IDEA Report: The District Energy Industry

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TABLE OF CONTENTS

1. DISTRICT ENERGY SYSTEMS
   a. OVERVIEW
   b. TYPICAL DISTRICT ENERGY SYSTEM
   c. FEATURES AND BENEFITS
   d. DISTRICT COOLING ADVANTAGES

2. DISTRICT ENERGY INDUSTRY
   a. BACKGROUND OF U.S. INDUSTRY
   b. SAMPLE SYSTEM – NEW YORK CITY
   c. CAMPUS ENERGY SYSTEMS
   d. MARKET CONDITIONS
   e. SAMPLE DISTRICT ENERGY SYSTEMS
   f. DISTRICT ENERGY BEYOND NORTH AMERICA

3. INDUSTRY AND ASSOCIATION TRENDS
   a. DISTRICT ENERGY SPACE
   b. COMBINED HEAT AND POWER
   c. EPA CHP PARTNERSHIP PROGRAM
   d. RECYCLING ENERGY INITIATIVE
   e. IDEA SYSTEM OF THE YEAR AWARD
   f. FEDERAL SUPPORT FOR DISTRICT ENERGY

4. APPENDIX
   a. IDEA MEMBER OPERATIONS REPORT
   b. CASE STUDIES
   c. RELEVANT LINKS AND RESOURCES

District Energy Systems Overview

The fundamental idea of district energy is simple but powerful: connect multiple heating and cooling energy users (buildings) through an underground piping network to environmentally responsible energy sources (central plants), such as combined heat and power (CHP), industrial waste heat and renewable energy sources such as biomass, geothermal and natural sources of heating and cooling. (See Figure 1)

District energy systems produce and pipe steam, hot water or chilled water underground through a dedicated piping network to heat or cool buildings in a given area, reducing energy costs and greenhouse gas emissions, while freeing up valuable space in customer buildings by centralizing production equipment and, through economies of scale and equipment management, optimizing the use of fuels, power and resources. District energy (primarily district heating currently) delivers about 3.5 % of the total final energy demand in the industrial, residential, public, and commercial sectors.[1] About 6.5% of commercial buildings in the U.S. are heated with district heating.[2]

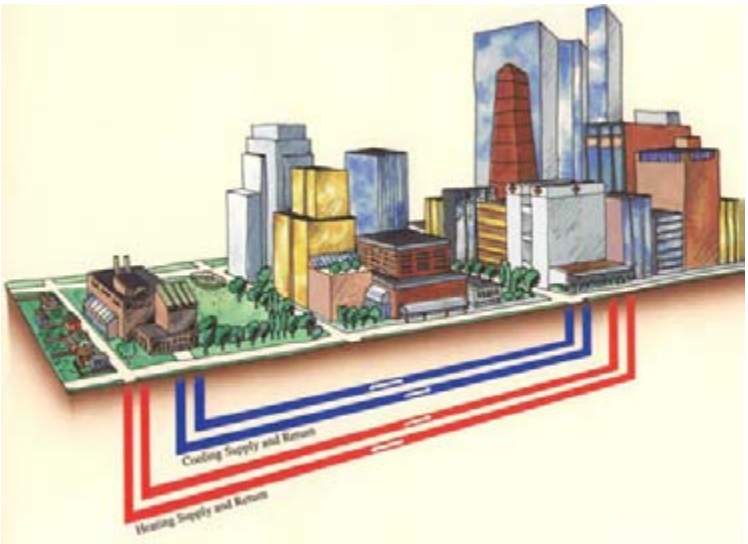


Figure 1. District heating and cooling systems serve multiple buildings within a given area from an energy-efficient central plant.

In North America, district energy systems are typically located in dense urban settings in the central business districts of larger cities; on university or college campuses; and on hospital or research campuses; military bases and airports. District energy systems in North America typically serve "clusters" of buildings, which are sometimes commonly owned, as in the case of a private or public university campus or hospital. Frequently, however, in downtown systems, the customer buildings have distinct and separate owners; are generally located near each other in a central business district or segment of the city, and are interconnected individually to the distribution piping network. The number of customer buildings served by a typical district energy system may range from as few as 3 or 4 in the early stages of new system development to as many as 1,800+ customer buildings served by Con Edison Steam Business Unit in Manhattan, the largest district steam system in the world.

[1] Sven Werner, "Globally avoided carbon dioxide emissions during 1998 as a benefit from the current use of DH/CHP," presented at the Euroheat & Power annual conference, Brussels, March 5, 2002.
[2] U.S. Energy Information Administration, "Commercial Buildings Energy Consumptions Survey,' 1999.

Mature steam systems in U.S. cities like Philadelphia, Indianapolis, Boston or Denver serve between 200 and 400 customer buildings. Larger and established combination district heating and district cooling systems such as those in Hartford, Minneapolis, and Omaha generally serve between 65 and 150 customer buildings on heating and between 50 and 125 customer buildings on cooling. In most cases, the urban district energy system typically serves over 50% of the Class A commercial office space in the central business district and in many cases, market share exceeds 85%[3].

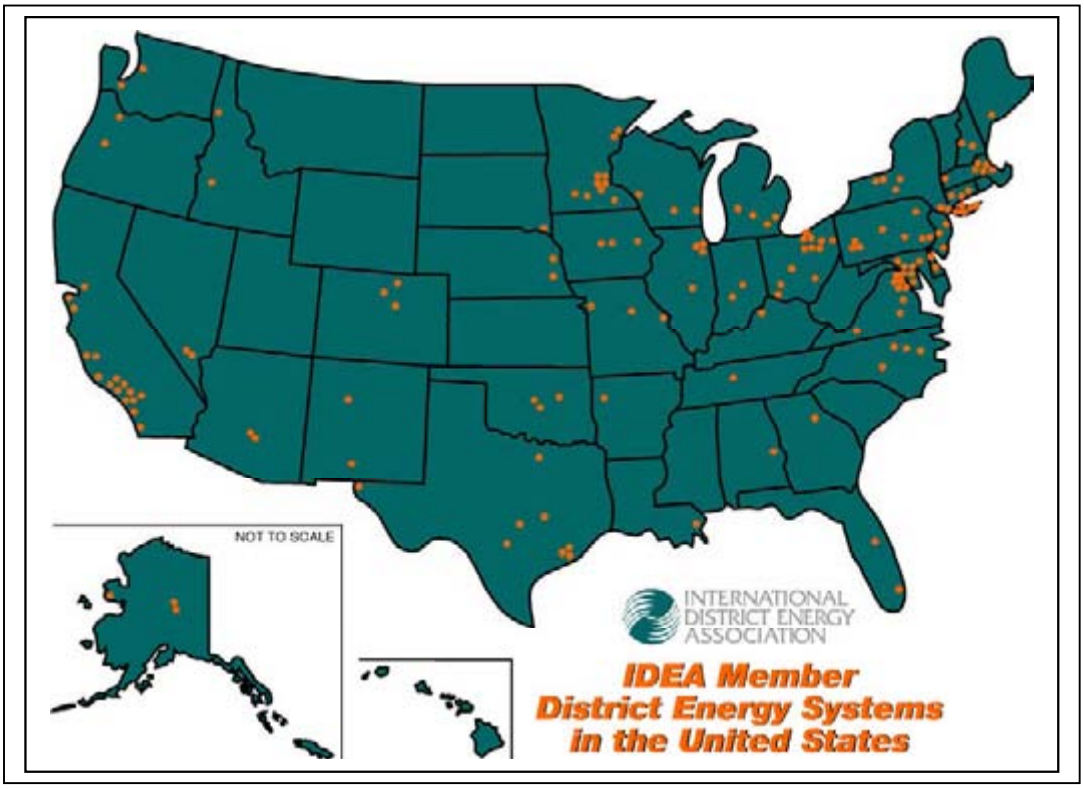


Figure 2 – District energy systems operated by IDEA members are in 38 of the United States. US Department of Energy (Census 1992) estimates that there are over 2500 district energy systems operating in United States.

District energy systems are the preferred method of heating and cooling most major college and university campuses. In the U.S. hundreds of campus energy systems provide highly reliable and scalable energy supply. Many U.S. universities are adding or increasing their ability to generate electricitiy on campus and are recycling heat from power generation to heat buildings and drive steam chillers for campus air conditioning. [4]

[3] (See District Energy St. Paul, www.districtenergy.com, Hartford Steam Company; www.hartfordsteam.com)
[4] http://www.districtenergy.org/guidebook/CHP.Webdoc.Homepage.htm

Typical District Energy System

District energy systems enjoy the economy of scale and operational benefits of connecting to a large, diverse portfolio of customers. By aggregating the thermal requirements of dozens or even hundreds of different buildings, the district energy system can employ industrial grade equipment designed to utilize multiple fuels and employ technologies that would otherwise simply not be economically or technically feasible for individual buildings, such as deep lake water cooling; direct geothermal or waste wood combustion. As depicted in Figure 3 below, the diversity of energy options and fuel flexibility creates a market advantage for district energy systems and establishes the district energy system as an asset for community energy planning. Additionally, the availability of district energy service reduces the capital cost of developing an office building by cutting the boiler and chiller plant capital cost from the project.

In many cases, the district energy facility can utilize local fuel resources (such as waste wood in St. Paul [5] or oat hull by-products at the University of Iowa [6]). This keeps energy dollars recirculating in the local economy and as a renewable energy source, may qualify for a production tax credit under a renewable energy portfolio standard.

