Drummond Area School District
Solar Photovoltaic (PV) Site Assessment

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with
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The information presented here provides a feasibility study level overview of solar PV projects siting, sizing, generation, site electricity use offset, pricing and project economics. It should not be used as the only source of information.

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Executive Summary

Recommendations

- The PV array should be sited on the school's open/unshaded flat roof areas. The array should face due south with a 10° tilt from the horizontal. The racking system uses ballasted pans with no roof penetrations.
- A PE stamp is required to approve the building to bear the weight of the array and related loads. The District is encouraged to have a PE review the roof area before going forward with the project.
- The PV system should be sized to be eligible for Xcel Energy's net energy billing rate (i.e., not more than 100 kW AC). This optimizes the system's economics.
- The PV system should be owned by the District. At this time, we do not recommend the third-party ownership option.
- The District should invest $700-$1000 to install an eGauge energy monitoring system (or similar) to collect the school's 15-minute electricity use data. Knowing the school's energy use for a full year (or even from mid-summer 2019 to mid-winter 2019/20) would be useful for the energy analysis (and of interest to students).

Findings

- The modeled 99.9 kW AC (118 kW DC) net-energy billing PV system generates: 125,108 kWh/year
- PV system efficiency: 1063 kWh of solar generation per kW DC of PV module
- Meet's 28% of the school's use
- With 30% energy efficiency savings, meets: 40% of the school's use

Financial Analysis Key Assumptions

- Year one value of solar generation: 6.723 cents/kWh
- Year one value of solar demand savings
    - Monthly: 15% of the kW DC rating of the PV system
    - Annual: 10% of the kW DC rating of the PV system
- System cost: $1.85/watt DC
- Incentives
    - Couillard Solar Foundation, Solar on School's program, donating 162 PV modules (total 58.32 kW DC) estimated value: $27,000

    - Focus on Energy, Renewable Energy Competitive Incentive Program (RECIP), grant covering 20% of the PV systems cost
    - The Wisconsin Office of Energy Innovation, Energy Innovation Grant: no funding
- Loan/financing/bonds (for system cost not covered by incentives)
    - Interest rate: 3.5%
    - Term: 20 years
- Other assumptions
    - System output degradation: 0.5%/year
    - General inflation: 3%/year
    - Electricity cost inflation: 2.5%/year
    - Discount rate: 3%

Financial Analysis Findings

Energy Production and Costs	
Estimated installed cost	$217,745
Focus on Energy Incentive	$43,549
Couillard Solar Foundation Donation	$27,000
Loan Amount	$147,169

Year-one CO_2 reduction	55.1	Tons
Simple payback period	13.4	Years
Years to cost recovery	11	Years

Year	IRR	Discounted NPV
10	2.5%	$(99)
15	17.5%	$5,521
20	21.8%	$14,559
25	25.5%	$51,757
30	26.3%	$86,839

Sensitivity Analysis Findings

System Price – lower or higher system cost

	Optimistic < ---------- > Pessimistic			
System Price	$1.75/kW DC	Base Case $1.85/kW DC	$1.95/kW DC	$2.05/kW DC
20 Year IRR	163%	21.8%	6%	3.3%
20 Year NPV	$25,976	$14,559	$3,143	-$246

Solar Generation - impact of the white roof

	Optimistic < ---------- > Base Case			
Solar Generation (from white roof)	20% increase 1,276 kWh/kW DC	10% increase 1,169 kWh/kW DC	5% increase 1,116 kWh/kW DC	Base Case 1,063 kWh/kW DC
20 Year IRR	Can not be determined	788.4%	47.2%	21.8%
20 Year NPV	$44,528	$29,511	$22,073	$14,559

Electricity Price – lower or higher electric rate increases

	Optimistic < ---------- > Pessimistic			
Electricity Escalation Rate/Year	3.5%	3%	Base Case 2.5%	2%
20 Year IRR	37.1%	29.7%	21.8%	12.5%
20 Year NPV	$33,101	$23,559	$14,559	$6,071

Financing Interest Rate

	Optimistic < ---------- > Pessimistic			
Financing Interest Rate	3%	Base Case 3.5%	4%	4.5%
20 Year IRR	49.6%	21.8%	10.7%	3.3%
20 Year NPV	$21.461	$14,559	$7,493	$264

Demand Savings

	Optimistic < ---------- > Pessimistic			
Demand savings	17.5% Monthly 12.5% Annual	Base Case 15% Monthly 10% Annual	12.5% Monthly 7.5% Annual	10% Monthly 5% Annual
20 Year IRR	49.6%	21.8%	9.9%	1.3%
20 Year NPV	$22,726	$14,559	$6,393	-$1,774

Introduction

Solar Photovoltaic (PV) Systems - Basic Information

- No moving parts and low maintenance needs
- Modules have a 25-year warranty (to produce 80% of their rated capacity)
- Inverters typically have a 10 or 15-year warranty
- Racking systems typically have a 10 to 15-year warranty
- With regular maintenance and as needed inverter replacements solar PV system should have a 30 to 40-year life
- The National Electric Code includes solar PV systems
- All key components are UL certified
- Several highly qualified licensed electricians with PV certification are available to design, specify, and install solar PV systems to code
- Solar modules are made of the high-strength glass and are rated for hail
- Property insurance policies cover solar PV systems
- Solar system prices after significant declines over the last 19 years have been increasing somewhat over the last 1 to 2 years

Technical and Economic Modeling

"Prediction is very difficult, especially if it's about the future." - Niels Bohr

And even more difficult if the prediction looks forward 25 years.

This analysis attempts to use realistic assumptions. All assumptions are clearly presented. The assumptions are more important that the results. Thus, please review and consider them carefully.

Assumptions such as the system's price, amount of the Focus on Energy grant, year one insurance costs, year one generation, and utility interconnection costs can be precisely determined after bidding and design of the PV system.

