

新能源示范城市的实践与思考

New Energy Pilot Cities: Thoughts on Practices

-吐鲁番市新区可持续发展城市项目

-Turpan New District Sustainable Development City Project

2011.05

Research Center for Sustainable Urban Development

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项目概述：

启动时间：2008年 10月

研究团队：汪光焘主任为首席科学家的“可持续城市发展研究中心”

研究对象：吐鲁番市新区

支持机构：美国能源基金会

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Project Overview

Start Date: October 2008

Research Team: Research Center for Sustainable Urban Development

Chief Scientist: Wang Guangtao (Director of Environmental and Resources Protection Committee of NPC, Former Minister of Construction,)

Object of Study: New District of Turpan City

Supporting Sponsor: The Energy Foundation of USA

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Solar Energy Resource Analysis 太阳能资源分析

建筑与发电一体\充分利用太阳能和地域建筑的有机结合
Make full use of integration of solar energy with regional building

管理

- 基于光伏发电的微电网系统方案与运行模式
Management
- plan and implementing Micro-grid Projects based on PV system

应用

- 基于微电网应用的绿色交通
• 与老城区电力系统相互支撑
Usage
- Develop Green transport system based on Microgrid
- Interactive with city Grid

实践

- 起步区一期详细规范
- 示范区建筑设计
- 新城區微电网构建与管理

Practice

- Detailed construction specifications for the first stage
- Building design in the Pilot area
- Construct Mricrogrid of New District

