Environmental and Energy Study Institute

Fact Sheet

What is District Energy?

September 2011

District energy systems are a highly efficient way to heat and cool many buildings in a given locale from a central plant. They use a network of underground pipes to pump steam, hot water, and/or chilled water to multiple buildings in an area such as a downtown district, college or hospital campus, airport, or military base. Providing heating and cooling from a central plant requires less fuel and displaces the need to install separate space heating and cooling and hot water systems in each building.

The *sources* of thermal energy distributed by district energy systems vary. Often, district energy systems are connected to combined heat and power (CHP) plants. Also known as cogeneration plants, CHP plants generate electric power in addition to heating and cooling, and can achieve energy efficiencies above 80 percent. (This is far more efficient than a conventional power-only plant, which exhausts two-thirds of the energy content of its fuel as heat into oceans, rivers, and/or the atmosphere.)

Other sources of thermal energy include "waste" heat from industrial processes, coal- or gas-fired boilers, and renewable energy such as geothermal, hydrothermal, solar thermal, biogas, municipal solid waste, or other types of biomass.

District energy systems that were built on college campuses and in central cities many decades ago were usually powered by fossil fuels. The majority of district energy systems being built today run on natural gas, but many take advantage of locally-produced renewable fuels.

According to the International District Energy Association, there are more than 700 district energy systems in the United States (including at least one system in every state), some of which date back to the 1800s. But there are many more locations where district energy would be appropriate and hundreds of district energy systems with expansion potential.

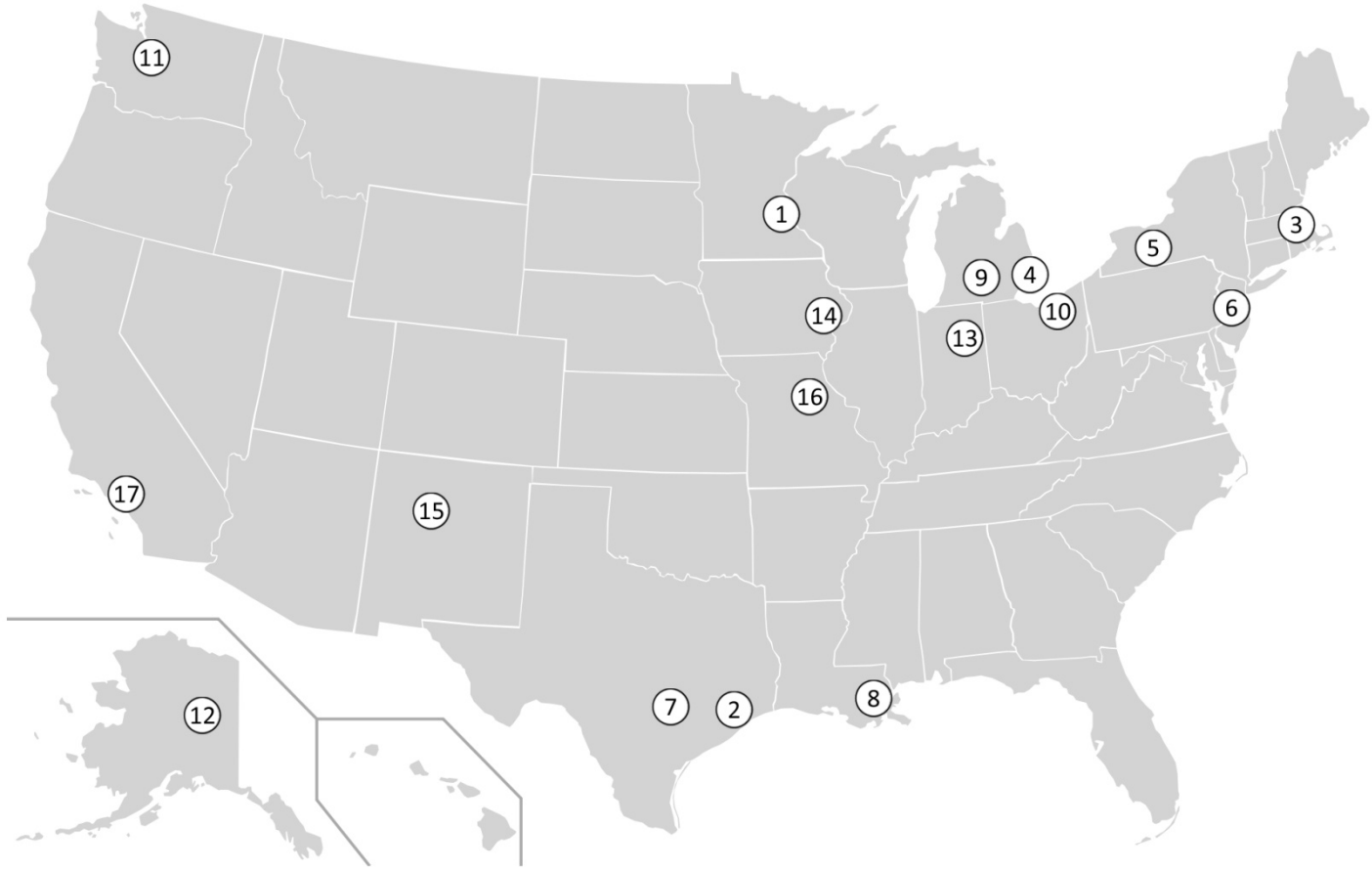
District energy helps communities reduce their operating costs and keep more energy dollars local by reducing their need to import fuel for heating and cooling. Environmental impacts from heating and cooling are significantly reduced because of the greatly improved efficiency of these systems and developing district energy/CHP systems can help ease the transition of the power sector as older, polluting coal plants are shut down and removed from the grid. District cooling can cut peak electrical demand that typically occurs in the late afternoon – reducing strain on the grid and avoiding expensive peak power costs.

