CHINA ENERGY ENGINEERING GROUP
GUANGDONG ELECTRIC POWER DESIGN INSTITUTE CO., LTD.

ADB

Enhancing Power System Resilience

Improving Power System Adaptation to Climate Change

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GEDI – a Leading Engineering Service Provider Throughout Entire Project Circle

- Planning Consultancy
- Survey & Design
- EPC Contracting
- Project Supervision
- Investment

POWER GENERATION

- Coal-Fired (25-1000MW)
- Nuclear (1000-1750MW)
- Oil/Gas (40-660MW)
- Renewable Power (Hydraulic, Wind, Biomass, Solar, Geothermal)

POWER TRANSIMISSION & DISTRIBUTION

(AC 110kV~1000kV,DC ±500kV~ ±1100kV)

- Power System Planning
- Transmission and Distribution systems
- Substations
- Distribution Network Control

BUILDING & INFRASTRUCTURE

- Commercial Building and Public works
- Environment (FGD, DE-NOX Plant, CO_2 Capture, Waste Water)
- Infrastructure (Jetty, Seawater Desalination, Water Treatment, Road & Tunnel)
- IT, Communication And automation

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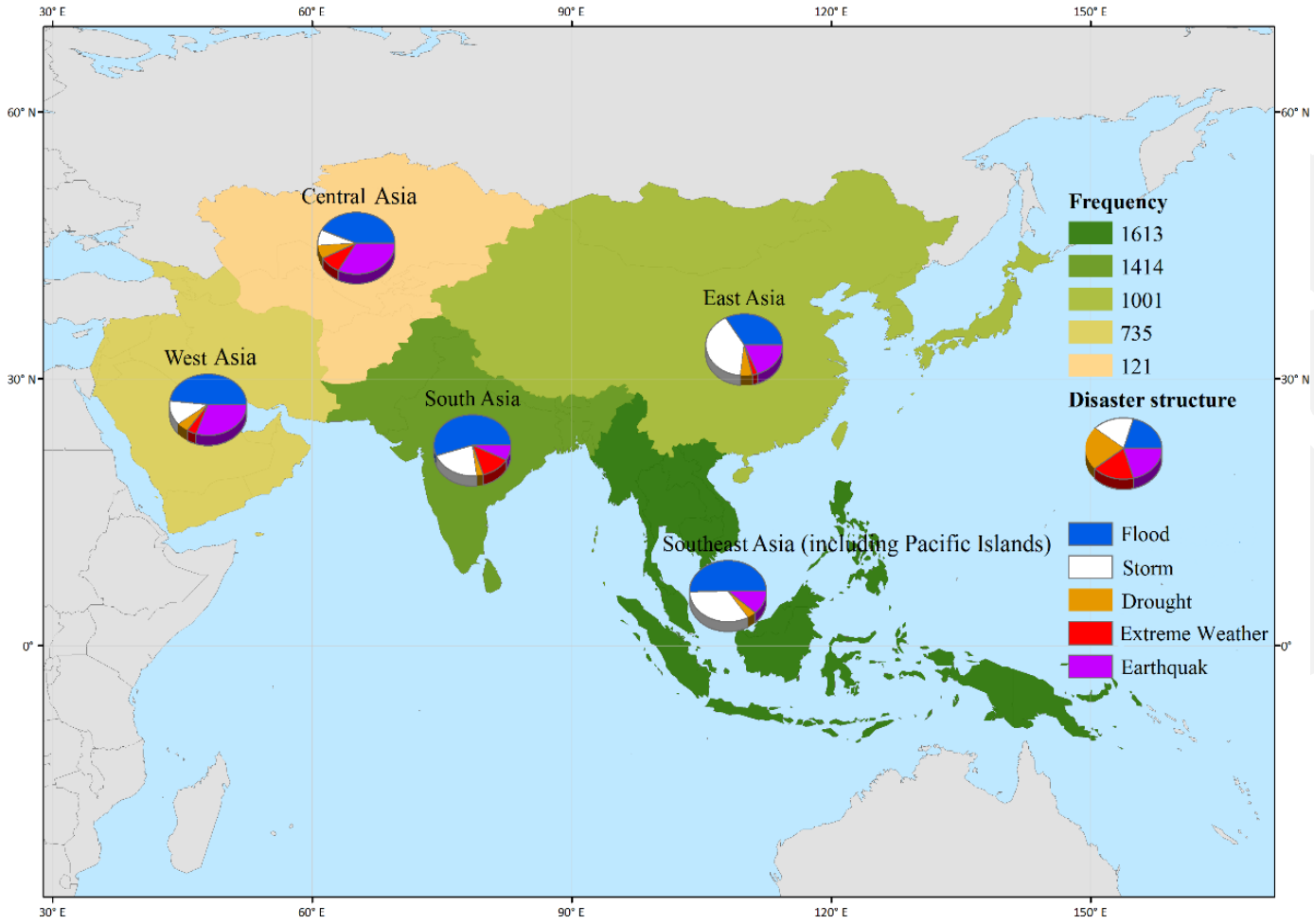
Asia suffers most climate disasters causing system loss every year. GEDI proposes a whole-process proactive solution to enhance system Resilience.



