

# **“Local Governance, Electricity Provision and Decentralization in Nepal”\***

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With more than a billion people around the world lacking electricity access, many view decentralized renewable energy as one pathway to increase electrification rates, particularly through regions in which grid connections are prohibitively expensive. Given its rugged topography, decentralized renewables have played a significant role in Nepal's substantial gains in electrification rates. Approximately 23% of households are served by off-grid technologies (World Bank, 2018). With more than 3,000 Microhydro plants (MHPs), the technology has been deployed extensively in Nepal. With a typical capacity between 10 kW and 200 kW and an expected lifespan of at least 20 years, MHPs can deliver electricity to both households and commercial enterprises. But to do so, MHPs must be well maintained and financially viable. While many MHPs successfully operate for many years beyond the 20 year expected lifespan, it is not uncommon for others to fail well before then.

The factors underpinning the sustained functionality of MHPs are not well-documented. To better understand these factors, we surveyed 1800 households and more than 200 MHP officials across 72 MHPs in Western Nepal. The fieldwork, conducted in fall 2019, was in collaboration with the Alternately Energy Promotion Center (AEPC) and the United Nation's project on Renewable Energy and Rural Livelihood (RERL). This study generates new evidence on this topic, resulting in policy recommendations for local governments and AEPC.

We believe this detailed investigation into the characteristics and functioning of MHPs contributes to a better understanding of sustained functioning of decentralized renewables and the decentralized delivery of public services more generally. This is particularly important given that Nepal's 2015 Constitution marked a major shift toward decentralization and federalism. With more governing authority given to local governments, the functionality of MHPs has three critical implications for Nepal's ongoing process of federalization: First, when they function well, MHPs stimulate economic activity that can be an important source of revenue for decentralized governments; second, when MHPs breakdown, local communities turn to municipal governments, which typically assume much of the cost of resulting capital outlays; third and finally, MHPs dictate which households, enterprises, and communities benefit from electrification. Moreover, sustained functionality is a challenge for many other types of local infrastructure and public services such as irrigation, drinking water, and rural roads. Many of these services will be impacted by the shift to federalism. As such, the findings on MHPs are relevant to the quality of local services and governance in Nepal, more broadly.

After describing the performance of the 72 MHPs studied, we organize the report around three dimensions critical to MHP performance:

1. Load management, which depends on the MHP's power generating capacity, the magnitude and timing of consumers' demand, operators' ability to manage variability in the electricity supply to minimize surges, and the resulting reliability of MHP equipment;
2. Tariff design and consumer payments that ensure cost recovery and that MHPs can afford maintenance and repairs;
3. Community governance, which influences customers' willingness to pay bills and contribute to system maintenance.

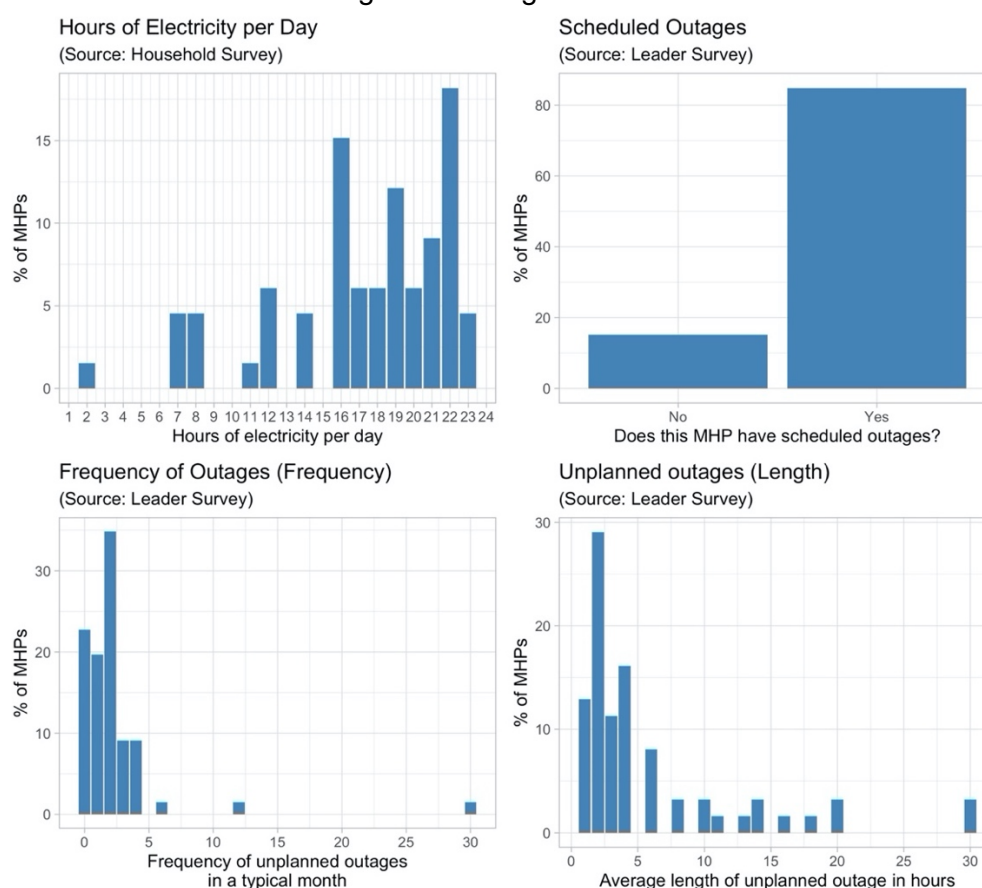
We conclude with some broader recommendations bearing on the impact of MHPs on the process of federalization.

