



Combustion

Historical Background

A primary factor favoring the development of WTE in Florida is the adverse environmental and land use consequences of landfilling (the other major disposal option) and the failure of competing disposal technologies other than landfilling. By the early 1980s, increasing ground water contamination from unlined landfills began to become apparent and many landfills ended up on the National Priority List as Superfund sites. Even when lined, because of Florida's generally high ground water conditions, landfills begin at ground level and go up, in a so-called "high rise" configuration. While protective of ground water, these landfills can rise to as high as two hundred feet above ground level and are prominent features of the landscape in many Florida counties. The landfill is commonly the highest elevation in Florida coastal counties. In addition, as population density increases--particularly in the coastal counties--finding a suitable site for a landfill (where typically 1,000-4,000 acres of land are needed) at a suitable cost is becoming all but impossible.

A related issue is the lack of success of competing technologies other than landfilling. Mixed waste composting was touted in the early 1980s as a cost effective rival of WTE, but several mixed waste composting projects have failed in Florida (as in other states).

At this time, only one mixed waste facility is in operation in Central Florida. Anaerobic digestion has also been proposed and piloted, but has never been brought into large-scale, commercial operation.

A second factor spurring WTE development was the energy crisis of the mid-1970s, which led to increased interest in alternative energy technologies. Indeed, all alternative energy resource development

Waste-to-Energy Capacity

Florida has grown from having one small Waste-to-Energy (WTE) plant in 1982 to 13 operating waste-to-energy facilities in 2002, which have a capacity to burn a total of 19,176 tons/day. Florida has established the largest capacity to burn MSW of any state in the US. Table 7 shows a detailed list of the WTE plants in operation in the State.

The rapid growth of WTE facilities in Florida is shown in Figure 18, where additions of capacity by year and cumulative total capacity are shown. Actual combustion in each of calendar years 2000 was 5,563,565 tons or 15,243 tons per day. This is a decrease of about 1 percent (54,637 tons) from the 5,618,202 tons reported in 1998.

The 13 operating WTEs in Florida have the capacity to generate over 534 megawatts of electricity each day and have become an essential component of Florida's municipal solid waste management strategy.

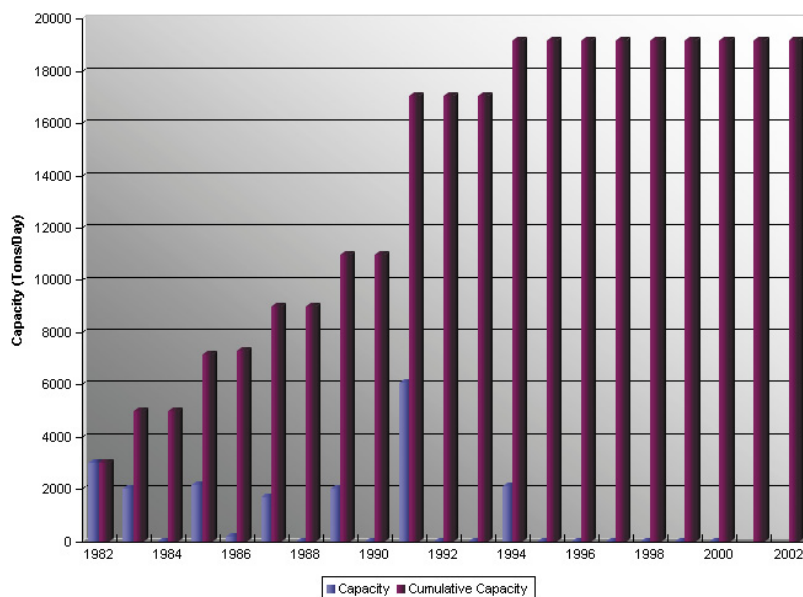
planning of that era included WTE as a central element, although in retrospect it appears that the amount of energy available from this source was overestimated.

