Changing Waste-to-Energy in Nashville, Tennessee

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Abstract

For almost 30 years, the Metropolitan Government of Nashville and Davidson County has been relying on one of the more innovative approaches to waste management. Since the early 1970s, the now 1,000 tons per day WTE facility has been the primary energy source for supplying steam and chilled water for a downtown district energy system serving some 39 buildings. A recent review of alternatives has resulted in Metro deciding to close the facility and replace it with a more traditional district energy supply system and at the same time re-engineer its solid waste management programs to include more efficient collection and recycling programs.

This paper will present the planning process and analysis that were done; describe the key factors that led to Metro Nashville's decisions; detail the procurement and development process that has been initiated; and outline the timetable for implementing the decided upon changes. The authors believe this case study will provide insights for other WTE projects that from time to time struggle with peaceful co-existence with other elements of integrated solid waste management.

The authors have been serving as advisors to Metro throughout this process. Mr. Gershman has recently been designated by Metro as its overall Project Manager for its District Energy System.

Overview

For the past 30 years, the Nashville, Tennessee metropolitan area has relied on one of the most innovative approaches to waste management — the utilization of the energy in municipal solid waste (MSW) to heat and cool buildings in the City. The system was operated by the specially created Nashville Thermal Transfer Corporation, known as Thermal. Since the early 1970s, Thermal has been operating a waste-to-energy plant in downtown Nashville that produced and distributed chilled water and steam to 39 downtown commercial and governmental buildings for the purpose of heating and air conditioning, including those of the Metropolitan Government of Nashville and Davidson County (Metro) and the State of Tennessee. The WTE plant began operation in 1974 with expansions in 1976 and 1984. Until recently, the Thermal facility had the rated capacity of 1050 tons per day of refuse, which produced energy for the generation of 250,000 pounds of steam per hour in 3
boiler/incinerators. When refuse or other solid fuel was not used as a fuel source, two gas/oil-fired boilers were used as an alternative. Major emission control upgrades were implemented in 1999 to bring the facility in compliance with Title V Air Quality Standards. Because of a long history of poor operational, environmental and financial performance, which continued after these retrofits, the Thermal facility was evaluated in the context of a new solid waste plan for Metro. GBB was tasked with leading this work; other firms involved included Gresham Smith and Partners, HDR Engineering, Inc., PricewaterhouseCoopers, Normal Hall and Associates and Wilmot and Associates.

As part of his announced Solid Waste Master Plan, issued in early 2001, Mayor Bill Purcell slated the Thermal WTE facility for closure within 3 to 5 years to be replaced by a new energy generating facility (EGF) using more traditional fuels other than municipal solid waste. This decision was made in the context of promoting more recycling, using less costly available waste disposal alternatives, continuing to offer competitively priced district energy services, and freeing the site for more valuable downtown redevelopment. Thus, Metro initiated two new major efforts related to this: re-engineering solid waste/recycling services and implementing a new district energy system (DES).

The decision was based in part on the results of a comprehensive study begun in July 2000 to evaluate the solid waste management alternatives for Nashville’s metropolitan area, including the alternatives for the future of Thermal. The study included an evaluation of the overall integrity of the energy distribution system (EDS) that distributes and delivers the steam and chilled water to Thermal’s customers; the physical plant’s long-term availability to the customer, the ability to add customers as downtown Nashville grows, and the financial impact of maintaining the current system. It found that the EDS was in sound shape and provided a valuable service to its customers. However, the WTE plant was unreliable and resulted in high costs of waste disposal. In light of this, Metro decided to continue the energy services it was currently providing, but to convert from waste-to-energy to fossil fuel firing. This would allow Metro to provide a more reliable service, and even add new DES customers.

Solid Waste Management in 2000

Nashville is Tennessee’s capital and the center of a metropolitan area of over one-half million people. When the Purcell Administration began in 2000, it found that there were no long-term strategies for waste disposal, very low levels of recycling and a waste-to-energy plant with uncontrolled, escalating costs, poor reliability and air permit violations. Instead of being self-sufficient on energy product sales and tipping fees, Thermal was demanding an ever-growing amount of taxpayer subsidy to keep it viable. Compounding the reliability and operating cost problems, the pricing of steam and chilled water was kept below the market value and the cost of production so that a Metro subsidy of over $80 million had accumulated since 1976. As shown in Figure 1, the drain on Metro’s treasury had grown from less than $1 million per year in 1976 to
almost $8 million per year in 2000. For Fiscal Years (FY) 1990 to 2000, the annual tax subsidy to make up for Thermal losses rose approximately 14%, while the Consumer Price Index had only risen by less than 3% per year. (Note: Subsequent to the decision to close Thermal, Metro’s subsidy continued at $11.6 million in FY 2001 and $12.7 million in FY 2002; in other words, matters with regard to Thermal continued to get worse.)

