



Power Stability Expert

# Microgrid Solution

For sustainable power supply, flexible and resilient operation of Microgrid



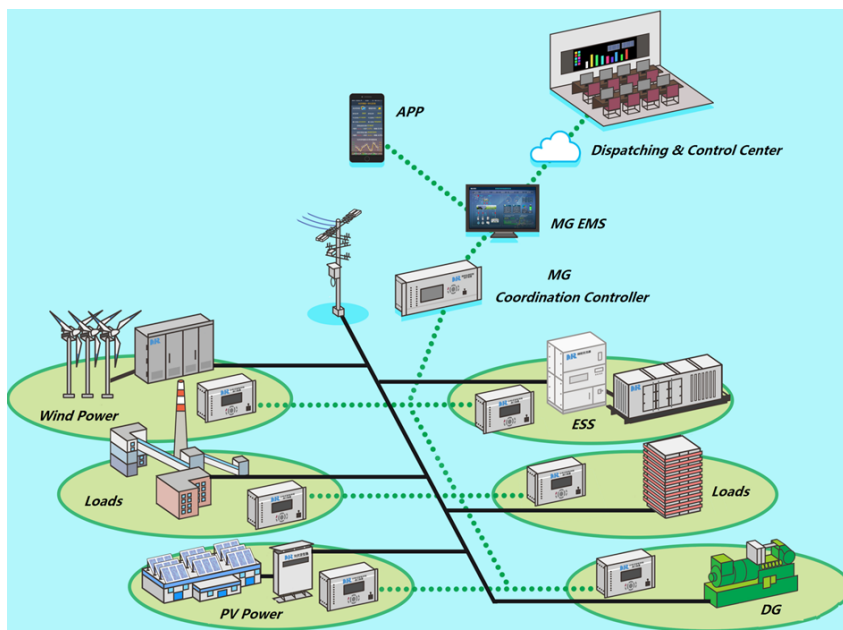
There are two types of microgrid, namely grid-connected microgrid and permanent islanded microgrid. The grid-connected microgrid is synchronized with the external power grid and generally applied in industrial parks and enterprises, communities, hospitals, schools, etc. It operates in parallel with the distribution network to realize the bidirectional energy exchange. During the external grid outage, it operates in the islanded mode to enhance the power-supply reliability. The permanent islanded microgrid is standalone networks and normally applied in the remote districts uncovered by the large power grids, such as countryside, island (in the sea), etc. It operates independently to meet the load demand by the DGs(Diesel Generators) or ESS(Energy Storage System) within microgrids.

NR Electric provides a complete solution for maintaining sustainable power supply and stable operation of Microgrid. NR's all in one microgrid solution covers the overall planning, design, equipment manufacturing and procurement, testing and commissioning.

## NR Microgrid Solution

### 1) Leading microgrid solution provider

NR provides a safe, stable and reliable solution for both grid-connected and islanded type microgrid, which adopts the design of layered and distributed control system, inherits the technology of smart substation and carries out the coordination of control & protection among different layers to realize the stable and economic operation of microgrid system. This solution greatly increases the proportion of grid-connected renewable DGs in the microgrids.



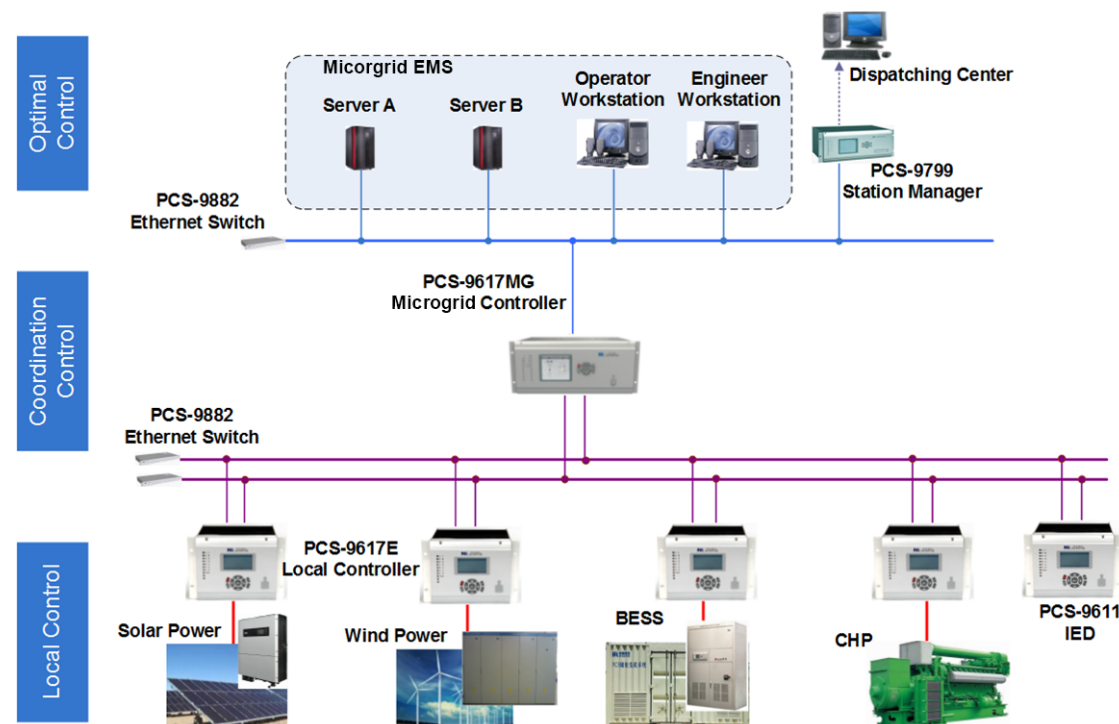
As a leading microgrid solution provider, NR can provide all the key equipment for microgrid system, including microgrid EMS, SCADA, microgrid controller, microgrid local controller, microgrid protection IEDs, battery energy storage system, PV inverter, dynamic reactive-power compensator (SVC/STATCOM).

