

Biweekly 007 Nov/07

“Pie” or “Trap” - China Electricity Sales Reform

Nov. 2016



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The Following Terms are Used in This Report

Acronym	Definition
PV	Photovoltaic
SGCC	State Grid Corporation of China
CPC	The Communist Party of China
Li-ion battery	Lithium-ion battery
Ni-MH Battery	Nickel–metal hydride battery
GSHP	Ground source heat pump
EV	New energy vehicle

Ningxia's First Grid-Connected Megawatt Intelligent Micro-Grid Play an Exemplary Role In Electricity Sales Reform

Feb. 25, 2016

Source: Securities Times

1

Ningxia's first commercial megawatt intelligent micro-grid with wind/photovoltaic/energy storage hybrid power system was successfully connected to electricity grid, which is the third micro-grid project of Beijing Etechwin Electric, wholly-owned subsidiary of Goldwind Science and Technology, and play an exemplary role in China's electricity sales reform.

The project is located in the Jiaze Hongsipu base of the local industrial park, which started in late July 2015 and took six months. The project integrates the energy and load equipment such as wind electricity, PV, energy storage, micro-turbine and chargers, and can operate steadily with and without connection to electricity grid, which provides an economical, green and convenient energy solutions for enterprises in the industrial park.



Guangdong Electricity Trading Center Established

Jun. 29, 2016

Source: people.cn

2

Guangdong Electricity Trading Center was established on June 29, 2016, whose function is to manage trading in electric power industry, which means that Guangdong's electricity sales reform market has entered the actual operation phase.

The center will make full use of the market forces in allocating resources by establishing the competitive mechanism. So far, **390 big electricity users, 38 electricity generating companies and 13 electricity sales companies have participated in trading through the center.** In the next step, according to the requirements of electric power system reform, Guangdong will further push electricity sales market construction, electricity transmission and distribution price reform, as well as opening of electricity distribution market into Implementation, and establish the market operation system with sound function, transparent rules, regulate operating and perfect service based on the platform of Guangdong Electric Power Trading Center.



Shanxi States Electricity Sales Reform and 44 Electricity Sales Companies have been Established

Oct. 19, 2016

Source: Xinhua Net

3

Since the establishment of Shanxi Electricity Trading Center in September, 44 electricity sales companies have registered with the Department of Industry & Commerce in Shanxi.

Shanxi is **SGCC's first electric power system reform comprehensive pilot province, as well as China's third electricity reform comprehensive pilot province**, one of whose major tasks is to promote the electricity sales reform. Shanxi has issued electricity sales implementation scheme, **gradually loosening requirements for entry into electricity sales market and developing multiple electricity sales companies.**



1 China begins electricity sales reform, and the market has big growth potential, but also faces many issues

- China keeps improving the electricity sales reform, and **the release of Document No.9 and relative supportive documents for electric power system reform** signals the start of electricity sales
- Electricity sales reform breaks traditional electricity trading model **by making trading institutions and electricity sales company become main market participants**
- China's electricity sales market has big growth potential, whose trading value is expected to reach trillions of yuan. China's electric power system reform is still in early stage and **faces many issues**, such as **the monopoly electricity grid companies, unfair electricity settlement, single electricity sales business model**, etc.

2 Electricity sales reform may boost the development of energy storage technology and stimulate its demand

- Electricity sales reform will improve the development of energy storage industry and chemical energy storage technology is widely used in electricity sales
- Electricity sales reform will break supply monopoly, directly stimulating electricity sales company to focus more on user needs and **developing the applications of energy storage technology** and with the development of distributed energy, **the demand of energy storage is expected to increase finally**
- Electricity sales reform will increase demand for energy storage in electricity use sector, **allowing the explosive growth of energy storage market**

3 The applications of energy storage technology are expanding in many countries

- Electricity trading market in the US has a long development history, the market model and the marketization process of which vary between the states. The **energy storage technology is widely used in the US** and the demand for energy storage in electricity use sector is being gradually released
- Electricity market in Australia is mature, with lots of PV system users, but **the applications of energy storage technology is limited at present**. However **the energy storage market may have great potential** once PV subsidies expire
- **China's electricity market is developing quickly** and lots of demonstration projects have been built successfully, which **may further stimulating energy storage demand**

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Electric Power System

Concepts

1. Electric Power

- Electric power is an energy that uses electricity as power
- Electric power is a form of energy
 - Can be easily transformed into other forms of energy
 - Can be transmitted over long distance via high voltage transmission lines conveniently, quickly and economically

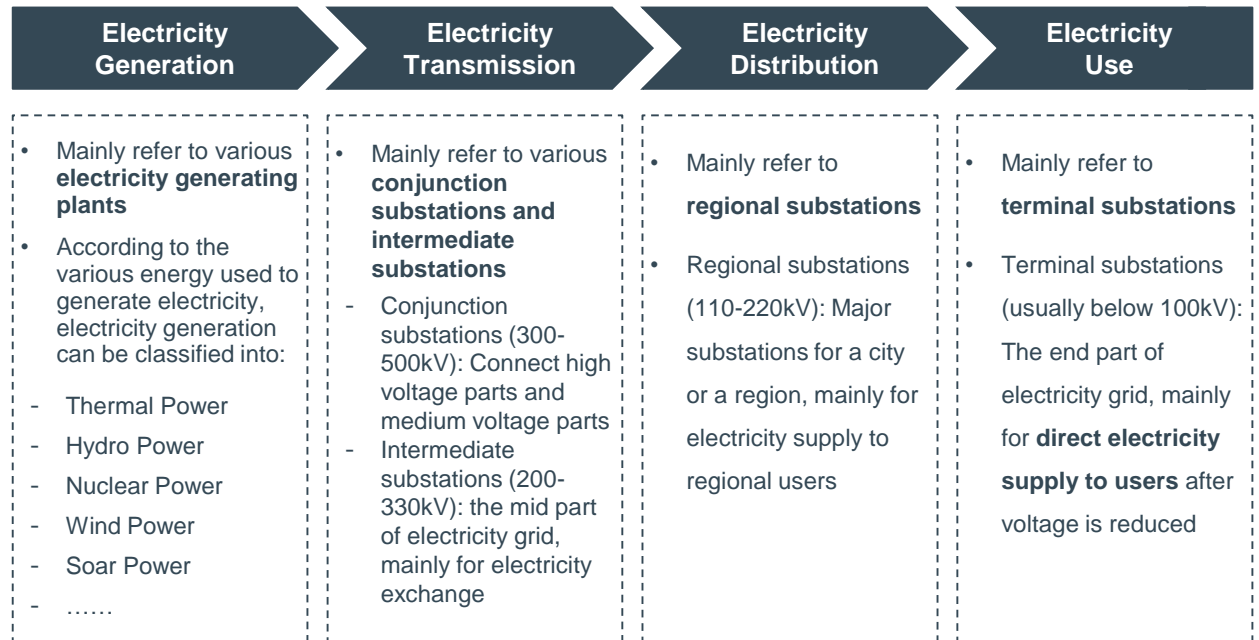
2. Electric Power System

- Definition: Electricity generation and consumption system
- Function: Turn primary energy in nature into electricity via electricity generating devices and supply that to users through electricity transmission, transformation and distribution

