1.4 Methodology and data collection

1.4.1 Case selection

According to Cook et al. (2005), a priority for future energy studies is to conduct more in-depth empirical research using qualitative and participatory methods to help gain insight into energy projects. However, doing in-depth research is difficult, as limited resources limit the sort of study undertaken (Singleton and Straits, 2005). For example, many difficulties surround the conduct of field research in remote rural areas of western China. Different studies have described the difficulties for conducting field research in remote rural areas of western China (see World Bank, 2000a; CAS, 2006a; CAS, 2006b; Hölzer and Huba, 2007; Bruehl and Haskamp, 2003a; Bruehl and Haskamp, 2003b; Haskamp, 2004a; Haskamp, 2004b; Zange, 2005; Schaber, 2005; Zheng and Zange, 2006; Klingshirn and Mueller, 2005). Under such constraints, two townships in two different provinces were selected for this study as the cases for an in-depth examination of rural electrification practices in remote rural areas of western China.

1) Selection of provinces

The 'Township Electrification Program', was implemented in the remote rural areas of 11 western provinces: Tibet Autonomous Region (AR)[10], Xinjiang AR, Qinghai Province, Sichuan Province, Inner Mongolia AR, Gansu Province, Shaanxi Province, Hunan Province, Yunnan Province, Chongqing Municipality, and Jiangxi Province. The selection of the case provinces is 'purposive sampling'. Unlike probability sampling, purposive sampling has the weakness of not being able to control for investigator bias during selection process (Singleton and Straits, 2005). The selection of the case provinces in this study is based on the following two reasons:

First, when there are only few cases, probability sampling is less reliable and generation from sample to population becomes a matter of judgment (Singleton and Straits, 2005: 132). The selection of cases is better left to expert or researcher judgment to select a

[10] Autonomous regions in China are areas associated with one or more ethnic minorities. The Chinese government officially recognizes 55 ethnic minorities, excluding the dominant ethnic group of Han Chinese. Ethnic minorities are given additional autonomy regarding their culture in the PR China.

representative or typical case (Singleton and Straits, 2005: 133). Among the 11 western provinces, Xinjiang AR, Qinghai Province, and Tibet AR have the most serious problems of electricity access, especially Tibet AR. From the number of installed solar PV power stations in the Township Electrification Program, Xinjiang AR, Qinghai Province, and Tibet AR were the main target provinces (see Table 1-1). Hence, these three provinces were selected in the first stage as potential case provinces.

Table 1-1 Implementation results of the 'Township Electrification Program': Solar PV power stations and solar PV/wind hybrid power stations

Province	The quantity of power station	Total Installed capacity (kWp)	The number of households benefited	The number of people benefited
Tibet AR	329	6,763	28,966	141,635
Xinjiang AR	159	2,378	18,416	105,887
Qinghai Province	112	2,715	8,640	40,650
Sichuan Province	46	1,817	5,500	24,900
Inner Mongolia AR	42	752	2,840	11,369
Gansu Province	23	995	4,164	37,942
Shaanxi Province	9	100	520	1,856
Hunan Province	1	20	100	420
Total	721	15,540	69,147	340,395

Source: Compiled by author based on NDRC, 2005a; CAS, 2007a; CAS, 2007c.

Second, under certain circumstances, when certain individuals or institutions refuse to cooperate in a study or when a researcher is unable to gain access to research targets, the researcher has to accept a purposive sampling or abandon the study altogether (Singleton and Straits, 2005: 132). In China, it is not common for individual researchers to carry out household surveys, particularly in rural areas. Household surveys are usually done by the government, such as through Statistic Bureaus. However, without governmental support or approval, carrying out survey research is usually impossible in China. Among the three potential case provinces, this study was only granted governmental support to carry out survey research in Qinghai and Tibet. Because of this constraint, this study could only select townships in Qinghai and Tibet and had to abandon the inclusion of the Xinjiang AR.

2) Selection of townships

The selection of townships was relied on experts' judgment and recommended by this study's provincial research partners, Mr. Tsultrim Dargye and Mr. Osmanla. Both men worked for GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit, German Agency for Technical Cooperation) at the GTZ Qinghai and Tibetan provincial offices. Both men were research assistants for GTZ's 'Sino-German Technical Cooperation Project of Renewable Energies in Rural Areas' from 2001 to 2007. Together, they possessed 6 years of project experience and had both visited a number of townships and villages which applied renewable energy at remote and rural areas, as well as carried out survey studies with German experts. Mr. Dargye and Mr. Osmanla had also visited a number of townships that implemented the 'Township Electrification Program'. Ethnically, both were local Tibetan, and spoke not only Chinese and English, but also Tibetan which was spoken widely in remote and rural areas of these two provinces. Besides these qualifications, both men had very good contacts with provincial government and local governments.

Two criteria were used to select the township. First, the township should be one of the targeted townships of the Township Electrification Program. Second, it should be possible to get research support from the provincial and township government.[11]

The selection process started from a list of the townships suggested by research partners according to the two selection criteria. Discussions and communications with potential case townships and provincial governments about this study and research activities then ensued to decide the case townships. Finally, Saierlong Township in Qinghai Province and Namcuo Township in Tibet province were selected as case townships in this study.

