

Where the Rubber Meets the Road: Scrap tires viable fuel in Akron

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In the mid-1990s, Akron Thermal LP took a proactive approach to reduce its reliance on natural gas at its Akron, Ohio, district energy facility. The company engaged in some 'new thinking' about fuel diversification, restarting a coal-fired boiler in late 1994 and introducing recycled waste wood in early 1996. Although waste wood was available, there were hurdles to maintaining required daily supply as well as maintaining consistencies and stabilization of the British thermal units. These hurdles forced management to look for the ideal fuel supplement – a solution that would be environmentally acceptable, readily available and would provide the added Btus needed to complement the operation without requiring it to turn to expensive natural gas. The answer: scrap tires, or 'tire-derived fuel' (TDF).

Exploring TDF

Historically, TDF has been used in cement kilns and power-generating facilities. Environmentally, TDF is a clean-burning fuel when used in a controlled-burn situation. It boasts 13,000 to 15,000 Btu/lb and has a low sulfur content. Many states have enacted laws to address the environmental impact of scrap tires – the ecological and health hazards they pose – and to provide funding for the development of markets for their use. In

Ohio, scrap tires have been banned from landfills since 1997. The ongoing and difficult problem of scrap tire disposal has forced Ohio legislators to follow the lead of neighboring states and create a funding mechanism to encourage the development of new scrap tire uses. Michigan, for example, has initiated proactive measures to foster and promote the use of TDF for power generation.

In early 2002, Akron Thermal's management arranged tours to several

Michigan power-generating facilities. In most cases, these generating facilities mix shredded scrap tires, at desired percentages, with their wood or coal supplies, creating a cheaper, high-Btu fuel. The Michigan plants' experience with TDF was positive.

Akron Thermal carried out further analysis of the technology, reviewing various technical papers and online research on the topic of TDF. The company developed a feasibility study in early 2002 outlining the potential benefits of TDF to



Akron Thermal's district energy plant in Akron, Ohio, began using scrap tires as a fuel supplement to reduce natural gas use – a move that is saving the company more than \$1 million annually.

Courtesy Akron Thermal LP. Photo David Rodgers.



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The scrap tires burned by Akron Thermal, purchased from an area tire recycler, arrive pre-shredded in approximately 1-inch-square chips with the bead wire removed.

its operation. This investigation gave the company the confidence to further pursue the possibility of TDF use.

As a fuel source, TDF is a petroleum byproduct; it has an energy value nearly equal to oil, 10 percent higher than coal and 2.5 times higher than wood fuel. TDF helps the environment by reducing reliance on nonrenewable fuels such as coal, coke, oil and natural gas. TDF use helps reduce tire stockpiles that become breeding grounds for mosquitoes and other pests. TDF also burns cleaner than coal, benefiting air quality, and helps keep tires out of landfills or from being

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illegally dumped. Testing done by the U.S. Environmental Protection Agency on air emissions from a variety of facilities – from industrial and electrical generating boilers to cement kilns – also showed that TDF could be burned with traditional fuels without exceeding the regulated emission rates for these types of facilities.

Despite these positive findings, Akron Thermal, like many companies, was reluctant to forego traditional fuels.

Based on its investigation and experience, Akron Thermal determined that switching from natural gas to waste wood and TDF would be complicated for a couple of reasons. It found that extensive testing and monitoring must accompany any changeover to TDF, which could lead to unanticipated expenses should problems arise.

A test burn exemption was therefore submitted to the Ohio EPA so the company could assess whether the air emission testing would fall within state mandates. The estimated time to complete this task was between six and 10 months (actual time frame was six months). The test burn indicated TDF was indeed a cleaner fuel alternative and boasted excellent operating data that assured success. Akron Thermal came away from its testing confident that it could successfully introduce TDF as a supplemental fuel.

Project funding was another issue for Akron Thermal. Given the ongoing maintenance of its two power-generating facilities, the needed capital for the TDF project was limited at best, despite the positive financial results of the company's feasibility study.

A year earlier, however, the Ohio Department of Natural Resources (ODNR) Division of Recycling had created a pilot program to provide seed money to spur new market development to help alleviate the environmental impact of scrap

tire piles. Knowing about the program, Akron Thermal approached the local Summit/Akron Solid Waste Authority, a quasi-government agency whose primary function is to manage the solid waste generation and recycling policies for Summit County, Ohio. With the agency's assistance, Akron Thermal developed a project narrative to highlight the TDF retrofit project. This narrative and a preliminary application were submitted to the ODNR review board for consideration. These documents provided an overview of the project to redesign and/or retrofit existing solid fuel-handling equipment to accept, transfer and commingle TDF with waste wood fuel and to deliver the fuel mixture to both solid fuel boilers.

