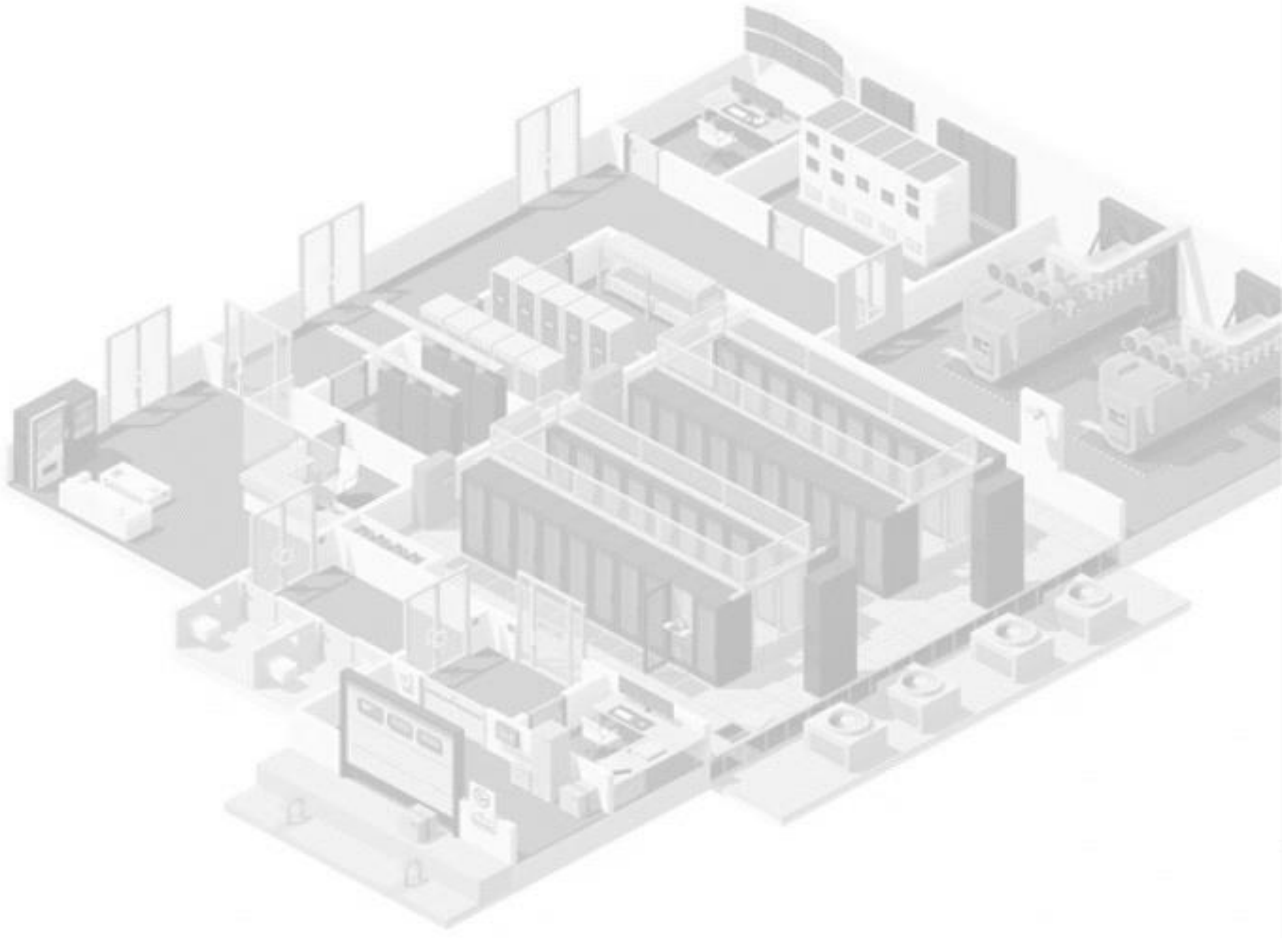
MODULAR

Powered by GENEXIS + RENOZ ENERGY



Hybrid Power System

for critical infrastructure

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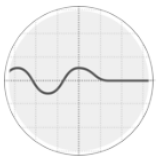
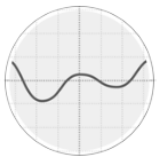
Common power issues affecting Power System



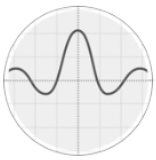
AC BLACKOUT

A total loss of utility power occurring for more than 2 cycle.



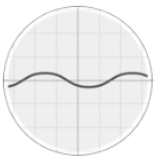
POWER SAG

Short-term low voltage caused by starting inrush current of large equipment, utility switching, or a temporary overload.



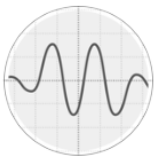
VOLTAGE SURGE

Short-term high voltage above 110% of nominal for several cycles.



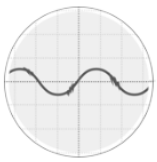
BROWNOUT

Long-term reduced line voltage for an extended period of a few minutes to a few days.



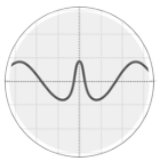
OVERVOLTAGE

Extended periods of increased line voltage ranging from a few minutes to a few days.



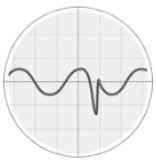
NORMAL MODE NOISE

High frequency electrical waveform between line (L) and neutral (N) caused by RFI or EMI interference.



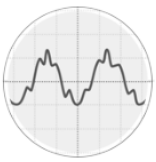
FREQUENCY VARIATION

Frequency change from nominal 60Hz or 50Hz. Operation from engine generators can produce frequency variations.