Preliminary Planning Stage

Planning of Eco-Friendly and Robust Power System.

Construction Enhancement Stage

High Standard Construction and Reinforcement of Vital Network Devices to enhance system resilience.

Emergency Proactive Management

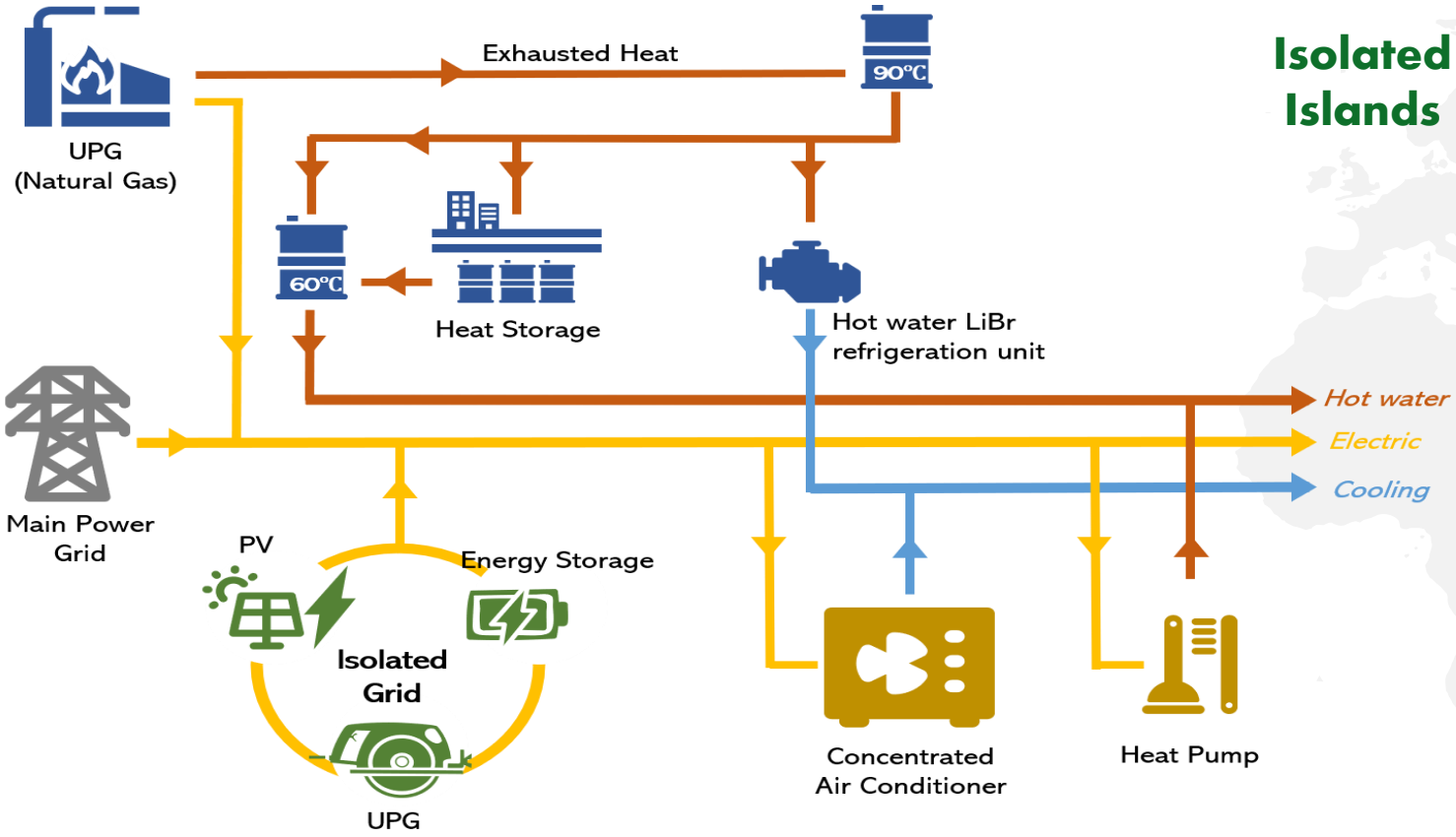
Applying High Level Technology to Realize a Proactive Emergency Management

