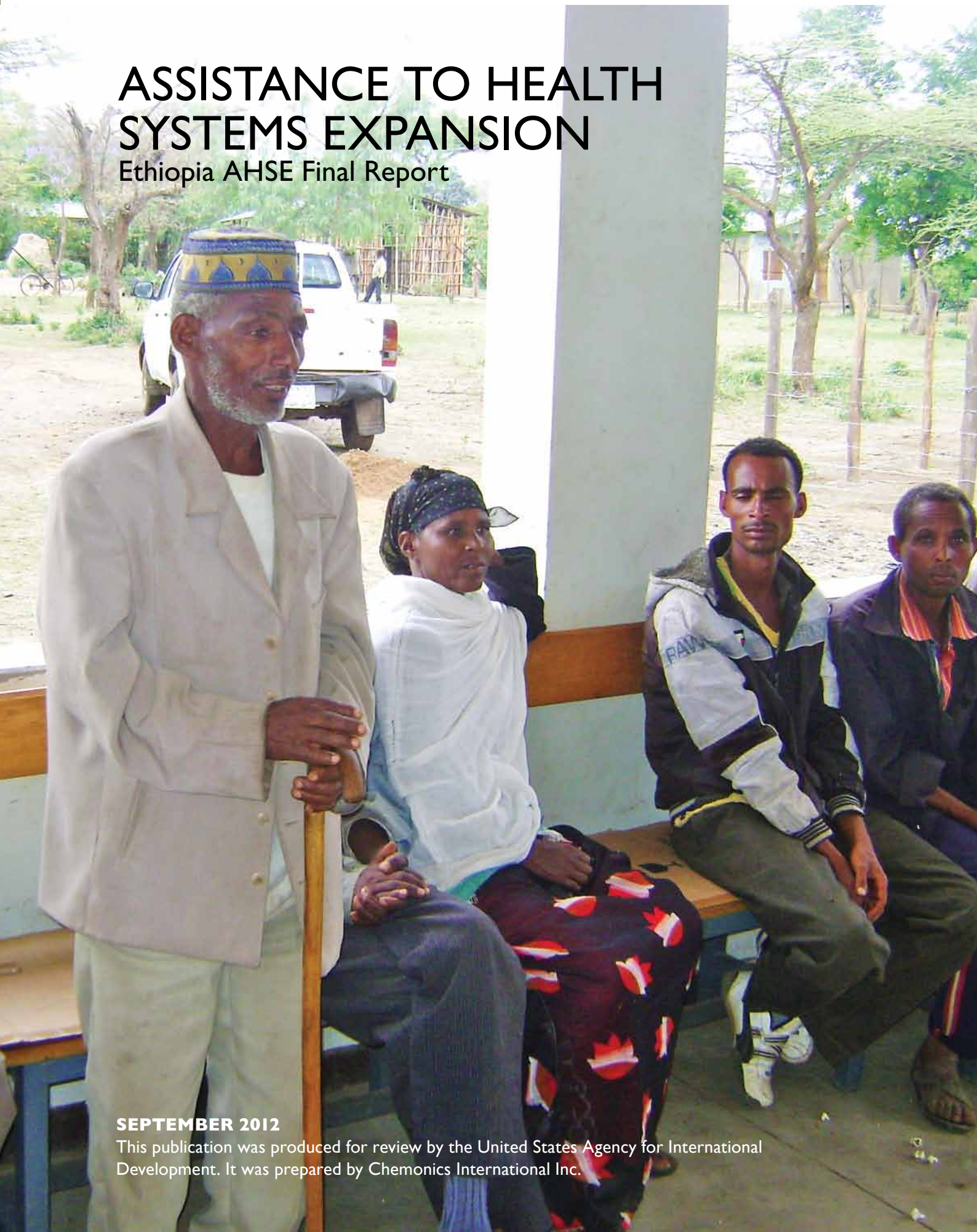
USAID | ETHIOPIA
FROM THE AMERICAN PEOPLE

ASSISTANCE TO HEALTH SYSTEMS EXPANSION

Ethiopia AHSE Final Report



SEPTEMBER 2012

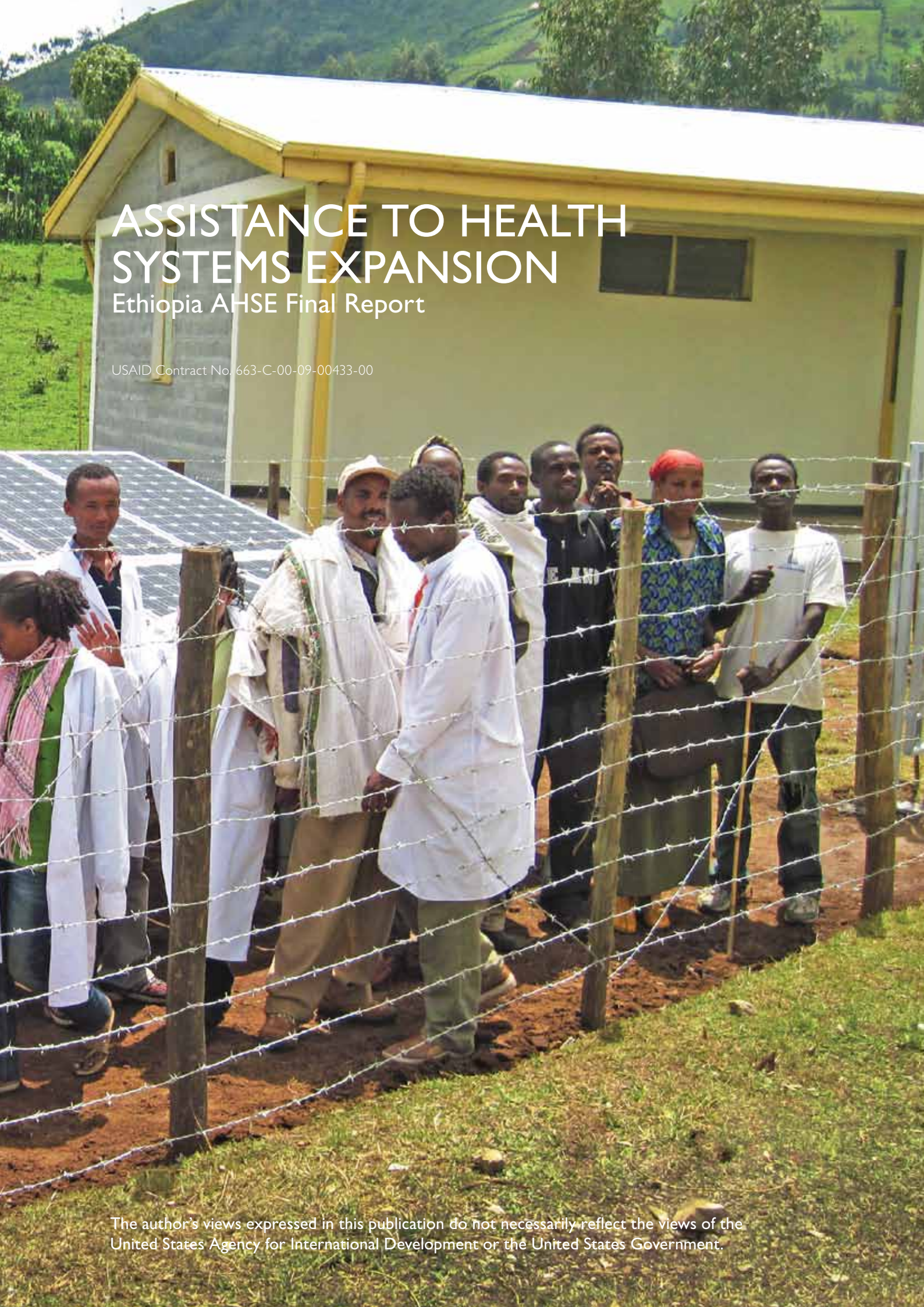
This publication was produced for review by the United States Agency for International Development. It was prepared by Chemonics International Inc.

U.S. Agency for International Development
1300 Pennsylvania Avenue, NW
Washington, DC 20523
Tel: (202) 712-0000
Fax: (202) 216-3524
www.usaid.gov

ASSISTANCE TO HEALTH SYSTEMS EXPANSION

Ethiopia AHSE Final Report

USAID Contract No. 663-C-00-09-00433-00



The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

© ETHIOPIA AHSE

CONTENTS

EXECUTIVE SUMMARY viii

IMPROVED HEALTH CENTER CONSTRUCTION, RENOVATION, AND MAINTENANCE 1

STANDARDIZED HEALTH FACILITIES 7

LOCAL AND NATIONAL COORDINATION 13

TRAINING AND CAPACITY BUILDING 19

INNOVATIONS FOR WATER AND ELECTRICITY SYSTEMS 27

RECOMMENDATIONS 39

ANNEX A: PILOT PROJECTS 43

ANNEX B: INDICATOR SUMMARY TABLE 57

LEFT: Participants in the training-of-trainers health facility plumbing course inspect the Sendafa Health Center plumbing system.

© ETHIOPIA AHSE

INSIDE FRONT COVER: After completing the on-the-job training program for photovoltaic (PV) solar systems, trainees give health workers and community leaders a tour of the Haroshifa Health Center in Southern Nations, Nationalities, and People's Region on May 14, 2012.

© ETHIOPIA AHSE

FRONT COVER: Community members visit a rural health center seeking primary healthcare services.

© ETHIOPIA AHSE

BACK COVER: An engineer evaluates a hot air sterilizer at the Debre Berhan Hospital in Amhara during a "first look" medical equipment maintenance course implemented in collaboration with the Ethio-China Polytechnic College in December 2010.

© ETHIOPIA AHSE

© ETHIOPIA AHSE

A technician receives a certificate after successfully completing the PV solar system installation and maintenance training course.

ACRONYMS

AHSE	Assistance to Health Systems Expansion
FMOH	Federal Ministry of Health
CJTF-HOA	Combined Joint Task Force — Horn of Africa
ConMIS	Construction management information systems
GIS	Geographic information system
GIZ	Deutsche Agentur für Internationale Zusammenarbeit (German Agency for International Cooperation)
GPS	Geographic positioning system
KRA	Key result area
NGO	Non-governmental organization
OJT	On-the-job training
PEPFAR	President's Emergency Plan for AIDS Relief
PHID	Public Health Infrastructure Directorate
PIR	Project intermediate result
PMU	Project Management Unit
PPP	Public-private partnership
PV	Photovoltaic
RHB	Regional Health Bureau
SNNPR	Southern Nations, Nationalities, and People's Region
TOTs	Training-of-trainers
TVET	Technical and vocational education and training

© ETHIOPIA AHSE

A laboratory technician examines a sample at the Burka Dembel Health Center in Oromia.

EXECUTIVE SUMMARY

Infectious disease, nutritional deficiency, and poor maternal health are major challenges for Ethiopia's health system, according to Ethiopia's Health Sector Development Program IV. These issues are complicated by infrastructure problems, such as lack of access to safe drinking water and poor sanitation, at health facilities that are unevenly distributed across the country and often difficult to access, particularly in rural areas.

The Government of Ethiopia has embarked on an ambitious program to renovate existing health centers and build new ones to achieve universal access to primary healthcare services for communities across the country. This program responds to Ethiopia's new decentralized, three-tier health system, through which primary healthcare is provided at rural and urban health centers serving 25,000-40,000 people and district and primary hospitals serving 60,000-100,000 people, while secondary and tertiary healthcare is provided at general and specialized hospitals. The Public Health Infrastructure Directorate (PHID) of the Federal Ministry of Health (FMOH) and the regional health bureaus (RHBs) have been leading the effort to upgrade and expand Ethiopia's health infrastructure.

Because these activities have stretched the limited capacities of the ministry, the directorate, and the regional bureaus, USAID launched the Assistance to Health Systems Expansion (AHSE) project in late 2009 to improve the design, construction, renovation, and maintenance of health centers, and build the capacity of the government, RHBs, and local commercial organizations. AHSE was tasked with assisting the government in its ambitious

© ETHIOPIA AHSE

AHSE KEY RESULTS BY PIR

AHSE OBJECTIVE | Build the capacity of the Government of Ethiopia, its regional health bureaus, and local commercial organizations to expand and improve health facility infrastructure design, construction, renovation, and maintenance.

PIR 1 | Government of Ethiopia and local authority capacity for construction, renovation, and maintenance strengthened

- Assessed structural integrity at more than 150 health centers and hospitals, and medical equipment at 170 health facilities.
- Provided technical support and systems strengthening for regional health bureaus and the Public Health Infrastructure Directorate. Building flaws at health centers — such as poorly aligned concrete block walls or cracked columns — dropped 61 percent in the second half of 2010, according to the directorate.

PIR 2 | Standard facility design and maintenance systems institutionalized

- Developed new designs for primary hospitals — construction is under way for 700 new ones — and multi-story urban health centers.
- Refined designs for district hospitals and provided on-site adaptation for rural health centers.

PIR 3 | National and local health facility planning and coordination strengthened

- Conducted regional workshops for more than 630 architects, engineers, and health professionals.
- Planning forums and meetings improved coordination among the Federal Ministry of Health, regional health bureaus, stakeholders, and international donors.

PIR 4 | Limited pre-service training packages developed and integrated

- More than 800 professionals gained experience in topics ranging from waste management to maintaining biomedical equipment.
- Partnered with General Wingate, Selam, and Ethio-China technical and vocational education and training colleges to develop courses on health facility plumbing, electrical equipment, photovoltaic solar energy, and housekeeping.

PIR 5 | Government of Ethiopia and local authorities supported in addressing electricity and water systems

- Assessed 83 health centers for water and electricity needs and developed pilot projects for 10 health centers:
  - *Collaborated with the German Agency for International Cooperation to install photovoltaic solar panels and train health center workers.*
  - *Collaborated with the U.S. Army's Combined Joint Task Force-Horn of Africa to drill wells at three health centers, providing water for health services as well as the surrounding communities.*
  - *Installed rooftop rainwater harvesting systems at two health centers and, at one of them, a solar-powered water disinfection unit to purify water for delivery and invasive procedures.*
  - *Installed solar-powered water heaters at a health center in Addis Ababa to replace electric heaters, reducing costs and interruptions to hot water.*

goal of increasing the number of health centers from 600 in 2008 to more than 3,200 by 2010. By supporting government-planned health facility expansion and maintenance, AHSE contributed to strengthening Ethiopian health systems, while working toward the U.S. President's Emergency Plan for AIDS Relief (PEPFAR) objective of extending the prevention, treatment, and care of people living with HIV/AIDS in Ethiopia, as well as the Millennium Development Goals of reducing child mortality and increasing access to reproductive healthcare by 2015.

AHSE had multiple components, including capacity building, training, design and engineering, planning and operations, and monitoring and evaluation, as well as a project management unit (PMU) embedded in the directorate. By focusing activities on Addis Ababa, Oromia, Amhara, Tigray, and the Southern Nations, Nationalities, and People's Region (SNNPR) — which make up more than 70 percent of the Ethiopian population — and fostering coordination at all levels of government, AHSE's impact was regionally targeted and nationally felt.

AHSE's approach emphasized local leadership and sustainability through peer-to-peer learning. FMOH/PHID and RHB personnel were trained to deliver construction management and health facility maintenance training courses to their colleagues at the regional and woreda (district) levels. The project facilitated regular meetings with representatives from different layers of the FMOH, stakeholders, and international donors, which promoted strategic planning at the national level as well as federal-regional-zonal-woreda coordination for health systems expansion.

With a diverse team of trainers, health professionals, biomedical engineers, architects, engineers, alternative energy specialists, and water and waste management experts, AHSE was able to lay the groundwork for lasting coordination across relevant stakeholders in the Ethiopian health sector. AHSE's dynamic team effectively collaborated with multiple partners, enabling the project to serve as a coordination, planning, and synchronization "hub" with national and international stakeholders for health center design, renovation, and construction.

Although health center services are vital for the entire community, some of the most important services target women and children, such as obstetric care and preventing mother-to-child transmission of HIV, and at-risk populations, such as people living with HIV/AIDS. AHSE integrated the needs of vulnerable groups into health facility assessments, design, construction and renovation activities, technical assistance, and planning meetings. The project also worked with the directorate to update health center accessibility standards to meet the needs of patients with disabilities.

