CHAPTER 10

# Maintenance and Sustainability

Since its inception, the MVP has made substantial progress in addressing the infrastructure and energy indicators outlined in the Millennium Development Goals. Looking ahead at the next five years, MVP is committed to addressing issues of sustainability and maintenance, ensuring that energy and infrastructure projects in the Millennium Villages endure beyond the duration of the project. While each energy and infrastructure intervention raises unique issues and challenges, several overall themes and lessons emerge from the Millennium Villages. This last chapter briefly examines the issues and provisions that seek to ensure sustainability.

Each of the MVP technical solutions requires specific maintenance that must be addressed with attention to the local context. Size, scale and the cost of infrastructure, both in terms of the initial investment and ongoing maintenance, must be considered. As was discussed in Chapter 3 (Operations), the physical and demographic scale of the MVP sites—clusters of villages, with geographic areas typically in the hundreds of square kilometers and populations of generally 30,000 to 60,000—is much smaller than the administrative unit for which infrastructure planning and budgetary allocations are typically made. In MVP countries, examples of these larger administrative units include districts, counties, woredas (in the case of Ethiopia) and other local jurisdictions with populations ranging from 100,000 to 500,000. In cases in which the local government is expected to adopt, scale-up or maintain MVP projects or similar interventions, this issue of relative scale plays an important role.

At the local level, the strategy for funding the maintenance of infrastructure—such as community level piped water systems and solar photovoltaic micro-grids (SharedSolar)—has been a fee-for-service approach. At the regional level, the responsibility for upgrading and maintaining roads often falls to district offices, which request and receive funding from national or sub-national government taxes. At the national level, power utilities provide electricity service and maintain grid infrastructure, which is paid for primarily through the collection of tariffs.

However, efforts to maintain and sustainably manage infrastructure are beset by economic and technical challenges that come with the task of serving the poorest. Although funds are collected at each management level, they are frequently insufficient. The need to measure and collect payments for numerous, small service deliveries often increases recurring costs to the point that traditional billing and payment methods are no longer cost-effective, and novel management systems and technologies are required. At least a minimal amount of water and electricity services are necessary—or nearly so—for people's very survival, and the poorest may have virtually no ability to pay during cash-poor seasons, necessitating special provisions such as "lifeline tariffs" or minimum daily allocations for these users. Commercial providers tend to locate in cities and large towns, making technical expertise for system maintenance scarce and costly in poor, remote areas. If systems are not properly sized for the poorest at the outset, according to these users' needs and ability to pay, the imbalance adds to the difficulty of recovering costs.

MVP projects have faced these and other challenges. Some of the approaches used to address them are described below:

## Drinking water

The effective maintenance of drinking water systems is demonstrated by projects targeting areas of comparable scale to MVP sites. This can work well when villagers obtain water from a distribution system fed by either a borehole or surface-water, when a system is in place for collecting small user fees for maintaining the water supply and paying for fuel for pumps. But in areas served by other types of systems—such as standalone hand pumps, which often make sense from a technical perspective—both the mechanism and the resources for maintaining the pumps are not always in place. Issues beyond drinking water supply can also be challenging: Establishing a mechanism to carry out regular water quality checks is very difficult to institutionalize. In the MVP, it has also been difficult to institutionalize sanitation and hygiene education and practice.

## Schools and health facilities

For infrastructure in social institutions such as schools and health facilities, even in cases where the initial investment in buildings and equipment is satisfactory, there is often an unmet need for a range of services and goods that would pose additional recurring costs—including routine maintenance, major repairs and, in some cases, fuel—for water, sanitation and electricity systems as well as ambulances.