Components of Electric Power System

1. Components of Electric Power System

- Electric power system is composed of four parts: **Electricity generation, Electricity transmission, Electricity distribution and Electricity use (supply)**



Development Stages of Domestic and Overseas Electricity Markets

Overseas

Electricity sales reform in developed countries began earlier and **most of them have entered the mid stage of the development. Some countries, such as the US, UK and Germany, began to enter the mature stage.**

- Take Germany as an example:
 - Electricity users could obtain discounts by paying on a monthly or half-year basis or advance payment
 - Electricity sale companies offer rewards for clients transferring from other companies
 - Some electricity sales companies offers electricity tariff packages searching and choosing service for users and the users can choose the optimal package according to their requirements



Domestic

China's electric power market reform has experienced four stages since 1978, and now the reform is **at the later early stage of the development and is likely to enter the mid stage soon.**

- Development stages of China's electric power market:

Stages	Overview
1 st stage (1978-1985)	<ul style="list-style-type: none"> • Focus on solving electricity supply shortages • Promote electricity generation projects through fund raising, solving the construction fund shortage • For newly built electricity projects through fund raising, electricity tariffs are approved according to the paying principal and interest, breaking the single pricing pattern and developing the market pricing mechanism
2 nd stage (1987-2002)	<ul style="list-style-type: none"> • Focus on pushing separation between administration and corporate • Propose "separating government functions from enterprise activities, recognizing each province as an individual units, interconnecting the provincial grids for unified distribution and adjustment, and pooling capital to develop new power capacity"
3 rd stage (2002-2012)	<ul style="list-style-type: none"> • Separation of electricity generation and grid and the start of the market-oriented reform • In December 2002, the State Council issued Electricity System Reform Scheme
4 th stage (2013 till now)	<ul style="list-style-type: none"> • Electric power system enters the "new normal" and the marketization speed up • Lots of policies are introduced, electric power market reform is implemented and reform on electricity transmission and distribution tariffs and opening of electricity sales market become hot topics, electricity industry restructuring speeds up and electricity pricing system becomes more flexible, focus on development and applications of renewable energy, focus on combining government planning with opinions of enterprises

Impact of Electricity Reform Policy on Electricity Sales Reform

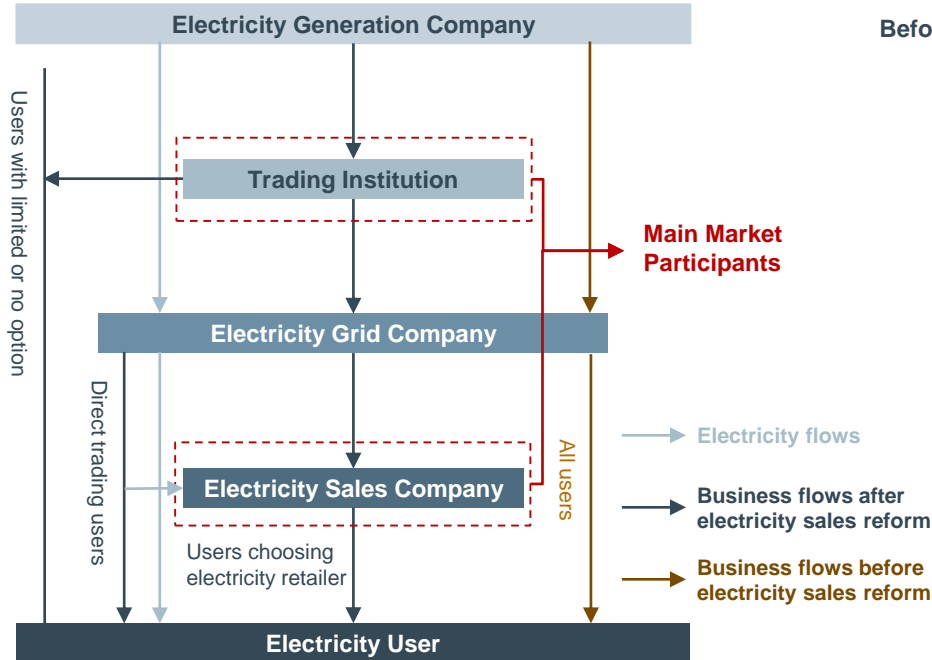
Policy Types	Date of Issue	Policy Title	Description
Old and New Policies of Electric Power System Reform	2002	<i>Electricity System Reform Scheme (short as "No. 5 Document")</i>	Separating electricity generation from grid , separating the main business from auxiliary services, separating electricity transmission from distribution , competitive bidding for on-grid electricity prices
	2015	<i>Several Opinions of the CPC Central Committee and the State Council on Further Deepening the Reform of the Electric Power System (short as "No. 9 Document")</i>	liberalization of operational electricity prices except for electricity transmission and distribution, liberalization of electricity sales business , liberalization of incremental electricity distribution business, liberalization of electricity generation and supply plans except for public welfare and regulation, independent trading platform
Six Core Supportive Documents for Electric Power System Reform	2015	<i>Implementation Opinions on Advancing the Electric Power Market Construction</i>	Gradually establish market mechanism that mainly focuses on mid-term and long-term trading and supported by spot trading
	2015	<i>Implementation Opinions on the Establishment of Electricity Transaction Institutions and Standardized Operation</i>	Establish relatively independent trading institution with standard operations and enhance supervision over trading institution
	2015	<i>Implementation Opinions on Promoting Reform on Sales Side</i>	Provide guidelines for electricity sales reform and lay foundation for electricity market liberalization
	2015	<i>Guiding Opinions on Enhancement and Regulation of Supervision and Administration of Coal-Fired Captive Power Plant</i>	Propose guidelines for captive coal-fired electricity plants from the perspective of environmental protection
	2015	<i>Implementation Opinions on Orderly Decontrolling Electricity Generation and Utilization Scheduling</i>	Gradually shift from government-oriented to market-oriented and promote energy-saving and emission-cut
	2015	<i>Implementation Opinions on Advancing Reform on Transmission-distribution Price</i>	Establish independent electricity transmission & distribution price system with clear rules, reasonable price level, strict supervision and transparency
Two Documents about Electricity Distribution & Sales	2016	<i>Measures for Administration of Entry and Exit of the Electricity Sales Companies</i>	Detail the entry, exit, rights and obligations of electricity sales companies , as well as the credit system construction of the companies
	2016	<i>Measures for Administration of Entry & Exit of the Power Sales Companies</i>	Detail the administration, operation and scope of electricity supply service of incremental electricity distribution projects , as well as rights and obligations of the project management

