### CASE STUDY

# OLMSTEAD COUNTY, MINNESOTA WASTE TO ENERGY FACILITY

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#### **EXECUTIVE SUMMARY**

#### ENERGY RECOVERY CASE STUDY: OMLSTED COUNTY

In 1987 Olmsted County began operation of a 200 ton per day mass burn waste to energy (WTE) facility (OWEF), which it both owns and operates. Located in the southeastern corner of Minnesota covering a land area of 660 square miles, the county is comprised of 26 cities and townships with a population of 103,000 people. Rochester, the site of the waste to energy plant is the home of the renowned Mayo Clinic, the largest medical center in the world and is been on *Money Magazine's* "Best Cities to Live" lists for the past several years.

The county, in conjunction with Dodge County, which shares in the use of Olmsted County's WTE plant and landfill, generates about 163,000 tons of refuse per year. Of that amount about 40% of the waste is recycled, 37% is processed for energy at the OWEF and 23% is diverted to Olmsted County's Kalmar landfill. Due to the success of waste to energy facility, the county is expanding the OWEF, adding a third boiler. This new unit will become operational by the end of 2010 and will move the county closer to its goal of processing or recycling 90% of its solid waste stream.

#### **Economic Impacts**

• **Energy efficiencies:** The OWEF was established on a site that had a pre-existing steam loop serving hospital, education and prison buildings. Thus, the county was able to use and expand the loop, creating a highly efficient waste to energy cogeneration system. The plant

produces the equivalent of about 14,000 mwh (megawatt hours) of electricity and 679 million GJ (gigajoules) of heat. This is enough energy to heat and power the equivalent of about 20,000 home and displace about 70,369 barrels of crude oil Currently 26 federal, state, county and municipal buildings are being served by the steam loop, with an additional 4 being added with the construction of the third unit. About 25% of the energy recovered comes from non-recycled or residual plastics.

- Employment impact: The facility offers employment to 37 permanent skilled workers. Including benefits the average compensation of these employees is \$93,100. In total on an annual basis they are returning about \$2.5 million to the local economy. The facility also contributes indirectly to the economy, since much of its purchasing is done through local suppliers. In addition, the recently completed \$94 million plant expansion resulted in the creation of 100 skilled jobs during the design and construction phase. This project also spawned approximately 100 additional jobs as well as additional spending through indirect purchases and economic activity throughout the region.
- Impact on public budget: The OWEF does not rely on any tax monies. It is operates as a self sufficient enterprise fund. Revenues come from: 1) tip fees charged on a per ton basis to refuse haulers, who bring their waste to the facility; 2) a solid waste generation surcharge levied on residential and commercial waste hauler bills; 3) steam and electricity sales. About 54% of the plant's operating expenses were financed from user fees and charges and 46% from energy sales. When Unit #3 becomes fully operational, these proportions will change, since the plant will be nearly doubling its electricity output, adding more steam customers and recovering valuable metals from the incinerator ash. Under state law, OWEF receives renewable energy credits for the electricity it sells, helping to increase energy revenues.
- Impact of new unit: The addition of the third unit will preserve existing capacity of the county's landfill and preclude the need to export waste out of state. It will reduce reliance on OWEF's fossil fuel back up boiler which is used when the solid waste combustors are down for maintenance or other reasons. It will permit Olmsted County to serve its growing population with an efficient, reliable source of renewable energy, while attaining its goal of landfilling no more than 10% of its waste.
- Real estate footprint: Olmsted County is fortunate that it secured a site for its waste to energy facility in the midst of a cluster of institutions as well as nearby to populated areas. The OWEF occupies a site of about 7 acres as compared to the county's Kalmar landfill, which covers 160 acres. Only two miles from downtown Rochester, the facility is convenient to haulers, saving them the time and expense of long hauls to distant disposal sites.

#### **Environmental Impacts**

- Recycling Levels: A national U.S. study has demonstrated a positive correlation between energy recovery in the region and higher than national recycling rates. Olmsted County's recycling behavior reflects this finding. Both the state and county have a strong emphasis on recycling and waste diversion. In the period between 1988 and 2008, the county's recycling rate increased from 18% to 40%, refuting the claim that recycling and waste to energy are not compatible.
- Landfill Diversion: Much of the area around Olmsted County consists of sensitive Karst geology on which it is impossible to site a landfill. While the county was able to permit a non-Karst site in the late 1980s, it knew that it had to preserve the landfill's capacity to the

extent possible. The inability to site a new landfill in the county was a driving force behind the decision to construct the waste to energy plant. Since its inception, about 1.2 million tons of solid waste have been diverted from the landfill and converted to energy. The county reduced its need for landfill space by about 90% as well as avoiding the disposal of about one-half million gallons of leachate into the public sewer system. By diverting over one million tons of waste from the landfill, the OWEF has reduced the hazardous gaseous emissions from the landfill as well.

- Captured energy: The plant produces both steam and electricity, heating the equivalent of about 20,000 homes, with baseload energy from a renewable source. There are 26 buildings tied to the steam loop, which include Rochester City Hall, the Mayo Civic and Art Center, and the Federal Prison Medical Center. Several new buildings, including the local community college are being added to the district heating/cooling system.
- Greenhouse gas reductions: While waste combustion produces CO<sub>2</sub>, the amount produced is extremely small, less than one percent of total output of carbon dioxide in the area per year. Approximately 99% of CO<sub>2</sub> comes from fossil fuel combustion such as vehicle emissions and coal fired power plants. In addition, by processing about 62,000 tons of waste per year into energy and recycling at a rate of about 40%, the OWEF is displacing reliance on fossil fuels and diverting waste from the landfill. The result is a net reduction of 24, 800 MTCE metric tons of carbon equivalent per year. This is equivalent to reducing the vehicle emissions of about 16.629 cars.
- Air emissions: The Olmsted County waste to energy plant operates under strictly monitored and enforced federal and state air emissions requirements. Materials separation, combustion conditions, types of air pollution control equipment operator training are all monitored to tightly specified conditions. For all measured emissions, the OWEF is well below the mandated limits. For heavy metals (lead and cadmium), dioxins and furans, opacity of the plume, the facility is operating at a small fraction of a percent of the limits.

#### **Political/Institutional impacts:**

- The OWEF has had strong political and community support since its inception. Olmsted County's goal is to eliminate landfill disposal of waste, managing as much of its waste above ground as possible. This goal is enthusiastically endorsed by its citizens. In a region with a high concentration of technical and medical personnel, the OWEF has received high marks. When the county decided to add a third unit to the plant, there was no opposition. This despite the fact that the plant is located two miles from downtown Rochester and .4 miles from the closest residential area.
- Rochester has consistently been on various "Top Cities to Live" lists. The existence of a renewable energy steam loop, linking public and non-profit institutions is a source of pride to the entire region. The Convention and Visitors Bureau touts Rochester as a "Green City" due to the OWEF and the fact that many of the city's institutions as well as the Mayo Civic Center receive heat, electricity, and air conditioning from the waste to energy facility.
- The former Olmsted County Solid Waste Manager who supervised plant operations for many years stated in an interview: "There was no opposition to the plant as it was planned or when it was built. Our community was growing and we were determined to be proactive in our solid waste planning. Our mantra was 'handle all waste above ground' if at all possible. The OWEF has certainly helped us move towards this goal."

As a representative of Marilyn Hansmann, Vice President of Finance and Facilities of Rochester Community and Technical College said: "One of our 700,000 square foot buildings has been using steam from OWEF for heat since 1988. It is reliable, has saved us money and has gone a long way in helping us reach our goal of reducing the college's dependence on fossil fuel. It has been so successful that in the current remodel of the building we will be adding an absorption chiller so that the building will use renewable energy for cooling as well as heating. Through the "Green Pipes" project more of our buildings will be connected to the OWEF. We are excited about the Green Energy Management program we have just started and the OWEF system will be one of the learning labs our students will use."

#### **CASE STUDY**

#### OLMSTED COUNTY, MN WASTE TO ENERGY FACILITY

Olmsted County is the eighth largest county in Minnesota and is located in the southeastern portion of the state. It is comprised of 8 cities and 18 townships and has a population of approximately 141,000. Its largest city and county seat is Rochester, with a population of about 103,000. Rochester is the third largest Minnesota city, after Minneapolis and St. Paul and is home to the world-renowned Mayo Clinic, the largest medical center in the world. Due to the presence of the Mayo Clinic and the various health related firms that have located in the county, Rochester has been deemed as "recession resistant" by a MSNBC telecast. <sup>1</sup>

The Olmsted County Waste to Energy facility (OWEF), built in 1987, is located in the city of Rochester. It was one of 15 waste to energy (WTE) plants that were operating in Minnesota as of 1990. In terms of number of plants, Minnesota was second only to New York and had about 10% of all existing WTE plants at that time. Currently Minnesota has nine operating plants. By 1980 with its passage of the Waste Management Act, the state had established a waste hierarchy, placing waste to energy (or "resource recovery" as it was called then), composting and recycling above land disposal. As a result, many of the more populated counties began to plan to implement waste to energy.

#### DEMOGRAPHIC PROFILE OF ROCHESTER AND OLMSTED COUNTY

#### Demographic Characteristics<sup>3</sup>

On February 20, 1855, two years after the first permanent non-Native American settlements were established, an area of 660 square miles in southeastern Minnesota was legally declared to be Olmsted County, named after pioneer David Olmsted. This area of the country was initially

<sup>&</sup>lt;sup>1</sup> "Recession-resistant, but would you live there?" msnbc.com, May 5, 2009.

<sup>&</sup>lt;sup>2</sup> The number of plants does not include two dedicated RDF boilers, which receive materials from several RDF facilities.