AHSE worked collaboratively with the RHBs, FMOH, Federal

INTERNATIONAL KNOWLEDGE SHARING FOR HEALTH SYSTEMS EXPANSION

AHSE Presentations at International Conferences

1. Improving HIV/AIDS Services Through Health Infrastructure
   Impacts of Health Facility Construction, Maintenance, and Utility Training Courses in Improving HIV/AIDS Services
   International Conference on AIDS and STIs in Africa; Addis Ababa, December 2011
2. Improving Medical Equipment Management
   Challenges of Medical Equipment Inventory Management and Pilot Implementation
   International Conference on AIDS and STIs in Africa; Addis Ababa, December 2011
3. Assessing Health Facilities to Improve Primary Care
   Structural Assessment of Primary Healthcare Facilities in Five Regions of Ethiopia
   13th World Congress on Public Health; Addis Ababa, April 2012
4. Strengthening Healthcare Delivery Through Waste Management
   Improving Healthcare Delivery in Five Regions of Ethiopia: A Secondary Data Analysis of Waste Management Practices and Innovations to Improve Quality Of Care
   American Public Health Association Annual Meeting; San Francisco, October 2012
5. Assessing Health Facilities to Improve Primary Care
   Structural Assessment of Primary Healthcare Facilities in Five Regions of Ethiopia
   American Public Health Association Annual Meeting; San Francisco, October 2012

Ministry of Education, public and private organizations, and international donors to build the capacity of more than 1,400 health professionals through workshops, training courses, and seminars on procurement, contract management, construction, renovation, maintenance, alternative energy, and related topics essential for the improvement of Ethiopia's health facilities. To standardize health infrastructure design and engineering, AHSE designed and implemented checklists for pre-construction activities to help make architectural, structural, sanitary, and electrical components of health facilities more uniform across the country. Through workshops, planning forums, meetings, and short-term technical assistance, AHSE fostered coordination between FMOH, local stakeholders, and international donors working on health infrastructure development. Sharing information at international conferences reinforced capacity building (see box).

To complement AHSE's health facility assessment, design, renovation, construction, standardization, and training activities, the project developed and implemented 14 pilot projects to target key areas for health systems improvement, with an emphasis on alternative energy solutions and water systems. The pilot projects were developed on a small scale to test feasibility and determine the potential for future replication and expansion by the FMOH, stakeholders, and international partners.

A lack of information at the FMOH, regional, and woreda levels about the status of existing and newly constructed health centers posed a significant challenge for the project. Without

Technicians at a rural health center perform a routine maintenance check to ensure that the recently installed PV solar system is functioning properly.

updated information about water and electricity supplies, human resources, geographical conditions, and construction quality, it was difficult to plan activities and identify target health centers. The health facility assessments, site adaptation activities, and design revisions carried out by the AHSE team — in collaboration with civil engineers at respective RHBs and supervising engineers at the woreda where the health center was located — made a significant contribution toward compiling this information to inform Ethiopian health infrastructure decisionmaking.

Although there were unique lessons learned for each component, central themes emerged by the end of the project. There continues to be strong need for training courses at the woreda, regional, and national levels, especially in construction management, healthcare waste management, and biomedical equipment maintenance. Another lesson learned is that health facility construction should be automated through the use of computer software to improve management and procurement processes. During the implementation of the alternative energy pilot projects, it became clear that health center staff should be involved in planning, installation, and maintenance, to foster ownership and ensure long-term sustainability.

During three years of implementation, AHSE laid the groundwork for future health systems expansion in Ethiopia, identifying successes, opportunities, and challenges in the country's complex healthcare environment. AHSE's key recommendations for continued improvement in the Ethiopian health sector include increasing training on health facility construction oversight management, improving biomedical equipment maintenance, healthcare waste management and housekeeping, and expanding alternative energy water supply and electricity generation projects. By building on AHSE's accomplishments, stakeholders can contribute to the expansion of Ethiopia's health systems and strengthen primary health services across Ethiopia.

© ETHIOPIA AHSE

The AHSE team assessed construction quality as well as electricity and water supply at rural health centers, such as the one shown here.

CHAPTER ONE

IMPROVED HEALTH CENTER CONSTRUCTION, RENOVATION, AND MAINTENANCE

PIR 1 | Government of Ethiopia and local authority capacity for construction, renovation, and maintenance strengthened

↑

KRA 1.1 | Procurement and management systems enhanced

↑

KRA 1.2 | Trained individuals deployed in Government of Ethiopia and local authority offices

BACKGROUND

The FMOH/PHID developed health center designs and began construction to achieve the Health Sector Development Program goal of having one health center to provide primary health services for every 25,000-40,000 people. Preliminary assessments carried out by the FMOH during the first phase of the program revealed that rapid building processes resulted in health facility construction problems that could have costly implications. Simultaneously, there was a need to increase the skills and expertise of professionals working on health infrastructure expansion, particularly mid- and senior-level FMOH and RHB employees responsible for managing construction contracts. AHSE assisted the government by building capacity for planning, assessment, and construction for health infrastructure decisionmaking.

MAJOR ACHIEVEMENTS

During the first two years of implementation, AHSE assessed 583 health facilities (527 health centers, 50 district hospitals, 5 health posts, and 1 regional laboratory) in the target regions. The team conducted integrated supportive supervision surveys and biomedical equipment assessment surveys, in collaboration with consultants from Addis Ababa University. Planners, architects, and engineers at the regional and woreda levels participated in survey and assessment activities to build local capacity. Project staff also assessed electricity and water supply, construction quality, and the availability of capacity building opportunities at the health facilities. AHSE exceeded the initial targets established for health facility assessments due to high demand from the RHBs to conduct quality audits and

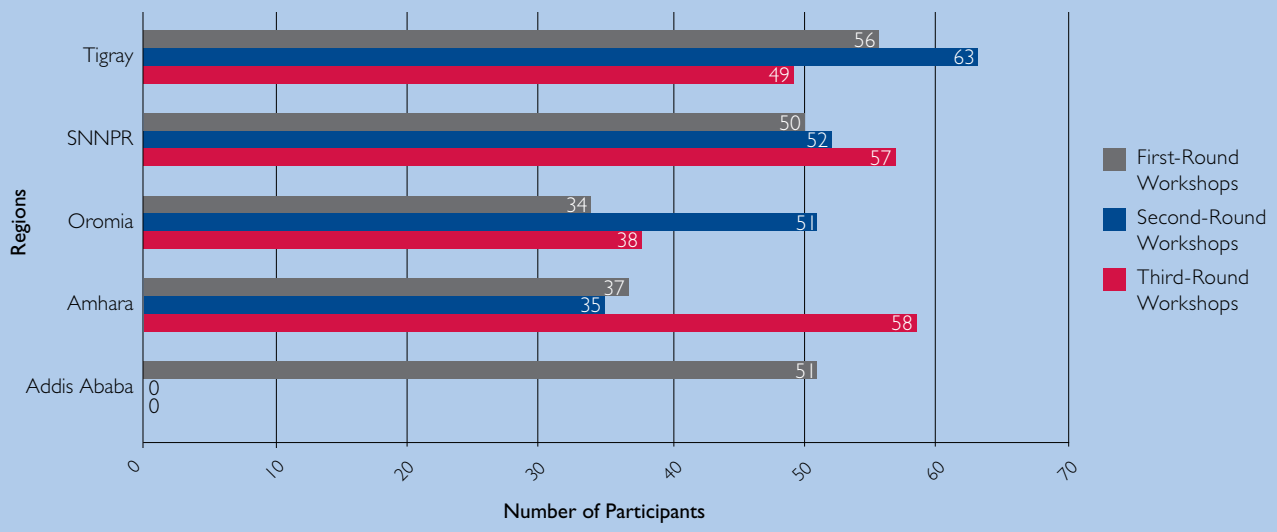
© ETHIOPIA AHSE

REGIONAL WORKSHOPS AND NUMBER OF PARTICIPANTS BY REGION

First-Round Regional Workshops	
Theme	*Health Center Planning, Design, Construction, and Operation Introductory Workshop*
Purpose	Build awareness about health infrastructure
Dates	Apr. to Aug. 2010
Topics	Socio-demographic issues of health centers; basic health center architecture; health facility planning; health facility pre- and post-construction activities and maintenance; water supply and sanitation for health centers; electricity for remote health centers & alternative energy sources; providing safe water for medical use in remote areas
Participation	Total 228 (195 male, 33 female) engineers, architects, health professionals, and administrative and management staff
Main Findings	Need for capacity building for engineers on construction oversight and management; need to solve resource bottlenecks at regional level; strong need for healthcare waste management systems at health centers.

Second-Round Regional Workshops	
Theme	*Standardizing Health Center Infrastructure, Utilities, Facilities, and Management Workshop*
Purpose	Promote health center standardization
Dates	Nov. 2010 to Jan. 2011
Topics	Gender integration at health centers; communicable disease prevention; integrating population, health, and environment; community mobilization in healthcare; procurement of consultancy services and works: procurement and tendering process; rooftop rainwater harvesting design; and management for remote health centers
Participation	Total 201 (184 male, 17 female) engineers, architects, health professionals, and administrative and management staff
Main Findings	Need to make health professionals aware of standards and guidelines; need to promote construction automation, especially using software for inventory and construction management; need for pilot projects to address lack of water and electricity.

Third-Round Regional Workshops	
Theme	*Strengthening Healthcare Infrastructure Development in Ethiopia: Scale Up, Own, and Sustain*
Purpose	Promote sustainability
Dates	Nov. 2011 to Feb. 2012
Topics	Healthcare needs of women and children; housekeeping and landscaping; structural assessments of primary healthcare facilities; continuous quality improvement; integrated disease surveillance and response; public health emergency management
Participation	Total 202 (174 male, 28 female) engineers, architects, health professionals, and administrative and management staff
Main Findings	Need to provide training on sustainability for local stakeholders; need to expand alternative energy projects, such as PV solar panels and wind turbines; need to involve local community in health center decisionmaking; need to expand use of software for inventory management at health centers.



assessments, particularly in the area of health center construction. Another reason the project was able to surpass the target for the number of health facilities assessed was that indicator targets were established only for Years 2 and 3 of the project (no indicator targets were set for Year 1) (see Annex B, Indicators 3.9.1 and 4.2.2). These surveys and assessments provided data to create standards for health facility design, construction, and maintenance and develop customized training courses to address key areas for Ethiopian health systems improvement and expansion.

Recognizing that sustainable development impact occurs when a project effectively trains host country nationals and firms, one of AHSE's guiding principles was to build the capacity of local stakeholders. To improve regional level decisionmaking, AHSE designated regional architects to work within each RHB to provide one-on-one mentoring on construction oversight and management for 22 engineers and planners at the SNNPR, Oromia, Amhara, and Tigray RHBs. The mentoring activities focused on strengthening the procurement process and improving management practices for health center construction. Representatives of the Ethiopian Public Procurement Agency provided key information on the requirements for procurement and contracting. By targeting technical and managerial leaders through direct mentoring, AHSE increased the quality of supervision at the regional level to ensure that the appropriate specifications, designs, and oversight mechanisms were in place for effective health center construction. Mentoring was not carried out in Addis Ababa, because the Urban Construction Bureau managed health facility construction and no engineers there were dedicated specifically to health facilities.

After identifying areas for improvement through the health center assessments, AHSE conducted three rounds of workshops in each of the five regions to foster information sharing among health professionals, engineers, and architects. Each round of workshops focused on a different theme with the goal of facilitating increased dialogue and partnership among professional associations, private companies, training institutions, government entities, and the public in the development of health infrastructure. More than 630 professionals attended the workshops to share expertise and lessons learned about Ethiopian health infrastructure (see opposite page). All meeting proceedings were made available to the public via the FMOH webpage.

Pilot Project: Training in Computer-Assisted Construction Management

Health system engineers and architects in Ethiopia often have to do their calculations manually or on Excel spreadsheets. AHSE launched a pilot project to train selected engineers and architects

© ETHIOPIA AHSE

Mulugeta Mideksa uses HarvestCEMS, a specialized computer program, to create an inventory of biomedical equipment at Black Lion Hospital. The automated system will enable the hospital to better serve patients by preventing maintenance interruptions and providing more accurate diagnosis and treatment.

SNAPSHOT
Hospital to Save Money While Improving Health Services

Black Lion Hospital, Ethiopia's largest teaching and specialty care referral hospital in Addis Ababa, is set to launch a biomedical equipment inventory system. The 56-year-old hospital has high patient volumes — staff treat an average of 1,500 patients each day — making it challenging to develop a systematic way to manage equipment. To respond to this issue, the USAID-funded Assistance to Health Systems Expansion (USAID/AHSE) project assessed biomedical equipment inventory practices at the hospital and introduced specialized software.

A two-day training on HarvestCEMS software was given to two engineers from Black Lion Hospital and the Federal Ministry of Health. Trainees learned how to use the software to generate maintenance schedules, send notifications about upcoming tasks, and access equipment maintenance manuals. As part of the training, a webinar was held with the U.S.-based software developers, who were able to answer questions. "Among all other software that we have seen, Harvest is the best because it was developed by a biomedical engineer. The program developer knows the environment very well," said Mulugeta Mideksa, Black Lion Hospital's biomedical engineering technical advisor.

Mideksa said that thanks to AHSE's efforts, Black Lion Hospital is taking steps to procure and implement the software. Johns Hopkins University, which has been providing assistance on information technology for the hospital's biomedical engineering department, has agreed to procure the software for the hospital. "Because we participated in the training and online discussion organized by AHSE," Mideksa said, "Harvest has agreed to give us a discount — for this, also, we want to thank AHSE."

Black Lion is the first hospital in Ethiopia to use software to create an inventory of all equipment and automatically schedule preventive maintenance. Once the software is fully implemented, there will be a "dramatic change in the hospital's way of doing business," Mideksa said. By using the software, Mulugeta estimates the hospital will save more than 10 million Ethiopian Birr (about $500,000) per year by reducing maintenance and repair costs, planning equipment spending more efficiently, and preventing maintenance interruptions.

Properly managed biomedical equipment enables health workers to diagnose patients accurately and save lives. In the future, Mulugeta hopes the software can be implemented at health facilities across Ethiopia.

on a multi-user, state-of-the-art construction management information system (ConMIS) that can be used for cost estimation, scheduling, and planning for materials (see Annex A).

CHALLENGES

As part of the Health Sector Development Program, the PHID began constructing health facilities in 2008 in an effort to achieve the goal of 3,200 health centers and increased primary healthcare services for the people of Ethiopia. Because AHSE was launched after the majority of health center construction began, particularly in rural areas, the project was only able to assist the FMOH/PHID and the RHBs in ongoing health center construction oversight activities. An earlier project launch would have enabled staff to collaborate with the FMOH/PHID and RHBs on systematic planning before the start of the construction phase and contribute to construction preparation and the initial health center design.

LESSONS LEARNED

After conducting assessments and mentoring RHB personnel, there continues to be a strong need to automate health center construction management by providing computer software training for engineers and architects working on health infrastructure expansion projects.

Biomedical and medical equipment lifetime management, from procurement through disposal, should be a priority.

Piloting creative interventions to mitigate the challenges in providing health centers with electricity and water should continue and be expanded to a larger scale.

In collaboration with stakeholders, project staff conducted site visits at health facilities across the five target regions — including the rural health center featured here — to assess construction quality, improve site adaptation, and develop health facility design, renovation, and construction guidelines.

CHAPTER TWO

STANDARDIZED HEALTH FACILITIES

PIR 2 | Standard facility design and maintenance systems institutionalized

↑

KRA 2.1 | Standard health facility blueprints, utility systems, and equipment packages analyzed and improved

↑

KRA 2.2 | Maintenance systems and standards for new and renovated health centers established

BACKGROUND

Before AHSE was launched, there was little information about the status of existing Ethiopian health centers in terms of structural integrity, maintenance practices, and electricity and water quality. In the first phase of implementation, AHSE's assessments showed that some of the health centers constructed across the country had construction problems and lacked access to reliable sources of electricity and water. In addition to health center construction and renovation challenges, health facility maintenance was given low priority at most health centers in Ethiopia. Because most health facilities lacked trained maintenance personnel and funding for these activities, there was a strong need to create feasible guiding documents on maintenance for existing and newly constructed health centers.

