The Emergence of Green-Powered IT Page 12

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U.S. CTO Shares Strategy for Innovation

Aneesh Chopra, CTO of the United States, was the keynote speaker at the NJTC 2010 CIO Conference.

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Envisioning the Future

with a Technology Available Today

BY NICHOLAS SMITH-SEBASTO, PH.D.

The Car Allowance Rebate System (CARS), also known as the Cash for Clunkers program, was in effect for a period of time in 2009. Under the program, vehicle owners were provided with the unique opportunity to receive up to $4,500 to be applied toward a trade-in of a "clunker" for a newer, more fuel-efficient, lower-polluting vehicle. The cost to U.S. taxpayers was $3 billion!

Almost 700,000 vehicles were involved in the program. The problem is that almost 100,000 of the vehicles purchased as part of the program had EPA mileage ratings of less than 20 mpg. If the CARS program was designed to be an environmental success, the outcome clearly could have been better. The idea of reducing the amount of carbon dioxide and other emissions being released into the atmosphere is certainly a worthwhile one, especially since carbon dioxide, known as a greenhouse gas, has been identified as one of the atmospheric gases most influenced by human activities and most clearly associated with global climate change.

There is another opportunity available to Americans to reduce greenhouse gas emissions. This one does not involve cars or trucks, instead it relies on an emerging technology that has a far greater potential to make a substantial contribution to addressing the concerns over global climate change by reducing greenhouse gases. That technology is food waste composting.

According to the United States Environmental Protection Agency (USEPA), Americans generated 31 million tons of food waste in 2007 (the most recent year for which these data are available). Also according to the EPA, for every ton of food waste that is composted approximately 1 metric ton of carbon dioxide equivalent emissions are avoided. So, if every ton of food waste was composted, especially if on-site, aerobic, in-vessel technologies were used, the resulting reduction in carbon dioxide equivalent emissions would be roughly equal to removing, not exchanging as with the CARS program, six million cars from the roads.

An additional concern associated with food waste is what happens to it after it is landfilled. Because modern landfills are designed in such a way that most biochemical decomposition is suppressed, and that which does occur happens under anaerobic conditions, methane is emitted. Methane, like carbon dioxide, is a greenhouse gas with a major distinction; it has a global warming potential about 70 times that of carbon dioxide.

Again, if all of the food waste generated in America in just one year

were to be composted, the amount of methane emissions avoided would offset the global warming potential roughly equal to 30 million flights between New York and London.

The amount of landfill space saved in just one year if all of the food waste generated in America were composted would be roughly equal to the volume of 45 Empire State Buildings! The area saved by not landfilling food waste would be about 775 acres, an area roughly the size of 40 Giants' Stadiums! In a state with limited, if any, space for new landfills and with numerous existing landfills reaching capacity, saving as much space as possible is important.

Restoration of degraded soil is also a benefit of composting food waste. Globally, nearly 250 million acres of soil are classified as extremely degraded; nearly 750 million acres as severely degraded; nearly two billion acres as moderately degraded; and nearly two billion acres as slightly degraded. Compost produced from food waste is rich in vital macro- and micronutrients and makes an excellent soil amendment that restores nutrients as well as water holding capacity to degraded soils. Using compost also often results in a reduction in the amount of synthetic fertilizer that must be used as well as decreases in the amount of topsoil and/or decorative mulch that must be purchased for landscaping projects.

Did you know that less than three percent of all of the food waste generated in America gets composted? Why?

Part of the answer lies in the technology used to compost food wastes. Certain technologies, such as outdoor windrowing, have limitations regarding what may be composted and odors that may be associated with the composting process. For example, if proteins from sources such as meats and dairy products are added to a windrow, pests may be drawn to the site. Additionally, odors may be a problem if the windrow is not adequately aerated.

The truth is that many of these challenges have been overcome with newer technologies that improve the capacity of composting facilities to maintain proper oxygen levels in the windrow and to control any odors. Advances in on-site, aerobic, in-vessel digestion options, in which there are no limitations concerning proteins, have improved the opportunities for certain food waste generators to process their waste on site, thereby eliminating the need to transport the waste to an appropriate disposal site.

This results not only in environmental benefits, but financials savings as well. Opportunities for large-scale composting of food wastes are also increasing. In New Jersey, a facility is now in operation that is capable of composting 250 tons of food waste daily. To address the unique collection and transportation issues associated with food waste, specialty haulers are appearing. Lastly, experts in conducting food waste audits to precisely determine the amount of food waste a facility generates as well as the real total costs of transportation and disposal are increasing.

Perhaps during the next five years, composting of food wastes will reach its full potential and the benefits to humankind scientists have envisioned will be fully realized. ■

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Case in Point:
Food Waste Composting at Kean University

The emerging technology of on-site, aerobic, in-vessel digestion of food waste holds enormous potential to address contemporary environmental issues. The process is remarkably simple; the planet has been doing a variation of it for several billion years. A demonstration project of this technology is available at Kean University.

Food scraps are collected from dining locations on campus. In a system custom-designed for the university based on a food waste audit, the food scraps are blended with wood chips in a mixer designed for that purpose. The wood chips are obtained from a cabinet manufacturer in Paterson, for whom they are a waste product. They are from kiln-dried, cabinet-grade dimensional lumber and are slightly larger than one cubic centimeter is size. They used to be picked up by a waste hauler and transported to a landfill for disposal. Now they are provided at no cost for use in this project and the cabinet manufacturer has reduced its waste hauling costs: it's a gain-gain relationship.

Once an appropriate mixture is achieved (determined by moisture content as well as the ratio of carbon and nitrogen in the mixture), it is conveyed via an enclosed auger to a vessel where microorganisms biologically breakdown both the food scraps and wood chips (which serve the purpose of absorbing the excess water often found in food scraps; providing carbon, which is an essential part of the microorganism's diet; and creating air voids in mixture once it is in the vessel). Shredded cardboard may also be used for these purposes, but the wood chips produce superior compost. Wood chips from tree-felling operations may also be used, but they need to be further processed before they will be effective in this type of composting process.

The food scraps and wood chips are loaded into the vessel in a process that occurs every weekday so that the mixture added each new day pushes the mixture from the previous day toward the discharge end of the vessel. Temperatures inside the vessel will reach 130 to 145 degrees Fahrenheit in certain locations. This is sufficient to kill any harmful bacteria. No additional heating is required. These temperatures are created by the metabolic activities of the microorganisms that digest the food waste and wood chips. Bacteria also do not need to be added to the process; they already exist in the food we eat.

After five days, compost produced from the food scarps and wood chips that were loaded into the vessel five days earlier is off-loaded. The compost will be used in a variety of landscaping applications on campus.

The total energy cost, which is for electricity only, to compost one ton of food waste into rich, organic compost is less than $4 per ton. The total footprint of the composting system, including the greenhouse that will be constructed to house it, is 1,000 square feet. ■