FOURTH QUARTER 2008

Denver’s Historic System: Still Full Steam Ahead

Aesthetic Thermal Storage Makes the Grade

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Honolulu’s Seawater Cooling Project Moves Forward

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100th Anniversary Countdown

and more…
DENVER’S 128-YEAR-OLD STEAM SYSTEM:
“THE BEST IS YET TO COME”


Denver’s district steam system may not be the first commercial district steam system (that would be the Lockport, N.Y. system founded 1877), nor the largest (that would be Con Ed in New York City), but it indeed has the distinction of being the oldest continuously operated commercial district heating system in the world. Steam service began to the first customers of The Denver City Steam Heating Co. Nov. 5, 1880, and has continued for 128 years. Today, as part of Xcel Energy Inc., the system serves more than 135 customers in the downtown Denver area from its original plant site. A decade ago this year, the system added chilled-water cooling to its portfolio of services. Over the years, the system has expanded, surmounted challenges, embraced new technologies – and always kept its sight set on the future as it continually anticipates the changing needs of its customers.

The Early Days
On Dec. 15, 1879, four visionaries filed papers incorporating The Denver City Steam Heating Co. with a capital stock of $500,000. The purpose of the company was “to sell and supply steam for heating of stores, dwelling houses and all buildings in the city of Denver, for motive power, cooking purposes and to such other purposes as steam may be required by the Holly district system of steam heating.”

At the time, the four steam system incorporators were among the richest men in Denver: John W. Smith, president, was a successful businessman who also started Colorado Savings Bank after moving to the city in June 1860. Vice President Erastus F. Hallack ran a local lumberyard and was a director of the Denver Water Works Co. George Tritch, treasurer, started a successful hardware business in the 1860s. Chief engi-
The Denver City Steam Heating Company
Denver, Ordinance No. 2, 1880

Be it ordained by the City Council of the City of Denver:

Section 1. That the Denver City Steam Heating Company, a corporation organized under the laws of the State of Colorado, are hereby authorized and empowered to use the street, alleys and avenues in said city, under such rules, regulations and restrictions as the City Council may hereafter adopt, by digging trenches and laying of main and small pipes and expansion junction service boxes, as far as may be necessary and proper to convey and furnish steam from the boiler station or stations for heating the various buildings, or a portion of them, for motive power, and such other purposes as steam may be used for in the City of Denver, by the Holly District system or any other system of steam heating that said company adopt.

Passed by the City Council of the City of Denver, and approved by me this fifth day of January, A.D. 1880
R. Sopris, Mayor

Figure 1. Artist Rendition of the City of Denver’s Ordinance No. 2 Granting a Franchise to the Denver City Steam Heating Co.

THE DENVER STEAM SYSTEM
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HEATING SYSTEM IN THE WORLD.

Engineer Leonard W. Eicholtz gained his experience as a civil engineer building military railways for the Union during the Civil War. The men petitioned the city council for a franchise, which was issued in January 1880 (Fig. 1).

Before steam service began, building operators would normally bank a building’s boilers at 10 p.m., draining out the day’s ash, filling the boiler full of wood to last the night and then heading home. But operators quickly acknowledged the safety benefits of steam service, as the dangers of on-site boilers grew even more pronounced as elevators and other power machinery requiring the use of higher boiler pressures became more common. The explosion of Denver’s Gumry Hotel boiler, which was attributed to operator error, undoubtedly gave the fledgling steam company a marketing boost, as its steam flowed safely to more and more buildings.

By the late 1880s, the Denver system had grown to the point where boilers were added in 1887 and a new 14-inch main distribution pipe was installed to replace the original 8-inch piping. Local materials were employed, as the company learned several years ago when crews unearthed an original carrier pipe insulated by a hollowed-out log. (See photo next page.)

