



# Identifying Environmental Process Improvements through Benchmarking MN Ethanol Facilities

Minnesota Air Water and Waste Environmental Conference  
February 27, 2008

Presented by:

Nancy Kelly, Minnesota Technical Assistance Program,  
University of Minnesota

**Mn  
TAP**

helping businesses  
reduce waste and  
maximize efficiency

# Minnesota Technical Assistance Program

The Minnesota Technical Assistance Program (MnTAP) is an outreach program at the University of Minnesota that helps Minnesota businesses develop and implement industry-tailored solutions that prevent pollution at the source, maximize efficient use of resources, and reduce energy use and cost to improve public health and the environment.

- Technical Assistance by phone or site visits
- Intern Program
- Materials Exchange
- Fact sheets, Case Studies, Checklists on Pollution Prevention and Energy Conservation



# MnTAP Ethanol Benchmarking April - December 2007

Energy  
Water  
Air Quality  
Water Quality



# Important Issues Not Addressed

- Wet Mill Plants
- Feedstocks other than corn
- Cellulosic Process
- Impacts from increased corn production
  - soil erosion
  - runoff
  - water used for crop irrigation



# Understanding a Process through Benchmarking

- Definitions
- Data Collection
- Results
- Examples of Best Practices



# You Manage What You Measure

**Benchmarks:** *numerical standards for comparison*

- Thermal Energy Use - 35,000 Btu/gallon ethanol
- Electrical Energy Use - 0.8 kWh/gallon ethanol
- Water Use - 4.2 gallons water/gallon ethanol

**Best Practices:** *demonstrated techniques or process modifications*

- *Combined Heat and Power to Recover Waste Steam*
- *No Contact Steam Systems to reduce water use*
- *Biomethanators to improve water quality*
- *Fractionation to provide benefits for reduced energy use, water use, and air emissions*