The Impact of Old VS New Policies of Electric Power System Reform on Electricity Sales Reform

Policy Title	Issuing Branch	Guidelines	Direction of Reform	Others
No. 5 Document	State Council	Separating electricity generation from grid, separating the main business from auxiliary services, separating electricity transmission from distribution, competitive bidding for on-grid electricity tariffs	Separate electricity transmission and distribution	Electricity price cross subsidy, entrance requirements, electricity trading mechanism, electricity trading institution and etc. are not mentioned in the No.5 Document
No. 9 Document	CPC Central Committee	4 liberalizations, 1 independency	Pipeline in the middle, open at both ends	
Impacts on Electricity Sales Reform	Central government attaches greater importance to new round of electricity reform	Income model for electricity grid company shift to "approved costs plus reasonable profit". After separation of electricity sales from grid, a diversity of electricity sales companies will emerge	Continue partial control and regulation over electricity transmission and distribution market and try to introduce the market-oriented reform in the electricity generation and sales market	New Electricity reform focuses on mechanism construction and industry management, aiming to develop new energy service form and new economy form, and to form electricity market trading system, gradually restoring its commodity properties

China Electricity Trading - Changes in Electricity Sales Market

Electricity Sales Reform Leads to Business Changes



Notes: **Users with limited or no option:** Electricity users with no or weak bargaining power, such as residents, public utilities and etc.

Direct trading users: Electricity users with fixed needs and strong bargaining power, such as large industrial parks, large electricity users and etc.

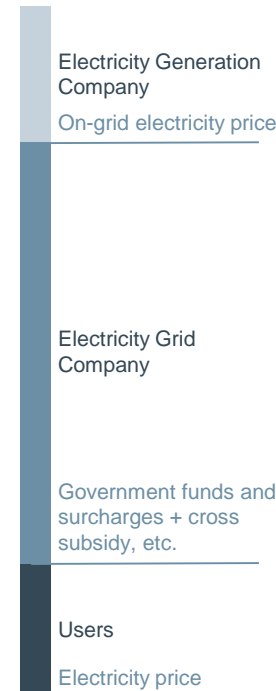
Users choosing electricity retailers: Ordinary industrial and commercial electricity users, mainly with small and medium size

Electricity Sales Reform

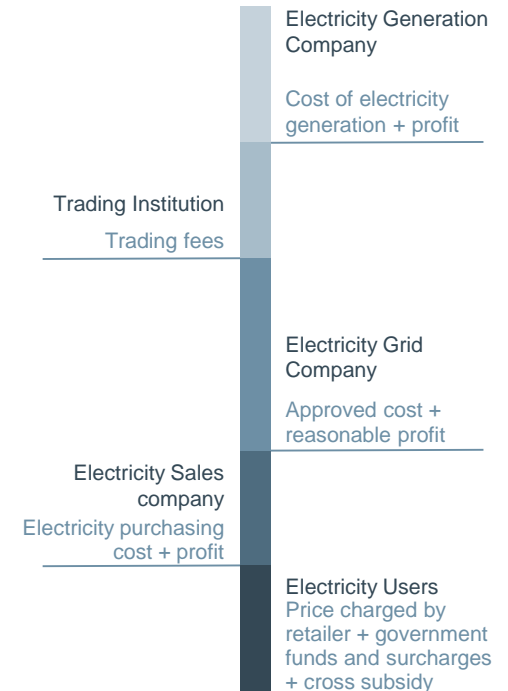
- **Trading institutions and electricity sales companies** are newly added main market participants
- Electricity flows do not change much, and only **electricity sales companies with energy storage system** can be added
- Big changes in business flows: Shift from traditional single model “**Electricity generation company-Electricity grid company-Electricity user**” to a diversity of models (e.g. “**Electricity generation company-Electricity user**”, “**Electricity grid company-Electricity user**” and “**Electricity sale company-Electricity user**”)

Components of Electricity Price

Before Electricity Sales Reform



Before Electricity Sales Reform

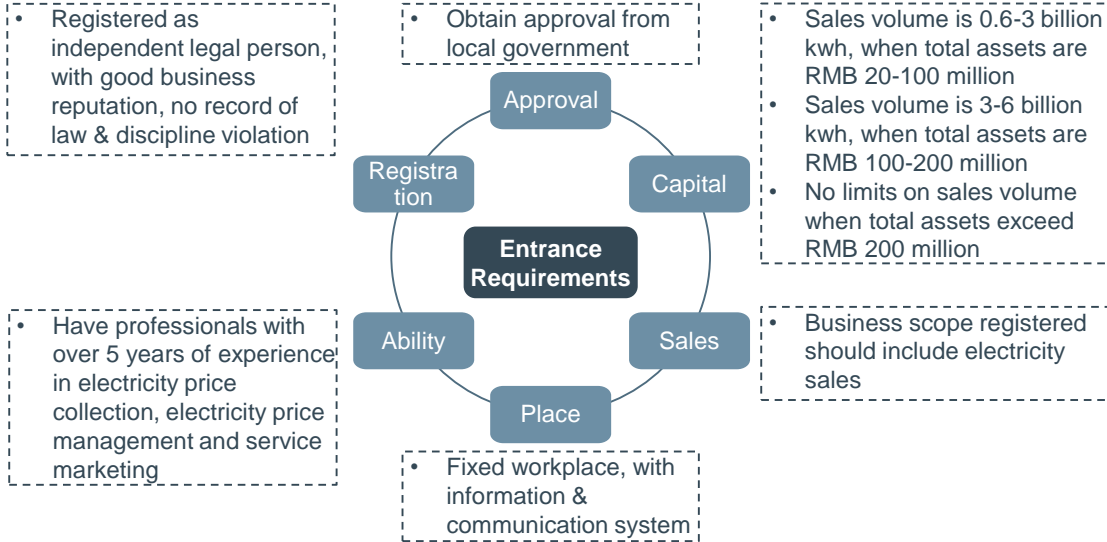


Note:

- Electricity sales reform **breaks the monopoly of electricity grid company and involves more entities in the market trading**
- Income model for electricity grid company changes from “**differences between generation and retail prices**” to “**approved costs plus reasonable profit**”

Electricity Sales Reform - Introduction of Electricity Sales Companies

1. Entrance Requirements for Electricity Sales Company



- Clarify the entrance requirements for electricity companies and establish **open market environment**
- Entrance requirements for electricity sales companies are relatively low. So far, **over 700 electricity sales companies** have been registered across China, and market competition will get increasingly fierce

Source: Measures for Administration of Entry and Exit of the Electricity Sales Companies

