

# Analysis of a Biomass/RDF Facility at Rock-Tenn

## Executive Summary

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### Introduction

Rock-Tenn Company operates a paper mill in St. Paul, Minnesota, that processes over 1,000 tons per day of recycled fiber. Rock-Tenn represents a significant local recycling market for solid waste management programs and a significant employer in the local economy.

To process recycled fibers into new paper products requires a large amount of energy—process steam and electricity. Historically, Rock-Tenn has received steam via a dedicated steam line, with the steam produced at an Xcel Energy power plant fueled by coal. To reduce air emissions, Xcel is converting the power plant to use natural gas as the fuel and will no longer produce steam as part of their electrical generation process.

Rock-Tenn is losing their steam source and must develop a cost-effective alternative. They are evaluating various biomass sources and processes. The selected approach must be very reliable 24 hours per day, every day of the year to meet Rock-Tenn’s process steam demands. One potential approach includes the use of biomass fuels produced from solid wastes such as refuse-derived fuel (RDF) or biomass fuels produced by separating wood and fiber from construction & demolition wastes (C&D).

Rock-Tenn is evaluating their options and holding preliminary discussions with various parties, including Ramsey/Washington Counties (Counties) because of the Counties’ role in solid waste management and interest in waste processing. The Ramsey/Washington Counties Resource Recovery Project Board (Project) desired to have an “independent” analysis of the feasibility of a biomass/RDF based energy recovery facility at Rock-Tenn and authorized this study.

### Rock-Tenn Energy Market Analysis and Fuel Needs

#### Rock-Tenn Energy Demands

Rock-Tenn uses steam to process the recycled fibers as well as for heating in the winter. Electricity is used to operate the equipment. They have significant steam and electrical loads. The annual average steam demand is 225,994 pounds per hour with a peak load of approximately 325,000 pounds per hour. The electrical demand is 12,488 KW. Equating this steam demand to fuel needs yields an average biomass/RDF demand of 45 tons per hour, or an annual total of 394,200 tons of RDF per year (1,080 tons per day).

#### Refuse-derived Fuel (RDF) Supply

Historically, over the last ten (10) years, the average annual output of RDF from the Newport Facility has been approximately 330,000 tons per year. Thus, the demand for RDF by

Rock-Tenn is approximately 120 percent of the annual RDF output from the Newport Facility (Rock-Tenn could use all the RDF produced annually at Newport plus another 64,200 tons).

Without continuing RDF deliveries to the Xcel combustion facilities in Red Wing and Wilmarth (Mankato), the Newport Facility has the permitted processing capacity to meet the RDF needs of Rock-Tenn. Combining the Xcel historical RDF demands from the Newport Facility with the projected needs of Rock-Tenn would require almost 900,000 tons of municipal solid waste (MSW) to be delivered to the Newport Facility in order to produce the RDF required. There is not enough MSW generated in Ramsey and Washington Counties (latest reported totals are approximately 525,000 tons per year of MSW) to meet these combined fuel needs. To meet the combined RDF needs of Xcel and Rock-Tenn is projected to require a regional approach for the MSW supply or a combination of MSW and C&D produced biomass.

### Rock-Tenn Biomass/RDF Facility

The Rock-Tenn Biomass/RDF Facility analyzed in this study was assumed to be built in the southwest corner of Rock-Tenn’s paper mill located at 2250 Wabash Avenue, St. Paul. The analysis includes two (2) parallel train boiler systems consisting of traveling grate stoker boilers complete with all necessary components. The boilers would each be sized for 275,000 pounds per hour of steam at 600 psig pressure and 700 F. Steam would be sent directly to meet Rock-Tenn demands with excess steam run through a turbine/generator to produce electricity. Although not considered in this preliminary analysis, the boiler plant capacity may provide some portion of a district’s heating and cooling needs for the surrounding area.

The boilers exhaust flue gas would pass through a state-of-the-art pollution control system as required by applicable environmental regulations. It is anticipated that this equipment will include a lime scrubber for SO<sub>x</sub> and chlorine emission controls, an activated carbon injection for mercury emission control, and an industrial, reverse air baghouse for particulate control.

Table ES-1 provides a summary of key preliminary cost and revenue projections associated with the Rock-Tenn Biomass Facility.

