

Red Lodge Solar Rooftop Panel Analysis



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Introduction

The following report is an examination of potential rooftop solar available on City of Red Lodge Municipal buildings. This report has two parts; The first takes into account the current electricity used at each building and determines an appropriate size solar array that will cover 100% of the City's electricity costs at that location. The second part goes beyond just covering electricity costs and examines the total rooftop space available for solar. For example, City Hall and the Police Station have more rooftop space than what their electricity needs are at that location. Please note that solar panels provide offsets for electricity use only. Even after offsetting the electricity costs, the buildings will still have payments for the use of natural gas.

Current Regulations

There are several state policies that currently limit the amount of renewable energy the City can produce at each location. The first limits the number of kilowatts for a solar system to 50kW (about 180 solar panels) per location. The second restricts the ability to produce electricity in one location to then offset electricity use in another location. The third restricts customers with multiple meters to offset electricity use at one location to offset electricity at another location. For example, the City of Red Lodge is currently billed for 32 energy meters and cannot spread the savings of a larger photovoltaic rooftop system at the Public Works Shop to offset electricity costs at the Water Treatment Plant, even though it is all under the same City of Red Lodge account.

Despite the regulatory setbacks, the goal is to determine how much investment it would take to cover our electricity costs at each location and go a step further to determine how much energy the City could produce with solar overall. This will be important in the future when regulations change and the City has an opportunity to offset the electricity used at other locations outside of the main municipal buildings.

Analysis Overview

Five locations were examined for rooftop solar production potential. The locations are separated based on their electricity meters via NorthWestern Energy. The analysis looks at the type of photovoltaic system best suited for the rooftop space (flush roof mount or tilted arrays), projected install costs, estimated return on investment, and projected greenhouse gas reduction. Estimated costs are based on installed wattage. Cost estimates for installing solar are based on a dollar amount per each watt installed. In Montana, that average is about \$3 per watt and is the basis for Projected Project Costs in this analysis.

Finally, it should be noted that the cost of photovoltaic solar panels has dropped significantly since 2008 going from around \$7 per kilowatt installed down to around \$3 per kilowatt in 2017. In addition, NorthWestern Energy estimates the cost of their electricity to increase over the next few years providing an additional cost incentive into the future.

Solar Panels

Estimates are based on a 17 square foot solar panel, with a production of 280 Watts or .28 kilowatts. To estimate production, National Renewable Energy Laboratory's (NREL) PVWatts Calculator was used to determine solar system size. Estimates were based on a 26 degree tilt for an average roof pitch and 18% system loss to account for snow and excess cloudy days. All other parameters in the calculator were left as default. PVWatts can be accessed here:

<http://pvwatts.nrel.gov/>

Cost Estimates

Install costs of \$3 per kilowatt installed are based on a regional average in 2017.

Rooftop Measurements

Rooftop size was measured using Google Earth measurements in square feet. This may affect the accuracy in number of solar panels due to measurements not being made at the site. There may be room for error as well with additional structures on the rooftop that may not be seen from Google Earth.

City Hall and Police Station - 1 South Platt Avenue

NorthWestern Energy Account Number: 713550-2

Annual Electricity Use: 38,362kWh

Annual Electricity Costs: \$4,220



Size needed to offset electricity costs for

1. Solar System -
City Hall: Flush mount
Police Station: Flat roof ballasted system
2. Square Feet: 1,700
3. Number of Panels: 100
4. Combined system size: 28kW
5. Install Cost at \$3/kW: \$84,000
6. Projected Energy output: 38,195 kWh/year
7. Projected Electricity Savings: \$4,201/year
8. Projected Return on Investment: 20 years
9. Projected Greenhouse Gas Savings Per Year:
Carbon Dioxide – 36,302lbs
Nitrogen Oxide – 48lbs
Sulfur Dioxide – 25lbs

Total Potential Solar Production

1. Solar System -
City Hall: Flush mount
Police Station: Flat roof ballasted system
2. Square Feet: 5,000
3. Number of Panels: 346
4. Combined System Size: 97kW
5. Install cost at \$3/kW: \$291,000
6. Projected Energy Output: 132,326kWh/year
7. Projected Electricity Savings: \$14,555/year
8. Estimated Return on Investment: 20 years
9. Projected Greenhouse Gas Savings Per Year:
Carbon Dioxide – 125,761lbs
Nitrogen Oxide – 166lbs
Sulfur Dioxide – 87lbs

