



Indigenous community preferences for electricity services: Evidence from a choice experiment in Sarawak, Malaysia



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ABSTRACT

Providing indigenous communities with electricity services requires an understanding of preferences to ensure that electrification schemes are congruent with the communities' specific development pathways. We contribute to the literature by using a choice experiment to rank and quantify household preferences for electricity services in two indigenous villages in Sarawak, Malaysia. Specifically, we disaggregated electricity services into five attributes: private use for household appliances and lighting, public use for community facilities, productive use for income generation, the operator model and the monthly tariff. We found that the most value was placed on the operator-model underpinning the provision of electricity services and that there was a strong preference for a community-based model over a utility-based model. Interestingly, our results suggest that the preference for a community-based operator model may be related to the experience of using electricity for productive uses. We contend that our results demonstrate the importance of social and institutional challenges to providing electricity services to indigenous communities in Sarawak and highlight the need for the state utility to engage with indigenous communities to overcome these challenges.

1. Introduction

The vast majority of the rural electrification literature focuses on relatively homogenous ethnolinguistic communities based in rural areas. This literature has yielded important insights on what is required to provide universal access to electricity services in these areas (e.g. Barnes, 2007; Sovacool, 2012; Van Gevelt 2014). The same cannot be said for indigenous communities. Often located in extremely remote rural areas, many indigenous communities are among the most income and energy poor in the developed and developing world (Eversole, 2005). In an effort to address this poverty, indigenous communities are often the targets of modernization policies initiated by the government. These modernization policies often clash with the preference of indigenous communities to follow their own development pathways that harness and manage external influences while consolidating elements of their traditional organizational structures and culture (Curry, 2003; Altman, 2004; Anderson et al., 2006; McCaskill and Rutherford, 2005).

Providing access to electricity for all rural communities requires the matching of schemes to community preferences. For example, Sovacool (2012) details how a variety of community preferences, such as a social norm prohibiting the collection of tariffs for electricity, inhibited the

deployment of electrification schemes in Bangladesh, Papua New Guinea, and Nepal. The literature further details a number of unintended consequences that may result due to rural electrification schemes. These include, for example, increasing gender and income inequality, changes to the social fabric of villages and increased vulnerability of customary land to encroachment by state and non-state actors (Zomers, 2003; Perera, 2009; Wong, 2009; Knight and Gunatilaka, 2011). Taken together, this strongly suggests that providing access to affordable and reliable electricity services to indigenous communities requires a detailed understanding of community preferences to both ensure that electrification schemes are designed and implemented appropriately, and to ensure that the community is able to balance both intended and unintended outcomes of electrification to fit their own development pathways.

We contribute to the literature by using a stated-preference choice experiment to understand, rank and quantify preferences for electricity services for two indigenous communities in Sarawak, Malaysia. Section 2 provides an overview of indigenous communities and electricity services in Sarawak, with a particular focus on small-scale efforts to improve rural electricity coverage. Section 3 contextualizes the data collection process, choice experiment design and selected econometric estimation strategy. Section 4 presents the results of econometric

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models and our estimations of the marginal willingness-to-pay for attribute changes. Section 5 provides a discussion of our findings. Section 6 concludes with a focus on policy implications for both providing rural electricity services to indigenous communities in Sarawak and globally.

2. Indigenous communities and electricity services in Sarawak

Located in Borneo, Sarawak has a population of approximately 2.6 million people. Almost 70% of the population is comprised of indigenous groups, collectively known as Orang Ulu or Dayak.¹ Collectively, the Dayak face common problems of encroachment of customary land for mega-infrastructure projects and logging, disenfranchisement from the political process, and comparatively low economic, education and health outcomes (Lasimbang, 2015).

Although there has been a steady stream of out-migration from Dayak communities in the Borneo interior, the majority continue to live in small rural communities along rivers and streams in the highlands (Lee and Bahrin, 1993; Amster, 2006). There are an estimated 6235 villages in Sarawak of which 2216 are underserved with respect to access to electricity services. These communities typically rely on small petrol and diesel generator sets which run for an average of 2–3 h a day. A minority of communities are also served by pico-hydro solutions, or mini-hydro or solar-diesel hybrid systems funded by development agencies or universities and non-governmental organizations (NGOs) (Sarawak Energy, 2014).

The government's approach to rural electrification in Sarawak is coupled with plans for economic growth at the state-level. The focus has largely been on mega-hydro projects, such as the Bakun Hydroelectricity project with an installed capacity of 2400 MW, in order to provide the conditions required to attract heavy industry to the state. As a result, electricity generated from Bakun does not reach the underserved Dayak communities despite being built largely on Dayak customary land (Sovacool and Valentine, 2011; Sovacool and Bulan, 2013).

