Hennepin Energy Recovery Center: An urban waste-to-energy facility

SWANA
2011 Waste-to-Energy Excellence Award Application

Hennepin County
Environmental Services
www.hennepin.us/HERC
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Executive summary

The Hennepin Energy Recovery Center (HERC) is a mass-burn waste-to-energy facility located in downtown Minneapolis, Minnesota, and owned by Hennepin County. Hennepin County is home to about 1.4 million residents, which is about one quarter of the state’s population. HERC generates electricity for the local power grid and exports steam to the Minneapolis district energy system and Target Field, the new outdoor ballpark of the Minnesota Twins.

HERC is in a unique and highly visible urban location. The neighborhood around the facility has changed significantly since operations began in 1989. Target Field was constructed just 122 feet from HERC. The facility is also located next to new light rail, commuter rail and other mass transit projects. The neighborhood around HERC has seen new residential and commercial projects with more development, including a new transit center and more business opportunities, planned in the next few years.

To ensure HERC continues to be a good neighbor, Hennepin County has implemented numerous projects to control odors and improve the aesthetics of the facility. The county has worked with community partners to assess HERC’s role in the redeveloping neighborhood and to make HERC a valuable asset to the surrounding community.

HERC’s location

HERC is located in downtown Minneapolis next to Target Field and near many mass transit projects. The neighborhood around HERC has seen a renewal of new residential and commercial projects. Hennepin County has implemented several projects at HERC and is assessing future opportunities that make the facility an asset to the surrounding community.
The Hennepin Energy Recovery Center (HERC) is a mass-burn municipal waste combustor that processes 365,000 tons of waste annually to generate electricity and steam. HERC was designed and constructed by the Blount Corporation and began operations in October 1989. HERC is owned by Hennepin County and operated by Covanta Energy.

HERC receives residential and commercial solid waste from waste haulers licensed to collect trash in the county, including all of the residential solid waste from Minneapolis. The facility also accepts a limited amount of pre-approved industrial solid waste. Pursuant to state permit and local ordinance, HERC is currently limited to processing a maximum of 365,000 tons of solid waste per year.

All municipal solid waste (MSW) is delivered to the HERC facility by trucks, which weigh in and out at an automated scalehouse. MSW is then dumped and stored in a fully enclosed tipping hall. An inward airflow is constantly maintained in the tipping hall through the use of high-speed truck entrance and exit doors and by drawing the furnaces’ underfire air from the tipping hall. This serves to confine MSW odors, dust and vehicle noise inside the tipping hall.

Waste dumped on the tipping floor is pushed by loaders into a 40-foot deep bunker where waste is stored prior to processing. The bunker can store up to 8,300 tons of MSW. Two 12-ton Landel Bridge & trolley grapple cranes located above the bunker mix the MSW and feed the hoppers, which lead into the combustion units. Mixing the MSW helps achieve a more uniform fuel and allows the crane operator to visually scan the waste and remove items that should not be combusted.

The facility has two identical combustion units each rated for a throughput of up to 606 tons of MSW per day. Each combustion unit consists of a Distral Energy waterwall furnace equipped with a Widmer +Ernst horizontal stoker grate and convection passes comprised of two evaporators, two superheaters and two economizers. The steam design conditions (Maximum Continuous Rating) at each boiler’s superheater outlet are 171,400 lb/hr at 630 psig and 752° F. Each combustion unit is capable of generating steam at a peak rate of 188,850 lb/hr.

Steam from the combustion units’ superheaters is used to operate a Westinghouse turbine-generator set rated at 38.71 megawatts at 350,756 lb/hr steam flow at 605 psig, 750° F and 2.5-inch HGA. The 13.8 kV output of the generator is stepped up to 115 kV in an onsite transformer and sent through a county-owned 0.72-mile overhead transmission line to an Xcel Energy substation. The plant utilizes an average of 3.8 megawatts for its internal power needs. The turbine-generator can operate, at reduced output, with one of the combustion units shut down.
In 2008, Hennepin County entered into a joint venture with NRG Energy to supply the downtown Minneapolis district energy system with supplemental steam from the HERC facility. Beginning in February 2009, 5,000 to 20,000 lb/hr (50,000 lb/hr maximum) of steam is extracted from either HERC’s main steam header (pre-turbine) or from the first stage of the steam turbine. The steam is then de-superheated to 140 psig and 370°F and piped to NRG. Steam is also supplied to Target Field for heat transfer to space heating, hot water and warming the soil under the playing field. Condensate from this steam is returned to HERC, polished to remove iron, particulates and hardness, and reused as boiler makeup water.

Spent turbine steam not sold to steam customers is piped to an Ecolaire surface steam condenser, which is cooled by water from a Hamon 3-cell cooling tower. The cooling tower can be operated in both a dry and wet mode to conserve energy or reduce its visible water vapor plume.

