CASE STUDY

MARION COUNTY, OREGON WASTE TO ENERGY FACILITY

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EXECUTIVE SUMMARY

ENERGY RECOVERY CASE STUDY: MARION COUNTY, OREGON

The Marion County waste to energy facility (WTEF) is the only such plant in Oregon. Owned and operated by Covanta Energy Corporation, it has been operating successfully without disruption for 24 years. The WTEF services Marion County with a population of 318,000 persons and also processes some waste from Portland Metro as well as neighboring Linn and Polk Counties. The County itself generates about 487,000 tons of refuse, of which about 50% is recycled 13% is landfilled and 36% or about 171,000 tons is treated through the energy recovery facility. An additional 12,000 tons per is processed at the WTEF from generators outside the county. The County has also routinely been in the top two counties in the state with respect to recycling and is continuously working to reduce its waste generation and increase its recycling.

Economic Impacts

- **Energy Efficiencies:** The 183,000 tons of waste processed at the WTEF produces about 86,154 Mwh (megawatt-hours) of electricity sold to the grid enough to service about 7800 homes and displace about 51,000 barrels of crude oil annually About one-quarter of the energy recovered is from residual or non-recycled plastics.
- **Employment:** The plant offers employment to 38 permanent skilled workers. These workers contribute about $2,000,000 to the local economy annually. In addition, the facility contributes an additional $1,250,000 to the region annually through purchases of goods and services.

- **Impact on the Public Budget:** The County receives about $6,000,000 in electricity and materials sales revenues from the plant. This covers about two-thirds the cost of the operations and maintenance of the facility. In conjunction with flow control, the tip fees the county collects at the WTEF and its other solid waste facilities allows it to finance a wide array of recycling, composting and educational programs.
- **Real Estate Footprint:** The WTEF is centrally located in the county, nine miles from the state capital of Salem. It occupies 16 acres to treat 183,000 tons of waste per year. A landfill capable of taking this amount of waste would occupy at least 10 times this amount of space.

Environmental Impacts

- **Recycling Levels:** Marion County ranks first or second in recycling rates across all counties in Oregon, depending on whether one includes the additional credit given by the state for converting non recyclables wastes into energy. Since the plant has been in operation, the county has vastly expanded its recycling programs. Urbanized areas of the county have automated or semi automated curbside collection of yard waste, commingled recyclables, as well as usable latex paints, cooking oil and dry cell batteries. The County is currently piloting a commercial/institutional food composting program with the plan to expand a food waste collection program to all households. Since 1992, the county's recycling rate has nearly doubled from about 26% to 48%.
- **Metal Recovery:** The facility recovers about 4200 tons per year of ferrous metals at a value of approximately $850,000. The facility operator is examining an improvement in this recovery system and is also evaluating adding a non-ferrous metal recovery system.
- **Landfill Diversion:** Over the plant's life, about 4.3 million tons have been kept out of landfill. The county reduced its need for landfill space by about 90%. In addition, by keeping wastes out of a landfill, it diminishes the production of leachate as well as the emission of hazardous gases at the landfill. Because of the waste to energy plant, the county avoids a 30 to 60 mile round trip to out-of-county landfills, contributing to a reduction of truck traffic and harmful automotive emissionsand saving on the consumption of gasoline. fossil fuels
- **Reduction of Reliance on Fossil Fuels:** The plant combusts the non-recyclable portion of the waste stream and generates energy. This energy is sold onto the grid and is enough to service about 7800 households as well as meet the in house energy needs of the plant. In addition, if the county had to truck its waste to out of county landfills, it would be consuming an additional about 83,300 gallons of gasoline per year.
- **Greenhouse Gas Reductions:** The processing of 183,000 tons of waste at the WTEF contributes to the net reduction of Greenhouse Gas (GHG), if one assumes that without the WTEF, this waste would be landfilled. Using the US EPA's WARM model, one can calculate that the WTEF is contributing to a net reduction of 28,240 MTCEs (Metric Tons Carbon Equivalents), which is comparable to taking about 18,965 cars off the road.
- **Air Emissions:** The WTEF operates under strict federal and state air emissions and operating standards. Air emissions as well as plant operating procedures are monitored and tested on a regular basis. The WTEF was the first in the United States to be regulated for dioxin levels under state law and the first to install a scrubber/baghouse combination for dioxin/furan and particulate matter control. Dioxin/furan emissions at the plant are

only a quarter of the new state standard, which is more stringent than the federal standard. Particulate, lead, cadmium and mercury emissions as well as heavy metal emissions are hundreds or thousands of times below the standards. A recent study of the impact of the WTEF on particulate matter concentrations in the Salem area found that the plant contributed 1/40,000 of the total particulate emissions or a nearly negligible percentage.

Political/Institutional Impacts:

- **Community Support:** The plant has operated without significant opposition over the last 24 years. In fact, Randy Franke, a county commissioner and the person who was most instrumental in persuading the county to construct a waste to energy facility, went on to become a national expert on solid waste issues. He was elected president of the National Association of Counties in 1995 and National County Leader of the Year in 1997. He considers the plant his pride and joy and one of his major accomplishments.
- Jeff Bickford, Environmental Services Division Manager has indicated that not only has the plant allowed the county to manage the majority of its waste within its boundaries, but it has permitted the Division to focus on its priorities of reducing and recycling waste.
- **Industry Recognition:** Covanta has been recognized by the State of Oregon for its outstanding record on worker safety at the WTEF. In addition the Marion County plant was granted membership in US EPAs Performance Track Program, which recognizes ongoing environmental programs and a high level of environmental performance.

INTRODUCTION

Located south of the Portland metropolitan area in western Oregon and named for the American Revolutionary War hero General Francis Marion, Marion County stretches from the Willamette River to the Cascade Mountains. Encompassing 1194 square miles, the county is made up of 20 incorporated cities and 37 unincorporated communities and has a total estimated population of 318,000. Most of its area is less than two hours from the Pacific Ocean. The county is bounded to the east by the Cascade Mountains, the west by the Willamette River. Salem, the state capital, is located within the county and government employment is a major element of the county's economy. In addition, Marion County leads all Oregon counties in agricultural production, particularly berries, nuts, vegetables and nursery products and also supports an active food processing industry.

Similar to other localities in the United States, the state of Oregon and some of its more populated cities and counties began to examine waste to energy in the late 1970s. Lane County, home of the University of Oregon, actually built a Refuse Derived Fuel (RDF) system, which operated for a short time prior to closing. The Portland Metro area also reviewed waste to energy alternatives, but abandoned their plans, due to long term availability of landfill space. Marion County was the only county in the state to proceed to construction and continued operation of a facility.

