

在可持续发展方面的可再生能源应用潜力和案例

Potential and Application of Renewable Energy for Supporting Sustainable Development

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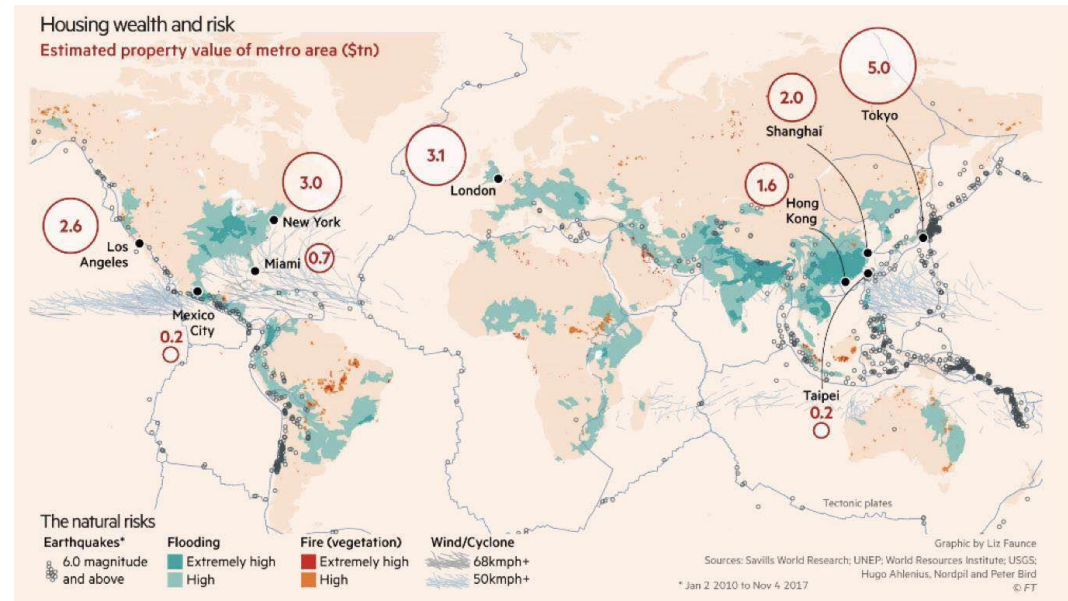
安徽·黄山 | Huangshan·Anhui
2018.11.2

提纲 Content

- 1 优势和机遇 | Advantage and Opportunities
- 2 集中式应用 | Centralized Case for Resilience
- 3 分布式应用 | Distributed Case for Resilience
- 4 热电联供 | CCHP by 100% RE
- 5 支撑可持续发展目标 | Supporting SDGs

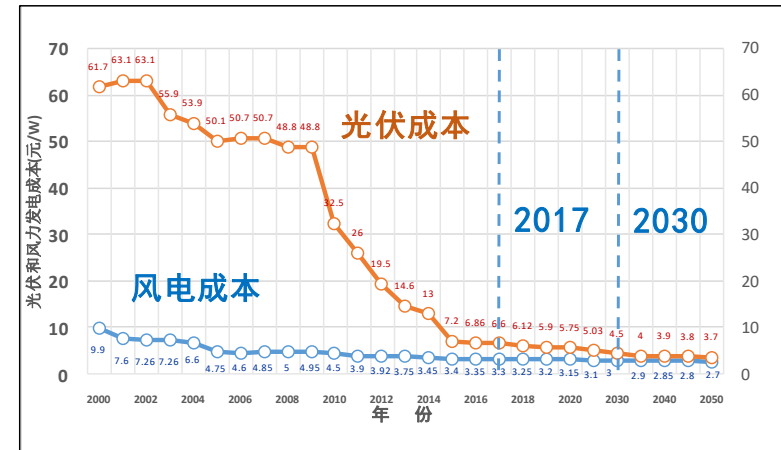
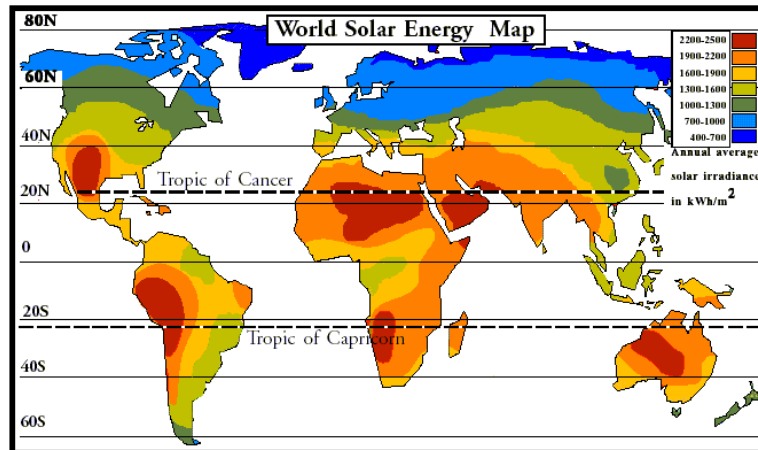
SDG13 and Resilience for Climate-related Disaster

