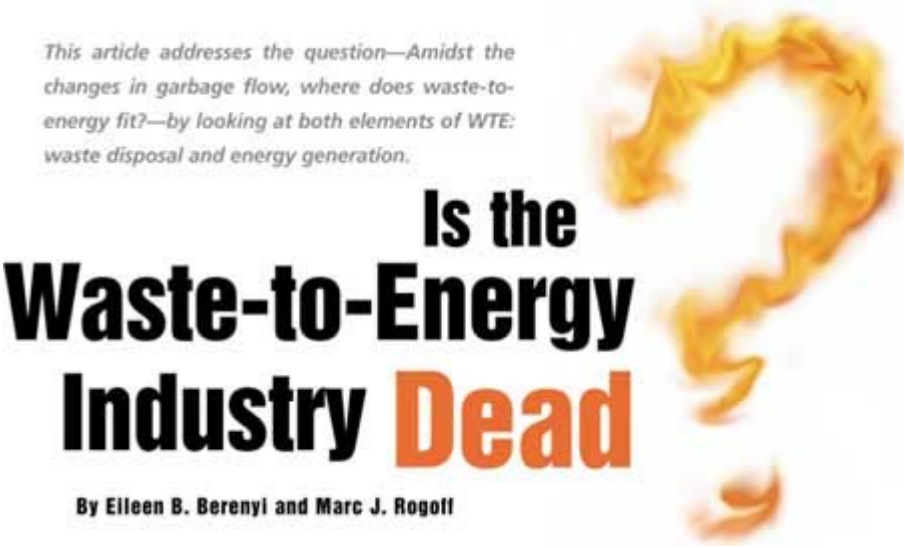


By Eileen B. Berenyi and Marc J. Rogoff

The solid waste industry has been undergoing great change for a number of years. Many companies have merged, and now a handful of full-service firms dominates solid waste collection and disposal. In conjunction with industry consolidation, the policies and politics of solid waste disposal have been shifting and reshifting. The specter of the "garbage barge" of 1993—plying the waters, looking for a place to dispose of waste—was replaced by landfills and other disposal facilities that, since 1995, have been bidding aggressively for waste and pushing disposal rates lower and lower in many regions. As of early 1999, the garbage barge has resurfaced as a symbol, again becoming a rallying cry of states seeking to stop the flow of garbage across their borders. Where does WTE fit in? Is it in its final death throes or are there signs of future life?

The WTE industry emerged from a twofold need in the 1970s: (1) the necessity of finding an environmentally sound means of disposing of refuse and replacing unregulated open dumps and (2) a need to develop alternative energy resources in the era of the Arab oil embargoes, when it was thought that energy would

be a scarce commodity and prices would continue to rise uncontrollably.

WTE facilities are primarily waste-disposal alternatives. Policy changes and industry shifts have undermined the position of many WTE facilities. First, a shortage of waste-disposal facilities, so feared in the early 1990s, did not materialize. Intense efforts to recycle, the construction of large new landfills, or the permitted expansion of existing landfills helped to mitigate the problem. Second, state and federal regulations originally favored WTE as a safe and environmentally sound alternative to landfills and an energy conservation method to boot. Federal incentives included grants for feasibility studies and pilot projects, investment tax credits, favorable tax treatment for equipment depreciation, and permitting many facilities to be publicly financed, so as to reduce interest rate burdens. After 1986, most of these regulatory incentives disappeared or were substantially curtailed. Recycling and source reduction have become the focus of many local policy initiatives. From the standpoint of waste disposal, policy initiatives have centered on achieving environmentally sound disposal, whether in a landfill or at a municipal waste combustor (MWC) facility. In addition, the control of the negative impacts of waste incineration and air pollution from these facilities became a major goal of federal regulations. Third, as the result of the 1994 US Supreme Court ruling in *Carbone* v. *Town of Clarkstown*, waste has been freed from any public regulation that impedes the cross-border interstate commerce of it.