1.4.2 Research approaches

A combination of available data research, field research, and survey research were

[11] Government approval was a key factor if this study was to be successfully carried out in remote rural areas of western China with the support from provincial governments, township governments, and village heads since field research and survey research were rarely conducted in these areas and it was politically sensitive to conduct field research and survey research in these areas. Without the support of provincial and township governments, field research and survey research could not have been accomplished in these areas.

chosen as research approaches, to carry out this study.[12]

For 11 months from July 2007 to May 2008, field research was carried out in Beijing Municipality, Qinghai Province, and Tibet AR. This approach aimed to gain firsthand knowledge of the Township Electrification Program that was implemented in remote rural areas of western China, and to collect information of the problems and benefits of the Program from the households. The study combined quantitative and qualitative methods, including observation, interviews, and household surveys.

Three field research trips were carried out in the two selected townships in Qinghai Province and Tibet AR. The first field research trip during October 2007 was a pilot study, and aimed to examine if the selected research sites were appropriate for this study, to develop a basic understanding of the research sites, and to arrange future research trips and activities with provincial and township officials. During this initial trip, transition walks, mapping, observation, semi-structured interviews, and unstructured interviews to learn about the township, people's living conditions, energy situation, energy needs and problems, education, medical, public services, and small businesses which were related to electricity supply from renewable energy sources. This research trip helped to clarify research objectives, refine research questions, specify subtopics for semi-structured interviews, and revise the questionnaire for survey.

The second field research trip was carried out from November to early December 2007 in Saierlong Township, Qinghai Province. During this trip further, a household survey was conducted and several semi-structured interviews were conducted with township officials, operators of the solar PV station, the principal of the township school, and the director of the health center. The final field research trip was conducted in Namcuo Township, Tibet AR in December 2007. A household survey and several semi-structured interviews were undertaken to collect primary data.

[12] There are four basic research approaches for social sciences: experiments, surveys, field research, and the use of available data (Singleton and Straits, 2005). More detail regarding these four approaches are described in Singleton and Straits (2005), chapter 6 to 11.

1.4.3 Methods of data collection

Both qualitative and quantitative methods are applied in this study to collect data. The aim of combining both methods is to cross check the validity of collected data and reduce the weakness of one method by the strengths of another.

1.4.3.1 Qualitative methods

Several qualitative methods were used in this study to collect data. The aim was to get rich and varied information about the townships, the households, and the implementation situation of the Township Electrification Program in both selected townships. These methods enabled local people to analyze, enhance and share their knowledge of local conditions for this study (Gerke, 2006).

1) Observations

Observations were conducted in the field to understand the implementing situation of the Program in both selected townships and at the households.

2) Unstructured interviews

Unstructured interviews provided a less formal structure and allowed for more wide ranging discussions, and spontaneous questioning of research subjects (Singleton and Straits, 1999: 222-223). Several unstructured interviews were conducted at the beginning of the field research with government officials, operators of the solar PV power stations, poor households, rich households, and key informants in order to get basic information about the townships, local opinions of the implementation situation of the Program in both selected townships and at the households.

3) Transect walks

Transect walks with knowledgeable local people in both selected townships were conducted to observe and discuss the implementation situation of the Program and

related problems by visiting the townships and the solar PV stations. The transect walks helped to identify which parts of the townships were not connected to the solar PV stations.

4) Mapping

Maps of the townships and electricity distribution were drawn by township officials, operators, and local people to provide an overview of the townships and electricity distribution situation in the two selected townships.

5) Semi-structured interviews

Semi-structured interviews guided by a list of open-ended questions were conducted with experts, government officials, township leaders, operators, households, and key informants to gain information about different perceptions of the implementation situation of the Program in the two selected townships (see Photograph 1-1 left). The semi-structured interviews helped to revise the draft questionnaire of the household survey.

Photograph 1-1 Semi-structured interview (left) and household survey (right)

Source: Photographs taken by author in the field from October to December, 2007.

1.4.3.2 Quantitative method

A household survey was carried out in the two selected townships to collect data of energy situation, energy needs, problems and socio-economic benefits of the Township Electrification Program, as well as household characteristics (see Photograph 1-1 right).

1) Unit of analysis

The unit of analysis in this study is households, and is based on the rationale that in remote rural areas electricity demand is mostly from households (World Bank, 2000a).

2) Population frame

The population frame is the number of the households in the two selected townships. There are 250 households[13] in Saierlong Township and 60 households in Namcuo Township.

3) Sample design

Households in the selected townships did not have addresses to identify house numbers. Besides, township leaders could not provide complete lists of households for this study. Hence, 'systematic sampling' was applied to select samples. Doing so followed a World Bank's study (2000) assessing markets for renewable energy in rural areas of northwestern China, the survey used 'systematic sampling' because there were no house numbers and no available lists of households. The sampling started with a randomly chosen case of the population, and then selected every *K*th case, e.g. fifth or tenth, from the population (Singleton and Straits, 2005: 131-132). The sampling interval (*K*) was the ratio of the number of cases in the population to the desired sample size. For example, if the desired sample size was 100 households out of a population of 400 households, the ratio would be 4. The selection of households began with selection of one household at random in the township, and then walking through the entire township taking every fourth household encountered. Systematic sampling was also a probability sampling, utilized to ensure that every household had an equal chance of being included in the sample, and that the probability of being included in the sample could be known (Singleton and Straits, 2005: 119).

[13] The number of households in Saierlong Township excluded 150 monk households, which were located in the monastery area of the township. It was the local tradition to respect monk's still and quite life. Township officials required that the research activities should not disturb the monks.