State-of-the-art emission control technology is used to treat flue gases and ensure that emissions are below the facility permit limits. Flue gases from waste combustion pass through a series of air emission control devices before leaving the facility (air emission controls are further described on page 10).

Bottom ash from each combustion unit is discharged into a quench tank, which also serves as a water seal for the furnace. A hydraulic ram pushes the bottom ash onto a vibrating pan conveyor common to both units. Bottom ash moves across a grizzly screen to remove 6-inch oversize material onto a belt conveyor and under a drum magnet to remove undersize ferrous material. Water and dolomitic lime-conditioned fly ash from a pugmill is then mixed with the bottom ash. The combined ash is conveyed to a stockpile in an enclosed ash storage building where it is loaded into covered semi trailers for transport to either of two ash landfills.

The oversized and magnetically separated ferrous materials are loaded into rolloff boxes and transported to a secure area at a Minnesota ash landfill where they are processed to remove any remaining non-ferrous material prior to shipment to scrap metal markets. More than 11,000 tons of metal is recovered at HERC and recycled each year. This is almost double the 6,500 tons of ferrous metal that are collected annually in curbside and drop-off recycling programs in Hennepin County.

**Operational plan**

The HERC facility is operated continuously 24 hours a day, 365 days a year. Four six-person crews consisting of a shift supervisor, crane operator, control room operator, two auxiliary operators and a utility operator are organized to work 12-hour shifts.

HERC is open to waste haulers from 4 a.m. to 10 p.m. Monday through Friday, 6 a.m. to 6 p.m. on Saturday and 7 a.m. to 3 p.m. on Sunday. An average of 190 trucks drop off solid waste at HERC each weekday, an average of 50 drop off on Saturday and an average of 25 drop off on Sunday. Trucks are on the site for an average of only seven minutes.

The combustion plan is to feed as close to 25 tons per hour of MSW as possible into each furnace while staying within equipment and process limitations and recommendations and within permitted air emissions standards.
The two combustion units undergo planned outages in the spring and fall of every year. Convection pass cleaning outages are conducted every 12 weeks. The spring outage is usually staggered to keep one combustion unit continuously operating. The fall outage includes some total combustion shutdown to work on equipment common to both combustion units. Waste deliveries and waste combustion operations are not altered to accommodate ballgames or other events at Target Field; however, spring and fall outages are scheduled to coincide with Twins road trips.

**Environmental impacts and regulatory compliance**

Since beginning operations, HERC has processed more than 7 million tons of MSW that otherwise would have been sent to a landfill. Processing waste at HERC has saved more than 8 million cubic yards of landfill space. Generating energy at HERC reduces the need to burn fossil fuels such as oil and coal for energy production. Energy produced at HERC since 1990 has saved the equivalent of 7 million barrels of oil or 2.8 million tons of coal. The site for HERC, which formerly housed a bus maintenance garage, was selected because of its proximity to waste sources and energy markets and the opportunity to clean up and reuse contaminated land.

![2009 HERC Emissions as a Percent of MPCA Permit Limits](image)

**Air permits and emissions**

Emissions from HERC are well below the limits set by the Minnesota Pollution Control Agency (MPCA). From 2003 to 2008, emission levels were on average about 80 percent below the permit limits. The facility is in compliance with all of its permits, including Title V air permit, NPDES discharge permit and MCES sanitary sewer permit. Regular inspections are conducted to ensure that the Storm Water Pollution Prevention Plan and Spill Prevention Control and Countermeasure Plan are implemented.
Awards

HERC won the SWANA 1995 Gold Award for Waste-to-Energy Excellence and was awarded a National Association of Counties Achievement Award for Integrated Approach to Regional Waste Processing.

Health and environmental quality studies

In association with a proposal to use the full capacity of HERC and construction projects near the HERC site, extensive investigation and modeling has been conducted in the past three years on the impact of HERC on human health and the environment.

An Environmental Assessment Worksheet (EAW) that assesses the overall impact of HERC on human health and environmental quality was prepared as part of a proposal to use the full capacity of HERC. HERC is currently limited to processing 365,000 tons of waste per year. Covanta Energy, on behalf of Hennepin County, is proposing that HERC be allowed to operate at its designed capacity. This would increase the amount of waste processed at HERC by about 40,000 tons of waste per year and would increase the amount of electricity and steam produced at the facility. A Human Health Risk Assessment and NAAQS air dispersion modeling are being prepared as part of the EAW.

Additionally, an Environmental Impact Statement (EIS) was prepared in 2007 for the construction of Target Field. As part of the EIS, an air dispersion modeling and risk assessment was conducted to answer two basic questions – will the ballpark adversely affect the dispersion of HERC emissions at surrounding locations, and will exposure of ballpark patrons and staff to emissions from HERC be at levels of concern from a health perspective?