The Waste to Energy facility (WTEF) was built in 1986 by Ogden Martin (now Covanta). It is a mass burn waterwall plant with two 275 ton per day (tpd) boilers. It processes about 183,000

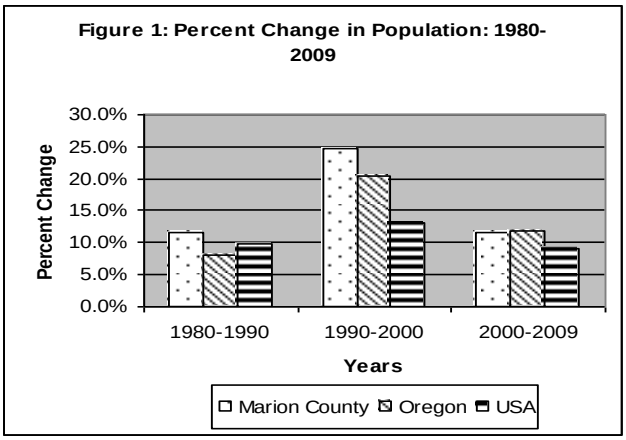
tons of waste per year, handling the waste generated in Marion County as well as some waste from neighboring Portland Metro and Linn County. It also takes a small amount of medical waste. The plant is located in the unincorporated sparsely populated area of Brooks (population 400), which is about nine miles north of Salem.

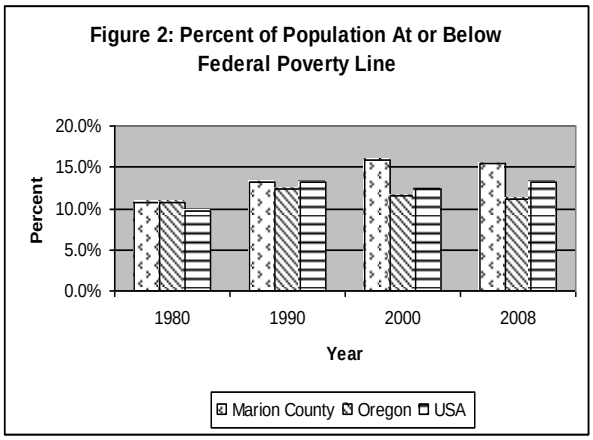
DEMOGRAPHIC AND ECONOMIC PROFILE OF MARION COUNTY

Demographic Characteristics[1]

Marion County with a population of about 318,000 persons is one of the more populous counties in Oregon due to the presence of the state capital Salem and its location in the fertile Willamette River valley. It grew by about 25% between 1980 and 2000, but growth has slowed in the decade after 2000. As shown in Figure 1, between 1980 and 1990 as well as between 1990 and 2000, its growth rate outpaced both those of Oregon and the U.S., but after 2000, the percent of population growth matched the state and was close to that of the nation as a whole.

The county in terms of poverty, unemployment and median income mirrored the state and the country in the 1980s and 1990s but began to lag behind after 2000. As reflected in Figure 2, the percentage of its population with incomes at or below the federal poverty line continued to increase from about 11% in 1980 to 16% in 2008, while that of the state and country decreased somewhat. This finding is borne out somewhat by looking at unemployment rates in Figure 3. Through the late 1990s, the unemployment rates in Salem City (about 9 miles south of Brooks) Marion County and the state were quite similar to that of the United States. However, after this period, the rates of the state, county and city, while nearly identical, began to move ahead of the national average. By 2008, national unemployment rates had come close to those in Oregon.





[1] 1990, 2000, 2008 Population, housing and income data from Decennial Census and 2006-2008 American Community Survey 3-year Estimates. http://factfinder.census.gov. 1980 data is from U.S. Department of Commerce, Bureau of the Census. **County and City Data Book: 1983, 10th Edition,** 1983. Data on employment is from the Bureau of Labor Statistics. Local Area Unemployment Statistics. http://www.bls.gov/lau/#tables.

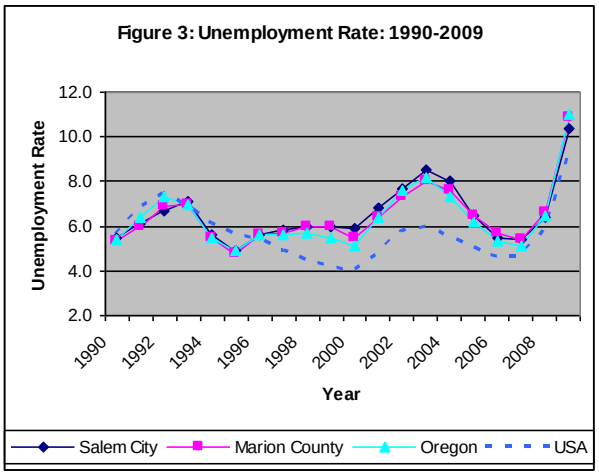
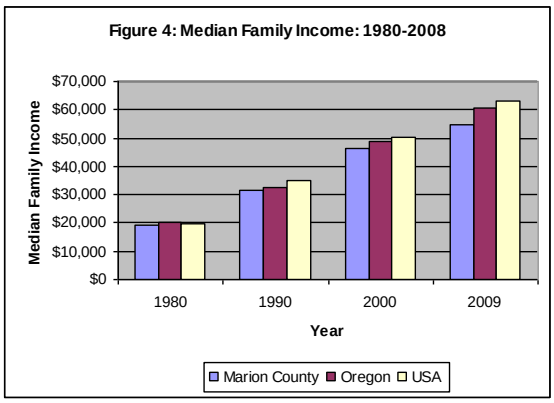
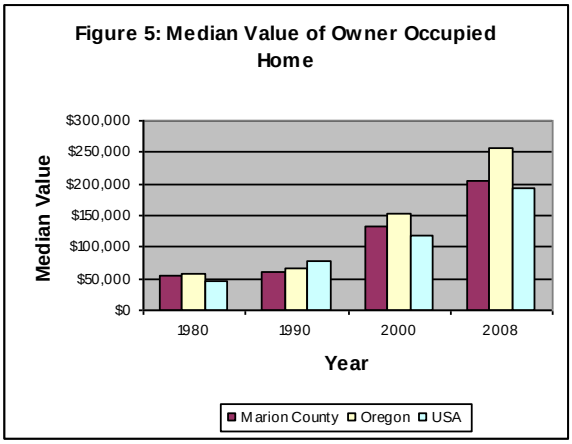
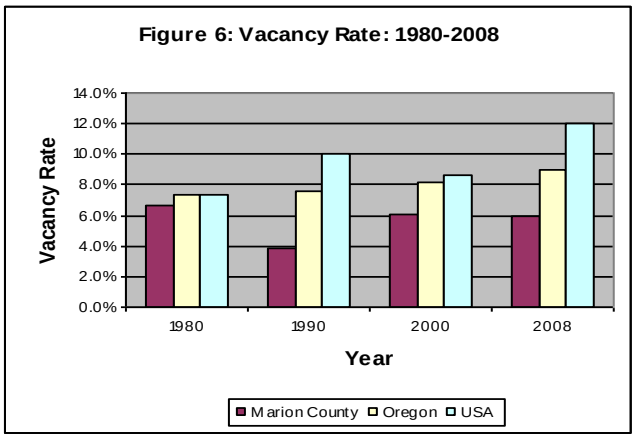


Figure 4 shows median family income in the county as compared to the state and nation. In 1980 the county, state and country showed nearly identical median incomes. However, by 1990 Marion County's median family income began to lag behind Oregon and the United States, falling below state and national medians even further in 2000 and 2009.