**First, we describe the technical performance of the MHPs we studied, including the features of load management that bear on system performance.** Our survey captures

currently functioning MHPs. Therefore, our data will underestimate concerns regarding system failure, as we do not capture MHPs that have ceased operating altogether.

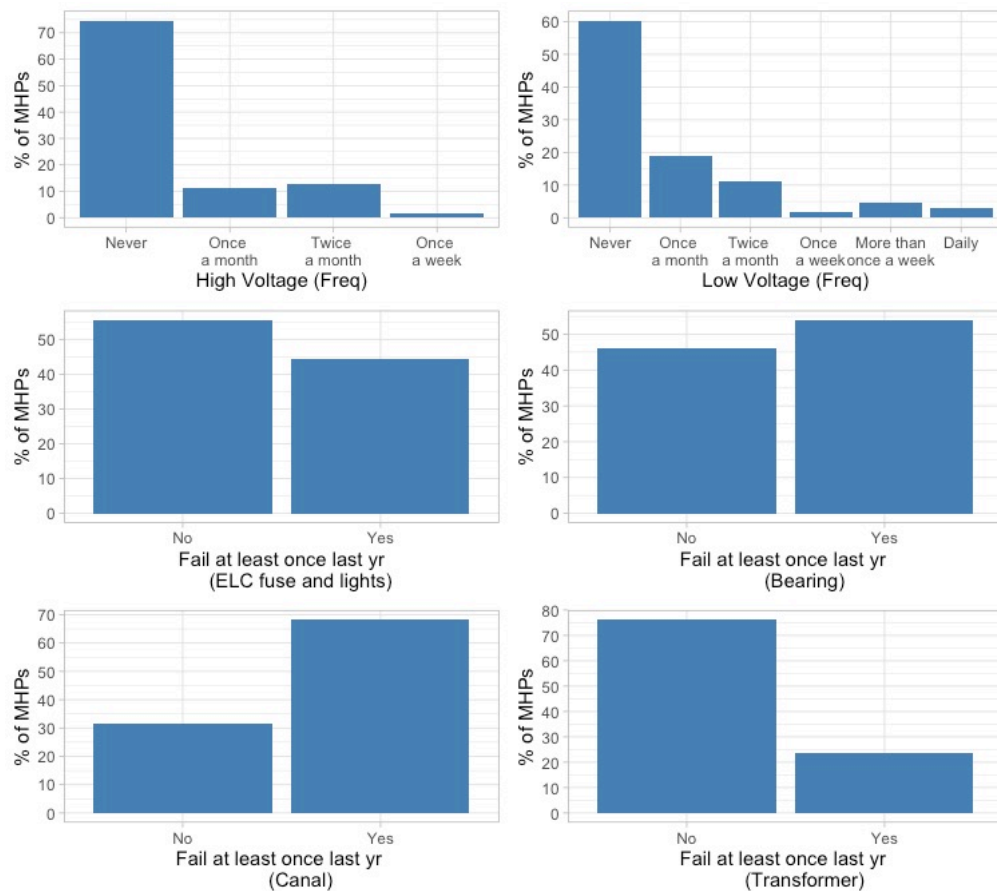
The surveys (and Figure 1 below) show that while 10% of MHPs surveyed provide less than half a day's coverage, more than 80% of the MHPs operate for 16 hours or more per day. The number of hours when MHPs are offline mostly reflects the decision of leaders and operators to suspend service during the hours of low demand, allowing for operators' rest-time. However, more than half of the MHPs have two or more unscheduled blackouts in a typical month that last 3 hours on average (though some are as much as 20-30 hours) and a number of MHPs also report having more unplanned outages in certain months.

