Technology Assessment Report

Environmental Management Technologies, Inc.

Prepared for
The Massachusetts Strategic
Envirotechnology Partnership
STEP

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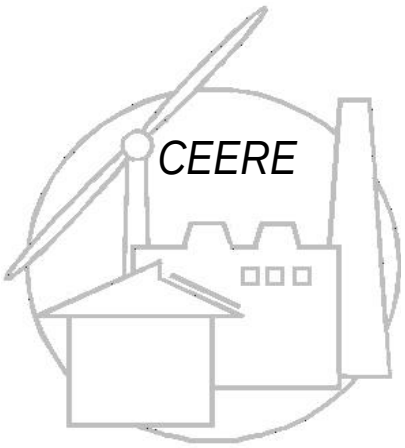
Prepared by

Center for Energy Efficiency and Renewable Energy
University of Massachusetts Amherst
Engineering Laboratory Box 2210
Amherst, Massachusetts 01003-2210



Center for Energy Efficiency and Renewable Energy

University of Massachusetts Amherst
UMASS

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PREFACE

The STEP technology assessment process is designed to identify those technologies that will support the economic and environmental/energy goals of the Commonwealth of Massachusetts and may benefit from STEP assistance. The process is meant to be one of screening, in which technologies are evaluated by independent technical specialists. Recommendation from this process does not constitute an endorsement of the technology or of the absolute validity of the technology. Rather, STEP technical assessments attest only that, through the screening process, the reviewers feel there may be benefit to the Commonwealth of Massachusetts.

Executive Summary

Applicant: Environmental Management Technologies, Inc.

642 Brush Hill Road

Milton, MA 02186

Environmental Management Technologies, Inc. (EMT) is a private corporation established in Massachusetts in February of 1994 to develop, manufacture and market equipment for computer-based monitoring of fossil fuel underground storage tanks (UST). EMT offers a service for a fee to UST and gas station operators that improves their UST monitoring system.

Technology

EMT manufactures "SiteWatch", a microprocessor-based system for maintaining and analyzing Underground Storage Tank (UST) information. The company developed the equipment and copyrighted the necessary software to provide tank owners with data related to fuel and water tank levels and trouble conditions, and to detect any signs of improper operation or possible leaks. The system has a site control processor (SCP) which collects, stores and transmits data from the tank gauge and from Pump Monitoring Modules (PMM) to the central computer. The system has a battery backed clock and memory with a standard industrial PC/DOS (Personal Computer/Disk Operating System) board processor. It has standard add-on cards for serial I/O (Input/Output) and memory. The PMM is a device that collects data from gasoline pumps or fuel flow meters on boilers, and transfers the information to the site control processor. The summary of data is transmitted via modem to the EMT host site once every 24 hours, where it is analyzed. The aim of the service is to achieve automatic inventory control, leak and over-flow detection, and other information needed for regulatory compliance reports. The system will automatically store data on fuel delivery, fuel use and fuel losses that have not been accounted for. Anomalies are immediately brought to the customer's attention. Otherwise the client receives monthly reports.

Competing Technologies

There are no other known companies that provide the same type of service. A certain number of companies have the knowledge and resources to develop a competing service, including tank gauge manufacturers, fuel management and system manufacturers and environmental control firms, but they are currently doing so.

Environmental/Energy Benefits

Human error has often caused long term hazardous releases to the environment. Leaks went undetected, for example, because operators did not adhere to the daily operational and maintenance protocol. EMT's automated daily inventory and tank monitoring service can help detect leaks early and reduce environmental hazards. In addition to its environmental benefits, the system offers the UST owner the opportunity to prevent fines resulting from unintentional errors and also to prevent theft.

There are no direct energy savings associated with this technology.

STEP Support Required

Energy Management Technologies Inc. has asked for help from STEP in the following areas:

1. Approval of technology as an environmentally and economically viable UST management system

2. Introduction to potential customers in the State government agencies

3. Clarification of the state bidding process, and how a new company can get help in getting started

4. Financial support for the development of a new technology

Assessment Findings

The data presented by the EMT and the documentation on the existing system in operation indicate that the technology is capable of performing as claimed. The claim is supported by a customer who expressed satisfaction with the service provided. There are certain limitations to the technology that can be improved by incorporating temperature readings into the fuel pump monitoring modules, but overall, the system offers a sound business opportunity and could help reduce human error which can result in harmful effects to the environment.

Market assessment

EMT is a startup company founded in February 1994 to provide on-site monitoring of Underground Storage Tanks (UST) using computerized data collection and transfer. The data help UST owners manage their tank inventories and collect data for compliance reports. The company has a team of five people that share responsibilities for technical, administrative and marketing services.

We expect the company to succeed because its product can save time and money when used as part of an integrated system. Application can help achieve automatic inventory control and leak and overflow detection, and can produce regulatory compliance reports.

If STEP verifies the performance of the EMT system as a viable technology, the company can begin to develop ongoing customer relationships. This is critical to EMT, since the technology is new and potential customers may be hesitant to take it on a trial basis. Once the technology becomes accepted by the regulatory community, however, competition from other companies is expected to increase rapidly.