Thirdly, WTE was given a major boost in Florida in the late 1970s with the passage of several key pieces of State Legislation which created favorable legal and tax conditions for the construction of WTE facilities. The Florida Resource Recovery Act created the Resource Recovery Council to evaluate and promote resource recovery (which includes WTE). The Act further directed the 19 most populous Florida counties to draft resource recovery and management plans, to determine if WTE was a feasible option. As a consequence, through the remainder of the 1970s, comprehensive evaluations of WTE were conducted in all of Florida's most populous areas. Moreover, in response to concerns from the finance community about the fiscal viability of resource recovery facilities without a guaranteed waste stream, the State Legislature enacted a flow control statute. This provision authorized

Table 7: Operational Waste-to-Energy Plants in Florida

PROJECT NAME	LOCATION/ CITY	COUNTY	DESIGN CAPACITY (TPD)
Bay County Resource Recovery Facility	Panama City	Bay	490
North Broward County Resource Recovery Facility	Pompano Beach	Broward	2,250
South Broward County Resource Recovery Facility	Ft. Lauderdale	Broward	2,250
Dade County Resources Recovery Facility	Miami	Dade	3,000
Hillsborough County Solid Waste Energy Recovery Facility	Brandon	Hillsborough	1,200
McKay Bay Refuse to Energy Project	Tampa	Hillsborough	1,000
Lake County Resource Recovery Facility	Okahumpka	Lake	528
Lee County Solid Waste Resource Recovery Facility	Ft. Myers	Lee	1,200
Southernmost Waste-to-Energy Facility	Key West	Monroe	150
North County Regional Resource Recovery Facility	West Palm Bch.	Palm Beach	2,000
Pasco County Solid Waste Resource Recovery Facility	Hudson	Pasco	1,050
Pinellas County Resource Recovery Facility	St. Petersburg	Pinellas	3,150
Ridge Generating Station	N. Central LF	Polk	908
TOTAL (See Appendix 14C for more information)			19,176

Figure 18: Growth in Florida's Waste-to-Energy Capacity



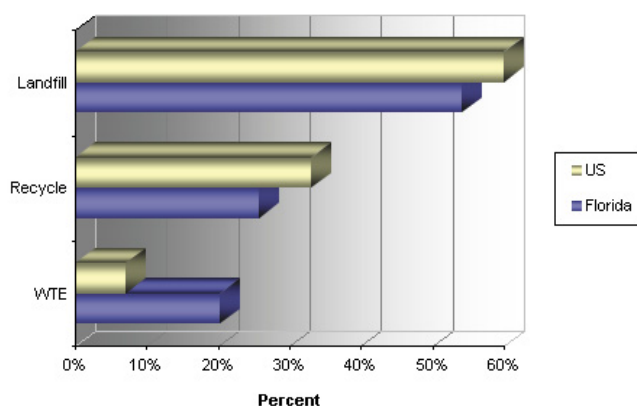
counties which were undertaking resource recovery to direct the flow of municipal solid waste generated in the county to a designated solid waste disposal facility. WTE and other resource recovery facilities were given a further advantage when the legislature exempted resource recovery equipment owned by, or operated on behalf of, local governments from the state sales tax.

In the comprehensive Solid Waste Management Act of 1988, WTE received a further financial incentive. The Act directed that, when the utility industry purchased electricity

from WTE facilities, the WTE facilities were to be assumed to have a 100% capacity factor (other co-generation facilities selling to utilities are given a lower capacity factor, e.g., 80%). This increased the revenues to the plants from energy production.

However, at the time of the 1993 revisions to the Solid Waste Management Act, much of the early enthusiasm for WTE had cooled because of perceived conflicts with recycling and concerns about emissions. Regarding recycling, concerns began to be raised that WTE was in conflict with the State's burgeoning recycling program. It was feared that if there was excess WTE capacity, materials which would have otherwise been recycled would be burned. To ensure that no excess capacity developed, the 1993 Amendments subjected WTE facilities to a series of new siting and need criteria affecting the siting of new facilities and expansion of existing facilities. Key among these criteria are the requirement that WTE facilities cannot be built unless the county in which the facility was to be located had met the State's required thirty percent waste reduction goal, and the county can show that the facility is an integral component of the county's solid waste management program. Although criteria affecting the permitting of WTE plants were enacted by the Legislature in 1993, the Department has delayed plans to incorporate these criteria into Rule

Figure 19: MSW Management: Florida-US Comparison CY 2000



62-705, Criteria for Determining Waste-to-Energy Facility Integration, until the flow control issue is resolved by Congress.