As expected in any business, the Denver City Steam Heating Co.’s management team turned over until Henry Porter, one of the original investors, became president and ran the company until it was sold to Denver Gas and Electric Co. (DG&E) in 1907. Henry L. Doherty, president of DG&E, saw great potential in the steam business. He was also concerned, however, about the threat of his electrical customers installing their own cogeneration systems, so he launched a campaign to improve and grow the steam system. New and bigger boilers were installed. By that time, steam and condensate meters were standard, allowing the company to
This log, discovered several years ago, had been hollowed out, lined with asbestos paper and wrapped around the Denver system’s steam line in the late 1880s as a means to reduce line losses. Xcel Energy invites its district energy colleagues to stop by when they are in Denver to see this piece of ‘insulated main line,’ which sits in a place of honor in the company’s steam conference room.

measure consumption and price accordingly – as compared to the former practice of pricing the service at flat rates based on a building’s square footage. In spite of subsequent mergers, ultimately becoming part of the Public Service Co. of Colorado (PSCo.) in 1923, the steam system had grown to serve 295 customers.

Rebuilding With CHP

With the onset of the Great Depression, a subsequent slow recovery and World War II, the number of steam customers dwindled to 54. Public Service Co. of Colorado commissioned a study that recommended expanding the steam system versus closing it down. In 1948, as a way to increase the system’s overall reliability while reducing its production costs, a 14-inch, 8,000-ft tie line was constructed to connect PSCo.’s Zuni Station electrical generating plant (built in 1900) with the steam distribution system. In this combined heat and power application, steam was extracted from the turbine and sent to the steam customers. In the ensuing years, the steam system steadily recovered from its post-World War II lows and over

time signed both service agreements and purchase agreements enabling it to buy peaking steam from various buildings in downtown Denver.

In 1964 the company signed a long-term agreement with the state of Colorado to serve the nine-building State Capitol complex with steam, which required leasing and operating the state’s boiler plant. The State Capitol, the main steam plant and the Zuni Station then began to provide a ‘three-legged stool’ approach to overall system reliability, as each plant is located approximately 2 miles from the other two. Dual-fuel capability at the original plant and Zuni Station added further reliability for customers.

In the past 10 years, the thermal business has worked with the city of Denver to transition some of the boilers and chillers at city facilities downtown for use in conjunction with the company’s district steam and chilled-water-served facilities. The additional city facilities include the Colorado Convention Center, Wellington E. Webb Municipal Building, Denver City and County Building, Denver Public Library, Denver Art Museum, The

The American House, one of the Denver steam system’s original customers, was the city’s leading hotel in the 1870s through the late 1880s. Located on the northeast corner of 16th and Blake streets, it was one of the early large brick buildings in what is today called the Lower Downtown Historic District. According to an ordinance enacted after a devastating downtown fire in 1863, new buildings had to be constructed of brick or stone; the ordinance was in place for about 80 years.
Setting a Standard for Green Design

In conjunction with the General Services Administration, the U.S. Environmental Protection Agency held a two-stage design competition for a new Region 8 Headquarters building in Denver, Colo. to ensure the building would represent the best in design, environmental performance, work environment and security, while providing taxpayers a good value. The result is a 249,000-sq-ft, nine-story office facility in Denver’s revitalized Lower Downtown Historic District that is a model of energy efficiency and sustainability. (Its interior atrium is featured on the cover.) Since it opened in March 2007, the building has received the U.S. Green Building Council’s Leadership in Energy and Environmental Design (LEED®) Gold certification and won awards for its use of renewable energy technologies.

The building’s heating, ventilation and air-conditioning system was designed for energy and ventilation efficiency. Steam from Xcel Energy’s district heating system is used for space heating and domestic hot water. The building boasts numerous green features, including 10 kW of roof-mounted photovoltaics that were added in 2006 and a 20,000-sq-ft green roof, which helps minimize heat island effects and absorbs carbon dioxide.

The building’s location near Denver’s Union Station offers access to multiple public transportation options, and extensive bike parking and shower facilities are available in the building.

EPA’s Region 8 covers the states of Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

For more on the building, visit www.epa.gov/oaintrt/facilities/denver-hq.htm.

Denver Center for Performing Arts complex and the new Denver Justice Center (court- house and detention center), scheduled to open in 2009.

