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Landfill Methane Integration in Ukraine

The end of the ice age saw a decrease in the number of big game animals because of over-hunting. The hunter-gatherer tribes were left with smaller game, compelling them to develop dependable, alternative sources of food. The domestication of plants and animals provided humans with a more reliable food source and reduced the amount of land required to sustain a single person. This “invention” of agriculture was a major turning point in the history of the human species, moving the human race towards more complex social and cultural patterns. As industrialization caught up with agriculture, the need for fuel sources to operate machinery that would lead to record harvests would increase exponentially.

As it triggered the development of agriculture, so has climate change compelled humans to develop dependable alternative sources of fuel to minimize pollution and maintain our agricultural productivity. Political instability, dwindling reserves, and higher consumer demand are also factors that have forced an evaluation of our fossil fuel use. People are receptive now more than ever toward safer, cleaner, cheaper, renewable energy, opening the door for the development of fuels that address environmental issues and agricultural production and prices - biofuels.

Biofuels have the potential to help those developing countries in eastern Europe and western Asia particularly prone to political instability and economic growth tied to fossil fuels consumption. Ukraine, a country in eastern Europe and a former member of the U.S.S.R., depends on imports to meet about three-quarters of its annual oil and natural gas requirements. This reliance on foreign fossil fuels has made the Ukrainian economy vulnerable, threatening to reverse the gains made in the last decade and placing its citizens and sovereignty in jeopardy.

Like many other former Soviet republics, Ukraine has a recent history full of political turmoil. In 1917, Russia was seized by revolutionaries but in the following year, Ukraine became an independent country. Four years later, Russia seized it back and Ukraine became one of the original republics of the Soviet Union. In August of 1991, upheaval in Soviet government caused by resistance to reform and discontent with a less-socialist but more stagnant economy afforded Ukraine an opportunity to free itself from the yolk of Soviet domination. The Ukrainians declared their independence, and gained recognition by the United Nations after the breakup of the Soviet Union in December of 1991.

Ukrainian agriculture has been expanding since the breakup of the Soviet Union in 1991. During Soviet rule most property, factories, and businesses were in the possession of the government. When independence was declared, state farm property had to be divided among the farm workers. During Soviet Rule many of Ukraine’s most knowledgeable farm workers were displaced to develop new state farms in the central plains of the republic. The first round of farm reforms in 1992-1993 initiated the privatization of land through the distribution of paper shares to the rural population. They also mandated the transformation of former collective and state farms into corporate shareholder structures (Lerman). As farmers adjusted to the new government and many other changes farm production fell by more than 50 percent in the first ten years of development. The second round of farm reforms began in 1999 when the corporate farms were compelled by presidential decree to convert the paper land shares into fully titled land plots for their shareowners. Following these land reforms nearly 7 million rural residents became owners of physical land plots, not just paper shares. This was a big step towards financial advancement for most of Ukraine’s subsistence farmers.

Land ownership is an important source of income for rural farmers. Renting out land provides the average landowner with about 400 hryvna per year (Lerman). 400 hryvna is the equivalent of about two and a half months of a peasant farmer's wages. The transfer of agricultural land to individual farms has accelerated rapidly in the last ten years. About 65 percent of all arable land in Ukraine is now held by rural individuals, instead of corporate farms. The average size of a peasant farm in 1998 was 25 hectares. Over a five year period this number increased almost 300 percent to 70 hectares (Lerman).

Even with these changes in land ownership, agricultural production lags well below the levels needed to meet the needs of its people. Malnutrition and poverty are substantial issues. According to the Food and Agriculture Organization of the United Nations 31.7 percent of the national population is in poverty and less than 80 percent of Ukrainian children are receiving adequate nutrition.+ There are a number of issues preventing sustained growth of agricultural production.

The availability of arable land is not one of those factors, however. Most of Ukraine's terrain consists of vast fertile plains, or *steppes*, and plateaus. The large country covers approximately 60 million hectares of which roughly 42 million are classified as agricultural. The climate of Ukraine is something like that of Kansas (Lindeman). The weather is suitable for both winter and spring crops and the average annual precipitation ranges from 30 inches in the north to about 9 in the southern regions.

Most rural farmers live in small wooden cottages, or even smaller apartments, on scattered farms where they maintain a very low standard of living (Moss 288). Most families do not have enough money to support their children; therefore the average family size is decreasing. All children from the ages of seven to eighteen are expected to attend and do well in school. Many of the brightest young people in rural areas move away in order to attend higher education at one of the nine state universities. After they receive their degrees, most never return to their rural beginnings. Instead they take up a professional job in one of the major cities, like Kyiv or Kharkiv. Ukraine also faces growing unemployment as it continues to move towards a free-enterprise economy. Poor economic conditions have contributed to a growing crime rate.

Corn is the third most important feed grain in Ukraine and the planted area has increased despite numerous obstacles. Obsolete and inadequate harvesting equipment, the high cost of production (especially post-harvest drying expenses), and pilferage are just a few of the hurdles that the Ukrainian farmers must continue to overcome (Lindeman). Corn, used primarily for poultry and swine feed, production and consumption have been increasing since 2000 when there was a rebound in poultry production.

