# RENON

Commercial & Industrial BESS Solutions

RENON

RENON POWER

Renewable | Reliable | Remarkable

# Index.

# Who We Are

Headquartered in McKinney, USA, Renon Power is a veteran-founded innovator in energy storage.

We focus on **residential and C&I storage**, delivering bankable products, certified integrations, and end-to-end support through regional partners.

To serve customers closer and faster, **Renon Power Technology B.V.** is our European hub in the Netherlands, combining U.S. R&D with **EU-grade compliance and local service**.

**JOIN US ON OUR MISSION TO MAKE RENEWABLE ENERGY WITHIN REACH.**

Get Started

# Core Business

Our products are designed to meet the needs of a wide range of applications, from residential and commercial buildings to industrial facilities and utility-scale projects. Whether you're looking to reduce your energy bills, increase your energy independence, or support your sustainability goals, Renon has the right solution for you.

Residential Batteries

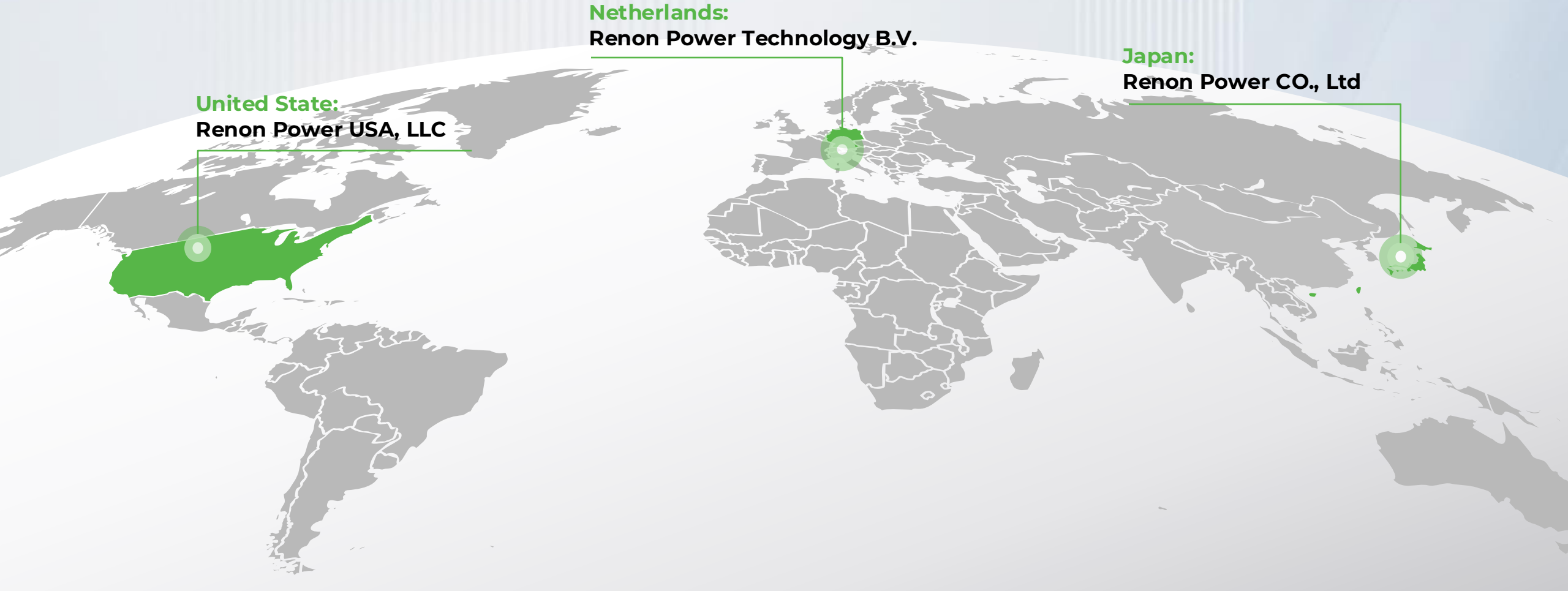
Commercial & Industrial BESS

Battery-Buffered DC Fast Charging

Portable BESS

# Global Footprint

We have established sales offices and product centers in the United States and Japan, providing prompt and efficient solutions and services to local customers.



# North American Gigafactory Groundbreaking


## 3 GWh

Planned annual capacity

## McKinney, Texas

580 McIntyre Rd. Ste. 100, McKinney, TX 75071

- Global headquarters and North American manufacturing site under construction.
- Targeting compliance with Domestic Content / FEOC / BABA by early 2026
- Established in collaboration with the City of McKinney & McKinney EDC
- Veteran-owned leadership enabling innovation and clean energy jobs
- A strategic extension of our global energy storage capabilities

# Our US Leadership

## Meet Our Team

### Paul Buckwalter

**Owner & VP of Sales**

15+ Years Experience in Battery Research and Development

**Jane. H**
CEO

**Joshua Brown**
Director of Residential ESS

**Jose Illedge**
Senior Technical Support Manager

**Pablo Vial**
Director of Marketing

**Russell Willems**
Director of Customer Empowerment

The Renon U.S. team, founded and led by a U.S. military veteran, is deeply rooted in the local market and dedicated to delivering advanced, reliable energy storage solutions for customers in North America. Our team of industry-savvy professionals combines global technology expertise with localized service, driving the adoption of residential and C&I storage. Guided by our core values — Renewable, Reliable, Remarkable — we work alongside our partners to build a cleaner energy future.

OUR HISTORY

# Development Timeline

### Renon Power Established

Originated from BMS technology and solutions

2014

### Launched 1st Generation of HESS

The first generation of residential products successfully developed and installed in the America.

2017

### Launched C&I Solutions

The C&I Solution successfully put into trial production by the Indonesian Military Communications Ministry.

2019

### Focusing on Continuous Energy Solution Innovations

Our dedicated R&D team is at the forefront of innovation, constantly exploring new technologies and methodologies to enhance the efficiency and reliability of our energy storage solutions.

## 2022

### 2nd Generation of HESS

Obtained all critical certifications required globally, including UL system for US market, and IEC series for EU standard

## 2023

### New R&D Center

Improved R&D capabilities and achieved annual sales of nearly $40 million.

## 2024

### Strategic Partnership with Sol-Ark

Renon and Sol-Ark unite to expand solutions, with residential ESS as the cornerstone, driving sustainable energy growth..

Sol-Ark

## 2025

### Focused on Utility Scale Solutions

Expanded product lines, with residential ESS as the cornerstone, while continuously developing our solutions for all energy applications.

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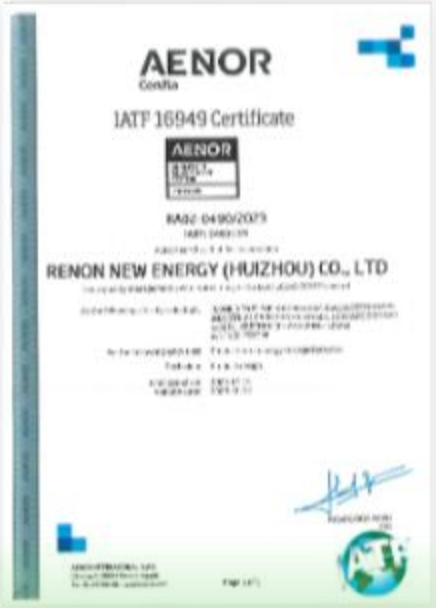
80%

### Global Manufacturing

Renon Power is currently constructing a second gigafactory in McKinney, Texas with plans of residential and C&I ESS assembly lines utilizing domestic content and locally sourced talent and materials.

# Principles of Quality Management

- Focus on Customers
- Employee Involvement
- Continuous Improvement
- Relationship Management
- Leadership
- Process Methodology
- Strategic Decision Making

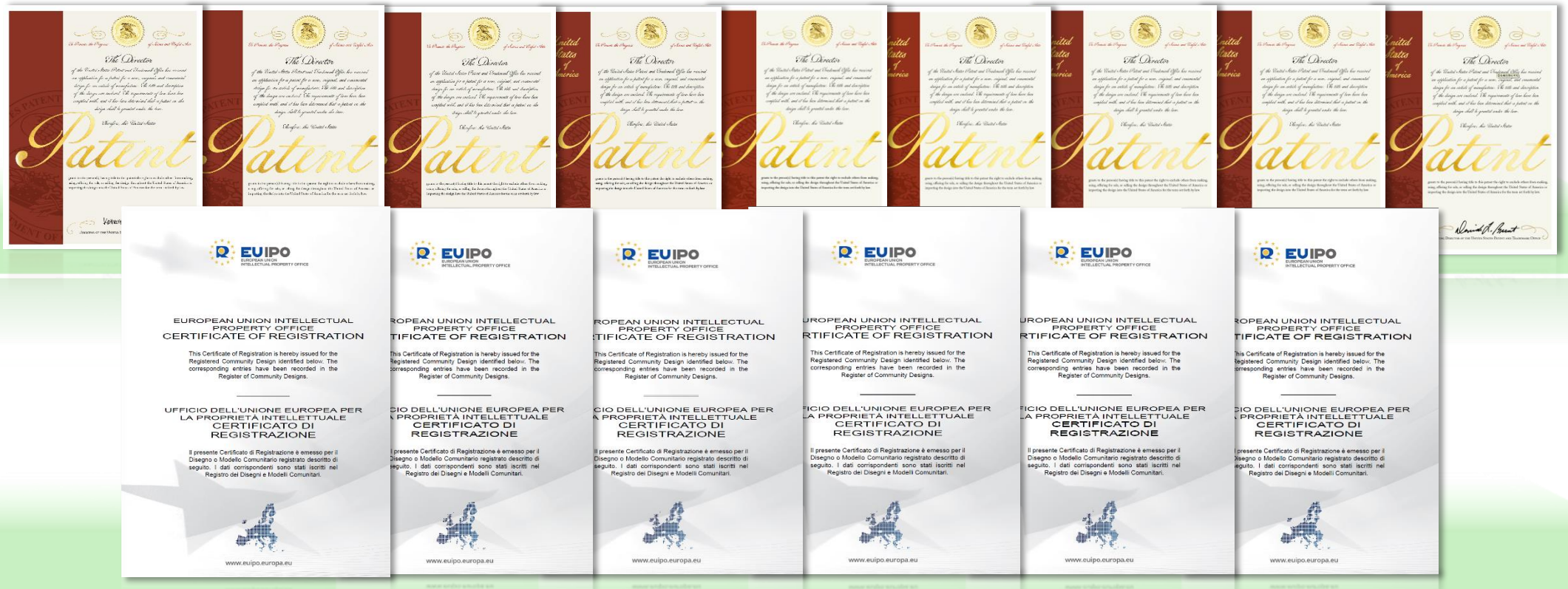

# Patents

**8**
**Invention Patents**

**10**
**International Patents**

**9**
**Software**

**37**
**Utility & Appearance Patents**



# II. CORE TECHNOLOGY

- 60+ Patents
- Energy Storage BMS Technology
- Cloud EMS Technology
- Integrated Safety Technology
- Local EMS Technology
- Integrated Thermal Management Design
- Intelligent PCS Technology
- System Three-proof Design

# Cloud EMS Technology - Technical Features

The cloud-based EMS for energy storage is the core of current smart energy storage systems. It integrates energy storage devices, cloud computing, big data, AI algorithms, and more, to achieve remote monitoring, intelligent scheduling, optimized operation, and auxiliary maintenance functions.

## 1. System Architecture:

**•Cloud-edge Collaborative Architecture**
The cloud is responsible for big data storage, analysis, and strategy optimization.
The edge (EMS controller) responds in real-time to on-site data to ensure safety and stability.
The cloud and edge together form an efficient architecture with real-time control + global optimization.

**•Modular Design**
Includes modules for data collection, forecasting optimization, scheduling control, operation monitoring, safety management, etc., supporting flexible expansion.

## 2. Intelligent Algorithms & Optimization Technologies

**•AI Prediction Model**
Electricity price prediction, load prediction, photovoltaic/wind power generation prediction.
Supports daily/weekly/monthly load curve modeling and rolling forecasts.

**•Multi-strategy Scheduling Optimization**
Supports various operating strategies such as peak shaving, demand management, photovoltaic priority, grid priority, and electricity price arbitrage.
Optimization objectives include: maximum economic benefits, minimum carbon emissions, and highest equipment efficiency.

**•Machine Learning + Experience Rules Combination**
Trains models based on historical operation data, while incorporating on-site expert rules to enhance system intelligence and robustness.

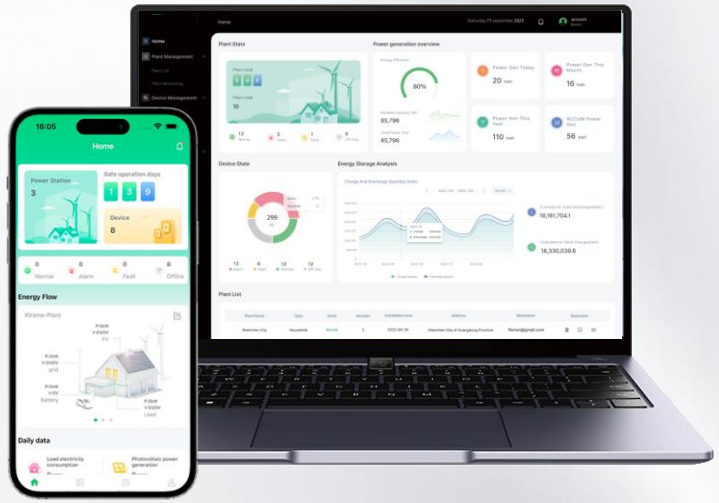
## 3. Functional Features:

**•Multi-site Centralized Management**
A single platform can centrally manage multiple energy storage sites, supporting network operation, strategy synchronization, and distributed scheduling.

**•Real-time Monitoring and Visualization**
The cloud platform provides a graphical interface to display real-time data such as battery status (SOC, SOH), power, electricity price, and revenue.

**•Alarms and Fault Diagnosis**
Multi-level alarm mechanisms (notification/alarm/shutdown), intelligent fault analysis, and diagnostic recommendations.

**•Reports and Data Analysis**
Automatically generates operation reports, carbon reduction statistics, revenue analysis, and efficiency evaluations.



## 4. Integrations and Compatibility

**•Open API Interfaces**
Supports third-party platform or energy management system access, facilitating integration into microgrids, VPPs, park EMS, and other systems.

**•Compatibility with Multi-brand Energy Storage Devices**
Supports access to equipment from mainstream manufacturers such as PCS, battery systems, weather stations, environmental monitoring devices, etc.

## 5. Support for VPP and Grid Interaction

**•Aggregated Control Capability**
Can serve as a local node or scheduling unit in a virtual power plant (VPP) dispatch platform, supporting load response and demand-side regulation.

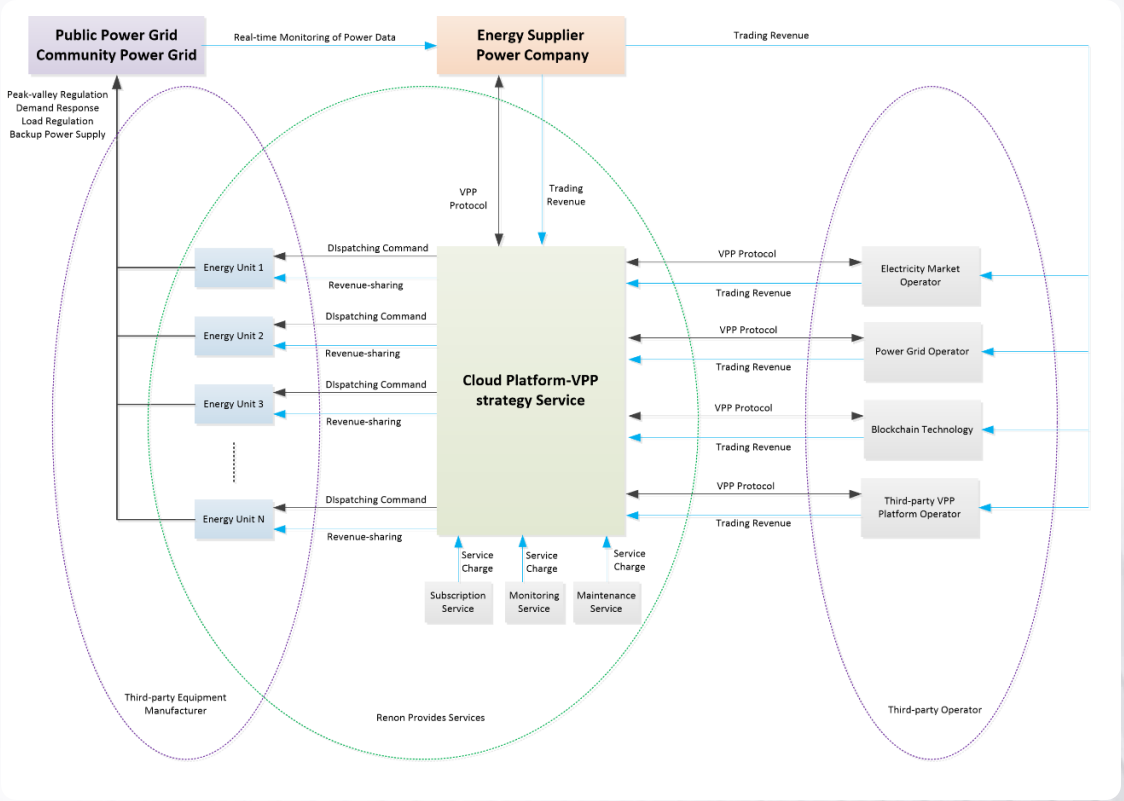
**•Grid Interaction Interface**
Interfaces with grid dispatch platforms such as AGC, frequency regulation, peak shaving, auxiliary services, etc., supporting transactions and market participation.

# Cloud EMS Technology - Technical Applications

## Technical Applications

| | |
|---|---|
| **Grid Frequency Regulation Revenue** | The energy storage system responds to grid operator instructions, providing second-level/minute-level frequency regulation services (such as primary/secondary backup), earning service fees by smoothing out grid fluctuations. |
| **Peak Shaving and Energy Arbitrage** | Charge during low electricity price periods and discharge during high electricity price periods, reducing electricity costs or earning price difference revenue. |
| **Demand Response Revenue** | Green electricity produced by home photovoltaic + energy storage systems is sold directly to nearby enterprises, communities, or traded via blockchain platforms. |
| **Distributed Green Power Direct Supply** | Green electricity produced by home photovoltaic + energy storage systems is sold directly to nearby enterprises, communities, or traded via blockchain platforms. |
| **Carbon Credits and Green Certificates** | After integrating with a VPP, each MWh of green electricity generated by the energy storage system can produce a Renewable Energy Certificate (REC) for sale in the carbon trading market. |
| **Professional Aggregator Model** | Integrate decentralized residential storage resources to participate in the electricity market and share the revenue. |
| **Heat Pump Compatible & Bidirectional EV Charging** | Energy storage systems interact with heat pumps and electric vehicle charging stations to optimize household energy usage through the energy management platform. |

## Application Topology



# Local EMS Technology

## 1. Technical Features

- The local EMS for energy storage is the core control unit deployed at the energy storage system site. It is primarily responsible for real-time monitoring, status perception, control execution, and strategy implementation for the energy storage system and its related devices (such as PCS, BMS, loads, PV, etc.). Compared to the cloud EMS, the local EMS emphasizes real-time performance, security, and edge intelligence.

## 2. Intelligent Algorithms & Real-Time Control

### • Real-time Control

Supports millisecond-level response time, enabling fast control and fault response for PCS and BMS.
Locally executes energy scheduling strategies (e.g., charge/discharge control, photovoltaic-follow load, off-grid operation, etc.).

### • Edge Intelligence Algorithm

Embedded optimization algorithms (e.g., SOCP, MILP, rule logic, etc.), supporting intelligent operational decision-making in off-grid states.
Can independently complete prediction + optimization + scheduling control loops in the absence of network or communication interruptions.

### • Multi-device Local Collaborative Control

Supports multi-device coordination, such as energy storage systems, photovoltaic inverters, wind power generators, loads, diesel generators, etc.
Provides various control modes: constant power, constant voltage control, frequency response, frequency regulation, black start, etc.