The primary competitors will probably be tank gauge manufacturers. Since EMT technology uses data from the UST gauge, gauge manufacturers will be forced to start selling this as part of their standard service offering. They also have the financial resources to lower prices, in what will be a highly competitive market.

The key to the EMT's competitive strategy will be low cost. The purpose of the technology is to make monitoring and recognition of irregularities simply and easy. There are still some details that must be addressed before the technology is perfected. As the method gets more robust, it will become a commodity service where the low cost supplier will dominate the market.

EMT has an opportunity in the next few years to establish itself as a credible technical service provider. The company's stated goal of being bought out by a large firm is realistic if its business development efforts are successful.

Technology performance

The technical service offered by EMT, as described in the application, is on-site monitoring of fuel consumption and mandatory leak testing for UST. The technology is based on hardware devices which collect information using tank gauges, fuel flow meters and copyrighted software.

The equipment takes the information from the fuel gauges and stores it in a Site Control Processor (SCP). EMT's central computer contacts the SCP via modem and prepares a status report for each tank. The system has a battery backed clock and memory with a standard industrial PC/DOS board processor. It has standard add-on cards for serial I/O and memory.

The Pump Monitoring Module (PMM) is a device that collects data from gasoline pumps or flow meters on boilers and transfers the information to the site control processor. The summary of data is transmitted via modem to the EMT host site once every 24 hours, where it is analyzed. The aim of the service is to achieve automatic inventory control, leak and over-flow detection and regulatory compliance reports. The system will automatically store data on site fuel delivery, fuel use and losses which have not been accounted for. Anomalies are immediately brought to the customers attention. Otherwise the client receives monthly reports.

Quality of Technical Information Submitted

EMT's automated daily inventory and tank monitoring service is not a stand-alone system. It must be interfaced into the existing UST system and be connected to the existing tank gauge and pump gauges. The technical disclosure, includes a list of components and only a general description of how the system works. The documentation does not provide any indication of how the interface is accomplished. It is reasonable to assume that it would not be hard to achieve such interfacing but this information is not necessary for the technology evaluation at this stage. Data analysis and interaction with central monitoring system is accomplished by the use of proprietary MS-DOS® based software. There is no information provided about the software because it is proprietary and is expected to be patented with the technology. The system collects data from the tank gauges and pump flow meters and stores them in the on-site control processor. EMT's central computer places a daily telephone call via modem and transmits the data to a file server. The software then analyzes the data and prepares a daily report for each tank.

At this point there are several clients in New England that are successfully using this technology. Some of them are:

Spare Memorial Hospital, Plymouth, NH

Wentworth-Douglass Hospital, Dover, NH

Energy North, Inc., Merrimack, NH

Dairy Mart, Vernon, CT

The sample of the UST inventory audit report produced for one of the technology users is part of this technical report. The UST inventory audit reports consist of ten status reports of which the most important one is the Compliance Status Report. This report is required by state law, and in Massachusetts the company has to perform a test once a month for each UST. With the help of EMT's technology this report can be easily performed as needed, and the frequency can be negotiated with EMT as a part of a monthly service agreement. Also important are the Daily Inventory Report, the Purchase History Report and the Balance Report. They provide the owner with extensive information about daily fuel use and delivery, and point to problems if they can be predicted from the data.

Claims and Use of Proposed Technology

The technology allows for the generation of nearly real-time data that can guide UST owners and answer important questions related to tank status in a timely manner. This allows for more frequent sampling, and reduces the chance of undetected leaks. Appropriate implementation of this technology clearly has positive technical implications for environmental contamination assessments, and moreover, the technology itself has relatively low environmental impact and consumes little energy.

EMT's fees are divided into two categories: the cost for the installation of required hardware, and the charge for monthly UST monitoring. EMT's current hardware cost is $675 for the Site Control Processor, $350 for the Pump Monitoring Module (explosive-proof enclosure) or $150 (non-explosive-proof enclosure). Generally these hardware devices are marked up by 40%. The installation cost is $520 at present, but is expected to decrease.

The average fee for the monthly monitoring service ranges from $50-$85 per month per UST, depending on the tank construction and frequency of use. A volume discount will be offered to customers with multiple sites.

The EMT's system operation is based, in part, on the information provided by tank level monitors. The system provides accurate and automatic fuel inventory control, and continuously monitors selected tank conditions such as the height of the fuel, and the water and fuel temperatures. The information is delivered by probes installed in the tank.

Fuel and water levels are determined from the vertical position of fuel and water floats. The water float is designed to sink in fuel and float on water. Magnets placed inside each float generate a magnetic field which is detected and converted into fuel and water level measurements with high accuracy (±0.0005 inches). Temperature is measured at five different locations along the tank height. The five locations represent equal-volume cross sections of the tank.