Moreover, WTE facilities were identified as significant sources of mercury. In the late 1980s and early 1990s, the extent of mercury contamination in Florida fresh water fish and mammals began to be recognized. A health advisory warning was issued for the consumption of large mouth bass in nearly a third of Florida's fresh water bodies. The primary sources of mercury in the municipal solid waste stream include: batteries, mercury containing devices such as thermostats, thermometers and switches, and lighting. In a study conducted for the Department of Environmental Regulation in 1992, WTE plants were determined to be one of the major sources of anthropogenic mercury emissions. Other major sources include biomedical incinerators and fossil fuel power plants. In the 1993 Amendments, measures were enacted to reduce mercury in the waste stream. These included provisions to control the amounts of mercury in packaging and batteries and required the recycling of mercury containing batteries, devices and bulbs. The 1993 legislation further called for a demonstration project to collect and recycle fluorescent tubes. In October 1993, Florida's Environmental Regulation Commission adopted what was then the strictest mercury emission limit in the nation for WTE facilities. Currently, all new and existing WTE units with capacity to incinerate 250 tons per day or more are required to meet EPA's Maximum Achievable Control Technology (MACT) standards, adopted in

Table 8: MSW Management By WTE Counties 2000

County	Landfilled	Recycled	WTE
Bay*	34%	12%	54%
Broward*	39%	23%	38%
Dade	56%	19%	25%
Hillsborough	40%	29%	31%
Lake*	32%	22%	46%
Lee	29%	27%	44%
Monroe	57%	13%	31%
Palm Beach	32%	28%	40%
Pasco*	35%	16%	48%
Pinellas	32%	19%	49%
Polk	63%	31%	6%
Average	41%	22%	37%

* The higher combusted values may be due to contributions of MSW from other counties

Air Pollution Controls

Table 9: WTE APC Equipment By Start-up Year

Project	Start-up Year	Air Pollution Control
Dade	1982	DSCR/FF/NOX/CEM/CI
Pinellas	1983	ESP
McKay Bay	1985	DSCR/FF/NOX/CEM/CI
Key West	1986	ESP
Bay	1987	ESP
Hillsborough	1987	ESP
Palm Beach	1989	DSCR/ESP
Broward North	1991	DSCR/FF
Broward South	1991	DSCR/FF
Lake	1991	DSCR/FF/CI
Pasco	1991	DSCR/FF/CI
Ridge Gen.	1994	DSCR/FF/NOX/CEM
Lee	1994	DSCR/FF/NOX/CEM/CI

A major element in both the size and cost of WTE technology has been the steadily increasing requirements for air pollution control equipment. This is illustrated in Table 9 which lists Florida's WTE facilities by start-up year and type of air pollution control equipment. The earliest plants built were required to have electrostatic precipitators (ESP) for particulate control. By the late 1980's, dry scrubbers (DSCR) for acid gas controls were required as well as filter fabric baghouses (FF) for particulates. The latest plant built, in 1994, was required to have DSCR and FF, as well as nitrogen oxide controls (NOX) and continuous emission monitoring (CEM). Five plants have also installed an activated carbon injection system (CI) for mercury and dioxin control. Facilities subject to Section 129 of the Clean Air Act have completed retrofits to upgrade their emission controls to Maximum Achievable Control Technology (MACT) standards for all Municipal Waste Combustors (MWCs).

December 1995, and amended in August 1997.

In 1993, the Legislature also funded a study to determine the effectiveness of waste cleaning techniques on emissions from WTE facilities. To conserve resources, this study was combined with the mercury-containing lamps and devices demonstration project conducted by the City of Tampa with the cooperation of Hillsborough County. The required report to the Legislature was submitted in December of 1995, with additional study results submitted in June 1998.