2. Types and Business of Electricity Sales Company

Different Types And Relevant Competitiveness

Company Types	Electricity generation assets	Electricity distribution assets	Competitiveness
Electricity generation-distribution-sales	Own	Own	Strong
Electricity generation-sales	Own	No	Modest
Electricity transmission-distribution-sales	No	Own	Strong
Independent Electricity sales	No	No	Weak

Development of Business

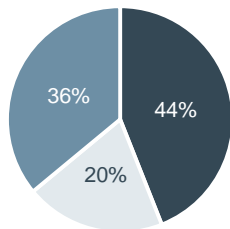
Basic	Value-Added	Internet Innovation
<ul style="list-style-type: none"> Electricity purchase & sales trading Basic marketing service 	<ul style="list-style-type: none"> Fault handling & maintenance Energy-saving service, information service Benefit sharing service after reduce the purchasing cost 	<ul style="list-style-type: none"> User information & value digging



- Electricity generation-distribution-sales companies** and **electricity transmission-distribution-sales companies** have resource advantages and **strong competitiveness**
- Electricity sales **companies focus on basic business at present** and will develop other businesses in the future

Electricity Sales Market Analysis

Proportion of Different Types of Electricity Users in China (2015)

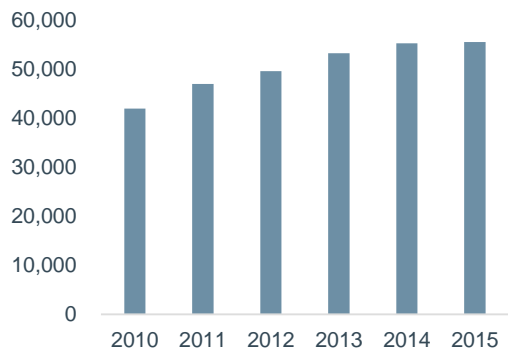


- Users choosing electricity retailer
- Direct trading users
- Users with limited or no option

Sources: *bjx.com.cn* , *SMM*

Total Electricity Consumption in China (2010-2015)

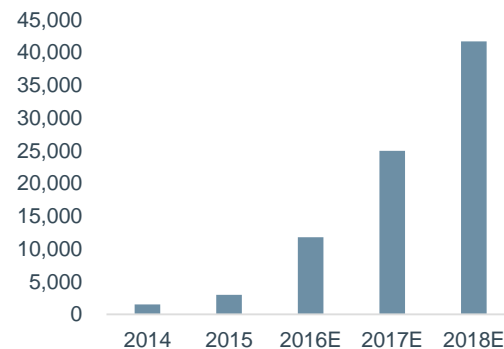
Unit: 100 million kWh



Sources: *qianzhan.com* , *SMM*

Electricity Directly Traded in China (2014-2018)

Unit: 100 million kWh



Sources: *Galaxy Securities* , *SMM*

- User with limited or no option takes a big share in all electricity users and such users **are likely to turn into users choosing electricity retailer**. The proportion of users choosing electricity retailer **are expected to expand in the future**, which will benefit electricity sales companies, improving the supporting service and **boosting energy storage demand**

- Electricity sales market share is roughly estimated as **RMB 2.73 trillion**, based on **5.55 trillion kWh** total electricity consumption in China in 2015
- Total electricity consumption growth slowed down in China in recent years, but **the base is large so there remains room to growth**

- Although **China opened electricity market late**, electricity trading maintains a sound momentum of development, and electricity directly traded grows year by year, **with a big growth potential**
- Electricity directly traded in China is expected to reach **4.17 trillion kWh** by 2018, **and the trading value is likely to reach trillion yuan** even if some users with limited or no option are counted out



Note:

- *Total electricity consumption in China is large. Electricity sales reform may invigorate electricity use market and the market have a great growth potential, with the trading value expected to reach trillion yuan*

Issues & Bottlenecks

Main Market Participant Issues

1 Electricity grid company

- **Electricity grid company** has stable market position and electricity sales company solely funded by it has **inherent advantage over other market participants**, which may weaken their enthusiasm

2 Electricity generation company

- For electricity generation company, market-based electricity prices are relatively low and big electricity users are even bargaining for lower prices. And it is in a weak position when in cooperation with electricity grid company. So, **it takes time for electricity generation company to engage in electricity sale business on a large scale**, even they focus a lot on the business

3 Independent electricity sales company

- Independent electricity sales company has no advantage in resources and relies on single business model which may **cause vicious price war among the companies and it hard for them to develop**

Electricity Trading Settlement Issues

1 Electricity settlement rights

- **Electricity settlement rights remain controlled by State Grid** and almost all electricity trading centers are also controlled by electricity grid companies and so most of electricity sales companies have to operate with light assets, which influences the market development to some extent

2 Electricity trading is being controlled

- For it is common to bargain for lower electricity prices in the market, **electricity generation companies buy back electricity from their subsidiary electricity sales companies**, which makes **the market initiative bake to the generation-side**, unfavorable for development of electricity sales market

Electricity Sales Business Issues

1 Not a investment with high returns and stable profit

- It's easy for electricity sales companies to establish but not easy for them to make profit for their business model lacks diversity, and many professionals are needed in electricity purchase & sales, as well as value-added service and **it takes a lot of time to cultivate soft power and maintain customer relationships in the early stage**

2 Lack of spot market

- Electricity trading is carried out mainly in mid-term and long-term wholesale market that targets big users now and **lack of spot market** lead to the incomplete market and **lack of price discovery and guide for steady electricity consumption**

3 Electricity price settlement

- Electricity price settlement and invoice issuance do not take into consideration rights and obligations of electricity sales company, electricity generation company and electricity grid company, and it is easy to **trigger disputes for no definite relationship between them**



Note:

- *China's electricity sales reform remains in early stage and will face many issues over time, and **further reform will be pushed***
- *At present, **electricity grid company is still in a dominant position**, hard to share its fundamental interests and electricity sale companies solely funded by it will develop much better than other types of electricity sales companies, so it may remain the main market participant in the near future*

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Energy Storage Applications in Electricity Sales Side