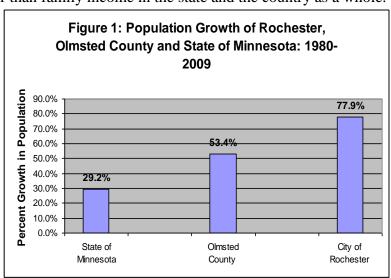
<sup>&</sup>lt;sup>3</sup> Demographic data from U.S. Bureau of Census, www. ucensus.gov after 1990. 1980 data is from U.S. Department of Commerce, Bureau of the Census. **County and City Data Book: 1983, 10<sup>th</sup> Edition,** 1983. Data on employment is from the Bureau of Labor Statistics. Housing Index is compiled from the Federal Housing Finance Administration Quarterly Data.

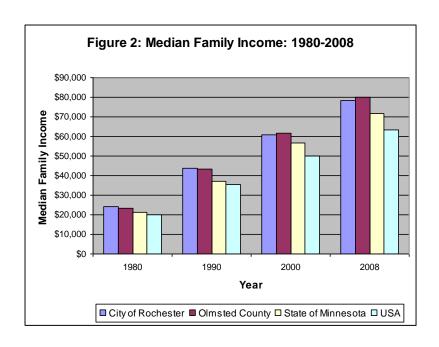
settled by various Native American tribes from the Upper Mississippi, Northern Woodlands and the Western Prairies. Europeans first came to the area, seeking the Northwest Passage to the Pacific. Both French and English had small settlements in the area. The major city, Rochester, served as a crossroads for settlers coming into southeastern Minnesota and quickly grew in population. It was designated as the county seat in 1858.

A significant event in the history of the city and county was the arrival of Dr. William Morrall Mayo in Rochester in 1863 to take up the post of examining surgeon of federal draftees during the Civil War. After a major tornado swept through the town in 1883, the Sisters of St. Francis approached the doctor to discuss the need for a hospital. The Sisters offered to build and maintain the hospital if Mayo would provide the medical staff. Two of Dr. Mayo's sons also became physicians and joined their father in building the medical practice and the hospital. Over time other doctors joined the Mayos and further developed the hospital and scientific laboratories. The Mayo Clinic, a world renowned medical institution, currently dominates the region, employing more than 30,000 persons and stimulating the development of other technology and medically related firms in the county.

Since 1980, both the county and the city have enjoyed robust growth in terms of population and income. Rochester's population has nearly doubled from 57,906 persons in 1980 to approximately 103,000 persons in 2009. Olmsted County grew from a total of 92,000 to 142,000 during the period. As shown in Figure 1, Rochester grew by 78%, Olmsted County by about 54%. The robust growth of the region can be compared to Minnesota as a whole which increased its population by about 29% during the same period.

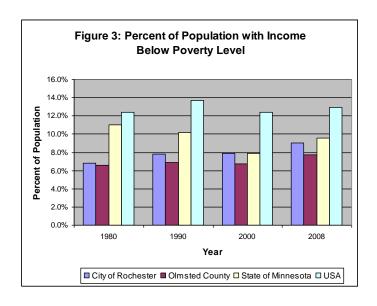
Median family income in the county and city also grew, comparing favorably to both state and national numbers as seen in Figure 2. For each period, median family income in the city and county was greater than family income in the state and the country as a whole.

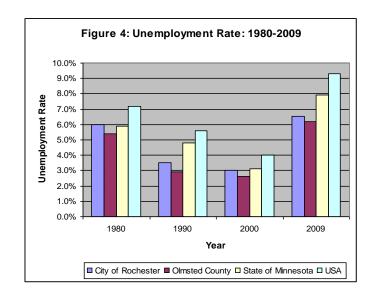




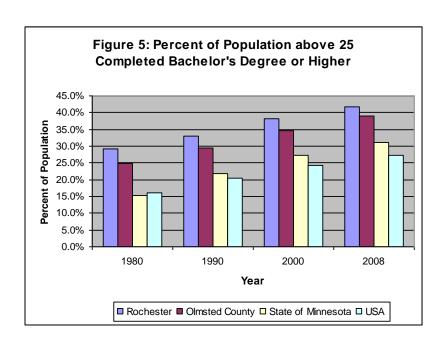
The soundness of the local economy is also reflected in the low percentages of persons with incomes below the poverty level as well as unemployment figures. Figure 3 examines the extent of poverty in both the city and county as compared with state and national numbers. Over the 30 year period, the average percent of population with incomes below the poverty level has ranged between 7% and 8% for the city of Rochester and Olmsted County, compared to nearly 10% in the state of Minnesota and 13% for the nation.

While not immune to economic forces, again the Olmsted County region has fared well with respect to the employment of its workforce. Both the city and county have managed to keep their unemployment rate several percentages below national and state rates. For 2009, the Bureau of Labor Statistics reported a seasonally adjusted national unemployment rate of 9.3%. The State of Minnesota was nearly 8%, while both Rochester and Olmsted County maintained their unemployment rate at about 6.3%.

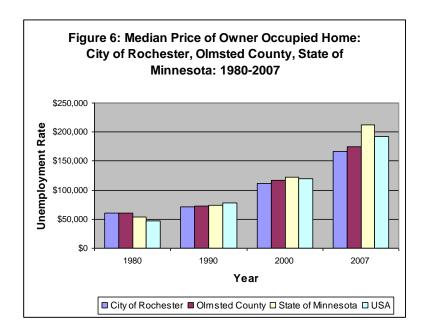


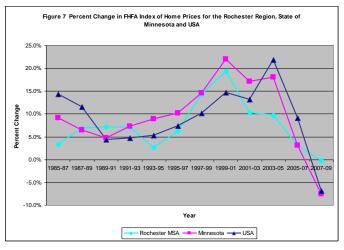


It cannot be stated enough that the Mayo Clinic and the various medical and technology firms that surround it have given this region a unique orientation. The Clinic and other firms have drawn a highly educated workforce to the area. As shown in Figure 5, which examines the percent of the population over 25 years of age which have completed a Bachelor's Degree or higher, the percentage for Rochester and Olmsted County well outpaces those of the state of Minnesota and the United States. For example in 1980, Rochester had nearly twice the percent of population with higher education, 29% than the nation with 15%. By 2008, this gap had narrowed somewhat. Rochester's percentage had increased to 42%; the country to 27.4%.



Finally if one looks at the median price of owner occupied homes, one can see in Figure 6 that median home prices in the Rochester-Olmsted County region are very much in line with both state and national figures, if not somewhat lower after 1980. More importantly, there appears to be less volatility in the local housing market particularly when compared to the price movements nationally. Looking at Figure 7, which graphs the changes in the FHFA housing price index in two year increments for the Rochester MSA, (Metropolitan Statistical Area which includes Olmsted County) the State of Minnesota and the United States, one can observe that in the Rochester MSA, the percent change in the housing price index was rising steadily from 1993 to 2001 similar to the experience in home prices in the state as well as the country. While the rate of growth in the price index began to decline steadily in 2001, the rate of decline in the index for the Rochester MSA was not nearly as great as that experienced by Minnesota and the country. In fact, while the index dove into negative territory both for the United States, and Minnesota, it did not do so in the Rochester MSA.





The city of Rochester and Olmsted County are areas of steady population growth with a highly educated citizenry and a robust economy. Their housing situation is stable and the region outperforms the state and the nation with respect to levels of employment and percent of population below the federal poverty line. It is in part due to projected population growth and economic development that the county decided to embark upon a waste to energy facility in the mid-1980s.

#### The Local Economy

The dominant actor in the local economy is the Mayo Clinic. In 2009 it employed about 32,000 people in Olmsted County, which is about 38% of total county employment. Since 1999, the number of employees at the clinic employed in Olmsted County has increased by about 8600 people. IBM is the second largest employer in the County with 4,400 employees in Rochester. The local IBM plant occupies about 3.6 million square feet of space (equivalent to 78 football fields). Initially, after the plant opened in 1957 it focused on manufacturing, but is now largely focused on design and product development, including chips for powerful gaming systems, the Blue Gene/L supercomputer, and most recently the Roadrunner supercomputer, which is ranked first among all supercomputers. Building on the existence of the Mayo Clinic and IBM, a Minnesota BioBusiness Center was completed in Rochester in 2009. This will house a for-profit arm of the Mayo Clinic, as well as other firms in the biotechnology and medical device fields. Supporting these efforts, the University of Minnesota opened its newest campus in Rochester in 2007, with a focus on health sciences and biotechnology. UMR has unique programs in bioinfomatics, computational biology, and related fields as well as more traditional areas such as business, education, graphic design, public health, and social work.

After health care and technology, agriculture is the county's next largest industry, with nearly 1,400 working farms. Several local agribusinesses, such as Kemps, make products for national distribution. There are approximately 150 small manufacturing firms in the area. And due to the presence of the Mayo Clinic and IBM, the hospitality industry plays a major role in the the local economy. Nearly 5,000 hotel rooms serve more than one million national and international visitors each year.

#### WASTE TO ENERGY IN MINNESOTA AND OLMSTED COUNTY

#### State of Minnesota

The steps taken by Minnesota and Olmsted County to control waste disposal and invest in waste to energy have their roots in growing concern about environmental issues during the 1960s. At that time open burning and dumps were the primary form of land disposal in the United States. Across the country there was concern that the air and water pollution problems generated by the thousands of such facilities needed to be addressed. Both the federal government and states took action. In 1965, the federal government took the initiative on the issue and passed the Solid Waste and Disposal Act. For the first time the federal government became involved in municipal waste disposal, an activity that heretofore had been the exclusive domain of state and local governments. The 1965 Act created an Office of Solid Waste in the U.S. Public Health Service and directed the office to promulgate and enforce regulations for solid waste collection, transportation, recycling, and disposal. It provided financial assistance for states to study and

develop solid waste management plans as well as support for research and development for improved methods of waste management. It specifically promoted resource recovery (waste to energy) as a preferred method of disposal.