According to a May 2011 report by the International Energy Agency, heat represents 37 percent of final energy consumption in OECD countries and 47 percent globally. Yet federal energy policy has focused primarily on electricity and transportation fuels, largely excluding the important role of thermal energy.

Constructing a new district energy system is a major infrastructure project, involving connecting all of the buildings in a district to the central plant through underground pipes. Even though the long term energy savings and environmental benefits are significant – and the project would generate many good paying jobs – the high upfront costs can discourage developers. Connecting CHP systems to the power grid can also be problematic. The federal government can play an important role in encouraging investment in district energy/CHP systems through various financing and regulatory mechanisms.

EXAMPLES OF DISTRICT ENERGY SYSTEMS

There are more than 700 district energy systems in the United States. Here are just a few examples:



1. Central Business District - St. Paul, MN

District Energy St. Paul provides heating to more than 80 percent of St. Paul's central business district and cooling to more than 60 percent of the central business district. District Energy St. Paul meets 70 percent of its customers' annual heating from a biomass CHP plant. It has reduced greenhouse gas emissions by over 200,000 tons per year, and reduced sulfur dioxide and particulate emissions by more than 60 percent. In 2011, District Energy St. Paul became the first district energy system in the nation to integrate large-scale solar thermal technology.

2. Texas Medical Center - Houston, TX

Texas Medical Center, the world's largest medical complex with 6,800 patient beds, uses CHP and holds the largest campus district energy system in the United States. The system, operated by Thermal Energy Corp (TECO), is projected to reduce carbon emissions by about 305,455 tons per year – the equivalent of removing 53,000 cars from the road – and save approximately $200 million in energy costs over the next 15 years. District energy/CHP allows the medical center to meet its thermal energy needs without relying on the electric grid.

3. Downtown Boston, MA

Veolia Energy installed a pipe across the Charles River to export steam from a Cambridge power plant to downtown Boston, making use of heat that would have otherwise been released into the river. By using waste heat for energy, carbon dioxide emissions were reduced by 150,000 tons per year. Veolia Energy invested $12 million in technical and environmental upgrades, has more than 200 employees in the Cambridge and Boston area, and more than 240 customers for heating, process use and cooling.

4. Detroit, MI

Detroit Renewable Energy's energy-from-waste facility processes up to 3,300 tons of municipal solid waste per day into refuse-derived fuel that is combusted to create steam for heat and power. The CHP facility can generate up to 68 megawatts of electricity and heat over 140 businesses.

5. Cornell University - Ithaca, NY

In December 2009, Cornell University upgraded its central heating plant with a cogeneration system that cut its greenhouse gas emissions by over 20 percent. The system prevents an estimated 89,300 tons per year of carbon dioxide emissions. Cornell pumps cold lake water through a district energy system to cool its buildings. This has reduced the university's electricity use for central cooling by 86 percent (important for reducing peak demand) and eliminated 10 percent of overall campus electricity use.

6. Princeton University, NJ

The Princeton Energy Plant uses CHP and district energy to provide electricity, steam, and chilled water to power, heat, and cool the 150+ buildings on the Princeton University campus. Through cogeneration and waste heat recovery, Princeton's plant reaches about 80 percent efficiency. The plant can switch from natural gas to biodiesel when natural gas demand and prices are high. CHP, district energy, and demand side management reduce Princeton's peak demand by 25 megawatts, freeing this system capacity for use elsewhere in the local grid and saving the university money.