# How Do You Get Data?

## Plant Data

15 Dry Mill Plants

3 Site Visits

3 Phone/Email  
Interviews

## Other Data

Emission Inventory Reports

Water Permits and Reports

Water Use Reports

EAWs

Trade Journals

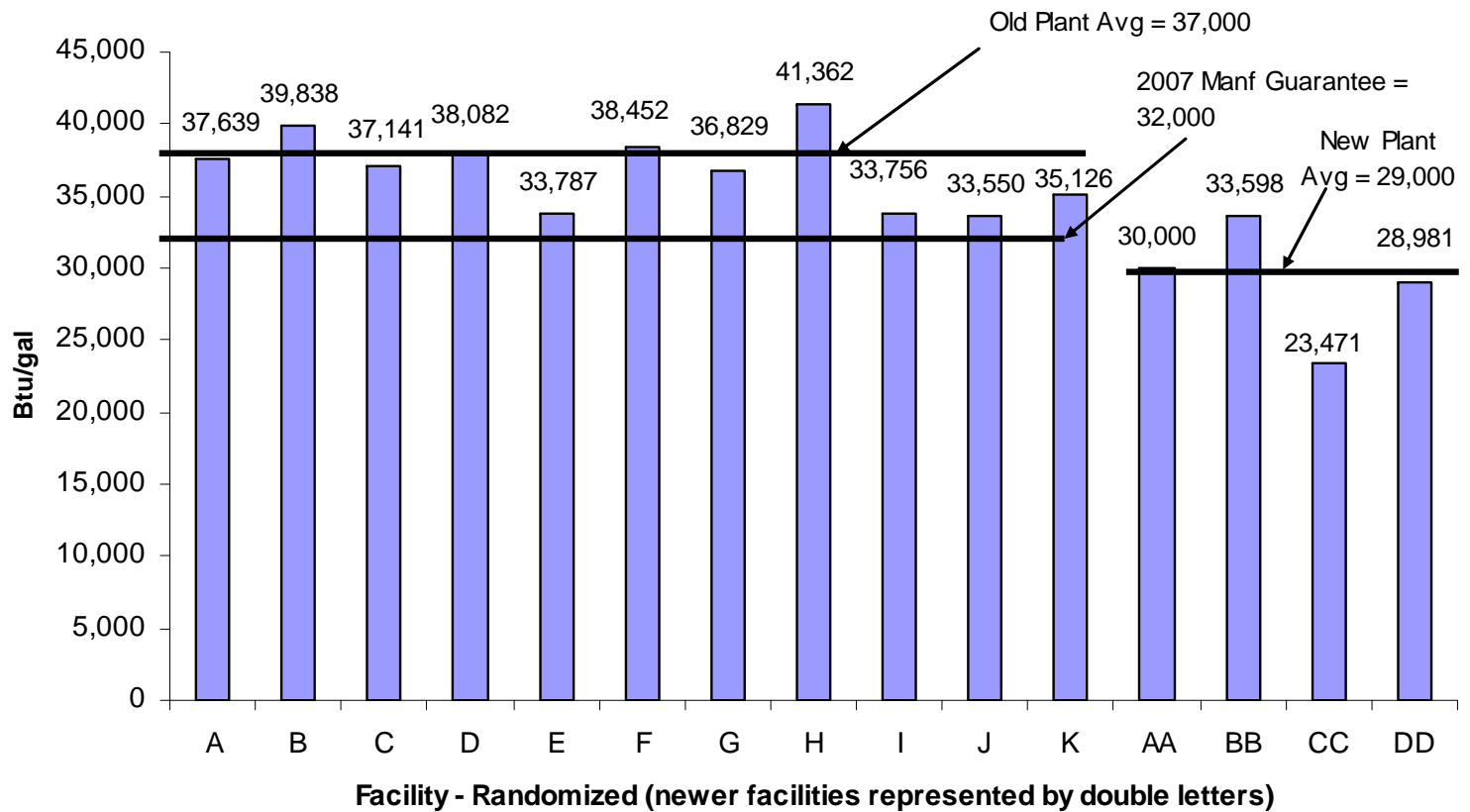
Research Articles

Conferences



# Thermal Energy Use Index

2006 Thermal Energy Use Index