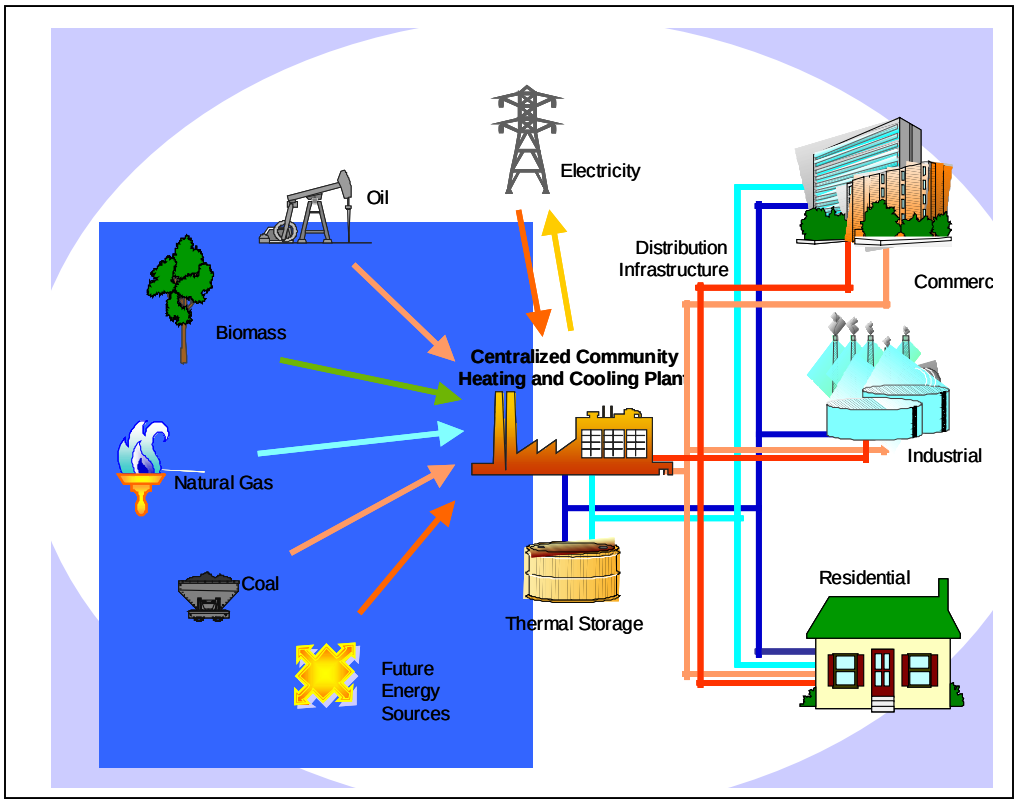


Figure 3 — This figure illustrates how a central district energy facility can utilize various sources of fuel to create electricity, heating and air conditioning to supply a variety of users in a community.
Courtesy of District Energy St. Paul

[5] http://www.districtenergy.com/CurrentActivities/chp.html
[6] http://www.districtenergy.org/CHP_Case_Studies/University_of_Iowa.pdf

Urban district steam systems primarily provide space heating and domestic hot water service, and in some cases, steam is used for commercial or industrial processes such as commercial laundries, breweries, and for production lines in biotech laboratories.

Combination heating and district cooling systems provide chilled water that is used for air conditioning of building space and process cooling for data centers and switchgear. In a city, there is generally a diversity of load as different types of buildings (i.e. residential, commercial, retail, convention, etc) will use energy under different operating conditions and set peak demands at different times of day. Serving this variety of loads allows the central plant to operate at optimal output over a longer time period. Additionally, many district cooling systems incorporate thermal storage systems to further expand peak capacity and increase the operational flexibility and efficiency with the ability to operate equipment at optimal output.

Features and Benefits of District Energy Systems

Economies of Scale Yield Energy Efficiency

All district energy business models create and harvest value by re-capturing or producing thermal energy, conveying it in one or more forms to an energy conversion or usage point in the customer building. The amount of customer value created depends upon how economically and efficiently the district energy provider does this relative to rival centralized energy sources or customer solutions such as on-site boilers and chiller plants, electric space heating, individual heat pumps, or building-scale cogeneration facilities.

Since urban energy consumers typically have multiple alternatives for heating and cooling buildings, the economic competitiveness of the district energy option is enhanced by the ancillary benefits including capital savings from avoided investment in building equipment; reduced labor and maintenance expenses due to simplified operating systems; lower costs for water, chemicals, insurance and fuel (including storage); and generally higher operating efficiencies due to scale and better load matching. Additionally, in a dense urban environment, there is often a premium value for space that can be reclaimed for other productive uses by displacing mechanical equipment, flues and cooling towers. In particular, rooftop and penthouse space can be shifted from a cost center for large mechanical systems to profit center for third parties (i.e. cell and microwave towers; restaurants, leasable footprints).

Customer Benefits

From a customer perspective, there are a number of advantages to connecting a building to district energy service, including:

- Ease of use and simplified building operations
- Avoided capital costs for in-building heating and air conditioning equipment
- Reduced labor, repair and maintenance expenses
- Space is made available for alternative uses and other income activities
- Highly reliable energy services
- Less fuel and chemicals stored and combusted on-site

For commercial real estate developers, especially in dense urban settings where real estate acquisition and construction costs are high, economics demand high yield from every available square foot of leaseable space. District energy services displace large mechanical equipment and eliminate the need for stacks and flues throughout the building core. Valuable rooftop or penthouse space can be reclaimed from noisy and unsightly rotating equipment and structural loads for equipment can be reduced. Moreover, by removing aging or operational boilers and chillers from existing buildings, usable space can be reclaimed and the electrical capacity of building transformers and vaults can be freed up and re-used for tenant electrical demands.

Simplified Systems and Operations

District cooling services simplify building operations by removing the chilled water production cycle from the building. District chilled water is delivered to the building intake valves at 42 - 37 Deg F. A heat exchanger or energy transfer station circulates the cold district chilled water building water across the coil. The building side water gives up its heat to the district water and is re-circulated through building air handler coils to absorb more heat from the building.

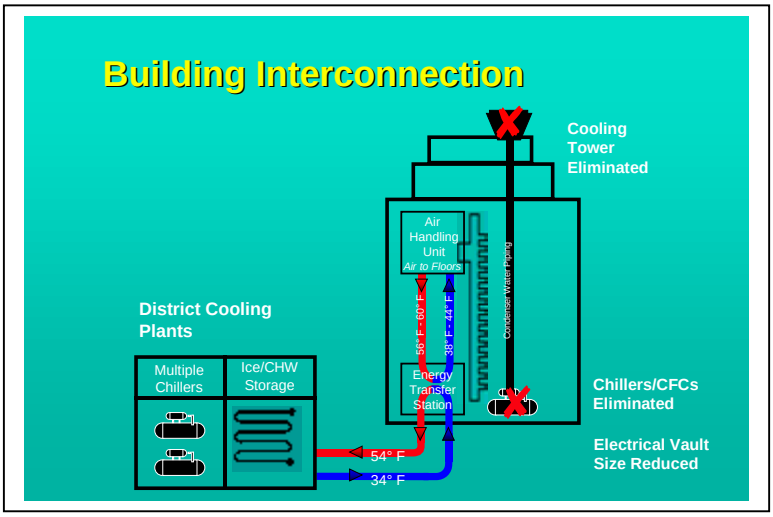


Figure 4 depicts how district cooling service connects with the building system and displaces on site equipment for air conditioning.

Highly Reliable Service is Hallmark of District Energy Industry

The benefits most frequently cited by district energy customers are the convenience, ease of use and reliability of district energy service. Most district energy systems operate at four nines of reliability (service is available 99.99 percent of the time on an annual basis)[7]. In fact, operational reliability has been a hallmark of the district energy industry. When conducting due diligence on operating history, the former owners of Minneapolis Energy Center reported only three hours of unscheduled outage over 25 years of operations. Similarly, with the natural disasters of the San Francisco earthquake of 1989; the great Ottawa ice storm in 1998; and the Seattle earthquake of 2001, the only utilities that reported continuous and uninterrupted service were the respective district steam systems in San Francisco, Montreal and Seattle. Service reliability is critical when serving a primary or tertiary care hospital, a campus research laboratory or a Federal Government operations center. District energy systems offer highly reliable service.

[7] http://www.districtenergy.com/Advantage/communities.html

Fuel Flexibility and Optimal Operations

The principal business challenge in a district energy business is to manage plant production capacity and fuel risks to meet coincident customer heating and cooling peaks most efficiently. This might involve diverse production units to more efficiently supply seasonal load characteristics. With the recent escalation in commodity fuel costs for coal, natural gas and oil, and concomitant increase in power costs, many district energy providers are exploring alternative fuel sources to increase fuel flexibility as a hedge against fossil fuel costs and to potentially qualify for renewable production tax credits and portfolio standard programs. Most district energy businesses have a mechanism in rates that allows for fuel cost adjustments and recovery.

Better Use of Capital

When a commercial building owner or developer does not have the option of connecting to a district chilled water network, the most common approach is to install electric drive chillers and rooftop cooling towers. When a consulting mechanical engineer designs the onsite chiller plant, consideration is given to a number of design factors that effect the cost, size and operational performance of the stand alone cooling system for that building. The designer and mechanical contractor must install sufficient cooling capacity to meet the air conditioning demand on a peak day, although that peak may only occur a few hours every few years. The array of chillers are selected with some redundancy so that if one should need repair or be out of service for maintenance, there is still adequate capacity available to meet cooling demand. The chillers are designed to operate at part load efficiency but are most in demand when outside temperature and humidity are highest and operating performance is least ideal.

With the increase in computers, lighting and density of personnel in buildings today, many commercial office buildings require some base load level of cooling 24/7/365. In winter months, some buildings utilize winterized cooling towers to reject heat for core cooling. With the internal heat generation in today's typical commercial office building, cooling is much more of a 12-month operation than simply comfort cooling in summer months. Finally, a prudent consulting engineer will consider the useful life of the chiller plant of around 23 – 25 years and plan for performance degradation over time due to fouling, wear and tear and simple depreciation. All of these factors lead to installation of more cooling capacity than actually required and can result in higher operating costs, less efficient operations and in some cases, higher electricity demands than necessary.

A district cooling customer has the advantage of contracting for the optimum contract cooling capacity from the district energy provider. In most cases, the customer will contract for the actual peak hourly cooling demand as set under peak summer conditions, yet the contract capacity is still often 30 to 50% less than would have been installed in the building with its own standalone chiller plant. Because the district energy provider is actually selling "rejected heat on a real time basis", the district cooling customer is then able to maximize building systems to better manage peak cooling demand and can take the correct amount of cooling as determined by the load rather than the lower limit flow rate determined by an on site chiller system. This is particularly valuable during spring and fall months where low loads are most likely.

District Cooling Contract Capacity vs Installed OnSite Capacity

Depicted in Figure 5 below are three commercial office buildings that were constructed and connected to the district cooling system in Hartford, CT in the 1980's. The chart compares the difference between the chiller capacity that was designed for an in-building chiller plant and the actual contract cooling capacity experienced by each building in operations. The design for stand-alone chiller plants typically call for installation of between 30 % and 100% more cooling capacity than will be required from a district cooling provider. When district cooling is an option, the building owner is able to avoid the full capital investment in on-site chiller plant and can allocate that capital to other income-producing activities or tenant amenities. With an average capital cost of at least $1,000 per ton of installed cooling capacity, the capital savings range from $800,000 to over $2.4 million in these buildings. In the case of Building B in Figure 5 below, the contract capacity of 695 tons for a 540,000 gross sq ft commercial office building equates to 775 square feet per ton of capacity. This is about twice as capital efficient as a stand alone chiller plant which would typically be sized at 400 square feet per ton of installed chiller.