MAJOR ACHIEVEMENTS

AHSE visited more than 180 health centers in the target regions, during which project staff identified construction problems and provided technical advice to RHB supervisors, architects, and engineers.

Because most rural health centers were already under construction, AHSE was unable to contribute to the initial design, but rather carried out onsite adaptation to address the unique circumstances of each health center location. AHSE found that the rural health center standard design being implemented was not adapted to site-specific conditions, such as demographics, topography, soil type, available building materials, and climate. AHSE proposed refinements for the design that would allow adaptation for each location's specific conditions.

© ETHIOPIA AHSE

IMPROVED HEALTH CENTER DISABILITY ACCESS

AHSE's regional architect for Oromia recommended that a ramp be built to facilitate movement at the Mojo Health Center, which serves more than 50,000 people.

BEFORE

AFTER

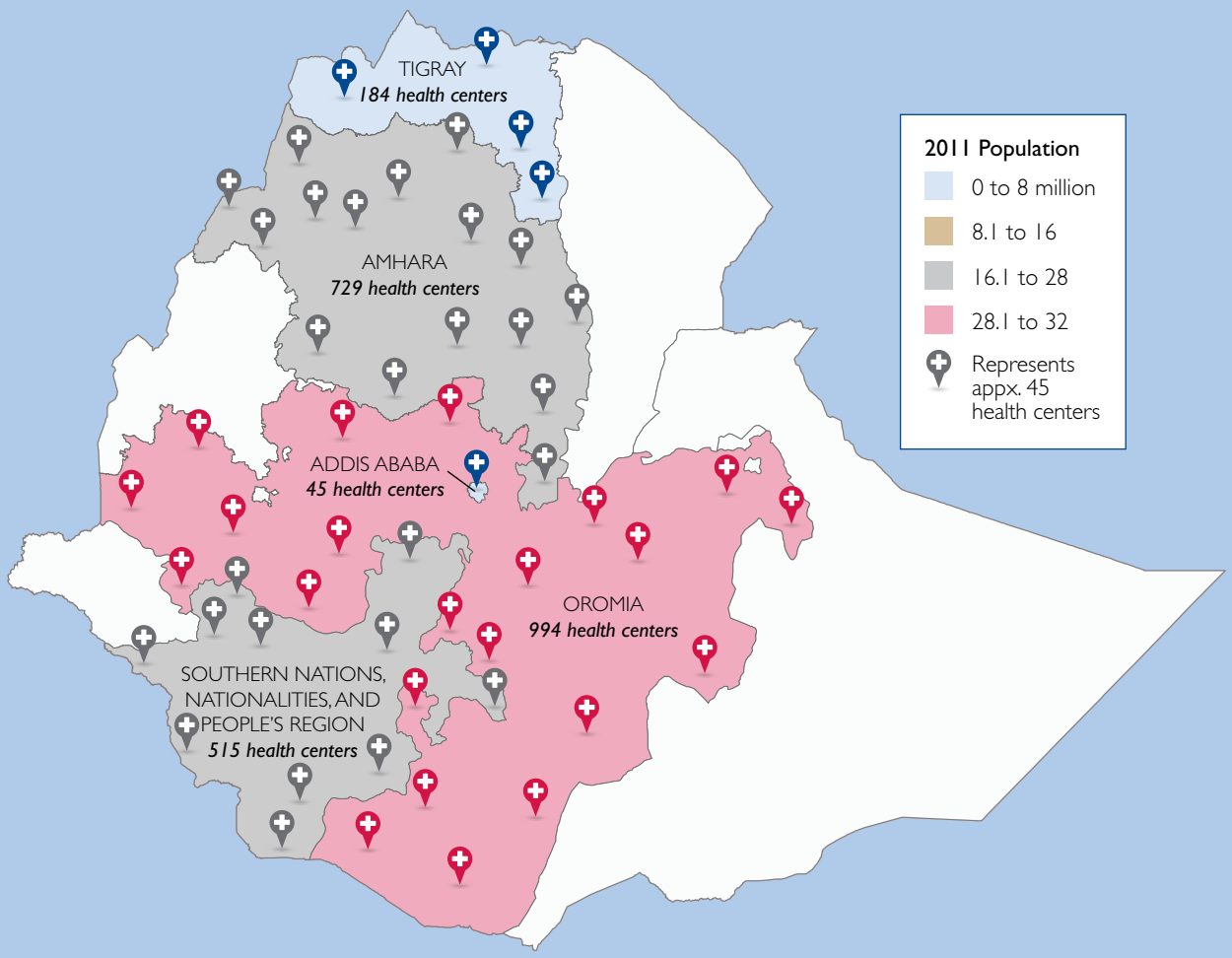
AHSE emphasized access for persons with disabilities by ensuring that ramps and other features to facilitate movement were in place throughout the health centers, especially those located in hilly areas with uneven terrain. Because these issues were not taken into consideration in the standard design, AHSE made a significant contribution to improving rural health center construction.

The PHID PMU and RHBs had quality control mechanisms, such as checklists, in place to monitor and evaluate health center construction activities, but lacked adequate human resources to implement these mechanisms properly during construction. To address this need, the regional architects embedded within the RHBs conducted periodic site visits, during which they identified a wide range of issues, such as deflected ceiling beams, poorly aligned and fractured hollow concrete block walls, and cracked, buckling, and/or crooked concrete columns. Under the guidance of AHSE's design and engineering director, the regional architects acted as independent third parties to ensure accurate reporting on construction quality and design issues to the PHID PMU. This provided an essential layer of oversight for the PHID PMU and the RHBs to ensure successful health center construction. After conducting a semi-annual follow-up assessment for AHSE's construction quality assessment, the PHID PMU reported that the number of health centers with poor-quality construction decreased from 185 in August 2010 to 114 in December 2010 — a 61 percent improvement.

AHSE identified the need to develop standard designs for multi-story urban health centers, which, under Ethiopia's tiered health system, are intended to provide primary healthcare services for 40,000 city residents. The team focused on improving patient flow within the facility, separating communicable disease treatment from routine outpatient activities, and addressing the needs of vulnerable populations, such as women, people living with HIV/AIDS, and individuals with disabilities. After reviewing international standards and the challenges identified in the Health Sector Development Program, AHSE developed a standard urban health center design. This standard design addressed sanitation and waste management systems, cross-ventilation issues, infection control, and efficient triage systems. There was an emphasis on meeting the healthcare needs of vulnerable groups by increasing access for persons with disabilities and dedicating specific areas to emergency obstetric care and HIV counseling. In collaboration with the Ethiopian National Association for the Physically Handicapped, AHSE incorporated access features, including ramps and accessible lavatories and corridors. These standards were developed in collaboration with the PHID and will be used by the FMOH for future urban health center development.

At the FMOH's request, AHSE assisted the PHID in formulating standard designs for primary hospitals — a new type of two-story, 7,000-square-meter facility with 30 to 50 beds needed to link health centers with higher

NUMBER OF HEALTH CENTERS CONSTRUCTED WITH AHSE'S ASSISTANCE



level general and specialty hospitals. The FMOH and RHBs are using this prototype to construct 700 primary hospitals across the country over the next three years. This timely intervention by AHSE will help the FMOH maximize the resources invested to expand Ethiopia's health infrastructure by effectively linking the tiers of the health system.

AHSE technical staff found that designs for district hospitals, which serve 60,000 to 100,000 people, lacked adequate flooring specifications for operating and delivery rooms, functional layout for patient flow, and separate administration areas, among other key elements for effective health services provision. The Oromia Health Bureau director of engineering and maintenance service commented that AHSE's efforts to refine the district hospital designs resulted in reducing the discrepancies among architectural, structural, and sanitary plans while staying within the RHB's budget. As a result of these activities, AHSE contributed to the improvement of the Guder, Agaro, Batu, Moyele, Chiroo, Kokossa, and Shashemene district hospitals under construction in Oromia, Ethiopia's most populated region.

The assessments carried out at the beginning of the project showed that there was a dearth of reference materials on health-care facility design, renovation,

Engineers and health infrastructure specialists prepare to conduct a construction assessment at a rural health center.

CONSTRUCTION QUALITY ASSESSMENT RESULTS

At the Gerba Fundido Health Center, which serves 25,000 people in SNNPR, AHSE recommended and assisted in repairing the septic tank, which improved safety and prevented the spread of infection.

BEFORE

AFTER

construction, and maintenance. Based on internationally recognized guidelines, such as those prepared by the American Society for Healthcare Engineering and the American Hospital Association, AHSE created the "Guidelines for the Design and Construction of Healthcare Facilities" for the Ethiopian healthcare context. After peer review by health sector experts representing professional associations, private consulting firms, government authorities, and RHBs, AHSE distributed the guidelines across the country and made the document available on the FMOH website. The guidelines will help government officials, healthcare professionals, engineers, and planners to make informed decisions about design, construction and maintenance issues, such as access for persons with disabilities, fire safety, seismic risk control, environmental health issues, and infection prevention.

AHSE also recognized the lack of established systems, guidance, and operation manuals on health center maintenance. The team developed a maintenance manual for health centers to address those needs.

CHALLENGES

Fragmented information on both existing and newly constructed health facilities in the country presented a challenge for selecting target health centers. The lack of information about health facility furnishings, water and electricity supplies, and human resources made it difficult to plan activities and coordinate efforts. AHSE conducted assessments to fill some of the information gaps and designed the geographic information system (GIS) base mapping pilot project to address this problem (see page 14 and Annex A).

Another challenge — that most of rural health centers were already under construction — prevented AHSE from contributing to the initial design standards. Project staff therefore focused on site adaptation for health centers being constructed to ensure that specific location conditions, such as topography and the availability of building materials, were taken into consideration.

Although AHSE initially set out to support health center design, construction, and renovation, a need arose to also contribute to primary and district hospital design to support Ethiopian health systems.

LESSONS LEARNED

The needs of health centers are constantly changing, as are the technologies available to address those needs. Standards and guidelines should be revisited periodically at the national, regional, zonal, and woreda levels to ensure that they are relevant and appropriate. Standards and guidelines are dynamic documents that should be adapted according to the unique conditions in which the health facility operates.

© ETHIOPIA AHSE

Trainees learn housekeeping techniques as part of a public-private partnership to provide professional housekeeping services for health centers in Addis Ababa.

CHAPTER THREE

LOCAL AND NATIONAL COORDINATION

PIR 3 | National and local health facility planning and coordination strengthened

↑

KRA 3.1 | National, regional, and local planning of health facility construction and renovation strengthened

↑

KRA 3.2 | Coordination of donors and stakeholders improved

BACKGROUND

The Health Sector Development Program requires close coordination between the RHBs and the PHID. The RHBs fall under the direction of the FMOH, but previously operated independently in many cases, with limited interaction with national-level decisionmaking. Woreda-level authorities often selected new health center locations, but lacked the equipment and training needed to effectively assess the site feasibility. Without the proper tools and coordinated efforts, it was difficult to evaluate proposed sites based on environmental factors, availability of energy sources, and proximity to existing health facilities at the woreda and regional levels. AHSE's planning and coordination efforts not only increased federal-regional-woreda communication but also integrated international donors in strategic planning to leverage resources for effective health systems expansion.

MAJOR ACHIEVEMENTS

Planning. AHSE's 22 short-term engineering consultants (architects; civil, electrical, and contract administration engineers; procurement; and monitoring and evaluation specialists) embedded in the PHID PMU directly supported the construction of 814 health centers (combined value of 1.3 billion Ethiopian Birr, or about $72 million) and provided technical support to the RHBs for the construction of 1,185 health centers (project value 2.1 billion Ethiopian Birr, or about $117 million). These experts reviewed designs and conducted site adaptation so that the health centers could be planned appropriately and modified during construction. To ensure effective use of health infrastructure funding, the short-term engineering consultants supported the budgeting and procurement processes by forecasting expenditures and supervising construction companies.

© ETHIOPIA AHSE

Technicians practice electrical equipment maintenance techniques during the practical session of a training course.

© ETHIOPIA AHSE

AHSE facilitated government planning by designing new features for the PHID's website (http://www.fmoh.gov.et) in both English and Amharic, making the site more dynamic and secure. The website, launched in January 2012, increased the FMOH's ability to share information on facility design, construction, maintenance, training activities, and health infrastructure planning with health professionals, international stakeholders, and the public.

Pilot Project: Introducing GIS Base Mapping to the FMOH

AHSE developed a GIS mapping pilot project to help facilitate the decisionmaking process as to where new facilities should be constructed. This pilot project provided a five-day GIS and geographic positioning system (GPS) training course for 26 representatives of the FMOH/PHID and RHBs from all 11 regions in Ethiopia. Twelve GPS units were supplied to the PHID for future mapping of health facilities. This project will help to establish base maps and profiles of health facilities, reduce the time and resources needed to plan for new health facility construction, and eventually contribute to the country's information communication technology and health management information systems initiatives (see Annex A).

Coordination. One of AHSE's guiding principles was to promote coordination within the government and between the FMOH, RHBs, and other

AHSE MAKES EXCEPTIONAL CONTRIBUTION

"The FMOH has many international partners, but few work directly with the PHID on health infrastructure projects to achieve the goals laid out in the Health Sector Development Program. As PHID's main partner, AHSE has fulfilled key coordination and capacity building needs to improve health infrastructure development. The planning and coordination forums have been integral for creating direct links between the activities of the government and local and international partners who previously worked independently of each other, often duplicating efforts. Without AHSE, capacity building would be very difficult for the PHID.

The Ethiopian three-tier health system has sparked the need to develop new types of health facilities, such as primary and general hospitals. AHSE played a key role in developing the designs for these facilities so that construction could be initiated in a timely manner to reach the Health Sector Development Program goals. AHSE has made an exceptional contribution to health facility design and assessment, capacity building, and human resources training in Ethiopia."

— Getachew Wolde,
PHID Director

stakeholders. Health Infrastructure System Development Planning and Coordination forums were held every two months to facilitate decisionmaking and promote consensus building on health facility infrastructure development among FMOH, RHBs, and international donors. Participants included representatives from the PHID, Health Services Directorate, Pharmaceutical Funding and Supply Agency, International Relief & Development, Tetra Tech, German Agency for International Cooperation (GIZ), Ethiopian Drug Administration and Control Authority, and other stakeholders. Through these forums, AHSE encouraged effective resource allocation for infrastructure planning within the FMOH/PHID, while leveraging international donor resources to improve health center design, construction, and renovation.

