The Stone Arch Bridge runs diagonally over the Mississippi River in Minneapolis, above. Left, St. Paul's skyline, and, top left, a pair of novelty signs promoting the two cities.
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A modern round of Twin Cities firsts

Cousin district systems in Minneapolis and St. Paul share an affinity for innovation and technology

By Brent Israelsen

They're called the Twin Cities, but Minneapolis and its alter ego, St. Paul, are more like cousins.

So too are their respective district energy systems – Cordia Energy in Minneapolis and District Energy St. Paul – which together provide heating to 76 million square feet of space and cooling to about 47 million square feet in the dual-city metropolis.

In St. Paul, district energy began almost 150 years ago, evolved slowly in fits and starts, and today runs as a nonprofit utility. In Minneapolis, district energy burst onto the scene in earnest much later, in the early 1970s, as a pure business play to drive a commercial boom that outpaced much of the U.S. in GDP until about 2000 and continues steady to this day.

Though their origins and business models are decidedly different, Cordia and District Energy St. Paul share some common traits: a diverse customer base with various needs and aspirations; a focus on adapting to harsh weather at both extremes, especially as affected by climate change; and a keen eye toward innovation and technology.

Those traits will likely become more important over the next 25 years, as the Twin Cities' population of about 2 million is expected to rise by another 650,000 and as the region pursues net-zero carbon goals.

HOW A SINGLE SKYSCRAPER GOT DISTRICT STEAM GOING

A half-century ago, the Minneapolitan skyline – like many Midwestern cities of the time, save Chicago and St. Louis – was height-challenged and bland. The arrival of the Investor Diversified Services, or IDS, Building in 1972 changed that. Rising 57 stories to more than 900 feet, the post-mid-century-modern glass skyscraper was, for a while, the tallest building west of the Mississippi River.

"IDS was a big, gleaming glass tower that looked totally out of place," said Jacob Graff, Cordia's regional president.

Also out of place at the time was a large new energy plant built on Fourth Avenue through a partnership between IDS and the natural gas utility Minnegasco. Eclipsing the city's two small single-customer systems that were built in the 1930s, the new Main Plant's natural gas boilers and electric chillers fired up in 1972 to provide steam heat to about 3.8 million square feet of space in the new IDS building and cooling to 2.7 million people.

Despite the growth-hampering national stagflation of the 1970s, the IDS – still one of the most imposing structures in Minneapolis – encouraged a sizeable real estate expansion, and by 1982 the district energy system had managed to nearly triple its heating and cooling footprints.

The commercial real estate boom was in full swing by the late 1980s, culminating in the opening of the Convention Center in 1990. Within two years, another plant was added on First Avenue, and a northern loop was built, growing the heating customer base to 24.8 million square feet and the cooling base to nearly 14 million.

"We're really starting to fill in by 1992," Graff said, noting the system's growth was from a mix of new construction and retrofits. Customers ran the gamut from retail and residential to medical, hospitality and sports. In the latter category – and in what must be a singular bragging right in the realm of district energy – Cordia provided ambient comfort to the World Series, the Super Bowl and the NCAA men's basketball Final Four and championship game, all within a seven-month span from 1991 to 1992.

Growth in the customer base popped another 58% by 2002 before tapering slightly, and today Cordia – which acquired the Minneapolis district energy system in 2022 – provides steam or hot water to more than 44 million square feet and chilled water to more than 28 million.

Ten years after the tallest building west of the Mississippi opens, a district energy system nearly triples its heating and cooling footprints.

BIG-NAME CUSTOMERS BEHIND THE MINNEAPOLIS BOOM

Besides IDS and most of its fellow skyscrapers, Cordia's notable customers include the Minneapolis Star Tribune newspaper, the Capella Tower, the Wells Fargo Center, the Target Center (home to the NBA's Timberwolves and the WNBA's Lynx) and U.S. Bank Stadium, home of the NFL's Vikings.

The Minneapolis operations helped Cordia – which owns and/or operates 26 systems in Minnesota, Nebraska, Pennsylvania, New Jersey, Connecticut, Arizona and California – to take home two honors from IDEA's 2024 conference, for total number of buildings and square footage added to its system.

Cordia's system is energized primarily from its workhorse Main Plant, which houses four gas-fired 200,000-pound-per-hour boilers that can also run on #2 fuel oil. Three of those can use electricity or steam to run the plant in case of grid failure, and two of them have heat-recovery wheels.

