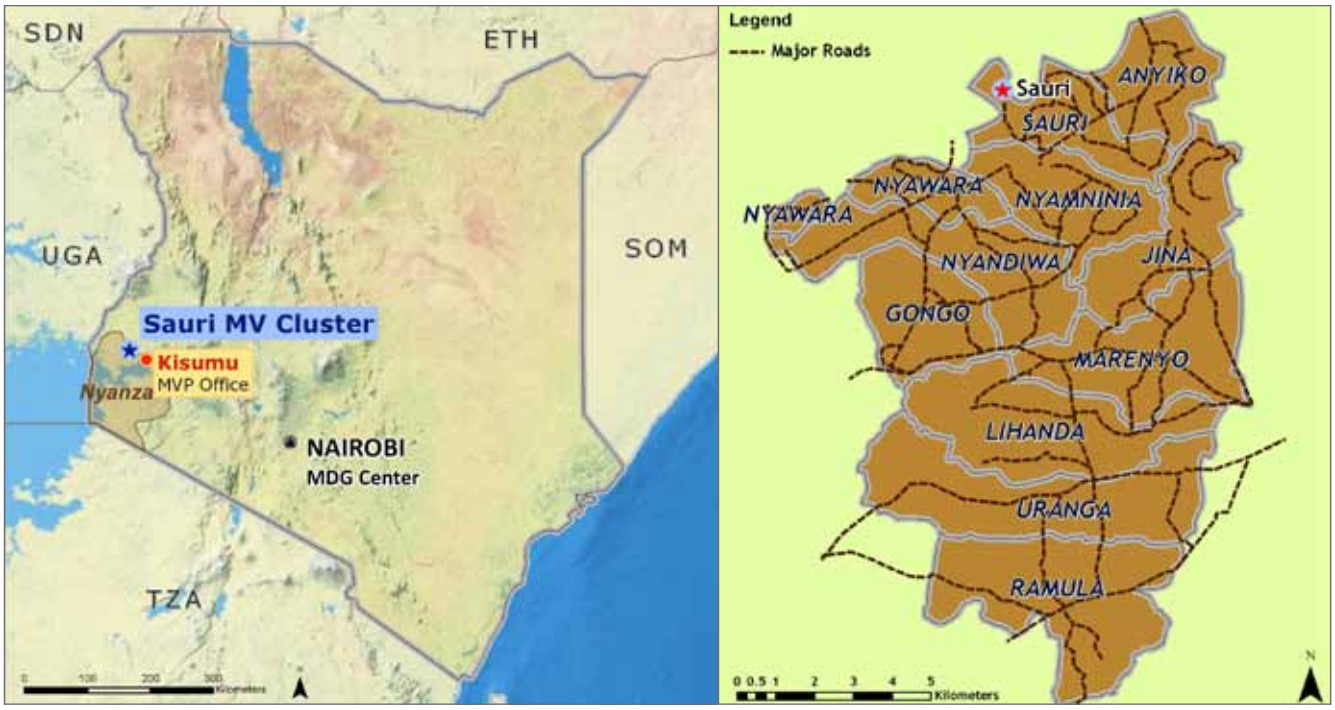
CHAPTER 8

Site Profile: Sauri, Kenya



The Millennium Villages Project began with Bar Sauri, a rural area of roughly 5,000 people located in the Siaya District in the highlands of western Kenya, near the city of Kisumu. As the project expanded, the Sauri MVP cluster came to comprise approximately 65,000 people spread over 132 square kilometers.

When the MVP began, the population density in Sauri was already high (500–600 people per square kilometer), and poverty and hunger were widespread, with almost 80 percent of the population earning less than $1 per day. Education and health facilities were generally in poor condition. Most schools lacked grid electricity, supplies and improved latrines, and few had sufficient teachers. With just five government health facilities and one referral hospital in the area, the average distance from villagers' households to a clinic was more than five kilometers. Although a major, paved road passes through the cluster, local roads were in poor condition. Most markets were served by the central electricity grid, but high fees prevented connections for most households. Despite the abundance of water from rivers and streams, only seven percent of the population had access to an improved drinking water source, with the majority using unimproved springs that showed high levels of contamination.

Summary of Infrastructure Outcomes and Lessons Learned

- Clear division of roles and expenditures in partnerships with local utilities were essential to the rapid implementation of grid electrification projects.
- A trial subsidy and loan program to reduce the costs of household connection fees has shown some potential to increase penetration rates.
- Improved "rocket" stoves have been installed in all primary schools (saving an estimated 200 tons of fuelwood annually).
- In implementing roads projects, MVP prioritized funds according to economic feasibility and population density, capitalized on community participation and addressed land rights issues prior to construction.
- Thorough investigation was important to ensure that water sources followed population density, project costs were kept low and delays were avoided with p artners.