Ukraine's ever-present lack of modern harvesting equipment remains one of the main obstacles to increasing grain output and quality. Farmers estimate that ten to twenty percent of the standing crop is usually lost due to harvesting delays caused by their outdated and inefficient machinery. The accessibility of harvesting equipment is what continues to divide small, unprofitable farms from the large corporate ones. According to the United States Department of Agriculture's Mark Lindeman, "Ukraine [just] is going through a "winnowing process" whereby unprofitable, usually smaller farms will either collapse or join more successful farms" (Lindeman).

Ukraine's dependence on Russia for energy supplies has made their economy defenseless. Ukraine depends on imports from Russia and Central Asia to meet about three-quarters of its annual oil and natural gas requirements. A dispute with Russia over pricing in 2005 led to a temporary gas cut-off. Ukraine eventually concluded a deal with the Russians in January 2006, but the price of their imported fossil fuels doubled.

Pollution is a major problem in Ukraine, especially in its cities. Factory smoke and other wastes have damaged the quality of air and water, especially in the heavily industrialized region of eastern Ukraine.

Methane is a hydrocarbon that is the primary component of natural gas (Energy). It is often produced as a byproduct in landfills, coal mines, and oil and natural gas systems. If the methane is allowed to escape into the Earth's atmosphere it becomes a potent green house gas, meaning that its presence in the atmosphere affects Earth's climate and temperature system. Efforts to reduce methane emissions, by using it for energy production, can yield considerable environmental, economic, and energy benefits.

Landfill gas is created as a natural byproduct of decomposing organic matter disposed of in landfills, and consists of about 50 percent methane (Energy). Direct use of landfill methane technologies include combusting gas in boilers, furnaces, kilns, or other equipment to provide steam or heat. The landfill gas can also be processed for other valuable uses such as vehicle fuels or chemical production (Energy). The collection and utilization of Ukraine's landfill gas could offer a cheaper, more reliable source of energy for rural farmers. Providing affordable, reliable energy is the first step towards a more efficient agricultural economy.

Landfill gas is extracted from using a series of wells and a vacuum system, which directs the collected gas to a point to be processed. From there, it can be used in at least three ways. One option is to produce electricity with engines, turbines, or other technologies. The second option is to process the landfill gas and make it available as an alternative fuel to local industrial customers or other organizations that need a constant fuel supply—direct use of the gas is reliable and requires minimal processing and minor modifications to existing combustion equipment. The third option, the one I believe to be most beneficial to Ukrainian farmers, is to create pipeline-quality gas or alternative vehicle fuel with landfill gas.

When establishing LFG energy projects a variety of issues must be addressed. These issues include the recovery potential of the landfills, financing, determination of the project structure, and the determination of gas rights ownership (Background).

Open dumps and unmanaged landfills are the most common disposal options in many developing countries. However, many of these countries are currently shifting to environmentally sound landfills from less restrained systems. This shift is due to the fact that open dumps contain very little amounts of methane, making them poor candidates for landfill gas energy development.

Ukrainian towns generate 10 million tones of garbage and more than ninety percent of this waste is disposed of in one of the more than 700 Ukrainian landfills (Geletukha). More than 140 of these landfills are suitable sites for the extraction and utilization of landfill gas. Together these sites could produce about 400 million cubic meters of landfill gas per year (Gelaturukha).

A Methane to Markets Partnership can help facilitate a transition to landfilling by sharing information on landfill design and management. Methane to Markets is an international initiative launched in 2004 that advances cost-effective methane recovery and its use as a clean energy source (Background). The goal of the Partnership is to reduce global methane emissions in order to enhance economic growth, strengthen energy security, improve air quality, improve industrial safety, and reduce emissions of greenhouse gases. This voluntary initiative was established to build on the successful work done in the Environmental Protection Agency's (EPA) Landfill Methane Outreach Program (LMOP).

I don't believe that the Ukrainian farmers are undergoing a "winnowing process." The break-up of the Soviet Union left them decades behind the modern world. Providing renewable, reliable, reasonably priced energy could make the dream of new farm equipment a reality for many rural farmers. More efficient farm equipment would improve crop yields, increase the annual income for the peasant farmers, and benefit the nation's developing economy.

Just seven miles down the road from my high school sits the Metro Park East Landfill. This landfill accepts 15 percent of Iowa's waste and conducts a highly sophisticated operation. Each day the deposited waste is compacted and covered with six inches of soil to control odor, litter, and health problems. A combination of a liner and collecting pipes collect the precipitation that seeps through the waste so that it doesn't affect water quality. Gases produced by this landfill are collected and sent to the Metro Methane Recovery Facility where they are converted into electricity to be used by homes in the metro area.

Hopefully, someday soon a teenager in Ukraine will be able to say something similar. Hopefully, someday soon Ukrainian families will have adequate access to new technology, be able to reap the benefits of new technology, and improve their standard of living.

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