

# Commercial PV Site Assessment Report



**Prepared For:** Town of Rome Energy Committee  
1156 Alpine Drive, Nekoosa, WI 54457

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## Attachments:

- NREL System Advisor Model Report
- Adams Columbia Electric Coop Energy Bills for the Town Of Rome
- Town of Rome Energy Summary 2011 – 2014
- Adams-Columbia Rate GS Schedule
- Adams-Columbia Rate RGL Schedule
- Adams-Columbia Rate RGS Schedule
- Town of Rome Zoning Permit Application

## 1.0 Executive Summary

To the Town of Rome Energy Committee and Town Board,

Thank you for the opportunity to work with you to analyze the town's 'main campus' energy use and provide unbiased options for the installation of a grid-tied photovoltaic system. From our first conversation, the town's goals were clearly stated; investigate the impact and financial viability of a solar electric system for the town's main campus.

The two stipulations to this investigation included (a) not using any ground space and (b) not using the roof of the highway building. There are a couple of small sheds that offer little in the way of usable space for a PV system. We recommend utilizing the roof of Storage Building #3 and the north end Municipal Building. Storage Building #3 offers unobstructed solar resource. While there is tree shading and fire tower shading on the Municipal Building, there is ample space on the north half of the roof with an unobstructed solar resource, but a Professional Engineer (PE) will be needed to evaluate the structure for the necessary dead weight increase. Initial feedback from a PE indicates that structure enhancement will not be needed for the additional 3 psi.

The recommended PV array can be attached to the trapezoidal standing seam roofs without ballasts. We recommend the PV modules be pitched to an angle of 15 degrees, so clamping to the standing seams will be an adequate method of fastening.

There are four meters serving the property. According to Adams Columbia Electric Co-op, if each meter does not exceed 20 kW (AC) in system size, all energy bought and all energy sold back onto the grid will be valued at the full retail rate. Meeting this design criterion insures the system's financial performance.

NREL System Advisor Model – Project Financial Summary

Metric	Value
Annual energy (year 1)	97,207 kWh
Capacity factor (year 1)	15.7%
Energy yield (year 1)	1,376 kWh/kW
Performance ratio (year 1)	0.86
Battery efficiency	0.00%
Levelized COE (nominal)	17.06 ¢/kWh
Levelized COE (real)	13.49 ¢/kWh
Electricity bill without system (year 1)	\$17,030
Electricity bill with system (year 1)	\$6,823
Net savings with system (year 1)	\$10,207
Net present value	\$9,713
Payback period	14.3 years
Net capital cost	\$174,223
Equity	\$0
Debt	\$174,223

We sized the recommended system based on 2013 data, which showed the entire Municipal Main Campus consuming 158,667 kWh of energy. If the town were to utilize all four meters and adhere to the 20 kW (AC) design maximum, and if (a) the trees in front of the Municipal Building were removed, and (b) the fire tower was de-commissioned, there would be adequate unshaded roof space for this 80 kW system. The maximum amount of annual energy generation in this scenario is 112,923 kWh, or 71% of campus energy use. Within these limits, 100% energy offset is not achievable.

As there is reluctance to remove trees and decommission the fire tower, we recommend as much of the municipal building roof space that is unshaded. This would accommodate a 70.2 kW (DC), 60 kW (AC) system, grid-tied to three meters. This system will offset 61% of the town's main campus energy use, or 97,207 kWh in year one. This system would provide the highest amount of solar generated energy at the best financial performance.

The installed cost of this system may run in the range of \$2.50 per Watt, or about \$175,000.

Unfortunately, as an untaxed entity, the town is unable to realize the benefits of the 30% Federal Investment Tax Credit, nor the benefits allowed by the depreciation of this capital expenditure or a USDA grant. Also, Wisconsin's Focus On Energy Program is not offering a competitive commercial incentive as they have in the past: only a small \$2,400 'Cash Back Reward'. The future of the Focus On Energy cash incentive program is in serious question, and will not be known for certain until after the next quadrennial budgeting is completed at the end of 2016.

Given these parameters, we estimated the town would realize a first year energy savings of \$10,207. If we assume a 3.5% annual energy cost escalation rate, this system would demonstrate a 14.3 year cost recovery.

Given the lack of incentives and tax credits, and the need to finance the purchase, this system performs quite well financially.

