

SOLAR FOR THE CITY OF NORTHFIELD

CITYWIDE RENEWABLE ENERGY POTENTIALS STUDY

Who is Ted



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Our mission:

To hasten the transition to an authentically sustainable, no carbon economy and to elevate the public discourse.

paleBLUEdot Certifications/Affiliations



Introduction – Project Overview

Goals:

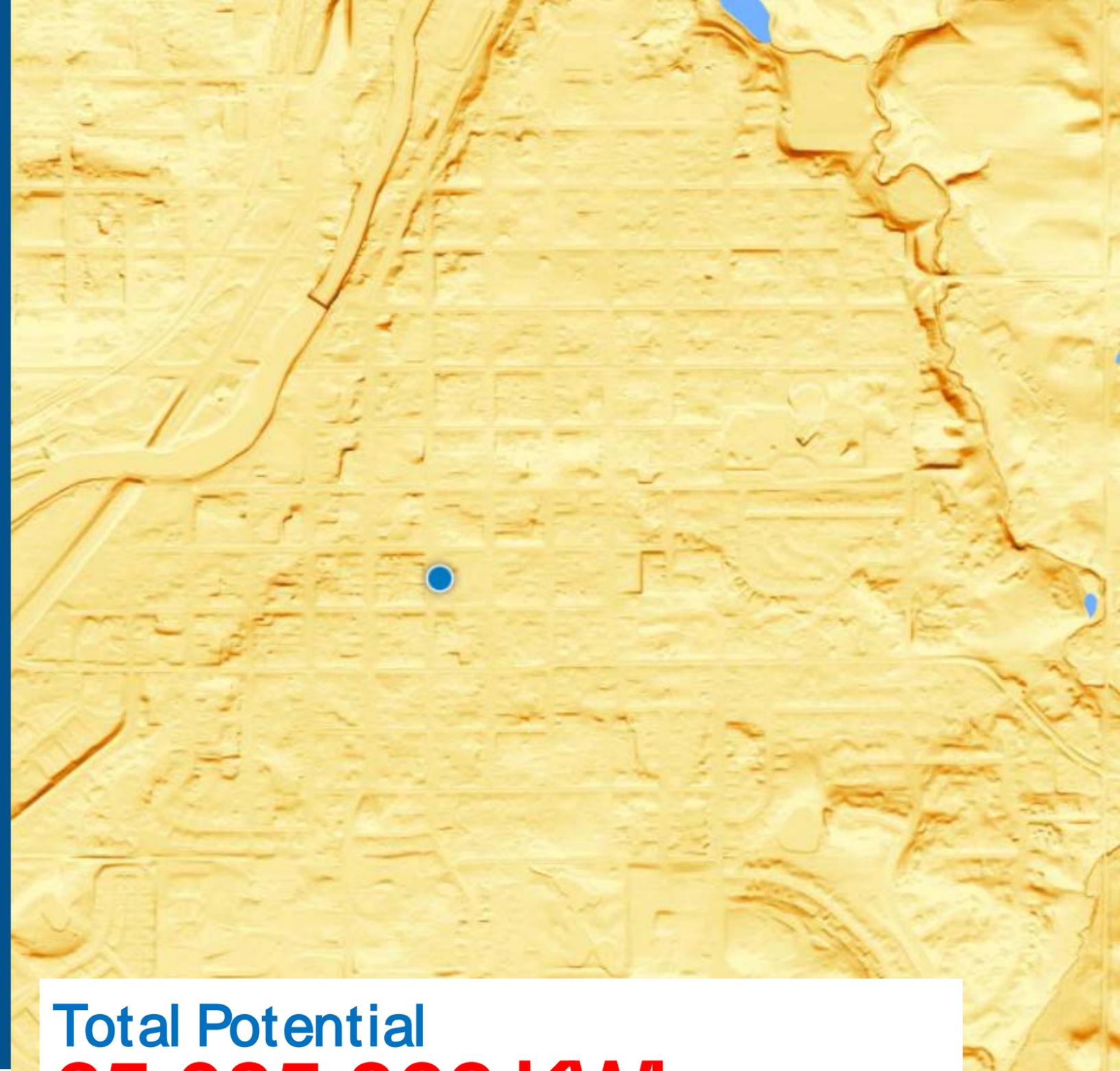
- 1) Determine the overall rooftop solar pv potential in support of the City's Climate Action Plan.
- 2) Determine the solar pv capacity of the primary City of Northfield facilities.
- 3) Recommend implementation strategies to achieve net zero electricity for City of Northfield facilities.