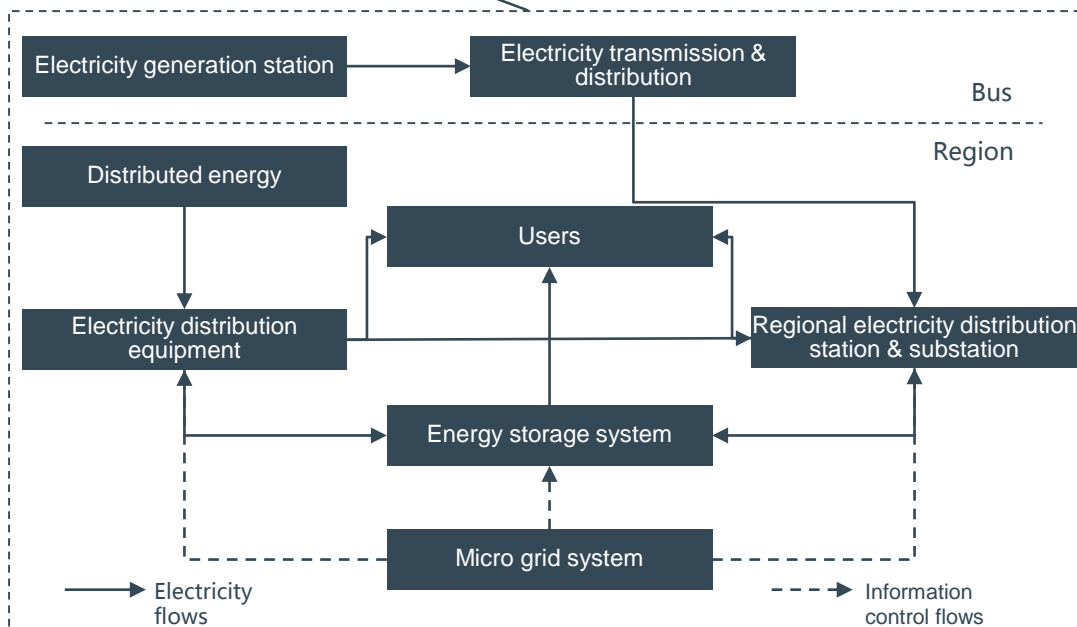
1. Electrochemical Energy Storage

- **Electrochemical energy storage:** A range of technologies used to store electricity energy in chemical way and release such energy when needed
- **Electricity sales side mainly uses electrochemical energy storage**

2. Chemical Energy Storage Technology

Energy Storage Technology	Features
Lead-acid battery	Most mature technology at present, with complete industry chain, and will be replaced in the future
Lead-carbon battery	Based on the complete industry chain of lead-carbon battery and will gradually replace it because of low costs and fast charging performance
Li-ion battery	Performs well in many ways , and reduce energy storage costs through Li-ion battery echelon use
Sodium-sulfur battery	Still in R&D stage in China, hard to be generalized in short term, and may be applied to some fields in the future
Ni-MH Battery	Will be replaced by Li-ion battery gradually due to serious memory effect and large self discharge
Flow battery	Vanadium flow battery has good performance and Chinese companies have intellectual property rights, expected to develop rapidly

3. Electrochemical Energy Storage Applications in Electricity Sales Side



- Energy storage system, **especially electrochemical energy storage**, is needed for electricity sales companies to establish **micro grid and renewable energy connection to electricity grid**
- **Electricity energy** in micro grid comes mainly from **electricity generation station and distributed energy**, and is then **controlled and scheduled by micro grid system** to sent into energy storage system or electricity users
- Electricity, **energy storage devices** and intelligent micro grid energy management system together constitute **micro grid**, which could manage demand side effectively, eliminate the peak-valley difference between day and night, smooth load and etc., **effectively improving energy utilization rate**

Impacts of Electricity Sales Reform on Energy Storage Market (1): Electricity Sales Company Will Develop the Applications of Energy Storage Technology

- Electricity sale reform **will break traditional supply monopoly**, stimulating electricity sales company to focus more on user needs and **developing the applications of energy storage technology**

Components of Electricity System that Different Types of Electricity Sales Companies apply Energy Storage Technology to

Components Of Electricity System Using Energy Storage Technology	Electricity Generation-Distribution-Sales	Electricity Generation-Sales	Electricity Transmission-Distribution-Sales	Independent Electricity Sales
Electricity Generation	√	√		
Electricity Transmission	√		√	
Electricity Distribution	√	√	√	
Electricity Use	√	√	√	√

Source: SMM

- Various electricity sales companies could apply energy storage technology in different components of electricity system to meet their own requirements. However, in order to meet user needs better, **energy storage technology should be used mainly in electricity use**
- Big Electricity users are located mainly in industrial parks. So far, there are **347 national industrial parks** and **1,136 provincial industrial parks** in China, whose **annual electricity consumption totals 1.2 trillion kWh**, representing **over RMB 200 billion electricity distribution & sales market**. So electricity needs from industrial parks could significantly improve performance for every type of electricity sales companies and **installing energy storage system on a large scale could further develop their business**

Types of Energy Storage Technology Applied To Different Components of Electricity System

Types of Energy Storage Technology	Electricity Generation	Electricity Transmission	Electricity Distribution	Electricity Use
Physical Energy Storage	√	√		
Electromagnetic Energy Storage		√	√	
Chemical Energy Storage		√	√	√

Sources: CITIC Securities, SMM

- There is demand for energy storage technology in all components of electricity system but **types of technology applied varies between different components**
- Chemical energy storage technology is the most widely applied one, mainly applied to electricity transmission, distribution and use. After electricity sales reform, **user-oriented electricity sales company may prefer application of energy storage technology to electricity use. Li-ion battery and lead-carbon battery may achieve explosive growth thanks to advantages in technology and costs**

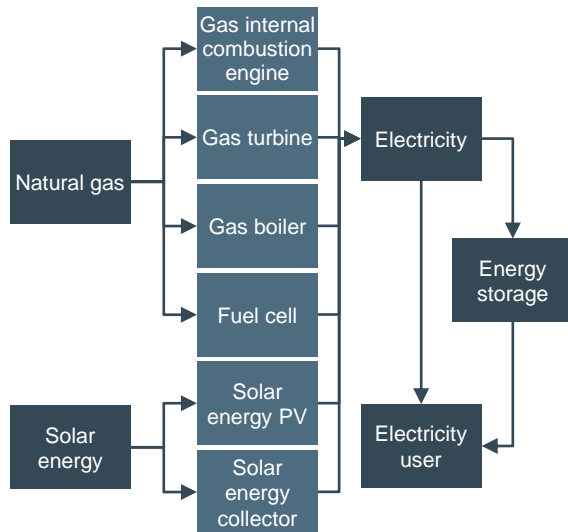
Note:

- Different types of electricity sales companies could apply energy storage technology to different components of electricity system based their own situation. Profit and market share will drive electricity sales companies to focus more on applications of chemical energy storage technology in electricity use*

Impacts of Electricity Sale Reform on Energy Storage Market (2): Distributed Electricity Will Boost Energy Storage Demand

- Electricity sales reform will actively promote distributed electricity, thereby boosting energy storage demand

Distributed Energy Combine with Energy Storage to Establish Distributed Electricity

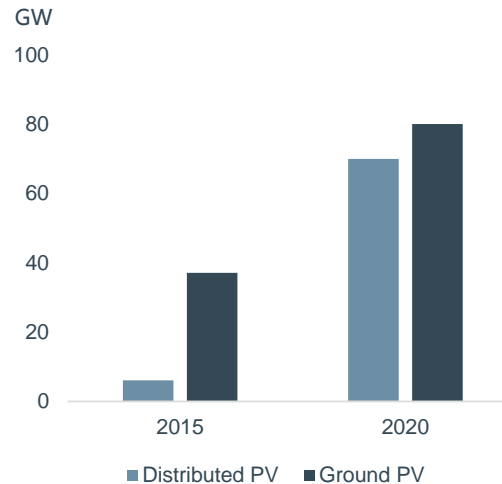


Sources: Essence Securities, SMM

Note: Distributed energy could also use diesel, wind electricity and biomass energy, etc.