## 3. Communication and Compatibility Technologies

| | |
|---|---|
| **Multi-protocol Compatibility** | • Supports various industrial communication protocols: Modbus RTU/TCP, CAN, IEC104, OPC UA, DLT645, IEC61850, etc.<br>• Can interface with mainstream PCS/BMS/inverters/smart meters/PV DCDC devices, ensuring high compatibility and scalability. |
| **High Reliability Communication Network** | • Supports various physical interfaces such as RS485, CAN, Ethernet, and fiber optics to build a reliable field communication network.<br>• Supports second-level or millisecond-level data acquisition and reporting for real-time scheduling and alarm response.<br>• Uses SSL/TLS encryption, VPN channels, security authentication, whitelist mechanisms, etc., to ensure system communication security. |

## 4. Local Automated Control Function

| | |
|---|---|
| **Built-in Operating Logic** | • Photovoltaic priority, peak shaving, valley filling, electricity price arbitrage, demand control, microgrid island operation, etc. |
| **Flexible Scheduling and Automation** | • Supports automatic switching between operating modes (grid-connected/off-grid, electricity price mode/energy backup mode, etc.).<br>• Supports strategic switching triggered by time periods/events, such as automatically enabling electricity price arbitrage strategy during peak and valley periods. |

# Local EMS Technology

## 5. Safety and Fault Handling Mechanism

### Local Fault Diagnosis and Protection

Quick identification and handling of over-voltage/under-voltage, over-temperature, SOC anomalies, etc. Provides local power-off protection, black start control, emergency shutdown control, and other safety protection mechanisms.

### Intelligent Alarm System

Multi-level alarm levels (information/warning/serious/shutdown), with on-site outputs such as buzzers, lights, SMS, etc.

## 6. Human-Machine Interaction and Local Visualization

### Local HMI or Touch Screen

Supports 10-inch HMI touch screens, providing a visual operation interface for easy on-site maintenance and system status viewing.

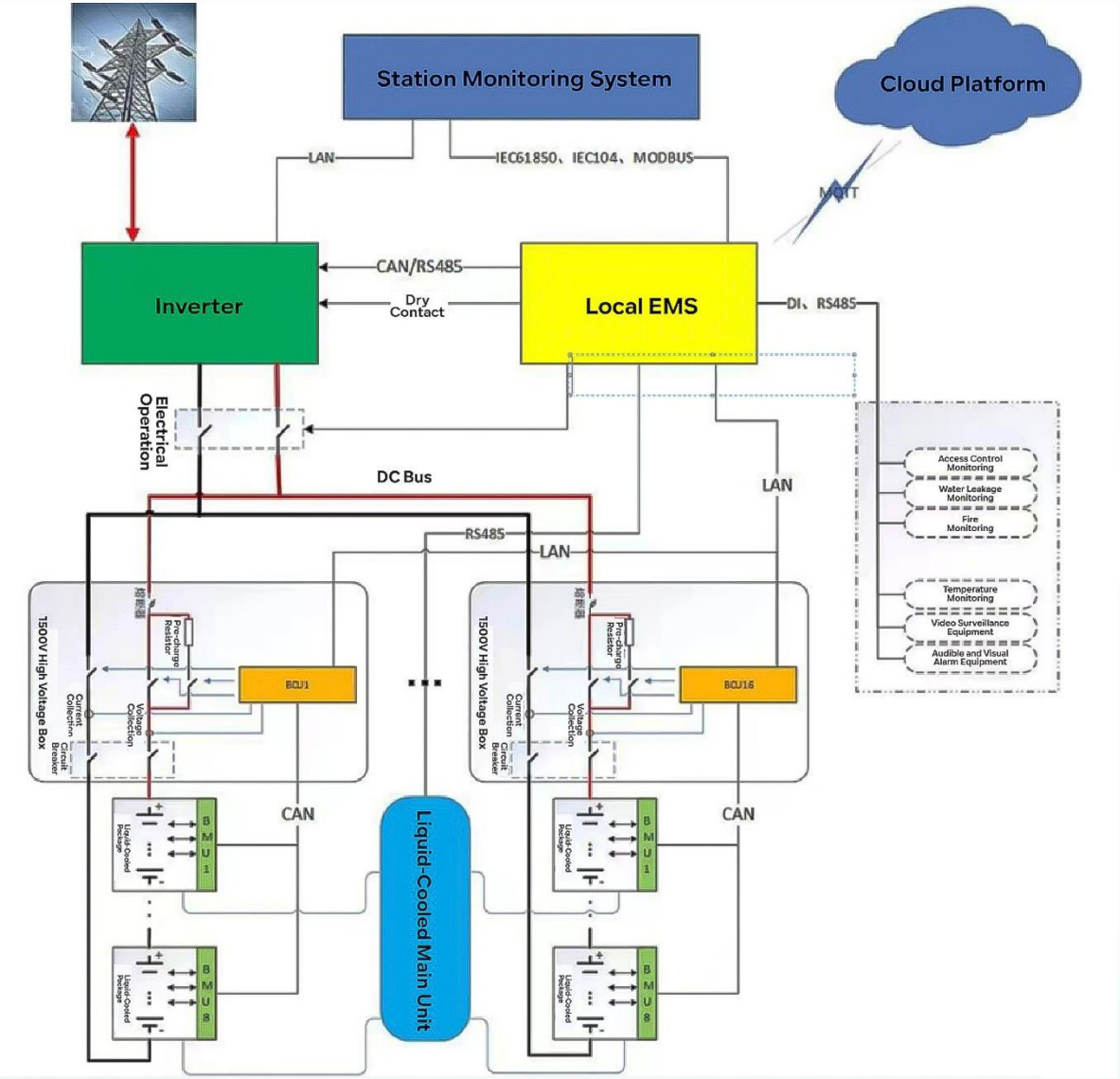
### Web/APP Access

Enables browser access through a local web server or LAN connection, without relying on the cloud.

## 7. Local Data Storage and Upload

- Supports breakpoint caching and automatic data upload: When disconnected from the cloud platform, data is stored locally, and when communication is restored, it is automatically uploaded.
- Local data can be used for event tracebacks, operation analysis, and log tracking.

## 8. Application Topology



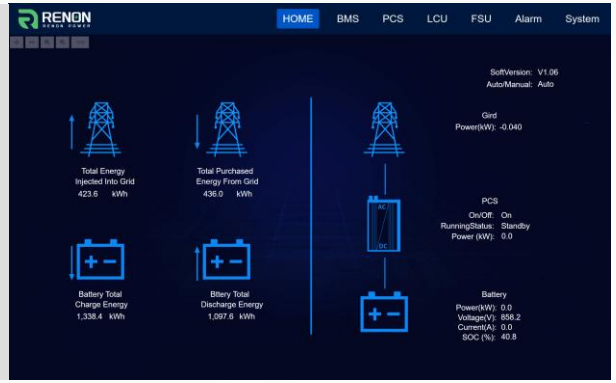
LOCAL EMS

# ProControl Prime

## Cabinet Level Local EMS

High-end integrated display and control system for commercial and industrial energy storage solutions.


- High-Performance Data Processing MCU
- Advanced Graphics and AI Capabilities
- Robust and Durable Design
- Independent Smart Local Control
- High-Brightness Full-View Touch Display
- Comprehensive Communication & Control Interfaces
- Flexible Cloud Connectivity





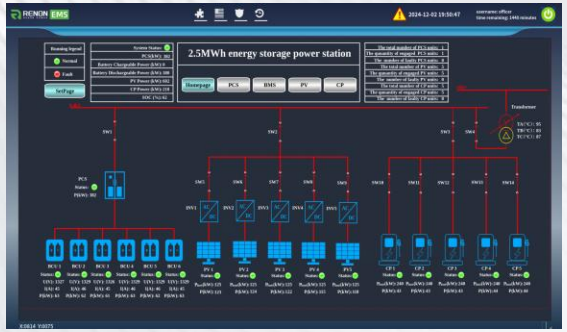
LOCAL EMS

# ProControl Base

## Station Level Local EMS

Reliable control and display solution for large distributed energy storage systems

- High-Performance Data Processing
- Advanced Graphics and AI
- High-Brightness Touch Display
- Comprehensive Communication Interfaces
- Robust and Durable Design
- Smart Local Control Modes
- Flexible Cloud Connectivity

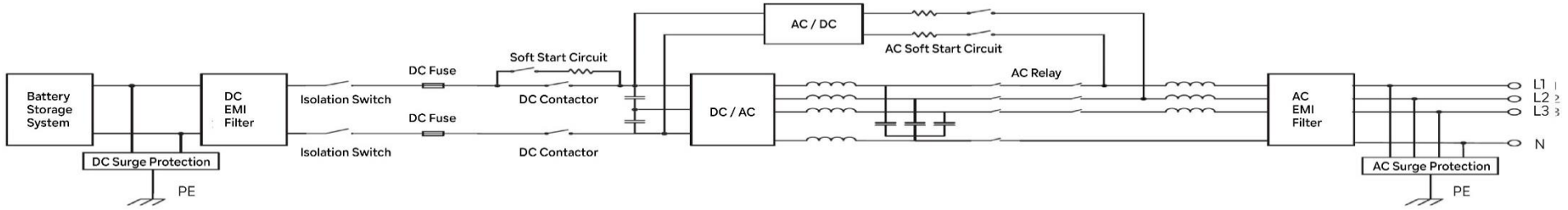



# Intelligent PCS Technology

The energy storage PCS is one of the core devices in the energy storage system. It is primarily responsible for the bidirectional flow and control of energy between the battery and the grid/load. It not only serves as an energy "hub" and "regulator", but also plays a critical role in ensuring the system's safety, stability, and efficient operation.

| | |
|---|---|
| **Bidirectional Energy Conversion** | ·Realizes bidirectional energy flow between DC (battery) and AC (grid/load).<br>·It has both DC-to-AC inversion (DC→AC) and AC-to-DC rectification (AC→DC) capabilities, supporting bidirectional charging and discharging operations. |
| **Multi-mode Operation Capability** | ·Grid-connected/off-grid switching: Supports grid-connected operation and island mode (off-grid) operation, with seamless switching.<br>·Multiple control modes: Constant power, constant voltage, constant current, SOC control, electricity price arbitrage, frequency regulation/voltage regulation, black start, etc.<br>·Supports microgrid applications: Maintains voltage/frequency stability in off-grid microgrid systems. |
| **Intelligent Scheduling and Quick Response** | ·Supports dynamic control by the EMS system (e.g., Modbus, CAN, IEC 104, IEC61850, etc.).<br>·Fast response to external control commands (e.g., AGC dispatch, millisecond-level response).<br>·Has intelligent features such as power auto-distribution, multi-machine parallel control, and redundant switching. |
| **High Efficiency and Wide Operating Range** | ·High conversion efficiency, with a maximum efficiency of up to 99%.<br>·Wide voltage range design: Battery side supports DC 150~1500V, adaptable to various battery systems (LiFePO4, NMC, etc.).<br>·Supports high-power output: Single machine power ranges from 30kW to MW level, suitable for home to grid-side energy storage systems. |

| | |
|---|---|
| **Intelligent and Digital Control:** | ·Supports embedded control systems + DSP/FPGA high-speed data processing.<br>·Real-time data acquisition, fault diagnosis, and operation optimization.<br>·Can connect to cloud platforms for remote monitoring, OTA upgrades, and operational log recording. |
| **Complete Safety Protection Mechanism** | ·Built-in multiple protection functions: over-voltage, under-voltage, over-current, short circuit, grounding, reverse connection, insulation fault, over-temperature, etc.<br>·Supports fast fault isolation and self-recovery.<br>·Complies with various grid connection standards (e.g., IEEE 1547, GB/T 34120, VDE-AR-N 4105, etc.). |
| **High System Compatibility** | ·Compatible with multi-brand batteries, BMS, and EMS systems.<br>·Supports integration with photovoltaic inverters, wind power systems, diesel generators, etc., to form microgrid systems.<br>·Supports SVG function (Static Var Generator) as a replacement for reactive power compensation devices. |
| **Environmental Adaptability and Reliability** | ·Industrial-grade design, supports operation in harsh environments (-86°F~140°F/-30°C ~ 60°C).<br>·Modular design, supports wall-mounted and rack-mounted configurations.<br>·Supports air cooling/liquid cooling, adaptable to complex environments such as sandstorms, high temperatures, and humidity.<br>·Product supports IP54~IP65 protection ratings. |



# Energy Storage BMS Technology

The energy storage BMS is the "brain" and "safety guard" of the energy storage system. It is primarily responsible for monitoring, protecting, managing, and optimizing the battery's operating state, ensuring the system's safety, efficiency, and reliability. Compared to power batteries, the energy storage BMS emphasizes system-level coordination, long-life maintenance, and intelligent communication control.

## Multi-level Distributed Architecture Design

### BMU (Battery Management Unit)

Collects basic data such as voltage, temperature, current for each battery cell string.

### RCU (Remote Control Unit)

Manages battery packs, executes balancing control, and drives relays.

### SCM (System Coordination Module)

Coordinates the system, uploads data, and communicates with PCS/EMS for decision-making and protection.

## Precise Monitoring and State Estimation Technology

- **High-precision Sampling:** Voltage accuracy up to ±2mV, temperature accuracy ±1°F, current sampling < ±0.5%.
- **SOC (State of Charge) Estimation:** Based on Coulomb counting + Kalman filter algorithm to improve estimation accuracy.
- **SOH (State of Health) Assessment:** Based on cycle life, internal resistance growth, and capacity degradation modeling.
- **SOP (State of Power) Prediction:** Dynamically determines the maximum charge/discharge power of the system.

## Intelligent Balancing Management Technology

- **Active Balancing (e.g., charge transfer, inductive coupling):** Improves energy efficiency and reduces thermal loss.
- **Passive Balancing (resistive dissipation):** Simple structure but causes more energy waste.
- **Dynamic Balancing Strategy:** Flexibly adjusts balancing strategies during charging, discharging, or idle states.

## Strong Communication and System Compatibility

**Supports Multiple Communication Interfaces**

CAN, RS485/RS232, Modbus, Ethernet, IEC104, OPC UA, IEC61850, etc.

**Can Interface with PCS, EMS, SCADA, Cloud Platforms, etc., for Unified Scheduling and Remote Maintenance.**

**Supports Hot-plug, Series and Parallel Configuration Recognition, Multi-cluster Redundant Control.**

## Complete Protection and Fault Handling Mechanism

### Basic Protection

Over-voltage, under-voltage, over-current, short circuit, over-temperature, low-temperature, etc.

### System-level Protection

Voltage differential protection between packs, balancing anomalies, cable disconnections, insulation detection.

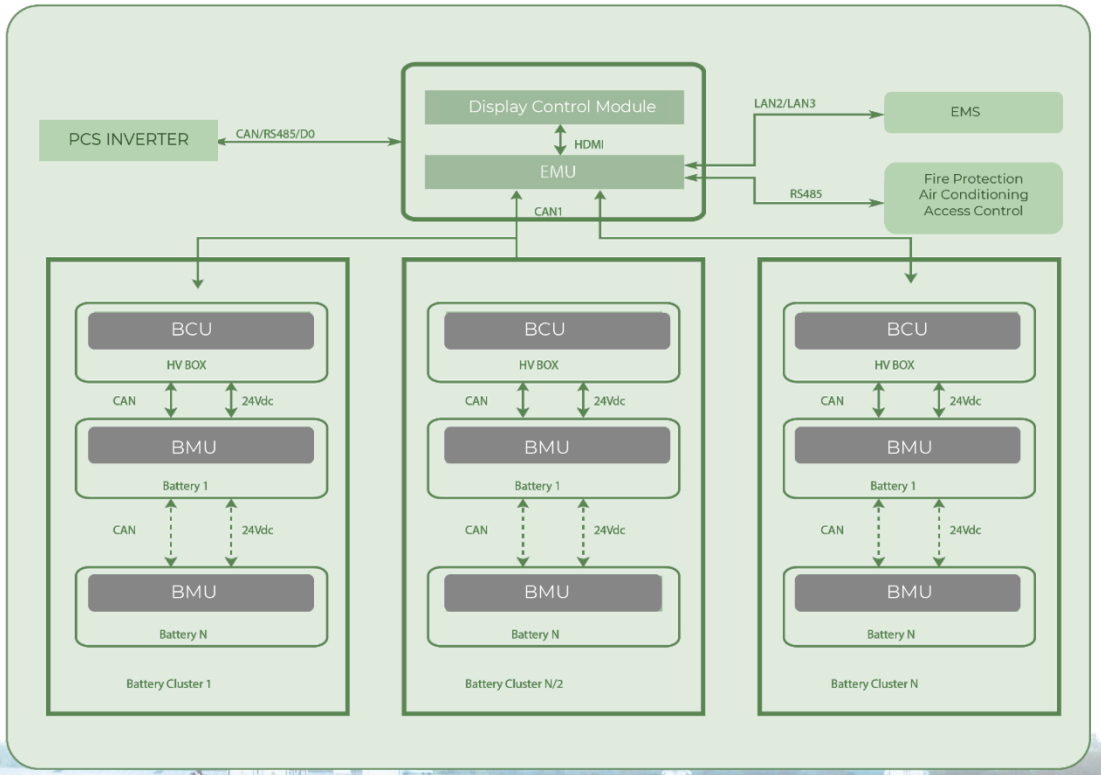
### Fault Level Management

Pre-warning, alarm, emergency fault, shutdown.

### Hardware and Software Redundancy Design

Enhances system fault tolerance, supports online diagnosis and automatic recovery.

# Energy Storage BMS Technology




## Intelligent Maintenance and Remote Operation and Maintenance Functions

·Real-time data collection, event logging, "black box" storage.

·Supports remote BMS firmware upgrades (OTA), parameter configuration, and diagnostic debugging.

·Can connect to cloud platforms for data analysis, life prediction, and operation scheduling.

## Modular and Highly Compatible Design:

·Supports multi-brand, multi-specification battery systems (LiFePO4, NMC, sodium-ion, etc.).

·Can adapt to system architectures with different cluster numbers, voltage levels, and battery capacities.

·Modular hardware/software design for customization and rapid deployment.

## System-level Battery Optimization Strategies:

·Lifecycle Management: Intelligent scheduling to extend battery life.

·Aging Cluster Peak Shaving Strategy: Automatically adjusts power distribution, prioritizing the use of healthy battery clusters.

·Thermal Management Collaboration: Integrated control with air conditioning, air cooling, and liquid cooling systems.

·EMS Collaborative Control: Supports VPP, peak shaving, valley filling, and demand-side response strategy execution.

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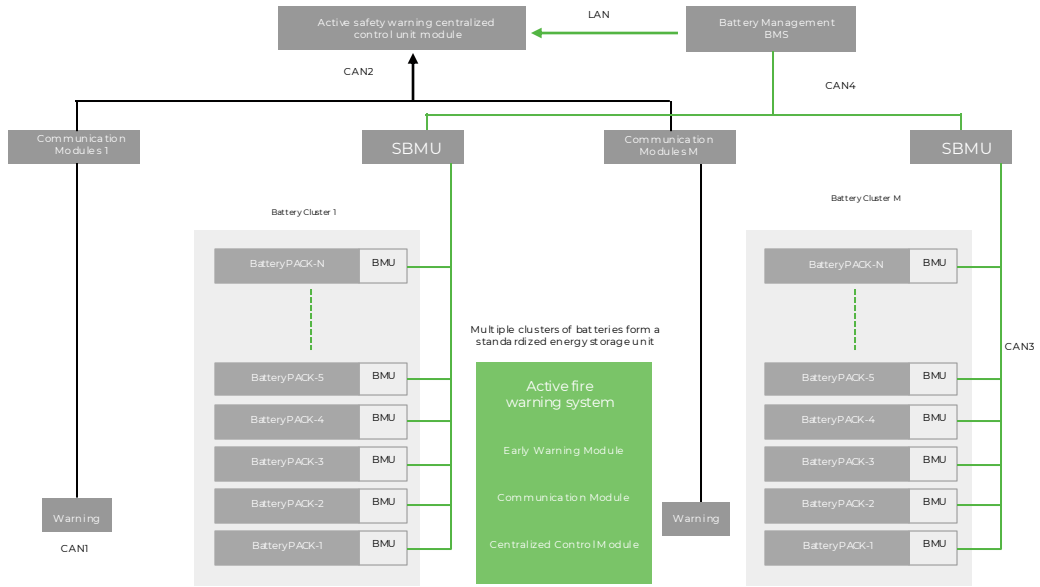
# Integrated Safety Technology




## 1. Battery Safety Management Technology

·**High-reliability Lithium Battery Selection** (e.g., LiFePO4, sodium-ion batteries).

·**Precise SOC/SOH/SOP Estimation Algorithms** to prevent overcharging and overdischarging.

·**Thermal-electrical Coupling Modeling and Thermal Runaway Prediction Algorithms.**

·**BMS Three-level Management Architecture**: Diagnosing inter-cluster voltage differences and temperature differences.

·**Passive + Active Balancing Control Strategy** to enhance battery cell consistency.

## 2. BMS/EMS/PCS Collaborative Protection Control Mechanism

·**Quick Fault Diagnosis → Cascade Power-off → Event Traceback.**

·**Multi-system Interlocking Mechanism**: BMS → PCS → EMS.

·**Supports "Soft Shutdown" and "Step-by-step De-islanding"** Mechanisms to reduce false protection frequency.

·**Real-time Upload of Battery Parameters** to trigger dynamic adjustments in control strategies.

