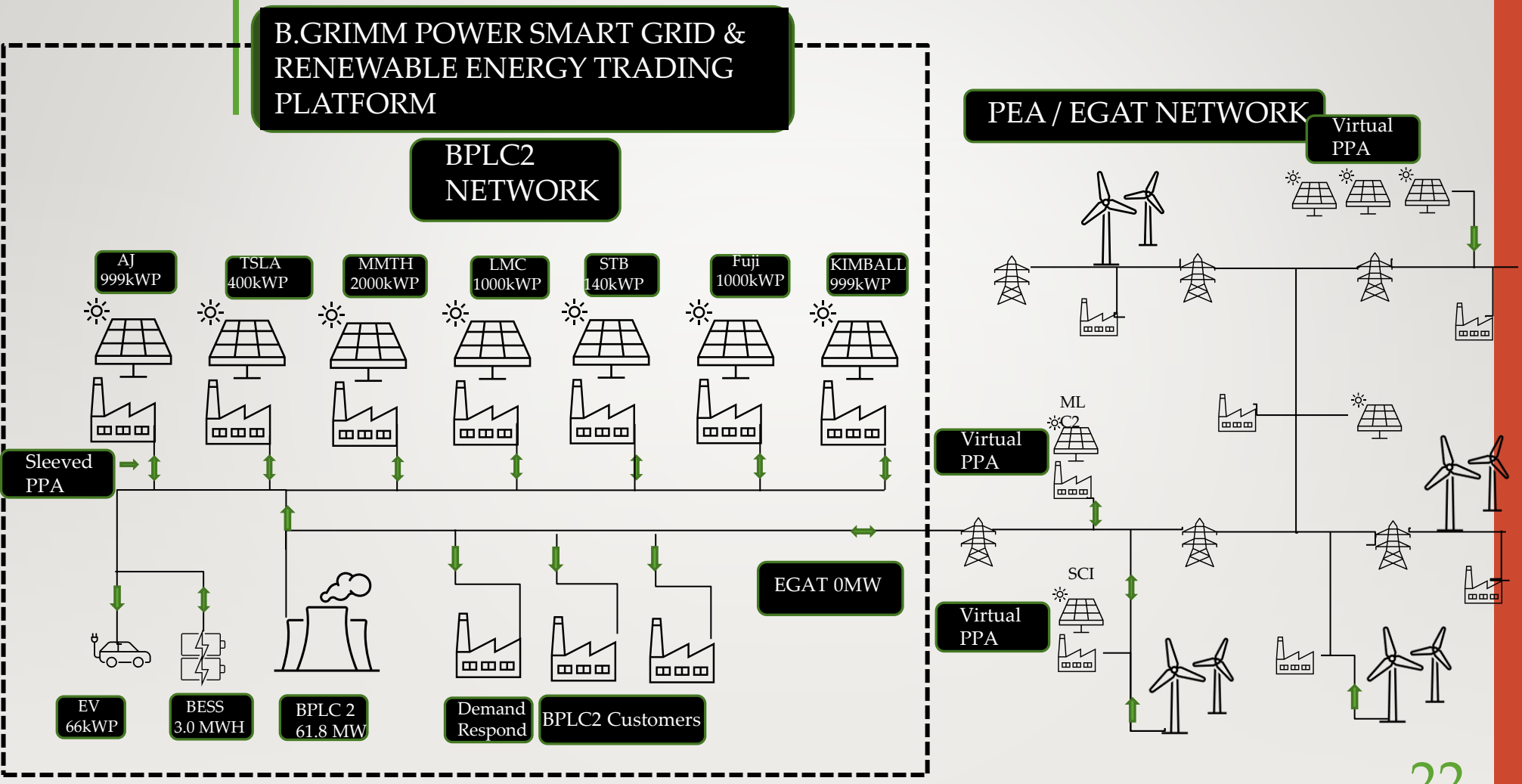

PCS_N
PXiSE Energy Solutions
B.G.R
SINCE 1878
REC
PCS
PCS:01
PCS:01
VIEW >>>
PCS:02
VIEW >>>
PCS:03
VIEW >>>
PCS:04
VIEW >>>
DC Input
DC Link voltage
Configure V
AC Output
Line Active Power
Configure kW
Line voltage
Configure V
Line Reactive Power
Configure kVAR
Line Current
Configure A
Line Frequency
Configure Hz
Temperatures
Power Unit Air intake Temp
Configure °C
PCS Status
Ready for switching
Configure
Q7 DC Switch closed
Configure
Ready
Configure
Q10 precharge CB closed
Configure
Operation Enabled
Configure
Q72 Fan CB closed
Configure
Switching ON Inhibited
Configure
Alarm Present
Configure
3WL Main CB closed
Configure
Fault Present
Configure
Total PCS
GHI FORECAST-SoC TRACKING
(Local-Auto Mode Only)
ENABLE
DISABLE
DISABLED
Local SOC Reference
50 %
Local SOC Ref. Table (+2hrs.)
50 %
GHI Forecast Reference (+2hrs.)
0 W/m2
Total PCS Status
Description
Value
PCS Remote / Local
Configure
PCS Ready To Run
Configure
PCS Ready
Configure
PCS Heartbeat
Configure
PCS ES Status
Configure
PCS DS Status
Configure
PCS CB Status
Configure
