MINNESOTA TECHNICAL ASSISTANCE PROGRAM

Report Summary

UNIVERSITY OF MINNESOTA

Ethanol benchmarking and best practices

Fuel ethanol production is a complex, energy intensive process, that is experiencing a significant growth throughout the United States. This is a summary of the ethanol study conducted by MnTAP in 2008.

The *Ethanol Benchmarking and Best Practices** study provides an overview of ethanol production and potential environmental issues related to the ethanol production process. This study also introduces the potential for improvements in using resources including energy and water as well as reducing environmental impacts. Additionally, this report highlights the resource conservation challenges faced by facilities to conserve resources.

Fuel ethanol production is a complex, energy intensive process, that is experiencing a significant growth throughout the United States. Therefore, benchmarks were developed during this study and include ethanol yield in gallons per bushel of corn used, energy use per gallons of ethanol produced, and water use in gallons of water used per gallon of ethanol produced. Typical best practices include efficiencies related to water use, renewable energy sources, or waste heat recovery processes.

Questions Answered

- Do new facilities use fewer resources than older facilities?
- Can retrofits be made to older facilities to improve performance?
- Do the potential savings justify the significant capital investment required to implement changes in facilities?
- Can low-cost actions be taken to reduce environmental impact or energy and water consumption?
- What areas need support and where can MnTAP provide that support?

In an effort to answer these questions MnTAP obtained 2006 facility information from publicly-available data sources. Site visits were used to validate best practices and to potentially assist with energy efficiency or pollution prevention practices.

Findings

Based on the information obtained within the study's constraints of limited time and access, the following conclusions were made about the ethanol industry in Minnesota. This is not a complete list; the entire report can be found on MnTAP's website <www.mntap.umn.edu>.

Newer facilities are using fewer resources than older facilities.

Generally newer and larger facilities should be more efficient, but some older or smaller facilities have been retrofitted and have efficiencies similar to new facilities. There are two older or smaller facilities that have thermal energy use indexes less than 34,000 Btu/gal, only slightly above the level being guaranteed by new plant designers in 2007. It is possible to retrofit existing plants to achieve reductions in resource use.

MnTAP • 200 Oak Street SE, Suite 350 • Minneapolis, Minnesota 55455-2008
612.624.1300 • 800.247.0015 (Minnesota only) • FAX 612.624.3370 • www.mntap.umn.edu

Low cost actions that will achieve reductions in resource use are possible.

The following examples will provide you with a quick return on your investment: steam trap maintenance, use of high efficiency motors, minimizing air compressor leaks, lighting upgrades, and proper steam pipe insulation. Short-term savings are not specific to ethanol facilities but are general practices that apply to all industrial facilities.

Natural gas prices will drive innovation towards further reductions in energy consumption.

Even though some best practices require a high capital investment, if savings of 20-40% can be achieved, the payback in fuel savings makes these investments attractive. An indirect benefit of many energy conservation measures (e.g. fractionation or raw starch hydrolysis) will be reduced water consumption.

Improvements in water quality are being driven by the MPCA's regulatory process.

Regulatory oversight has increased as permits get renewed, which should reduce water quality impacts from facilities. The water quality impacts related to TDS were not foreseen with the initial permitting of ethanol facilities and may be related to increased rates of recycling. Facilities are being required to improve the capabilities of their water treatment processes. Modifying ethanol plants to include treatment for wastewater will be considered in the cost of doing business.

Best Practices

Best practices are widely discussed at industry conferences and in trade publications. Best practices include practices that leverage opportunities within the local market. The following are examples of best practices for the ethanol industry.

Water Quality and Efficiency

Water Resource Planning Prior to Site Selection. An accurate, well-defined water balance diagram and water treatment design are important first steps in the ethanol project site selection process. Understanding the water quality issues related to supply and discharge are key to determining the types of equipment needed to treat the water. Additionally, the availability of water supply is critical to obtaining approvals for water appropriations.

Recycling Existing Wastewater Discharge Streams
Recycling wastewater in the process stream may require a change in treatment chemicals and the potential effects on the process must be monitored to ensure no adverse reactions occur. An example of an adverse reaction would be a decrease in the fermentation rate. Wastewater streams that could be recycled in the process stream include stormwater, boiler blowdown, reverse osmosis (RO) reject water, softner water, iron filter reject water, and cooling tower blowdown.

Zero Discharge of Non-Contact Utility Water. This practice is commonly called "Zero Liquid Discharge Technology". Using appropriate equipment, a facility can treat the plant's non-contact utility water so there is no water discharge.

For additional information on water quality and efficiency best practices, refer to MnTAP's fact sheet Best practices for dry mill ethanol plants: water quality and efficiency #134FS.

Energy

Use Ring Dryers vs. Rotary Dryers. Although more costly, ring dryers consume less energy than rotary dryers because they have less air leakage. It is estimated that a ring dryer consumes 5-10% less energy than a rotary dryer.

Use of Renewable Energy. Ethanol facilities have the potential to supply much of their own energy through the use of renewable fuels. For example, facilities may use local sources of biomass such as wood waste, corn stover co-products such as corn syrup, or DDGS. For electrical supply, facilities may use energy from wind turbines.

Air Quality

CO_2 Recovery The most significant air quality best practice is related to CO_2 emissions. Each bushel of corn produces about 18 pounds of CO_2, resulting in over 130,000 tons of CO_2 each year for a 40 MGY facility. Facilities can collect this gas, compress it and sell it to other facilities for processing. A typical use for captured CO_2 is carbonated beverages. Transportation is the most significant factor for the feasibility of CO_2 recovery. The facility using the CO_2 must be close enough so the transportation cost is not excessive. CO_2 is recovered in at least five Minnesota facilities.

**All company data used in compiling the Ethanol Benchmarking and Best Practices study is confidential, specific company names are not listed in the report.*

For More Information

MnTAP has a variety of technical assistance services available to help Minnesota businesses implement industry-tailored solutions that maximize resource efficiency, prevent pollution, increase energy efficiency, and reduce costs. Our information resources are available online at <mntap.umn.edu>. Please call MnTAP at 612.624.1300 or 800.247.0015 for personal assistance or more information about MnTAP's Intern Program.