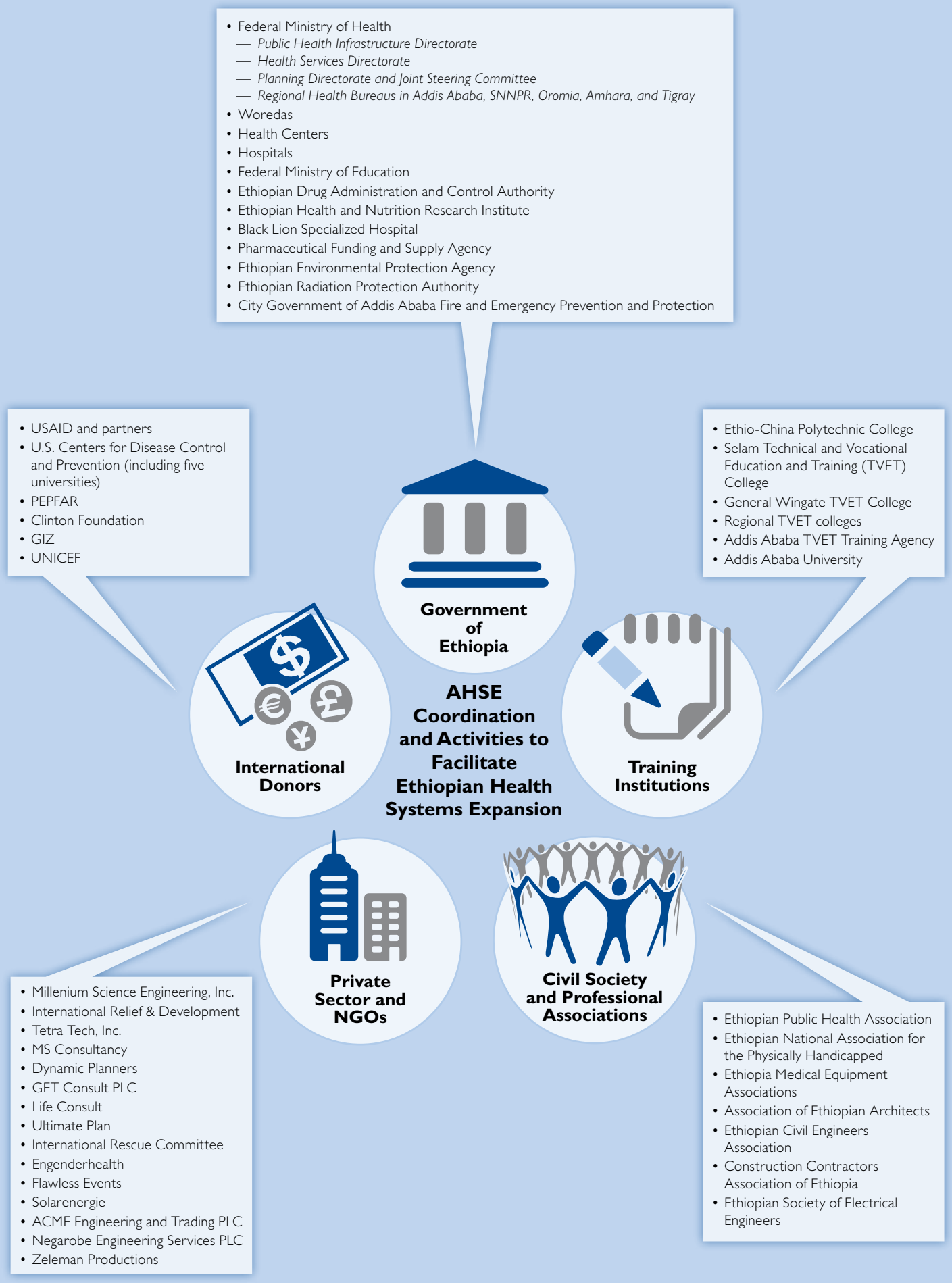
AHSE organized monthly meetings with staff from USAID and the Ethiopian Health Infrastructure Program to share information across USAID/Ethiopia health systems strengthening projects. Project staff shared lessons learned in the Ethiopian operating environment about the procurement process, health facility construction needs, and electricity and water systems. This collaboration enabled USAID's implementing partners to build on existing knowledge and avoid duplicating activities.

AHSE arranged consultative meetings with professional associations, including the Ethiopian Public Health Association, Association of Ethiopian Architects, Ethiopian Civil Engineers Association, Construction Contractors Association of Ethiopia, Ethiopian Society of Electrical Engineers, and local consulting firms. Representatives from these organizations provided inputs for AHSE's annual work planning, development of training modules, guidelines and manuals, and design of pilot projects.

Environmental concerns were addressed during consultative meetings with the Ethiopian Environmental Protection Authority. Specialists from Addis Ababa University's public health, architecture, and civil and electrical engineering departments provided inputs to address public health, fire safety, and radiation concerns.

By organizing regular meetings with the National Technical Working Group, RHBs, and PHID and facilitating several ad hoc consultative meetings with the FMOH and stakeholders, AHSE was able to surpass the targets set for planning and coordination meetings with stakeholders concerning health center construction and renovation. The project also facilitated the semi-annual Health Infrastructure Planning and Coordination Forum, although the second forum in Year 2 and both forums in Year 3 did not take place due to key stakeholders' competing priorities (see Annex B, Indicators 3.1.3, 3.2.1, 3.2.2).

AHSE COORDINATION AND ACTIVITIES



Pilot Project: Regional Planning and Coordination

A massive undertaking like the GOE's effort to expand Ethiopia's health infrastructure requires coordination and planning. AHSE hired five nurses with planning experience to serve as coordinators for the project's five target regions. These regional coordinators helped form 11 partnerships, bringing together the efforts of government agencies (including some outside the FMOH), educational institutions, non-governmental organizations (NGOs), and donors to help develop Ethiopia's health system infrastructure (see Annex A).

Pilot Project: Outsourcing Housekeeping to a Public-Private Partnership

A clean and safe health facility builds confidence in the services provided and translates into improved patient satisfaction. Because health facility staff are often too busy to perform housekeeping activities themselves, outsourcing these services is one possible solution. AHSE established a public-private partnership (PPP) to train people to provide professional housekeeping services for health centers, providing trainees with cleaning tools, personal protective equipment, and seed money to establish their own housekeeping firm. Health facilities in the Addis Ababa area can outsource housekeeping services to this firm for a reasonable fee (see Annex A).

CHALLENGES

Government staff had to manage competing commitments, which made it difficult to achieve full representation from various levels of government at the coordination meetings.

LESSONS LEARNED

Coordination meetings with government representatives and implementing partners helped to avoid duplication of efforts. Government and other stakeholder plans for expansion, renovation, and upgrades often did not match. Some health system expansion activities were not reported, and others were double-counted. In some cases, construction of a health center was completed, but staff, furnishings, and equipment were not available.

Another lesson learned was that community participation in health sector decisionmaking, especially health center planning, site selection, and maintenance, is important for sustainable health facilities expansion.

A trainer teaches participants about cleaning techniques, sanitation, and personal safety during a health facility housekeeping training course.

CHAPTER FOUR

TRAINING AND CAPACITY BUILDING

PIR 4 | Limited pre-service training packages developed and integrated

↑

KRA 4.1 | Appropriate pre-service vocational training identified, expanded, and delivered

↑

KRA 4.2 | Advocacy to Government of Ethiopia on human resource requirements for health facility maintenance conducted

BACKGROUND

AHSE conducted customized assessments to identify training needs for health center workers, plumbers, electricians, solar energy technicians, electrical equipment repair personnel, sanitary engineers, and maintenance and landscape workers. Staff then designed and implemented training courses that incorporated both theoretical and practical information to respond directly to health infrastructure training needs. By targeting a wide range of professionals working across the country, these training courses acted as a catalyst for strengthening Ethiopian health systems.

MAJOR ACHIEVEMENTS

AHSE developed curricula in priority health center construction, renovation, and maintenance areas by using competency-based training and adult learning principles. With an emphasis on local partnerships, project staff worked with the PHID, RHBs, and colleges of technical and vocational education and training (TVET) to develop training-of-trainers (TOTs) and on-the-job training (OJT) courses. AHSE training specialists focused on in-service learning for these professionals, combining on-site activities, field visits, problem-solving, and mastery approaches for integrated learning experiences. "The trainings were very different, beyond our expectations," said a health facility plumbing trainee. "We had theoretical knowledge before, but our practical training was very low. This time, we had practical, hands-on training." These strategies not only made the training courses relevant for day-to-day work but also kept training course costs to a minimum by avoiding expensive training venues.

AHSE worked with the Federal Ministry of Education and TVET colleges to develop licensure programs and collaborated with General Wingate TVET

> **" The trainings were very different, beyond our expectations. "**
>
> **A HEALTH FACILITY PLUMBING TRAINEE**

© ETHIOPIA AHSE

TRAINING INNOVATION IN ETHIOPIA

AHSE made a significant contribution to Ethiopian health systems expansion by developing new courses on health facility housekeeping, plumbing, biomedical equipment installation, health facility electrical equipment installation, and "first look" repairs — key training topics never before addressed in the Ethiopian health sector.

College to develop a health facility housekeeping course for its new Housekeeping and Laundry Service Program. College officials have committed to offering the housekeeping course for the long term. Similarly, AHSE worked with Ethio-China Polytechnic College to develop biomedical equipment maintenance and "first look" repairs training courses and with Selam TVET College to develop health facility plumbing and photovoltaic (PV) solar installation and maintenance training courses. Through these collaborative efforts, AHSE institutionalized health facility medical equipment repair, maintenance, plumbing, and PV solar systems curricula at educational centers, increasing the sustainability of training opportunities for Ethiopian health workers.

AHSE developed and deployed more than 50 training modules in key management areas through the regional workshops and core training packages. The team developed about 22 key training modules in the first year alone. In Years 2 and 3, the project delivered more training courses in key management areas than planned after receiving positive feedback from workshop and training participants. Due to the high level of interest in the training, and the fact that indicator targets were only established for Years 2 and 3 (no indicator targets were set for Year 1), AHSE exceeded the indicator target for number of training modules developed and deployed (see Annex B, Indicator 1.2.5).

The project trained 802 individuals across the five target regions in construction management and maintenance skills such as plumbing, equipment repair, PV solar energy, landscaping, healthcare waste management, and construction management. These national, regional, woreda, and local training courses created a conducive environment for technicians and managers to develop key skills to contribute to health infrastructure expansion and health facility maintenance (see table on opposite page).

Participants in the national TOTs, or "first-generation," courses did not conduct as many regional, or "second-generation," training sessions as initially planned due to the need to reallocate funds to pilot projects, which included regional-level training components. However, AHSE trained more than 1,300 Ethiopian professionals on strategic information activities — such as information management and monitoring and evaluation issues — for health systems expansion through regional workshops and core training packages. The project surpassed the overall targets for providing training on strategic information activities due to the success of these regional workshops and core training packages, as well as the fact that targets were set only for Years 2 and 3 (see Annex B, Indicator 1.1.5 and 1.2.1).

AHSE's training impact assessment, which was conducted for 110 trainees six months after the training courses were delivered, showed that 92.7 percent of trainees from the construction oversight and management, biomedical equipment maintenance,

PARTICIPATION IN INTERNATIONAL WOMEN'S DAY

A video documenting AHSE's contributions to women's empowerment through training was produced for the International Women's Day celebration in March 2012. The video, which is included on the DVD accompanying this report, captures participants' feedback on the biomedical medical equipment maintenance, housekeeping, landscaping, and healthcare waste management training courses.

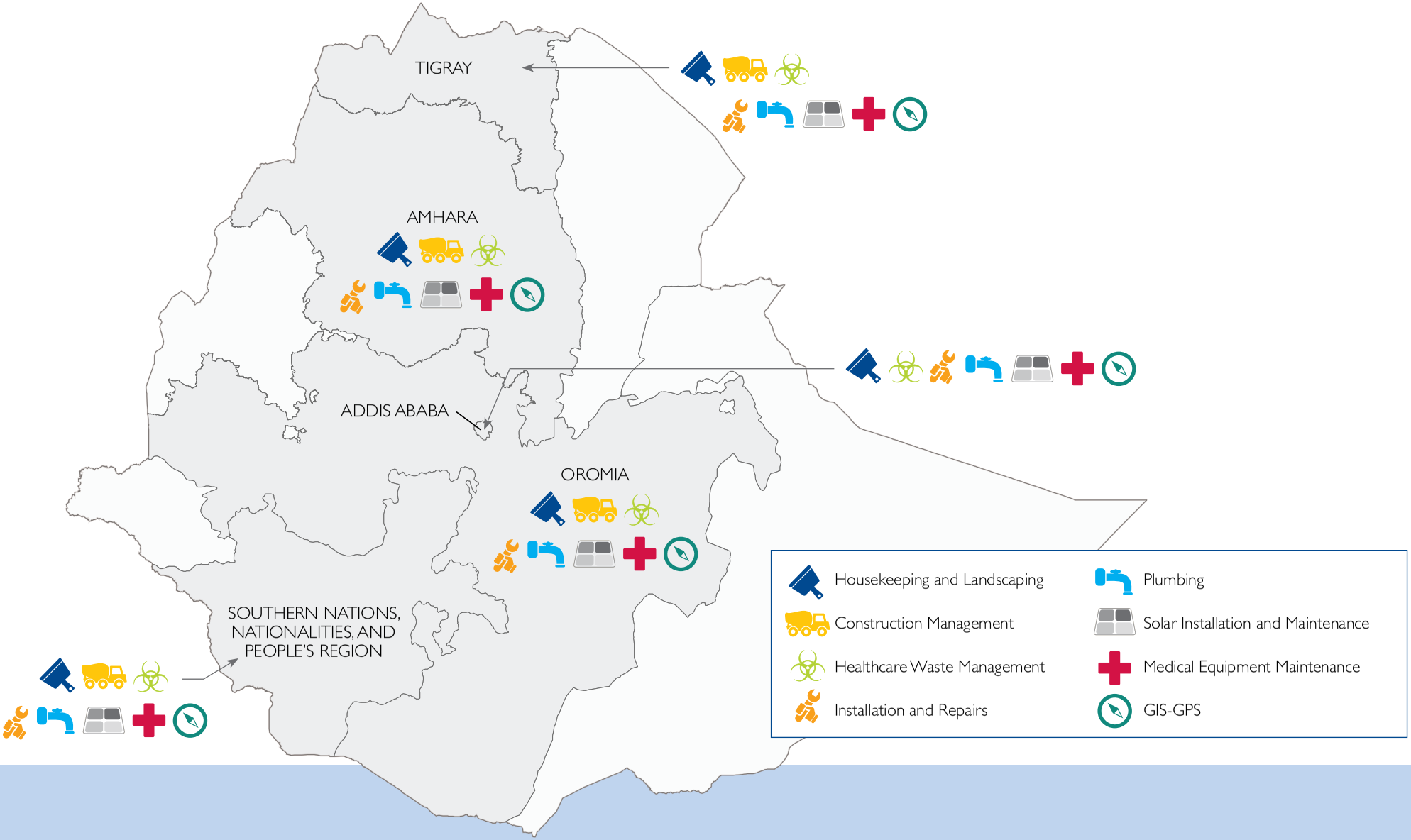
and basic electrical installation courses described the courses as very useful in performing their activities. More than 85 percent of the trainees reported that they made changes in their working practices after attending the training courses. Eighty-five percent of the trainees said they shared the knowledge they gained from the training with their colleagues.

Trainees expressed a strong commitment to applying the newly acquired knowledge in their workplaces. "Proper waste disposal is a new concept for us," said a healthcare waste management trainee. "Hazardous and infectious waste generated by health centers has to be managed properly to ensure our safety and that of our patients." A regional health facility housekeeping trainee said her course taught her how important her work is for Ethiopian health services. "We have agreed that we can bring about transformation in the health system of our country," she declared.

After participating in the biomedical equipment repair and health facility electrical principles training courses, engineers and technicians can now solve utility problems and maintain electrical systems at health facilities across the country. A training participant who works at the Addis Ababa City Administration Health Bureau commented, "In the future, I plan to share the skills and knowledge I have gained with my colleagues at the Addis Ababa Regional Health Bureau, hospital, and health center." A trainee from the electrical equipment principles course said that she learned how to convert direct current to alternating current and now feels confident that she can maintain the equipment at the health center where she works.