Figure 5

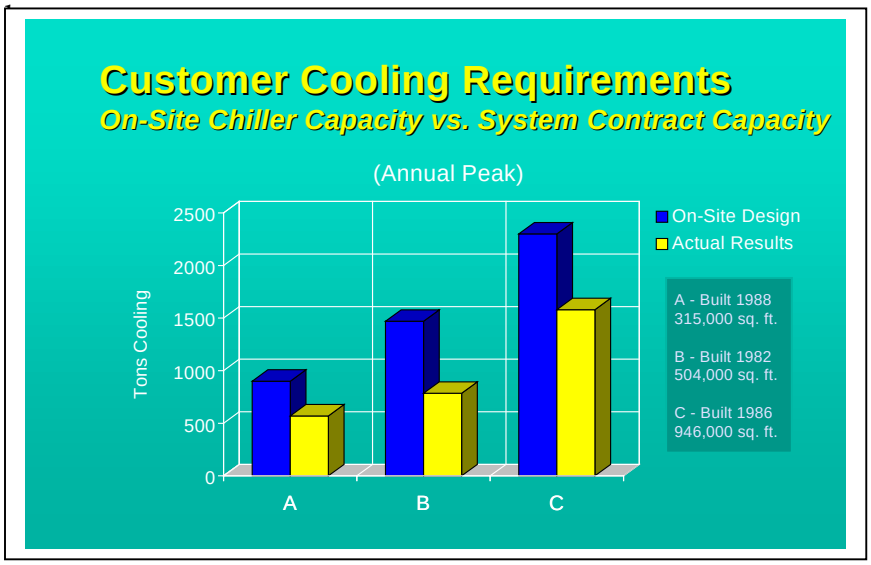


Figure 5 – Indicates the difference in actual cooling capacity requirements in three buildings in Hartford, CT between capacity designed for an onsite chiller plant (blue) and the actual contract capacity required (yellow) for peak hour cooling capacity in Tons from the district cooling system.

The distinction between contract capacity and installed capacity becomes is very important in an existing building that is considering replacement of an aging chiller plant with connecting to the district cooling network. In many cases, the district cooling provider is placed in the unique situation of trying to sell less contract capacity than the building operator currently has installed on site. It is important to accurately set the contract capacity based on the peak hour rejected heat demand of the building, and not based on the volume of chiller capacity installed on site. District cooling rates are typically fixed over a twelve month capacity charge based on the peak annual requirement, along with a unit consumption charge based on the variable monthly metered volume of rejected heat. The competitiveness of the district cooling offering often hinges on the difference in contract capacity at 70% to 50% of the installed cooling capacity.

Flatter Electricity Demand Profile With District Cooling

From an operational perspective, the impact of district cooling service on electricity demand profile is illustrated below from an actual 350,000 sq ft commercial office building in Cleveland, OH in Figure 6 below.

Figure 6

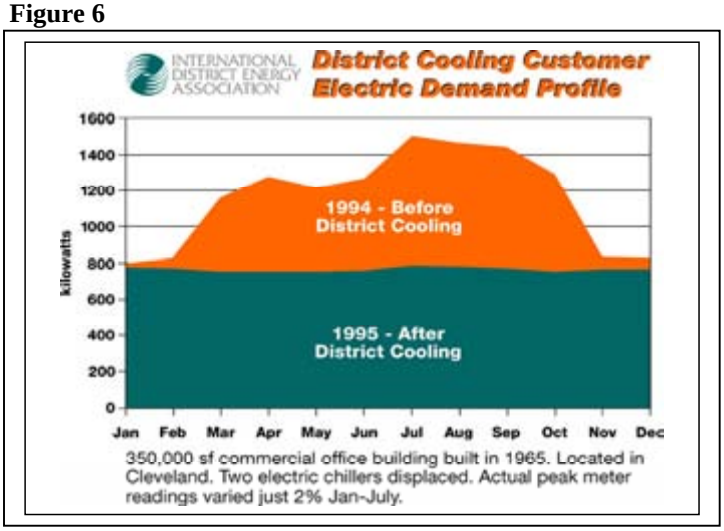


Figure 6 – Actual electrical meter readings kilowatt demand in 350,000 SF office bldg "Before - Orange" and "After – Green" district cooling service was installed and electric chillers displaced.

Displacing two electric drive chillers resulted in a flattening of the peak electric demand from 1485 KW to 798 KW in July. The end result for the building was a much flatter electric demand profile year round, varying by less than 2% from January through July to December. This flatter electric demand profile has great value to the customer, the tenants and the local electrical grid.

In some cases, installing district cooling and displacing peak electric demand from chillers provides additional benefits to the building owner and major tenants. In some cases, this "frees up" valuable electrical transformer or vault capacity for other electrical needs in the property. Sometimes, electrical supply is limited, capacity can be constrained and replacing or upgrading electrical transformer faults can be expensive and difficult in certain sub-basement conditions. Space can be difficult to work in. Available space can be at a premium and the timing and difficulties of downtime can also be problematic for certain tenants. By displacing the chiller load, which is typically the single largest source of peak electric demand in a commercial office building, the property owner can "harvest" additional electrical capacity for other beneficial uses.

From the perspective of the local electricity grid operator, displacing nearly 700 KWD in one building may not seem like much, but with district cooling potentially serving dozens of buildings in a congested urban setting, there is potential to shift many megawatts of peak electric demand from the overtaxed power grid to either steam driven chillers, thermal storage or more efficient district cooling facilities. A district cooling system provides greater operational flexibility to a central city or college campus.

Background of US District Energy Industry

The commercial U.S. district energy industry can be considered in two distinct segments: pre-1960 downtown steam systems, and post-1960 combined downtown district heating and cooling systems. In many cases, the systems in the first segment actually date back to the late 1880's or 1890's when investor-owned utilities were first being formed to provide electricity services in central cities.

In fact, when the original "Edison Electric Utilities" were being formed in major US cities like Boston, New York, Chicago, Detroit, Philadelphia, Baltimore and others, many utility operators found that steam service revenues were very important to the profitability of the early enterprise. In some cases, the offering of a.c. (alternating current) electricity service from the fledgling investor utility required displacement of an in-building dynamo or a dc generator which also happened to produce the steam used for building heating. In order to convince the prospective customer to purchase electricity from the local nascent power grid, and therefore shut down his building generator and heat source, the electric utility had to sometimes simultaneously agree to provide "piped-in steam".

For instance, back in 1906 Thomas Edison built his first electricity generating station on Walnut Street in downtown Philadelphia. Edison determined that his business couldn't make a profit by just selling electricity so he entered into an agreement to sell steam to the nearby Thomas Jefferson University Hospital. In order for his downtown combined heat and power station to produce and distribute electricity at a competitive price, the business needed to recover fuel costs and generate contribution margin by also selling steam service to nearby customers. This formed the beginning of the downtown steam business in Philadelphia. Thomas Jefferson University Hospital is still a customer of the district steam system in Philadelphia, nearly one hundred years later in 2005.

This first sector of the U.S. industry is comprised of large urban district heating systems in center city locations (e.g., New York City, Boston, Philadelphia, Denver, Indianapolis, Cleveland, San Francisco, Baltimore, etc). These systems generally distribute steam (78 % of all U.S. heating systems distribute steam versus hot water) to multiple buildings for buildings to use for space heating, humidification, and domestic hot water. In some cities, district steam systems supply high pressure steam (125 to 150 psig) for buildings to operate on-site steam driven chillers for air conditioning.

One example of large scale steam-based cooling is Consolidated Edison Steam Business Unit in New York City, where approximately 350 customer buildings operate steam driven chillers (turbine drive and absorption) to produce approximately 650,000 tons of cooling capacity. Using steam to make chilled water for air conditioning, rather than electrically-driven chillers, displaces over 400 MW of summer peak electric demand from the local electric grid. Steam driven cooling is used by large buildings in many large cities and is used extensively in conjunction with combined heat and power production facilities on campuses to optimize the heat recovery capability for electricity generation in summer months. The Con Edison Steam System, the largest district steam system in the world, is actually the result of the merger and consolidation of multiple downtown steam systems that once served respective segments of Manhattan.

HISTORY OF THE NEW YORK CITY STEAM SYSTEM

Figure 7 – Con Edison Steam circa 1882

The Con Edison Steam System is the result of growth and acquisition over more than 120 years. Today's system is the result of consolidating at least 4 formerly independent companies and still bears technical and operating remnants of its predecessors.

The original NYC system had only 3 miles of main, operated at 80 psig and served only 62 customers in the downtown area. The steam system preceded Edison's Pearl Street Station (which opened on September 4, 1882) but did not, as some believe, provide the steam for Edison's dynamos. The electric and steam systems were not fully wedded to become "Consolidated" Edison until the 1930s.

Figure 8 – Con Edison Steam circa 1936

The steam system continued to grow both organically and through acquisition. In 1936 Con Edison purchased the New York Steam Company and its 65 miles of main, 6 generating units, and rights to serve 2,500 buildings. This strengthened Con Edison's position in the midtown area, today one of the fastest growing parts of New York City.

Today the system comprises over 100 miles of main and service lines and serves over 1,800 customers. But, if you look closely, you can still see the outlines of the predecessor systems.

Figure 9 – The New York City Steam System Footprint Today

Today, the Con Ed Steam System serves over 1800 buildings from the upper West Side to the Battery Park downtown. The system has greatest penetration in the dense areas of Mid-town and Downtown. Charles Copeland of Goldman Copeland, a prominent New York City engineering firm, points out that the steam system helped build the Manhattan skyline by making it possible to build without boilers and huge chimneys. In turn the shape of the system – two dense load centers dominated by high rises, one in Midtown, the other Downtown – reflects the underlying geology of Manhattan island. Underlying most of the island is Manhattan schist, a 450 million year old metamorphic rock formed under the pressure of the once towering Taconic Mountains. The schist lies only 18 feet below Times Square but plunges to 260 feet below Greenwich Village. Another shallow section lies below the Downtown section. These shallow schist formations constitute the bedrock upon which high rises are built and explain the clustering of the largest buildings.[8]

Figure 10 – Aerial satellite depiction of Manhattan island c/o Google Earth Pro.

[8] Glaciers in New York, an Introduction to Regional Geology. Courtesy of CCN Management Counsel – Steam Task Force Report, June 22, 2005.