## 3. Thermal Runaway Warning and Fire-fighting Linkage Technology

·**Key Thermal Runaway Warning Link**: Monitoring the rate of temperature rise (ΔT/Δt) for individual cells, real-time detection of smoke/flammable gases (TVOC), and determining abnormal sealing by pressure difference/humidity in the battery pack.

·**System Interlocking Design**: BMS thermal runaway signal → EMS control → Forced shutdown of PCS and interlocked fire-fighting system; supports dry powder, aerosol, FM-200, and water-based fire suppression systems.

## 4. High-reliability Electrical Protection and Isolation Technology

·Dual Grounding Protection Design.

·Main Circuit/Control Circuit Level Circuit Breaker, Contactor, Fuse Combination Design.

·Insulation Monitoring + Warning + Forced Isolation.

·Arc Fault Detection and Quick Disconnect Technology.

## 5. Thermal Control and Thermal Management System Safety Technology

·Air Cooling, Liquid Cooling, or Fluorine Pump Thermal Management System with precise temperature control (±33.8°F/1°C).

·Multi-point Temperature Detection (>2 points per battery cluster) + Cold/Hot Zone Strategy.

·Cold/Heat Failure Warning Mechanism (Fan/pump flow/cooling unit self-diagnosis).

·Interlocking with BMS/EMS Systems: Intelligent temperature regulation, power limitation, current limitation protection.

## 6. Communication and Network Security Mechanism

·Multi-layer Communication Structure: BMS ↔ PCS ↔ EMS ↔ SCADA/cloud platform.

·Encryption Protocols (e.g., TLS/SSL), Firewall Isolation, Whitelist Control.

·Prevention of Network Attacks, Data Hijacking, and Mis-control.

·System Log Recording + Fault Traceback.

## 7. Intelligent Maintenance and Remote Safety Management

·Visualization of System Operating Status and Fault Warning Reporting.

·Supports Remote Debugging, OTA Remote Upgrades, and Remote Downloading of Operational Logs.

·Three-level Maintenance Permission Classification: System Administrator/Engineer/User.

·Supports "Black Box" Operational Records for Accident Traceback Analysis.

# Integrated Thermal Management Design

## Thermal Management Control System

### Thermal Simulation Layout
Ensures the design meets the required specifications.

### Interlocks with Firefighting System
Temperature rise/smoke/gas alarms → Linked to dry powder/aerosol systems.

### Power-off/Isolation Mechanism
Multiple thermal control failures → Emergency power-off or physical separation of the cluster system.

### Interlocks with BMS
Cell temperature rise → Load reduction → Abnormal shutdown.

### Interlocks with EMS
System pre-load prediction → Pre-cooling or power limitation.

## Thermal Management Control System

### Dense Temperature Sensing Points Layout
Temperature collection accurate to the cell level.

### Liquid Cooling System Temperature Difference Control
Requires cell temperature difference < 37.4°F/3°C.

### Air Cooling System Temperature Difference Control
Requires cell temperature difference < 46.4°F/8°C.

### Integrated AI Strategy
Adjusts temperature control strategy in real-time based on system operation patterns.

## Core Technology of Liquid Cooling System

| | |
|---|---|
| **Efficient Heat Transfer Design** | Optimized cooling plate structure (serpentine flow channels/multi-channel structure), achieving full contact heat conduction with the battery cells. |
| **High Heat Dissipation Efficiency** | Liquids have a high specific heat capacity and a thermal conductivity far higher than air, making them suitable for high-rate charging/discharging or large-capacity energy storage scenarios. |
| **Intelligent Control Algorithm** | Adjusts flow rate and pump frequency in real-time based on BMS temperature feedback, predicts temperature rise trends in advance, pre-starts cooling, and interlocks with EMS to automatically switch between "high-performance" and "energy-saving" modes based on load changes. |
| **Good Temperature Uniformity** | Heat balance control ensures thermal consistency between clusters, integrated cabinets, and individual cells. Battery pack temperature differences can be controlled within ±37.4°F/3°C to reduce the risk of localized overheating. |

## Core Technology of Air-Cooling System

- Directional Air Duct Design: Optimizes the air duct structure to ensure even airflow distribution between battery cells.
- Module Temperature Equalization Technology: Each battery module is equipped with a temperature equalization device to ensure uniform temperature across each battery module.
- Multi-stage Wind Speed Adjustment: Variable frequency fans or PWM speed control: Adjusts airflow in stages based on cell temperature.
- Intelligent Interlock Control: Interlocks with BMS/EMS/SCADA to dynamically adjust the fan operating mode.

# Integrated Thermal Management Design

In commercial and industrial energy storage systems, the thermal management system is one of the core technologies ensuring battery safety, efficiency, and longevity. As the system's power and energy density increase, the risk of thermal runaway significantly rises. Thermal management has become the "lifeline" of system integration.

## Core Technology of Air Cooling System

- Directional Air Duct Design: Optimizes the air duct structure to ensure even airflow distribution between battery cells.
- Module Temperature Equalization Technology: Each battery module is equipped with a temperature equalization device to ensure uniform temperature across each battery module.
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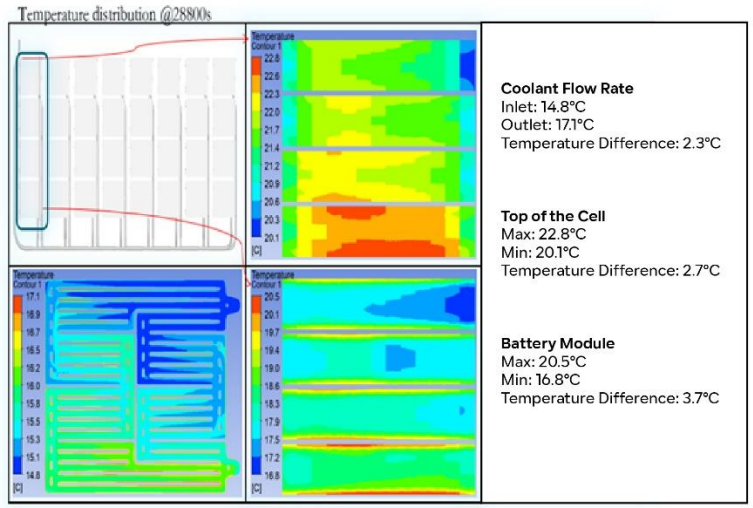
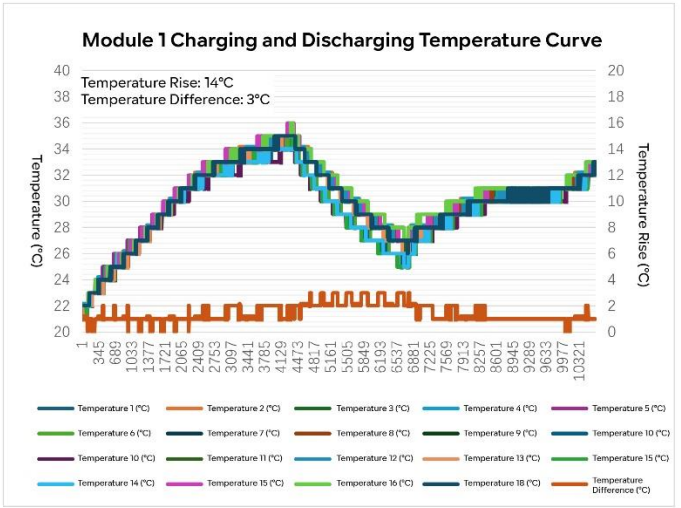
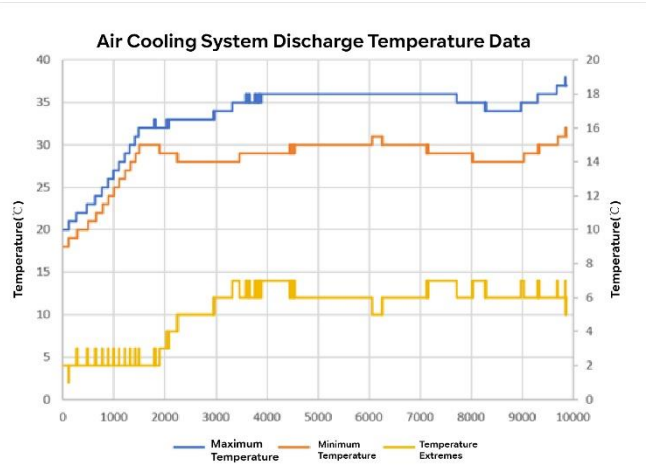



**Liquid Cooling System Thermal Simulation Report [Cell Top Temperature Difference < 37.4°F/3°C, Cell Bottom < 39.2°F/4°C]**




**Liquid Cooling System Measured Data [Cell Temperature Difference < 37.4°F/3°C]**




**Air Cooling System Measured Data [Cell Temperature Difference < 46.4°F/8°C]**

# System Three-proof Design

The "three-proof design" of commercial and industrial energy storage systems refers to a systematic engineering design for waterproofing, dustproofing, and corrosion protection. It is a key guarantee for ensuring the long-term safe operation of energy storage devices in various complex or harsh environments. Especially in outdoor, seaside, high-humidity, high-dust, or highly corrosive environments, the three-proof design is the basic prerequisite for compliant access and safe operation.

## Thermal Management Control System

- **IP55, IP65 Protection Rating Products**: Can be applied in various outdoor environments.
- **Integrated Ventilation Filter Device:** Ensures ventilation requirements are met while effectively preventing rainwater ingress, while also ensuring internal electrical safety.
- **Customizable Salt Spray Ventilation Filter Device**: More effectively ensures protection of internal components when used in coastal areas.

233 Energy Storage Cabinet Waterproof Test

## Enclosure Rust and Corrosion Protection Design:

·Uses electrophoresis + spraying process.
·The protection grade is typically C4, with customizable C5 protection to meet coastal usage requirements.

Sheet Metal Rust Prevention Test

# III. Product Training

- ✓ MPack 261A
- ✓ MPack 261AS
- ✓ Smart Matrix A

# MPack 261A

AC Distributed Energy Storage System


## Product Features

**Value and essence of the product from the very first**

*MPack 261A Distributed Energy Storage System is an all-in-one outdoor solution for commercial, industrial, and microgrid applications. Each unit integrates a 261 kWh liquid-cooled battery, a 135 kW bidirectional PCS, a local EMS, and a 120 kW MPPT controller. Five units together with one grid cabinet form an array, supporting 15 kV and 35 kV grid connections.*

| Function Module | Function Description | Customer Value |
|---|---|---|
| **Bidirectional Power Conversion** | Supports two-way energy flow and power balancing control | Peak shaving and valley filling for energy arbitrage |
| **Liquid Cooling Management** | Dual-loop thermal control keeps cell temperature within ±2 °C | Extends battery life by 20% and ensures stable operation |
| **Multi-level EMS** | Coordinated control across unit, local, array, plant, and project levels | Optimized scheduling and maximum system revenue |
| **Safety Architecture** | Three-level BMS protection (cell, module, system) with fire partitioning | Compliant with UL 9540A / NFPA 855 standards |
| **Communication & Cloud Access** | Supports Modbus TCP / MQTT / Open ADR protocols | Plug-and-play integration with aggregator platforms |
| **Modular Scalability** | Expandable from single unit → array → matrix → project level | Flexible investment and fast replication |

RENON

Renewable | Reliable | Remarkable

# Product Value Highlights

**The ways Renon deals with industry pain points make our solutions the obvious choice.**

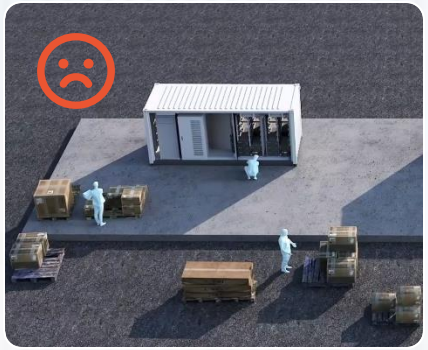
## Industry Pain Points vs. Renon Solutions

### High Electricity Costs


- Pain Point: High C&I tariffs, large peak-valley gaps

- Renon Solution: AI-based energy scheduling
- Customer Value: Save 30%+ on electricity bills

### Long Construction Period

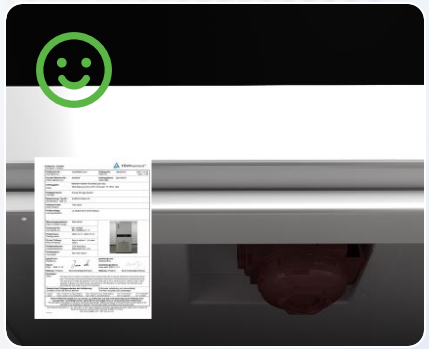


- Pain Point: Complex on-site integration

- Renon Solution: Modular, factory-built all-in-one system
- Customer Value: Installation in under 48 hours

### Strict Safety Standards

- Pain Point: Challenging safety certification and fire compliance



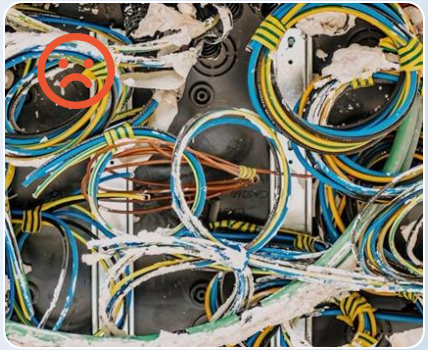
- Renon Solution: UL 9540 / 9540A certified + Fire Zone design
- Customer Value: Zero-incident operation, fully compliant

### Complex Grid Connection

- Pain Point: Complicated interconnection processes

- Renon Solution: Built-in 15 kV / 35 kV protection logic
- Customer Value: 5–8% CAPEX reduction

### Difficult O&M



- Pain Point: Labor-intensive maintenance and high costs

- Renon Solution: Cloud EMS + AI self-healing
- Customer Value: 60% lower O&M cost

# Application Scenarios

**Where to make profit. Where they save cost. Let them feel the value.**

| | | | | |
|---|---|---|---|---|
|  | **C&I Parks** | Peak shaving + demand management | Reduce energy bills by 30%+ | ROI ≈ 4 years |
|   | **Cold Chain Warehouses** | PV + storage coupling + backup supply | Improve temperature stability | Cut energy use by 12% |
|  | **Public Charging Stations** | Integrated storage + charging + power balancing | Reduce grid expansion investment | Peak demand ↓ 25% |
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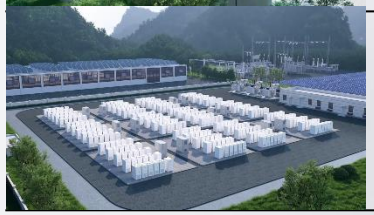
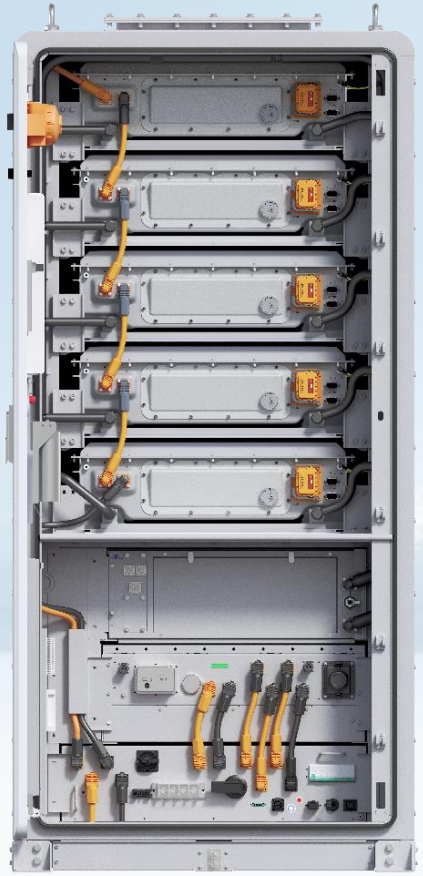
|  | **Microgrid Projects** | On/off-grid dual mode + aggregated control | Energy arbitrage + frequency revenue | Dual-layer profitability |