Training Courses	Number of People Trained
Health Facility Housekeeping	173
Health Facility Landscaping	10
Construction Oversight and Management	90
Health Facility Electric Equipment Installation and "First Look" Repairs	86
Basic Health Facility Electric Equipment Principles and Service Installation and Maintenance	86
Health Center Medical Equipment Maintenance and "First Look" Repairs	73
Healthcare Waste Management	76
Health Facility Plumbing	81
PV Solar System Installation and Maintenance	59
Biomedical Equipment Installation, Repair, and Maintenance	30
GIS-GPS Training (participants from all eleven regions of Ethiopia)	26
Computer-Assisted Construction Management	12
TOTAL	**802**

TRAININGS BY TARGET REGIONS



HEALTH FACILITY HOUSEKEEPING CASCADE TRAINING

PHASE I: NATIONAL LEVEL

Modality: Training-of-Trainers **Time:** 2 weeks/80 hours

Location: Addis Ababa

Trainers: General Wingate TVET and AHSE trainers

Participants: 22 staff from RHBs

Language: English

Topics:
- *Personal protective equipment*
- *Infection prevention*
- *Health facility cleaning*
- *Culinary services*
- *Laundry*
- *Pest control*
- *Preventative maintenance*
- *Waste management*

PHASE II: REGIONAL LEVEL

Modality: On-the-Job Training **Time:** 1 week/40 hours

Location: Addis Ababa RHB
Trainers: RHB staff
Participants: 30 health center staff
Language: Amharic

Location: Tigray RHB
Trainers: RHB staff
Participants: 30 health center staff
Language: Tigrinya

Location: SNNPR RHB
Trainers: RHB staff
Participants: 30 health center staff
Language: Amharic

Location: Amhara RHB
Trainers: RHB staff
Participants: 30 health center staff
Language: Amharic

Location: Oromia RHB
Trainers: RHB staff
Participants: 30 health center staff
Language: Oromiffa

PHASE III: LOCAL LEVEL

Modality: On-the-Job Training **Time:** Varied, according to health center needs

Location: Local health centers
Trainers: Health center staff
Participants: Health center staff
Language: Local

Location: Local health centers
Trainers: Health center staff
Participants: Health center staff
Language: Local

Location: Local health centers
Trainers: Health center staff
Participants: Health center staff
Language: Local

Location: Local health centers
Trainers: Health center staff
Participants: Health center staff
Language: Local

Location: Local health centers
Trainers: Health center staff
Participants: Health center staff
Language: Local

Location: Local health centers
Trainers: Health center staff
Participants: Health center staff
Language: Local

Location: Local health centers
Trainers: Health center staff
Participants: Health center staff
Language: Local

Trainees from the RHBs in the five regions learn about health facility plumbing during a TOTs course at Selam TVET College in Addis Ababa in October 2010.

© ETHIOPIA AHSE

Pilot Project: Producing a Comprehensive Training DVD

Training videos offer a feasible, cost-effective alternative to OJT courses for thousands of professionals that support Ethiopia's expanding health system. Through a pilot project, AHSE produced a DVD covering personal protective procedures, health center waste management, housekeeping, environmental health, and equipment maintenance and safety. The video includes narration in English, Amharic, Oromiffa, and Tigrinya and is easy to duplicate and transport to health facilities across Ethiopia (see Annex A).

Pilot Project: Medical Equipment Maintenance Training

Most of Ethiopia's health facilities have no medical equipment maintenance program, trained maintenance technicians, or adequate maintenance budget. This has compromised health services and led to the mismanagement of resources. Through a pilot project, AHSE conducted OJT for 73 health center technicians in medical equipment maintenance and repair, and created a standard logbook (the first of its kind in the Ethiopian primary healthcare system) for the maintenance, cleaning, repairing, and installation of the equipment (see Annex A).

Pilot Project: Integrated Healthcare Waste Management Training

Many health facilities in Ethiopia have no systems in place to ensure proper healthcare waste collection, transport, treatment, and final disposal. To respond to this need, AHSE developed a pilot project to train 76 RHB officials and health center staff involved in waste management at health centers from the five target regions. The course included classroom sessions and practical, hands-on work focused on segregating, collecting, transporting, and disposing of healthcare waste and using personal protective equipment (see Annex A).

Pilot Project: Building Better Incinerators to Destroy Infectious Waste Safely

Incinerators at health centers are often broken. Even when they work, they do not burn hot enough to destroy infectious waste and sharp items. Using local labor, materials, and construction techniques, AHSE built a dual-chamber incinerator at Wolliso Health Center in Oromia that can reach the proper temperatures to dispose of infectious waste safely (see Annex A).

CHALLENGES

A training challenge was finding effective ways to teach participants about specific electricity, plumbing, and maintenance needs at health facilities and how they relate to the provision of health services for health facility end users and support staff.

At times, it was difficult to reach agreement with the RHBs on training priorities, particularly between strengthening health infrastructure development programs (such as health facility plumbing and electricity) and clinical aspects of health service delivery.

LESSONS LEARNED

AHSE continued to receive training requests from RHBs, health centers, and hospitals during the final months of the project. It is important for the FMOH and stakeholders to continue providing training courses, particularly in the areas of healthcare waste management and biomedical equipment maintenance, to meet training needs at the woreda, regional, and national levels.

It is important to invite health center staff to participate in developing the training courses so they can learn how to conduct assessments and determine training objectives. These professionals understand the unique context in which the health center functions and can develop materials in local languages to increase health facility training opportunities for diverse communities across Ethiopia.

AHSE training courses combined hands-on and theoretical sessions during OJT at health facilities. This was appreciated by the trainees and respective regional offices and health facilities.

OJT was cost effective, time saving and practical, allowing participants to learn in a familiar environment and also allowing for participation by health center managers.

A health worker checks the level of the water storage tank, which is part of the rainwater harvesting system at the Biyo Health Center.

CHAPTER FIVE

INNOVATIONS FOR WATER AND ELECTRICITY SYSTEMS

PIR 5 | Government of Ethiopia and local authorities supported in addressing electricity and water systems

↑

KRA 5.1 | Electricity and water assessed at selected health centers

↑

KRA 5.2 | Direct support provided to selected health centers for water or electricity upgrading and pilot projects

↑

KRA 5.3 | Communication materials to support the efficient use of electricity and water in health facilities developed

BACKGROUND

Most health centers are equipped with properly installed and tested electrical circuits and plumbing systems, but many lack running water and electric power to make the health center fully functional. Many rural health centers are not connected with the national grid, making it difficult to access consistent electricity sources. Although some health centers have electrical generators, many are not being used because they need to be repaired or lack fuel.

Due to the unavailability of water and electricity, particularly in remote areas, communities do not receive proper medical attention and in many cases are referred to another health center, which involves considerable travel time and cost. In these conditions, health workers are unable to provide satisfactory health services for their patients and experience low job satisfaction.

MAJOR ACHIEVEMENTS

The AHSE team assessed 83 health centers to determine the availability of potable running water and electricity sources. Results showed that most health centers lacked consistent access to electricity and water supplies, and many serve a larger population than their intended capacity, particularly during seasons with peak malaria levels. Only 31 percent of the health centers had an adequate supply of clean water.

AHSE's technical experts researched shallow ground water, solar, and wind technologies to determine which alternative energy solutions could be used for pilot projects in the Ethiopian context. Of the 14 pilot projects developed by AHSE, six tested alternative energy technologies. These projects were developed based on potential technology transfer, feasibility, sustainability, impact on quality of health services, and stakeholder support.

© ETHIOPIA AHSE

On October 12, 2010, people from the local community fetch water from a hand-dug well, which is the only source of water for the Golesha Health Center in Amhara. AHSE assessments showed that the water from the well was not clean and could spread infection. A new, properly drilled well could provide clean water for both the health center and the local community.

© ETHIOPIA AHSE

There was a focus on small-scale renewable energy applications to contribute to climate protection while improving the quality of health services. These pilot projects leveraged the knowledge of Ethiopian firms with specialized experience in local water systems and electrical grids.

The AHSE team worked to reduce water and utility problems at health centers through training activities, the distribution of communications materials, and testing alternative energy pilot projects that can be scaled up in the future. AHSE not only provided training on water and electricity systems but also distributed technical bulletins, newsletters, and communications materials to the FMOH, RHBs, zonal and woreda health offices, workshop and core training participants, and other stakeholders. These materials provide detailed information on managing utilities and on using alternative energy applications for water and electricity systems. By implementing alternative energy pilot projects and providing recommendations for future scaling up of these technologies, AHSE has made a significant contribution to developing sustainable water and electricity solutions for Ethiopian health facilities (see Annex B, Indicators 5.2.2, 5.3.2, and 5.3.3).

Pilot Project: Bringing Hot Water to the Shiro Meda Health Center

Electrical water heaters use a lot of energy, consuming limited electricity that could be used for medical equipment. Given Ethiopia's abundant sunshine, solar water heating offers a pragmatic solution. AHSE built a solar water heater at Shiro Meda Health Center in Addis Ababa, giving the center a reliable supply of hot water through clean, renewable energy (see Annex A).

Pilot Project: Training Technicians to Install and Maintain PV Solar Systems

Over 50 percent of Ethiopia's health centers lack electrical power, especially those in rural areas. Using PV solar systems to generate electricity is a viable alternative for centers in off-grid areas. In collaboration with GIZ, AHSE provided OJT to teach technicians how to install and maintain PV solar systems (see Annex A).

Pilot Project: Harvesting Rainwater From Rooftops

Some health centers are located in remote areas, far from any water source. Harvesting rainwater is an economical way to supply these centers with potable water. AHSE built systems at two health centers to collect rainwater from rooftops through gutters and downspouts, and then filter and pump it to elevated water tanks. The centers now have enough water to provide health services for the populations they serve (see Annex A).

Pilot Project: Installing a Solar-Powered Disinfection Unit

Along with the rooftop rainwater harvesting project at Biyo Health Center, AHSE launched an additional pilot project to install a solar-powered disinfection unit, an excellent option for health centers that have plenty of sun and need purified water. The unit has the capacity to disinfect up to 1,850 liters of harvested rainwater per day for use in the delivery and laboratory rooms. This pilot project has great potential to be replicated in other health centers where the water supply is not clean enough for clinical activities (see Annex A).

Pilot Project: Installing a Wind Turbine at Bura Barak Health Center

Health centers without electrical power have difficulty providing basic healthcare services; medical appliances that require electricity cannot function, making laboratories virtually useless. AHSE purchased and installed a state-of-the-art wind turbine at Bura Barak Health Center, which was off the power grid but was exposed to powerful winds. The wind turbine now provides electricity for the new health

PV SOLAR ENERGY SYSTEMS INSTALLATION AND TRAINING PILOT PROJECT: OUTCOME ANALYSIS

SITUATION

- 78 health centers without electricity were assessed to determine pilot project feasibility

OBJECTIVE

- Select 4 rural health centers (one in each region, except Addis Ababa) for pilot projects with the following criteria:

Outside of national electrical grid

Accessible for installation and training

- Provide on-the-job training for technicians on PV solar installation and maintenance
- Develop collaboration with RHBs and GIZ

OUTPUTS

- Trained 22 health center staff on PV solar energy systems installation, operation, and maintenance
- Installed 2.04 kilowatt panels at 4 health centers
- Equipped trainees with basic PV solar energy tools

OUTCOMES

- Increased patient flow in target health centers:

Ardibo Health Center, Amhara:

Patients/day: 5-8 to 20-25

Burka Dembel Health Center, Oromia:

Patients/day: 10 to 25-30

Vaccinations/ week: 18 to 37

Deliveries/ week: 1 to 7

Haroshifa Health Center, SNNPR:

Patients/day: 49 to 79

Tseadalaka Health Center, Tigray:

Patients/day: 10-15 to 25-30

- Emergency health services provided at 4 health centers
- Increased health workers' motivation and working hours
- Reduced transportation time and cost for patients who previously would have been referred to other health facilities for laboratory services
- Consistent refrigeration and use of vaccines and drugs
- Leveraged resources by collaborating with RHBs and GIZ
- Provided on-the-job training for technicians at selected health centers on PV solar installation and maintenance

center. Community members no longer have to travel to the nearest town for medical care. The microscopes, sterilizer, and other laboratory equipment now work. The center has begun to provide services at night, allowing it to treat more patients (see Annex A).

Pilot Project: Drilling Water Wells at Health Centers

Ethiopia has an ample supply of ground water. This supply has to be tapped, however. Without wells to access the ground water, many health centers have to bring in water by donkey. AHSE joined forces with the U.S. Army's Combined Joint Task Force – Horn of Africa (CJTF-HOA) to drill wells at health centers in southern Ethiopia serving more than 70,000 people (see Annex A).

CHALLENGES

The main challenge in implementing the alternative energy pilot projects was identifying contractors, mainly due to the small size of the projects. For example, the requests for proposals for the rainwater harvesting and wind turbine projects had to be extended because there were only a few bidders, which delayed implementation.

LESSONS LEARNED

It is helpful for contractors to provide user manuals and train health center workers to troubleshoot problems to promote ownership and increase sustainability.

It is crucial to carry out feasibility assessments before implementing water and energy pilot projects to determine if the project is appropriate for the health facility.

© ETHIOPIA AHSE

Oliyad Bilbila, Biyo Health Center laboratory technician, demonstrates how rainwater collected from the roof of the health center is transferred to the reservoir and then filtered through a sedimentation process. Next, it is piped through a solar-powered disinfection unit and stored in water tanks. The health center now has potable water for deliveries, laboratory analysis, and healthcare services.

SNAPSHOT
Alternative Water Supply for Biyo Health Center

In the past, health workers at the Biyo Health Center in Oromia were unable to properly treat patients who had traveled on foot or on horse-drawn carts from as far as 20 kilometers away due to the lack of water. Because of high rainfall in the area, AHSE selected the health center to implement rooftop rainwater harvesting and photovoltaic (PV) solar disinfection systems.

Before the water systems were installed, health center staff often served their patients with water brought from nearby wells. "The well water was contaminated and unfit for healthcare purposes," said Sister Meka Abdella, a midwife at the health center. "Hand washing is basic before and after any procedure, but this was the only water we had to clean our hands and our instruments before and after delivery."

Sister Meka explained, "When a mother came to our center to deliver her baby, it was difficult to ask the women that accompanied her to fetch water. We stored water collected from wells and rain for such emergencies, but in many cases we asked patients to bring their own water."

Now, water is collected in the rainwater harvesting reservoir, passed through a PV solar disinfection unit, and then stored in water tanks. Sister Meka confirmed that this new system will dramatically change health services at the center, saying, "Now we have clean, potable water for washing our utensils and hands, and we can also keep the facility clean."

Oliyad Bilbila, a laboratory technician, described how the water systems will enable him to better serve his patients. Previously, he was unable to conduct stool, blood, and pregnancy tests because there was no water to wash laboratory utensils or clean his hands. Now, he looks forward to providing laboratory services for the community. "We have been trained to serve the people," he said, "but without the means to provide much needed health services, we were frustrated and concerned about losing our skills. Now we are able to properly diagnose patients, perform laboratory analysis, and give appropriate treatment, which brings us great satisfaction."

© ETHIOPIA AHSE

Messele Kassahun, Burka Dembel Health Center director, demonstrates how electricity provided by the PV solar system powers the laboratory microscope. With assistance from USAID, the PV solar system now supplies electricity for centrifuges, sterilizers, refrigerators, and light bulbs as well as microscopes.

SNAPSHOT
Solar Panel Brings Electricity to Health Center

In May 2012, the Burka Dembel Health Center staff were busy unpacking and installing refrigerators, sterilizers, centrifuges, and electronic microscopes that had been in storage for two years. Thanks to the photovoltaic (PV) solar energy system recently installed with assistance from USAID, as well as the German Agency for International Cooperation, health workers at the center now have electricity for equipment needed to properly diagnose and treat their patients.

Located in Oromia, about 12 kilometers down a dirt road from the main highway, the Burka Dembel Health Center had previously been inactive. Despite its proximity to the community and a nearby elementary school, its lack of electrical power made refrigeration of vaccines impossible and kept the center from being open at night.

"We did not have the resources to treat emergency cases like rabies," said Burka Dembel's director, Messele Kassahun. "We had to travel to the nearest town on motorbike to get medicines in boxes with ice that would last about a day, and then throw out the unused drugs. Patients knew that the health center could not provide medical services, and would travel past it to go to other health facilities. Work was very frustrating."

"For some reason, babies choose to come to this world at night," said Kassahun with a smile. "We are prepared for it now. We are happy to bring these babies into the world, since we now have power in our health center. Mothers are happy to give birth here. Before there was electricity, the health center only had one delivery. Since the PV solar installation, we have had eight successful deliveries in just one month."

The PV solar energy system has brought many benefits. "The community now believes in us," Kassahun said. "Before the PV solar panel was installed, it was impossible to get anybody to come to outreach programs. Recently, we organized a nutrition outreach program and the center was filled with people. We now are confident that we can not only teach the community about HIV/AIDS, immunizations, and nutrition, but also provide voluntary counseling and testing and immunization services at our center."