- **SDG13.1:** Strengthen resilience and adaptive capacity to **climate-related hazards** and **natural disasters** in all countries
- ◆ **Facts:** **1.5°C** of the increase in global temperature will lead to average sea level rise **40-63cm** by 2100.
- ◆ **Risks:** Many regions and large cities are threatened with property value exceeding **\$18 trillion**.



Why technology of RE is basic ability for resilience?

- Energy acts as the corner-stone of resilience for wide usage pre-, in and post-disaster.
- **Advantages of RE** comparing with diesel and power grid.
 - Abundant resources of solar and wind layout around the globe.
 - Growing technology of PV and wind power accelerates the cumulated installation to reach **1TW** by 2017.
 - Flexible scale enables to power LED-light (in **Watts**), rescue equipment (in **100kW**), and reconstruction(**1MW+**)
 - Convenient deployment enables to fast install at disaster site on ground, water surface, rooftop, tent and etc.
 - Simple distribution enable less need of transmission lines and transformers.
 - Low feed-in-tariff of PV and wind power, which is as low as **2-3 cents/kWh**, leads to grid parity in 100+ countries.



Diverse installation of PV and wind power



Ground-mounted PV (1kW-10GW)



PV rooftop (1kW-50MW)



Off-grid PV system(<100kW)



Wind farm (200kW-10GW)



Small wind(horizontal-axis)



Small wind(vertical-axis)

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Yushu Earthquake in Qinghai Province



- On April 14, 2010, earthquakes occurred in downtown Yushu, with the highest magnitude 7.1.
- ◆ **Situation:** 90% houses collapsed, 2700 people died, and 200,000+ homeless.
- ◆ **Challenge:** 400km away from main grid, local hydro-power stations were destroyed.