Energy in the Sauri Cluster

ELECTRICITY

At baseline, the Sauri cluster already had an extensive electricity grid, with 38 kilometers of medium voltage line reaching all but one of its 14 trading centers. However, most primary schools and health facilities were not connected, and few households were connected, even in areas near transformers, due to high connection fees ($500 or more) charged by the national power utility, KPLC. With good pre-existing grid access in markets, the MVP prioritized grid extensions to clinics and schools as well as household connections. These projects targeted about 36 institutions, including 25 schools, eight health facilities, and three institutions of different types, at a total cost of nearly $680,000, a mix of MVP funding (~72 percent or $559,000) and Kenyan government support (the remaining 28 percent or $121,000). Details of institutional electrification are provided in the sections describing education and health facility interventions. This section focuses on general costs and implementation steps for grid projects.

A sustained, high-level of engagement with the Kenyan national utility and government was critical to the success of grid extension projects. The public Rural Electrification Program (REP), later Authority (REA), prioritized the extension of the electricity grid to health facilities, secondary schools and community water pumping stations. Agreements with the local utility, Kenya Power and Lighting Company (KPLC), defined specific projects for which KPLC carried out technical work and MVP paid extension costs. Following this agreement, applications for extensions to institutions were submitted to KPLC, which sent engineers to conduct detailed site surveys, including generating designs and costs. For most projects, particularly schools, MVP paid grid extension costs, and KPLC extended power lines to the institutions. For other projects, primarily health centers, the utility undertook extensions with government funding. Contractors were engaged to do the internal wiring.

These projects provide detailed grid electricity cost information. They are of two basic types: low voltage (LV) connections and medium voltage (MV) line extensions. The average cost of MV line extension, $25,000/kilometer, is within the usual range for sub-Saharan Africa. Around $12,000 of this went to MV line equipment, while the balance was for other equipment (LV line, transformers, labor, permits, etc.)

To help overcome KPLC's high household connection costs ($432), MVP initiated a pilot program to support connections for households located within a 600-meter radius of a transformer. The project paid $185 per household (more than 40 percent of the full connection fee), and the household contributed the remainder. To date, just 91 households have been connected under this arrangement, suggesting that the balance of connection costs ($247) is still too high for most households.

Figure 8.1: Map of Sauri cluster medium voltage grid extension projects

Table 8.1: Approximate cost breakdown of grid extension projects, Sauri, Kenya

Full project costs (MV & LV equipment, and all other)		Equipment costs		Other Costs, (Ave. per project)	
$ per kilometer of MV line	Ave: ~$25,600 $/km	MV ($/km)	$12,000	Labor	$4,000
	High: ~$49,600 $/km	LV ($/km)	$8,500	Materials Transport	$1,800
	Low: ~$16,500 $/km	Transformer (each)	$4,000	Permits & Supervision	$13,200

Table 8.2: Approximate cost breakdown of grid connection projects, Sauri, Kenya

Connection Costs (per project)	"drop down" (with 1-2 LV poles)	Connection with transformer
Household:	$432	Not applicable
Institutions (Schools, Clinics & Community Centers, etc.)	$400-500	~$6,000—6,500 per connection

To help fill the gaps in electricity services for institutions lacking both a grid connection and a solar photovoltaic system, MVP introduced 134 LED lanterns to health facilities and primary schools for lighting and installed solar photovoltaic systems in four health facilities, which eventually got grid connections as well.

Health (Construction and Energy)

MVP Target:	Electrify health facilities as selected by MVP health sector
Status at Project Launch: 40% Electrification of Clinics	5 clinics existed in cluster (2 with grid, zero with solar PV)
Outcome at 5th Year: 100% Electrification of Clinics	All 10 health clinics in the cluster are electrified (10 with grid, 4 of which also have solar PV backup)
MVP expenditures: Estimate: $4,700	Estimated grid costs (connection only) for 4 clinics undertaken by the MVP
Government contribution: Estimate: $ 120,00	Kenya's REP/REA funded grid MV extensions to four clinics at an average cost of ~US$30,000 per project.