Bob Smith  
PV Installers  
March 22, 2016

## 2.0 Client Contact Information

<b>Business Name</b>	Town of Rome, WI
<b>Point of Contact (POC)</b>	John – Director of Buildings and Grounds
<b>POC Phone</b>	715.555.6666
<b>POC Cell Phone</b>	715.555.7777
<b>POC Email</b>	john@gmail.com
<b>Site Address</b>	1156 Alpine Drive
<b>City</b>	Nekoosa
<b>State</b>	WI
<b>Zip Code</b>	54457
<b>Municipality</b>	Town of Rome
<b>County</b>	Adams
<b>Electric Utility Provider</b>	Adams-Columbia Electric Cooperative
<b>Initial Date Of Contact</b>	January, 2013

### Project Summary:

The town is looking to continue their work in reducing energy usage in its municipal buildings with a focus on the town's 'Main Campus' property. The Main Campus property is home to the Town Hall, Highway Department, and Fire and Police Stations. Town representatives believe they have a lot of roof space that could be used for solar. They would like to offset 100% of their electric usage on site but have don't know if that's possible, either from a space standpoint or a cost standpoint. The town feels they are in a good place financially and think that now is a good time to pursue a solar energy project.

There are two areas considered "off limits" for to siting a PV array. The first area is anywhere on the ground. The town would like to keep all ground space available for any future building expansion. There appears to be space in the front yard, but that is not available due to a WI-DOT setback for the controlled intersection of Highway 13 and Alpine Drive. The second area in question is the old and structurally questionable Highway Department Building. There are plans in the 15-year budget forecast to replace the Highway Building.

### 3.0 Client Profile

<b>Business Type</b> (For Profit, Non-Profit, Municipality, etc.)	Municipality
<b>Property Ownership</b> (Owned, Leased, Rented (by whom))	All property is owned by the Town of Rome.
<b>Client Goals</b> (Criteria for a successful project)	Significant energy offset of the property's energy consumption. Reduce monthly energy costs. They do not know what can be expected.
<b>Project Timeline</b>	Installation to begin in the fiscal year following town board approval. However, the town board approval process may take a year or more.
<b>Preferred Array Location</b>	On the rooftops of the town hall, police station, and fire department. They would prefer not to use ground arrays – allowing flexibility for future building expansion.
<b>Decision Makers</b> <ul style="list-style-type: none"> <li>Who decides?</li> <li>How will they choose?</li> <li>When will they choose?</li> </ul>	<p>First step is to win approval of the energy committee, then of the town board. The energy committee is made up of people that will be more favorable to solar. The town board will depend on who is in office at the time the project is brought up for approval.</p> <p>Annual budgets are discussed throughout the year, becoming higher priority in September and October. Budgets are typically approved by the end of November for the subsequent calendar year.</p>
<b>Project Financing</b>	Through Nekoosa Credit Union: Robert - 715.555.2222 or Robert@gmail.com
<b>Obstacles to Implementation</b>	The energy committee felt that Return on Investment will be important but could not communicate what that number needed to be.
<b>For Roof Mount Option</b> <ul style="list-style-type: none"> <li>Gather information for roof loading questions.</li> <li>Will builder provide written certification of roof loading?</li> </ul>	<p>Yes. Only 'Storage #3' building contractor can be contacted, Mid-State Building. The building contractors for the other structures are no longer in business.</p> <p>Need to make contact with builder.</p>
<b>Additional Client Goals</b> <ul style="list-style-type: none"> <li>Does client want array to be visible? List any obstacles.</li> <li>Will system be used for Marketing or Education?</li> <li>Does client want to monitor system performance?</li> <li>Others goals?</li> </ul>	<p>The energy committee is trying to enhance energy efficiency awareness within the community. They believe that a town installed PV system will increase the visibility of solar within the community.</p> <p>A monitoring portal on the town website would be nice. Maybe a kiosk in the lobby of town hall.</p>
<b>Energy Storage</b> (back-up)? <ul style="list-style-type: none"> <li>Discuss critical loads</li> </ul>	Not at this time but possibly in the future.

## **Project Opportunities and Challenges Analysis:**

The Town of Rome has a favorable tax structure – about 2,000 full time residents and 3,000 seasonal residents live on the three Finger Lakes. In 2007, the town invested in developing an industrial park, which has had slow interest because of the timing with the recession. However, finances are looking much better with a large golf course development (Sand Valley Golf resort). All in all, John believes the environment is right for a project like this.

The Energy Committee will be the champion of this project. The committee was formed in 2007 to monitor energy consumption within the municipal buildings and make improvement recommendations. Since their inception, they have reduced overall energy use within municipal buildings by 12%. They are now looking to solar to continue that reduction.

