District Energy St. Paul Narrative

Company History

In 2013, District Energy St. Paul celebrates 30 years of service to customers. Launched as a demonstration project in 1983, District Energy was Saint Paul's response to the energy crises of the 1970s. The venture was a public-private partnership between the City of Saint Paul, State of Minnesota, U.S. Department of Energy, and the downtown business community, all of whom believed in the viability of a hot water district heating system to alleviate the strain of the energy crisis.

District Energy St. Paul was formed in 1979 as a result of a collaborative effort by public and private stakeholders including local, state, and federal government representatives and agencies, community groups, the Saint Paul Building Owners and Managers Association, and the University of Minnesota. The results of this innovative and collaborative public/private partnership remain embedded in the company's culture, values, and mission today.

District Energy St. Paul was built from the vision of Saint Paul Mayor George Latimer. Led by Mayor Latimer, the city lobbied state and federal governments for assistance in adopting a technology developed in Europe that could solve the heating problems of the city. Using the expertise of Hans Nyman, District Energy's first president, the system was successfully designed to offer energy efficiency, fuel flexibility, and rate stability for its customers.

Feasibility studies and marketing efforts were completed in 1982. The signing of 30-year customer service agreements and successful project financing were the next steps to securing the new energy future for Saint Paul. The next generation of customer service agreements is being secured as we move into our next 30 years of service delivery! System construction was completed one year ahead of schedule and $1.3 million under budget. The first downtown customers received hot water service in fall 1983. The heating system now serves more than 32 million square feet of building space and operates at twice the efficiency of the former steam district heating system while using the same amount of fuel. District Energy St. Paul has long held the belief that economic growth and environmental stewardship go hand-in-hand.

True to that belief, in the late 1980s, District Energy St. Paul created District Cooling St. Paul to expand its operations and services. In 1993, ten years after the successful startup of the district heating system, District Energy began offering cooling service to downtown building owners. The district cooling system was financed in 1991, constructed in 1992, and began serving its eight initial customers in spring 1993. The district cooling system was designed to integrate the use of thermal storage to enable the system to shift a significant portion of the cooling load to off-peak hours. The system includes a 2.5-million-gallon chilled water storage tank built in 1994 adjacent to the District Energy St. Paul facility and a 4-million-gallon storage tank built in 2003 in conjunction with a cooling plant in the northeast corner of Saint Paul's central business district. The integration of district cooling has also significantly reduced the use of chlorofluorocarbon (CFC) refrigerants in customer buildings. The use of two thermal storage tanks as well as advanced maintenance and operational techniques enables District Cooling St. Paul to shift up to 9 MW of electric demand to off-peak hours. This has benefited its customers and the electrical grid. Today the district cooling system has more than 100 customers,

representing 20 million square feet of building space, or approximately 60 percent of Saint Paul's central business district.

Ten years later, in 2003, District Energy was a partner to a major efficiency improvement, with the construction of an affiliated combined heat and power (CHP) plant that is fueled by a renewable resource—clean, urban wood residuals. Using renewable fuel, the CHP plant simultaneously produces approximately 65 MW of thermal energy for District Energy and 25 MW of electricity for Xcel Energy. When constructed, it was the largest wood-fired CHP plant serving a district energy system in the nation, annually consuming approximately 280,000 tons of wood residuals. The CHP plant is capable of operating at almost twice the efficiency of conventional electric plants and has reduced sulfur dioxide and particulate emissions, carbon dioxide emissions, and the use of oil, natural gas and coal. The CHP plant provides the thermal energy to meet over 60 percent of the district heating system's load.

In 2011, the system was further advanced with the installation of the Midwest's largest solar installation. It is the country's second largest hot water solar project and the first in the United States to be integrated into a district heating system. The system peaks over 1.2 MW (thermal equivalent) and provides hot water and space heating to the Saint Paul RiverCentre (the system's host site), as well as exporting energy to serve other District Energy customers.

Our company has a rich history of commitment to our customers, community, and the environment, which is shown through our stable energy prices, reliable energy supply, and ongoing pursuit of production and distribution efficiency. In our 30 years of service, we have tripled the space heated while cutting our carbon emissions per square foot served by over 50 percent.

Essential Infrastructure

The role of energy has become a planning priority in vibrant communities. The need for a reliable, yet versatile infrastructure is more important than ever to meeting diverse economic and environmental needs. District Energy is part of the important infrastructure fabric of the city of Saint Paul. Our strong foundation in this city is not limited to, but includes the physical components of the plant, the distribution system, and the customer connections.

District Energy St. Paul currently heats almost 200 buildings and 300 single-family homes (32.2 million square feet) and cools more than 100 buildings (20 million square feet) in downtown Saint Paul and adjacent areas.