In December 2000, the Solid Waste Assessment concluded that Thermal’s equipment was aging badly and an immediate infusion of $15 million would be required to keep it operational. Operating costs were climbing because of WTE equipment low availability and its increasing maintenance requirements. Metro controlled about 450 tons per day of MSW and Thermal’s inability to attract sufficient waste, required the purchase of natural gas to raise steam. To operate efficiently, it was also concluded that Thermal needed at least 900 tons per day of solid waste, but was only burning 685 tons per day. Morale was low among both management and workers, and there was little budgetary control or accountability.

All of the alternatives for attracting more waste were unattractive to Metro. Since the Carbone decision, waste control issues severely limited Metro’s ability to direct more waste to the facility. Tipping fees had already been reduced to try to attract more waste without measurable success because the market rate for disposal was even lower. Acceptance of out-of-county waste was politically unpalatable and untested. The expansion of city-controlled waste collection would further burden already strained collection resources, and imposing a solid waste generating fee or tax was evaluated to be out of the question.

Although energy prices to customers were among the lowest for district energy systems across the United States, recent increases led customers to the opinion that their current rates were reasonably close to what their self-heating and cooling costs would be if they were not to be served by Thermal or a replacement district energy system. Growing customer resistance to further increases in energy prices meant that Metro could not just raise rates for a Thermal-based solution without a concomitant assurance of better service—something the customers were skeptical about ever receiving from Thermal.

The central issue in formulating a new long-term solid waste management plan was clearly what to do about the Thermal WTE plant. Only when this problem was solved could the other pieces of a new solid waste plan be put into place.

The Assessment of the System

The study of the future of Thermal, begun in July 2000, focused on the evaluation of all of the logical alternatives for the Thermal facility as part of an overall solid waste management plan. The strategy was to develop the overall financial cost of each alternative future from Metro’s perspective on a net present value basis. The ultimate cost of each Thermal option was included in the analysis of the overall Metro cost of waste management, including recycling, trash,
bulk, and yard waste collection, hauling, disposal, processing and residual disposal, as well as the Metro cost of continuing to produce and sell steam and chilled water for its own buildings, either through WTE or other means.

The net cost to Metro of Thermal also included the consideration of the alternative uses of the Thermal site if it were no longer needed for waste conversion/disposal. The eleven-acre Thermal site is in the southeastern edge of the downtown area on the waterfront of the Cumberland River, which flows through the heart of downtown. When it was built in the early 1970s, the Thermal facility replaced a variety of unsavory industrial uses far from the heart of downtown development. Over the years, however, the downtown expanded out to engulf the facility’s site. The other sections of downtown waterfront were redeveloped from industrial type uses to people-friendly and accessible uses, new transportation corridors were built around the site, and in general Thermal became less acceptable as a downtown neighbor. From an environmental perspective as well, the Thermal location was an issue in the analysis. Odor, air quality, traffic generation and aesthetics were non-quantifiable aspects of the consideration to use, close or relocate the Thermal facility. Reuse of the site and its development and economic value, therefore, became an important component of the overall analysis.

There were three general alternatives in the analysis of Thermal:

1. WTE: Maintain the use of Thermal as a waste-to-energy facility, providing steam and chilled water

   a. Scenario A: maintain operations as is (685 TPD), with low WTE availability (70%), high operations and maintenance costs to service the old equipment and a high use of natural gas back-up equipment

   b. Scenario B: maintain operations with a major equipment rehabilitation effort ($15 million) over three years, resulting in a higher availability (900 TPD at 85-90%) and lower operating costs

   c. Scenario C: overhaul existing facility by installing two new WTE boilers over three years ($82 million), bringing high availability (90%), greater capacity (about 1400 TPD) and low operating costs

2. Fossil Plant: Cease Thermal operations and replace it with a new fossil fuel-based facility to provide steam and chilled water

   a. Scenario A: put the new fossil fuel plant on the existing Thermal site

   b. Scenario B: put the new fossil fuel plant on an alternate site

   c. Scenario C: expand the concept to include cogeneration via a combined cycle gas turbine facility

3. No Build: Cease Thermal operations and have each building currently served is responsible for its own heating and cooling services.
Waste-To-Energy Alternatives. All the WTE alternatives included the adding of a 500-600 TPD capability for transfer hauling to rationalize the requirements for by-pass and noncombustible wastes at the downtown facility. The scenarios with new investment assumed the continued recycling of bottom ash and the maintenance of the dedicated ash monofill for fly ash. In the WTE cases, no value was ascribed to the property as a site for redevelopment.