The results of the EIS showed that the ballpark slightly altered the pattern of dispersion from HERC but did not affect the magnitude of the concentrations of HERC emissions. The health effects of HERC were modeled using meteorological data. To more accurately simulate inhalation exposure, only the days on which the Minnesota Twins had scheduled home games were modeled to estimate air concentration. As an upper limit, the regular season schedule was extended to 11 games in October to simulate Division and League Championship and World Series games. Fans were assumed to spend six hours at the ballpark and players and staff were assumed to spend nine hours. The concentrations of 15 Compounds of Potential Concern (COPC) were investigated. The COPCs were:

- Arsenic
- Cadmium
- Carbon monoxide
- Chromium
- Hydrochloric acid
- Lead
- Mercury
- Nickel
- Nitrogen dioxide
- PM-10
- PM-2.5
- Polychlorinated dibenzo-p-dioxins/polychlorinated dibenzo-p-furans (dioxins)
- Sulfuric acid mist
- Sulfur dioxide
- Total suspended particulate

Two sets of COPC emission rates were applied in the assessment. One set corresponded to actual HERC emissions based on the average of the three most recent stack testing reports (2003-2005) and another corresponded to the MPCA permit limits. The risk calculations showed that for emissions based on both permit limits and actual measurements, the carcinogenic and noncarcinogenic risk results for the various receptors were less than the U.S. EPA and MPCA’s cancer risk level of $1 \times 10^{-5}$ and Hazard Index of 1, respectively.

The results of the EAW confirm the findings of the Target Field EIS that the emissions from HERC do not and will not contribute to community health risk. The actual HERC emission rates are much less than the permit limits as can be seen in the following table.
Additional confirmation that HERC does not pose any health risks to the community comes from the results of the EPA Schools Monitoring Initiative, which monitored the outdoor air quality at the Minnesota International Middle School in 2009. The school was monitored as part of a nationwide initiative to assess whether outdoor toxic air pollution poses health concerns to schoolchildren. The Minnesota school was selected due to its proximity to a coating manufacturing facility and HERC. The EPA discontinued air toxics monitoring at the school because the analysis showed monitored concentrations of hexavalent chromium, manganese and nickel to be below levels of concern for both short-term and long-term risks for health problems and because the monitors did not detect any diisocyanates.

The results of multiple dispersion models, emissions monitoring at HERC and ambient air monitoring by the EPA demonstrate that HERC does not have a negative impact on human health and environmental quality.

**Solid waste management system**

HERC is one part of Hennepin County’s integrated solid waste management system, which includes extensive programs to reduce, recycle, compost and process waste. The county’s solid waste management system is set up in compliance with the Minnesota Waste Management Act, which establishes a waste management hierarchy that favors waste-to-energy over land disposal for managing waste that cannot be recycled or composted.

The county has been measuring and reporting recycling activities since 1984 when the recycling rate was 22 percent. Through the efforts of the county and its partners, the recycling rate had increased to 41 percent by 2009. Hennepin County’s recycling rate is comparable to other high performing communities in the United States and Canada. Hennepin County is currently working with cities, residents and other partners to develop strategies to further increase recycling and composting.
HERC is ideally located to process waste that is not recycled or composted. Minneapolis residential garbage is hauled directly to HERC, and the movement of MSW from the suburbs is controlled by a county-operated transfer station in Brooklyn Park, a suburb north of Minneapolis. Waste from the Brooklyn Park Transfer Station is directed to HERC as needed.

**Performance**

**Efficiencies**

HERC’s location in downtown Minneapolis is efficient for both its proximity to waste sources and to energy markets. The HERC facility is convenient to MSW haulers because of its highly accessible location and delivery hours. HERC is close to both its power sales markets. It is 0.71 miles from Xcel Energy’s Aldrich substation and is connected by a 1,600-foot steam line to NRG Energy’s district energy system and Target Field.

Adding the steam line has increased the efficiency of HERC. Prior to construction of the steam line, all waste combustion and energy sales stopped if the turbine/generator was down for maintenance. With the steam line, the plant was able to combust an average of 1,289 tons of MSW per day during a 10-day complete turbine shutdown in October 2009 by exporting an average of 30,000 lb/hr of steam. Steam export also allows for increased thermal energy capture and energy sales if a cooling tower module is down. For 10 days in July 2010, even though a cooling tower module at the HERC facility was down for maintenance, the facility combusted an average of 1,129 tons of MSW per day and exported an average of 13,000 lb/hr of steam.