Distributed Uninterrupted Power Generation – Emergency Power and Intelligent Energy

Based on the eco-power generation and power grid planning. **Distributed Uninterrupted Power Generation** can act as an emergency power resource when outage occurs, which can operate as a **step-utilization intelligent power resource** by the application of Natural Gas.

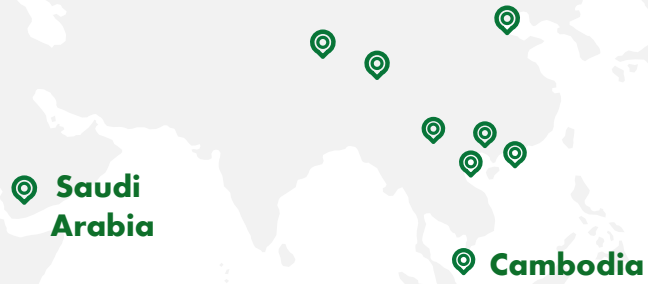
- Be accessed to distributed network directly
- Operate as a Black-Start Energy to main Power Grid
- Intelligent Power Source By Step-Utilization

GEDI has realized an intelligent energy circulation system based on distributed UPG to fully improve power efficiency.



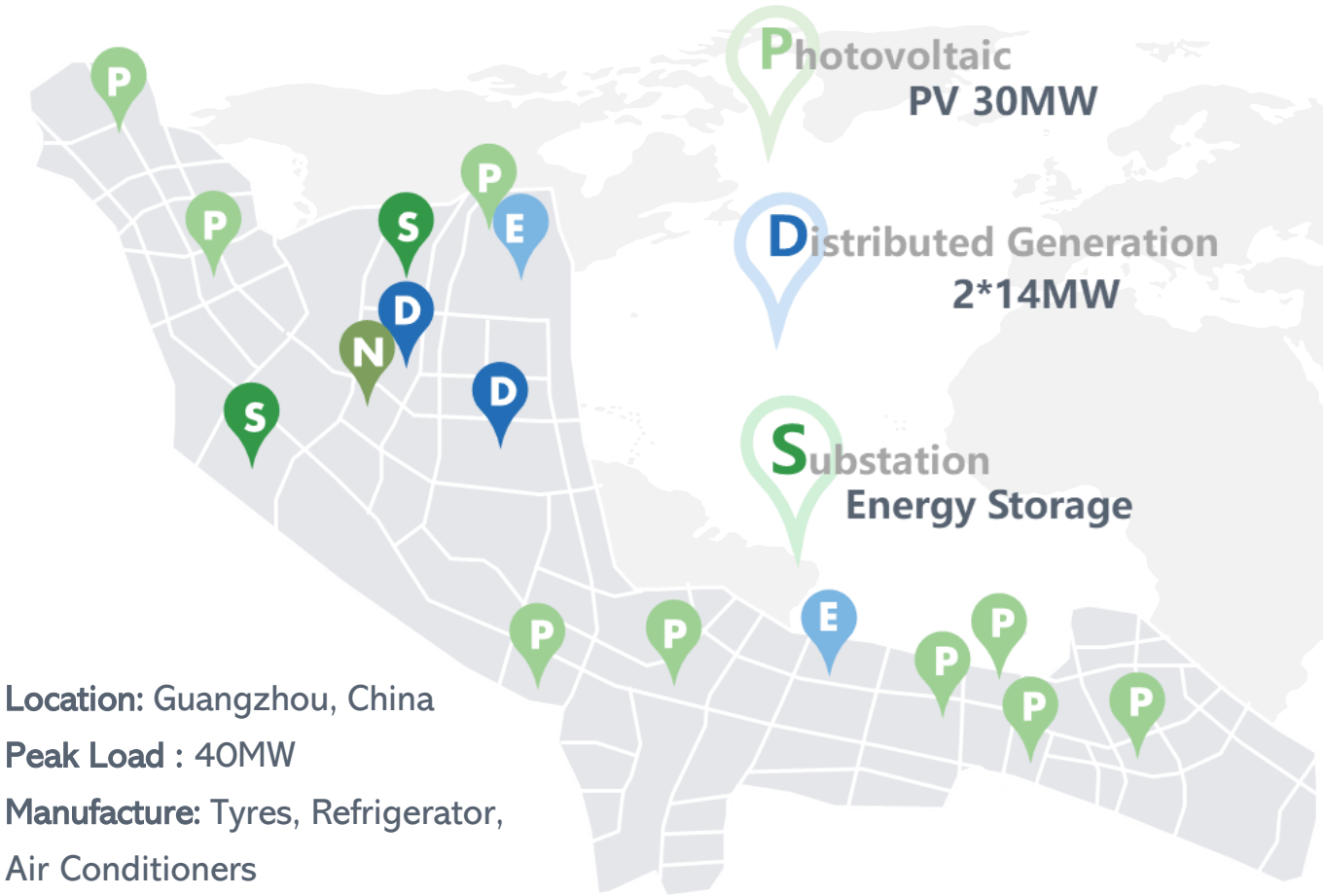
Integrated Energy System in distributed power grid and micro-grid improving primary resource efficiency up to 80%

