How it Works
The catalytic process is an oxidation reduction reaction that converts natural gas into three components: infrared energy, CO2 and water. There is no open flame, and no ethylene glycol or other chemical charge. Perhaps most notably, catalytic infrared is a direct, rather than indirect, heating method, which translates into substantially higher efficiencies and lower operating costs. Specifically, in field operation, a catalytic pipeline heater generating infrared energy has an average heat transfer efficiency for higher than water bath transfer efficiency. This advantage can save thousands of dollars each year in operating expense.

Environmental and the Environment
Worker safety also is an issue in which water bath devices and catalytic heaters contrast sharply. In the U.S., for example, ethylene glycol is a poisonous chemical designated a hazardous substance under Section 3(b) of the Federal Hazardous Substances Act. Excessive exposure can damage the central nervous system, heart and kidneys; damage red blood cells and bone marrow; and induce an assortment of other ailments.

Finally, there are environmental issues to consider. The transportation and use of a hazardous substance in the U.S. and other advanced economies are regulated and add a liability component to operating costs. All installations in which large quantities of ethylene glycol are used -- perhaps especially so in unmanned facilities -- are the ongoing threat of inadvertent (or malicious) chemical release. For reasons such as this, ethylene glycol use requires permitting in the U.S.

New Life for an Old Mill
After more than a century of operation, the mill in Baileyville, Maine -- closed. High petroleum prices and poor market conditions prompted its then-owner, to divest the operation.

The foresight of the new owners and their willingness to invest in the conversion was a linchpin to the plant, and the surrounding economy. The Bruest HotCat catalytic infrared heaters that condition the incoming natural gas were critical to insuring the success of the conversion, and to assuring the ongoing viability of the natural gas supply.

Bruest Catalytic Heaters are approved for Division 1 & 2, Group D areas. They are also approved by CSA, FM, Alex and Tokyo Gas.

For more information, contact Bruest Catalytic Heaters, Division of Catalytic Industrial Group, Inc. www.bruestcatalyticheaters.com (800) 835-0557. E-Mail: sales@bruestcatalyticheaters.com

World Leader in Flameless Gas Infrared Catalytic Heaters
Bruest Catalytic Line Heaters Ensure Supply of “Dry” Gas to Maine Pulp Mill

Two HotCat HC2000 catalytic infrared line heaters were engineered by Bruest, allowing the Pulp mill to replace costly oil with natural gas.
While the former owner owned the plant, market conditions were such that the formerly integrated (produced pulp and paper) mill’s papermaking operation was shuttered because it was unprofitable. Things worsened when a combination of low pulp prices and high oil prices caused the plant to “indeﬁnitely” close in 2010. Fortunately, that closure lasted only twenty days. With the help of the black liquor tax credit (passed by the U.S. Congress in 2005 to support the use of liquid alternative hydrocarbon fuels and expanded in 2007) to include non-mobile uses of liquid alternative fuel derived from biomass and stabilization in pulp prices, Damtar re-opened the mill, though in short order they decided to divest it.

They found a buyer and in the Fall of 2010 the new owners took possession of the mill. The facility, previously in jeopardy of closing, was revised by its new owners, who were eager to invest in the mill’s competitiveness. As an employer of about 300 people with an annual payroll of $20-$25 million, the direct and downstream economic effects of the mill’s closing would have dealt an incalculable blow to the broader local economy of Eastern Maine.

The story of how this happened is an interesting one, full of lessons about new ways of doing old things, how changing market conditions can bring down an old mill, and how a willingness to invent oneself can save a mill — and a regional economy — from economic foreclosure.

The pulp mill is situated adjacent to the St. Croix River, an international natural boundary between Maine and New Brunswick, Canada. The mill produces Woodland St. Croix Hardwood, a premium ECF (elemental chlorine-free) bleached kraft pulp manufactured using hardwood chips from Maine and New Brunswick, Canada. Its product is used all over the world in coated, machine glazed, carbonless, bond and copy papers.

In January 2011, the process of converting the mill’s back-up fuel to natural gas began. Equipment conversions and modiﬁcations were made, and by May 2011 the mill started receiving trucks ﬁlled with liquid natural gas (LNG) to temporarily supply their back-up fuel needs. These trucks came from Massachusetts, and the mill was consuming 4-5 truckloads per day as its new natural gas pipeline was being built.

