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System Description

Colebrook, New Hampshire appears to offer a viable opportunity to develop a new community-wide district energy network that would rely on clean local renewable energy resources. Similar systems are widely used in Europe, particularly in Scandinavia. In Denmark, for instance, about 61% of all households in the country are connected to district energy networks, the majority of which using waste heat and renewable energy resources. Additional conduits can also be installed with the underground piping for metering and control, and could also be used to distribute fiber optic cables to all buildings connected to the district energy system.

The vast majority of buildings in Colebrook heat with oil, which has seen significant recent price increases and is currently selling for well over \$4.00 per gallon in Northern New Hampshire. Coupled with other rising commodity prices, high heating fuel costs create significant financial pressures for low income households, small businesses, governments, and institutions that will inevitably harm the local economy. Unlike most other commodities, however, it is technically and economically feasible for a community like Colebrook to use district energy to eliminate the use of oil for heating and allow Colebrook's energy dollars to stay in the local community rather than pay for imported fossil fuels.

A district energy system for a community such as Colebrook has three basic elements – customers willing to participate, a low cost heat source, and a thermal distribution network. The built-up area of Colebrook has approximately 638 housing units, many in multi-unit buildings. In addition Colebrook has a small commercial district, an industrial park, and several governmental buildings. A district energy system would be designed to serve every building in the built-up area of the community, plus any anticipated future growth. The actual construction schedule could be phased in over a period of time, which could be accelerated if oil costs remain at high levels.

Colebrook has no existing heat source so a new one would have to be built to serve the proposed district energy system. This could take several forms, but the basic options are to use modular biomass hot water generators to build up the system load, after which a properly sized biomass combined heat and power (CHP or cogeneration) plant could be built to take advantage of the efficiencies of that thermodynamic process. Alternatively, it may be possible to construct a biomass CHP plant along with the initial thermal delivery network, using revenues from sale of electricity and renewable energy credits to cover the plant's cost until the thermal network was built out. This second option would probably require a risk-sharing partner to invest in the plant, and it should be fairly straightforward to find out if any one might be interested in this arrangement. The CHP option would require higher capital and operating costs, but would deliver heat at a lower total cost. It appears that the Town's existing recycling site off of Bridge Street might be suitable for this biomass plant, and an ample local wood fuel supply appears to be available.

The third element is a thermal distribution network, which would be designed in accordance with European Standards for district heating systems to insure the quality, integrity and long service life of the piping network while securing the lowest possible installation cost. Hot water at approximately 203°F (95°C) would be distributed through the piping network to individual buildings, where heat exchangers would supply individual space and domestic hot water systems. Some buildings may require conversion or replacement of existing heating systems, depending on

the age and condition. The hot water can also be used for snow-melting of sidewalks and steps, and also used to produce cooling using hot water absorption chillers.

The proposed Colebrook district energy system would be fundamentally similar to the biomass energy system as The Balsams Grand Resort Hotel (which has operated for over thirty years) but the Colebrook system would distribute hot water rather than steam.

Simple Economics

The following table shows the cost of heat delivered from at various heating oil costs and individual building boiler efficiencies:

Existing Boiler Efficiency	Heating oil cost \$/gallon					
	\$2.00	\$2.50	\$3.00	\$3.50	\$4.00	\$4.50
100%	\$14.49	\$18.12	\$21.74	\$25.36	\$28.99	\$32.61
90%	\$16.10	\$20.13	\$24.15	\$28.18	\$32.21	\$36.23
80%	\$18.12	\$22.64	\$27.17	\$31.70	\$36.23	\$40.76
70%	\$20.70	\$25.88	\$31.06	\$36.23	\$41.41	\$46.58
60%	\$24.15	\$30.19	\$36.23	\$42.27	\$48.31	\$54.35

Most older boilers are probably in the 60 to 80% efficiency range, while the newest high efficiency oil boilers can exceed 90%.

The delivered cost of hot water from a district energy system depends on several factors. A recent feasibility study for a similar heat-only project in Groveton shows that a system serving the entire community (427 buildings and 839,393 square feet) would deliver heat for about \$27/mmbtu if financed over 20 years, which would be equivalent to \$3.00 per gallon fuel oil and an 80% efficient boiler. Colebrook appears to have a denser heat load area than does Groveton, which would result in lower installation costs for a new system, but this would require more detailed study to verify. The Groveton study also showed that the initial system serving the denser heat area would have costs about \$4/mmbtu less than the built-out system serving every house. Combined heat and power production could reduce the cost of heat by selling electricity at high market prices with renewable energy credits.

In addition to the basic heating cost savings, a district energy project would also benefit Colebrook by creating new jobs to build, operate and maintain the system. The Groveton study estimates that the total community annual heating fuel cost is about \$2.4 million, almost all of which leaves the local area to pay for imported fossil fuels. The new biomass system would use about \$600,000 of local biomass fuel, and these expenditures would stay in the local community.

The next steps would be to collect additional information on each building in Colebrook, including square feet and information on existing heating systems and fuel. This information can then be overlaid onto existing tax map survey data to allow a preliminary cost estimate to be prepared.

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