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Assessment of the Cambodian National Biodigester Program☆

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ABSTRACT

The National Biodigester Program (NBP) was established in 2006 to build and maintain household biodigesters in Cambodia. In its first six years, the program installed almost 20,000 biodigesters and established an in-country network of local financiers, construction companies, skilled masons, bioslurry specialists and after-care technicians accessible to rural users in 14 of 24 Cambodian provinces. Since its initial success, the program's adoption rates have stalled despite increasing government support and high rates of user satisfaction. Building on an initial evaluation of the NBP in 2013, this updated assessment identifies multiple changes in its second implementation phase that have undermined the initial momentum of the program. Abrupt interruptions in institutional support, deteriorating supply side services (access to construction agents, masons, repair services) and reduced access to credit for farmers have eroded the service network that the first implementation phase established. Structural changes in the rural economy may also contribute to declining demand. Government support to another biodigester program which offers a lower investment price, but does not provide after-sales services, has also undercut the long-term implementation strategy of the NBP. The paper finds that despite these programmatic changes, the installed biodigesters continue to perform according to expectation and to be maintained and valued by their users, but the future viability of the program remains uncertain.

Introduction

The National Biodigester Program (NBP) was established in 2006 with the aspiration of building and maintaining household biodigesters throughout the Kingdom of Cambodia. The program was originally a joint endeavor by the Dutch Development Organization (SNV) and the Cambodian Ministry of Agriculture, Forestry and Fisheries (MAFF). It has been operating as an independent Cambodian initiative since 2015 (Lam, 2017a).

The key feature of the NBP is an integrated approach to biodigester adoption and maintenance. The program builds upon the agricultural extension services already established within Cambodia to add training and incentives for biodigester masons, bioslurry experts and program promoters. Buyers receive warranties and access to local technical support. Biodigester financing is facilitated through a special agreement with local banks and credit unions, thus representing an integrated approach to technology dissemination and adoption. In 2013, the program was evaluated by independent consultants, who concluded that while NBP had successfully introduced domestic biodigesters into Cambodia, it would be difficult to fully remove subsidies (Buysman & Mol, 2013a). They also noted that NBP's reliance on carbon finance to fund subsidies was unsustainable because carbon markets had been struggling, and that sustained external assistance was needed. Five years later, this paper provides an update on the status of the NBP and finds that despite increased government support and a stable source of carbon finance, the project has been undermined by other factors. We argue that sustained development assistance is necessary, but insufficient for the long-term provision of domestic biogas within the country. Further, we note that supply-side services (construction services, technical after-care, and access to finance) are crucial to the success of the NBP.

Arguments for the promotion of biodigester programs usually point to their associated co-benefits. Decreased dependence on conventional rural cooking fuels is expected to reduce financial expenditure and/or alleviate the burden of women's work, which usually includes wood collection and transportation (Schlag & Zuzarte, 2008). Biogas is said to particularly benefit women and children who spend the most time at the hearth (Katuwal & Bohara, 2009). Other expected benefits associated with domestic biogas include the convenience of lighting a burner rather than starting a fire, the status symbol of possessing a modernized stove top, and expanded hours for work and study enabled by the introduction of biogas-lit lamps (NBP, 2011). Biogas combustion has been demonstrated to significantly reduce HAP when compared with traditional wood and charcoal stoves (Berkeley Air Monitoring Group &

☆ ISN clean fuel implementation case study series.
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SNV World, 2015) and users, predominantly women, report high levels of satisfaction with the level of convenience and associated time savings (Kooijman, 2015).

However, the durability of social, economic and environmental co-benefits is uncertain (Karhunmaa et al., 2015). A review of biodigester usage in Africa identifies financial constraints, lack of livestock, water constraints, educational barriers and construction difficulties as limiting the ability of rural populations to access and utilize the technology. In addition, aftercare services (warranties and local repair services) are needed to support a biodigester program (Mwirigi et al., 2014). A qualitative study on the potential social and economic benefits of biogas in Ghana demonstrates that improvements in health, agricultural productivity, financial savings and environmental sustainability are achievable provided that financial support systems and subsidies are available (Arthur et al., 2011).

Contextual background

The Royal Kingdom of Cambodia is a tropical country in southeast Asia. The climate is dominated by an annual monsoon cycle. Cambodia has a population of over 15 million increasing at roughly 1.6% per year. The country is organized into 24 provinces plus its capital city, Phnom Penh, which is administered as a 25th province.

Cambodia was classified as a Least Developed Country at the start of the NBP implementation period, although it graduated to lower middle-income status in 2015 (World Bank, 2018). Poverty is declining, but it persists, particularly in rural areas. For example, in 2014, the poverty rate was 14%, down from 48% in 2007. About 90% of the poor live in the countryside and 4.5 million people remain "near-poor", with incomes slightly above the poverty line (World Bank, 2016).