On December 6, 2011, the new pipeline built and all conversions made, the mill’s back-up fuel ofﬁcially became natural gas. It all happened in less than a year. The investment required to make this conversion was about $18 million. The project, initially thought to take three years to recover the investment, was close to break-even after only about one year of operation.

**Switching from Oil to Natural Gas**

As the new owners took control of the pulp mill, they were still faced with difﬁcult market conditions and understood they would have to ﬁnd a way to secure the long term viability of their investment.

As an energy-intensive operation, the mill would greatly improve its ﬁnancial performance if it could reduce its energy costs. The primary fuel consumed by the plant was “black liquor,” a derivative of the kraft pulp-making process in which lignin and cellulose are separated from the wood chips entering the plant as raw material.

Varying production and mill conditions, however, necessitate the availability of a back-up fuel. Until well into 2011, that back-up fuel was #6 fuel oil, which was used to ﬁre the mill’s production and power generation boilers. Nonetheless, oil’s high price was prohibitive to the mill’s continued operation. The mill’s primary fuel may have been black, but without some changes its bottom line would continue to be in red.

Fortunately, there was a Canadian natural gas pipeline (which locally crossed over into the U.S.) from which the mill could be fueled. The mill’s new owners approved a multi-million dollar investment to build a 5-mile pipeline that connected with the trunkline in the U.S. At the heart of this decision was, of course, the favorable price of natural gas versus the price of oil. As it turned out, the price differential between oil and natural gas was enormous, lowering the back-up fuel price from about $16/million BTUs with oil to about $5/million BTUs with natural gas.

The project to transmit the gas to the mill was completed and the pipeline was commissioned in the Fall of 2010. The investment required to make this conversion was about $18 million. The project, initially thought to take three years to recover the investment, was close to break-even after only about one year of operation.

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**Conditioning the Gas**

Nonetheless, the conversion to natural gas presented its own set of implications. Those who transmit natural gas through a pipeline know well that pressure drops in the natural gas cause it to cool signiﬁcantly. This, in turn, induces the Joule-Thomson effect, which causes hydrates in the gas to form ice particles that can damage equipment downstream.

Technically, natural gas hydrate is methane clathrate, also known as hydroxymethane, methane hydrate, methane ice or “ﬁre ice.” Extremely cold climatic conditions may induce pipeline freezing in the traditional sense. However, the dominant “freezing” problem in the mill’s pipeline is the Joule-Thomson effect, which freezes hydrocarbon liquids as the pressure of incoming natural gas is reduced to feed the mill’s boilers.

The catalytic process is an oxidation reduction reaction that converts natural gas to heat. Given the parameters of incoming pressure, ﬂow rate, inlet gas temperature of 35°F and the anticipated cooling from the pressure drop, the problem of solid hydrate formation was solved by technology developed by Bruest and proved in hundreds of installations worldwide. The technology is the Bruest HotCat catalytic infrared line heater.

Two HotCat HC2000 line heaters were installed to operate in parallel. Though either unit could accommodate the mill’s nominal daily load, the mill purchased two units for redundancy. It is fortunate they did, for on a tough day in late 2012 the mill had to run both units “full-out” to keep the mill’s boilers fed with natural gas.

**Benefits of Infrared Catalytic Heaters**

In most natural gas pipelines around the world, infrared catalytic heaters compete primarily with water bath heaters (or “glycol heaters”) that use heated ethylene glycol to prevent the formation of hydrates. Since 2005, however, a conﬁdence of market drivers has increasingly favored the use of catalytic heaters. Among these favorable drivers are easy installation, low maintenance requirements, no need of hazardous chemicals, no open ﬂame in operation, and a heat exchanger design that maximizes heat transfer.

In fact, had originally speciﬁed water bath heaters to condition their incoming natural gas. However, Bruest’s short lead time of only 2 months to deliver the appropriate units dovetailed nicely into the mill’s already hurried timetable. Additionally, the cost of the HotCats compared very favorably with the water bath heater. Whether the comparison is capital cost, installation cost, operational cost, or total life cycle cost, 21st century HotCat Catalytic technology is more economical than water bath devices.