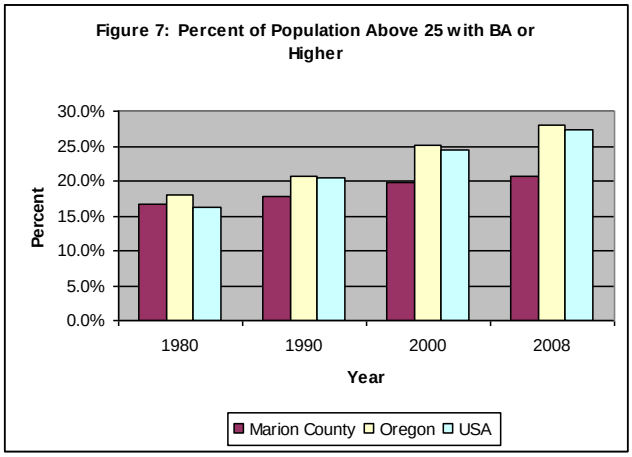
The median value of owner occupied homes outpaced the national median since 1980; however, values were below that of the state, in each of the census time periods. As shown in Figure 5, median values more closely follow that of the country, but are not as high as overall medians of the state. In 1980, the median home value for the county was $53, 900. By 2008, it was $205,000. In comparison, in 1980 the median home value in the state was $59,000. It increased to $255,000 by 2009. While county housing prices were lower than in the state as a whole, vacancy rates remain well below state and national averages as shown in Figure 6. Over the period from 1980 to 2008, one observes the vacancy rate remaining between 4 and 6.6%.







With respect to educational attainment, Marion County is at or below national and state averages. The percentage of the population above 25 that has a college degree or better has risen slightly from about 17% in 1980 to about 20% in 2008. As can be seen in Figure 7, not only do these percentage fall below those of the state and country after 1980, but the level of growth is also below that of the state and nation.



Thus, Marion County presents a picture of robust population and income growth through 2000, keeping pace with the state and the nation as a whole. After 2000 however growth in the county began to slow and lag behind state and national averages.

The Local Economy

As has been mentioned, Marion County has a diversified agricultural base and is largest agricultural producer among Oregon's 36 counties. Crops consist of berries, vegetables, nuts, grasses and specialized nursery plants. In addition, there is sufficient land in the Willamette River Valley for grazing and the raising of livestock. The area is a large producer of poultry and beef for markets. Complementary to agricultural production is an active food processing industry, which is considered one of the largest in the nation.

Despite its strong agricultural base, the county's largest employer is government, including federal, state, county and local agencies. These organizations employ more than 25% of those working in the county. By far the largest single employer is the State of Oregon, which employs 13.3% of all those working in the county. Out of the 10 largest employers in the county, only two are private firms, Norpac Food Inc a food processor and T-Mobile Corporation. Since 2000, a private firm employing about 1300 persons left the county.[2] Thus, from the standpoint of large employers, this is not a highly diversified economy, nor is it insulated from the ravages of the economic cycle.

HISTORY OF WASTE TO ENERGY IN MARION COUNTY[3]

Marion County made a decision to invest in a waste to energy facility as a result of the energy crises of the 1970s and federal and state laws mandating closure of its sub-standard landfill which were promulgated during this period. Marion County's existing landfill, Brown's Island, located in a flood plain of the Willamette River was slated to be closed and the county began an active search for a new site. After raucous public hearings on various alternative locations for a new landfill, the county decided to halt its search due to strong community opposition to any of the suggested sites. In parallel, in 1978, state law designated Marion County as a solid waste planning and implementation agency with full responsibility for solid waste management. One year later the County Solid Waste Advisory Council (SWAC) was formed comprised of solid waste professionals, public officials and citizens. This council began further work on examining possible solutions to the closure of the landfill and a potential solid waste disposal crisis.

By the early 1980s, additional federal and state legislation helped created incentives for waste to energy and encouraged the county to revisit waste to energy. The 1978 federal Public Utility Regulatory Policies Act (PURPA) was passed, requiring utilities to purchase electricity from non-utility alternative energy producers at an avoided cost rate. In addition in 1981, the state of Oregon passed SB 479, which permitted the county to impose flow control over waste generated within its borders. Furthermore, the law permitted the county to enter into long term contracts with utilities for the purchase of energy generated at a waste to energy plant. The county hired an engineering consulting firm, Trans-Energy, to study waste to energy, focusing particularly on refuse-derived fuel (RDF) technology.

However, while the county was proceeding on an evaluation of waste to energy feasibility and technologies, it had not yet abandoned the idea of constructing a new landfill. In 1980, it developed and published landfill siting criteria and began re-examining possible areas for the landfill and one year later re-opened public hearings on a possible landfill. The specter of the closure of Brown's Island had grown more imminent, since the site had officially been classified by the federal government as an open dump. The state of Oregon permitted two extensions on the landfill's closure deadline, but had refused to grant a third.

As public opposition to any landfill intensified, the county based on engineering and financial analyses issued an RFP (Request for Proposals) for a waste to energy facility and began a series

[2] Marion County. Comprehensive Annual Financial Report, Year Ended June 30, 2009. p. 120.
[3] Much of the information in this section was obtained from Marion County Department of Public Works. "Marion County History of Solid Waste Management". September 28, 1994.

of public information meetings. The solid waste director also went to Europe to tour existing waste to energy plants. In January 1982, the engineering firm Trans Energy, which had previously undertaken a study of RDF, was selected as the winning bidder to construct a waste to energy facility. Contract negotiations with the firm were completed one year later in 1983.

