The Status of Distributed Generation in China

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12 Dec. 2017
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PART 1

The distributed generation status quo in China
Definition of distributed generation

According to the definition from “Temporary method of Distributed Generation Management” (NDRC Energy [2013]1381) issued by National Development and Reform Commission: Distributed generation refers to building and installing at the site or near the site of the user, with self-consumption and extra generation coming online, and power generation facilities featuring power distribution network system balance adjustment or comprehensive and stepped utilization of energy cogeneration facilities with power output.

Distributed generation forms:

- Small hydropower stations with total installed capacity at 50 MW and below
- New energy generation including wind, solar, biomass, ocean, geothermal, which integrating into power distribution networks at various voltage class
- All kinds of waste-to-energy except the direct combustion of coal, various energy complemented generation, residual heat, residual gas power generation, coal mine power generation and other comprehensive utilization of resources power generation
- Coal-bed methane power generation with a total installed capacity of no more than 5 MW
- Cogeneration and cooling of natural gas with 70% comprehensive utilization rate and consumed locally.
Development of distributed generation

Start-up stage (1990-2000)

From 1990 to 2000, the policies and projects were in the form of “cogeneration” or “Cogeneration and cooling”, no “distributed energy” concept yet.

Implementation stage (2001-2010)

In 2004, “distributed energy” showed up formally in “Report on the Issues Related to the Distributed Energy System by the National Development and Reform Commission”, and several policies approved intensively, but grid integration was still difficult at the stage.

Transition stage (2011-NOW)

Distributed energy develops faster in China, and the policies are more targeted and feasible. The development of distributed energy in China enters into an important transitional period.

Mature stage

Guidance of application

Policy enhancement
The distributed generation accelerates in China

During recent years, China has built a group of distributed generation demonstration projects.

- Guangzhou college town natural gas distributed energy supply system
- Tianjin Eco-city distributed generation project, which is mainly about distributed PV and wind power
- Micro gas turbine-centered Ciqu city natural gas cogeneration project in Tongzhou district, Beijing
- Gas internal combustion engine-centered Beijing Gas Group command and dispatch center building cogeneration project
- Small gas turbine-centered Shanghai Pudong International Airport cogeneration project
- PV generation-centered Guangdong Foshan Sanshui industrial park distributed PV generation project
By the end of 2016, the total installed capacity of small hydropower stations reached 78 GW, the annual energy output reached 268 million GW, and both of the installed capacity and annual energy output is a quarter of the national hydropower generation, and equals with the capacity of three “The Three Gorges”.

By the end of 2016, the installed capacity of distributed natural gas projects built and building in China is 3.8 GW, the national installed capacity is 1360.19 GW, accounting for 0.28% of the total capacity.

By the end of June, 2017, in the State Grid pitching area, PV installed capacity is 94.63 GW, with year-on-year growth of 56%. Among which, large PV stations in utility scale is 78.42 GW, accounting for 83% of the total PV capacity, mainly in Northwest and North China; Accumulated installed capacity of distributed PV was 16.15 GW, accounting for 17% of the total PV capacity, and mainly distributed in Eastern China.
Distributed PV is the brightest spot

The top 10 provinces of distributed PV capacity by the end of June, 2017

- **Larger capacity and more market share**
  - First half of 2017: newly installed capacity >7 GW, June >3 GW

- **“PV plus” applications**
  - Building PV, agricultural PV, floating PV, and distributed PV alongside roads and railways.
  - Zhejiang, Shandong and Jiangsu Provinces contribute a half of the new installation by this June. Followed by Anhui, Jiangxi, etc., 10 provinces have 80% of the new installation.
  - Zhejiang has more than 10 thousand households PV.

From January to June, the newly installed capacity of distributed PV was 7 GW, the year-on-year growth was 5.16 GW. By the end of June, 2017, the cumulative installed capacity in State Grid area was 16.15 GW. The cumulative installed capacity in Eastern China was 8.47 GW.
PART 2

Industrial policies of distributed PV

Distributed PV plays an important role in the community construction, especially in rural areas, so the application of distributed PV is encouraged by central and local policies.
The opportunity of distributed PV - poverty alleviation

- **Guidance on the Poverty Alleviation with PV Generation** (2016) by NDRC
  Around 35 thousands poor villages of 471 counties from 16 provinces under better light conditions will be developed by 2020. To guarantee the growth of annual income.

  Explore revenue sharing of energy development and other new poverty-relief systems.
  Coordinate the construction of distributed system, solar PV generation and the application of heating.
Key policies

From investment subsidy to feed-in tariff.

- 2009-2012, investment subsidy.
- 2013, feed-in tariff. 0.42元/kWh
- 2014, NEA adjusted the policy of subsidy.
- Distributed energy participated in market trading.
Key policy

September, 2014: the debut of “Distributed PV”.
2016: the concept of distributed generation getting clear.
- Distributed PV generation has no scale restriction for a local government.
- 0.42 yuan/kWh subsidy from the national fund.
- Two options: Self use + selling to the grid OR all selling to grid
Key policy

At the end of Nov, 2017, NDRC & NEA issued *The Notice of Market-based Transaction Pilots for Distributed Generation* ( [2017]1901). Distributed energy participating in electricity market as the subject of incremental market marked a milestone in the reform of electric power industry.

- It is more practical for PV to gain grid parity from the user side by 2020.
- An comprehensive integration between production, distribution, sale and service.
- Business model innovation: direct sale of electricity

< 35kV, < 20 MW;
< 110kV, 20 MW—50 MW.
PART 3

Interactions among Relevant stakeholders

◆ Expending prosumers
◆ Opening the market to new actors
◆ Changing utility business models
Two revenue models of distributed PV projects

- **“All online” model**
  PV feed-in-tariff (0.65/0.75/0.85 yuan/kWh) + local subsidy

- **“Extra online” model**
  self use price = basic price (savings) + 0.42 yuan/kWh + local subsidy
  online price = FGD benchmarking electricity price + 0.42 yuan/kWh + local subsidy
The industrial basis of unsubsidized distributed PV

**Investment cost basis**
- 2010: 25000 yuan/kW
- 2017: 5000-6000 yuan/kW

**LCOE basis**
- 1100 hours for first year
- 30% capital
- 6.5% capital cost
- 6 yuan/W investment cost
- 0.15 yuan/W O & M

- LCOE of 20 years < 0.53 yuan/kWh
- First year < 0.71 yuan/kWh

Investment cost decrease 0.5 yuan/W, LCOE of 20 years decrease 0.03 yuan/kWh
The policy environment of unsubsidized distributed PV

- Policies
  - solving subsidizing problems.
  - ER as captive power supply.
  - enjoying the rights for priority options to utilities
  - local consumption
  - the rights for priority investment to new distribution network
  - Non subsidized preferential policies.
Financial innovation of unsubsidized distributed PV

- Invigorating the precipitated capital.
- Building distribution Asset standard system.
- Entering stock market.
- Financing to expand the distributed PV.
- Industry funds drives distribution network investment.
- Encouraging green bonds.
- Financializing the trade of green power certificate.
谢谢！
Thank you!