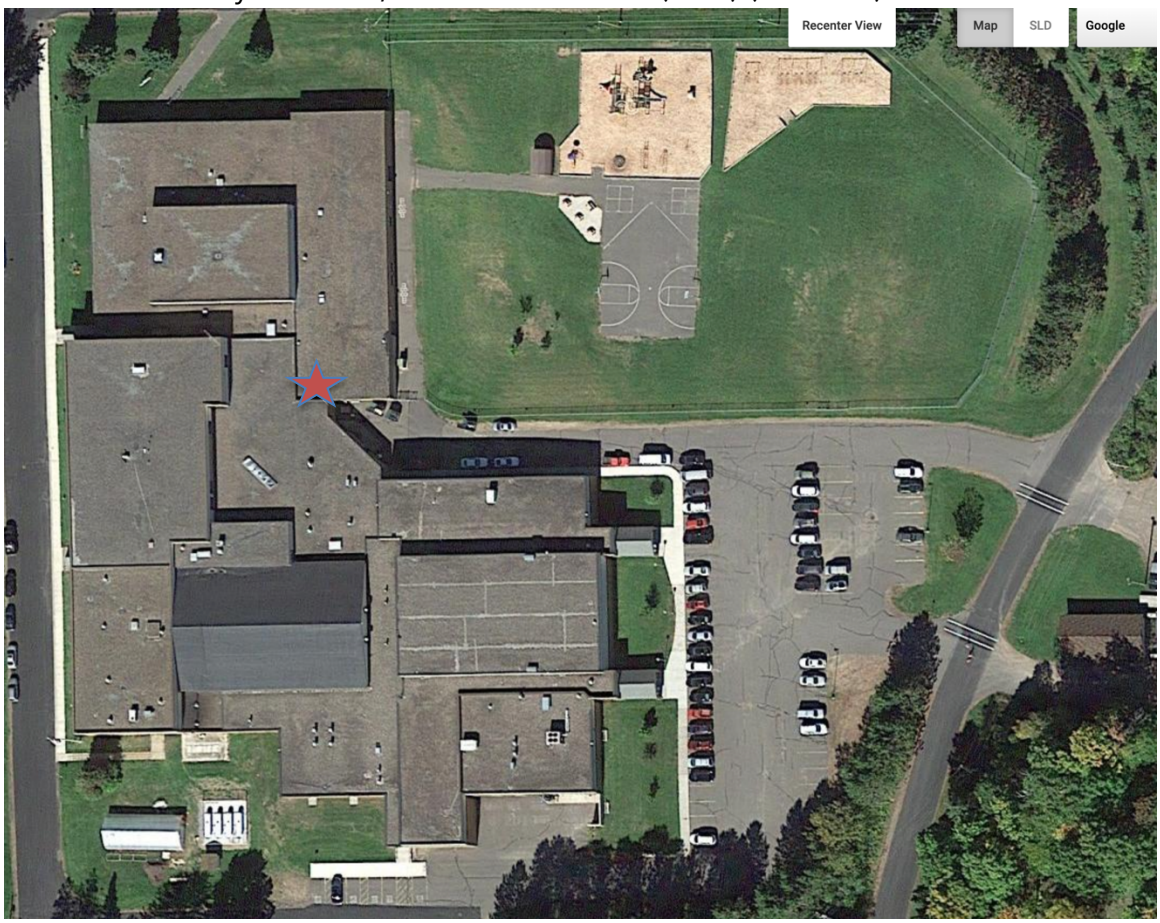
Perhaps the largest unknown is the future value of the solar energy produced and demand savings. Every year or two, Xcel can change both the customer purchase rates and the parallel generation rates.

Scenarios are provided to show the impact of some changes to the assumptions on the project's financial metrics. (Additional scenarios can easily be run, just ask.)

Site Assessment

Drummond Area School District K-12 Building

Address: 52440 Eastern Ave., Drummond, WI 54832
Rate: Xcel, General TOD Service-Sec, secondary voltage
Annual electricity use: 442,400 kilowatt-hours (kWh) (2018/19)



Google Earth Image of the DASD Building. The building's electric room is approximately under the red star.

Site Visit Notes

- Proposed system location: roof mounted,
  - The entire roof was replaced with a white roof in 2017
  - Roof has a 20-year warranty (See Annex 1)
  - Roof was previously stone ballasted
- Electric Service: 120/208 three phase, 4 wire, 1600 amp
- Electric room is under the proposed PV array location

- Electric room has a server, easy data connection point for PV system monitoring
- The school's CT cabinet is in electric room
- Electrical entrance is on the exterior wall due east of the electric room
- Little summer use of the school
- School has air conditioning only in limited areas
- An energy audit is being completed currently with this solar PV site assessment

Recommended PV System Siting: Rooftop Mounted

Recommended Array Siting: Northern Roof Area

- Recommended array siting strategy:
    - Sited on open/unshaded flat roof areas
    - Facing due south 10° tilt from the horizontal
    - Racking system uses ballasted pans with no roof penetrations
    - The array would be visible from the east side of the school's property

The recommended PV system uses low profile racks. Low profile racks mount the solar PV modules with a 10° slope (see photo below). This has become the standard on flat roof tops because low profile systems are less prone to suffer damage from wind events, do not require roof penetrations, and require less structural support from the building's roof to support wind, snow and ice loads. Low profile racking systems are also more cost effective; the extra cost of higher profile (greater than 20°) racking is generally higher than the extra value of the solar kWh generated.

PV System on the Roof of Holy Wisdom Monastery, Middleton WI

The low-profile rack systems typically use concrete ballasts to weigh them down to the roof. A protective layer (i.e., slip sheets) is placed beneath the racks and the building's roof membrane for additional protection. The systems can be disassembled and moved to other roof areas.

The site owner should consult with a Wisconsin Professional Engineer PE to ensure that the roof can support the weight of the PV array and wind and snow loading (please refer to "Next Steps", Annex 2).

