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SolarWall Feasibility Study for Minnesota Army National Guard

August 6, 2016

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Executive Summary

Conserval Systems conducted a preliminary review for 15 locations:

Building A - Bemidji NGA
1430 23rd St. NW Bemidji, MN 56601

Building B - Bloomington NGA
3300 W 98th St. Bloomington, MN 55431

Building C - Brainerd NGA
1115 Wright St.
Brainerd, MN 56401

Building D - Crookston NGA
1801 University Ave.
Crookston, MN 56716

Building E - Detroit Lakes NGA
915 Lakes Ave.
Detroit Lakes, MN 56501

Building F - Jackson NGA
108 Country Road 51
Jackson, MN 56143

Building G - Mankato NGA
100 Martin Luther King Drive
Mankato, MN 56001

Building H - Moorhead NGA
1002 15th Ave. N
Moorhead, MN 56560

Building I - Pine City NGA
1305 Main Street
Pine City, MN 55063

Building J - Red Wing NGA
885 East 7th St
Red Wing, MN 55066

Building K - Redwood Falls NGA
530 Highway 101
Redwood Falls, MN 56283

Building L - Rosemount FMS
14221 Biscayne Ave. W
Rosemount, MN 56304

Building M - St. Cloud NGA
1710 Veterans Drive
St. Cloud, MN 56303

Building N - St. Cloud AASF
2185 45th Ave. SE
St. Cloud, MN 56304

Building O - Air National Guard 133rd Air Wing
631 Minuteman Drive
St. Paul, MN 55111

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After reviewing the sites, 8 locations have been isolated as excellent SolarWall candidates. These locations are:

Location B - Bloomington NGA
Location C - Brainerd NGA
Location E - Detroit Lakes NGA
Location G - Mankato NGA
Location H - Moorhead NGA
Location M - St. Cloud NGA
Location N - St. Cloud AASF
Location O - Air National Guard 133rd Air Wing

At Air National Guard 133rd Air Wing location in St. Paul, we are also considering the mounting photovoltaic (PV) panels (for electricity) on our SolarWall panels as part of the study. This patented SolarWall PV/T (Photovoltaic/Thermal) system will provide electrical energy and thermal energy from the same footprint. This technology is optimal at 133rd Air Wing due to the orientation and roof angle of the buildings reviewed on-site.

For the purpose of this study we used an estimated complete system installation rate ranging from $\$40/ft^2$ - $\$52/ft^2$ depending on the nature and/or complexity of each individual installation. For the 133rd Air Wing location, approximately $\$80/ft^2$ was used to allow for the added cost of the PV/T sytem.

Overall estimated results were as follows:
Budget Cost.....$3,273,832
Made in Minnesota Rebate Total .....$ 230,500
Net Cost.....$3,043,332
mmBtu/yr.....12,859 mmBtu
kWh/yr.....268,070 kWh

Product Description

SolarWall 2-Stage is the latest version of the SolarWall technology and has been recommended for most of the successful buildings surveyed for the Minnesota National Guard. Other buildings have received a recommendation of the SolarWall 2-Stage rooftop SolarDuct system. On a sunny day the SolarWall 2-stage technology can have a temperature rise that readily exceeds 100°F above ambient temperature. In many cases, the SolarWall 2-Stage or SolarDuct 2-Stage system will connect to the existing AHUs or ventilation units for the building, super-heating the incoming air during the heating season and reducing the load on the natural gas burners within those units. In other locations, standalone SolarWall fan systems are introduced to introduce and distribute the fresh air into the building.
In the case of standalone SolarWall fans, variable speed fans draw the warm air from the SolarWall and move it into the building ceiling area. In order to move the warm air to the floor

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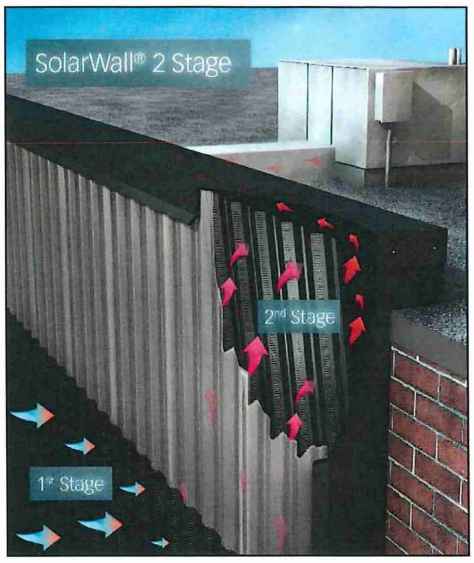
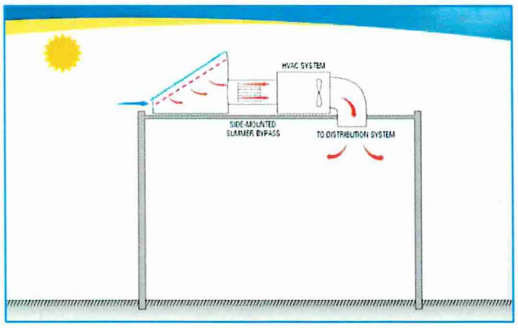
area, High Velocity Low Speed (HVLS) fans are incorporated into the design. These additional large ceiling fans are air de-stratification fans. The phenomenon of warm air rising and cold air falling is described as air-stratification. Removing the warm air layer near the roof and mixing it with the cold air near the floor can result in significant energy savings during the cold weather periods.



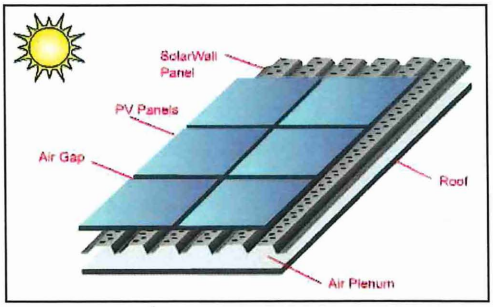
The SolarWall 2-Stage pre-heats the air twice; fresh air initially enters through tiny perforations in the bottom half of the SolarWall, which is unglazed, and then moves into the second stage. The second stage of the SolarWall system has a polycarbonate glazing over the perforated panels to provide a temperature boost, without any losses from wind.

The panels consist of perforated metal sheet absorbers, forming the exterior of the SolarWall, and are mounted out from the existing wall on 18 Ga.-G90 steel framing. Flashing material closes the opening around the perimeter of the SolarWall to prevent the intrusion of air from the edges.



SolarDuct is a modular rooftop application that allows the SolarWall collector to be installed on a rooftop. A SolarDuct array is typically used in situations where there is not a suitable wall location or when the proximity to ventilation units is more easily achieved by mounting on the roof. An added benefit of the SolarDuct technology is that it is angled to maximize the absorption of solar thermal energy, which it then delivers to the building via insulated rooftop ducting which connects to the building's ventilation system.

SolarWall PV/Thermal (PV/T) technology system is a co-generation system which produces both electricity and heat from one surface. Uniform air flows through each hole and over the entire surface of the SolarWall®. The thermal surface heat along the back of the PV panel is harvested from a short distance into the SolarWall collection cavity, allowing the ambient air to pass around and behind each PV module in a uniform manner, reducing PV module operating temperature and increasing the electrical output while simultaneously delivering the heat energy to the building.



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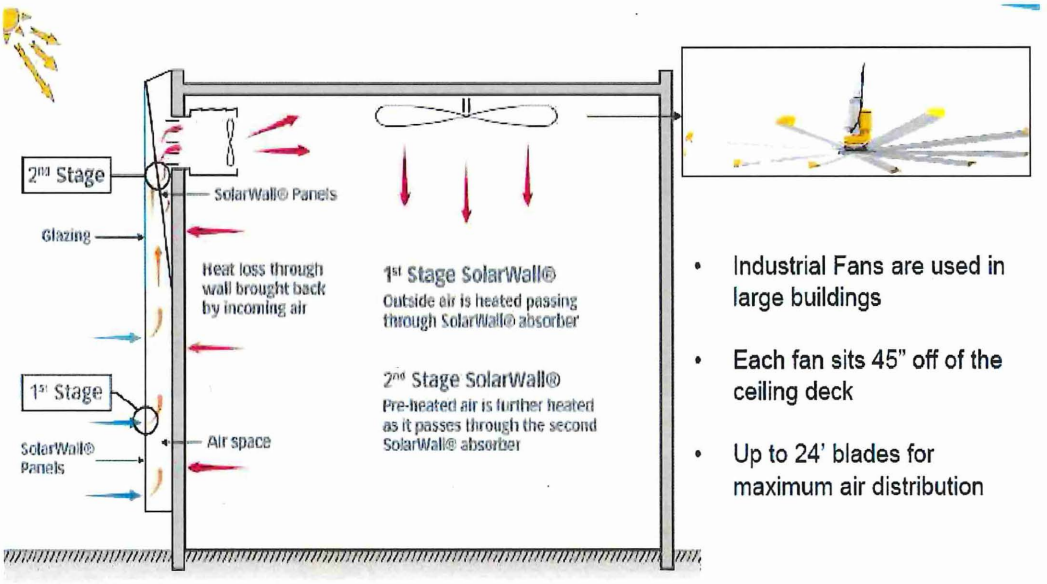
Solar Heated Air Distribution

Industrial Ceiling Fan – Some buildings in this study will include an industrial ceiling fan to provide de-stratification. When there is a call for heat and the SolarWall exceeds building set point the intake fans will turn on. Once the temperature sensor in the ceiling is 10° above building set point the industrial fans will turn on to move the warm air down. It is important to note that the intake fans and ceiling fans run completely independent of one another. This will help achieve maximum benefit of the industrial fans. At any time, if the heat in the ceiling is 10° above the floor, these fans should come on. In summer they will operate in the reverse direction and speed up to provide a cooling benefit for the occupants.

Since these fans are designed to move the warm air from the ceiling to the floor, they are the perfect delivery system for SolarWall. HVLS (High Volume Low Speed) fans can move air up to 85ft from the fan's center in all directions.



- Industrial Fans are used in large buildings
- Each fan sits 45" off of the ceiling deck
- Up to 24' blades for maximum air distribution

US Manufacturers include:

Big Ass Fans	1 877 244 3267	www.bigassfans.com
Rite Hite	1 888 841 4283	www.ritehite.com

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Design Assumptions

This proposal utilizes budgetary costs and it is assumed in this analysis that all costs associated with any given SolarWall installation are accounted for.

The table below outlines the way typical costs are broken down on a SolarWall bid. This gives an idea of all the components that are needed on the installation of SolarWall.

	Percentage of project
SolarWall	17.90%
Monitoring	6.57%
Engineering	1.11%
Mechanical	19.71%
Install	12.70%
Electrical	4.49%
Overhead	19.71%
Profit	12.33%
Insurance	3.90%
Tax	1.58%
Total	**100.00%**

It is important to note that the above table does not have an amount for design. Typically outside design is not necessary. However, if design is needed that could add another 7-10% depending on amount of involvement.

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Location B - Bloomington National Guard Armory
3300 W 98th St, Bloomington, MN 55431

South Wall 2-Stage SolarWall System
A SolarWall 2-Stage system 1,600 ft^2 in size is installed on the south wall section as illustrated below. It will connect into the existing louver and will be supply two existing AHU units located inside the building.

Rooftop 2-Stage SolarDuct System
A total of 80 SolarDuct modules will be installed in the areas indicated below and will service the fresh air supply to 4 existing AHU units.

The estimated material/install cost for the SolarWall 2-Stage and 2-Stage SolarDuct systems at Bloomington is $183,040. The available "Made in Minnesota" rebate will discount the cost by $25,000, making the net total $158,040. Approximately 956 MMBTU will be delivered to the building yearly.

NOTE:
The intake louver on the 2-Stage SolarWall section of the building is in an ideal position for incorporating the SolarWall. An in-wall summer bypass damper shall be incorporated into the 2-Stage SolarWall on the south wall section.