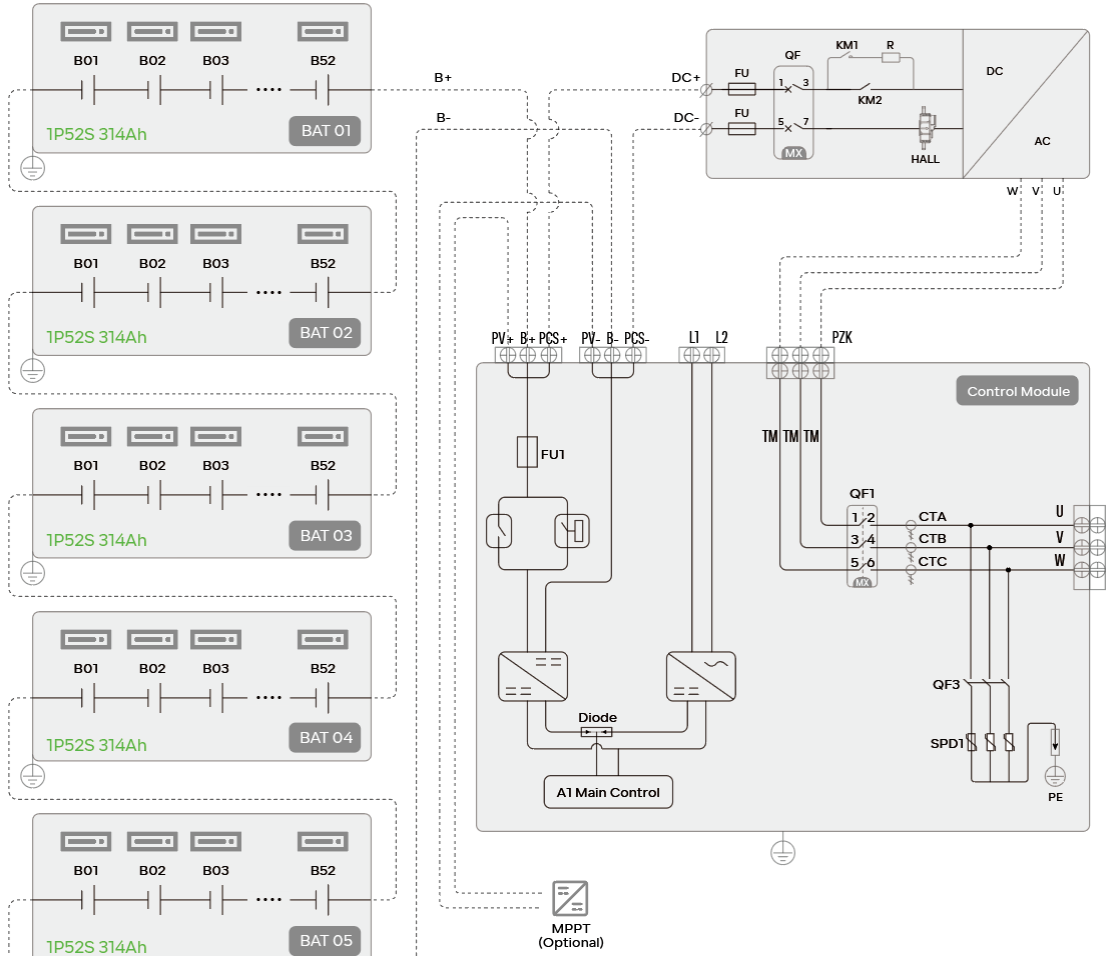
# MPack 261A

AC Distributed Energy Storage System

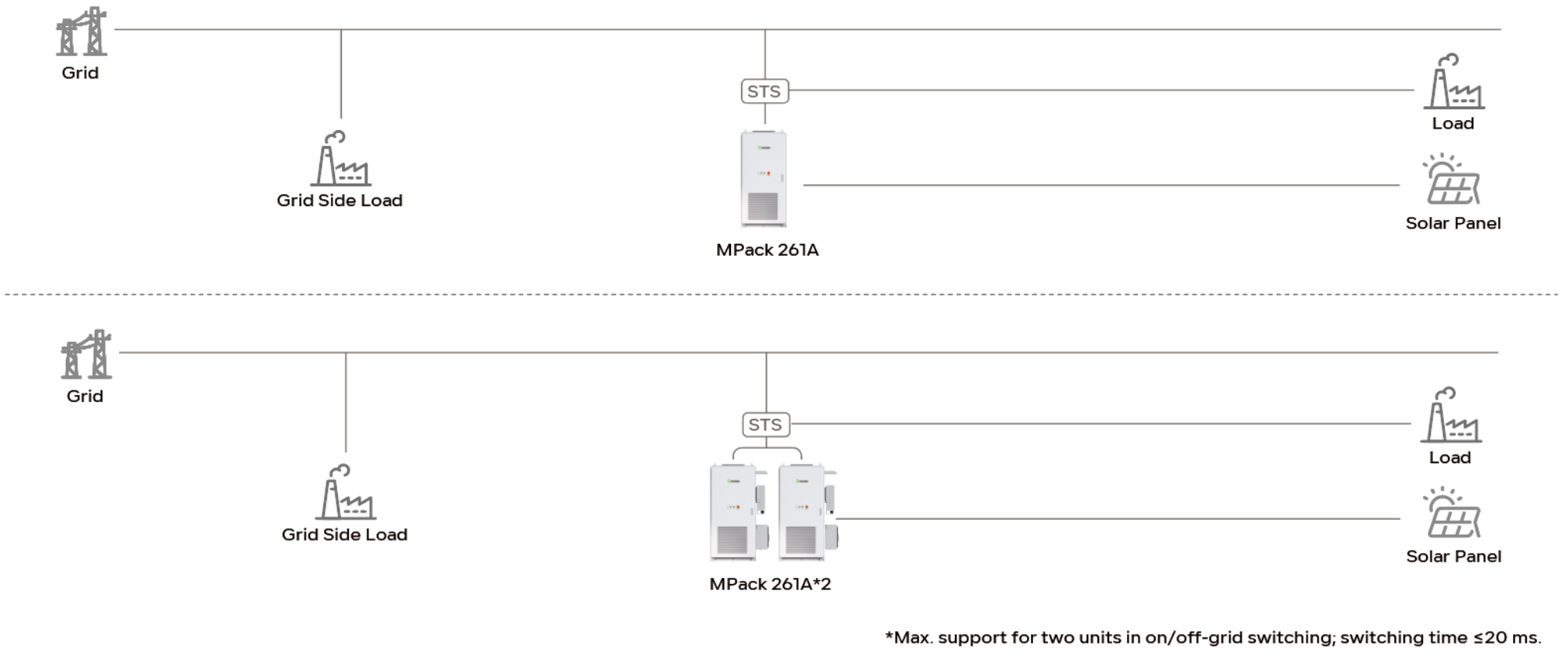


## Product Topology

**Clear structure. Clear configuration. Clear connection.**

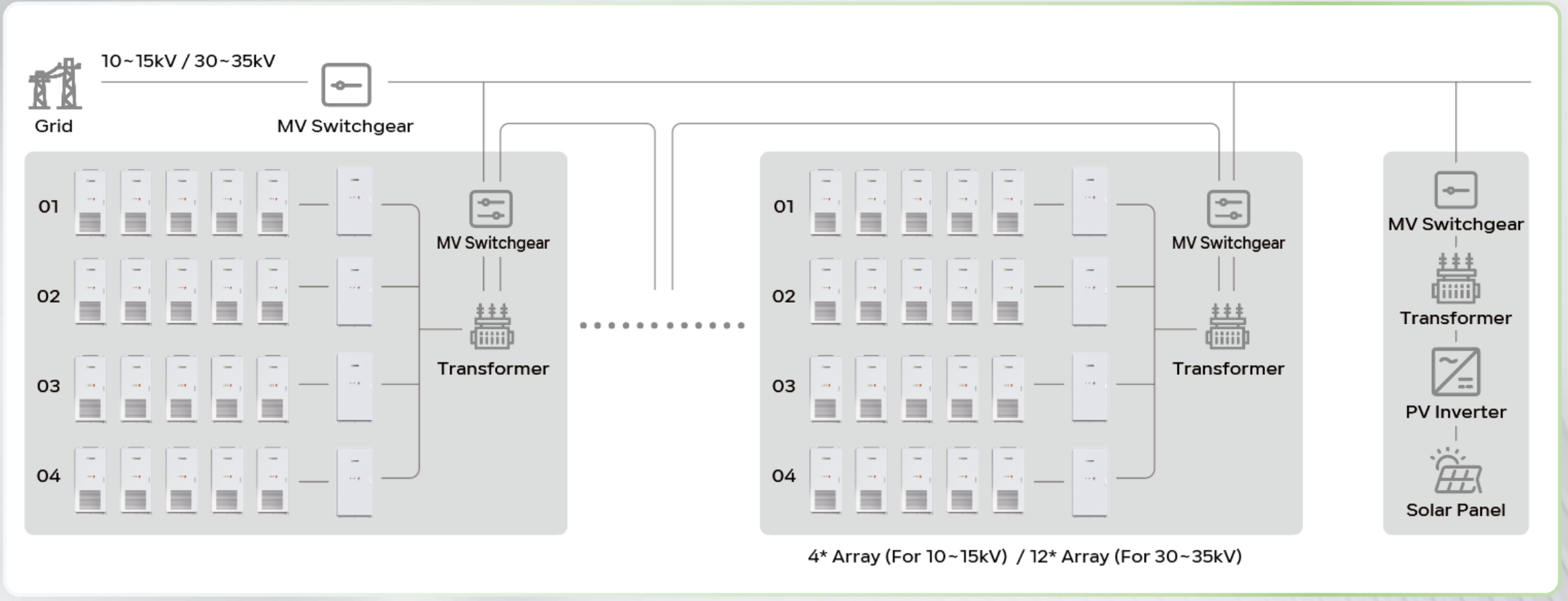


# On/Off-grid System Layout




*Max. support for two units in on/off-grid switching; switching time ≤20 ms.

# On-grid System Layout




*PV AC coupling

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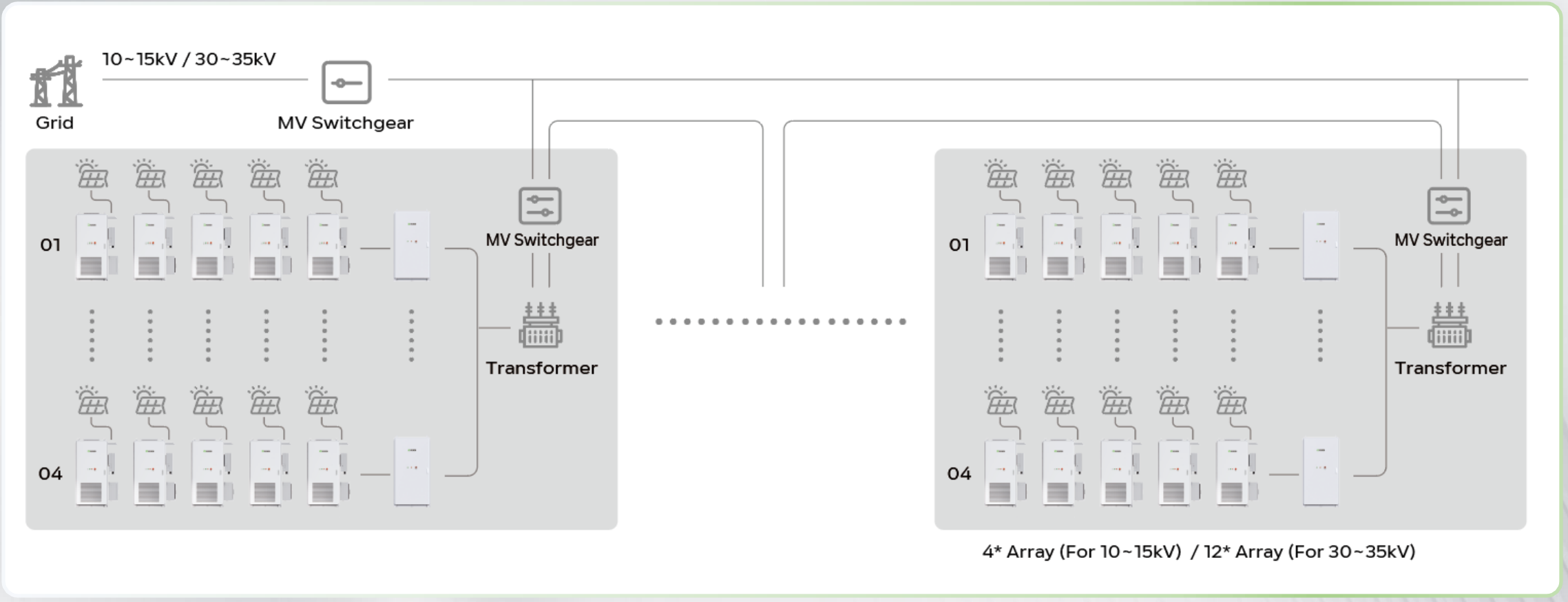



*PV DC coupling

# Installation & Deployment

**Reduce the tough installation worries— help customers realize the ease of installation and fast lead times**

### Transportation
Factory-assembled delivery in full container
Rapid on-site deployment

### Installation
Transformer, busbar, and AC parallel connection - ≤ 2 days - Electrical installation completed.

### Commissioning
EMS auto-recognition and self-check - 4 hours - Plug & play ready.


### Grid Connection
15 kV verification and protection testing - 1 day - Stable grid integration.

### Acceptance
Cloud access and system registration – Immediate - Online operation.

# Core Service Modules

**Less effort needed. Less cost. Less manpower. More trust.**

## Remote Monitoring

- 24/7 real-time data collection (1s sampling).
- 120+ indicators: voltage, current, power, temperature, SOC, alarms, etc.
- Web / Mobile / SCADA synchronized monitoring.
- Key equipment status uploaded to Cloud AI Engine in real time.

## Predictive Maintenance

- AI trend analysis provides 7–14 days early warning.
- Health (SoH) assessment & failure probability curves.
- ≥ 90% of maintenance tasks shifted to “planned maintenance.”
- Mean Time to Repair (MTTR) < 3 hours.

## On-Site Support

- Standard response time: ≤ 4h (urban) / ≤ 8h (remote).
- Three service types: installation & commissioning, routine inspection, emergency repair.
- FAE teams equipped with Renon Smart O&M Terminal + AI Diagnostic Assistant.
- Each site assigned a dedicated technical manager with service records.

## AI Self-Healing & Strategy Optimization

- Cabinet-level AI Agent detects anomalies and executes:
  1. Fault isolation → 2. Parameter reconstruction → 3. Grid reintegration.
- Self-healing success rate >95%, human intervention <5%.
- Cloud AI auto-optimizes dispatch strategy every 24 hours based on performance feedback.

## Lifecycle Management

- Digital Twin tracks cell/module degradation curves.
- Regular LCOE analysis and revenue reports.
- Supports OTA firmware updates and parameter tuning.
- Enables full lifecycle asset visibility & valuation.

## Emergency Response

- 3-tier emergency mechanism:
  Self-healing (≤ 30 s)  Remote intervention (≤ 1 h)  On-site support (≤ 8 h)
- Overall system availability ≥ 99.9%.

## Customer Enablement & Training

- Renon Cloud O&M Academy: remote training + virtual simulations.
- 100+ standard SOP videos & AI-guided manuals.“
- Customer Self-Maintenance + AI Guidance + HQ Review” 3-level system.

Renon Cloud O&M Center

“Renon Power makes energy simple, cost-effective, and low-maintenance — so you can save time, money, and manpower with confidence.

# Business Model

## Energy Investors / Operators

Clients seeking long-term and stable investment returns, typically involving large-scale energy storage deployment and operation.

## Aggregators / VPP

Companies managing multiple energy storage units, integrating and coordinating them for grid balancing and optimization.

## EPC Companies

**Engineering, Procurement, and Construction**

Companies responsible for the design, construction, and delivery of energy storage projects, often including long-term maintenance.

## End-Users

**Data Centers, Cold Chain Warehouses, etc.**

Large-scale customers requiring reliable power supply, particularly during peak electricity price periods.

## Energy Investors / Operators

### Models

- **Equity Partnership:** Joint investment, profit-sharing from grid services and price arbitrage.
- **Long-Term O&M Service:** Continuous monitoring and maintenance.
- **AI Optimization Sharing:** Revenue split from energy optimization gains.

### Highlights:

- Low risk, long-term ROI.
- Supports carbon-neutral projects.

## Aggregators / VPP

### Models

- **System Sales + Connection Fee.**
- **Revenue Sharing:** Profits from grid frequency & peak regulation.
- **AI Dispatch Service:** Subscription-based optimization.

### Highlights:

- Multi-device integration.
- Diverse income: sales, services, sharing.

## EPC Companies

### Models

- **Project Partnership:** System supply and integration support.
- **Turnkey Packages:** Equipment + installation + O&M.
- **Long-Term Service Contract.**

### Highlights:

- Value-added bundled delivery.
- Reliable O&M ensures stability.

## End-Users

### Models

- **Customized Sales:** Backup or load management systems.
- **TOU Arbitrage Sharing:** Profit from electricity price difference.
- **Value-Added Services:** Emergency power, black start.
- **Financing / Leasing Options.**

### Highlights:

- Flexible, low upfront cost.
- Stable power, optimized cost.

**RenonPower helps customers make money, save costs, and profit from energy price arbitrage through intelligent energy management.**

# The Distributed Energy Storage Cluster Project for Highway Service Areas

## Example Case

### Project Requirements and Pain Points

| Function Module | Core Pain Points | Demand Goals |
|---|---|---|
| Transportation Energy Operators | Peak load impact, high electricity prices, unstable charging pile power | Ensure stable fast charging during peak hours, reduce demand charges |
| Investors | Long cycle, uncertain returns | Modular deployment, ROI ≤ 5 years |
| Regulatory Authorities | Safety and fire compliance | Meet NFPA 855 + UL 9540 A dual certification |

### Project Configuration Plan

| Module | Configuration Parameters | Description |
|---|---|---|
| System Scale | 20 stations × (10MWh/5MW) = 200MWh/100MW | Distributed deployment, cloud-based aggregation |
| Product | 261 AC cabinets (261kWh/135kW, IP54) | 5 cabinets = 1 array, 8 arrays per station |
| Grid Voltage | 15kV Medium Voltage | Supports bidirectional energy flow |
| EMS Architecture | Cabinet → Array → Matrix → Site → Cloud EMS | Station-level EMS limit: 10MWh/5MW |
| Firefighting System | FK-5-1-12 gas fire suppression + ventilation system | Compliant with NFPA 855 requirements |

### Operation Strategy (EMS Dispatch Logic)

- AI Prediction: Predict load based on traffic flow, electricity prices, and temperature.
- Dynamic Dispatch: During peak hours, energy storage outputs 5MW for peak shaving, and automatically charges during off-peak periods.
- Event Response: Respond to Aggregator signals within 1 second.
- AI Revenue Feedback Loop: 24-hour rolling revenue prediction and strategy adjustment.
- O&M: AI self-healing > 95%, availability rate ≥ 99.9%.

### Business and Profit Model

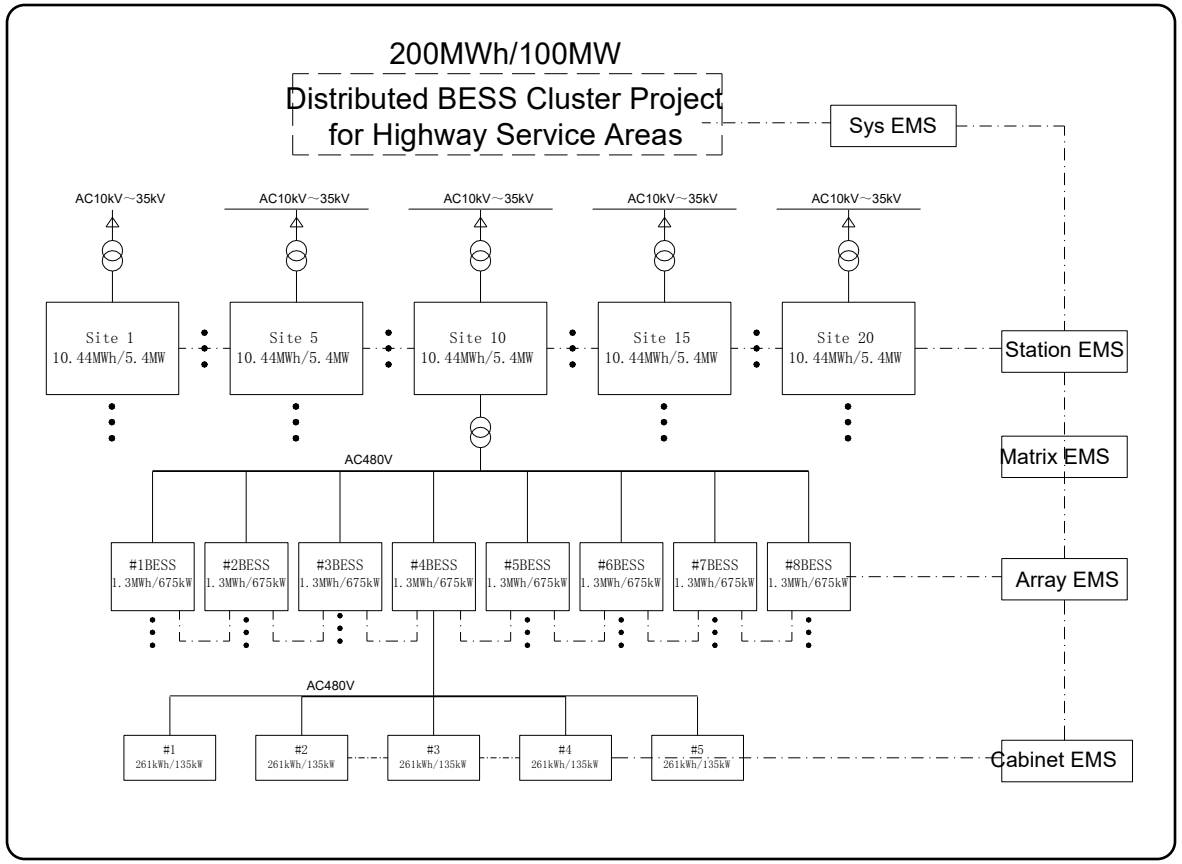
| Module | Investment Structure | Revenue Sources |
|---|---|---|
| EaaS Energy Leasing Model | Investor 70% + Operator 30% | Electricity price arbitrage + Peak shaving + Demand Response (DR) revenue |
| Revenue Sharing Ratio | Investor 70% + Operator 20% + Aggregator 10% | Monthly settlement (smart calculation by cloud-based EMS) |

### Revenue Analysis

| Indicator | Value | Description |
|---|---|---|
| Annual Peak Shaving Revenue | ≈120,000 USD per station | Demand charges reduced by over 40% |
| DR and Ancillary Services | ≈60,000 USD per station | Participation in ISO dispatch 30 times per year |
| Aggregation and Carbon Revenue | ≈30,000 USD per station | Carbon reduction of 320 $tCO_2e$ per year |
| Total Revenue | ≈210,000 USD per station | ROI ≈ 4.3 years, IRR ≈ 16% |

# The Distributed Energy Storage Cluster Project for Highway Service Areas

## Example Case



# Energy Storage System Network for a 5-Star Hotel Group

## Example Case

### Project Requirements and Pain Points

| Customer Type | Core Pain Points | Demand Goals |
|---|---|---|
| Hotel Group | High peak electricity costs, high backup power costs | Reduce operating electricity costs by >20% and ensure emergency power supply |
| Investment Company | Long payback period | Stable returns + Carbon asset monetization |
| Government and Fire Safety | Strict compliance requirements | Meet UL 9540 + NFPA 855 dual certification |

### Project Configuration Plan

| Module | Configuration Parameters | Description |
|---|---|---|
| System Scale | 30 hotels × 10MWh = 300MWh | 5MW per station, grid connection at 15kV. |
| Product | 40 cabinets per station (261 AC × 40) | station-level EMS integrated with building BAS. |
| EMS Architecture | Forecast electricity prices and load | dynamic dispatch of charging and discharging power. |
| Firefighting System | Zone-based FK-5-1-12 fire suppression + smoke detection linkage | system IP54, suitable for outdoor deployment. |

### Operation Strategy (EMS Dispatch Logic)

- Model: Peak shaving + TOU arbitrage + Emergency power supply + DR response.
- AI Control: Automatic switching between PV-BESS-Grid modes.
- Strategy: Peak shaving on weekdays, backup power on holidays + VPP response.
- O&M: Hotel O&M team remote monitoring + Cloud-based AI alarms.

