

Think Global, Act Rural

Approaches and Experiences of a Sino-German Cooperation



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1. Background

In China, between 1996 and 2001, around 30 million people were newly connected to the public grid. However, despite these enormous efforts, there are still around 7 million households, in some 29,000 villages (in total approx. 30 million people), living without electricity and will, according to the expansion plans of the Chinese power utilities, remain unconnected, even in the medium or long term, due to economic and technical reasons.

2. China's 'Brightness Programme'

In view of this situation, in 1996, the Government of the People's Republic of China decided to launch the so-called 'Brightness Programme'. Within the framework of this programme, which is scheduled to run until 2010, around 23 million people living in remote rural areas of the Western provinces of China will be supplied with electricity by means of de-centralised energy systems based on renewable sources of energy such as solar and wind.

3. The Township Electrification Programme

Within the framework of the Brightness Programme, in 2002, the National Development and Reform Commission (NDRC), decided to supply electricity to around 1000 townships in 7 Provinces by means of PV and PV/Wind-Hybrid systems by 2004. The average PV capacity installed will range from between 5 and 200 kW. The overall budget allocated for this purpose is equivalent to US\$ 340 million. The systems are installed

exclusively by Chinese system integrators.

4. Technical Cooperation Programme "Renewable Energies in Rural Areas"

Since 2001, the German Government has provided Technical Assistance in the field of institutional development, dissemination strategies and quality assurance, in order to promote the large-scale dissemination of renewable energy technologies in rural areas. The Sino-German programme "Renewable Energies in Rural Areas" is aimed at improving the social and economic situation of the population living in remote rural areas of the 4 provinces of Qinghai, Yunnan, Gansu and Tibet, by providing the appropriate, decentralised energy services based on renewable sources of energy adapted to local conditions. The target groups of the project, which are predominantly comprised of representatives of various ethnic minorities, are above all:

- private households of small and medium farmers,
- nomadic herdsmen,
- small-scale craftsmen,
- owners of service businesses.

In addition, the group who can draw direct and indirect benefits from the programme through training schemes, the creation of jobs and an expansion of their business activities includes:

- companies or businesses selling PV and wind energy conversion systems,
- local technicians who are able to carry out installation and maintenance work,



- power supply companies at both national and province level,
- rural cooperative banks providing loans,
- state planning institutions,
- laboratories and test facilities that are able to perform quality testing.

The implementation concept of the programme is comprised of three core components:

■ Institutional development

This component aims at improving the overall political and institutional framework conditions for an efficient promotion of renewable energy technologies, by providing advisory services to decision makers and institutions on both a national and provincial level.

■ Dissemination strategies

This component aims at elaborating appropriate, market-oriented dissemination strategies for renewable energy systems by increasing public awareness, establishing appropriate financing schemes and supporting the set-up of local networks of operation and maintenance through adequate training measures.

■ Technical quality assurance

This component will investigate the performance of available RE-systems and components and propose adequate measures for the sustainable improvement in quality according to international standards and national/local requirements.

5. The Capacity Building Training Programme

Having been approached by the NDRC to support the Chinese Township Electrification

Programme aimed at establishing appropriate installation and maintenance network in these 7 provinces, GTZ entrusted Fraunhofer Institute for Solar Energy Systems and Centre for Solar Energy and Hydrogen Research with the task of compiling and presenting a master-trainer course in PV/PV-Hybrid systems, which was held in Beijing in March/April 2003. Since this time, these master trainers have trained approximately 200 provincial trainers. They will now serve as trainers to more than 1500 service engineers and local system operators. The host organisation and organiser of the training course was JKD who worked in close co-operation with GTZ China. JKD, a Chinese institution affiliated with the Chinese Academy of Science, is working in this field on behalf of the NDRC.