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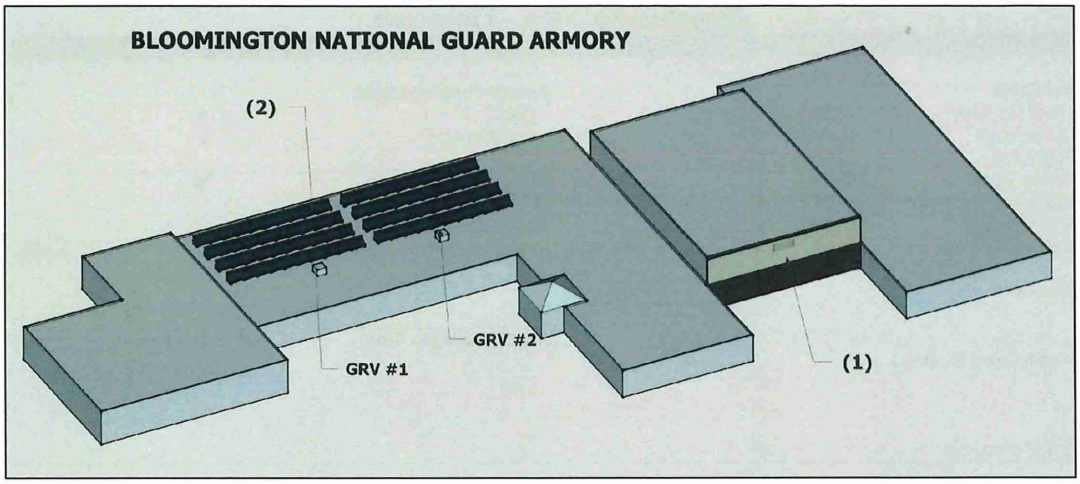

SYSTEM	ORIENTATION	AREA (SQF)	FLOW (CFM)	NOTES
1	SOUTH	1,600	6,000	2-Stage SolarWall connected to existing intake for MAX O/A of AHU #1 (2,800 CFM) & #6 (3,200 CFM). Wall mounted bypass to be installed in line with SolarWall.
2	SOUTH	1,920	7,370	4x Rows of 20 Fully Glazed SolarDuct modules connected to GRV #1 and #2 servicing O/A requirements for AHU #2,3,4,5

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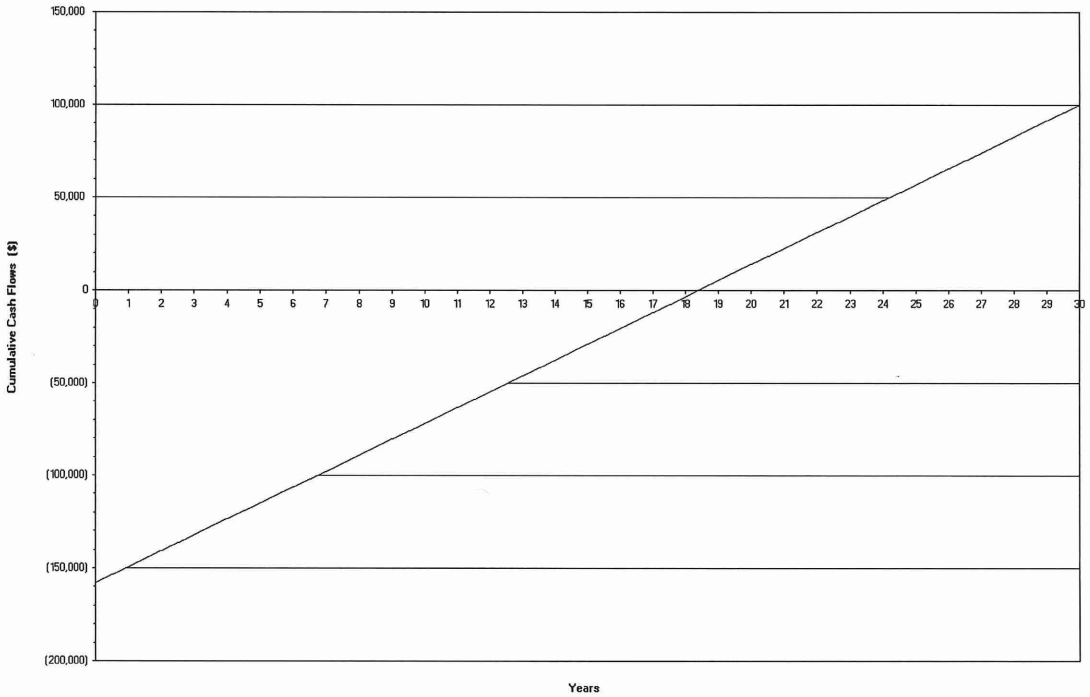
Bloomington NGA - Financials

Project Costs and Savings

Initial Costs				Annual Costs and Debt		
Feasibility study	0.0%	$	-	O&M	$	-
Development	0.0%	$	-	Fuel/Electricity	$	-
Engineering	0.0%	$	-			
Energy equipment	100.0%	$	183,040	**Annual Costs - Total**	$	-
Balance of equipment	0.0%	$	-			
Miscellaneous	0.0%	$	-	**Annual Savings or Income**		
Initial Costs - Total	100.0%	$	**183,040**	Heating energy savings/income	$	8,602
Incentives/Grants		$	25,000			
				Annual Savings - Total	$	**8,602**
Periodic Costs (Credits)						
		$	-			
		$	-			
		$	-			
End of project life -		$	-			

Financial Feasibility

			Calculate GHG reduction cost?	yes/no	No
Pre-tax IRR and ROI	%	3.5%			
After-tax IRR and ROI	%	3.5%			
Simple Payback	yr	18.4	Project equity	$	183,040
Year-to-positive cash flow	yr	18.4			
Net Present Value - NPV	$	(25,800)			
Annual Life Cycle Savings	$	(1,678)			
Benefit-Cost (B-C) ratio	-	0.86			



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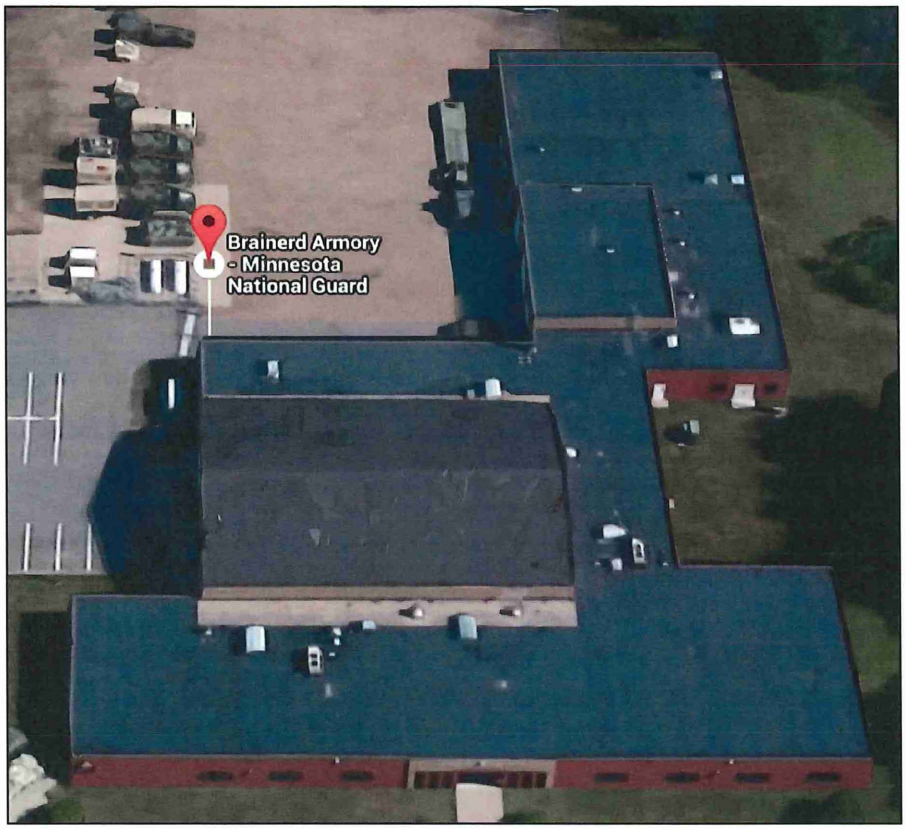
Location C - Brainerd National Guard Armory
1115 Wright St, Brainerd, MN 56401



2-Stage SolarWall System – Drill Hall's East and West walls.
2 SolarWall 2-Stage systems totaling 1,800 ft^2 in size will be installed on opposite sides of the Drill Hall. They will connect into new SolarWall fans that will deliver the solar-heated air into the Drill Hall. Existing de-stratification fans will assist in delivering the solar-heated air to floor level.

South Wall 2-Stage SolarWall System – East Wall (towards rear of building)
A SolarWall 2-Stage system 2,400 ft^2 in size will be installed on the east wall section as illustrated below. The SolarWall will extend above parapet level by approximately 2' and will connect via rooftop ducting into the existing AHU unit located nearby on the roof.

The estimated material/install cost for the SolarWall 2-Stage systems at Brainerd is $177,000. The available "Made in Minnesota" rebates will discount the cost by $44,250, making the net total $132,750. Approximately 945 MMBTU will be delivered to the building yearly.

NOTE:
The precise air volume for AHU #1 (to which the east wall SolarWall 2-Stage will be connected) was unclear. It is assumed in this analysis to be 4,000 cfm O/A but should be verified during design phase.

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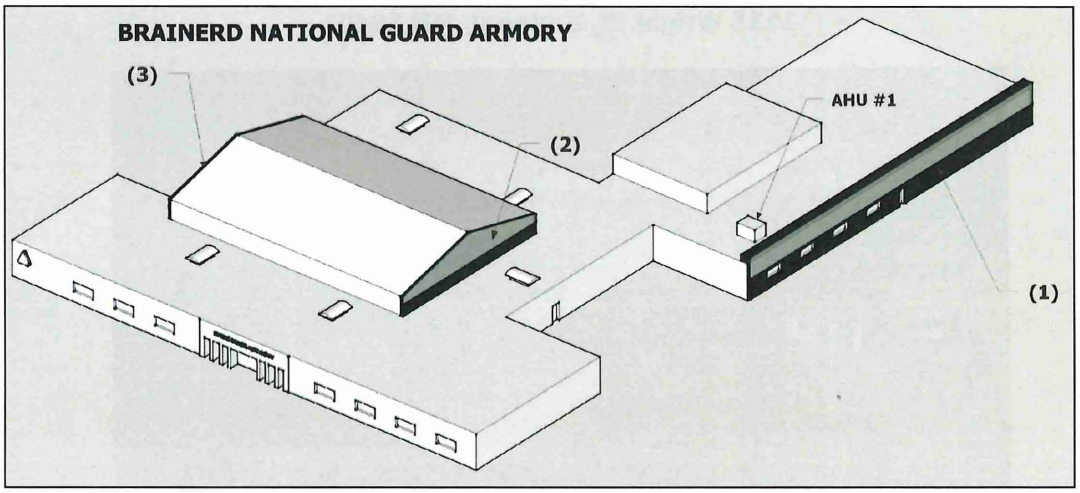

SYSTEM	ORIENTATION	AREA (SQF)	FLOW (CFM)	NOTES
1	EAST	2,400	<4,000	2-Stage SolarWall w/ backside canopy - rooftop ducting into AHU #1 (<4,000 CFM)
2	EAST	900	3,000	2-Stage SolarWall - internal ducting to new 3,000 CFM distribution fan
3	WEST	900	3,000	2-Stage SolarWall - internal ducting to new 3,000 CFM distribution fan

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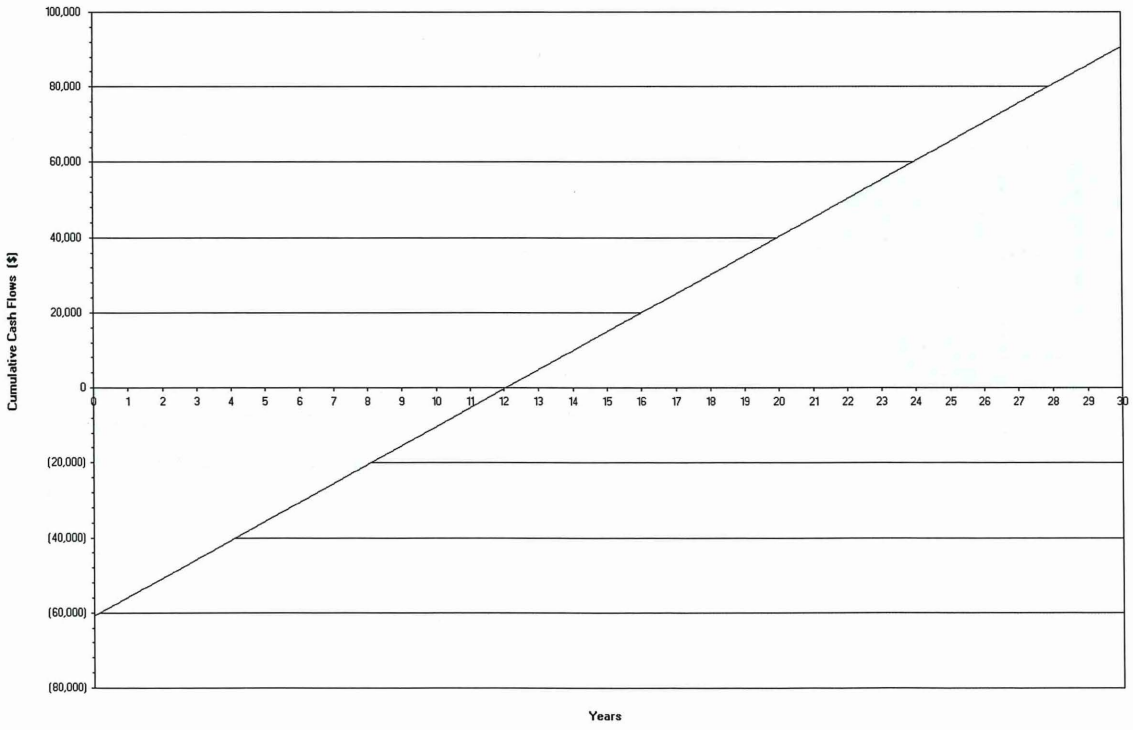
Brainerd NGA - Financials for East and West Elevations at Drill Hall