On the chilled water side, the plant features two 2,000-ton York electric chillers and three Carrier steam-driven chillers totaling 13,800 tons of capacity. The Main Plant also has five gas-fired and electric Caterpillar pumping units, a 90,000-gallon water storage tank, 300,000 gallons of underground fuel oil storage and 120,000 gallons of oil storage above ground.

Cordia also operates six satellite plants in Minneapolis, the most notable being the historic Foster House, which houses boilers and chillers that are able to serve the Federal Reserve in an island configuration, and at the Dayton's Project, a large office and retail development on First Avenue.

At the Dayton's Project, Cordia recently completed a massive overhaul, removing four decommissioned boilers and rejiggering the entire boiler room to make space for three 1,500-ton York chillers. They replaced three 1960s-era 700-ton chillers and doubled the plant's chilling capacity. The overhauled Dayton's Project plant, powered with solar- and wind-generated electricity purchased from utility Xcel Energy's "Renewable Connect" program, is a key part of Cordia's plan to achieve net-zero carbon emissions by 2050, Graff said.

ST. PAUL FOLLOWS TRAILBLAZER TRADITION

Aside from being the land of 10,000 lakes, Minnesota is also a place of many firsts, particularly in feats of engineering and technology: first bridge over the Mississippi; first home furnace thermostat; first concrete grain silo; and first refrigerated truck, to name a few.

District Energy St. Paul appears to be continuing that tradition of firsts – or, in a more modest assessment from its front office, "one of the firsts."

"The spirit of innovation is from top to bottom here," said Luke Gaalswyk, CEO and president of District Energy St. Paul.

Cordia's First Avenue Plant, far left, and its Main Plant.
Cordia

"We're watching the cutting edge very closely."

District Energy St. Paul is the parent company of Ever-Green Energy, established in 1998 to allow for a biomass project and other projects outside the city. Ever-Green today operates 10 systems, in Minnesota, Wisconsin, Illinois, Ohio and California.

With a main plant on West Kellogg Boulevard, District Energy St. Paul traces its roots to a late 19th century coal-fired steam plant along the river. In subsequent years, the Economy Steam Heat Co., St. Paul Light, Heat and Power, and Northern States Power all operated district energy in St. Paul.

In 1983, the system became one of the first in North America to transition from steam to hot water, thanks in large part to then-Mayor George Latimer, who four years earlier had hired Swedish engineer Hans O. Nyman to reinvent the district heating system, which had fallen into disrepair. The two formed a new public-private venture, and District Energy St. Paul was born. Today, it counts the Minnesota state Capitol complex, Regions and United hospitals and the N.H.L.'s Minnesota Wild among its customers.

In 2003, District Energy St. Paul became the first urban-scale DE system in the U.S. to employ biomass as a heat source. The biomass co-generation plant – fueled largely with the shredded remains of ash trees killed off by a widespread borer beetle infestation – has the capacity to produce 55 MW of thermal energy for St. Paul customers and 25 MW of electricity to sell to Xcel for the grid.

Both cities are diversifying their energy sources, including perhaps tapping into waste heat from data centers and wastewater systems.

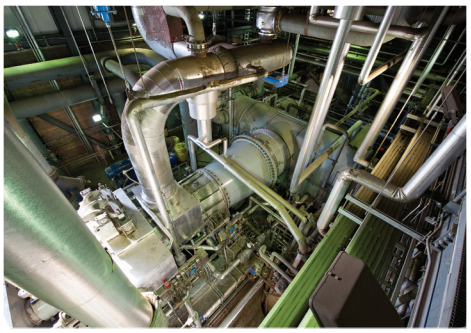
District Energy St. Paul in 2011 was among the first in North America to integrate thermal solar, collected from panels on the roof of the Saint Paul RiverCentre, a stone's throw from the Hans O. Nyman Energy Center, the system's main plant on the banks of the Mississippi.

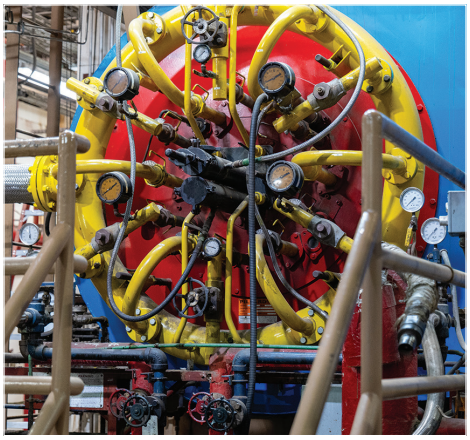
The system added a chilling network in 1993 to serve about a dozen customers. Today, its seven chillers at Nyman and three at a satellite plant on 10th Street count more than 100 customers, a number made possible in part through a total of 6.7 million gallons of thermal storage at both facilities. The cooling has been considered carbon neutral since 2021, when District Energy St. Paul began purchasing power from renewable energy projects in Minnesota and Wisconsin.

