EnergyTrust of Oregon, Inc.

STIRLING ENGINE BIOGAS GENERATING PROJECT

SUMMARY

The City of Corvallis (Corvallis) has requested $49,424 to support 55KW of generation using a new Stirling engine fueled by digester methane produced at their wastewater treatment plant. The request came through the Open Solicitation Program approved by the Board. The application met all the program's requirements.

Staff recommends its approval. This project will benefit the Energy Trust in the following ways:

- The project provides an example of private/public partnership that will be of interest to other municipalities.
- Demonstration of the new technology can facilitate similar installations at wastewater plants and other co-generation applications.
- The project provides a very visible urban example of an innovative renewable technology, helping to expand market opportunities.

BACKGROUND

Wastewater treatment facilities that produce electricity from digester gas have been generally limited to two equipment options: reciprocating engines, which have pistons and valves and are a much older technology, and microturbines.

The Corvallis wastewater treatment facility has been successfully experimenting with a third technology, the Stirling engine. They have been the test site of a beta version of an engine developed by STM Power. This test is complete and a new, commercial version of the engine is now available.[1] The proposed project would replace the beta model with a new, commercial ready design from STM. It will employ much of the same physical connections built for the beta test.

Microturbines and Stirling engines have two major advantages over reciprocating engines: 1) they pollute less; and 2) they are available in smaller sizes. Microturbines are available at sizes as low as 30 KW. Both Stirling engines and microturbines are 20%-30% cleaner than flared gas. They can reduce NOx emissions 75% or more, compared to reciprocating engines.

The smallest reciprocating engines that can operate effectively in a wastewater treatment facility produce 250 kW of power. Only 7 wastewater treatment facilities in Oregon produce enough digester gas to operate a reciprocating engine. At least, 11 wastewater plants produce enough gas to operate a microturbine or sterling engine, but presently flare the gas.

[1] Clean Water Services Durham Wastewater Treatment Plant cancelled their microturbine project, citing: costs for equipment to clean the biogas increasing beyond budget; difficulties in the municipal, capital acquisition process; and, the City of Portland's emerging problems with their microturbines.

The smaller size and air quality advantage of microturbines also provides greater flexibility. As digester gas volume increases with population growth, additional generating capacity can be added much sooner. Also, wastewater treatment facilities often have air quality permits, which may be able to accommodate additional microturbines where additional reciprocating engines would be prohibited.

DESCRIPTION OF PROPOSED PROJECT

- A new, commercial 55KW Stirling engine and related installation.
- Fueled by digester gas at the sewer treatment facility.
- Estimated annual generation is about 409,530 kWh per year.
- All energy will be used onsite and will provide 12% of the plant's electricity needs.
- The Corvallis wastewater plant is a customer of PacifiCorp.
- The project life for this specific technology application is 5-10 years depending on the actual cost of a major overhaul in the fifth year.
- The Energy Trust will own any green tags generated by the project for the first five years and 50% of those generated in the second five years.
- The expected project completion date is July-August 2004.

The City of Corvallis has a continual surplus of sewer gas. Currently, 70% of that gas is flared and wasted. Generation from sewer gas is difficult due to pollutants that foul internal-combustion engines. The Stirling engine burns with open combustion and thus shows great promise for reducing engine maintenance expense. The Stirling engine is quiet, modular and low in air pollution, it would also be suitable for a variety of co-generation opportunities.

The developer has a successful track record developing several on-site generation projects. In addition to the Energy Trust's goals, the project supports the City of Corvallis goals for sustainability and will be used to create public awareness of the benefits of small-scale renewable energy.

Since the City of Corvallis is limited by budget and staffing constraints, the project will be owned and operated by a third-party developer under a shared-savings arrangement with Corvallis. The developer will be responsible for operations, maintenance, management and insurance on the facility. The location was the site for a successful beta test of the generation equipment last year. Hence, the site is ready for a permanent installation of the new generator.

This project is the demonstration of new technology that appears to have significant benefits. However, as with any new technology there are uncertainties. The manufacturer will warrant the installation for five years and financing has been arranged for a five year term. The expectation is that after five years, the developer will refurbish the engine for a further five years of operation. Assumptions beyond ten years are highly speculative.

COST ANALYSIS

The table below summarizes the comparison of project costs and market values. The analyses assumed a ten year life, with a refurbishment in the fifth year. The refurbishment costs are included in the operations item below.

Cost/Value (NPV)	$
Installation	118,451
Operations, returns to investment[2]	126,653
BETC	- 30,205
Net Tax benefits of depreciation	- 36,131
Value of power	- 82,897
Above Market Cost	95,871
ETO share	49,424

ODOE will assist with finding a pass-partner for an Oregon Business Energy Tax Credit (BETC). The Energy Trust share represents 52% of the net, above market costs.

PROPOSED PAYMENT

ETO will pay on production over the first five years. Funds will be escrowed. ETO will not pay for power not produced and unclaimed funds will return to ETO.

BENEFITS/DEMONSTRATION VALUE

This project is a new application in Oregon and is intended to demonstrate the use of small-scale technology for smaller wastewater treatment facilities. If successful, it will open new opportunities for biogas in Oregon. Standardization and experience should also make the application less expensive and easier to implement. As noted above at least 11 other waste treatment facilities in Oregon could take advantage of this technology. As population grows, this number will expand.

The project will provide an alternative test to the City of Portland's microturbines installed at the Columbia Waste Treatment Facility. Further, the lease arrangement may help define a faster path for municipalities to develop and install renewable technologies. Working through the capital acquisition process for municipalities adds another year to the process and several more hurdles.[3] While leasing is not a new concept, it has not been embraced significantly in this field.

ACTIONS

Staff strongly supports this project. It builds on a successful beta test of a new technology, continues the effort to open the biogas arena to more renewable development, creates another financial mechanism for project participation and offers a low-risk opportunity.

[2] Return to investment and management were calculated at 10%, the low end of the standard range for generation projects in the current market. The developer is willing to accept an effective lower rate to partner with Corvallis.

[3] The City of Hillsboro withdrew their application for the 200 KW micro-hydro project citing, among other things, the length and difficulty of getting approval for additional capital acquisitions.