

## USING DIRECT STEAM INJECTION FOR ETHANOL PRODUCTION



### Innovation & Ethanol Expertise

At Hydro-Thermal, we continuously seek ways to reinvent our products and processes to be more efficient and effective for our customers. In our 80 year history of direct steam injection innovation, we've evolved our expertise from paper mills in Wisconsin to a vast array of diverse industries in more than 85 countries worldwide. A harbinger of innovation, Hydro-Thermal currently holds more than a dozen active patents that are registered in multiple foreign countries.

Over the past decade, Hydro-Thermal has installed approximately 367 Hydroheaters, also known as a Jetcooker™, in ethanol facilities in 19 countries worldwide.

Our staff has presented ethanol solutions at various venues, including regional ethanol maintenance and plant manager meetings, the All India Distillers Association (AIDA), and the Fuel Ethanol Workshop (FEW). Combining this process experience and our engineering expertise gives us a competitive edge when working alongside our customers in the ethanol industry.

Our engineering staff consists of 20 brilliant minds that span various specialties, including fluid, electrical, mechanical, and design engineers. They have formed strategic research partnerships with our customers, leading Midwestern universities, research associations, and independent R&D engineering firms to evolve our products and continuously inspire new product development.

### Ethanol Applications

Hydro-Thermal's patented direct steam injection technology allows ethanol producers to achieve precise temperature control and optimize their process.

The Jetcooker is used for more than mash heating. It is versatile enough to be used all over your facility. Below is a list of Hydro-Thermal's proven application expertise:

**Liquefaction/Slurry Mash Heating:** Achieve the highest possible ethanol yield in either dry or wet milling operations. Heating the corn mash in the Hydroheater (also called the Jetcooker) is the first step to opening the starch molecules so the enzymes can break it down into sugar. The slurry starts and has a targeted temperature of 185°F [85°C] Once it reaches the Hydroheater, the temperature setpoint has a range between 210°F and 225°F [98°C and 107°C]. It is equally important to maintain a constant pressure drop across the Jetcooker optimizing shear, mixing characteristics, and overall performance efficiency.

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**Depressurization Vapor Condenser System (DVCS):** Experience a decrease in the BTU load at the sieve vaporizer required by a boiler via recycling depressurization vapors and reduces the cooling tower load. For a more favorable water balance and a potential improvement in cooling capability through fermentation and distillation.

**Slurry Tank Heating:** Hydro-Thermal's turnkey solution reduces viscosity, providing additional flexibility for slurry solids adjustments and reducing downstream equipment load demand. It has also shown an improvement in corn oil yield. Finally, it provides a more uniform heating solution that eliminates mash hot and cold spots within the slurry tank. This will eliminate the need for tank sparging, bringing additional opportunities in potentially reducing enzyme dosing rates.

**Cellulosic Pretreatment:** A non-shear Solaris heater can be used to produce cellulosic ethanol. Hydro-Thermal's technology sufficiently hydrolyzes and opens up the structure of lignin-based biomass feedstocks to allow efficient and effective enzyme hydrolysis of the hemicellulosic sugars. Utilizing the Solaris heater has many benefits, including precise and accurate temperature control, increasing ethanol yield and corn oil production, and reducing energy costs.

**Beer Mash Slurry/Beer Mash Column:** In order to achieve more precise temperature control, Hydro-Thermal recommends installing a non-shear (Solaris) after the beer well but before the beer column for the existing mash stream. The goal is to provide a more consistent/accurate mash temperature to the beer column (135°F [57°C] current to 170°F [76°C] future). The goal is to reduce energy usage and more flexibility/efficiency from the beer/mash exchangers, beer bottoms base loss recovery, and a reduction in chemical use.

**Corn Oil Production:** Hydro-Thermal's products heat thin stillage/syrup beyond the normally targeted temperatures and help ethanol producers achieve their minimum feed tag specifications. The result is increasing corn oil production numbers and ultimately increasing revenue. These products provide accurate and consistent temperature control. The added temperature works as an emulsifier. As a result, ethanol producers may reduce or eliminate their emulsion breaker chemicals while still maintaining or increasing oil production.

## Water Heating

Beyond processing applications, Hydro-Thermal is also the expert at water heating applications. We have helped ethanol producers achieve  $\pm 1^\circ\text{F}$  [0.5°C] of their desired temperature.

**Reverse Osmosis (RO):** Hydro-Thermal can heat RO inlet water or heat membrane backflush water while achieving precise temperature control and eliminating wasted energy.

**Clean In Place (CIP):** Easily heats one to three CIP tank systems on demand. Hydro-Thermal's solution allows you to clean equipment at the optimal temperature in one pass. It also allows you to easily switch from tempered water to hot flush temperatures due to our technology's internal modulation.

**Tank Heating:** Easily and efficiently heats tanks on in-feed or in recirc mode, trim heat. We can heat the fluid going into the tank, re-circulate the tank to maintain a specific temperature, or leave the tank cold and heat the liquid exiting the tank, producing hot water on demand. Many customers see a return on investment (ROI) in less than three months.

**Need more information about Hydro-Thermal products?**

Go to [www.hydro-thermal.com](http://www.hydro-thermal.com) or contact us at [info@hydro-thermal.com](mailto:info@hydro-thermal.com)

400 Pilot Court | Waukesha, WI 53188  
(262) 548-8900 | (800) 952-0121

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