总结和推广

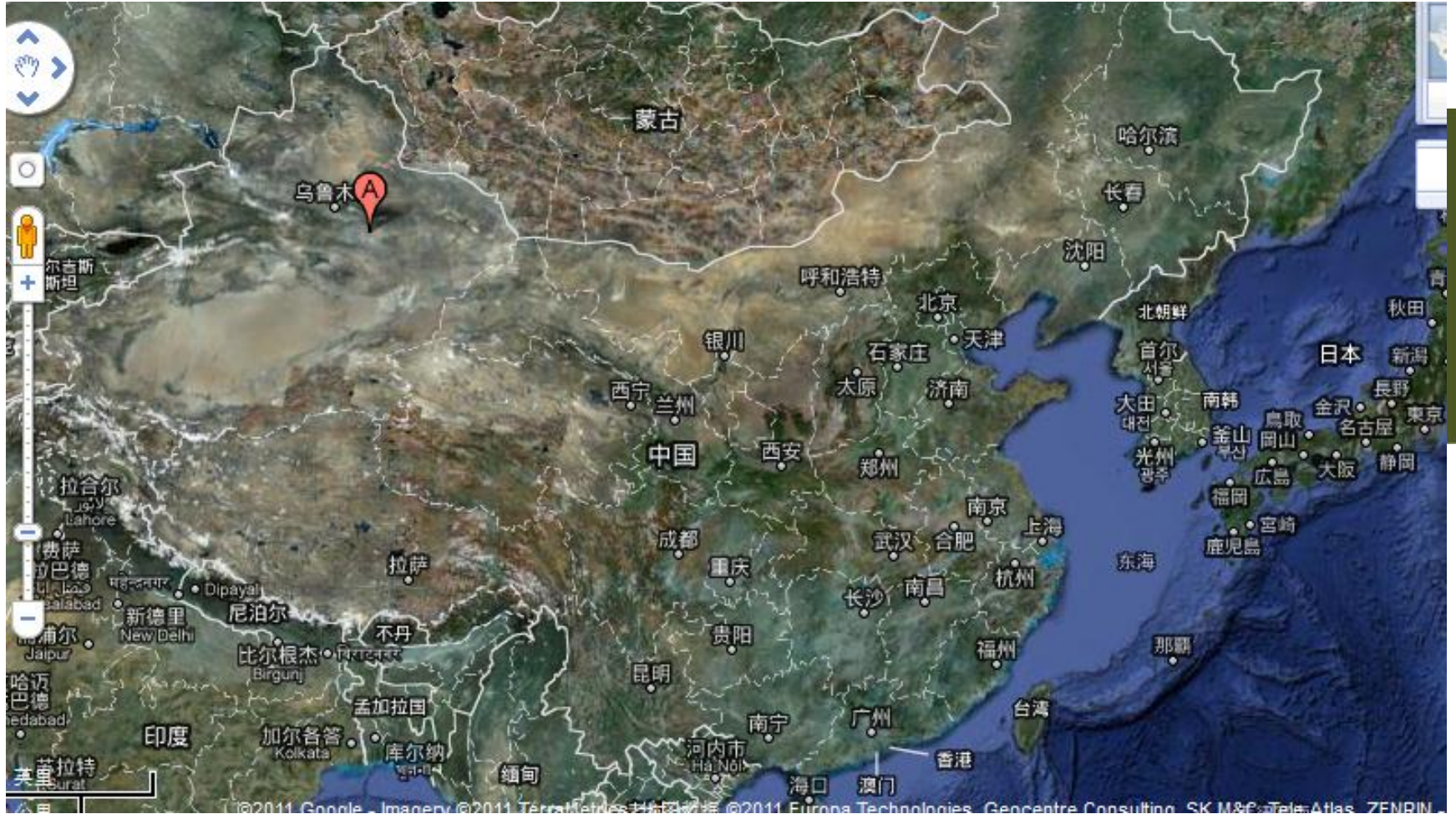
在技术和政策层面上为新能源的在城市内综合利用探索出规划、建设、运营之路

Conclusion and Promotion

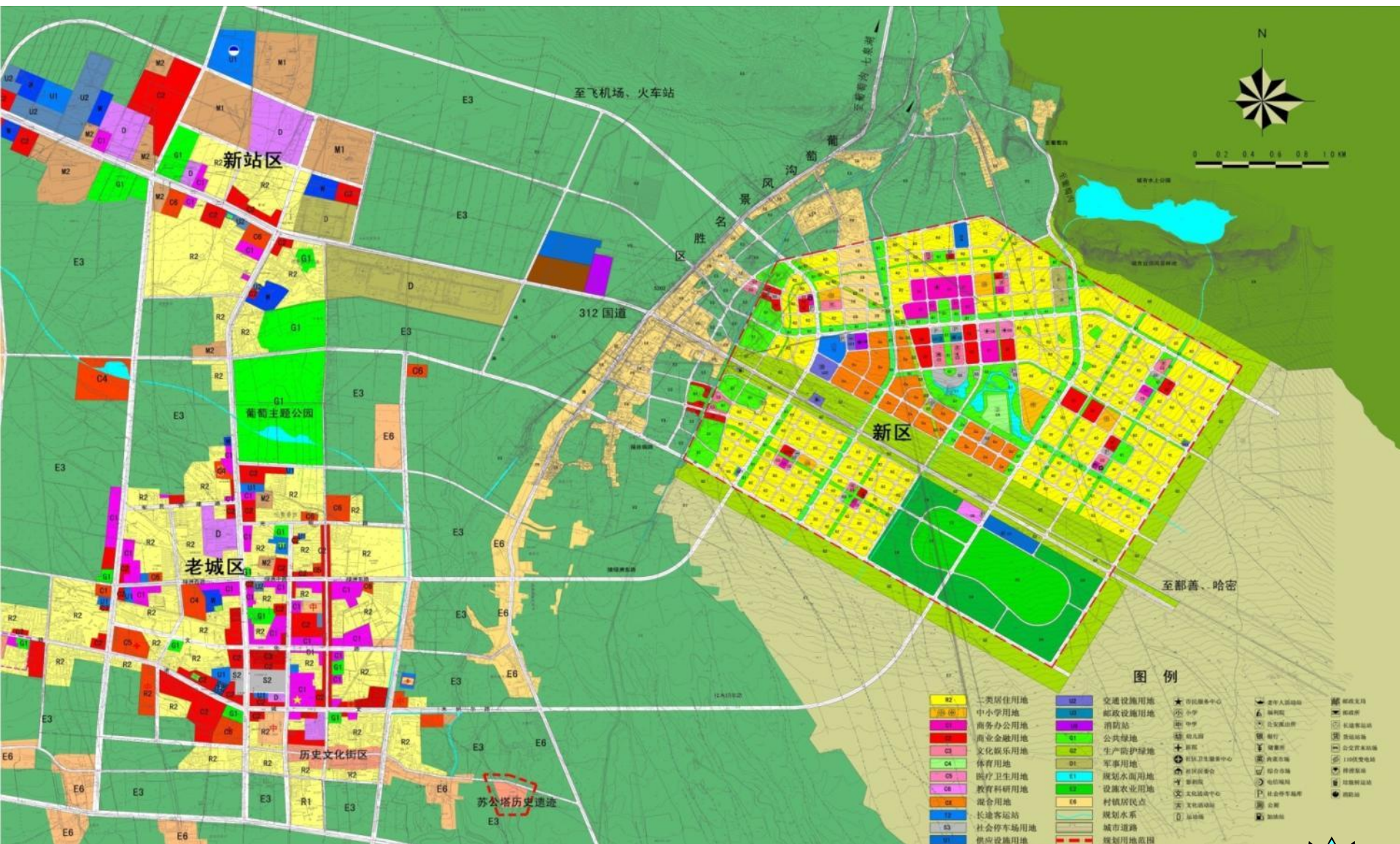
- Explore a way involving plan, implementation, operation to utilize new energy efficiently in Cities on technical and legislature level