As of 1999, there have been immense shifts in energy pricing and demand and waste generation and disposal. From the standpoint of energy, two major events have had a major impact on the power industry. First, the price of oil was at its lowest point in the beginning of 1999 since before the Arab oil embargo—$18/barrel as compared to its high of $35/barrel in 1978. In addition, natural-gas prices have dropped precipitously and are also at an all-time low. Dropping oil prices have spelled the death knell for the Public Utilities Regulatory Policies Act of 1978 (PURPA) and other state programs that have kept the price of electricity from WTE projects above avoided cost. Second, beginning in 1997, various states have begun to deregulate public utilities. Deregulation is changing the organization of energy generation and transmission, impacting pricing structures and helping to drive down energy prices and make the long-term institutional structure of energy generation cloudy or unstable. Thus, from the perspective of a WTE facility, the market for its product—energy—is undergoing change and is volatile in the near term.

It is in the midst of these developments that this article discusses the future of the WTE industry. In so doing, it will review the policy context and then examine the impact of policy and practice on the current state of the industry. As can be determined from the introduction, the near-term prognosis of growth is not good.

In most cases, facilities are finding it difficult to be price competitive for disposal. In addition, WTE does not have strong policy or political support. However, it is premature to prophesize an end to this industry in the long term.

Review of Recent Legislative, Regulatory, and Judicial Initiatives

Clean Air Act Amendments

In November 1990, Congress enacted the amendments to the Clean Air Act (CAA) of 1977. These amendments directed EPA to develop new emission guidelines for existing MWCs and New Source Performance Standards for new MWC facilities. Five years later, after much discussion, EPA published air-emissions guidelines for existing MWCs. The new guidelines covered not only large facilities (plant capacity greater than 248 tpd) but also contained requirements for smaller facilities. Though the requirements regarding smaller facilities were under challenge, they have been modified and are being implemented in 1999.

In sum, the new regulations require an aggressive approach to the reduction of toxic emissions through a combination of air-pollution-control (APC) systems, improved monitoring of emissions, application of tested combustion methods, training of personnel, and front-end materials-separation programs. Numerical limits were set for sulfur dioxide, hydrogen chloride, cadmium, lead, and mercury emissions. In addition, more stringent limits were set for dioxins and furans as well as for nitrogen oxides and fugitive fly and bottom ash. Facilities must adopt maximum-achievable control technology to reach acceptable levels of air emissions and must install continuous emissions monitoring systems. The deadline for large facilities to meet these criteria is 2000.

The result of this renewed emphasis on air-emissions control has been twofold: (1) certain smaller, older projects have shut down, calculating that it was no longer economically feasible to continue to operate given the large capital investment necessary to comply with new federal regulations and (2) existing projects have been undergoing or are planning significant upgrades to their APC systems, as will be discussed in a later section.

Changing Regulations Affecting Project Financing

As of 1999, the Tax Reform Act of 1986 and its various effects are "ancient history" for the MWC industry. As will be shown, the act caused severe downward pressure on the industry since it hampered the availability of low-cost capital and curtailed the favorable tax treatment afforded the

industry. In essence, with the removal of tax protection, MWC facilities had to rely more heavily on tip fees and revenues generated from energy sales. Since 1994, tip fees in general have faced tremendous downward pressure. The same has been true for revenues derived from the sale of electricity.

Since 1978, MWC facilities had enjoyed favorable pricing of electricity. As a result of the Arab oil embargoes of 1973 and 1978, Congress passed PURPA. This law, which is overseen by the Federal Energy Regulatory Commission (FERC), requires utilities to buy power from MWC projects. FERC does not set the purchase price, but states that utilities must purchase energy at a "fair and reasonable" price. In practice this has come to mean "avoided cost"—the utilities' marginal cost of the production or purchase of energy. In addition, individual states passed legislation to support this act, at times setting a rate or a minimum price to which utilities must adhere in the purchase of energy from these facilities. Long-term power sales contracts were signed that helped ensure the financial viability of these projects.

However, 20 years after the passage of PURPA, the picture has changed substantially, mainly as a result of falling energy prices worldwide and the flattening demand for energy because of widespread conservation and productivity gains. By the mid-1990s, FERC had substantially weakened the underpinnings of PURPA. It struck down various state laws requiring utilities to purchase electricity at prices in excess of avoided cost. FERC also overturned state initiatives requiring regulated utilities to purchase specific quantities of energy from renewable sources under the rationale that such purchases would lead to prices in excess of avoided cost.

