Technology for community development in Central Asia

Editor's note: Mining companies doing business in Central Asia, and parts of the developing world, should look for ways to promote community development through the introduction of appropriate technology.

This article should be of interest to SME members. It shows sustainable development type projects need not be massive or expensive. Smaller, utilitarian projects are equally valuable to developing communities as they seek to develop their own economic and social infrastructures.

Joint Development Associates International (JDA) began humanitarian relief and community development in Central Asia in 1992, following the collapse of the former Soviet Union. Appropriate technology has played an important role in the company's efforts to assist those segments of society that are most vulnerable to poverty and disease.

Three case histories are described here to illustrate the successful implementation of simple, but effective technology in community development.

Central Asia generally refers to those five independent republics of the former Soviet Union — Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan. Recently, Afghanistan has been included. (Fig. 1). They share a number of characteristics. All are landlocked, exhibit extremes of climate and terrain, are ethnically diverse, poverty stricken, predominantly Muslim and struggling to adapt to their newfound independence.

JDA has worked primarily in Uzbekistan and, more recently, northern Afghanistan. It has provided technical and financial assistance to communities, institutions, women-led families, disabled children and adults, and others who are socially and economically disadvantaged. The company has provided clean water to rural communities, micro finance programs to encourage a variety of family businesses, health education, leprosy training for national doctors, computer training, along with humanitarian aid, as required. The long-term goal of the company is to enable individuals, families, and communities to determine their own future using their own resources, abilities and opportunities.

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Appropriate technology

Many of the projects undertaken to advance the goals of the local populace involve the use of technology. That technology, if it is to be successfully applied, must be appropriate to the culture and the available resources. Many times sophisticated technology, widely accepted in the developed world, is doomed to failure due to lack of understanding or resources.

FIG. 1

Map of Central Asia.

An example JDA has encountered throughout Uzbekistan has been the failure of desalination plants to provide the clean water needed by the communities they serve. They were built by the Soviets, using Russian technology and operators. After independence, the Russians left. The new government had no trained operators, no repair parts and no funds for upkeep. The result has been devastating to the health of those who were supposed to benefit.

FIG. 2

Solar disinfection technology.

FIG. 3

Hand-operated, cable-tool drill rig.

Appropriate technology has these characteristics:

- It is easy to understand, operate and maintain.
- It uses locally available resources.
- It is culturally acceptable.
- It is affordable, effective and sustainable.

Community development

Community development is any activity that improves a community's infrastructure, the health of its residents or their ability to engage in meaningful work to provide for their basic needs. Community development is usually introduced by outside sources. But it is transferred to the community through technical assistance and education.

Some examples of community development activities with which JDA has been involved include construction of schools and community buildings, rehabilitation of leprosy institutions, community health clinics, vocational education, microfinance programs, and community water supplies and sanitation.

Case histories

Solar disinfection of water. Clean water is necessary for a healthy community. However, throughout most of Central Asia, the primary water sources are often contaminated for a variety of reasons. Water wells may be located close to latrines or livestock pens. Ground water is often contaminated by excessive use of chemical fertilizers and pesticides. Surface water may be contaminated by runoff from fields and from the discharge of raw sewage. Boiling is the most common way of cleaning the water for household use. Boiling requires fuel, a scarce resource in those desert areas of the region.

In 2000, JDA introduced an alternate technology, Solar Disinfection (SODIS), into the Ferghana Valley of Uzbekistan. The technology was developed by the Swiss Federal Institute for Environmental Science & Technology. It has been field tested in developing nations around the world.

The process is simple. Solar radiation is used to destroy pathogenic micro-organisms present in the water. Transparent containers are filled with water and exposed to direct sunlight for several hours. In practice, polyethylene (PET) beverage bottles are painted black on one side, filled nearly full with water from any source, shaken to introduce oxygen into the water, filled to the brim, then placed on an inclined black painted surface in direct sunlight (Fig. 2). Exposure to temperatures of 50° C (122° F) for about five hours has been shown to destroy all water-borne pathogens. What the temperature does not destroy, the ultraviolet radiation does.

Household needs determine the amount of clean water produced. A family member collects and cleans twice the daily number of containers (usually 1.5 L soft drink bottles) required. One set of bottles can be cooling for use while the other set is being disinfected.

Acceptance of the method in the culture has required some promotion. Residents were initially skeptical, preferring to use the "time honored" technique of boiling. Resistance was overcome by referring to the technique as "sun-boiled water." They also had doubts about drinking cold-treated water and doubts about the effectiveness of the treatment. Demonstrations by JDA staff overcame these objections. When the staff did not get sick from drinking the cold-treated water, doubts slowly vanished.

The technology was introduced through school children. Puppeteers presented the basic process and reinforced it through a participative game. Children then urged their families to try the technique. District government health departments and local village councils were supportive and have had many of their field staff trained in the use and promotion of the technology by JDA.

JDA has now been recognized by the Swiss as a SODIS resource center, providing information and training for other groups in Central Asia wishing to use the technology.

Shallow water wells. Much of Central Asia is in the midst of a multi-year drought. It has decimated the surface and ground water sources relied on by many rural communities. The Uzbek province Autonomous Republic of Karakalpakstan, an area adjacent to the shrinking Aral Sea, has been particularly hard hit.

The shrinking of the sea is an environmental disaster of global proportions. Water feeding the sea was diverted in Soviet times through a system of irrigation canals into the desert to support a huge cotton-growing industry. Each successive five-year plan called for increased production quotas. This created a need for chemical fertilizers and toxic pesticides to sustain yields. When increased yields failed to materialize, the canal system was extended farther and farther into the desert. Increased evaporation and leakage through unlined canals has caused remote villages dependent on the canals for their water to suffer greatly.

