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Introduction for Photovoltaic Power System Test in China

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Nov. 6, 2012

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Testing Status of PV power systems in China

- The main type of PV power systems were PV stand-alone systems before 2003. There are quality problems existed and lacking the evaluation standards and methods.
- Begin from 2003, the grid-connected PV systems have been developed and built in China.
- Under Research PV projects in China— 6 Grid-connected MW Power Stations during the 11th "5 Year Plan" have been built.
- "Golden Sun Demonstration Project" of Ministry of Finance of China support many grid-connected PV systems.

Establish test capacity for PV power systems in order to evaluate PV systems, ensure their quality, manage the market and protect the benefits of users.

Testing Status of PV power systems in China

Chinese test institutions for PV products:

- The 18th Research Institute of China Electronics Technology Group Corporation
- Photovoltaic and Wind Power Systems Quality Test Center, Chinese Academy of Sciences. (It was one of the first laboratories to carry out the testing for PV power systems)
- The 811 institute of Shanghai Academy of Spaceflight Technology
- Shenzhen Electronic Product Quality Testing Center
- National Solar PV Product Quality Supervision and Inspection Center
- Yangzhou PV Product Test Center
- China Telecommunication Technology Labs (CTTL)
- ▪▪▪▪▪

Testing Status of PV power systems in China

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Photovoltaic and Wind Power Systems Quality Test Center, Chinese Academy of Sciences (PWQTC)

Accreditation Certificates

- Established in 1999.
- An authoritative testing organization with the third-party notarial status, accredited respectively by China National Accreditation Service for Conformity Assessment (CNAS) and China Metrology Accreditation (CMA).
- The reports that PWQTC provided have law effect in China.

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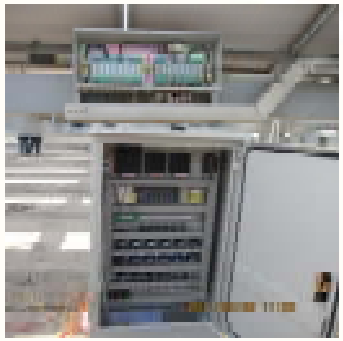
Testing Status of PV power systems in China

Test capacity of PWQTC :

- Crystalline Silicon and thin-film solar Cell
- Crystalline Silicon and thin-film PV module
- PV charge controller and inverter
- PV stand-alone systems:
  - ★Solar home systems
  - ★ Portable solar photovoltaic lanterns
- Grid-connected PV systems
  - ★ Onsite test
  - ★ Data acquisition and monitoring



Test standards for PV power systems

For PV stand-alone systems:

- GB/T 19064－2003 Solar home system specifications and test procedure
- IEC61214: Photovoltaic (PV) stand-alone systems – Design verification.
- PVRS11A 2005-03 Amendment 1, 2008-03 Portable solar photovoltaic (PV) lanterns-Design qualification and type approval
- Technical specification for stand-alone photovoltaic systems (not issue yet)

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Test standards for PV power systems

For grid-connected PV systems:

- CGC/GF003.1:2009 Basic acceptance requirements for grid-connected PV systems
- GB/T 19939-2005 Technical requirements for grid connection of PV systems
- GB/T 20513-2006 (IEC 61724) Photovoltaic system performance monitoring- Guidelines for measurement, data exchange and analysis
- IEC 62446 Edition 1.0 2009-05 Grid connected photovoltaic systems – Minimum requirements for system documentation, commissioning tests and inspection

CGC: China General Certification Center

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PV stand-alone systems test

Test system development

indoor test system

- ❖ Developed outdoor test system (2004-2005）
- ❖ Developed indoor test system （2006）

✓Test system equipped with 7 channels

- ✓ 4 channels for maximum 100W system testing
- ✓ 2 channels for maximum 300W system testing
- ✓ 1 channel for maximum 600W system testing