PRE-1960 DISTRICT ENERGY SYSTEMS

By and large, these vintage steam systems were originally owned by the local investor-owned or municipal electric utility. The steam distribution was essentially a by-product of electric generation at downtown combined heat and power stations. In the 1960's and 1970's, with the advent of larger power generating stations (both coal and nuclear stations) being constructed in more remote locations and funded by utility consortiums, many electric utilities began to cease electricity production at these smaller scale, less efficient generating plants downtown. Additionally, the combination of emission restrictions taking hold in central cities and fossil fuel cost escalation with the Second Oil Embargo, a number of investor-owned electric utilities began to make plans divest of steam business assets. Without electricity production and running boilers to only make steam, steam rates began to increase and the businesses needed to re-allocate fixed and variable operating costs to lessen rate impacts on existing steam customers.

Entering the 1980's, many of the existing steam systems were also in need of capital infusion for production capacity upgrades and distribution system maintenance and repair. At the same time as capital needs were climbing, steam revenues were flattening as commercial office buildings began to be designed more tightly without operable windows and reduced outside air intake brought on by rising energy costs. Additionally, the advent of personal computers and greater employee density was causing internal heat loads to rise and as a result space heating requirements per square foot of conditioned space began to decline. From the perspective of the macro electric utility industry, the size and scale of district energy system operating revenues was also shrinking as a percentage of overall electric utility revenues, which were increasing due to industry merger and consolidation. Steam service as a core business in the hometown of the investor utility became less important as headquarters moved with consolidation and the regional utility market expanded.

In the mid to late 1980's, entrepreneurs and private investors emerged to acquire some of the steam business assets that electric utilities were divesting. One early group, Catalyst Thermal, acquired the steam systems from the investor-owned electric utilities in Boston, Philadelphia, Baltimore, Youngstown, Cleveland and San Francisco. Catalyst Thermal and its later chain of successors (United Thermal and Trigen Energy) developed business plans that involved renewed focus on the business fundamentals of steam operations and more attentive customer service to restore market confidence in the district energy businesses (i.e. Cleveland Thermal; Boston Thermal, etc). Other strategies involved adding cogeneration to add electricity revenue and lower steam costs (Trigen Philadelphia); or cutting operating costs through alternative steam supplies (i.e. Baltimore RESCO waste to energy steam supply).

As the 1980's moved into the 90's, new district energy industry entrants also emerged to invest in adjunct district cooling subsidiaries (Denver, Cleveland, Indianapolis, etc.) to supplement the district steam businesses. Because the original owners of these vintage steam systems were generally the regulated local electric utility, the steam systems in many locations are still regulated utilities with published steam tariffs and rules and regulations set by their respective state and local public service commissions. In almost all cases, there is also a form of franchise agreement with the local City Hall that might include some other caveats like permits for street construction and traffic interference; rights of way; limits on other commodities allowed to be sold through incumbent pipeline assets and in some cases, there are royalties or franchise fee payments to local governments or agencies.

POST 1960 – COMBINED DOWNTOWN DISTRICT HEATING AND COOLING SYSTEMS

Another category of newer district energy systems launched in the U.S. after 1960 were largely combined district heating and district cooling systems. The world's first downtown combined steam district heating and chilled water district cooling system began operations in 1962 in Hartford, CT. The Hartford Steam Company was constructed by Hartford Gas Company, the predecessor of Connecticut Natural Gas Company, to provide modern heating and air conditioning service via steam and chilled water supply to the multi-acre planned urban renewal project of Constitution Plaza. In the 1960's, urban renewal development block grants and city planners began to implement significant urban renewal projects.

The concept of natural gas-fired district heating and cooling infrastructure began to take hold as cities followed the example set by Hartford, CT. In fact, the next ten (10) downtown district heating and cooling systems that followed in the late 1960's and early 1970's in the U.S. were developed, owned and operated by the local natural gas distribution company (LDC) as a means to sell more natural gas during summer periods of excess gas pipeline capacity.

Combined district heating and cooling systems in cities like Minneapolis, Omaha, Pittsburgh, Century City, Oklahoma City, and Tulsa were constructed by the local gas distribution company and began to grow. In most cases, the regulated gas utility set up a separate non-regulated subsidiary to own and operate the district energy business. The combination of steam and chilled water service offered real competitive advantages to building owners by reducing mechanical room capital and space requirements in new buildings, cutting first cost capital and risks in building construction, and offering simplified building operations while delivering year round comfort with lower overall owning, operating and maintenance costs.

These post-1960 era systems are almost 100% non-regulated utilities, as both heating and air conditioning services have substantial competition. Since there were clearly heating and cooling alternatives in these cities, there was no "utility obligation to serve" for these non-regulated combined businesses. Heating and cooling service was generally provided based on negotiated agreement of a long-term (10 to 25 year term) contract with the building owner. Over time, some of the natural gas utilities (i.e. Oklahoma City, Tulsa and Omaha) sold their district energy assets in order to harvest shareholder value or to focus capital resources on the core business of distributing natural gas. In most cases, these district energy systems continued to grow along with the growth of their respective city central business district.

In Hartford, the district energy system doubled in size between 1987 and 1992 as commercial construction accelerated downtown. The Capitol District Energy Center was constructed to provide district hot water and chilled water service to anchor customers like the Aetna Home Office Complex and multiple State of Connecticut buildings. At one time, the Hartford Steam Company was providing nearly 25% of the earnings per share of the parent regulated natural gas company with only 10% of the revenue of the parent corporation. In the mid 1990's, there was some retrenchment in Hartford as the city and regional economy sputtered, but the district energy system recently celebrated forty years of operation with solid operating results.

The downtown district energy system begun in Minneapolis in 1972 also demonstrated significant growth throughout the 1980's and 1990's. The district heating system grew to serve over 120 customer buildings and the district cooling network expanded to supply nearly 40 buildings downtown, as it became one of the largest combined systems in the United States, if not the world. The Minneapolis Energy Center grew at pace with the expanding central business district in Minneapolis. One unique aspect of downtown Minneapolis is the Skyway

System, an enclosed second floor walkway that interconnects over 40 million square feet of buildings throughout the city and is principally heated by Minneapolis Energy Center. The Skyway allows downtown office workers to virtually traverse the city in conditioned comfort even when the arctic winter winds blow in the Twin Cities. NRG Energy Center Minneapolis is owned and operated by NRG Thermal LLC, which also owns and operates district energy systems in Pittsburgh, PA, San Francisco, CA, Harrisburg, PA, San Diego, CA, Dover, DE and a number of other energy assets.[9]

The Minneapolis market has the unique conditions of extreme weather in both summer and winter where design conditions can reach minus 10 deg F in winter and the summer time can exceed 100 deg F with high humidity. This leads to significant peak capacity for both steam and chilled water capacity and forms an excellent base business condition. Both Hartford and Minneapolis were operated as stand-alone district energy businesses with particular attention paid to operations, capacity planning, customer service and marketing and sales.

1990'S - DISTRICT COOLING SYSTEM JOINT VENTURES WITH ELECTRIC UTILITIES

In the late 1980s and early 1990s, another trend emerged in the district energy industry as investor-owned electric utilities formed non-regulated subsidiaries to construct district-cooling systems. In some cities, district chilled water systems were developed to complement the existing district heating operation (i.e. Cleveland, Indianapolis; St. Paul, Toronto, et. al.). These investments were often designed as adjunct business operations to the existing steam district system and capitalized on the incumbent customer relationship; the option to add cooling capacity in pre-existing production facilities, and the ability to leverage existing general and administrative and management resources with the addition of a second revenue stream of cooling services. In some instances, competition emerged for the steam provider as the local investor electric utility formed a joint venture to offer district cooling service as an alternative to the incumbent district steam system. In some cases, the provision of district cooling by an alternative provider didn't impinge on the steam company sales necessarily but wasn't always perceived as a direct complement to incumbent utility steam service (Comfort Link in Baltimore, et al).

The joint venture model for district cooling development in the electric utility industry emerged from Commonwealth Edison of Chicago as Northwind Chicago in the early 1990's. Joint ventures were formed with the subsidiaries of the local investor utilities in the respective cities as Northwind Boston, Northwind Houston, etc. The business model principally called for construction of large electric driven chiller plants in key urban locations near dense downtown loads using ice thermal storage capacity to shift principal production costs to night time hours when operating conditions were preferable (i.e. cooler weather conditions, lower humidity, lower electricity costs and favorable peak electric demand rates).

[9] http://www.nrgenergy.com/pdf/thermal.pdf

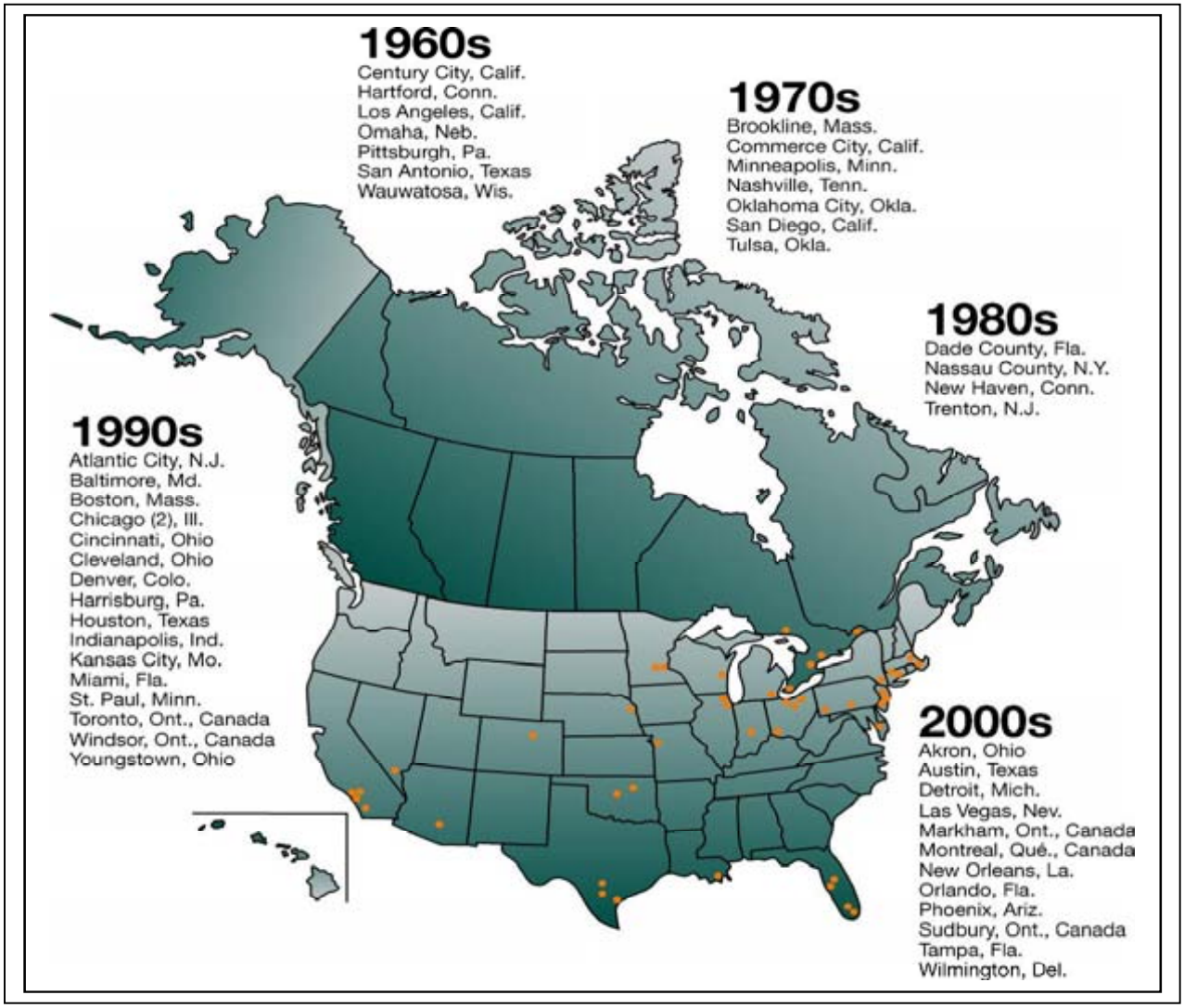


Figure 11 – Map of major downtown district cooling systems in North America and the decade in which service commenced.