Equipment	Type	Description
Microgrid EMS	PCS-9000	Microgrid dispatching automation system for data acquisition, supervisory control, optimization and management.
Microgrid Controller	PCS-9617MG	Controller has the functions of control, protection, measuring, monitoring, communication, etc. and carries out the coordinative control of DG, energy storage, diesel generator and controllable load to realize the safe, stable and economic operation of the microgrid.
Microgrid Local Controller *	PCS-9617E	Controller will be installed at the sides of DG, energy storage, diesel generator and load for realizing the local information acquisition, monitoring and control, etc.
PCS	PCS-9567	The PCS (power conversion system) supports multiple operating modes, such as PQ, VF, droop control, VSG, black start, constant-DC voltage, constant-DC current, etc.
PV Inverter	PCS-9563	Rated capacity: 33kW~1000kW
Hydropower Station SCADA System	PCS-9150	This system carries out the monitoring and control of hydroelectric generating unit.
Microgrid Protection Equipment	PCS-9600 Series	Protections for mid-/low-voltage line, transformer, capacitor, etc.
Reactive-power Compensator (SVC, STATCOM) *	PCS-9580 PCS-9583	The system supplies dynamic reactive-power compensation for the large-capacity microgrid.
Battery		lead-acid, lead-carbon, lithium-ion, zinc-bromine, vanadium flow battery and sodium-sulfur, etc.

Note: \* labeled equipment is normally applied in the large-capacity microgrids (MW-level).

## 2) Layered and distributed control configuration for microgrid

NR's microgrid control & protection system adopts the layered and distributed design configuration, which is divided into local control layer, coordinative control layer and optimal control layer.



### • Local control layer

The Local control layer includes DGs, PCS, local controller and protection IEDs. The automated local control system, generally not depended on communication system, can provide fast response speed during disturbances or short-circuit faults, and stabilize power-supply by the self-regulation of converter or the fast action of protection equipment.