The committee clearly states that a roof mount is the preferred option. Ground arrays may limit the future expansion of buildings. The only other area is in the southeast corner of the property, and there is a DOT setback that will prohibit installation.

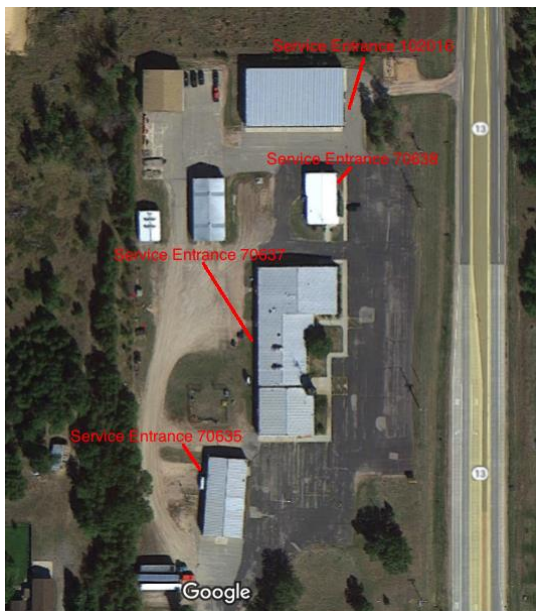
The roof of the Highway Department should not be considered. The future of this building is in question. Storage Building #3 is the newest and most robust roof structure. The Municipal Building was built in about 1960 (with two additions), the Police Building in 1972.

John says that cost recovery is an important number to the town board but gave no indication what the critical number would need to be. He is aware that as a municipality, they do not qualify for the 30% ITC or any depreciation. With no tax basis, they do not qualify for a USDA REAP grant. Given these points, John was advised that cost recovery might exceed 20 years.



## 4.0 Client Energy Profile

<b>Past 24 months energy bills</b> (copies)	Attached. The town used 158,000kWh of energy on this property in 2015.
<b>Meter Number</b>	N/A
<b>Account Number(s)</b>	Storage #3: 102016 Police Station: 70638 Municipal Building (Town Hall): 70637 Highway Dept: 70636
<b>Current Rate Schedule</b>	Residential Service GS
<b>Current Energy Rate</b>	10.5 ¢/kW
<b>Current Demand Rate</b>	None
<b>Number/Type(s) of Service Entrances</b>	(4) Town hall, Police Station, Highway Department, Storage Building #3.
<b>Single or Three Phase Power?</b>	Single
<b>Panel Make, Model, and Amperage</b>	See Images Below.
<b>PV System Disconnect Location</b>	Within 30' of meter per ACEC
<b>Potential Interconnection location(s)</b>	See diagram
<b>Future Energy Projections</b> (Increase/Decrease estimates)	The energy committee anticipates a continued reduction in base load.
<b>Energy Efficiency/Load Reduction/Demand Reduction Suggestions</b>	Based on our conversation, they are really following through on EE projects. They have been in touch with Focus On Energy to facilitate more EE projects.



Service entrances on property



Service Entrance 70636 – Highway Dept.





Service entrance 102016 Storage #3



Load center 102016 Storage #3  
Square D HOM4060M200C



Service entrance 70637 - Municipal Bldg.



Load Center 70637 – Municipal Bldg.  
Square D HOM30M200C



Service Entrance 70638 - Police Bldg.



Load Center 70638 – Police Bldg.

**Energy Analysis:****Usage History**

Month/Year	Energy (kWh)	Energy \$	Demand (kW)	Demand \$	Fixed Fees \$	TOTAL \$*
2015 – Muni/Town Hall	102,720	\$10,785.60	0	0	\$339.02	\$11,124.62
2015 – Police	13,759	\$1,444.70	0	0	\$339.02	\$1,783.72
2015 – Storage #3	22,592	\$2,372.16	0	0	\$339.02	\$2,711.18
2015 – Highway Dept.	19,596	\$2,057.58	0	0	\$339.02	\$2,396.60
TOTAL	158,667	\$16,660.04	0	0	\$1,356.08	\$18,016.12

\*Does not reflect entire energy bill.

Based on the energy analysis, there could be a case made to install more than 20 kW (AC) on the roof of the Municipal Building. With an energy consumption of 102,720 kWh in 2015 and a mostly 8am to 5pm workday, the energy use may coincide with the solar resource, minimizing overproduction and avoided cost energy. However, this can be a 24-hour operation, so it may be worthwhile to do more analysis on the Municipal Building energy usage.