The hot water district energy system has proven to be twice as efficient as the previous steam heating system in downtown Saint Paul. Today, the system serves twice the square footage of building space with the same amount of input energy as when the system began in 1983. The distribution system includes 106,000 feet of underground twin supply and return piping (up to 28 inches in diameter) circulating 910,000 gallons of hot water. The system's main distribution pumps circulate up to one million gallons of water per hour. The system's reliability has exceeded 99.99 percent since heating service began.

The cooling system includes two water storage tanks that hold more than 6.5 million gallons of water which is chilled at night, during off-peak electrical hours, for use during the day. The system has achieved over 99.99 percent reliability in both heating and cooling service to customers since its inception.

DISTRICT ENERGY ST. PAUL SYSTEM DATA	
Buildings served with district heating	192 Buildings, 298 single family homes
FY 2012 energy sales	314,000 MWh
Current billed demand	177 megawatts
Total Building Area Served:	32.2 million square feet
Heat Source Total	292.7 MW
District Energy Plant (gas/oil/coal boilers)	192 MW
Combined heat and power plant:	65 MW
Regions Hospital Plant (gas/oil-fired)	25 MW
Mobile boilers (temporary and/or backup):	7.5 MW
Solar thermal	1.2 MW
Piping Materials: prefabricated steel pipe w/ polyurethane insulation encased in polyethylene jacket	
Length:	106,000 feet each, supply and return
Volume:	915,000 gallons
Supply Temperature:	190-250 degrees F
Return Temperature:	140-160 degrees F
Supply Pressure:	180 psi
Reliability rate:	99.992%
DISTRICT COOLING ST. PAUL SYSTEM DATA	
Buildings served with district cooling	102
FY 2012 Energy Sales:	42,900,000 ton-hours
Building Area Served:	20 million sq. ft.
Chilled Water Sources (electrical and absorption chillers)	**35,437 tons**
Piping Materials: steel pipe, protective coating with cathodic protection	
Length:	37,800 feet each, supply and return
Volume of distribution system:	1,050,000 gallons
Volume of storage system:	6,700,000 gallons
Supply and Return Temperatures:	42 degrees F/56 degrees F
Supply Pressure:	150 psi
Reliability rate:	99.990%

Modernization and Integration: Core Components of Our Success

Energy production and delivery is an essential service in any community. District Energy refuses to become stagnant in our charge. District Energy's vision propels us to promote energy conservation, provide a high standard of customer service and to give careful attention to environmental concerns, long-term price stability, and good corporate citizenship. Our company values push us toward modernization and integration at every turn. We continue deep partnerships with business and government partners and count on their support for our continued success.

The commitment to our customer base and the community we serve requires our team to have on-going, meaningful, and trustworthy relationships. Without these relationships efforts to modernize the system and implement more complex integration would not be possible.

In the past five years, District Energy has fully integrated our solar thermal installation into the district heating system, integrated a customer's solar thermal installation into the heating system loop, enhanced the data collection and metering components of the system, and developed a Delta T program for customer service engineers to help manage efficiency.

Modernization has not been limited to the pursuit of system enhancements and energy efficiency improvements. Communication and community engagement has also changed to deepen the conversation with customers, community members, and stakeholders about global climate change and the ways we can minimize our energy footprint.

While internationally recognized for integration of waste heat from the biomass-fueled combined heat and power plant, the system has also expanded to integrate solar thermal heating capabilities – both from our own generation source and from a customer's source.

Integrating Large-Scale Solar Thermal

For years, District Energy St. Paul had a vision to integrate large-scale solar thermal into its hot water district energy system. This vision was realized when District Energy developed and commissioned the Midwest's largest solar thermal project, with system start-up in March, 2011.

This project demonstrates how solar energy can supplement existing district systems from both technical and business model perspectives. The solar energy produced for domestic hot water and space heating is used within the Saint Paul RiverCentre, the city's convention center and solar installation host site. The building was connected to district heating during original construction, 15 years prior to the solar development. Excess solar energy production is distributed into the district heating network for the benefit of the system and other customers. District Energy recognizes the long-term value of these projects for the system and the customers we serve as an investment in sustainability and energy security.

Prior to this installation, solar thermal in the United States was focused on smaller, residential applications. District Energy was committed to demonstrating that integration of large-scale solar thermal – a common practice in Europe – was possible in the United States. Our project was implemented to offer a unique system application, lower the system's overall carbon footprint, and to transform the U.S. market for solar thermal. Since the installation, a Minnesota manufacturer - Solar Skies, has begun production of a commercial-industrial grade collector. This product will be the first in

the United States to match the larger scale and higher temperatures of the international counterparts. This promotes the use of solar hot water in new commercial sectors and advances the environmental goals of the public and private sector.

This large-scale, high-performance showcase lowers the carbon footprint for the District Energy system and our customer by approximately 460,000 pounds of CO2 per year. The 144-collector system was expected to produce a peak of 1 MW of solar thermal energy, but in fact the system has demonstrated production numbers exceeding 1.2 MW capacity.

