

Natural Gas Is a Natural

for Green Buildings... and Green-Loving Business Owners



AT A GLANCE

- ▶ Natural gas can provide energy efficiency and good air quality in “green” buildings
- ▶ Installing high-efficiency gas furnaces and boilers is a good first step
- ▶ Natural gas cooling saves money and decreases demand on the electric grid
- ▶ Power generation with gas reduces greenhouse gas emissions
- ▶ Desiccant dehumidification reduces cooling costs

By replacing old heating equipment with high efficiency natural gas boilers, the 594,000-sq.-ft. Standard Life complex has become a model for reducing greenhouse gas emissions.

Among the many roles that natural gas can play in green buildings are improving air quality with natural gas-regenerated desiccant dehumidification, generating on-site power while producing heat that can be used to make hot water or steam, and fueling tankless water heaters in order to prevent standby energy losses from tank-style water heaters. It can reduce or eliminate the need to sanitize dishes with chemical cleaners in restaurants, and replace high-carbon-emission fuels such as coal and oil. And, naturally, it can supply the basics: highly efficient space cooling and heating, as well as water heating.

These improvements in energy efficiency also keep more “green” in the pockets of building owners.

GO GREEN WITH GAS HEATING

While heating and cooling systems and cutting-edge technologies such as fuel cells and microturbines tend to get the most attention, the first step in any effort to improve

When people think of “green” buildings, they usually expect them to operate with solar or wind power. However, natural gas is a true natural fuel, readily available to offer high energy efficiency for both green and everyday structures.

Natural gas can play a key role in promoting energy efficiency and good air quality in many of the buildings certified as LEED (Leadership in Energy and Environmental Design) by the U.S. Green Building Council. The LEED Green Building Rating System™ is the nationally accepted benchmark for the design, construction and operation of high-performance green buildings.



On the cover: Buildings that employ natural gas to drive HVAC and on-site power generation systems have chosen smart options environmentally... and economically.

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the energy performance of an existing building starts with the building envelope. Ensuring optimum insulation levels and controlling air infiltration are the critical foundations upon which energy efficiency is based. These types of investments tend to cost the least yet provide the biggest returns, both financially and environmentally.

But once the fundamentals have been addressed in terms of insulation, air infiltration and high-efficiency lighting, where does natural gas fit into the “green” equation? Upgrading to high-efficiency gas furnaces and boilers is one of the easiest ways to begin saving energy with natural gas as an energy source, according to John Gordon, General Energy Consultant for National Fuel Gas Distribution Corporation, a natural gas utility serving western New York State and northwestern Pennsylvania.

“If you’re incorporating a green approach within your building, installing a state-of-the-art high-efficiency natural gas heating system would be one of the first steps,” he says. “When combined with heat recovery equipment to capture and reuse exhaust heat within a well-insulated, tight building with high-performance windows and doors, controlled ventilation, high-efficiency lighting, and natural gas water heating, you have an integrated building system that is very energy efficient. You have to look at the package as a whole and at how each component interacts and impacts the other. Natural gas is an important part of the equation.”

In Canada, where the government strongly promotes efforts to reduce greenhouse gas emissions, the 594,000-sq.-ft. Standard Life complex in Toronto is now heated with high-efficiency RayPak boilers designed to cut operating costs by \$125,000 a year.

Standard Life is a multi-use structure with two commercial office towers, the Shepard Centre retail mall, and one of Toronto’s largest parking garages. It is served by a single central heating plant with 10 natural



Natural gas can warm (or cool) our homes and businesses, provide hot water, cook our food, dry our clothes, generate clean power, and fuel our industries, all without destroying our environment. It does so economically, with proven and reliable technology and it is produced right here in North America... all of which makes natural gas the fuel of choice.” — *John Gordon, General Energy Consultant for National Fuel Gas Distribution Corporation*

gas-fired boilers that supply 24 million Btus of hot water for space heating at 87% efficiency. These replaced an aging, oversized gas boiler system that was only 65% efficient. It was costing \$50,000 a year to maintain the older boilers. The new boilers, installed in early 2007, will pay for themselves in three years.

The insurance and real estate firm had already upgraded the complex by installing efficient lighting and making other energy-saving improvements, according to Norman Almeida, Technical and Construction Manager for Central Canada Property Management, Standard Life Real Estate Service Inc.

“We pay incentives for customers to reduce their gas consumption through high efficiency equipment,” says Bill Chihata, Program Manager, Commercial Sector, for Enbridge Gas Distribution Inc., the natural gas utility that serves Toronto. “Enbridge is one of the pioneer utilities in Canada in promoting energy conservation to their customers, leading to substantial reductions in greenhouse gas emissions.”

GREEN POWER, GREEN COOLING

When building owners decide to take their conservation efforts a step further, it’s time to explore power generation and cooling.

One of the hottest topics in the energy business is the use of natural gas for on-site electric generation in order to curtail construction of new electric generating plants. Such plants are costly to construct, resulting in higher power costs for all ratepayers. They also release large

amounts of carbon dioxide, fine particulates and other emissions that negatively impact air quality.