As of 1999, state and proposed federal legislation to deregulate the retail electricity industry was poised to change the nature of the generation and transmission of electricity to industry and consumers. Deregulation is shattering the institutional structure upon which PURPA was built and will directly or indirectly impact most WTE facilities. While the federal government is still working on the final shape of a bill, at least 18 states have passed or are anticipating passage of some measure of deregulation. Under the proposed federal bill, all consumers would be able to choose their electricity provider by January 1, 2001. Major issues for WTE projects are the sanctity of existing power sales contracts and the requirement that power providers meet a renewable-energy standard. While all plans call for the protection of existing contracts, there is already pressure by utilities to buy out expensive contracts and renegotiate subsequent rates downward.

Furthermore, controversy continues to swirl around the renewable portfolio standard and the inclusion of WTE projects under this rubric. Under proposed federal legislation, the

renewable portfolio standard requires that each electric generator in a state generate renewables, or purchase renewable energy credits, equivalent to a certain percentage of their generation. This percentage has been proposed at 3% in 2005, rising to 4% in 2010. Renewables include power generated from such "green" energy sources as wind, solar, and biomass. Certain groups are arguing that energy from MWCs should be excluded from the biomass category because of the general inefficiency of these plants and the high level of air emissions associated with them. Energy deregulation legislation has introduced further uncertainty into the business environment of WTE facilities. While in the long run it might prove beneficial to those plants that can negotiate directly with an end user for electricity, the short-run impact of deregulation is uncertainty and downward pressure on rates.

Supreme Court Decisions

In the mid-1990s there were two major US Supreme Court decisions that drastically changed the WTE industry: *Chicago* v*. Environmental Defense Fund* (*EDF*) and *Carbone* v*. Town of Clarkstown*. In the first case, the court held that ash residue from an MWC is subject to hazardous-waste rules. (Up to that point, there had been a lack of consensus within EPA regarding appropriate ash management practices.) Furthermore, EPA then stipulated that MWC operators sample and analyze their ash to determine whether it was hazardous according to RCRA, Subtitle C regulations. The agency ultimately issued a policy guidance requiring that all MWC ash be tested using the Toxicity Characteristic Leaching Procedure (TCLP) to determine if it is hazardous. Importantly, EPA also ruled that each plant could combine its ash streams into a single stream for testing, as long as the streams were generated within the confines of the plant enclosure.

The Supreme Court's decision in the *EDF* case and EPA's subsequent policy guidance caused concern among owners and operators of MWCs regarding the financial and environmental liabilities surrounding ash disposal. Owners and operators were particularly greatly concerned about potential Superfund liability. In a number of cases, the operating costs of MWCs increased significantly as a result of the new requirements for the treatment and disposal of ash.

The *EDF* court decision not only had a profound effect on the MWC industry, it also adversely affected providers of MWC ash-recycling services, such as Rolite. The ruling created substantial confusion and uncertainty with respect to the recycling of MWC ash because of the concern over potential liability issues. This uncertainty caused MWC owners and operators to be more favorably inclined to dispose of their ash in landfills rather than through recycling.

While the *EDF* decision forced MWC owners and operators to examine and, in some instances, change their methods of ash handling and disposal, they were able to adapt to new testing requirements and disposal methods, incorporating these upgrades into their costs. With proper combustion techniques, most of the incinerator ash passed the TCLP test. However, the second Supreme Court decision in the same month—May 1994—had a much more dramatic impact on the MSW combustion industry. In *Carbone* v. *Town of Clarkstown*, the Supreme Court held that mandatory solid waste–flow control ordinances constituted an impermissible restraint on interstate commerce and were in violation of the Commerce Clause of the US Constitution. Prior to this decision, local governments were able to direct the flow of waste within their jurisdiction's boundaries to a given facility or location. Haulers were forced to pay the tipping fees levied at the mandated facility, even if they could find a cheaper solid waste–disposal alternative elsewhere. As a result of the *Carbone* decision, haulers could take their waste to any licensed facility. Thus, many MWCs were suddenly forced to compete for the waste. With landfills aggressively seeking waste, MWC projects had to lower their tipping fees, causing a decline in their operating revenues. This created a fundamental change in the financial structure of MWCs, which had previously been dependent on noncompetitive tipping fees.