### Business and Profit Model

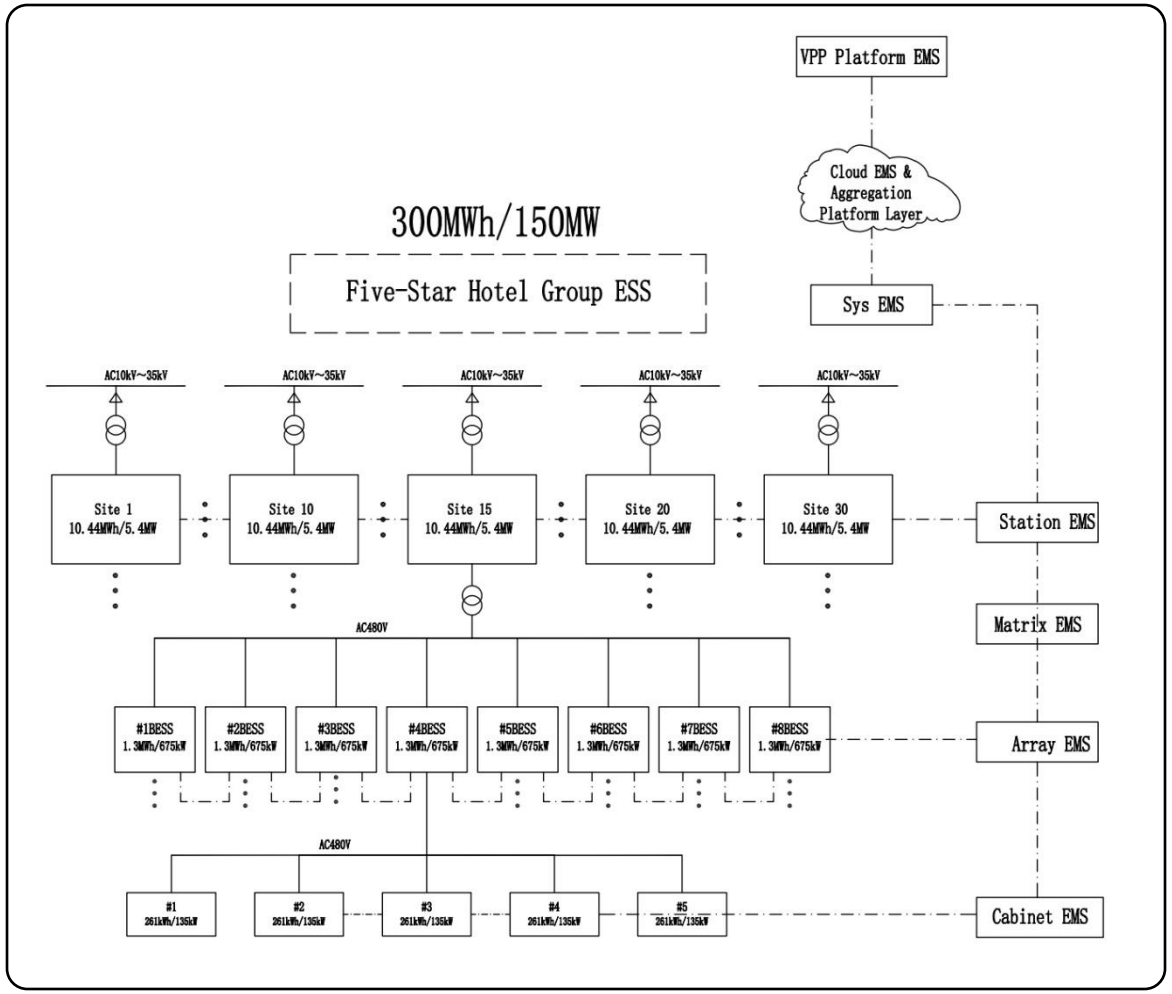
| Module | Investment Structure | Revenue Sources |
|---|---|---|
| JV Partnership Model | Investor 80% + Hotel Group 20% | Electricity cost savings + DR + ESG carbon credits |
| Revenue Distribution | Investor 70% + Hotel 20% + Renon AI Platform 10% | Quarterly revenue sharing settlement |

### Revenue Analysis

| Source | Amount | Percentage |
|---|---|---|
| Electricity Cost Savings | ≈115,000 USD | 52% |
| DR + Ancillary Services | ≈55,000 USD | 25% |
| Carbon Credits + ESG Brand Value | ≈25,000 USD | 12% |
| AI Optimization Gains | ≈20,000 USD | 11% |
| Total Annual Revenue | ≈215,000 USD per station | ROI ≈ 4.0 years, IRR ≈ 17% |

# Energy Storage System Network for a 5-Star Hotel Group

## Example Case



# MPack 261AS

AC Integrated Energy Storage System


## Product Features

**Value and essence of the product from the very first**

*The MPack 261AS Integrated Energy Storage System is a fully integrated unit designed for the global energy storage market, combining advanced liquid-cooled battery systems, bidirectional PCS, array-level EMS, and grid protection & monitoring. The system delivers plug-and-play functionality and instant benefits upon installation.*

| Function Module | Function Description | Customer Value |
|---|---|---|
| **Bidirectional Energy Management** | Automatically manages charge/discharge cycles (supports PV, grid, and off-grid operation) | Peak shaving / Energy arbitrage |
| **Liquid-Cooled Management System** | Dual-loop temperature control ±2 °C; extends battery life by 20%+ | Reduced maintenance costs |
| **Smart EMS Control** | Supports array/plant/cloud EMS coordination; AI forecasting | Automated dispatch, Optimal revenue |
| **Safety Protection** | Fire-Zone protection + 3-level BMS + dual redundancy for temperature and smoke sensors | UL 9540A grade safety |
| **Remote Monitoring** | Modbus TCP / MQTT / OpenADR communication + OTA upgrades | Remote operation, Zero on-site staffing |
| **Black Start Capability** | Seamless grid transfer < 50 ms | Emergency backup power, Microgrid operation |

RENON

Renewable | Reliable | Remarkable

# Product Value Highlights

**The ways Renon deals with industry pain points make our solutions the obvious choice.**

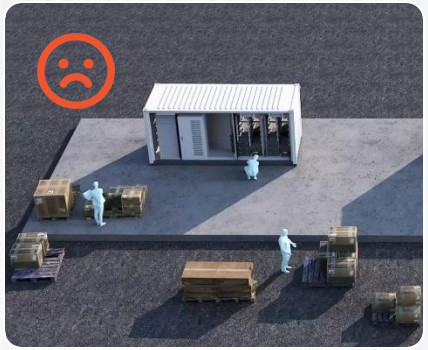
## Industry Pain Points vs. Renon Solutions

### High Electricity Costs


- Pain Point: Fluctuating electricity prices

- Renon Solution: AI forecasting + strategic discharge
- Customer Value: Save 30%+ on electricity bills

### Long Construction Period



- Pain Point: Complex on-site integration

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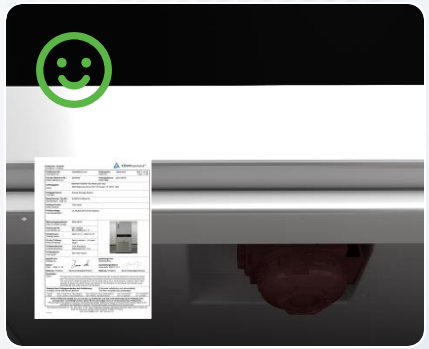
- Pain Point: Challenging safety certification and fire compliance



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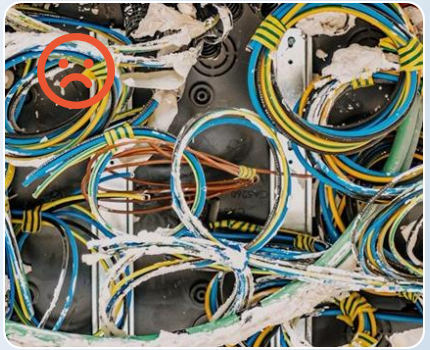
### Difficult O&M



- Pain Point: Labor-intensive maintenance and high costs

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- Customer Value: 60% lower O&M cost

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**Where to make profit. Where they save cost. Let them feel the value.**

| | | | | |
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|  | **C&I Parks** | Peak shaving + demand management | Reduce energy bills by 30%+ | ROI ≈ 4 years |
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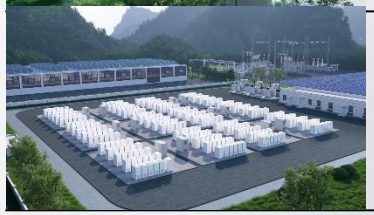
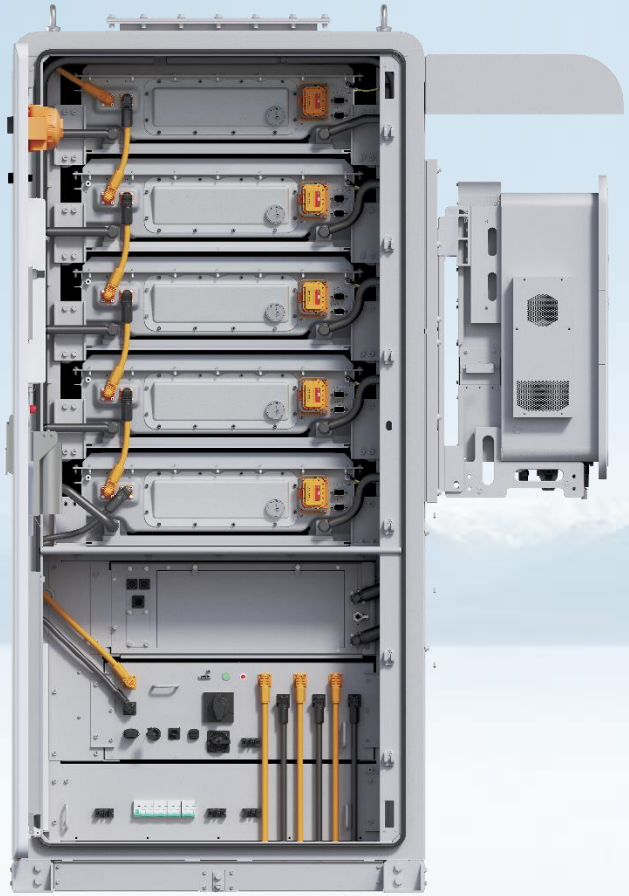
|  | **Microgrid Projects** | On/off-grid dual mode + aggregated control | Energy arbitrage + frequency revenue | Dual-layer profitability |

# MPack 261A

AC Distributed Energy Storage System



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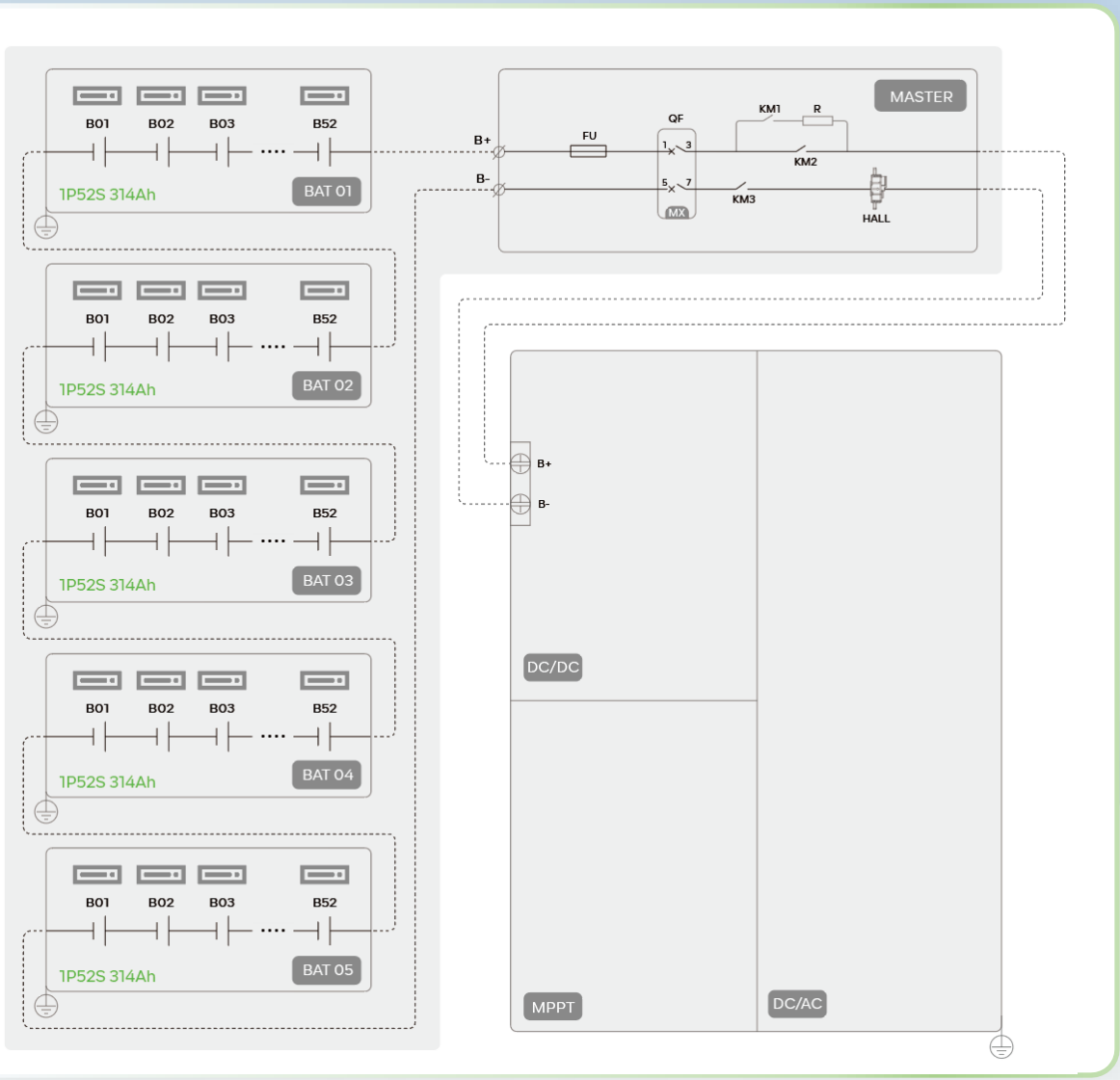

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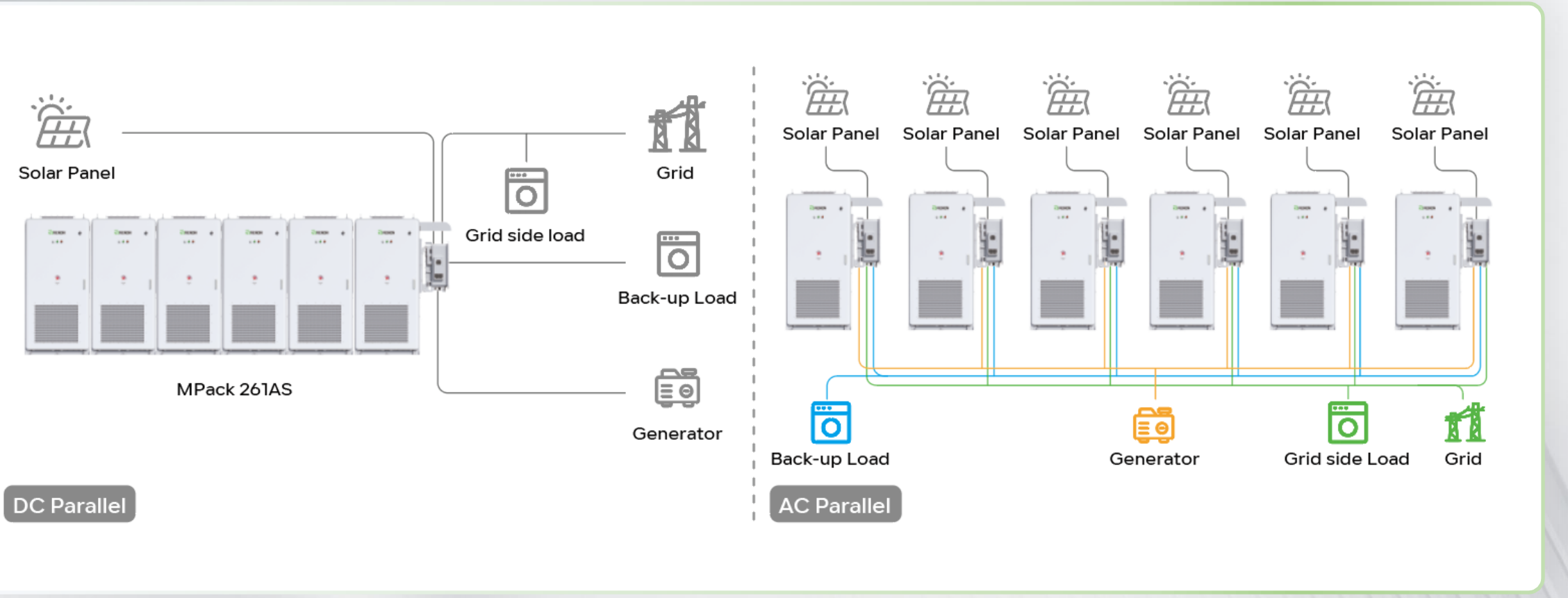

# Installation & Deployment

**Reduce the tough installation worries— help customers realize the ease of installation and fast lead times**

**Transportation**
Standard container size, supports land/sea shipping

**Installation**
Modular base + plug-in connectors

**Grid Commissioning**
EMS auto-recognition-4 hours-No manual setup

**Acceptance**
Remote acceptance + Cloud data up-InstantFull traceability

# Core Service Modules

**Less effort needed. Less cost. Less manpower. More trust.**

## Remote Monitoring

- 24/7 real-time data collection (1s sampling).
- 120+ indicators: voltage, current, power, temperature, SOC, alarms, etc.
- Web / Mobile / SCADA synchronized monitoring.
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- AI trend analysis provides 7–14 days early warning.
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- **Equity Partnership:** Joint investment, profit-sharing from grid services and price arbitrage.
- **Long-Term O&M Service:** Continuous monitoring and maintenance.
- **AI Optimization Sharing:** Revenue split from energy optimization gains.

### Highlights:

- Low risk, long-term ROI.
- Supports carbon-neutral projects.

## Aggregators / VPP

### Models

- **System Sales + Connection Fee.**
- **Revenue Sharing:** Profits from grid frequency & peak regulation.
- **AI Dispatch Service:** Subscription-based optimization.

### Highlights:

- Multi-device integration.
- Diverse income: sales, services, sharing.

## EPC Companies

### Models

- **Project Partnership:** System supply and integration support.
- **Turnkey Packages:** Equipment + installation + O&M.
- **Long-Term Service Contract.**

### Highlights:

- Value-added bundled delivery.
- Reliable O&M ensures stability.

## End-Users

### Models

- **Customized Sales:** Backup or load management systems.
- **TOU Arbitrage Sharing:** Profit from electricity price difference.
- **Value-Added Services:** Emergency power, black start.
- **Financing / Leasing Options.**

### Highlights:

- Flexible, low upfront cost.
- Stable power, optimized cost.

**RenonPower helps customers make money, save costs, and profit from energy price arbitrage through intelligent energy management.**

# Texas 60-Site Community Energy Demonstration Project

## Example Case

## Project Requirements

**Weak Grid and Frequent Power Outages**
A remote town (3,000–5,000 people) over 80 km from the nearest substation experiences 20–30 hours of power outages annually due to extreme weather. Key loads like clinics and gas stations lack reliable power.

**High Diesel Generation Costs and Pollution**
The town relies on 2–3 diesel generators as a backup power source, facing rising fuel and maintenance costs. Prolonged diesel use leads to noise and environmental pollution, impacting residents.

**Underutilization of Renewable Energy**
Despite good sunlight, the town's solar energy potential is limited due to lack of storage and scheduling, leading to instability in solar output and significant curtailment during peak periods.

**Microgrid with Grid-Connected/Off-Grid Capability**
The town aims to build a microgrid with solar, storage, diesel, and grid integration for daily grid connection, islanding during outages, and long-term integration with Aggregators/VPP for flexibility services.

## Project Plan and Configuration

- This project involves the deployment of standardized arrays based on the 261AS product across 60 communities, serving as the foundational configuration for community energy units:
- Standard Array Definition
- 6 × 261AS outdoor liquid-cooled battery cabinets (approximately 261 kWh per cabinet)
- 6 × 125 kW Solis energy storage inverters (AC parallel connection)
- → Forms one 261AS standardized array, creating a power-capacity unit of approximately 1.566 MWh / 750 kW.
- Grid Connection and Access
- Inverter side is connected in parallel to the community's 480 V AC low-voltage bus.
- Connected to the 15 kV medium-voltage node via a step-up transformer, ensuring compatibility with the local distribution network.
- Standardization Benefits
- All sites use identical array configurations, achieving high standardization in site surveys, equipment selection, construction commissioning, spare parts management, and strategy configuration.
- The cloud-based EMS models and schedules based on the "standard array" as the smallest logical unit, greatly simplifying multi-site aggregation and VPP integration.

## Project Objectives

- **Economic Objectives**
- Reduce overall community electricity costs by ≥ 25%.
- Lower demand charges and over-contract penalties by ≥ 50%.
- Control the static investment payback period to 4–6 years.

- **Reliability Objectives**
- Ensure key community loads have power availability of ≥ 99.9%.
- Reduce the number of high-impact power outages (>30 minutes) by ≥ 60% compared to pre-upgrade levels.

- **Standardization and Replicability Objectives**
- Establish a complete technical template with "261AS Standardized Array + Three-Level EMS Architecture + 15 kV Access".
- Ensure the ability for rapid replication across more communities and regions.