Despite substantial progress in the past decade, Cambodia remains far behind in human development. Undernourishment is prevalent and stunting remains widespread, affecting 32% of children under five years old in 2014 (National Institute of Statistics/Cambodia, Directorate General for Health/Cambodia, & ICF International, 2015). 18% of the total population has access to piped water and 66% of the rural population practices open air defecation (UNICEF & World Health Organization, 2014).

Energy use

Cambodia relies heavily on fuelwood and charcoal, particularly in the residential sector, where it constitutes 90% of energy consumed (IEA, 2017). However, LPG is gaining popularity and access to electricity has expanded rapidly, reaching near universal access in urban areas and nearly 50% of rural households by 2014, though few households cook with electricity (Fig. 1).

Background on the NPB

Feasibility studies for the NBP began in 2004, and it has been operational since 2006. SNV, a Dutch non-governmental organization (NGO), signed a Memorandum of Understanding with the Cambodian Ministry of Agriculture, Forestry and Fisheries (MAFF) to establish the NBP. Hivos, also a Dutch NGO, joined the consortium in 2007, providing carbon finance. Hivos and SNV have worked together on eight national biodigester programs in Africa and Asia. The programs all follow a similar model involving close collaboration with a national partner. SNV representatives are given fixed terms to start the initiative, with an "expiration date" built into their tenure in order to ensure the local organization takes ownership (Lam, 2011).

The NBP supports and monitors the creation of an in-country network of masons, trained to build the "Farmer's Friend", which is closely modeled after the Chinese "fixed-dome" biodigester (Bond & Templeton, 2011). The digester requires skilled, local, labor to construct on-site and lacks moveable parts. The digester is installed below ground level and varies from 4 m^3 to 12 m^3 or larger. A 4 m^3 digester can accommodate waste from 2 to 3 cows or 4–6 pigs. Farmers keep the animals in stalls for the majority of the day, shoveling the dung for use in the biodigester. They mix the animal waste into the biodigester inlet with water, the waste collects at the bottom of the dome where anaerobic digestion creates a methane-rich gas and a bio-slurry that can be used as a soil amendment. As the gas forms, it creates pressure within the dome that both pushes the gas through a pipeline to the farmer's home and pushes the effluent into a storage trough outside the biodigester (NBP, 2011).

The NBP's original goals were to create a self-financing biodigester market in Cambodia that would achieve the following: 1) install 20,000 biodigesters over the first project implementation period (2006–2012) and double that number by 2018; 2) ensure that installed biodigesters are well-maintained and continue to be used over the long-term; 3) ensure that the "co-benefits" associated with the biodigester, i.e. the bio-slurry fertilizer and household lighting functionality, are maximized and 4) build national capacity to technically and to financially carry forward the project in the absence of SNV (Buysman & Mol, 2013a; Lam, 2011). Policy emphasis on financial sustainability

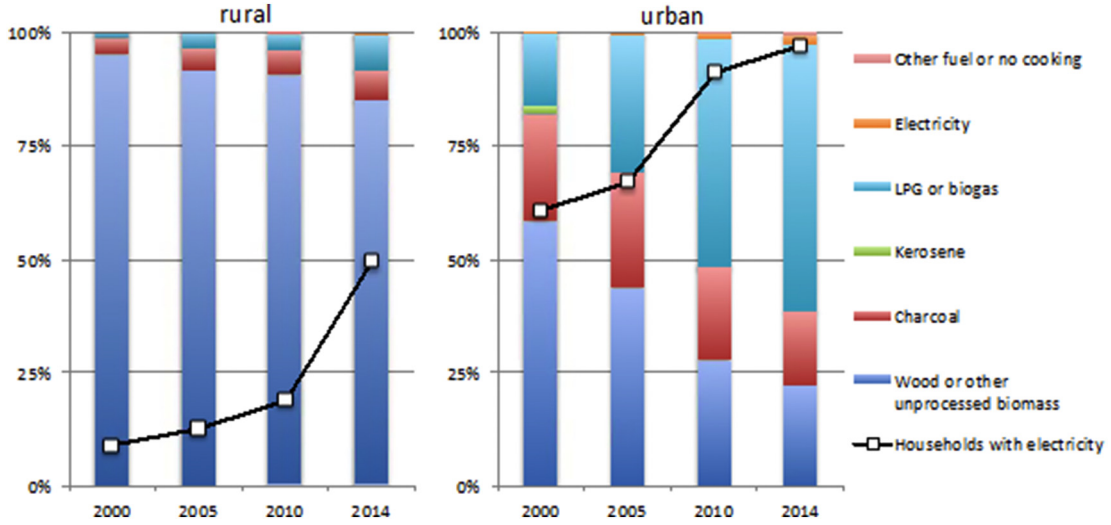

Fig. 1. Primary household cooking fuel and electricity access nationwide (NIPH, NIS, & ORC Macro, 2006; NIS, DGH, & ICF International, 2011, 2015; NIS, DGH, & ORC Macro, 2001). The original data combines LPG and biogas; however, the majority of households use LPG.

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