Since the Supreme Court decision, state and local governments have attempted to find ways around it, with only limited success. For example, New Jersey mandated waste-flow control to its state MWC facilities. As a result of a recent court decision that found New Jersey's flow-control law unconstitutional, the state's MWCs have lost captive control of their solid waste supply, and several of the bonds for New Jersey MWCs have been downrated.

Major policy and legislative initiatives have affected the WTE industry from the mid-1980s through the present. Stringent APC and combustion requirements, as well as mandated ash-handling and disposal practices, have added to the capital and operating costs of these facilities. The loss of the ability of local governments to dictate the flow of waste to particular projects has permitted waste to flow freely to the lowest-priced disposal option. More costly WTE facilities are finding it difficult to compete for waste. Finally, the power industry is in a state of flux, with energy prices at a low. Power sales revenues accruing to MWC tend to be dropping.

Landfill Capacity and Disposal Prices

All the developments cited above might not have undermined the municipal WTE industry had landfilling not reemerged as the disposal option of choice. Concerns in the late 1980s about possible landfill-capacity shortages proved to be unfounded. In fact, for the past decade, while the number of landfills that accept

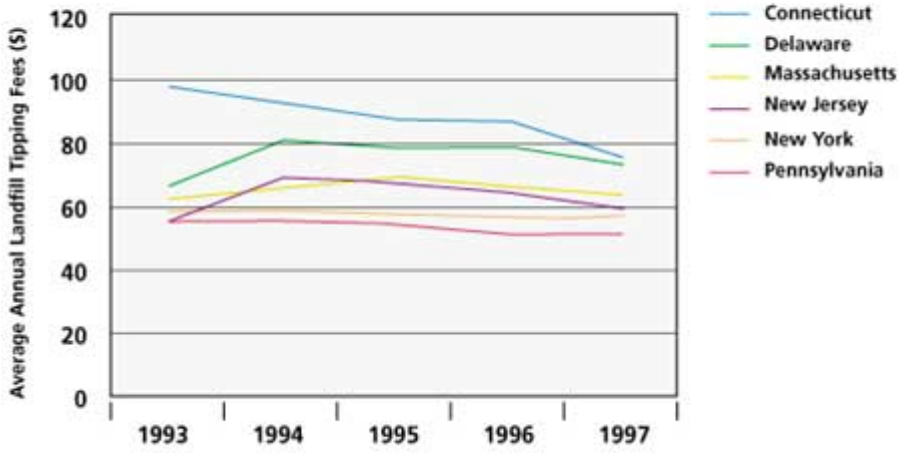
MSW has plunged by approximately 60% because of the closure of small, substandard landfill, available landfill capacity has increased. In fact, in a national survey undertaken by *BioCycle* magazine in April 1998, of the 37 states providing an estimate of their landfill capacity, 13 reported remaining capacity to be 20 years or more and another 16 estimated 10 years or more. Furthermore, they reported more landfill capacity available than at any other time over the past 10 years.

Federal and state regulations on landfill construction, leachate management, closure, and methane gas control helped mitigate the negatives associated with landfilling. In addition, landfill capacity has grown with the permitting of new "mega" regional landfills and the vertical and horizontal expansion of existing landfills. Because of the significantly lower capital and operating costs of a landfill compared to a WTE facility, the price of landfill disposal can often be cheaper than that of a waste combustor. With the lifting of flow control, landfills became aggressive competitors for waste, drawing it away from waste combustors. Because controlling waste flow is no longer legal, waste is traveling considerable distances—even across states—to landfills charging the cheapest prices.