At project launch, Sauri had five health facilities with a catchment area of 96,000 people. Three of the health facilities did not have grid power, and all five relied on rainwater harvesting and surface water collected from nearby streams. The project's strategy regarding infrastructure for the health sector is an integrated approach: improved health facilities (i.e. clinics, dispensaries, posts, etc.), improved housing conditions for health facility staff, better access to

Figure 8.2: Electricity status of health facilities

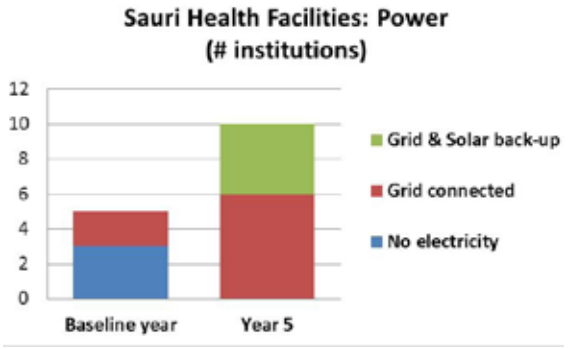


Figure 8.3: Health sector related construction

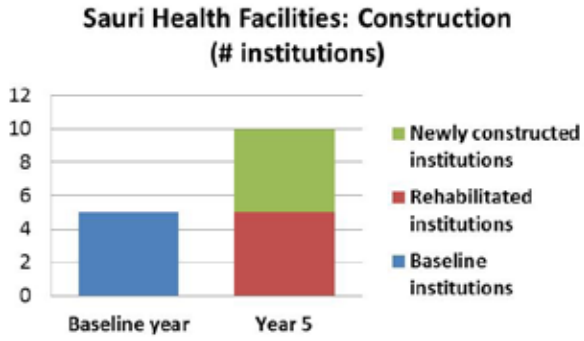


Figure 8.4: Availability of health services

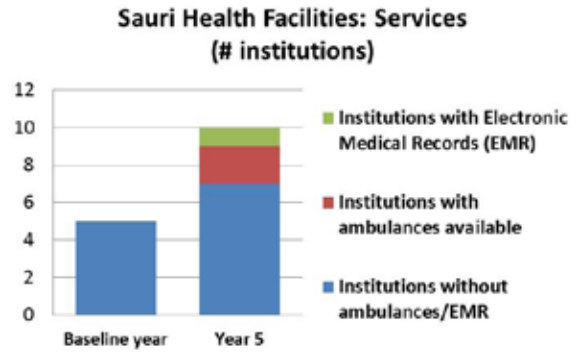


Table 8.3: Cost breakdown of health facility building projects: rehabilitation and new construction

	Rehabilitation			New Construction		
	Existing facilities (Area, in m^2)	Total costs (US$)	**Unit cost (US$/$m^2$)**	New facilities (Area, in m^2)	Total costs (US$)	**Unit cost (in US$/$m^2$)**
By Year 5	2,501	$296,455	**$118/$m^2$**	1,204	$218,107	**$181/$m^2$**

facilities (i.e. roads and ambulances) and enhanced telecommunications (i.e. mobile telephony) between health facilities and the community for both community health worker visits and emergencies. These objectives were to be achieved by upgrading the level of services in existing facilities, rehabilitating and constructing new centers and staff quarters and connecting these to clean water and power. Transport and ICT interventions related to health will be discussed in the transportation and telecommunication sections, respectively.

Clinic construction was the first building activity in the Sauri cluster. The community provided land, labor, and local materials, and MVP worked with local governments to determine the type and architectural plan for the structures. The Yala Sub-district Hospital (SDH), a referral hospital located near Sauri village, has undergone major changes, including the construction of two wards and the renovation of the hospital's operating theatre to ensure continuous availability of medical services for expectant mothers and other patients. MVP also installed a voltage stabilizer to safeguard sensitive medical equipment against power fluctuations and a compact water treatment plant, donated by General Electric, to filter water pumped to the facility from a nearby borehole. Other interventions, some of which were undertaken in partnership with the Constituency Development Fund (CDF): construction of new facilities and maternity units at six locations (Bar Sauri, Lihanda, Gongo, Onding, Masogo and Mindhine) and building rehabilitation, including main facility structures, staff houses, and outpatient and maternity units at four facilities (Ramula, Marenyo, Nyawara, Mindhine).

To ensure the maintenance of facilities and sustainability of services, the health facilities were registered by the government and listed on its Master Facility List (MFL), permitting them to receive supplies from the Kenya Medical Supplies Agent (KEMSA).

In order to provide for services while awaiting grid extension, the project provided solar photovoltaic systems for four health facilities. The Kenyan government took the lead in grid electrification of health facilities. REP/REA provided ~$120,000, or 96% of all funding for MV line extensions to four health facilities (Bar Sauri, Gongo, Lihanda, and Onding), at an average of ~$30,000 per facility, and roughly 1.5 kilometers of MV line per institution. The remaining four percent, paid by MVP, was for grid connections at four other facilities (Masogo, Ramula and Marenyo and Mindhine Dispensary), typically at a cost of $400-$500 each.

