Financing the last mile of electricity-for-all programs: experiences from China

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Executive summary

1. Motivations underlying the research

Electrification is key to deliver modern energy services and other fundamental services that dependent on energy. China has achieved electricity for all by end of 2015. This is an impressive achievement, giving China's large population and the world still has more than 1 billion population without electricity access. Finance is one of the main barriers to deliver energy to the world poorest. While there are numerous programs to facilitate and promote electrification in developing world, there are significant finance gaps to achieve UN's Sustainable Energy for All by 2030. About 6 billion USD a year in commitments went to increase residential electricity access for medium or high levels of electricity service, which falls well below the estimated 45 billion USD needed annually to meet the 2030 objective of universal electrification. There are still significant financial gaps to fill to enable global electricity for all.

China's progress in electrification has drawn academic attentions on its history and success factors. However, there is little discussion on the last push to achieve electricity for all in China. He and Victor (2017) analyzed the experiences and lessons from this last-mile problem and showed coordination between central and local governments and other stakeholders, selection of appropriate technologies to fit local situation and demand, and embedding electrification into overall social economic development, are key to the success. This comment is a follow up analysis of the financial mechanisms of the last mile programs and their implications for global efforts.

2. A short account of the research

In this comment, we briefly reviewed the history for China to achieve electricity for all. We investigated the financing mechanisms of China's electricity for all programs with a focus on the last mile problem, and we found central investment, cost sharing, and public-private partnerships are essential for China's success in such programs. We also discussed the challenges to disseminate those financial mechanisms to enable successful electricity for all programs.

From 1998 to 2015, there were six rounds of rural grid innovation initiatives that targeted to upgrade the grid quality, extend the grid service, and bridge the urban-rural power gap (the prices difference, and per capita electricity consumption difference). The total investment added up to 2024 billion RMB (nominal value in its historical year, same thereafter) in the twelfth five year plan period only (2011-2015), including a final push to achieve electricity for all in 2015. In 2012, the central government initiated its Electricity for all three-year action plan (2013-2015) that

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outlined a plan to assure electricity supply to the last 2.73 million people. Through those programs, in 2015, China announced the achievement of electricity for all.

Table 1 The four stages for China to achieve electricity for all

Period	Before 1978	1978-1997	1998-2012	2013-2015
Stage	Setting up a national management system	Transferring electricity system management to local government	Promoting market-oriented reform	Achieving electricity for all
Finance for rural electrification programs	Little support from the central government. Building small power plants, mostly hydro, during the 1960s and 1970s.	Central government poverty reduction efforts. Local government investment to encourage economic development.	Unifying rural and urban electricity pricing, specified central government fund for grid innovation and extension.	Specified central government fund, central-local governments cost sharing, PPP, and other financial mechanism.
End of stage electrification rate	65%	95%	99.7%	100%

Note: The first three stages are adapted from *Rural Electrification in China: History and Institution* (Peng and Pan 2006).

The term "last mile" describes the final utility infrastructure needed to deliver electricity to the whole population. We consider the "last-mile" to be high cost of both through grid extensions and remote mini-grids or distributed power systems. Grid connection is prohibitive expensive in some of most isolated areas. The average investment cost per capita had grown from 25.5 thousand RMB per household in 2012 to 55.1 thousand RMB per household in 2015.

The financial mechanisms to fund the last mile is therefore must come out from bold plans that could mobilize resources to incentive multiple key stakeholders to join the push for full electrification. In China's electrification process, cross subsidization provides the fundamental financial resources for grid renovation, and PV installation and maintenance. Full electricity access requires central government leadership, and essentially funding support, in China, about 20% to 80% of the total cost depending on the local conditions. The last mile grid extension projects are in charge by provincial electric power corporation. The distributed solar PV systems, and small hydro projects are through a collaboration between provincial government, state owned power companies and private companies.

3. Main conclusions and policy implications of the work

Financing the energy access is a pressing challenge, especially for the global efforts to achieve sustainable energy for all by 2030. Many countries yet to fulfill the goal of full electrification and the last mile might stock the overall commitment. China's push in the last mile of achieving electricity for all programs offers experiences on how to finance the last mile programs: these include bold financial investment through central governmental subsidization, appropriate central local cost sharing scheme, and successful public-private partnerships.