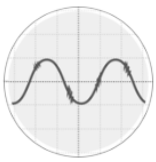
SWITCHING TRANSIENT

Fast high voltage spike with very short duration time.



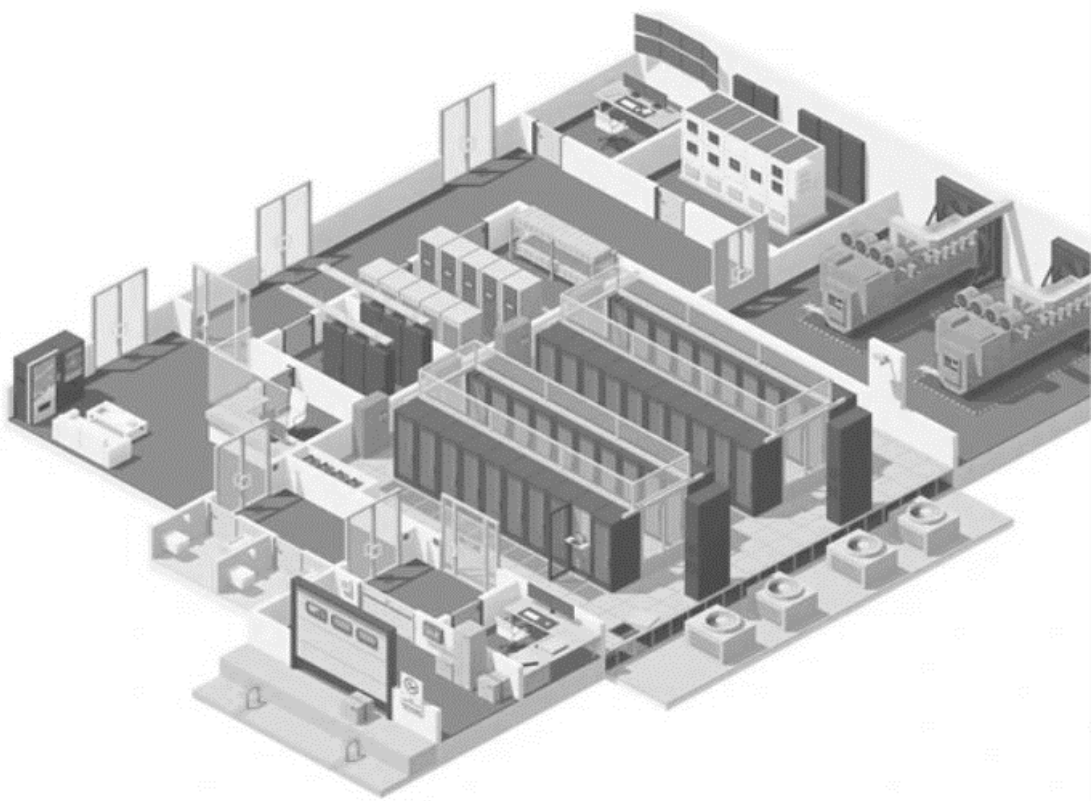
HARMONIC DISTORTION

Distortion of the normal waveform generally caused by nonlinear loads such as rectifiers, switch mode power supplies, and variable frequency drives.