**Table ES-1 Key Cost and Revenue Values - Rock-Tenn Biomass/RDF Facility**

Category	Amount (2006 \$)
Capital Cost	\$140,900,000
Annual Operating Cost	\$14,325,640
Annual Steam Revenues	Range from \$11,500,000 up
Annual Electrical Revenues	Range from \$2,000,000 up

## Fuel Production Facility Analysis

### Ramsey/Washington Counties Resource Recovery Facility – Newport Facility

The existing Ramsey/Washington Counties Resource Recovery Facility located in Newport, Minnesota (Newport Facility) consists of a 129,000 square foot building on a 14-acre parcel. It is currently owned and operated by NRG Energy Inc. (NRG). The facility was originally constructed in 1986 to 1987. It is permitted to process 500,000 tons of solid waste per year. The current equipment consists of two processing lines, each rated at 50 tons per hour throughput. The facility can process approximately 1,700 to 2,000 tons per day of MSW. It could be expanded by the addition of two more processing lines once again each rated at 50 tons per hour. Thus, potentially the Newport Facility could be expanded to have the capability to process 1,000,000 tons per year.

Historically the Newport Facility has received an average of approximately 430,000 tons per year of MSW and produced an approximate average of 330,000 tons per year of RDF. Approximately 190,000 tons of RDF per year are transported to Xcel Energy's power plant in Red Wing and 140,000 tons are transported to Wilmarth (Mankato). Xcel's Wilmarth facility receives some RDF from the Elk River Resource Recovery Facility.

Working with representatives from NRG and other solid waste industry data sources, Foth & Van Dyke developed an estimate of the annual operating costs for the Newport Facility. The estimate resulted in a total estimated operating cost of \$22,090,700 (2006\$).

### Purchase Option

The Project Board has an option to purchase the Newport Facility from NRG at the termination of the Service Agreement in 2007. By July 2007, the Counties will have paid the full capital and financing costs of the Newport Facility as part of the Service Fee over the life of the 20-year Service Agreement. Article XI of the Service Agreement between the Project Board and NRG provides:

*Upon expiration, the Counties shall have an option to purchase the Facility and Facility Site, including all machinery, equipment, supplies, and other materials necessary for the continued operation of the Facility as an RDF production and resource recovery plant.*

The Service Agreement further defines the notice, negotiation process, and potential for arbitration to reach an acceptable purchase price. The context of the basis for the purchase price focuses on the value as an ongoing RDF production and resource recovery plant. Therefore, the approach to estimating the purchase cost of the Newport Facility for the Counties is to approach it as an investor in an ongoing business based on its potential financial performance. Using this approach, this report projects a purchase cost of approximately \$8,400,000 for the Newport Facility. There are numerous variables that may enter into a final negotiated purchase price. This estimate provides an initial basis for negotiations and preliminary financial analysis.

## Newport Facility Expansion

To meet both the Rock-Tenn and Xcel combustion plant needs for RDF from the Newport Facility would require permitting, design, and installation of two additional processing lines each rated at 50 tons per hour. The original Newport Facility design included consideration of adding a third processing line. In addition, the original facility tipping floor was added onto, and at the time of that expansion, consideration was given to the addition of the fourth processing line.

Foth & Van Dyke obtained information on the existing facility capabilities and worked directly with the primary equipment vendors for the existing process equipment to develop a preliminary estimate of the capital cost to expand and double the processing capacity. The total capital cost estimate for all the new equipment, as well as remodeling of existing equipment and building, is \$45,620,000.

Foth & Van Dyke also discussed operating and maintenance costs associated with such an expansion with NRG representatives and industry representatives. Significant economies of scale may be achieved with the increase in throughput. Where the projected operating costs per ton at the current average throughput are over \$51 per ton, the projected operating costs at the MSW throughput to meet the expanded RDF needs were reduced to just over \$34 per ton.

## Newport Facility Summary

Table ES-2 summarizes the key cost components of the Newport Facility used in this analysis.

Table ES-2 Key Cost Components - Newport Facility

Category	Amount (2006 \$)
Annual Operating Cost	\$20,090,700
Projected Purchase Cost	\$8,400,000
Projected Expansion Cost	\$46,620,000
Projected Change in O&M Cost	From \$51.37 down to \$34.10

## C&D Waste Processing Facility

C&D waste processing facilities have become more common over the last few years as more focus has been placed on reducing C&D landfilling and recovery of recyclable materials. According to available data, in 2004 there were approximately 1.3 million tons of C&D wastes landfilled in the Greater Twin Cities area and another 1.1 million tons of industrial wastes. Additional data needs to be gathered regarding these waste streams locally, such as the typical compositions and common generating sectors. Data is available from other locations, which were used in this preliminary feasibility analysis.