Soon afterward, in 1967 Minnesota created the Minnesota Pollution Control Agency (MCPA), with the charge to control air, water and land pollution. While the MPCA was not given the authority over solid waste activities, it was directed to study and make recommendations on solid waste disposal needs for the legislature. In 1969 the State Solid Waste Act became law. prohibiting open burning, establishing a solid waste facility permitting process, mandating the upgrade of existing landfills and the creation of sanitary landfills, with adequate air and water pollution controls. One year later, the County Solid Waste Management Act took effect which empowered counties to conduct solid waste studies and gave them legal and operational tools to undertake solid waste programs.

In 1970, the federal government passed the Resource Recovery Act of 1970, which amended the 1965 Act. This law focused specifically on the reclamation of energy and materials from solid waste. It authorized grants for demonstration projects for new waste to energy technologies and required annual reports from the newly formed Environmental Protection Agency on progress made towards promoting resource recovery, recycling, and waste reduction. It specifically promoted waste to energy as a sound alternative to landfilling. In 1971, as part of the Office of Solid Waste Management Programs, the Resource Recovery Division was established.

Six years later in 1976, the US Congress passed Resource Conservation and Recovery Act (RCRA) placing the federal government in a more direct, regulatory role over solid waste disposal. RCRA required the closing of all remaining open dumps and stimulated even greater state and county oversight of municipal waste management. Under sub-title D, EPA was to establish appropriate operating criteria for all landfills. Any facility not meeting the criteria would be closed. During the intervening six years between the 1970 and 1976 Acts, the country experienced the first Middle East oil embargo. This traumatic event emphasized the need for alternative energy sources and helped to create a favorable environment for the development of waste to energy facilities.

With the impetus of additional federal legislation as well as federal grant assistance, the MCPA required all counties to submit plans regarding the closing or upgrading of sub standard open dumps to sanitary landfill status. Minnesota estimated that there were at least 1500 sub-standard landfills or "dumps" in the state. During the decade of the 1970s many of these open dumps or sub-standard landfills were closed. As new national and state landfill regulations were promulgated and more disposal facilities closed, a disposal crisis was predicted for the Rochester, Minneapolis-St. Paul, Duluth, and St. Cloud areas. Landfills were closing and there was not enough existing or future disposal capacity to handle what was anticipated to be a growing solid waste stream.

Responding to both federal mandates and developing disposal problems within the state, Minnesota passed the 1980 Waste Management Act. Most solid waste in the state was still going to about 135 landfills and nearly 200 illegal open dumps. These waste facilities were often located in low areas such as excavated gravel pits. Any pollutants passed easily into drinking

water. Furthermore, it was not unusual for operators of open dumps to burn the waste to reduce the volume, emitting air pollutants often inhaled by nearby residents.

The 1980 Act laid out the mission of the state with respect to solid waste policy and established the legal and regulatory framework which continues to guide state and county solid waste strategies today. It clearly enunciated the solid waste hierarchy and established the goal of an integrated approach to solid waste management. The stated purpose of the 1980 statute was to:

(a) protect the state's land. air, water and other natural resources and the public health by improving waste management in the state to serve the following purposes:

- 1. reduction in the amount and toxicity of waste generated;
- 2. separation and recovery of materials and energy from waste;
- 3. reduction in indiscriminate dependence on disposal of waste;
- 4. coordination of solid waste management among political subdivisions; and
- 5. orderly and deliberate development and financial security of waste facilities including disposal facilities.
- (b) The waste management goal of the state is to foster an integrated waste management system in a manner appropriate to the characteristics of the waste stream and thereby protect the state's land, air, water and other natural resources and the public health. The following waste management practices are in the order of preference:
  - 1. waste reduction and reuse;
  - 2. waste recycling;
  - 3. composting of yard waste and food waste;
  - 4. resource recovery through mixed municipal solid waste composting or incineration;
  - 5. land disposal which produces no measurable methane gas or which involves the retrieval of methane gas as a fuel for the production of energy to be used on-site or for sale; and
  - 6. land disposal which produces measurable methane and which does not involve the retrieval of methane gas as a fuel for the production of energy to be used on-site or for sale.<sup>4</sup>

In addition to the waste hierarchy, the legislation established a landfill siting process. It set up a Waste Management Board within MPCA as well as a Legislative Commission on Solid Waste. Grants were provided through the MPCA for research for solid waste planning and new resource recovery technologies. Building upon previous legislation, counties were given responsibility for solid waste planning and implementation, with the legal tools, i.e. flow control to do so. After passage of the 1980 Act, more stringent controls were placed on existing landfills. Any new landfill developer had to demonstrate a need for additional capacity.

To assist in ensuring that recycling and waste reduction programs would be implemented, the Select Committee on Recycling and the Environment (SCORE) was established in 1989 under the auspices of the new Office of Waste Management in MPCA. Focused solely on stimulating and tracking recycling and waste reduction in the various counties and the Metro area (Minneapolis/St. Paul), the SCORE program provided grants and technical assistance to implement recycling programs. It also collected and published recycling and solid waste data provided by the counties.

As a result of federal and state regulations, by the end of 1990, of the 135 landfills permitted to operate in Minnesota at the beginning of the decade only 55 remained. Of those, only 27 remained five years later due to additional state legislation, which offered to fund the closure

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<sup>&</sup>lt;sup>4</sup> Minn. Stat. § 115A.02.

costs to those landfills which voluntarily closed by 1994. As of 2010, only 21 landfills are operating in Minnesota.

Not only did the state enact a series of laws, which re-oriented the system away from landfilling towards an integrated planning approach incorporating resource recovery and recycling, it also provided various sources of financing for these efforts. As early as 1971, the state enacted a statute permitting counties to levy a dedicated tax on property to cover solid waste services. In 1984, legislation was passed permitting counties to levy a fee on landfills located within the county to help fund post closure care and groundwater mitigation efforts. In 1989, the SCORE sales tax was passed. The 6% state sales tax was extended to all waste hauling activities. Monies collected from this tax on hauling went into the General Fund, but were partially used to fund recycling programs as well as grant and loan programs to counties to offset costs of implementing recycling. In 1997, the SCORE tax, and a newly established solid waste generator fee were combined into the Solid Waste Management Tax. This tax is a sales tax specifically on solid waste services. Customers using residential waste hauling services pay a 9.75% charge; commercial customers pay a 17% charge. Generators of construction and demolition waste pay \$.60 per loose cubic yard. Of the total revenues collected, 50% are allocated to the solid waste fund for landfill cleanup, groundwater monitoring and other solid waste activities and 50% are allocated to the state's general fund.

Thus, the state from the early 1970s either followedthe federal government or at other points went beyond federal initiatives in implementing solid waste policy. It took a proactive and aggressive approach tosolid waste management. Its mission from the beginning was to look beyond landfilling and to direct the state towards waste reduction, recycling as well as energy recovery from waste. Through the MPCA, Minnesota put in place a regulatory and policy structure to direct the various programs, relying largely on counties to implement approved plans. Furthermore, the state established a financial framework, to assist in funding solid waste programs, including waste to energy that the counties, public authorities and cities were developing. The state accurately perceived that recycling and waste to energy were both necessary strategies to reduce land disposal.

#### Olmsted County

It is against this background that Olmsted County, with its growing population, made the decision in the early 1980s to construct a waste to energy plant. IBM had located its manufacturing plant in the county and was expanding as was the Mayo Clinic. In addition, landfill space in the county was extremely limited. An existing 50 acre county landfill was deemed substandard and closed. The county had been able to site a new 160 acre landfill in 1988, the last such landfill permitted in Minnesota. However, of the 160 acres, 71 acres were designated for actual landfilling, with only 22 acres set aside for municipal solid waste (MSW). Siting this landfill was fraught with difficulty. Given the Karst geology of the area, with thin soil layers over well drained fractured limestone causing a high risk of water contamination from leachate, there were few locations where a landfill could be located. The county had to search for a non Karst site on which to construct the landfill. The mantra of state and county waste management officials at that time became-- handle all solid waste above ground if possible. <sup>5</sup>

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<sup>&</sup>lt;sup>5</sup> Interview with Gene Mossing, former Solid Waste Manager, July 16, 2010.

There had already been problems in the area with groundwater contamination from landfills and open dumps. In addition, the Love Canal disaster, which occurred in upstate New York in 1976, was fresh in the minds of county officials and citizens. Toxic chemicals from waste dumped in the area by a chemical company, had contaminated the ground and water in an entire neighborhood, which eventually had to be evacuated and all houses razed. Rather, than rely on a landfill with long term potential negative impacts, Olmsted County officials were highly receptive to possible waste disposal alternatives.

Upon passage of the 1980 Minnesota solid waste management act and the realization that its old landfill would be closed under newly promulgated regulations, the county began to examine the possibility of constructing a waste to energy plant. The 1980 Act had placed resource recovery above landfilling in the solid waste hierarchy and had included funding to counties looking to implement such a plant. Olmsted County applied for and received a state grant for \$600,000 and a loan for \$300,000. This money was used for final design and construction of a new waste to energy facility.

In addition, Olmsted County was not operating in a vacuum. As early as 1982, there were four waste to energy facilities already operational in Minnesota, including a Refuse Derived Fuel (RDF) plant in Duluth, and three small modular waste combustion facilities in Collegeville, Red Wing, and Savage. In the 1984 to 1986 period, six additional counties applied for and received funding to build waste to energy plants. Furthermore, as a result of the 1970 federal Resource Recovery Act as well as the 1973 oil embargo, the U.S. Environmental Protection Agency and other national organizations were actively promoting resource recovery through a myriad of publications, conferences and information sessions. Thus in 1974, as required in the 1970 law, the Environmental Protection Agency delivered its first report to Congress entitled Resource Recovery and Source Reduction. Two years later, the EPA published a series of reports under the rubric **Resource Recovery Plant Implementation: Guides for Municipal Officials.** These handbooks included information on planning, technologies, financing, procurement, contracts, etc.

