

2014 Symposium On Microgrid



NANJI ISLAND
Microgrid Demonstration



STATE GRID ZHEJIANG ELECTRIC POWER COMPANY

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南麂岛离网型微电网示范工程

stand-alone microgrid demonstration on Nanji Island

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Background(1)



1、南麂岛--海上仙山，贝藻王国，远离大陆，柴发供电，用电困难。

Nanji Island--a fairy mountain on the sea, serious electricity shortage with few diesel generators

2、海上可再生能源充足，以此建设一个清洁、高效、经济的小型独立电网—南麂岛微电网示范工程。

Based on the abundant renewable resources, a clean, efficient, economical isolated grid is established--Nanji Island microgrid demonstration project

3、南麂岛微电网属于含多种分布式电源的离网型示范工程，是浙江省电力公司承担的国家863计划“含分布式电源的微电网关键技术研发”课题中两个示范工程之一。

With multiple distributed generations, Nanji microgrid is one project of the national development program(863 program) taken by Zhejiang Power Grid, China

Background(2)

南麂微电网地理分布图 Geographical distribution of Nanji Island microgrid



Integration of the microgrid(1)

南麂微电网系统组成 System structure of the microgrid on Nanji Island



光伏发电 solar generation
660kW

后隆站550kWp, 专线接入
special line
办事处站: 110kWp, 线路T接
T-connection



储能系统 storage system

4×500kW×2h 锂电池储能
lithium battery
2×500kW×15s 超级电容储能
supercapacitor



风力发电 wind generation

10×100kW 永磁直驱
permanent magnet
synchronous generator



电动汽车充换电站
EV filling station
120个充电工位
charging units



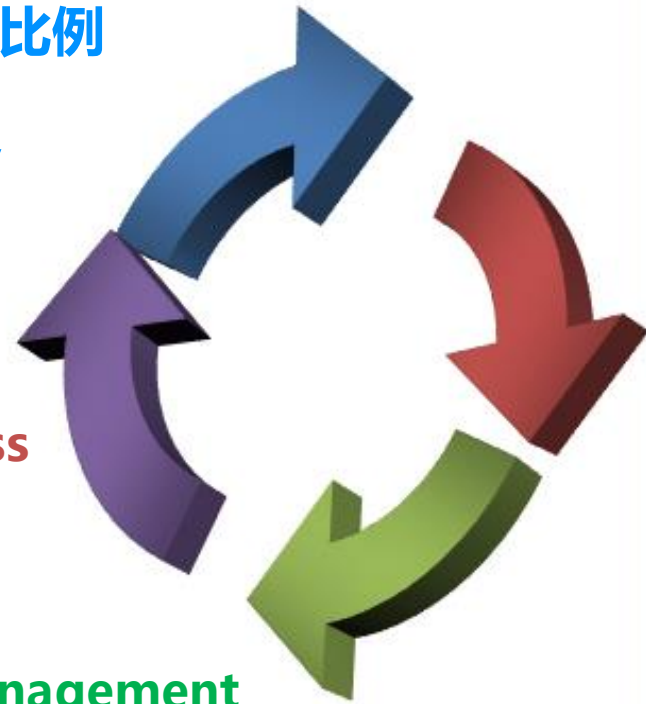
柴油机发电 1.7MW
diesel generator

1×500kW
4×300kW
1×200kW

Integration of the microgrid(2)

工程亮点 Highlights

- 实现微电网内负荷高可靠性供电、全年新能源发电比例 > 55%
- high reliability of power supply, new energy output penetration > 55%
- 多微网结构灵活、无缝切换、多种运行方式的协调控制
- Flexible structure with multi-microgrids, seamless switching, coordination of multiple operation modes
- 多元复合储能联合协调控制, 能量优化
- Control of hybrid energy storage and energy management
- 电动汽车充换电站、智能用电与微电网间的友好互动
- Well interaction of the EV filling station, smart power and microgrid