In parallel to mega-projects, the state utility – Sarawak Energy – is tasked with promoting small-scale efforts to improve rural electricity coverage in Sarawak (Government of Malaysia 2006). For villages within 30 km of the existing electricity grid, the preferred approach is grid extension. For villages more than 30 km from the electricity grid, an off-grid approach is adopted with a preference for deploying hydro-diesel hybrid or solar-diesel hybrid mini-grids. As of 2015, there were 66 villages powered by 30 hydro-diesel hybrid or solar-diesel hybrid minigrids in Sarawak. Examples include the mini-hydro plant at Long Banga in Ulu Baram which consists of two 160 kW run-of-river turbines and an 80 kW diesel backup generator serving 132 households and the Solar-diesel hybrid at Rumah Dau in Betong which has a combined generation capacity of 147 kW and serves 26 households. Capital and operational funding for off-grid solutions is provided from the Federal government with Sarawak Energy being responsible for generation, transmission and distribution of electricity. With regards to the operator model for off-grid solutions, Sarawak Energy favours a utility-based model with the state utility fully-owning, operating and maintaining the systems (Sarawak Energy, 2014).

There are numerous cases of unsuccessful rural electrification schemes among indigenous communities in Sarawak. For example, Bario, an indigenous community in the Kelabit Highlands, has been the site of two mini hydro-electricity plants and a wind farm that have all encountered significant issues due to poor planning, design and implementation of the schemes. The unsuccessful outcomes of such projects has been largely attributed to an inadequate understanding of

the electricity needs of indigenous community members and their lack of involvement in the conceptualization, design and implementation stages of the process (Koay, 2011; Kiew, 2012; Holmes, 2015). Additionally, there are cases where indigenous communities have rejected proposals to be connected to the electricity grid citing concerns over tariffs being raised unilaterally and implications surrounding their customary land ownership rights (Penan village elders, pers comm, 2016). This suggests that there is a need to better understand indigenous community preferences for electricity services in order to allow for electrification schemes to be designed and implemented appropriately.

3. Methods

3.1. Study sites

Our choice experiment was undertaken in two remote Penan villages in the upper Baram region of Sarawak: Long Lamai and Long Kerong (Fig. 1). The two communities are reachable from the nearest city, Miri, only through a combination of twin-otter aircraft, four-wheel drive over logging roads and a one-to-three-hour boat ride through river rapids. The communities of Long Lamai and Long Kerong consist of 116 and 40 households, respectively. Both communities were only permanently settled approximately 50 years ago, when many of Sarawak's Penan transitioned from a nomadic forest-dweller livelihood to a settled or semi-nomadic livelihood. All Penan settlements, however, continue to rely on the forest for a wide range of non-timber forest products that provide, among other uses, food, medicine and construction material (Donovan and Puri, 2004; Siew et al., 2013).

Both communities aim to balance outside influences with traditional and cultural organizational structures and express a desire to follow their own development pathways. The main livelihood strategies for both communities are hunting and gathering from the forest and agriculture. Several households in both Long Lamai and Long Kerong supplement this by offering homestay experiences for a small number of tourists every year. Recent years have seen the permeation of the cash economy into the social fabric of both communities. The Malaysian Ringgit is now the preferred medium for both inter- and intra-community exchange in both communities although its salience is more pronounced in Long Lamai than Long Kerong. Both communities face challenges to their traditional way of life as a result of settling. This has manifested itself most significantly in increased migration of the youth due to few economic opportunities and the allure of urban life (Brosius, 2006).

In terms of infrastructure, Long Lamai has limited access (during the wet season) to electricity through a 12 kW run-of-river mini-hydro plant built and operated with the assistance of the University of Malaysia, Sarawak and the Japan International Cooperation Agency. Long Lamai is also served by a primary school and a community hall. These facilities are not found in Long Kerong. The communities of Long Lamai and Long Kerong are both familiar with private, public and productive uses of electricity due to, among other factors, their frequent visits to trading communities served by the electricity grid. Additionally, school-aged children in both communities often move as far as the city of Miri to attend school and, when visiting home for school vacations, bring back a familiarity with electricity services that is communicated to adult household members.

3.2. Choice experiment

With its basis in welfare economics and random utility theory, choice experiments are a stated preference method for non-market valuation. The underlying assumption behind a choice experiment is that any good, service, programme or policy is describable in terms of its attributes and the various levels that these attributes may take. Experimental design theory can then be used to create different profiles

¹ Indigenous groups include the Berawan, Bidayuh, Bisayah, Kayan, Kedayan, Kelabit, Murut, Penan and Punan (Lasimbang, 2015).

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