Figure 1: Outage statistics



As shown in Fig 2 below, there are many causes of unplanned outages: i) water canal failure at least once in the past year (70% of MHPs), ii) breakdown of the Electronic Load Controller (ELC) and the bearings of the generator (50% of MHPs), iii) high voltage (20% of MHPs), and iv) low voltage (more than 30% of MHPs). These issues bearing on the management of load and equipment failure have important implications for municipal governments, because as describe below, most MHPs do not maintain financial reserves, and thus, many such failures result in ad hoc demands on municipal finances for new equipment and repairs.

Figure 2: Sources of outages, based on MHP operator surveys



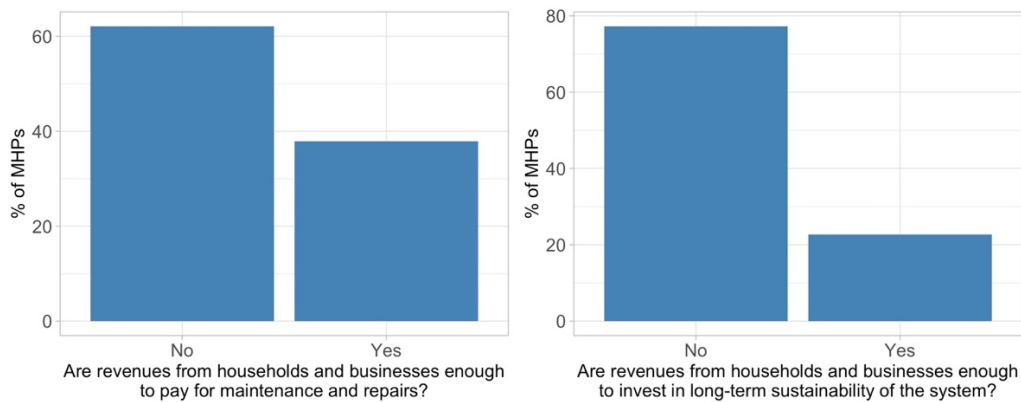
Frequent outages and poor electricity service quality may affect the demand for electricity services within these communities, as they may influence decisions regarding business creation (or the type of business) and/or the types of appliances to purchase and use.

**Second, we describe the challenges inherent in charging appropriate prices and ensuring customers pay those tariffs, as needed to secure the MHPs' financial viability.**

Financial contributions to MHPs are crucial throughout a system's lifespan, which has two key phases: (1) the pre- and during- construction period, and (2) the post-construction period, when the MHP is providing electricity. For the purposes of this report, we focus on the post-construction finances for existing plants. Consumer tariff payments post-construction determine whether the MHP has funds to pay for recurring expenses, such as a salary for MHP operators, system maintenance, and repairs. These payments -- from both residential and commercial consumers -- are crucial for the sustained functioning of the system and provision of electricity services.

Figure 3 shows that more than 60% of MHP leaders do not believe that revenues from consumers are sufficient to pay for MHP maintenance and repairs, and nearly 80% of them report that revenues are insufficient to ensure long-term functioning.