吐鲁番的位置

Where is Turpan









- **2009年01月至2009年05月**

2009年3月14日，完成总体规划, 并通过专家组评审。

2009年3月20日，自治区人民政府将吐鲁番市新区列为“**自治区和谐生态城区和城乡一体化示范区**”。

2009年7月31日，自治区人民政府批准《**吐鲁番市新区总体规划**》。

- **From January 2009 to May 2009**

Mar. 14 2009, Completed the general plan for Turpan City New District

March 20, 2009 ,the government of autonomous region listed Turpan City New District as an “**Autonomous Region Harmonious Ecological City and Urban/Rural Integration Pilot Area**”

July 31, 2009 the government of the autonomous region approved
Turpan City New District General Plan

•2009年06月-2010年4月

《建筑和太阳能的一体化研究及示范区设计》

《基于光伏发电的微电网系统研究》

《基于太阳能综合运用的绿色交通研究》

《主要指标、经济及碳排放的初步估算气象研究》等研究。

2010年4月获得“**国家能源局关于新疆吐鲁番市新区创建国家新能源示范城市的复函**”。

•2010年05月-至今，示范项目实施阶段。

•From June 2009 to April 2010

-- Study on BIPV design in Pilot Area

-- Study on Microgrid Systems based on Photovoltaic Power Generation

-- Study on Green Transport based on Microgrids

-- Meteorological Research on Estimate of Key Indicators, Economy, and Carbon Emissions

-- In April 2010, "New Energy Pilot City" named by National Energy Administration

✓ From May 2010 to present - Implementation Phase of Pilot Project

研究介绍:

目标: 建设充分利用太阳能资源的可持续发展新区。

思路原则: 采用光热与光电相结合的原则;

难点和创新点:

- ✓ 气象预测与光伏出力预估;
- ✓ 微电网的智能化管理。

Study highlights

Purpose: To construct a city that utilizes solar energy resources in efficient way;