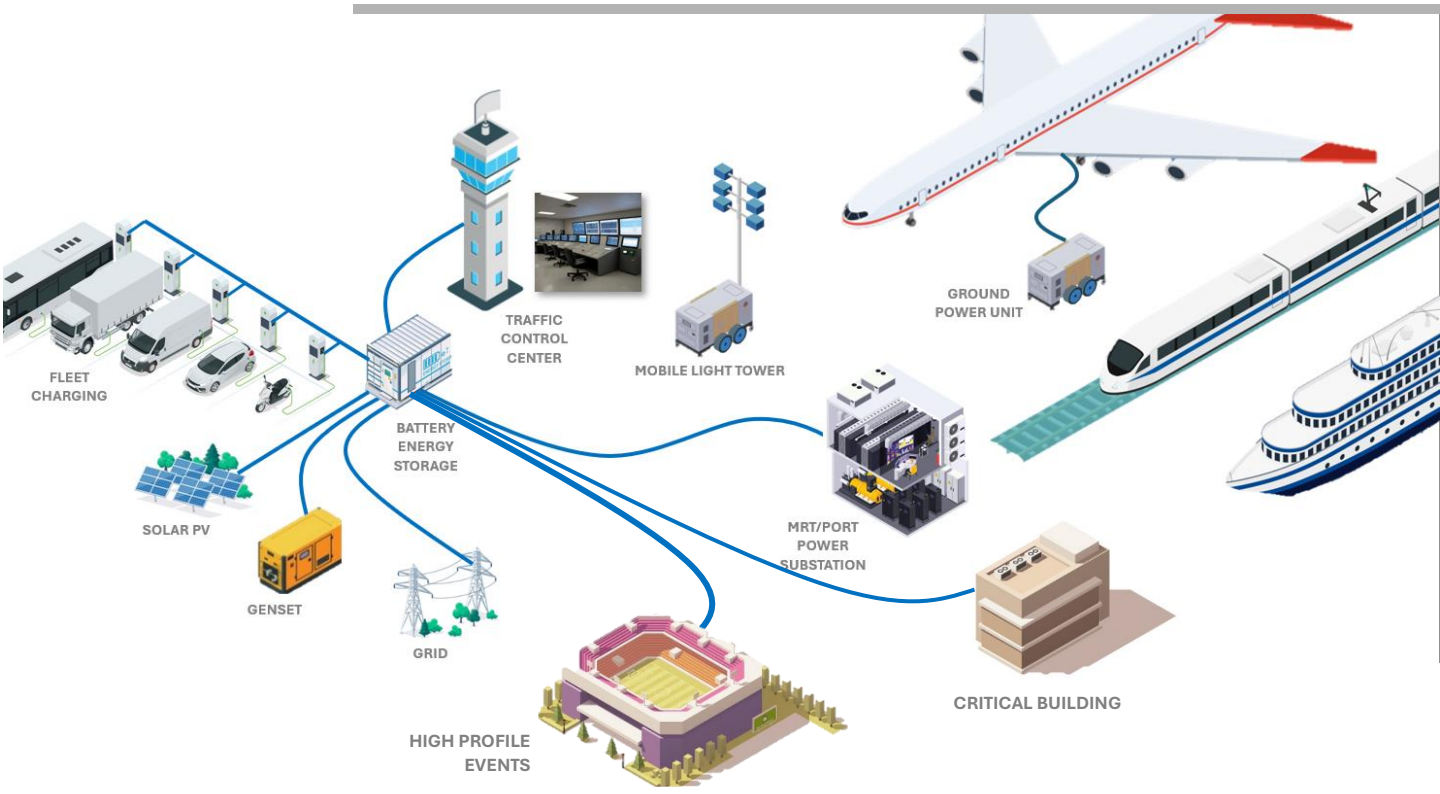


COMMON MODE NOISE

Electrical Interference that is measured between ground and either neutral (N) or line (L) of a typical AC power line.



Solution for Critical Infrastructure



MODULAR ENERGY

Uninterruptible Power & Backup Quality

Power Conditioning System (PCS) in a data center safeguards sensitive equipment from issues with the incoming electrical supply. Integration with Battery Energy Storage (BESS), allows greater enhancement, more resistance to even deep power disturbance, brownout, or blackout. Integration of PCS+BESS forms Advanced UPS functionality

Cost Saving

- Load Shifting. PCS can control BESS to store energy in cheaper low demand and use it during peak demand higher cost period. Saving Opex
- Peak shaving. PCS + BESS can act as buffering for onsite genset and DRUPS. Allowing engineering to size them down for average demand calculation instead of peak demand. SavingCapex

Integration with Onsite Renewable

BESS & PCS can intelligently manage intermittency of onsite renewable generation e.g Solar PV or Wind, allowing low cost & green energy and improving carbon footprint.

Grid Stabilization Support

Data Center power consumption, with its high demand and sometimes uneven may strain the grid. PCS & BESS can help to mage such condition in-bound and even out-bound if permittable by regulation.

MODULAR ENERGY

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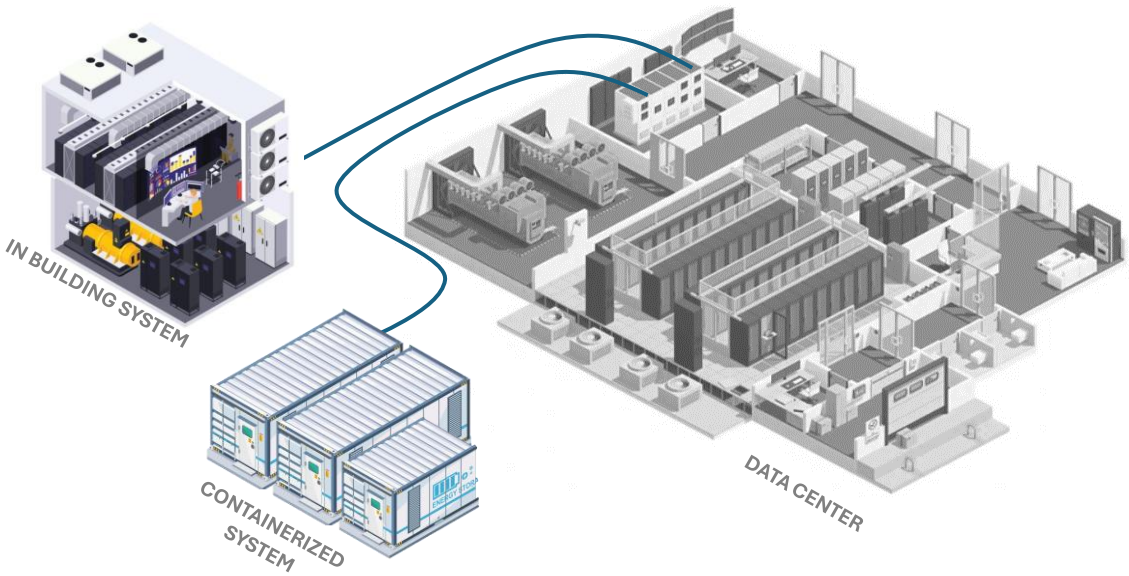
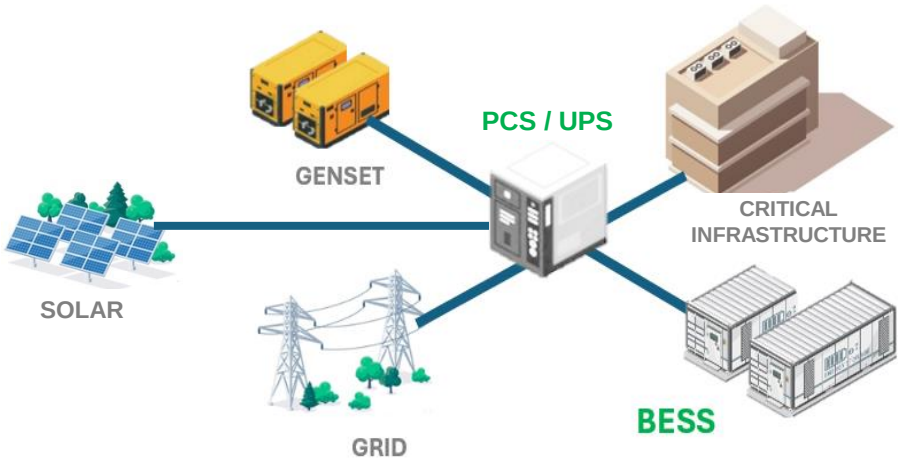