If 20 kW is installed on each meter/load center, the installer will need to interconnect by means of a line side interconnection. All associated load centers are 200 amp boxes with ample space for this connection to be made.

## 5.0 Utility Profile

<b>Electric Utility Provider</b>	Adams Columbia Electric Cooperative
<b>Distributed Generation Contact</b> <ul style="list-style-type: none"> <li>Name</li> <li>Phone</li> <li>Email</li> </ul>	Patrick 715.555.4444 patrick@gmail.com
<b>Can utility provide demand data?</b>	N/A
<b>Potential rate schedules post PV installation</b>	Rate Schedule RGS: Grid tied PV systems under 20 kW AC; all energy in and out is at retail rate (currently 10.5 ¢/kWh under rate schedule GS). Rate Schedule RGL: Over 20 kW AC grid tied systems; all exported energy is at avoided cost (currently 3.2 ¢/kWh) Rate schedules are provided in the addendums.
<b>Electrical Installation Requirements</b> <ul style="list-style-type: none"> <li>NEC enforced</li> <li>Local licensing</li> </ul>	PV Generation meter at each service meter. External Disconnect within 30' of meter.
<b>What is the transformer size that feeds the property?</b>	
<b>Will a study be required?</b> <b>What will be the cost?</b>	PV systems at 20 kW AC or less per meter, no study required. Over 20 kW requires an ACEC review and could result in a possible study.
<b>What is the utility's interconnection application process?</b>	Under 20 kW – Submit a DG6027 and DG6029 with associated insurance documentation, single line diagram and equipment specification sheets. Email to Patrick. Approval takes less than 1 week.

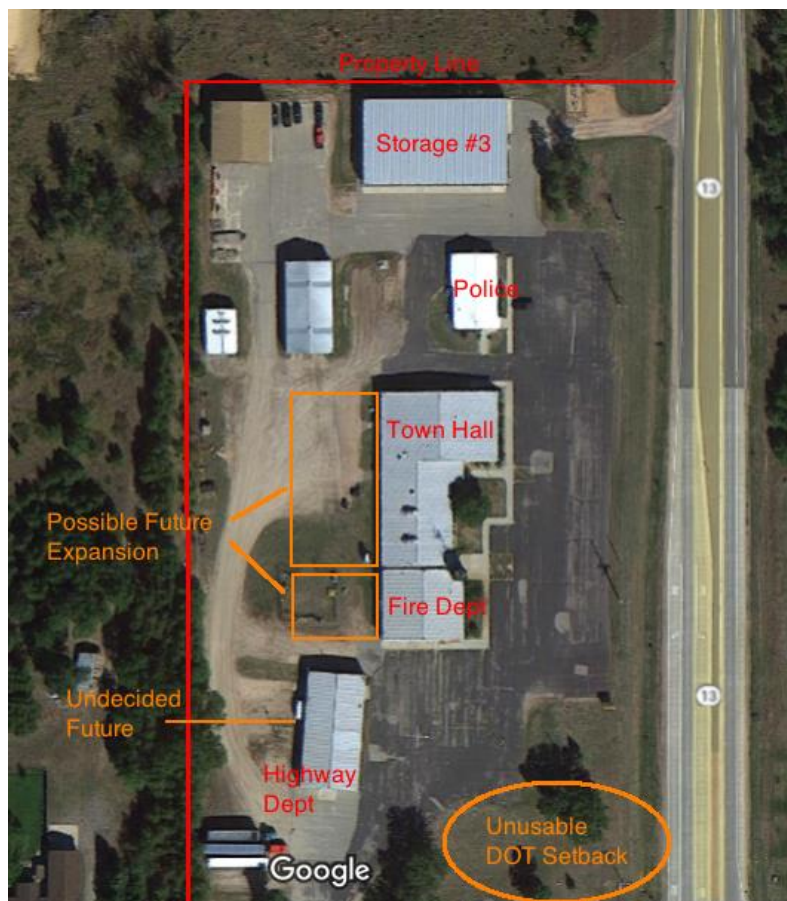
### Utility Opportunities and Challenges Analysis:

The Energy Committee has already had initial conversations with Patrick from ACEC.

ACEC has 17 distributed generation installation in their district. They have a reputation of being open minded and easy to work with. Keeping ACEC in the loop during the entire process will make that relationship even easier.

