The largest hydroelectricity producer in the world, China’s hydropower generating capacity has developed rapidly in recent years, growing to 213,400 MW in 2010. Under pressure from China's low-carbon policy, this dependence on hydropower will likely grow in the future. But reports of the negative impacts of hydropower development – ecological damage, dried-up rivers, the displacement of populations from their homes – appear often in the media. To witness the problems with my own eyes, and to understand their full impact, I investigated the hydropower situation in Sichuan province this past September.

The background to this investigation

Sichuan is China’s richest province in terms of water resources. It has many river systems, and many hydropower stations (including some still under construction). I chose to investigate the Baoxing-Qingyi River, which is part of the Min River system. The Baoxing River originates at Balang Mountain in Baoxing County, flows through Lushan County, and becomes the Qingyi River downstream of Feixianguan.

In terms of hydrological engineering, the Baoxing River is rich for exploitation. Running for 142 km, it falls 3,472 metres, with an average gradient of 24.2%. The river’s water flow, mostly accumulated from rainfall, is plentiful in the Qingyi River catchment area where the average annual rainfall is 1,243 mm. The hydropower potential of Baoxing River is an estimated 1,942 MW, of which 1,389 MW can be exploited. By 2007, 1,295 MW of this had been exploited.
Hydropower development on the Baoxing River

The existing hydropower stations on the Baoxing River can be divided into two categories: medium-sized stations on the main stem of the river and small stations on the tributaries. (In China, hydropower stations with a capacity of 25 MW, or under, are called ‘small,’ and those between 25 MW and 250 MW are classified as medium-sized.) The right to develop hydropower on the main stem of the Baoxing River was granted to Huaneng Baoxing River Power Inc. by the government in 1991. The company planned to construct one large reservoir and eight smaller reservoirs downstream, with a total capacity of 1,005 MW and an estimated annual power output of 5 billion kMh. To date, only the large reservoir and five of the smaller hydropower reservoirs have been built. By 2009, Huaneng Baoxing River Power Inc. had assets valued at 4.7 billion yuan, had generated 18.2 billion kMh of power cumulatively, and had paid 940 million yuan in taxes.

Hydropower on the Baoxing River has been developed by a combination of state-owned enterprises, town and village-owned enterprises and private companies. The Huaneng Baoxing River Power Inc. is a state-owned enterprise and is responsible for constructing dams and power stations on the Baoxing River. Meanwhile, other small hydropower stations have been built and are owned mainly by private enterprises.
The right to develop hydropower is granted by different levels of government, depending on the size of the project. Projects with a maximum capacity of 5 MW, or under, can be approved by the county government – an important power for local governments that are intent on promoting economic growth. The head of Baoxing County revealed that of the county's total tax revenue of 20 million yuan in 2006, 15 million yuan came from taxes on hydroelectric power plants.

All companies, whether state-owned or private, can submit bids to the county government for the right to develop hydropower. If they do so, they are obliged to submit environmental and fish impact assessments.

As a state-owned enterprise, in which the local government shares an interest (usually in the form of water resources), Huaneng Baoxing River Power Inc. gets government support. For example, financing for construction comes mainly from state-owned banks. For instance, 80 percent of funding for the largest dam and power station to be built on the river was given in the form of a loan from the China Construction Bank. All of the power Huaneng Baoxing River Power Inc. generates from its dams is sold to the State Grid Corporation at an average price of more than ¥0.2 per kWh.

For the most part, power generated by either large state-owned companies or local...
state-owned enterprises, and even small private generators, must be sold to the State Grid Corporation. The price of power sold to the State Grid is a regulated price, determined by the government.

There are exceptions to this rule, however. In some cases, large generators will sell power directly to large consumers, but only with official approval. In these cases, the power purchaser is able to negotiate a lower price than they would have to pay the State Grid. In other cases, local industries and metallurgical companies will produce power for themselves, guaranteeing their industrial operations a supply of electricity at a better price. They will also, sometimes, sell power to the State Grid.

The price consumers pay for power is controlled by the National Development and Reform Commission, but set by provincial National Development and Reform Commissions, which can cause differences in costs to consumers from one province to another. While the price of power from privately owned hydropower companies may not always be the cheapest, if the companies, both privately owned and state-owned, use their own power, it will always be cheaper than purchasing power from the State Grid.

Hydropower development and environmental protection

Besides the Qiaoqi Hydropower Station, Huaneng Baoxing River Power Inc. has been given the right to build other stations on the main stem of the Baoxing River – mainly water diversion plants with low dams. There are also some waterfall-type stations, but these generate small amounts of energy and have relatively little impact on the environment.

In order to create water-diversion stations, companies dig tunnels, construct buildings to house the generators and turbines, as well as the power plant, pile up waste, flood land for the reservoir, and so on. All of this activity takes a toll on the environment. At the moment, hydropower stations along the Baoxing River do not pose a serious threat to soil through erosion or loss of vegetation: in fact, vegetation cover in the area is doing very well. But in the absence of a clear plan for development and supervision, negative impacts on the environment will increase.
Several stations along the river are located in, or adjoin the Fengtz Nature Reserve, with another plant under construction. But it is puzzling they were approved at all.