The EPA was not the only organization involved in dissemination information and data. The newly created Department of Energy undertook and published a series of cases studies of European and existing U.S. plants in 1978. Argonne, the lead national laboratory for the U.S. Department of Energy prepared and published a series of nine assessments to document the state of development of disposal/recovery technologies. The U.S. Conference of Mayors also

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<sup>&</sup>lt;sup>6</sup> RDF is a facility with front end processing to remove non-combustibles from the waste stream. The combustible portion is converted in to a more homogeneous, uniform fuel, which can be pelletized, shredded, or powdered. The RDF can be combusted on-site or transported to an off-site boiler; Modular is a small pre-fabricated combustion unit shipped fully assembled or in modules to a given site. A typical unit has a primary and secondary combustion chamber. While common across the United States initially, most of these facilities were forced to close for economic reasons.

<sup>&</sup>lt;sup>7</sup> US EPA First Report to Congress, 1974.

<sup>&</sup>lt;sup>8</sup> Resource Planning Associates, Inc. *European Waste-to-Energy Systems: Case Study of Ivry-Sur-Seine, France.* Prepared for U.S. Department of Energy, Assistant Secretary for Conservation and Solar Applications, Washington DC 20545, September 1978.

<sup>&</sup>lt;sup>9</sup> J.L. Kuester. *Thermal Systems for the Conversion Municipal Solid Waste, Volume 5.* Argonne National Laboratory, Energy and Environmental Systems Division. 1983.

undertook case studies of various materials separation and resource recovery initiatives in the United States.<sup>10</sup> The Office of Technology Assessment of the U.S. Congress published an evaluation of technologies with respect to resource recovery and materials separation.<sup>11</sup>

Local planning considerations also contributed to incentives for the county to build a waste to energy plant. In 1982, the state closed the Rochester State Hospital freeing up considerable acreage on the east side of the town, which the county purchased. The county sold the hospital portion of the state hospital to the federal government, which redeveloped it as a new Federal Medical Facility, serving long term physical and mental health needs of male offenders.,On the remaining land, Olmsted county built an office campus for its social service agencies and also built a juvenile detention facility. Finally, the county public works department moved its offices and truck yard to the newly acquired site. Within several blocks was a county hospital as well as a community college campus. The older facilities all had existing pipelines for steam and thus, a ready made district heating loop was in place. With the clustering of a large amount of public sector offices and other institutions in one area, there was a ready long term, stable energy market for heating and cooling, which was highly favorable to the development of a waste to energy facility on the same parcel of land.

In sum, when the Olmsted County plant was being developed there was strong impetus to implement waste to energy from within the county, from the state of Minnesota, and from the federal government. State legislation gave counties the responsibility for solid waste and established grant programs for counties to construct facilities to recover energy and materials from waste. In addition, there was grave concern about the immediate and long term potential of groundwater contamination by landfills. Finally, Olmsted County had a ready site for a waste to energy facility with existing fuel customers complete with a system of existing steam lines and piping. During the planning period of the plant from 1982-1984 there were few hurdles and an array of incentives that led state and county officials to consider and then adopt the waste to energy alternative. Based on past experience, the County sought to ensure that all waste generated in both counties could be appropriately processed and disposed, above ground if possible, within its boundaries.

# DESCRIPTION OF THE OLMSTED COUNTY WASTE TO ENERGY FACILITY (OWEF)

Site

Construction for the OWEF was authorized in 1984 and the plant began operation in 1988. It is the first mass burn non-modular (built on-site) facility built in Minnesota. It is owned and operated by Olmsted County. Public ownership and operation of such a plant is somewhat of a current rarity in the United States. Of 87 operating waste to energy plants, only 11 are currently publicly owned and operated, of which four are in Minnesota.

The plant is located on the east side of Rochester, adjacent to a Federal Medical Prison facility, the County campus, which includes a juvenile detention center, the offices of the Olmsted Public

<sup>10</sup> US Conference of Mayors, Institute for the Development of The Urban Arts and Sciences. 1980.

<sup>&</sup>lt;sup>11</sup> Office of Technology Assessment, Congress of the United States. **Materials and Energy from Municipal Solid Waste.** 1979.

Works Department, the Recycling Center and Household Hazardous Waste drop off center. The closest residential neighborhood is about .4 miles from the plant.

#### **Technical Specifications**

The OWEF is comprised of two Riley Stoker mass burn waterwall units with Riley Stoker and Takuma grates. There is one Murray steam turbine. The plant has a combined processing capacity of 200 tons per day (tpd). It processes in the range of 60,000 tons per year, producing about 3.0 MW gross of electricity as well as providing energy for a district heating and cooling system comprised of 26 buildings. About 1.5 MW of electricity is sold to the Southern Minnesota Municipal Power Agency or Rochester Public Utilities (RPU). Ash from the plant, about 42 tons per day, is going to the county owned Kalmar landfill. Through combustion, the reduction of waste by volume is 90%. The county has been investigating alternative uses for the ash, hoping to initiate a pilot program to use ash as construction aggregate after separation and treatment.

In 2003, a major upgrade to the air pollution control system was undertaken, with a cost of about \$11,000,000. Electrostatic precipitators were replaced by dry scrubbers and fabric filters to better control particulate emissions and a carbon injection system for mercury reduction was added. Under federal and state laws WTE plants must control for and monitor various acid gases (sulfur dioxide and hydrogen chloride), nitrogen oxides, furans, dioxins, heavy metals and particulate emissions which result from combustion. This is accomplished by: 1) monitoring what is placed into the combustors (i.e. keeping mercury laden thermometers and batteries out of the waste stream; 2) controlling the combustion process itself with temperature control and air flow; 3) cleaning the flue gases as they are emitted at the back end. A new continuous emissions monitoring system was also installed at that time, bringing the plant into full compliance with the U.S. EPA Best Available Control Technology (BACT) air emissions regulations for small municipal waste combustors (equal to or below 250 tpd).

Olmsted County is about to begin performance testing of a third combustion unit, with a capacity of 200 tpd. The new unit is expected to become fully operational by late 2011. With the new unit the plant will double its capacity. The unit will include a steam turbine, with a 5MW capacity and will be integrated into the existing structure. As the two existing boilers are aging and will need to go offline for upgrades and maintenance, the new combustion unit will serve to ensure

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<sup>&</sup>lt;sup>12</sup> Types of air pollution control devices are: 1) Electrostatic precipitator (ESP)—an earlier method of control of particulate emissions, which is no longer considered BACT. Suspended dust particles or suspended fly ash are electrically charged by a high voltage field and are attracted to collectors of opposite polarity. The dust or ash is then collected; 2) Wet Scrubber—the scrubber brings dust particles in contact with water and lime, which scrubs out dust particles, removing both gaseous, mainly sulfur dioxide and particulate pollutants. These are used in combination with other control devices, but are not common in U.S. WTE plants; 3) Dry Scrubber/Baghouse or Fabric Filter-This is considered BACT for particulate and acid gas control. The fabric filter acts like a vacuum cleaner bag, removing particulates from the flue gas by trapping them. Dry scrubbing of gases takes place by injecting lime into the gas stream, which is then sent to the fabric filter, dust collector. This removes sulfur dioxide and other acid gases and lowers dioxins considerably; 4) Selective Non-Catalytic Reduction (SNCR) for Nitrogen Oxide control-This is considered BACT. It is a process, whereby ammonia or urea is injected into the hot flue gases, reacting with the nitrogen oxide to form nitrogen; 5) SCR (Selective Catalytic Reduction) for Nitrogen Oxide Control. This consists of the decomposition of nitrogen oxide on a catalytic surface. It is not frequently used in WTE facilities currently, but is receiving new attention; 6) CEMS (Continuous Emissions Monitoring System)—These are instruments which measure emissions, including opacity, carbon monoxide, carbon dioxide, acid gases, nitrogen oxide, ammonia, etc.,

continuous waste processing, eliminating the need to bypass additional waste to the landfill and allowing for uninterrupted energy production. In addition, it will handle increased throughput due to population growth that is anticipated over the next twenty years. The cost of the new unit is \$94.33 million and it is currently in shakedown pre-operational testing.

#### Waste Flow

The majority of the waste coming to the OWEF originates in Olmsted County. However, at the plant's inception, Olmsted County signed a twenty-year Joint Powers Agreement (JPA) with neighboring Dodge County, giving Dodge County full access to the facility as well as Kalmar landfill and ashfill. About 54,000 tons per year (tpy) are generated in Olmsted County and 8,000 tpy in Dodge County. The JPA was recently renewed through 2028, ending when the debt for the new unit is expected to be paid in full.

In both counties a large portion of the waste is collected by private haulers, who make individual arrangements with each household and business. Olmsted County requires all of its private haulers to register and secure a license to haul and dispose of waste. It has entered into long term contracts, in which the haulers agree to dispose of their waste at Olmsted County facilities. Similarly Dodge County licenses its haulers. However, it also has a local ordinance that mandates that all MSW generated in the county must go to the county's transfer station. From the transfer station, Dodge County transports the waste to the OWEF.

#### **Financing**

The OWEF and the solid waste program in Olmsted County are run as an enterprise fund, with no property tax monies allocated to their funding. Rather, the program depends on revenues from sale of energy and materials, tip fees, as well as a solid waste management service charge. The county has received state capital grants for the Unit #3 construction. Periodic state grants for recycling and waste reduction activities also provide revenue. However, the amounts of these grants have been declining due to heavy budget constraints facing the state.

