



Warming up to trash: Using garbage as energy

Do you remember waiting in lines to purchase gasoline? Interstate speed limits of 55 miles per hour? Year-round daylight savings? The nationwide energy crisis of early 1970s changed the American way of living. More than three decades later, those events are distant memories for many Iowans or took place before they were born. Yet, many decisions made during this time continue to impact the way cities do business today.

Thirty years ago, as Americans reeled from the decision by oil-producing nations to cut off supply to the United States, the Iowa Legislature explored ways to increase energy production and decrease waste. In the age of increased awareness of the environment, including the designation of the first national celebration of Earth Day, change was on the horizon. In Ames, it came in the form of a large, two-story facility built for the purpose of turning garbage into energy.

The history of the Arnold O. Chantland Resource Recovery System tells the story of how one city moved forward with a progressive plan to use new technology to address two community concerns: reliance on non-renewable fuels and using valuable Iowa farmland for landfills. Despite the small numbers of operating facilities and large upfront costs, Ames began investigating a waste-to-energy process by first looking at other sites across the country and in Canada.

Initial planning for the Ames facility began in 1971. It was funded through general obligation bonds and construction began in 1974. Since its opening in August 1975 as the first municipally operated waste-to-energy facility in the nation, the Resource Recovery Plant has been cited in engineering journals, recycling articles and public works publications as a model system.

“We took the best concepts out there, and put something together,” Arnold Chantland recalled in 2005 when being interviewed for the facility’s 30th anniversary.

The concept of using garbage to produce refuse-derived fuel (RDF) for the Ames Power Plant relies on a mechanical separating process to create a combustible product. The Resource Recovery Plant receives garbage from Ames and the surrounding communities in Story County. Private contractors are available to haul garbage, but citizens can do it themselves. The garbage is dumped on the tipping floor, a space capable of holding 450 tons of garbage, and the separation process begins.

From the tipping floor, garbage is placed on a conveyor and taken through the primary shredder. By using steel hammers,

the shredder breaks the garbage into football-sized chunks. A different conveyor takes these smaller pieces under an electromagnet to remove ferrous metals. From there, the garbage travels across the primary disc screen to separate out fine particles and grit. The remaining garbage goes over a second disc screen to eliminate even smaller particles, which fall through and are rejected.

The garbage continues its journey through a second shredder where it is reduced to golf-ball size. The remaining product travels a series of conveyers to the air knife, which separates the material into either burnable refuse-derived fuel or heavier non-burnable rejects. Another series of conveyers takes the burnable product to the twin screwfeeders that push the material into a pneumatic tube, which conveys the RDF underground to the Ames Power Plant located nearby.

Although the process rejects very large pieces, glass and wet garbage, the amount of recycling exceeds rates of traditional recycling. Between the recovery of ferrous metals and the production of refuse-derived fuel, 70 percent of the waste brought to the facility is reused as fuel or recycled. The RDF supplies 10 percent of the fuel used to generate electricity at the Ames Power Plant and supplements the coal used in the boilers. Through this process, fossil fuels are conserved and sulfur dioxide emissions decrease when coal is burned with RDF.

The rejects are sent to a landfill. Since it is shredded, it takes up much less volume in the landfill than it would if it were buried whole.

Through the years, Resource Recovery employees have kept up with industry regulations and technological changes, constantly improving their system to reduce rejects, and provide the best fuel product possible for the power plant. Their creative thinking and innovation has enabled the facility to remain in peak operating condition, allowing Ames and Story County residents to meet and exceed federal and state guidelines for recycling.

Beginning in 2006, Ames initiated a program of glass recycling

to reduce the amount of glass in the waste stream. When pieces of glass are mixed in the RDF and injected into the furnace section of the Power Plant boiler, the glass melts. Solidified glass, called slag, collects in the boiler tubes causing expensive repairs. Additionally, glass often ends up with the non-burnable garbage sent to the landfill, which increases transportation and dumping costs. The City worked with local grocery stores who agreed to place large yellow recycling drop boxes in their parking lots. Since its inception, the glass recycling program has diverted more than 100 tons of glass from the landfill.



What does the city do with all that glass? The glass is taken to the Resource Recovery Plant where it is sent through a glass crusher and can be crushed to the size of sand particles. The sand-like product is used in landscaping, industry and construction.

Future projects at the Resource Recovery Plant include the installation of a system to remove non-ferrous metals, which will increase the recycling capacity and create revenue through the sale of additional metal for salvage.

The decision to pursue a waste-to-energy facility in the early 1970s meant moving forward during tumultuous times in untested waters. It was a gamble for city leaders, but most considered it a calculated risk with the potential for huge benefits. Looking back, Ames is fortunate to have benefited from this investment. As in the 1970s, alternative fuels such as solar, wind and biomass are again capturing the attention of the public.

"I've always been interested in alternative fuel concepts – it's something we need to keep working on," Chantland said. "Engineers believe in taking science and doing something useful with it. Hopefully, the public will accept it and think it's useful."

Questions about this article can be directed to the City of Ames at sgwiasda@city.ames.ia.us or (515) 239-5101.

The Resource Recovery Plant is making the most out of solid waste:

- The average person throws away 3.7 pounds of garbage every day.
- The plant turns 65 percent of the waste received into fuel.
- The plant saved more than 80 acres of Iowa farmland from becoming a landfill.
- Over a 25-year period, the plant processed enough refuse to fill Hilton Coliseum more than 453 times.
 - The plant processed more than a million tons of solid waste since it opened in 1975.
- The plant recovers enough metal to make 1,200 car bodies each year.
- The plant produces enough refuse-derived fuel to help heat more than 4,600 homes each year.

Another Municipal "Commodity"

Solid waste – garbage – is not the only municipal "commodity" that can be processed and burned to create electrical energy. Since 1991, when an initial upgrading of its Waste Water Reclamation Facility in Southeast Des Moines was nearing completion, the Des Moines Metropolitan Wastewater Reclamation Authority (WRA) has been reclaiming and using the methane gas generated in its wastewater digesters. The methane gas is diverted from the digesters to three large combustion engines where it is burned, turning generators to create electricity. Electricity

from the generators is used to power portions of the treatment process, and waste heat from the engines is reclaimed to heat portions of buildings at the treatment plant and to provide heat to the treatment process when needed.

In the three year period from 2005 - 2007, the WRA generated approximately 36 million KWH of electricity, averaging about 12 million KWH per year. The amount of power generated by the WRA over this period is equivalent to nearly a million gallons of gasoline. Between 2002 and 2007, the WRA generated approximately 42 percent of its annual power needs.

In May of 2007, a gas pipeline was constructed to a nearby Cargill grain processing plant, giving the WRA the option of selling excess gas to Cargill at times when the treatment plant doesn't need all of the heat or power that it could generate. During the remainder of that year, over 178 million cubic feet of digester gas was sold and piped to Cargill for use in its grain processing operations, generating significant income to the WRA. The WRA estimates that in fiscal year 2008, it produced about 465 million cubic feet of biogas. At a cost of \$9 per dekatherm of natural gas, the WRA estimates it saved \$2.7 million in power costs during that period.

Other cities in Iowa, including Ames, Marshalltown and Davenport, make similar use of wastewater treatment plant digester gas.

Sources: Des Moines Metropolitan Wastewater Reclamation Authority and the Iowa Water Pollution Control Association Publication, 2008 Volume 5.