## 6.0 Site Profile

<b>General Site Description</b>	<p>The site is generally flat with few trees; however, there is a cluster of mature trees immediately to the east of the municipal building.</p> <p>All buildings are surrounded by asphalt or crushed gravel. The buildings are more like pole sheds, corrugated siding and trapezoidal standing seam roof. The roof of storage #3 has a 0.5:12 north pitch. The police and town hall roofs have 1:12 east/west roof pitches with north/south ridge. The highway department building is not to be considered.</p>
<b>Future Property Use Considerations</b>	<p>Building expansions that are part of a 15-year town plan – expansion of the town hall and fire department. Highway department building is slated for replacement. See drawing below.</p>
<b>Potential Array Sites</b> <ul style="list-style-type: none"> <li>Show aerial imagery below. For ground arrays, note buried obstacles.</li> </ul>	<p>Roof of Storage #3 Roof of Police Roof Of Town Hall/Fire Dept.</p>



Town of Rome Main Campus – Aerial View



Town of Rome Main Campus - Building Dimensions

### Site Opportunities and Challenges:

To maximize the DC capacity for each meter, we propose trenching to and utilizing the police station meter. This will require cutting asphalt for the 24" deep conduit trench.



## 7.0 Authority Having Jurisdiction (AHJ) Profile

<b>Authorities Having Jurisdiction (AHJ)</b>	Town of Rome
<b>AHJ Contact</b> <ul style="list-style-type: none"> <li>Name</li> <li>Phone Number</li> <li>Email</li> </ul>	Jerry 715.555.3333 jerry@gmail.com
<b>Required Permits, Requirements, and Fees</b>	Electrical Permit (\$5/\$1000 project cost) Zoning Permit (\$100 for one address). The property is not located within a wetland. Adams county has given all permitting authority to the town of Rome.
<b>Property Lines/Roof Setbacks</b>	N/A if we install on the roof.
<b>Required Inspections</b> <ul style="list-style-type: none"> <li>Who?</li> <li>What?</li> <li>When?</li> </ul>	Jerry will inspect electrical system after completion and before commissioning.
<b>Is Professional Engineering required?</b>	Will be dependent on if roof drawings can be found. If not, yes, the roofs without drawings will require PE stamp.
<b>Other organizations with governance</b> (business park association, franchise requirements, historical preservation, etc.)	None identified
<b>What is the permitting process?</b>	According to Jerry (a member of the Energy Committee), since this is a project for the town, the process should be quite smooth – provided that the installation meets code requirements.

### AHJ Opportunities and Challenges Analysis:

- Required permits are attached to the end of this report.

## 8.0 Available Incentives/Grants/Tax Credits

<b>Utility Incentives/Grants</b>	None Available
<b>State Incentives/Grants</b>	Focus On Energy – Competitive Grant (No funding in 2016 – Possibility In 2017)
<b>Federal Investment Tax Credit</b>	Town does not qualify
<b>MACRS Depreciation</b>	Town does not qualify
<b>Other Grants</b>	None Identified
<b>Financing Options</b>	Nekoosa Credit Union (Town of Rome Financial Inst.)
	Board of Commissioners of Public Lands; 608.266.1370

### Incentives Summary:

As an untaxed entity, the town of Rome does not qualify for Tax Credits or USDA grants. There is a slim chance that the Wisconsin State program Focus On Energy will offer a RECIP (Renewable Energy Competitive Incentive Program) incentive in 2017. At this point, it would appear that the chance is less than 50%.

As for lending opportunities in Wisconsin, the Board of Commissioners of Public Lands manages over \$1 billion in trust fund assets and lends moneys to municipalities and school districts for public purpose projects. The interest payments on these loans go directly to fund school libraries. The Town of Rome could specify the school district, which would benefit from these funds.



## 9.0 PV Array Options

Total system:

70.2 kW (DC), 60 kW (AC)

216 SolarWorld 325 Watt modules and 6 SolarEdge 10000 Inverters and 216 SolarEdge P400 Optimizers

### Sub-Array 1: On the roof of Storage #3

23.4 kW (DC), 20 kW (AC)

72 SolarWorld 325 Watt modules and 2 SE10000 inverters with 72 P400 Optimizers

Interconnected to Account #102016 (Storage Building #3)

Line-side connection in

Inverters located inside east wall of Storage #3

### Sub-Array 2: On the roof of Storage #3

23.4 kW (DC), 20 kW (AC)

72 SolarWorld 325 Watt modules and 2 SE10000 inverters with 72 P400 Optimizers

Interconnected into Account #70638 (Police Station)