- **Platform and Market Integration Objectives**
- Develop a unified platform with cloud-based EMS, aggregation platform, and VPP capabilities.
- Lay the foundation for connecting more sites, power markets, and external VPPs for direct reuse.

## Project Evaluation

**Technology and Architecture Evaluation**
The architecture of "261AS-based standardized arrays + three-level EMS + cloud-based all-in-one platform" has shown stable performance across 60 sites in continuous operation.
The ≤10 ms grid connection/disconnection switching, site autonomy, and predictive maintenance have significantly improved community power reliability and equipment availability.

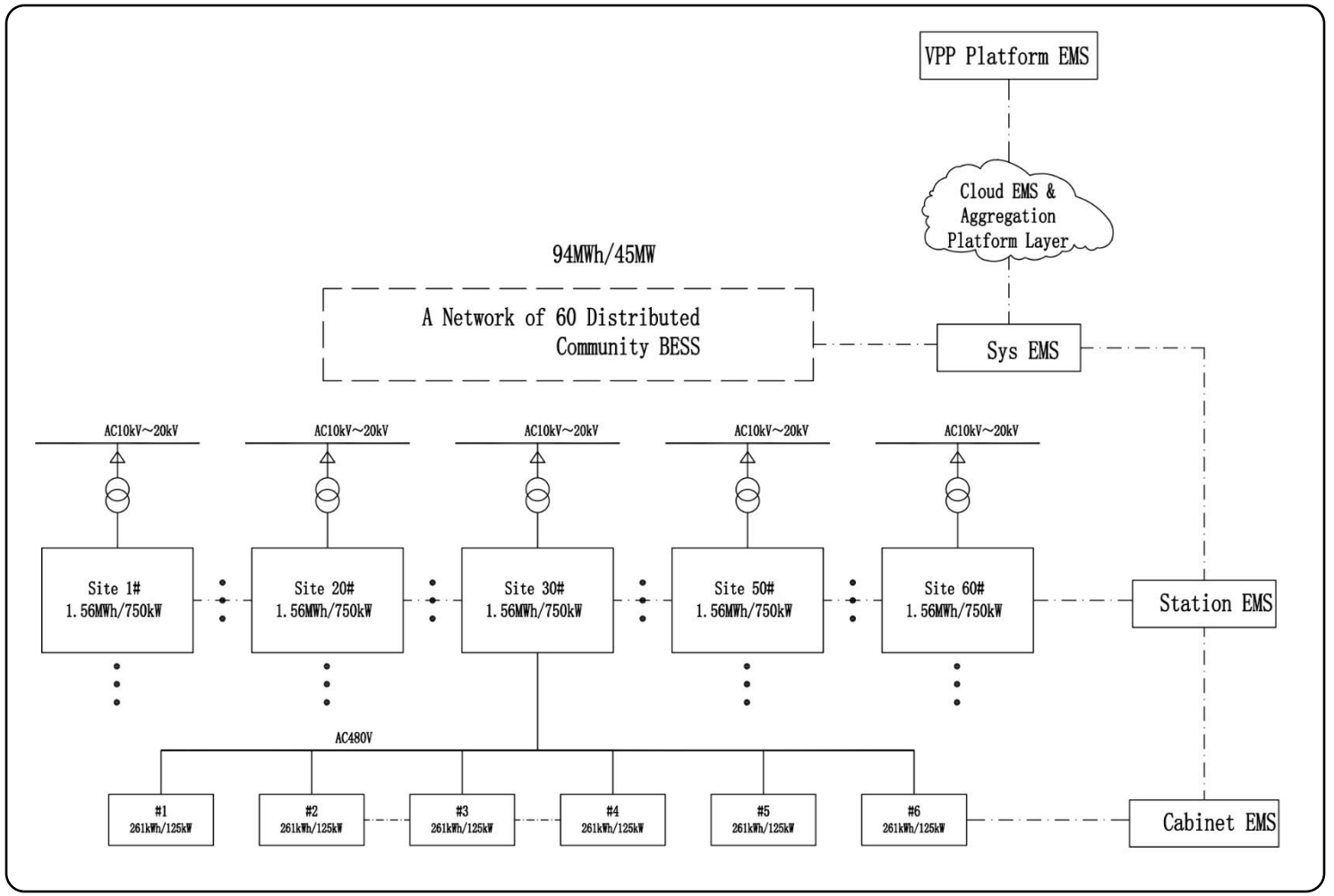
**Operation and Maintenance Evaluation**
The operation and maintenance model has shifted from "individual site inspections" to "centralized monitoring + scheduled maintenance," significantly improving efficiency and safety.
The average Mean Time to Repair (MTTR) has been notably shortened, and unplanned downtime has significantly decreased.

**Commercial and Market Evaluation**
The project has proven that, under Texas's electricity pricing and grid conditions, community energy storage + standardized arrays + three-level EMS architecture forms a clear commercial loop.
The cloud-based EMS integrates EMS, aggregation, and VPP capabilities, providing a unified platform foundation for future site expansion and participation in more markets.

**Replicability and Promotion Value**
Technically: As long as the load structure and distribution network conditions are similar, this project can serve as a direct template for community energy projects in other states.
Commercially: By focusing on electricity cost savings and reliability improvements as the "base return," and VPP and power market participation as the "growth flexibility," the project forms an investment structure that is both capital-acceptable and scalable for sustainability.

# Texas 60-Site Community Energy Demonstration Project

## Example Case



# Virtual Power Plant (VPP) in North American

## Example Case

### Project Requirements

**Complex Electricity Pricing and High Costs**
Industrial users in states like California and Texas face high peak rates, demand charges, and additional fees, making traditional single-site energy efficiency upgrades ineffective for overall cost reduction.

**Wide User Distribution and Limited Site Scale**
Many medium-sized users (1–5 MW loads) cannot participate directly in electricity markets or ancillary services with individual energy storage solutions.

**Need for Controllable VPP Resources**
As ISO/RTOs open DR, capacity markets, and ancillary services, they require resources that are predictable, schedulable, and measurable with clear capacity and power limits.

**Lack of Standardized Asset Units**
Current projects have inconsistent site configurations, making VPP modeling complex and increasing operational risks. A standardized hardware and EMS solution is needed for unified, schedulable VPP units.

### Project Plan and Configuration

**Deployment of Standardized 261AS Arrays**
This project uses the 261AS standardized array as the base asset for the VPP. Each array consists of 6 × 261AS outdoor liquid-cooled battery cabinets (261 kWh each) and 6 × 125 kW Solis inverters. The array has a capacity of ≈ 1.566 MWh and power of ≈ 750 kW, with grid access via a 15 kV medium-voltage node and 480 V AC low-voltage bus.

**Site Types and Configuration**
The project includes 30 sites, with medium-sized sites (1–3 MW load) using 1 array, and large sites (3–6 MW load) using 2 arrays. This results in 40 arrays total, providing ≈ 62.64 MWh capacity and 30 MW power, managed as a unified VPP resource pool.

**EMS and VPP Platform Architecture**
Each site has a local EMS that handles peak shaving, demand management, and backup strategies, with islanding capability during grid disturbances. A project-level EMS manages multiple sites across regions, while the cloud-based EMS aggregates data from all sites, forecasts market signals, and generates unified scheduling plans. The VPP platform can integrate with external markets and Aggregators for DR, capacity, and ancillary services.

**External Interfaces and Third-Party Platform Integration**
The cloud EMS provides an open API for integration with third-party platforms, exposing data on available capacity, power, and performance. It enables the 261AS resource pool to be accessed by power retailers, Aggregators, and ISO/RTO markets as a VPP asset.

### Project Objectives

**Revenue Targets**
Reduce electricity costs by ≥ 20–25% through peak shaving, demand management, and TOU optimization. Participation in DR, capacity markets, and ancillary services will boost overall asset IRR.

**Controllable and Adjustable Targets**
Meet market requirements for response speed, minimum capacity, and duration:
DR Events: Achieve target output within 10–30 minutes.
Ancillary Services: Provide minute-level or faster responses.

**Platform and Expansion Goals**
Develop a unified cloud-based EMS and VPP platform, enabling seamless integration of more 261AS arrays and additional resources like solar, EV chargers, and controllable loads.

### Project Evaluation

**Technology and Architecture Evaluation**
Using 261AS standardized arrays simplified multi-site integration, and the cloud EMS platform combines EMS, aggregation, and VPP scheduling, reducing platform fragmentation.

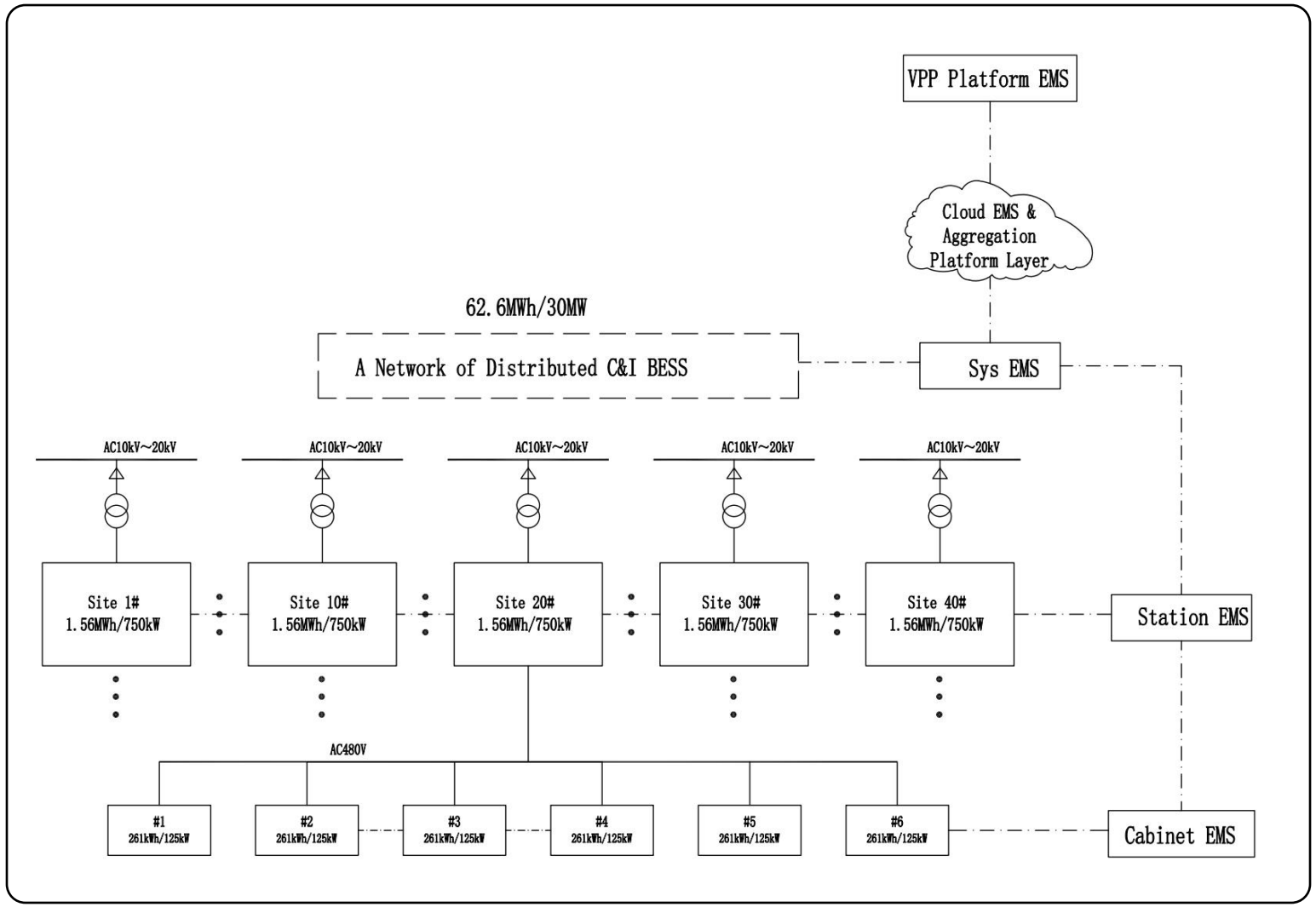
**Operation and Maintenance Evaluation**
Multi-site scheduling and operations are managed on a single platform, lowering collaboration costs. Predictive maintenance and unified version management minimize technical and performance risks.

**Business Model and Market Evaluation**
The project combines site cost savings and system market revenue, offering higher returns than traditional energy-saving projects and turning commercial users into tradable energy assets.

**Replicability and Promotion Value**
The project can be replicated in other regions by adjusting to local pricing and regulations. The platform can integrate more 261AS arrays and other resources, creating a scalable C&I VPP solution.

# Virtual Power Plant (VPP) in North American

## Example Case



# North American Remote Community Microgrid Demonstration Case

## Example Case

## Project Requirements

- High Electricity Costs：Summer peak load due to air conditioning, commercial loads, and charging stations, leading to high electricity prices and demand charges (30–35% of some community bills).
- Unstable Power Supply Due to Extreme Weather：Extreme weather (blizzards, heatwaves, tornadoes) causes voltage fluctuations and power outages, with key loads like clinics and small businesses lacking stable backup power.
- Challenges in Distributed Energy Integration：Communities have rooftop solar and fast-charging stations but lack unified scheduling and energy storage to balance peak loads, with grid companies cautious about new load connections.
- Lack of Standardized Aggregatable Assets：The owner seeks to package community energy storage into a unified resource pool for aggregation, scheduling, and participation in DR, capacity markets, and ancillary services.

## Project Plan and Configuration

**Based on 261AS Standardized Microgrid Arrays**
This project uses the 261AS standardized array as the energy storage unit for the microgrid. The configuration includes 6 × 261AS liquid-cooled battery cabinets and 6 × 125 kW Solis inverters, creating a power-capacity unit of approximately 1.566 MWh and 750 kW. The system connects to the 480 V AC bus and interfaces with the 15 kV medium-voltage grid via a step-up transformer.

**Microgrid Site Configuration (Example)**
The site configuration includes 2 × 261AS arrays (3.132 MWh, 1.5 MW), approximately 2.5 MWp of ground-mounted and rooftop solar, and 2 × 1.0 MW diesel generators for backup. The system can operate in grid-connected or off-grid mode. It is managed by a site-level EMS and a cloud-based EMS platform, which also supports aggregation and VPP integration.

**EMS and Control Strategy**
The site-level EMS monitors real-time performance, prioritizing solar power usage and storing excess energy. It switches to island mode within ≤10 ms during grid failures and optimizes energy costs through peak-valley arbitrage. The cloud-based EMS forecasts load, solar output, and prices, and manages the entire system remotely. It supports aggregation and VPP capabilities, allowing the system to participate in demand response and ancillary services.

## Project Objectives

**Supply Reliability**
Ensure ≥ 99.9% power availability for critical loads during extreme weather or grid failures and reduce high-impact outages (>30 minutes) by ≥ 70%.

**Economic**
Cut diesel usage by ≥ 40% annually and lower the Levelized Cost of Energy (LCOE), with a project payback period of 5–7 years.

**Green and Environmental**
Maximize solar self-consumption, reduce $CO_2$ emissions, and support local sustainability and emission reduction goals.

**Platform and Expansion**
Develop a model project for interconnecting with nearby microgrids and commercial sites, while gathering data for future integration with Aggregator/VPP platforms.

## Project Evaluation

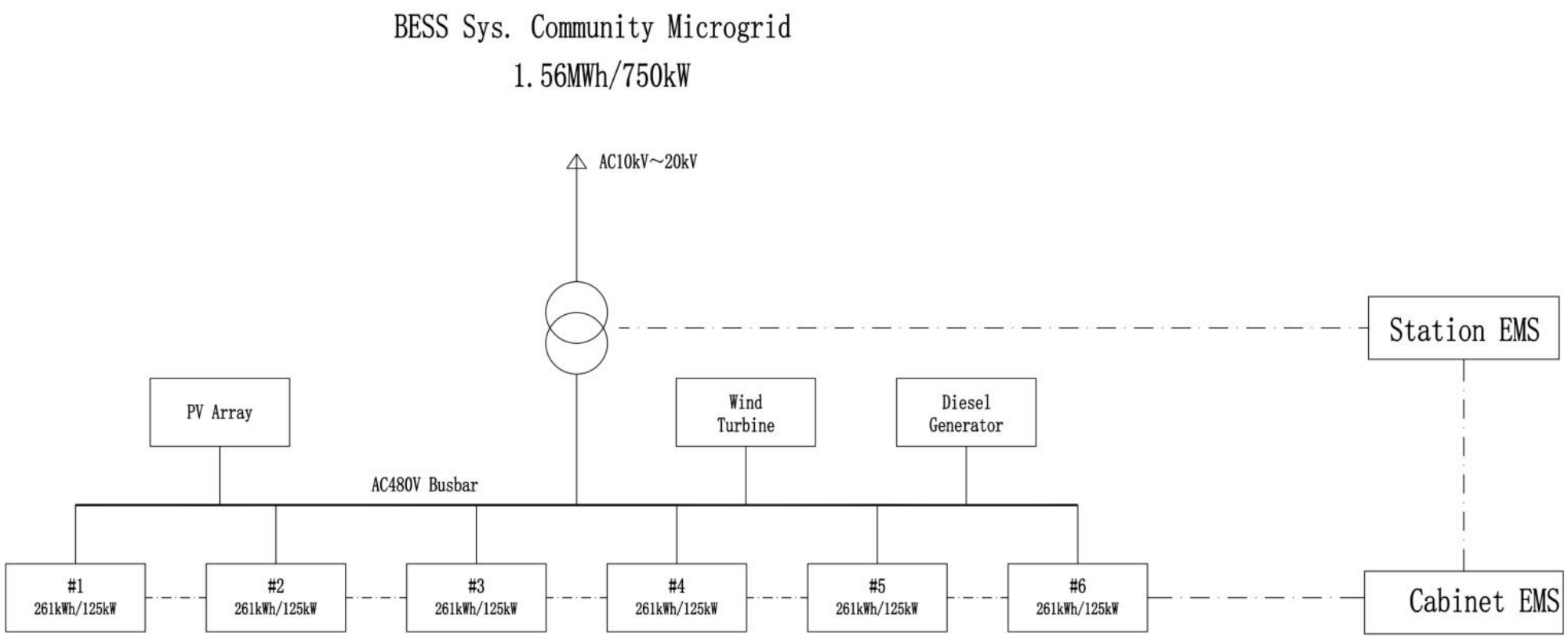
**Direct Economic Benefits**
Fuel Cost Savings: By using solar and 261AS storage, diesel generator hours are reduced, saving on fuel, transport, and maintenance costs.
Electricity Purchase Optimization: In areas with favorable pricing, buying electricity during off-peak hours and using storage for peak shaving lowers overall purchase costs.

**Indirect Benefits**
Avoided Losses: Prevents commercial losses due to outages, like food spoilage and communication disruptions.
Policy and Brand Benefits: Increases renewable energy use, supporting local emissions reduction and enhancing the brand's green image, while possibly qualifying for energy transition incentives or tax breaks.

**Medium to Long-Term VPP/Market Benefits**
VPP/DR Participation: Involvement in VPP or DR programs can yield capacity compensation and additional service fees for peak shaving and frequency regulation.
Additional Revenue: Beyond cost savings, VPP integration offers a new revenue stream for both the town and investors.