Natural gas is very low in carbon. When burned, it releases carbon dioxide as a byproduct, but not as much carbon as other fossil fuels.

Reducing a building’s dependence on power obtained from less efficient electric generating plants benefits both the environment and the bottom line.

“By utilizing natural gas equipment instead of electric equipment, you are eliminating the need for additional generating capacity,” says Gordon. “Generating plants are costly

NATURAL GAS CAN “GREEN” A BUILDING BY:

- Providing the fuel for high-efficiency space cooling and heating, as well as water heating
- Replacing high-emission fuels such as coal and oil that release greenhouse gases
- Eliminating by gas cooling the use of CFCs that damage the earth’s ozone layer
- Generating electric power onsite, thereby reducing demand on power plants
- Cutting carbon emissions from electric generating plants
- Lessening the need to build new generating plants
- Regenerating desiccant dehumidifiers to maintain proper indoor air quality and ventilation and prevent “sick building syndrome
- Reducing the size requirements for conventional air conditioning systems
- Decreasing the need for chemical cleaners by means of booster water heaters
- Preventing energy waste and heat loss from hot water pipes by replacing tank-style water heaters with tankless natural gas water heaters



Ten RayPak HiDelta Phase 2 natural gas-fired boilers operating at 87% efficiency are expected to shave \$125,000 per year from heating costs at the Standard Life complex in Toronto.

to build. It's more cost effective to eliminate demand than to build new generating plants. It's also more benign from an environmental perspective, by reducing greenhouse gas emissions, smog and acid rain."

True energy efficiency should consider not only the site appliance efficiency but the full-cycle efficiency, including all energy losses from the fuel source through conversion and consumption. Natural gas in its original state is piped from the well directly to the customers, typically losing less than 10% of its original source energy value, as compared to more than 70% lost, mostly in electric generation, but also through transmission and distribution. Electricity is not a naturally occurring energy source. Its source fuels – coal, oil, natural gas, and plutonium – must go through an inefficient conversion process that depletes the original energy value and, in the case of coal or oil, produces higher emissions.

Consider a typical 40-gallon electric water heater requiring 4.5 kW to operate. For 100,000 water heaters, a 450 MW power plant would be needed. At \$1,000 per kW, that plant would cost ratepayers \$450 million to build.

Using direct-fired natural gas technologies to reduce electric kilowatt demand is an important strategy to efficiently utilize natural energy resources while reducing carbon dioxide and other greenhouse gases that have detrimental environmental impacts, says Steve Lisk, Technical Services Engineer with Piedmont Natural Gas of Charlotte, North Carolina. When building a new generating plant costs \$1,000 per kilowatt, he says

lowering power demand is a necessity. "This benefits all of us ratepayers," Lisk says.

The heat recovered from power generation can be converted to air conditioning through absorption chillers. Absorption chillers use heat instead of mechanical energy to cool air. When added to a cogeneration system, an absorption chiller turns it into a "trigeneration" power plant with up to 90% system efficiency.

SAVE WITH MOISTURE CONTROL

Natural gas-regenerated desiccant dehumidification systems, which remove moisture from air with adsorbent materials, can vastly reduce the amount of electric power needed to cool buildings. When excess moisture is removed from indoor air, building occupants can feel comfortable at higher temperatures. For every degree that a thermostat's cooling set point is raised, it is possible to significantly lower electric use while reducing demand on the overstrained power grid.

Some building operators overcool buildings in an attempt to control excess moisture. This can result in condensation problems, freezing occupants and high power bills. The problem can easily be rectified with desiccant dehumidification. Optimum moisture levels also prevent growth of molds and bacteria that contribute to "sick" buildings.

"These (desiccant) systems also help meet green building requirements," says Ed Berger, CEM, Project Engineer, Marketing, for UGI Utilities, Inc., of Reading, Pennsylvania. "First, they

guarantee relative humidity in the building. Second, by saving money using gas versus electricity, you have a lower overall operating cost."

Natural gas can harmonize with other energy sources such as solar power to provide optimum efficiency, according to Gordon. He cites Clarion University of Pennsylvania, a public university with plans to install a hybrid power generation system that blends a solar photovoltaic system with a microturbine fueled by natural gas. The microturbine will offset a portion of the building's electrical energy, supplemented by solar-generated electricity. The exhaust heat from the microturbine will be used to reduce the heating and dehumidification loads.

"We see some synergy in that," Gordon says. "It's important to remind ourselves that natural gas is largely a North American resource – as opposed to foreign oil. It's good for the nation from a public policy perspective. Natural gas is the fuel of choice in our evolving transition to a future where renewable energy will play a greater role."

At night there is far less power demand on campus, making it possible to employ the microturbine at very high efficiency levels. With heat recovery for pool heating, space heating and domestic hot water, the microturbine's overall energy efficiency can reach up to 80%.

"Natural gas can warm (or cool) our homes and businesses, provide hot water, cook our food, dry our clothes, generate clean power, and fuel our industries, all without destroying our environment," says Gordon. "It does so economically, with proven and reliable technology, and it is produced right here in North America... all of which makes natural gas the fuel of choice."

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