MVP Target:	New construction and electricity service for educational facilities as required by MVP education sector
Status at project launch: 16% electrification of schools	5 of 35 primary and secondary schools were electrified at baseline
Outcome at 5th year: 89% electrification of schools	5 new schools and 51 new classrooms built All 41 of 46 schools electrified
MVP expenditures: $460,000	Electrification of ~22 schools (13 LV connections, 9 MV extensions) at an average cost of $21,000 per school
Government contribution: estimate: $45,000	Three MV extensions at an average cost of $15,000 per school

Prior to the Project, the cluster had 35 primary schools, five that were connected to the grid and the others with no power. Most schools were in a deplorable

Figure 8.5: Uyonga Primary School (before (left) and after construction (right)

state, with classrooms that were temporary mud structures with earthen floors and teachers frequently conducting lessons under trees. The education sector goal of increased access to a full course of quality primary education for all children was supported through:

- Construction and rehabilitation of schools to improve access for underserved areas of the cluster
- Construction of improved kitchens and installation of improved stoves to strengthen the school meals program
- Provision of electricity and ICT services to primary schools and administration blocks
- Construction of more gender-separate latrines to improve retention for girls (described further in Water and Sanitation)

A total of 51 new primary school classrooms were constructed. Clean water was also supplied to all schools through improved rainwater harvesting systems. These interventions helped improve learning environments, encourage better attendance and advance the performance of existing students. To ensure sustainability, MVP conducted interactive sessions with school administrators and management committees on best practices to maintain the newly constructed structures.

The number of schools with electricity increased from five (of 35 total) at baseline to 41 (of 46 total) at year five, at an approximate cost of $21,000 per school. The cost breakdown for each project was determined largely according to the required equipment: the 11 schools that required only LV line connections cost between $400–500 each, while the two schools that required transformers, but no MV extensions, cost ~$6,300 each. The 10 schools that required full

Figure 8.6: Construction for Sauri cluster education sector

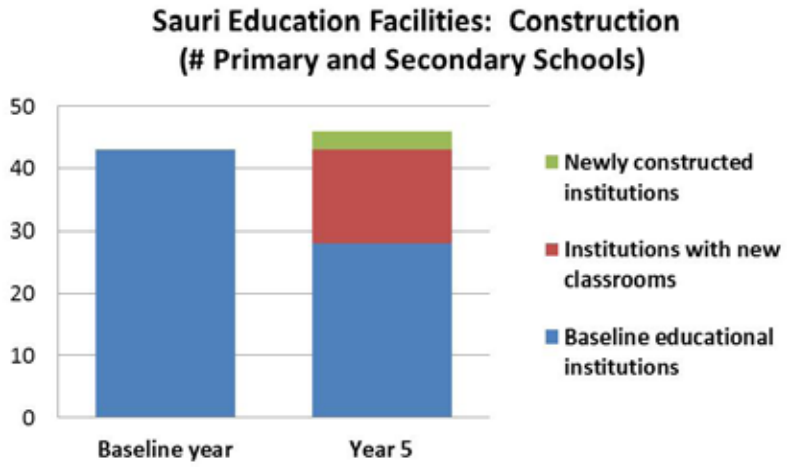


Table 8.4: Approximate cost breakdown of construction of new classrooms

New Classrooms:	Number	Area (m^2)	Total cost (US$)	**Unit Costs (US$/$m^2$)**
By Year 5	51	3,970 m^2	$327,704	**$82.5/m2**

Figure 8.7: Electricity status of Sauri cluster primary schools

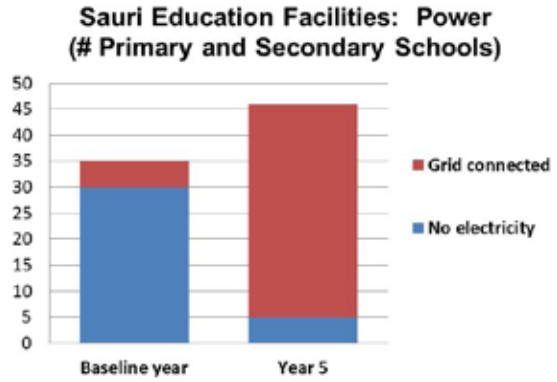


Figure 8.8: Sauri cluster educational institutions with improved stoves.