Hybrid Power System
for critical infrastructure



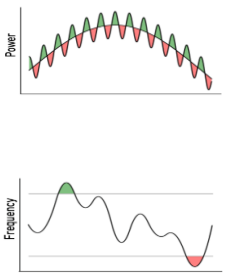
Hybrid power system, combining uninterruptible power supplies (UPS) or power conditioning systems (PCS), battery energy storage systems (BESS), and distributed generation (DG), offers a robust solution to address power issues. This integrated approach leverages the strengths of each component to provide reliable, efficient, and sustainable power supply.

UPS and PCS ensure clean and stable power for critical loads, while BESS stores excess energy from DG or the grid for later use, allowing possibility to lower power cost. DG, such as solar PV, wind power, or engine generator can supplement the grid and mitigate possibility of power outage. By working together, these components combines resilient power system that can withstand disruptions and provide reliable power even in challenging conditions.

Persistent Power Quality

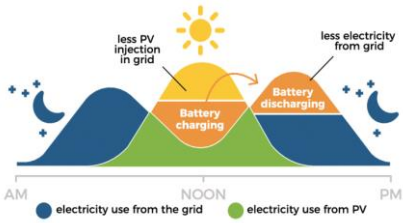
Rapid Response to Fluctuations: PCS can react rapidly to fluctuations from the grid. This real-time response capability helps to maintain a stable power, voltage sags/swells and dips.

Frequency Regulation: PCS can act as a fast-acting frequency regulator by absorbing or injecting energy as needed. This helps to maintain the system frequency within precision range.



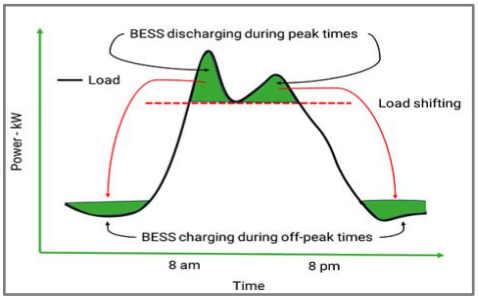
Onsite Renewable Generation

While renewable energy sources such as solar and wind power offer possibility of **virtually free energy,** their inherent variability and intermittency can pose challenges for critical system. BESS can function as large-scale storage of surplus electricity generated during periods of sunny days or high-wind hours and allows for the later utilization of this clean energy.



Load Shifting Cost Saving

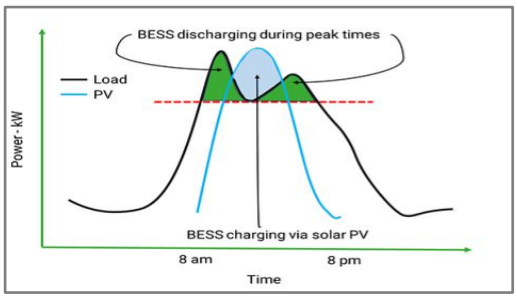
This strategy leverages the ability of BESS to store electrical energy. Absorbing the energy from Grid during low-rate hours, and then discharge them during remium-rate hours, when demand and electricity prices are at their highest. This **reduce overall electricity costs**



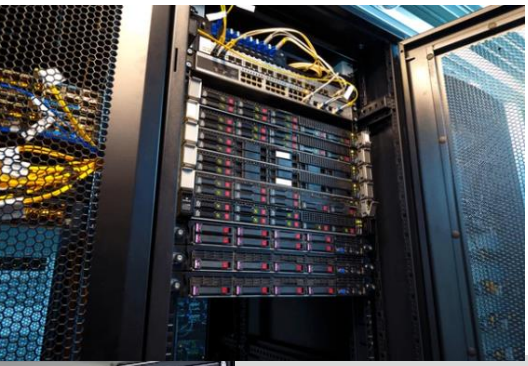
Peak Shaving cost reduction

Business & utilities can avoid **unnecessary expensive investments** by sizing down generator capacity to meet **realistic average demand,** instead of following peak demand.

BESS also reduces the need for traditional power plants to **frequent ramp up and down** to meet fluctuating demand. This minimizes wear and tear, and improves their overall efficiency, leading to **cost savings and reduce emissions.**



Hybrid Power System
Branch site server



Branch site office servers, while often more remote than edge datacenter often plays a crucial role in data collection and exchange with the central data center. Its availability is critical in nowadays app-dependent business operation.

Advanced UPS+BESS can provide a **reliable and efficient backup power** source, ensuring that critical data operations continue uninterrupted even during power outages or grid instability.

PCS+BESS systems can further enhance data protection by providing excellent voltage & frequency regulation, and rapid response times to power fluctuations from grid.

Together, these technologies can significantly improve the resilience and reliability of branch site operations, safeguarding valuable data and maintaining business continuity.