Current Status

As noted above, Florida has 13 WTE facilities, with a combined capacity to burn just over 19,000 tons/day of municipal solid waste, or fuels derived from municipal solid waste. At this point, a word about the number of WTE facilities in Florida and what is a "WTE facility" is in order. First, the Ridge Generating Station in Polk County is not a "WTE facility" as defined in Florida law, because it burns

shredded wood waste and waste tires, rather than municipal solid waste. However, it is included in this analysis because its primary reason for existence is as a solid waste management facility, and the fuels it burns are derived directly from municipal solid waste. On the other hand, the City of Lakeland McIntosh Power Plant burns approximately 300 tons/day municipal solid waste, but since this facility is primarily a fossil fuel power plant, and the waste burned is an incidental amount compared to the total material burned, it is not included in this analysis. In 2000, a total of 5.6 million tons of waste was burned in WTE plants, accounting for 20% of the total waste managed in the State.

As shown in Table 8, when looking just at the counties with WTE facilities, the average percentage of waste burned is 37%. This table shows a decrease in the percentage of MSW managed by recycling. This decrease may raise the concern about conflicts between recycling and WTE, since these counties now achieve an average recycling rate of 22%, which falls short of the State's goal.

The percentage of waste burned in Florida in 2000 is substantially higher than the national average. Florida's landfilling rate and, now, the recycling rate is lower (Figure 19) than the national average. National data is taken from Biocycle magazine's nationwide annual survey, "The State of Garbage In America", December 2001.

Figure 5 (chapter 1) shows the trends in municipal solid waste management in Florida over the period stabilizing in recent years, with minor increases in landfilling rates attributable to population growth.

Key Future Issues

The following are some of the key issues facing WTE in Florida. Two of them stem from US Supreme Court decisions made in 1994. Others result from legislative actions, including the federal Clean Air Act Amendments of 1990 and the Florida Solid Waste Management Act Amendments of 1993. And others are technological issues, stemming from the changing technological front in municipal solid waste management.

Flow Control

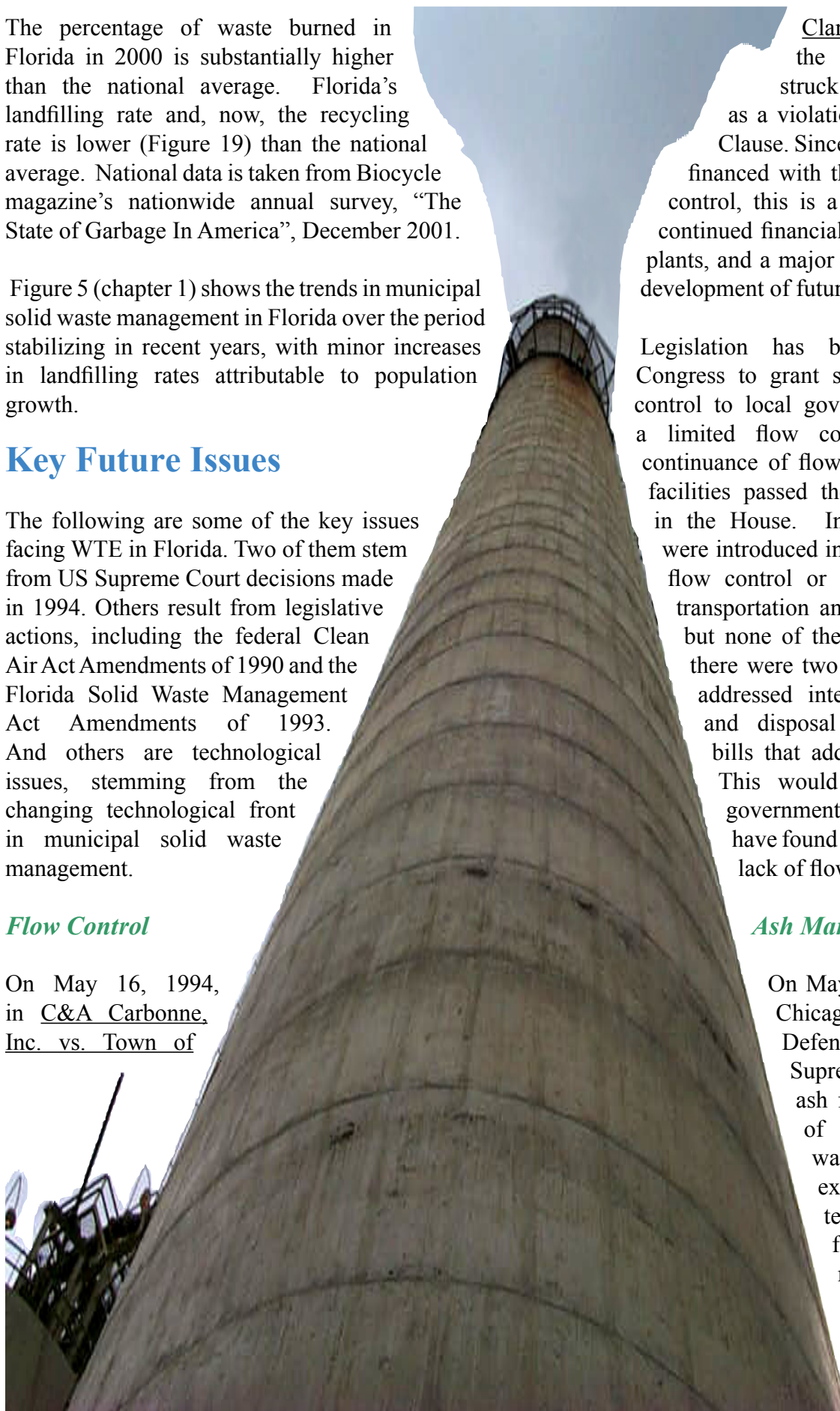
On May 16, 1994, in C&A Carbonne, Inc. vs. Town of