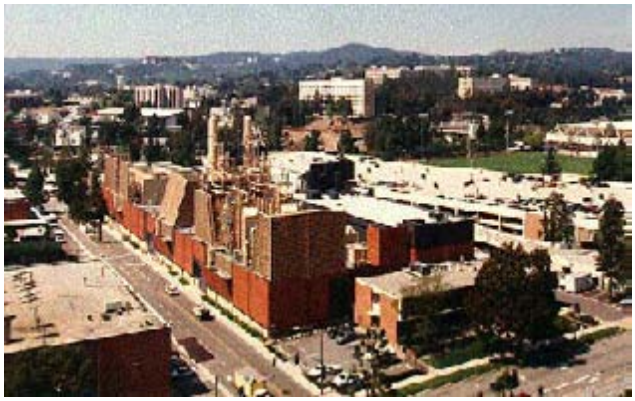
In the early 1990's, district cooling growth was largely driven by an increase in peak electric rates and by the imminent phaseout of CFC's (chlorofluorocarbons), the principal chemicals in refrigerants used in building chillers. While the surge in chiller replacements never occurred at projected levels, building owners were attentive to new cooling options and many subscribed to district cooling as an alternative to risky replacements or challenging refrigerant conversion projects. The original Northwind Chicago business experienced rapid growth in the 1990's, reaching over 100,000 tons of installed capacity with four (4) interconnected chilled water plants in the Loop section of downtown Chicago. As shown in Figure 11 above, thirty-four (34) new downtown district cooling businesses were launched in North America since 1990.

BACKGROUND OF CAMPUS ENERGY SYSTEMS

In the case of early campus energy systems, in some cases, the construction of the central power and heating station for the university preceded the construction and operation of the local municipal or investor-owned electric utility. The University of Northern Iowa began production of power and heating in 1884 to serve the newly planned university campus. Today, combined heat and power (CHP) is a mainstay on many larger public and private universities.

For example, the University of Texas Austin, the largest public university campus in terms of student population in the United States, today produces one hundred percent (100%) of the electricity, heating and air conditioning needs of the 50,000 student campus[10]. The University of Missouri - Columbia can produce up to 100% of its electricity and heating and cooling needs for the campus with a combination of coal, natural gas, oil and tire-derived fuel from shredded, waste automotive tires[11]. University of Missouri is able to optimize energy operations and minimize costs by selecting least cost fuels, managing and dispatching loads and purchasing lower cost power when available. Campus systems are increasingly employing combined heat and power in order to increase fuel efficiency, reduce operating costs and enhance overall utility reliability by generating electricity on campus. Systems at Princeton University, Massachusetts Institute of Technology, Stanford University and UCLA all exemplify the trend toward campus CHP. [12]

Campus district energy systems also create opportunities to apply innovative technologies such as using landfill-gas in lieu of other fossil fuels. University of California Los Angeles (UCLA) obtains nearly 40% of its annual fuel for producing campus power, heating and air conditioning from a landfill nearly three miles away as the landfill methane gas is recovered and shipped via pipeline to the UCLA campus facility. [13]



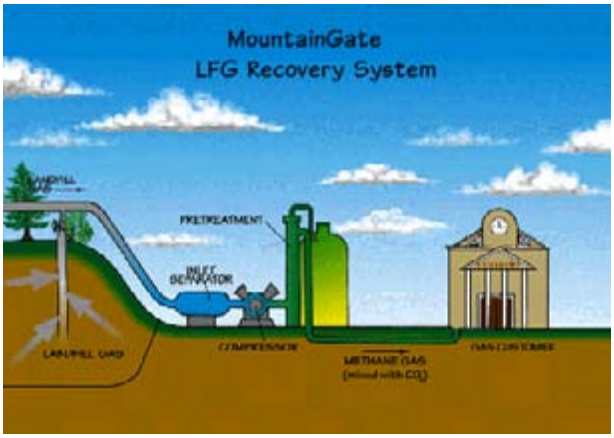


Figure 12 – UCLA Cogeneration Facility
Figure 13 – Landfill gas recovery system

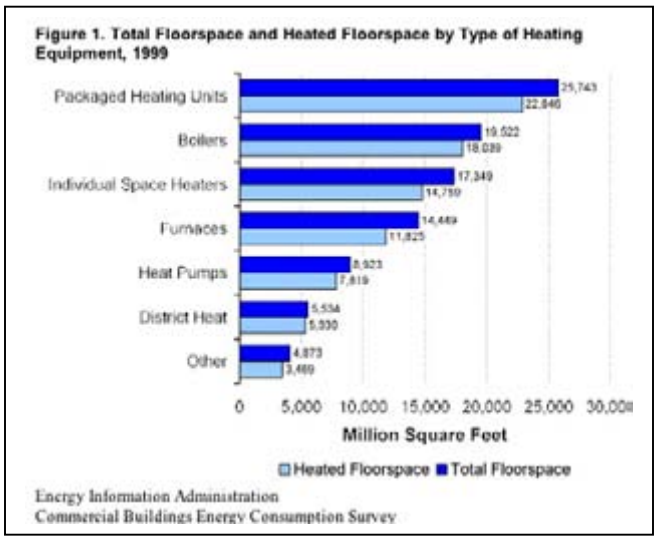
[10] See CHP Campus Case Study – http://www.districtenergy.org/CHP_Case_Studies/UT_Austin.pdf
[11] See http://www.cf.missouri.edu/energy
[12] See http://www.districtenergy.org/CHP_Case_Studies/collegemap.htm
[13] http://www.districtenergy.org/CHP_Case_Studies/ucla.pdf

MARKET CONDITIONS FOR DISTRICT ENERGY SYSTEMS IN NORTH AMERICA

As mentioned above, district energy in North America principally exists in the central business districts of large urban cities and on college and university campuses where there is common ownership of real estate and energy facilities. Likewise, district energy investments have historically occurred where there is either significant vertical density of floor space or common ownership under a contiguous real estate location like a campus. The market sectors typically served by district energy systems are commercial office space, large hotels, convention centers and sports arenas and increasingly, apartment buildings and condo conversions. In the US, residential building stock has historically grown in the suburbs and outside the CBD. As a result, residential space has historically not been constructed within the geographic area traditionally served by North American district energy systems.

Unlike Europe and Eurasia, where district energy services are owned and managed principally by the municipal utility company (city or state-owned), the systems serve a high percentage of residential building stock which exists in central cities and in nearby sections.

Therefore, when evaluating market share for district energy systems across a population of buildings, in North America it is important to assess penetration in the types of buildings likely to be located in an urban setting (i.e. building size greater than 55,000 sq ft.)



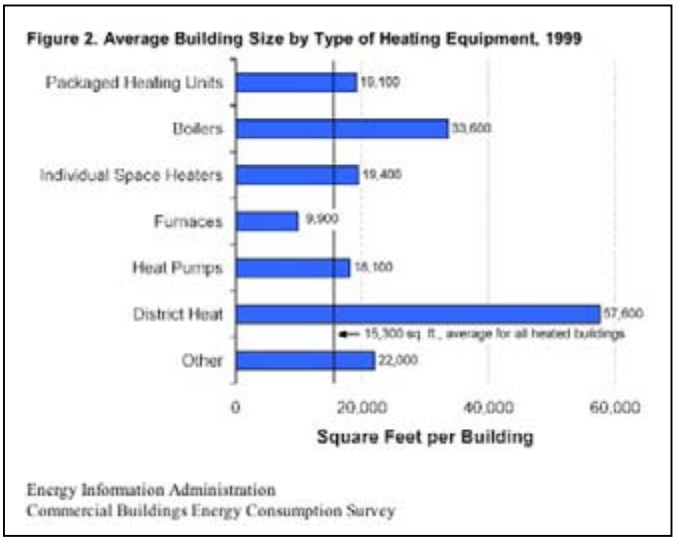


FIGURE 14 – US Energy Information Administration – Commercial Buildings Energy Consumption Survey

Sample District Energy Systems

Figure 15 - The table below provides data on representative district energy companies.

