SHP Development in China

Huang Yan

International Center on Small Hydro Power (ICSHP)

March 2016, Accra

Contents

SHP Development History in China

- **Hydropower development in China began with SHP**
- **The first hydropower station was completed in 1912**
  - **Shilongba SHP station in Kunming, Yunnan Province**

SHI LONG BA hydropower station
(480 kW)

SHP Development History in China

Before 1980, most rural areas in China lacked electricity.

SHP Development History in China

In the 1980s policies were issued to stimulate SHP development. Polices including the "three-self" policy issued with financial support.

Three-self policy:

Self-construction
Self-management
Self-consumption

Key policy feature: Those who invested in SHP stations would receive the benefits from the station.

5

SHP Development History in China

Three Stages of SHP Development in China

- **The first stage (1950s - 1970s)**

Main function: address electricity shortages
Consumers: mainly domestic lighting
Annual average installation: 58 MW (1960s) 580MW (1970s)

- **The second stage (1980s - 1990s)**

Main function: poverty relief, primary rural electrification
Consumers: township industry, agricultural processing, pumping irrigation
Annual average installation: 660 MW (1980s) 1,100MW (1990s)

- **The third stage (2001 -)**

Main function: promoting R.E., boosting local economy, ecological environment protection, meeting the electricity demand in mountainous areas
Annual average installation: 3,000MW

Definition of SHP

In general, SHP refers to a station with installed capacity below 10MW.

Mini/Micro Hydro are much smaller.

Definition of SHP

SHP in China < 50 MW

The theoretical SHP potential in China is 170 GW, with 128 GW economically exploitable.

SHP Development History in China

- By the end of 2014, total installed capacity about 73,000 MW with 46,000 stations.
- About 1/2 of China's territory, 1/3 of counties and 300 million people in rural areas rely mainly on SHP.
- 700,000 people employed by SHP enterprises.
- 27% of hydropower, 7% of electricity industry

Main contribution of SHP

Promotion of rural electrification. The electrification rate among households in rural hydropower supply areas has increased from less than 40% in 1980 to 99.6% in 2011.

Main contribution of SHP

Stimulating socio-economic development in rural areas. The profit taxes from SHP account for a large proportion of the total revenue for counties.

Main contribution of SHP

Many villages used *revenues from SHP generation to invest in* cultural, educational, communication, social security and other *public welfare undertakings*.

Main contribution of SHP

Ensuring electricity supply during emergency periods.(**"Black-start" "Decentralized Power Systems")**

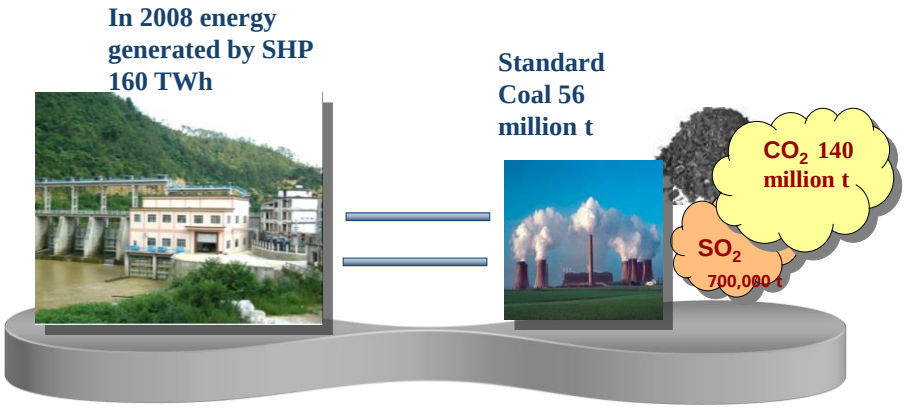
Case: isolated operation during abnormal disconnection from national grid in a disaster emergency in 2008

Main contribution of SHP

Very soon after the *Wenchuan Earthquake in May 12, 2008*, power at the Xiazhuang Hydropower Station (12MW) was restored, providing emergency electricity to the local earthquake control and relief headquarters, hospitals and communication sectors.