The capital costs of the new construction are being financed out of both tip fee and service charge revenues. The County has issued \$71.4 million of General Obligation Resource Recovery Revenue Bonds in 2007 and an additional \$14.69 million in similar bonds in 2009. The base tip fees charged at the OWEF are \$83.00/ton for Olmsted County contracted haulers, \$108.31 per ton for Dodge County haulers These charges are incorporated into a household or business customer's bills. However, in addition to the tip fee, both Olmsted and Dodge counties charge a solid waste management service fee to cover debt service for the plant as well as to fund recycling, hazardous, landfill closure and other solid waste activities. Initiated in 2007 the service charge was 5% of gross receipts collected by haulers and \$10/ton for self haulers from commercial sites. This charge was increased to 17% of gross receipts in 2009 due to additional debt service requirements brought on by Unit #3 construction. The county estimates that for residents who pay on average about \$28.00 per month for solid waste and recycling services, the surcharge adds about \$3.00 to the bill. The state of Minnesota Solid Waste Management tax is currently 9.75% on the refuse bill; thus, residents of Olmsted County are currently paying a 26.75% surcharge on their refuse collection bill.

As of 2009, it is estimated that energy revenues comprise about 26% of total plant revenue. Tip fees make up about 44% of total plant revenue and service charges about 30%. Total plant revenue is approximately \$14.3 million. In terms of expenses, operations and maintenance costs come to about \$9.4 million, with debt service totaling about \$4.5 million.

## ECONOMIC IMPACTS OF THE WASTE TO ENERGY PLANT IN OLMSTED COUNTY

#### Energy Recovery

The Olmsted County plant was built as part of an integrated waste management strategy, meant to recover materials and energy from the waste stream to the extent possible. The current county goal is to process up to 90% of the waste, with only 10% going to landfill. Because garbage is being used as a fuel, which can be highly variable, energy efficiencies are somewhat limited. On the high end, a WTE plant in the Netherlands reports an energy conversion efficiency of 32%. By way of comparison, the average energy efficiency of a fossil fuel fired power plant is in the United States is between 32 and 37%. <sup>13</sup> An average waste to energy plant may achieve efficiencies in the 18% to 25% range. <sup>14</sup> Because it is producing mainly steam, Olmsted County is achieving energy efficiencies above 30%. Enough electricity and steam is being produced to heat the equivalent of about 20,000 homes and to displace about 70,369 barrels of crude oil.

As had been mentioned a partial, pre-existing steam loop had existed in the area where the WTE plant was built. In addition, with other county facilities and the Rochester city center nearby, it was relatively simple to add other facilities into the system. The customer base for the energy has remained somewhat stable over the last several years, since in order to achieve fuel economies, one has to be a user of sufficient size. There are currently 26 buildings that are part of the district energy loop, which supplies steam and chilled water to buildings in the Federal Medical Facility, County Office Campus, County Medical Center, Work Release Center, Olmsted Government Center, Rochester Public Library and the Mayo Civic and Art Center.

As of 2009, a new 2 mile pipeline is being installed to the Rochester Community and Technical College. Called the "Green Pipes" project, the \$5 million cost is partially funded through federal stimulus monies and state grants. This will add four more buildings to the steam loop. The college expects a savings of 30% on its heating bills once the system is fully operational. As the new Unit #3 comes on line, there are plans to add additional customers, most likely the new University of Minnesota Rochester, or other large institutional or industrial users. The "green pipes" project alone is expected to generate about 80 temporary jobs in the area.

Under current Minnesota law, waste qualifies as a renewable energy source and utilities can purchase electricity generated from waste to help in fulfilling their renewable portfolio requirements. The local utility, purchasing the electricity is also paying for renewable energy

<sup>13</sup> Wina Graus, Mauro Toglieri, Piotr Jaworski, Luca Alberio. *Efficiency and Capture-Readiness of New Fossil Fuel Plants in the EU*. Ecofys Netherlands, bv., Utrecht, for the European Commission. July 2008

<sup>&</sup>lt;sup>14</sup> R.B. Williams, B.M. Jenkins, D. Nguyen. *Solid Waste Conversion: A Review and Database of Current and Emerging Technology Final Report.* University of California at Davis, Department of Biological and Agricultural Engineering, for California Waste Management Board, December 2003.

credits. However, to the extent that steam and chilled water generated from waste is displacing coal or other fossil fuels, there are energy benefits accruing to all users. Steam is sold at a discounted price tied to a three-year average of natural gas prices. Thus all public sector facilities, using the waste generated energy are saving on their fuel bills, which impacts taxpayers. These savings and other benefits of the plant are indicated on the county's web site as well as in department newsletters distributed to the public and highlighted in annual budget and end of year financial reports. In addition, the educational institutions in the loop can pass on energy savings to their tuition-paying students. More specifically the "green pipes" project with the local community college has been publicized on radio and TV. In addition, the school has added new course on green energy and will be using this project as a learning tool for its students.

#### **Employment and Community Development Impacts**

The OWEF employs about 32 full-time equivalent (FTE) workers at a skilled or semi-skilled level. The Unit #3 addition will bring on about 8 new employees. The investment of \$94 million in the construction of the new unit has a much larger temporary impact on the region, employing as many as 100 workers over the period of construction. Using an economic multiplier of construction employment of about 2.0, <sup>15</sup> one can expect about 200 new short term jobs in ancillary industries will have been created as a result of the new construction. Furthermore, the ability of a firm or institution to tie into the existing steam loop, thereby purchasing energy at a discounted rate, may play a role in location decisions, having a positive economic impact on the region.

In terms of operation, 37 full-time equivalent individuals (including Unit #3) are employed at the plant, excluding management. All employees are licensed boiler operators. Each employee rotates tasks at the facility on a daily basis, handling cranes, monitoring the tip floor, troubleshooting problems. The county decided on this approach to ensure a high level of professionalism and to combat fatigue. The jobs are high paying, with salaries averaging about \$66, 500 per year. If one adds in benefits total salary comes to \$93,100 per year. These employees are locally based and in total are putting about \$2.5 million back into the local economy.

While the OWEF has some employment and development impacts on the region, these are dwarfed by the mammoth economic engines of the Mayo Clinic enterprise, IBM, the various colleges and universities and biotechnology companies as well as the hospitality industries which service the approximately 1 million visitors coming into the county per year. However, the OWEF contributes to the overall quality of life and ambience of the area, since it can boast of creating the "green" energy which is used by area institutions.

#### Public Budget Impacts of Plant

As has been mentioned, the plant, when constructed in 1987, faced little or no opposition. The major solid waste concern was groundwater contamination caused by sub-standard landfills. While the county had also just gone through the process of closing its own sub-standard landfill and permitting a new Subtitle D compliant landfill, the size of the landfill was relatively small and its capacity limited. Given the difficulties, the county anticipated that it would not be able to permit an additional landfill in the future. Thus, the waste to energy facility met Olmsted

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<sup>&</sup>lt;sup>15</sup> Duluth study of Port Expansion for American Recovery and Reinvestment Act

County's current and prospective waste disposal needs, decreasing its reliance on landfilling, while also conserving energy.

However, the years since the plant first began processing waste have not been stress free. The major sources of stress have been budgetary, relating to two developments on the national level: 1) the 1994 U.S. Supreme Court Decision striking down flow control; 2) the passage of U.S. EPA Clean Air Act air emissions mandates.

The first occurred within five years of the plant's operations and had a direct impact on the OWEF's budget. In order to secure financing to build a waste to energy plant, developers had to guarantee a certain minimum waste flow. These guarantees were accomplished through "put or pay contracts" in which the public entities sending waste to a facility pledged a certain minimum annual amount. If this amount of waste was not forthcoming, the entity had to pay the fee regardless. These contract waste guarantees usually lasted for the life of the bonds, about 20 years.

Given the waste guarantees that were made, counties and local governments sought to ensure that all waste generated within their boundaries were taken to the waste disposal facility rather than other facilities outside the city, county or state. They enacted flow control or waste assurance ordinances, which directed all haulers to dispose of their waste in the designated facilities. Across the country generally and in Minnesota specifically, these ordinances were challenged by various private haulers who wanted to take their waste to non-designated facilities, which charged lower disposal rates. <sup>16</sup> In 1994, the issue of flow control was settled at the national level when the Supreme Court heard *C & A Carbone, Inc. v. Town of Clarktown, New York.* In its decision, the Court struck down flow control ordinances as unconstitutional, deciding that they were a violation of the Interstate Commerce Act. <sup>17</sup>

While Olmsted County had drafted a flow control ordinance, it was never enacted as potential legal problems loomed. Because it was a publicly owned and operated facility, Olmsted County initially secured agreements with haulers to bring the waste to the OWEF based on the drafted waste flow ordinance. It set a tip fee commensurate with anticipated waste flows at \$45.00/ton, which increased to \$49.00/ton through the early 1990s. However, with the demise of the possibility of flow control and the corresponding leakage of waste out of the county, as well as additional state recycling, hazardous waste and other requirements, the county was forced to nearly double its tip fee to \$82.65/ton by 1993, exceeding the national average by \$25.52 per ton. The average tip fee charged at Minnesota plants was somewhat higher than the national average at about \$59.00 per ton in 1993, but Olmsted County was still high in comparison. That meant that households and businesses saw their solid waste bill increase by more than two-thirds within a short period of time, assuming that haulers passed on these charges to their customers.

<sup>18</sup> Governmental Advisory Associates, Inc. **Resource Recovery Yearbook, Directory and Guide., 1987, 1989, 1994** (Westport, CT).

<sup>&</sup>lt;sup>16</sup> In 1992, two counties Martin and Faribault which through a JPA formed the Prairieland Joint Powers Board, were successfully sued by a private hauler contesting a waste designation statute. Showing that it could haul the waste to Iowa at a rate \$20.00/ton less than that charged at the county facility, it successfully won the case.

<sup>&</sup>lt;sup>17</sup> C & A Carbone v. Town of Clarkstown, New York. No 114, S. Ct. 1677 (1994).