Important role of RE in rescue



House-hold PV



PV equipment in nursing home



PV system for satellite receiver



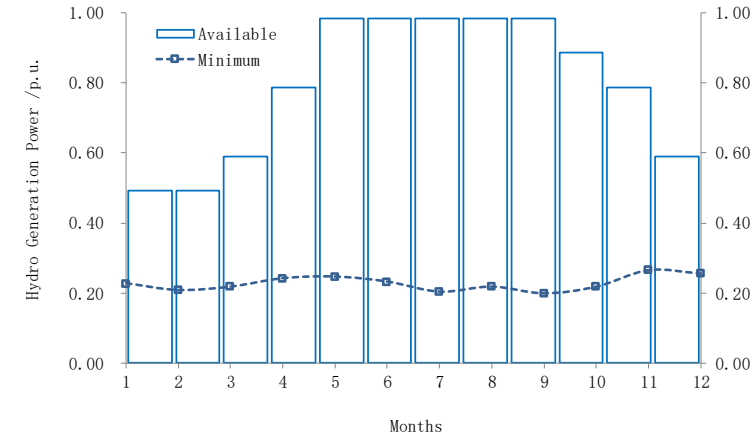
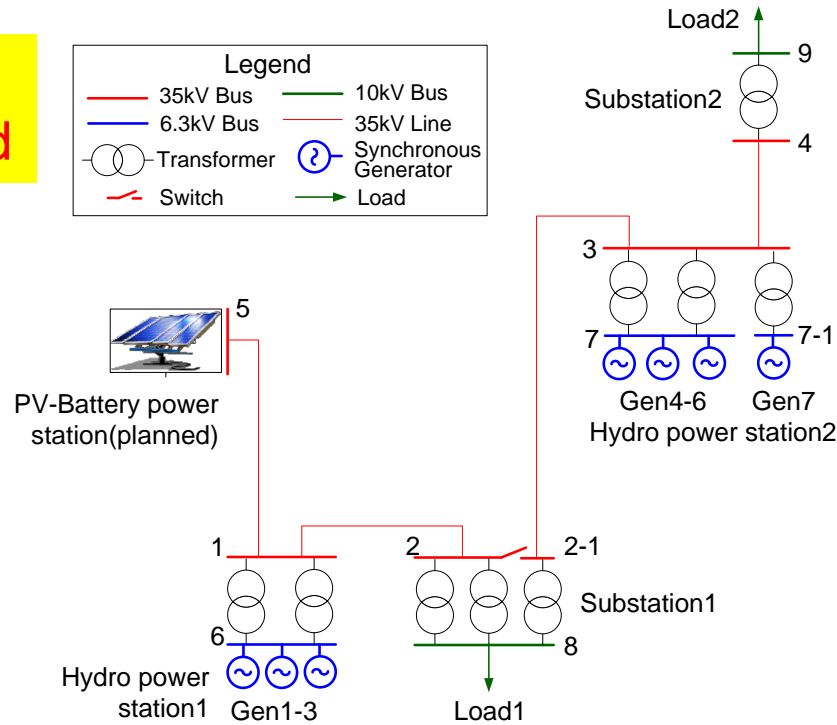
8kW wind/PV hybrid system in lama temple



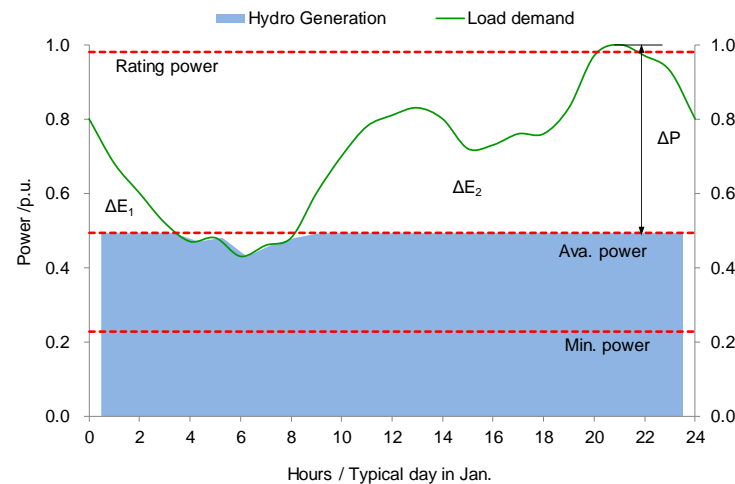
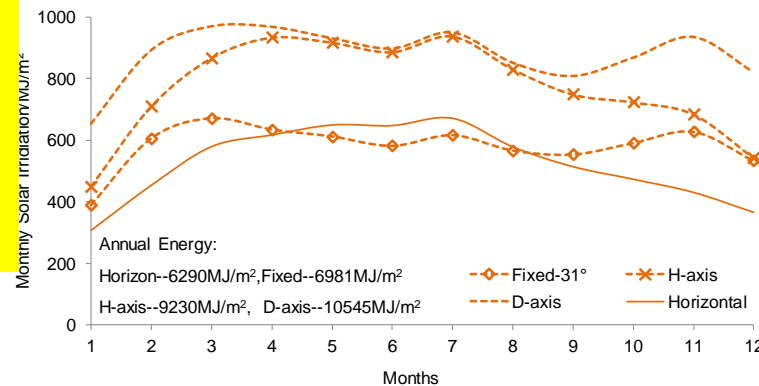
Off-grid station (30kW wind+20kW PV+100kWh Battery for 50 households)

Challenges in reconstruction

1) To be dispatched



3) To supply stand-alone when grid is down.