PV solar systems installed with assistance from USAID provide electricity for the Haroshifa Health Center in SNNPR, the Tsadalaka Health Center in Tigray, and Ardibo Health Center in Amhara Region. More than 20 health workers at these centers have been trained to maintain the solar panels, ensuring long-term high-quality health services for their communities.

© ETHIOPIA AHSE

Jebessa Tesfa, Bura Barak Health Center director, explains how the wind turbines convert wind energy into electric power. He says the alternative energy source is easy to implement and maintain and is the most suitable for remote areas.

SNAPSHOT
Wind Turbines Bring Health Center to Life

"These health workers are serving us very well," said a farmer who came to the Bura Barak Health Center in the mountains of Oromia to inquire about immunizations for his newborn baby. "Immunization services for our other children were provided by health extension workers who visited our home," he said, pointing to a tin roof that could be seen from the high elevation of the health center. He wanted to know if the health center could provide immunizations for his newborn, rather than waiting for the health extension worker's next visit.

Bura Barak Health Center is located on a winding dirt road about 40 kilometers north of Addis Ababa, and previously did not have electricity to store vaccines. USAID provided assistance to install wind turbines to supply electricity to the remote health center. The health center now has electricity to power refrigerators, laboratory equipment, and lamps for provision of health services at night. Because health workers at the center can provide immunizations and health services for the local community, health extension workers can now focus on making house calls for families that live in remote areas beyond the reach of the health center.

"We now can efficiently serve the community with deliveries, immunizations, and emergency services," says Jebessa Tesfa, Bura Barak Health Center director. "Previously, patients with tuberculosis had to travel to Addis Ababa or a nearby town called Sendafa to give sputum samples, a distance of over 30 kilometers — a 3- to 4-hour trek on foot. Now they can come to the health center to receive these services."

He added, "After accidents and deliveries, the most common health concern in this area is parasitic illnesses. The laboratory is crucial for making accurate tests and diagnosing patients. With a microscope, centrifuge, and sterilizer, we can efficiently manage problems now."

The health workers told the farmer to bring his wife and their baby to the health center for timely immunizations. They also asked him to tell his neighbors that immunizations and other healthcare services are now available at the health center.

© ETHIOPIA AHSE

The AHSE team collaborated with the U.S. Army's CJTF-HOA to drill wells at three health centers using specialized equipment and materials. These wells will provide clean water for health services and the local community.

SNAPSHOT
Ground Water to Benefit Health Centers and Local Communities

Many health centers in rural Ethiopia lack access to clean, running water. According to an assessment conducted by the USAID-funded Ethiopia Assistance to Health Systems Expansion (AHSE) project, staff at these health centers cannot maintain basic sanitation, as they cannot wash their hands or clean equipment and treatment rooms between patient visits. Without water, laboratories cannot function properly. Patients had to provide up to 20 liters of water at their own expense for health services.

To address the need for water, AHSE identified health centers located in areas with high ground water potential where wells could be drilled. Because well drilling in Ethiopia is expensive — the cost for each borehole and well development, if water is found at all, is approximately $50,000 — AHSE collaborated with the SNNPR Regional Health Bureau and the U.S. Army's Combined Joint Task Force – Horn of Africa (CJTF-HOA) to mobilize a drilling team with a Versa Drill unit. AHSE provided the drilling and construction materials, and the CJTF-HOA provided the equipment, machinery, and team to drill the wells.

In July 2012, about 20 U.S. Army personnel arrived from Djibouti, established a base camp, and initiated drilling at the Chito Health Center, which serves about 32,000 people. Two weeks later, the well was completed, producing enough water not only for the health center, but also for the surrounding community. The health center director, Dawit Gume, explained the critical need for access to a reliable source of water, saying, "Before this USAID initiative, we did not have water at the health center and faced many problems with preventing infections."

After finishing the well at the Chito Health Center, the CJTF-HOA drilling team moved to the Gedeb Health Center, where a primary care hospital is currently being built. The well at the Gedeb Health Center was completed on August 23, 2012, 10 days ahead of schedule. The team used the remaining time to drill a third well at Jaradado Health Center.

Thanks to the efforts of USAID, AHSE, and the CJTF-HOA, the communities served by these health centers now have access to high-quality health services and clean drinking water.

Shiro Meda Health Center staff inspect the solar water heater.

© ETHIOPIA AHSE

After completing drilling, AHSE staff and the U.S. Army's Combined Joint Task Force — Horn of Africa (CJTF-HOA) team construct a well.

RECOMMENDATIONS

AHSE has developed key recommendations for future health systems strengthening and infrastructure expansion in Ethiopia.

Expand biomedical equipment maintenance training and establish repair facilities. The FMOH and RHBs have allocated funding to buy biomedical equipment, but maintenance plans for management and repairs are still needed at most health facilities. Biomedical equipment repair facilities should be established in Addis Ababa and at accessible locations across the country. Multiple repair sites could be set up in areas that have several health centers or are densely populated. Biomedical equipment management should be addressed starting from procurement or donation and continuing until final disposal according to environmental guidelines.

Continue regional training courses on electrical equipment, plumbing, solar power, housekeeping, and landscaping. As the project approached completion, AHSE received multiple training requests from RHBs and health facilities, showing continued need to develop the skills of health facility technicians. Partnerships to create training courses for health workers can be established with public and private educational institutions, such as Addis Ababa University, Jimma University, Bahirdar University, and TVET colleges.

Implement housekeeping and landscaping public-private partnerships. Routine housekeeping and landscaping programs are needed to foster a therapeutic environment for healing at health facilities. These activities not only increase patient satisfaction but also increase health center utilization

© ETHIOPIA AHSE

and health services uptake. Because health facilities are often short-staffed, workers have little time to dedicate to cleaning and landscaping. By outsourcing these services, individuals with specialized training can carry out housekeeping and landscaping activities, while health center personnel focus on providing high-quality health services for the community.

Provide supervisory and project management training for FMOH/PHID and RHB engineers and architects who manage construction, renovation, and maintenance contracts. Training should focus on automating the construction process by using design and management software — such as the software used in AHSE's computer-assisted construction management pilot project — to make procurement and building processes more efficient, reduce errors, and improve documentation.

Implement proper healthcare waste management practices and standards, including collection, storage, transport, treatment, and recycling, at all health facilities. In many cases, the majority of health center waste can be disposed of on-site with a proper healthcare waste segregation system and an incinerator capable of burning sharp items and plastic materials. Hospitals often produce hazardous waste, such as pharmaceuticals and x-ray chemicals with high lead content, which must be collected, stored, and disposed of by staff with specialized training. All healthcare waste management plans should be assessed regularly for environmental impact.

Continue and expand alternative energy projects for water supply and electricity generation, including installation and training. These projects are especially important for rural health centers that are outside the national electric grid. Building on the AHSE pilot projects, research should be conducted on alternative energy options that are cost-effective, user-friendly, and sustainable.

Increase focus on gender integration and disability access at health facilities and in health workforce training curricula. Special attention should be given to health center layout, accessibility, and patient accommodations, such as private treatment rooms for mothers and children and people living with HIV/AIDS.

Continue national and regional health systems planning and coordination meetings and forums. These activities should involve the FMOH/PHID, RHBs, international donors, and stakeholders to integrate input on health infrastructure expansion and prevent duplication of efforts. These forums also provide opportunities for civil society groups and community representatives to participate in health systems decisionmaking.

Establish a database of Ethiopian health facility profiles and indicators. Housed within the PHID, this database can be

A GIZ technician and trainees connect the PV solar panel modules with the power supply system at the Burka Dembel Health Center in Oromia on April 28, 2012.

© ETHIOPIA AHSE

shared across the health sector to provide key data on the status of health facilities, such as location, population served, water and electricity supply, number and type of human resources, structural and design issues, priority maintenance needs, and biomedical equipment and supply inventory. GIS mapping, GPS technologies, and related software can facilitate data collection by tracking geographic coordinates, target populations, local resources, and water availability. The information compiled in the database can contribute to strategic planning and coordination activities carried out by the FMOH/PHID, RHBs, and stakeholders.

Develop a health infrastructure e-learning database that can be accessed by health system personnel, engineers, and architects. These online resources could be accessed by professionals who have limited opportunities for continuing education due to demanding work schedules, personal commitments, and geographical location.

Develop safety guidelines for health facilities construction and renovation to protect engineers, architects, technicians, patients, and staff. Existing and newly constructed health facilities have different safety issues ranging from structural concerns to toxicity levels. The guidelines should be reviewed periodically and take into consideration the date and type of construction, level of patient flow, and geographical location.

Technicians complete the PV solar system training course in May 2012.

ANNEX A: PILOT PROJECTS

Training in Computer-Assisted Construction Management

What is ConMIS? ConMIS have long been used for construction cost estimation and planning. Such a system would be indispensable to the ongoing construction drive in Ethiopia's health sector. An assessment of health construction sites in Oromia in April 2010 found that engineers and architects use antiquated construction management practices, employing manual computations or spreadsheets on isolated computer systems.

The pilot project. To meet this need, AHSE launched a pilot project to train selected architects and engineers on ConMIS software and ensure its use in construction management activities. PHID and the Oromia RHB selected 12 trainees from Oromia and four from PHID who were directly involved in managing health facility construction. The training was conducted by a consultant from AHSE subcontractor Millennium Science and Engineering, Inc.

The AHSE team chose Prolog — a construction management package used extensively in the international construction industry — as the software best suited to the Oromia RHB's and PHID's needs. The software was customized to the Ethiopian scenario by the consultant. The project allocated two laptops for trainees to allow them to practice using 30-day demonstration copies of the software. Class content included presentations, exercises, analogous problem-solving assignments, interactive webinars, videos, group forums, and hands-on training. The training was conducted from November 29 to December 17, 2010. The project was implemented within the estimated cost and ran on schedule.

Challenges. Trainees could not conduct practical data migration, application exercises, demonstrations, or replication using Prolog, because the demonstration software expired in a month. (The full, licensed software was very expensive). Follow-up supervision could not be conducted due to budget constraints limiting the consultancy to one month.

Successes. This pilot project has created awareness among PHID and RHBs on the importance of using ConMIS to manage the construction of health facilities efficiently. All the trainees performed well, understood the benefits of using the software, and were excited both about the training and the possibility of implementing it in their day-to-day work.

Lessons learned. The FMOH and RHBs should try to find affordable and easily available software to build on the knowledge gained through the ConMIS training. The Resident Management software package (which, although not compatible with Prolog, has the same functionality and is available for free) is one option that could ensure continued use of ConMIS in future construction plans.

© ETHIOPIA AHSE

Introducing GIS Base Mapping to the FMOH

The need for proper planning for construction. Choosing the proper site for a health facility is essential. Factors such as coverage of population; distance to road networks; referral networks at the woreda, zonal, and regional levels; soil condition; environmental factors; and energy sources all influence construction. When health centers are built without considering such factors, they are unlikely to meet the community's needs. Some centers have been built in inaccessible areas far from the people who need their services and the infrastructure to keep them running. Lack of proper planning has made it hard to supply centers with construction materials and medicine.

How GIS could help. GIS and GPS could provide a versatile dataset used to improve health service delivery and plan for expansion. RHBs could implement their planning with digital and electronic tools, without needing to use physical maps. Materials, supplies, personnel, and logistics could be managed for each center. These maps, when merged, would form a single base map containing information on property ownership; communications networks; and the sewage, water, and electricity lines required for maintenance and growth of these systems. Using these maps, planners, architects, and engineers can optimize existing systems before committing to expansion of basic services, assuring more efficient, cost-effective use of limited funds.

The training. As part of the capacity-building initiatives under its design and engineering component, AHSE launched a pilot project to introduce GIS base mapping to RHB architects, engineers, and health professionals to help them plan and properly select health center sites. AHSE procured 12 GPS devices and evaluation versions of the Arc View/ArcGIS software to facilitate the training and practice. Twenty-six professionals from all of Ethiopia's 11 regions received the training, which was held in Addis Ababa on February 20-24, 2012, by a trainer experienced with Ethiopian health systems and USAID programs. The trainees were IT professionals, monitoring and evaluation specialists, architects, civil engineers, health management information systems professionals, and other support staff. The training included lectures, question-and-answer sessions, and instructor-led tutorial exercises.

How participants will use the training. After the training concluded, the devices were delivered to the PHID to support base mapping exercises around the country, for which the engineers, architects, and health professionals trained by the project will collect GIS data on health facilities in their localities and apply their GIS skills in health facility site selection, design, maintenance, and construction work.

Results. As a result of this training, PHID and RHB representatives have learned how to operate handheld GPS devices and the basics of the ArcGIS software. This, in turn, will position them well to begin gathering and updating health infrastructure data. The pilot project was completed successfully, on time and under budget, and met the PHID's needs and expectations.

Regional Planning and Coordination

The need for planning and coordination. Proper planning and coordination with different health infrastructure development implementers, stakeholders, and various sectors of the GOE impacts the pace and quality of health infrastructure development in Ethiopia. Through assessments, AHSE discovered that the PHID and the RHBs required assistance to plan, coordinate, and develop health programs effectively and to monitor and evaluate the outcome of stakeholders' activities.

AHSE's response. To respond to this need, AHSE launched a pilot project to demonstrate the benefits of joint planning and coordination. AHSE recruited five qualified nurses with planning experience to serve

as coordinators in the project's five target regions. These regional coordinators were assigned to assist RHBs with health infrastructure development planning and coordination activities with various stakeholders and establish community mobilization programs.

Getting everyone on the same page. One of AHSE's major activities with PHID was organizing health infrastructure planning and coordination forums among partners at RHBs and their respective woredas. Through these forums, the regional coordinators brought together engineers and health professionals from scattered directorates and health bureau departments to work actively on health infrastructure development, including expansion and rehabilitation services, medical equipment maintenance, and health information technology improvements. Each task falls under the purview of different GOE department structures, some of which are not part of the FMOH. Through their efforts, the regional coordinators formed 11 partnerships, bringing the work of non-health-related agencies like the Regional Works and Urban Development Bureau, educational institutions, NGOs, and U.S. and international donors to bear to help develop Ethiopia's health infrastructure. Some of these partnerships formed the basis of other AHSE pilot projects, such as those on housekeeping, health center maintenance, and waste management.

Challenges. It was challenging to keep all these stakeholders on the same page. It was difficult to ensure attendance at meetings by decision makers because of their extended commitments and priorities. It took more time than anticipated to convince implementing partners, particularly NGOs, to participate in the joint planning and coordination meetings. Although the coordinators succeeded in fostering collaboration, the improvement they brought about was relatively small, given the enormous scale of the GOE's health infrastructure development program currently in progress.

Successes. RHBs have begun establishing PHID units at the RHB level and health infrastructure planning and coordination forums to empower communities, with the help of health extension workers and the new strategy of the health sector development program. The pilot project increased collaboration and harmonization between stakeholders and the offices for health development and planning, which directly impacts service delivery and patient satisfaction outcomes. This approach is cost-effective, and patients reap the rewards of improved health infrastructure development. The community's involvement also enhances sustainability.

Outsourcing Housekeeping to a Public-Private Partnership

The importance of housekeeping. A clean and safe health facility builds confidence in the services provided and translates into improved patient satisfaction. A slovenly one creates the opposite impression. It is difficult for health facility staff to perform housekeeping activities themselves, because their workload is stretched. Outsourcing is one possible solution.

POTENTIAL FOR REPLICATION

The PPP on housekeeping project has great potential to be replicated at various levels in health facilities to provide auxiliary health services. These partnerships enable health centers and hospitals to not only create nurturing, sanitary environments for staff and patients, but also generate training and employment opportunities for health professionals. This project should be replicated in other health centers throughout the country by the FMOH, donors, and stakeholders to address the challenges of poor housekeeping at health facilities.

An innovative solution. Through a pilot project, AHSE established a PPP to ensure good housekeeping practices in at least 10 health centers in Addis Ababa. Fourteen women selected from 10 sub cities of Addis Ababa were trained at Wingate TVET College for two weeks. AHSE provided cleaning tools, personal protective equipment,

and seed money for the trainees to establish their own housekeeping firm. The pilot project was designed to train people to provide professional housekeeping services for health centers. Hospitals could outsource housekeeping services for a reasonable fee. The firm is expected to become a PPP working with the health centers in Addis Ababa on a fixed-fee basis. An office for the PPP has been established at Kazanchis Health Center, with the center providing it free office space.