Clarkstown, New York, the US Supreme Court struck down flow control as a violation of the Commerce Clause. Since many facilities were financed with the guarantee of flow control, this is a major issue for the continued financial viability of existing plants, and a major impending factor for development of future facilities.

Legislation has been introduced in Congress to grant some power of flow control to local governments. In 1996, a limited flow control bill allowing continuance of flow control for existing facilities passed the Senate, but failed in the House. In 1997, eleven bills were introduced in Congress to address flow control or control of interstate transportation and disposal of waste, but none of them passed. In 1998, there were two bills introduced that addressed interstate transportation and disposal of waste and no bills that addressed flow control. This would suggest that local governments with WTE plants have found ways to cope with the lack of flow control authority.

Ash Management

On May 2, 1994, in City of Chicago v. Environmental Defense Fund, the U.S. Supreme Court ruled that ash from the combustion of municipal solid waste was no longer exempted from the testing requirements for hazardous waste required by the federal Resource Conservation and Recovery Act (RCRA). Since



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the decision, all WTE facilities in Florida have tested their ash and none was found to exhibit the toxicity characteristics of a hazardous waste. Therefore, the opportunities for the reuse of ash may be on the horizon, provided the potential for its use to create a threat to public health or the environment are properly evaluated.

EPA Emission Guidelines and NSPS

Section 129 of the Clean Air Act requires EPA to develop Maximum Achievable Control Technology (MACT) standards for all Municipal Waste Combustors (MWCs) with capacity to burn more than 40 tons per day of municipal solid waste. The EPA proposed the MACT standards, which would be applicable to new and existing MWCs, in September 1994, and promulgated the standards in December 1995.

Originally, the MACT standards designated WTE facilities as “small” (aggregate capacity to burn 40 tons per day or more, but less than 250 tons per day) and “large” (aggregate capacity to burn 250 tons per day or more). However, a decision by the US Court of Appeals for the District of Columbia Circuit vacated the small facility standards and interpreted Section 129 to mean that EPA could only subcategorize based on the capacity of individual WTE units, not the aggregate capacity of WTE facilities.

Pursuant to the court’s decision, in September 1997, the EPA amended their MACT standards to only apply to WTE units with capacity to burn 250 tons per day or more. Immediately after publishing the MACT rule amendments, EPA began work on MACT standards which will apply to small WTE units with capacity to burn 40 tons per day or more, but less than 250 tons per day. Ten of the 13 WTE facilities in Florida contain large units which must be in full compliance with EPA’s MACT standards no later than November 11, 2000.