# North American Remote Community Microgrid Demonstration Case

**Example Case**



# Smart Matrix A

10 ft AC Integrated ESS

Combiner Cabinet

Communication Cabinet

## Product Features

**Value and essence of the product from the very first**

*A globally deployable C&I storage module combining liquid-cooled batteries, bidirectional PCS, array-level EMS, and built-in protection — ready to run upon delivery, profitable upon connection.*

| Function Module | Function Description | Customer Value |
|---|---|---|
| **Bidirectional Energy Management** | Automated charge/discharge scheduling (PV-coupled, grid-tied, islanding) | Energy arbitrage / peak shaving |
| **Liquid Cooling System** | Dual-loop thermal control ±2 °C; +20% battery life | Lower maintenance cost |
| **Intelligent EMS Control** | Supports array / plant / cloud EMS; AI forecasting | Automated dispatch, maximum revenue |
| **Safety Architecture** | Fire-Zone partitions + 3-level BMS + dual smoke/temp redundancy | UL 9540A-grade safety |
| **Remote Monitoring** | Modbus TCP / MQTT / Open, ADR + OTA upgrades | Remote O&M, zero on-site staffing |
| **Black Start Capability** | Seamless on/off-grid switching < 50 ms | Backup power / microgrid operation |

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# Product Value Highlights

**The ways Renon deals with industry pain points make our solutions the obvious choice.**

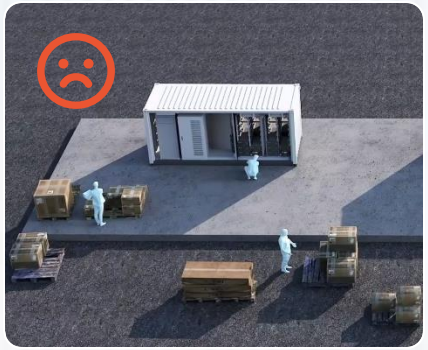
## Industry Pain Points vs. Renon Solutions

### High Electricity Costs


- Pain Point: High C&I tariffs, large peak-valley gaps

- Renon Solution: AI forecasting + discharge strategy
- Customer Value: Annual return > 20%

### Long Construction Period



- Pain Point: Complex on-site integration

- Renon Solution: Factory-prefabricated delivery
- Customer Value: On-site installation in 48 hours

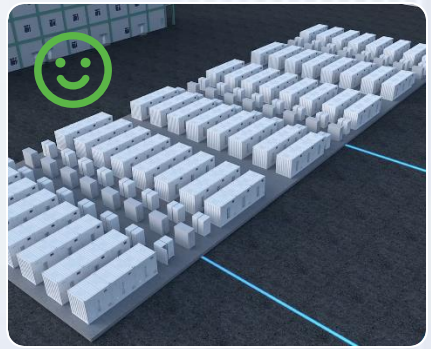
### Harsh Temperature Environments

- Pain Point: Harsh temperature environments

- Renon Solution: Liquid cooling + adaptive air cooling
- Customer Value: +2 years battery life

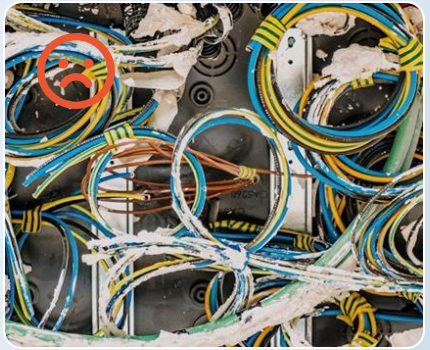
### Complex Grid Connection

- Pain Point: Complicated interconnection processes



- Renon Solution: Built-in 15 kV / 35 kV protection logic
- Customer Value: 5–8% CAPEX reduction

### Difficult O&M

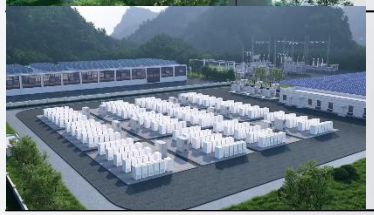


- Pain Point: Labor-intensive maintenance and high costs

- Renon Solution: Cloud EMS + AI self-healing
- Customer Value: 60% lower O&M cost

# Application Scenarios

**Profitability, Cost Savings, & Residual Value**

| | | | | |
|---|---|---|---|---|
|  | **C&I Parks** | Peak shaving + demand management | Reduce energy bills by 30%+ | ROI ≈ 4 years |
|   | **Cold Chain Warehouses** | PV + storage coupling + backup supply | Improve temperature stability | Cut energy use by 12% |
|  | **Public Charging Stations** | Integrated storage + charging + power balancing | Reduce grid expansion investment | Peak demand ↓ 25% |
|  | **Commercial Complexes** | Peak shaving + frequency regulation | Avoid load penalties | Better load balancing |
|  | **Microgrid Projects** | On/off-grid dual mode + aggregated control | Energy arbitrage + frequency revenue | Dual-layer profitability |

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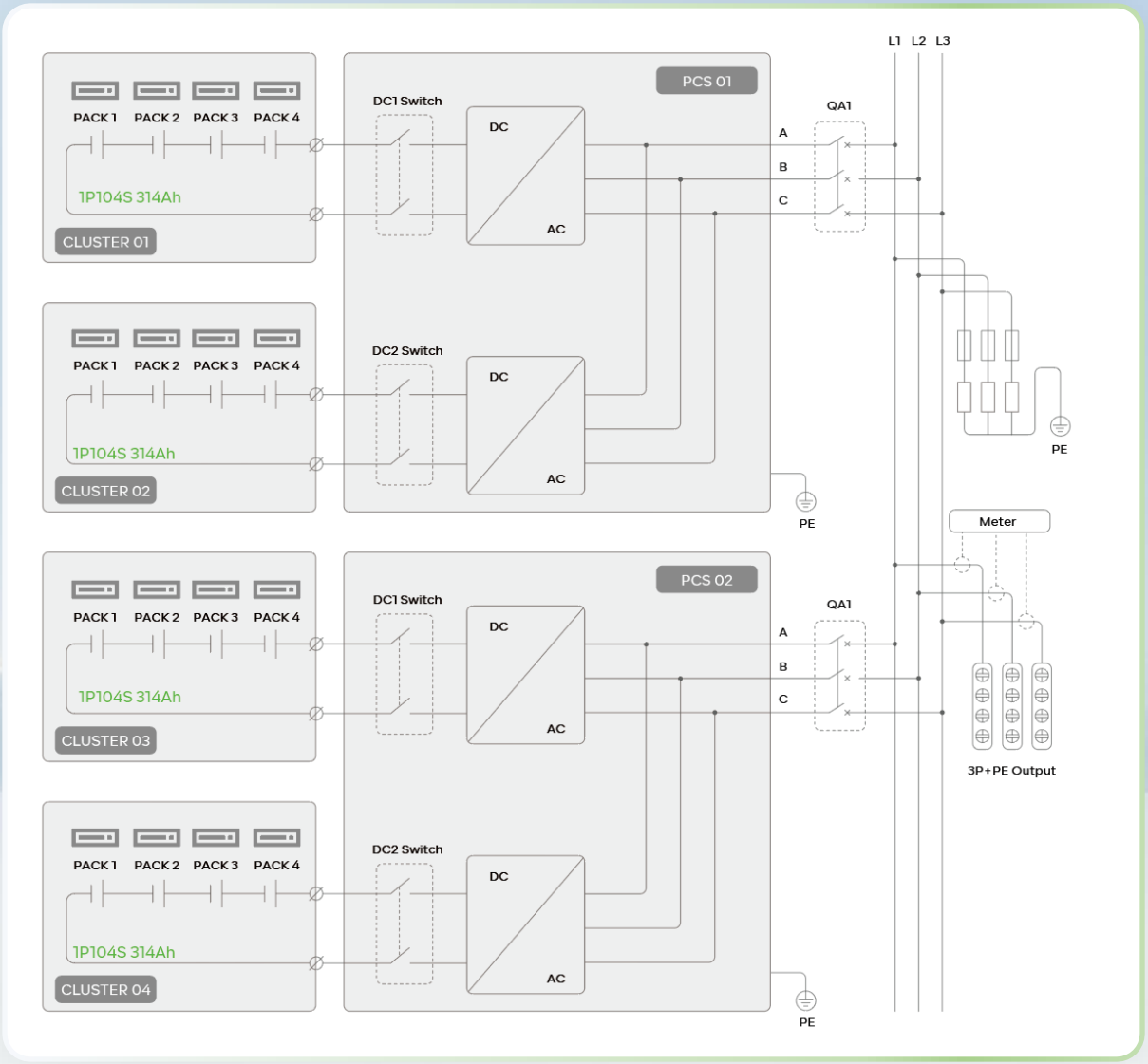
# Smart Matrix A

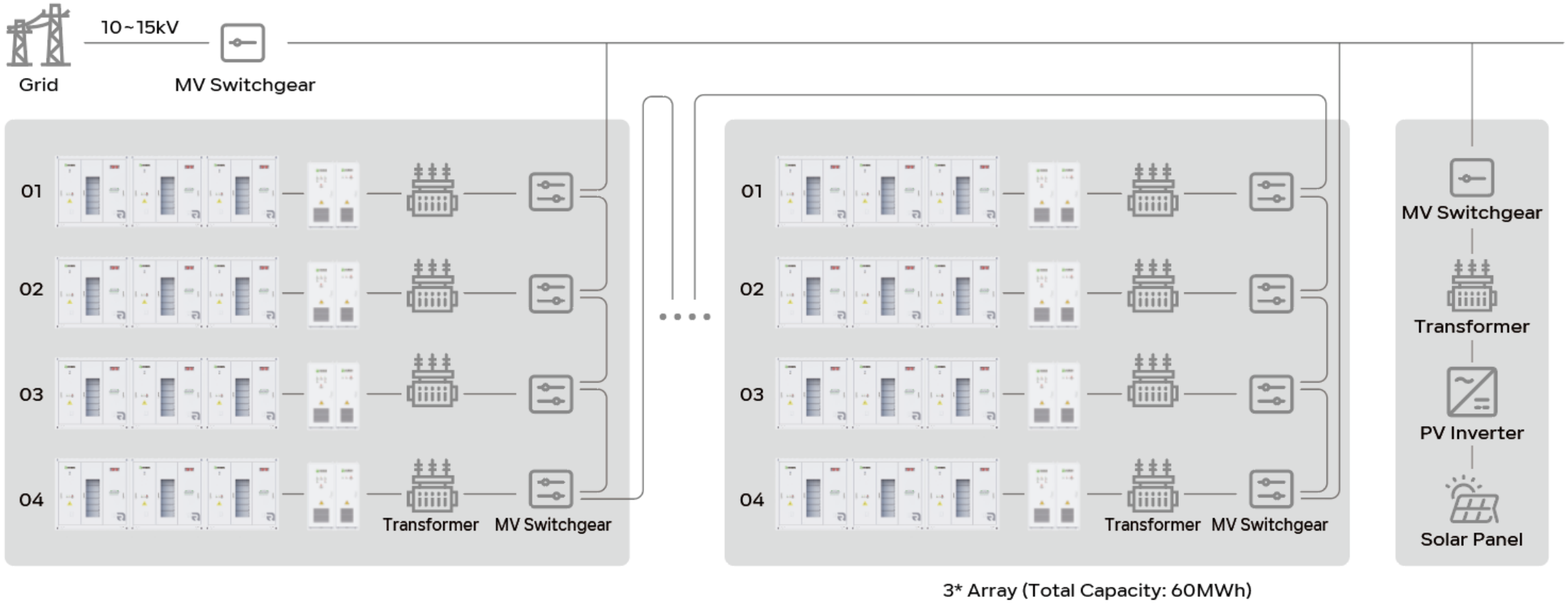
10 ft AC Integrated ESS

## Product Topology

**Clear structure. Clear configuration. Clear connection.**



# System Layout



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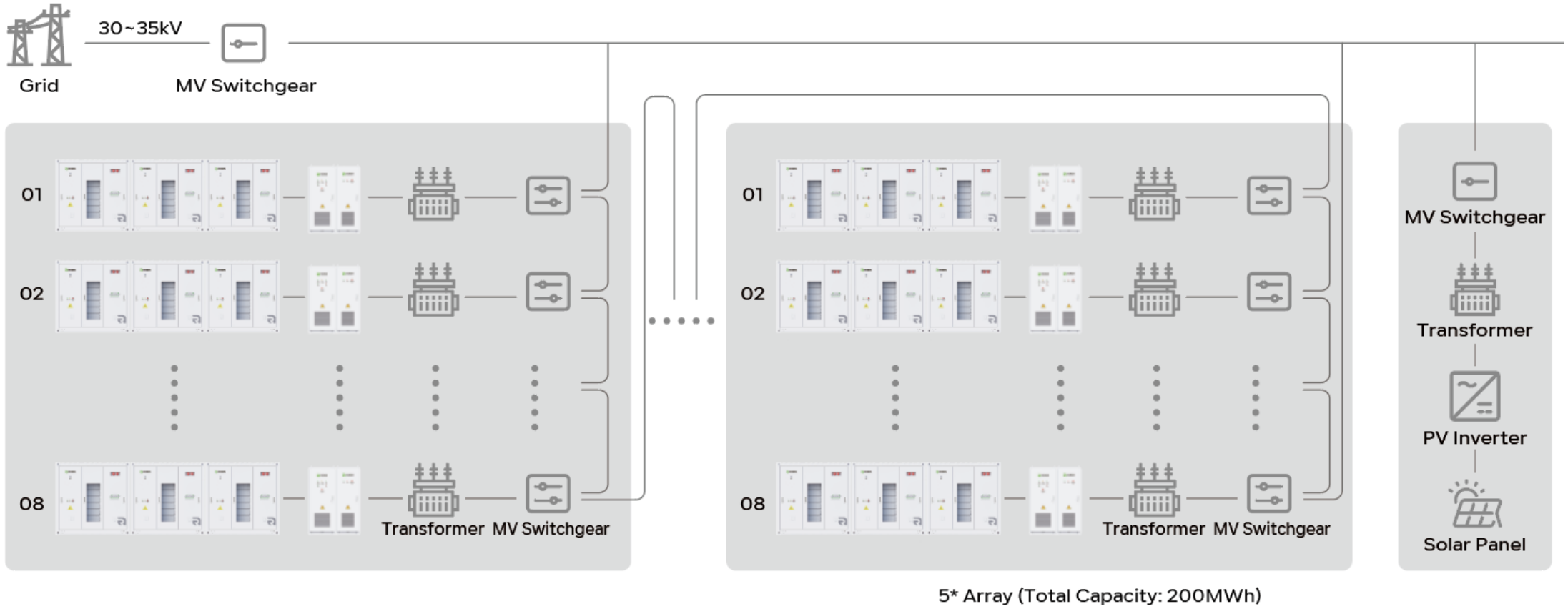

# Installation & Deployment

**Simplified Installations with fast lead times**

**Transportation**
Standard container size, supports land/sea

**Installation**
Modular base + plug-in connectors

**Grid Commissioning**
EMS auto-recognition-4 hours-No manual setup

**Acceptance**
Remote acceptance + Cloud data up-InstantFull traceability

# Core Service Modules

**Less effort needed. Less cost. Less manpower. More trust.**

## Remote Monitoring

- 24/7 real-time data collection (1s sampling).
- 120+ indicators: voltage, current, power, temperature, SOC, alarms, etc.
- Web / Mobile / SCADA synchronized monitoring.
- Key equipment status uploaded to Cloud AI Engine in real time.

## Predictive Maintenance

- AI trend analysis provides 7–14 days early warning.
- Health (SoH) assessment & failure probability curves.
- ≥ 90% of maintenance tasks shifted to “planned maintenance.”
- Mean Time to Repair (MTTR) < 3 hours.

## On-Site Support

- Standard response time: ≤ 4h (urban) / ≤ 8h (remote).
- Three service types: installation & commissioning, routine inspection, emergency repair.
- FAE teams equipped with Renon Smart O&M Terminal + AI Diagnostic Assistant.
- Each site assigned a dedicated technical manager with service records.

## AI Self-Healing & Strategy Optimization

- Cabinet-level AI Agent detects anomalies and executes:
  1. Fault isolation → 2. Parameter reconstruction → 3. Grid reintegration.
- Self-healing success rate >95%, human intervention <5%.
- Cloud AI auto-optimizes dispatch strategy every 24 hours based on performance feedback.

## Lifecycle Management

- Digital Twin tracks cell/module degradation curves.
- Regular LCOE analysis and revenue reports.
- Supports OTA firmware updates and parameter tuning.
- Enables full lifecycle asset visibility & valuation.

## Emergency Response

- 3-tier emergency mechanism:
  Self-healing (≤ 30 s)  Remote intervention (≤ 1 h)  On-site support (≤ 8 h)
- Overall system availability ≥ 99.9%.

## Customer Enablement & Training

- Renon Cloud O&M Academy: remote training + virtual simulations.
- 100+ standard SOP videos & AI-guided manuals.“
- Customer Self-Maintenance + AI Guidance + HQ Review” 3-level system.

Renon Cloud O&M Center

“Renon Power makes energy simple, cost-effective, and low-maintenance — so you can save time, money, and manpower with confidence.

# Business Model

## Energy Investors / Operators

Clients seeking long-term and stable investment returns, typically involving large-scale energy storage deployment and operation.

## Aggregators / VPP

Companies managing multiple energy storage units, integrating and coordinating them for grid balancing and optimization.

## EPC Companies

**Engineering, Procurement, and Construction**

Companies responsible for the design, construction, and delivery of energy storage projects, often including long-term maintenance.

## End-Users

**Data Centers, Cold Chain Warehouses, etc.**

Large-scale customers requiring reliable power supply, particularly during peak electricity price periods.

## Energy Investors / Operators

### Models

- **Equity Partnership:** Joint investment, profit-sharing from grid services and price arbitrage.
- **Long-Term O&M Service:** Continuous monitoring and maintenance.
- **AI Optimization Sharing:** Revenue split from energy optimization gains.

### Highlights:

- Low risk, long-term ROI.
- Supports carbon-neutral projects.

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### Models

- **System Sales + Connection Fee.**
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- Multi-device integration.
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- **Project Partnership:** System supply and integration support.
- **Turnkey Packages:** Equipment + installation + O&M.
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### Highlights:

- Value-added bundled delivery.
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### Models

- **Customized Sales:** Backup or load management systems.
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- **Value-Added Services:** Emergency power, black start.
- **Financing / Leasing Options.**

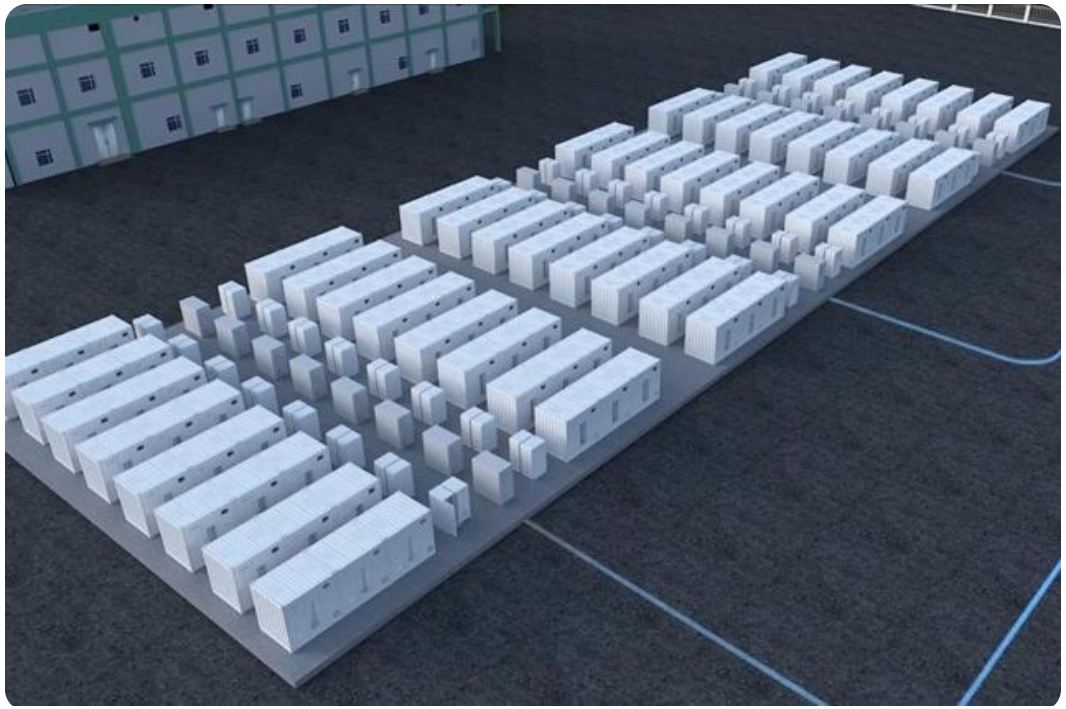
### Highlights:

- Flexible, low upfront cost.
- Stable power, optimized cost.

**RenonPower helps customers make money, save costs, and profit from energy price arbitrage through intelligent energy management.**

# Energy Investment Project – 400MWh/200MW Distributed VPP System

## Example Case



### Project Overview

- Project Type: Multi-site distributed energy storage + cloud-based VPP + Aggregator collaboration
- Project Scale: 400MWh/200MW (20 sites, each 10MWh/5MW)
- Construction Period: 6 months (modular + prefabricated deployment)
- EMS Structure: Cabinet-level EMS → Station-level EMS → Project-level EMS → Cloud-based VPP platform
- Communication Method: Fiber optic IEC 61850 + MQTT + REST API, interfacing with ISO/RTO markets

### Needs & Pain Points

- North American Peak Electricity Price Difference > 0.3 USD/kWh, requiring cross-site unified peak shaving arbitrage.
- Grid Response is Slow and Lacks Flexibility, requiring a 200MW rapid dispatch energy storage network.
- Traditional ROI > 6 years, with an excessively long payback period.
- Project Requirements: Full-chain compliance with UL 9540, NFPA 855, and FEOC standards.

