The North Country Resource Conservation and Development Area, Inc

Preliminary Feasibility Analysis for Distributed Energy and District Heating in the Village of Groveton, New Hampshire

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RAMBØLL

horizons Engineering PLLC

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0. Executive summary

In January 2008 the North Country Resource Conservation & Development Area Inc. (NCRC&D) commissioned Horizons Engineering L.L.C. and Ramboll Denmark A/S to carry out a feasibility study of a district heating network in the Village of Groveton, New Hampshire. The study was funded through a Memorandum of Understanding with the North Country Council, Inc to administer part of the US Department of Commerce, Economic Development Administration's Coos County Economic Adjustment Implementation Plan.

NCRC&D organized an Advisory Committee that together with NCRC&D would follow the study. The Advisory Committee was to assist in making information available, to oversee the progress of the study and to finally accept the study report. The Advisory Committee has also an important role to play in the discussions following the issuing of the report, in particular on how to take the next step towards developing a district heating network.

Today the residents of Groveton rely heavily on oil to heat the homes and buildings in the village. With the increasing oil and gas prices an important objective of a district heating network is to reduce the heating costs and to maximize energy efficiencies. A district heating project should also seek to support growth of new business and industry in Groveton. The use of local, renewable energy supplies, such as biomass, would be an additional objective.

Two of the key principles in the study are to avoid advanced technologies during the early stages and to avoid overspending on the district heating network. A phasing of the build-out is part of the suggested approach and for the assessments made in this study Groveton has been divided into three main areas, two of which are proposed supplied from the heat network.

The study does not describe the provision of heat for the district heating network. Assumptions have been made with regard to the location of the heat source at the Wausau Papers property and the use of wood chip as the main fuel in order to assess the economy of the project.

The most difficult and time consuming part of the study has been to obtain precise heating data for the buildings in Groveton. It has been assumed that the district heating supply will cover both the heating of the buildings and the domestic hot water demand, which is the normal procedure when introducing district heating.

The report briefly outlines the heat production technologies available for the supply of a district heating network, including a description of the combined production of heat and power. This section also deals with wood as a fuel, some of the questions surrounding heat storages, alternative heat sources and the requirements for back-up boilers.

Another section of the report is dedicated to planning issues and the possibilities of funding that Horizons Engineering and Ramboll have identified.

The objective of the district heating network is to supply the majority of Groveton with heat and domestic hot water in the most economically feasible way. This means that the network needs to be divided into two networks and implemented over three phases.

Two district heating networks have been outlined in the study to find the right pipe dimensions and to develop project cost estimates. The first network covers the central part of Groveton, west of the Wausau Paper property, and the second network covers the northern part of the village.

It is assumed that a wood chip fired heat production facility is established close to the Wausau Paper property. The facility will have oil-fired back-up boilers.

The connected buildings will have a hydraulic interface unit with a heat exchanger and a cylinder for domestic hot water.

Three scenarios have been examined to assess the feasibility of a district heating network. The scenarios 1A, 1B and 2 represent a development in three stages; scenario 1A covers the area closest to the boiler plant, scenario 1B takes a step further, covering a larger area (including 1A) and scenario 2 is a further development to an even larger area (including both 1A and 1B).

In order to make the financial appraisal we have estimated the costs of the pipe network, the costs of establishing a wood chip fired heat production facility with oil-fired back-up boilers and the costs related to the connection of each building to the district heating network through a hydraulic interface unit. Also assumptions about the oil price and the price of wood chips are included in the study.

The total cost estimates for the three scenarios are listed in the table below. It should be noted that both the development scenarios and the costs are cumulative, i.e. the total cost of construction for the system described in scenario 1B includes the cost of scenario 1A. In the same way the cost of construction for the system described in scenario 2 includes the cost of scenario 1B, which again includes scenario 1A.

Construction costs estimate for each scenario				
Scenario	Plant ($)	Network ($)	HIU *) ($)	Total ($)
1A	1,300,000	1,943,000	681,000	3,924,000
1B	1,500,000	4,332,000	1,308,000	7,140,000
2	1,800,000	9,220,000	2,144,000	13,164,000

HIU = The Hydraulic Interface Unit or consumer's heat exchanger unit

When looking at the results of the calculations, the most interesting figure is probably the heat price that customers will have to pay, if they connect to the district heating system.

The price is in dollars per million Btu ($/MMBtu), and in the following table it has been calculated for the three scenarios used in the study. It should be observed that the price in Scenario 1A is the lower and that the price in Scenario 2 is the higher with Scenario 1B in between. The reason is that it takes a shorter network to supply heat to the buildings closest to the boiler plant and the investment in the network is therefore lower. The consequence is a lower heat price.

Another feature of the table is the payback time and the table shows the results for three different periods: 10, 15 and 20 years. The payback period is interesting because a large part of the heat price is used to pay back the investment in the network and in the heat production facilities. With a shorter payback period, the heat price will become higher.

Heat price to be paid by customers connected to district heating			
Scenario	10 years payback ($/MMBtu)	15 years payback ($/MMBtu)	20 years payback ($/MMBtu)
1A	32	26	23
1B	33	27	24
2	39	31	27

The heat price should be compared with the price paid by residents with individual oil-fired boilers. With a retail oil price of $ 4.00 per gallon and a boiler efficiency of 85%, the comparable price of heat based on oil is $ 39 per MMBtu. For a less efficient oil-fired boiler the price would be higher.

In other terms, with a payback period of 10 years and a development of the district heating network following Scenario 2 (which represents the full build out within the area identified for district heating), the price of heat from the district heating system is the same (39 $/MMBtu) as the price paid when heating with oil. If the payback period is 20 years instead, the heat from district heating is 27 $/MMBtu or 31% lower than heating with oil.

If we look at Scenario 1A, the same numbers are 32 $/MMBtu or 18% lower for 10 years payback and 23 $/MMBtu or 41% lower for 20 years payback.

The results of this study will quite naturally be influenced by changes in fuel prices and the uncertainty in the construction costs estimates. It is therefore important that any work based on these results takes a critical view on current developments within both the oil price and the price of wood chip. Also a review of the estimated construction costs should be included in any further work

The report concludes with a recommendation that the study is followed by a more detailed investigation in the heat production facility options and the network itself. In particular the cost estimates are based on assumptions, which have to be verified. It is also important that a business plan for the enterprise (or enterprises) is developed and anchored within the community.