Project Costs and Savings

Initial Costs				Annual Costs and Debt		
Feasibility study	0.0%	$	-	O&M	$	-
Development	0.0%	$	-	Fuel/Electricity	$	-
Engineering	0.0%	$	-			
Energy equipment	100.0%	$	81,000	**Annual Costs - Total**	**$**	**-**
Balance of equipment	0.0%	$	-			
Miscellaneous	0.0%	$	-	**Annual Savings or Income**		
Initial Costs - Total	100.0%	**$**	**81,000**	Heating energy savings/income	$	5,048
Incentives/Grants		$	20,250			
				Annual Savings - Total	**$**	**5,048**
Periodic Costs (Credits)						
		$	-			
		$	-			
		$	-			
End of project life -		$	-			

Financial Feasibility

Pre-tax IRR and ROI	%	7.3%	Calculate GHG reduction cost?	yes/no	No
After-tax IRR and ROI	%	7.3%			
Simple Payback	yr	12.0	Project equity	$	81,000
Year-to-positive cash flow	yr	12.0			
Net Present Value - NPV	$	16,855			
Annual Life Cycle Savings	$	1,096			
Benefit-Cost (B-C) ratio	-	1.21			



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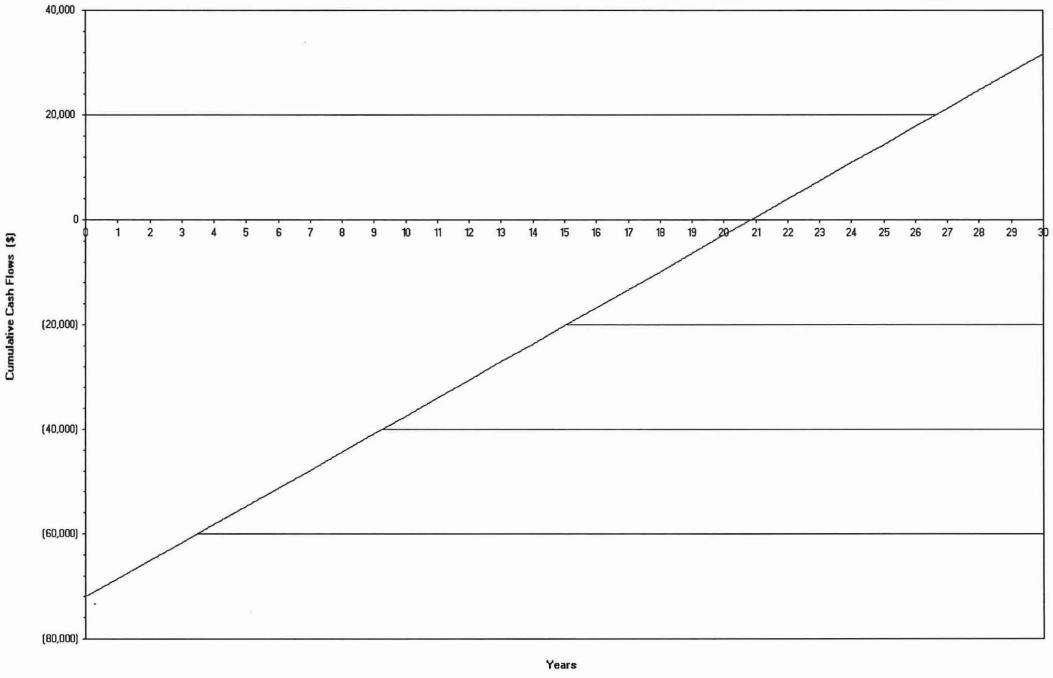
Brainerd NGA – Financials for East Wall

Project Costs and Savings

Initial Costs				**Annual Costs and Debt**		
Feasibility study	0.0%	$	-	O&M	$	-
Development	0.0%	$	-	Fuel/Electricity	$	-
Engineering	0.0%	$	-			
Energy equipment	100.0%	$	96,000	**Annual Costs - Total**	$	-
Balance of equipment	0.0%	$	-			
Miscellaneous	0.0%	$	-	**Annual Savings or Income**		
Initial Costs - Total	100.0%	$	**96,000**	Heating energy savings/income	$	3,454
Incentives/Grants		$	24,000			
				Annual Savings - Total	$	**3,454**
Periodic Costs (Credits)						
		$	-			
		$	-			
		$	-			
End of project life -		$	-			

Financial Feasibility

Pre-tax IRR and ROI	%	2.5%	Calculate GHG reduction cost?	yes/no	No
After-tax IRR and ROI	%	2.5%			
Simple Payback	yr	20.8	Project equity	$	96,000
Year-to-positive cash flow	yr	20.8			
Net Present Value - NPV	$	(18,909)			
Annual Life Cycle Savings	$	(1,230)			
Benefit-Cost (B-C) ratio	-	0.80			



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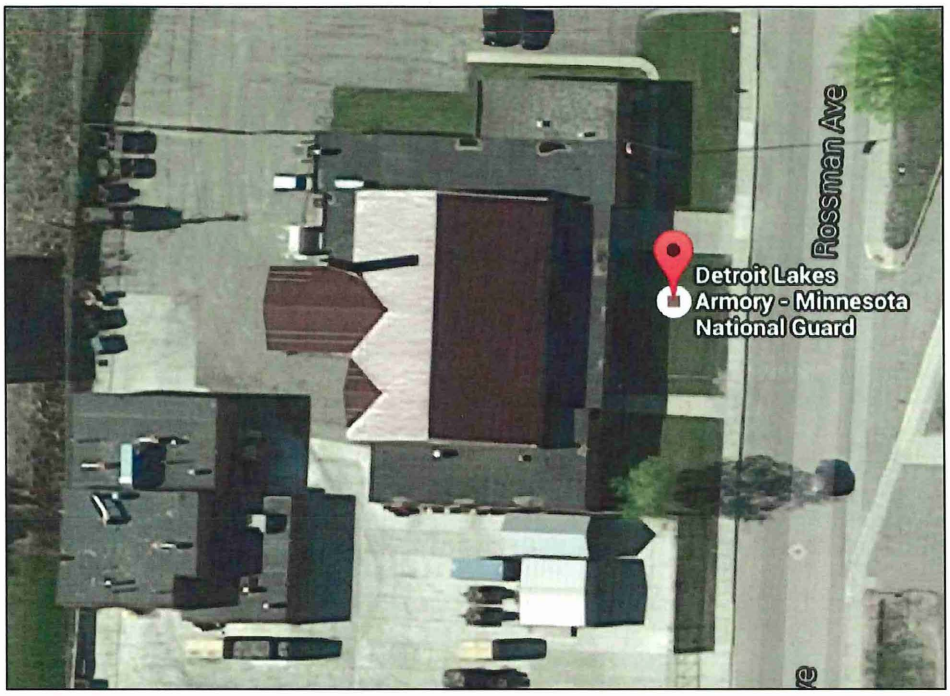
Location E - Detroit Lakes National Guard Armory
1220 Rossman Ave, Detroit Lakes, MN 56501



2-Stage SolarWall System – Drill Hall
The SolarWall 2-Stage system 1,000 ft^2 in size will be installed on the south facing wall of the Drill Hall. It will connect into a new SolarWall fan that will deliver the solar-heated air into the Drill Hall. Existing de-stratification fans will assist in delivering the solar-heated air to floor level.

The estimated material/install cost for the SolarWall 2-Stage system at Detroit Lakes is $45,000. The available "Made in Minnesota" rebates will discount the cost by $11,250, making the net total $33,750. Approximately 367 MMBTU will be delivered to the building yearly.

NOTE:
The Drill Hall currently has a manually operated air intake on both South and North elevations to allow fresh air to enter. The south intake would be connected to a fan and controls system which would actively bring in heat to the area provided it was sufficiently above set-point during the winter months.

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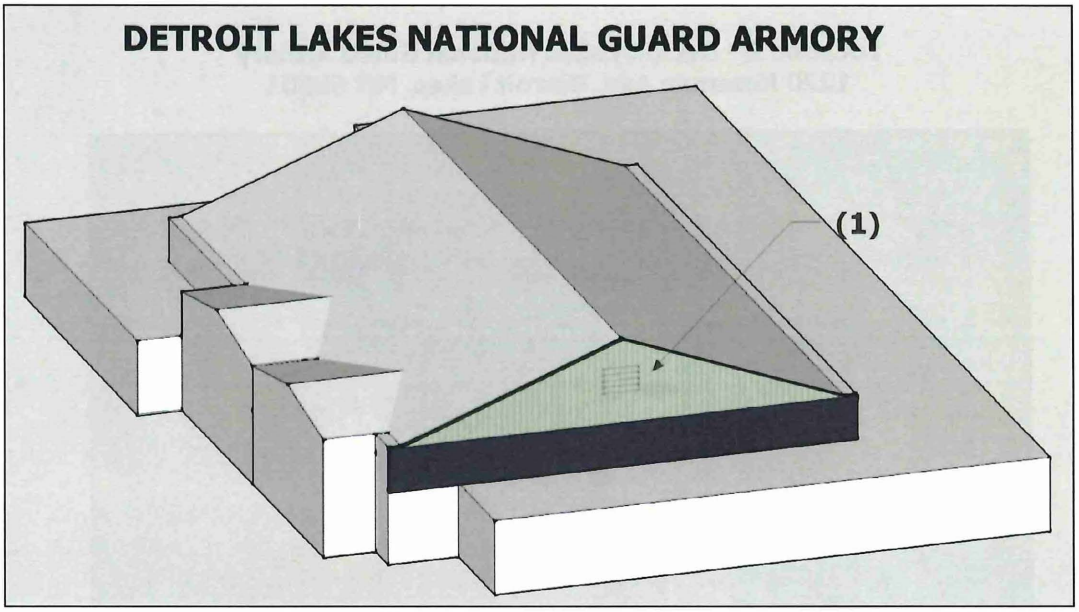
DETROIT LAKES NATIONAL GUARD ARMORY



SYSTEM	ORIENTATION	AREA (SQF)	FLOW (CFM)	NOTES
1	SOUTH	1,000	<3,500	2-Stage SolarWall - internal ducting to new 3,500 CFM distribution fan

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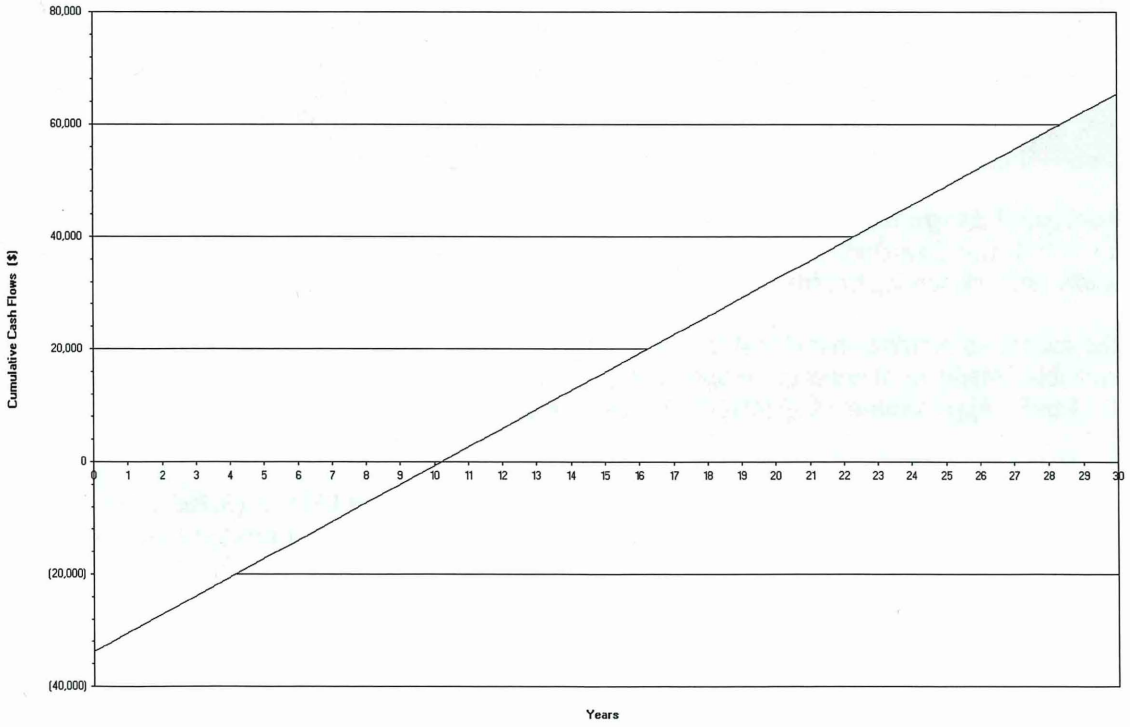
Detroit Lakes NGA – Financials