### • Coordinative control layer

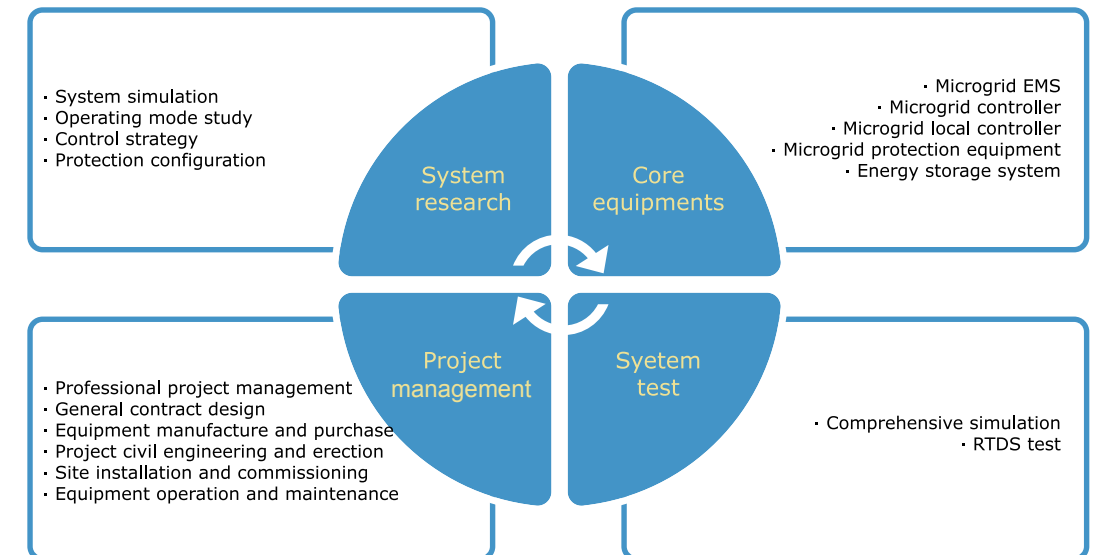
The coordinative control layer includes the microgrid controller, which acquires the information of DGs, energy storage, diesel generators and important load via the control communication network. When microgrid operates in the islanded mode and large disturbance occurs (such as non-scheduled grid outage, large-capacity DG tripping, etc.), the microgrid controller coordinates the operating modes of energy storage, diesel generator as well as the output power of DGs, to maintain the voltage and frequency within the allowable ranges, guarantee the stable and safe operation of microgrid system.

### • Optimal control layer

The optimal control layer includes the microgrid EMS and depends on the data supplied by SCADA system, dispatching & schedule system, load forecast system, etc. It realizes the functions of data analysis, energy prediction, load management, optimal operation, economic dispatching to maximize the comprehensive utilization of the DGs within microgrid.

## 3) Turnkey supplier for microgrid

Based on the comprehensive power system application experience, NR Electric has ability to supply turnkey solution of microgrid to fit diversified customer needs. The NR's turnkey solution includes system research, equipment manufacturing and procurement, project management, system test and commissioning.



### • System Research

NR Electric integrated with research and analysis of steady-state, transient-state, operating modes, control strategy and protection configuration for microgrid. NR also undertaken comprehensive research in multiple domains including power system analysis, stability control, FACTS application, AC/DC hybrid transmission system, analysis for grid applications, etc. NR is fully capable of the core technologies for microgrid with high end system research and analysis facilities.

### • Core Equipment

NR can provide all the high-end equipment to build your microgrid system including microgrid EMS, microgrid controller, microgrid local controller, microgrid protection IEDs, microgrid energy storage system, PV inverter and dynamic reactive-power compensator (SVC/STATCOM). This ensures a one-stop contact for a stable and economic microgrid system.

### • System Test

NR has established RTDS test facility, RT-LAB test facility, dynamic analog simulation test facility and synthetic test loops to simulate site application scenarios and to verify the control & protection system, guarantee the correctness of control and protection logics, and cut down the site commissioning work.

### • Project management

NR has the professional project management system with project managers certified by the international Project Management Professional (PMP). The general contract design covers the primary electrical engineering, secondary electrical engineering, civil engineering as well as the design capabilities of the conventional substation, DC transmission, FACTS, renewable energy generation, etc. The manufacturing of core equipment, the procurement management of auxiliary devices and the operation & maintenance management of operating equipment also are included in the complete microgrid solution.

## Features

- The effective coordination of control and protection among different layers, with both centralized and distributed features, is very helpful to realize the stable and economic operation.
- The control-layer networks can be redundantly designed and configured independently with high reliability and safety.
- The high-performance and ms-level response speed of the microgrid controller enables the seamless switch between different operation modes.
- The control logic in microgrid controller can be flexibly configured, the specified logic required by user.
- Sufficient communication ports and protocols in microgrid controller to realize the communication access to the converters from different manufacturers.
- The communication card and I/O module in microgrid controller can be flexibly and optionally configured to meet the requirements of different microgrid capacities.
- Microgrid EMS integrates data of different subsystems seamlessly to provide a unified interface for easy realization of the flexible interaction among different application functions.
- There are various built-in DG models in microgrid EMS, to support the optimal dispatching management for different DG.

Microgrid EMS senses the real time situation of microgrid and responses quickly to the variation of source, network and load. This ensures the microgrid to be an effective, economic, safe and reliable operating condition at any time.

Quality, Safety, Health, Environment (QSHE) are always the prime priority in project management and delivery.

- NR guarantees providing all lifecycle service from project start-up to the end of the microgrid project, including supplying spare parts, trainings, upgrades and retrofits.

NR's regional engineering teams are always working in close cooperation with end users to reduce site testing and commissioning time

- and cost. This service enables NR well trained technical engineers to provide hands-on trouble shooting and training.

## References

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