



Renewable • Reliable • Resourceful  
Biomass Energy Resource Center

## BIOMASS COMMUNITY DISTRICT ENERGY SYSTEMS

### WHAT IS DISTRICT ENERGY?

District energy systems use one or more central plants to provide thermal energy to multiple buildings. This approach replaces the need for individual, building-based boilers, furnaces, and cooling systems.

Underground pipelines from the heating (or cooling) plant to each of the connected buildings distribute thermal energy in the form of hot water, steam, or chilled water. Energy is then extracted at the buildings and the water is brought back to the plant, through return pipes, to be heated or cooled again.

### DISTRICT ENERGY IN HISTORY

The concept of district energy dates back to ancient Rome, where hot water was used to heat public baths and other buildings. Urban steam systems first became common about 100 years ago (the first North American system was built in 1877 in Lockport, New York), and modern hot water systems have been used extensively in Europe since the 1970s. Today, as modern district energy rapidly gains acceptance, systems are being built in increasing numbers in cities and communities across North America.

### APPLICATIONS FOR DISTRICT ENERGY

District heating systems can provide space heating and domestic hot water for large office buildings, schools, college campuses, hotels, hospitals, apartment complexes, and other municipal, institutional, and commercial buildings. Systems can also be used to heat neighborhoods and single-family residences.

Municipalities can incorporate district energy into the infrastructure of their downtown business districts or encourage its use in such new developments as office building complexes and industrial parks. When local biomass fuels, such as woodchips, are used instead of oil or gas, the benefits of renewable energy can be brought to many buildings.

### COMBINING HEAT & POWER

District energy plants can be designed to produce not only heating and cooling, but also electrical power. This is called cogeneration or combined heat and power (CHP). CHP plants are able to get more usable energy out of the input fuel than one producing electricity only.

Illustration courtesy of  
Prince Edward Island  
Department of Economy,  
Development & Tourism.



### ADVANTAGES OF DISTRICT ENERGY

A district energy system—particularly one that increases the use of indigenous biomass—has the following advantages for both system customers and the surrounding community:

#### Low, Predictable Energy Costs

Higher fuel usage provides access to the lower costs associated with bulk purchasing. The use of locally grown biomass as a portion of the fuel mix further enhances the cost stabilizing benefit of district energy.

The price of wood fuel is not linked to world energy markets or unstable regions, but instead determined by local economic forces. For this reason, biomass systems do not experience the price instability of conventional fuel systems.

#### Fuel-Type Flexibility

Because a central heating plant can have boilers that burn different fuels, the option exists to use whichever fuel is the most economical at any given time.

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### **Better Air Quality**

Air quality improves—as does community livability—when emissions from a single, well-managed plant replace uncontrolled stack emissions from boiler plants in many individual buildings. The result is magnified when district energy systems, as they often do, replace multiple systems that use conventional fossil fuels.

If the central system uses wood fuel, the emissions of sulfur dioxide (which contribute heavily to acid rain) will decrease, while emissions of particulates and certain toxic air contaminants will increase. The emissions increases, however, do not result in a higher concentration in the air because of changes in the location of the emissions and the improved dispersion of pollutants resulting from a single tall stack.

Yet another advantage in improving air quality with district heating is the ability to install best available technology emissions control equipment, which may not be affordable in individual building heating plants.

### **More Local Jobs**

Conventional energy systems require labor in fuel extraction, processing, delivery, operation, and maintenance as well as in system construction and installation. Fossil fuel supply is based on energy resources outside the community, thus, all jobs associated with extraction and processing are outside the local and regional economies. By contrast, jobs and most of the raw materials associated with wood fuel extraction, reforestation, and fuel transport are within the local and regional economies.

### **Dollars Remain in the Local Economy**

Unlike fossil fuels, which come from outside the northern New England region, wood fuel is a local and regional resource. The businesses associated with wood supply (logging operations, trucking companies, and sawmills) tend to be locally owned, so that profits are retained in the regional economy. These activities contribute to the state and local tax base. Conversely, the use of fossil fuels creates a net economic drain on a community and state. The Vermont Job Gap Study found that Vermonters spend more than \$1 billion annually for fuel and energy imported from outside the state.

### **Revitalized Communities**

District energy infrastructure and stable rates improve a community's business climate, make local businesses more competitive, help to revitalize downtowns and urban core areas so they can better compete with suburban sprawl, and, using biomass as the fuel source, help build a sustainable infrastructure.

### **Reliable Equipment**

District energy systems have an unparalleled record of reliable service. They achieve this by well-managed central plant operation, by using multiple fuels, by having backup boilers in one or more locations, and by having standby power at the central plant.

### **Use of a Plentiful & Renewable Resource**

Biomass is a renewable resource that can continue to replenish itself when managed and harvested sustainably. Wood-fired heating systems provide a market for lower-grade wood not suitable for furniture or other high-profit products. These markets can be especially critical for restoring commercial and biological quality to harvested forests. In addition, the use of waste wood for energy can reduce the need for and costs of disposal.

### **Reduced Environmental Risks**

District energy systems can help to mitigate environmental risks by consolidating fuel storage to one or a very few locations compared to numerous onsite storage tanks that serve individual buildings. Conventional onsite fuel storage includes underground and aboveground storage tanks. Aboveground tanks can pose fire hazards as well as the risk of dislodging in the event of a flood. Failing underground tanks can pose a threat to ground and surface waters.

### **A Meaningful Way to Address Global Climate Change**

Carbon dioxide (CO<sub>2</sub>) is the major greenhouse gas implicated in global warming. When fossil fuels are burned, carbon that was sequestered underground (as oil, gas, or coal) is converted to CO<sub>2</sub> and released into the atmosphere. While CO<sub>2</sub> is a major component of the combustion emissions of both fossil and biomass fuels, burning biomass for energy adds no net CO<sub>2</sub> to the atmosphere.

For biomass energy to be an effective climate change mitigation strategy, however, the biomass must be harvested in a fashion that sustains the forest resource and increases its vitality and productivity over time. If a forest is clear cut and does not regenerate, there will be no trees to sequester, and carbon and CO<sub>2</sub> levels in the atmosphere will increase. A study by the Oak Ridge National Laboratory found that “using part of the forest harvest residue for district heating in Vermont has a positive impact on reducing the amount of carbon discharged to the atmosphere.”

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