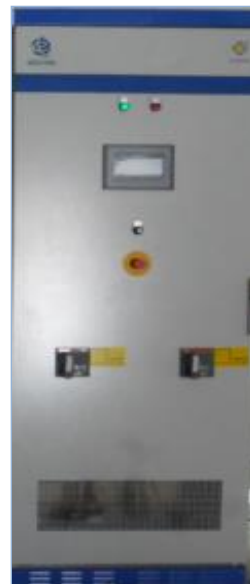
2) To supply in night



青海玉树光伏/储能电站（2011年建成）：2 MW光伏阵列+15.2 MWh储能系统
PV/battery station in Yushu County finished by Nov. 2011: 2 MW PV array + 15.2 MWh Battery



150 kVA电压源型逆变器（下垂控制）
150kVA Inverter with Droop Control



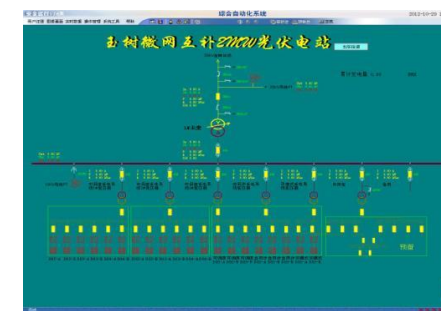
150 kW DC-DC充电控制器
150kW DC-DC Charger



胶体蓄电池组
GEL Battery



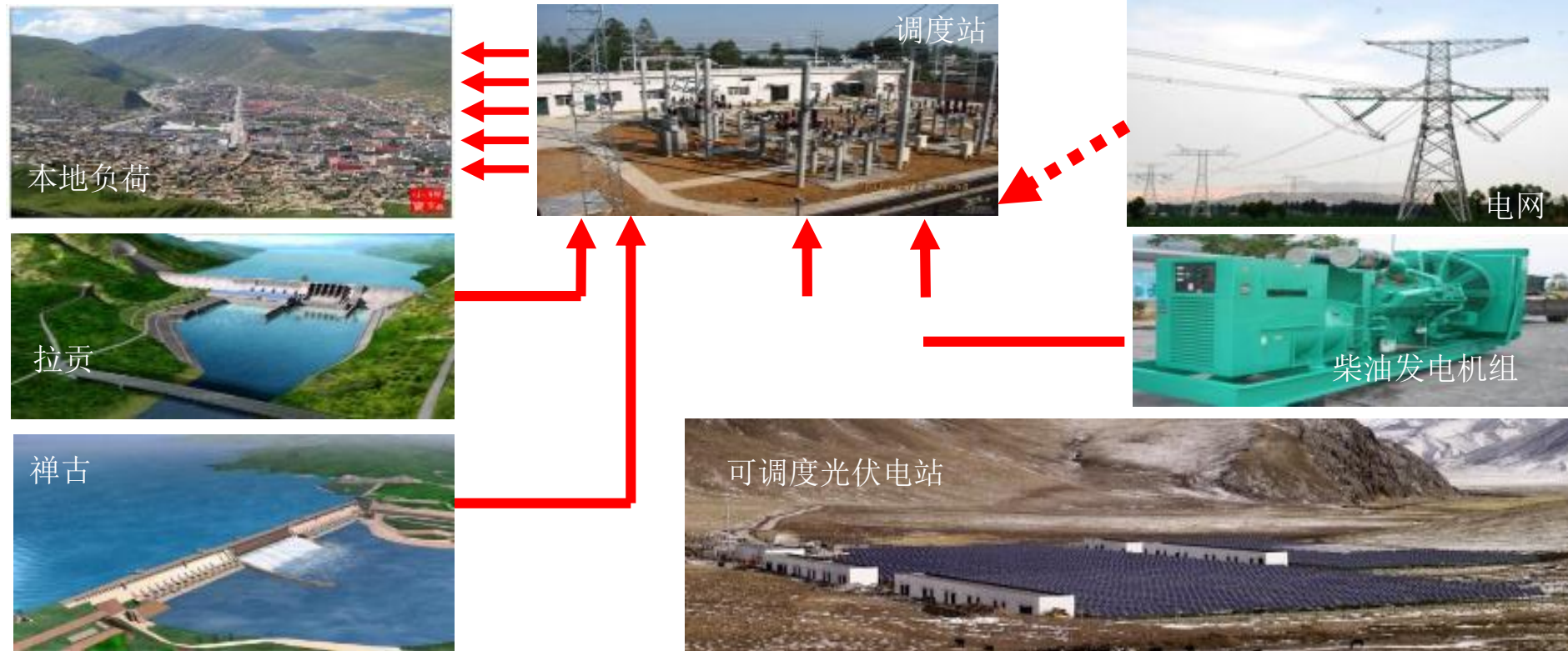
水平单轴跟踪系统
H-axis Tracker



综合自动化系统
Software HMI of automation system

Hydro/PV hybrid demonstration for reconstruction

- Fill about **60%** of Yushu's electricity gap (3M kWh), which is strongly support of reconstruction.
- Reduce usage of diesel and carbon emissions, which is greatly protection for weak ecological environment in that area.



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Portable RE for disaster relief



PV Charger



PV source
10W ~ 100W



During Kyushu earthquake in April 2016, the affected people charged the mobile phone with solar charger.



During Nepal earthquake in April 2015, portable solar equipment is necessities for disaster relief.

Potential for Energizing Rescue Equipment



PV-powered UAV for rescue

Airbus Zephyr 8, the longest voyage 23h47m,
the highest altitude is 18805m



Rapid-deployed PV system for rescue

Hanergy RDS, 20 inch standard container, 5-100kW,
deploy in 3 hrs.

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Pre-disaster · Stand-alone CCHP based on 100% RE

- Riyue county is supplied by a micro energy grid, which can operate even without electrical grid and heat grid, since March, 2018.



Pre-disaster · RE and Hydrogen

- PV, hydrogen and fuel cell coupling system has been used to strengthen resilience in Japan. When disasters occur, it can provide electricity, hot water and hydrogen.