Recommended PV System Sizing

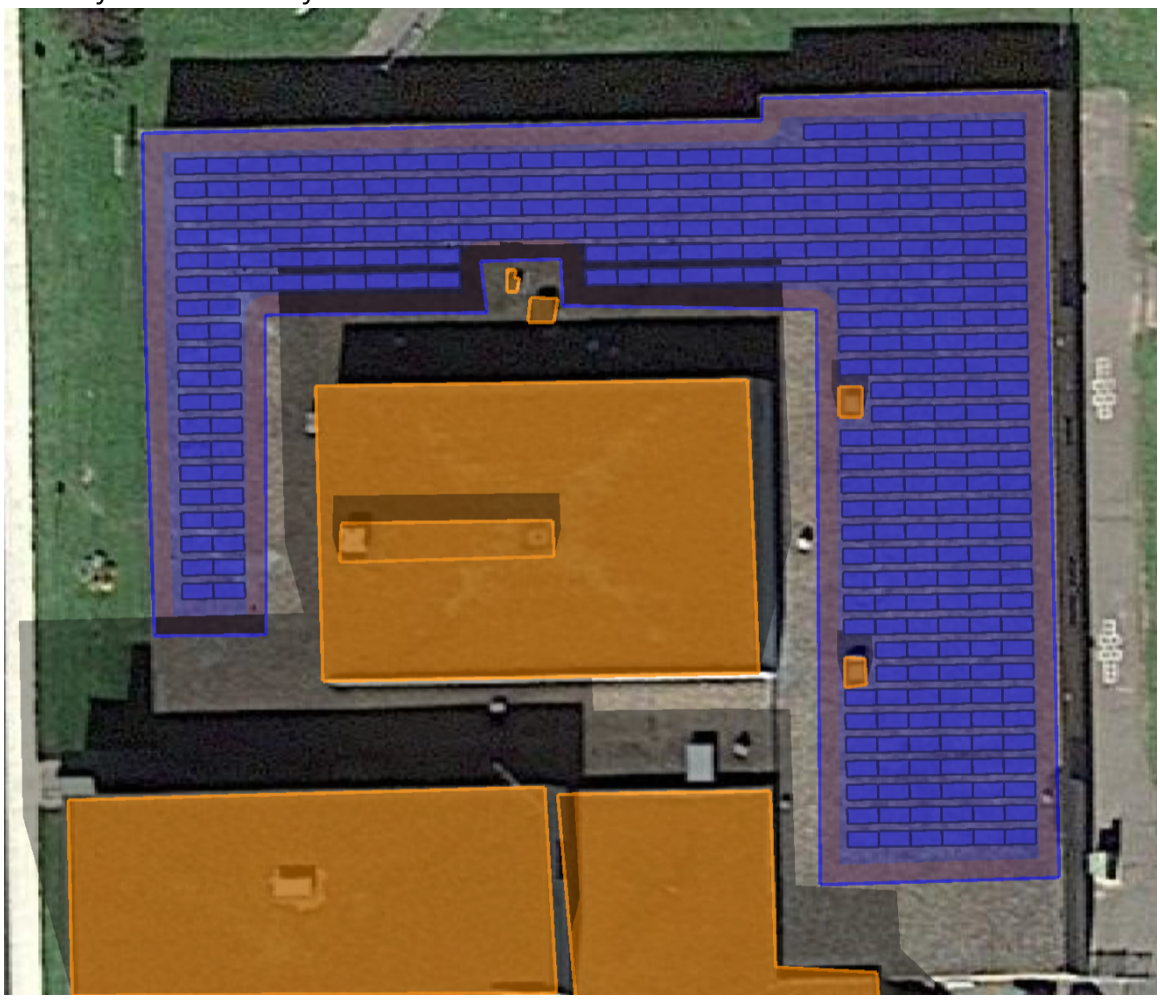
The system should be sized at 100 kilowatts (kW) alternating current (AC) or less in order to be eligible for Xcel Energy's net energy billing rate (PG 1, Annex 3).

Ideally PV systems are sized to meet the site's annual electricity (kWh) needs, however:

- For Xcel customers this works, only for PV systems of under 100 kW AC (or ~125 kW direct current (DC)). These systems are "net metering".
    - A Net metering PV system can put power on the grid at any time, and that power is valued at the site's retail electric rate

- PV systems that are larger than 100 kW AC (not net metering) any power they put onto the grid during any 15-minute period of the year, is given to Xcel.
    - For PV projects to be economically viable, it is important to ensure that solar power generated is valued at the site's retail electric rate. So, either it is net metered or, if the system is over 100 kW AC, it rarely puts any power onto the grid.

100 kW AC PV system sited on the Drummond School Roof (source Helioscope modeling). Array shown in blue. Orange areas shade the array during parts of the day. The PV array could be sited on other roof areas.



PV System Generation Estimate

Assumptions

- PV System Components Used in Modeling
    - Modules: Adani ASM-7-PERC 360 watt
        - High efficiency monocrystalline
        - PERC[1] modules
        - Tier 1 manufacturer
        - Made in India
        - Type of module currently being donate by the Couillard Solar Foundation's "Solar on Schools" program
    - Inverter AP Systems YC1000
        - Micro inverter, each inverter supplies three modules
        - Meets NEC 2017 rapid shutdown requirements
        - Includes module-level monitoring
        - 10-year warranty
        - Made in China
    - Modeled PV system size:
        - 117.7 kW DC - total DC rating of the PV modules
            - 327 PV modules
        - 99.9 kW AC - total AC rating of the PV inverters
            - 109 Inverters
    - Shading estimates from Helioscope modeling tool
        - Obstacle (mainly from the elementary school gym and some rooftop mechanicals) shading: 2%
        - PV system inter-row shading: 0.4%
        - Total shading: 2.4%
    - Monthly snow-cover and soiling loss estimates (estimated by the author). Shown as the share of the month the panels are covered

January	65%
February	65%
March	25%
April to October	2%
November	10%
December	50%

[1] Passivated Emitter and Rear Cell is a newer PV cell technology aimed to achieve higher energy conversion efficiency by adding a dielectric passivation layer on the rear of the cell.

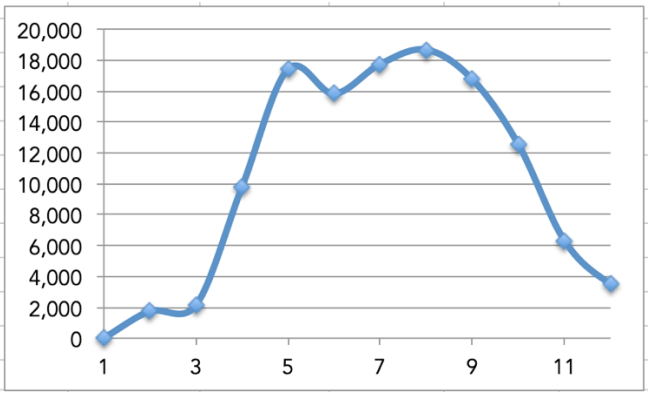
- Solar resource data - Used in Helioscope
    - Using Ironwood, Michigan National Renewable Energy Laborator (NREL) Typical Meterological year (TMY)3 data solar radiation data
    - Located ~50 miles from Drummond
- PV system electricity generation
    - 125,108 kWh/year
    - PV system effectiveness (kWh/kW DC): 1,062.8

The PV System's Expected Monthly and Annual Generation

	Grid (kWh)
January	1,746
February	2,147
March	9,792
April	17,427
May	15,842
June	17,757
July	18,686
August	16,775
September	12,558
October	6,333
November	3,529
December	2,517
Annual	125,108

The school has a white roof. This increases the amount of light on the roof significantly. This will result in increased solar energy production. Solar modeling tools do not model the impact of white roof tops. Thus, this analysis assumes a standard roof.

The PV System's Expected Monthly Generation (kWh/ month) over 12 months, January to December.