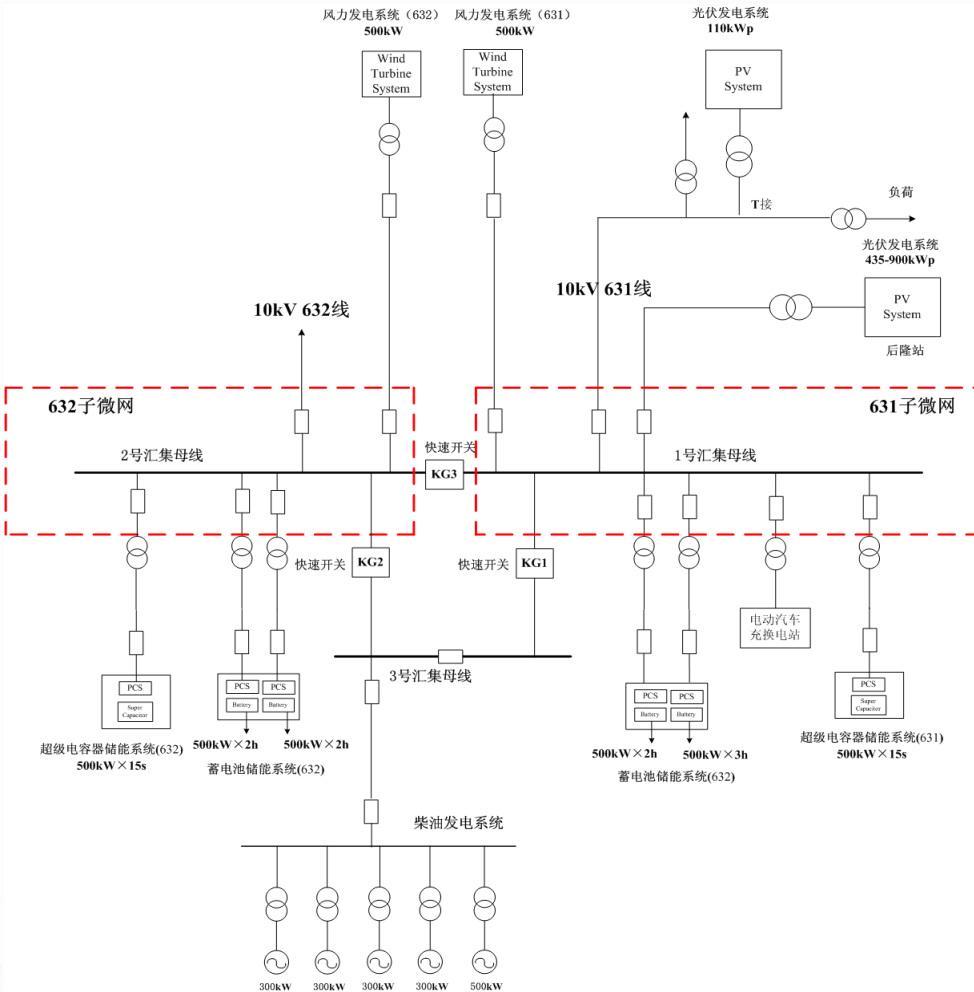


Integration of the microgrid(3)

南麂微电网系统设计图 System design

结构特点

- ✓ 离网型微电网 stand-alone
- ✓ 多子微网结构
multiple subsystems
- ✓ 可再生能源集中与分布式接入相结合 integration of centralized and distributed accesses
- ✓ 电动汽车充换电站接入
filling stations of EVs
- ✓ 多达7种运行控制模式
7 operation modes