By 1997, the county went further in terms of locking in its waste supply and ensuring a stable source of funding for all of its solid waste programs. It entered into long term 10-year contracts with private haulers, securing their agreement that all waste would be hauled to the OWEF. A similar agreement was secured with Dodge County haulers, who had the option of taking the waste to the Dodge County transfer station or hauling it directly to OWEF. In addition, Olmsted County instituted a waste generation fee, the first county in Minnesota to do so. A 5% charge was levied on the gross receipts of each hauler doing business in the county. The hauler was to levy this charge on each individual bill and remit it to the county. Households and businesses were directly absorbing the costs of the facility at higher rates than originally planned. When the county again raised tip fees by \$10.00/ton from \$83.00/ton, a major regional hauler sued the county for breach of contract. The suit was finally settled out of court, but there have been periods of uneasy relationships between some of the larger haulers and Olmsted County for some period. <sup>19</sup>.

By the end of 2008, all trash haulers in the County agreed to an extension of the contract through 2022. However, although the base waste tip fee has stayed the same, the solid waste surcharge has been raised to 17% of the hauling bill, to be collected by haulers. It is yet to be seen if this charge will again lead haulers to try to take waste out of county.

The second national development with budgetary impacts for Olmsted County was the U.S Congress' passage of the Clean Air Act Amendments of 1990. These amendments to the 1977 Clean Air Act directed the EPA to develop new emission guidelines for existing waste to energy facilities and New Source Performance Standards, for new facilities built after 1990. After intense debate and numerous court challenges, standards were promulgated for large facilities (individual units above 250 tons per day) in 1995 and for small facilities (250 tons per day and below) by 1999. Large facilities had to be in compliance by December 2000, using Maximum Achievable Control Technology (MACT) to meet the guidelines. Small facilities were given until June 2005. Olmsted County with two units of 100 tpd, qualified under the small facility designation.

As the original facility was fitted with Electrostatic Precipitators, which would not meet the new standards, particularly with the addition of a third unit, Olmsted County planned and implemented a full upgrade of its air pollution control system. It installed a scrubber/baghouse combination to achieve higher particulate emission control as well as a carbon injection system to control dioxins and mercury emissions. As required a new Continuous Emission Monitoring System (CEMS) was also installed. These retrofits were made in 2003 and 2004 at a cost of about \$11,000,000. However, this level of capital investment, which had no impact on plant efficiency and revenues, occurred at a time of stable to declining waste flow as well as low electricity and natural gas prices. Thus tip fees had to remain high. By 2005 another tip fee increase had occurred, which was passed through to local citizens and businesses.

Following the State Solid Waste Management Act of 1980, Olmsted County in partnership with Dodge County, chose to take full responsibility for the waste generated within the borders of the

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<sup>&</sup>lt;sup>19</sup> Rochester Post-Bulletin, Kiger' Notebook, April 28, 2005; Proceedings, Omsted County Board of Commissioners, November, 14, 2006. The hauler agreed to pay monies owed that it had withheld and make a voluntary contribution to the solid waste fund.

two counties, rejecting the landfilling and the exporting of waste beyond its borders. This decision has come at a price, driving up the relative immediate costs of solid waste disposal. With the construction of the new unit at OWEF an additional \$94,000,000 was bonded. As of 2009, outstanding bonds for the waste to energy plant constituted 60% of all outstanding county bonds. Unfortunately the completion of the new plant coincided with the severe recession in 2008-2009, with corresponding dips in solid waste generation. As capital costs went beyond initial planning estimates, the county was forced to increase its solid waste generation charge to 17% of hauler receipts. If this increase does not cover the expected debt service, the county will be compelled to obtain waste from additional customers, increase its tip fee or again increase the service charge. To complicate issues, waste amounts are not at the levels projected by the planners of the expansion. When the new unit comes on line, Olmsted County will have to actively find new waste streams.

#### ENVIRONMENTAL AND HEALTH IMPACTS OF THE PLANT

#### Recycling

The state of Minnesota and Olmsted County have emphasized recycling as a basic component of solid waste policy since the 1970s. The state has a stated goal of 35% recycling, which the county has met and passed. In addition, the county is striving towards the goal of processing 90% of waste, leaving only 10% that will be landfilled. The county mandates that at a minimum all residential and commercial generators recycle at least newsprint, glass containers, corrugated cardboard, aluminum cans and aluminum scrap as well as mixed paper for commercial generators. Thus, plastic is not a mandated recyclable material. However, private haulers, which collect nearly all residential waste, except that which is self-hauled, are required to provide same day curbside collection of recyclables and solid waste and all include at least #1 and #2 plastic bottles in their collection. While there is a drop-off recycling center at the OWEF, there is no processing plant for recyclables within Olmsted County. Recyclables are taken by private haulers to plants in the Minneapolis area. State law bans numerous materials from landfills, including waste tires, various types of batteries, yard waste, appliances, florescent tubes and telephone books.

Haulers can implement any type of recycling collection method, as long as the mandated list of materials is collected. Recently, some of the major regional and national haulers have been implementing single stream recycling, in which residents can place all their recyclables, including paper and metal, glass and plastic in a single container. According to one county official, it appears that recycling tonnages have increased; however, it is too early for definitive statistics.

#### Overall Recycling Rates

Recycling rates are difficult to obtain from state and county records before 1991 when the state began to publish county data based on its SCORE Reporting System. Thus, one cannot ascertain recycling tonnage prior to the construction of the OWEF. However, as of 1991 through 2008, the amount of waste recycled as well as the percentage of waste recycled has continued to trend upwards. Figure 8 reflects the tons of waste disposed and recycled from the two counties which use the waste to energy plant. As can be seen, totals tons of waste generated (recycled and

<sup>&</sup>lt;sup>20</sup> SCORE Reports for Olmsted County and Dodge County-1991-2008.

disposed) is increasing. While the amounts of waste processed at OWEF have remained flat at about 61,000 tons annually, both tons recycled and landfilled have risen. Especially, disturbing to the county has been the greater reliance on its landfill. The construction of the new unit at the OWEF will assist in prolonging the landfill's life, precluding the need to export waste out of county.

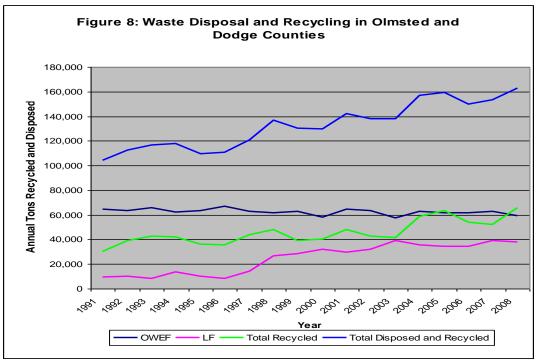
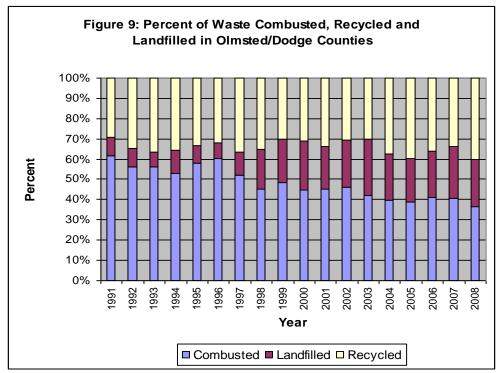


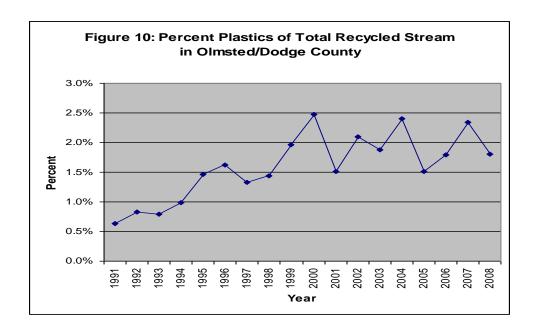
Figure 9 reflects the percentage of waste from the waste shed that is recycled, landfilled or combusted. As is shown, the proportion of total waste generated that is going to the OWEF is decreasing. Over time the percent of waste that is landfilled has tended to increase. However, what the graph also shows is the success of the recycling program. The recycling rate for Olmsted and Dodge is 39.5% as of 2008, increasing to almost 50% if one takes into account credits for waste reduction and yard waste compost!! Since the OWEF has been in operation, the recycling rate has increased about 11 percentage points. Once the third burner on the OWEF is fully operational, the county will be performing at a level of certain European and Asian countries, recycling nearly 50% of its waste and generating energy from the remaining 50%. The county will fulfill its original goal of eradicating its reliance on landfills.

#### **Plastics Recycling**

While plastics are not a mandated material for recycling collection, there are provisions for drop off at the Olmsted County Recycling Center. In addition, private haulers collect plastics from curbside programs throughout the area. Using the SCORE data, it is possible to determine the percentage that plastic comprises of the total recycled stream. These numbers are shown in Figure 10. Again the percentage is trending upward since 1991, with the peaks and valleys probably reflecting vagaries in the data, rather than actual amounts. The average percentage for

Olmsted County over time is 1.6%, which compares to national EPA data, which reports that plastics are about 2.6% of total recovered materials.<sup>21</sup>





<sup>21</sup> US EPA, Office of Solid Waste. *Municipal Solid Waste In the United States: 2008 Facts and Figures*, November 2008, p.5. www.epa.gov/waste/nonhaz/municipal/pubs/msw2008rpt.pdf.