For this analysis, a C&D processing facility to handle 250,000 tons per year was considered. This would be a totally enclosed facility that includes both mechanical and manual sorting processes. The sorting process will separate metals, concrete, and brick for recyclables markets.

Other non-biomass materials will be separated (either by diverting from the process as by-pass residue or positively sorted). Based upon operating experience from similar facilities in other Midwest locations, it was assumed that 50 percent of the C&D could be recovered as a biomass fuel, another 15 percent will be recovered as recyclable material, with the remaining 35 percent assumed to be landfilled (this percentage may be reduced depending on the actual composition of the C&D waste stream and/or development of potential markets).

The capital cost for this C&D waste processing facility was estimated to be \$11.1 million dollars, with an estimated operating cost per ton of just under \$38. While these costs are less than the RDF facility cost estimates above, it is noted that a lower percentage of biomass fuel is projected to be produced from the C&D processing than the MSW processing. On a cost-per-ton-of-fuel-produced basis, the C&D process is projected in the analysis to be higher cost than the RDF facility. This could change if more materials can actually be recovered from the C&D waste stream than projected (depending on the actual composition of the local C&D waste stream).

### **Residues**

The types of residues from these facilities already have a history of regulatory control and proper management and disposal in the state of Minnesota. Process residues from the Newport Facility are currently landfilled in an MSW landfill. This is assumed to continue for purposes of this analysis. Process residues from the C&D Processing Facility can be landfilled in a C&D landfill, the location the materials would be managed if not recovered.

The ash from the Rock-Tenn Power Plant could some day be beneficially re-used; but for purposes of this feasibility analysis, the ash is assumed to be disposed in an ash monofill, similar to how ash is currently handled at other locations in Minnesota.

### **Permitting Process**

The process to gain permits for these facilities will be extensive. The steps will include an Environmental Assessment Worksheet, an Environmental Impact Statement, including an Air Emissions Risk Analysis (AERA), Title V air permit including an air dispersion modeling assessment, and local permitting needs.

The estimated time period for the permitting process is approximately 2.5 years. Assuming another 1.5 years for construction, it will be 2011 prior to beginning operation with 2012 being the first full year of operation.

## Financial Analysis

### Complex Variables

The financial analysis of a potential Biomass/RDF Facility for Rock-Tenn as considered in this study is complex in that it not only includes a new power plant at Rock-Tenn but considers the use of the Newport Facility to provide the basic fuel needs at Rock-Tenn and also the potential continuation of RDF to the Xcel combustion plants. In addition, biomass fuel from a new C&D processing facility is considered.

There is potentially new debt associated not only with the Rock-Tenn Biomass/RDF Facility, but also with the purchase of the Newport Facility, potential expansion of the Newport Facility, and construction of the C&D processing facility.

The operating costs at the Newport Facility are not linear, there are economies of scale as more MSW is processed. There are unknowns associated with the economics of the Xcel combustion plants. The potential steam and electrical energy sales rates per unit to Rock-Tenn are not yet established. Finally, the tipping fee that is marketable in the future is not fully known.

### Approach to Financial Analysis

To address these variables and provide a methodology to assess the financial impact of different scenarios, Foth & Van Dyke developed a Life-Cycle Financial Analysis covering the anticipated debt service period for the Rock-Tenn Biomass/RDF Facility (assumed to be 20 years from start of operations). The Financial Analysis addresses each of the potential components of the system.

A Base Case analysis was established on which different “sensitivities” using different assumptions could be tested for the financial impact. The base case and three sensitivities were as follows:

- ◆ Base Case – RDF from Newport
- ◆ Sensitivity 1 – Revised Steam, Electric, and Tip Fee Rates
- ◆ Sensitivity 2 – Expanded Newport – Both Rock-Tenn and Xcel Plants
- ◆ Sensitivity 3 – C&D Processing, Partially Expanded Newport, with Both Rock-Tenn and Xcel

As a place to begin, the Base Case was based on an assumption that RDF from the Newport Facility is used as the Rock-Tenn fuel source. The Xcel combustion plants are not included in the Base Case analysis.