Moreover, the average price of landfilling has declined nationally over the last five years. One of the most dramatic declines in landfill tipping fees has been in New Jersey, where the overturning of the state's flow-control law has allowed more solid waste haulers to use out-of-state landfills in Pennsylvania and farther south. As a result of this increased competition for solid waste, many New Jersey MWCs and landfills have dramatically dropped their tipping fees. For example, Union County, NJ, recently sold its MWC to Ogden Corporation because it could not afford to run the facility without flow control. Camden County, NJ, has had to reduce its tipping fees by half to remain competitive and has had to rely on reserve funds to pay expenses.

Figure 1 graphically illustrates the trend of declining landfill prices from 1993 to 1997 in six key northeastern and Mid-Atlantic states, where a significant number of MWCs are located. The data reveal a downward trend in landfill prices throughout the region during this time period.

FIGURE 1. Average Landfill Tipping Fees in the Northeast



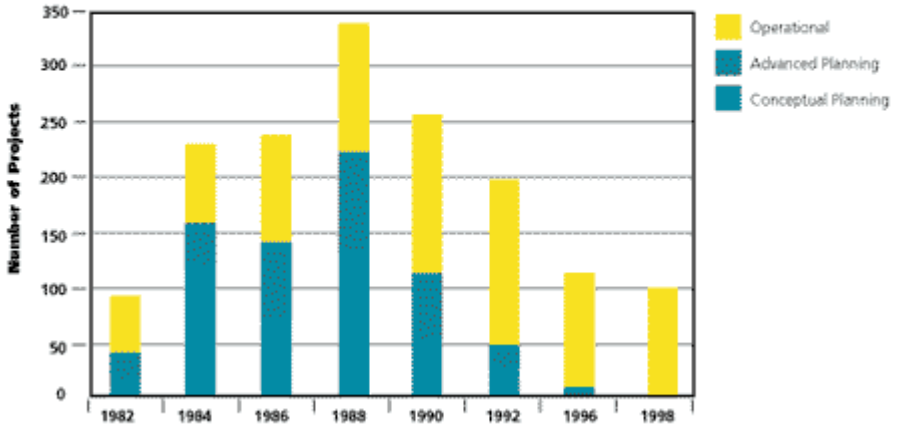
Source: Solid Waste Price Index, 1993-1997

Status of MWC Facilities

Number of Projects

As is to be expected, the various factors outlined above have had a negative impact on the municipal WTE industry. These impacts are evident by the trends shown in Figure 2, which examines the number of facilities by status since 1982, when Governmental Advisory Associates Inc. first published its periodic survey of the industry. Total projects rose from 96 in 1982 to a high of 341 in 1988. After 1988, however, numbers started dropping to a total of 257 in 1990, 198 in 1992, 117 in 1996, and 101 in 1998. The peak in 1988 reflects the various governmental policies in place that drove the construction of MWC projects. Despite the fact that tax reform was passed in 1986, a large number of projects still in the pipeline were ultimately built.

FIGURE 2. Status of MWC Facilities by Year

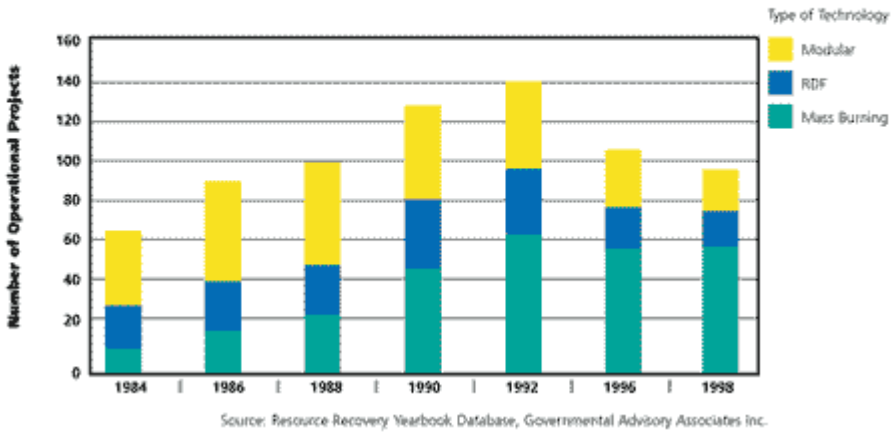


Source: *Resource Recovery Yearbooks: 1982-1998*, Governmental Advisory Associates Inc.