Similar to the experience with the new landfill, the proposal to construct a waste to energy plant encountered broad opposition. To counter citizen opinion against a plant, Randy Franke a county commissioner began a yearlong education campaign, speaking to community groups, service organizations and business associations. Seeing both short term and long term benefits to plant construction, he rallied the county political leaders to support the plant, driving the process of implementation. An industrial site in Brooks, a sparsely populated area north of Salem became available and was selected. With a site selected, opposition intensified. Air pollution issues became the rallying point of the opposition and various legal means were attempted to block construction. The city council of Salem voted not to support waste to energy. Keizer, the second largest city in the county placed a question on the ballot to raise money for legal fees to fight the construction of the waste to energy plant. This was voted down. In addition, opposition groups mounted legal challenges to the overall site selection procedures and to the particular site. By the end of 1983 through 1984, many of the challenges were denied by Oregon courts as well as the state Department of Environmental Quality. In March 1984, a countywide initiative to ban waste to energy in the county was placed on the ballot. It failed by a vote of 18, 233 against banning the plant and 14, 146 for a plant ban. A few months later the Brooks site was upheld, after approval of the state DEQ and the Land Use Board of Approvals. A particularly strong opponent was a flower farmer with fields in the area of the plant. The farmer continues to oppose the plant after twenty-five years.

While Trans Energy Systems, the winning bidder, developed the concept of the plant, assisted the county in finding a suitable site, and provided engineering expertise, it realized that it did not have the financial capacity to bring the plant to fruition. In July 1984, Ogden Martin (now Covanta) bought out Trans Energy. Ogden put up $12.6 million in equity and helped devise a floating-rate, tax-free publicly financed bond issue for the balance. In September 1984, ground was broken at the Brooks site and in July 1986, commercial operations began. In September 1986, the issue that had begun the County's quest for a disposal alternative, the closure of Brown's Island landfill and other smaller landfills, was resolved. The landfills were closed to municipal solid waste and two transfer stations in Keizer and Woodburn were opened.

Thus, the key force in the development of the waste to energy plant was the imminent closing of the County's landfill, particularly when it was officially designated by the US EPA as an "open dump" and listed as such in the Federal Register. The failure of the county to find an alternative suitable site for a landfill as well as strong community opposition to any new site gave the county impetus to examine the feasibility of waste to energy. With the additional power of flow control and the ability to enter into long term contracts with utility purchasers, the county had further incentive to push towards a waste to energy plant. It encountered strong community concern over air pollution and truck traffic around the plant, but with a sustained effort at education and citizen involvement, Marion County was able to overcome opposition and construct the plant.

DESCRIPTION OF THE MARION COUNTY WASTE TO ENERGY FACILITY (WTEF)

Site

The plant is located on a 16 acre site in the unincorporated city of Brooks, which has a population of 400. It is nine miles north of the center of the city of Salem in an industrial area adjacent to a cannery and highly accessible to transportation, including two interstate highways and a railway line. It is surrounded by farm land on its west. There is a residential sub-division and a school located within several miles of the facility.

Technical Specifications

The facility began operations in 1986. It is mass burn waterwall plant with two Zurn Industry boilers and Martin grates, each with a design capacity of 275 tons per day. Tonnage throughput averages about 507 tons per day. In 2008, 182,700 tons were processed at the WTEF. The plant was designed and built by Ogden Martin (now Covanta), which also operates the plant under a contract which expires in 2014. It produces about 13.1 MW of electricity per year, of which 11.1 megawatts is sold to Portland Gas & Electric, the local utility and the remainder is used in house. It also recovered about 4200 tons of ferrous metal post combustion in 2008. The county receives 92% of the revenues from electricity sales and 50% of the revenues from the sale of materials, both of which offset the waste processing fee charged by Covanta.

The WTEF reduces the volume of waste by 90%. Ash makes up the residual 10%. Ash disposal is the county's responsibility and is landfilled at the county's designated ash fill, the North Marion County Disposal Area. About 50,000 tons of ash are produced annually, which is approximately 26% of total waste processed by weight.

When the WTEF was built in 1986, it pioneered various approaches to air pollution control. It was the first plant to operate under a dioxin limitation established by the state of Oregon. It was also the first plant in the United States to use the combined dry scrubber/fabric filter in combination to control particulate and other emissions.[4] The plant was selected to be included as one of the reference plants used by the EPA to develop maximum achievable air emission standards for large combustors as part of the 1990 Amendments to the Clean Air Act. In 1998, the plant added a NOx control system as well as a dry sorbant injection system to control for mercury.

Since 1986, there have been several upgrades to the plant to improve efficiencies and conserve water and energy. Furthermore, there is a plan to upgrade the ferrous metal separation system as well as a non-ferrous metal separation system. The non-ferrous recovery system is on hold due to the weak economy and the long ten plus year payback period.

Waste Flow

In 1978 Marion County was designated as the governmental unit responsible for solid waste planning implementation as called for in the Federal Resource Recovery and Conservation Act of 1976. More specifically, Oregon statutes granted the county the ability to establish waste flow

[4] Interview with Jeffrey Hahn, Covanta Energy, August 25, 2010.

control in order to oversee waste management within its boundaries. Under Oregon state law, Marion County is granted the right to:

> "Regulate, license, franchise and certify disposal, transfer and material or energy recovery sites or facilities; establish, maintain and amend rates charged by disposal, transfer and material or energy recovery sites or facilities; establish and collect license or franchise fees; and otherwise control and regulate the establishment and operation of all public or private disposal, transfer and material or energy recovery sites or facilities located within the county. Licenses or franchises granted by the board may be exclusive."[5]

The county manages a fully integrated solid waste management system. In addition to the WTEF and ash fill, the county has two transfer stations, a construction and demolition (C&D) landfill. Furthermore, a cooperative of franchised refuse haulers own and operate the Marion County Resource Recovery Facility (MRRF), which serves as a drop off and recycling center for commercial waste as well as C&D waste. Excess waste above the capacity of the WTEF, averaging about 55,000 tons per year is hauled to area landfills, mainly Coffin Butte in Benton County and Riverbend in Yamhill County.

Under flow control, the county has designated that all commercial and solid waste be taken to its transfer stations or directly to the WTEF. The Salem/Keizer Recycling and Transfer Station (SKRTS), owned and operated by Allied Waste, handles about 33,500 tons. This site also houses a public drop-off site for waste and recyclables, a household hazardous waste (HHW) drop-off facility, as well as a drop off site for yard and wood waste. The second transfer station North Marion County Disposal Facility (NMCDF) is owned and operated by the county and services the northern portion of the county. It handles about 9500 tons per year.

The bulk of the waste comes to the WTEF through the eight franchised haulers, which are contracted by the county to pick up both residential and commercial waste in designated geographic areas. Franchise terms run for seven years, with options to renew. Under flow control and the conditions of their franchise, waste must be disposed of at the WTEF or a county designated transfer station. Of the franchise collected waste about 137,000 tons goes directly to the WTEF. About 12,000 tons of wasteare imported on an as needed basis from Portland Metro and neighboring Linn and Polk Counties. Medical waste comprises about 1300 tons. About 33,000 tons comes from the county's transfer stations and residue from the MMRF.