Project Costs and Savings

Initial Costs				Annual Costs and Debt		
Feasibility study	0.0%	$	-	O&M	$	-
Development	0.0%	$	-	Fuel/Electricity	$	-
Engineering	0.0%	$	-			
Energy equipment	100.0%	$	45,000	**Annual Costs - Total**	**$**	**-**
Balance of equipment	0.0%	$	-			
Miscellaneous	0.0%	$	-	**Annual Savings or Income**		
Initial Costs - Total	100.0%	**$**	**45,000**	Heating energy savings/income	$	3,307
Incentives/Grants		$	11,250			
				Annual Savings - Total	**$**	**3,307**
Periodic Costs (Credits)						
		$	-			
		$	-			
		$	-			
End of project life -		$	-			

Financial Feasibility

Pre-tax IRR and ROI	%	9.1%	Calculate GHG reduction cost?	yes/no	No
After-tax IRR and ROI	%	9.1%			
Simple Payback	yr	10.2	Project equity	$	45,000
Year-to-positive cash flow	yr	10.2			
Net Present Value - NPV	$	17,082			
Annual Life Cycle Savings	$	1,111			
Benefit-Cost (B-C) ratio	-	1.38			



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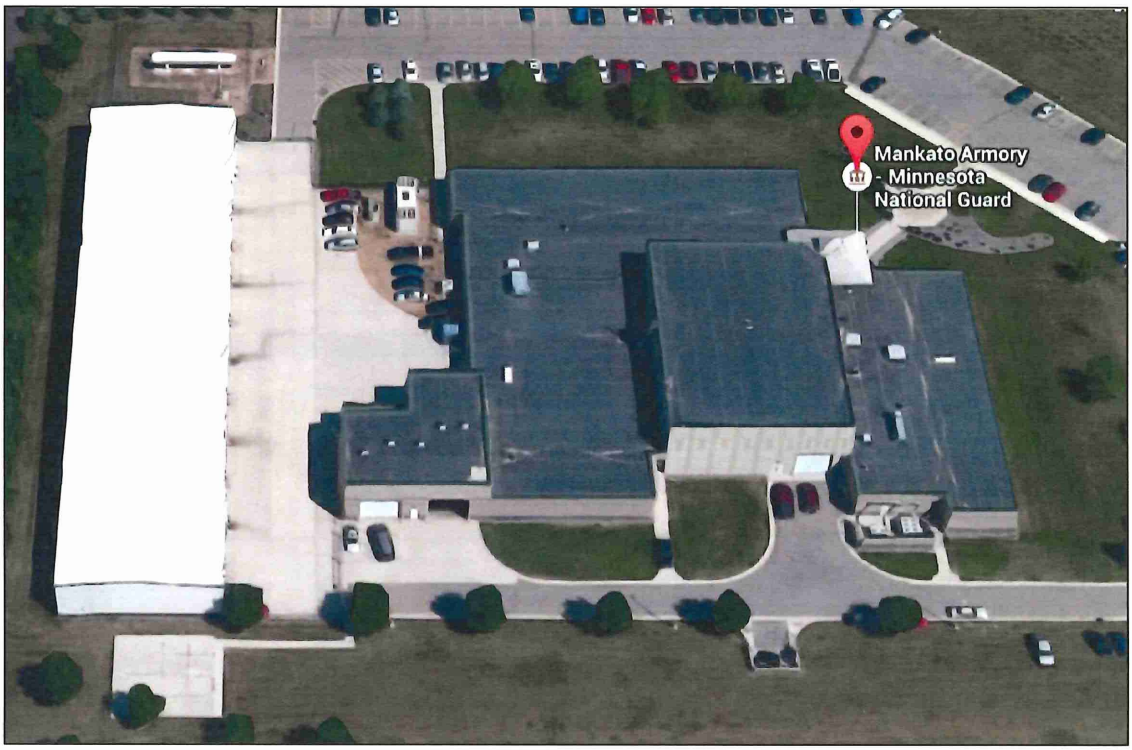
Location G - Mankato National Guard Armory
100 Martin Luther King Jr Dr, Mankato, MN 56001



Rooftop 2-Stage SolarDuct Systems
A total of 120 SolarDuct modules will be installed in two separate arrays in the areas indicated below and will service the fresh air supply to 2 existing AHU units.

The estimated material/install cost for the 2-Stage SolarDuct systems at Mankato is $189,696. The available "Made in Minnesota" rebate will discount the cost by $25,000, making the net total $164,696. Approximately 939 MMBTU will be delivered to the building yearly.

NOTE:
The rooftop units which lend themselves best to this application are DFU-1A (3,700 CFM) and ERW-1 (5,760 CFM). Other intakes available (either too large or in a poor position) IP-B (AHU-C - 9,260 CFM), IP-1A (26,400 CFM), IP-2A (2,630 CFM)

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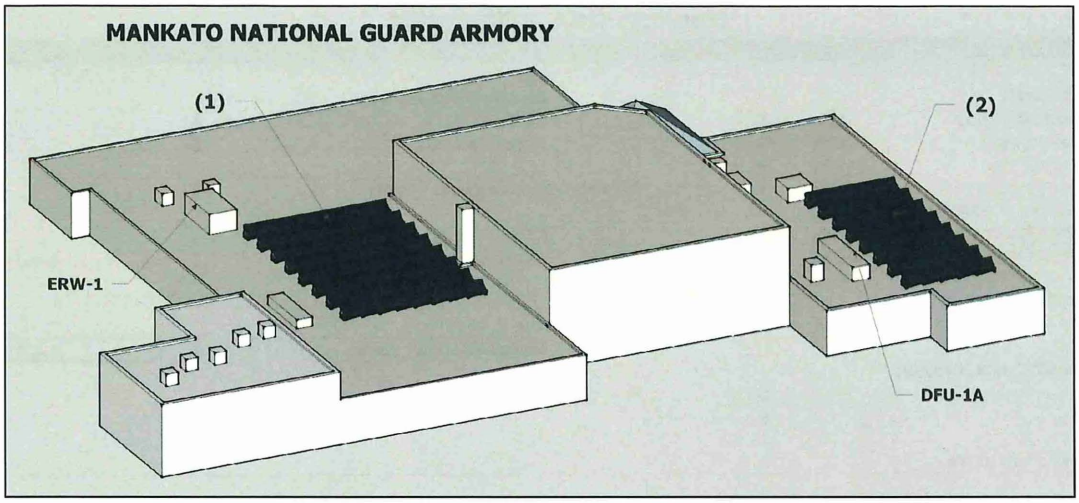

SYSTEM	ORIENTATION	AREA (SQF)	FLOW (CFM)	NOTES
1	SOUTH	1,920	5,760	8 Rows of 10 Glazed SolarDuct modules with rooftop ducting into ERW-1. Bypass damper to be installed for summer operation.
2	SOUTH	1,728	3,700	8 Rows of 5 Glazed SolarDuct modules with rooftop ducting into DFU-1A. Bypass damper to be installed for summer operation.

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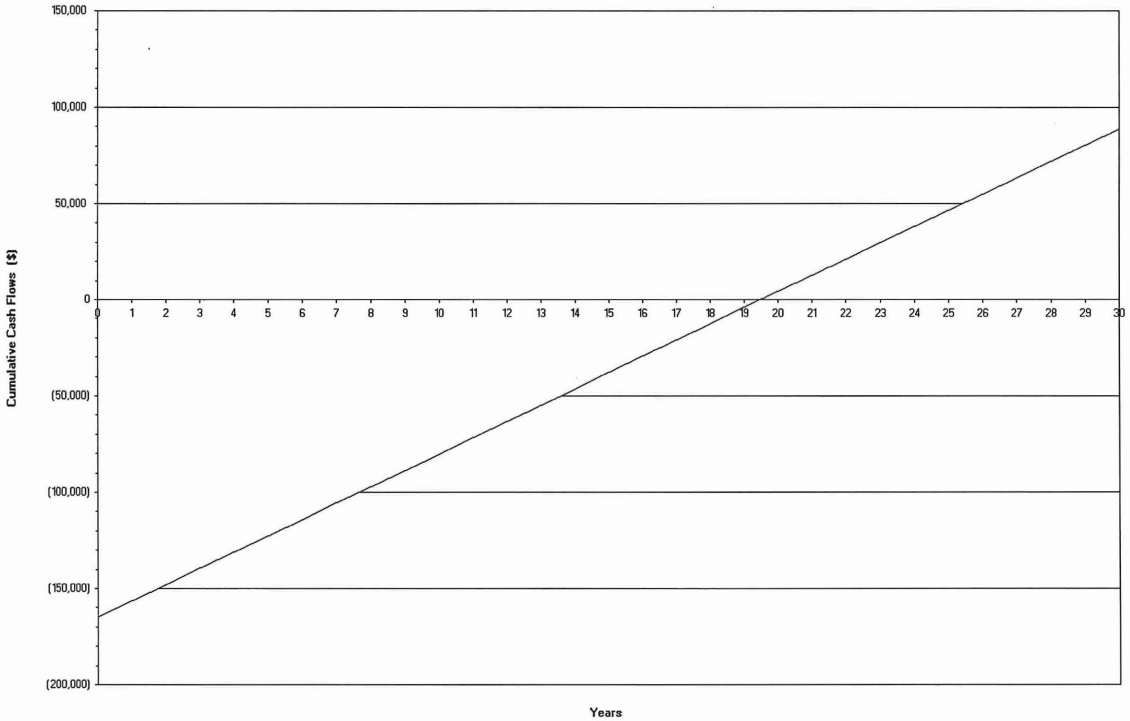
Mankato NGA – Financials

Project Costs and Savings

Initial Costs				Annual Costs and Debt		
Feasibility study	0.0%	$	-	O&M	$	-
Development	0.0%	$	-	Fuel/Electricity	$	-
Engineering	0.0%	$	-			
Energy equipment	100.0%	$	189,696	**Annual Costs - Total**	**$**	-
Balance of equipment	0.0%	$	-			
Miscellaneous	0.0%	$	-	**Annual Savings or Income**		
Initial Costs - Total	100.0%	**$**	**189,696**	Heating energy savings/income	$	8,451
Incentives/Grants		$	25,000			
				Annual Savings - Total	**$**	**8,451**
Periodic Costs (Credits)						
		$	-			
		$	-			
		$	-			
End of project life -		$	-			

Financial Feasibility

Pre-tax IRR and ROI	%	3.0%	Calculate GHG reduction cost?	yes/no	No
After-tax IRR and ROI	%	3.0%			
Simple Payback	yr	19.5	Project equity	$	189,696
Year-to-positive cash flow	yr	19.5			
Net Present Value - NPV	$	(34,789)			
Annual Life Cycle Savings	$	(2,263)			
Benefit-Cost (B-C) ratio	-	0.82			



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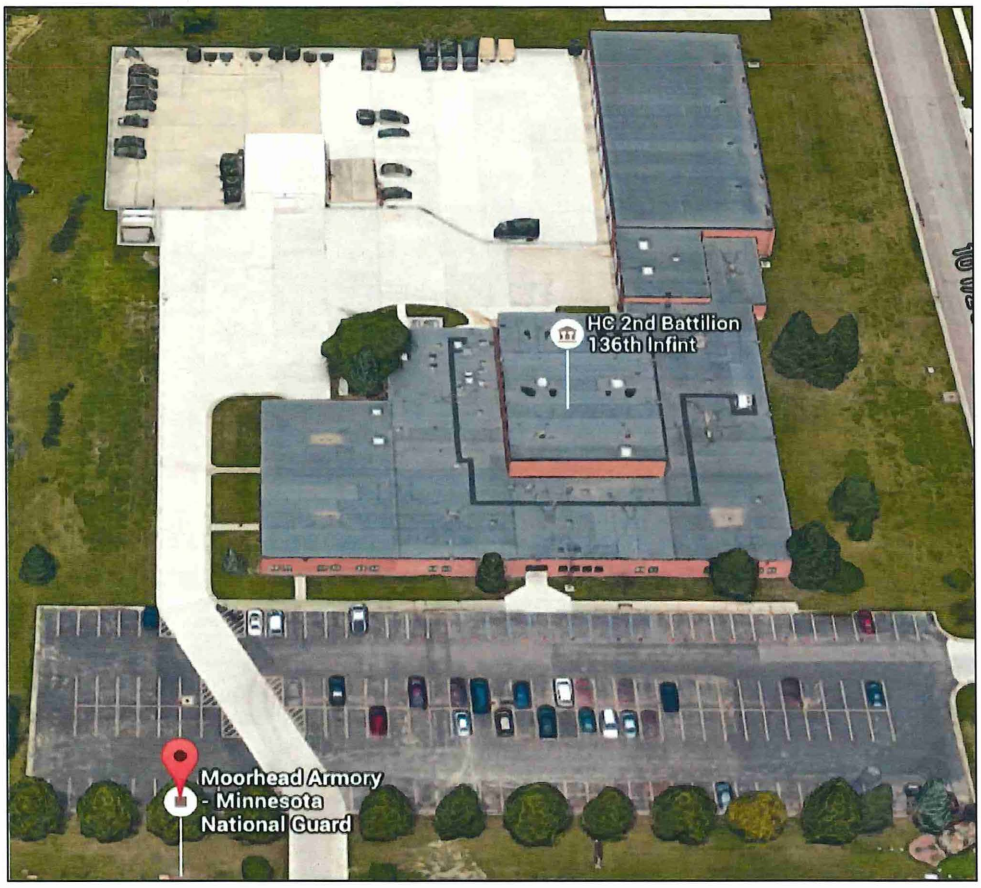
Location H - Moorhead National Guard Armory
1002 15th Ave N, Moorhead, MN 56560



Rooftop 2-Stage SolarDuct Systems
A total of 280 SolarDuct modules will be installed in four separate arrays in the areas indicated below and will service the fresh air supply to 5 existing air handling units.