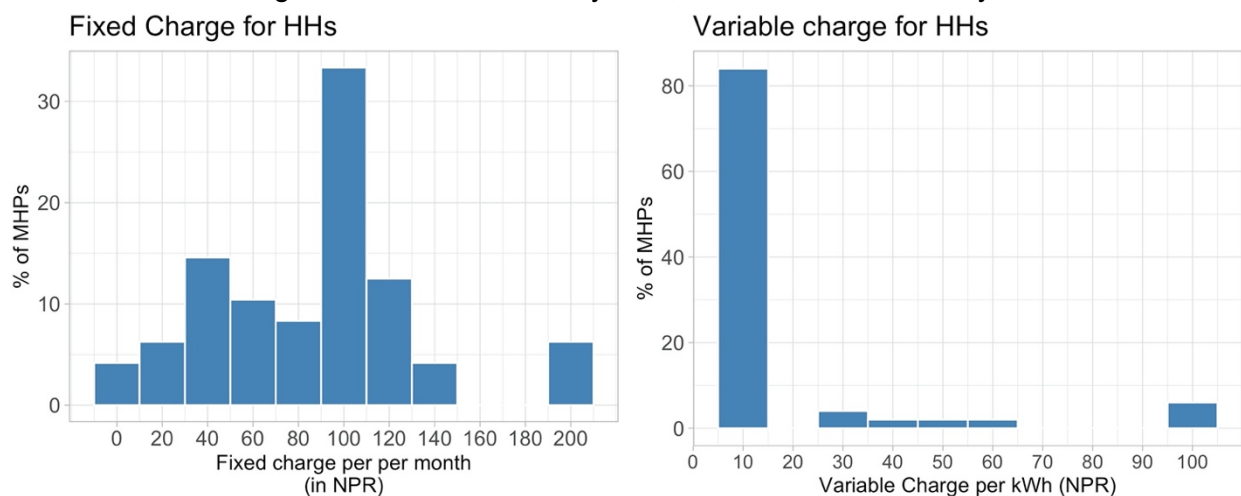
Figure 3: MHP Leader Perceptions of Financial Viability



Further, there are two common impediments to cost recovery that contribute to insufficient MHP revenues: first, electricity prices are set too low; and/or some electricity consumption is unpaid, either the result of electricity theft or bill non-payment. Here we investigate these potential sources of low cost recovery for MHPs.

*Setting tariff prices:* More than half of surveyed MHPs charge residential and commercial customers the same price. These prices can be a variable rate or a fixed charge. Approximately 60% of MHPs charge a variable rate based on the amount of electricity consumed. The mean variable charge for residential consumers is 25 NPR per kWh (27 NPR per kWh for commercial consumers). As shown in Figure 4, however, there is substantial heterogeneity in prices across MHPs. Fixed household charges range from 0 to 200 NPR per month. These prices are likely too low for MHP management to develop reserves and pay for system maintenance and repairs.

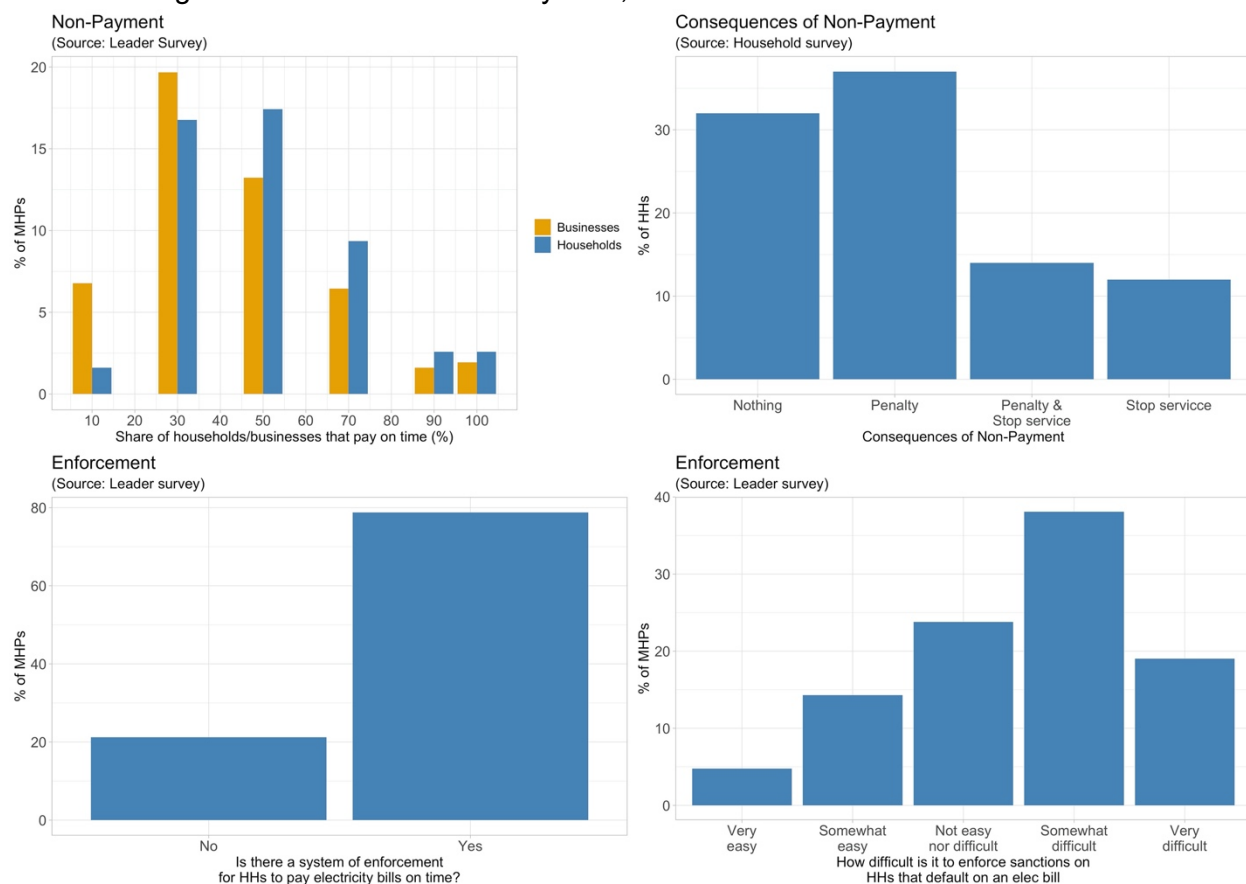
Figure 4: Form of electricity tariff, based on leader surveys