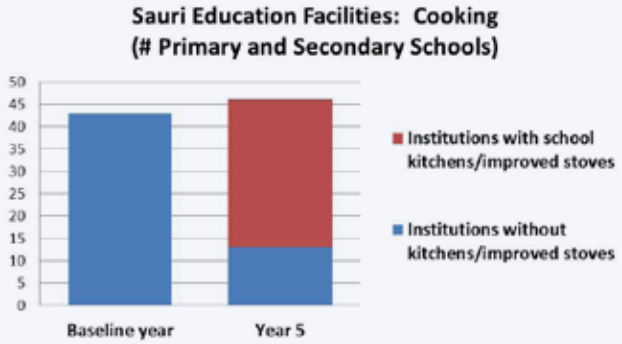


Figure 8.9: Cooking at Nyamninia Primary School using a three stone stove (left) and a fixed institutional Rocket stove (right)

MV extensions and transformers, plus LV line, cost an average of $48,000 each, at an average MV extension length of 1.8 kilometers. The MVP paid the majority of these costs, contributing around $500,000 total for the connection of roughly 23 schools, accounting for 97% of all expenditures for school electrification. The Kenyan government contributed only three percent of the total school electrification expenditures: about $45,000 for MV extensions serving three schools.

Prior to the project, all schools and nearly all households in Sauri cooked with collected fuelwood over traditional three stone fires. To address this, MVP implemented two improved cooking interventions. First, MPV constructed school kitchens in all 31 primary schools. It installed 88 rocket stoves, which use large pots (about 100 liters), and reduce fuel consumption for the schools' free mid-day meals programs by around 35 percent, amounting to total fuel wood savings of roughly 250 tons per year across all participating primary schools.

The household cookstove model chosen for Sauri was the Lorena Rocket, a mud and clay design built in each household kitchen costing less than $5. To date, 6,894 improved cookstoves have been constructed in the cluster, reaching 51 percent of the total households in Sauri.

Roads and Transportation in the Sauri Cluster

MVP Target: 50% within 2km of all-weather road	At least fifty percent of the population with 2km of an all-weather road
Status at Project Launch: less than 30% access	Less than one third of the population lived within 2km of an all-weather road
Outcome at 5th Year: Greater than 50% access	Over 90 kilometers of road improvements , over 1,200 meters of culverts installed
MVP expenditures: $1,221,348	Includes road repair and construction, with some preliminary maintenance
Government Contribution: $361,227	Includes road repair and construction, with some preliminary maintenance

Although Sauri is served by a major paved road, at baseline, about 75 percent of the cluster's more than 300 kilometers of local roads were in poor condition, and less than one third of the population lived within two kilometers of an all-weather road. MVP's transportation strategy focused on upgrading existing roads to all-weather standards and constructing new roads to bring at least 50 percent of Sauri's villagers within two kilometers of an all-weather road.

The Kenyan Ministry of Roads & Public Works categorizes roads as either classified (maintained by the government) or unclassified (not government maintained). The MVP focused on the rehabilitation of unclassified village roads to improve access to roads leading to major trading centers, schools, health fa-

Figure 8.10: (left to right) Rehabilitated Saola Road in Jina Village, Rawalo-Madangala Road construction, Culverts at Muhanda-Arude Road



cilities and community centers. After mapping the existing road networks, the Sauri MVP worked with village roads committees to prioritize roads for rehabilitation and collaborated with the government to identify spots for improvement and the costing of road works. The community contributed labor for bush clearing and land where road widths were inadequate.

Over 90 kilometers of roads were improved (dozed, graded, graveled, compacted, or spot-patched) to upgrade their classifications to all-weather roads. In addition, over 1,200 meters of ring concrete culverts were installed to improve drainage and to allow the passage of small streams during rainy seasons, improving access for villagers to markets, health facilities, schools and other institutions.

In view of this significant MVP contribution to the community, the MVP engaged the district roads engineer to upgrade rehabilitated roads to classified status to ensure the availability of national funds for maintenance and rehabilitation. The local road authority inspected the rehabilitated roads as a preliminary step. Meanwhile, at the local level, over 400 road committee members were trained in basic road maintenance techniques such as culvert cleaning, weed removal and limited spot-gravel.

Water and Sanitation in the Sauri Cluster

MVP Target:	100% access to an improved drinking water source, year-round: during both wet and dry seasons
Status at Project Launch: 6.9% coverage	6.9% of population at baseline with access to improved drinking water source at baseline
Outcome at 5th Year: 93% coverage	93% of population at year 5 with access to improved drinking water source
MVP expenditure: $426,000	Includes spring construction ($104,000), rainwater harvesting ($165,000) borehole drilling and equipping and pipeline construction ($157,000)
Government Contribution: $83,000	Including spring construction ($41,000), borehole drilling and equipping and pipeline construction ($42,000).