Financing

The Department of Public Works, Environmental Services Division operates the solid waste management system as an enterprise fund. This means that the sources of funds come mainly from franchise fees, tip or gate fees at each facility as well as revenues generated from the sale of electricity and materials. There is no direct reliance on federal, state or local taxes.

The original capital cost of the WTEF was $47,500,000. It was paid through a publicly financed revenue bond issue of $57,325,000 in 1984 and an equity contribution by Covanta. A portion of the revenue bonds were refunded in 1995 and 1996. All debt was fully paid off in 2008. Debt

[5] Oregon Revised Statutes 459.125

service averaged about $4,200,000 per year and made up a part of the processing fee.[6] Without the debt service payment, the county has the option of reducing the tip fee or building up the reserve fund. It has chosen the latter as it anticipates additional capital expenses in the future.

Covanta has an agreement with Marion County to process its waste through 2014. The County has a "put or pay" contract which guarantees Covanta 145,000 tons of waste per year. The county pays a surcharge on any tonnage in excess of this amount. Under the agreement, the county pays service fees equal to the annual debt service, operation, maintenance and pass through costs, less any credits for electricity generation and the sale of secondary materials. In the fiscal year ending June 2009, the county paid Covanta a service fee of $735,000 per month or about $8.8 million per year. The tip fee at the WTEF is $67.45 per ton, which has not changed since 1992. Of this fee about $46.00 per ton goes towards the operations of the WTEF. The remaining $21.45/ton is allocated to recycling education, landfill closure funds, hazardous waste collections and composting. Revenues from electricity sales are about $5.5 million, of which the county retains 92%. Revenues from ferrous metal sales are about $1.27 million of which the county receives half. About 68% of the operating costs of the facility are paid through power and secondary material sales. If the county elects to terminate its contract with Covanta in 2014, ownership would be retained by Covanta, who would be able seek waste from other localities in order to continue operating the plant.

ECONOMIC IMPACTS OF THE WASTE TO ENERGY PLANT IN MARION COUNTY

Energy Recovery

The WTEF has a dual goal of reducing the county's reliance on landfilling and producing energy. It relies on a Mitsubishi turbine to produce a total of 13.1 megawatts (MW) of which 11.1 MW are sold to Portland General Electric Company, an investor-owned utility in the area and 2 MW are used in-house. This translates into 86,154 megawatt hours (mwh) of electricity sold unto the grid which is enough to serve about 7800 homes and displace the use of about 51,000 barrels of oil annually.[7]

As of Fall 2010, the state of Oregon is considering a revision of its renewable portfolio standard legislation, which mandates that the largest utilities in the state must provide 25% of their retail electricity from newer, clean renewable sources. Initially energy from an existing municipal waste combustion facility (built before 1995) was not included as a renewable source. This despite the fact that landfill gas to energy facilities do qualify. The revised rule permits waste combustion facilities built before 1995 to qualify for up to 11 MW; however, these credits cannot be claimed by a utility until 2026. Any solid waste facility built after 1995 could qualify for up to 9MW of renewable energy credits, which again could not be used until 2026. Should the Marion County WTEF qualify, its electricity revenues will probably increase over current amounts.

Employment and Community Development Impacts

[6] Marion County Department of Public Works. "Solid Waste Updates: Solid Waste Plan and Solid Waste Fund Issue Brief", 2008.
[7] Household calculation is based on U.S. DOE average kwh per household data.

The WTEF employs 38 full-time equivalent skilled workers, exclusive of management. These individuals are from the local area and are unionized by Local 701 Operating Engineers. With an average salary conservatively estimated at about $60,000 per year, these employees put back about $2 million into the local economy. Covanta, the firm that owns and operates the plant has been recognized by Oregon OSHA for its stellar record in worker safety. In 2008 it was awarded VPP Star Status and in 2005 it achieved SHARP Status. Both are voluntary programs that encourage employers to meet rigorous workplace safety standards to protect workers and reduce injuries. To earn SHARP status, Oregon employers must achieve a Lost Workday Case Incidence Rate below the state industry average and establish an intensive employee safety program.

In addition to providing direct employment, the WTEF regularly relies on local and regional contractors to provide goods and services. In 2008 it spent over $1,250,000 on businesses providing construction and maintenance, uniforms and health services, road cleaning, grounds maintenance and janitorial services.

Public Budget Impacts

Since the 1980s, the county has used a dedicated enterprise fund for solid waste management to finance operations of all its programs. This means that the program is not reliant on tax revenues but generates monies from tip fees at disposal sites, including the two transfer stations, WTEF, C&D landfill, and compost facility. In addition, the county collects franchise fees from franchised garbage haulers, generates interest from reserve funds and obtains revenues from the sale of recycled materials and power.[8] The county sets the tip fee, which at $67.45 per ton has remained the same since 1992. About $46.00 per ton is paid to Covanta for WTEF operation and maintenance. The county retains $21.45 which it uses towards its recycling and hazardous waste programs. The fees collected are used to subsidize medical waste disposal costs, provide free hazardous waste collection and disposal sites, free household battery, fluorescent lamp, and mercury thermometer recycling, provide Master Recycler classes, provide free Styrofoam drop-off location for recycling, hold green building seminars, provide major event recycling, provide enhanced recycling and waste reduction education, fund a full-time recycling educator in the school district, and provide free resource efficiency evaluations for businesses.

In addition, the solid waste fund has about $20 million in reserves. Most of this money is dedicated for specific purposes such as landfill closure and post-closure care, and potential environmental clean up activities at the county landfills. However, some money is being held to fund large capital improvements which may include upgrades in air pollution control systems at the WTEF and installation of a post combustion non-ferrous metal recovery system at the plant. In the past, the county was paying an additional $4.2 million per year for debt service on the plant. As the bonds were paid off in 2008, the reserve fund will rise unless there are new capital projects that the solid waste management division will undertake.

From the standpoint of the budget, the WTEF in conjunction with flow control, has provided a steady stream of revenue to the department, permitting it to implement the wide array of composting, recycling and hazardous waste programs. It has also allowed the solid waste

[8] Department of Public Works Solid Waste Updates. “SW Plan and SW Fund: Issue Brief”, 2009.

department's budget to be on a "pay as you go" basis. The county's share of revenues from the WTEF is about $6,000,000 and cover about two thirds of the plant's operating expenditures.

