



Spotlight on Waste

As a continuation of the March issue focus topic, this month and next, *EM* will feature a special spotlight on waste management with planned articles that will consider topics as varied as landfill leachate problems, zero waste as an achievable goal, food waste challenges and opportunities, and waste-to-biofuels conversion.



Energkem Alberta Biorefinery.
Photo courtesy of Energkem

Energkem Process Converts Waste to Biofuels and Green Chemicals in Canada

Managing municipal waste is an increasingly daunting challenge for communities around the world. In Edmonton, Alberta, Canada, the city has partnered with Energkem—an innovative waste-to-biofuels producer—to provide a sustainable alternative to the challenges associated with waste disposal.

Cities all around the world are struggling with a daunting challenge when it comes to municipal waste management. In addition to the environmental problems associated with conventional management practices, it is becoming increasingly difficult to permit new landfills or combustion waste-to-energy plants due to more stringent regulations and considerable opposition from the public. This, resulting in decreased landfill capacity, poses a major obstacle for cities to offload their waste. A number of municipalities are on the hunt to find new ways to reduce waste sent to landfills. New cleantech solutions are coming to reality and may just be what communities need to resolve one of the biggest environmental challenges of our time: waste generation continues to increase, while available landfill capacity decreases, and related sustainability concerns mount.

One of the most notable innovations in this field is well underway in Edmonton, Alberta, where the city has partnered with an innovative waste-to-biofuels producer to leverage its proprietary technology and provide a sustainable alternative to the challenges associated with waste disposal. Instead of landfilling unrecoverable waste in Edmonton, this technology uses the waste as a feedstock in a process that converts the waste to green chemicals. The process recycles the carbon contained in the trash to produce renewable chemicals used to manufacture paints, glues, solvents, textiles, automotive parts, and the like, as well as biofuels, rather than using the traditional, fossil- or crop-based feedstocks in the production. Accordingly, the technology not only provides a sustainable alternative to the challenges associated with conventional waste disposal methods, it turns waste into a valuable resource to make everyday products greener.

Edmonton: A World Leader in Waste Management

Reduce. Reuse. Recycle. Three words synonymous with the way the City of Edmonton handles its trash. A world leader in environmentally sound and efficient solid waste management, sustainable energy, and wastewater treatment, the city is often cited as a sustainable model for municipalities around the globe to replicate.

But it wasn't always this way. After years of conventional landfilling, Edmonton's management of municipal solid waste and the capacity for taking on more volumes came to a head in the 1980s. Waste began to choke the city of 600,000 residents and a landfilling crisis ensued. The main city-owned landfill was near capacity and was on its way to not be able to continue accepting the city's waste as it had for decades.

There was a need to find a new way. Just over a decade ago, with support from other municipal and environmental leaders and advocates, Edmonton's Mayor Stephen Mandel and his successor Mayor Don Iveson developed a bold and ambitious plan to transform the way in which the city's trash was handled. With impressive recycling, composting and hazardous waste management efforts already in place since the 1990s, a new wave of waste management programs began to take hold in Edmonton. The city was now poised to take on the next challenge in handling its garbage.

In the early 2000s the city began to explore a new approach to reduce waste sent to landfill. Elected officials recognized the feasibility of developing an innovative technology plant adjacent to the Edmonton Waste Management Center—a mere 10 miles from downtown. The goal was to make this the world's first site of an innovative and commercially-viable alternative to traditional waste processing and disposal methods.

Ambitious Plan to Divert 90% of Solid Waste from Landfill

In 2007, the City of Edmonton selected Enerkem, a Montreal-based biofuels and chemicals producer with an award-winning and transformative technology, to partner with the city to achieve its ambitious goal of diverting up to 90% of Edmonton's municipal solid waste from landfill. The city viewed this innovative technology as providing an ideal solution to its waste management problem.

The Enerkem Edmonton project received permitting to move forward in 2009 and construction began in 2010. The plant would first produce biomethanol and was poised to produce ethanol thereafter. In four years, construction was complete and the first of a kind commercial-scale plant began operations. The location of the Enerkem plant within the Edmonton Waste Management Center is depicted in Figure 1.

With impressive private investment and support from provincial government and city leaders, the Enerkem Alberta Biofuels Facility was well on its way to becoming a new player not only in the city's successful handling of waste otherwise destined for landfill, but also a notable reference plant for other cities around the world to look to. Today, the plant successfully converts unrecoverable waste to ethanol biofuel. The Enerkem Alberta Biofuels Facility is also the first-ever waste-to-biofuel facility to sell its ethanol under the U.S. Renewable Fuel Standard (RFS). In addition, the facility obtained certification from the International Sustainability and Carbon Certification (ISCC) system.



Figure 1. Enerkem Biorefinery at the Edmonton Waste Management Center

Photo courtesy of Enerkem.

“All around the world, managing waste is proving to be one of the greatest challenges of our time,” says Michael Labrecque, branch manager, Waste Services, City of Edmonton. “Like other municipalities, we aim to divert as much from landfill as possible, and if in the process our waste can be used as a resource, that’s a bonus.”

While the production of biofuel at the facility is still in ramp up mode, once it reaches full capacity, the Edmonton facility will process over 100,000 dry tons of unrecoverable municipal solid waste per year, which represents approximately 30% of Edmonton’s household waste. When combined with recycling and composting programs put in place by the city, each respectively contributing close to 20–40% of waste diversion, these programs all together will allow the city to reach its 90% waste diversion goal.