The Site's Electricity Use and Estimated Solar PV Generation

Drummond School's Electricity Use (2018/2019) Expected Solar Generation and Net Use after the Solar Generation

	Current Power Use (kWh)	Solar Generation (kWh)	Power Use after Solar (kWh)
January	43,040	1,746	41,295
February	43,840	2,147	41,693
March	37,280	9,792	27,489
April	38,880	17,427	21,453
May	38,720	15,842	22,878
June	32,000	17,757	14,243
July	26,400	18,686	7,714
August	28,320	16,775	11,545
September	32,320	12,558	19,762
October	36,640	6,333	30,307
November	38,400	3,529	34,872
December	46,560	2,517	44,043
Annual	442,400	125,108	317,292
Percent Reduction			28%

Incorporating in the Energy Efficiency Measures, assuming the energy efficiency reduces the school's electricity use each month by 30%.

Drummond School Electricity Use from 2018/2019, including an Estimated 30% Electricity Savings from Implementing the Energy Efficiency Measures, Expected Solar Generation and Net Electricity Use after the Solar Generation and Energy Efficiency Investments.

	Current Power Use (kWh)	Expected Savings from EE (kWh)	Power Use after EE (kWh)	Solar Generation (kWh)	Power Use after EE and Solar (kWh)
January	43,040	12,912	30,128	1,746	28,383
February	43,840	13,152	30,688	2,147	28,541
March	37,280	11,184	26,096	9,792	16,305
April	38,880	11,664	27,216	17,427	9,789
May	38,720	11,616	27,104	15,842	11,262
June	32,000	9,600	22,400	17,757	4,643
July	26,400	7,920	18,480	18,686	(206)
August	28,320	8,496	19,824	16,775	3,049
September	32,320	9,696	22,624	12,558	10,066
October	36,640	10,992	25,648	6,333	19,315
November	38,400	11,520	26,880	3,529	23,352
December	46,560	13,968	32,592	2,517	30,075
Annual	442,400	132,720	309,680	125,108	184,572
Percent Reduction		30%		28%	58%

Note, as modeled above, only in July is the school a net solar energy producer (putting a surplus of power onto the grid). However, because much of the EE savings are from lighting, which will not be used during the summer months, it is unlikely that the school will be a net energy producer during any month of the year.

Data Used and Assumptions in Financial Modeling

<u>Xcel Electric Rates</u>

CG-7 General TOD Service-Sec, secondary voltage rate

- See Annex 4

Usage (kWh) charges

Rate	Off peak electricity use ($ per kWh)	Business day electricity use 9 am to 9 pm ($ per kWh)	
		Summer	Winter
CG 7	$0.05602	$0.07521	$0.07021

Demand (kW) Charges

	$/month kW		
Annual	$0.5		
	Summer $/kW		Winter $/kW
Monthly	13.00		11.00

There are two components of an electric bill that vary with the site's power use:

- Electricity usage charge – measured in kilowatt hours (kWhs), which is the amount of electricity used over the billing period
- Electricity demand charge – measured in kilowatts (kW), which is the site's peak electricity use during any 15-minute period over the last month (during on peak periods) and during the last year during (during on and off-peak periods)

Parallel Generation (net metering) rate PG-1

- See Annex 3
- Net metering for PV systems of 100 kW AC and under
- No customer charge or other fees

<u>Value of Solar Generation: CG-7 and PG-1 rates</u>

Estimated using hourly PV Watts data for Iron Wood MI and the CG-7 tariff schedule.

Electricity usage (kWh) value:

- Array facing due south 10° tilt: 6.723 cents/kWh

Electricity demand (kW) Value
Weighted average monthly (based on expected generation): $ 11.95/kW
Annual demand savings: $0.50/kW

Estimated Value of Demand Savings
- Monthly: 15% of the kW DC rating of the PV system
- Annual: 10% of the kW DC rating of the PV system

There is a Dane County School with limited summer use, but with air conditioning that over the last five years has reduced its monthly demand charges by 25% of the PV system's DC rated capacity and reduces annual demand charges by 30% of the PV system's DC rated capacity.

To better estimate the demand charge reductions, it is best to model the PV system's expected 15-minute power generation and compare it to the site's 15-minute power use from a recent 12-month period. The 15-minute data can be requested from the electricity provider (i.e., Xcel).

System Cost

Roof ballasted racking mounted: $1.85/watt

- Pricing does not include
    - Extended warranty for inverters
    - Unusual Xcel interconnection costs
    - Local government costs including staff, consultants, legal review, etc.
    - Large unforeseen site expenses (e.g., electrical panel/system upgrade, roof structural issues, etc.)

Incentives

- Couillard Solar Foundation, Solar on School's program
    - Website: couillardsolarfoundation.org
    - Need to request grant from the Foundation
        - Recommend getting the agreement in writing in the form of a memorandum of understanding (MOU)
    - Donate six pallets of PV modules to PV systems of ~100 kW AC
        - Assuming, 27 modules/pallet: 162 PV modules total

        - Assuming 360 watts/module: 58.32 kW DC total
        - Estimated value: $27,000
- Focus on Energy Renewable Energy Competitive Incentive Program (RECIP)
    - Website: www.focusonenergy.com/RECIP
    - Competitive grant program – can choose funding level. However, the more funding requested, the lower the chance of the project being funded
        - Need to apply for the grant
        - Three grant rounds per year
    - In the last round (winter 2019) under 50% of the applications were funded
    - Assuming the RECIP covers 20% of the PV systems cost
- The Wisconsin Office of Energy Innovation (OEI) (formerly the state's energy office) operates the Energy Innovation Grant Program.
    - OEI may issue a grant round in 2019
    - Website:psc.wi.gov/Pages/Programs/OEI/EnergyInnovationGrantProgram.aspx
    - US made components are required, which increases project costs, and the grant approval process has been very slow
    - This analysis assumes no OEI funding

Other General Modeling Assumptions

- System output degradation: 0.5%/year
- General inflation: 3%/year
- Energy cost inflation: 2.5%/year
- Discount rate for the local unit of government: 3%
    - Used only in Net Present Value (NPV) calculation
- Pounds CO_2 emitted per kWh of conventional power generated: 881 pounds/kWh (Source: Xcel 2016 Corporate Responsibility Report)

Annual Costs

- Insurance: 0.35% of system cost
- Operation and Maintenance: 0.25% of system cost
- Replacements: 0.1% of system cost

Inverter replacement costs

- Year 20, 0.5% of system cost

- Year 25, 0.25% of system cost

Loan/financing/bonds

- Interest rate: 3.5%
- Term: 20 years

Financial Analysis

Financial Definitions

Simple Payback Period

- Defined as: The system cost less all incentives, including depreciation benefits, divided by year one bill savings
- Does not include maintenance, insurance, output degradation, increased value of power production, etc.