District Energy's leadership chose to use the solar thermal installation for education and outreach. District Energy staff has led almost 1000 visitors on public educational tours plus private tours for engineers and investors interested in the potential of large scale solar installations. Tours have included installers, manufacturers, engineers, architects, building owners and managers, building superintendents, researchers, and academics from around the world. This installation demonstrates educational opportunities to teach the effectiveness of solar thermal applications, the potential of solar energy in urban areas, and the impact solar energy can make when integrated into larger community energy systems. We are pleased that this important modernization led to a customer's interest in integrating their own solar thermal installation into the District Energy St. Paul loop.

Customer Integration of Solar Thermal into District Energy's System

A successful district energy system depends on collaboration between the system and the customers. District Energy has been proud to develop partnerships with our customers as they seek greater environmental certifications, industry awards, building performance objectives, and, most recently, the development of alternative energy within their building systems.

Last year, Ramsey County identified an opportunity to reduce the environmental footprint of the Law Enforcement Center (LEC), located near downtown Saint Paul. The LEC houses an average of 350-400 inmates per day. This population creates a steady daily demand for hot water for showers, food preparation, and other domestic needs.

Until September 2012, the county had been using the District Energy's heating system to meet 100% of the Law Enforcement Center's hot water needs. The solar thermal collectors were installed in August and September 2012. The solar collectors are tied into the District Energy St. Paul system and now heat up to 40 percent of the Law Enforcement Center's domestic hot water.

Using solar energy means cleaner air, fewer carbon emissions, and a positive impact for the environment. Ramsey County partnered with District Energy, the City of Saint Paul, and the State of Minnesota, to launch this solar installation. The 35 solar thermal collectors were manufactured by Solar Skies, located in Alexandria, Minnesota. This is the first solar thermal installation of this size in District Energy St. Paul's network. The 320-million-annual-BTU system is a unique demonstration site for small-to-medium sized systems linked to district heating systems. This system will also keep 54,000 pounds of carbon out of the atmosphere annually. The Law Enforcement Center complex now utilizes two renewable energy technologies – District Energy's cogeneration and solar thermal.

While solar thermal integration provides an excellent opportunity to reduce carbon emissions, enhanced data collection and management offers another important modernization of the District Energy system expected to result in reduced carbon emissions and increased system reliability.

Modernizing Infrastructure Upgrades and Real-Time Customer Service

In 2010, District Energy began evaluating options for improving the quantity and quality of data. The planned development of a light rail line through the central business district offered the opportunity for District Energy to upgrade the data lines. Our engineers and distribution team recently completed an intensive, multi-year project focused on relocating existing district heating and cooling distribution piping infrastructure during the construction of this light rail line. This complex project included removal of 1983 vintage copper and smaller fiber optic communication lines and subsequent replacement with new fiber optic communication cable. These new fiber optic lines provide crucial, real-time leak detection, communication between meters and the central plant, and important data connections for local and state units of government.

Although District Energy has used fiber optic capabilities since the early 1990s, the recent enhancements allow our teams to collect minute data through simple meters and manage a wide range of data from buildings and plant operations at the server level. Previous data collection was on the hour and at calculations occurred at the meter. These data enhancements allow for the installation of almost any type of meter in a customer building without overhauling an end-to-end data system. Ultimately, server-based calculations will be used to inform modeling when making decisions for improvements in customer buildings and within the system.

The customer service team flag potential problems in customer buildings and connect with the building engineer. The meter data allows our customer service engineers to connect with customers to troubleshoot problems and increase building efficiencies by reviewing detailed trend reports.

Delta T Energy Conservation

While data systems are essential to maintaining system and building efficiencies, our customer service program is directly linked to the relationship with our customers - the building owners and managers. Stable rates and reliable service remain priorities for our team and customers. To maintain stable rates, each customer needs a unique formula for service support to keep their building running effectively.

Through enhanced data management, moisture conditions, closed valves, and other building system inefficiencies that can affect a building's ability to transfer energy efficiently are rapidly identified. Delta T management is unique to hot and chilled water energy systems. We send hot water to the loop between 185°F and 250°F and work to identify buildings facing challenges to return hot water below 160°F. Similar monitoring takes place with chilled water sent into the loop at 42°F to assure that customers return the chilled water above 56°F. If the building return temperatures are outside of our ideal system design parameters, increased flow is required through our distribution network - increasing wear on pipes and increased pumping costs to exchange the same amount of energy. Inefficiency results in increased costs to the customer in excess flow charges, increased energy use, and even damage to a buildings piping system.

By providing each customer with real-time information on building demand and return temperatures, our customer service engineers provide invaluable troubleshooting for the customer. While communication with our customers and the community regarding our downtown Saint Paul system is a

critical and core function of our work, we strive to serve as a liaison and a leader in education on climate and the environment.