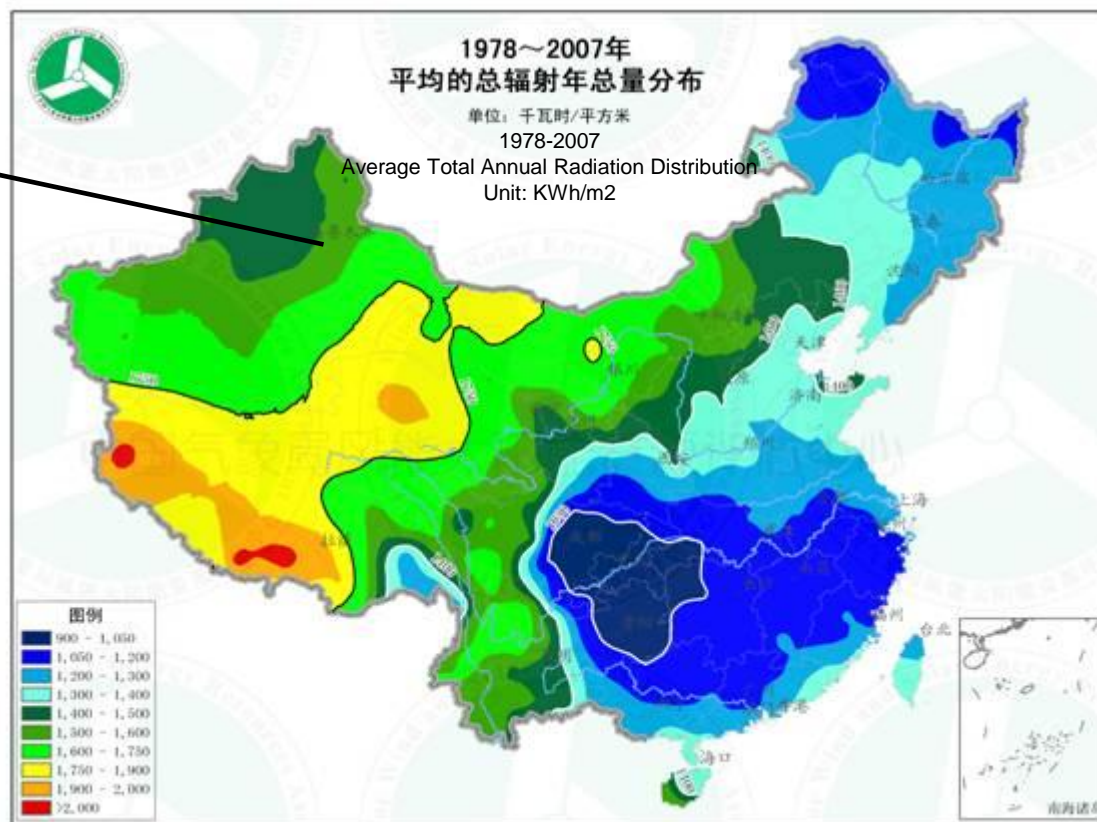
Principles: Integrate application of solar heating and solar PV technologies;

Challenge:

- ✓ The real-time power prediction of PV and meteorology forecast;
- ✓ Microgrid management and operation

Climatic Condition: Total solar energy resource in Turpan District is recognized as “Abundant Region.” Over one half of China’s land area has equivalent or greater annual radiation.

≈1500kWh/m²



Region	Total Annual Radiation Indicator (kWh m ⁻²)
Most Abundant	≥ 1750
Abundant	1400 - 1750
Less Abundant	1050 - 1400
General	< 1050

Solar Resources of Some European Cities (kWh/m²)

City (Nation)	Helsinki (Finland)	Hamburg (German)	Stockholm (Sweden)	London (United Kingdom)	Vienna (Austria)	Paris (France)
Total Annual Radiation	917	952	987	1010	1080	1115

居民建筑布局设计：

The design for layout of residential building



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规划方案：

Design Program



变压器并入电网示意图

The diagram of transformers



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示范区

一期示范区约1.5平方公里；
总建筑面积：753972 m²；
住宅建筑面积：686375 m²；
示范区内有8个以变电站、公交站、公交车充电为核心建设的社区中心。
光伏板装机容量：13.4兆瓦。
约为住宅用电量的1.3倍。
预计年产生减排量按电量边际计算：16197 tCO₂。