Isolated Islands → **High-Tech Centre** → **Industrial Park** → **City Smart System**



- **The Red Sea, Saudi Arabia**
- **Koh Rong Island, Cambodia**
- **Guangzhou Pearl Industrial Park, China**
- **Shenzhen Low Carbon City, China**
- **Xiamen Multi-Industrial Park Energy Internet, China**
- **Shenyang Intelligent Energy Planning, China**

In Guangzhou Industrial Park, GEDI constructed an intelligent energy system based on Distributed UPG, Photovoltaic, EV Charging and Energy Storage.



Location: Guangzhou, China
Peak Load : 40MW
Manufacture: Tyres, Refrigerator, Air Conditioners
Energy Demand: Electricity, Heat

Reliability Enhancement

Based on distributed energy, reliability can be enhanced in case of climate disaster.

Efficiency Improvement

Distributed UPG can supply electricity and heat energy to improve primary efficiency up to 80%.

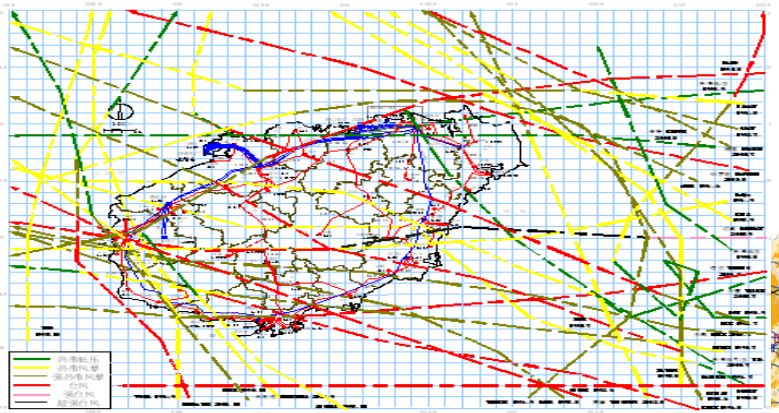
Load curve optimization

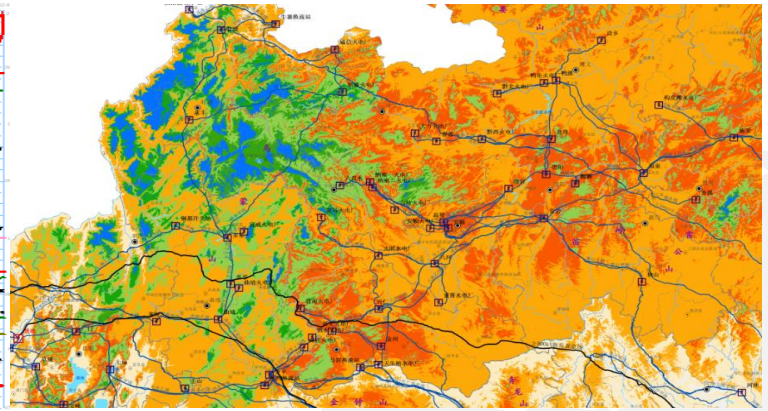
With Energy storage, the short peak load will be shaved to save cost of redundant investment of grid.

Black Start Source of Grid

UPG also serves as a black start resource to support main power grid as well

In Hainan with various Typhoon Disaster. GEDI has dedicated in the differentiated construction, which realized enhancement and economical performance.





Extreme Disaster Risk Analysis

- Typhoon Historical Data
- Ice Disaster Historical Data

Overlay Disaster Historical Data and Grid Data

Transmission Line Importance

- Grid Structure Analysis
- Power Flow Analysis
- Special Line as Train Crossing

Emergency Management System to Provide Proactive Solution in Advance to Reduce Disaster Influence