The estimated material/install cost for the 2-Stage SolarDuct systems at Moorhead is $349,440. The available "Made in Minnesota" rebate will discount the cost by $25,000, making the net total $324,440. Approximately 2,336 MMBTU will be delivered to the building yearly.

NOTE:
This building is ideally configured to offset a large energy load.

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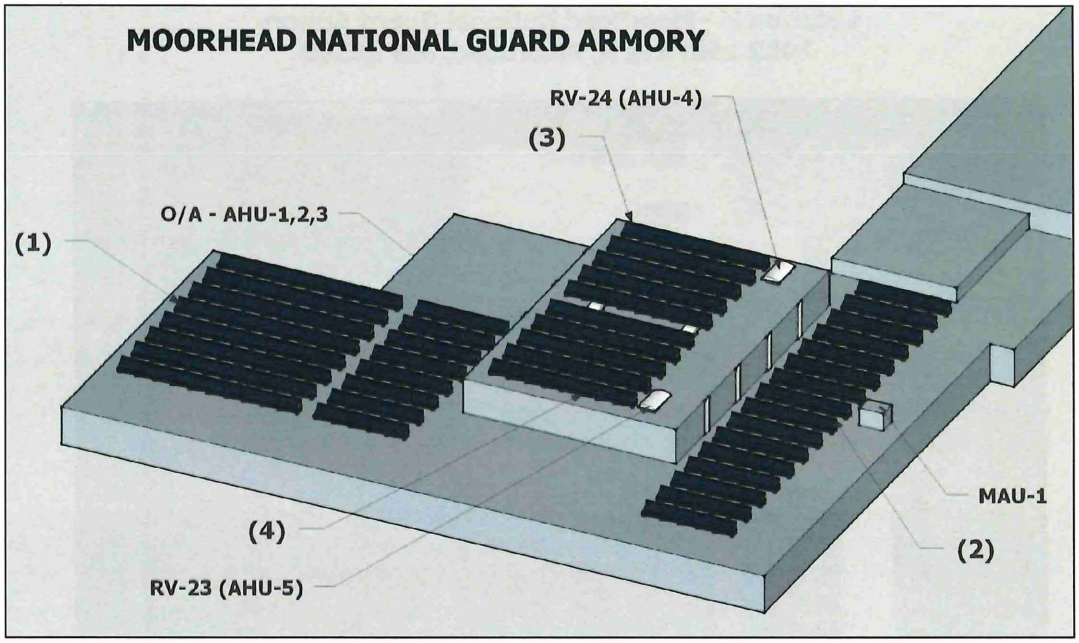

SYSTEM	ORIENTATION	AREA (SQF)	FLOW (CFM)	NOTES
1	SOUTH	2,880	<11,235	8 Rows of 15 Glazed SolarDuct modules with rooftop ducting into inside O/A ducting for AHU #1, #2, #3 (8,750 CFM, 1,430 CFM, 1,055 CFM)
2	SOUTH	1,920	<16,140	16 Rows of 5 Glazed SolarDuct modules with rooftop ducting into MAU-1
3	SOUTH	960	<3,750	5 Rows of 8 Glazed SolarDuct modules with rooftop ducting into RV-24 (RV-24 into AHU-4 - 3,750 CFM O/A)
4	SOUTH	960	<3,750	5 Rows of 8 Glazed SolarDuct modules with rooftop ducting into RV-23 (RV-23 into AHU-4 - 3,750 CFM O/A)

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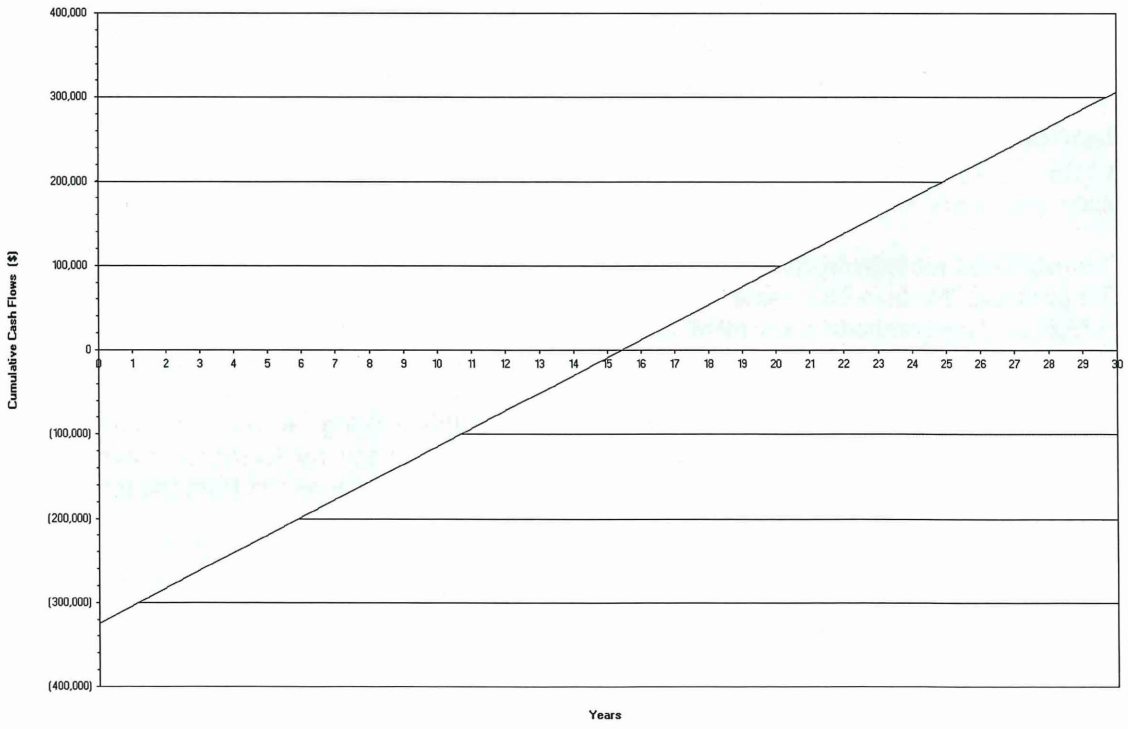
Moorhead NGA – Financials

Project Costs and Savings

Initial Costs				Annual Costs and Debt		
Feasibility study	0.0%	$	-	O&M	$	-
Development	0.0%	$	-	Fuel/Electricity	$	-
Engineering	0.0%	$	-			
Energy equipment	100.0%	$	349,440	**Annual Costs - Total**	**$**	**-**
Balance of equipment	0.0%	$	-			
Miscellaneous	0.0%	$	-	**Annual Savings or Income**		
Initial Costs - Total	100.0%	**$**	**349,440**	Heating energy savings/income	$	21,023
Incentives/Grants		$	25,000			
				Annual Savings - Total	**$**	**21,023**
Periodic Costs (Credits)						
		$	-			
		$	-			
		$	-			
End of project life -		$	-			

Financial Feasibility

Pre-tax IRR and ROI	%	5.0%	Calculate GHG reduction cost?	yes/no	No
After-tax IRR and ROI	%	5.0%			
Simple Payback	yr	15.4	Project equity	$	349,440
Year-to-positive cash flow	yr	15.4			
Net Present Value - NPV	$	(1,268)			
Annual Life Cycle Savings	$	(82)			
Benefit-Cost (B-C) ratio	-	1.00			



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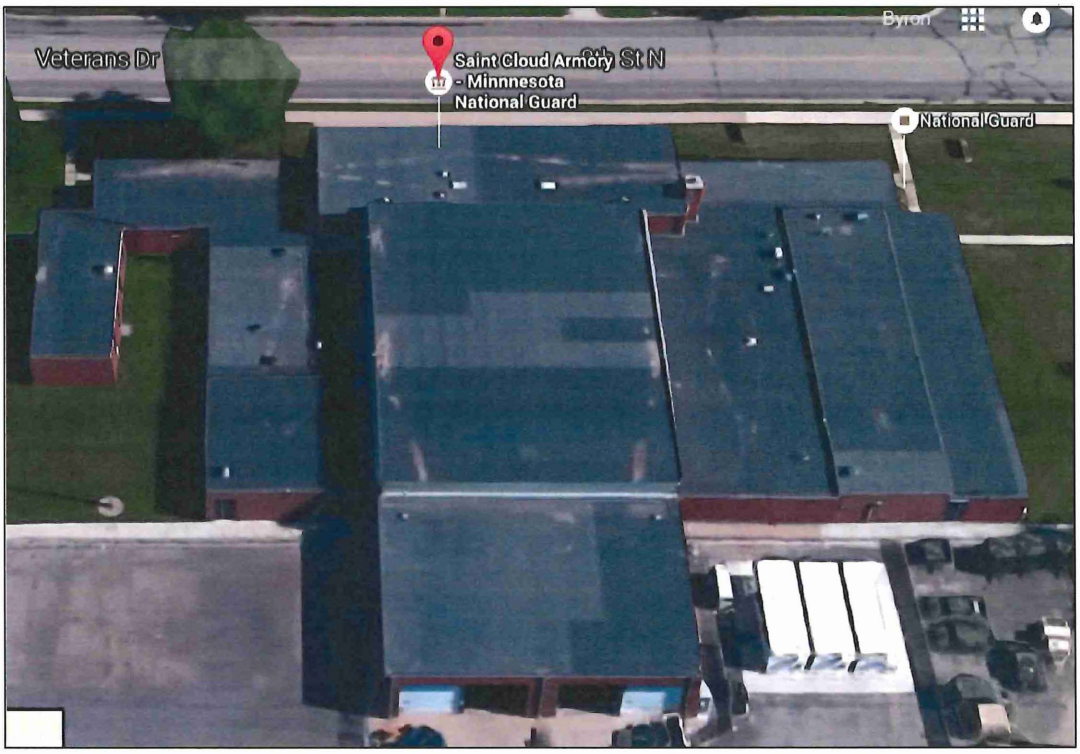
Location M - St Cloud National Guard Armory
1710 8th St N, St Cloud, MN 56303



Rooftop 2-Stage SolarDuct Systems
A total of 172 SolarDuct modules will be installed in two separate arrays in the areas indicated below and will service the fresh air supply to existing air handling units.

The estimated material/install cost for the 2-Stage SolarDuct systems at Moorhead is $214,656. The available "Made in Minnesota" rebate will discount the cost by $25,000, making the net total $189,656. Approximately 1,322 MMBTU will be delivered to the building yearly.

NOTE:
No drawings of mechanical information was availiable for this building. As there is a large amount of clear roof space available there could be potential for several SolarDuct arrays depending on the existing air intakes for the building which can be accessed from the rooftop.