Based on my observations, the most damaging environmental impact of hydropower development is the decline or complete elimination of fish stocks. Although, drains (or sluices) have been built on the dams, with drainage rates set by the government to maintain enough water in rivers to promote ecological stability, there is no effective supervision, so there is almost no water in the downstream river reaches below dams. One local man said that before the dams were built, there were a lot of fish in the river, yielding a large catch quickly. Now, with the dams, fish stocks have diminished severely.
Governments cannot be relied upon to solve the environmental problems that have emerged: they permit hydropower development for their own benefit, and many of the hydropower companies are state-owned enterprises (SOEs). As the developer, tax collector and environmental regulator for these projects, they are in a conflict of interest position. It would also be impossible for independent journalists and environmental NGOs to monitor all projects. The only solution to the irrational and uneconomic exploitation of Sichuan’s water resources is for local people and organizations to exercise public oversight over the use of their natural resources.

Dams, reservoirs and migrants

The dam at the Qiaoqi Hydropower Station stands 123 metres tall, with a generating capacity of 240 MW, and a reservoir measuring 212 million m$^3$, the largest one on the main stem of the Baoxing River. The most serious damage caused by the reservoir to date is a landslide – still visible – which harmed farmland, roads and houses. Reparations for this damage, and repairs to the road, came late due to government inefficiencies.

An estimated 520 families were displaced when the Qiaoqi dam reservoir was filled. Some of them resettled in cities, and some remained dependent on reparation funds. Most migrants from the area were moved to houses higher up the slope above the reservoir, behind their original homes, which they built themselves using funds they received from their local government.

During our interviews, migrants complained about a number of pressing issues.

First, they feel that the level of compensation they received for their old homes was
too low. Compensation was based on the value of their original homes and not on the cost of the new homes they had to build. Since the price of building materials had increased over time, it was difficult for them to build new homes of the same size using the compensation funds they had been given. Furthermore, migrants were not satisfied with the compensation they received for farmland and trees lost to the reservoir. Meanwhile, local people, who are not migrants, think the compensation given to migrants has made them richer than they were before. Whether the compensation is more or less than they deserved, I think, it is unjust that the compensation funds were unilaterally determined by the government without negotiation with migrants.

Finally, the migrants, now finding themselves in a new and different environment, found it difficult to make a living. Some migrants, who lost their farmland, have seen a drop in their incomes and the young have had to leave home to work elsewhere. Meanwhile, most of the people who migrated to cities have been unable to find jobs.

Qiaoqi dam and reservoir

Summary

Only when the property rights of those affected by dams are enforced and market mechanisms are able to convey the values and choices of victims and beneficiaries, will dam builders internalize the full costs of their hydropower projects. Only then, will migrants' livelihoods be truly protected and social unrest subside. Then, the interplay of citizens, power consumers, and investors will determine which power investments proceed, not governments through their detached and self-interested administrative orders.
The China Huaneng Group is a key state-owned company established with the approval of the State Council. According to the company's website, “The Company has adhered to the concepts of ‘clear direction, continuous innovation, extensive cooperation, and mutual benefits,’ and has cultivated corporate culture with Huaneng characteristics, such as the ‘three-color’ corporate mission of ‘a Red company serving the need of socialism, a Green company advocating technology advancement and environmental protection, a Blue company emphasizing continuous innovation and internationalization,’ and the core values of ‘Integrity, Cooperation, Innovation, Performance-oriented, and Serving the Nation,’ etc.”

That is, the power Huaneng Baoxing River Power Inc. generates from its big dam and five smaller dams.

The State Grid Corporation of China is the largest electric power transmission and distribution company in China and in the world. It has five subsidiaries which distribute its power: North China Power Grid Company, East China Power Grid Company, Central China Power Grid Company, Northeast Power Grid Company, and Northwest Power Grid Company. After the electricity sector reforms of 2000, the assets of the State Electric Power Corporation, including both power plants and the electric grid throughout mainland China, were divided into five “power generation groups” that retained the power plants, and the State Grid Corporation headquartered in Beijing with its five regional subsidiaries, as well as the China Southern Power Grid Corporation, headquartered in Guangzhou, that, altogether, operate power transmission, distribution and other assets of the old State Electric Power Corporation.

According to the State Grid Corporation’s website, “SGCC was established on December 29th, 2002. It is a government-owned enterprise approved by the State Council to conduct government authorized investment activities. SGCC was ranked the 8th in the Fortune Global 500 in 2010, seven ranks higher than 2009, and is the largest utility in the world.

“The mission of the company is to provide safe, economical, clean and sustainable electric power for social and economic development. The company’s core businesses are the construction and operation of a power network that covers 26 provinces, autonomous regions and municipalities. Its service area represents 88% of the national territory, supported by more than 1,500,000 employees to serve a population of over one billion.”

The price of power sold to the State Grid is regulated by the powerful National Development and Reform Commission of the PRC. The NDRC is a macroeconomic management agency under the Chinese State Council, which has broad administrative and planning control over the Chinese economy. The NDRC studies and formulate policies for economic and social development, maintains “balance” in China’s economy, and guides restructuring of China’s economic system.

Three types of hydro power station ownership exist: 1) some are privately owned hydro dams, but they tend to be small; 2) some hydro dams are owned by townships and villages, but there are fewer of them today than in the past, and they tend to be neglected, and 3) state-owned hydro dams, which account for the largest dams and the largest capacity. Power for the most part, must be and is sold to the State Grid (or to sub-grids such as the Southern...
Power Grid in Guangdong, Guangxi, Yunnan, Guizhou and Hainan provinces, and the Inner Mongolia grid in western Inner Mongolia) at the “on-grid” price.

vi By bypassing the State Grid, the seller will earn a higher price for power sold and the seller will pay a lower price, thereby benefitting both sides in the transaction.

vii For their related industrial or metallurgical enterprises.

viii A conflict of interest exists when an individual or organization is involved in multiple interests, one of which could possibly corrupt the motivation for an act in the other.