Emergency **Management**

Condition Monitor

- Weather System
- Substation Monitoring
- Equipment Monitoring

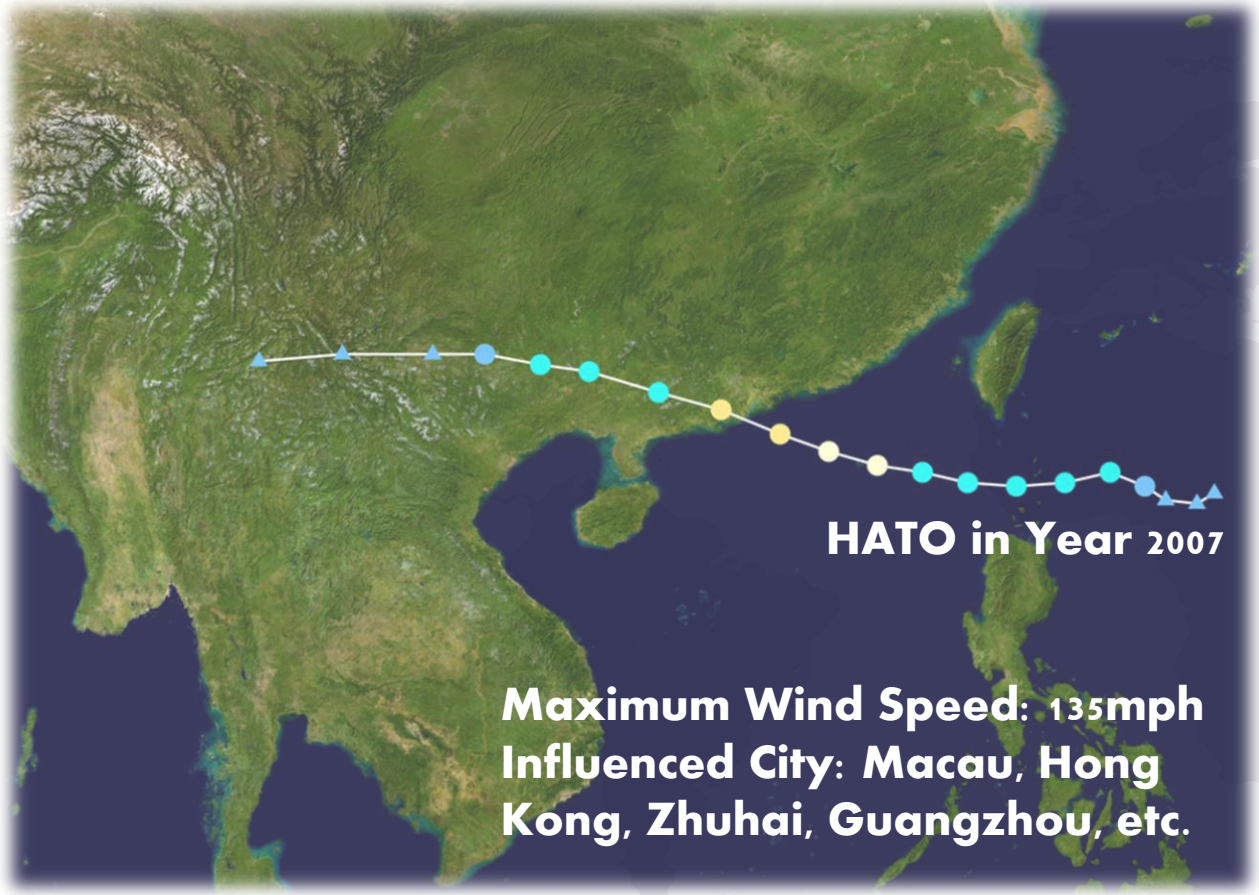
System Data Base

- EMS/DMS
- GIS System
- HR System

Resource Management

- Inventory Management
- Equipment Management
- Marketing System

When extreme climate attacks, under application of emergency management system, power system can be recovered in shortest time period.



System Influenced

Tripped Lines:135

Substation Outage: 73

Recovery for Rigid Customers in 1 hour

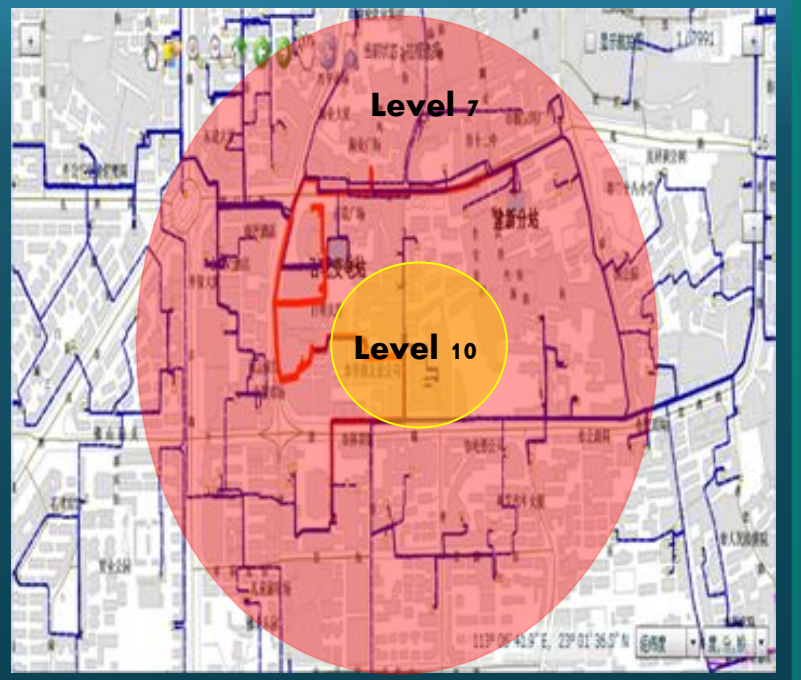
50% of the affected clients had been restored

Further Recovery in One Day

Tripped Lines:54
Substation Outage: 3
Clients Restored: 75%

Emergency Management provides proactive process preparing resources to recover the system in advance.

Disaster Impact Prediction



Equipment Losses	
Power line pole	69

Interrupted Customs	
Total	3450
VIP	3

Supply Need	
Wire	10k
Power line pole	60

Response Team Need	
Personnel	200
Power Generator Car	3

Precise Resource Dispatching

Findings

- Facing various climate disaster to cause system loss, a planning-construction-management whole –process proactive solution is proposed to enhance system resilience.

- Distributed Uninterrupted Power Generation should be located in important customers such as data centre and industrial parks, step-utilization should be applied to improve power efficiency.

- In area with various typhoon disasters, an overall research of transmission line reinforcement is strongly proposed to realize enhancement and economical performance.

- Proactive emergency management based on internet technology providing disaster estimation, resource preparation, on-site survey and decision support can help recover system failure in the shortest time instead of reactive procedures.

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Thanks.

To make energy more efficient, environment more beautiful.

Zixuan Guo, Senior Engineer of Power System

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