Like many district energy systems unshackling themselves from coal in recent decades, District Energy St. Paul joined the trend in 2019. Since then, it and Ever-Green have forged ahead on an array of other carbon-reducing technologies, including:

- **Geo-exchange with aquifer thermal energy storage, or ATES**, where two projects are in progress to use aquifers to store energy from a closed-loop, networked geo-exchange system. The first is well underway east of downtown, at The Heights, an ambitious 112-acre redevelopment project on the site of former golf course that will bring low-income housing and jobs as well as sustainable, affordable heating and cooling to the economically disadvantaged community.

In what appears to be the first large-scale ATES application to district energy in the U.S., the geo-exchange system at The Heights will use an aquifer directly below the development as a source and a sink for thermal energy. Heat pumps powered with electricity from renewable sources will regulate and distribute the energy among the buildings and from a series of well couplets for cold water and another series for warm water. Additional wells could be added as demand grows, Gaalswyk said.





Inner workings at Cordia's Main Plant include modern digital control banks, top right, analog meters, above, and a CHP turbine. The Hans O. Nyman Energy Center in St. Paul, right.
Cordia
District Energy St. Paul

The other geo-exchange system using ATES – believed to be the first in an urban setting – is planned for the Lake Street Redevelopment Project in the Longfellow neighborhood of Minneapolis. That multi-use project on 2.4 acres is comprised of two buildings, one of which was donated by U.S. Bank after it was damaged in the aftermath of George Floyd's murder in 2020.

- **Hydrogen**, which is being developed in partnership with Caterpillar and the U.S. Department of Energy as District Energy St. Paul conducts a small pilot project outside its main plant to produce electricity and heat using hydrogen and natural gas. Deploying a Caterpillar 2-MW CHP generator package, the project will study how hydrogen and hydrogen blends with gas can best be integrated into a DE operation. Though District Energy St. Paul has no immediate plans to add hydrogen to its mix of fuels, the experiment is expected to inform other DE systems whose locations are more suitable for hydrogen use. For its part, the company will get to keep the Cat for backup power and heat.

METRO-AREA COLLABORATION AND NOT MUCH SPOKEN RIVALRY

Because by ordinance its parent company can serve just St. Paul proper, Ever-Green was formed in 1998 to pursue projects outside the city. The Lake Street project is one example.

Ever-Green – which operates Energy Park Utility Co., serving a 218-acre business park between the Twin Cities – recently won the operations and maintenance contract, previously held by Cordia, to run the Hennepin County Energy Center in Minneapolis. The county-owned gas-fired facility near U.S. Bank Stadium produces steam and chilled water to serve 5 million square feet of public and private space, including to Hennepin Health Care Medical Center.

Ever-Green last year also outbid incumbent Veolia to operate the University of Minnesota's district energy system, whose three gas-fired plants serve about 30 million square feet

of space in 250 buildings in the Twin Cities.

"We're excited to expand our footprint in Minneapolis," Gaalswyk said.

While Ever-Green's inroads in Minneapolis might smack of a rivalry between the cities, the two companies bristle at such a suggestion.

"We don't view each other as rivals due to differences in business models and ownership structures," Gaalswyk said. "Those differences are in many ways complementary and could lead to more collaboration here in the Twin Cities in the years ahead as we tackle tough problems as an industry."

'The spirit of innovation is from top to bottom here.'

For his part, Graff prefers to look beyond the Twin Cities to the bigger picture of what Cordia has accomplished nationally.

"Are we the first in the country? The biggest in the country? No. But we're the best. We have a diversity of customers and plants," he said. "This system has done a little of everything in the district energy space. We have done it with a healthy economic model."

Graff said he expects growth in Cordia's business to be steady over the next 10 years, with the company likely picking up some retrofits and a handful of skyscrapers downtown. It also is eyeing development in the North Loop and the Farmers Market area, where the Timberwolves are looking to relocate, a move that would require Cordia to build a new plant.

On the technology front, Cordia this year plans to launch an artificial intelligence-enabled operations optimization project, one of the first of its kind in the U.S. It will start with the chilled water system at the Central Plant, then later be used for the steam system, Graff said. AI will not operate the systems, Graff noted, but will offer suggestions on controls and energy mixes to achieve the highest possible efficiencies and the lowest carbon footprint.