PCS Black Start
Configure
PCS 4 Prohibited from Operating
Configure
PCS 3 Prohibited from Operating
Configure
PCS 2 Prohibited from Operating
Configure
PCS 1 Prohibited from Operating
Configure
Container Door Open (From 2 Doors)
Configure
Total PCS Alarms & Faults
Description
Value
Comms Fault
FAULTED
AIR CONDITION ALARM
Configure
PCS Alarm
Configure
MAIN DISTRIBUTION BOARD ALARM
Configure
N2 FIRE SUPPRESSION DISCHARGED
Configure
N2 FIRE SUPPRESSION ALARM (CROSS ZONE)
Configure
N2 FIRE SUPPRESSION SYSTEM FAULT
Configure
OVERCURRENT RELAY OPERATED
Configure
OVERCURRENT RELAY FAIL
Configure
OIL LEVEL ALARM
Configure
OIL TEMPERATURE ALARM
Configure
OIL TEMPERATURE TRIP
Configure
RMU COMMON ALARM
Configure
RMU LOCKOUT OF SF6
Configure
RMU LOSS OF SF6
Configure
UPS FAIL
Configure
PCS Fault
Configure
WATER SPRAY FLOW SWITCH
Configure
WATER SPRAY SUPERVISOR SWITCH
Configure
SoC Schedules
89.008 %
GHI Forecast
642.56 W/m2
SoC Actual
0 %
GHI Ref.(+2hrs.)
122.6 W/m2
SoC Ref.(+2hrs)
88 %
20:00
0:00
4:00
8:00
12:00
16:00
20:00
0:00
4:00
8:00
12:00
16:00
20:00
0:00
4:00
8:00
12:00