Years to Cost Recovery

- The year the system's cumulative cash flow goes positive
- Includes: electric price changes, output degradation, maintenance and insurance costs, etc.

Internal Rate of Return (IRR)

- Definition 1: The actual return provided by the project's cash flows
- Definition 2: The interest rate at which the net present value of all the cash flows (both positive and negative) from a project or investment equal zero
- Can be used to compare other investment returns

Discounted Net Present Value (NPV)

- The difference between the discounted value of cash inflows and the discounted value of cash outflows
- Discounting uses the discount rate, the discount rate is
    - The percentage that each future year's cash inflows and outflow are reduced to reflect the time value of money

Analysis Results with PV System Ownership by the District

The District pays the full cost of the PV system and owns, operates, maintains and insures the PV system. The project's State and Federal tax benefits are not monetized.

Energy Production and Costs	
Production	
Solar electric systems rated module capacity (kW DC)	117.70
Estimated output year one (kWh/year)	125,108
Cost	
Estimated installed cost	$217,745
Focus on Energy Incentive	$43,549
Couillard Solar Foundation Donation	$27,000
Total Grants and Donations	$70,549
Loan Amount	$147,169
Total Loan, Grants and Donations	$217,745

Year-one CO_2 reduction	55.1	Tons
Simple payback period	13.4	Years
Years to cost recovery	11	Years

Year	IRR	Discounted NPV
10	2.5%	$(99)
15	17.5%	$5,521
20	21.8%	$14,559
25	25.5%	$51,757
30	26.3%	$86,839

Sensitivity Analysis

Significant Assumption include:

- System price
- Electric escalation rates
- Financing interest rate
- Demand savings

System Price Sensitivity Analysis

	Optimistic < ---------- > Pessimistic			
System Price	$1.75/kW DC	Base Case $1.85/kW DC	$1.95/kW DC	$2.05/kW DC
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20 Year IRR	Can not be determined	788.4%	47.2%	21.8%
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Electricity Price Sensitivity Analysis

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Electricity Escalation Rate/Year	3.5%	3%	Base Case 2.5%	2%
20 Year IRR	37.1%	29.7%	21.8%	12.5%
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Financing Interest Rate Sensitivity Analysis

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Financing Interest Rate	3%	Base Case 3.5%	4%	4.5%
20 Year IRR	49.6%	21.8%	10.7%	3.3%

20 Year NPV	$21.461	$14,559	$7,493	$264

Demand Savings Sensitivity Analysis

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Demand savings	17.5% Monthly 12.5% Annual	Base Case 15% Monthly 10% Annual	12.5% Monthly 7.5% Annual	10% Monthly 5% Annual
20 Year IRR	49.6%	21.8%	9.9%	1.3%
20 Year NPV	$22,726	$14,559	$6,393	-$1,774

Best Case Scenario

With these assumptions:

- System price: $1.75/kW DC
- Generation: 1,169 kWh/kW DC
- Electric escalation rates: 3%/year
- Financing interest rate: 3%
- Demand savings: 17.5% Monthly and 12.5% Annual

Financial Metrics

- 20 Year IRR: Cannot be determine, cashflow positive from year one
- 20 Year NPV: $57,004

Worst Case Scenario

With these assumptions:

- System price: $1.95/kW DC
- Generation: 1063 kWh/kW DC
- Electric escalation rates: 2%/year
- Financing interest rate: 4%

Demand savings: 12.5% Monthly and 7.5% Annual

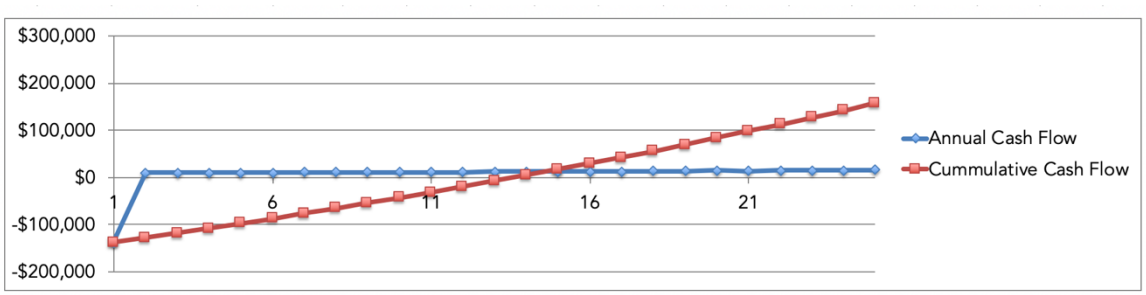
Financial Metrics

- 20 Year IRR: cannot be calculated, negative from year 2 to 20
- 20 Year NPV: -$20,664

District Ownership, without a Loan

Simple payback period	13.4	Years
Years to cost recovery	14	Years

Year	IRR	Discounted NPV
10	-6.8%	-$58,647
15	1.5%	-$17,734
20	4.9%	$21,749
25	6.6%	$58,947
30	7.5%	$94,029



Co-owned with Third Party Participant (TPP) Investors

Note: that some Wisconsin utilities do not currently allow third party co-owned PV systems (e.g., We Energies).

Bill Bailey contacted Xcel Energy, Deborah Erwin, Manager Regulatory Policy, about Xcel's position on third- party ownership. A few excerpts from her response:

- The issue with third party ownership is a legal issue, and isn't ultimately Xcel Energy's call.
- The question is whether the third party owner would meet the legal definition of a public utility, and if they do, then third party owned projects within any other public utility's service territory are problematic and potentially invalid…
- I can't give you any comfort that any of these arrangements will be "ok" at the end of the day.
- I would not recommend pursuing third party ownership at this time.

There is currently a docket open at the Public Service Commission of Wisconsin and an ongoing court case underway on this topic. As of 2019, Focus on Energy is unwilling to fund such projects unless there is a letter of support (or similar) from the site's electric provider.

The TTPs are outside investors that own, operate, maintain and insure the solar PV system. They receive the project's tax benefits and energy service payments from the local government through the term of the Energy Services Agreement. The TPP sells the system to the local government any time between then end of year 7 and 25.

- The District is the "Applicant" for purposes of the Wisconsin Public Service Commission's Distributed Generation Application Form and the local electric utility
- The project is largely owned by an LLC entity created solely for this project and in order to monetize the tax benefits
- The District's co-ownership is often paid by the Focus on Energy grant and/or another grant
- The District's co-ownership is typically between 10% and 25% of the PV system.