Main contribution of SHP

Promotion of energy-saving and emission reduction.



Three significant programs

Building model for SHP-based rural electrification counties with Chinese characteristics

The Chinese government began the project in 1983:

• **653** primary rural hydropower electrified counties were built up from 1985 to 2000 (From 7th Five-Year Plan to 9th Five-Year Plan).

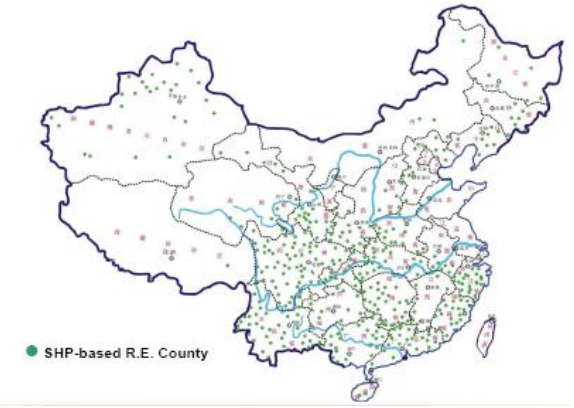
• **409** rural hydropower electrified counties were established from 2001 to 2005 (10th Five-Year Plan).

• There were another **400** rural hydropower electrified counties implemented from 2006 to 2010 (11th Five-Year Plan).

• Program for new rural hydropower electrified counties implemented from 2011 to 2015 (12th Five-Year Plan).

Three significant programs

"Building SHP-based Rural Electrified Counties with Chinese Style"



Three significant programs

Chinese government launched the "*SHP Replacing Firewood Environmental Protection Project*" initiative in 2003

Three significant programs

SHP Replacing Firewood Environmental Protection Project

Construction & management modes:

Investment input: Central government 50% Local government: 30%, bank loan 20% (interest rate 6.21%)

Affordability: Favorable tariff: 0.17 Yuan (kWh) Consumption per household per year: 1200 kWh, Household expense per year: 204 Yuan (About 2.4% of rural household income)

Key measures:

- The investment from central government may not turn-back, only annual depreciation counted.
- Ownership kept by the central government
- Local government supervise/manage the state asset
- Using right belongs to farmers: tariff, quantity, responsible for the protection of fores

Three significant programs

A great deal of labor force needed for cutting wood

Firewood was cut down for use as fuel

Excess deforestation led to soil erosion

Before project implementation

Three significant programs

Post project implementation

Green mountains and clear water are protected

More labor force available

电炊具做饭简便、卫生

Change in conventional mode of energy consumption

Three significant programs

The "SHP Replacing Firewood" pilot project has provided 800,000 farmers with electricity and protected 230,000 hectares of forest.

Three significant programs

SHP Efficiency and Capacity Expansion (2011 - 2015）

According to statistics, about 22,000 SHP stations with total installed capacity of 18,000 MW were built before 1995 in China.

Refurbishment!

6 years

9,476 stations

1012.82 x 10^4 kW installed capacity

Three significant programs

SHP Efficiency and Capacity Expansion

Achievements:
No. of stations: 733 (2011-2012), 4000(2013-2015)
Average efficiencies: <65% to >85%
Capacity: 32% ↑
Generation: 52% ↑

Finance subsidies from the Central Government
-State grant funds: 1.2 billion Yuan (2011-2012)
8.0 billion Yuan (2013-2015)
-700 Yuan/kW for East, 1000 Yuan/kW for Middle, 1300 Yuan/kW for West