Citywide Potentials

Methodology:

- 1) Input Data:
 - Roof plane survey (NREL)
 - lidar data obtained from U.S. (DHS)
- 2) Roof plan classification by orientation and tilt
- 3) Calculated solar PV energy generation potential assuming typical system capacities
- 4) Estimated the total array capacity likely to be cost effective with today's systems



Total Potential

65,085,866 kWh Annually
25% of Citywide Consumption

Citywide Potentials

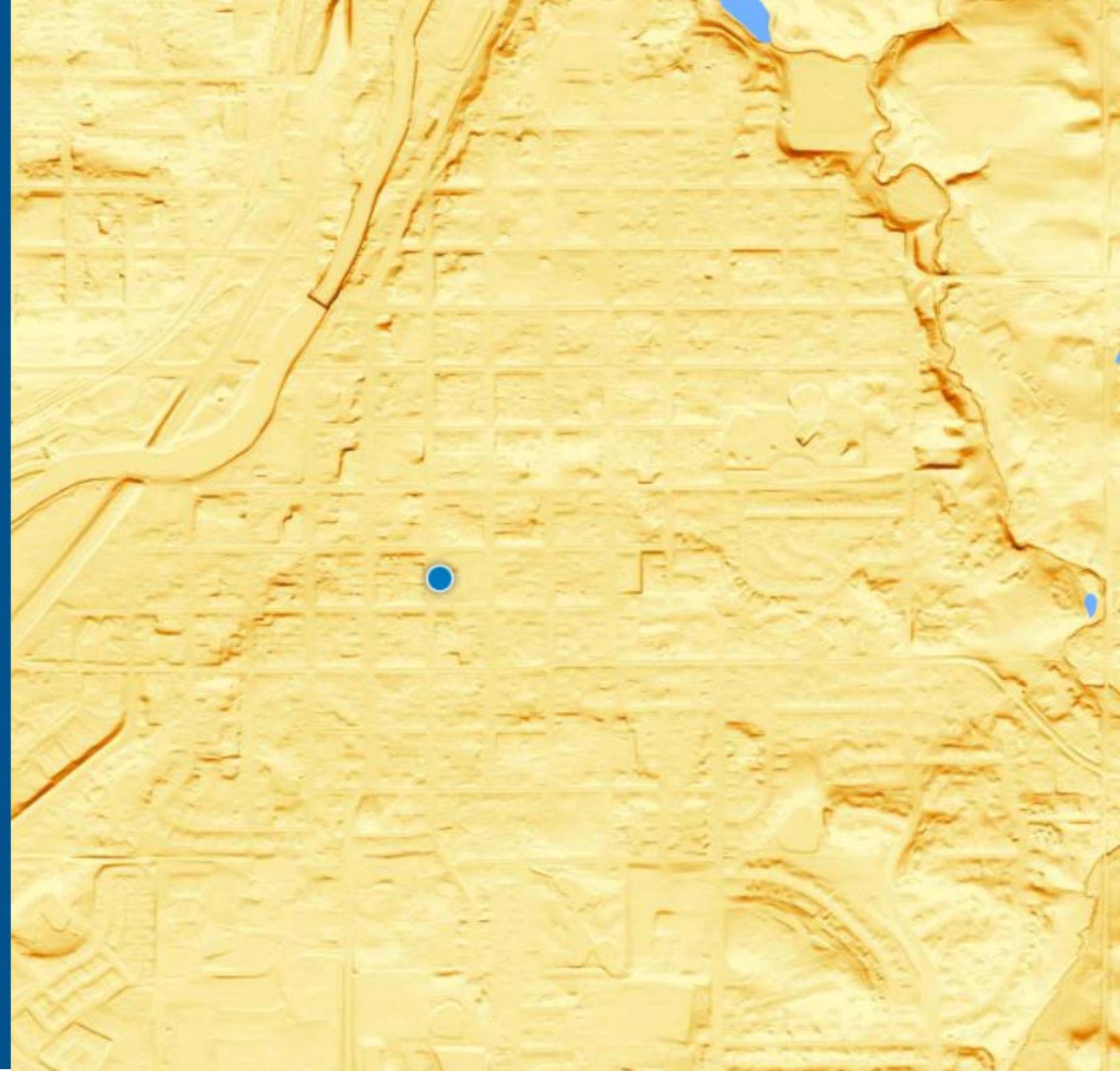
Methodology:

5) Using 5 and 10 year Statewide solar install projections for State of Minnesota, Project “Market Absorption” Scenarios to Determine *likely* solar array installs in city:

Scenario A: Based on current city share of Statewide install trends (higher than average number of arrays, lower than average KW installed per-capita)

Scenario B: Increasing city share to match Statewide install trends per-capita

Scenario C: Illustration of adoption needed to meet City’s CAP goals (10% distributed solar by 2030, 20% by 2040)



Scenario A: Northfield Rooftop Solar PV Projection Based on Potential Market Absorption Maintaining Current Adoption Rate and Average Array Size (6.8 KW)

Year	Cumulative Installed (KW)	Annual Generation (KWH)	% of City Electric Consumption	This is Equivalent to adding (x) Average Residential Arrays Annually:	Or Equivalent to adding (x) Commercial Arrays Annually:
2024	913	989,667	0.38%	13	2.2
2030	1,900	2,060,439	0.79%	24	4
2040	3,917	4,246,631	1.63%	30	5

Scenario B: Northfield Rooftop Solar PV Projection Based on Potential Market Absorption and Increasing City Adoption Rate to Population Share (measured by KW installed)

Year	Cumulative Installed (KW)	Annual Generation (KWH)	% of City Electric Consumption	This is Equivalent to adding (x) Average Residential Arrays Annually:	Or Equivalent to adding (x) Commercial Arrays Annually:
2024	3,552	3,850,992	1.47%	110	18.7
2030	7,395	8,017,579	3.07%	94	16
2040	15,242	16,524,484	6.33%	115	20

Though improved over Scenario A, this projection indicates a shortfall from the City's current goal of 10% on-site solar by 2030 and 20% on-site solar by 2040 as established in the City's Climate Action Plan.



**Scenario C: Northfield Rooftop Solar PV Adoption Rate Required to Meet
City's Climate Action Plan Goals**
(measured by KW installed)

Year	Cumulative Installed (KW)	Annual Generation (KWH)	% of City Electric Consumption	This is Equivalent to adding (x) Average Residential Arrays Annually:	Or Equivalent to adding (x) Commercial Arrays Annually:
2024	9,412	10,204,165	3.91%	326	55.4
2030	24,084	26,111,041	10.00%	503	86
2040	48,168	52,222,081	20.00%	600	102

This illustrates the pace of annual new installs needed to match goal if all are residential scale

This illustrates the pace of annual new installs needed to match goal if all are commercial scale

City Facilities



City Facilities – Solar Feasibility



City Facilities – Solar Feasibility

Array Concept – the second page of the “Annual Production Report” provides an illustration of the solar array concept and a summary of the array components planned.

Components: an overview of the solar array components used in modeling the potential production. Specific components such as the solar module or inverters used will have slight performance differences.

Detailed Layout provides an illustration of the solar PV array design concept used in this feasibility assessment. Alternative array locations and configurations are possible and may affect the potential array’s ultimate cost and performance.



City Facilities – Solar Feasibility

Annual Production Report – this document provides a summary of the solar array size and annual performance.

System Metrics: an overview of the proposed array size, efficiency rating, and total annual electrical generation.

Monthly Production: an estimate of electric generation by month, responding to varying weather and sun conditions.

System Losses: all solar arrays have “losses” representing a reduction in total energy generated from the maximum potential of the panels. This provides an estimate of losses by category, such as shading or high panel temperature in strong sunlight conditions.



City Facilities – Solar Feasibility

Project Budget - For each site, the Project Budget includes a preliminary opinion of project costs.