- The District is a party to a co-ownership agreement with the LLC entity and is a member of the board that manages the operation of the project
- The LLC Entity enters in to a services agreement with the District that may provide:
    - The solar power (kWh and kW benefits from the PV system
    - Building energy management services to increase the energy efficiency of government buildings;
    - Solar energy system services for design, installation, operation, and for delivery of solar energy;
    - Informational services, including background information and data kiosk support.
- The services agreement incorporates a fixed monthly service fee (annual fee adjustments, in some cases, may apply)
- At the end of the contract term, the District may either purchase the solar PV system or ask it to be removed by the TTP (at the TPP's cost)
- The District is not required to purchase the PV array
- The District's purchase cost must be greater or equal to the residual value of the PV system (IRS requirement)
- It is recommended that the District entering a contract with a TPP has legal representation

Risk

Risk Matrix – who carries each risk

	PV System Owned by Local Government	PV System Co-owned with TPP
Installation Risk	Local Government	TPP
Technology Risk	Local Government	TPP Local Government after taking ownership
Solar Resource/Power Production Risk	Local Government	TPP[2] Local Government for large acts of nature[3]
O&M Risk	Local Government y	TPP Local Government after taking ownership
Regulatory Risk	Local Government	TPP

[2] For normal variations of the solar resource

[3] For example, major volcanic events or geo-engineering/cloud seeding

		Local Government after taking ownership
Natural Disaster Risk	Covered by insurance	Covered by insurance

Additional assumptions

- Upfront fees
  - Permits, property insurance, Xcel fees: $1,650
  - Legal, general liability, construction loan interest: $5,300
  - Development fee: $10,304
- Developer's
  - Discount rate: 5%
  - Federal tax rate: 25%
  - State tax rate: 5%
- Ongoing fees - O&M, property and general liability insurance, tax prep:
  - Year 1 and 2: $4,230/year
  - All other years: $3,030
- Non capitalized costs, checking account, organizational legal, accounting fees, loan fees, DFI fee, bank fees, etc.: $2,878
- Year 12 Buyout price: 27% of system cost less Focus on Energy Grant and CSF donation: $39,743
- Developer's
  - Loan interest rate: 4.5%
  - Loan term: 12 years

Results

Project entity's loan amount: 59.5% of total capitalized investment or $97,848
Debt service coverage ratio: 1.3
Year one payment/kWh: 10.3 cents/kWh

Financial Metrics

	NPV	IRR
20 year	$ 6,768	7.2%
25 year	$ 32,204	11.5%
30 year	$ 56,374	13.2%

Annex 1: Roof Warranty

DURO-LAST®

20-Year NDL Warranty

Warranty No. IA149 7348

I. TERMS and CONDITIONS

Duro-Last®, Inc., ("Duro-Last") grants this No-Dollar Limit ("NDL") Warranty to the owner of a building ("Owner") containing a **Duro-Last Roofing System ("Duro-Last System")** installed by a Duro-Last Authorized Dealer/Contractor ("Contractor"), subject to the terms and conditions and limitations contained herein.

Duro-Last's obligation during the 1st through 20th year shall be to repair any leak in the Duro-Last System caused by any defect in a component of the Duro-Last System or by the workmanship of the Contractor, but only as the workmanship relates to the installation of the Duro-Last System itself and not as it relates to other work performed, if any. Duro-Last's obligation includes, at Duro-Last's discretion, either the repair or replacement of part or all of the Duro-Last System and also includes the furnishing or cost of labor to repair the Duro-Last System provided the following conditions are met:

A. Duro-Last and Contractor have been paid in full for the Duro-Last System, its installation and any outstanding invoices issued by Duro-Last that arise after the installation;

B. The Duro-Last System has been approved by Duro-Last following inspection by an authorized Duro-Last Quality Assurance Technical Representative ("Duro-Last QA Tech Rep"), this No-Dollar Limit Warranty has been signed by a Duro-Last QA Tech Rep or Quality Assurance Manager, and the Contractor confirms that the Duro-Last System was installed in accordance with Duro-Last's specifications and written installation requirements;

C. The Owner has notified Duro-Last within 14 days of the discovery of any leak, failure or other alleged Duro-Last System defect. Owner must notify Duro-Last by calling the Duro-Last Quality Assurance Department at 1-866-284-9424, by e-mailing ws@duro-last.com, or by certified mail, return receipt requested;

D. The Owner allows Duro-Last's QA Tech Rep(s) and/or Duro-Last Contractor(s) access to the roof including, if necessary, the removal and replacement by Owner at Owner's expense any and all obstructions, including but not limited to: rooftop gardens, earth, soil, pavers, ballast, decks, patio and walking surface materials, photovoltaic system, and other overburden; and

E. Duro-Last authorizes the repair and, at Duro-Last's option, either Duro-Last's QA Tech Rep(s) or an authorized Contractor makes the repair.

II. OWNER'S RESPONSIBILITIES

The Owner is not entitled to recover under this No-Dollar Limit Warranty unless Owner exercises reasonable and diligent care in the maintenance of the Duro-Last System, including but not limited to inspecting and maintaining the Duro-Last System regularly and as needed, including after storms or natural disasters, and for removing any debris from the Duro-Last System, rooftop, and adjacent areas, and maintaining and keeping all drains in working order and clear of debris and other obstructions.

III. LIMITATIONS and EXCLUSIONS

A. This No-Dollar Limit Warranty does not apply to a Duro-Last System installed on a single-family residence.

B. Duro-Last shall not be liable for damages arising from defects in the design or construction of the building or roof assembly, including inadequate or insufficient drainage; nor shall Duro-Last be liable for any other products aside from the Duro-Last System.

C. Duro-Last is not liable for any Duro-Last System failure nor for subsequent damages arising from Acts of God or causes outside Duro-Last's control including, but not limited to:

1) Damage caused by fire, lightning, hurricane, gale, hail, tornado, flood, earthquake, animals, insects; or
2) Damage caused by accident, vandalism, intentional act, negligence or failure to use reasonable care, whether on the part of the Owner or another; or
3) Damage caused by any unauthorized modification to the Duro-Last System including, but not limited to: damage caused by unauthorized components used in installation or repair, by additional equipment or structures added to or made a part of the roof, by traffic, or by chemicals not normally found in nature or the like; or
4) Interior condensation and/or moisture entering the Duro-Last System through walls, copings, structural defects, HVAC systems, or any part of the building structure, including from adjacent buildings.

D. Duro-Last does not warrant the watertightness of metal products that are located outside of the termination of the Duro-Last membrane.

E. Duro-Last does not warrant against color change and/or pattern change and/or print change in the Duro-Last System.

F. Duro-Last shall have no liability under any theory of law for any claims, repairs, or other damages relating to the presence of asbestos or any vapors, fumes, molds, fungi, bacteria, spores, mycotoxins, or the like on or in the Duro-Last System or in the building or in the air or water serving the building.