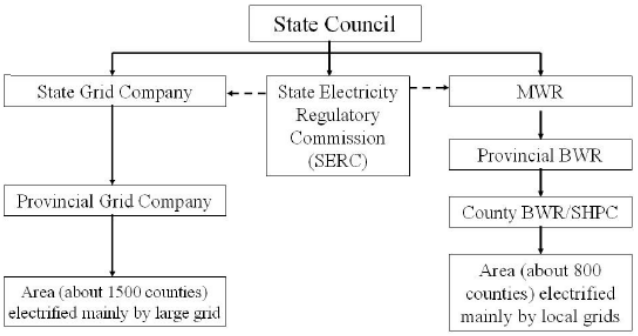
Chinese SHP Experiences

Since the 1980s, SHP has developed rapidly as a result of:

- **Appropriate mechanism & policies**
- **Government support**
- **Financing**
- **Local people participation (PPP)**
- **Technological progress and innovation**
- **……**

Mechanism

County-based decentralized management



Decentralized Administration Policy: Local Grid, County as Basis

Local government: planning, development, operation, management and manufacturing

China's SHP Policies

Policies on development

- **Focusing on local capability with assistance from the Central Government**
- **3-self policy:**

  Self-construction, self-management, self-consumption
- **Emphasis on *coordinated balance between development and conservation*.**

China's SHP Policies

Policy on investment & loan

- **"Electricity Supports Electricity": all profits from SHP stations can be exempted from tax and re-invested into SHP**
- **Low-interest loans from central and local govt. (10 years)**
- **Subsidies and incentives provided by the government**

Central government grants:

1985 - 2011: 6.45 billion RMB for construction of hydropower-based rural electrification counties
2003 - 2012: 1.93 billion RMB for "SHP Replacing Firewood Environmental Protection Project"
2011 - 2012: 1.2 billion RMB for 733 pilot projects aimed at SHP efficiency and capacity expansion among 6 provinces

China's SHP Policies

Policy on taxation

- Preferential Value Added Tax (VAT) for SHP has, since 1994, stood at 6% (vs 17% VAT for large HP stations)
- The sales tax only 5% of the profit from a SHP station before 1994;
- Income tax 33%, but half of it in some provinces and zero in some others

China's SHP Policies

Localized policy

- Local people participation
- Identify local potential of SHP resources
- Mobilize locally available funds
- Encourage local technology progress
- Use of local construction materials
- Local consumption prioritized

Other policies

Other preferential policies

- The grid is required to absorb all the electricity generated by SHP and apply the same tariff within the same grid
- Reasonable allocation of water resources budget for SHP projects that combine flood control, irrigation and water conservation
- Scientific and technology progress
- Technology Oriented Policy: Open, Appropriate, Cost-effective; Simplification, Standardization, Automation

China's SHP Technology Transfer

Built a mature SHP technological service system
- more than 100 scientific research institutes
- over 1,000 design and construction units
- over 300 small hydropower equipment manufacturers, which adopt unified design and drawings as well as standardized spare parts

China's SHP Technology Transfer

An integrated technological standard system has been established in small hydropower planning, design, construction, installation, testing, operation, equipment manufacturing etc. to provide thorough technological support and service

Win-Win Strategy

- Chinese SHP enterprises are encouraged to provide services abroad, including planning, design, construction, management, and equipment manufactures
- More than sufficient capacities to develop SHP worldwide
- Many African countries, have big potentials to develop SHP for industrialization
- SHP Technology Transfer is a potential win-win strategy

Challenges

- **Demand direction: SHP development potential and demand in African countries**
- **Target countries willingness for SHP technology transfer**
- **Policy and regulation frameworks for SHP technology transfer**
- **Future benefit expectations of SHP enterprises**
- **……**

Message from ICSHP

International Center on Small Hydro Power, is tasked to promote SHP worldwide.

ICSHP serves as headquarters of The International Network on Small Hydro Power, including the voluntary participation of regional, sub-regional and national focal points, relevant institutions, utilities and enterprises, with 470 members from over 80 countries.

Thank you !

International Center on Small Hydro Power (ICSHP)
P.O Box 202, Nanshan Rd. 136, Hangzhou, China
Tel: +86-571-87079113 Fax: +86-571-87023353
Email: yhuang@icshp.org www.icshp.org