PV stand-alone systems test

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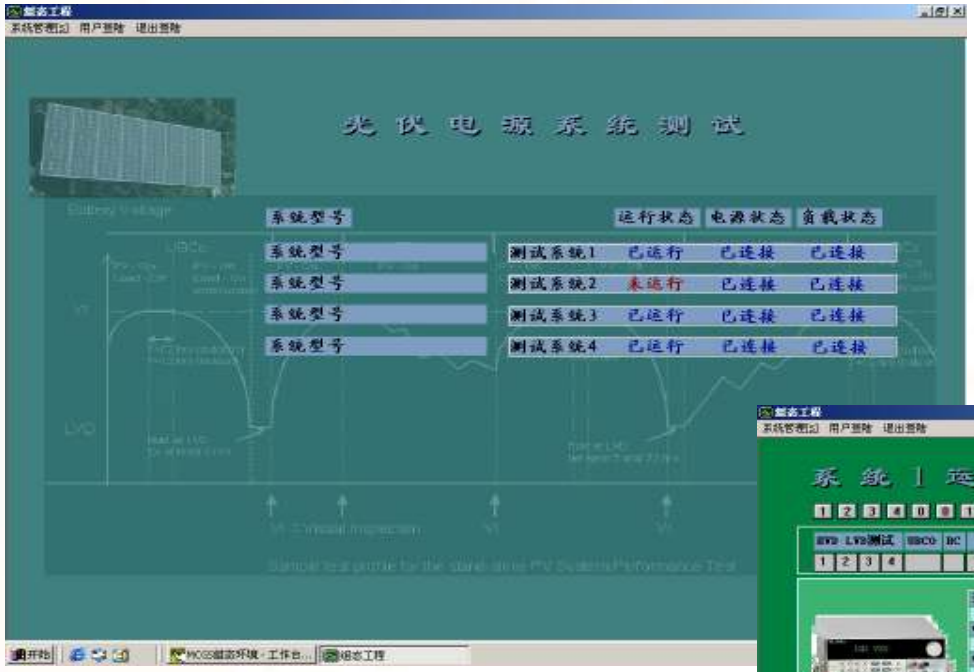