Library - 3 8th Street

NorthWestern Energy Account Number: 713548-6

Annual Electricity Use: 23,673kWh

Annual Electricity Costs: \$2,600



Size needed to offset electricity costs and total Capacity

1. Solar System: Flat roof ballasted
2. Square Feet: 638
3. Number of Panels: 38
4. Projected System Size: 10.5kW – only space for 60% of bill
5. Projected cost at \$3/kW: \$31,500
6. Projected Energy output: 14,324kWh/year
7. Projected Electricity Savings: \$1,576/year
8. Projected Return on Investment: 20 years
9. Projected Greenhouse Gas Savings per year:
 - Carbon Dioxide – 13,606lbs
 - Nitrogen Oxide – 18lbs
 - Sulfur Dioxide – 9lbs

Public Restroom - 305 N. Oakes Avenue

NorthWestern Energy Account Number: 1447849-9

Annual Electricity Use: 2,511kWh

Annual Electricity Costs: \$300



Size needed to offset electricity costs and total capacity

1. Solar System: Flush Roof Mount
2. Square Feet: 121
3. Number of Panels: 7
4. Projected System Size: 2 kW
5. Project Cost at \$3/kW: \$6,000
6. Projected energy output: 2,728 kWh/year
7. Projected Electricity Savings: \$302/year
8. Projected Return on Investment: 20 years
9. Projected Greenhouse Gas Savings per year:
 - Carbon Dioxide – 2,589lbs
 - Nitrogen Oxide – 3lbs
 - Sulfur Dioxide – 2lbs

Public Works - 6801 US HWY 212

NorthWestern Energy Account Number: 713563-5

Annual Electricity Use: 18,050kWh

Annual Electricity Costs: \$2,000



Size needed to offset electricity costs

1. Solar System: Flush Roof Mount
2. Square Feet: 911
3. Number of Panels: 54
4. Projected System Size: 15 kW
5. Install at \$3/kW: \$45,000
6. Projected Energy Output: 20,462 kWh/year
7. Projected Electricity Savings: \$2,250 kWh/year
8. Projected Return on Investment: 22 years
9. Projected Greenhouse Gas Savings per year
 - Carbon Dioxide – 19,445lbs
 - Nitrogen Oxide – 26lbs
 - Sulfur Dioxide – 13lbs

Total Potential Solar Production

1. Solar System: Flush roof mount
2. Square Feet: 4,190
3. Number of Panels: 246
4. Projected System Size: 69kW
5. Install at \$3/kW: \$207,000
6. Projected Energy Output: 94,129 kWh/year
7. Projected Electricity Savings: \$10,354
8. Projected Return on Investment: 20 years
9. Projected Greenhouse Gas Savings Per Year:
 - Carbon Dioxide – 89,459lbs
 - Nitrogen Oxide – 118lbs
 - Sulfur Dioxide – 62lbs

Recycling Center - 1220 N. Haggin Avenue North

NorthWestern Energy Account Number: 713563-5

Annual Electricity Use: 2,778kWh

Annual Electricity Costs: \$300



Size needed to offset electricity costs

1. Solar System: Tilted Roof Mount
2. Square Feet: 121
3. Number of Panels: 7
4. Projected System Size: 2 kW
5. Estimated Cost at \$3/kW: \$6,000
6. Projected Energy Output: 2,728 kWh/year
7. Projected Electricity Savings: \$302/year
8. Projected Return on Investment: 20 years
9. Projected Greenhouse Gas Savings per year:
 - Carbon Dioxide – 2,589lbs
 - Nitrogen Oxide – 3lbs
 - Sulfur Dioxide – 2lbs

Total Potential Solar Production

1. Solar System: Tilted Up roof mount
2. Square Feet: 2,400
3. Number of Panels: 143
4. Projected System Size: 40kW
5. Estimated Cost at \$3/kW: \$120,000
6. Projected Energy Output: 54,567 kWh/year
7. Projected Electricity Savings: \$6,000/year
8. Projected Return on Investment: 20 years
9. Projected Greenhouse Gas Savings per year:
 - Carbon Dioxide – 51,858lbs
 - Nitrogen Oxide – 68lbs
 - Sulfur Dioxide – 36lbs