- Renewable distributed energy, such as solar energy and natural gas, will be incorporated into energy storage technology so as to create distributed electricity and to improve the electricity using environment

Expected Booming Installed PV Capacity May Benefit Energy Storage Market



Sources: NEA, Pacific Securities, SMM

- Ground PV is being applied as electricity generator on a large scale. Distributed PV may achieve explosive growth as the electricity sales reform. Installed distributed PV capacity is expected to reach 70GW by 2020, up 63.94GW from 2015, which may benefit energy storage market

Market Comparisons Before and After Electricity Sales Reform

Before Electricity sales reform

- Low economic value:** Some energy and equipment rely on imports, low energy utilization rate
- Difficulty in connection to electricity grid:** Obstacles exist for distributed energy connection to electricity grid because of disputes over profit
- Government dominates:** Projects rely mainly on governments, with low participation by private capital, and develop slower than in the developed country

After Electricity sale reform

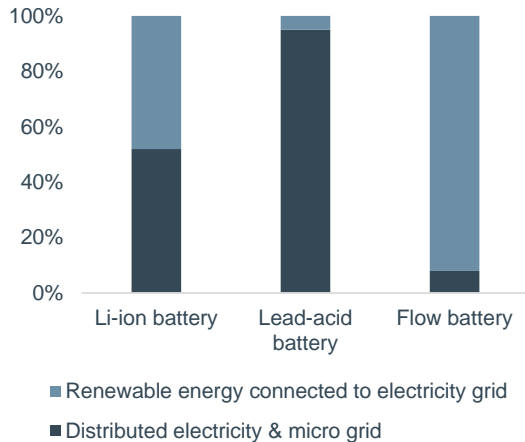
- Improve economic value:** Improve economic value of distributed energy through policy
- Solve grid connection:** Break traditional profit model, form electricity marketization, encourage creativity and promote distributed energy connection to electricity grid
- Development of Government & enterprise:** Shift from government-dominance to development of both government and enterprises

- Electricity sales reform is expected to fundamentally change the development of distributed energy and may boost its applications
- Applications of distributed electricity will become mature along with development of distributed energy, which may boost demand for energy storage

Impacts of Electricity Sales Reform on Energy Storage Market (3): Growing Energy Storage Demand in Electricity Use

- Electricity sales reform will improve energy storage demand in electricity use and **boost energy storage**

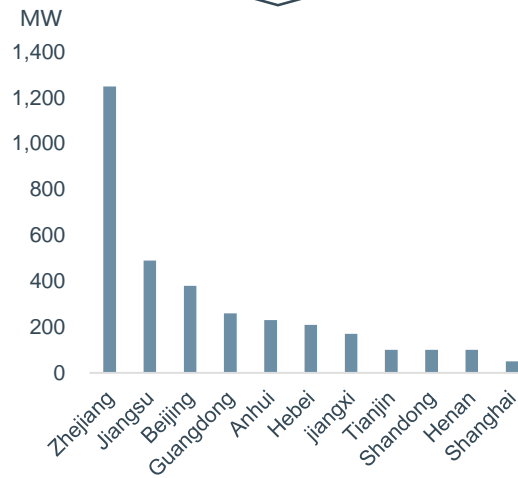
Proportion of Different Energy Storage Technology Application in Electricity Use in China



Sources: Southwest Securities, SMM

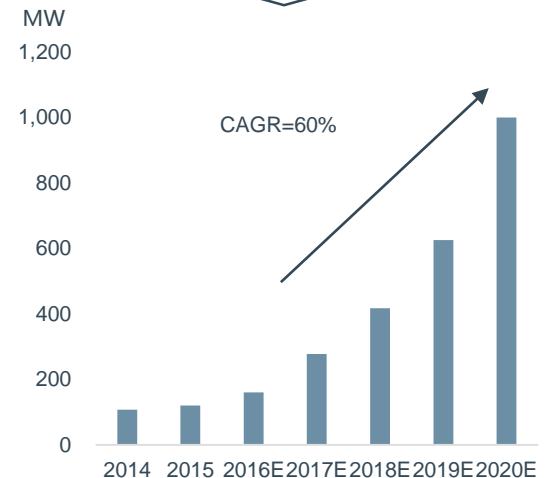
Note: lead-acid battery will gradually be replaced by lead-carbon battery

Planned Installed Capacity of Distributed Electricity Generation Demonstration Projects (2015)



Sources: Zheshang Securities, SMM

Accumulative Installed Capacity of Energy Storage (2014-2020)



Sources: CICC, SMM

In Electricity use, lead-acid battery is applied mainly to distributed electricity generation and micro grid, while flow battery is applied mainly to renewable energy connected to electricity grid. Because of **good performance, Li-ion battery is applied in both fields** and develops rapidly, and may **gradually realize commercialization**

Distributed electricity generation demonstration projects are being carried out in many regions, especially in Zhejiang. **Distributed energy may be established with combination of energy storage technology and control system**, which help improve electricity use efficiency

As one of the key parts in micro grid, installed capacity of energy storage will grow at a **CAGR of 60%** to **at least 1GW** by 2020

“Pie” or “Trap” - Electricity Sales Reform

Support

- **Central government:**
As major proponent of electricity reform, its aim is to adjust electricity market structure and promote social and economic development
- **Local government:**
Actively carry out electricity sales reform pilot program as responding to central government, aiming to reduce electricity costs and **improve regional competitiveness** with the help of electricity marketization
- **Social capital, big electricity users:**
Huge Electricity sales market may boost demand for services and equipments. **Big electricity users’ bargaining power will strength**, allowing them to further control electricity costs

Obstacles

- **National functional department :**
Except for establishment of relatively independent trading institution, new electricity reform does **not mention establishment of new institution and institution restructuring or adjustment in functions**
- **State-owned electricity grid company:**
The monopoly in the traditional market system, **the biggest obstacle to electricity market reform** and dampen interest in participation in electricity sales market to some extent
- **Electricity settlement:**
Electricity settlement remains controlled by State Grid, which will constrain development of both electricity sales companies and electricity market

“Pie” or “Trap”

- **Big electricity sales market:**
Direct electricity trading will grow year by year and **trillion-yuan trading value facing reallocation**
- **Favorable policy:**
Many electricity sales reform documents have been issued and electricity sales reform pilot projects are being carried out, benefit of the policy is foreseeable
- **Low entrance requirements for electricity sales company :**
Good to attract private capital and to improve the development of every component of electricity system