Sensitivity 1 – Revised Steam, Electric, and Tip Fee builds on the Base Case by changing the revenue rates for each of these items as follows:

- ◆ Steam sold to Rock-Tenn raised from \$6.00 per mlb to \$6.50 (2006\$)
- ◆ Electricity sold raised from \$0.0387+ per kwh to \$0.05 (2006\$)
- ◆ Tip Fee raised from \$39.10 in 2011 to \$55 in 2011

Sensitivity 2 – Expanded Newport with both Rock-Tenn and the Xcel plants in operation builds on Sensitivity 1 and includes expanding the permitted capacity of the Newport Facility to provide RDF to Rock-Tenn and both Xcel plants.

Sensitivity 3 – Adds the C&D processing facility to the fuel mix while maintaining the operation of both the Rock-Tenn and Xcel combustion facilities. The Newport Facility expansion is assumed to be reduced in half.

### Financial Analysis Summary

Table ES-3 provides a summary of some of the key points in the Base Case and 3 Sensitivities.

Table ES-3 Financial Analysis Comparisons

Scenario	Base Case	Sensitivity 1	Sensitivity 2	Sensitivity 3
Fuel Source	Newport RDF	Newport RDF	Newport RDF	Newport RDF & C&D Biomass
Combustion Plants	Rock-Tenn	Rock-Tenn	Rock-Tenn & Xcel	Rock-Tenn & Xcel
Net cost per R-T MSW ton 2011 <sup>1</sup>	\$50.12	\$50.12	\$48.64	\$51.59
Net cost per R-T C&D ton 2011 <sup>1</sup>	NA	NA	NA	\$39.24
Steam price/mlb	\$6.00	\$6.50	\$6.50	\$6.50
Steam revenue 2011 <sup>2</sup>	\$13,168,788	\$14,266,187	\$14,266,187	\$14,266,187
Electric price/kWh	\$0.038719564	\$0.050000000	\$0.050000000	\$0.050000000
Electric revenue 2011 <sup>2</sup>	\$2,831,023	\$3,655,804	\$3,655,804	\$3,655,804
MSW tip fee 2011 <sup>2</sup>	\$39.10	\$55.00	\$55.00	\$55.00
C&D tip fee 2011 <sup>2</sup>	NA	NA	NA	\$25.00
MSW processing payment 2012 <sup>3</sup>	\$42.18	\$21.59	\$19.94	\$26.55
C&D processing payment 2012 <sup>3</sup>	NA	NA	NA	\$26.55

<sup>1</sup> Net processing cost per ton in 2011. Operating costs and revenue sources typically escalate at 3 percent per year.

<sup>2</sup> Year 2011 is the first year of operation. Steam and electric rates assumed to escalate at 3 percent per year.

<sup>3</sup> Year 2012 is the first year of full Rock-Tenn plant debt service (all costs online).

Foth & Van Dyke offers four key observations.

- ◆ Based on projected costs and revenues, the system appears to continue a need for some “subsidy” either in processing payments or excess electricity revenues.
- ◆ To get the subsidy (processing payment) in the \$20 per ton range requires an MSW tipping fee at approximately \$55 per ton, steam sales starting at \$6.50 per mlb and up, with electrical revenues starting at \$0.05 per kwh.

- ◆ Expanding the Newport Facility and fueling both Rock-Tenn and the Xcel plants has the lowest projected per ton cost under current assumptions. This approach would also result in the highest capital investment and quantity commitment to waste processing.
- ◆ Using C&D biomass raises the system cost based on current fuel recovery assumptions.

In addition, it should be noted that each \$0.50 increase in the starting price for steam from Rock-Tenn equates to a projected \$2.31 per ton decrease in the projected processing payment per ton. Also, for each \$0.01 increase in the starting price for electrical sales, the projected processing payment is reduced by \$1.54 per ton. Finally, for every \$1 increase in the starting tip fee, the processing payment is reduced by \$1.03 per ton (the dollar for the tip fee and the assumed 3 percent per year escalation built into the financial analysis).

There are many variables that will affect the economics of this potential waste processing and energy recovery system, including basic structures of future business relationships. For example, NRG is pursuing the sale of their resource recovery system assets, including the Newport Facility. The new owner could contract with the Rock-Tenn Biomass/RDF Facility operator to purchase fuel resulting in revenue offsets to MSW processing rather than steam and electrical revenues. Nevertheless, the financial analysis covers the “system” costs/revenues and relates them to the key revenue sources of energy (steam and electricity or fuels) and waste disposal (tipping fees and processing payments). The financial analysis provides an approximation of what energy revenues and disposal costs could be expected in such a “system.”