**Operational Performance**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>2010 Annual</th>
<th>Guarantee</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSW delivered (tons)</td>
<td>363,139</td>
<td></td>
</tr>
<tr>
<td>MSW combusted (tons)</td>
<td>363,381</td>
<td></td>
</tr>
<tr>
<td>MSW combusted, adjusted for HHV (“Reference” tons)</td>
<td>364,219 *</td>
<td>365,000 *</td>
</tr>
<tr>
<td>Net Kilowatt-hour per reference ton MSW processed [for 5,037 btu/lb HHV]</td>
<td>576</td>
<td>527</td>
</tr>
<tr>
<td>Combined ash landfilled (tons)</td>
<td>84,693</td>
<td></td>
</tr>
<tr>
<td>Combined ash landfilled as % of MSW combusted</td>
<td>23.3%</td>
<td></td>
</tr>
<tr>
<td>Total ferrous extracted (tons)</td>
<td>11,125</td>
<td>4,561</td>
</tr>
<tr>
<td>Gross Electricity Generated (MWh)</td>
<td>242,832</td>
<td></td>
</tr>
<tr>
<td>Net Electricity Sold (MWh)</td>
<td>209,641</td>
<td></td>
</tr>
<tr>
<td>Total steam generated (klbs)</td>
<td>2,453,187</td>
<td></td>
</tr>
<tr>
<td>Steam sold (klbs)</td>
<td>82,504</td>
<td></td>
</tr>
<tr>
<td>Average boiler availability</td>
<td>88.5%</td>
<td></td>
</tr>
<tr>
<td>Turbine on-line availability</td>
<td>98.3%</td>
<td></td>
</tr>
<tr>
<td>Average boiler efficiency</td>
<td>74.1%</td>
<td></td>
</tr>
</tbody>
</table>

* December 2010 was the snowiest December on record for Minneapolis (33.6 inches at MSP airport vs. normal 10.0 inches). Snow diminishes combustion performance.
Air emissions control system

State-of-the-art emission control technology is used to treat flue gases and ensure that emissions are below the facility’s permit limits. Flue gases from waste combustion pass through a series of air emission control devices before leaving the facility.

- Optimum placement of overfire nozzles in the furnace walls controls nitrogen oxide emissions.
- Activated carbon is injected upstream of the dry scrubbers to control mercury and dioxins/furans. HERC was the first waste-to-energy facility in the country to use activated carbon injection to control mercury emissions.
- Flue gases pass through a Research-Cottrell/Joy Environmental dry scrubber vessel (one for each of the combustion units) where lime slurry is injected to control acid gases, including sulfur dioxide and hydrogen chloride.
- Combustion gases pass through a Research-Cottrell reverse-air, fabric-filter baghouse (one for each of the combustion units) to remove particulate matter, metals and dioxins. Each combustion unit’s baghouse is composed of eight modules. Each module contains 208 Teflon-coated, woven fiberglass bags that are eight inches in diameter and 24 feet long.

In 2007 and 2008 the existing thermal DeNOx system for nitrogen oxides control, which used anhydrous ammonia, was replaced by Covanta’s LN™ system, which uses no chemical reagents. This was done to eliminate a source of a possible gaseous ammonia release so close to Target Field and other possible new receptors.

Feedback from the Continuous Emissions Monitoring Systems (CEMS) and other process sensors is used to optimize combustion (thereby reducing the formation of carbon monoxide and volatile organic compounds) and monitor the operations of the dry scrubber and baghouse.

Ash management strategies

HERC ash is managed in accordance with industry standards and the requirements of the Minnesota Pollution Control Agency and the Wisconsin Department of Natural Resources. Fly ash collected from the dry scrubber and baghouse is mixed with water and dolomitic lime to control dusting and stabilize pH. It is then mixed with bottom ash in the ash conditioning building.

The combined ash is stockpiled in a fully enclosed ash storage/truck scale building. High-speed doors with a four to five second closure time are used on this building. Ash is loaded from the building into fully covered semi trailers and transported directly to the ash landfills. About 85 percent of the combined ash is hauled 25 miles to the ash monofill cell at the SKB Industrial Waste landfill. The remaining 15 percent is hauled 110 miles to a backup disposal facility at Republic Waste’s Lake Area Landfill near Sarona, Wisconsin. Both of these disposal facilities have liner systems that exceed their regulatory requirements and send their leachate to publicly owned sewage treatment facilities.
Program planning

Solid waste planning

Hennepin County manages waste according to state statutes and regulations that govern solid waste. The county’s programs to reduce, recycle and compost waste and process waste at HERC are part of an integrated system to fulfill these requirements.

The Minnesota Waste Management Act and the Metropolitan Solid Waste Act requires waste generated in the Twin Cities metro area to be processed before disposal to reduce the amount sent to landfills. These acts help establish the waste management hierarchy. These acts are incorporated into Hennepin County’s Solid Waste Management Master Plan, which has been approved by the Minnesota Pollution Control Agency. The Master Plan was most recently updated in 2005.