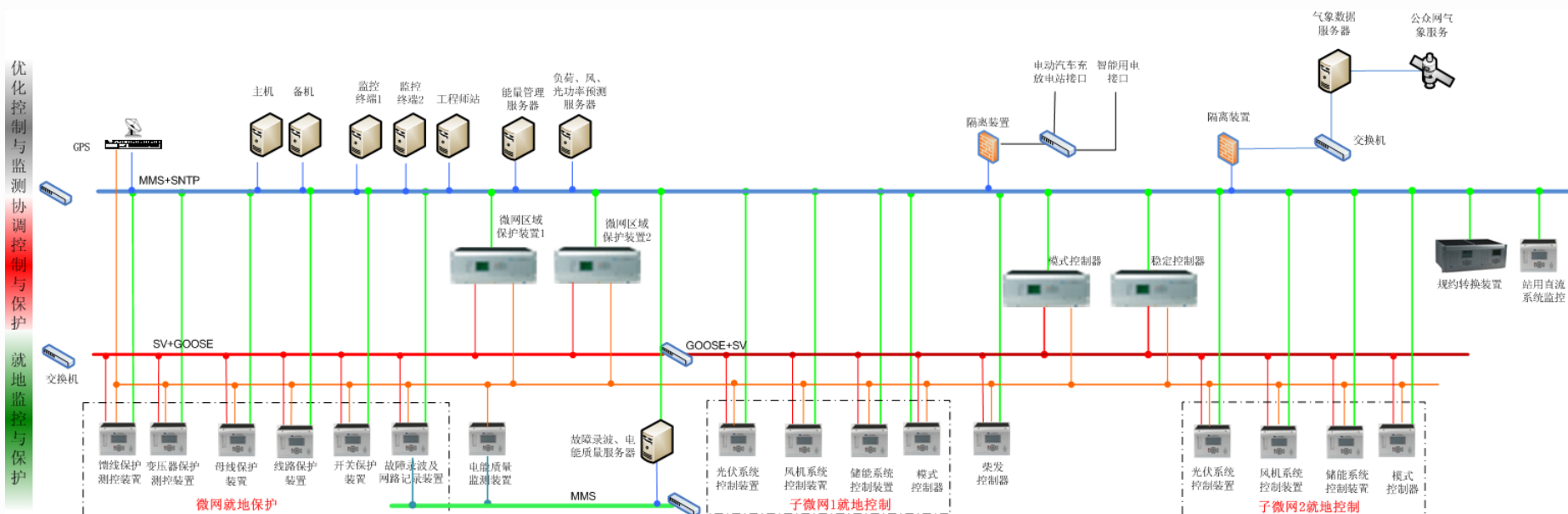


Integration of the microgrid(4)



Key technology research(1)

南麂微电网控制系统结构图 Control structure

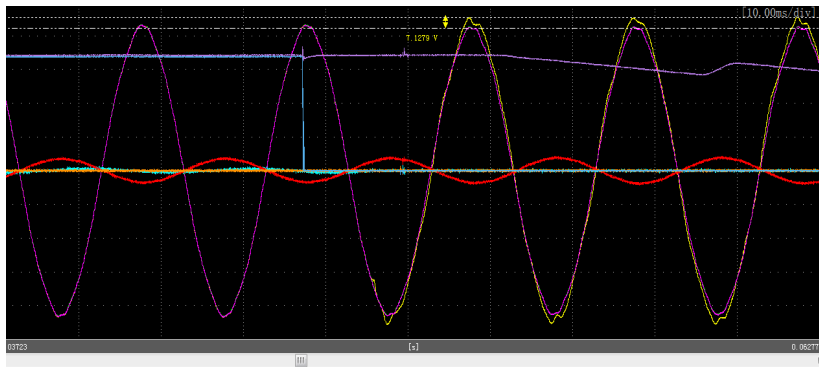
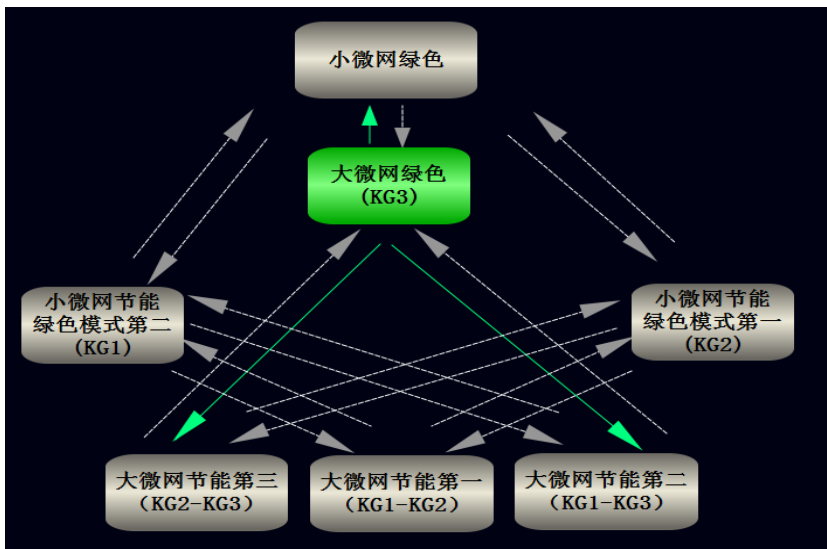


