2012 Heating the Midwest Conference and Expo
April 26, 2012

Setting a Big Vision
for Regional Biomass Heating Systems

Drivers of the Current Energy System
Global Population Growth

![Global Population Growth Chart](chart.png)

Source: UN

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**PRESS RELEASE**

March 26, 2012, 9:00 a.m. EDT

**Growth in Urban Population Outpaces Rest of Nation, Census Bureau Reports**

WASHINGTON, March 26, 2012 /PRNewswire via COMTEX/ — The nation’s urban population increased by 12.1 percent from 2000 to 2010, outpacing the nation’s overall growth rate of 9.7 percent for the same period, according to the U.S. Census Bureau. The Census Bureau released the new list of urban areas today based on 2010 Census results.

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District Energy St. Paul

www.districtenergy.com
Projected Global Energy Demand

Global energy demand is projected to nearly double between 2000 and 2035.

World Liquid Fuels Consumption

Source: Short Term Energy Outlook, January 2012.
Imagine a World Without Oil

Time Left With Current Reserves At Current Consumption

41 Years

Source: EIA, University of MN
http://www.environment.umn.edu/momentum/issue/3.311/feature_worldwithoutoil.html

Source: EIA Energy Outlook 2012

Figure 5. Average annual world oil prices in three cases, 1980-2035 (real 2010 dollars per barrel)
Global Natural Gas Trends

Trends in natural gas spot prices at major global markets
U.S. dollars per million British thermal units (MMBtu)

- Japan (average LNG import price)
- UK (NBP)
- U.S. (Henry Hub)

“Natural gas can command five times the U.S. price in Asia or Europe.”
Biomass is an age-old energy resource...

...with a renewed interest today.
Woody Biomass – A Fuel Source for Schools and Communities

Opportunity: Integrated Energy Systems

“If the heating, cooling and electricity needs of a larger collection of buildings can be linked together in an integrated system without major distribution losses, then significant savings in primary energy use are possible – beyond what can be achieved by optimizing the design of a single building. Community-scale energy systems also offer significant new opportunities for the use of renewable energy.”

Intergovernmental Panel on Climate Change
Saint Paul’s
Integrated Energy System

Saint Paul’s Community Energy System

- Serving Saint Paul customers since 1983
- North America’s largest hot water district energy system
- Minnesota’s leading biomass, renewable energy system
- A model for integration of renewable energy, combined heat and power and a district energy system

Biomass Fired CHP in Downtown Saint Paul
Our Mission

“Be the preferred provider of community energy services that benefit our customers, the community and the environment.”

Heating and Cooling Saint Paul
Community Integrated Energy System

Integration of Biomass-Fueled CHP
St. Paul Cogeneration – Combined Heat & Power

- 25 MW of electricity
- Renewable, clean, urban wood residue
- Greenhouse gas CO₂ reduced up to 280,000 tons per year

Integration of Biomass

- Up to 300,000 tons/year
- Clean wood waste diverted from landfills
- Created new industry for collecting and processing wood
- Up to $12 million annually put into local economy
Biomass – Where does it come from?

- Wood residuals from manufacturing processes
- Construction waste/clean dimensional lumber
- Urban and park tree trimmings
- Storm and disease damaged trees
- Trees removed as part of a timber management plan/restoration

Solar Thermal Startup - 2011
Community Infrastructure Enables Integration of Diverse Local Energy Sources

Stable Rates

District Energy St. Paul

Combined Rate Summary, 1984-2012

District Cooling St. Paul

Combined Rate Summary, 1993-2012

District Energy St. Paul

www.districtenergy.com
Satisfied Customers

“District Energy St. Paul’s founding principles—energy efficiency, environmental stewardship, stable rates, reliability and customer service—and the company’s track record of meeting them day in and day out, allow Travelers to locate many people here in Saint Paul. Because of District Energy’s reliability, we can also locate vital information technology equipment operations in downtown Saint Paul where a unique setup allows us to meet our business needs in the most cost-efficient manner.”

Jim Scannell, Senior Vice President
Administrative Services
Travelers

In 2009, District Energy St. Paul hosted visitors from 38 countries.
What is possible?

Energy Input for District Heating (Sweden)

- Waste Heat
- Heat Pumps
- Electric Boilers
- Biomass
- Coal
- Natural Gas
- Oil

Source: Swedish Energy Agency

*55 TWh of heat in 2005
Economic Growth & Carbon Reduction

Denmark
Composition of Fuels for District Heating Production

Source: Danish Energy Authority
National Energy Account

District Energy: Empowers Communities for the 21st Century

- Unlocks efficiency gains
- Enables integration of local resources
- Improves security and reliability
- Stable and economical rates
- Reduce GHG emissions
- Solution for today with flexibility for tomorrow
Why is community based infrastructure and the integration of local energy sources so important to securing our energy future?

Source: https://flowcharts.lnl.gov

District Energy St. Paul  www.districtenergy.com
U.S. ENERGY FLOW – 1980
(NET PRIMARY RESOURCE CONSUMPTION 75 QUADS)

Source: https://flowcharts.lnl.gov

Net Primary Resource Consumption 98.5 Quads

Facilities: 23.1% of rejected energy

Facilities: 14.5% of rejected energy

Source: https://flowcharts.lnl.gov
“If you always do what you've always done, you'll always get what you've always got”
Current U.S. Electricity System

Opportunity — Useful heat rejected/dumped to the environment

Energy Consumed To Generate Electricity
100%
33.8 Quads

Electric Utilities

Conversion Losses
66%
22.1 Quads

Plant Use
0.6 Quads

Transmission and Distribution
1.0 Quads

Resource Utilization
33%
11.3 Quads

Centralized generation drawbacks:
- No opportunity to recover heat generated when converting fuel to electricity
- Substantial losses in transmission/distribution of electricity — particularly during peak
- Large plants and the grid are vulnerable to disruption

*Quads = Quadillion Btu's

District Energy St. Paul

Opportunity for More Efficient and Secure Energy System

Combined heat and power solution to recycling waste heat:
Distribute electricity generation to where waste heat can be recovered and put to use.

Fuel Distribution

Distributed Generation

Conversion Losses 25%

75% Overall

Recovered Heat
42%
- Domestic hot water
- Space heating
- Space cooling
- Ventilation air humidity control

Benefits:
- More efficient use of our natural resources
- More secure against natural and man-made disasters
- Reduced pollution
- Enhanced indoor air quality and comfort

Electricity 33%


District Energy St. Paul
“Here's to the crazy ones. The misfits. The rebels. The troublemakers. The round pegs in the square holes. The ones who see things differently. They're not fond of rules. And they have no respect for the status quo. You can quote them, disagree with them, glorify or vilify them. About the only thing you can't do is ignore them. Because they change things. They push the human race forward. And while some may see them as the crazy ones, we see genius. Because the people who are crazy enough to think they can change the world, are the ones who do.”

- Steve Jobs