In addition, the WTEF has brought direct benefits to Brooks where plant is located. In 1988, the town voted to build a new school. Because of the presence of the waste to energy plant on the tax rolls, it did not have to raise taxes to cover the bond issue. Due to the location of the plant within its boundaries, the town has actually decreased its taxes.[9]

ENVIRONMENTAL AND HEALTH IMPACTS OF THE PLANT

Recycling

Oregon has been highly proactive with respect to recycling, establishing a policy context to support local governments to reach recycling goals. Specific recovery rate goals have been set since 1991. Currently the state is striving to attain a 50% recovery rate. As of 2008, the state recycling rate was 44.5%. If one adds in credits for various additional waste reduction and reuse programs, the total recycling rate moves to 48.2%, very close to the this goal.
In 1983 the State passed the Opportunity to Recycle Law, which mandated curbside collection programs in cities with populations above 4000, the creation of recycling education programs. It also established the the state"s solid waste hierarchy, which is first prevent, then reuse, then recycle, then compost, then recover energy and only as a last resort to landfill the waste. The law also required any permitted disposal site, such as a transfer station, to have a recycling drop-off depot. In 1991, the Recycling Act was passed, which established the statewide and individual watershed recovery goals. It also established a list of key program elements for a successful recycling program including weekly curbside collection, expanded education, commercial recycling, multifamily recycling and yard debris collection. The law also mandated household hazardous waste collection. The state has also mandated an aggressive electronics recycling program. By January 2009 every county and cities above 10,000 must have one drop off site for electronics. These are free to residents and are to be paid for by manufacturers. As of 2010, no electronics are allowed in landfills.

Furthermore, Oregon was the first state to pass a bottle bill in 1971 in order to address a growing litter problem along roads, beaches and in other public places. There are now 11 states with bottle bills. In 2007, the state passed an expanded bottle bill, which was implemented in 2009. Water, juice, sports drinks, wine and liquor bottles have been added to the program. Furthermore, the deposit will increase from $.05 to $.10 in 2011.

Marion County and its largest cities responded early on to the state legislation. In 1984, Salem area collectors began curbside recyclable collection, one of the first such programs in the country. By 1986, the county was the first in the state to have its wasteshed recycling program approved. In 1987 and 1988, the county was listed first in the state for its recycling activities. By 1991, it had begun its first leaf composting program and began receiving state grants in support of recycling and waste reduction by 1994. The county is currently piloting a food composting program among commercial establishments.

[9] Marion County, Department of Public Works. "Marion County History of Solid Waste Management".

The county implements its recycling program through its franchised haulers. Recyclables must be picked up at the same time as garbage. Materials that must be collected are: newspapers, corrugated cardboard, mixed paper (junk mail, cereal and cracker boxes), tin and aluminum cans, glass bottles and jars, plastic bottles and rigid plastic containers, with the exception of Styrofoam. Furthermore, used motor oil, latex paint, and dry cell consumer batteries are also collected curbside. In some cities, residents can also put out yard waste in special containers, which is collected weekly. The county has a targeted program to assist multi-family condominium developments and businesses to establish recycling programs with their haulers.

There are recycling drop-off centers at each of the two transfer stations which are open to the public and to self-haulers. These transfer stations also have receptacles for plastic bags, such as grocery, newspaper delivery and dry cleaning bags. The plastic bag drop off program is run by Agri-Plas Inc., a local plastics recycler. This firm also recycles all types of agricultural and nursery based plastic products. A consortium of the franchised private haulers also owns and operates the Marion Resource Recovery Facility (MRRF). The MMRF receives mixed residential recyclables, which are transferred to a processing facility. It also receives construction and demolition waste as well as some dry commercial waste loads. Wood waste, metals and corrugated cardboard are recycled from these loads on site.

Recycling Rates in Marion County

Responding to state initiatives and the desires of its citizenry, Marion County implemented a multi-faceted recycling program. Figure 8 shows recycling rates as reported to the state since 1992. As can be seen, there has been a steady increase through 2002, when the rate suffered a slight dip. It rose again and is now approaching 50%. Waste to energy processes about 36% of the waste, leaving about 14% which is going to landfills. The county is looking to reduce the landfill disposal percentage through more aggressive commercial recycling.

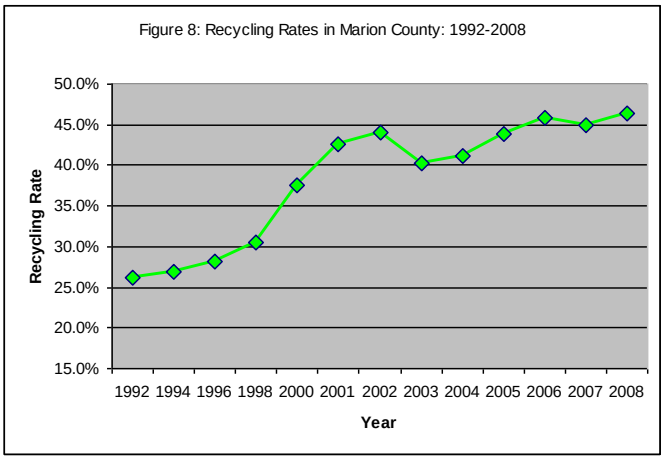
The presence of a waste to energy facility has not inhibited recycling. In fact, Marion County has among the three highest recycling rates in the state even though it has the only waste to energy plant in the state. The county has been examining the feasibility of expanding the WTEF to further reduce its reliance on land based disposal. However, it would have to seek additional waste from surrounding areas to support a third boiler.

Plastics Recycling

Plastics have been a part of the curbside recycling collection program in Marion County, since the program began. Within the last several years, the county has mounted an aggressive program to increase their recycling rate and have added rigid plastic containers with a recycling logo on them such as yogurt and margarine containers as well as plastic trays. Furthermore, there is a bottle bill in place in the state which has been expanded to include plastic water and sports drink bottles as well as liquor bottles. Plastics make up about 6.4% of the generated waste stream in Marion County, excluding construction and demolition waste. As of 2007, approximately 18.7% of these plastics generated were recycled, a rate which has held constant since 2000.[10] In terms

[10] Marion County. **Solid Waste Management Plan.** November 2009., p.2-14.

of the composition of the total recyclable waste stream, plastics comprise about 2.2%, which compares to national EPA data in which plastics make up about 2.6% of recovered materials.[11]



As of 2008, about 5500 tons of plastic were recycled and 24,000 tons were disposed at either the waste to energy plant or landfill. About 75% of the waste disposed, exclusive of construction and demolition waste goes to the waste to energy facility. If one assumes that the percentage of plastic in the waste does not vary by loads going to the waste to energy facility or landfill, then about 18,000 tons of plastic are combusted per year at the WTEF, about 10% of the incoming waste stream.