# Annual Energy Savings Potential

Current Benchmark: 37,000 Btu/gal

Avg Plant Size: **32 MGY**

Gas Use = 37,000 Btu/gal x 32 x 10<sup>6</sup> gal = **1,184,000 MMBtu**

Gas Cost @ \$8/MMBtu = 8 x 1,184,000 = **\$ 9.5 million**

Goal: New Benchmark of 34,000 Btu/gal

Savings of **3,000 Btu/gal**

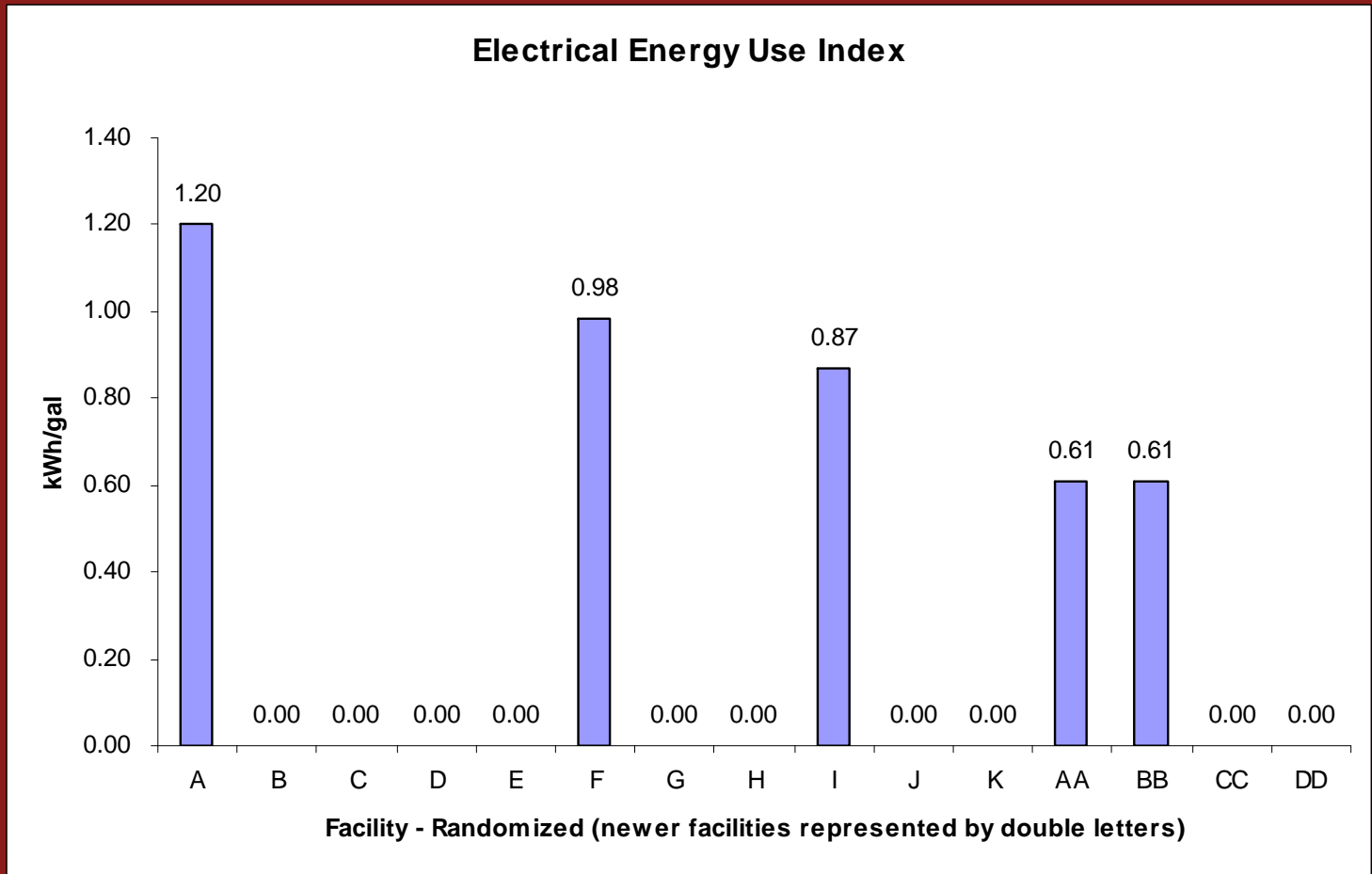
Gas Use = 34,000 Btu/gal x 32 x 10<sup>6</sup> gal = **1,088,000 MMBtu**