*Bill collection:* Even if the prices were set appropriately, the MHP may still struggle with cost recovery if customers do not pay for the electricity consumed. This could happen due to electricity theft (consumers are not billed for the amount consumed) or non-payment of bills (the MHP bills the consumer, who does not pay).

Figure 5 indicates that bill collection is a serious challenge for MHPs; non-payment and late payment are widespread. Moreover, more than 30 percent of MHPs do not sanction households for not paying their bills, and only about 25 percent of them cut service to households that do not pay. In slightly more than half of the MHPs, non-payment is met with a financial penalty, but the size of those penalties vary a lot, ranging from 1 to 500 NPR (average of 29). The second panel shows that those penalties are quite hard to enforce. In well over half of MHPs, MHP committees find it “somewhat” or “very” difficult to enforce sanctions on non-paying households.

Figure 5: Incidence of Non-Payment, Sanctions and Enforcement in MHPs



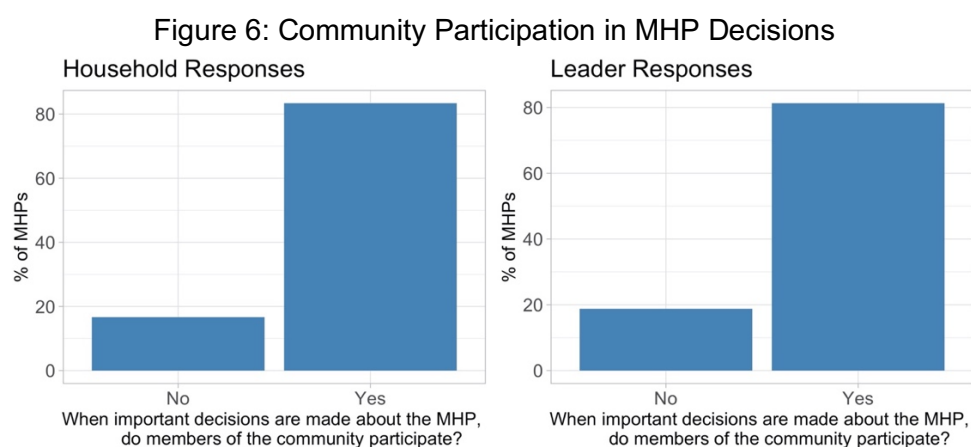
Failure to pay bills may be correlated with either the poor electricity service quality (consumers do not feel compelled to pay when service quality is poor) or the lack of enforceable sanctions for nonpayment.