The water and sanitation sector's primary goal is to halve the proportion of people without access to safe drinking water and basic sanitation services by expanding the coverage of improved water sources (e.g., piped water, boreholes, spring protection, rainwater harvesting etc.) and sanitation structures (VIP latrines in households and institutions). At baseline, access was low to both improved water (6.9 percent of households) and improved sanitation (14.4 percent). The average distance to a water source was 370 and 429 meters during the wet and dry seasons, respectively, and most villagers used unprotected springs complemented by informal, dirty household rainwater harvesting systems. A piped water system, Sidindi-Malanga, was present in Nyamninia Village, but due to the deterioration of pipes and the breakdown of pumps at the Yala River intake, some household taps had service just two days of the week while others had not produced water for years. Sauri made great progress in increasing access to improved water sources through a diverse range of strategies, principally boreholes, piped water, rainwater harvesting, improved springs and ventilated improved pit (VIP) latrines. By the end of year five, 93.6 percent of households had access to improved water sources and almost 20.5 percent of households had access to proper sanitation.

MVP constructed four piped water networks, extending over 17 kilometers in length and serving more than 11,000 villagers. The MVP worked with the Lake Victoria South Water Services Board to rehabilitate the intake of the Sidindi-Malanga Water Supply from the Yala River, which fed a water treatment plant and 3,300 cubic meter reservoir. The system served a total population of 15,000 people, 4,160 within the Sauri Cluster. Works involved the repair of two turbines and the installation of two new pumps, plus an extension of the pipe network by 13 kilometers. This project cost around $51,000, roughly half borne by MVP, and served around 15,000 people, resulting in an investment of roughly $3.40 per beneficiary, considering populations both inside and outside the cluster.

Figure 8.11: Impact of water interventions

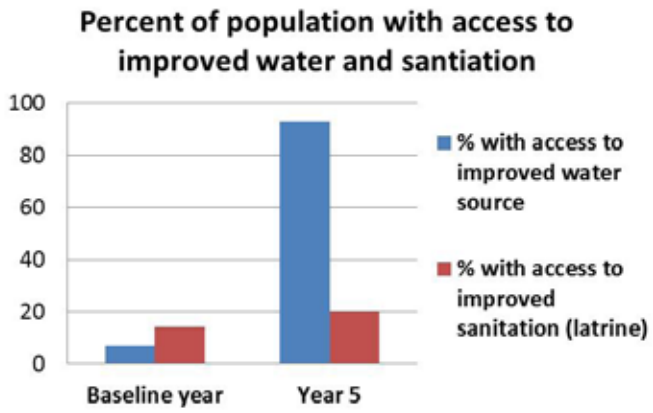


Figure 8.12: Number of piped water networks

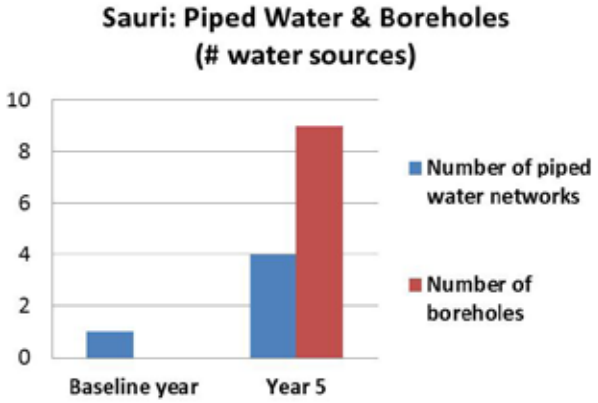


Figure 8.13: The Sidindi-Malanga project: turbine to be rehabilitated at Yala River intake (left); water treatment plant in Nyamninia Village (right).

Table 8.5: Sauri piped water interventions

	No. of newly constructed Piped water networks	Total length of new pipes (km)	No. of rehabilitated Piped water networks	Total length of rehabilitated pipes (km)	No. of drilled boreholes
Year 5	3	17	1	8.60	9

Other piped water projects implemented in collaboration with the community include:

- The extension of 3.8 kilometers of pipes to supply water from Rabuor tank to Marenyo Health Centre, in partnership with Ahono Singa Community Water Project, Marenyo Village.
- The extension of Ramula piped water supply from the borehole to Ramula Health Centre and market.
- The extension of two kilometers of pipes to supply 47 households in in the Sauri Village.

