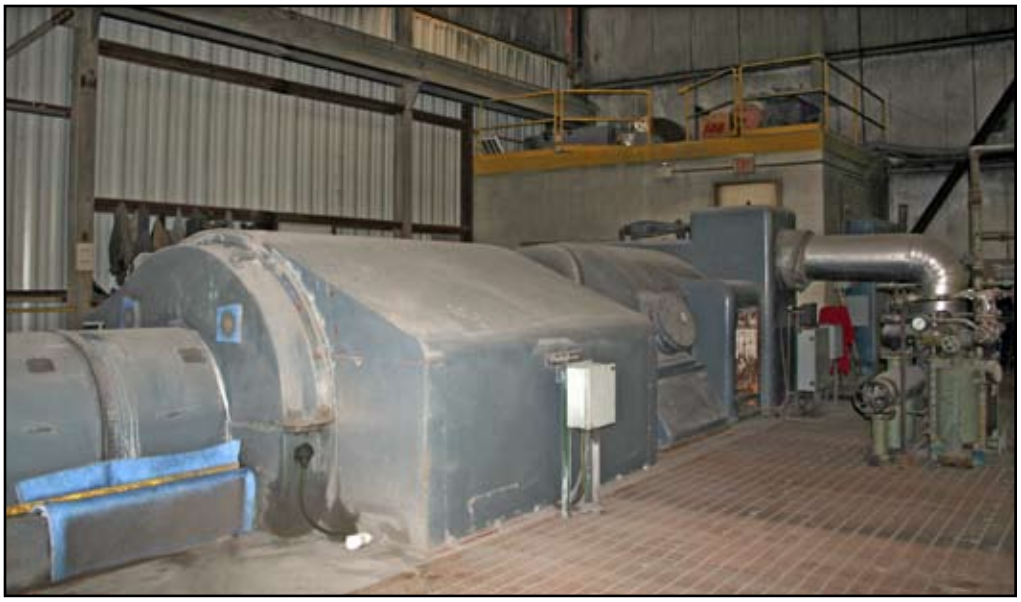
BFC Gas & Electric
Cedar Rapids, IA



Technical Specifications

100 MMBtu Energy Products of Idaho Fluidized-bed Gasifier

60,000 PPH Nebraska Package Boiler

7.5 MW Westinghouse Turbine Generator

Project Cost: $12,500,000

AERLP: $250,000

Loan Term: 10 yrs.

Lender: Guaranty Bank & Trust, Cedar Rapids, IA

Lender Share: $12,250,000

O & M Cost: $1,056,000

Est. Payback: 10 yrs.

Installation Date: June 1998

A Cedar Rapids biomass energy plant generates enough electricity to power about 4000 homes while diverting 150 tons of solid waste per day from area landfills.

In operation since June 1998, BFC Gas and Electric relies primarily on "clean, industrial byproducts" for its fuel source, according to company vice-president Jeff Carter who founded BFC with partner Warren Dunham. These materials include sawmill waste, outdated seed corn, non-recyclable paper, and many similar waste products.

Construction debris was once a significant fuel component but was deemed too difficult to work with by 2007. As a replacement, BFC began experimenting with railroad ties: a waste problem on par with used tires, says Carter.

The company charges a tipping fee to compensate for the high cost of processing the solid fuel products. They also earn revenue through their ability to burn sensitive materials confidentially and completely, such as biotech plant material with proprietary genetics.

The fuel stocks are shredded, blended, and then combined with superheated sand (1200-1400° F) in a low-oxygen environment to produce a low-Btu, methane-based gas. The fuel is then piped to a 60,000 PPH Nebraska boiler that produces steam to drive a 7.5 MW Westinghouse turbine.

The plant generates an average of nearly 23,000 MWh of electricity annually, but boiler failures and process challenges have plagued the project since it began. The plant brings in more than $1 million each year, according to Carter's estimates, but revenue falls well short of the $1.74 million BFC has spent annually to operate and upgrade the plant.

"Anytime you're on the cutting edge, it's an expensive learning curve," says Carter.