Gas Cost @ \$8/MMBtu = 8 x 1,088,000 = **\$ 8.75 million**

Cost Savings @ \$8/MMBtu = \$9.5 – \$8.75 million = **\$750,000**

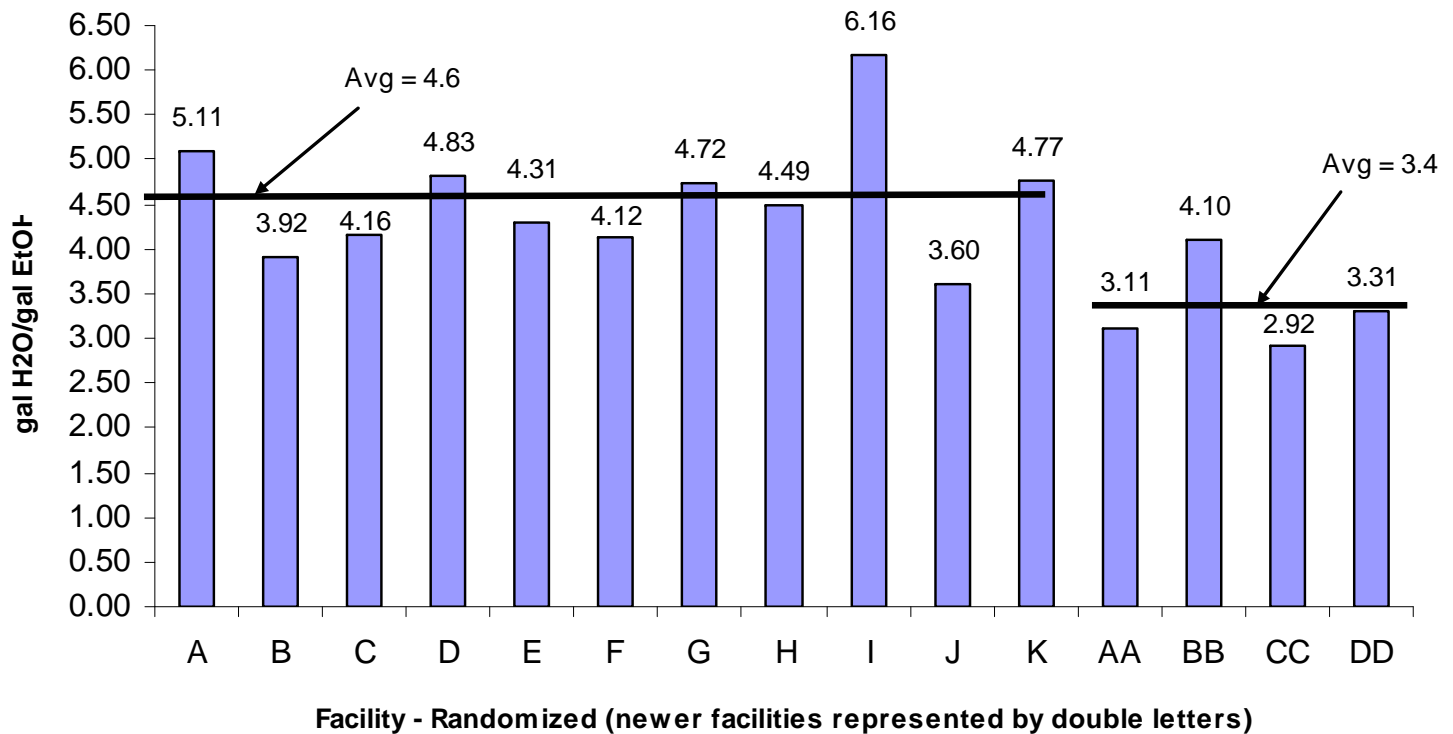


# Electrical Energy Use Index



# Water Efficiency

**2006 Water Efficiency**  
(Based on Undenatured)