Landfill Diversion

Since the beginning of its operation, the WTEF has resulted in the diversion of about 4.3 million tons of waste from surrounding landfills. This diversion avoided the production of leachate as well toxic gas emissions from the landfills. Marion County still relies on two out of county landfills for solid waste disposal in excess of the WTEF's capacity—Coffin Butte landfill in Benton county and Riverbend Landfill in Yakima County. As of 2007, about 55,000 tons of waste was shipped out of county to Coffin Butte. This has declined somewhat in the last two years due to the recession. Without the WTEF, the county would have probably transported its waste to these two landfills or further east to more distant landfills beyond the Cascade Mountains. In either case, these shipments would be associated with increased truck traffic resulting in additional fuel consumption, as well as increased truck and fugitive dust emissions associated with hauling.

Reduction of Fossil Fuel Consumption

The WTEF generates 11.1 MW of electricity which is sold onto the grid, thereby reducing the amount of fossil fuel consumption in the region. The amount of fossil fuel saved is enough to power the equivalent of about 4000 automobiles annually. The WTEF also avoids reliance on the transfer of waste to landfills, which are located about 30 miles from the county. If transfer trailers would be traveling to the nearby landfills instead of the WTEF, these trailers would be

[11] 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.

traveling an average of about 35 additional miles to the landfill, or a total 500,000 extra miles annually. At an average gas consumption rate of 6 miles per gallon, then one can assume that about 83,300 additional gallons of gasoline would be consumed annually if waste had to be transported out of county for disposal.

Reduction in Greenhouse Gas (GHG) Emissions

Modern waste to energy plants with up to date air pollution controls have successfully reduced greenhouse gas emissions so that on a per megawatt hour (Mwh) basis they generate less greenhouse gas emissions than oil or coal fired plants and perform nearly as well as natural gas power plants. Furthermore, landfill gas to electricity projects generate nearly 6 times the amount of greenhouse gases per Mwh when compared to waste to energy projects. Only nuclear power plants create less greenhouse gas emissions on a per megawatt-hour basis than do waste to energy projects.[12]

In order to compare greenhouse gas emissions with other solid waste disposal and recycling alternatives, the U.S. EPA has developed the WARM Model. Using this model with specific data from Marion County, one can determine that the WTE facility, given its current level of recycling results in a net reduction of about 28,240MTCE (Metric Tons Carbon Equivalents) compared to a scenario in which the county disposes of all its waste at the out of county landfills.[13] This reduction is the equivalent of taking about 18,965 cars off the road per year. It is achieved by the replacement of electricity generated by fossil fuels with that generated by waste combustion, the recycling of metals at the waste to energy plant, and the shorter distances traveled by trucks to the centrally located waste to energy facility as opposed to the more distantly located landfills.

Covanta, the operator of the plant has been an active participant in the efforts to measure and control greenhouse gas emissions. It is a member of the Western Climate Initiative (WCI), which was started in 2007 by the Governors of Arizona, California, New Mexico, Oregon and Washington to develop regional strategies to address climate change. In 2008, Covanta also joined The Climate Registry ("TCR"), a voluntary, North American GHG emissions reporting and verification program made up of about 300 corporations, state and local governments and non-profit firms. In 2009, the firm will voluntarily report its 2008 GHG emissions from 19 energy-from-waste facilities located in six states. Covanta also plans to participate in rulemaking efforts at the state and federal level which may rely on TCR as the basis for GHG regulation. To date, approximately 300 corporations, state and local governments, and other organizations have joined TCR as voluntary reporters of GHG emissions.[14]

In September 2009, the U.S. EPA issued its final rule on Mandatory Reporting of Greenhouse Gases, which requires all waste to energy facilities with GHG emissions greater than 25,000 tons of carbon dioxide equivalents to report their GHG emissions as of 2010. In the case of Marion

[12] P. Ozge Kaplan, Joseph DeCarolis, Susan Thornloe. "Is it Better to Burn or Bury Waste for Clean Electricity Generation?" **Environmental Science and Technology.** 2009. 43. 1711-1717.
[13] U.S. EPA. Waste Reduction Model (WARM) –Excel Format, Version 10, October 2009.
[14] Annual Report Covanta Holding Company, 10-K, December 31, 2009.

County and Covanta, they have been voluntarily reporting emissions, which are below the EPA threshold***Fully Controlled and Monitored Air Emissions***
Waste to energy facilities operate in a highly regulated environment with respect to air emissions, water discharges as well as the transportation, storage and treatment of solid waste. Since the federal Clean Air Act Amendments of 1990, there have been stringent requirements placed on Waste to Energy facilities to use "maximum available control technology (MACT). The Marion County plant was built with the first dry scrubber/baghouse combination in the United States to control particulate and dioxin/furan emissions and was used as one of the reference facilities for the emissions criteria developed by the U.S. EPA under the 1990 Clean Air Act Amendments. It also installed a continuous monitoring system for carbon monoxide, oxygen gas, nitrogen oxide, sulfur dioxide, hydrochloric acid, and opacity as stipulated by both federal and state law.

In May 1998, the air pollution control system was retrofitted with a NOx and mercury control system to meet additional standards promulgated as part of the 1990 Clean Air Act Amendments for large municipal solid waste combustors (those that burn more than 250 tons per day of waste). The facility has met its performance operating requirements each year since 1987. It has never received a Notice of Violation from the Oregon Department of Environmental Quality, the designated oversight agency. The strong record of the facility with respect to air pollution control is shown in Table 1. As can be seen the plant is performing far below both federal emissions standards and the newly implemented Oregon DEQ limits (April 2009).

Table 1: Marion County Waste to Energy Facility Emissions (2008) vs. Permit Levels

	EPA Permit Limit	New Oregon DEQ Limits	Marion County Plant Emissions (2008)
Lead (ug/dscm)*	400	200	.052
Cadmium (ug/dscm)	35	20	.0045
Dioxin/Furan (ng/dscm)**	30	15	3.8
Particulate(mg/dscm)***	25	25	.007
Mercury (ug/dscm)	50	50	.0063

Source: Marion County. Solid Waste Management Plan. November 2009.

*ug/dscm = microgram per dry standard cubic meter

**ng/dscm = nanograms per dry standard cubic meter

***mg/dscm = milligram per dry standard cubic meter

There are additional environmental regulations which have been recently implemented and may be legislated in the future. In 2006 EPA issued revisions to the New Source Performance Standards (NSPS) as well as emissions guidelines in a Revised MACT Rule. These revisions lowered emissions limits for most regulated air pollutants. This revised rule is being challenged and may result in standards being made more restrictive for some pollutants. In addition, there is a revised rule with respect to fine particulate matter, which will impact waste to energy facilities in areas of generally sub-standard air quality.