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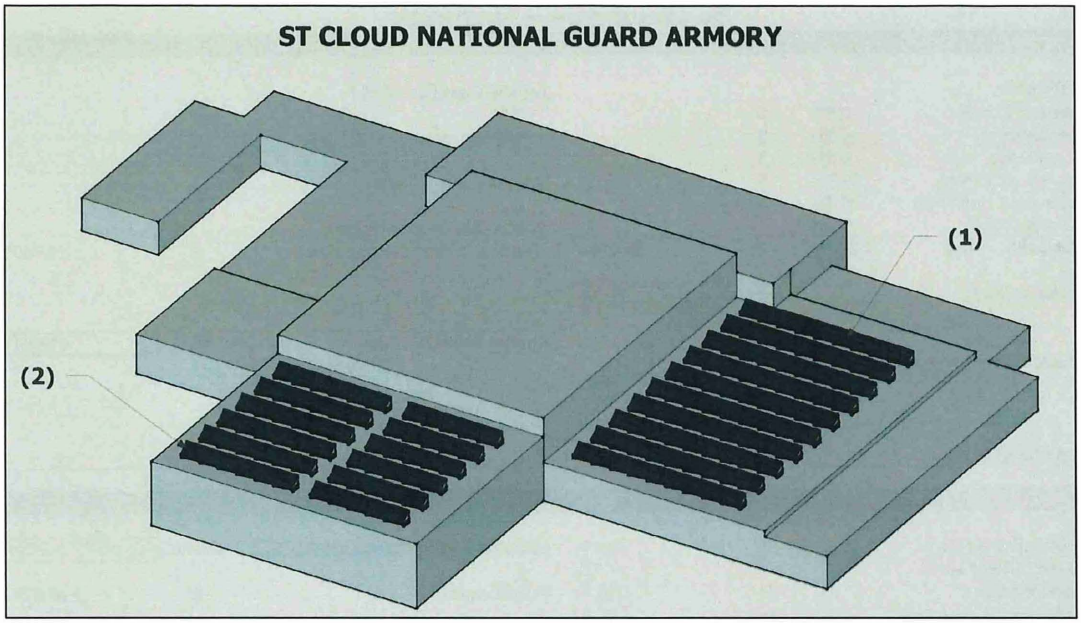

SYSTEM	ORIENTATION	AREA (SQF)	FLOW (CFM)	NOTES
1	SOUTH	1,728	<9,600	6 Rows of 12 Glazed SolarDuct modules with rooftop ducting into any available rooftop air intakes not to exceed 9,600 CFM total
2	SOUTH	2,400	<6,900	10 Rows of 10 Glazed SolarDuct modules with rooftop ducting into any available rooftop air intakes not to exceed 6,900 CFM total

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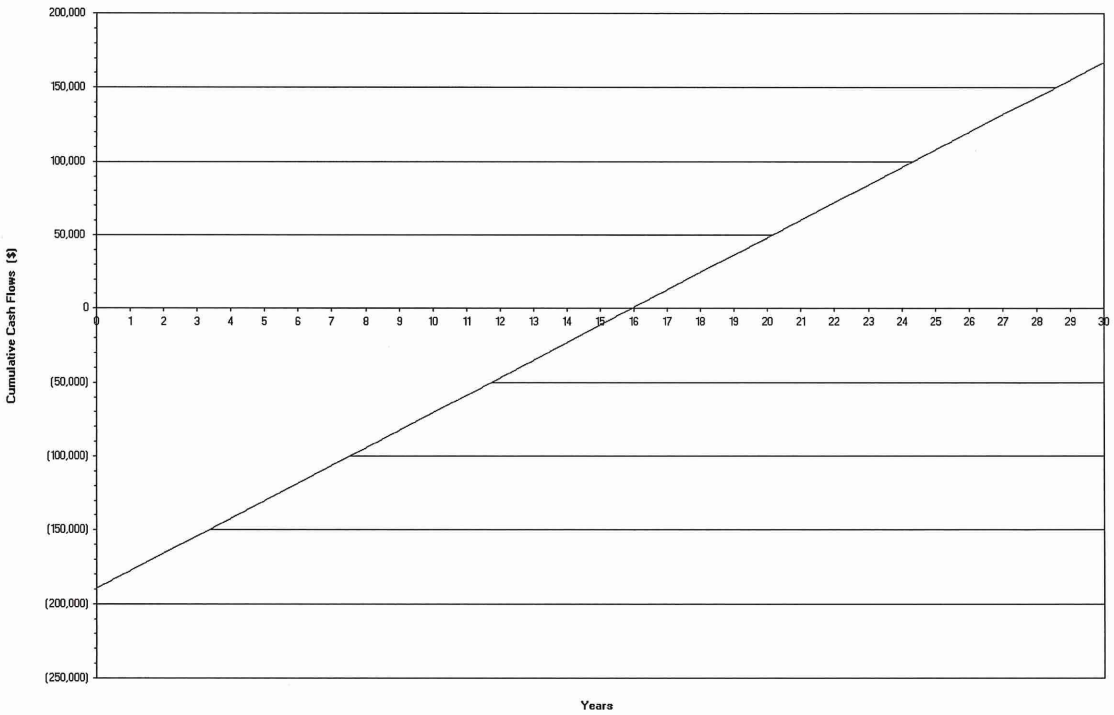
St. Cloud NGA – Financials

Project Costs and Savings

Initial Costs				Annual Costs and Debt		
Feasibility study	0.0%	$	-	O&M	$	-
Development	0.0%	$	-	Fuel/Electricity	$	-
Engineering	0.0%	$	-			
Energy equipment	100.0%	$	214,656	**Annual Costs - Total**	**$**	**-**
Balance of equipment	0.0%	$	-			
Miscellaneous	0.0%	$	-	**Annual Savings or Income**		
Initial Costs - Total	100.0%	**$**	**214,656**	Heating energy savings/income	$	11,900
Incentives/Grants		$	25,000			
				Annual Savings - Total	**$**	**11,900**
Periodic Costs (Credits)						
		$	-			
		$	-			
		$	-			
End of project life -		$	-			

Financial Feasibility

Pre-tax IRR and ROI	%	4.7%	Calculate GHG reduction cost?	yes/no	No
After-tax IRR and ROI	%	4.7%			
Simple Payback	yr	15.9	Project equity	$	214,656
Year-to-positive cash flow	yr	15.9			
Net Present Value - NPV	$	(6,729)			
Annual Life Cycle Savings	$	(438)			
Benefit-Cost (B-C) ratio	-	0.97			



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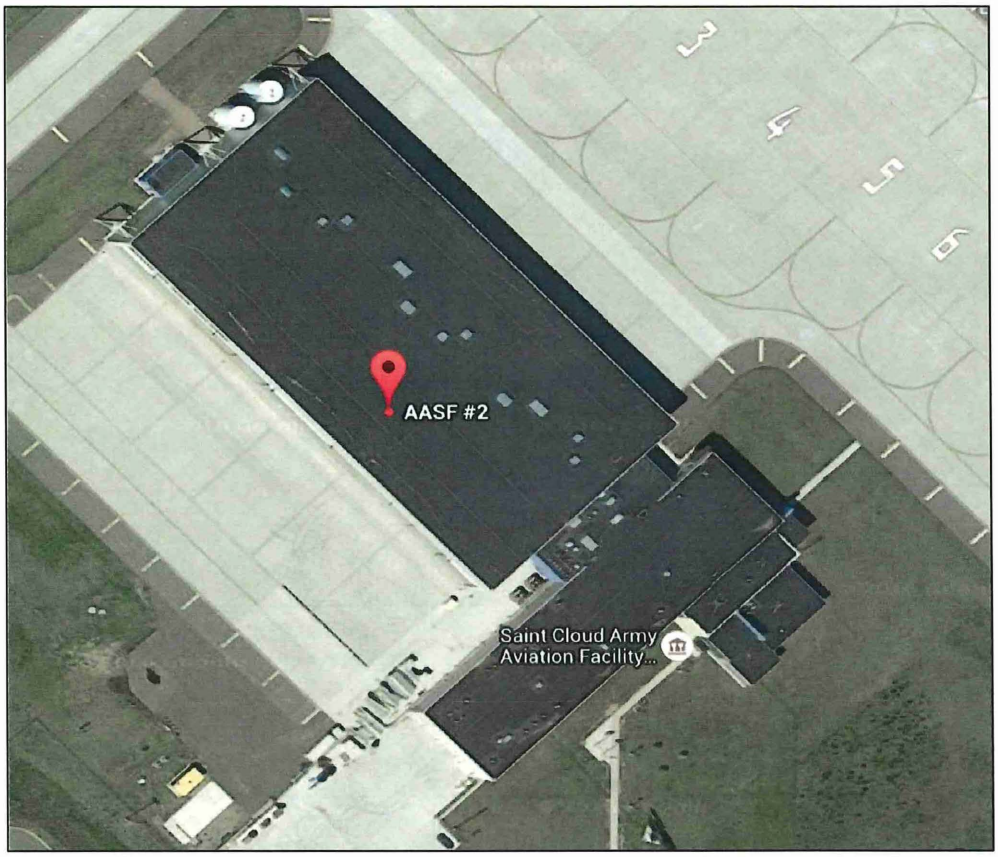
Location N - St Cloud Army Aviation Support Facility
2185 45th Ave SE, St Cloud, MN 56304



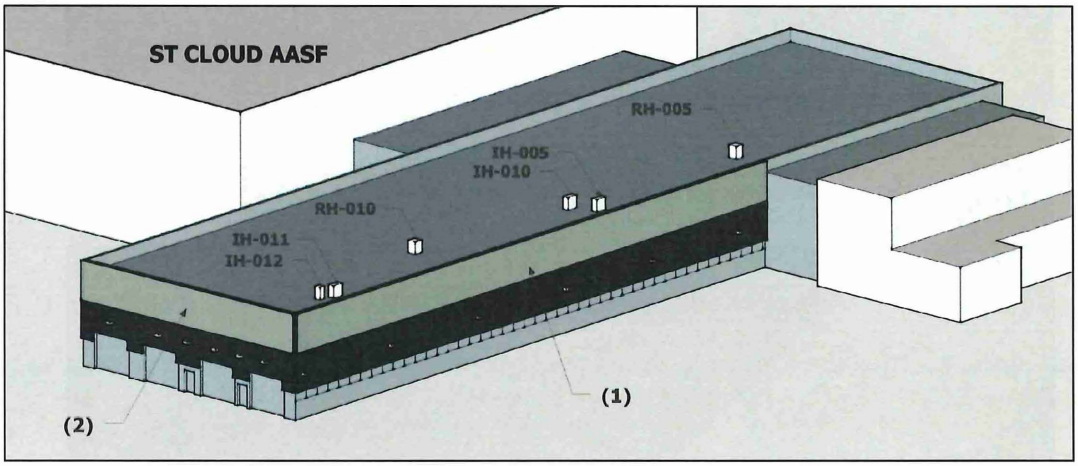
2-Stage SolarWall Systems – Southwest and Southeast facing walls

Two SolarWall 2-Stage systems totaling 7,400 ft^2 in size will be installed on the southwest and southeast facing walls of the facility. They will connect through the parapet into existing ventilation units that service the building.

The estimated material/install cost for the SolarWall 2-Stage system at St. Cloud AASF is $333,000. The available "Made in Minnesota" rebate will discount the cost by $25,000, making the net total $308,000. Approximately 1,733 MMBTU will be delivered to the building yearly.

NOTE:
There are alarming Health and Safety concerns at this facility. The installed siding has been reported to have come off in high winds, which presents a large safety risk. Fasteners for the existing cladding were noted onsite to have been pulled out and the cladding in its current condition is very unsafe. Installation of the SolarWall 2-Stage system which will install overtop of

the existing cladding will remedy this issue. It is recommended that this project be prioritized above all others due to the very real and **immediate safety concerns** at this site.