Advanced UPS / PCS
for Hybrid Power System

Flexible Modularized Design

ADVANCED UPS / PCS MODULE SELECTION

Hybrid UPS module
5 – 10 kWh / block
24 – 48V batteries /DC bus
220(1ph) / 380(3ph) AC input-output
40 – 500 V DC MPPT PV input
CAN/RS485 communication

Power Rectifier/Inverter
2000-6000W / block
12 - 72 V DC input-output (DC mode)
220(1ph) - 380(3ph) V AC input
40 - 500 V DC MPPT*2 PV mode
SNMP/CAN/RS485 communication

PV charger module 45kW (summable)
250-830V PV side
700-830V DC Bus
MPPT *3

Bi-directional Power module 30kW/45kVA
150-750V Charging
700-830V DC bus
400±15V AC
RS485 communication

Intelligent Transfer Switch 100kVA
- 1ph 220/230VAC
- 3ph 380/400/480VAC

TN-C-S, TN-S, TT, TN-C Grid
SCADA/DER controlled & EMS

Static VAR Generator
30 – 120 kVAr
400 – 690 V
50 / 60Hz (auto sensing)

Bi-directional storage inverter
Off grid & Interactive mode
30kW - 1.7MW Scalable blocks
150-1500VDC
380/400VAC 3Ph+N
SCADA/DER controlled & EMS

Hybrid inverter
45kW - 1.7MW Scalable blocks
250-830VDC MPPT Input
380/400VAC 3Ph+N Output
SCADA/DER controlled & EMS

Active Harmonic Filter
Capacity 5 - 300A
228 – 456 V
IEEE519

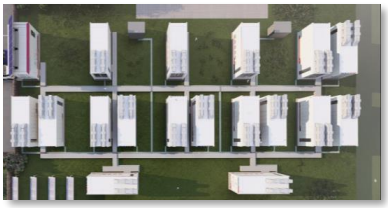
BATTERY ENERGY STORAGE (BESS)

Indoor LV Rack System
5 - 30 kWh / block
12 - 72 V DC mode
Natural / forced air

HV Rack System
30 - 50 kWh / block
240 - 584 VDC
Forced air / natural cooling

Specialty System
Indoor / outdoor enclosure
200 - 450 kWh / block
240 - 584 VDC
Air Conditioning / Liquid cooling
Fire suppression

CONTAINERIZED SYSTEM



Advanced UPS Features

HIGH RELIABILITY

Dual controllers and dual auxiliary power supply ensure continuous system operation and reliable communication.

Power module automatic offline function for continuous operation to avoid downtime caused by single power module failure

Wide input voltage range (138V~486V) allows UPS to work in harsh electrical environments to minimize the battery use

Online dual conversion mode provides continuous, high-quality power to the load

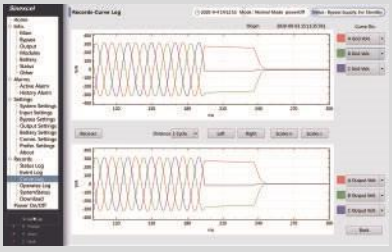
FULLY MODULARIZED DESIGN

Hot-swappable modular design, easy to replace the power module, reduce the mean time to repair (MTTR) close to zero without downtime

ADVANCED ANALYSIS SYSTEM

Record the waveform of power abnormal event to support advanced event analysis

Record parameters: input and output voltage, current waveform display, events quantities, waveform data can be exported to USB flash



BATTERY MANAGEMENT SYSTEM

Battery charge and discharge current, voltage monitoring and controlling
SOC check to reflect remaining capacity of battery
Temperature detection function, charging voltage intelligent adjustment according to battery temperature

COLD-START FUNCTION

UPS can start without mains

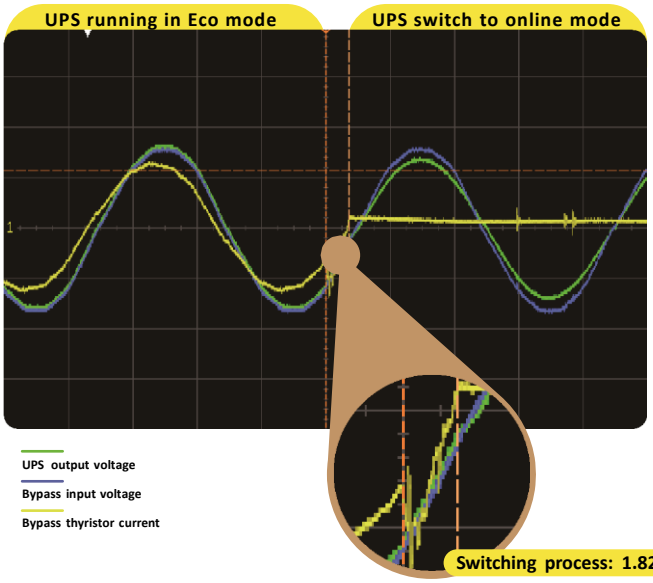
Advanced UPS feature

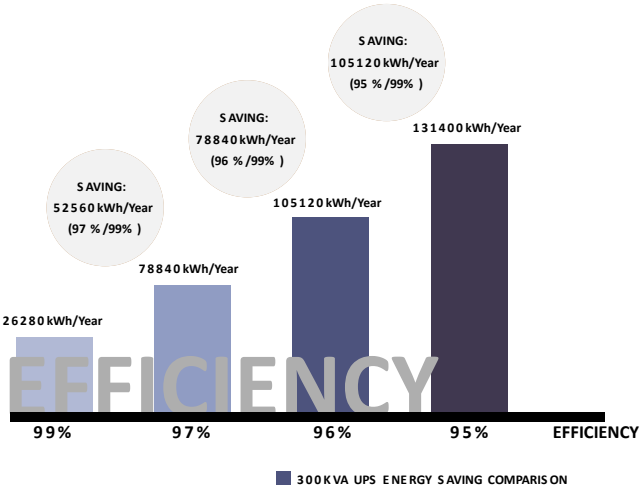
Loads can sustain for 5ms such short time voltage outage at switching time. This is the reason Advanced ECO mode UPS can be used as default mode.