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Project Performance

Year	Production (MWh)	Working Hours
12/15/98 - 5/19/99	10,558	2,202
5/20/99 - 5/31/00	25,838	5,664
6/1/00 - 5/31/01	20,920	4,504
6/1/01 - 5/31/02	28,043	6,803
6/1/02 - 5/31/03	25,773	6,703
6/1/03 - 5/31/04	22,203	5,936
6/1/04 - 5/31/05	14,195	4,198
totals	147,530	36,010
avg.[1]	22,829	5,635

[1] Notes: avg. excludes first year because data not complete; avg. includes slightly long FY00.

BFC had hoped to operate at a 6.5 MW rate, but the design of their retrofitted natural gas boiler limits them to 70% of this capacity. In addition, persistent boiler tube failures and boiler pluggage have caused frequent plant shutdowns.

The boiler problems stem from the migration of sand particles into the boiler where they erode the heavy steel boiler tubes. In addition, gas by-products fuse in the boiler forming slag deposits that cause corrosion and overheating. The gasification of seed corn, for instance, produces potassium and sodium, both of which are particularly prone to slag creation.

Shutdowns due to boiler problems occurred every seven to ten days during the first two years of operation. Each shutdown requires a minimum of three days downtime as it takes two days simply to cool down and then restart the plant.

BFC increased uptime from about 62% to 77% by systematically upgrading to tubing plated with Inconel, a nickel-based alloy, beginning in 2001. They also invested in a gasifier overhaul to improve combustion and limit sand migration; an internal boiler camera to visually monitor the combustion chamber; and acoustic cleaners that use low-frequency sound to disrupt slag buildup.

And they continue to experiment to find the best mix of fuels for clean, efficient combustion. This is no easy task, as the types of materials they receive changes constantly.

Though the biomass gas proves problematic in the plant's operation because of its "dirtiness," Carter says it's far cleaner and more efficient than burning the materials directly. He adds that the gas burns cleaner even than natural gas, with levels of nitrogen oxides, sulfur dioxide, carbon monoxide, and other chemicals falling well below allowable standards.

"The great thing about gasification is that the high temperatures create a much cleaner fuel because the materials are consumed so completely," says Carter.

Furthermore, the relatively low-volume of high-density ash consistently meets environmental standards. The ash is used at area landfills for odor control and as an ingredient in compost that is sold publicly. The plant was required, though, to mitigate particulate emissions by installing a baghouse in 2005 at a cost of more than $300,000.

Despite BFC's difficulties, Carter remains optimistic that they will perfect the waste-to-energy process, but thinks electricity generation may not be their best market. Instead, Carter envisions owning and operating other plants that generate steam to distill ethanol and drive other industrial processes.

Though their AERLP loan was a small piece of their financing, Carter says it "gave credibility to the project" when seeking additional funds.

"Having the backing of the Iowa Energy Center not only shows that we've done our homework to secure other funds, but also that our plan has been reviewed by a respected organization and is worth funding in their view."

ALTERNATE ENERGY AERLP REVOLVING LOAN PROGRAM

The Iowa Energy Center's Alternate Energy Revolving Loan Program (AERLP) plays a supporting role in stimulating renewable energy development within the state. Since its inception in 1996, the AERLP has supported numerous wind, biomass, solar, hydro, and hybrid projects.

Successful applicants receive a low-interest loan from a combination of Energy Center and lender funds. The Energy Center provides loan funds equal to 50% of the projects financed cost (up to $250,000) at 0% interest. Matching financing must be obtained from a lender of the applicant's choice. The maximum loan term for the Energy Center's funds is 20 years.

The lending institutions are responsible for financially qualifying the borrower, while the energy center assists in technically qualifying the borrower. By partnering with expertise from lending institutions the Energy Center is able to cost-effectively process the loans in a timely manner and maximize the impact of the loan program.

Eligibility

The AERLP is open to all individuals and groups who want to build renewable energy production facilities in Iowa. Utilities that are not required to be rate-regulated are not eligible. AERLP loan funds may not be used to refinance an existing loan or be applied to existing alternate energy facilities.

Application Deadlines

January 31
April 30
July 31
October 31

For more information

Contact the Iowa Energy Center,
(515) 294-8819
www.energy.iastate.edu

The Iowa Energy Center is dedicated to improving Iowa's energy efficiency and use of renewable energy through research, demonstration, and education.

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