Multiple temperature measurements are required to compensate for different liquid temperatures at different heights. Net gallons, which represent the actual volume of fuel, are determined using gross gallons - or the measured fuel level - and the average fuel temperature, based on a table that is programmed into the fuel monitoring system.

Values are calculated for perfectly round tanks installed according to the manufacturer's instructions. If the tank is not installed according to specifications, or if it is dented during installation, the readings will be inaccurate, since EMT's product does not correct for this. It is not standard practice to test whether a tank is properly installed.

The tank gauges store historical and current status data. The data can be displayed on the LCD or transmitted to the serial port. These gauges have been designed to meet various Environmental Protection Agency and third party safety standards.

The other information required for the operation of EMT's system is delivered by the fuel pumps. For one large group of UST owners, retail gasoline stations, this information comes from electronic gasoline dispensers. These units track gasoline pumped with both mechanical totalizers and electronic totals stored in the dispenser memory. These totals are used by EMT's SCP through a serial port to monitor fuel use. An alternate source of those totals may be a cash register which can be polled via a serial communication link, using an appropriate protocol, to the SCP.

For other UST owners, consumption of fuel is determined from fuel meters. These readings are also routed to the SCP.

All the data on fuel level, temperatures, and fuel pump dispenser readings are collected with software that polls site devices at predetermined times each night, and saves the information in a database in EMT's central computer. The data is checked for irregularities and the customer is notified if they exist. Otherwise, monthly reports designed to meet state and federal record-keeping requirements are produced and mailed to the customer.

Technical Assessment Findings:

Based on the UST inventory audit reports provided, conversations with EMT's personnel and a review of on-site system operation, the conclusion is that the EMT's system provides a dependable and reliable service. The quality and quantity of information provided in the inventory reports is sufficient to supply the owner with information about daily fuel use and delivery. These reports are particularly important for sites which are not involved in fuel sale (like hospitals), and monitoring of fuel consumption and fuel reordering are left to boiler operators. The reports can help improve fuel handling and reduce risk of long term undetected fuel leaks.

So far there were no leaks detected by the system. The users are satisfied with its operation as expressed in the letter from one of them that can be found elsewhere in this report. The only time the system was not able to provide the required information was after an on-site power failure that resulted in a loss of two day's data.

The system of monitoring and analyzing UST information also increases the comfort level of owners and on-site personnel through its ability to analyze tank data automatically on a day-to-day basis. This can lead to prompt detection of abnormalities, and signal possible leaks before they become a serious threat.

The system can also help make timely complaints in cases where the delivery log-book and readings from the tank monitoring system have discrepancies. The procedure of delivering the fuel requires the measuring of the fuel level in the UST using a stick before and after the delivery. If the record of delivery differs from the stick and EMT system's showings, the UST owner has a legitimate reason for complaint. In a situation like this, and also if the stick readings were not performed, EMT's system is a valuable tool for any UST owner.

The technology is already in use at several locations in Massachusetts, Connecticut and New Hampshire, and the users are satisfied with system operation and the quality of the data provided. But while users have not complained about it, under some circumstances there is a problem determining the accurate number gallons used. When the UST is far from the fuel pump, and the use of dispensers is infrequent, the measured fuel temperature in the tank is lower than the fuel temperature at the pump. According to EMT's reports, however, this has not been a significant obstacle to obtaining satisfactory results with the system. Since the dispensers are manufactured by others, and have to meet certain performance and safety requirements, it is unlikely to expect that the fuel temperature measurements can be incorporated into these dispensers.

When the monitoring system is used for boilers and generators running on #4 or #6 fuel oil, the fuel temperature is not measured. Instead, it is introduced into the calculations as an input parameter and is prescribed to be equal to the recommended fuel temperature set up by the burner manufacturer. Even though this temperature can be maintained within a narrow range, its measurement can improve the reliability of the technology. A temperature sensor can be installed at the same time as the fuel flow meter, and its presence can influence the accuracy of the results. Although the EMT system is still effective with the prescribed temperature, results are better when the temperature is measured, especially with heavier fuels which must be preheated for proper burner operation.

Energy and Environmental Impact of Technology

Human error has often caused long term hazardous releases to the environment. EMT's automated daily inventory and tank monitoring service can help detect leaks and eliminate environmental hazards. In addition to its environmental benefits, the system offers the UST owner the opportunity to prevent fines resulting from unintentional errors and also to prevent theft. It should be noted, however, that these goals are achievable without an EMT system, if the UST owner is diligent enough.

The EMT's technology, if applied properly, can have a positive environmental impact in several ways. The speed of analysis makes data available for making important decisions in a timely manner. Daily tests provide significantly more information than the required monthly tests, providing potentially valuable information that would not otherwise be obtained. Appropriate implementation of this technology, which generates no pollution itself and consumes little energy, clearly has positive implications for environmental monitoring. There are no health or safety benefits or hazards for a on-site employees resulting from the use of this technology.

There are no direct energy savings associated with this technology, though leak prevention could conserve fuel and save energy used for clean-up.

Recommendations

Based on the potential environmental impacts, we recommend that the proposed technology receive STEP support.