For Traditional UPS bypass, the SCR must be turned off completely at the current zero crossing point, this process will take 10ms at longest.

The UPS Advanced ECO mode from both the software to hardware design to realize 5 ms fast switching time from ECO mode to online mode,

typical response time 2ms.

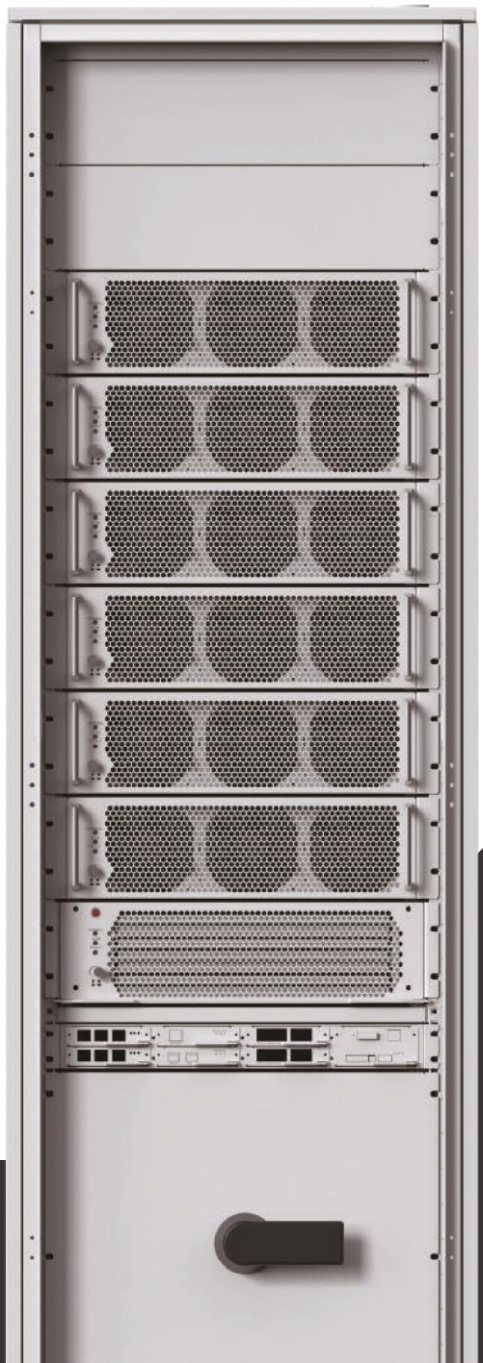




RELIABLE ADVANCED ECO MODE

UPS industry mostly put ECO mode as auxiliary function. We evaluates the great energy saving benefits of ECO mode on the clients' aspect, with the innovative development from the R&D team, we released Advanced ECO mode which can realize constant work and fast switching to online mode, ensuring the reliable protection to the connected loads.

The design of UPS Advanced ECO mode is from AVC-RTS (Real-time Active Voltage Conditioner), which the system structure nature is as same as ECO mode, it has been used for years in critical applications of semiconductor PLC system control, automotive robot painting process, beverage, pharmacy high automation production line .



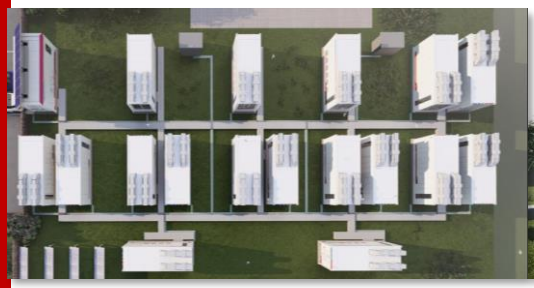
Advanced UPS Product Range

Capacity ranging from 20kVA to 2400kVA, equipped with 99% Advanced ECO mode and 97% on-line double conversion working modes that delivers continuous green backup power supply.

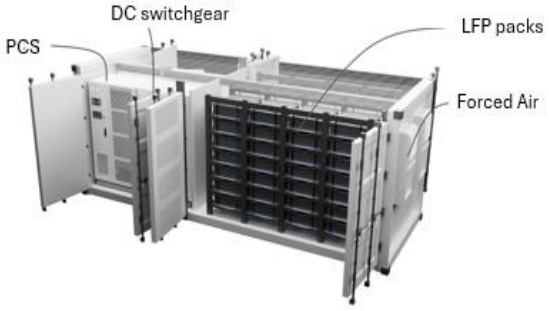
High availability with cost effectiveness to meet different customer needs.