SYSTEM	ORIENTATION	AREA (SQF)	FLOW (CFM)	NOTES
1	SOUTHEAST	5,400	15,985	2-Stage SolarWall system to be installed up to top of existing parapet. Intakes to be made through parapet extension into existing intake/relief hoods: RH-010 (5,400 CFM), IH-005 (5,185 CFM) and RH-005 (5,400 CFM)
2	SOUTHWEST	2,000	6,735	2-Stage SolarWall ssytem to be installed up to top of existing parapet. Intakes to be made through the parapet extension into existing intake hoods: IH-011 (3,935 CFM) and IH-012 (2,800 CFM)

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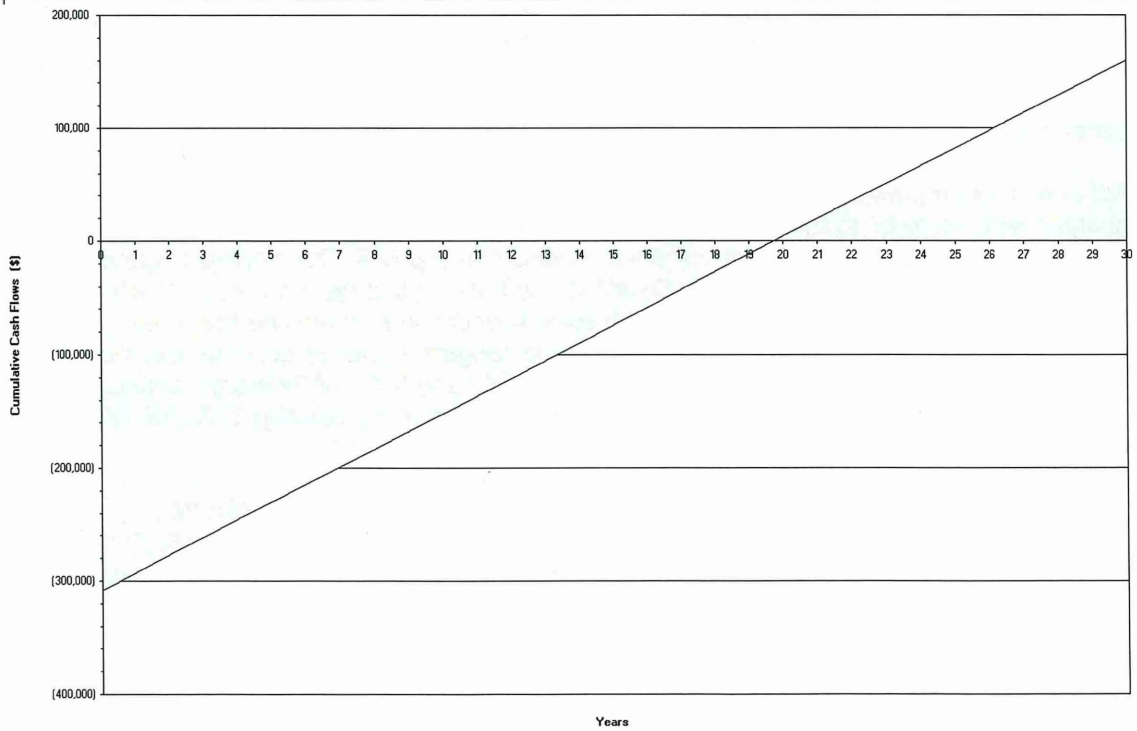
St. Cloud AASF – Financials

Project Costs and Savings

Initial Costs				Annual Costs and Debt		
Feasibility study	0.0%	$	-	O&M	$	-
Development	0.0%	$	-	Fuel/Electricity	$	-
Engineering	0.0%	$	-			
Energy equipment	100.0%	$	333,000	**Annual Costs - Total**	**$**	-
Balance of equipment	0.0%	$	-			
Miscellaneous	0.0%	$	-	**Annual Savings or Income**		
Initial Costs - Total	100.0%	**$**	**333,000**	Heating energy savings/income	$	15,596
Incentives/Grants		$	25,000			
				Annual Savings - Total	**$**	**15,596**
Periodic Costs (Credits)						
		$	-			
		$	-			
		$	-			
End of project life -		$	-			

Financial Feasibility

Pre-tax IRR and ROI	%	2.9%	Calculate GHG reduction cost?	yes/no	No
After-tax IRR and ROI	%	2.9%			
Simple Payback	yr	19.7	Project equity	$	333,000
Year-to-positive cash flow	yr	19.7			
Net Present Value - NPV	$	(68,257)			
Annual Life Cycle Savings	$	(4,440)			
Benefit-Cost (B-C) ratio	-	0.80			



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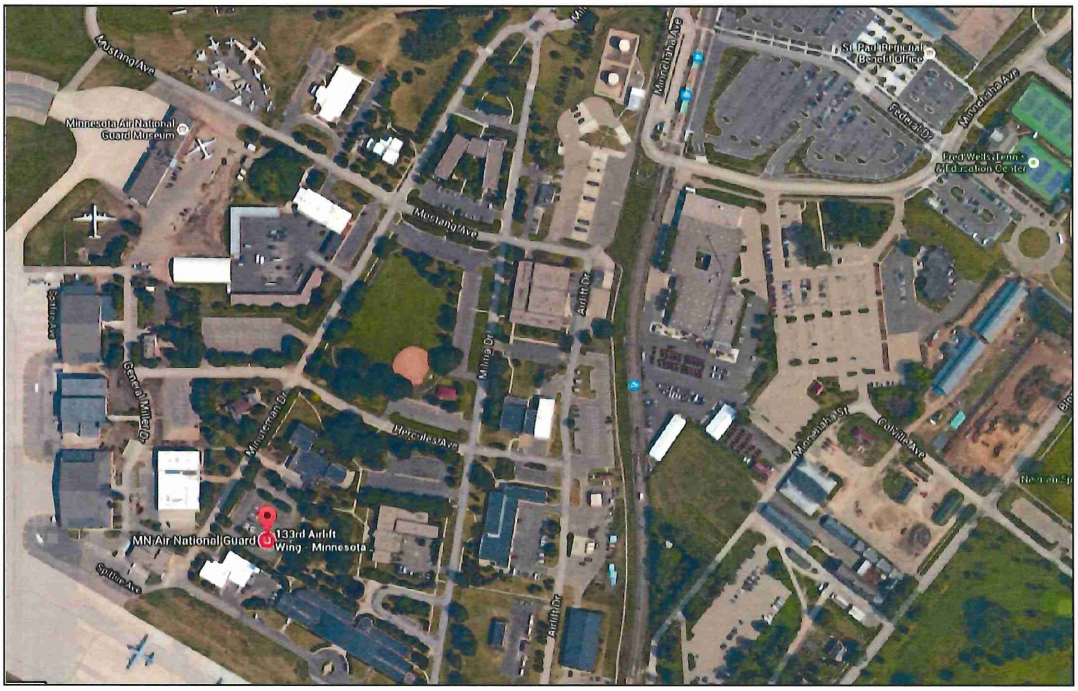
Location O - 133rd Airlift Wing Minnesota National Guard
631 Minuteman Dr, St Paul, MN 55111



SolarWall PV/T Systems – Buildings 680 and 688

Although there are a fairly large number of buildings within the 133rd Airlift Wing, the feasibility analysis was narrowed to the large buildings with greater potential for SolarWall applications. Of these, the most promising were the Hangars, Building 680 and 688. The proposed system for both buildings is a combination rooftop SolarWall and Photovoltaic system known as SolarWall PV/T. This patented system will connect with some new distribution fans for the builidng. This approach will provide additional space heating to the hangars as well as generate electricity for use on site. 11,000 ft^2 of SolarWall will be combined with 116.6 KW of PV electric panels on building 680. On building 688, 11,700 ft^2 of SolarWall will be combined with 127.2 KW of PV electric panels

The estimated material/install cost for the SolarWall PV/T systems at 133rd Airlift Wing is $1,782,000. The available "Made in Minnesota" rebates will discount the cost by $50,000, making the net total $1,732,000. Approximately 4,261 MMBTU will be delivered to the building yearly and the electricity generation will be 268,070 kWh each year.

NOTE:
The steeper sloped roof of each building offers an excellent opportunity for both thermal and electric generation at this location.

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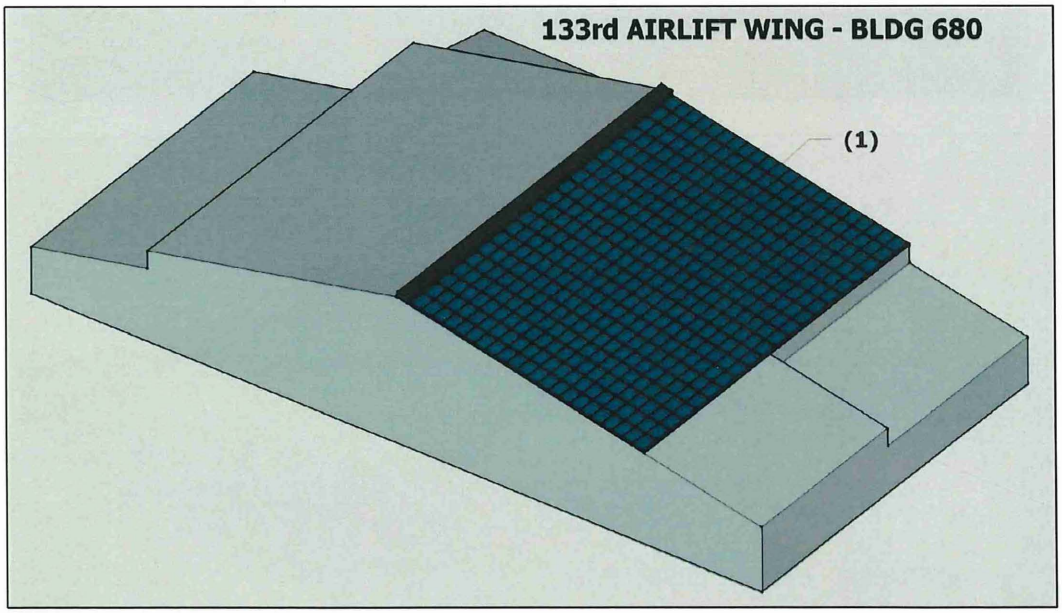
BLDG 680



SYSTEM	ORIENTATION	AREA (SQF)	FLOW (CFM)	NOTES
1	SOUTH	11,000	40,000	440x 265 W PV panels are proposed for a 117 kW PVT system on the existing south-sloped roof. 4x 10,000 CFM Intake fans will be connected to the front-side canopy single stage system.

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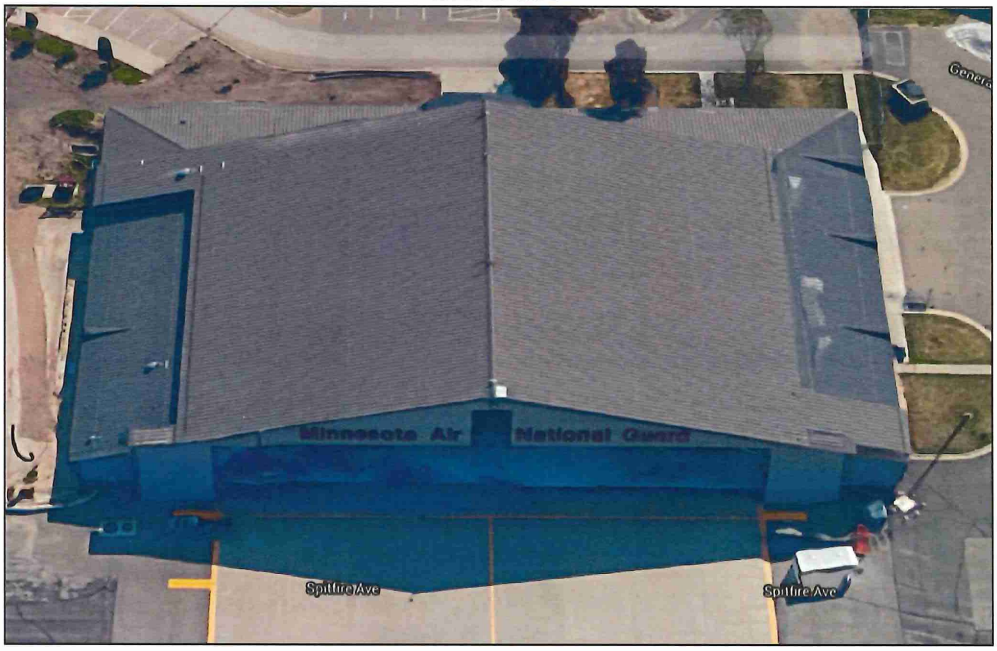
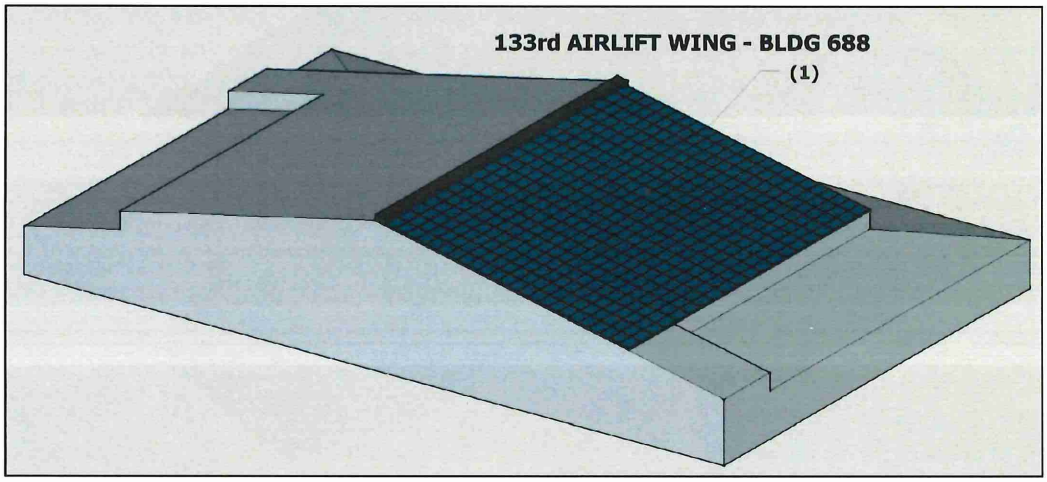
BLDG 688





SYSTEM	ORIENTATION	AREA (SQF)	FLOW (CFM)	NOTES
1	SOUTH	11,700	40,000	480x 265 W PV panels are proposed for a 127 kW PVT system on the existing south-sloped roof. 4x 10,000 CFM Intake fans will be connected to the front-side canopy single stage system.