The county implements a variety of programs to reduce, reuse, recycle and properly manage household hazardous waste. No property taxes are used to pay for any of the county solid waste programs. All funding comes from revenue generated by HERC and from licensing fees.

Recycling and special waste programs

Curbside recycling programs are the cornerstone of the county’s recycling efforts. The county board provides funding to municipalities to operate curbside recycling programs. To obtain funding, municipalities must meet certain minimum requirements to maximize curbside collection of recyclable materials. Municipal programs must include recycling of boxboard, cardboard, magazines, mixed papers, newspapers, glass containers, metal cans and plastic bottles.

Hennepin County also operates numerous programs to properly manage household hazardous wastes and problem materials. The county operates two permanent drop-off facilities and organizes three to five three-day collection events throughout the county each year.
Wastes collected at household hazardous waste drop-off facilities and collection events include automotive products, batteries, corrosive cleaners, electronics, fluorescent and HID lights, mercury, paint, and pesticides. More than 124,500 people visited the facilities and events to drop off 6,048 tons of problem materials and household hazardous waste in 2010.

In addition to curbside recycling and household hazardous waste collection programs, Hennepin County has implemented a variety of programs to divert waste from landfills. Examples of special waste diversion projects include:

- Implementing, funding and supporting organics recycling programs in nearly 100 schools, numerous businesses and more than 5,000 households in nine cities. The amount of organics material collected increased from a few hundred tons in 2006 to about 10,500 tons in 2010.

- Providing $300,000 annually in Waste Abatement Incentive Fund grants to cities, schools and public organizations for innovative reuse, recycling and composting programs. Since 2000, the county has awarded $1.7 million in grants, which included $1.2 million to support the collection of organic waste for recycling into compost.

- Developing one of the first mattress recycling programs in the United States in partnership with PPL Industries. PPL’s mission is to work with lower-income individuals to help them achieve greater self-sufficiency through employment training, support services and education. PPL Industries disassembled 8,464 mattresses in 2010 to recycle the foam, metal, cotton and wood.

- Operating Free Product Centers at the county drop-off facilities. The program makes usable products brought to the drop-off facilities for disposal available to the public free of charge. In 2010, more than 54,000 items were taken from the Free Product Centers.

- Operating an electronic waste program to recycle televisions, computers and other e-waste. E-waste is collected at the county drop-off facilities and household hazardous waste collection events. The county also arranges for the recycling of e-waste collected curbside by the City of Minneapolis and at events held by other cities. The county supported legislation that now requires manufacturers to share responsibility for recycling e-waste in Minnesota. The electronics program collected 3,298 tons in 2010.

- Organizing medicine collection events, in partnership with the Hennepin County Sheriff’s Office, to provide proper disposal of medicine from households. In 2010 about 2 pounds of materials was collected from the 676 participants during in the county’s first medicine collection event. The county is holding four medicine collection events in 2011.
• Collecting batteries at multiple locations throughout the county. In 2010, the county collected more than 132 tons of household batteries. The county also supports and promotes the recycling of rechargeable batteries through the Call2Recycling program, a program created by battery and product manufacturers.

• Organizing an annual Choose to Reuse Campaign to promote reuse opportunities in Hennepin County. In this program, the county partners with reuse retailers to offer coupons in October and November. In 2010, 80 reuse organizations participated and 124,000 coupon books were distributed.

• Awarding Community POWER (Partners on Waste Education and Reduction) grants to community organizations and schools to conduct waste reduction, toxicity reduction and recycling education projects. In the past six years, Hennepin County has given grants to 47 groups, including school districts and community organizations, totaling $377,000.

• Implementing a Master Recycler/Composter program in which participants are trained on waste prevention, recycling and composting through an intensive training course. Master Recyclers/Composters then volunteer 30 hours on projects to reduce waste generation and increase public awareness of opportunities to recycle and compost. The first training course started in April 2011.

• Providing financial support to Second Harvest Heartland since 1995 to operate a recovery program for fresh produce that would otherwise be disposed. In 2009 more than 660 tons of fresh produce were collected by Second Harvest.

• Providing funding since 2000 for the collection of plastic bags through “It’s in the Bag” program.

• Sponsoring pilot reuse and recycling projects at the Brooklyn Park Transfer Station with the NetWork for Better Futures, which is an organization that promotes recovery, resiliency and prosperity of high-risk adults. Pilot projects have included collecting, sorting and recycling waste from the Minneapolis St. Paul Airport and sorting reusable items from trash delivered to the Brooklyn Park Transfer Station. The reusable items were sold or dismantled for recycling.

The county also demonstrates leadership in managing its own waste in accordance with the waste management hierarchy. An internal county-wide recycling program has been implemented, and purchasing guidelines and management policies have been revised to take advantage of reuse and recycling opportunities.