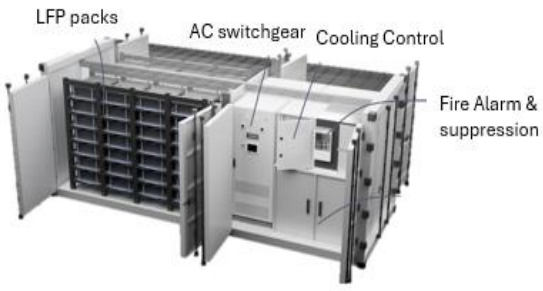
MODEL		UPS 40KVA	UPS 50-2400KVA
INPUT	Rated Voltage	380/400/415VAC	
	Voltage range	138~486V (linear derating between 138~305V)	
	Current harmonic distortion	＜3%	
	Power factor	＞0.99	
	Rated Frequency	40~70Hz	
OUTPUT	Output Voltage of Converter	380/400/415Vac	
	Stabilized Output Voltage Accuracy of Converter	±1%	
	Efficiency	Efficiency of Advanced ECO Mode is over 99% ; Online Double Conversion Mode: single module efficiency >97.5%, whole cabinet efficiency > 97%	
	Response Time	Online Mode response continuously; switching time of Advanced ECO Mode ≤5ms, typical 2ms	
	Overload Capacity of Inverter	110% load, switch to bypass after 60min	
		125% load, switch to bypass after10min	
		150%load, switch to bypass after 1min	
	THDv	<1% (linear load)	
BYPASS	Voltage	380/400/415Vac	
	Frequency	50/60Hz, depend on the load	
	Overload	≤135%, temperature ≤30℃, long-time operating	
		≤125%, temperature ≤40℃, long-time operating	
		150%~200%, last for 5min	
		200%~1000%, last for 1min	
		>1000%, last for 100ms	
SYSTEM	Parallel Operation	Max. 8 cabinets in parallel	
	Charge Mode	Intelligent battery management system Battery configuration: lead acid battery, lithium battery, super capacitors	
	Audible Noise (1 meter)	60~75dB	
	Protection level	IP21 (can be customized)	
	Cable entry	Bottom entry (side entry can be customized)	
	Communication Interface	RS485, CAN, Ethernet, backfill preventing card, WIFI (optional), 4G (optional), dry contact (optional)	
	Temperature	Operation ambient temperature: -10 ～40℃, storage temperature: -40 ~ 70	
	Relative Humidity	0～95% without condensation	
	Altitude	≤1000m (over 1000m, please take IEC62040-3 standard derating for reference, max 4000m)	
	Monitoring	12-inch monitoring touch screen, supporting multiple languages	
	Dimension	300kVA cabinet size 600*830*2000mm(W*D*H), for other capacity, battery cabinet, or customized size, please contact Sinexcel engineers	
	Cabinet Color	Standard color is RAL7035 (can be customized)	
	Certification	TLC,CE(EN602040-1,E N602040-2)	

Containerized PCS+BESS

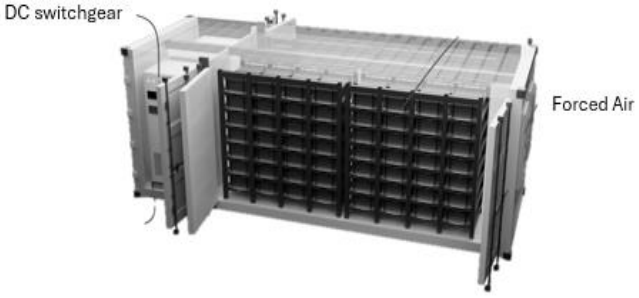


0.5MW / 0.8MWh
Built-in PCS

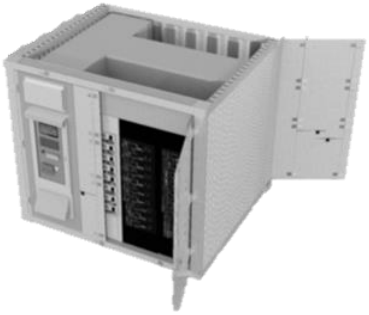




1MW / 1MWh
External PCS



300-500kW / 0.4-0.6MWh
Built-in PCS



Cost Optimization
Micro Hybrid Power System

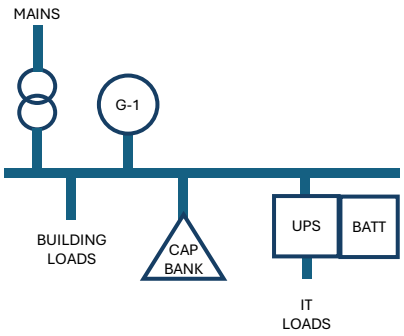
Comparison of power generation system with VS without BESS

Data center, critical buildings, & various operations can benefit from capital savings enabled by deploying BESS into power system design, particularly from **Load Shifting Feature** and **Peak Shaving strategy.**

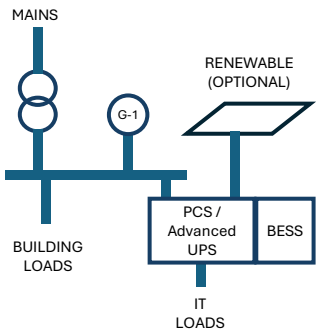
EXAMPLE CASE

Branch site server rack
50kW rated
(tier-1)
*60% average load
80% peak load of 3 hour

Conventional system



Hybrid power system



INITIAL COST
Peak Shaving

(optimize genset sizing and use BESS to fill in demand)

Conventional Sizing:
Sizing for average load
50kW x 60% / 0.8PF = 37.5kVA
37.5kVA x 130% = 48.7kVA

Sizing for peak load
50kW x 80% / 0.8PF = 50kVA
50kVA x 130% = 65kVA

Select 1 x 80kVA genset
+ 1x UPS 60kVA 10 min backup

Cost:

1 x 80kVA genset	USD 11K
1 x 60kVA UPS **10 min backup**	USD 26K
1 x Capacitor Bank 60kVAR	USD 4K
Total Capex compared	**USD 41K***