A total of 10 borehole projects were undertaken by the project: eight boreholes equipped with pumps at a total cost of $34,500 (around $4,300 each) serving 5,200 villagers, yielding a cost of $6.65 per person served. The other two boreholes were equipped with electric submersible pumps. The project also drilled a borehole at the Yala Sub-District Hospital; this project included a generous donation for pumping and water treatment by General Electric.

Rainwater harvesting (RWH) was a major part of the water strategy. The Project installed 52 plastic and concrete RWH tanks in 40 institutions, at a cost of about $3,200 per water point, serving an estimated 18,000 users and almost doubling the cluster's storage capacity from 642,000 to 1,279,000 liters. The RWH systems at schools facilitated the school meals programs, because students no longer had to fetch water from nearby sources. At health facilities, RWH systems capture water, which is pumped into overhead tanks with treadle pumps and then gravity-distributed to points within the facility.

Working closely, and through cost-sharing, with the community's help, MVP protected 270 water springs at a cost of around $550 per spring. The total cost was $145,000, 72 percent of which was borne by the MVP. These springs are estimated to serve a population of 35,000, yielding a cost of around $4.10 per person. Spring management committees, made up of users, were trained on catchment conservation and contamination reduction techniques such as surface water diversion and buffer zone tree planting.

MVP Target:	Reduce by half the population without access to basic sanitation services
Status at Project Launch: **14.4% of households** **20% of institutions**	14.4% of households and less than 20% of health centers and other institutions have access
Outcome at 5th Year: **20.5% of households** **100% of institutions**	20.5% of households and all schools, health centers and other institutions have access
MVP expenditure: **$220,501**	More than 400 VIP latrines constructed (approximately $550 each)
Government Contribution: $5,598	Septic tanks for schools ($5,598)

At baseline, sanitation in the cluster's primary schools was insufficient, consisting of mud-wall latrines with neither roofs nor doors, and some schools had no gender-separate facilities. Kenyan Ministry of Education guidelines required that a total of 1,296 gender segregated toilet stalls be installed, at a ratio of one to each 25 girls and 30 boys. The key sanitation intervention was the construction of over 400 gender-separate Ventilation Improved Pit (VIP) latrine cubicles in health facilities, primary schools, households, and public facilities at a unit cost of approximately $550 each. This project included more than 280 gender-separate VIP latrine cubicles in primary schools, with the objectives of improving sanitation while targeting