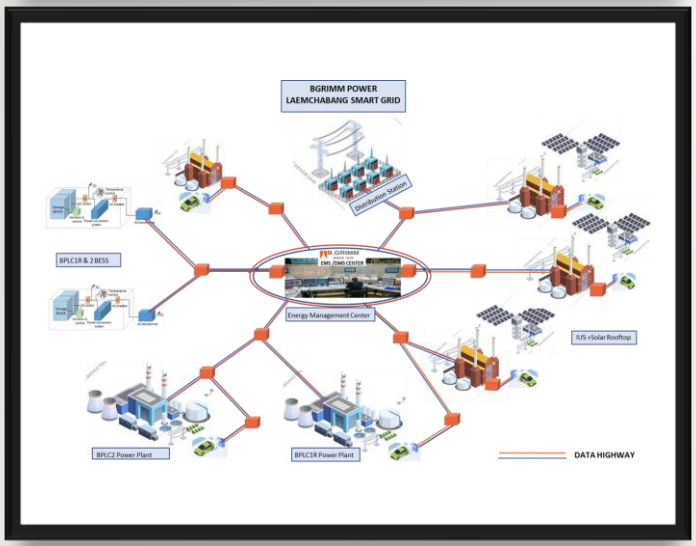

FJT_SOLAR_NEW
Asset: FACEPLATE+
PXiSE Energy Solutions
Active Alarms: No Data
B.GRIM SINCE 1878
REC
FJT SOLAR
SETPOINT CONTROL
POWER FACTOR
Submit
0.95
ACTIVE POWER
Submit
770 kW
SMARTLOGGER
REAL POWER
165.39 kW
REACTIVE POWER
54
PF
1
COMMS
FAULTED
VAB
403.3 V
VBC
405.4 V
VCA
402.6 V
IA
247 A
IB
247 A
IC
247 A
SOLAR PLC
REAL POWER
166.14 kW
REACTIVE POWER
53
PF
1
DCS connection status
BPLC1 BREAKER
OPEN
BPLC2 BREAKER
CLOSE
MAIN BREAKER
CLOSED
AC SYSTEM
OK
BATTERY SYSTEM
OK
COMMS
OK
Main Breaker Auto Trip
ENABLE
DISABLE
DISABLED
Main Bkr. Open Control
OPEN
RESET
INACTIVE
Main Bkr. Close Permissive
ENABLE
DISABLE
ALLOWED
NAMEPLATE RATING:
952.56 kW
REAL METER
0 kW
REACTIVE METER
0 kVAR
PF METER
Invalid Data
REAL SP
90.909 kW
REACTIVE SP
0 kVAR
PF SP
0.92
P FORECAST
539.3 kW
8/3/2023 3:02:33 PM
3d
8/6/2023 3:02:33 PM
10/27/2023 7:13:38 AM
8h
Now
10/27/2023 3:13:38 PM


FORECAST_N
Asset: FACEPLATE+
PXiSE Energy Solutions
Active Alarms: No Data
B.GRI SINCE 1878
REC
FORECAST
GHI_FORECAST
642.66 W/m2
RH_FORECAST
66.83 %
TEMP_FORECAST
30.29 °C
AJP P FORECAST
No Data
KMBL P FORECAST
85.09 kW
MIC P FORECAST
No Data
MIT P FORECAST
1,251.3 kW
STB P FORECAST
86.466 kW
TSLA P FORECAST
250.26 kW
SoC Lookahead
68.828 %
10/28/2023
10/29/2023
10/30/2023
10/31/2023
11/1/2023
11/2/2023
11/3/2023

Energy Trading Platform -Trade




B.GRIMM POWER SMART GRID & RENEWABLE ENERGY TRADING PLATFORM
BPLC2 NETWORK
PEA / EGAT NETWORK
Virtual PPA
AJ 999kWP
TSLA 400kWP
MMTH 2000kWP
LMC 1000kWP
STB 140kWP
Fuji 1000kWP
KIMBALL 999kWP
Sleeved PPA
ML
C2
Virtual PPA
SCI
Virtual PPA
EGAT 0MW
EV 66kWP
BESS 3.0 MWH
BPLC 2 61.8 MW
Demand Respond
BPLC2 Customers



BESS OVERVIEW

The objective of BGPLC2 BESS in Smart Grid.

The BESS Main Eqipment.

BESS Configuration.