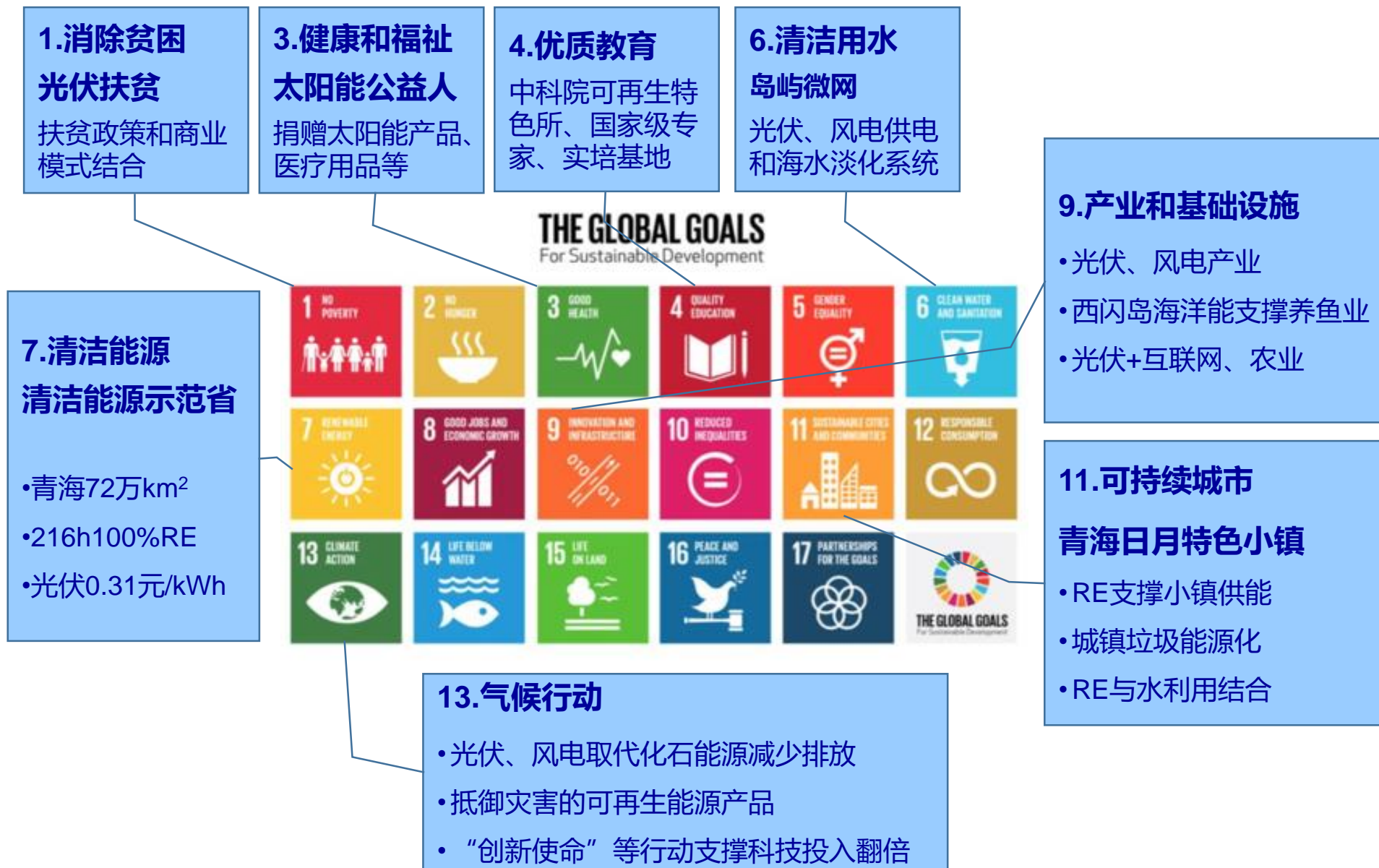


川崎市东扇岛中公园避难所H2One示范
30kW, 1Nm³/h, 电和水可供300人/周

提纲 Content