- **State-owned electricity grid company still in the dominant position:**
Electricity sales reform did not change state-owned electricity grid company’s dominance and **all market participants will still compete with each other**
- **Profit model lacks diversity:**
Electricity purchase & sale is basic business for electricity sales company, with single profit model. Electricity sale company needs to improve service quality and **develop value-added service to extend the market share**
- **Competition to intensify in Electricity market:**
Low entrance requirements for electricity sales company **will intensify market competition**

Opportunities

Challenges



Note:

- *Electricity sales reform brings both opportunities and risks and electricity sales companies need to rely on not only capital but also **cultivating their own soft power***
- *The development of electricity sales reform will **benefit energy storage greatly***

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US: Multi-Model Electricity Trading Market & Wide Applications of Energy Storage Technology

Background

- **Country:** US
- **Electricity market:** **22 out of 55 states in the US have launched electric power reform.** By loosening controls over electricity generation and asking private electricity companies to strip off all or partial electricity generation assets, a large number of independent electricity generation companies have been established, but 7 states of them have stopped the reform and none of the rest 28 states have taken substantial measures so far, although most of them used to study or are studying whether to carry out the reform

Electricity sales market

- **Market: Classified by market objects:** Electricity wholesale market, Electricity retail market, Electricity financial market; or **classified by market places:** PJM electricity market, Texas electricity market and California electricity market
- **Main market participants :** Electricity generation company, Electricity trading exchange, Public electricity grid company & group, Electricity sales company, Electricity user
- **Market operations: Adopt two settlement system** – The real-time market only settled the deviation of the market result and locational marginal price at real time and in the previous day and overnight trading
- **Market trading: Submit the next day's bidding plans** to the PJM between 8 am-12 am every day; the PJM announces results to members between 2 pm-4 pm every day and the range of offers is wide

Applications of energy storage in electricity use

- **Installed capacity of energy storage:** As of 2015 Q1, installed energy storage capacity totaled 30MW in California, including 22MW electricity grid energy storage, **7MW industrial & commercial energy storage and 1MW residential user energy storage**
- **Industrial & commercial PV and energy storage can reduce annual spend by USD 390** (Industrial & commercial electricity prices are expensive, so energy storage equipment installation is a preferred choice and its demand is expected to grow significantly)
- **Residential users PV and energy storage will spend extra USD 15 annually** (Electricity prices are low in the US. Energy storage demand will grow along with falling energy storage costs)

Focus of future development

- **Explore cooperation among regional markets** so as to consume the booming renewable energy in a larger market
- Focus on and promote design of renewable energy super short-term (e.g. 10mins) electricity generation market
- Actively improve **design of supporting service market**
- **Demand side response mechanism construction**

Note: PJM Electricity market refers to Pennsylvania-New Jersey-Maryland union market and is the biggest union electricity market in North America
This page mainly describe the energy storage market in California because California is a leader in US energy storage industry and is typical

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Note:

- **US electricity market models are diverse** and may deepen further
- **Combination of electricity trading, PV and energy storage** has great demonstration effect and could further stimulate growth in energy storage market

Australia: Enormous PV System Users & Energy Storage Market with Great Potential

Background

- **Country:** Australia
- **Electricity market:** electricity grid interconnection is limited in Australia and there is **no unified electricity market**. Market rules and electricity tariffs vary from state to state. In each state, the mixture of public and private ownership for electricity generation, distribution, transmission and retail sales assets is different. In most states, electricity transmission and distribution are highly regulated and operated by government, while electricity generation and retail sales are not subject to control and belong to private ownership

Electricity sales market

- **Market:** Electricity wholesale market, electricity retail sale market, electricity futures market
- **Main market participants:** Electricity generation company, electricity grid service institution, electricity trading center, Australia market operation center, electricity sales company, market user
- **Market operations:** Electricity plants submit offers of electricity amounts and prices simultaneously and **electricity trading and dispatching are completed simultaneously**.
- **Market trading:** Electricity plants submit offers every 5 minutes. Operating center announces spot settlement price every 30 minutes, with the deadline at 16:00 each day. The range of offers is wide and negative figure is allowed (range from –AUD 1,000/kWh to AUD 13,800/kWh; usually dozens of Australian dollars per kWh)

Applications of energy storage in electricity use

- **Installed capacity of energy storage:** Australia is rich in solar energy, with over 1.5 million households that have installed solar energy system, which however is limited and is **concentrated in ranches and remote communities**
- At present, PV electricity prices are USD 0.086/kWh in Australia (including USD 0.05/kWh subsidy), which are relatively low. However, once **government PV subsidies to 300,000 households expire** in 2016, PV electricity prices will increase, which will stimulate electricity users' demand for energy storage and create **1.5 million kWh energy storage market**.

Focus of future development

- **Remain committed to development of clean energy** and focus on renewable energy, such as wind electricity, solar energy and etc.
- **Shift from traditional energy system to intelligent system**, that is to say, based on large number of PV devices, add energy storage equipment and control system so as to achieve intelligent use of electricity and reduce electricity use costs
- **Set more perfect energy storage standards and corresponding subsidy policies** so as to push for energy storage technology applications



Note:

- *Australia's electricity market is **mature and developing orderly**.*
- ***Lots of PV users will turn to energy storage market after government subsidy expires, which will boost development of energy storage market, with great potential***

China: Rapidly Developing Electricity Market & Successful Demonstration Projects May Further Boost Energy Storage Market

Background

- **Country:** China
- **Electricity market:** China's electricity market **reform started late and is speeding up**. Electricity trading market has been basically established and pilot projects are proceeding in many provinces. However, electricity market mechanism and system still need to be improved and the decisive role of market resource allocation has yet to be established

Electricity sales market

- **Market:** electricity wholesale market
- **Main market participants:** Electricity generation company, state electricity grid company, electricity trading center, electricity sales company, market user
- **Market operations:** Bilateral consultation or competitive bidding through declaration in electricity technology support system
- **Market trading:** At present, electricity trading is carried out on a monthly and yearly basis. The ceiling and floor could be set for offers or trading price spreads. Declared electricity amount: 1 million kWh; declared electricity tariff: RMB 0.001/kWh

Applications of energy storage in electricity use

- Energy storage projects in electricity use are mostly **government-dominated demonstration projects**, which are used mainly in public utilities. As of 2015, installed capacity of energy storage in electricity use totaled **105MW**
- **Park-targeted electricity sales model has entered exploration stage: Hangzhou Zhongheng Electric, in cooperation with Zhejiang Narada electricity Source**, has signed energy storage electricity station project contract with three companies in Suzhou Industrial Park. Under the contract, these two companies will complete construction of **390MWh distributed energy networks** within the next two years. The project will attract customers by offering electricity prices as low as RMB 0.05-0.06 /kWh and will yield **RMB 3.95 million and RMB 1 million, respectively, in annual incomes** for Hangzhou Zhongheng Electric and Zhejiang Narada electricity Source, thus a two-win for both companies. Though small in volume, once business model gets mature, which is expected to be applied in the **market with over 3 million special-use transformer users**