District Energy Systems	Trigen Philadelphia	Citizens Thermal Energy	Enwave Energy Corporation	General Services Administration (GSA)
Location	Downtown Philadelphia	Downtown Indianapolis, IN	Downtown Toronto	Downtown Washington, DC
Products	Steam, Electricity	Steam, Chilled Water, Electricity	Steam, Chilled Water	Steam, Chilled Water, Electricity
Plant Capacity	2,300,000	2,450,000 Lbs	1,785,000 Lbs	1,680,000 Lbs
Steam - Lbs/Hr; Chilled Water – Tons Refrigeration;	0	42,000 Tons	75,000 Tons	17,000 Tons
Electricity - MW)	170 MW	15 MW	0	17 MW
Steam Sales (Annual Mlbs)	3,770,000	6,220,000	2,560,000	2,037,145
Steam Peak Hourly Sendout (Lbs/Hr)	1,300,000 (e)	1,500,000	1,100,000	850,000 (e)
Steam Revenues (Estimated)	$60,000,000	$40,300,000	$40,000,000	$40,000,000
Customer Buildings or Area Served (SF)	100,000,000 SF	N/A	130 buildings	60,000,000 SF heat 4,000,000 SF cool
Distribution System (linear ft pipe – heat/cool/condensate)	160,000 heat	121,000 heat 68,000 cool n/a conden	65,600 Ft heat 4,500 cool 23,000 Ft conden	100,320 heat 100,320 cool 100,320 conden
Fuels	Natural Gas, low sulfur diesel	Purchased Steam Waste to Energy; Coal; #6 fuel	Natural Gas; #2 fuel oil	Natural Gas; #2 fuel oil
Total Personnel	110 FTE (e)	102 FTE	56 FTE	120 FTE
Marketing/Customer Service Staff	6	6	4	6

DISTRICT ENERGY BEYOND NORTH AMERICA

In Europe and Eurasia, the market penetration for district energy is much broader with a greater percentage of the customer base including residential properties. For comparison, Compagnie Parisienne de Chauffage Urbain (CPCU), the large district heating and cooling system in Paris, France serves over 8,700 customers and approximately 46% are residential properties.[14] Similarly, in Seoul, Korea, nearly 49% of the customers of Korea District Heating Corporation (KDHC) are residential buildings. In fact, KDHC is projecting significant growth from 1.3 million households served to more than 2 million households served by 2010.[15]

In European and Scandinavian cities and communities, housing tends to be more clustered and residential populations are denser, providing advantageous market conditions for investing in heating distribution networks. Government policies encouraging district heating for its energy efficiency and environmental benefits along with historically higher per capita energy costs have also contributed to greater market share for district heating in Europe vis a vis North America.

Another important market difference is that North American cities tend to be commercial centers while European cities generally include a greater density of residential properties. Many cities in the U.S. are expanding the percentage of urban residential real estate with urban housing starts increasing as "empty nesters" migrate back to center cities for easier access to culture, health care and urban living. Historically in the U.S., however, urban condominiums and residential buildings have been less receptive to district energy services due to a preference for more direct billing of utility costs versus a shared allocation methodology when heating and cooling services are delivered to the common building as with district energy services. In many European and Eurasian countries, district heating costs are "allocated" to tenants based on a square footage formula applied to the metered monthly consumption. In some applications, property owners have upgraded to incorporate meters that record fan run time or volume of flow as a more equitable method to allocate energy costs to discrete end users.

One impediment to the residential market in the U.S. is the incremental cost of accurate BTU metering in individual condominium or apartment units. This additional capital expense often erodes the first cost advantage that district energy service might provide the large residential property developer. The alternative, which is to allocate heating and cooling costs on a condominium fee basis, does little to encourage conservation and energy efficiency. For instance, a residential condominium occupant will not appreciate a large heating bill for a winter month when they in fact are off premises in Florida at a winter home.

Some district energy providers have solved the sub-metering challenge in residential properties with innovative infrared and web-based metering solutions. Others have retained third party billing agents to support the metering, billing and collections cycle for large multi-tenant residential properties. The industry will need to effectively address a cost-effective business solution in order to compete for the growing residential segment in U.S. cities.

[14] http://www.districtenergy.org/pdfs/IntnlPresentatons/FrancePresentation.pdf
[15] http://www.districtenergy.org/pdfs/IntnlPresentatons/KoreaPresentation.pdf

Current Industry Trends – District Energy Space

Since 1990, IDEA has been tracking the growth of new customer buildings and the square footage from reporting systems on an annual basis. Systems report the number and size of new customer buildings that are either connected or committed contractually each year. Also, we ask that respondents categorize new customer building by use so that we can identify and track progress in the following categories: commercial office space, hotels, schools, hospitals or institutions, residential and other; government; and finally entertainment, arena or special use.

Since 1990, IDEA members have reported over three hundred seventeen million square feet (317,483,736 SF) of new customer space committed or connected to district energy systems , averaging approximately 21.1 million square feet per year. In 2004, members reported 27,364,889 SF in North America and nearly eleven million square feet (10,899,219 SF) of new committed or connected space reported in the Middle East.

Figure 16

District Energy Space 1990-2004

317	Million Sq Ft Customer Space Committed - Reported since 1990
22	Million Sq Ft 15 year Average Annual Customer Space Committed
41.5	Million Sq Ft Annual Customer Space Committed in 2003
28	Million Sq Ft Last 5 Year Average Annual Customer Space Committed

	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04
Million Sq Ft Of Customer Building Space Added To District Energy Systems Annually	8.8	5.7	5.86	26	17	51	15	16	28	22	25	29	23	42	27

While this growth in customer base is significant and appears to be trending positively for the district energy industry, it should be noted that the number of systems reporting results represents only a segment of the total district energy sector. IDEA is working to collect new customer data from more IDEA member systems and across all sectors to include more campus, airport, military base and hospital sector district energy systems.

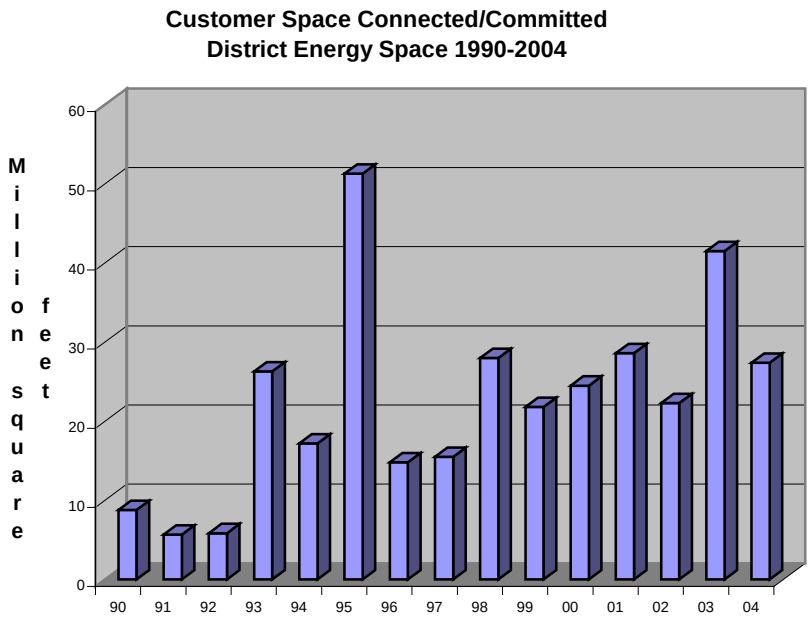


Figure 17 – Chart of new customer space (Million Sq Ft) committed or connected to IDEA district energy systems by year.

For more details on prior years and photo samples of new customer buildings, please visit the IDEA website – **http://www.districtenergy.org/de_space.htm**. DE Space Reports are downloadable back to 2000.

Additionally, the DE Space section on IDEA web site provides information on the size, use and location of reported buildings. This data is intended to assist IDEA member companies with cross-referencing potential new customers for references in other locations. Additionally, by aggregating the new customer data by Use (i.e. Hotel, Convention, etc), the DE Space Report can demonstrate acceptance in the market.

Each year, IDEA recognizes those member organizations for reporting the greatest number of new buildings and the greatest cumulative square footage reported for the prior year. In 2004, Enwave Energy Corporation received the Gold Award for Most Square Footage Committed and tied for Gold Award with District Energy St. Paul for Most Buildings Committed with 22 new buildings.

Figure 18 – DE Space Report

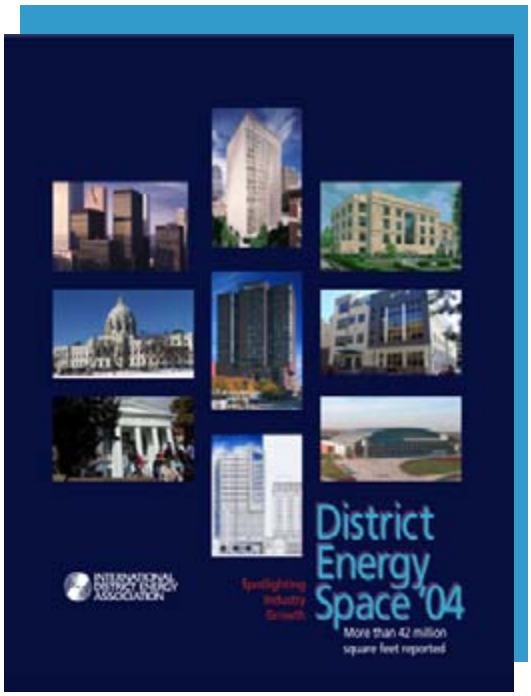
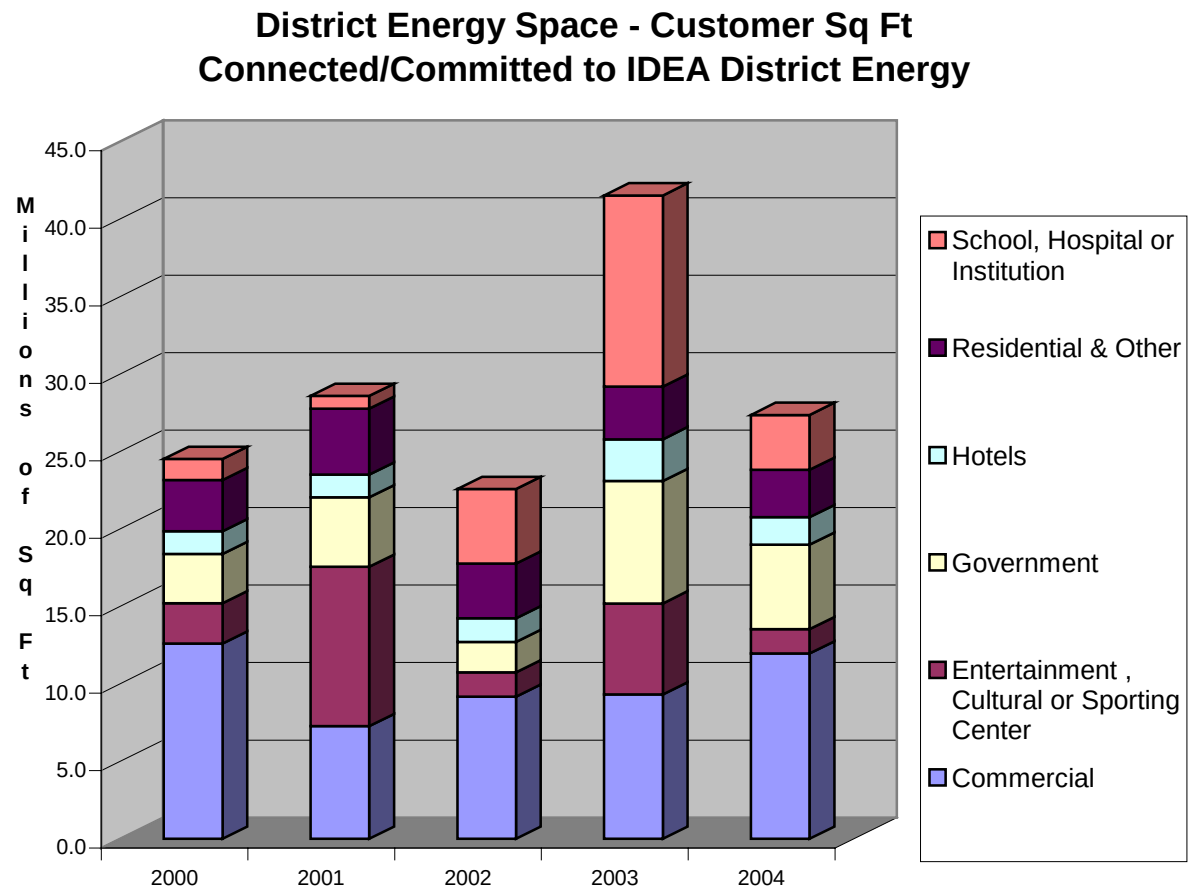