### System Configuration

| Level | Composition | Description |
|---|---|---|
| Cabinet Level | 10ft AC liquid-cooled cabinets × 3 per array | Includes 1.67MWh liquid-cooled battery, 830kW PCS, cabinet-level EMS, independent fire safety/critical environment systems |
| Array Level | 3 cabinets + 1 communication cabinet + 1 AC distribution cabinet | Forms one array unit |
| Station Level | 8 arrays per station × 10 stations | Each station has 1 station-level EMS server |
| Project Level | High-performance EMS server × 1 | Fiber optic interconnection for 10 stations × 8 arrays |
| Cloud | Renon Aggregator Cloud | AI scheduling, revenue analysis, and carbon credit calculation |

### Business Model

- Investment Structure：Energy investment company 80% + Aggregator 20%
- Operation Model：EaaS (Energy as a Service) + Aggregator revenue sharing + Carbon credit trading
- Revenue Structure: Peak-valley arbitrage 40% / Frequency regulation & DR 27% / Capacity leasing 15% / Carbon revenue 10% / Platform profit sharing 8%
- Contract Duration：15-year PPA model + Aggregator profit-sharing settlement mechanism

### Profit Model

- Indicator: Total Investment (Pre-tax) Value: 92M USD Description: Including construction, installation, certification, etc.
- Indicator: Tax Incentives (IRA 30% + FEOC 10%) Value: 36.8M USD Description: After tax, the net investment is ≈55.2M USD.
- Indicator: Annual Revenue Value: 21.5M USD Description: AI scheduling + aggregator revenue (tax included).
- Indicator: Annual Net Cash Flow Value: 14.2M USD Description: OPEX reduced by 20%.
- Indicator: IRR Value: 16.2% Description: ↑0.8 pp vs V3.0.
- Indicator: ROI (10 years) Value: 198% Description: Long-term sustainability.
- Indicator: Payback Period Value: 3.7 years Description: Meets the <4-year target.
- Indicator: DSCR Value: 1.65 Description: Eligible for A-level financing.

### Investment Return Highlights

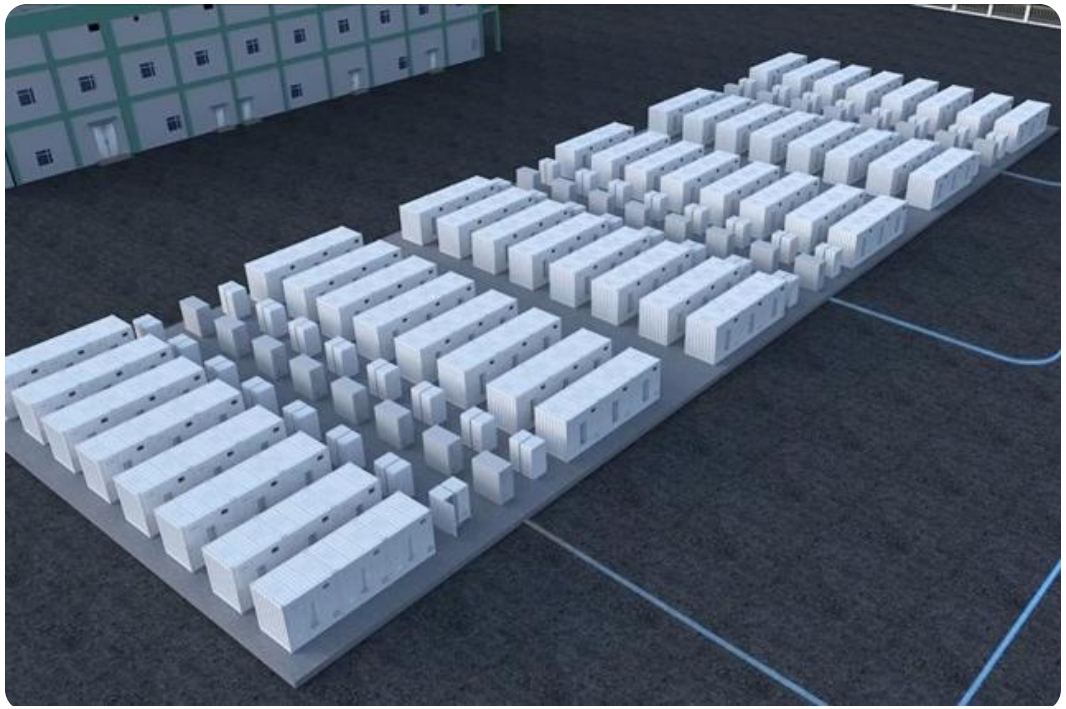
- AI prediction scheduling + cross-site collaboration increase revenue by approximately 13%.
- OPEX reduced by approximately 20%, with average availability exceeding 99.5%.
- Stable revenue from both peak-valley arbitrage and DR dual-market participation.
- Carbon assets generate approximately 2.2M USD per year.
- Project IRR remains stable above 16%, ensuring long-term cash flow security.

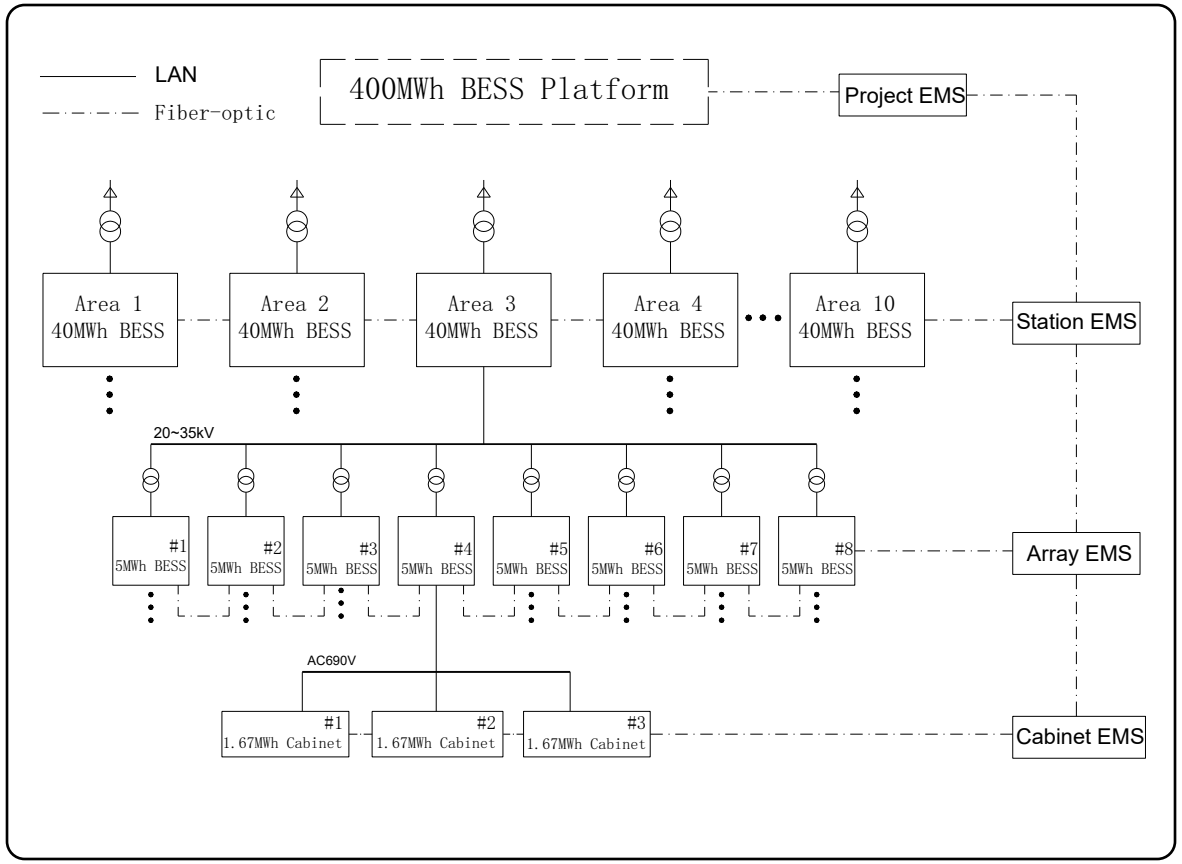
### Evaluation

| Indicator | Composition | Description |
|---|---|---|
| Technology Maturity | 9.6 | Liquid cooling + AI EMS system stability |
| Investment Attractiveness | 9.4 | Payback period < 4 years |
| Compliance and Safety | 10.0 | UL9540/NFPA 855/FEOC certification |
| Replicability | 9.6 | Modular deployment |
| Overall Rating | A+ | High return × High safety × Scalable replication |

# Energy Investment Project – 400MWh/200MW Distributed VPP System

## Example Case





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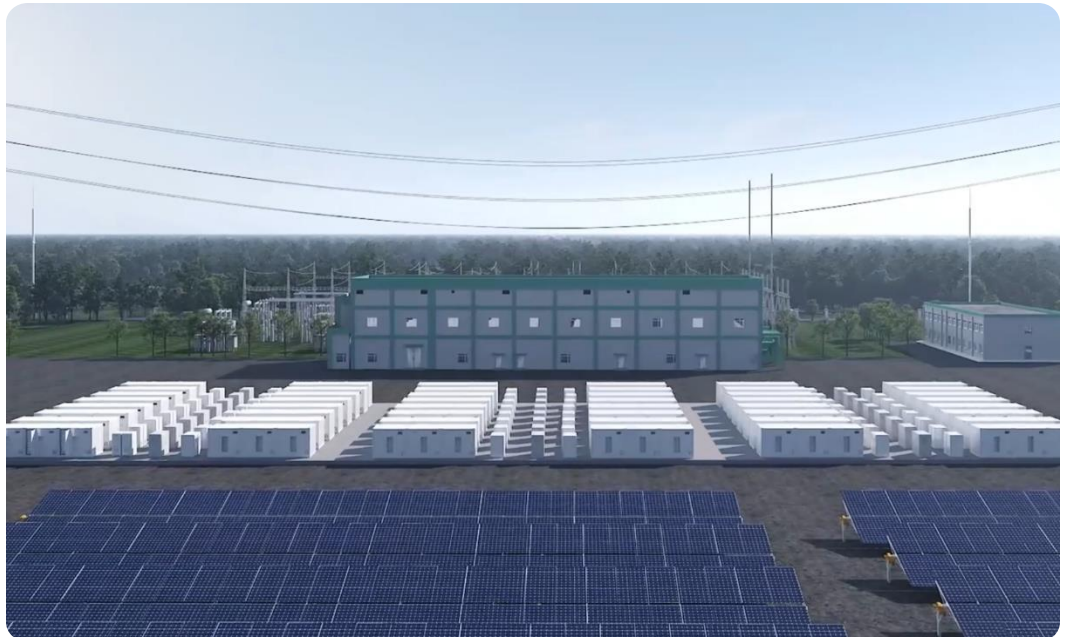
# Community Energy Project 300MWh/150MW Multi-Site VPP System

## Example Case



## Project Overview

- Type: Community distributed energy network + VPP aggregation + cloud-based Aggregator scheduling
- Scale: 300MWh/150MW (60 stations)
- Deployment Period: 8 months
- Control Structure: Cabinet level → Site level → Project level → Cloud
- Scheduling Interface: IEC 61850 + MQTT + OpenADR 2.0b

## Needs & Pain Points

- Community load is discrete, and solar output fluctuates significantly → AI-based unified prediction and balancing is required.
- Large number of sites → High maintenance costs with traditional manual operations.
- Microgrid ROI is relatively long → VPP aggregation and carbon revenue are introduced to improve returns.
- Strict compliance requirements: UL9540/9540A, NFPA 855, IEEE1547, FEOC.

## System Configuration

| Level | Composition | Description |
|---|---|---|
| Cabinet Level | 10ft AC liquid-cooled cabinets × 3 | 1.67MWh + 830kW PCS + cabinet-level EMS + fire safety/critical environment monitoring |
| Site Level | AC distribution cabinet (with built-in site-level EMS) + communication cabinet | Centralized management of site power, temperature control, and alarms |
| Project Level | High-performance EMS server × 1 | Unified management of 60 sites; fiber optic interconnection |
| Cloud Aggregator | Renon VPP Platform | Revenue aggregation + carbon trading + AI optimization scheduling |

## Business Model

- Investment Structure: Joint venture operation between community energy developers and Renon Power
- Operation Model: PPA + EaaS + Aggregated revenue + Carbon credit trading
- Revenue Structure: Arbitrage 35% / Aggregated frequency regulation & DR 25% / Capacity leasing 20% / Carbon 10% / Platform 10%
- Contract Duration: 10–15 years

## Profit Model

| Indicator | Value | Description |
|---|---|---|
| Total Investment (CAPEX + Initial OPEX) | ≈72M USD | Modular construction + certification |
| Tax Incentives (IRA 30% + FEOC 10%) | ≈28.8M USD | After tax, net investment ≈43.2M USD |
| Annual Revenue | 162M USD | AI + aggregator revenue (tax included) |
| Annual Net Cash Flow | 9.6M USD | OPEX reduced by 20% |
| IRR | 14.9% | Stable returns |
| ROI (10 years) | 182% | Sustainable |
| Payback Period | ≈4.0 years | Eligible for financing |

## Investment Return Highlights

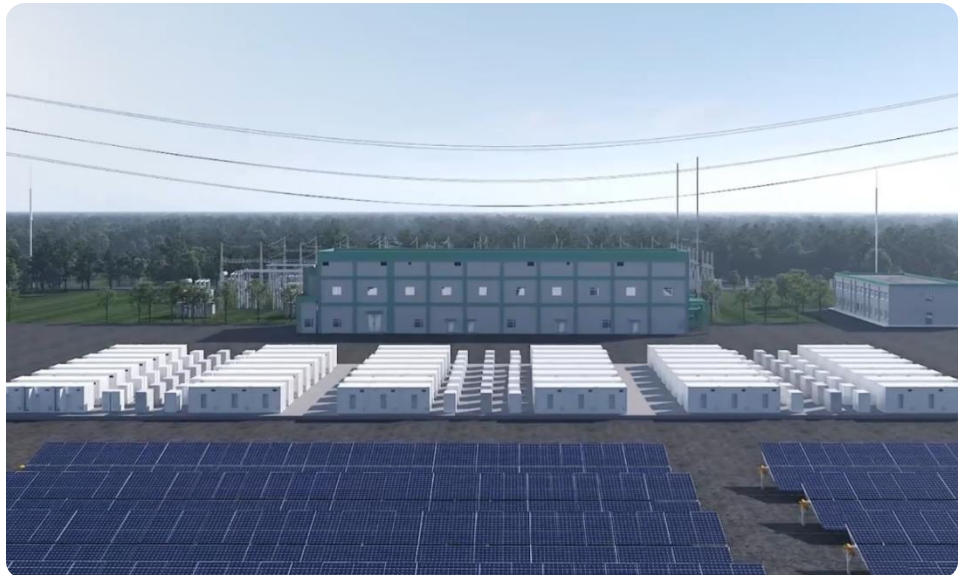
- AI Prediction Accuracy ≤ 3%, Response Time ≤ 1.5s
- VPP Aggregation increases revenue by approximately 10–12%
- AI Remote Operation & Maintenance reduces manual labor by approximately 40%
- OPEX Reduction by approximately 20%; System availability ≥ 99.4%
- Carbon Revenue ≈ 1.5M USD per year

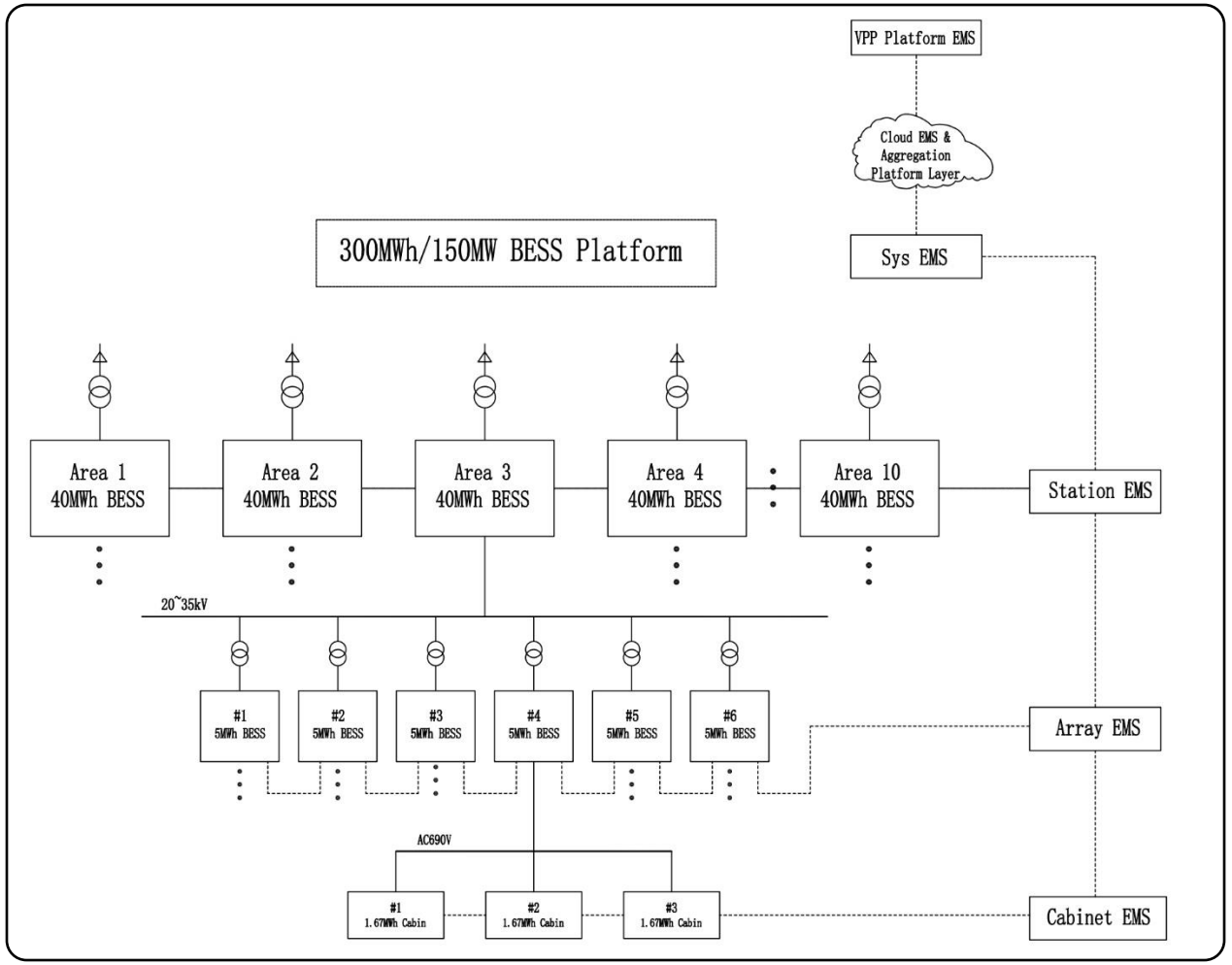
## Evaluation

| Indicator | Score (Out of 10) | Description |
|---|---|---|
| Technology Maturity | 9.5 | 10ft AC cabinets + distributed EMS system |
| Intelligence | 9.6 | AI prediction + VPP scheduling |
| Revenue Stability | 9.2 | Diversified revenue sources |
| Compliance | 10.0 | UL/NFPA/FEOC certification |
| Overall Rating | A+ | High return × High replicability × Community-friendly |

# Community Energy Project
# 300MWh/150MW Multi-Site VPP System

## Example Case





Commercial & industrial

# Installation Cases

Renon Power's global installations of microgrid systems enhance energy efficiency and sustainability, providing reliable power solutions for diverse commercial and industrial applications.

C&I Solutions

# 233kWh MPack AC Solution

## Pennsylvania, USA

Renon MPack **233kWh**

AC Power **125kW**

RENON
RENON POWER

C&I Solutions

# 233kWh MPack Solution

## Niederösterreich, Austria

MPack 233A*5 (1.165MWh)

Yunt PCS **625kW**

C&I Solutions

# 215kWh ECube DC Solution

## Utsunomiya, Japan

Renon ECube 215D

DC Power **215kWh*27**

PV PCS **49.5KW *27**

PV: **2400KW**

# CONTACT US [Renon Power]

We're here to help you power a sustainable future. For more information about our products and services or to discuss your energy storage needs, please get in touch.

www.renonpower.com

@renonpower

## ADDRESS

North America

**Renon Power USA, LLC**
**580 McIntyre Rd. McKinney, TX 75071**

Netherlands

**Renon Power Technology B.V.**
**Rietbaan 10, 2908 LP Capelle aan den IJssel**

Japan

**Renon Power CO., Ltd**
**5F VORT hakozaki, 20-5 Nihonbashihakozakichō, Chuo City Tokyo 103-0015, Japan**

**EMAIL**
info@renonpower.com

**PHONE**
US: +1 (833) RENON-US +1 (833) 736-6687
EU: +31 (152) 402-905