Producing a Comprehensive Training DVD

The need. Waste management in health centers leaves much to be desired. Many of Ethiopia's newly built health centers have broken medical equipment requiring basic repair and fall short of standard hygienic and infection prevention practices. AHSE has provided training in areas such as medical equipment first-look repair and maintenance, basic electricity, and health facility housekeeping and landscaping; however, providing OJT to thousands of workers across the country is difficult and costly.

REPLICABILITY

This pilot project has great potential to be scaled up to include additional languages and procedures. The FMOH should include these DVDs as part of the induction procedures for new heath center workers and create mechanisms to ensure that staff adhere to the maintenance and hygiene guidelines. It is also recommended that the FMOH upload the DVD to its website to make it accessible to a wider audience.

The solution. In collaboration with the FMOH, AHSE produced the Health Center Hygiene, Environmental Health, and Maintenance Self-Help DVD to provide consistent, uniform how-to information for health center professionals in Ethiopia. The pilot project's purpose is to demonstrate that self-help and training videos can be used to provide training to a large audience of professionals, while maintaining uniformity and consistency and remaining cost-effective. They can be viewed repeatedly, are easy to duplicate and transport, and can be modified to include additional procedures and languages. They are easily accessible to health centers across the country (most health centers are equipped with DVD players and TVs) for behavior change communication purposes.

AHSE worked with a local production firm to produce the DVD, which covered personal protective procedures to safeguard health center workers against infectious waste, health center waste management, housekeeping (i.e., cleaning healthcare facilities), environmental health, and equipment maintenance and safety. The DVD is narrated in four languages, English, Amharic, Oromiffa, and Tigrinya — the most widely spoken languages in AHSE's target regions.

Results. As a result of this project, thousands of health centers will have easily accessible training materials for health center maintenance and hygienic practices, and will be empowered to train their own staff. Both the minister of health and the FMOH's Public Relations Directorate have provided positive feedback about the coverage and quality of the video. Training DVDs offer a feasible, systematic, cost-effective approach to training challenges, given the rapid pace at which Ethiopia's healthcare system is expanding.

Medical Equipment Maintenance Training

The need to standardize medical equipment maintenance. According to a survey conducted by AHSE, most of Ethiopia's health facilities lack equipment maintenance programs, staff trained to maintain equipment, adequate budget for maintenance, maintenance records, or management systems for formal maintenance requests. This has led not only to compromised health services due to inaccurate diagnosis because of uncalibrated equipment but also to mismanagement of resources — malfunctioning equipment often

Trainees from the Addis Ababa City Government Health Bureau learn how to maintain health center medical equipment in May 2012.

© ETHIOPIA AHSE

occupies space needed for clinical services. The reasons for this include the shortage of trained medical equipment technicians in health centers and inadequate funding for the operation and maintenance of medical equipment.

The pilot project. To address this need, AHSE designed a pilot project to establish capacity-building programs in preventive maintenance and first-look repair of medical equipment. The two main components were OJT programs and the development of a health center medical equipment maintenance and first-look repairs logbook to record the maintenance, cleaning, repairing, and installation of medical equipment.

The training. In collaboration with the Amhara, Oromia, Tigray, SNNPR, and Addis Ababa RHBs, five regional OJT programs were implemented at health centers to upgrade the skills and knowledge of health workers, including laboratory technicians and biomedical (electrical) technicians, in the area of medical equipment maintenance and first-look repairs. The course, which took place between March and May 2012, included modules on the major types of medical equipment; installation, maintenance, safety, and repair of equipment; repair checklists; and how to use a standard logbook (the first of its kind in the Ethiopian primary healthcare system). Seventy-three health professionals from health facilities, woreda health offices, and RHBs participated in the training. During the training, 50 pieces of broken medical equipment (including dry ovens, refrigerators, autoclaves, and steam sterilizers) were repaired and reinstalled for use in the five health centers.

Successes and sustainability. According to an AHSE follow-up assessment, the project has already begun to have a positive impact on healthcare services in the centers where it was implemented. These centers will continue to serve as sources of best practices for other health centers, as health workers and laboratory technicians from other centers will be able to visit and learn from previously trained personnel to enhance their skills in the maintenance and first-look repair of medical equipment.

Integrated Healthcare Waste Management Training

The risks of improper waste management. Many health facilities in Ethiopia lack adequate healthcare waste management practices, including systems to ensure the health and safety of the people involved in waste collection, transport, treatment, and final disposal. In some cases, waste is directly unloaded at disposal sites without being properly segregated. In other cases, infectious waste is burned in open concrete pits, causing both environmental and health risks.

Delivering training courses on healthcare waste management — from waste collection and transport to treatment and disposal — is a first step toward improvement.

Meeting the need. AHSE launched the Integrated Healthcare Waste Management pilot project to provide health centers with guidance on improving their waste management practices. The project consisted of two major components: 1) delivery of OJT on integrated healthcare waste management in the selected health centers, and 2) provision of personal protective equipment to the health centers.

Five health centers, one from Amhara, Oromia, Tigray, SNNPR, and Addis Ababa (AHSE's five target regions), were selected, in consultation with the RHBs, to participate in the training. The 76 trainees included RHB officials, health center management, healthcare providers, and most important, support staff involved in the waste management process who had never received this type of training.

The training. Three days were allocated for theoretical and practical training at each training site. Theoretical training was based on practical, real-life scenarios, following a manual AHSE prepared, based on the procedures outlined in the FMOH's recent "Hospital Reform Implementation Guidelines." Practical training focused on using personal protective equipment while segregating, collecting, transporting, and disposing of healthcare waste.

Looking forward. Proper healthcare waste management promotes the safety and well being of patients, staff, visitors, and the community at large and can help prevent the transmission of infection. Proper healthcare waste management depends on good administration and organization. AHSE recommends that the FMOH develop a national policy on this issue in order to delegate responsibilities to the appropriate government authorities and ensure adequate budget allocation.

Building Better Incinerators to Destroy Infectious Waste Safely

The dangers of burning infectious waste in the open. Ethiopia's standard health center design includes a single-chamber, brick-and-mortar incinerator for waste disposal. AHSE's rapid assessment of 170 new health centers revealed that most of these incinerators were broken, and that those that worked did not create sufficient heat to burn infectious waste and sharp items. Because incinerators were not working, health center workers resorted to burning infectious waste in open pits and disposed of general waste improperly, leading to high risks of infectious disease transmission and environmental hazards such as carcinogens, toxins, and heavy metal emissions from incomplete burning of waste.

The pilot project. In response, AHSE launched a pilot project to introduce a more appropriate combustion system at Wolliso Health Center in Oromia. The De Montfort Mark 9 incinerator is affordable, user-friendly, effective, can be built with local materials, and can be easily modified to insure continuous improvement. A two-chamber incinerator like the De Montfort Mark 9 promotes complete combustion with the required temperatures — primary (600-800°C) and secondary (900-1200°C). Mechanical

The new incinerator at the Wolliso Health Center in Oromia.

© ETHIOPIA AHSE

multiple-chamber units can reach these temperatures; the single-chamber units currently available in the health centers cannot. The incinerator design is freely available on the web at http://www.mw-incinerator.info/en/101_welcome.html and only requires adaptation to local materials and laborers' skills.

Results. The pilot project was completed on schedule. Using locally available construction materials and techniques, the project succeeded in building an incinerator with a greater combustion capability. The health center staff and the surrounding community were informed about the challenges associated with inefficient incinerators. With the new incinerator, Wolliso Health Center is now able to burn hazardous waste in a protected and efficient space, without danger to the surrounding community or the environment.

Lessons learned. The introduction of the De Montfort Mark 9 incinerator is one step toward addressing waste disposal at health centers. Further reconstruction and testing needs to take place before the program can be expanded to all of Ethiopia's health centers.

Bringing Hot Water to the Shiro Meda Health Center

The promise of solar water heating. Only 22 percent of Ethiopians, and only 2 percent in the country's rural areas, have access to electricity. Some health centers have no source of electrical power at all. Hardly any of Ethiopia's health centers (including those with access to electricity) have hot water, because the available power supply is inadequate. Yet to deliver hygienic medical services, hot water is essential.

Cleanliness is vital to the health and safety of a health center's patients, staff, and visitors, and of the community. Hot water and detergent remove 80 percent of microorganisms, and routine cleaning is necessary

to ensure an environment that is visibly clean and free from soil and dust. Moreover, clean facilities look appealing and improve the morale of the staff and patients alike.

Given the ample supply of sun (Ethiopia is known for having "13 months of sunshine" a year), solar water heating offers a pragmatic solution. Solar water heaters are not subject to future price increases or blackouts and offer environmental benefits. Electric water heaters are "energy hogs" — a single electric water heater of the sort being installed in the new health centers consumes 1.2 kilowatt hours of energy and has a capacity of 50 liters of heated water. Replacing an electric water heater with a solar one saves 50 tons of carbon dioxide emissions over 20 years.

A PRACTICAL OPTION

The average life expectancy of a solar water heating system is 20 years, much longer than standard gas or electric storage water heaters. When such systems are implemented in low-income areas with abundant sunshine, the money saved can lead to improved health outcomes. Installing solar water heaters has benefits that go beyond the center itself. Green, renewable heating systems can reduce carbon dioxide emissions.

The pilot project. To demonstrate the value of this technology, AHSE launched a pilot project to install a solar water heater in Shiro Meda Health Center in a low-income section of Addis Ababa. Even though it had electrical heaters in each of its laboratory and delivery rooms, none of them worked. The center, designed to serve 40,000 patients, was actually providing services to more than 90,000.

The project chose to install a thermo-siphon vacuum tube solar water heater, which requires minimum maintenance and works with water fed through gravity. The heater has a capacity of 180 liters of heated water and consumes no electrical power at all. The system was supplied and installed by local contractors experienced in alternative technology. AHSE provided operational guidance and basic preventive and routine maintenance to ensure the heater's sustainability. The new heater replaced the electric water heaters in two of the delivery and two laboratory rooms. The project, which took 23 days to implement, saved the health center 4.8 kilowatt hours of electrical power by producing heated water through clean, renewable energy.

Results. Now that Shiro Meda Health Center has a reliable source of hot water, healthcare workers in the delivery and laboratory rooms can wash their hands with hot water after seeing patients, thereby decreasing infections. New mothers at the center also have access to hot water post-delivery.

Training Technicians to Install and Maintain PV Solar Systems

Over 50 percent of Ethiopia's health centers lack electrical power, especially in rural areas. Finding alternative power sources for these facilities is paramount.

A viable alternative energy source. Using PV solar systems to generate electricity is a viable alternative for centers in off-grid areas. GIZ, in collaboration with FMOH, has installed PV solar systems at 100 health centers, which have been proven to work well. Although the initial cost is relatively high, these systems can function throughout Ethiopia and require no recurrent expenses for more than 15 years after installation.

Training technicians for future sustainability. To train technicians and health center personnel to operate and maintain these systems for future sustainability, AHSE launched a pilot project that provided TOT courses on PV solar energy at Selam TVET College. Training focused on theoretical and practical sessions. OJT was provided during actual installations of PV solar systems at Burka Dembel Health Center

An AHSE training specialist and trainees from the Oromia RHB discuss how to connect PV solar panel modules at the Burka Dembel Health Center on April 28, 2012.

© ETHIOPIA AHSE

in Oromia, Horoshifa Health Center in SNNPR, Ardibo Health Center in Amhara, and Tsadalaka Health Center in Tigray.

REPLICABILITY

This pilot project proved to be effective in addressing utility challenges in rural areas with abundant sunshine. OJT during installations should be expanded by the FMOH, donors, and stakeholders.

Leveraging stakeholder support. Responsibilities among the various stakeholders were divided as follows: the FMOH and RHBs identified the site and trainees, AHSE procured the installation equipment and ran the TOT programs, and GIZ agreed to supply 6.8 Peak Kilowatt PV solar power systems for the four health centers with professional support. Participants included personnel from woreda health offices and health facilities and 20 regional maintenance technicians (five per center). The project was implemented on schedule, and 60 percent of the pilot project's expenses were leveraged through AHSE's partnership and coordination activities.

The impact. The four health centers have begun to refrigerate vaccines, sterilize water, and can now provide care at night. The new PV solar systems will benefit a population of 160,000 and lead to improved health service delivery. The technicians trained on this project can now monitor existing solar power systems and install new ones. Each technician serves six to eight health centers. Four woreda offices now have technicians available to provide maintenance for the new systems and support future expansion. Most importantly, the project created awareness at all levels.

An engineer completes the water storage tank for the rainwater harvesting system at the Biyo Health Center in March 2012.

© ETHIOPIA AHSE

Harvesting Rainwater From Rooftops

The rooftop rainwater harvesting pilot project was designed to show that harvesting rainwater is the most reasonable, economical way to supply potable water to health centers with no clean water supply. The project was implemented at the Biyo and Waltea Dekole Health Centers in Oromia region.

Effects of the water shortage. Biyo Health Center had to transport water in by donkey. The center consumed 40 liters of water a day for cleaning, delivery, laboratory, and emergency services. Budget constraints prevented it from buying more. Families of expectant mothers were asked to buy the required amount of water themselves; as a result, the center was performing few deliveries. Other healthcare services, such as emergency and laboratory services, also suffered from inadequate water supply. The center's toilets, showers, washbasins, and kitchen sinks had never been operational.

Waltea Dekole Health Center used to have to buy water from a spring seven kilometers away. It used less than 100 liters of water a day. Due to the water shortage, its toilets and showers had never been used. None of its plumbing fixtures were functional. The center averaged only one delivery a month. Most pregnant women were referred to a better equipped health center 14 kilometers away.

The rainwater harvesting system. The rooftop rainwater harvesting system built at the two health centers consisted of a 50 cubic-meter storage tank, gutters and downpipes to convey rainwater to the tank, a rain separator, a filter, a solar-powered disinfection unit, and pumps to lift the rainwater from the storage tank to existing elevated water tanks. At Biyo, which had electrical power, the pumps were electric; at Waltea Dekole, which has no electricity, they were manually operated.

THE POTENTIAL FOR REPLICATION

This pilot project can be replicated wherever rainwater is the most convenient source of alternative water supply until a main supply grid is provided. AHSE recommends the replication of such alternative water supply projects in other health centers where there is sufficient rainfall and a lack of clean water.

The system was built using local materials and artisans. The construction technology employed was the kind commonly used in the country. The entire system was built for less than $74,000.

The impact. At the Biyo center, the new rainwater harvesting system is supplying about 400 liters of rainwater per day, enough water to provide standard healthcare services to the population it serves. The solar-powered disinfection unit has greatly improved the quality of the harvested rainwater, making it clean, disease-free, and potable.

At Waltea Dekole, the system is supplying about 400 liters of water per day; laboratory and emergency services have improved, and the center now provides proper laundry services. The center's hygiene and sanitation have improved greatly, and the plumbing fixtures now work.

Installing a Solar-Powered Disinfection Unit

The pilot project. Along with the rooftop rainwater harvesting project at Biyo Health Center, AHSE launched an additional pilot project to install a solar-powered disinfection unit, an excellent option for health centers that have plenty of sun and need purified water.

Because solar-powered disinfection units are not available in Ethiopia, AHSE procured the unit from a U.S.-based company called Aqua Sun. The unit was shipped to Ethiopia and installed and integrated with the rooftop rainwater harvesting system by subcontractor MS Consultancy, which also installed the rainwater harvesting system.

SUSTAINABILITY AND REPLICATION

The health center's management and the local community are expected to operate and maintain the system. The woreda health office will provide the necessary budget and technical support to guarantee the sustainability of the unit after the pilot project concludes. The pilot project has great potential to be replicated in other health centers across Ethiopia where there is abundant sunshine yet the water supply is not clean enough for clinical activities. The solar-powered disinfection unit can disinfect water from a shallow well, rain water, or other sources.