主要特点

- ✓ 就地控制、协调控制、能量管理三层控制结构 hierarchical control
- ✓ 完全基于IEC61850国际通讯标准
- ✓ 统一监控数据平台，发、输、配、用全信息共享 global information sharing

Key technology research(2)

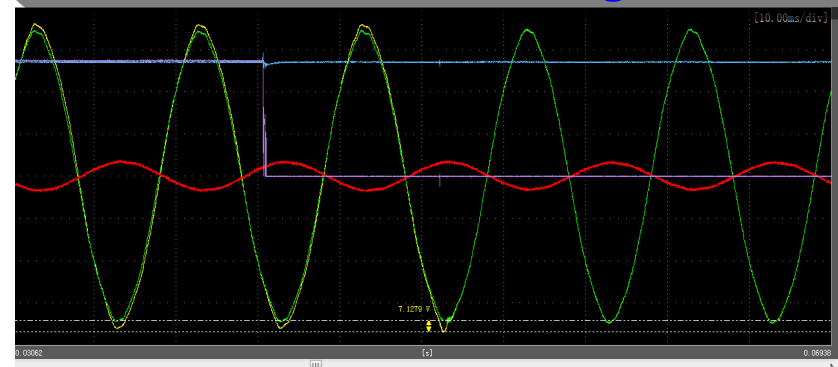
南麂微电网运行模式与切换控制 Operation modes and switching control



632子微网并网转独立运行
Grid-connected to stand-alone

技术特点

- ✓ 7种运行控制模式，3种节能模式
3 energy-efficiency modes、4种绿色模式 4 green modes
- ✓ 储能PCS下垂控制与快速开关相结合，实现模式间无缝平滑切换PCS droop control and FTS achieve the seamless switching



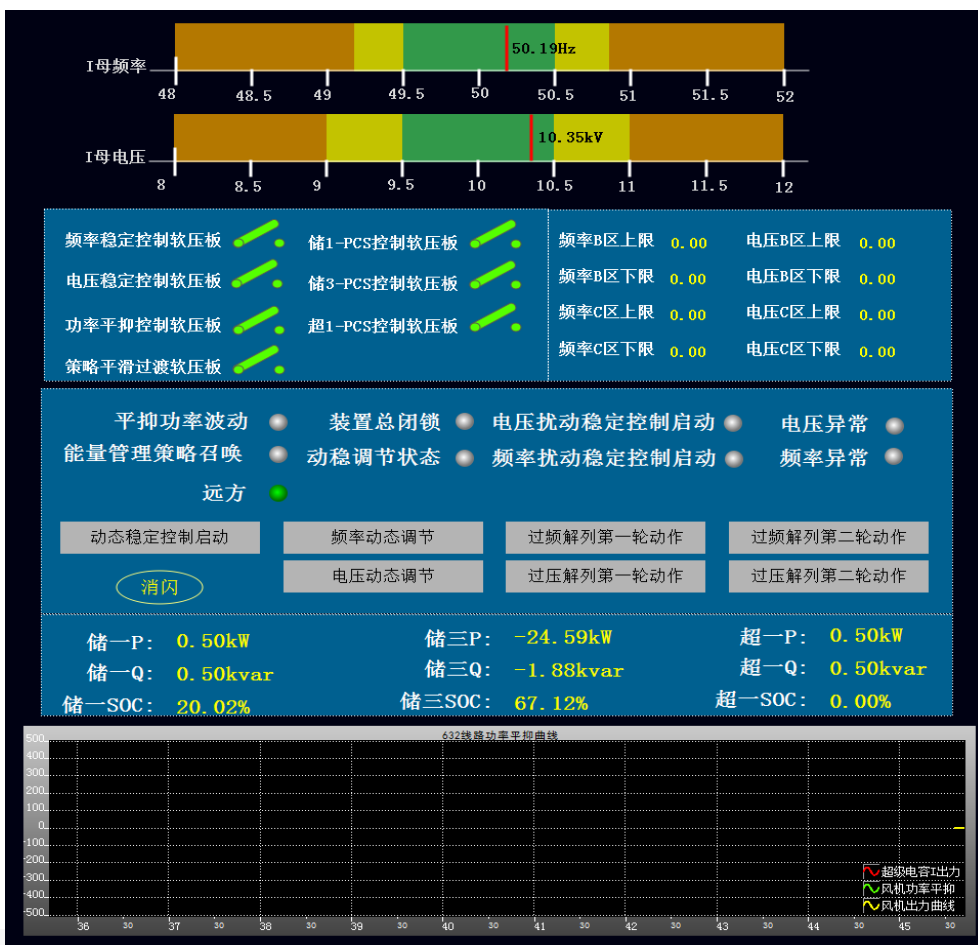
632子微网独立转并网运行
stand-alone to grid-connected

