



# Water Conservation at Heartland Corn Products

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**Driven to Discover<sup>SM</sup>**

# Company Background

## Winthrop, Minnesota

- Agriculture cooperative, 1992
- 173,000 m<sup>2</sup> (32 football fields)
- 60 employees
- Ethanol, corn oils, animal feeds
- 95,000 gal/day wastewater discharge



**Figure 1:** Evaporators and distillation columns at HCP

# Incentive to Change

## Expansion

- Increase ethanol production without onsite water treatment facility

## Sustainability

- Minimize wastewater discharge to the city
- Enhance energy and water conservation

# Manufacturing Process

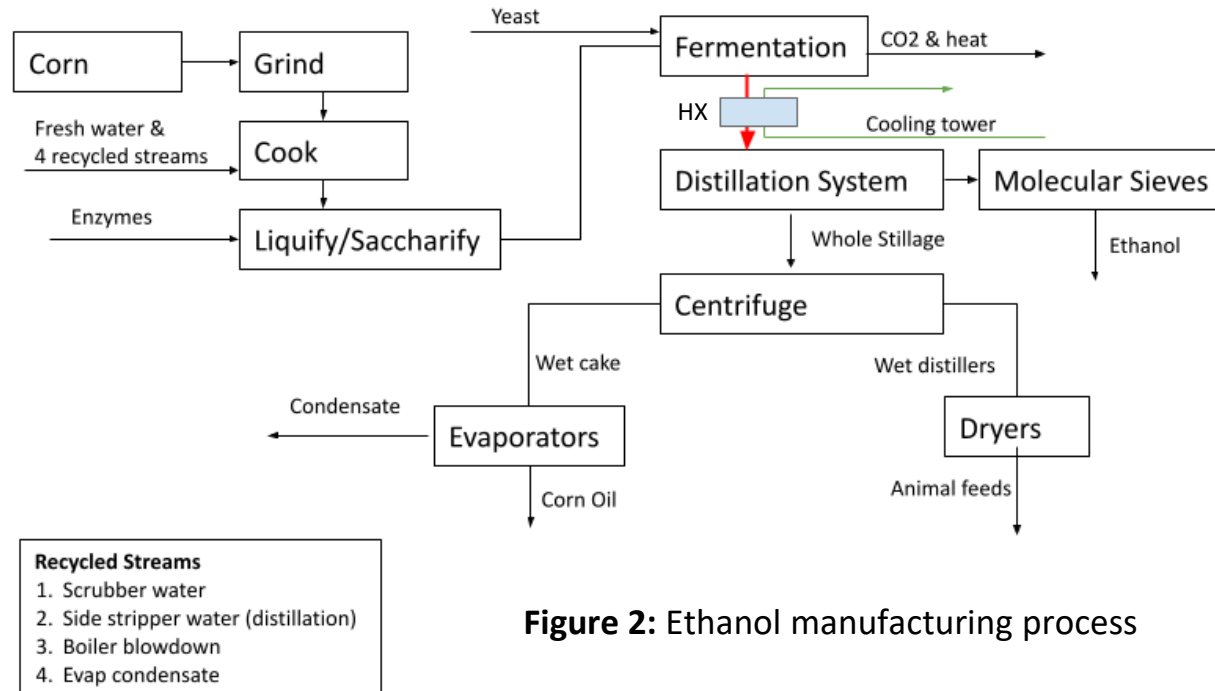


Figure 2: Ethanol manufacturing process

# Cooling Tower (CT)

- Specialized heat exchanger used for cooling industrial processes

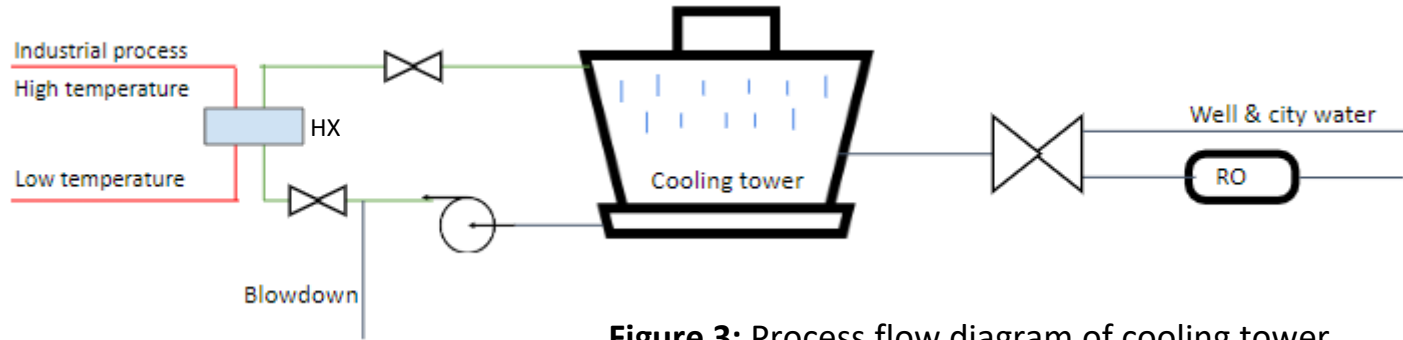


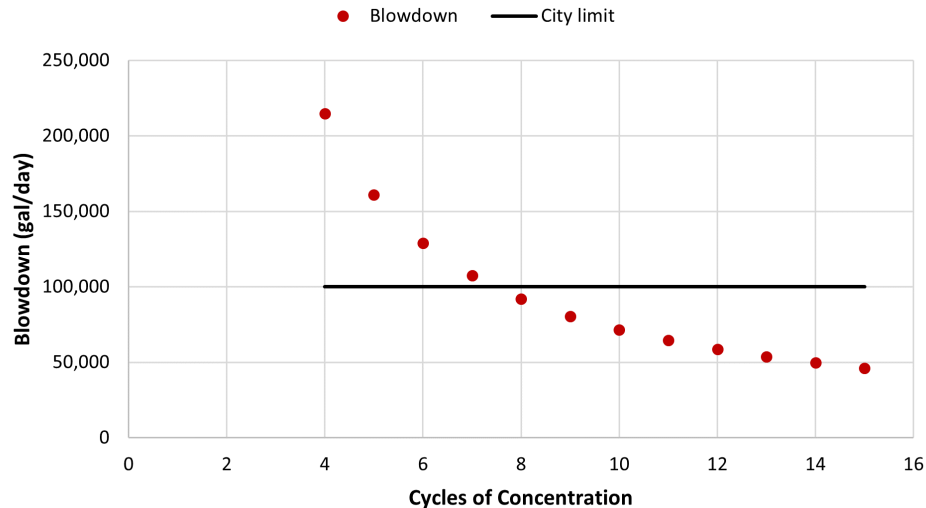
Figure 3: Process flow diagram of cooling tower

## Cooling tower water conservation

1. Treat wastewater discharge (blowdown)
2. Increase cycles of concentration

# Increase Cycles of Concentration (COC)

- COC is the ratio of blowdown to make-up water
- COC is inversely proportional to blowdown



**Figure 4:** Blowdown based cycles of concentration

- Increase COC from 6 – 7 to 9 - 11

# Impact: Increase Cycles of Concentration

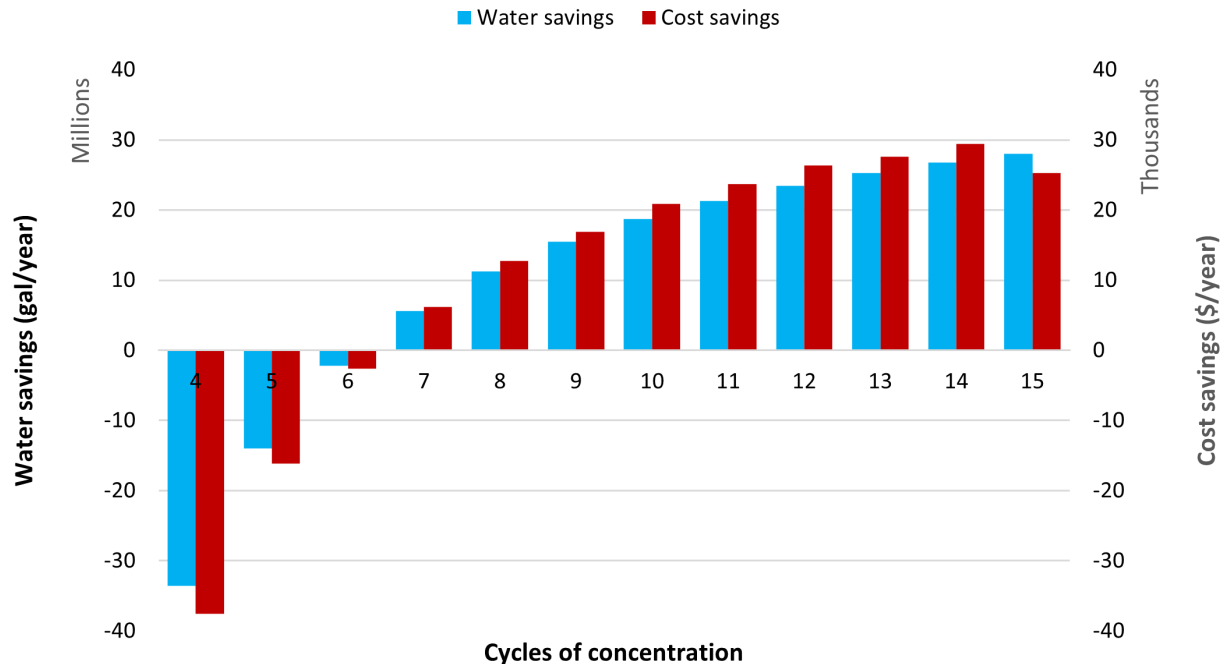


Figure 5: Annual water and cost savings