DESCRIPTION	Quantity	Unit Price	Total Price	Subtotal	Total
ADMINISTRATIVE COSTS					
LEGAL FEES & CONTRACT REVIEW	1	250	250	250	250
SOIL BORINGS (for ground mounted arrays)	1	100	100	100	100
INSTALLATION COSTS					
PERMITS	1	100	100	100	100
FOUNDATION	1	100	100	100	100
ARRAY MOUNTING	1	100	100	100	100
WIRING	1	100	100	100	100
LABOR	1	100	100	100	100
DEVELOPER OVERHEAD AND PROFESSIONAL FEES					
DESIGN ASSISTANCE	1	100	100	100	100
RFP/PROCUREMENT ASSISTANCE	1	100	100	100	100
CONTINGENCY					
CONTINGENCY	1	100	100	100	100

Administrative Costs: provide an allowance for general project costs such as legal/contract review and soil borings (for ground mounted arrays).

Installation Costs: provides a detailed opinion of the actual solar array construction costs. This section is what a building owner might anticipate paying a solar contractor to construct the array.

Professional Fees: provides an allowance for possible professional fees, such as design assistance or RFP/procurement assistance the site owner may choose to engage.

Contingency: provides an allowance for a recommended project contingency to cover unexpected costs. This value should be seen as protecting a project budget and under the control of the site owner.

City Facilities – Solar Feasibility

30-Year Energy Generation

Energy Generation Sched: an estimate of annual array performance.

Potential Revenue: an estimate of the value to the site of the solar energy generated with assumed electric rate inflation.

30-Year Energy Budget Table

Energy Generation Schedule (Based on Predicted Load)

Year	Annual Energy Generation	Energy Savings (Value of)	Generated Cash	Net Cash Flow
1	86,280 kWh	\$2,328	\$1,942	\$386
2	88,290 kWh	\$2,390	\$1,970	\$420
3	90,300 kWh	\$2,452	\$2,000	\$452
4	92,310 kWh	\$2,514	\$2,030	\$484
5	94,320 kWh	\$2,576	\$2,060	\$516
6	96,330 kWh	\$2,638	\$2,090	\$548
7	98,340 kWh	\$2,700	\$2,120	\$580
8	100,350 kWh	\$2,762	\$2,150	\$612
9	102,360 kWh	\$2,824	\$2,180	\$644
10	104,370 kWh	\$2,886	\$2,210	\$676
11	106,380 kWh	\$2,948	\$2,240	\$708
12	108,390 kWh	\$3,010	\$2,270	\$740
13	110,400 kWh	\$3,072	\$2,300	\$772
14	112,410 kWh	\$3,134	\$2,330	\$804
15	114,420 kWh	\$3,196	\$2,360	\$836
16	116,430 kWh	\$3,258	\$2,390	\$868
17	118,440 kWh	\$3,320	\$2,420	\$900
18	120,450 kWh	\$3,382	\$2,450	\$932
19	122,460 kWh	\$3,444	\$2,480	\$964
20	124,470 kWh	\$3,506	\$2,510	\$996
21	126,480 kWh	\$3,568	\$2,540	\$1,028
22	128,490 kWh	\$3,630	\$2,570	\$1,060
23	130,500 kWh	\$3,692	\$2,600	\$1,092
24	132,510 kWh	\$3,754	\$2,630	\$1,124
25	134,520 kWh	\$3,816	\$2,660	\$1,156
26	136,530 kWh	\$3,878	\$2,690	\$1,188
27	138,540 kWh	\$3,940	\$2,720	\$1,220
28	140,550 kWh	\$4,002	\$2,750	\$1,252
29	142,560 kWh	\$4,064	\$2,780	\$1,284
30	144,570 kWh	\$4,126	\$2,810	\$1,316

COSTS AND FINANCING

Total Initial Array Capital Investment (Other costs excluded)	\$1,142,000
Search, Review, No Obligation Period	\$5
Total Interest Payments	\$25,517
Operational Expense Allowance (Insurance, O&M, 30-year)	\$28,007
Total Finance Project Costs	\$1,200,524

SAVINGS

Total 30-Year Project Savings	\$141,912
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OUTCOME

Net Array Project Costs or Savings	\$1,058,612
Total Range of Cost Payback (Years)	3.8 - 7.6
Value to City (Range)	\$1,058,612 (4.5 - 10.0)
Electricity Production (kWh, 30-year)	3,200,700 kWh
Percent of Electricity Usage Covered by Solar (Year 1)	7.8%

Financing: an allowance for array loan or bonding finance.