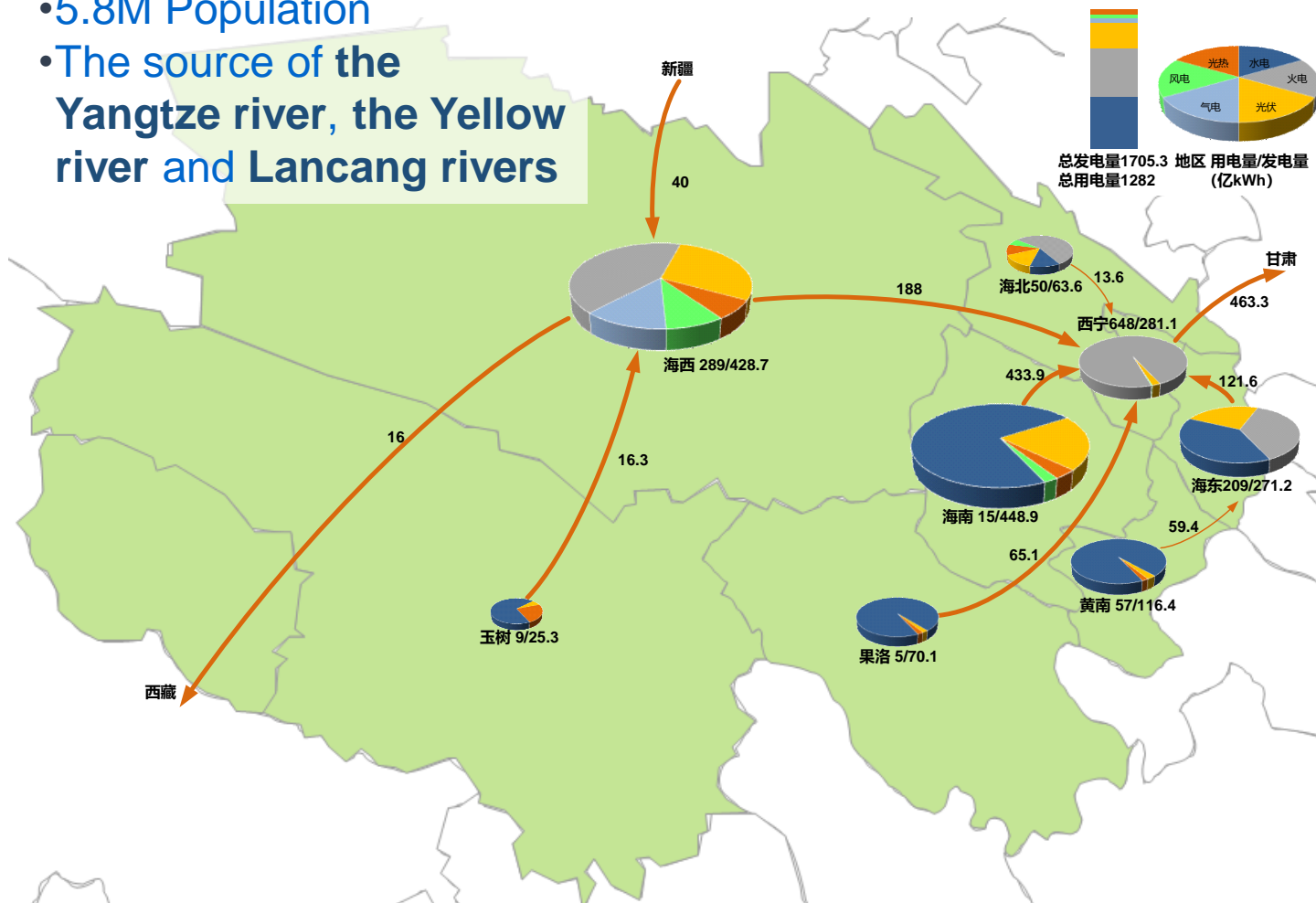
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RE is basic ability for supporting SDGs