Key technology research(3)

南麂微电网稳定控制 Stability control

功能模块

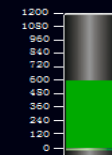
- ✓ 微电网电压稳定控制
voltage stability
- ✓ 微电网频率稳定控制
frequency stability
- ✓ 通过超级电容平抑可再生
能源出力波动
alleviating fluctuation of
renewable energy
- ✓ 系统紧急控制
emergency control



○ #1超级电容



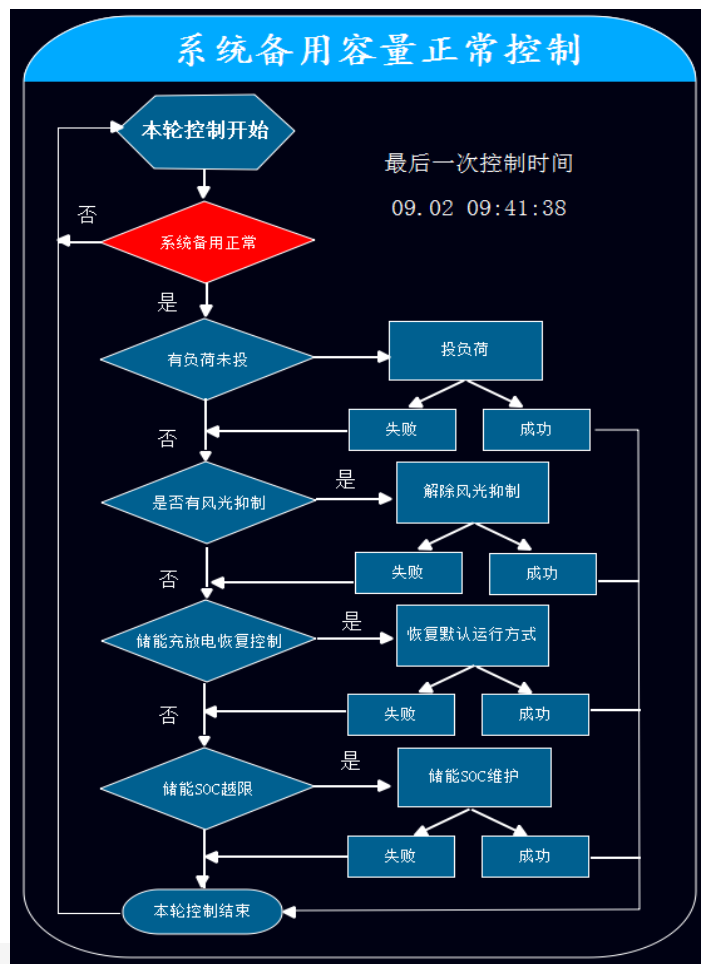
P: -0.00kW
Q: 0.00kVar



SOC: 64.08%

Key technology research(4)