7. University of Texas at Austin - Austin, TX

UT Austin uses CHP and district energy to provide 100 percent of power, heating, and cooling for the 200 buildings on its campus. The campus has not been a load to the Texas electrical grid since 1929. Investments in energy efficiency improvements saved about $170 million worth of energy costs between 1996 and 2008 and have resulted in a system energy efficiency of more than 90 percent. Its highly efficient CHP system has enabled UT Austin to achieve carbon-neutral growth.

8. New Orleans Medical Center and Downtown New Orleans, LA

Entergy Thermal began construction on a district energy system in the New Orleans Medical Center and downtown New Orleans district in 1999 and began providing service 14 months later. At full build-out, the NORMC District Energy Center will have the capability to produce 33,000 tons of chilled water and provide air conditioning to over 12 million square feet of commercial property in the NORMC district and downtown New Orleans.

9. Battle Creek Veteran's Affairs Medical Center - Battle Creek, MI

Nexterra Systems Corp. announced in September 2011 that it signed a $6.9 million contract to deliver a biomass gasification system that will provide heat and power for the U.S. Department of Veterans Affairs Medical Center (VAMC) in Battle Creek, Michigan. The total cost of the project is $18 million. Switching from fossil fuel to biomass supports the Department of Veterans Affairs' objectives of achieving a 30 percent reduction in greenhouse gas emissions (GHG) by 2020, producing a minimum of 7.5 percent of electricity from renewable sources.

10. Downtown Cleveland, OH

Cleveland Thermal's district energy network includes two plants on opposite ends of Downtown Cleveland, which provide 30 percent of the heating and cooling needs of the city's business district. Cleveland Thermal's pipeline spans more than 30 million square feet, bringing steam and chilled water to commercial, institutional, and municipal buildings in downtown Cleveland. Customers have reduced their peak power demand, thereby reducing their cost per kilowatt hour.

11. Central Business District - Seattle, WA

Seattle Steam, a privately-owned utility, provides district heat to approximately 200 buildings in Seattle's Central Business District and First Hill neighborhoods. The company produces thermal energy from five boilers located in two plants in downtown Seattle. In 2009, Seattle Steam converted to renewable energy and began burning clean urban waste wood as its primary source of fuel. This reduced the carbon footprint of Seattle Steam and its customers by 50 percent.

12. University of Alaska Fairbanks - Fairbanks, AK
The central utilities system at the University of Alaska Fairbanks provides steam, electricity, and chilled water to 7,000 students and over 3 million square feet of facilities. An engineering firm tasked with developing a cost-benefit analysis recently recommended the university update its plant and install a coal fired boiler with the capacity to also burn biomass; the university is in the process of pursuing funding.

13. Ball State University - Muncie, IN
Ball State University is in the process of building the nation's largest closed-loop geothermal energy system to replace its four aging coal-fired boilers. The university-wide system will heat and cool more than 45 buildings and span the entire 731-acre campus. Once fully implemented, the project will save the university $2 million a year in operating costs and will cut the university's carbon footprint roughly in half.

14. University of Iowa - Iowa City, IA
The University of Iowa fuels its district energy system with oat hulls (a by-product of cereal-making from the neighboring Quaker Oat facility) that are co-fired with coal and natural gas. Since the University of Iowa began using biomass in its on-site power plant, carbon dioxide emissions have been reduced by over 50,000 tons each year.

15. University of New Mexico - Albuquerque, NM
The University of New Mexico uses CHP and district energy to provide power, heating, and cooling for its 8 million square feet of facilities. The CHP system operates at approximately 64 percent efficiency, uses approximately 18 percent less fuel than equivalent separate heat and power facilities, and effectively reduces carbon dioxide emissions by 8,200 tons per year.

16. University of Missouri - Columbia, MO
In mid-2012, the University of Missouri is expected to complete a large biomass district energy system project that will use 100,000 tons of regionally supplied biomass per year. The boiler system will use a wide variety of sustainably sourced biomass feedstocks such as woody biomass, grasses, waste papers, and agriculture residues.

17. University of California Los Angeles - Los Angeles, CA
The UCLA cogeneration plant is fueled by natural gas and seven percent landfill gas. Landfill gas often is flared, which is both wasteful environmentally destructive. Capturing the gas for use as a renewable energy source offsets the need for coal or other petroleum based fuels.

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