Line-side connection in

Inverters located on outside of north wall of Police building

**\*\*A trench for conduit will need to be run from Storage building #3 to the Police station.**

### Sub-Array 3: On the roof of Town Hall

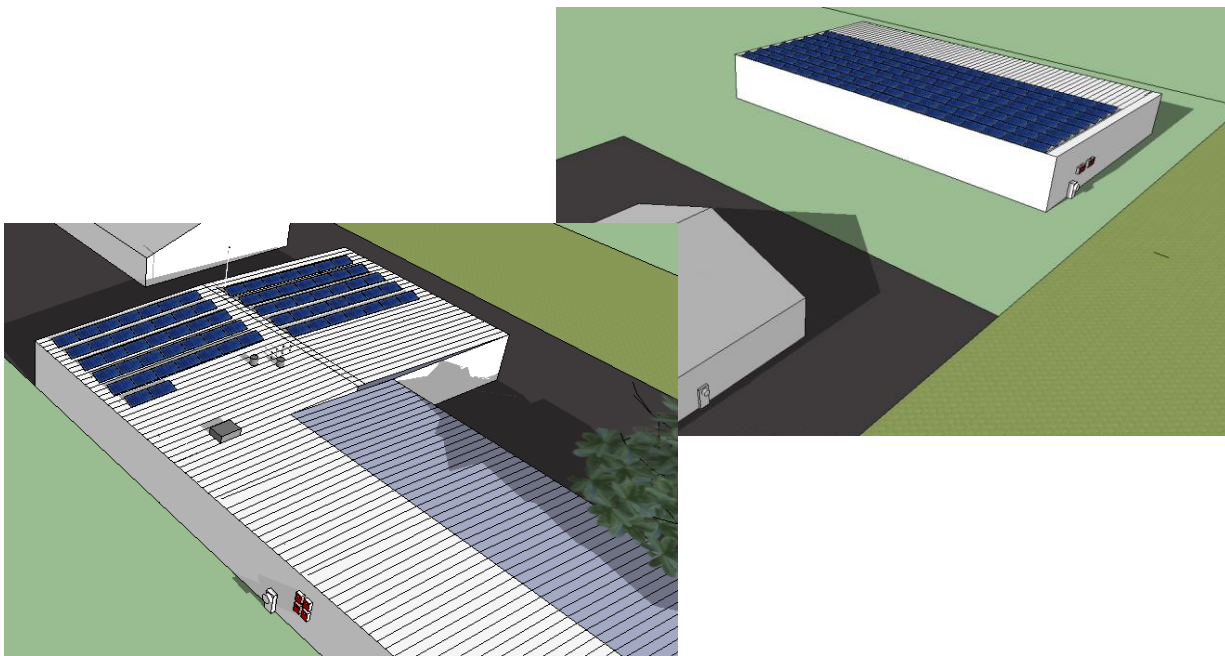
23.4 kW (DC), 20 kW (AC)

72 SolarWorld 325 Watt modules and 2 SE10000 inverters with 72 P400 Optimizers

Interconnected into Account #70637 (Municipal Building)

Line-side connection in

Inverters located on outside of west wall of Town Hall



Proposed Array Locations

### Array Description

<b>Site Layout</b> <ul style="list-style-type: none"><li>Show aerial imagery above.</li></ul>	See above.
<b>Ground Arrays</b> <ul style="list-style-type: none"><li>Identify soil types and depths.</li></ul>	N/A
<b>Ground Arrays</b> <ul style="list-style-type: none"><li>Identify trench obstacles</li></ul>	N/A
<b>Ground Arrays</b> <ul style="list-style-type: none"><li>Setback Issues</li></ul>	N/A
<b>Roof Arrays</b> <ul style="list-style-type: none"><li>Dead Load/Wind Loading Issues</li></ul>	Will need PE approval for town hall array
<b>Roof Arrays</b> <ul style="list-style-type: none"><li>Fastening/ballasting issues</li></ul>	Trapezoidal standing seam – Use S5! Clips for racking attachment
<b>Roof Arrays</b> <ul style="list-style-type: none"><li>Setback Issues</li></ul>	3' Minimum per Jerry @ Town of Rome
<b>Solar Resource</b>	Town Hall: Fire tower and mature maple in front of building – Though none of these will impact proposed array.
<b>Azimuth</b>	180
<b>Array Tilt</b>	15
<b>% Annual Energy Offset</b>	61%
<b>Value of Energy</b>	\$10,207 / first year
<b>Potential Impact on Demand</b>	No demand charges