JDA began a multi-year well drilling and completion program in 2000. It drilled more than 250 shallow

community wells throughout the hardest hit area of Karakalpakstan. As time has passed, more than 600 more wells have been drilled to provide drought relief.

The technology used is cable tool drilling. It uses a hand operated drill rig mounted on a wood tripod (Fig. 3). The drilling operation requires six men, who can drill a 15-m (50 ft) well in about one day. Although labor intensive, it provides much needed employment in an area where unemployment can reach 80 percent to 90 percent.

Cable tool drilling allows the driller to locate thin, water-bearing sands below and adjacent to canals. Leakage from the canals percolates down until it reaches a clay layer, saturating the sand immediately overlying the clay. Individual well yields vary widely. But, as a rule-of-thumb, each well will provide for the household needs of five to 20 families. In many villages, wells are strategically positioned to serve the needs of a neighborhood.

Wells are completed using a 108-mm (4.2 in.) high-densisty polyethylene casing fitted with a slotted screen and a gravel pack. The well is bailed, then a simple hand pump and drop pipe, with a specially manufactured check valve on the inlet, are installed. The collar of the well is sealed with a sanitary seal to prevent contamination and surrounded by a protective fence to keep livestock away from the well (Fig. 4).

The pumps are manufactured locally and rely solely on mechanical leverage to lift the water. Water quality varies from well to well. But, when combined with SODIS technology, they provide clean water and reduce illness due to waterborne pathogens.

The wells have been accepted by most of the villagers. The drilling program is complemented by a community health education program. It emphasizes the benefits of clean water in reducing disease, particularly among young children.

Villagers are then willing to try the well water. Each well drilled in a community is assigned to a resident to maintain. He or she establishes a schedule for daily usages by his or her neighbors and keeps the concrete surface seal area clean and the fence in good repair.

When the drought ends, these wells will probably no longer be needed. But, until then, they provide the only reliable source of water.

Compressed soil block manufacturing. Much of Central Asia lies within an active seismic belt where earthquakes are common. The tremors affect the stability of structures built of soil blocks (adobe). Homes, schools and other community buildings have been destroyed or severely damaged by recurring seismic events. In an attempt to improve structural stability, JDA has introduced compressed block technology as a viable alternative to traditional mud bricks for construction.

Central Asians have been making mud bricks by hand for thousands of years (Fig. 5). Using local clayey soil and water, mud bricks are formed in molds and allowed to dry in the sun. It is not uncommon for workers to make 2,500 bricks a day. The strength of the bricks is highly variable. But ancient fortresses in Karakalpakstan attest to durability of well-made bricks. Figure 6 shows a portion of a wall built in the 14th century. Note the layer of reeds in the middle of the photo. The reeds were placed near the base of the wall to dampen vibrations from seismic tremors.

FIG. 4

Completed community water well.

Several hand-operated mechanical block presses were imported from India. The presses are simple to operate and rely on mechanical leverage to increase block strength through compression (Fig. 7). A trained operator and a helper can manufacture about 1,000 blocks per day, a production rate comparable to traditional mud brickmaking. The compressed blocks can develop compressive strength about 65 percent of that of kiln-fired bricks.

Surface deposits of clayey soil are abundant throughout Uzbekistan and Afghanistan. Montmorillonite clay content of 65 percent or greater is suitable for blocks.

FIG. 5

Traditional soil block technology.

With less than 65 percent, cement must be added to ensure sufficient compressive strength. Soil samples taken from several local sources have been tested for suitability in a government laboratory in Tashkent.

JDA set up one machine in the courtyard of its Tashkent office for demonstration and training. Compressed soil blocks have been used to construct a privy in the courtyard to demonstrate their utility (Fig. 8). Local villagers have been trained to test the soil and use the machine to produce soil blocks for sale in the local bazaars.

FIG. 6

14th century mud brick wall.

FIG. 7

Hand operated mechanical block press.

FIG. 8

Compressed block privy.

The initial trial was conducted at Karnap, a small village on the eastern edge of the Kyzylkum Desert in central Uzbekistan. A local entrepreneur leased a unit, using a loan granted through JDA's microfinance program, and began manufacturing soil blocks as a family business. The blocks have proven to be competitive in quality with fired bricks produced in government-owned kilns. However, they cannot yet compete price-wise with the subsidized kiln-fired bricks. In Afghanistan, the blocks should be competitive because there is no government subsidy. The compressed blocks are being marketed for foundations and bearing walls, rather than for general building construction.

Acceptance of the technology has been slow to develop. Sun-dried mud bricks have been used for construction in the region for thousands of years and villagers are reluctant to try something new. Because of their poor economic status, many villagers cannot afford to use the compressed bricks, even though their superior strength can be demonstrated. It will probably take a number of years before the technology becomes widely accepted.

It is important to continue marketing the blocks for special construction, where structural integrity is especially important. Schools, hospitals and other community buildings are likely candidates.

Conclusion

Technology, wisely selected, applied and accepted by the local culture, can be an important tool for community development in countries anxious to improve their economic and social infrastructure. It can provide opportunities for local businesses to thrive by providing needed goods and services to a community, while allowing the entrepreneurs to learn the basics of free enterprise. It can lead to improved health, better education and more advanced technology to increase competitiveness.

A family, community, region or nation that can meet its own needs, improve its standard of living and freely exercise its skills and abilities, will be one that will tend to understand and embrace democratic values. JDA is grateful for the opportunity of assisting the people of Central Asia in their quest. ■

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