The solar-powered disinfection unit uses a filter system to remove sediment, rust, dirt, and odors, and an integrated ultraviolet process to kill 99.9 percent of pathogens and harmful microorganisms (such as viruses, bacteria, and protozoa) present in the source water. The rooftop solar panel provides enough power to disinfect 1,850 liters of water per day for use in the delivery and laboratory rooms.

Successes. With the new solar-powered disinfection unit, a health center that once could not deliver babies or provide laboratory services due to a lack of potable water now fully provides both services. Four to five babies are delivered there each month, and this number is expected to increase to 10 or 12 in the near future.

Installing a Wind Turbine at Bura Barak Health Center

The plight of remote health centers without electrical power. Health centers without electrical power have difficulty providing basic healthcare services; medical appliances that require electricity cannot function, making laboratories virtually useless. Although refrigerators can

run on kerosene, it is a known pollutant and safety hazard, and rural health centers lack the funds to buy kerosene regularly. Although some have been given electrical generators, many generators are in disrepair or cannot be used due to the lack of adequate fuel supplies.

Bura Barak Health Center is in a remote location, with no possibility of being connected to the electrical grid in the next five years. It is situated on a hill exposed to winds with above average speed, which could be harnessed and converted to electric power using wind turbines. AHSE decided to implement a pilot project to demonstrate the efficacy of a wind turbine.

About the turbine. A Hummer twin wind turbine was supplied and installed at Bura Barak. The turbine was light and compact in design. It was capable of generating two kilowatts of energy at an average wind speed of nine meters per second, more than enough to render the laboratory functional and provide lights to the living premises of the health center workers.

This wind turbine is one of the most technologically advanced small wind turbine systems in the world. These turbines include supercritical generators that are smaller, one-third to one-fifth lighter, and 10 to 30 percent more efficient than traditional generators operating at the same wind speeds. They are better suited to operate in all weather conditions than normal wind turbines, emit less noise, and are easy to install. They are designed to be easily assembled and can be transported on the back of a pickup truck.

Procurement and installation. Because wind turbines are unavailable in Ethiopia, a manufacturer was identified from overseas. Once the wind turbine was received from abroad, an Ethiopian firm, Negarobe ES, was subcontracted to install and commission the turbines. Once the turbine was installed and commissioned, the project was handed over to the woreda health bureau, in accordance with the project's sustainability plan.

Successes. Now that the wind turbines have made electrical power available, community members no longer have to travel to the nearest town for medical care. The microscopes, sterilizer, and other medical equipment in the laboratory now work. The money that once had to go to buy kerosene for the deep refrigerators is free to be spent elsewhere, as the refrigerators can now run on electricity. The center has begun to provide services at night, allowing it to treat more patients.

Drilling Water Wells at Health Centers

Ethiopia's ground water potential. Ethiopia is estimated to have a ground water potential of 2.6 to 6.5 billion cubic meters, which is high by any standard. This ground water is naturally filtered, meaning there is no need to use chlorine to remove microbial contaminants to make the ground water safe.

However, the supply has to be tapped. Without wells to access the ground water, many health centers have to have water delivered in containers, which are brought in by donkey. This water is then transferred to pitchers with spigots and stationed at the point of use, which often leads to contamination.

The pilot project. AHSE launched a pilot project to drill wells at the Chito and Gedeb Health Centers in SNNPR, which lacked access to potable water yet are located in areas with high ground water potential. In an innovative cost-sharing measure, AHSE collaborated with the U.S. Army's CJTF-HOA, stationed in Djibouti. AHSE provided the drilling and construction materials; CJTF-HOA supplied the well-drilling equipment and the team to operate it.

The wind turbines provide power to support health services at the Bura Burak Health Center, which is located in a rural area not covered by the national electrical grid.

© ETHIOPIA AHSE

The rig supplied was capable of drilling up to 300 meters below ground level, but for environmental reasons, the wells were designed to be no deeper than 150 meters. This would allow the use of unplasticized polyvinyl chloride (uPVC) casings, which do not rust, and hence, do not pollute the water with iron oxide deposits. The well was planned to accommodate both a hand pump and a submersible pump.

Challenges. Of the 25 items on the list of drilling and construction materials that CJTF-HOA requested that AHSE supply, only eight were available in Ethiopia; the rest had to be imported by the CJTF-HOA well team. In addition to the difficulty in procuring the necessary supplies, there were delays in getting the CJTF-HOA team to the drill site. Equipment and materials were loaded onto eight trucks, some of which had to travel 1,000 kilometers through three different regions of Ethiopia, having to clear customs on multiple occasions. Due to the border-crossing challenges, the well team arrived during the rainy season, which also complicated matters.

Successes. Once the well team arrived, work proceeded quickly. The well at Chito Health Center, which was 75 meters deep, was drilled in a week. The second well, at Gedeb Health Center, 102 meters deep, was finished a month later. The project was finished 10 days early, which gave the well team time to drill an additional well at Jaradado Health Center.

As a result of this pilot project, three health centers that serve more than 70,000 people now have access to clean drinking water. This number will increase to 200,000 people when the Gedeb Health Center is converted into a primary hospital.

A trainer helps technicians connect the PV solar panel modules to the battery bank at the Haroshifa Health Center in SNNPR on May 14, 2012.

ANNEX B: INDICATOR SUMMARY TABLE*

PIR 1: GOE and local authority capacity for construction, renovation, and maintenance strengthened								
KRA 1.1: Procurement and management systems enhanced								
Indicators		Y1 Actual	Y2 Target	Y2 Actual	Y3 Target	Y3 Actual	Overall Target	Overall Actual
Indicator 1.1.1	Number of PHID (PMU and RHB) staff using new or improved systems	N/A	35	48	35	25	**35**	**48**
Indicator 1.1.2	Number of GOE's Federal, Regional, and Woreda health staff capacity improved in participating facilities	225	250	201	250	202	**500**	**628**
	Male	*196*		*184*		*174*		***554***
	Female	*29*		*17*		*28*		***74***
Indicator 1.1.3	Number of health centers trained and using new databases for inventory and information management	N/A	6	6	5	21	**6**	**21**
Indicator 1.1.4	Number of newly constructed or ongoing health center construction programs supported by AHSE	267	860	782	243	47	**1,103**	**1,096**
Indicator 1.1.5	Number of RHBs and Woreda-level staff provided with training on strategic information activities	225	250	570	250	412	**500**	**1,207**
	Male	*196*		*446*		*264*		***906***
	Female	*29*		*124*		*148*		***301***
KRA 1.2: Trained individuals deployed in GOE and local authority offices								
Indicators		Y1 Actual	Y2 Target	Y2 Actual	Y3 Target	Y3 Actual	Overall Target	Overall Actual
Indicator 1.2.1	Number of persons trained in second-generation trainings	N/A	450	159	245	61	**695**	**220**
	Male			*97*		*7*		***104***
	Female			*62*		*54*		***116***
Indicator 1.2.2	Number of supervision visits to RHBs, HCs, and Woreda offices with MOH staff	19	100	78	20	82	**120**	**179**
Indicator 1.2.3	Number of training sessions held by the TOTs and / master trainers	3	16	12	22	8	**38**	**23**
Indicator 1.2.4	Number of TOTs participants trained in key management systems	43	225	101	70	30	**295**	**174**
	Male	*40*		*76*		*16*		***132***
	Female	*3*		*25*		*14*		***42***
Indicator 1.2.5	Number of training modules in key management areas developed and deployed	22	5	18	5	11	**10**	**51**

* *The indicator summary table includes data current as of August 31, 2012.*
Indicator targets were only established for Years 2 and 3; no indicator targets were set for Year 1.

© ETHIOPIA AHSE

PIR 2: Standard facility design and maintenance systems institutionalized								
KRA 2.1: Standard health facility blueprints, utility systems, and equipment packages analyzed and improved								
Indicators		Y1 Actual	Y2 Target	Y2 Actual	Y3 Target	Y3 Actual	Overall Target	Overall Actual
Indicator 2.1.1	Number of health facilities constructed in compliance with improved design, utility specifications and fixture/ equipment packages	267	860	782	243	47	**1,103**	**1,096**
Indicator 2.1.2	Number of workshops to review and consider recommendations for assessments done on facilities	5	6	5	5	5	**11**	**15**
Indicator 2.1.3	Number of health facilities functioning with updated furnished equipment, telecommunications and/ or information technology	80	258	235	73	14	**331**	**329**
KRA 2.2: Maintenance systems and standards for new and renovated health centers established								
Indicators		Y1 Actual	Y2 Target	Y2 Actual	Y3 Target	Y3 Actual	Overall Target	Overall Actual
Indicator 2.2.1	Number of health facilities following prescribed routine maintenance procedures	N/A	10	N/A	16	14	**26**	**14**
Indicator 2.2.2	Number of health facilities assessed to determine their maintenance needs, IT and telecommunication requirements	166	100	160	65	51	**165**	**377**

PIR 3: National and local health facility planning and coordination strengthened								
KRA 3.1: National, regional, and local planning of health facility construction and renovation strengthened								
Indicators		Y1 Actual	Y2 Target	Y2 Actual	Y3 Target	Y3 Actual	Overall Target	Overall Actual
Indicator 3.1.1	Ratio of average catchment population of new health centers to average catchment population for old health centers	1 HC for 72,829	1 HC for 25,000	1 HC for 32,775	1 HC for 25000	1 HC for 30,096	**1 HC for 25000**	**1 HC for 30,096**
Indicator 3.1.2	Web-based database for operational management developed	N/A	1	1	N/A	N/A	**1**	**1**
Indicator 3.1.3	Number of planning/ coordination meetings and/or attendees with FMOH, RHBs and other stakeholders (sessions)	7	5	26	6	19	**11**	**52**
Indicator 3.1.4	Number of short-term technical assistance to GOE for resource mobilization	13	13	28	22	10	**22**	**28**
Indicator 3.1.5	Number of database tool launched in workshops/ seminars	N/A	1	N/A	1	1	**1**	**1**
Indicator 3.1.6	Number of RHB, zonal, and Woreda staff trained to conduct facility assessment	80	258	235	73	14	**331**	**329**
	Male	*23*		*38*		*174*		***235***
	Female	*2*		*4*		*28*		***34***
Indicator 3.1.7	Number of local communities making data-based decisions	N/A	5	5	5	5	**5**	**5**
Indicator 3.1.8	Number of RHB, zones, and local community work plans	N/A	5	7	5	5	**10**	**12**
Indicator 3.1.9	Number of health facilities assessed	109	100	316	65	**85**	**165**	**510**
KRA 3.2: Coordination of donors and stakeholders improved								
Indicators		Y1 Actual	Y2 Target	Y2 Actual	Y3 Target	Y3 Actual	Overall Target	Overall Actual
Indicator 3.2.1	Number of semi-annual coordination forums held between FMOH, RHBs, and relevant donors	1	2	1	2	N/A	**4**	**2**
Indicator 3.2.2	Number of joint meetings or workshops held with different stakeholders to discuss health center construction and renovation	21	5	25	2	20	**7**	**66**

PIR 4: Limited pre-service training packages developed and integrated								
KRA 4.1: Appropriate pre-service vocational training identified, expanded, and delivered								
Indicators		Y1 Actual	Y2 Target	Y2 Actual	Y3 Target	Y3 Actual	Overall Target	Overall Actual
Indicator 4.1.1	Number of plumbers, electricians, and other relevant repair and maintenance contractors trained	78	450	264	350	220	**800**	**562**
	Plumber	*N/A*		*81*		*0*		***81***
	Contractor Type: Electrician	*29*		*102*		*73*		***204***
	Other	*49*		*81*		*147*		***277***
Indicator 4.1.2	Number of target schools and colleges adopting/ adapting new aid/support materials	8	8	8	8	8	**8**	**8**
Indicator 4.1.3	Number of training packages developed to support standardized materials for pre-service tasks	3	7	15	5	1	**12**	**19**
KRA 4.2: Advocacy to GOE on human resource requirements for health facility maintenance conducted								
Indicators		Y1 Actual	Y2 Target	Y2 Actual	Y3 Target	Y3 Actual	Overall Target	Overall Actual
Indicator 4.2.1	Financial and human resources allocated and expended for health center maintenance		5	N/A	2	14	**5**	**14**
Indicator 4.2.2	Number of assessment of HR involved in health facility construction and maintenance		100	155	65	85	**165**	**360**

PIR 5: GOE and local authorities supported in addressing electricity and water systems								
KRA 5.1: Electricity and water systems assessed at selected health centers								
Indicators		Y1 Actual	Y2 Target	Y2 Actual	Y3 Target	Y3 Actual	Overall Target	Overall Actual
Indicator 5.1.1	Number of health centers per region selected for pilot or demonstration project	5	5	11	16	14	**16**	**14**
Indicator 5.1.2	Number of health facilities assessed for system upgrades	10	100	83	65	51	**165**	**144**
KRA 5.2: Direct support provided to selected health centers for water or electricity upgrading and pilot projects								
Indicators		Y1 Actual	Y2 Target	Y2 Actual	Y3 Target	Y3 Actual	Overall Target	Overall Actual
Indicator 5.2.1	Number of pilot projects implemented	N/A	5	4	13	10	**13**	**14**
Indicator 5.2.2	Types of applicable technologies made available to solve problems of water and electricity.	3	3	3	3	6	**3**	**6**
KRA 5.3: Communication materials to support the efficient use of electricity and water in health facilities developed								
Indicators		Y1 Actual	Y2 Target	Y2 Actual	Y3 Target	Y3 Actual	Overall Target	Overall Actual
Indicator 5.3.1	Number of seminars and workshops delivered	5	2	7	10	7	**12**	**19**
Indicator 5.3.2	Number of facilities reporting fewer problems related to water and other utilities compared to MOH baselines	N/A	130	N/A	130	65	**130**	**65**
Indicator 5.3.3	Number of communications materials developed to support efficient use of electricity and water in health facilities	1	3	2	3	3	**6**	**6**

DVD ANNEXES

1. Project Newsletter, Vol. I No. 1, August 2010
2. Project Newsletter, Vol. I, No. 2, October 2010
3. Project Newsletter, Vol. I, No. 3, January 2011
4. Ethiopia AHSE Brochure April 2010
5. Technical Bulletin, Vol. I No. 1 July 2010: *"Healthcare Waste Management and Disposal in Ethiopia"*
6. Technical Bulletin, Vol. I No. 2 September 2010: *"Health Center Site Selection Considerations"*
7. Technical Bulletin, Vol. I No. 3 October 2010: *"Biomedical Equipment Maintenance in Health Facilities"*
8. Technical Bulletin, Vol. I No. 4 December 2010: *"Avoiding Seismic Risks to Health Center Buildings: Considerations and Rules of Thumb"*
9. Technical Bulletin, Vol. I No. 5 January 2011: *"Patient Flow for Clinical Services"*
10. Technical Bulletin, Vol. I No. 6 January 2011: *"Enhancing Gender Opportunities in Health Service Provision"*
11. Technical Bulletin, Vol. II No. 7 September 2011: *"Safe Water Supply for Health Centers"*
12. Technical Bulletin, Vol. II No. 8 December 2011: *"Integrated Disease Surveillance and Response (IDSR) in Ethiopia"*
13. Technical Bulletin, Vol. II No. 9 March 2012: *"Structural Assessment of Primary Healthcare Facilities in Ethiopia"*
14. Technical Bulletin, Vol. II No. 10 April 2012: *"Health Center Maintenance Practices in Ethiopia"*
15. Technical Bulletin, Vol. II No. 11 May 2012: *"Waste Management Practices in Five Regions of Ethiopia"*
16. Technical Bulletin, Vol. II No. 12 July 2012: *"Powering Health Centers Using Wind Energy"*
17. *Working to Better the Lives of Communities* (15 minute video)
18. *Access Made Easy* (24 minute video)

USAID
FROM THE AMERICAN PEOPLE

ASSISTANCE TO HEALTH SYSTEMS EXPANSION

ETHIOPIA AHSE FINAL REPORT

SEPTEMBER 2012 This publication was produced for review by the United States Agency for International Development. It was prepared by Chemonics International Inc.