Peak Shaving Sizing:
Use genset for average load
37.5kVA x 130% = 48.7kVA

Size PCS+BESS for covering peak load
50kW x (80% - 60%) = 10kW
10kW x 3h = 30 kWh
30kWh x 120% = 36kWh

Select 1 x 50kVA genset
+ 1 x 30kW PCS/Advanced UPS
+ 1 x 40kWh BESS (3 hours backup)

Cost:

1 x 50kVA genset	USD 8K
1 x 30kW PCS/Adv.UPS	USD 15K
1 x 40kWh BESS *3 hours backup	USD 15K
Total Capex	**USD 38K***

OPERATIONAL COST
Load Shifting

(adsorb energy during lower cost tarrif and release it during premium time tarrif)

Conventional System:
Non-peak time tariff power bill
50kW x 60% x 21h x 30d = 18900kWh
18900kWh x 0.09USD/kWh = USD1700/mon
USD1700 x 12mon = USD 20400/year

Peak time tariff power bill
50kW x 60% x 3h x 30d = 2700kWh
2700kWh x 0.12USD/kWh = USD324/mon
USD300 x 12mon = USD 3888/year

Assumed Grid Outage
98% availability/year = 175 hours/year
Covered by genset 100%
Genset fuel consumption 60kVA
14 l/hrs x 175 hours x 0.83 USD = USD 2033/yr

Total Opex compared **USD 26.3K/yr**

Load Shifting strategy with BESS:
Non-peak time tariff power bill
Same non-peak time tariff
= USD 20400/year

Peak time tariff power bill (18-24pm)
Use BESS entirely
2700kWh x 0.09USD/kWh = USD243/mon
USD300 x 12mon = USD 2916/year

Assumed Grid Outage
98% availability/year = 175 hours/year
175 h/year / 365 day= 0.4 hrs/day
Can be covered 100% by BESS

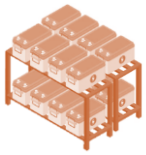
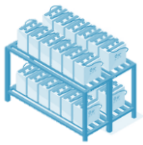
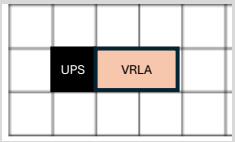
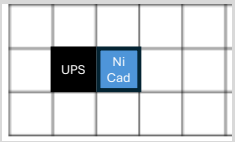
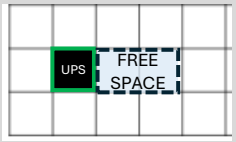
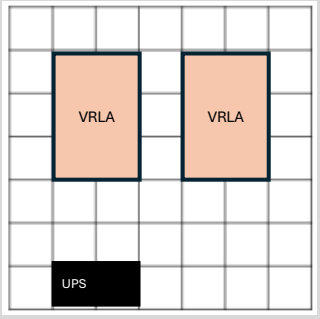
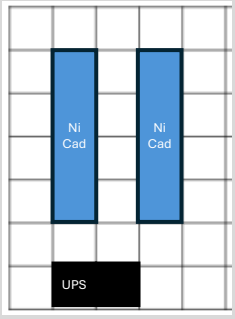
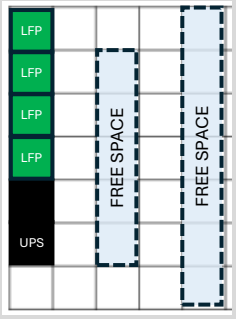
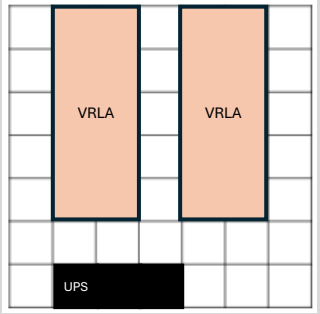
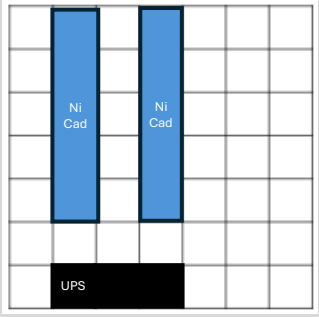
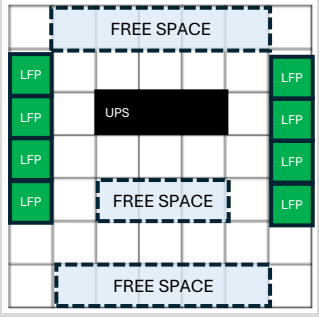
Total Opex compared **USD 23.3K***
(solar PV not yet accounted)

* Additional cost element may apply such as engineering hours, installation works, cabling, freight, duties, carbon tax if using renewable generation, etc.

Space optimization
Battery Energy Storage System

Footprint comparison VRLA & NiCad battery rack VS LFP BESS

Space optimization benefit can have trickle down effect to other support system such as HVAC, lighting, fire system, etc

	Traditional VRLA Battery Rack	Conventional NiCad Battery Rack	LFP BESS Cabinet
UPS & batteries in typical footprints *Example configuration	 VR LA	 Ni Cad	 LFP
10-60kVA UPS **Branch Site Server rack** 10 min backup*			 *UPS+LFP battery in the same cabinet
90-600kVA UPS **Edge data center** 8 min backup*			 *LFP cabinet do not need front-rear access
0.8-1.2MVA UPS **Tier-1 data center** 6 min backup*			 *LFP cabinet do not need front-rear access

*footprint multiplication will increase significantly with higher Tier system
*dimension in multiplication of 0.8 x 0.8 m square

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