On average, the steam system’s current customer base consumes approximately 900,000 Mlb of steam, with the hourly peak approaching 500 Mlb. The system operates approximately 12 miles of main and distribution piping, with 720,000 lb/hr in boiler capacity. Over the next two years, the company will be adding approximately 70,000 Mlb of chilled-water business. A dedicated Chilled Water Center was built in the heart of downtown Denver, ‘disguised’ to look like an eight-story office building. The first cooling customer was served in August 1998. The Chilled Water Center incorporates two ice tanks with storage capacity of 75,000 tons-hrs of cooling. Ice is made at night and melted during the day to provide cold-water service to the buildings, while reducing the electrical requirements on the downtown grid during the peak daytime hours.

Since service to the first customer began 10 years ago, the district cooling system has grown to include a distribution network of approximately 5 miles of 24-inch supply and return piping and a fiber optic network laid parallel to the piping, which interconnects all customers and six satellite plants with the Chilled Water Center. The chilled-water service customer base currently has 39 metered accounts, with two more buildings under contract that will initiate service in 2009. The Chilled Water Center and satellite plants serve 21,000 tons of contracted capacity.

New Opportunities, New Challenges

As the saying goes, however, “the best is yet to come.” Downtown Denver is in the process of redeveloping its historic train Union Station, a steam heating customer, which first opened June 1, 1881, and has since been renovated several times. This latest upgrade would transform Union Station into a multi-modal transit hub that would serve the greater Denver metropolitan area transportation needs for the next 30 years — with light rail, commuter rail, AmTrak and regional bus service. The rail and bus service portion of the complex is scheduled to begin receiving passengers in 2012-2013.

After the hub opens, commercial development is expected to continue for five to seven years — both at the 19-acre station site and the largely undeveloped Central Platte Valley along which the station sits. These two parcels offer a great opportunity for

THE DENVER SYSTEM’S FIRST COOLING CUSTOMER WAS SERVED IN AUGUST 1998.
Xcel Energy to introduce a whole new set of property owners to the value that district systems can provide their tenants.

With these opportunities come challenges that are common to many district energy systems. New main distribution lines will have to be installed amid increasingly competitive demands for infrastructure space. Emerging and dynamic LEED® (Leadership in Energy and Environmental Design) requirements will have to be met. Energy management programs, such as Energy Star, will demand overall efficiency improvements. Environmental concerns about global warming will require new and innovative business solutions. Old will become new, as the company goes back to the future and looks at new CHP applications for the benefit of both steam and electric customers. Opportunities for biofuel use grow as the district steam system works to reduce its carbon footprint.

One thing the Denver steam system has learned from its history is the need to be looking into the fog of the future and finding a path to success. Today’s systems are different from those of the past. Tomorrow’s systems will be different from today’s. In the early days, operators looked at gauges; later they read strip chart recorders. Today they study computer screens and analyze data in search of ways to improve performance. But through all of the changes and technological breakthroughs, there is a constant: the need to continue bringing viable solutions to help customers meet their heating and cooling needs.

**Jan Wagner** is the director of Xcel Energy’s Thermal Energy business and its Zuni Steam Electric Generating Station. She assumed the director duties for the chilled-water business in 1998. For the past 34 years, Wagner has held various positions in Public Service Co. of Colorado and was one of the first women in the nation to serve as a power plant director. She is a graduate of the University of Nebraska. Wagner has been a member of IDEA since 1987 and has served on the IDEA board of directors. She may be reached at jan.wagner@xcelenergy.com.

Based in Denver, Colo., **Steve Kutska**, CEM, is the development manager for Xcel Energy’s Thermal Energy (district steam and chilled water) business. His responsibilities include application engineering, energy-efficiency improvements, and LEED certification, as well as overall customer service. Prior to joining Xcel in 2002, he spent 20-plus years with General Electric, where he held various management positions within GE’s energy-related businesses, including field engineering, power delivery, and transportation. Kutska has a bachelor of science in mechanical engineering from the University of Missouri-Rolla. He is currently the co-chair of IDEA’s Business Development Forum. He may be reached at stephen.p.kutska@xcelenergy.com.

**District Energy Space entries for 2008 are due April 3, 2009.**