**Addressing community concerns**

To address community concerns, county and Covanta Energy staff attend meetings sponsored by the North Loop Neighborhood Association. These meetings serve as a platform for informing local residents about plant operations and future energy-related projects that will be compatible with future development in the neighborhood.
Future plans

In 2009, the county conducted recycling recovery rate studies in three representative cities. The studies helped identify what materials comprised a large portion of the garbage and could be targeted by new recycling programs. Organic waste was the most prevalent waste that could be targeted for new recycling efforts and the county is developing strategies to recover these materials from the waste stream. The county is also targeting ways to increase the diversion of recyclable paper, bottles and cans that were found in the garbage.

The county is currently assessing strategies to increase recycling and the collection of organic waste. Part of this process includes soliciting feedback from cities, residents and other community partners on the most effective ways to increase recycling.

Worker health and safety

Along with all other Covanta facilities, a total health and safety philosophy has been adopted at HERC. Covanta believes that each task can be and must be performed in a manner that protects the health and safety of every employee, contractor, visitor, customer and the community. This philosophy is accepted as both a management responsibility and an individual employee responsibility, as a condition of Covanta employment and as a way of life, both on and off the job.

Important aspects of the safety program at HERC include the weekly and monthly safety training meetings and the tracking of near misses. Each shift begins with a stretch and flex program, and there is supervisor safety training at every shift turnover.

Topics covered in 2010 safety meetings include:

- Mobile equipment safety
- Hazard communication
- Hearing conservation
- Heavy metals
- Respiratory protection
- Welding / hot work safety
- Confined space

The Total Case Injury Rate (TCIR) and the Days Away, Restricted, and/or Transfer (DART) rates for the past three years are shown in the table.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Cases</th>
<th>Hours</th>
<th>TCIR</th>
<th>DART</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>6</td>
<td>86,119</td>
<td>6.97</td>
<td>0.0</td>
</tr>
<tr>
<td>2009</td>
<td>6</td>
<td>89,800</td>
<td>6.68</td>
<td>2.23</td>
</tr>
<tr>
<td>2010</td>
<td>4</td>
<td>92,670</td>
<td>8.63</td>
<td>8.63</td>
</tr>
</tbody>
</table>
Economics and cost effectiveness

Project funding

The plant was constructed at a total cost of $160.5 million during the late 1980s. It was funded primarily by bond debt of $134.5 million. Construction was completed on schedule and within budget.

Operating costs and revenues

HERC’s operating costs for 2010 were $28.97 million. This includes debt service of $13.2 million. Revenues totaled $27.2 million. The total county subsidy for the year was $1.8 million. With the facility processing 365,000 tons, the per-ton subsidy was $4.95.

Operating costs for 2011 are projected to be $21.5 million. This is a reduction from the previous year because of reduced debt service due to the retirement of a bond series used to fund the purchase of the plant. Debt service for 2011 is $4.3 million. Projected revenues are $28 million. This results in a positive cash flow of $6.5 million. This excess revenue will be used to fund several capital projects to ensure that the plant continues to operate efficiently.

The tipping fee at HERC is currently $45 per ton, a price that attracts about 345,000 tons per year. The county sends an additional 20,000 tons from its transfer station to ensure that HERC processes waste at its permitted capacity. Hennepin sets its tipping fee in response to market conditions. The transfer station is important as it allows the county to control the fuel inventory.

Future opportunities

HERC is a valuable business asset that will become even more valuable in the near future. The debt service for the purchase of the plant will be completely retired in 2012. This will significantly reduce the cost of operating HERC. Also, the value of the energy produced by HERC increases as the cost of producing the energy with fossil fuels increases. Finally, the county can structure its future energy sales contracts to maximize revenues by using the steam to either produce electricity or to heat and cool buildings depending on the price of electricity and fossil fuels.

Selling renewable energy credits is another potential revenue stream. HERC is registered with the Midwest Renewable Energy Tracking System (M-RETS), which allows the renewable energy credits from HERC to be sold. One renewable energy credit is created for each megawatt-hour of electricity produced. The value of a renewable energy credit fluctuates with market supply and demand. The county hopes to sell about 220,000 renewable energy credits each year from HERC power generation.
Utilization of equipment and system technologies

The HERC mass-burn waste-to-energy facility utilizes two identical combustion units, each consisting of a Distral Energy 3-pass waterwall furnace equipped with a Widmer +Ernst horizontal double-motion 4-zone stoker grate and convection passes comprised of two evaporators, two superheaters and two economizers.

