Alternative Energy Requirements & Analysis
Renewable Energy Screening

As compiled by
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Energy Basis

The heating system for Building 9 consists of six boilers rated at 2 MMBTUH each. Two of the six boilers provide reserve capacity for heating. On this basis, sufficient capacity is available for maximum heating loads with two of the boilers out of service. One water cooled chiller, 300 tons, and one air cooled chiller, 100 tons, comprise the building cooling system.

Estimated energy requirements for heating and cooling are based on annual full load equivalent hours (FLEH). The FLEH for heating is 1,800. The water-cooled and air-cooled chillers have been assigned 1,200 FLEH and 900 FLEH, respectively.

On this basis the expected energy load for heating is 14,400 MMBTU per year. With energy ratings of 0.85 kW/ton and 1.05 kW/ton for the water cooled and air cooled chillers, respectively, the energy requirement for cooling is approximately 400,500 kWh (306,000 kWh + 94,500 kWh).

Heating:	4 x 2,000 MBH x 1,800 FLEH = 14,400 MMBTU
Cooling:	1 x 300 Tons x 1,200 FLEH x .85 kWh/Ton-hr = 306,000 kWh
	1 x 100 Tons x 900 FLEH x 1.05 kWh/Ton-hr = 94,500 kWh
DHW	10,500 Gal/day[1] x 365 days/year x 583.8 BTU/gal[2] ÷ 70% = 3,195.3 MMBTU
Electric	124,925 square feet x 19 kWh/square foot-year = 2,373,575 kWh

The domestic hot water (DHW) load is based on 10,500 gallons per day, 365 days/year, average temperature rise of 70° F., and seasonal efficiency of 70%, yielding a total energy requirement of 3,195.3 MMBTU. The anticipated non-cooling electric consumption is based on 19 kWh/square foot/year or about 2,375,575 kWh.

Renewable Energy Screening

The Clean Energy Project Analysis Software of RETScreen International was used to forecast the capacity and performance of the following systems: solar photovoltaic, solar domestic hot water, solar heating for ventilation, and wind. The software of RETScreen International software was developed by Natural Resources Canada with sponsorship of NASA, United Nations Environment Program, Renewable Energy and Energy Efficiency Partnership, and World Bank. The software incorporates local weather conditions, and was specifically designed as a decision making tool for the analysis of renewable energy systems.

The results of the screening (summarized in terms of capital cost, annual energy reduction, first year avoided energy expense and simple payback period) are highlighted in Table 1. For ease of presentation, the first year avoided energy expense is exclusive of minor electric loads necessary to operate the solar air and solar DHW systems. The value or avoided unit expense of energy is $10/MMBTU for natural gas and $0.06/kWh for electricity. Estimated capital costs are inclusive of procurement, installation and engineering.

Table 1
Summary of Renewable Energy Screening

Type of System	Wind	Solar PV	Solar DHW	Solar Air
Capacity	10 kW	5.6 kWe	9.98 kW	200 Sq. Ft.
Annual Avoided Energy	12 MWh	8.3 MWh	76.5 MMBTU	362.3 MMBTU
%-Annual Load	3%	2%	2%	2%
Annual Avoided Expense	$720/ year	$498	$765	$362
Capital Cost	$25,000	$67,200	$22,000	$35,000
Payback Period, years	29.8	134.9	28.8	96.7

[1] 300 Residents x 35 Gal/resident-day = 10,500 Gal/day
[2] 8.33 LB/gal x 1 BTU/lb/°F. x 70.1° F. temperature rise = 583.8 BTU/gal

Each system highlighted in Table 1 provides about 2% of the respective loads. However, the capital investment in the renewable energy systems can not be justified exclusively on the basis of project economics gauged by simple payback period. Tax incentives and grants may be available to subsidize the capital cost and operation of these renewable energy systems. Use of these incentives and grants are generally conditioned on ownership by taxable entities. Analysis of eligible ownership structures and applicable incentives and grants are beyond the scope of this general screening of renewable energy systems.

Geothermal (Ground Source Heat Pumps)

Ground Source Heat Pump (GSHP) systems utilize the solar energy stored in the earth as a heat sink for extracting and rejecting heat from building air conditioning systems. This technology relies on the availability of the site to support the installation of underground loop fields. These loop fields consist of buried high density polyethylene (HDPE) piping to act as a heat transfer medium. The loop fields can be buried as horizontal piping or as vertical piping installed in 8" diameter boreholes.

Typical vertical GSHP loop fields require roughly 225 square feet of land for each 1 ton borehole (at 100 foot depth). The current design load for Building 9 is 400 tons, which would require 90,000 square feet (2.06 acres) of land area than can be dedicated to support the loop field.

Soil borings for the Veteran's Home site indicate that limestone bedrock exists within 5 to 8 feet from the soil surface. These drilling conditions in bedrock will result in an extremely high installation cost. The installation cost for a 400 ton loop field at this site could easily achieve over $4 million dollars if it is feasible at all.

Typical energy savings of these systems can yield 20% to 40% less energy consumption when compared to boilers and chillers. This would result in an energy savings of $33,600 to $67,200 annually. However using even the highest savings of $67,200 and a first cost of $4.0 m, this system would yield a payback of 59 years.

Predesign Summary Statement

Summary Statement

The New Building 9 is intended to be a replacement building for the old Building 9 which is being demolished due to extensive structural damage.

The New Building 9 will be a four (4) story 100 bed nursing care facility based upon creating smaller environments – not an institution but a small community – a handful of residents, a handful of staff, a few family members and volunteers. Within the smaller groups, MVH will be highly involved and genuinely responsive to the needs of the community. This is accomplished by shaping smaller groups of residents and staff; by redesigning organizational and reporting structures; by enhancing the people skills of staff, family, and residents; and by focusing on learning and growth for all within a genuine community. For a better term we would like to call these "communities", ***neighborhoods***. Floors One (1) and Two (2) will have two neighborhoods each with 17 single resident rooms per neighborhood while Floor Three (3) will have two neighborhoods with 16 single resident rooms per neighborhood.

This facility will house a mix of nursing care levels including a high population of dementia and Alzheimer residents.

To complete the total new nursing care concepts the Lower Level will be a "Town Square" design with spaces that enhance the resident's life style and also acts to bring a centralized activity area for and link together Buildings 6, 9, and 17. Included within the level will be a new chapel, coffee shop, retail area, café, store, craft/community room, theater, community service area, therapy area, centralized administration office area, and support/service areas for Building 9.

To enhance the site a new main entry and approach circle will be designed including a low level special events amphitheater and a walkway link into the Minneapolis park area to give recognizable identity and public accessibility to the Minnesota Veterans Home. This will also include significant modifications to the parking area and the utilities (such as telecommunications, electric service, water, sewer, and steam) leading up to and serving the New Building 9.

Project Summary Information

Total Project Square Foot area	124, 925 sq. ft.
Total Construction Cost	$22,283,646
Cost per square foot	$178 / sq. ft.
Total Project Cost	$26,000,000
State of Minnesota Portion of Project Cost	$9,100,000
U.S. Government Portion of Project Cost	$16,900,000

Total Project Schedule	
Predesign	1/28/08 – 8/20/08
Funding	5/5/08 – 7/3/08
Schematic Design	10/22/08 – 1/28/09
Design Development	1/29/08 – 4/16/09
Construction Documents	4/17/09 – 10/9/09
Bidding	10/16/09 – 1/14/10
Construction	10/18/10 – 8/19/11
Project Completion	8/19/11

Building Audit/Data Information

See the following Appendix Q - Building Audit/Data Sheet