OPERATIONAL COSTS OF BREAKDOWNS AT THE COMMERCE REFUSE-TO-ENERGY FACILITY

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The authors have presented a useful tool for comparing the cost of downtime with the cost of various options for maintenance during such downtime. By knowing the cost of each hour of downtime, the plant manager can consider the economic effect of using overtime and/or contract labor to shorten total system outage time. Use of such economic comparisons would benefit the net bottom line at a plant.

The presentation left a few questions unanswered. The paper notes that the values of power sold, natural gas purchased, and refuse unprocessed vary on both the short term and the long term. Unfortunately, the author dismisses this by stating that the averages used may be more "accurate." How can that be the case? Could the authors give a few more details on these variations in values? Otherwise the reader is left to guess whether they are seasonal or daily night and day type changes. How great? Even if the paper continues to defend the use of the averages as reasonable, the reader may find the presentation more worthwhile if the magnitude and frequency of the cost change are offered for consideration.

The paper states that fluctuating power sales pricing and gas purchase pricing causes it to be economical to purchase and burn gas to produce power 6% of the time. Since this issue was mentioned in the paper, the reader should also be provided with some relevant statistics surrounding this issue.

It was interesting to note the percentages of downtime related to various component failures. Seven percent downtime for CO and SO_2 monitor failures has a significant environmental impact if the alternative disposal route was landfilling. Landfill is at the bottom of the priority pyramid established and recommended by the EPA. Has the EPA noted or commented on the impact of this factor? It seems reasonable to inform them of this factor and seek their comment on its environmental impact.

AUTHORS' REPLY

As Mr. Norton points out, using the cost of downtime to determine a maintenance strategy for individual outages is critical for optimization of plant economic performance. However, the authors have found that the study as discussed in the paper has been most useful in determining the cost of and allocation of resources to individual pieces of equipment, maintenance practices, or operations.

The price of power sold, natural gas purchased, and refuse tipping fees varies on different periods and to various degrees. The power sales price increases for the first 10 years by about 5% per year and then follows the avoided cost price with a \$0.09 per kWh floor. The price also varies throughout the year and each day based upon peak demand periods, from a minimum of approximately \$0.09 per kWh during non-summer nights to \$0.14 per kWh during summer weekday afternoons. The natural gas price fluctuates by a factor of approximately two, at times remaining fairly steady for several years and at other times rising or falling significantly over several months. The marginal tipping fee varies by approximately 25% depending on refuse supplies and plant performance.

These fluctuations and long-term changes affect the cost of reduced load and outages, but the variance is not included in the trends and calculations for several reasons. The maximum possible variance in the cost of a breakdown, due to changes in the price of power, gas, and refuse, is about 30%, but the cost estimate using the constant assumed costs is typically within 10% of the actual cost. Any breakdowns which result in a larger difference between the calculated and actual cost are noted internally.

A second reason for ignoring the variance in prices is because prices do not determine breakdown frequency or timing. By assuming constant prices, comparison over time and between two types of breakdowns is more accurate with respect to the overall performance of the equipment. Additionally, future failures may occur at any time, so it is more prudent to compare and predict equipment performance based upon typical prices rather than what the prices happened to be at the time of past breakdowns.

Nonetheless, the calculated cost of a particular breakdown is more accurately calculated by using the prices at that time. Evaluating maintenance and operating options in the event of a breakdown should, therefore, use the actual per hour cost or total cost for that incident.

During the summer peak period of 12 noon to 6 p.m. weekdays between June 1 and September 30, prices are such that sales of power produced with natural gas results in net income. This conclusion is based upon the prices of power and gas and the efficiency of the plant while on gas. The plant is permitted to use gas only for flame stabilization, among other reasons, so gas is not used solely to produce power. However, the burner is more frequently used during the above time periods for permitted reasons.

The cost due to emissions is not primarily due to monitor failures, but is due to curtailing operations in order to avoid violating 15 min, hourly, or daily limits. If the plant approaches the limit for a given time period and normal efforts to control the emissions are unsuccessful, the operator must commence shut-down procedures, which includes stopping refuse feeding and lighting the gas burner. If the time period concludes without exceeding the limits, the operator may then restart the plant and resume full production. Typically an incident such as this results in gas use and suspension of refuse combustion for 10–15 min. For reference, the four most stringent emissions limits and equivalent units are shown below.

Period	Pollutant	Permit Limit Total lb	Approximate Equivalent (Averages for the period)		Reduced Load Cost in 1993
			ppm @ 7% O_2	lb/MBtu	
Hour	SO_x	9	21	0.056	$82,000
Hour	CO	18	100	0.11	$50,000
Day	SO_x	100	9.7	0.026	$24,000
Day	CO	300	70	0.076	$21,000