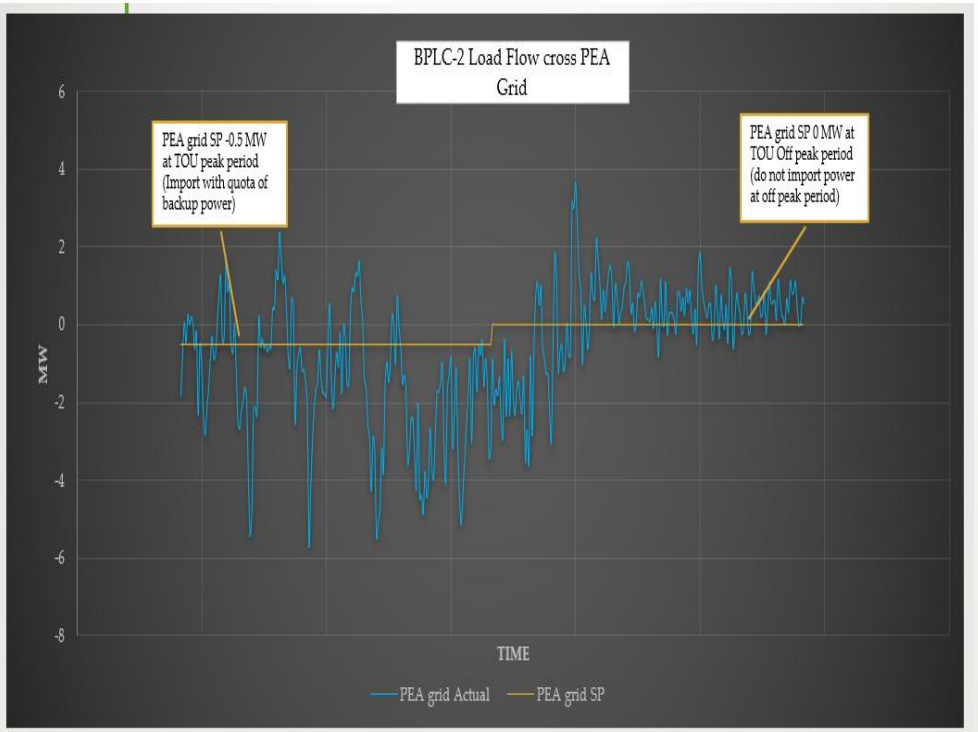
BESS OBJECTIVE

1. Maintain the stability of power flow across the PEA network according to the PPA at desired value in +/- 2% (600 kW)

Functions

1. Absorb the power from the network when the demand suddenly drop less than supply to support the main generator while it is trying to decrease the supply

2. Supply the power to the network when the demand suddenly increases and more than the supply of the main generator or suddenly solar disappears.



BESS OBJECTIVE

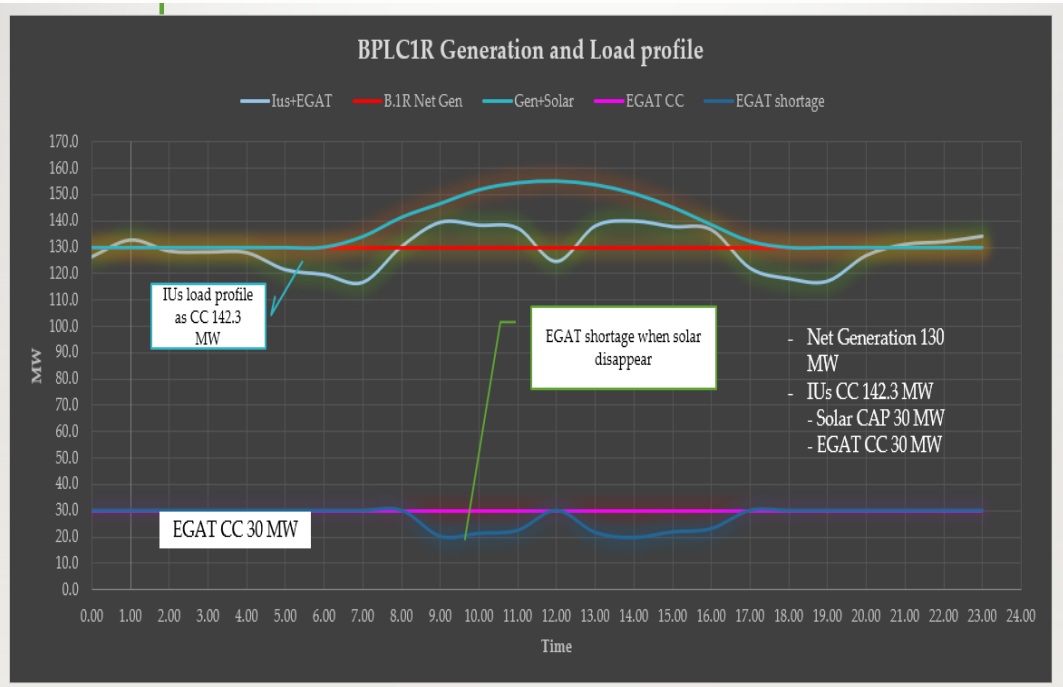
2. Provide the power to support the customers when the customers solar PV long hours disappeared during the peak demand from 08:00 – 12:00 Hrs. and 13:00 – 16:00 Hrs.