Fossil Fuel Alternatives. Without the WTE facility, Metro needed to find alternative ways to dispose of its waste and heat/cool its buildings. Transfer to an out-of-county landfill under a long-term contract was assumed for the waste disposal under these scenarios at a FY2000 cost of $30 per ton (in actuality the cost turned out to be $26.50). The costs of closure and post-closure of the ash monofill were included in the thirty-year projections. It was assumed that a $44.7 million gas-fired plant could be built as a substitute for Thermal within three years (Note: After the procurement for such a facility, the cost actually turned out to be within 10% of the estimate). Customer energy prices for the new facility were assumed to be at breakeven to avoid skewing the analysis. For an alternative site, Metro nominated several close-by vacant Metro-owned properties that were reduced to one with reasonable characteristics and proximity to the energy distribution system.

Redevelopment of the Thermal site was included in the analysis of the scenario with a new site. An appraisal of the site commissioned by Metro valued the Thermal site at $9 million. After a deduction of $2 million for site demolition and clearing, the net site value was $7 million. The team estimated the annual tax yield from the site to be about $4.3 million. These figures were used in the analysis to offset the costs of the fossil fuel-fired plant at a new site.

The use of cogeneration in formulating the options for Thermal proved interesting in concept but was included for informational purposes only as being too speculative for this analysis, to say nothing of the electricity buy-back problems that would be encountered since supply originates from the Tennessee Valley Authority.

No-Build Alternative. All customers were on their own after a two-year transition period (2000-2002) to allow them to design and install their own self-heating and cooling equipment. Metro used the same alternative disposal assumption as for the fossil fuel alternative. Metro’s costs were assumed to be the cost of building its own facilities and the additional cost of operating those facilities over what the central fossil fuel plant would have cost to service its loads. The Thermal site would be cleared after the transition period and made available for redevelopment, with the revenue credited against the cost of the alternative. It was noted, by the local utilities serving downtown Nashville, that replacing Thermal with natural gas and electricity services for 39 new self-heating and cooling customers would prove difficult logistically, and they made no guarantees about their ability to accomplish required interconnection upgrades.
All of the alternatives used the same assumptions for inflation, appropriate electricity and natural gas pricing, and system demands for heating and cooling. Gas prices were projected using U.S. Energy Information Agency data. The analysis was a 30-year net present value analysis using a discount rate equal to the Metro Nashville borrowing rate, assumed to be 5 percent.

Assessment Results. The net present value analysis was run for each of the alternatives (except the combined-cycle option) and the net costs calculated are displayed in Table 1. The least-cost option, continuing Thermal operations with a $15 million rehabilitation, was also the highest risk alternative, requiring Metro to deliver over 200 TPD of additional waste that it could not already find. Further, Metro would have to rely on a "patched-up" facility over the long term. In addition, the Thermal decision needed to be made in the context of the overall cost of waste management to Metro and not just the cost of Thermal or its replacement.

Each alternative for Thermal was paired with the appropriate waste management assumptions so that the full all-inclusive cost of any option could be projected and compared with any other option. Recycling targets, and their associated costs, were also added to reflect the Metro solid waste goals for the overall system. It was noted that the high recycling scenarios in the overall waste management Assessment, the further reduced the waste available to the WTE plant.

To facilitate the analysis, the $82 million reconstruction of Thermal was dropped; the fossil-fuel scenario with the new plant on the old Thermal site was dropped, as was the no-build option. The resulting alternatives were two WTE scenarios and the fossil fuel plant on a new site. When the results of the extended analysis were derived, the least-cost solution changed as follows:

- Keep Thermal as is with 685 TPD capacity - $553 million or $59.39/ton
- Keep Thermal with 900 TPD, $15 million retrofit and improved recycling - $479.0 million or $44.34/ton
- Close Thermal/recycle and landfill out of county - $435 million or $44.20/ton

The analysis concluded the WTE plant resulted in high cost waste disposal, environmental impacts, constraints on recycling and high risk factors. While the cost of solid waste management was equal for the rehab and abandon scenarios for the WTE plant, the risk to Metro was not. This can be seen in Table 1 and is reflected in the tonnage shortfall.