Four-Step Thermochemical Process

As depicted in Figure 2, Enerkem’s four-step thermochemical process consists of feedstock preparation, gasification, the cleaning and conditioning of syngas, and catalytic synthesis to recycle the carbon contained in trash and produce renewable chemicals and biofuels. In less than five minutes, Edmonton’s unrecoverable household and commercial waste is converted into a synthesis gas and then into advanced, low-carbon transportation biofuels.

The Enerkem Alberta Biofuels facility produces enough cellulosic ethanol to fuel more than 400,000 cars with a 5% blend of ethanol and gasoline. This is a win–win for sustainable waste management, as well as for renewable fuels and chemicals production. In addition to producing fuels used in the transportation sector, Enerkem’s thermochemical process also produces “green,” methanol-based byproducts that serve as building blocks for the production of secondary chemicals, such as olefins, acrylic acid, *n*-Propanol, and *n*-Butanol, which can then be used to develop thousands of everyday products more sustainably, such as glues, paints, and textiles.

Pioneers in Waste Management

From the company’s founding, there has always been the vision that the Enerkem technology could help communities all around the world achieve 90% waste diversion. The successful pairing of a forward-thinking and environmentally-oriented city leadership with an innovative and disciplined technology supplier has resulted in the world’s first successful deployment of this transformative technology for sustainable waste management.

Today, a number of North American municipalities are actively looking to follow in Edmonton’s pioneering footsteps in managing their unrecoverable waste more sustainably. Some major U.S. cities—including Los Angeles, New York,

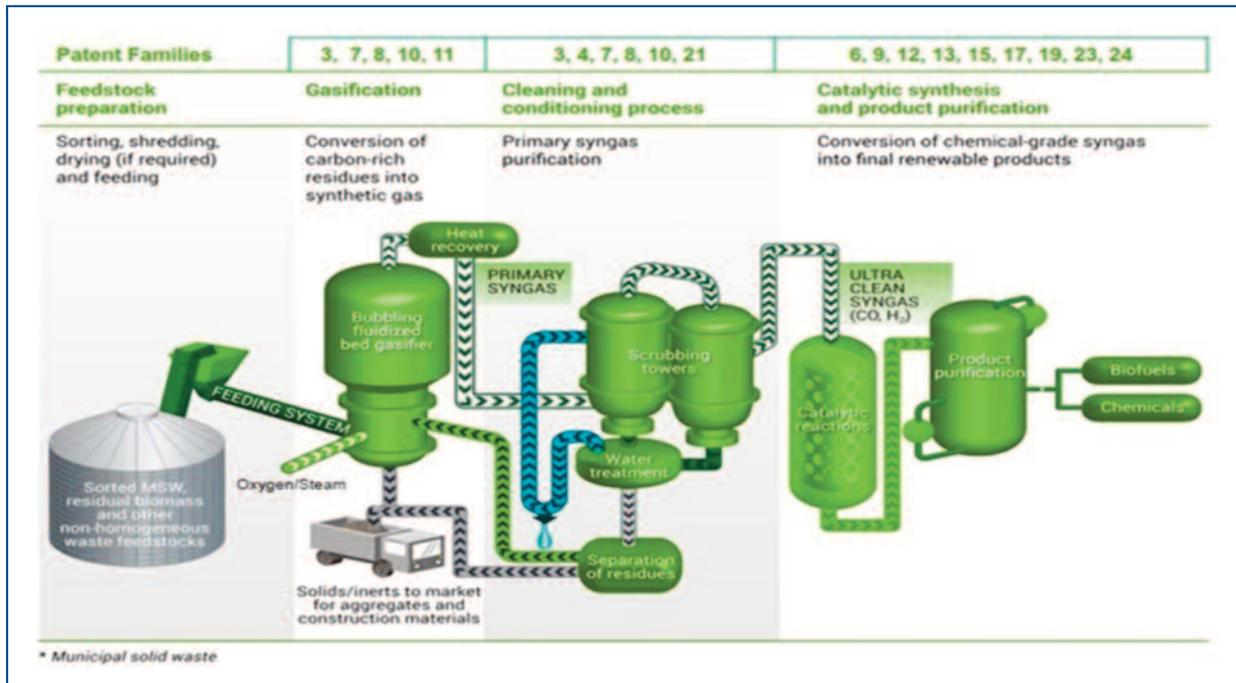


Figure 2. Enerkem Process for Converting Waste to Low-Carbon Transportation Biofuels.

Minneapolis, Seattle, Washington, D.C., and Philadelphia—have set ambitious recycling and zero-waste-to-landfill goals, which has led them to explore some of the smarter innovative technologies that can not only keep waste from reaching landfills in the first place, but can create new, valuable materials out of the things we discard every day.

With landfill capacity becoming increasingly scarce,

particularly near large cities, those cities could do well to emulate Edmonton and explore the innovative technologies becoming available for more sustainable management of post-recycling waste. Through successful implementation of the Enerkem process in Edmonton, the city is now reaping the sustainability benefits of preserving scarce landfill capacity, while producing biofuels and green chemicals, cutting pollution, and creating long-term local jobs. **em**

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