Each combustion unit is rated for a throughput of up to 606 tons per day of MSW with a Higher Heating Value between 3,800 and 5,200 BTU/lb. The steam design conditions (Maximum Continuous Rating) at each boiler’s superheater outlet are 171,400 lb/hr at 630 psig and 752°F. Each combustion unit is capable of generating steam at a peak rate of 188,850 lb/hr. In 2010 the boilers operated with an average efficiency of 74.1 percent and availability of 88.5 percent. The combustion units produce approximately 23.5 percent combined ash and scrubber residue per mass unit of MSW combusted.

Steam from the two combustion units’ superheaters operate a single Westinghouse SC23 condensing turbine-generator set rated at 38.71 megawatts at 350,756 lb/hr steam flow at 605 psig, 750°F, and 2.5-inch HgA. The generator is a 3-phase, air cooled synchronous type rated at 45,541 kVA and 13.8 kV and is connected to an onsite General Electric 115 kV delta to 13.8 kV grounded wye 25/33/46 MVA transformer. The turbine-generator can operate, at reduced output, with one of the facility’s combustion units shut down.

In September and October 2009 the turbine-generator was upgraded to install new high pressure and low pressure gland packing seals, diaphragm packing and rotor seals. Through this upgrade, the turbine-generator gained 3.21 megawatts of generating capability, as measured by the Midcontinent Area Power Pool (MAPP) rating test procedure. After the upgrade, the turbine-generator averaged 9.41 lb/hr of steam per kW of electricity generated.

HERC has a successful odor control program that depends largely on high speed truck doors. Three FastSeal FS-1000 overhead doors manufactured by Rytec Corporation are installed in the tipping hall and three doors are installed in the ash loadout/scale building. The high speed doors have a velocity of approximately 4 feet per second. A door remains closed until a truck nearing the door passes over a ground induction loop wire, opening the door in four seconds and holding it open for 10 seconds after the truck clears optical sensors in the doorframe.

The truck entrance to the tipping hall is a two-door system in which only one door is open at a time. This creates an airlock that helps keep odors inside the tipping hall. The exit door control system in the tipping hall is coupled with a laser beam door deactivation system set at a few inches below the door’s 16-foot clear portal opening height. If a waste hauler tries to leave the tipping area with its box or rear gate extended up higher than 16 feet, the laser beam will be broken and the Rytec door will fail to open for the truck, signaling to the driver and tipping hall attendant to lower the truck’s box or gate.

HERC’s odor control program also utilizes an Odor Management Inc (OMI) vapor phase system to atomize and disperse an odor neutralization agent in the tipping hall. The system consists of a neutralizing agent storage tank, tank heater, pump, compressor, 450 CFM fan and controller inside an enclosed metal box and 436 feet of 6-inch PVC piping system running along the eastern wall and truck door frames of the tipping hall. The system disperses one to three gallons per day of OMI’s Ecosorb 606 odor neutralizing agent. The system requires no water, which is advantageous because the tipping hall is unheated.
Two Jaybird ORSM mobile tank/fan fogging units set to dispense a 1:25 dilution of Ecosorb 606 to water are used as a backup to the vapor phase system and for supplemental odor neutralization. The Jaybird units hold up to 18 gallons of solution and can be set to dispense between one to five gallons per hour of solution as a fog of 10 to 20 micron size droplets.

**Public acceptance, appearance and aesthetics**

The neighborhood around HERC has changed dramatically in the past few years with the construction of Target Field, expansion of light rail and other mass transit and growth of residential and commercial opportunities. Hennepin County has made numerous modifications to HERC to ensure the facility continues to be a good neighbor and a good fit in its urban setting.

**Odor and litter control**

Hennepin County has gone to great lengths to ensure that odors from the facility are not noticed by patrons of the adjacent Target Field, users of light rail and commuter rail stations, and the residents of nearby condominium. Major modifications have been made to the HERC tipping hall, including changes to the entrance and exit doors, installation of new odor control technologies inside the tipping hall, and implementation of odor control operational strategies.

**Odor control modifications and technologies at HERC**

- Two 24-foot truck entrance and exit doors facing Target Field on the eastern side of the tipping hall were decommissioned. The asphalt roadways leading out of the former doors on the east side of the tipping hall were removed and replaced with extensive landscaping. The existing 24-foot entrance door on the south side of the tipping hall was lowered to 16 feet and recommissioned to be the new single exit door.

- A new two-door truck entrance vestibule into the south side of the tipping hall and its approach roadway was constructed. A 16-foot truck entrance door portal was built into the exterior wall of a seldom-used MSW loadout-feeding area in the tipping hall. A new wall and 16-foot truck door was also constructed on the opposite end of the MSW loadout-feeding area, forming a truck entrance vestibule. A new asphalt approach road into the truck entrance vestibule was constructed. The vestibule doors allow only one truck to enter at a time, keeping at least one truck door closed at all times. This forms an airlock to keep odors in the tipping hall.