Figure 19 – DE Space Breakdown 1999 – 2004 by Customer Use



Growth by Sector

Annual Customer Space Committed (Million Sq Ft)

	2000	2001	2002	2003	2004	5year average
Commercial	**12.6**	**7.3**	**9.2**	**9.3**	**12.0**	**10.1**
Entertainment , Cultural or Sporting Center	**2.6**	**10.3**	**1.6**	**5.9**	**1.6**	**4.4**
Government	**3.2**	**4.5**	**2.0**	**7.9**	**5.5**	**4.6**
Hotels	**1.5**	**1.5**	**1.5**	**2.7**	**1.8**	**1.8**
Residential & Other	**3.3**	**4.2**	**3.5**	**3.4**	**3.1**	**3.5**
School, Hospital or Institution	**1.4**	**0.8**	**4.8**	**12.3**	**3.5**	**4.6**
Total	**24.5**	**28.6**	**22.6**	**41.5**	**27.4**	**28.9**

Combined Heat and Power

In some ways, the district energy industry is returning to its early roots in adopting combined heat and power (CHP) as the principal source of thermal energy. This trend is particularly strong in campus energy settings as commodity fuel costs have escalated dramatically over the last two years and with that increase in fuel costs, so has the value of recycled heat. In fact, higher fuel costs have stimulated greater interest in investment in energy efficient infrastructure like CHP with district energy.

CHP, sometimes referred to as cogeneration, is the process of recovering the heat or steam produced while making electricity, and using that steam in a productive manner such as district heating or for steam-based district cooling rather than just releasing the heat as waste to local lakes, rivers and oceans as occurs in traditional electricity generating stations (See Figure 20 below).

Figure 20

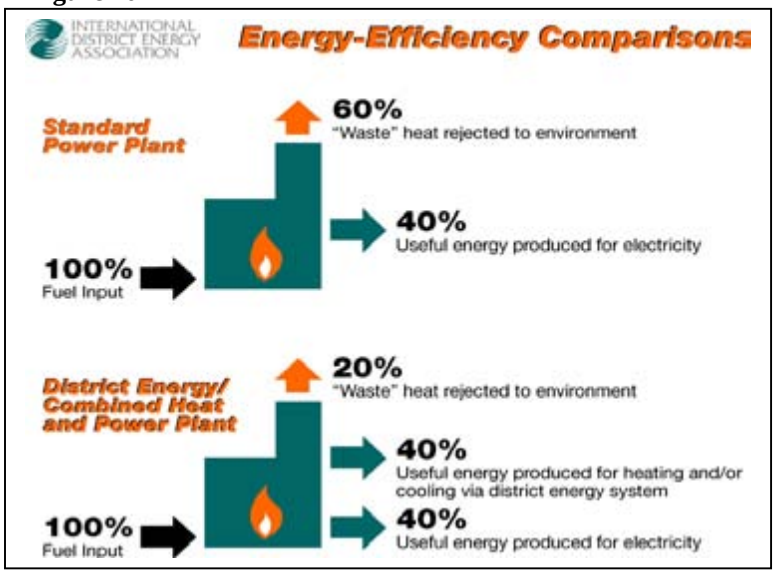


Figure 20 depicts the increased fuel efficiency of CHP combined with district energy (80%) vs traditional electric only generation (40%).

Traditional electric generating stations are only about 33% to 40% fuel efficient, which means that nearly two-thirds of the energy value in the fuel is released to the environment. Combined heat and power facilities are generally of a smaller scale (10 MW to 150 MW) than large central power stations and can be connected via a district energy network to a large grid of aggregated thermal users, are then able to recover and recycle the otherwise wasted heat. Using CHP heat for district energy services results in the operation of fewer heat-only boilers and reduces emissions like CO2 and Nox and SO2 that contribute to acid rain, global warming and smog. CHP is an environmentally preferable technology and has the support of the US Environmental Protection Agency as a means of reducing greenhouse gases and other harmful emissions.

CHP also makes economic sense, particularly in campus settings, where the university has full responsibility to meet the combined requirements of heating, cooling and power. In many cases, when the CHP system is sized to optimally meet the thermal energy requirements of the campus, it can also produce valuable power and reduce the amount of electricity purchased from the local grid. Moreover, having a source of electricity generation on the campus and

immediately adjacent to the load, enhances the reliability of the campus and provides greater assurance of continuous operations. This is particularly valuable when a campus energy system serves a research laboratory, research hospital, data center or other critical care operation.

While the US EPA has had a voluntary program supporting CHP for a few years, only recently have federal environmental policies and regulations begun to shift in favor of CHP. The EPA recently released for comment a draft "Output-Based Emissions Standard" that would propose to set emissions limitations of power plants based on the combined useful output of electricity and thermal energy, rather than the current methodology which caps emissions limits based on the BTU and emissions content of the fuel input to the plant. IDEA has been advocating for output-based emissions standard as a means to stimulate investment in more fuel-efficient technologies like CHP and to attract capital investment to schemes that harvest the greatest useful output.

Federal policies are moving towards cap and trade provisions for emissions like carbon dioxide. Cap and trade provisions have worked for other pollutants like Nox and So2 where emitters are granted a certain volume of annual emissions. If they are able to reduce emissions through operations, attainment, or equipment, they can trade or sell their excess emissions to another point source. There is an emerging market for CO2 and as CHP systems capture greater emissions savings, those credits become marketable and valuable assets that can enhance the return on investment in CHP and district energy. Another consideration for the industry is that if output based emissions standards are adopted, in some ways the value of CHP district energy investments will be enhanced by some factor of the annual value of increased emissions trading capacity.

More information on CHP policies and capturing emissions credits are available at the US Environmental Protection Agency CHP Partnership Program at http://www.epa.gov/chp/index.htm and at the Chicago Climate Exchange - http://www.chicagoclimatex.com.

In representing the district energy industry, IDEA has hosted the EPA CHP Partnership frequently at IDEA conferences and supported recognition for IDEA members for achieving high levels of environmental efficiency through CHP district energy systems.

EPA CHP Partnership and CHP Energy Star Award

The EPA CHP Energy Star Award recognizes those district energy systems that operate at very high annual fuel efficiency with lower environmental emissions as a result. IDEA members such as University of North Carolina Chapel Hill; Massachusetts Institute of Technology; University of Missouri-Columbia and Trigen Philadelphia have all received the EPA CHP Energy Star Award.

Figure 21 – UNC Chapel Hill Energy Utilities Director Ray DuBose and staff receive EPA CHP Energy Star Award from Rob Brenner of US EPA in October 2002.

Figure 22 - (below) is an aerial photo of the award-winning UNC Chapel Hill CHP facility.

Figure 22

States Are Leading The Way on Energy and Environment

While Federal policies have lagged, many states are adopting policies and regulations to stimulate greater energy efficiency that also provide environmental benefits. A common approach is a Renewable Portfolio Standard (RPS), which directs the electric utilities in a given state to make provision to purchase a percentage of the total electricity in that state from renewable resources such as wind turbines, solar photovoltaics, geothermal or biomass-based fuels.

In the case of RPS, certain district energy CHP facilities could potentially qualify if the fuel sources were to include renewable forms of energy such as woody biomass, switchgrass, and other naturally recurring re-sources. There are a number of locations in states like Idaho, Wyoming, and other western states where geothermal resources are natural prime movers for direct source district energy systems.

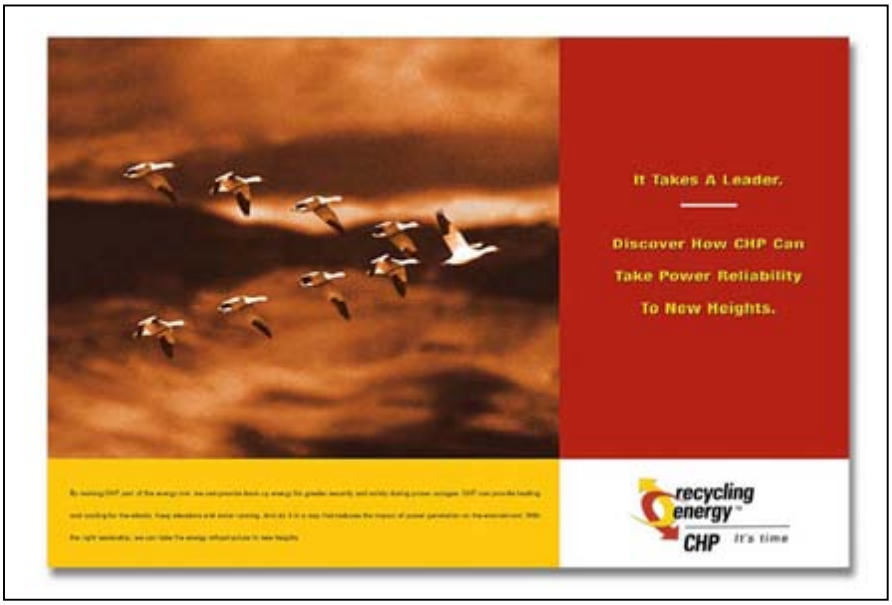
Texas environmental permitting policy resembles an output based emissions standard and serves to streamline permitting for CHP projects. Pennsylvania has enacted a Tier II Renewable Portfolio Standard for Clean Energy that could include certain forms of combined heat and power systems.