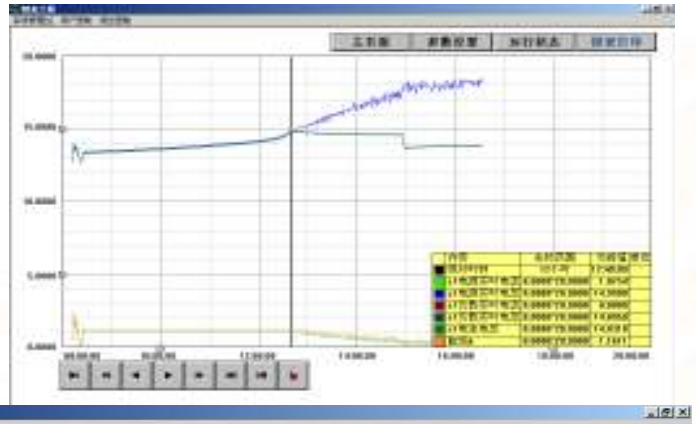

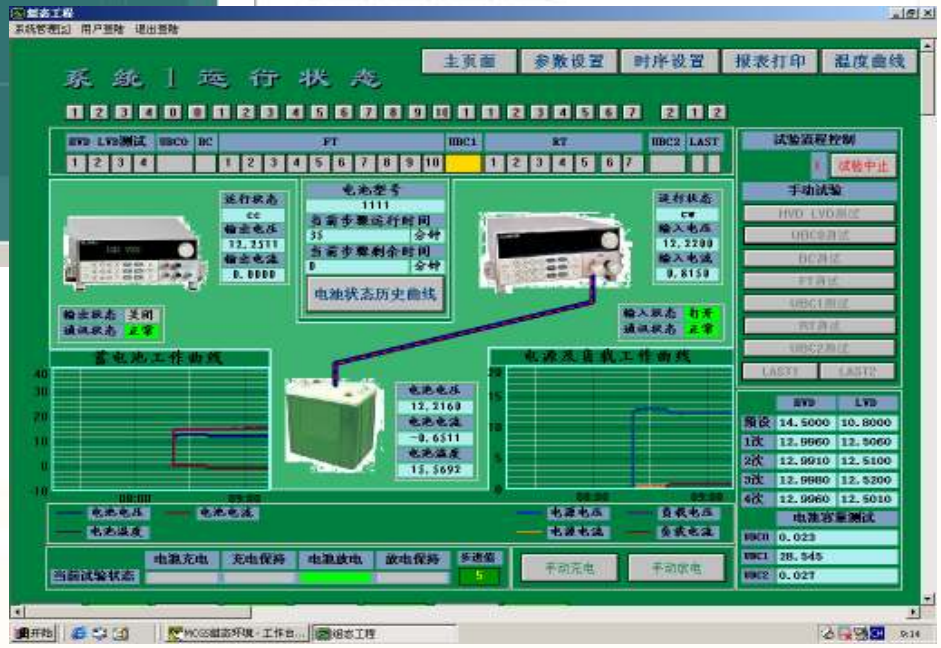

Software of the test system

PV stand-alone systems test

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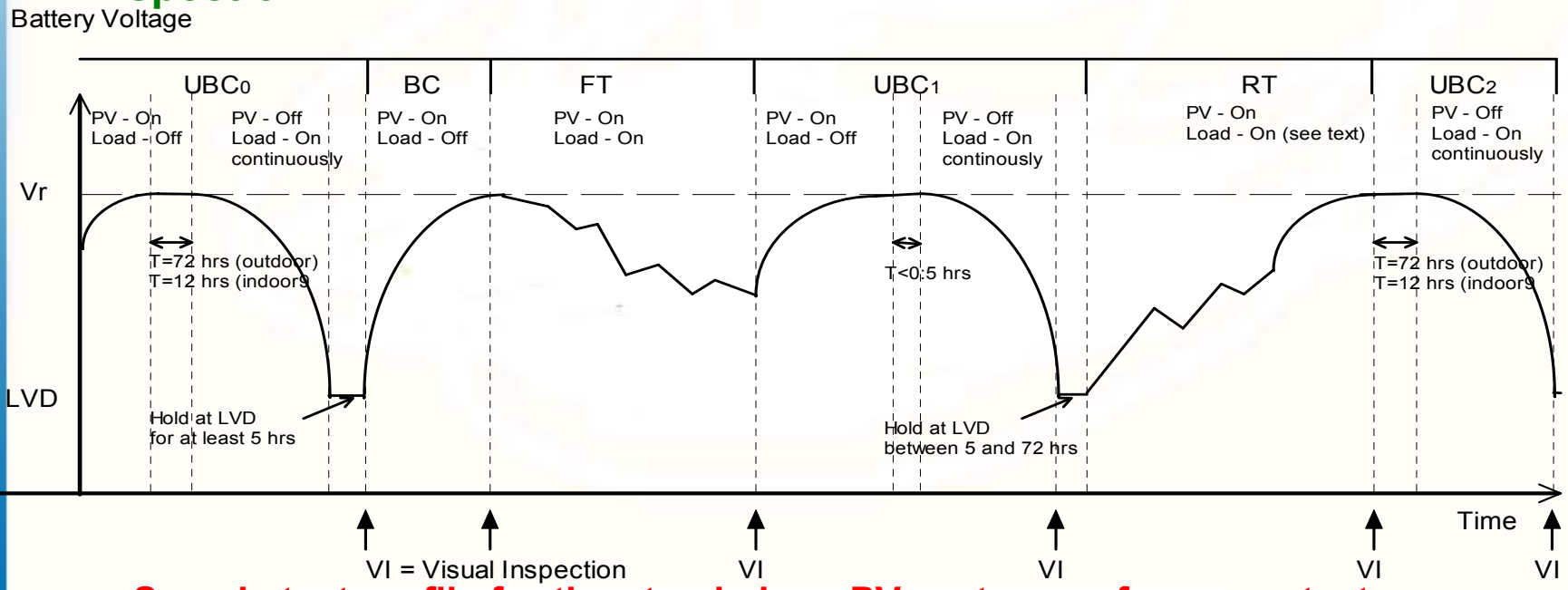
Test items for PV stand-alone systems (Standard:IEC62124, PVRS11A)

- **Documentation：**

  certificate, technical parameter, user manual, technicians' manual, design specification

- **Performance test:**

  load function, battery capacity, recovery test, system balance point, days of autonomy, load ability in high voltage, system status, visual inspection



Sample test profile for the stand-alone PV system performance test

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PV stand-alone systems test

Tested various PV stand-alone systems

Analysis for failed reasons:

- Load operation failed

  Reason: the daily load consumption (i.e daily watt hour) is too big. In such match, the system can not supply enough energy to meet the load consumption specified by the manufacturer.

- Decrease capacity of battery

  Potential reason: battery quality

- Controler point setting not properly
- Mismatch between module peak power and load Watt-hour




Grid-connected PV systems test

■ Onsite test

CGC/GF003.1:2009 Basic acceptance requirements for grid-connected PV systems

Test items

- ➢ Continuity of protective earthing and/or equipotential bonding conductors
- ➢ Polarity test

  PV string - open circuit voltage measurement
- ➢ PV string - current measurement
- ● PV string – short circuit test
- ● PV string – operational test
- ➢ Functional tests
- ➢ PV array insulation resistance test
- ➢ Nominal power test for PV array
- ➢ Power quality test




表1 绝缘电阻最小值

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Grid-connected PV systems test

- Electrical system efficiency test
- CPV module test
- Functional test for automatic tracking system





Grid-connected PV systems test

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■ Data acquisition and monitoring

GB/T 20513-2006 Photovoltaic system performance monitoring-Guidelines for measurement, data exchange and analysis

Parameters to be Measured in Real Time

- **Meteorology: total irradiance, in the plane of the array, ambient air temperature, wind speed**
- **Module tring/Combiner box/PCU// Utility grid : current, voltage, power, module temperature.**

Derived Parameters

- **Meteorology：daily global or direct irradiation, in the plane of the array**
- **Electrical energy quantities: energy from module string energy from combiner, energy to PCU, energy from PCU, energy to utility grid**
- **System performance indices: array yield, final PV system yield, reference yield, array capture losses, BOS losses, performance ratio, mean array efficiency, overall PV plant efficiency**