Some of the technical issues that contribute to poor maintenance are: a) poor initial sizing of the systems, b) failure to upgrade systems to match changing demand growth, c) poor initial technology choice, resulting in systems that are not robust and d) lack of routine maintenance protocols. Attempts by individual facility managers to work directly with private sector providers to specify, install and maintain individual systems can, without higher level technical and budgetary guidance, lead to fragmented and ad hoc implementation across many similar facilities, leading to inconsistent system specification and maintenance. There are also often administrative challenges: Health and education facility staff members rarely have the skills and time to attend to maintenance of infrastructure systems that operate at the facility level. Where training takes place or maintenance skills already exist, a facility often lacks the funds for crucial repairs, and skilled individuals may move on to other locations, taking their capacity with them. Transport difficulties and weak supply chains in remote areas make it difficult and costly to carry out routine maintenance that requires both periodic (monthly) service visits and a consistent supply of parts to keep pumps, generators and solar systems well maintained. While service contracts are one approach to addressing many of these maintenance issues, such contracts should be arranged to include not only traditional "maintenance" tasks and parts, such as the periodic servicing of an ambulance engine, but also "major repair" and "reinvestment" needs and costs, such as re-purchasing a battery for a solar system.

## Roads

Road and transport improvements are a quintessential public good, and can generate adequate enhanced economic activity and internal taxes to provide for their maintenance. A project at MVP's scale can demonstrate the building and rehabilitation of needed road infrastructure, but it is much more difficult for a project of this scale to ensure the maintenance of such roads works. This is primarily due to the political and administrative difficulty of ensuring the allocation of significantly more government resources, for a period of five to ten years, for maintenance only in the specific project area.

There are two primary reasons for this. First, the project area's administrative unit does not generally have internal mechanisms for levying taxes or generating revenues specifically for road maintenance. In most cases, maintenance budgets come from federal funds—which are likely to be partly raised from transport-related levies or taxes, for example, fuel taxes or vehicle registration/licensing fees or custom duties on the import of vehicles. Some countries have programs or civic traditions by which locales (jurisdictions that are smaller than districts) mobilize support for labor-based repairs by community members (Uganda, Rwanda), or apply for funds to allocated for specific roads projects (Kenya's CDF - Constituency Development Fund). Such programs can typically cover only a portion of the maintenance fund shortfall.

Second, the funds that are disbursed by the federal government for maintenance and repair are often inadequate overall, and specific road works may be delayed until a crisis situation leads to additional political pressures for repair. Nearly all metrics of development used by administrations and politicians see value whether in statistics or in media opportunities of reporting new infrastructure built. Moreover, the typical MVP project area is only part of the larger administrative area and its economic success cannot translate directly into a local maintenance budget. It may be better able to articulate an additional need for roads if, for example, there is a significant increase in surplus produce moving to market. Some ideas on how a project of this nature can provide added value by a) making current resources go further, and b) articulating the need to budget a greater allocation for maintenance, are presented later in this chapter.

Water systems in Potou: Nearly three-fourths (71 percent) of the delivery cost of piped water in Potou is due to fuel expenses for pumping. Steps being taken to manage and reduce service delivery costs include:

- Switching from diesel pumps to electric pumps with grid power should reduce recurring costs by 20 to 30 percent.
- The investment required to replace pre-existing but oversized generators with new, properly sized systems can quickly be recovered in reduced operating costs.
- Properly clarifying responsibilities and reducing redundancy in water supply management can lead to more effective maintenance.

Equally critical to the sustainable management of this new water infrastructure is the community's continued involvement and willingness to pay for services. An MVP study of household water collection patterns at the Potou, Senegal, site found that approximately 20 percent of the population that had access to a tap within one kilometer nonetheless continued using open wells. Distance was the most commonly stated reason for not taking advantage of pay-per-use taps, which in some cases required villagers to travel an additional 500 meters each way. ■

**The problem of financing for maintenance of systemic, network infrastructure is such still a deep unsolved challenge that most site-specific development projects shy away from building it. What would be desirable for long-term maintenance is to focus on ensuring that communities and/or local governments address maintenance as part of their ongoing work plans. In Sauri, Kenya, this involved re-classifying roads, sometimes to a higher designation, thus justifying more frequent maintenance by the district. The long-term question remains whether governments and communities will be able to sustain this commitment to maintain improved roads.** ■

## Electricity and mechanical power

For grid electricity, a utility is responsible for maintaining systems. If maintenance falls short, remedies may consist of improving overall utility management and cost-recovery and increasing penetration rates in areas with grid "backbone" but few connections. These are two types of improvements that tend to work together: Without sound management and efficient cost-recovery, additional customers may decrease overall reliability. But with both elements in place, increasing the number of rate payers for a given electricity line can increases revenue for the utility's system maintenance with relatively low additional capital expenses. The former issue is beyond the scope of this project, but for the latter, the primary lesson of MVP experience has been that penetration rates are higher in countries where grid connection costs for homes and businesses are already low (Ghana) or where additional subsidy programs are enacted (such as MVP's trial program in Kenya).