Functions

1. Charging the power in the nighttime (Low demand).

2. Discharging the power to the network from 8:00 – 12:00 Hrs.

3. Quick charging the power from 12:00 – 13:00 Hrs. to supply in the afternoon peak from 13:00 – 16:00 Hrs.



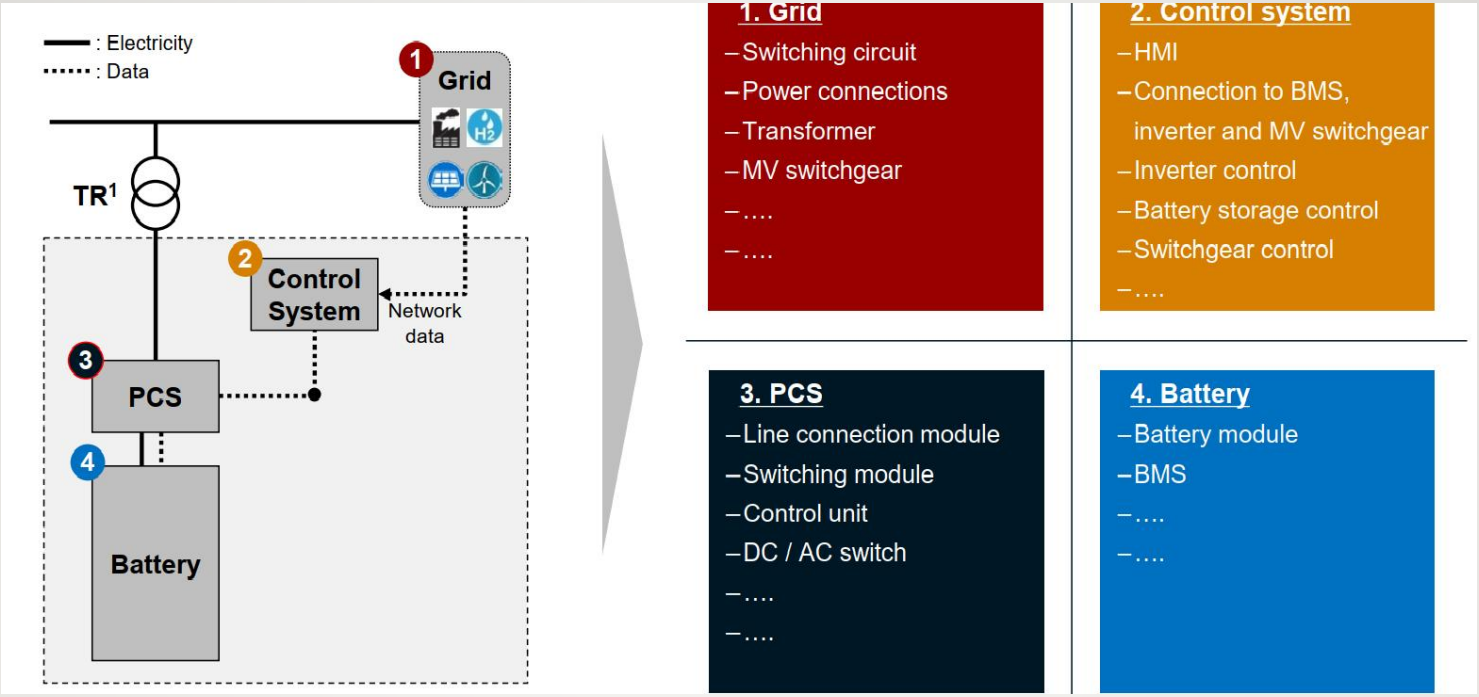
BGPLC2 BESS

- CAPACITY: 3MW/3.354MWH