Figure 8.14: Map of Sauri cluster water piping projects

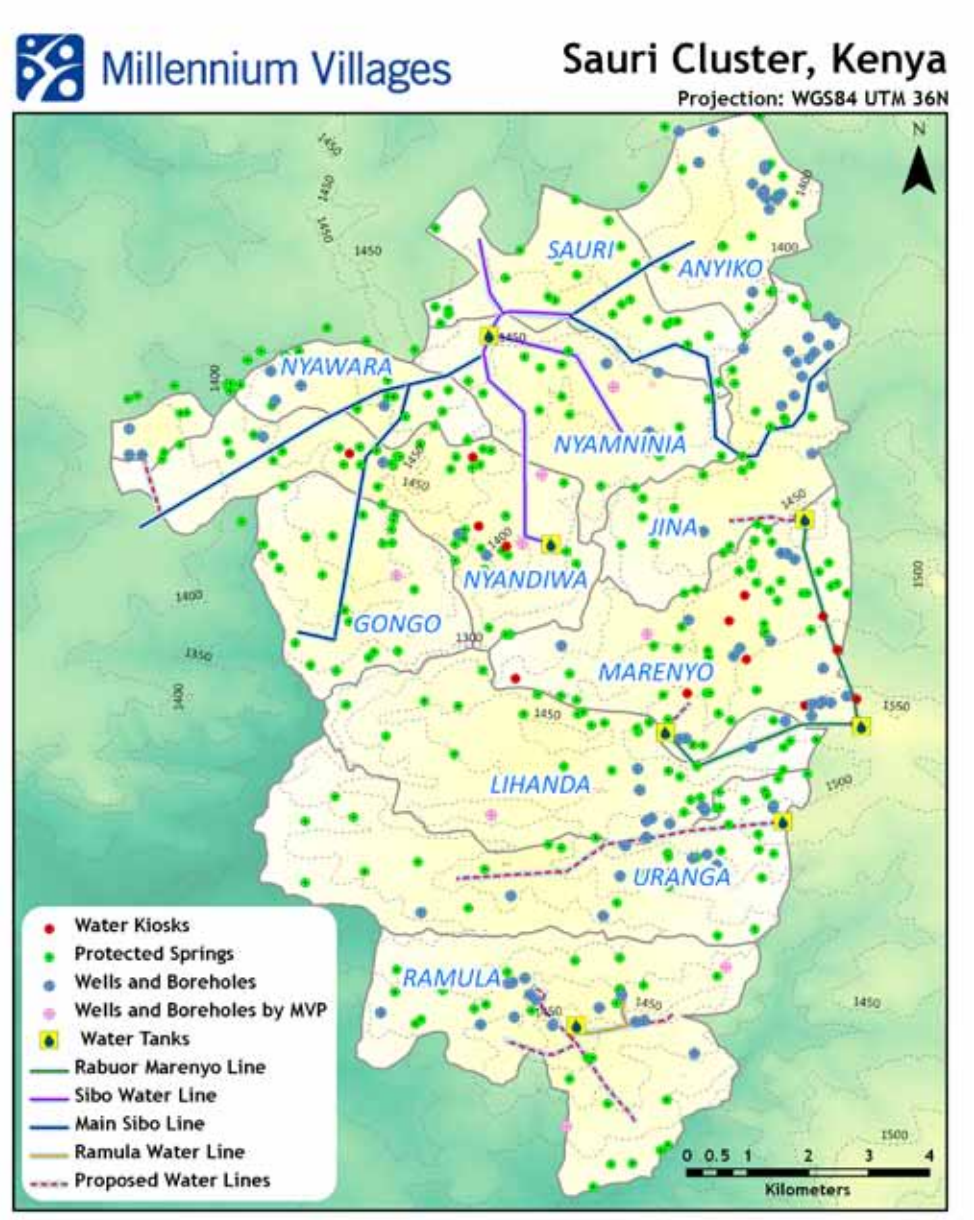


Table 8.6: Summary of rainwater harvesting projects in the Sauri cluster

	RWH Capacity (1,000 liters)	No. of schools with improved RWH	No. of health facilities with improved RWH
Baseline Year	642	—	—
Year 5	1,279	31	9

Figure 8.15: (left to right) Tatro Primary School latrine before, then after construction; training for construction of VIP latrines

improvements in the attendance of girl students, who may not attend school to avoid sharing toilets with boys. In order to build local capacity, some 33 villagers were trained on the construction of VIP latrines. Other sanitation interventions included participatory sanitation trainings for communities and schools, as well as the construction of incinerators and placenta pits for disposing of biomedical waste at health facilities. Sewage systems with septic tanks were also constructed at three health facilities.

Information and Communication Technologies (ICT)

MVP Target:	Mobile phone network access within 2kms of 80% of all households
Status at Project Launch: N/A	Limited access
Outcome at 5th Year: 80% coverage	Over 80% of households have mobile network coverage.

Prior to the MVP, telecommunications in the Sauri cluster were limited but more varied and extensive than at other MVP sites. Some villagers possessed cell phones, which were often left uncharged due to power limitations. Seven of the cluster's 14 markets had community pay phones, and five of the trading centers had photocopying, word processing, or printing services. The Project's objectives were to achieve mobile phone network coverage within two kilometers of 80 percent of all households; to improve villagers' access to educational materials, agricultural prices and related information and to introduce mobile phone-based health services.

Partnerships with Ericsson and regional GSM operators expanded and strengthened GSM network coverage. Ericsson worked with CelTel (later AirTel) to provide both voice and data GSM network coverage through the installation of five strategically located GSM service masts in the cluster--at Barkalare (Uranga), Muhanda, Rabour, Nyamninia, and Yala Centers. By 2010, the number of households using a telephone (primarily mobile) had risen to 80 percent.

Wireless networks were created for clinics, schools, and other institutions. MVP installed computers at nine health facilities, equipping them with wireless Internet terminals. The Project also installed VSAT at Siaya District Hospital, which was funded by General Electric. Good network coverage allowed for the introduction of mobile phone-based health services (mHealth), improved data collection and transmission for health workers, as well as the installation of an electronic medical record system (Open MRS) at

Yala Sub-district Hospital as well as the introduction of two on-call ambulances. For the education sector, MVP provided 265 computers, allowing Sauri to affordably create a computer lab in each of the 26 primary schools and offer computer training for teachers and students. The Project constructed Community Resource Centers (CRC) in four villages (Marenyo, Gongo, Nyawara, and Bar Sauri) that house community banks, adult education centers, computer rooms, meeting halls, and one community radio station that will endeavor to provide news, weather and agriculture-related education programs and pricing information. ■

Figure 8.16: Computer room at Nyamninia Primary School (left); computer training for teachers (right)