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133rd Airlift Wing BLDG 680 - Financials

Project Costs and Savings

Initial Costs			
Feasibility study	0.0%	$	-
Development	0.0%	$	-
Engineering	0.0%	$	-
Energy equipment	100.0%	$	875,250
Balance of equipment	0.0%	$	-
Miscellaneous	0.0%	$	-
Initial Costs - Total	100.0%	**$**	**875,250**
Incentives/Grants		$	25,000

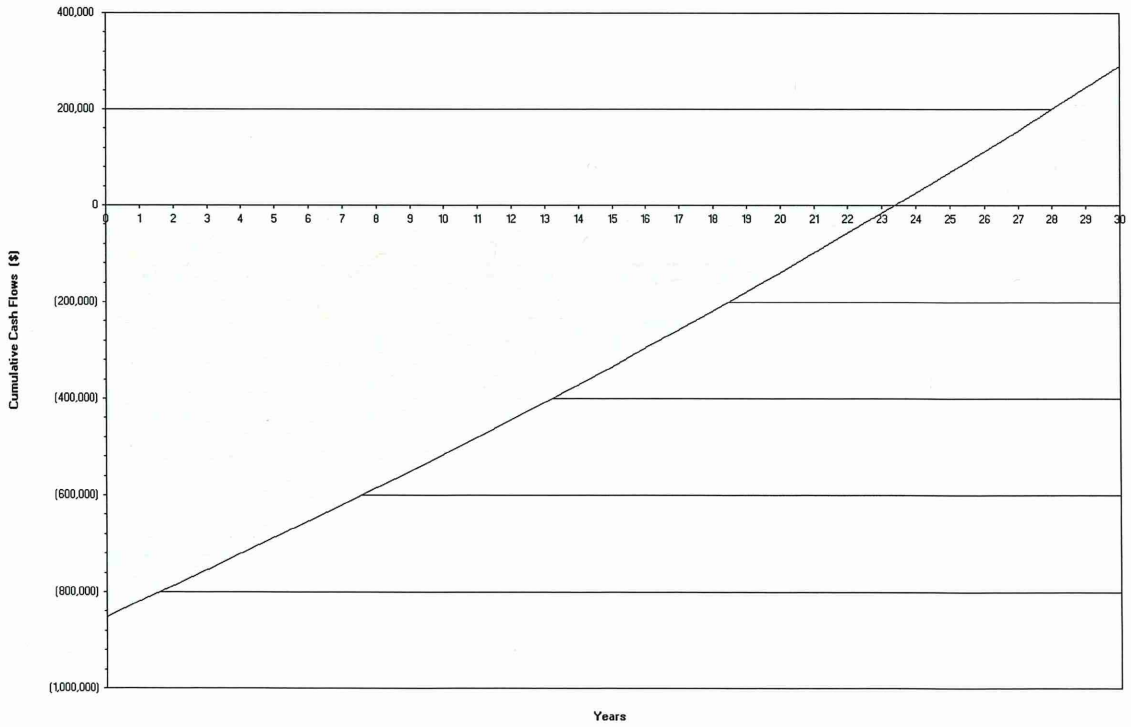
Periodic Costs (Credits)		
PV Energy	$	-
	$	-
	$	-
End of project life -	$	-

Annual Costs and Debt		
O&M	$	(12,854)
Fuel/Electricity	$	-
Annual Costs - Total	**$**	**(12,854)**
Annual Savings or Income		
Heating energy savings/income	$	18,751
Annual Savings - Total	**$**	**18,751**

Financial Feasibility

Pre-tax IRR and ROI	%	1.9%
After-tax IRR and ROI	%	1.9%
Simple Payback	yr	26.9
Year-to-positive cash flow	yr	23.4
Net Present Value - NPV	$	(290,770)
Annual Life Cycle Savings	$	(18,915)
Benefit-Cost (B-C) ratio	-	0.67

Calculate GHG reduction cost?	yes/no	No
Project equity	$	875,250



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133rd Airlift Wing BLDG 688 - Financials

Project Costs and Savings

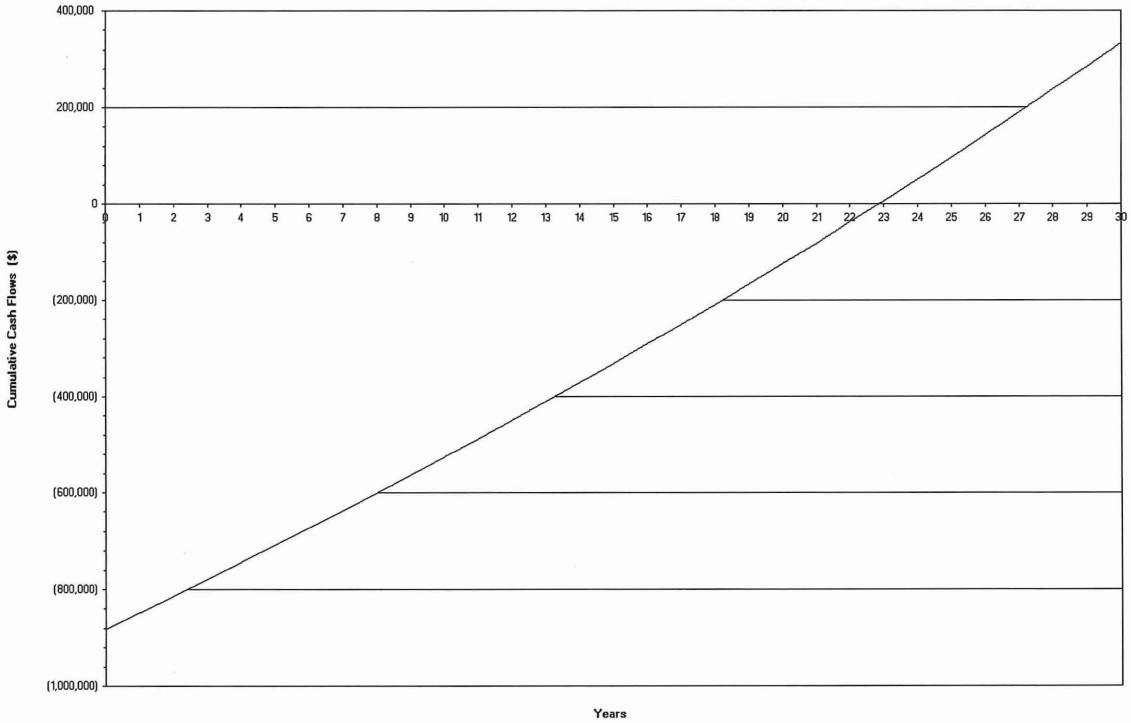
Initial Costs			
Feasibility study	0.0%	$	-
Development	0.0%	$	-
Engineering	0.0%	$	-
Energy equipment	100.0%	$	906,750
Balance of equipment	0.0%	$	-
Miscellaneous	0.0%	$	-
Initial Costs - Total	100.0%	**$**	**906,750**
Incentives/Grants		$	25,000

Periodic Costs (Credits)		
PV Energy	$	-
	$	-
	$	-
End of project life -	$	-

Annual Costs and Debt		
O&M	$	(13,952)
Fuel/Electricity	$	-
Annual Costs - Total	**$**	**(13,952)**
Annual Savings or Income		
Heating energy savings/income	$	19,599
Annual Savings - Total	**$**	**19,599**

Financial Feasibility

Pre-tax IRR and ROI	%	2.1%	Calculate GHG reduction cost?	yes/no	No
After-tax IRR and ROI	%	2.1%			
Simple Payback	yr	26.3	Project equity	$	906,750
Year-to-positive cash flow	yr	22.9			
Net Present Value - NPV	$	(286,062)			
Annual Life Cycle Savings	$	(18,609)			
Benefit-Cost (B-C) ratio	-	0.68			



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Rejected SolarWall Locations:

A combination of preliminary reviews via satellite/Google street and/or site reviews removed the potential for consideration of SolarWall for the sites below. In most cases, the locations of intakes did not correspond well with planned locations for SolarWall and/or SolarDuct installations, so to avoid large costs associated with ducting connections, the sites were removed from contention as viable SolarWall locations.

Building A - Bemidji NGA
1430 23rd St. NW Bemidji, MN 56601

Building D - Crookston NGA
1801 University Ave.
Crookston, MN 56716

Building F - Jackson NGA
108 Country Road 51
Jackson, MN 56143

Building I - Pine City NGA
1305 Main Street
Pine City, MN 55063

Building J - Red Wing NGA
885 East 7th St
Red Wing, MN 55066

Building K - Redwood Falls NGA
530 Highway 101
Redwood Falls, MN 56283

Building L - Rosemount FMS
14221 Biscayne Ave. W
Rosemount, MN 56304

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Equipment Details

- The SolarWall panels are installed on top of the existing walls and/or rooves.
- Material used to skin SolarWall is black in colour (SolarWall material SW 150 perforated 26ga galvanized steel, pre-painted). The second stage is a polycarbonate glazing.
- The SolarWall panels may need to be framed around doors and windows.
- Interior cavity is estimated to be 6-8" deep.
- Interior framing support is 18ga galvanized Z-bar and Hat-bar.
- Each SolarWall system is connected to building AHUs or a specified number of SolarWall fans.
- Each fan unit is connected to a corresponding perforated flexible/metal duct that runs through the building as indicated.

Energy Savings Analysis

Conserval Systems used a software program called RETScreen to determine the feasibility and approximate payback of each SolarWall system. RETScreen was designed by Natural Resources Canada and is used in over 100 countries around the world to determine the value of renewable energy projects. For Kansas National Guard we used RETScreen to model the amount mmbtu`s SolarWall could deliver to the building rather than savings because of the lack of fresh air into each building.

SolarWall Sequence of Operation for buildings

Winter Operation

This specification assumes that in most cases DDC Equipment Control equipment will not exist for controlling the SolarWall Systems. In the instances where the SolarWall or SolarDuct system is connected to the building's existing ventilation units, integration to the DDC is fairly simple or standalone controls may be used.

For SolarWall fans, the Variable Temperature Controls (VTC-1D) automatically controls the temperature in the room by adjusting the speed of the variable speed fans. When the temperature is at the temperature set point, the VTC-1D operates the fans at the idle speed setting. When the temperature exceeds the set point, the VTC-1D increases the speed. When the temperature drops below the set point, the VTC-1D shuts off the fans (in shut-off mode) or operates the fans at idle speed (idle mode).

The Fans would be controlled by a 365 day/24 hour time clock. This allows the end users to select an automatic turn on/off of SolarWall. For example, the client can set the SolarWall to start up Nov 1st and shut down April 1st along with weekends, and holidays

Summer Operation

The SolarWall units will be bypassed or shut off during the summer months

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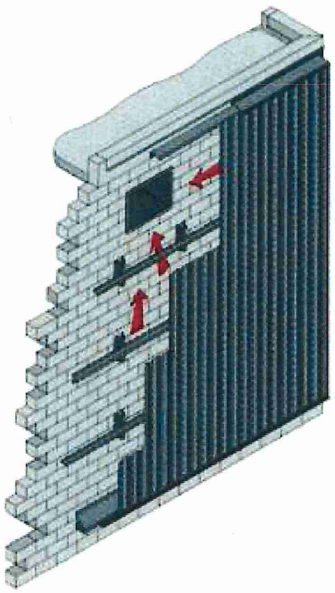
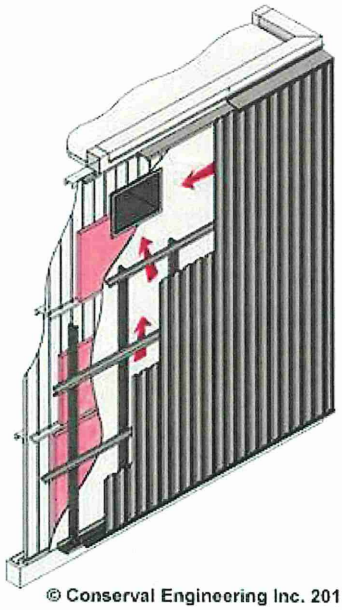
Typical SolarWall Construction



1-SolarWall panels on typical block wall construction



2-SolarWall panels on typical metal wall construction

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