These factors lead the Purcell administration to decide that the continued operation of Thermal was not desired. Keeping Thermal operating didn’t offer any long-term savings to Metro, and it posed the risk of major financial losses if solid waste tonnages fell short (a likely outcome based on post-Carbone history). If higher volumes of waste could be secured, it would make downtown Nashville a regional waste disposal site with 200 TPD of additional waste hauled in, retard the redevelopment of the downtown waterfront, pose potential health problems if mismanaged in the
future, and was at odds with Metro’s recycling goals. Further, because of poor environmental performance, the WTE plant had lost its community support and had created an active opposition.

As a result, the Mayor’s Solid Waste Plan called for the phasing out of Thermal as soon as practicable and the implementation of a new DES, based on natural gas firing and electrical use at a site other than the existing Thermal site. The goal for the DES was to have it be financially self-sufficient so that there would be no cost for Metro over and above the cost of heating and cooling its own buildings. A related goal was to make the pricing for steam and chilled water for all customers less than the cost projected under continued Thermal operations or through self-heating and cooling alternatives. This would decouple waste disposal and energy provision costs once and for all and ensure Metro that the only costs it would have for waste management would be the costs of administration, collection (waste and recyclables), recycling processing and transfer and disposal. In addition, the plan made available for redevelopment a choice, eleven-acre waterfront property in a key downtown location.

The other aspects of the Mayor’s plan included increased recycling through the creation of a new curbside pick-up program, the closure of the ash monofill, a long-term contract for transfer hauling and out-of-county landfilling (which was accomplished at $26.50 per ton under a twenty-year contract), the creation of a new waste management division within the public works department, investments in new rolling stock, and improved management systems for the operations overall. The resulting savings of the new plan over the old system was projected to be $184 million over twenty years (see Figure 2).

**Implementing a New District Energy System**

With the conclusion reached to phase out Thermal in January 2001, the next question was how to implement its replacement. Metro created the following set of goals to guide the development of a new DES:

- Use a public-private partnership approach
- Maintain the current Thermal rates or assure that rates were less than self-heating and cooling costs
- Secure guaranteed costs of construction, operations and maintenance
- Put in place an environmentally sound solution
- Enter into a long term relationship with a quality builder-operator

Metro saw this transition as an opportunity to get out of the structure under which heating and cooling services were provided through Thermal and move toward finding a competent private sector partner for the system, either to sell the system and just buy services for its buildings, or to maintain ownership and delegate the construction and operations functions to the private partner. To enlist the support and participation of the existing customers in this solution, Metro promised them that it would protect them from uncontrolled
price increases and other perceived risks of system privatization.

The most obvious solutions coming out of this goal set were (1) to procure a private partner on a design/build operate basis, with public financing to keep costs low, or (2) to sell the system with conditions on the private party in respect of pricing and customer treatment, in effect to create a locally-regulated private utility. Because the procurement of a public-private redevelopment of a DES is uncommon in the U.S., Metro was wary about making procurement choices without knowing the nature and proclivities of the private DES development community. To address this problem, Metro adopted two-step procurement with several opportunities for feedback from the respondents and a great deal of flexibility in its requirements. The procurement had several consultative aspects to it, including a preliminary written expression of interest from the respondents, three pre-proposal conferences, and private one-on-one discussions with the Metro procurement team.

Countering this need for communications was the requirement to complete the procurement process in under a year. To accomplish both ends required careful balancing as well as great efficiency in the process. The two-step process allowed Metro to maximize the time it allotted to the respondents to complete reasonably detailed and comprehensive proposals, while it built in several interaction and decision points to make sure each side of the procurement was productively considering the needs of the other in formulating the project.

The first step of the procurement was the issuance of a combined request for an expression of interest and a request for proposals Part I (RFP-1) on April 2, 2001. This allowed Metro to set forth its requirements for its partner in this endeavor while seeking the answers to several open issues about the procurement. The RFP-1 asked for team qualifications and experience along with a set of minimum experiential and financial requirements. The technical minimum requirements sought to establish a hurdle to limit respondents to those that had developed at least one system similar in size, scope and complexity to Nashville's. Proposal teams were required to cite experience with one system that they had operated for a minimum of two years, located in an urban setting where the distribution system used or crossed public rights of way (as opposed to a campus setting), with customers with at least five different ownerships, having capacities of at least 10,000 tons of chilling and 100,000 Mlbs./hour of steam using multiple fuels throughout the year. On the financial side, teams needed to have a leader with a $50 million minimum net worth. These criteria were reached with some knowledge of the private players in the field and the likely respondents to the procurement, while it simply cut out those who were unprepared or new to the industry. The evaluation of qualifications was done on a pass-fail basis at this point, while the qualitative evaluation of a team’s depth and breadth of experience was left to the next stage of the procurement.