Recently, the State of Connecticut enacted Connecticut House Bill 7501, "An Act Concerning Energy Independence," that includes numerous provisions which are positive developments for CHP, including a New Efficiency and CHP Portfolio Standard. The new law provides incentives for local electric utilities to purchase the excess electricity from CHP facilities rated less than 65 MW and sets up a funding mechanism to support the program. For more information, please find a copy of the legislation at http://www.cga.ct.gov/2005/TOB/h/pdf/2005HB-07501-R00-HB.pdf.

On an energy industry level, the advent and proliferation of Renewable Portfolio Standards has stimulated significant investment in wind turbines, wind farms and various forms of solar energy systems. Additionally, there has been a convergence with green power marketing and it seems that there is heightened societal interest in supporting environmentally benign forms of energy through purchasing and portfolio selection. One benefit of Renewable Portfolio Standards is that electricity produced from solar and wind systems typically have little or no greenhouse gas emissions and produce little or no environmental challenges other than siting and location.

IDEA suggests that recovering waste heat from power plants and combined heat and power plants has a similar salutary effect on environmental emissions in that recycling the heat allows for displacement of other fossil-based thermal or electricity production, and as a direct result, cuts down on harmful emissions. In many regions of the country, Recycling Energy could have greater environmental impact in that the annual load factor for recovered heat from thermal sources may exceed the load factor of solar photovoltaics and wind turbines. By reclaiming and re-using waste heat, a Recycling Energy facility could be displacing substantial emissions from fossil fuels.

In 2004, IDEA formed a coalition called the Recycling Energy Council with the Gas Technology Institute; the Engine Manufacturers Association and the US Combined Heat and Power Association, along with a number of industry participants. The purpose of the Recycling Energy campaign is to educate policy makers, government and industry leaders and regulators of the value of recycled energy as a means to improve fuel efficiency and reduce environmental impacts of energy use. For more information please visit www.recyclingenergy.org (See Figure 23 and Figure 24 below)



IDEA Members are World Leaders in District Energy Industry

The International District Energy Association (IDEA) was founded in Toledo, OH in June 1909 as the National District Heating Association. The association was originally formed as a non-profit industry association that would function much like a user group for steam system personnel. Early membership was comprised of steam utility management and operations personnel along with industry suppliers, manufacturers and engineering consultants. Today, nearly 100 years later, IDEA remains focused on that same mission of supporting our industry participants with technical training, peer exchange and consumer education and outreach. IDEA continues to educate on the features and promote the benefits of district energy systems while advocating for policies and legislation favorable to our industry, its customers and stakeholders.

Today, IDEA is a 501 (c) 6 non-profit organization with headquarters in Westborough, MA, approximately 30 miles west of downtown Boston, MA. IDEA boasts over 700 dues-paying members from 21 different countries. With a staff of five and a volunteer board of directors of 21 individuals from the industry, including an executive committee of six officers, IDEA has an annual operating budget of approximately $ 1.1 million US.

IDEA serves as an industry clearinghouse for business, technical and policy issues. For 96 consecutive years, IDEA has held an annual conference and trade show, which continues as one of the major activities of the organization. The IDEA Annual Conference typically attracts 350 to 450 attendees from around the world for a 3-day technical conference. The trade show offers exhibit booths for about 60 exhibitors and has completely sold out of available booth space in 4 of the past 5 years.

For 18 consecutive years, IDEA has also produced a Campus Energy Conference that is focused on the primary needs of energy executives and utility directors at college, university and healthcare campuses. The Campus Energy Conference has grown steadily over the past five years from roughly 125 attendees in 2001 to over 340 in 2005. The Campus Forum of IDEA provides strong leadership and a collegial atmosphere of open peer exchange, technical innovation and environmental stewardship.

IDEA publishes a full-color quarterly industry magazine entitled *District Energy*, which has a circulation of over 3400 and is included with association membership. The association web site is www.districtenergy.org which has numerous features including a growing on-line Archives of technical conference proceedings with nearly 1000 professional papers and presentations; a special Members Only section, an OnLine Buyers Guide for products and services; video downloads and other relevant industry materials.

In addition, IDEA produces specialized Workshops for industry practitioners focused on topics such as Distribution and Marketing. IDEA provides industry visibility in national and international energy forums and with Federal and State government agencies, such as the US Department of Energy; the US Environmental Protection Agency; the International Energy Agency; the US Department of Commerce and various other industry and trade groups such as American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE);

Association of Energy Engineers (AEE); US Combined Heat and Power Association (USCHPA) and many others. IDEA is an active member of the Sustainable Energy Coalition in Washington DC and interacts regularly with American Council for an Energy Efficient Economy (ACEEE); Energy and Environmental Policy Institute (EEI); American Council for Renewable Energy (ACORE) and a host of other non-governmental organizations.

IDEA AWARDS AND RECOGNITION

Each year at its Annual Conference, IDEA recognizes excellence within the industry with a number of prestigious and traditional awards. Since 1993, IDEA has held a competition for member organizations to submit their business or organization for consideration for IDEA System of the Year. This award was originally based on the BOMA Building of the Year Award (Building Owners and Managers Association) and was intended to recognize the excellent organizations within our industry. Drawing from examples of innovation, reliability, community involvement, business growth and employee safety and training and recognizing overall contributions to the industry were the hallmarks of excellence in the district energy industry. Submittal of an application is requires that participants provide significant operating and business background material for review by a committee of five industry representatives who are appointed by the President.

IDEA is proud to recognize our System of the Year Award Winners for the past ten years. The System of the Year Award is the top honor IDEA can confer on a district energy system. It recognizes an exemplary district energy system providing high-level performance and service that further the goals of the district energy industry.

The 2005 recipient of the IDEA System Of The Year Award is University of Cincinnati.

Previous winners include:

- 2004 - University of Missouri
- 2003 - Seattle Steam Company
- 2001 - Cornell University
- 2000 - Consolidated Edison of New York, Steam Business Unit
- 1999 - Enwave District Energy Ltd.
- 1998 - Trigen Energy Baltimore
- 1997 - University of California, Los Angeles
- 1996 - NRG Energy Center Minneapolis
- 1994 - Energy Systems Co., Omaha, Nebraska
- 1993 - District Energy St. Paul

Figure 25 – Chair Joel Greene (l) presents 2004 System of the Year Award to Paul Hoemann, University of Missouri – Columbia, Seattle, June '04.

IDEA and District Energy Recognized by President Bush, May 2001

Prior to the announcement of the Administration's Energy Policy Plan in 2001, IDEA was in contact with the White House administration of President George W. Bush to recommend a series of locations to serve as tour venue for launching President Bush's National Energy Policy. After reviewing multiple options, the White House elected to tour the main district heating and cooling facility of District Energy St. Paul in downtown St. Paul, Minnesota immediately in advance of the first major policy address of the Bush administration.

According to White House staff, District Energy St. Paul was an ideal location from which to make the announcement because it *"hit on all the cylinders of the National Energy Plan."* IDEA President Robert Thornton and District Energy St. Paul President Anders Rydaker hosted President George W. Bush, Department of Energy Secretary Spencer Abraham; EPA Administrator Christine Todd Whitman and St. Paul Mayor Norman Coleman (later Senator Coleman) on a tour of the new wood—fueled combined heat and power facility to be constructed at the Hans Nyman Energy Center.

In opening his speech to a national television audience in front of over 5,000 guests at the Excel Energy Center on the morning of May 17, 2001, President Bush said,

"The Twin Cities are a great place to discuss America's energy challenge… I had an early look at the future right here this morning, in St Paul. I toured a plant that harnesses the best of new technology to produce energy that is cleaner, and more efficient, and more affordable. The plant boils enough water to heat 146 major office buildings in downtown St. Paul. Not a bit of energy is wasted, not even the waste. The excess heat generated as the water boils is captured and used to create steam which is used to create still more electricity which is used to power pumps, and to deliver heat."

"The plant is a model of energy efficiency. It is also a model of energy diversity. It uses conventional fuels like oil, and natural gas, and coal… and renewable fuels, like wood chips. And the plant is a model of affordability. While other energy prices rise, District Energy has not raised its heating and cooling rates, in four years."

President George W. Bush
St. Paul, May 17, 2001

Figure 26 – Bush and Cabinet Tour

Figure 27 – Bush Tours Control Room

The Washington Post

HOME EDITION

Friday, May 18, 2001

Bush Issues Energy Warning

President Unveils New Policy, to Praise and Attacks on Party Lines

nel Splits
Nomination

Figure 28 – May 18, 2001 Cover of Washington Post depicting President Bush tour of District Energy St. Paul prior to National Energy Policy Announcement in St. Paul.

Figure 29 – President Bush inspects boiler flame in District Energy St. Paul while Energy Secretary Abraham and EPA Administrator Whitman look on with St. Paul Mayor Norman Coleman and Cinergy CEO James Rogers.

Figure 30 – Former EPA Administrator and Governor of New Jersey Christine Todd Whitman provided the keynote luncheon address at the IDEA Annual Conference & Trade Show, June 27, 2005 in St. Paul, MN

Appendix

A. IDEA Member Operations Report – FY 2003 Results

B. Case Studies – Campus Combined Heat and Power

1. Cornell University
2. UCLA
3. Princeton
4. University of Iowa
5. UNC Chapel Hill

C. Industry Links

Alliance to Save Energy

American Council For An Energy Efficient Economy

ASHRAE

Association of Energy Engineers

Association of Higher Education Facilities Officers

Building Owners and Managers Association

Canadian District Energy Association

Canadian Geothermal Association

Combined Heat & Power Association (UK)

Cooling, Heating, and Power for Buildings (CHPB)

Council of Industrial Boiler Owners

Electric Power Research Institute (EPRI)

Euroheat & Power, unichal

Geothermal Resources Council

International Association for Cogeneration (Cogen Europe)

International Cogeneration Alliance

International Emissions Trading Association

International Geothermal Association

International Institute of Ammonia Refrigeration

Midwest CHP Application Center

National Association of Energy Service Companies

National Association of Industrial and Office Properties

National Association of Regulatory Utility Commissioners

National Association of State Energy Officials

National Society of Professional Engineers

New York State Energy Research and Development Authority (NYSERDA)

Turbine Inlet Cooling Association

U.S. Combined Heat and Power Association

U.S. Department of Energy

U.S. Energy Information Administration

U.S. EPA/CHP Partners

U.S. EPA Energy Star Program for Business

U.S. Office of Air Quality Plans and Standards

U.S. Office of Energy Efficiency and Renewable Energy

U.S. Steam Best Practices Program