SDG7 Clean Energy & SDG13 Climate Action

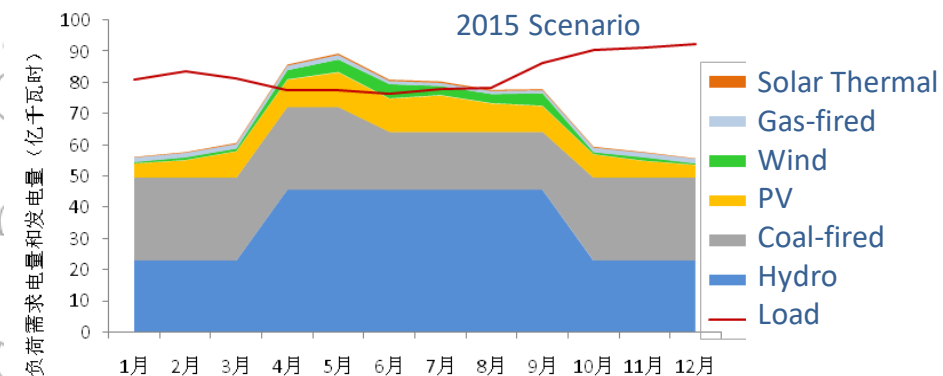
- 721,000 km²
- 5.8M Population
- The source of the Yangtze river, the Yellow river and Lancang rivers



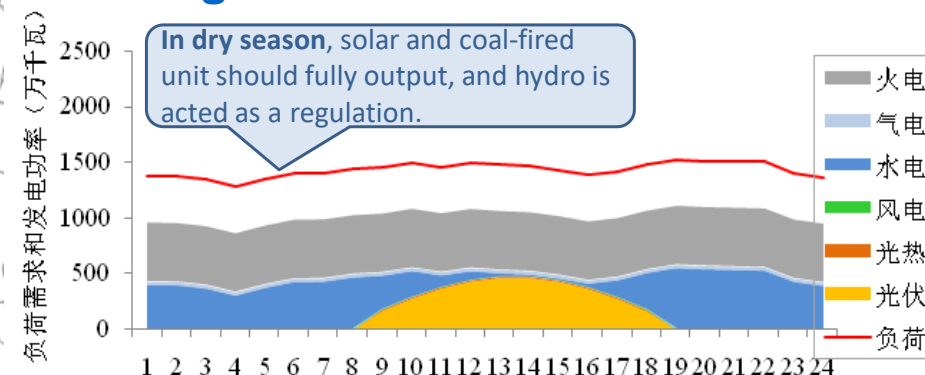
MILESTONE in RE (2018)