Plastics in the Waste Strea According to a 2000 statewide Minnesota waste composition study, plastics on average constitute 11.4% of the discarded waste stream.<sup>22</sup> If one applies this percentage to Olmsted and Dodge County, the two counties disposed about 11,000 tons of plastic in 2008 and recycled 1189 tons of plastic. Of the total amount of plastic generated in the counties, about 10% was recycled. This compares favorably to the national average reported in 2008 of 7.1%. <sup>23</sup> About 7000 tons annually or 56% of plastics are diverted to the waste to energy facility where the material is converted into energy. The remainder is going to the landfill. Residual and non-recyclable plastics make up about 25% of the heat value of the incoming waste. As Unit #3 becomes fully operational, the percentage of plastics going to landfill will be reduced. More non-recyclable plastics will be used to produce energy.

#### **Development of Recycling Programs**

Due to increasing tons being bypassed to its landfill, Olmsted County in conjunction with its partner Dodge County has periodically implemented new programs to reduce the waste flow. Thus, it has instituted electronics recycling as well as the composting of yard waste. Similarly, Dodge County has expanded its compost program and recycling activities over the years. The OWEF as presently configured does not do any materials sorting prior to or subsequent to combustion. In connection, with the addition of a third unit, the County looked into adding a precombustion sorting facility. It was included in the initial plans, but ultimately dropped due to the high capital costs associated with only a single digit potential increase in the recycling rate. However, the county will be adding equipment on the back end to capture ferrous and nonferrous metals. These systems are less costly and should provide an adequate return on investment.

Most of the expansion and innovation in recycling programs is being driven by the private firms, which are collecting the materials. Waste Management and Veolia (Onyx Waste) both are encouraging their customers to move to single stream collection, in which all materials paper, metals, glass and plastic are placed in a single container. Usually a change to single stream increases the array of materials that can be collected and processed, which is reflected in higher recycling tons. Various cities in the Olmsted County area are moving to this program. In addition, the state and county mandate that haulers charge their customers for solid waste collection on a volume or weight basis, thereby providing direct incentives for residents and businesses to throw away less and recycle more.

Recently, the state has become concerned that the percentage of materials recycled, excluding waste to energy, has flattened at about 35% statewide. The investment in time and money to move the percentages upward from this point are substantial. State and local governments appeared to have reached a plateau, which will not change unless there are changes in structure and incentives.<sup>24</sup> Of particular concern is the difficulty in achieving high recycling rates in the commercial and institutional sector. The extent to which counties and localities can control their

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<sup>&</sup>lt;sup>22</sup> Minnesota Pollution Control Agency, Minnesota Office of Environmental Assistance. Solid Waste Management Coordination Board. Final Report: Statewide MSW Composition Study—A Study of Discards in the State of Minnesota. March 2000

<sup>&</sup>lt;sup>23</sup> U.S. EPA. Municipal Solid Waste Generation: Recycling and Disposal in the United States. Facts and Figures for 2008.

24 Minnesota Polllution Control Agency. 2009 Solid Waste Policy Report. February 2010., p.5

waste flow continues to be an issue, as local governments try to secure the level of finances to meet their policy obligations.

#### Landfill Diversion

Since its inception, the OWEF has resulted in 1.2 million tons being diverted from the County's Kalmar Landfill or other landfills in the area. Without the OWEF, the landfill would currently be at or near capacity, with no possibility of siting another landfill in the area. Thus, waste would have to travel out of county, and most likely out of state with all the attendant problems that might bring. In particular, the County is particularly sensitive to long term environmental liability that it might have for waste going out of state. In the 1980s, the City of Rochester was assessed over \$100,000 for waste it had sent to a sub-standard landfill in the state of Washington.

In addition, by diverting waste from the landfill, the OWEF is reducing the amount of leachate is produced and must be treated. Had the OWEF not been in place, the county would have had to dispose of about 500,000 additional gallons of leachate into its public sewage system. <sup>25</sup> Also by diverting significant tons from the landfill, the OWEF has reduced the amount of greenhouse gas (carbon dioxide and methane) as well as other hazardous emissions of a landfill, which include non-volatile organic compounds (NMOCs) such as butane and ethanol as well as other hazardous air pollutants such as benzene and vinyl chloride. <sup>26</sup> According to modeling done by Wenck Associates, the construction of the third unit will initially lead to a drop in NMOCs by about 50%, due to less waste being bypassed to the landfill, assuming no landfill gas system in place. <sup>27</sup> This should be conservatively comparable to the net reduction in NMOCs resulting from the current operations of the OWEF.

#### Reduction on Fossil Fuel Consumption

The OWEF was conceived at a time when it was both federal and state policy to seek out alternative fuels and reduce reliance on fossil fuels. Due to its unique location in close proximity to a number of public sector buildings and other institutions, the OWEF is the center of a district energy system, supplying steam heat and cooling to 26 separate locations. Because it depends on solid waste, which is produced constantly and is not dependent on weather, it provides a strong baseline source of alternative fuel. Excess steam is used to run a turbine, which provides about 1.5 MW to the grid, enough to power about 1600 homes. Both the steam and electricity output will increase, when the third unit becomes operational. In addition, reliance on fossil fuels used at the plant will be reduced significantly. Currently, there is a natural gas boiler, which is used as a backup fuel source, when the waste to energy boilers are being serviced or are experiencing unscheduled outages. With the completion of a third unit, there will continuous backup, further decreasing reliance on fossil fuels.

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<sup>&</sup>lt;sup>25</sup> Wenck Associates, Inc. *New Source Performance Standards (NSPS) Sub-part AAAA Draft Siting Analysis: Olmsted County Waste-to Energy Facility Unit #3.* Prepared for the Olmsted County Public Works Department. June 2006.

<sup>&</sup>lt;sup>26</sup> The main source of vinyl chloride in landfills is largely the result of biological action of anaerobic bacteria on chlorinated solvents found in landfills. These solvents may include paint products, duplicating materials, various cleaners and degreasers, aerosols, glues, etc. A secondary, less frequent source is old PVC plastics, which have been leaching due to moisture.

<sup>&</sup>lt;sup>27</sup> Wenck Associates, Inc. *New Source Performance Standards (NSPS) Sub-part AAAA Draft Siting Analysis: Olmsted County Waste-to Energy Facility Unit #3.* Prepared for the Olmsted County Public Works Department. June 2006.

It is estimated that about 1.2 million tons of MSW have been processed at the waste to energy facility, since it first opened. Allowing for ash which is also a by-product of combustion and assuming two tons of MSW combusted equates to the conservation of one ton of coal, one can conservatively estimate that over the life of the facility, about 450,000 tons of coal have been conserved, which is the equivalent of about 15,000 homes heated.<sup>28</sup>

Furthermore, additional fossil fuels are conserved due to the location of the facility in the eastern quadrant of the most populated portion of the county. The average haul distance for most of the trucks to the OWEF is in the range of six miles. Without the facility, assuming that the Kalmar landfill would still have capacity to accept waste, trucks would be traveling an additional 10.4 miles on average to the landfill. Also trucks would be traveling in part on poorly paved surfaces on the landfill face. It is estimated that under these assumptions, trucks would have to drive about an additional 108,000 miles, consuming an additional 18,000 gallons of gasoline on an annual basis.<sup>29</sup>

#### Reduction of Greenhouse Gas (GHG) Emissions

By reducing consumption of fossil fuels for energy use and diverting waste from the landfill which is a strong source of greenhouse gas emissions, the OWEF contributes to a net reduction in GHG. This is further strengthened by the more energy efficient cogeneration system in place at the OWEF. In addition, the long time commitment of the state and county to an integrated waste program which places a strong emphasis on recycling in addition to waste to energy also contributes an overall reduction in GHG. The US EPA, using its Municipal Solid Waste Decision Support Tool (MSW-DST) evaluated ten solid waste management scenarios for a hypothetical medium size community, using national averages and default values for a number of parameters established in the model. The different solid waste management alternatives included various levels of recycling with landfilling, use of transfer stations and long haul of waste, and using a waste to energy facility for 70% of the waste, with 30% recycling. In terms of reduction of GHG emissions, the WTE scenario outperformed the other alternatives. It is the only solid waste management approach that resulted in a net reduction of GHG emissions as measured in MTCE (Metric Ton Carbon Equivalents). WTE with recycling showed a net reduction of 31,000 MTCE. Oppositely, if one removes the WTE facility from the model and allows for the waste to be sent to a landfill without a gas recovery system than the system becomes a net GHG emitter into the atmosphere at a rate of about 28, 000 MTCEs. 30

The U.S. EPA has also developed the WARM Model, which is meant to assist solid waste planners and organizations to evaluate different management approaches in terms of GHG emissions. Like the MSW-DST it uses a life cycle approach and draws on some of the data developed in the decision tool model. Using the WARM model with specific data from Olmsted County, one can determine that the WTE facility, with the current level of recycling is resulting in a net reduction of about 24,800 MTCE or the equivalent of greenhouse gas emissions from

Olmsted County Waste-to Energy Facility Unit #3. Prepared for the Olmsted County Public Works Department. June 2006, p. 10-6.

 <sup>&</sup>lt;sup>28</sup> Calculations are based on energy content equivalents, using numbers from Department of Energy, 2008.
 <sup>29</sup> Wenck Associates, Inc. *New Source Performance Standards (NSPS) Sub-part AAAA Draft Siting Analysis:*

<sup>&</sup>lt;sup>30</sup> Susan A. Thornloe, Keith Weitz, Jenna Jamback. *Application of the U.S. Decision Support Tool for Materials and Waste Management*. U.S. EPA/Office of Research and Development National Risk Management Lab, Air Pollution and Control Division, Research Triangle Institute. 2007.

16,629 cars, if compared to a scenario in which the county would be relying solely on landfilling. <sup>31</sup> Should the county decide to implement either pre or post combustion metal recovery, this would further increase the amount of greenhouse gases kept out of the atmosphere. The reduction of GHG emissions are achieved due to the reduction of fossil fuel consumption, the potential increase in metals recovery and the generally shorter distances traveled by trucks to the centrally located waste to energy facility.