These findings have implications for efforts to commercialize MHPs. The enforcement of private electricity contracts can be complicated when MHP owners and buyers are all members of a small community. The sustained functioning of MHPs requires that consumers, both household and business, believe that bill payment is necessary and non-payment will be penalized. In the absence of these beliefs, no one will pay, and the MHP will not be financially viable. For sanctions to be credible, the MHP owner must be able to credibly sanction the non-payment of bills. Where the local conditions for contract enforcement are not in place, efforts to

commercialize are likely to be very difficult and might even induce community conflict if they introduce new-found efforts to enforce sanctions for non-payment.

**Third and finally**, there are a number of governance challenges inherent in the maintenance and sustainability of MHPs. First, in community managed MHPs, community members must cooperate in the regular maintenance of systems. Second, MHPs may culminate from the support of a small number of local community leaders. When there are competing local leaders or the interests of community members and local leaders diverge, conflicts over the management of MHPs and/or the pricing of (and payment for) electricity may result.

Many local public goods--be they MHPs, pastures, or wells--require community cooperation in building, financing and maintaining them. As Figure 6 shows, the typical MHP is very participatory when it comes to decision making, with more than 80 percent of MHP administrators reporting citizen engagement with key MHP decisions. The figure also shows the share of household respondents who say that they participate in important decisions, which confirms very high rates of participation.



More demanding than decision making, however, is the household effort involved in maintaining MHPs and fixing them when they are broken. Indeed, these become particularly important where prices are low and enforcement of bill payment precludes regular investments in systems. Figure 7 shows that maintenance can be subject to shirking. While more than 70% of households report participating in maintenance, more than 30 percent of them report that some households contribute more effort than others. Likewise, in 60% of MHPs households typically have to contribute labor when there are breakdowns, but the bottom right panel shows that the amount of that effort varies quite considerably--in a substantial share of MHPs, it involves a few hours, but in about a quarter of them the household contribution is five hours or more.

Figure 7: Contributions to MHPs by Households

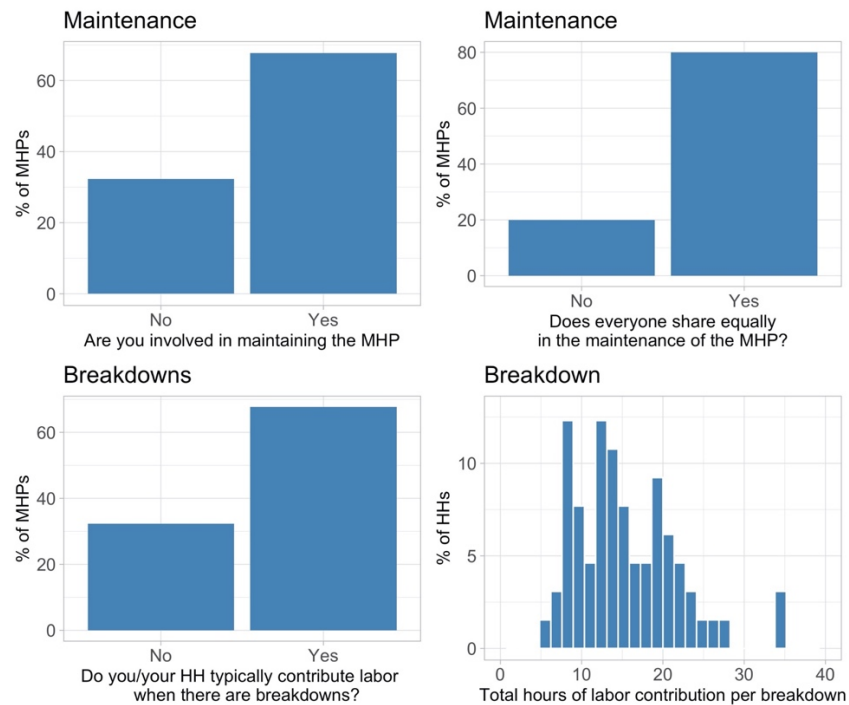


Figure 7

Finally, we turn to the challenges inherent in community leadership of MHPs. Often leaders helped organize the construction of the MHPs and remain as members of management committees. Membership on a management committee can provide a tool for building popularity or expanding local networks. When local leaders are also politicians, this can help during elections or in party building, but these activities can also serve to politicize the management of MHPs.