Siting Criteria

As noted above, WTE facilities are now subject to requirements concerning the siting of facilities, as a

consequence of the 1993 Amendments to the Florida Solid Waste Management Act. Eleven criteria are spelled out in the law, the most notable of which are that new WTE facilities, or expansions of existing facilities, cannot be built unless the county in which the facility is to be located has met the 30 percent waste reduction goal, and the county can show that the facility is an integral component of the county’s solid waste management plan. These criteria may be put to the test in the near future as such high growth counties as Lee, Hillsborough, and Pasco evaluate plans for expansion.

Competition With Other Technologies

All landfills in Florida which accept Class I waste (mixed municipal solid waste), are required to have composite or double flexible membrane liners, as well as leachate collection, gas management and storm water management systems, and extensive ground water monitoring. Nevertheless, tipping fees at such facilities average \$42.47 per ton statewide and are well below tipping fees at WTE plants which average \$58.83 per ton statewide. In addition, while mixed waste composting has faltered in the past, this technology could be a competitor of WTE, if the resulting product can be made acceptable to end use markets

New Technological Innovations

While the above issues loom as problems for WTE in the future, the industry continues to evolve and adopt to new challenges. New technologies, such as advanced air pollution controls, highly efficient boilers and innovative new concepts such as WTE/industry parks and “waste-to-water” (using the electricity generated at a WTE to desalinate brackish ground water), may well keep WTE an essential and competitive element of the Florida waste management system in the years ahead.

Renewable Energy

Federal Activity

Section 606 of the Dache/Bingaman Energy Bill sets out a program to encourage the development

Table 10: Counties Reporting MSW Used for Process Boiler Fuel (1992-2000)

County of Origin	Tons									Facility
	1992-93	1993-94	1994-95	1995	1996	1997	1998	1999	2000	
Alachua	3,160	1,129								Wood Resource Recovery
Bay					12,008					Stone Container
Brevard		6,051	32,746	56,190	30,853	43,432	45,839	22,308	38,275	Ridge Generating Station
Charlotte					6,635	3,383				Okeelanta/Osceola
Dade				65,960	75,223	92,351	91,098	38,501	115,609	Okeelanta/Osceola
Hillsborough		5,800	19,114	4,674	9,758	20,544	21,892	40,492	67,015	Ridge Generating Station, Okeelanta
Lee	1,918		400	1,289	3,625	3,625	1,830			Forestry Resources
Leon	45,567		16,162	16,533	16,830	17,335	37,882	20,465	20,225	Buck-Eye Cellulose, Timber Energy Resources
Manatee					16,753	27,285	37,366	44,847		Okeelanta/Osceola, Ridge Generating Station
Marion			81,183	14,933	9,637					Kenetech (Royal Oak Charcoal)
Pasco								4,877	3,417	
Palm Beach	1,874		14,313	3,197	19,601	35,416	75,391	88,081	82,501	Okeelanta/Osceola
Pinellas		13,133	28,728	7,951	127	10,043	13,442	5,970	2,731	Ridge Generating Station
Polk						75,552	76,847	80,003	55,044	Ridge Generating Station
St. Lucie				892	28,528					Okeelanta/Osceola
Sarasota					5,207			21		Okeelanta/Osceola
State Total	52,519	26,113	192,646	171,619	234,785	328,966	401,587	345,565	384,817	

of electrical generation from renewable energy resources. This bill would establish a minimum renewable resource generation requirement for retail electric suppliers. This involves submission of renewable energy credits by a retail electric supplier in an amount equal to a specified annual percentage of the supplier's base generation. That percentage increases annually over 15 years. Credits are earned by generating electricity from eligible renewable energy resources. These credits can be accumulated, sold, and traded, similar to emission credits. Retail electric suppliers are subject to significant penalties if the requirements are not met.

Future waste-to-energy (WTE) facilities that burn municipal solid waste could acquire renewable energy credits for the electricity they generate. These credits could be sold or traded to retail electric suppliers in order to meet requirements for annual percentages of electric generation using renewable

energy source by these retail producers. Retail electric suppliers could also earn renewable energy credits for "existing facility offsets" as a result of contracts with existing WTE facilities. However, these credits are not tradable and can only be used in the year generation actually occurs.