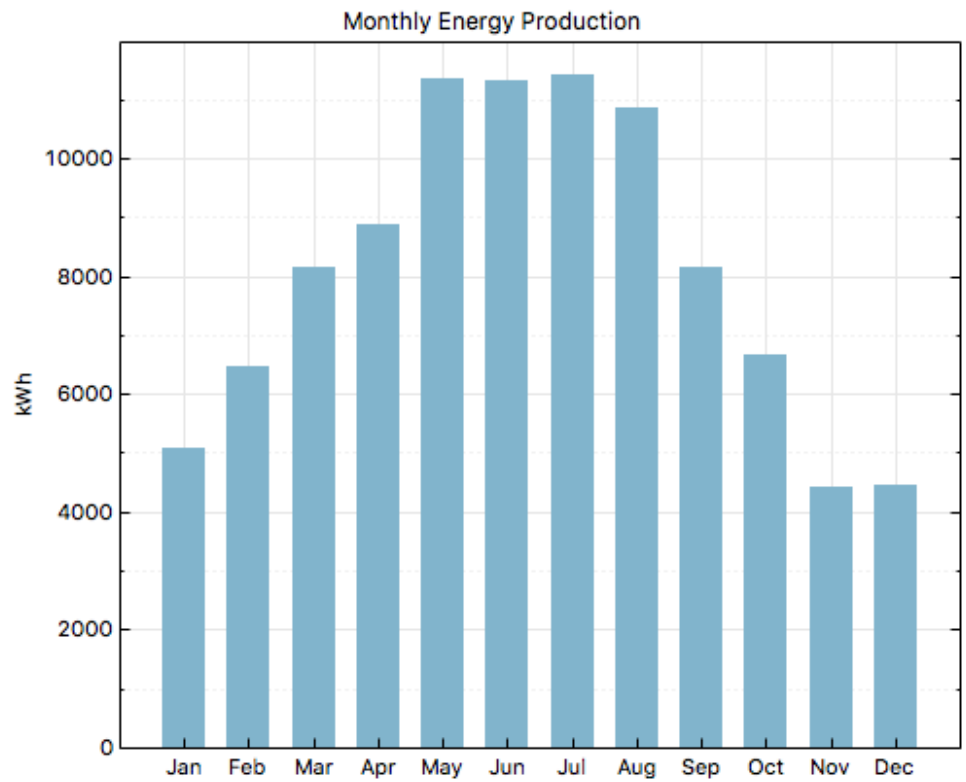
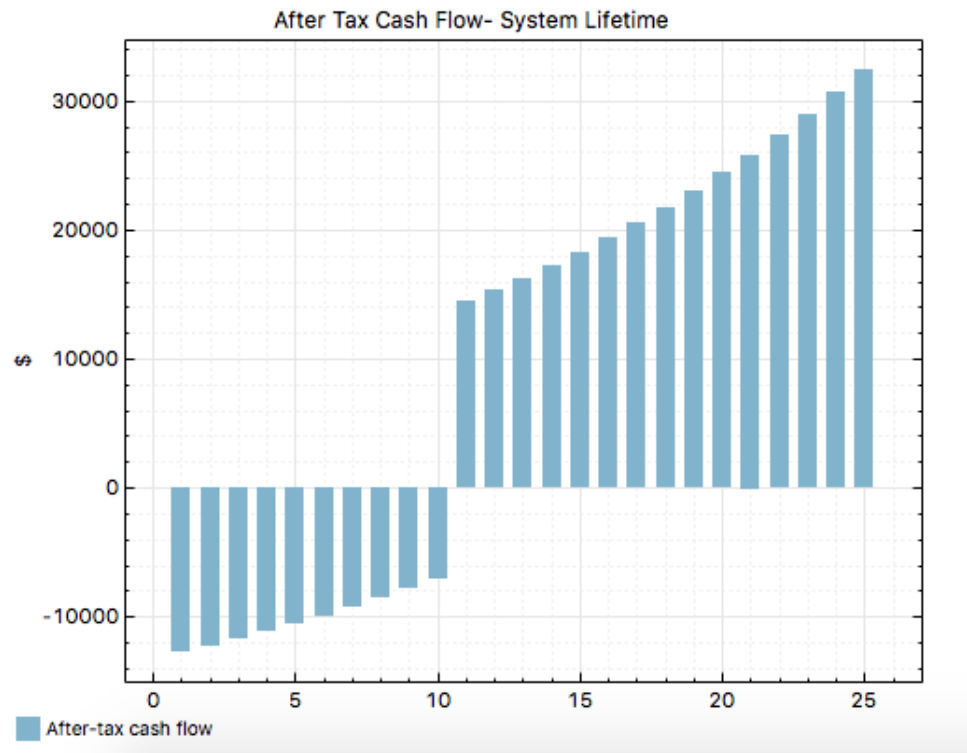
### Interconnection/BOS