The status of the projects in Figure 2 indicate that through 1988 there was a sizable proportion of planned facilities. In fact, there were almost twice as many planned projects than operating facilities between 1984 until 1988. At that point, the number of projects in planning began to decline, dropping precipitously between 1992 and 1996 until 1998, when there were effectively no planned facilities. These findings denote a mature industry, with negligible growth after 1992.

The data on operational projects reveal another interesting finding. The number of projects coming on-line increased from 1982 through 1992. Thus, while fewer and fewer facilities were being planned, most projects that had been in the pipeline were built. However, since 1992, the industry has contracted. Operational facilities are closing, which has reduced the number of plants from 150 in 1992 to 100 in 1998. The number of operating projects is now at the same level as 1986, which is about the time the industry began its largest growth spurt. Between 1992 and 1996, 43 operational plants closed or stopped accepting municipal waste. Of these 43, 27 were still on-line as of 1994. Between 1996 and 1998, an additional 16 shut down from APC concerns or lack of economic viability. These closures came in the wake of the implementation of strict EPA air-emissions guidelines and the inability of some of these projects to compete with landfills for waste.

FIGURE 3. Type of Technology Used in Operational Facilities by Year



Type of Technology Used

The type of technology employed at MWC facilities has also been undergoing a change. Three major categories of technology have been used. Mass burning is the most commonly used process. Raw MSW is taken "as is"—with little or no shredding or separation prior to combustion. Refuse is fed into individual furnaces, mostly of the waterwall type. The sides of the furnace contain closely spaced steel tubes through which water circulates. The refuse is burned, heating the water to produce steam, which is used as an energy product or as fuel for turbines generating electricity. Modular facilities have one or more small-

scale combustion units to process smaller amounts of waste, usually less than 200 tpd. The units are usually prefabricated and can be shipped fully assembled in modules to the site. Many have a two-chamber design, which in the years prior to the CAA Amendments provided an acceptable level of APC. Under new federal and state initiatives, this is no longer the case. The third type of technology is refuse-derived fuel (RDF). This approach employs a two-stage production system. Wastes are initially preprocessed to produce a homogeneous fuel product. The RDF can be sold to outside customers or burned on-site in a dedicated furnace.

In the early years of WTE, modular facilities were dominant. They were relatively simple to implement and did not require a high level of capital investment. However, as can be seen in Figure 3, the number of these projects had declined considerably by 1998. Their small size has made them unprofitable, particularly in areas with declining waste-disposal prices. Many of these facilities have been forced to upgrade their APC systems and have shut down rather than make the large capital investments necessary to meet current APC requirements. The majority of facilities that remain are using mass-burn, waterwall technology. Over the last two decades, this has proved to be the most efficient and effective in terms of combustion and energy generation. Nevertheless, many of these projects have undergone or will undergo significant upgrades to retrofit boilers and APC systems.

New Developments in MWC

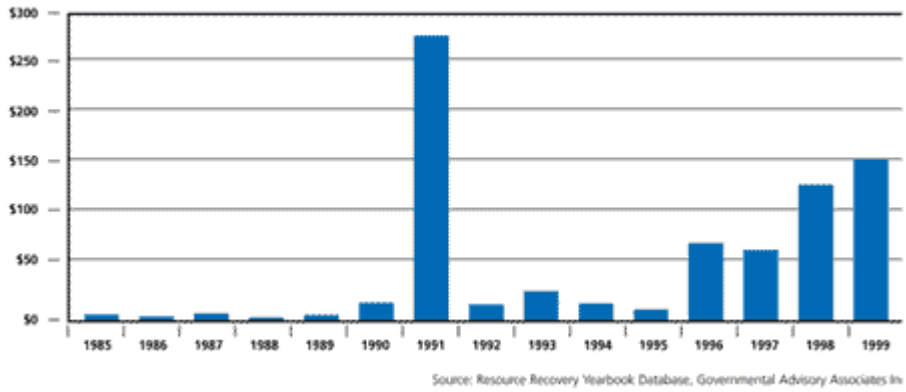
While the above discussion reflects an industry in contraction, there are two areas of projects in which there has been significant capital investment: (1) APC and boiler-system upgrades and (2) ash-handling methods. Both are direct results of federal and state regulations that are requiring system upgrades to incorporate state-of-the-art technology. As has been discussed above, these regulations are partially responsible for the increased rate of plant closures. Because of the competitive environment for waste and, thus, the need to keep tip fees low, facilities are unable to recoup the capital investment for the upgrade and, as a result, decide to close down.