Assuring that WTEs get or retain status as renewable energy resources will benefit Florida facilities. The benefit to the 11 Florida counties that are own or have WTEs operated on their behalf is primarily financial in that this designation will effect the negotiated price of electricity that these facilities can sell to retail suppliers.

Florida Activity

The 2002 Florida legislature passed HB 1601(SB 1142), which amends Chapter 366, F.S., to allow certain costs resulting from agreements between regulated electric utilities and the DEP or the EPA

to be subject to recovery under the Environmental Cost Recovery Clause. As part of this revision, the legislature directed the Public Service Commission (PSC), in cooperation with the DEP, to perform a study for the purpose of defining public policy with respect to the use of renewable energy resources in Florida. The study must assess cost, feasibility, deployment schedules, and impacts on the environment of increased use of renewables. The study must recommend options and mechanisms to encourage the increased deployment of renewables within the state.

Renewable energy is defined as “electricity generated from any method or process that uses

recommendations of the study, if they include a renewable energy portfolio standard, could provide significant impetus to the use of landfill gas and WTEs.

Process Boiler Fuel

Process boiler fuel is composed of yard, wood and/or paper wastes that are used as supplemental fuels in process boilers. Facilities process the material and use it as fuel on-site or sell the processed fuel to other facilities. MSW burned in WTE facilities is not considered process boiler fuel.

During the years 1992-2000, counties have reported



Row of Cooling stacks at the Deerhaven, FL WTE Plant. Photo: Bill Hinkley

one or more of the following sources of energy, but not limited to: biomass; municipal solid waste; geothermal energy; solar energy; wind energy; wood waste; ocean thermal gradient power; hydro electric power; landfill gas; and agricultural products and by-products.

The results of the study will be presented to the Legislature by February 1, 2003. The

tonnages of specific types of MSW used for process boiler fuel, increasing more than seven-fold in this time. Counties reporting wood, paper and yard waste tonnage used for process fuels over the past nine years are listed in Table 10.

In 1994-95, the largest user of process fuel in Florida was the Royal Oaks Charcoal Plant in Marion County. The second largest amount of

process fuel produced from waste in the state was burned at the Ridge Generating Station in Polk County. This facility, which began operation in 1994, utilizes only wood waste and shredded tires. It's design capacity is 908 tons per day.

In 1995-1996, the leading users of process fuels were at the Okeelanta facility in South Bay and its sister plant in Osceola County which consumed nearly two thirds of the process fuels used in 1996. These co-generation facilities take sugar cane bagasse and clean wood waste, convert it into process fuel and then use the fuel to operate the sugar processing facility on-site. The second largest amount of process fuel consumed from waste in the state was again burned at the Ridge Generating Station in Polk County, accounting for 17% of the fuels used.

Wood waste from Leon County is also used as supplemental process boiler fuel. Raw wood waste debris is chipped and sent to the Buck-Eye Cellulose plant in Taylor County. There, it is used by the cellulose manufacturing plant boilers that produce consumer products, such as inner linings for disposable diapers.

In May 1997, a new process fuel line opened at the Dade County Resource Recovery Facility. This line has a capacity of 270,000 tons per year and will produce about 50% (135,000 tons) process boiler fuel, 30% (81,000 tons) fines, 2.4% ferrous (6,480 tons) and 17.6% (47,520 tons) rejects. The facility operator, Montenay Power, has marketed the process fuel to the Okeelanta and Osceola plants.

From 1997 through 2000, Okeelanta and Ridge continued to share the lead in consuming processed fuel, with each consuming an average of 45% over the period.

The remaining processed fuel use is shared between minor users.



DEP Recycling staff with Lt. Governor Frank Brogan at the kick-off of the Davis Award Winning Capitol Complex Recycling Program on Earth day 2002.

Left to right are Lisa Bujak, Suzanne Boroff, Frank Brogan, Karen Moore, Melissa Smith, Bill Hinkley (Bureau Chief) , Kelly Lindsey, Jennifer Caldwell-Kurka, Peter Goren and Nancy Paul (Leon County).