南麂微电网能量平衡控制 Energy-balancing control

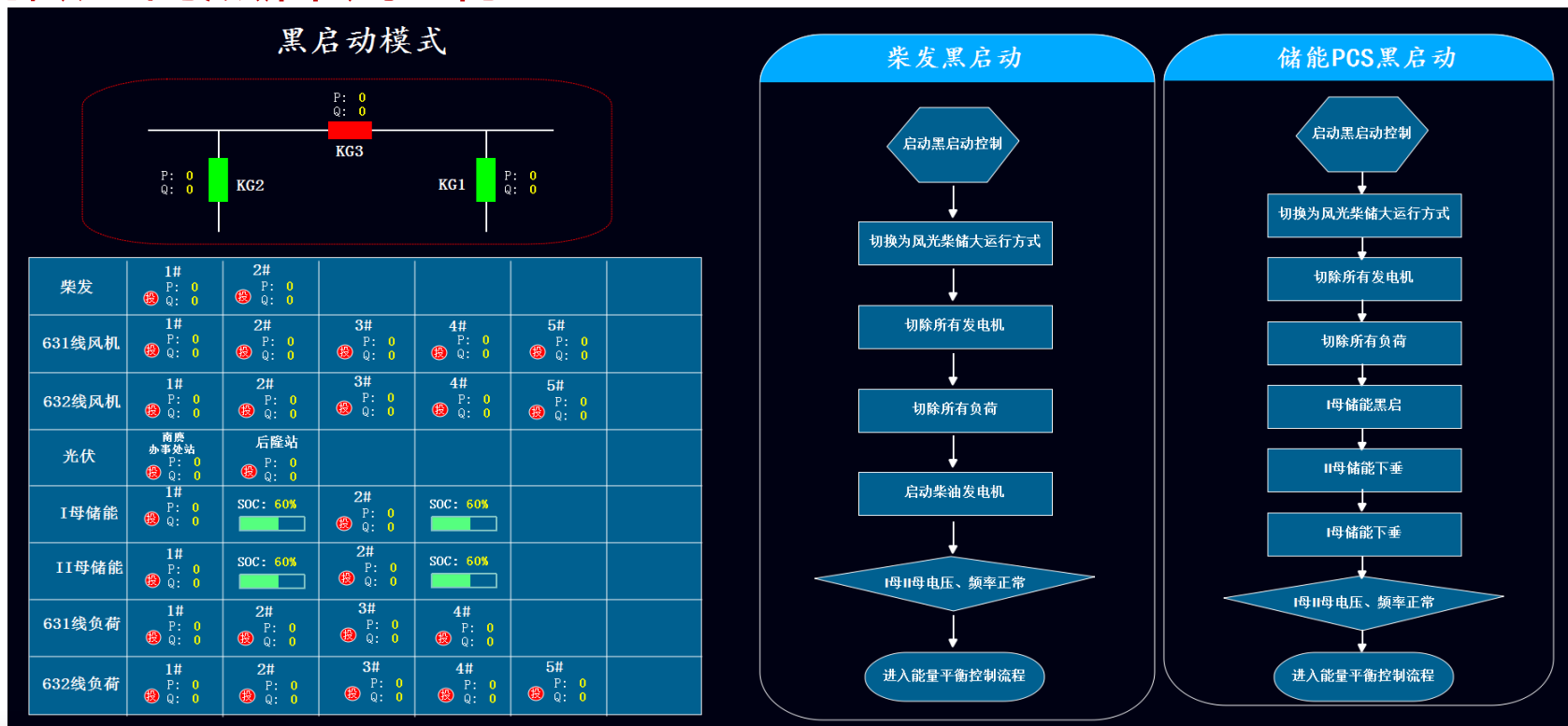


技术特点

- ✓ 适用于微电网7种运行模式
(含柴发、不含柴发)
suitable for modes with or without diesel generators
- ✓ 以最大限度利用可再生能源为控制目标
maximum renewable energy utilization
- ✓ 多控制对象 (风机、光伏、储能、电动汽车充换电站、可控负荷)
multiple control objects

Key technology research(5)

南麂微电网黑启动控制 black start



功能模块

- ✓ 柴发黑启动、储能黑启动两种模式 start with diesel generator or SE
- ✓ 自动流程控制与人工确认相结合 integration of automatic control and manual verification

Conclusion



混合储能系统与电动汽车充电站相结合，能使多余可再生能源得到充分利用

Hybrid storage system combined with EV filling stations, taking full use of surplus renewable energy



灵活的多微网结构和多运行模式的无缝切换，显著提高南麂岛负荷的供电可靠性

Flexible structure with multiple microgrids and seamless mode switching, increasing the power supply reliability remarkably.



多种绿色能源，结合电动汽车充电站，智能电表、用户交互等先进智能电网技术，建成后将成为一座标志性的绿色能源综合利用智能岛屿

Green energy, EVs, smart meters and user interaction together forming an iconic clean-energy-integrated smart island





THANK YOU!

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