The course itself, held in the form of lectures and for four hours each morning, covered the following topics:

- Decentralised electricity supply: the Chinese 'Brightness Programme'
- Hybrid electricity supply systems in Europe
- Solar radiation: resource and site analysis
- Photovoltaic cells and Photovoltaic modules
- Loads for decentralised electricity systems: power demand and type of loads
- DC/AC inverters: operating principles, efficiencies, specifications
- Energy storage in electricity supply systems - the lead acid battery
- Battery operation and battery lifetime
- Charge controllers: operating principles, specifications

- Back-up electricity in renewable energy systems: the diesel-generator set
- Wind energy: resource and site analysis
- Working principles, design and operation of wind turbines
- Design principles for PV/wind hybrid power systems
- Maintenance and troubleshooting for wind turbines
- Installation of PV/wind hybrid systems
- Electrical safety and village grid layout
- Maintenance and troubleshooting for PV/wind hybrid systems
- Technical management and socio-economic aspects of PV/wind hybrid systems and village grids
- Economic analysis of renewable energy for rural electrification

The afternoons were reserved for practical work performed in the laboratory and for theoretical exercises which the course participants solved on paper and on the blackboard. Both, practical and theoretical exercises, led to lively discussions among participants and resulted in hands-on learning experience covering technical and didactical issues. The course concluded with a written and oral examination.

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6. Challenges and Lessons Learned

The Chinese 'Brightness Programme' is facing a myriad of challenges, particularly in respect to the short implementation timeframe and the ambitious targets set for this period. The issues which should be addressed by other countries/regions when planning and implementing such a decentralised, village electricity supply programme are as follows:

- Institutional issues such as service standards, energy service companies and their operating framework, responsibilities for the systems after the period of implementation, the ownership and the user tariffs, must be discussed and agreed upon by all parties involved before the first system is installed.
- Organisational issues such as quality approval upon completion, acceptance tests, metering and billing, revenue collection, incentive programmes for individual users to buy and use energy saving appliances, must be clarified.
- Technical issues such as the reliability of components, robustness and service lifetime of systems, technical measures that limit energy and power delivered to the individual user which allow for a fair allocation of the limited energy resources, must all be established.
- Economic issues relating to the productive use of electricity once the electricity supply has been established. It is crucial for the sustainability of each rural electricity supply programme, be it by grid-extension or by decentralized renewable energy technology, to inform people about the potential of this new resource and to train them in how to use it both effectively and efficiently.

In order to control and to evaluate the technical performance and the socio-economic impact of the systems installed, it is strongly recommended that one installs a comprehensive technical and socio-economic monitoring system, providing up-to-date information on the actual technical performance of the systems as well as continuous long-term information on the changes in daily life patterns, economic development and social services, in the rural areas newly supplied with electricity. The information gathered can then be used to continuously improve technical standards as well as the institutional and organisational set-up in order to provide better services to the people most in need and to achieve long-term sustainability of such ambitious renewable energy based village electricity supply programmes.

GTZ is well aware of these challenges and provides the necessary services required to handle these issues. Based on 20 years of

experience in the field, our approach is focused on the integration of energy services within rural development strategies, providing job opportunities for technicians and end-users, better health and education services in remote rural areas and access to information and entertainment, thus creating new perspectives for rural people to improve their living conditions.

It is in this broader context that renewable energies in rural areas can indeed contribute to a great extent to the achievement of the most important development goals of this century - the so-called Millennium Development Goals such as poverty alleviation, gender equality, environmental sustainability, access to education and security of food supply. ■

PROFILE

The Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH is a service enterprise for development cooperation with world-wide operations. Established in 1975, GTZ is headquartered in the German town of Eschborn near Frankfurt/Main. Owned by the Federal Republic of Germany, the organization operates as a private-sector enterprise with a development-policy mandate: to improve and sustain the living conditions of people in partner countries and to conserve the natural resources on which life depends. GTZ has been engaged in China for more than twenty years. In the eighties, GTZ worked mainly on projects in vocational and technical education and poverty alleviation. In close collaboration with the Chinese Ministry of Commerce of the People's Republic of China (MOFCOM), GTZ has been constantly tailoring its portfolio according to the immense transition process in China. Since 1999, activities of GTZ China encompass four fields of operation: Vocational and Technical Education and Employment, Economic and Structural Reform, Natural Resources Protection and Poverty Alleviation, Environmental Protection and Energy Management. GTZ's project work is decentralized. At project level, 35 specialists assist their Chinese partners in the individual cooperation projects. With two seconded and 18 local experts, the GTZ Office Beijing coordinates project operations at national level and helps develop the country portfolio. GTZ Office Beijing supports the projects in administration, procurement and financial management.

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