Plant Retrofits

The degree of plant retrofits is directly related to the age of a facility. A relatively new project will have taken into account proposed federal and state regulations and incorporated these technologies into its construction plans. However, as previously shown, most projects have come on-line between 1988 and 1992, prior to the implementation of EPA's most recent regulations in 1995. Many of these facilities have undertaken or plan to undertake substantial systems upgrades. Figure 4 summarizes the level of capital investment in APC systems and

boiler upgrades by year.

FIGURE 4. Total Dollars Spent on Air-Pollution Control and Boiler Retrofits by Year (in millions)



From 1985 through 1990, there was minimal investment in APC systems. In 1991, total dollars spent spiked to about $284 million. This spending is a result of the 1990 CAA Amendments that mandated state-of-the-art APC systems on large MWC facilities. The facilities making the upgrades in 1991 were proactive, as final EPA regulations were not promulgated until 1995. The remaining projects clearly responded to these final guidelines as capital spending increases by year from 1996 through 1999. Of course, the 1999 amounts might be overstated. Not all facilities will decide to go ahead with their plans if there is no chance for long-term economic health.

Ash Reuse and Recycling

Reuse of ash from waste incineration has been a desire of the industry since the early 1960s, when the first research studies into MWC ash's engineering properties were initiated by the Federal Highway Administration. Despite the efforts of—and the proof from—comprehensive studies by EPA, numerous public agencies, and the WTE industry that ash can be used safely without violating groundwater regulations or impacting human health and the environment, the status of ash reuse and recycling from MWCs has not improved dramatically. Almost 40 years later, based on the results of two comprehensive surveys by the Solid Waste Association of North America, ash reuse has been limited. If it is used at all, it is primarily as a soil substitute for daily or intermediate cover on sanitary landfills. Public opposition by intervenor groups and a patchwork of regulations in many states have kept the material from reaching its recycling potential. Invariably, ash-reuse and recycling proponents have been asked by state regulators to conduct ash-recycling research or demonstration projects time and time again while at the same time requiring them to meet conservative regulatory standards for cancer risk along with requirements of institutional controls for ash reuse.

Notwithstanding these impediments, in recent years several

firms, such as American Ash Recycling Inc. (Jacksonville, FL), have been successful in receiving state regulatory approval in Massachusetts, Pennsylvania, and Tennessee for using MWC ash for such applications as base course in state roads and parking lots and structural fill in construction projects.

Conclusions

Overall, the near-term picture is not good. MWC is not a competitive solid waste–disposal alternative in many areas, nor does federal, state, or local policy support it. The level of capital investment is high, and revenues from low tip fees and falling energy prices are frequently not enough to cover and recoup capital spending. However, in the long term, the prognosis might be different. There are now serious challenges to the unbridled exporting of waste. In particular, Pennsylvania and Virginia are considering the regulation of waste imports. If costs to send waste out of state to large landfills increase, other disposal options might begin to look attractive. Additionally, new technologies that might significantly reduce air emissions are being revisited. These include pyrolysis and waste-to-alcohol (ethanol or methanol) processes.

Finally, electricity deregulation might positively benefit independent power producers, of which MWCs are a subset. These projects may be able to negotiate directly with electricity consumers for a higher rate than they are now receiving from utilities. For example, under the newly deregulated electricity market, it might be feasible to wheel electricity from a community's MWC to its large-energy users (water and wastewater treatment plants, airports, administrative complexes, municipal lighting districts, or correctional facilities). In some instances, the cost savings realized might underscore the value of having an MWC as part of a community's public works structure.

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