# What was Learned about Water Quality

Variability in Quality of Water Supply

Dissolved Solids Levels Increase with Recycling Rates

Multiple Water Quality Standards Related to Dissolved Solids Pollutants

## First Generation

- Limits on BOD and TSS

## Second Generation

- Increased Monitoring of Dissolved Solids or Phosphorus

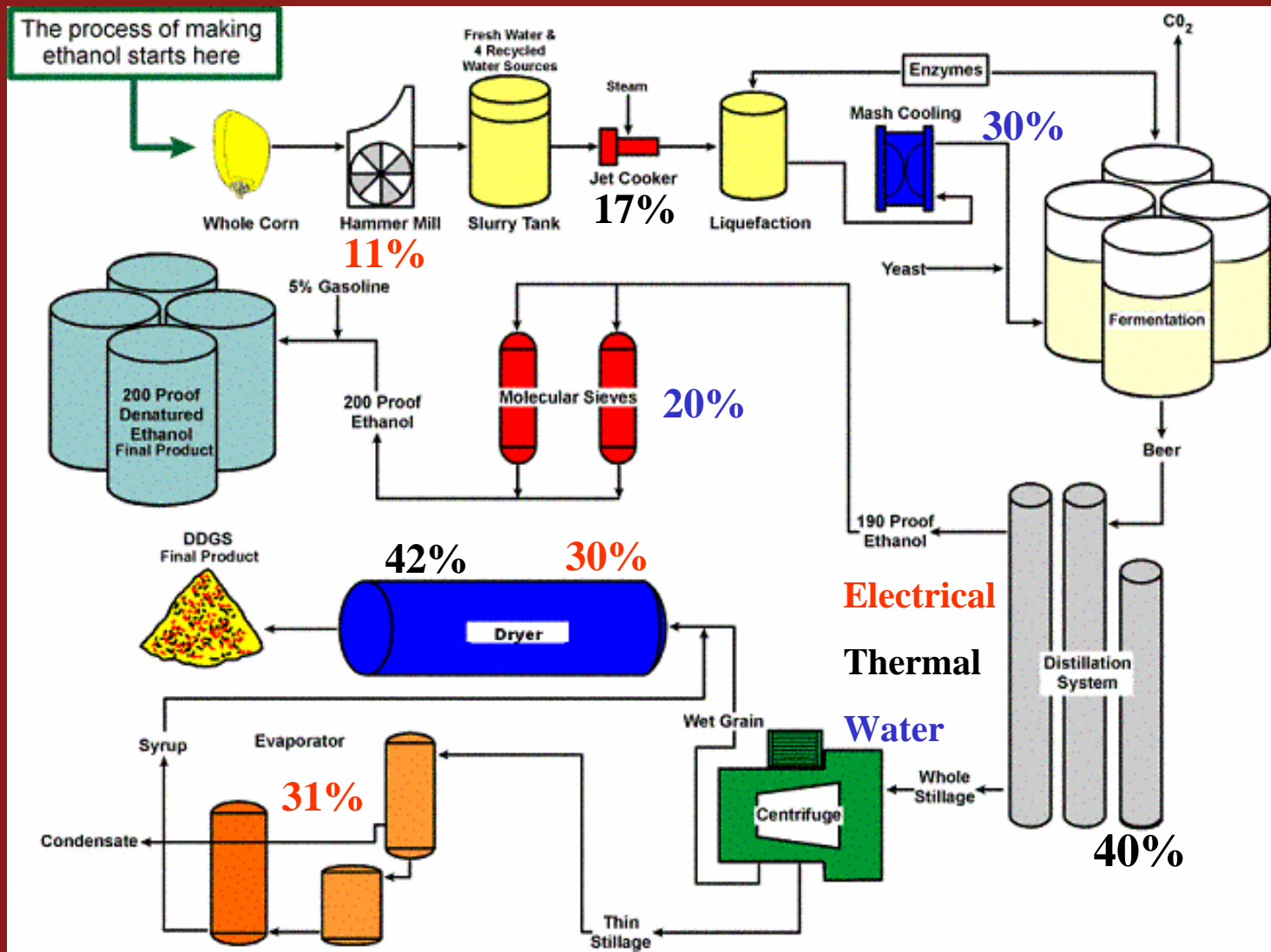
## New Construction

- More Limits and Zero Liquid Discharge Systems

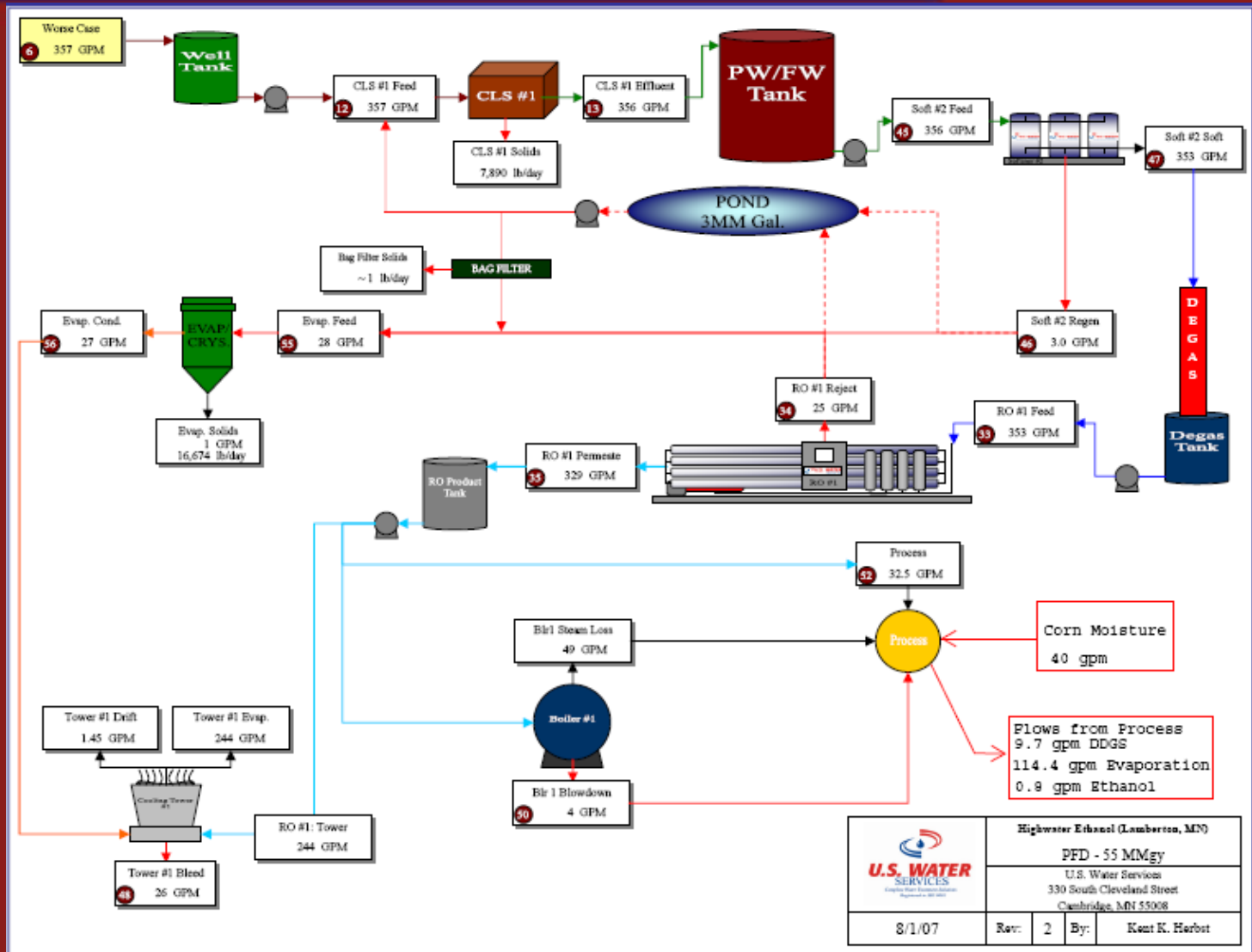


# Process Resource Use

Diagram from Midwest Ethanol Producers LLC