G. This No-Dollar Limit Warranty is transferable to subsequent Owners only upon the express written consent of Duro-Last and at Duro-Last's sole discretion. Duro-Last reserves the right to require an inspection of the Duro-Last

OVER: CONTINUED ON BACK

System prior to transfer of this No-Dollar Limit Warranty. The Owner (undersigned below) must pay a $500 warranty transfer fee and must pay for any non-warranted repairs identified by Duro-Last during any pre-transfer inspection. A transfer of this No-Dollar Limit Warranty shall not be effective unless all outstanding Duro-Last invoices have been satisfied.

H. This No-Dollar Limit Warranty must be signed by a Duro-Last QA Tech Rep or Quality Assurance Manager. Coverage under the terms of this No-Dollar Limit Warranty begins on the Effective Date. The Effective Date is determined by Duro-Last. Failure of the Owner or Contractor to sign this No-Dollar Limit Warranty does not alter the Effective Date.

I. This No-Dollar Limit Warranty shall be governed by the laws of the State of Michigan without regard to principles of conflicts of law. Duro-Last and Owner hereby agree that the Circuit Court for the County of Saginaw, State of Michigan, or the United States Federal District Court for the Eastern District of Michigan in Bay City, shall have the exclusive jurisdiction to determine any and all disputes, or claims relating to this No-Dollar Limit Warranty and do hereby submit themselves to the sole personal jurisdiction of those Courts.

J. No claim, suit, or other proceeding arising out of or related to the Duro-Last products or these terms, including without limitation this No-Dollar Limit Warranty, may be brought by the Owner or anyone else after one (1) year from the date it accrues.

K. Duro-Last does not waive any rights under this No-Dollar Limit Warranty by refraining from exercising its rights in full in one or more instances.

THIS NO-DOLLAR LIMIT WARRANTY AND THE RESPONSIBILITIES AND REMEDIES STATED HEREIN ARE EXPRESSLY AGREED TO BY OWNER AND DURO-LAST AND CONSTITUTE THE SOLE WARRANTY AND REMEDIES OF THE OWNER FOR ANY ALLEGED DEFECT OR FAILURE OF THE DURO-LAST SYSTEM, WHETHER MEMBRANE, ACCESSORIES, OR CONTRACTOR WORKMANSHIP.

THERE ARE NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE (EITHER EXPRESS OR IMPLIED IN FACT, LAW OR CUSTOM) THAT EXTEND BEYOND THE EXPRESS TERMS STATED IN THIS NO-DOLLAR LIMIT WARRANTY TO THE FULL EXTENT DISCLAIMER IS PERMITTED BY LAW. OWNER AND DURO-LAST TOGETHER JOINTLY DISCLAIM ANY OTHER OR FURTHER WARRANTIES EXCEPT THOSE INCLUDED IN THIS DOCUMENT. IN ANY EVENT, ANY IMPLIED WARRANTY THAT MAY ARISE BY LAW IS LIMITED IN DURATION TO THE TERM HEREIN. THE REPAIR OR REPLACEMENT PROVIDED HEREIN IS EXCLUSIVE AND IN LIEU OF ALL OTHER REMEDIES. DURO-LAST WILL HAVE NO LIABILITY TO ANYONE FOR CONSEQUENTIAL, SPECIAL, INCIDENTAL, INDIRECT, EXEMPLARY, OR PUNITIVE DAMAGES OF ANY KIND WHATSOEVER, INCLUDING WITHOUT LIMITATION PROPERTY DAMAGE, LOST PROFITS, LOST USE OR ANY OTHER PECUNIARY DAMAGE, WHETHER DUE TO ANY DEFECT IN THE PRODUCTS, BREACH OF THIS AGREEMENT, DELAY, NON-DELIVERY, NON-PERFORMANCE, RECALL, OR ANY OTHER REASON. ALL CLAIMS FOR NEGLIGENCE AND FOR FAILURE OF ESSENTIAL PURPOSE ARE EXPRESSLY WAIVED, RELEASED, AND EXCLUDED.

THERE ARE NO THIRD-PARTY BENEFICIARIES TO THESE TERMS. OWNER ACKNOWLEDGES THESE LIMITATIONS AND WAIVERS, DECLARES THAT THEY HAVE BEEN READ AND UNDERSTOOD, AND AGREES TO BE SO BOUND. ANY PAYMENT FOR THE DURO-LAST SYSTEM OR REGISTRATION OF THE WARRANTY WITH DURO-LAST SIGNIFIES THAT THE OWNER HAS VOLUNTARILY AND KNOWINGLY CONSENTED TO ALL TERMS.

The Contractor is not an agent of Duro-Last and does not have authority to bind Duro-Last. If any Contractor or sales representative made any statements about Duro-Last, its products, services, obligations, or warranties, those statements cannot be relied upon by Owner or any other party and cannot be attributed to Duro-Last. Furthermore, no person may change or modify any terms or conditions of this No-Dollar Limit Warranty, unless in writing and signed by the authorized representative of the Owner and by a Duro-Last officer or by the Duro-Last Quality Assurance Manager.

SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO SUCH A LIMITATION MAY NOT APPLY TO YOU. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS THAT VARY FROM STATE TO STATE. If any provision or individual term herein is invalid or unenforceable under any applicable law, the provision or term will be ineffective to that extent and for the duration of the illegality, but the remaining provisions and terms will be unaffected.

DURO-LAST®, INC.
525 Morley Drive
Saginaw, MI 48601

CHRISTOPHER COOK
QUALITY ASSURANCE SPECIALIST
Signature of Duro-Last QA Tech Rep or QA Manager

Drummond Schools
Name of Building

40 Eastern Ave
Address of Building

Drummond, WI 54832
City, State & Zip of Building

Entire flat Areas
Building Designation

8/24/12
Effective Date

400978
Serial No.

Signature of Owner

John Knight
Owner (printed)

Signature of Contractor

Nast Roofing
Contractor (printed)

111,071
Square Footage

IA 1497348
Warranty No.

DURO-LAST / DURO-TUFF / DURO-FLEECE / DURO-FLEECE PLUS / DURO-LAST EV
DL 20 YEAR NDL 4/2/15

Annex 2. Next Steps

1. Have roof approved to bear the weight of the PV array (expected array weight less than 5 pounds per square foot) by a Wisconsin Professional (structural) Engineer (PE).