Figure 8: Competition and Conflict Among Community Leaders

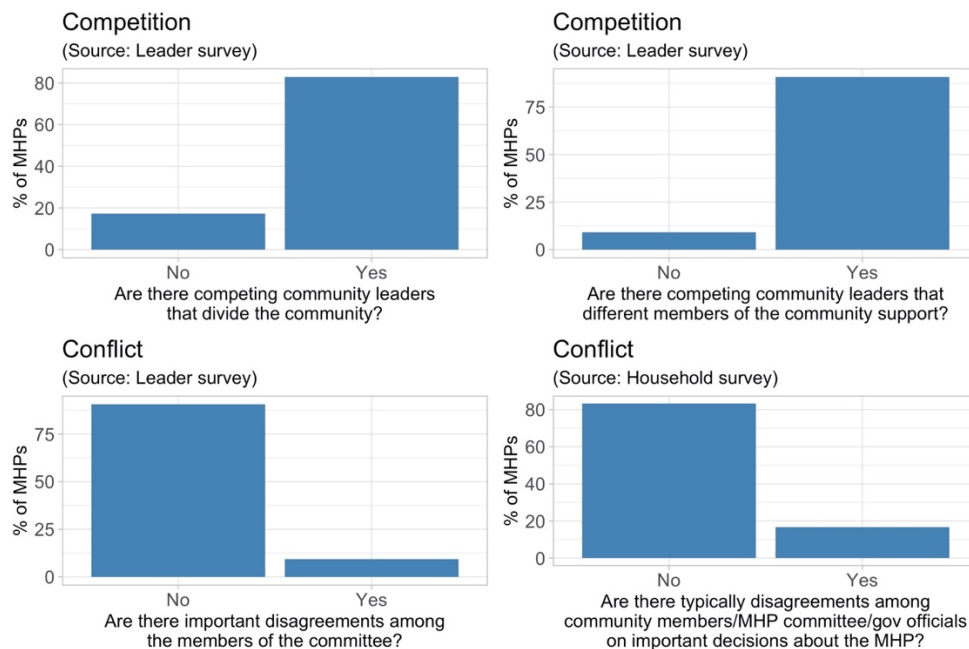




Figure 8 provides some key insights into the nature of community leadership and conflict in MHP communities. Most communities, i.e. more than 80%, have competing community leaders, and we find a positive relationship between leadership fractionalization and community and leadership conflict. As the right panel shows, however, these conflicts do not translate into the MHP management committees themselves, which are notably peaceful. One important implication of these figures is that the key disagreements seem to originate in the community more broadly rather than within the MHP committee. To the extent challenges in community participation or non-payment are rooted in broader community conflicts, this suggests two possibilities: First, it could be that MHP committees might have a limited capacity to resolve deeper conflicts if they are captured by one or another community leader; second and more hopefully, if MHPs are pursued on above and separate from broader conflicts, they might be an excellent venue for resolving those broader conflicts.

### **Conclusions and Policy Recommendations**

Our results point to opportunities for improving the quality of MHPs and local electricity provision. Moreover, one of the key justifications for decentralization is that it improves the link between the needs of local citizens and the services they receive. One area where Nepal has a great deal of experience with local governance is with MHPs. Thus, they provide key insights into challenges and opportunities that are likely to emerge in other service areas with further decentralization. We provide three suggestive lessons:

1. MHPs can have important implications for municipal finance. The economic activity they generate when they function well can be an important source of municipal revenue. On the other hand, when they breakdown those benefits cease. If MHPs do not have sufficient reserves to pay for repairs and turn to the municipality for financial assistance, they can become a drain on municipal finances. We have provided a description of the key challenges bearing on MHPs sustained functioning.
2. Some stakeholders are interested in commercializing MHPs. Pricing and the enforcement of payment are serious current challenges for many MHPs, which in turn has implications for their capacity to invest in maintenance. In many cases, prices are too low to support sustained functioning, non-payment is a problem, and sanctioning non-paying households or businesses is difficult. This suggests that steps toward commercialization of MHPs should be done with caution and account for such challenges. An alternative governance model that relies on community participation faces challenges of its own, but it is encouraging to see generally high levels of community participation in MHP decision-making and maintenance.
3. A great deal of attention and money has been spent building MHPs. The government and donors should pay attention to the local conditions that lend themselves to their successful, sustainable maintenance and governance. We hope to have provided some important insights into those conditions with our significant data collection effort.