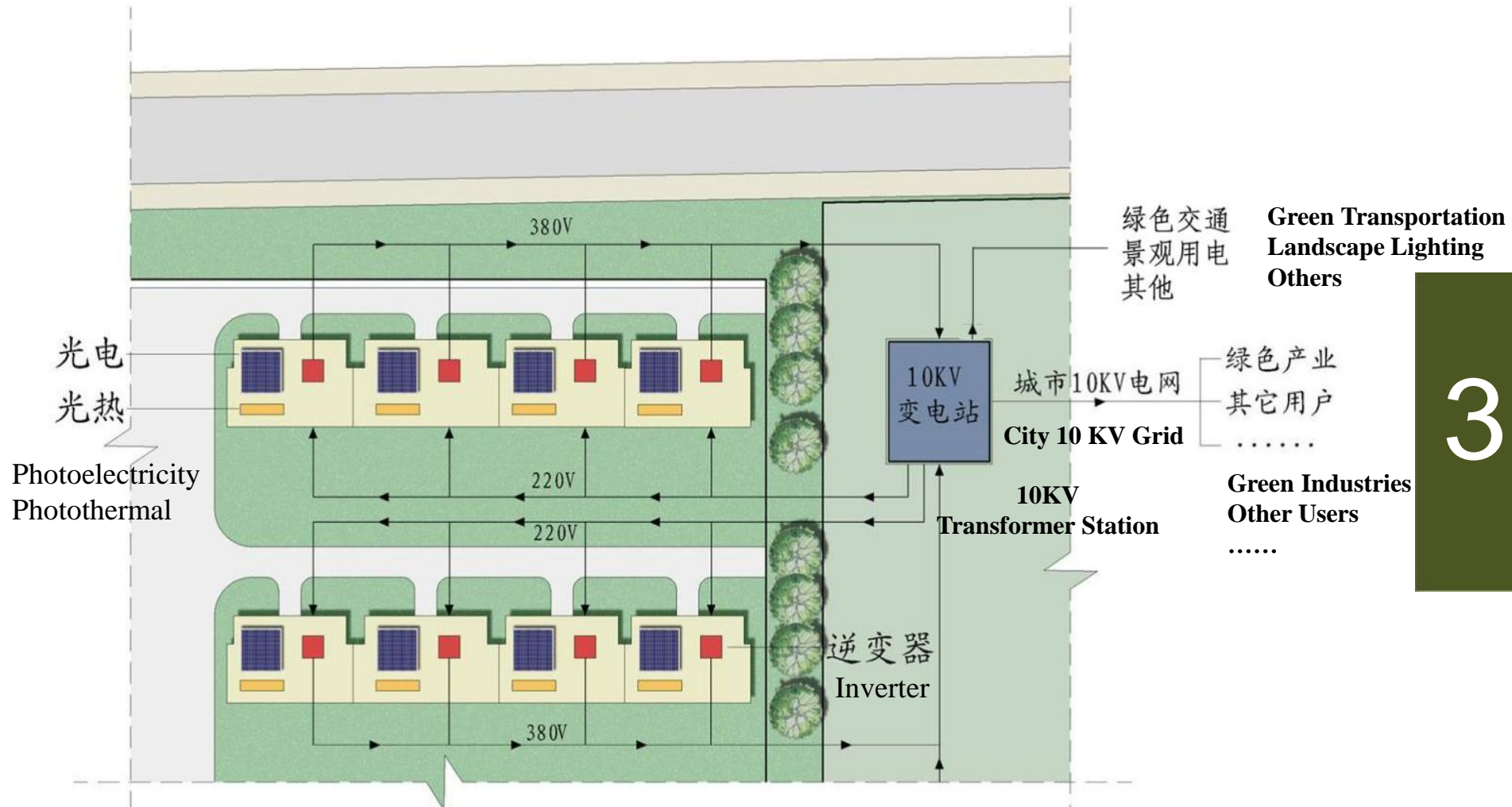


Pilot Area

- First phase Pilot district approximately 1.5 square km
- Total building area: 753972 m²
- Floor space of residential buildings: 686375 m²
- Community center will be constructed with the cores of converting station, transit station, and transit charging. There will be 8 community centers in the district.
- Installed capacity of photovoltaic panels: 13.4MW, about 1.3 times of household power consumption.
- Annual estimated emissions reduction calculated by operation margin: 16197 tCO₂.