The simultaneously issued RFP-1 inquired of firms seeking qualification to respond their considerations about ownership, method of project
implementation, desired type of business relationship with Metro and service delivery preferences. The open-ended request sought to get feedback that would influence the actual procurement methodology to follow. Prior to the submittal date, Metro held a pre-qualification statement briefing for interested parties. As a result of this step, Metro qualified five energy service subsidiaries of five major U.S. utility companies.

The feedback from participants and internal research led Metro to the shape of the second step of the procurement – the Request for Proposals Part II (RFP-2). The RFP-2 was first issued in draft to the five qualified firms together with an outline of the contract principles Metro hoped to offer respondents. A briefing for the five teams was held to review the draft RFP-2 and a round of one-on-one discussions was held on a voluntary basis with the Metro procurement team so that any concerns with the process, business terms and technical requirements could be identified and handled before the issuance of the final RFP-2. Metro went out of its way to solicit any concerns that respondents might have prior to the last stage of the competition.

From the various forums with the vendors, Metro shaped the final RFP-2 and issued it to the five qualified teams. The scope of work for the RFP-2 included the design and construction of a new EGF at a fixed price, the operation and maintenance of the entire system for fifteen years (with three five-year Metro options to renew) at a fixed operating price that would escalate annually by some agreed-upon measure of inflation, the general business management of the system, including administration, staff development, billing, collection, customer service and marketing, and the operation of the system fulfilling all environmental standards.

RFP-2 was open to a variety of ownership and financing options, but a base case was required with public ownership and revenue bond financing, and private operation and management. While options with private ownership would be entertained as alternative proposals, respondents were advised of the conclusion of Metro’s transaction counsel (Hawkins, Delafield & Wood) that in that case, the private operating entity would most likely be regulated by the State of Tennessee, something that Metro was discouraging. Respondents were allowed to use the Thermal site, while minimizing the extent of the site it would use. Alternatively, respondents could use one of several alternate Metro-controlled sites, or offer one of their own. (The ultimate choice of Metro was a site proposed by a respondent.) Technologically, a team could offer cogeneration, thermal storage or other energy conservation strategies, as long as the contribution to overall cost and reliability was positive.

The proposals included the description of the overall team, including the licensed designers and builders, the technical plan and management and staffing plan for the base case, as well as plans for marketing and sales, regulatory compliance, energy conservation, transition from the existing system, and communications and public relations. After completion of the base case and the cost proposal for the base case, respondents could offer any options that it considered favorable to its submittal.
The proposals were to be highly structured so as to be more easily comparable during the evaluation. Before the submittal date, another pre-proposal conference was held to offer clarifications for potential respondents. Site tours and interviews were also arranged at that time. To assist respondents in their analyses and costing, extensive amounts of background data and drawings for the system were offered both on the Internet and as CDs, comprising a “virtual data room” in lieu of the traditional physical space usually provided for that purpose. Two complete proposals were submitted to Metro for the evaluation stage.

The criteria for the evaluation of the proposals were:
- Net present value of the total cost of the proposed system (40%);
- Quality of the technical plan (25%);
- Qualifications, background and experience of the team (15%);
- Quality of the sales and marketing plan (10%); and
- Organization and staffing (5%) and other plans (5%).

The evaluation was made by a committee comprised of Metro management, Metro advisors, representatives of the customers (Metro, private and State), representatives of the existing Thermal Board and outside experts hired on behalf of the customer groups to provide some independent input. This represented a dramatic outreach on the part of Metro to try to achieve consensus among all interested parties on the transition, the final private partner and the process itself. Supporting the evaluation committee was the team of Metro consultants who also prepared an extensive evaluation report documenting the entire process. The result was the selection of Constellation Energy Source, Inc. (CES), the district energy services subsidiary of the Constellation Energy Group, one of the country’s largest and oldest public utility companies. The parent company of the services subsidiary provided guarantees of all of the subsidiary’s obligations, as well as letters of credit and insurances to minimize Metro risk on the design/build construction and long-term operation of the new facilities.