- 4 PCSs 950 KW/PCS
- 4 BESS / 838.65 KW BATTERY SET
- 1 STEP UP TRANSFORMER
- RMU
- LBS

Batteries
CATL
LFP – Liquid Cooled

MCP & PCS

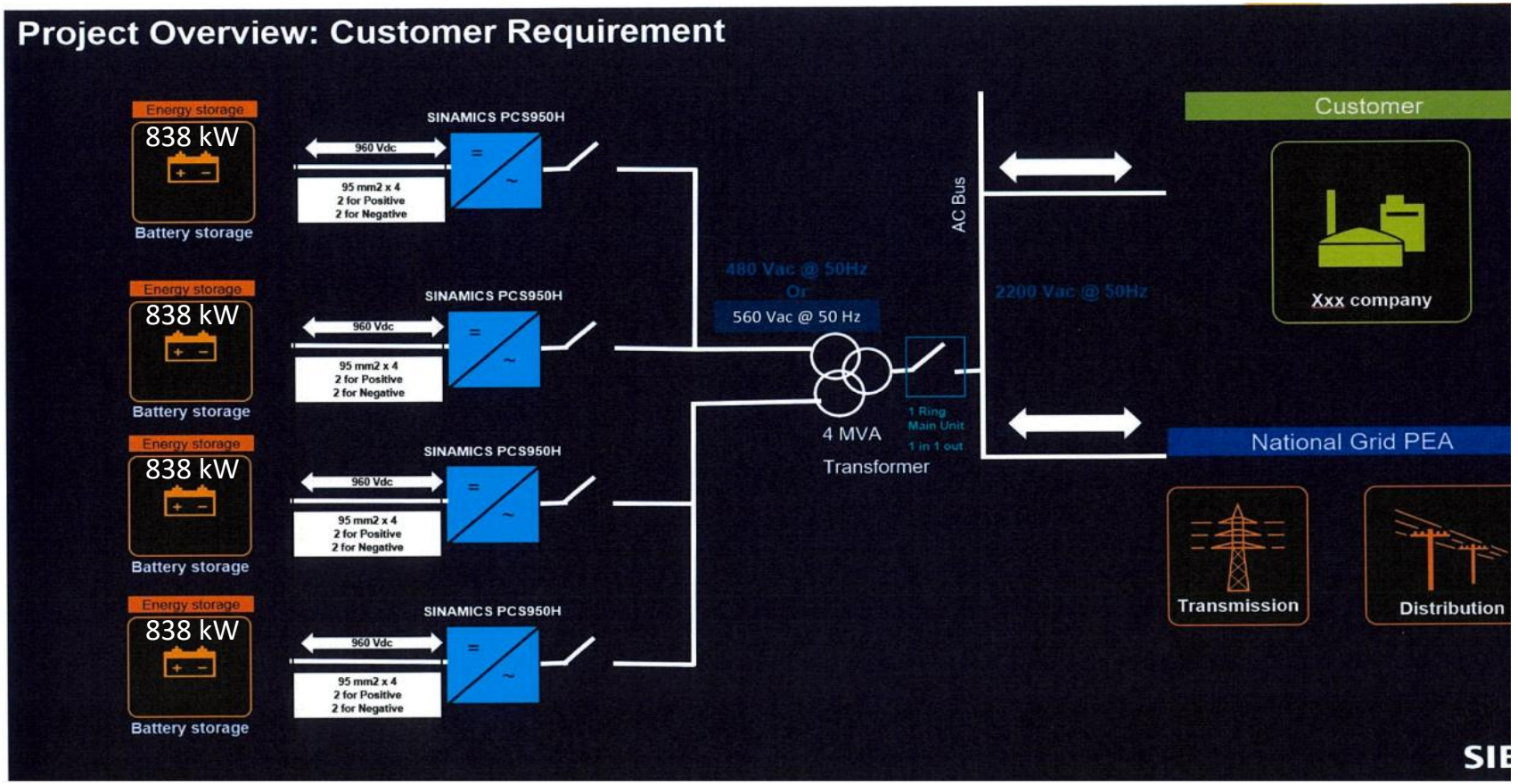
Fig 2.1 Basic MCP (Left) and Advanced MCP (Right) cabinet



BESS CONFIGURATION

BESS COMPONENT

BPLC2 BESS Configuration




Thank You
Q&A