Annual Expenses: allowances for insurance and maintenance expenses.

Simplified Cash Flow: an estimate of array cash flow / pay back annually for 30 year term.



City Facilities – Solar Implementation

Identified Sites that can achieve net zero electricity on-site

Established on-site solar priorities based on array performance

Table 5.2: Recommended Implementation Prioritization

General Information		Solar Feasibility Concept													
Name		Nameplate Capacity - Rooftop	Nameplate Capacity - Ground	Nameplate Capacity - Carport	Estimated Year 1 Generation	Estimated 30 Year Generation Total	Annual Generation Percent of Consumption	Net Zero Possible With On-Site Solar	Value	Concept Retains REC's (10 year) *	Cost (Estimated Total Lifetime)	Value to Cost Ratio	** Effective Cost per kWh Difference From Base Rate + REC	** Effective Cost per kWh Difference From Solar Subscription +REC	On-Site Solar Priority Level
City Hall	3	30.50			40,230	1,076,811	21.00%	No	\$169,327	No	\$109,221	1.55	0.020	\$0.047	3
Police Department	2	83.00	83.30		224,500	6,009,051	112.77%	Yes	\$861,483	Yes	\$480,686	1.79	-0.011	\$0.015	2
Wastewater Treatment Plant	2	161.40			220,000	5,888,602	6.14%	No	\$701,490	Yes	\$461,071	1.52	0.004	\$0.031	2
Water Department Office	3	15.40			20,980	561,559	9.32%	No	\$91,035	No	\$59,108	1.54	0.020	\$0.047	3
Northfield Community Resource Center	1	397.30	80.90		568,530	15,217,486	104.26%	Yes	\$1,987,027	Yes	\$1,364,180	1.46	-0.017	\$0.009	1
Outdoor Pool/Old Memorial field	1		81.30		112,500	3,011,217	106.53%	Yes	\$367,544	Yes	\$265,371	1.39	-0.026	\$0.000	1
Ice Arena	3	227.20		235.20	605,600	16,209,716	104.05%	Yes	\$2,078,084	Yes	\$1,703,102	1.22	0.025	\$0.051	3
Maintenance Facility	2	53.60			74,390	1,991,151	113.48%	Yes	\$195,505	Yes	\$171,589	1.14	0.000	\$0.027	2
Liquor Store	2	17.50			23,860	638,646	19.91%	No	\$109,466	No	\$66,546	1.64	-0.007	\$0.020	2
Northfield Area Fire & Rescue	2	59.20	69.60		169,780	4,544,395	110.77%	Yes	\$632,020	Yes	\$393,355	1.61	-0.003	\$0.023	2
Grand Total		1,045	315	235	2,060,370	55,148,633	35.7%		\$7,192,981		\$5,074,228	1.42			



City Facilities – Next Steps

Community-Wide Solar Recommendations

In support of the City's on-site solar goals included in its Climate Action Plan (10% generation by 2030, 20% by 2040) we recommend the following:

- 1) Maximize new installations in years 2020 and 2021 for both Residential and Commercial scale projects in order to leverage the greatest potential for local cost savings from the Federal Solar Investment Tax Credit. Actions to support this include:
- 2) Maximize new installations in years 2022 and beyond. Actions to support this include:
 - a) Become a SolSmart Community Gold level
- 3) Identify and develop quality large array locations to support faster solar PV adoption. Actions to support this include:

City Facilities – Next Steps

City Facilities Conclusions:

Establish a policy that energy cost savings from CSG subscriptions be first applied to purchase of RECs to achieve City's carbon free goal for those sites.

Explore proceeding with the procurement of solar pv for all "Priority Level 1 and Level 2"

Execute a joint bulk procurement Request for Proposal process within the 3rd or 4th quarter of 2020 for all "Priority Level 1" solar pv sites (note, City may leverage greater savings if Priority level 2 sites are included as an option)

Explore the inclusion of local business utilization as well as Northfield resident internship, training, and employment as major selection criteria for Request for Proposal consideration.

Thank you!

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