Zimbabwe’s Search for a Sustainable Energy Source

Background

Countries throughout the world are seeking to increase their energy independence and reduce their negative influence on the environment. Zimbabwe is pursuing both goals by developing biofuels from sustainable agricultural products. ASTM International standards provide a framework for creating a viable biofuel from the locally grown Jatropha plant. ASTM also provides standards for Zimbabwe’s ethanol production.

By signing the Kyoto Protocol, an international agreement connected to the United Nations Framework Convention on Climate Change, a country commits to reducing greenhouse gas emissions. Responding to Kyoto dictates, Zimbabwe’s government has established a policy to support biofuels such as biodiesel and ethanol-based fuels. This policy will reduce fossil fuel use, thereby reducing carbon emissions and helping to curb climate change and global warming.

Zimbabwe’s biofuels program concentrates on biodiesel made from the oil of seeds from the Jatropha curcas plant. By encouraging farmers to grow Jatropha, the government supports the additional goal of reducing unemployment and poverty.

Problem

Because Zimbabwe imports far more energy than it produces, the country needs to pursue technologies that help it become more energy independent. In addition, Zimbabwe must invest in environmentally friendly technologies for energy production to meet its Kyoto Protocol commitment.

Another serious problem facing the country is poverty and high unemployment levels, especially in rural areas. The government is seeking to merge the solution to the energy and poverty problems. Zimbabwe is encouraging rural farmers to cultivate the Jatropha plant as a means to empower its local agricultural communities and enlist them in the global search for and production of sustainable fuels.

Approach

Zimbabwe’s program for environmentally friendly technology to increase its energy independence centers on the Jatropha curcas plant. Jatropha is a locally grown, perennial, oilseed plant, a genus of approximately 175 evergreen succulents, shrubs, and trees from the family Euphorbiaceae. The plant is native to Africa, North America, and the Caribbean.

Jatropha is drought-resistant and able to tolerate the high-moisture stress conditions common throughout Zimbabwe. It also grows well across a wide range of land types including marginal areas, wasteland, and land unsuitable for traditional agriculture.

Jatropha produces seeds for up to 30 years, making it an ideal sustainable feedstock for producing biodiesel.

A local polytechnic technical college began the process of extracting biodiesel from Jatropha in the lab. Immediately, those involved in the government project recognized the need for standards to define performance criteria. The Standards Association of Zimbabwe (SAZ) assigned this task to its Technical Committee CH20: Petroleum Products and Lubricants, expanding its scope to include the Jatropha project.

In 2006, Technical Committee CH20 met and chose to adopt ASTM D6751, Specification for Biodiesel Fuel Blend Stock (B100) for Middle Distillate Fuels. Because D6751 was designed for soybean-based biofuels, Technical Committee CH20 planned to adapt it to Jatropha biodiesel.

ASTM D6751 is a performance standard. It establishes a substance's required performance by stipulating minimum standards for how it affects the environment and how it functions. However, D6751 and similar standards do not designate in detail aspects of the substance such as composition, size, density, and other measurable basic elements. Any formulation that meets the D6751 criteria qualifies under the standard. Qualifying assures predictable behavior and effectiveness without constraining the imagination of problem-solvers as they work to achieve the outcome.

ASTM International standards, such as D6751, are copyrighted and rarely allow others to develop a derivative standard. However, through the Memorandum of Understanding (MOU) program, ASTM International encourages previously marginalized stakeholder groups to participate in standards development through contributing to technical committees and subcommittees of national interest. Groups can take part either by actively participating in meetings or by using electronic means. SAZ, an MOU partner since 2002, encourages Zimbabwean experts to participate in developing ASTM standards. In addition, ASTM's agreement with SAZ allows and encourages SAZ to either adopt ASTM International standards or use them as the basis of their national standards.

The Zimbabwe biodiesel project requires extensive research to define Jatropha-based biodiesel blends because D6751 specifications, which use soybean as the feedstock, may differ from those involving Jatropha. Zimbabwe authorized Technical Committee CH20 to develop national standards for biodiesel blends ranging from B2 to B20 (diesel blends comprised of 2 to 20 percent biofuel). The committee includes representatives from academia, the motor and petroleum industries, biodiesel manufacturers, farmers' unions, government agencies, and SAZ. After analyzing the ASTM D6751 standard, which references a number of ASTM, European, and UPO test methods, they unveiled a full-scale project to commercialize biodiesel production adopting more than 20 ASTM standards.

The Zimbabwe Jatropha program is helping to remedy another serious problem: rural poverty and unemployment. Government and nongovernmental organizations are

encouraging rural subsistence farmers to grow Jatropha plants as a business. Local communities have embraced the project, and such groups as World Vision have shown strong support.

ASTM International standards have also influenced ethanol production in Zimbabwe where a blend of ethanol and gasoline is a traditional source of motor fuel. At one point, this fuel was the only gasoline available in the country. Several ASTM standards support this industry.

As another contribution to energy independence, Zimbabwe has the capacity to extract ethanol from sugar cane, a crop commonly grown on plantations in the low veld, South African grassland. For example, in 1975, Triangle Limited, a private enterprise, chose to make ethanol using surplus molasses resulting from the production of sugar. Their plant, starting production in 1979, operated for more than 18 years producing environmental benefits, skills transfer, and technological adaptation along with fuel. Currently, efforts are underway to restart production.

Outcome

Planting Jatropha for biodiesel production has become a viable business in Zimbabwe, and similar initiatives in other countries are producing comparable results. For example, Swaziland, Zambia, Madagascar, and Malawi have planted 41,044 hectares of Jatropha. (A hectare equals 10,000 square meters.) Swaziland has planted 9,244 hectares: 1,227 hectares on managed plantations and 8,017 hectares under contract farming. Zambia has planted 2,411 hectares on managed plantations and 20,760 hectares under contract farming.

Government and industry studies project that biodiesel can potentially contribute 30 percent of Zimbabwe’s fuel needs. Also, biofuel production will develop sustainable energy, industry, and agriculture. The crops have helped to reduce poverty levels and improve rural employment, creating thousands of jobs in Zimbabwe and across Africa. Without standards to help determine that the biodiesel from Jatropha performs as desired, this new sustainable industry would likely be impossible.