<b>Inverter</b>	Two SolarEdge 10000-US-U inverters per 72 module array
<b>Inverter Location</b>	Storage #3 : Inside on east wall next to load center Police Bldg.: Outside on North wall, adjacent to load center on inner wall. Town Hall: Outside west wall adjacent to room housing the load center.
<b>Method Of Interconnection</b> (Supply or Load side connection?)	Supply side interconnection
<b>Monitoring</b>	Comes with SolarEdge Inverter.

### Financial Analysis

<b>Installed Cost</b> (Range?)	\$2.40 - \$2.60 / watt
<b>Utility Incentives/Grants</b>	\$0.00
<b>State Incentives/Grants</b>	\$2,400 Focus On Energy
<b>Federal Investment Tax Credit</b>	\$0.00

<b>MACRS Depreciation</b>	\$0.00
<b>Financing Options</b>	Current financing through Nekoosa Credit Union: The financial analysis uses a 100% loan at 3% for 10 years.



## Non-Financial Benefits



PV FINANCE MODEL: ENVIRONMENTAL BENEFITS

Revised: 3/16/15

### Environmental Factors per 1,000 kWh of Electricity Produced Each Year by a PV System:

#### 1,000 kWh of Electricity Produced Each Year by a PV System Avoids:

burning	900	lbs of coal burned at a coal-fired power plant (1)
emitting	2,240	lbs of CO <sub>2</sub> emitted by a coal-fired power plant (2)
emitting	1,630	lbs of CO <sub>2</sub> emitted by non-baseload electric generation (3)

#### 1,000 kWh of Electricity Produced Each Year by a PV System Avoids the Equivalent of:

burning	27.3	gallons of gasoline (4)
produced from	1.44	barrels of crude oil (5)
which would emit	535	lbs of CO <sub>2</sub> (6)
while driving	642	miles in a car @ 23.5 mpg (2010) (7)

#### 1,000 kWh of Electricity Produced Each Year by a PV System is Equivalent to:

having	0.833	acres of forest offset the CO <sub>2</sub> emitted by a coal-fired power plant (8)
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### RESULTS:

During the first year, a PV system **7.20** kW in size, producing **7,200** kWh/year:

Avoids burning	<b>7,480</b>	lbs of coal
and avoids emitting	<b>17,728</b>	lbs of CO <sub>2</sub> by a coal-fired power plant
Avoids emitting	<b>58,436</b>	lbs of CO <sub>2</sub> by non-baseload electric generation

#### If all the electricity produced by this PV system were used to charge an electric vehicle, it would:

Avoid burning	<b>2,654</b>	gallons of gasoline
produced from	<b>140.0</b>	barrels of crude oil
and avoid emitting	<b>2,002</b>	lbs of CO <sub>2</sub> from burning gasoline
while driving	<b>2,402</b>	miles in a car with a U.S. average mileage of 23.5 mpg (2010)

#### The electricity produced by this PV system is equivalent to having:

<b>1.0</b>	acres of forest offset the CO <sub>2</sub> emitted by a coal-fired power plant
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Data provided by the Midwest Renewable Energy Association.

## 10.0 PV Project Summary and Recommendations

The recommended system takes full advantage of (a) unshaded roof space and (b) maximizing net metered energy which is valued at full retail price regardless of the amount of energy that is drawn at each meter. This makes calculating the financial benefits quite accurate.

As for future expansion, when the town replaces the highway department building, we would recommend a south-facing roof. With the availability of a meter at the existing site, there would be the capability of installing an additional 23 kW (DC), 20 kW (AC) for an additional 30,000 kWh of energy generation at the full retail value of energy.

Additionally, if the town were to reconsider the trees and fire tower shading obstacles, the array on the municipal building could be expanded. While this would exceed the ACEC 20 kW (AC) net metering rate schedule, it may not affect the value of solar generated energy as it appears that the majority of energy is being consumed during times of high solar resource. It may be worthwhile to perform a study of hourly energy use on the Municipal Building meter before expanding the PV array.

Please note that rate schedules are subject to change. While this could affect the value of any expanded systems, it should be noted that Wisconsin utilities typically grandfather existing grid-tied PV systems to the rate schedule that was in place at the time of installation for 10 years.