Because of the project's scale and the limited time frame to initiate and complete it – as well as limited grant funds available for each year – Akron Thermal decided to divide the project into Phase I and Phase II. The company applied for and received two market development grants: one for the 2002 grant year and, a year later, one for 2003. The company estimated that once both projects were

Scrap Tire Recycling in Ohio

Ohio is well ahead of other states when it comes to tire recycling: Around 70 percent of the state's scrap tires are recycled, as compared with 26 percent nationally. What accounts for this? Scrap tires have been banned from disposal in Ohio landfills for nearly 10 years. Another factor is a lack of in-state users of tire-derived fuel chips.

Recycled uses include making the tires into new products like playground and garden mulch or rubber surfacing for walkways and doormats, shredding them as a substitute for gravel in landfill drainage systems and mixing with other solid fuels to produce electricity in industrial boilers and cement kilns.

For all its recycling success, Ohio still winds up with more than three million scrap tires illegally dumped around the state or in tire-only landfills. To encourage further scrap tire reuse, the Ohio Department of Natural Resources has created a Scrap Tire Market Development Grant Program to help manufacturers and utility companies cover the startup costs of incorporating TDF in their operations. Akron Thermal received a grant from this program, which helped fund its scrap tire test burn project.

Source: Ohio Department of Natural Resources: www.dnr.state.oh.us/recycling/awareness/facts/tires.htm



Tire-derived fuel is delivered pre-shredded and travels on a conveyor (left) at a speed that appropriately mixes TDF with waste wood from the conveyor at right just before entering the boiler.

completed - Phase I in 2004 and Phase II in 2005 - it could effectively accept and dispose of the equivalent of 1.5 million-scrap tires annually.

In total, the ODNR review board ultimately granted Akron Thermal \$660,000, a figure that does not include matching funds from the company. In January 2004, Akron Thermal obtained the federal and state permits needed for this project, and deliveries began.

Test Burn a Success

Akron Thermal uses TDF produced at Liberty Tire Recycling, approximately 40 miles from its district energy plant. The material is delivered pre-shredded to approximately 1 inch by 1 inch with the bead wire removed. It is placed into a bunker, which feeds the TDF onto its own conveyor. Traveling on this conveyor at a speed calculated specifically for the appropriate mixing ratio, the TDF is then added to the waste wood, the company's

primary fuel, and the mixture is delivered to two stoker boilers. The carbon/hydrogen ratio of the TDF is 12 to 1, with 8 percent ash resulting from the fuel mixture.

During Akron Thermal's first year of operation after the completion of Phase I - the 2004 heating season - the company successfully received approximately 1 million tires (estimated by weight) despite experiencing several operational problems. Chutes on the new fuel-handling system had plugged due to a design flaw that created a bottleneck where the TDF/wood mixture became lodged. To remedy the problem, in Phase II, the company redesigned the

fuel chute to eliminate the bottleneck. A wood screen was also installed to filter out and remove oversized wood. This helped eliminate overheating and twisting of the boiler grate shaft in the company's No. 2 boiler, which occurred on two occasions when an inconstant TDF-to-wood mix likely caused TDF to pile up on the grate.

These problems caused several periods of downtime and required the system to switch to expensive natural gas to keep the boilers operational. The company then decided to change the project scope of Phase II to address these system design problems. Phase II modifications and retrofit items were completed in time for the 2005 heating season.

On a cost-per-MMBtu basis, TDF is 50 percent or less of the cost of waste wood, Akron Thermal's lowest-priced fuel, and 10 percent of the cost of natural gas. Under Akron Thermal's current operation, the company burns up to

10,000 tons per month of chipped wood; 1,000 tons of TDF; and 5,000 tons of bituminous sulfur coal. Waste oil and natural gas are used for peaking.

The timing of this TDF project couldn't have been better, given the volatility of the natural gas market. Since the addition of TDF in January 2004, Akron Thermal has reduced its natural gas use by more than 50 percent. Based on current natural gas pricing that trans-

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lates to fuel savings of more than \$1 million annually. Now in its second heating season using TDF, with the benefit of system improvements, the company is having a very positive experience with the fuel and continues to investigate other environmentally friendly fuels for its operation.

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