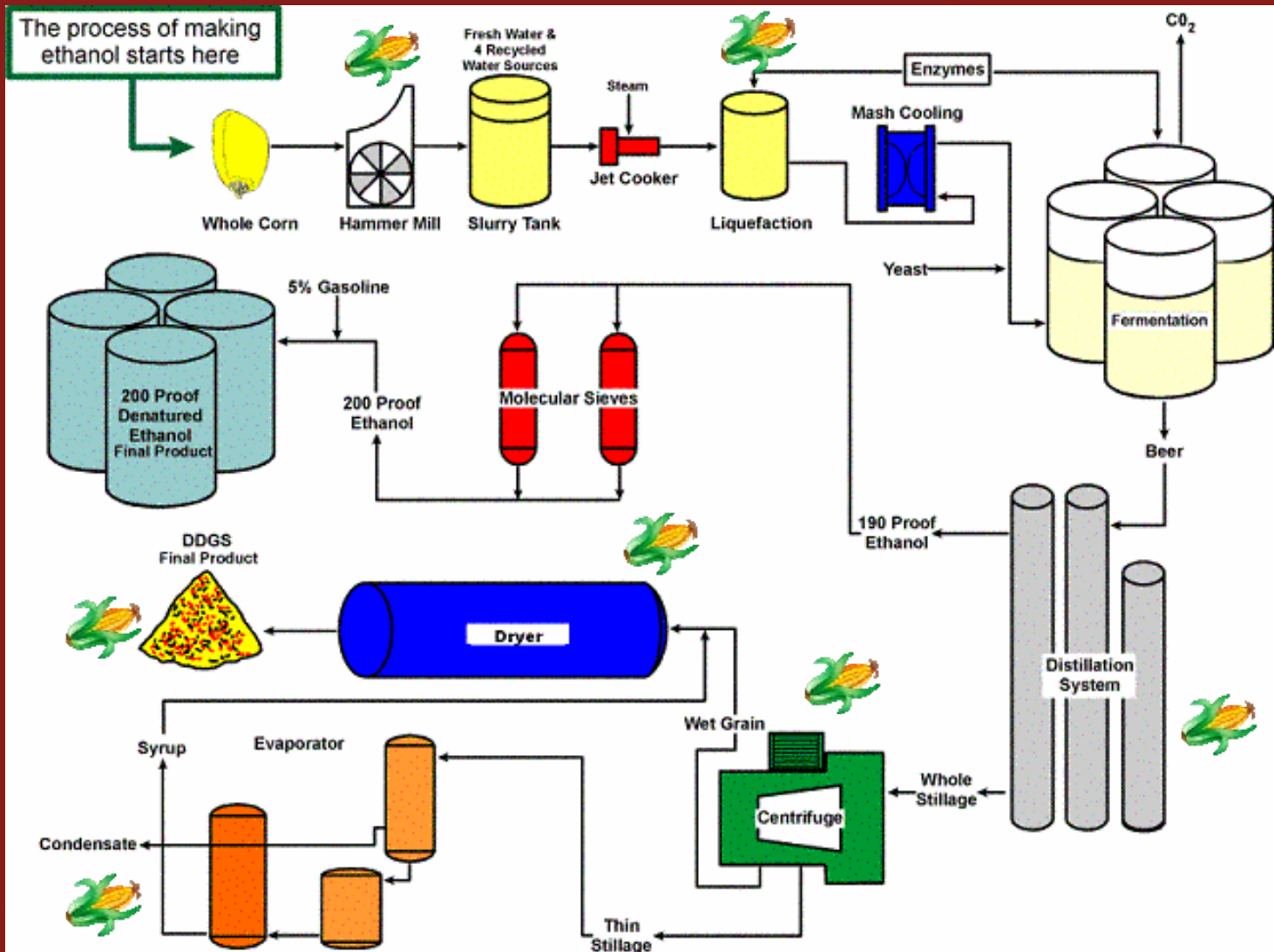


# The Water Balance Diagram



# Best Practices

Diagram from Midwest Ethanol Producers LLC

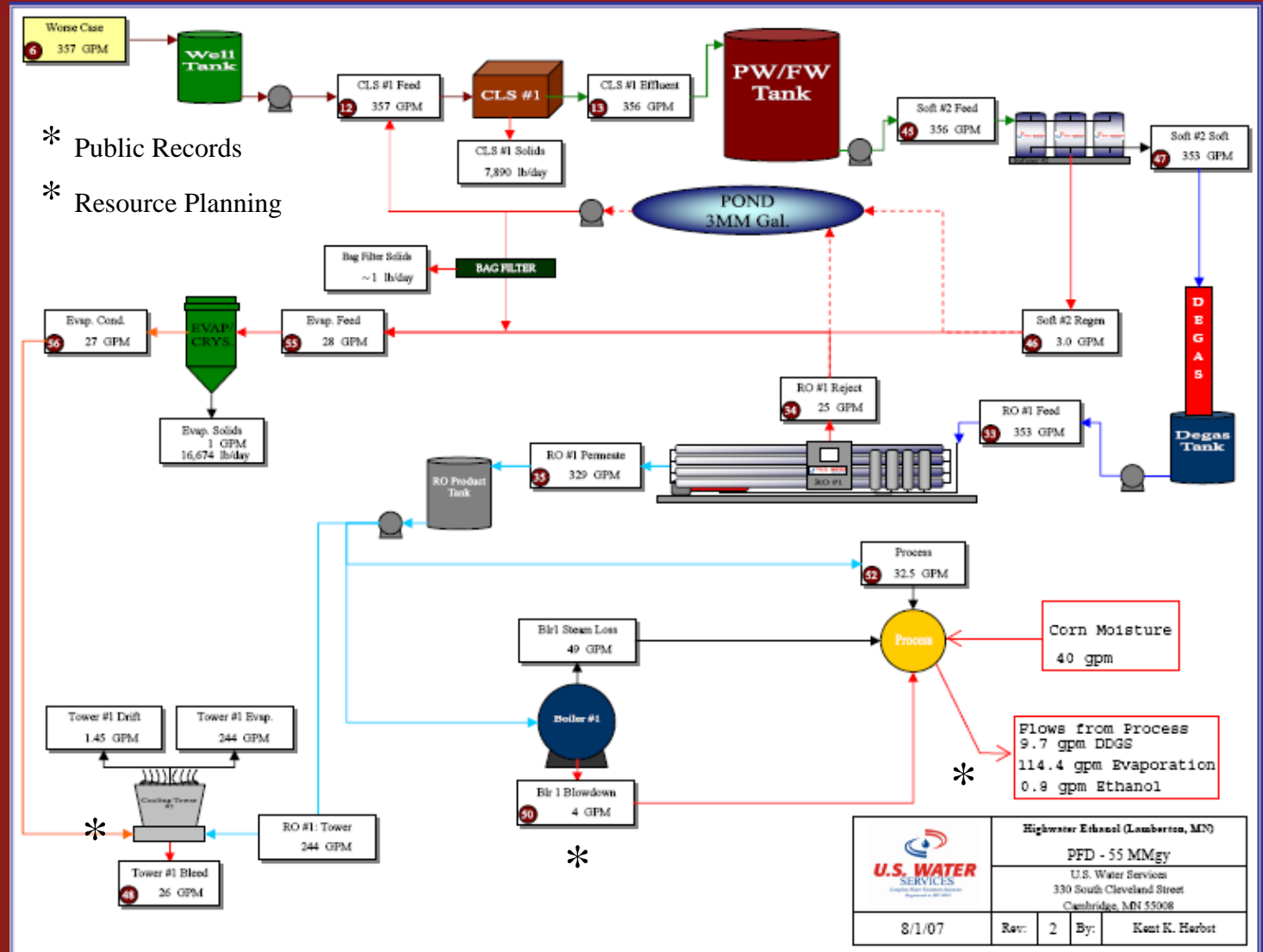


# Best Practices



**Mn  
TAP**

- \* Public Records
- \* Resource Planning



# What Was Learned from Benchmarking

- ❑ Water Quality is a significant issue
- ❑ Water use will go down as energy use is reduced
- ❑ Retrofits are happening at old plants
- ❑ Large investments can be justified
- ❑ Innovation is common
- ❑ Plants will give MnTAP a role