Grid-connected PV systems test

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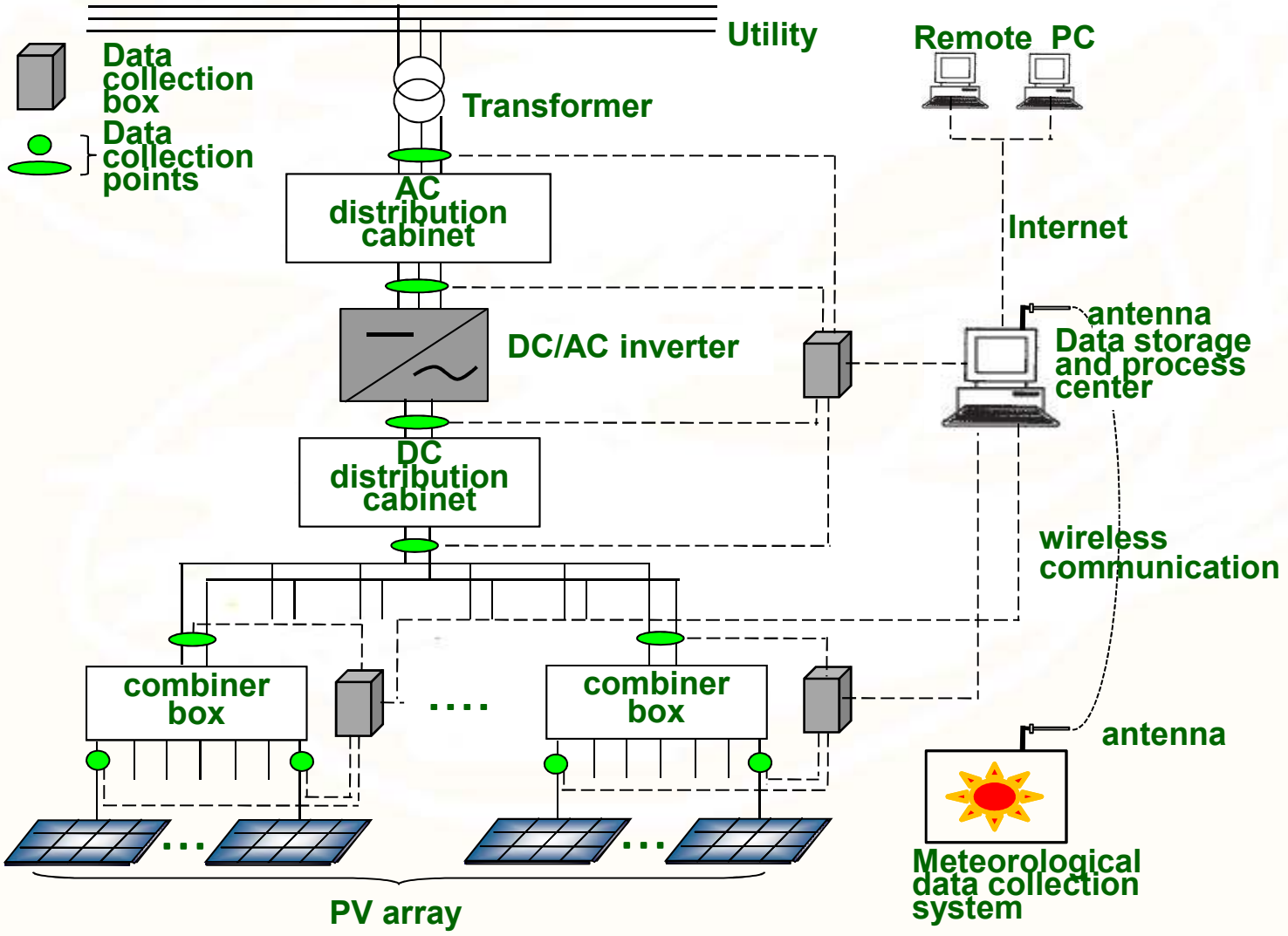
Overview of the grid-connected PV system and the data acquisition system



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Grid-connected PV systems test

- The acquisition system can be used to measure PV plants with different capacity and configuration by selecting and combining data collection boxes freely.
- The software can be used to process, display and store the collected data in the PC disk.
- Allow the user to access the data from the internet.

Future work

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➢ **Develop an movable onsite testing platform for PV power plants**

- **Purpose**：meet acceptance requirements of large number of now built PV plants, and carry out the overall performance analysis for these PV plants.
- **Test range**：the overall operation performance such as point of interconnection (POI) of PV power station, insulation characteristic, lightning protection and grounding, etc, the main component such as PV array, inverter, etc.

➢ Research the method to evaluate the design and performance of the PV power systems by testing and monitoring data.

Movable testing truck

Portable data acquisition module, IV tester, grounding resistance tester, power quality analyzer 、power analyzer, Insulation resistance tester …

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