System snapshot: Cordia Energy, Minneapolis

	Hot water or steam or steam/ combined heat and power system	Chilled water
Startup year	1972 – Main Plant 1976 – Baker CUP 1986 – North River 1995 – Foster House 1999 – Macy's CUP 2010 – Interconnect to HERC	1972 – Main Plant 1976 – Baker CUP 1986 – North River 1988 – Convention Center 1990 – First Ave. Plant 1995 – HCEC O&M 1995 – Foster House 1999 – Macy's CUP
Number of buildings served	100	55
Total square footage served	44 million	28 million
Plant capacity	1,075,200 lb/hr steam 9.5 MMBtu/hr hot water	37,550 tons
Number of boilers/ chillers	7 boilers	16 chillers
Fuel types	Natural gas, fuel oil	Electric, steam
Distribution network length	7.11 miles/trench miles	4.72 miles/trench miles
Piping type	Steam: insulated carbon steel casing with 1 inch of foam Chilled water: carbon steel schedule 40 Condensate: schedule 80 with 2 inches of foam	
Piping diameter range	2 to 18 inches	6 to 30 inches
System pressure	250 psig	120-140 psig
System temperatures	406 F	40 F supply / 54 F return
System water volume	N/A	3 million gallons

Source: Cordia Energy

"There's a lot of room to move toward utilizing AI in our operations," he said. "On the chilled water side, we hope to achieve 15 to 30% savings in energy costs and some in chemicals and water too."

Despite their differences, the cities share an affinity for diversifying their energy sources, including tapping into waste heat from data centers and wastewater systems. Graff said Cordia is in talks to recover heat from a data center or two from a tech-rich environment whose targets are about to become more numerous. The Minneapolis Star Tribune reported in February that the Twin Cities data center market, which currently requires 60 MWs of electricity, could grow exponentially, with the state's major electric providers gearing up to supply roughly 2.3 GWs to data centers by the early 2030s.

"If there's a 20-MW data center," he said, "then how can we capture 2 to 3 MWs of heat and use that? We're trying to make it all work out and line up."

Gaalswyk said Ever-Green also is interested in exploring data center

System snapshot: District Energy St. Paul

	Hot water or steam or steam/ combined heat and power system	Chilled water
Startup year	1983 – First hot-water customer 2003 – Combined heat and power installed 2011 – Solar thermal	1993
Number of buildings served	201 hot-water customers 302 single-family homes	123
Total square footage served	32.2 million	19.4 million
Plant capacity	6 gas/oil-fired boilers - 194 MW CHP Plant – 55 MW Regions Hospital Plant (gas/oil-fired) – 30 MW Mobile boilers (temporary/backup) – 7.5 MW Solar thermal – 1.2 MW TOTAL – 287.7 MW	35,437 tons Approximately 6.7 million gallons of thermal storage at <42 F
Number of boilers/chillers	6 gas/oil fired boilers	7 electric chillers at Kellogg 3 electric chillers at 10th Street
Fuel types	natural gas, fuel oil, biomass	electric
Distribution network length	40 miles of supply and return piping	15 miles of supply and return piping
Piping type	Prefabricated steel pipe with polyurethane insulation encased in polyethylene jacket, pre-insulated PEX pipe	Steel pipe wrapped in protective coating with cathodic protection, AquaTherm, HDPE
Piping diameter range	3/4-inch to 28-inch	3-inch to 30-inch
System pressure	180 psig	150 psig
System temperatures	180-250 F supply/ >160 F return	42 F supply/ 56 F return
System water volume	920,000 gallons	1,115,000 gal + 6.7 million gal storage

Source: District Energy St. Paul

heat recovery and is in discussions for projects in St. Paul and elsewhere in the U.S.

The same goes for wastewater heat recovery. District Energy St. Paul recently completed a feasibility study that could capture enough heat from the city's wastewater system to de-carbonize the system and displace natural gas as a primary fuel.

Given that Graff and Gaalswyk first met and worked together at a nuclear power plant, it is no surprise the two are keeping an eye on small nuclear reactor, or SMR, options, whose time many industry experts believe will come (see "Advanced nuclear reactors, coming (someday) to a campus near you," Page 69) to the enormous strains confronting electric grids everywhere and the potential for drastic carbon reduction.

"It's a technology we're paying attention to," Gaalswyk said, "and one that needs to be considered."

Though too early to say whether either Cordia or Ever-Green will become the first major district energy company to tap into data centers or to use SMRs in North America, it's a safe bet, based on history, that both will be, at the least, "among the first."

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Celebrating the start of a hot water network in 1983 and, right, an expansion groundbreaking in 2024 at The Heights.
District Energy St. Paul