- Three high-speed overhead doors were installed in the tipping hall and three were installed in the ash loadout/scale building.

- A vapor phase system to atomize and disperse a concentrated odor neutralization agent (as sub-micron size droplets) was installed in the tipping hall. Two mobile tank/fan fogging units that dispense a fog of the odor neutralizing agent and water are used as a backup to the vapor phase system and for supplemental odor neutralization. The vapor phase system is operated continuously from April 1 to November 1. Odor control is not needed in the winter.
Odor and Litter Control Operational Strategies

- Odor monitoring around the HERC site has been conducted since 2004. From April to November, trained staff perform and document daily odor intensity (dilutions-to-threshold) monitoring surveys around the perimeter of the HERC facility, utilizing the Nasal Ranger® Field Olafactometer and procedure, as developed by St. Croix Sensory, Inc.
- The volume of MSW stored in the tipping hall bunker is controlled by diverting some MSW haulers (to transfer stations, landfills or other MSW processing facilities) before and during periods of extended plant outages.
- MSW in the storage bunker is constantly mixed and turned over.
- A constant inward airflow into the tipping hall is maintained by use of high speed truck entrance/exit doors, including two-door entrance vestibule, and by drawing the furnaces’ underfire air from inside the tipping hall.
- A wet fog of diluted odor neutralization agent is dispersed via a mobile tank/fan fogging unit placed inside the truck exit door during all Twins home games and as otherwise needed.
- HERC roadways and the tipping hall are swept by a traditional three-wheeled commercial street sweeper one to three times per week. A small mobile sweeper/scrubber unit was purchased in 2011 to supplement the work of the contracted sweeper.
- Odor-neutralizing granules are dispersed inside and outside the tipping hall as needed.
- Daily outdoor litter picking is conducted.

Landscaping modifications

Ideas for the landscaping changes were developed by a team from the University Of Minnesota Center for Sustainable Building Research. During a summer project, the team developed two conceptual plans for the HERC site that would improve the aesthetics of the buildings and grounds.

To improve the aesthetics of the HERC site, landscape modifications were made to the facility in 2009. The landscape project included planting 200 trees, 1,375 shrubs, 3,200 perennials and 10,000 square feet of native prairie grasses. Landscape lighting was also added on the east side of the tipping hall facing Target Field and along the south side of the facility.
Public outreach

Information about HERC is available on the county website at www.hennepin.us/HERC. The website includes a summary of how waste is converted to energy, the environmental benefits of HERC, how HERC fits into the county’s solid waste system, frequently asked questions about HERC and information about the proposal to use the capacity of HERC.

News about the HERC facility is regularly included in Green Notes, a monthly e-newsletter that covers environmental news, programs and events from Hennepin County. The e-newsletter is distributed to about 1,300 recipients that include county and city staff and officials, media, and community partners.

The county also offers tours of the HERC facility. Tours are promoted as an environmental education opportunity to school, college and community groups. Tour participants learn how solid waste is managed in the county and about the operations of HERC. In 2010, eighteen tours were conducted of HERC. A video featuring a virtual tour of HERC was also recently developed and is available at www.hennepin.us/HERC.

Innovation and creativity

The location of HERC is unique among waste-to-energy facilities in the U.S. HERC was constructed in an industrial wasteland on the contaminated site of a former bus garage. The neighborhood around HERC has changed significantly since it began operations in 1989. With the ballpark and numerous urban renewal projects around the facility, Hennepin County is pursuing projects that will make HERC part of the vibrant new warehouse district in Minneapolis.

Hennepin County has worked with multiple partners, including the Minnesota Ballpark Authority, the Minnesota Twins and the North Loop Neighborhood to ensure that HERC continues to be a good neighbor and an integral part of downtown redevelopment. These groups are supportive of HERC.

Hennepin County is currently assessing projects that would use energy from HERC in new developments near the facility. One development project is the planned construction of a light rail/commuter rail interchange and pedestrian plaza that will be located on part of the HERC property currently occupied by a county building. Planning is underway to recover energy that is currently being lost at the HERC cooling towers and use it to heat new buildings that will be constructed on the site. In addition, water that would have been sent to the cooling towers will be used in a snow melt system for the pedestrian plaza and new light rail tracks. Eventually, HERC may also supply energy for a district heating system for the North Loop Neighborhood.

The county is also looking for ways to improve the efficiency of HERC’s operations. A lighting redesign and retrofit project that will improve lighting throughout the facility and save energy recently started at HERC. The project is partially funded by a federal energy efficiency and conservation stimulus grant. The project will result in energy savings of more than 1 million kWh per year once it is completed in the fall of 2011.

By working with community partners and assessing HERC’s role in development projects, the redevelopment of the neighborhood around HERC, instead of being a barrier to operations, has presented many opportunities for the facility to contribute to its surrounding community.