The strong performance of waste to energy facilities with respect to controlling harmful air emissions, while producing electricity has been documented in a comparative study of landfill gas to electricity plants, waste to energy plants, nuclear power plants as well as those facilities powered by oil or natural gas. In terms of sulfur dioxide emission control on a per megawatt basis, waste to energy outperforms all other types of power plants. Similarly, with respect to

nitrogen oxide emission control waste to energy plants outperform all other types of power plants with the exception of nuclear. Finally with respect to particulate matter control, waste to energy outperforms all plants with the exception of those fueled by natural gas.[15]

Health Impacts of the WTEF

While the WTEF operates under strict standards for air emissions and water pollution, there has been considerable attention paid by advocacy groups to the possible negative health impacts of fine particulate emissions less than 10 micron (PM_{10}) and less than 2.5 micron ($PM_{2.5}$). In 2008, the US EPA undertook dispersion modeling of estimated ground level concentrations of both PM_{10} and $PM_{2.5}$ resulting from the Marion WTEF at population centers downwind and upwind of the plant. It showed ground level concentrations of <.003ug/m^3 for PM_{10} and <.002ug/m3 for $PM_{2.5}$ at population centers downwind and about 10 times lower than these upwind in the Salem area.[16] The federal and state standards are 150 ug/m^3 for PM_{10} and 35 ug/m^3 for $PM_{2.5}$. Salem, OR had a total PM_{10} level of 15ug/m3 and a $PM_{2.5}$ level of 7.7 ug/m^3. This means that WTEF's contribution to ambient particulate level in Salem is about 1/40,000 of the total particulate measurement in the area, or nearly negligible.

A toxicologist also examined these modeled concentrations of particulates to determine potential health effects. At the concentrations that were derived, it was found that not a single premature death from any cause including heart and respiratory disease could be predicted. In addition, not a single hospitalization from any cause could be attributed to WTEF's particulate emission. Similarly, no impact on either adult or child asthmatics, or any case of chronic bronchitis or respiratory illness could be shown to have been caused by particulates emitted by the Marion County waste to energy plant. [17] In sum, in the twenty four years of the plant's operation there have been no documented negative impacts on health, nor could it be shown through detailed modeling that fine particulate emissions caused any deterioration of health.

POLITICAL AND INSTITUTIONAL IMPACTS OF WTEF

Since it began operations twenty-four years ago, the waste to energy plant has become part of the landscape. There is an elementary school and a residential development nearby. However, as has been discussed in a previous section, the development of the plant was not without obstacles. Community groups and individual citizens opposed various sites that had been proposed for the plant. There were also attempts to ban any waste to energy plant in the county and to legally challenge the state and county procedures to site a waste to energy plant. Much of the opposition centered on the threats to health that air emissions from the plant might cause.

Subsequently, there has been some community concern over the level of medical waste disposal permitted at the plant. In 2008, 1310 tons of medical wastes were processed, with 70% coming

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[15] P. Ozge Kaplan, Joseph DeCarolis, Susan Thornloe. "Is it Better to Burn or Bury Waste for Clean Electricity Generation?" **Environmental Science and Technology.** 2009. 43. 1711-1717.

[16] ug/m^3 = micrograms/cubic meter of air

[17] Jeffrey L. Hahn. " Covanta Marion Inc.: Operation and Environmental Performance 1984-2008." League of Women Voters of Marion and Polk Counties. Conference on Dealing with Waste in a Sustainable Community. Willamette University, Salem OR, February 26, 2009.

from within the county and the remainder from other Oregon communities. This continues to be an issue which the state and county are examining.
In addition, there has been ongoing concern over the air emissions impact of the plant. These concerns were voiced a few years ago, when the state DEQ is considered and approved a renewal of the operating permit of the plant. The recent publication of a draft solid waste management plan has also occasioned review and comments from various sectors of the community. With the operating contract between Marion County and Covanta expiring in 2014, the county is considering alternatives for its waste and reviewing what changes will be made if it proceeds to enter into a new operating agreement with Covanta. In particular, the Oregon chapter of Physicians for Social Responsibility has testified strongly against Marion County's continued reliance on the plant after 2014. Their opposition is based in part on the cost of the plant, which it sees as a "white elephant", particularly in the face of declining waste generation due to the recession and the potential increase of operating costs due to additional pollution control systems that may be required. The organization also strongly adheres to the point of view that the waste to energy plant has harmful effects on health due toxic air emissions that are not adequately measured or monitored. Even more problematic in its view is the potential damage to the environment and human health that are caused by nano particles, ultra fine particles which carry toxins for which no measuring device or appropriate regulations have been designed.[18]

The League of Women Voters has also become active in the discussions over the new Solid Waste Management Plan. They have held several forums in which various points of view have been presented. They have taken a position in favor of continuing the agreement with Covanta for waste disposal, while at the same time lobbying the state against legislation to permit current waste to energy plants to obtain renewable energy credits for electricity that they generate and sell. [19]

With the completion of its updated solid waste plan, the county is planning for its solid waste future. It hopes to expand its recycling efforts particularly among commercial establishments and multi-family dwellings. It is also examining initiating composting for food wastes. Furthermore, it is looking into possible re-use of its incinerator ash, in order to preserve space in the ash fill and lower its reliance on land disposal of the ash. Due to flow control, the county has been able to handle the waste within its borders and finance its recycling, education, and hazardous waste activities. It continues to operate solely on the solid waste fees that it charges and revenues it generates from electricity and material sales.

CONCLUSION

The Marion County Waste to Energy facility has successfully and without disruption disposed of approximately 5 million tons of refuse since it began full scale operation in July 1986. These tons produced about 2.3 million megawatt-hours of electricity, which was enough to service about 211,000 homes over the nearly 25 years the plant has been in service. The electricity

[18] Joseph Miller, Ph.D. "Continued Reliance on an Incinerator is an Economic Threat". Testimony by member, Board of Directors, Oregon Chapter, Physicians for Social Responsibility before public hearing Marion County Board of Commissioners considering adoption of the 2009 Marion County Solid Waste Plan. January 20, 2010.
[19] Letter to Ted Kulongoski, Governor State of Oregon from Marge Easely, President League of Women Voters of Oregon. Re: Veto of HB 2940, Solid Waste as Renewable Energy. July 13, 2009.

revenues as well as revenues from the ferrous metals recovered from the ash has helped the county to underwrite an ambitious integrated solid waste program, which includes curbside recycling, yard waste composting, household hazardous waste collection, event recycling, education programs and most recently pilot programs for the composting of food waste. With the debt service on the plant paid off as of 2008, nearly two-thirds of the plant's operating expenditures are covered by the electricity and metals recovered from the waste. The county is currently embarked on developing a solid waste management strategy for the next decades and the WTEF is expected to remain one of the foundations of its program going forward into the future.