#### Fully Controlled and Monitored Air Emissions

In each EPA model, waste to energy with recycling performs highly with respect to air pollutants emitted and toxicity impacts. These models are comparative, and the high ratings of waste to energy in conjunction with recycling are a function of the decreased reliance on fossil fuel production and the reduction of the production of virgin metals due to materials recovery programs.

Since the Clean Air Act Amendments of 1990, there have been stringent requirements placed on Waste to Energy facilities to meet strict air emission standards using Best Available Control Technology (BACT). While legal issues slowed the implementation of EPA regulations for small solid waste combustors (equal to or below 250 tons per day), the regulations were promulgated in 2000 with a five year implementation period. Under federal and state law, OWEF must meet emission standards for dioxins/furans, cadmium, lead, mercury, opacity, particulates, hydrogen chloride, nitrogen oxide, sulfur dioxide and fugitive ash. These are tested annually. In addition, OWEF is mandated to install a continuous emissions monitoring system (CEMS) which provides real time emissions data on opacity, sulfur dioxide and carbon monoxide. This data is streamed to the state pollution control agency. If the facility fails to meet standards, it is fined and, if problems are not corrected, it can be shut down.

In anticipation of the construction of a third unit, which would change some of the air pollution emissions standards for the facility as a whole, OWEF undertook an \$11,000,000 upgrade of its air pollution control system in 2007. It retired the electrostatic precipitators, installing spray dryers and fabric filters for dioxin furan and particulate control. In addition, it installed a carbon injection system to assist in controlling for dioxins and furans, reducing mercury emissions from about 60 lbs. /year to 3.5 lbs. /year. The US EPA examined the impact of its air emission rules after the passage of the Clean Air Act Amendments of 1990, comparing air emissions at all WTE plants in 1990 to those in 2005. There was a 99% reduction in dioxins/furans and reductions above 94% for mercury, cadmium, lead, particulate matter as well as HCL. Sulfur dioxide emissions were reduced 88%. Only large scale nitrogen oxide emission reduction remains difficult to achieve using existing technology, although waste to energy plants have succeeded in reducing these emissions by about 24% on average. <sup>32</sup>

With the new air pollution control systems, the OWEF is operating significantly below permit limits. For particulate matter, amounts from OWEF are too small to quantify. The dioxin/furan emission is at .25% of the limit, mercury is at 1.55% of limit, cadmium at .45%, lead at .1%, HCl

<sup>&</sup>lt;sup>31</sup> U.S. EPA. Waste Reduction Model (WARM) –Excel Format. 2007. Vehicle conversion numbers also taken from U.S. EPA Calculations and References- www.epa.gov/cleanenergy/energy-resources/refs.html.

<sup>&</sup>lt;sup>32</sup> U.S. EPA, Office of Air Quality and Planning. *Memo from Walt Stevenson, Emissions from Large and Small MWC Units at MACT Compliance*. August 10, 2007.

at 1%, NOx at 31%, SO2 at 1.6% and opacity at 0% (too small to quantify). Thus, all parameters from 2009 testing are about 98% below permitted limits with the exception of NOx and percent reduction of mercury which are below permit levels by about 70%. <sup>33</sup>

#### Health Impacts of OWEF

Not only does OWEF have to meet the technology and operationally based air emissions quality standards established by the US EPA, it also has to meet health based standards of air emissions set out in federal and state ambient air quality regulations. In an EIS (Environmental Impact Study) prior to the construction of Unit #3, Olmsted County had to examine the toxicity of air emissions and the potential human exposures to the chemicals incurred by the existing and new waste to energy units. In addition, it had to assess the cancer and non cancer hazards based on toxicity measures and exposure estimates, based on available data. No acute, sub-acute or chronic non-cancer risks were found. Tests for cancer risks have been conducted, but have not been released at the time of this report. The EIS is examining the direct and indirect human health risks as well as impacts on water and vegetation in the surrounding area.

#### POLITICAL AND INSTITUTIONAL IMPACTS OF OWEF

While the intervening 23 years since the OWEF has been built has seen improvements in the technology and practice of waste to energy, as well as many changes in the economic, political and energy environment, the institutional structure and community support for OWEF has not changed. Perhaps in part because it is so interwoven in the community, literally connected by the steam loop to many well used facilities in the community, the OWEF, a county owned and operated plant, has generated minimal opposition. The state and county made a commitment in 1980 to a fully integrated solid waste management policy, with landfilling as the least desirable method of disposing of waste. The county has stood by this commitment, even when less expensive alternatives existed. The Olmsted County area has one of the highest concentrations of trained physicians, health professionals, software engineers in the country. Neither in 1987 when OWEF first went into operation, nor in 2005, when the third unit was being proposed did any significant opposition surface.<sup>36</sup>

In addition, the waste shed has hardly changed. The main providers of waste are Olmsted and Dodge Counties, which was institutionalized in a Joint Powers Agreement prior to the construction of the 1987 plant. The agreement was renewed in 2007 and will run through 2028. Furthermore, Olmsted County has signed new contracts with its private waste haulers, securing the waste that is collected within the county through 2022. While there was some issue with a large hauler taking waste out of county, it was settled out of court in the County's favor.

<sup>34</sup> Olmsted County. *Voluntary Scoping Environmental Impact Statement*. Submitted to Minnesota Pollution Control Agency, July 2005.

<sup>&</sup>lt;sup>33</sup> OWEF Air Emission Comparion, November 2009 Results, Units #1 and #2.

<sup>&</sup>lt;sup>35</sup> Olmsted County. *Voluntary Scoping Environmental Impact Statement*. Submitted to Minnesota Pollution Control Agency, July 2005.

<sup>&</sup>lt;sup>36</sup> Interestingly, this is not the case with Minneapolis-St. Paul, where there are several active community groups against any expansion of tons going to the WTE facility or in fact its existence. These are the Climate Crisis Coalition of the Twin Cities, Neighbors Against the Burner, Sierra Club, MN Neighbors for Clean Air. In addition, 15 local legislators spoke out against any expansion of tonnage throughput.

However, despite the overwhelming community support for OWEF, there are some storm clouds on the horizon. The construction of Unit #3 is being handled through a complicated A&E and construction manager at risk arrangement. The firm providing construction management is a joint venture between three firms, Knutson, Harris Mechanic and Hunt Electric. As can be expected with any large and complicated construction project, there have been cost overruns and implementation delays. The new project, with its \$94,000,000 price tag will be coming on line just as the country is experiencing a sluggish economic recovery after the worst recession since the Great Depression. Garbage generation rates have declined as have recycling rates, particularly among newsprint and magazines. Because population of the county continues to grow, it is still expected that the facility will be needed, especially as the old units age out, but the timing of its implementation is not optimal. If required waste amounts are not met, the county will have to secure waste from elsewhere, raise the tip fee, or raise the service charge. Any increase in fees and charges could prove to be highly controversial in such difficult economic times.

A second institutional issue confronting the county is ensuring that it can control its waste stream. This is a particularly challenging issue, since most waste continues to be collected by private haulers. Any attempts of the county to change this situation have been met with strong, organized opposition. In 2006, the county proposed to set up five residential service districts. Private haulers would bid on servicing each district with each hauler or consortium of haulers eligible to win a maximum of two districts. This would replace the current system in which each homeowner hires a private hauler directly. Under the county's plan, commercial garbage hauling would continue under the free-market approach. The purpose was to rationalize the collection system, so that the county could control the waste within its borders. Under heavy opposition from some residents, haulers and trade associations, the county dropped the plan. In its place it created five districts, each with specific days in which licensed haulers must pick up residential waste.

Lastly, the state and the county are concerned that recycling numbers have flattened out over the last decade. State funds for recycling incentives have declined and counties are not in the financial position to fund educational and other outreach programs to ensure that high levels of recycling continue. The county has examined and rejected the possibility of constructing its own materials processing facility (MRF) on the basis of cost and the limited gains in recycling tonnage that would result. Product stewardship, aggressively extending recycling to multi-family units, commercial establishments, and restaurants and convenience stores are initiatives that the state and county are examining to increase recycling. In addition, the implementation of single stream recycling, direct incentives for residents or businesses to recycle are also being examined.

#### **CONCLUSION**

In some respects Olmsted County and its waste to energy facility are unique. The county has a strong and somewhat recession proof economic base with a growing population. Its citizenry, with their above average level of education and income are able to afford an environmentally

<sup>37</sup> Jeffrey Pieters. "Waste-to-Energy Project Delays Grow by the Day" **Rochester Post Bulletin,** June 1, 2010.

<sup>&</sup>lt;sup>38</sup> "Customers Give County an Earful about Trash Plan. **Rochester Post Bulletin,** June 28, 2006.

sound and responsible solid waste management strategy. The county is backed in its solid waste policy by the state of Minnesota, which clearly endorsed energy and materials recovery from waste above landfilling as early as 1980. In addition, the OWEF is owned and operated by the county, which is a rarity for waste to energy projects. It provides steam to a district energy system rather than to one or two private customers. With the construction of the OWEF, the county hoped that it could drastically reduce its reliance on the landfill, control the disposal of waste generated within its boundaries (as well as Dodge County) and provide energy for its citizens into the future. It re-confirmed this approach with the expansion of the WTE plant. With the drive towards alternative energy re-emerging as both a national and local goal, the county is able to offer its electricity purchasers a renewable energy source (as defined by the state of Minnesota) as well as provide direct renewable energy to its public sector customers at a discounted rate, which not only conserves scarce fossil fuel resources, but offers a savings to taxpayers. As it eyes the future, the OWEF will be testing new technologies to deal with sulfur dioxide and nitrogen oxide reduction. It will be installing a metal recovery system and it will be expanding its customer base for its steam and electricity.