Systems that mainly provide mechanical power, such as grinding mills and irrigation pumps, are generally owned by a private entity—an individual, cooperative or private business—and pumps are often provided for rental. In both cases, service is on a "pay-per-use" basis, providing an income stream to pay for maintenance by the owner.



## The way forward

Greater understanding and innovation are needed for improved maintenance and sustainability. Currently, the project does not have an overarching successful protocol or strategy to provide lessons for scale-up. There are, however, some ideas worth considering:

1. **Greater use of information systems for reporting operations and maintenance status.** Such information can be valuable in identifying the location of broken infrastructure, and what infrastructure is failing frequently and why. Particularly when such data is

aggregated over time and across a broad scale it becomes possible to identify patterns and reasons for failures and to address them in a systemic fashion. Information systems may be beneficial in managing parts inventories and procurement requirements, allowing for bulk purchasing and the efficient planning of repair visits. Both are significant operational benefits, especially when the cost of transport vehicles can dominate the small discretionary budgets of district and field offices, and when supply chains are weak in rural areas.

2. **Greater community Involvement.** Local health and school facility directors/heads/principals are not always empowered to spend discretionary budgets on repairs in order to prevent the misuse of funds. Moreover, while skilled labor (e.g. construction, trenching, piping, electrical and mechanical repair) exists in many small towns, such rural personnel may not be familiar with the bidding, procurement, licensing and payment requirements of state administrative structures or large NGOs. It is worth investigating what combination of community, civil and local governance structures can provide the necessary oversight to utilize local skills in a flexible manner that ensures that such systems are efficiently maintained.

3. **Greater role of private sector through service, performance and output-based contracting.** As many developing nations have grown rapidly in the last decade, their private sectors have matured. A parallel strengthening of legal, contractual and banking infrastructures is also taking place, at least in large urban centers. Thanks to ubiquitous monitoring and measurement systems that can leverage mobile phone and data connectivity, the cost of verifying service delivery is shrinking significantly. This opens a space for simpler contracts tied to measured performance and service delivery that in turn allows for larger private participation. For example, the electricity needs of an off-grid, rural health clinic may now be feasibly fulfilled by measured, monitored power delivered to the clinic using a model like that of **SharedSolar**.

4. In some sectors, help from higher management with modular system specifications can help in many areas, particularly in reducing problems with system design. Sectoral leadership (such as health and education ministries at the district or national level) can aggregate knowledge and experience across many facilities and longer timeframes to specify or recommend a standard set of infrastructure services required at specific facility types, then work with infrastructure specialists to determine standard system designs to cost-effectively meet those needs. Such a program could plan for maintenance in a systematic fashion, aggregating service needs across many facilities and taking advantage of economies of scale for service calls and replacement parts, thereby reducing the degree of ad hoc, high cost maintenance.

## Sustainability

The larger issue of sustainability is closely tied to the question of whether the infrastructure deficit of Sub-Saharan Africa is addressed at scale. For road/rail transportation, all the various networks—port facilities, rail (in dense corridors), pipes for fuel and efficient border crossings—must be addressed. The same holds true for power infrastructure: There are large gaps in generation and transmission that call for regional collaboration and coordinated action. For such investments to pay off, they must be made in concert (spatially and temporally) with the economic engines underpinning growth. Experience from the MVs shows, however, that there is an ability and willingness among the rural poor to pay for the small but crucial first few units of service (whether it is for connectivity, electricity or water) if that service is reliable and measurable. This "bottom-up" experience may create space for cheaper, leaner infrastructure to be deployed in rural settings, which can then be incrementally upgraded if and when demand grows. ■