A related operational advantage of the HotCat system is an unusually high turn-down ratio of 8:1 to 32:1 or higher. This high turndown ratio allows substantial operational cost savings during periods of low demand and low flow. The high turndown ratio is made possible by proprietary Bruest technology that delivers only the precise amount of energy needed to meet process requirements.

Complementing the operational advantages and efficiencies of catalytic line heaters are such things as a relatively small footprint and height requirement, minimal environmental impact, and the lack of a chemical charge that is the core of water bath devices. Typically, the chemical charge in a water bath heater is ethylene glycol, but mounting alarm over its toxicity has persuaded many users of water bath systems to use propylene glycol, which is less toxic and transfers heat more efficiently. However, propylene glycol is more costly, and less effective at freeze point depression. In addition, its higher viscosity increases head loss in the system and accelerates pump wear.

Safety

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

Environmental and Security Issues

Finally, environmental issues strongly weigh in favor of catalytic infrared technology. The transportation and use of hazardous substances such as ethylene glycol in the U.S. and other advanced economies is regulated, and adds a liability component to operating costs.

At installations where large quantities of ethylene glycol are used – and especially so where facilities are unmanned -- there is also the ongoing threat of inadvertent or malicious chemical release. For these and other reasons, ethylene glycol requires permitting in the U.S. and elsewhere, (though this was not a factor in Nigeria.)

Environmental factors that are important worldwide include the emission of VOCs and NOx. Water bath operation generates both of these continuously, in significant quantities; HotCat generates virtually zero of either pollutant.

Looking Ahead

The generating turbines at the Aba IPP will soon provide much-needed electrical power to the Aba River Valley's regional economy. If the performance history of the HotCat system is any measure, (the earliest systems were installed in 2003 and their track record for US and Canadian utilities is extensive) the use of this important 21st century heating technology will help the plant run smoothly, cleanly and quietly for many years.

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

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BRUEST HOT CAT

World Leader in Flameless Gas Infrared Catalytic Heaters

Bruest NG Line Heaters Will Protect GE Turbines at New Nigerian Power Plant

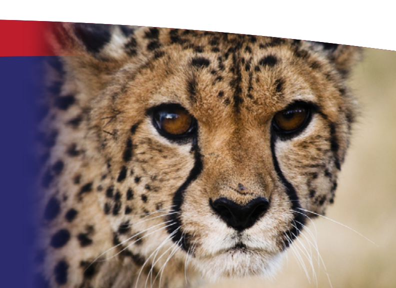
A new power plant in Aba, Nigeria goes on-stream in the first quarter of 2013.

The Aba Integrated Power Project will add 140 megawatts of generating capacity to the region and will be fueled by natural gas.

To guard the downstream power turbines from damage due to solid hydrates which form in the natural gas supply, Bruest Catalytic Heaters (Independence, KS) engineered a solution that is exceptionally reliable and cost-effective. Called the HotCat, this 21st century catalytic infrared technology is regarded worldwide as the most effective protection against hydrate formation and resultant freezing in applications involving the regulation of natural gas.

Three HotCat catalytic infrared line heaters were engineered by Bruest to keep turbine inlet gas free of damaging hydrates.

www.bruestcatalyticheaters.com



A trio of catalytic infrared natural gas line heaters, run in parallel, will prevent damage to the high-speed GE turbines that will generate electricity at the Aba Integrated Power Project ("IPP"), which is expected to come online in the first quarter of the new year.

The heaters were developed and manufactured by Bruest Catalytic Heaters, (Independence, KS.) The new facility will serve the Aba region, located in southern Nigeria on Africa's West Coast. In a region characterized by small villages and towns, Aba is the region's urban and commercial center.

Located in the Nigerian southern state of Abia, Aba is critical to the Nigerian economy, which is Africa's third largest after South Africa's and Egypt's. Nigeria is the world's 12th largest petroleum producing nation, with the world's 10th largest quantity of proven reserves. Given its rich

hydrocarbon endowment, which is the Nigerian economy's most important driver, it is not surprising that Nigeria's was the continent's fastest-growing economy between 2001 and 2011, averaging 9% annual GDP growth. To support this economic growth, the IPP will improve the supply to and the reliability of the region's power grid.

Aba, a city of more than 1 million people, is surrounded by oil wells that separate it from the trading center of Port Harcourt, 30 kilometers away. The region's pressing need for continued economic development made additional reliable power mandatory, and this is what spawned the $500 million Aba IPP. It was built by Nigeria-based Geometric Power Systems Ltd., with engineering performed by ADC Ltd., a prominent South African design firm.

The new plant will add 140 megawatts of generating capacity to the region and is especially important to Aba's industrial clusters, which have been plagued in recent years by the inadequacy and unreliability of Nigeria's public power system. A 30 kilometer natural gas pipeline feeds Aba from the Imo River natural gas reserve. Given the hydrocarbon energy reserves that surround the city, it is no surprise that the new power plant is natural gas-fired.