Educational Leadership

District Energy St. Paul places a high value on environmental stewardship and education and has significantly expanded our community engagement. By seeking partnerships with other energy, environmental, and business organizations, District Energy is able to maximize its reach to create local energy solutions and minimize effects on global climate. Saint Paul, Minnesota features a premiere showcase of energy technologies, energy saving programs, and educational opportunities all within blocks of City Hall, the Ramsey County seat and the Minnesota State Capitol. Anchored by District Energy St. Paul's utility operations, this unique corner of Saint Paul is complimented by its neighbors and customers, the Saint Paul RiverCentre and the Science Museum of Minnesota. The Saint Paul RiverCentre complex includes Roy Wilkins Auditorium and the Xcel Energy Center and features a nation-leading convention center. This complex has made noteworthy strides in sustainability, earning awards in waste reduction, recycling, innovation, energy efficiency, and leadership in convention and events sustainability. Our solar thermal installation on the Saint Paul RiverCentre roof has further enhanced the sustainability of the complex and served to inform hundreds of visitors about the important role of solar thermal energy in our downtown. It is incredibly important to our company to be partners in this sustainability and educational effort.

Future Earth, the newest Science Museum of Minnesota (SMM) produced exhibit, explores human impacts on our earth and the role of innovators in our earth's future thriving. District Energy continues to deepen its relationship with the SMM by exploring creative ways to engage professionals and community members in conversations regarding a diverse and clean energy future. From development of window clings to highlight the solar thermal installation across the street to intense work with the SMM, the city of Saint Paul, and District Energy to define the future of carbon emissions, the partnership with the SMM provides an invaluable opportunity to share joint messages.

Professional collaboration with a multitude of other organizations including the Will Steger Foundation, the National Park Service, Eco-Education and Fresh Energy, allow us to maximize our limited resources to reach professional, academic, and community audiences. We are developing a plan with our partners to launch a first-of-its-kind educational experience in our special corner of Saint Paul that will be based on the extraordinary energy and environment educational opportunities available to visitors and residents alike. We intentionally seek collaborative relationships with organizations that share a vision of a future which includes a stable climate, local and reliable energy options, and renewable fuel inputs.

What's Next?

Dual Thermal Storage Opportunities

District Energy's team finalized the conversion of a chilled water thermal storage tank to store hot and chilled water with the goal to effectively serve our affiliates District Energy and District Cooling St. Paul during times of peak heating and cooling. The conversion will allow an existing chilled water storage tank to transition seasonally from chilled to hot water storage. Converting the tank to perform in heating mode allows it to store and discharge heat when it is beneficial for the system. This operational versatility will, at times, allow constant boiler output through a predictable load peak.

Under certain circumstances, the tank discharge will allow delayed start of fossil fuel fired boilers. The charged tank will provide short-term redundancy to allow time for operational startup of alternate equipment in emergency or other short-notice situations. Next steps include final design and installation of the interface between the tank and the plant and distribution networks. Tank-specific construction to allow the hot water storage was complete in January 2013. This conversion is an opportunity to integrate additional capabilities, such as flue gas heat recovery and storage of additional renewable thermal energy at our system.

Advanced Heat Recovery

District Energy St. Paul is pursuing a heat recovery project that would extract additional energy from the flue gas of the biomass fired CHP plant. The benefits of this project will be amplified with the integration of our dual thermal storage as the opportunity to capture additional Btu would be used for charging the thermal storage tank.

Exploring and Integrating Energy Islands

Initially commissioned to explore the extension of District Energy during Green Line light rail transit corridor construction, the Energy Island Integration Study evolved with support from the Department of Energy and Congresswoman Betty McCollum to identify opportunities for local energy system improvements. The primary focus was integration of renewable energy, district energy systems, and the repurpose of energy from commercial and industrial facilities, health care complexes, academic campuses, and other energy islands. Energy islands are the existing production facilities and energy users operating independent of each other within a close proximity. These islands hold vast potential as integrated energy systems, with facilities possessing excess or waste energy resources (stranded energy) that could be recommissioned to sell to users with matching demands for energy. This stranded energy could be applied more efficiently throughout our system or be shared with other systems to increase productivity and efficiency.

Our Core Commitments

At District Energy St. Paul we take our commitment for the provision of renewable, reliable and local energy to heart. Local energy is an important value in the community we serve. As the majority of our heat for the district system comes from local wood residuals we are able to contribute millions to the local economy each year. These local jobs, local resources, and local commitment are a strong bond between our company and our community. Our teams are continually exploring innovative ways to reduce the carbon footprint of the system and to fully engage customers, the neighboring community, and visitors from all over the globe in what it means to maximize our value as an energy service provider while minimizing our environmental impact.