**Implementation to Date**

CES and Metro completed negotiations of their agreement by the end of November 2001, only 8 months from the issuance of the RFP-1. Parallel to the district energy services procurement activity was another to confirm the economics and availability of long-term transfer station and disposal services for waste that would no longer be disposed of at Thermal. That procurement resulted in the selection of and contracting with Browning Ferris Industries, Inc. (subsidiary to Allied Waste Industries, Inc.) under a twenty-year services agreement with initial rates starting at $26.50 per ton; this cost was well below the estimated cost in GBB’s earlier analysis and proved to confirm the availability of less expensive long-term disposal other than through Thermal. The Metro Council approved both contracts on January 15, 2002 – less than one year from the outset of the procurement. All but four of the existing 39 customers executed new 30-year service contracts for the new entity’s services, and one additional customer was added by spring of 2002.
During the winter of 2002, Metro's Public Health Department, the air quality regulator of the Thermal plant, held hearings on the extensive record of emissions violations over the previous year, something that Thermal was struggling with while the new procurement process was taking place. To stave off an order to close, the Thermal Board reached an agreement with the Public Health Department to cease WTE operations October 31, 2002. This in essence closed the book on waste-to-energy in Nashville. Because of this and the declining reliability of Thermal WTE operations, steps were taken to add two natural gas-fired temporary boilers at Thermal to bolster the reliability of the system during the transition period to the new DES. The wisdom of deciding to transition away from Thermal WTE and add the temporary boilers was validated on May 23, 2002 when a major fire swept through the solid waste portion of the plant. The fire, which started on the tipping floor and spread into an overfilled waste pit, ruined all of the waste handling equipment and put a premature end to Thermal's WTE operations. From that point onward, district energy services at Thermal became fueled entirely by natural gas until it is replaced with the new DES energy generation facility being built by CES that is scheduled for operations on or before July 1, 2004.

On September 18, 2002, $66.7 million in Metro system revenue bonds were issued for the new system and ground was broken on November 10, 2002. The new era for Nashville's district energy system has begun, and all indicators point to a successful completion and a final transition from the once innovative Thermal system.

The system assessment and procurement that Metro completed in the past two years have given the citizens and downtown businesses of Nashville a firm foundation for moving into an efficient and effective energy and waste management future.

Meanwhile, it should also be noted that Metro's re-engineered Waste Management Division has implemented a new curbside recycling program for 130,000 residences and businesses and procured long term transfer and disposal services that cost well below the estimates used in the Solid Waste Assessment. A creative public education program has been initiated to inform residents concerning waste and recycling issues, resulting in "Curby", the mascot and name for Metro's recycling program that has gained great favor amongst Nashvillians.
Figures and Tables

Figure 1 – Taxpayer Payments for Thermal, FY 1976-2000; see PPT slide in separate file attached.

Table 1 – NPV Costs of Thermal Alternatives; see at end of paper.

Figure 2 – Waste Disposal: Thermal vs. Contract Costs; see PPT slide in separate file attached.

References


2. “Request for Proposal #00-16 (Part 1) - Purchasing And/Or Managing The Nashville District Energy System; Designing And Building A New Energy Generation Facility For The System; Providing Steam And Chilled Water To The Current Downtown Customers; And Providing And Marketing The Services To New Customers”; issued by Metropolitan Government of Nashville and Davidson County, April 2, 2001.

3. “Request for Proposal #00-16 (Part 2) - Purchasing And/Or Managing The Nashville District Energy System; Designing And Building A New Energy Generation Facility For The System; Providing Steam And Chilled Water To The Current Downtown Customers; And Providing And Marketing The Services To New Customers”; issued by Metropolitan Government of Nashville and Davidson County, issued August 13, 2001.


5. For information about Metro’s solid waste and recycling programs, go to www.nashville.gov/recycle/.

6. For information about Metro’s district energy system, go to www.nashville.gov/des/.
# Table 1

## Financial Summary of Thermal Analysis Alternatives

### Base Case Scenarios

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<td>New Metro Capital Required</td>
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<td>Price of Steam-FY2005 ($ Per K Lbs.)</td>
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**NPV 30 years Costs (Profit) ($ millions)**

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<td>Base Cases, with Thermal Debt Service Continuing to Term*</td>
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Source: Reference #1, derived from Exhibit 5-6 and Appendix C.
Figure 1
Metro Subsidy FY 1976-2001
Total: $80.1 Million to Thermal

Figure 2
Cost per Ton to Contract T&D vs. Dispose at Thermal

* Contract is GBB’s estimate for Metro to transfer and dispose of MSW based on market information in Tennessee and Kentucky.