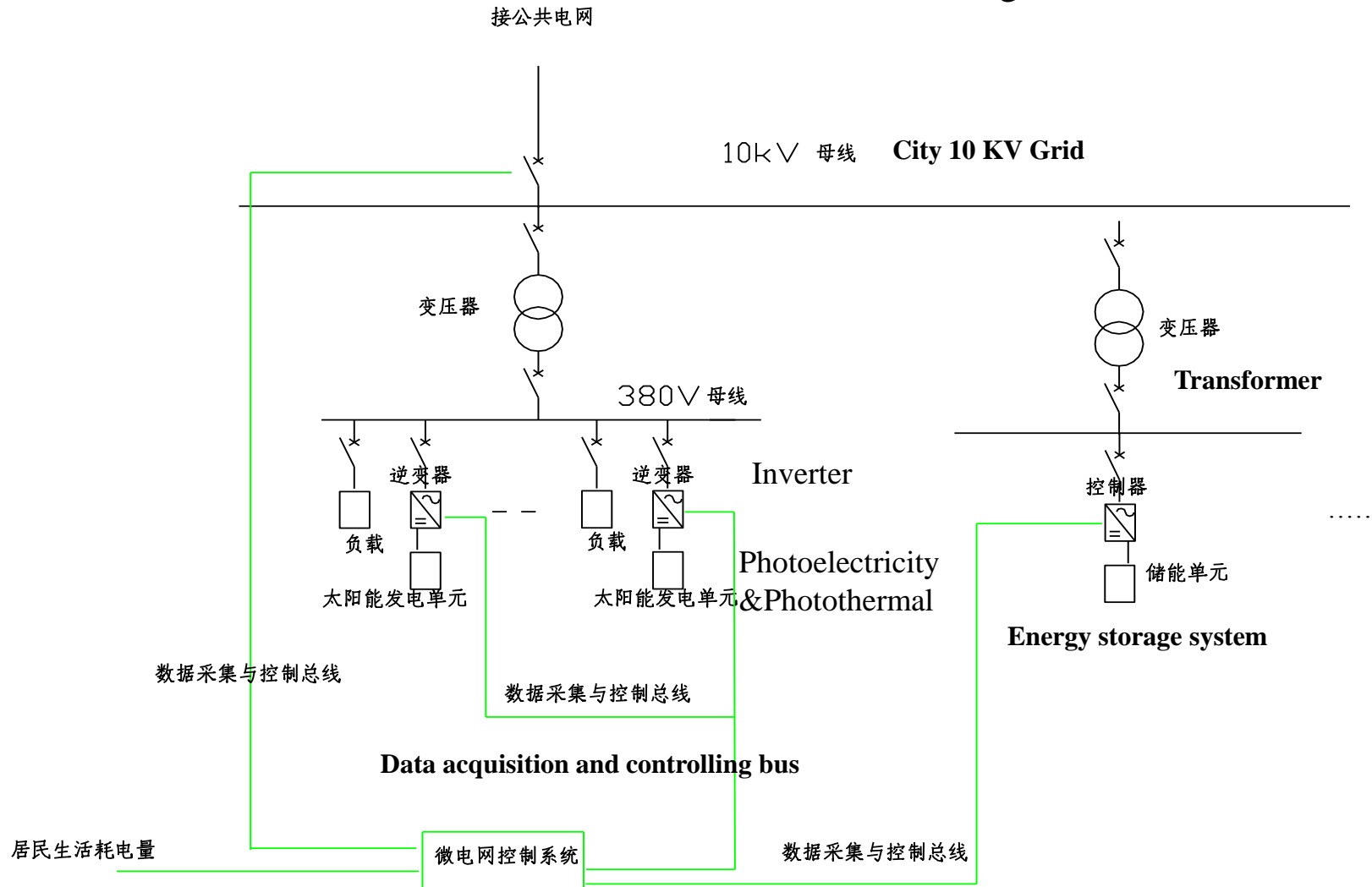
单元发配电示意图

The generating and distributing diagram



智能微网的电气接线

The Electrical Wiring of the Smart-Grid



The control system of Micro-grid

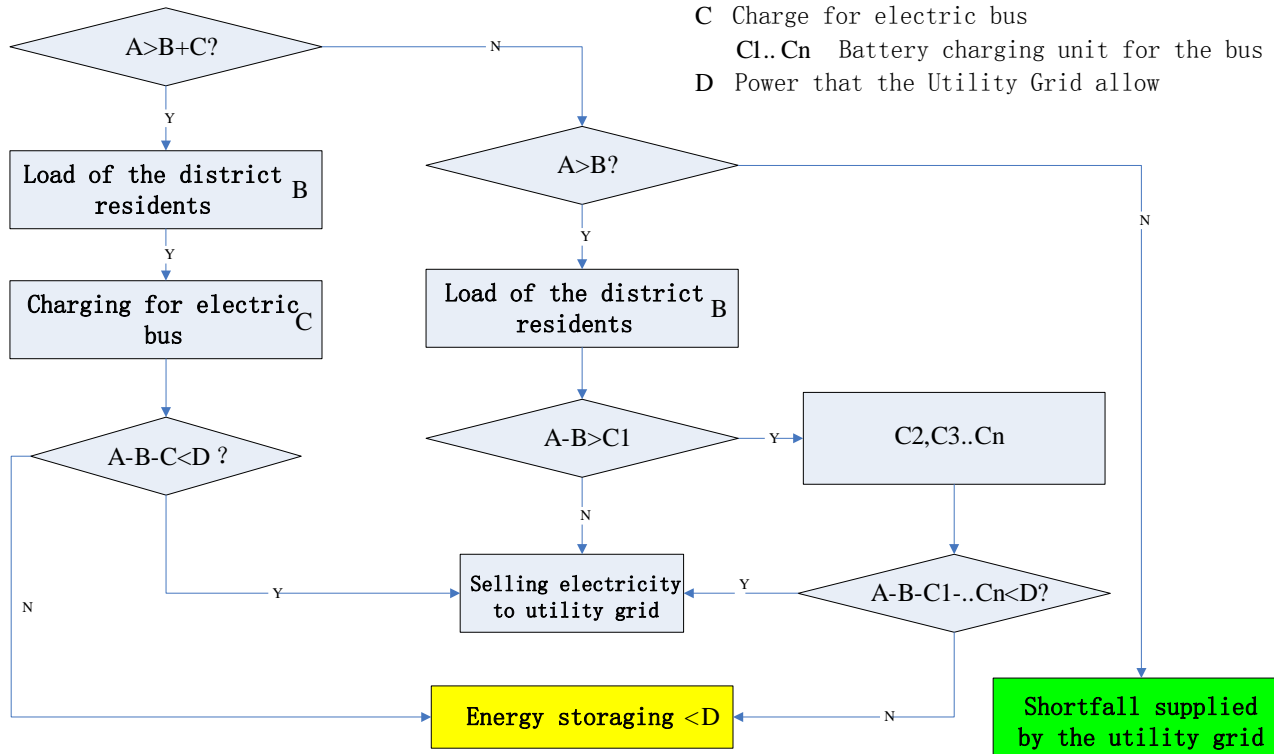
智能微网的控制策略:

The control strategy of Intelligent Micro-Grid :

The control strategy of Intelligent Micro-Grid :

Definition:

- A Stands for the energy generated by Photovaltic
- B Load of the district residents
- C Charge for electric bus
- C1..Cn Battery charging unit for the bus
- D Power that the Utility Grid allow



微网-分布式发电问题的终结:

Solving Problems through Micro grids

- 对电力系统规划的影响，加大了电力系统负荷预测的不确定性
- 电能质量问题。分布式电源的启停会引起电压波动
- 对继电保护的影响。
- 低电压穿越
- 孤岛运行问题
- 可靠性问题
- 配电网效益

1. Friendly connecting with city grid
2. improving PV power quality
3. power system protection
4. Low Voltage Ride Through
5. Islanding
6. Reliability...
7. Improving Distribution Efficiency

分布式能源以微网的形式运行将是一个很好的途径。

Taking the form of MicroGrid would be a good choice to the operation of Distributed Generation in the future.

实施情况

Implementation Status



项目已于2010年5月正式开工
Project launches May 2010



2010年8月建成气候监测站
Climate monitoring station
completed August 2010

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正在实施区域：
约51万平方米住宅



Constructing Area:
~ 510,000 m² residence housing

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示范作用:

把吐鲁番市新区打造成全疆乃至北干旱、半干旱地区新能源综合利用、城乡一体化重点项目示范区。

可复制性:

1. 气候条件

吐鲁番地区太阳能资源总量属于“丰富带”，中国有一半以上的国土面积其相当或在其之上。

2. 经济条件

吐鲁番地区在中国属于欠发达地区。

3. 城市模式

吐鲁番市是中国典型的中小城市。

Pilot Effect:

Turpan City New District becomes a main Pilot area of new energy resources and urban/rural integration in Xinjiang and north-west arid and semi-arid zones

Reproducibility:

1. Climatic Conditions: Turpan District belongs to “Abundant Region” in terms of solar resources; over one half of land area in China receives equivalent or greater solar radiation

2. Economic Conditions: Turpan District is a less-developed area in China

3. City Type: Turpan City is a typical small-medium city in China

Thank You!

谢谢!