Focus of future development

- Currently, China's electricity market still features co-existence of market mechanism and government planning. Trading that is fully based on market mechanism is limited only to trans-province trading, electricity generation right trading and big user trading. In order to achieve leapfrog development of China's electricity market, **sustainable development should be future goal of China's electricity market construction and China should enhance coordination of the whole electricity market**
- **Establish national electricity market** based on China's actual conditions
- **Speed up intelligent electricity grid construction**, further enhance demand side management, push for development of renewable energy



Note:

- *China's electricity market reform is still **in early stage** and **improvement is needed** in policies and mechanism*
- *Various energy and energy storage markets are gradually entering the stage of accelerated development. Combining park-targeted electricity sales with energy storage could **boost applications of energy storage technology***

Demonstration Projects on Energy Storage of Electricity Sales in China

Project	Distributed Energy	Energy Storage System	Operation Date
Large PV energy storage micro grid in Zaduo County, Yushu Prefecture, Qinghai	3MW PV	3WMh/12WMh bi-directional energy storage system	Dec. 2013
Intelligent light storage street light micro grid in Menyuan County, Haibei Prefecture, Qinghai	PV	Li-ion battery energy storage	Oct. 2013
New energy city micro grid demonstration project in Turpan, Xinjiang	13.4MW	-	End of 2013
Micro grid in Baerhu Banner, Hulun Buir City, Inner Mongolia	100KW PV、 75KW wind electricity	25KWh energy storage	Nov. 2014
Ecological rural micro grid in Chengde City, Hebei	50KW PV、 60KW wind electricity	128KWh Li-ion battery energy storage	Oct. 2015
Megawatt intelligent micro grid in Ao Island, Zhuhai City, Guangdong	1MW PV、 50KW wind electricity	2Mh lead-acid battery	Nov. 2013
Micro grid in Yongxing Island, Sansha City, Hainan	500KW PV	1MWh Li-ion battery energy storage	Jan. 2014
Micro grid in Luxi Island, Zhejiang	300KW PV、 1.56MW wind electricity、 1.2MWCAIYOU	4MWh lead-acid battery、 500KW super capacitor	Feb. 2014
Tianjin Eco City Public House Exhibition Center micro grid	300KW PV	648KWh Li-ion battery energy storage	Nov. 2012
PV-energy storage-GSHP integrated micro grid in Shijiazhuang, Hebei	0.2MW	0.35MWh Li-ion battery/super capacitor	Dec. 2014
New energy industry base intelligent micro grid project in Yanqing District, Beijing	1.8MW PV、 60KW wind electricity	3.7MWh energy storage	Dec. 2015



Note:

- Demonstration projects on energy storage of electricity sales in China are developed mainly in **remote mountain areas and rural areas, sea islands and several experimental bases**, but the **scope of pilot projects are expected to be expanded** in the future
- Most pilot projects have brought positive impact and have certain demonstrative effects and will gradually **realize commercialization** in the future

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Opportunity Exploring of Electricity Sales Reform

Electricity Sales Company

1 Electricity generation-distribution-sales integrated company

- Own a series of resources from electricity generation to distribution and to sale. Besides **traditional guaranteed electricity supply service**, such company could also participate in **competitive electricity sales service** and carry out more types of business in the future, which is **favorable for market competition**.

2 Electricity transmission-distribution-sales integrated company

- Electricity distribution is scarce resource.**
Ensure electricity transmission and have **electricity settlement rights**

Distributed Energy

1 PV distributed energy

- Technical progress reduces PV electricity generation costs and favorable policies boost development of PV industry. When combined with electricity sales reform, PV may **be built on a large scale as distributed energy**

2 Natural gas distributed energy

- Development of natural gas distributed energy is slow in China, due to high costs and difficulty in connecting to electricity grid. **Electricity sales reform may break this unfavorable situation and bring good opportunities for development of natural gas distributed energy under certain circumstances** based on actual conditions in local areas

Energy Storage

1 Li-ion battery

- Li-ion battery technology is becoming increasingly mature. By combining market with electricity sales reform, Li-ion battery can be **used in all fields of electricity sales, and together with demand from EV market, Li-ion battery will have great development potential.**

2 Lead-carbon battery

- Lead-carbon battery, as upgraded version of lead-acid battery, can be used in lead-acid battery field. Lead-carbon battery market is mature and stable, **and has realized commercial operations and will likely combine with park-targeted electricity sales model**

Recommendation of Key Companies to be Focused:

- Guangxi Guiguan Electric Power:** The company signed Cooperation Framework Agreement for Building Electricity Sales Company with Guangxi Electricity Grid, under which both sides plan to establish a electricity sales company and participate in electricity reform with the former holding 49% stake in the JV and the rest 51% by the latter. The company will likely become Datang Group's hydroelectricity consolidation platform in southwest China **and obtain high-quality asset injection from Datang Group**. As Datang Group's only listed hydroelectricity company in southwest China, the company has obvious advantage and is classified as **electricity generation-distribution-sales integrated company**
- Guangzhou Zhiguang Electric:** The company is classified as electricity distribution-sales company. Client resources accumulated in electricity use service industry could be core advantage for the company to carry out electricity sales business. The company obtained qualifications for electricity trading in Guangdong in June and **has engaged in incremental electricity distribution operations**. The company established a JV with Guangxi Rongkai Investment Development (property owner of Liuzhou automobile city electroplating industrial park), and the JV is committed to construction and operations of park electricity distribution networks
- Shenzhen Topray Solar:** As regards investment, construction and operations of PV electricity stations, the company, backed by complete industry chain and good ability in cost control, has competitive cost advantage in EPC construction **and successful experience in many PV electricity generation projects**. The company plans to focus on micro grid and energy storage business in 2016 and target new energy market
- Sichuan Datong Gas Development:** The company has been actively shifting toward clean energy market in recent years **and owns many gas companies, Including Shangrao Chase Gas Engineering**. The company will likely participate in IDC distributed energy project in Jiading District, Shanghai, which is considered as a good natural gas distributed energy project because of good conditions in many ways
- Zhejiang Narada electricity Source:** The company reported big increase in earnings in 2016 and is engaged in battery, energy storage electricity station and recycling business. **The company is a leader in domestic energy storage industry** and has engaged in battery business includes lead-carbon battery and Li-ion battery
- Shandong Sacred Sun electricity Sources:** The company is dedicated to design of various products, such as energy storage electricity source, reserve electricity source, motive electricity source and new energy system, as well as systematic solutions. In user energy storage field, the company could **provide grid-connected user energy storage system, independent alternate current/direct current user energy storage system, as well as independent direct current user energy storage system** based on customer needs

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