# Solutions

| Recommendation                         | Annual reduction             | Total cost  | Annual savings | Payback period | Status             |
|----------------------------------------|------------------------------|-------------|----------------|----------------|--------------------|
| Increase cycles of concentration       | 15,440,000-gal water         | \$0         | \$17,000       | Immediate      | Recommended        |
| Recycle 2nd stage RO*                  | 26,000,000-gal RO feed water | \$217,000   | \$19,000       | 6 years        | Recommended        |
| Recapture CT Evap water*               | 15,000,000-gal water         | \$2,750,000 | -\$13,000      | None           | Not Recommended    |
| Stack heat recovery <sup>+</sup>       | 8.82 x 10 <sup>11</sup> BTU  | TBD         | \$4,410,000    | TBD            | Future opportunity |
| Use enzymes active at low temperatures | TBD                          | TBD         | TBD            | TBD            | Future opportunity |

\* Must be implemented with increasing cycles of concentration

+ Extrapolated from average energy savings of 6,300 BTU/gal ethanol, 140-million ethanol produced per year and \$0.50/therm



# Personal Benefits

- Improved critical thinking and decision-making skills
- Exposed to the ethanol industry and learned a lot about RO systems, distillation systems, and cooling tower
- Improved communication skills by interacting with engineering contractors and HCP staff
- HCP staff were fun and welcoming



**Figure 6:** David recording RO conductivity data at HCP site