□ 216 hrs operation on 100% RE

□ RMB 0.31/kWh of PV FIT



Challenge#1: Seasonal unbalance



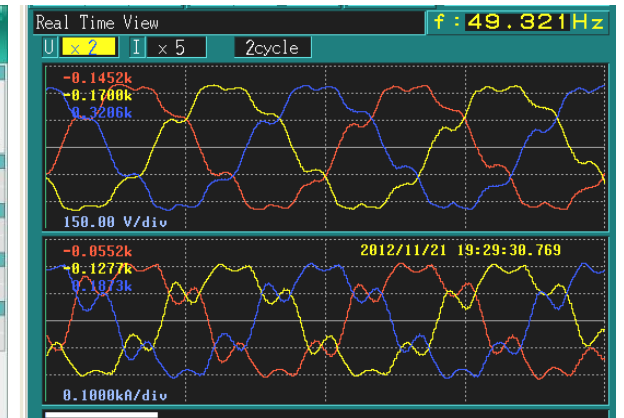
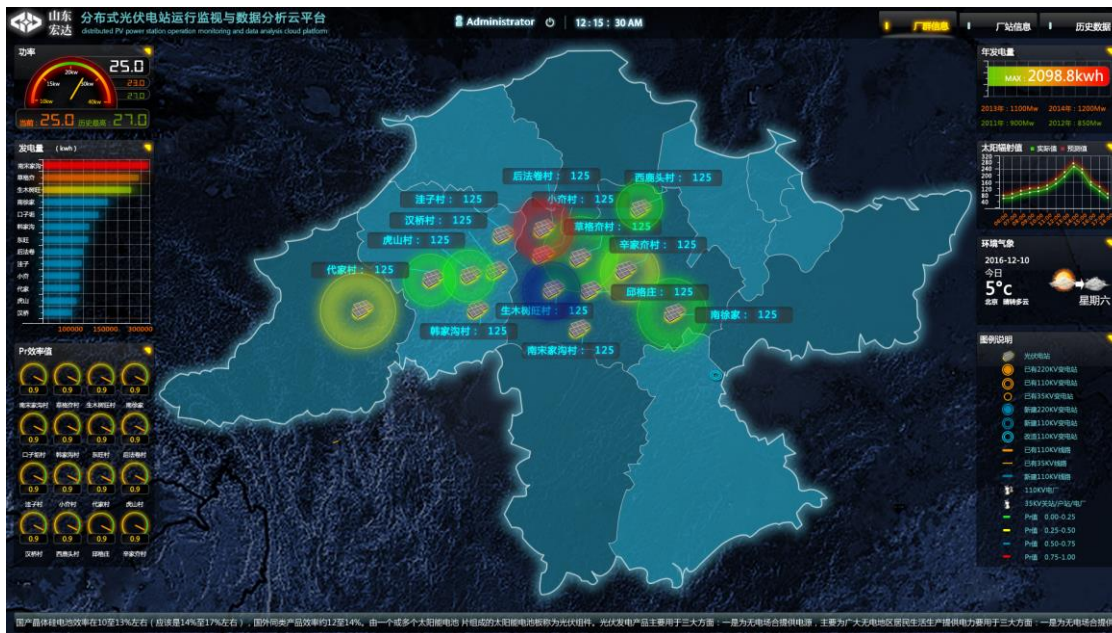
Challenge#2: Regulation in dry season

SDG1 No Poverty



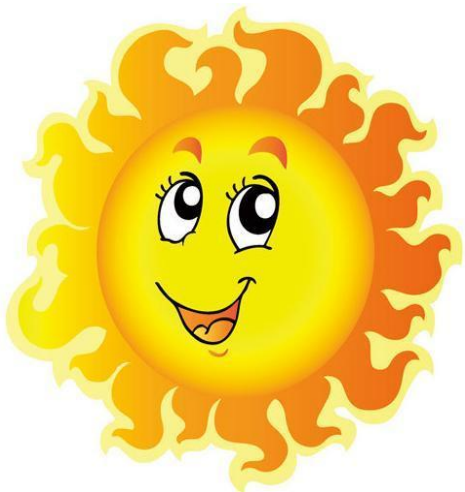
The "Photovoltaic Poverty Alleviation" plan will build PV projects in 16 provinces to help **2 M** Population out of poverty **From 2015 to 2020**.

- ❑ **Funding:** governmental investment + loan
- ❑ **Property right:** owe to the poor family
- ❑ **Profit:** $\geq 8\%$, return the poor family
- ❑ **Instance:** **~3 yrs** for paying off the loan and **17+ yrs** for long-term income.



Challenge#1: O&M of PV in the poor area

Challenge#2: Poor power quality in remote area



Thank You!

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