Reliant as Aba's IPP will be on natural gas, the fuel's reliable, and efficient flow is of prime importance to the project's success. One obstacle to the efficient supply of natural gas from the wellhead to the end-user is pipeline blockage and the threat of turbine damage due to ice formed by the freezing of hydrates during natural gas transmission.

To prevent this, three Bruest "HotCat" catalytic infrared natural gas line heaters will heat the inlet natural gas, thereby preventing frozen hydrates from forming and protecting the downstream pipeline and power generation equipment.

Fire and Ice

Regardless of the natural gas source ("produced gas" from an oil well or "natural gas" from a gas well), the presence of hydrates in the gas carries the threat of ice particle formation in natural gas pipelines that carry it from the wellhead to the power plant. Natural gas hydrate may be naturally present in the gas or introduced during processing and collection.

The system feeding gas through the transmission pipeline and into the IPP was engineered to heat the gas to 28 degrees C above the dew point of hydrocarbon liquids to prevent the formation of potentially disruptive frozen hydrates. Technically, natural gas hydrate is methane clathrate, (also known as hydromethane, 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 Nigeria's pipelines would be the result of pressure reduction that induces the Joule-Thomson effect, which freezes hydrocarbon liquids into damaging and disruptive solid particles as natural gas is delivered to the power plant. If allowed to remain, particles of ice from trace moisture and frozen hydrocarbon liquids can damage the pipeline, restrict the flow of gas, and compromise other power generating equipment.

Design Considerations

To prevent this problem, Gerhard Smit, engineering manager at ADC Ltd. calculated the required natural gas flow rate into the plant. Combined with the anticipated inlet temperature of the incoming natural gas, design engineers at Bruest did additional calculations and determined that three of their units -- two HotCat 2000s and one Hot Cat 2800 -- running in parallel would keep the inlet gas to the three power generating turbines free of damaging frozen hydrates: in other words, "dry."

Inlet natural gas would be split among the three catalytic infrared line heaters. Additionally, the combined heating capacity of this parallel system was deliberately overdesigned to accommodate a potential fourth turbine.

Initially, Smit and his ADC colleagues intended to use electric resistance heaters to heat the incoming natural gas. The IPP's original design specified electric heaters as original equipment, and the engineering firm had some experience with them from another project. The design calculations for the application of direct electrical heat were made, but circumstances caused approval of the electrical heaters to stall. It was during this time that catalytic infrared technology was first considered.

While he was exploring systems and suppliers, Smit discovered the Bruest website. After studying the company's technology in depth, he became convinced that Bruest's 21st century catalytic infrared technology was the preferred alternative for the Nigerian power plant project.

The Case for Catalytic Infrared Heaters

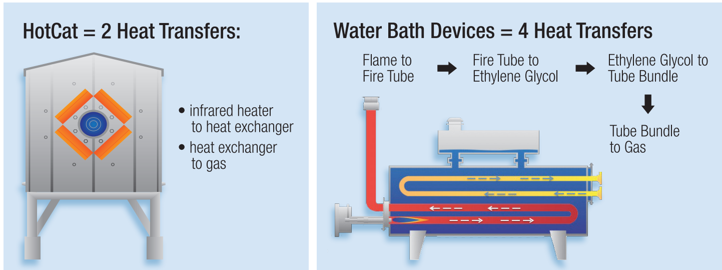
Compared to the electrical resistance heaters originally specified, catalytic infrared heaters initially appeared to be more costly. However, when Smit did a comprehensive capital cost analysis of electrical heaters versus infrared catalytic heaters, he found that the additional cost of transformers, cables, connectors, etc. required for resistance heaters far exceeded the total capital cost of infrared catalytic heaters. In fact, his calculations of relative capital and operating costs led him to conclude that the "initial capital investment for electrical heat was about three times the cost of that for catalytic heaters, and that the operating cost for installed catalytic heaters was only 25 percent that of electrical heaters."

In most natural gas pipelines around the world, infrared catalytic heaters compete primarily with water bath heaters, which use heated ethylene glycol to prevent the formation of hydrates in natural gas transmission lines. Since 2005, however, a confluence of market drivers has increasingly favored the use of catalytic heaters. Among these favorable drivers are low maintenance requirements, no need of hazardous chemicals, no open flame in operation, a heat exchanger design that maximizes heat transfer as it slows the flow of gas, and other considerations.

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 lower operating costs. Specifically, in field operation, a catalytic pipeline heater generating infrared energy has an average heat transfer efficiency of 70%, compared to the widely-published water bath transfer efficiency of 40-50%. This 30% advantage can save thousands of dollars in annual operating costs.

The key to the catalytic line heater's high heat transfer efficiency is the way in which it uses infrared energy. By surrounding the heat exchanger with catalytic infrared energy that is absorbed directly, system operation requires just two heat transfers: infrared to heat exchanger, and heat exchanger to gas.



By contrast, water bath devices involve four separate heat transfers: from flame to the fire tube inside the solution; from the fire tube to the ethylene glycol; from the ethylene glycol to the tube bundle; and from the tubes to the gas.