Some PE's include:

- Strand Associates Inc., Madison WI, 608-251-4843, www.strand.com
- Brad Romport, Larson Engineering Inc., Appleton, WI, BRomportl@larsonengr.com
- Kirk Haverland PE, Larson Engineering Inc. Appleton, WI, 920-734-9867 KHaverland@larsonengr.com
- Agron Gjinolli, independent engineer, Madison WI, agron_gjinolli@hotmail.com, 608-371-3726

2. Apply for the Focus on Energy Renewable Energy Competitive Incentive Program (RECIP) (three funding rounds per year)
    - For more information: www.focusonenergy.com/RECIP

3. Apply for the Solar on Schools PV module donation by contacting the Couillard Solar Foundation
    - Contact information: couillardsolarfoundation.org/solar-on-schools/

4. Check with Xcel on interconnection costs

5. As needed, complete the 15-minute site use and solar generation analysis (for sites on demand meters) to more accurately determine demand savings

    - Xcel recently notified the Project Team that they do not collect the 15-minute data for this school. In this case, the Project Team recommends investing $700-$1000 to install an eGauge energy monitoring system (or similar). The school's energy use for a full year (or even from mid-summer 2019 to mid-winter 2019/20) would be useful for the energy analysis.

6. Issue the installation RFP

7. Re-run financial analysis with updated costs, savings, grant amounts, etc.

8. Make final installation decision

9. Install the PV system

Annex 3. Xcel Energy, PG-1, Net Metering Electric Rate

NSP **NORTHERN STATES POWER COMPANY WISCONSIN**

REVISION: 9 SHEET NO. E 55

SCHEDULE Pg-1

WISCONSIN ELECTRIC RATE BOOK VOLUME NO. 7 AMENDMENT NO. 750

PARALLEL GENERATION - NET ENERGY BILLING SERVICE

Effective In All territories served by the Company.

Availability Available to any retail electric customer with customer owned renewable resource generation of 100 kW or less per site for purpose of operating generation interconnected with Company's system, where customer's delivery offsets retail electric consumption at the same site. If a customer has more than one electric generator on a site, the generators' ratings shall be summed and the sum may not exceed 100 kW per site. For purposes of determining compliance with this paragraph, N
generator size shall be determined based on the alternating current (AC) nameplate rating of the N
generator or inverter, as applicable. N

Renewable resource generators include generating systems which exclusively utilize wind,solar photovoltaic, wood or wood waste, refuse derived fuel, biogas, or hydro-electric generators that must meet the renewable resource definition contained in Wisconsin Statute 196.378. Renewable resource generation equipment must be located on the customer's premises serving only the customer's premises.

Monthly Energy Credit

1) A retail electric customer generating power with renewable resource facilities shall be billed monthly on a net energy basis. The retail electric customer may offset electricity usage measured on a single retail electric meter located at the same site each month on a net energy basis. For customers served under a Time of Use metered service, on-peak period generation shall only offset customer's on-peak period consumption. Off-peak period generation shall only offset customer's off-peak period consumption. For customers served under a non-Time of Use metered service, all generation shall offset customer's consumption, regardless of Time of Use.

2) Generation produced by Customer's facility and delivered to the Company in excess of Customer usage will be carried forward from month-to-month until the end of the calendar year in which the excess generation is produced. Customer usage in any given month will be netted against the outstanding generation balance(s).

3) At the end of the calendar year any excess generation will be netted against any usage not already offset during the calendar year. Customer will receive a credit for generation that is netted against any usage not already offset during the calendar year at the customer's retail rate. If customer receives retail service on a Time of Use basis, then customer will receive credit for any remaining generation balance after this netting at the appropriate (either on-peak or off-peak) Pg-2A service rate. If customer receives retail service on a non-Time of Use basis, then excess generation at the end of the calendar year, shall be compensated at the Pg-2A service using the weighted average of 34.8% of the on-peak Pg-2A rate and 65.2% of the off-peak Pg-2A rate.

4) This credit will be issued to the customer in the form of a check. Any credit balance $2.00 or less in value will be applied to the customer's account.

(continued)

ISSUED: December 26, 2017
EFFECTIVE: For service rendered on and after January 1, 2018.
PSCW AUTHORIZATION: Order in Docket No. 4220-UR-123 dated December 21, 2017.

PARALLEL GENERATION - NET ENERGY BILLING SERVICE (cont'd)

Special Rules

1) Customer's generation facility shall be permanently connected to only those facilities receiving service under schedules with similar rate designs. Customer shall not switch the generation between two or more rate schedules. This tariff applies only to the energy generated by Customer's renewable resource generation facilities.

2) Customer shall retain all renewable credits and other attributes associated with the energy provided to the Company pursuant to this tariff.

D

Energy Cost Adjustment Energy Payments based on retail energy rates are subject to the adjustment provided for in Energy Cost Adjustment. See Schedule X-1, Sheet No. E 63.

Late Payment Charge A one percent (1%) per month late payment charge will be applied to outstanding charges unpaid 20 days after the date of billing.

Terms and Conditions of Service See Schedule PG-3.

ISSUED: December 23, 2015
EFFECTIVE: For service rendered on and after January 1, 2016.
PSCW AUTHORIZATION: Order in Docket No. 4220-UR-121 dated December 23, 2015.

Annex 4. Xcel Energy, CG-7, Time of Day General Commercial Electric Rate

NSP **NORTHERN STATES POWER COMPANY WISCONSIN** | REVISION: 5 | SHEET NO. E 25.2
SCHEDULE Cg-7
WISCONSIN ELECTRIC RATE BOOK | VOLUME NO. 7 | AMENDMENT NO. 750

GENERAL TIME-OF-DAY SERVICE

Availability: Available to any non-residential customer for single- or three-phase electric service supplied through one meter where customer's demands are measured and where customer is not required to be on the Large General Time-of-Day service, Schedule Cg-9. This service is mandatory for customers that meet the above criteria and Time-of-Day metering is available. Other customers may select this service on an optional basis, if Time-of-Day metering is available.

Any customer that chooses this rate schedule as an option to other available rate schedules waives all rights to any billing adjustments arising from a claim that the bill for the customer's service would be less on any alternative rate schedule for any period of time.

Kind of Service: Alternating current at the following nominal voltages:

(a) Secondary Voltage Service– three-wire single-phase and three- or four-wire three-phase at 208 volts or higher;
(b) for Primary Voltage Service– three-phase at 2400 volts or higher.

Service voltage available in any given case is dependent upon voltage and capacity of existing Company lines in vicinity of customer's premises.

Rate:

Customer Charge per Month	$ 42.00		
Demand Charges per Month per kW			
On-peak Demand	Secondary Voltage	Primary Voltage	
June—September	$ 13.00	$ 12.35	R
October—May	$ 11.00	$ 10.45	R
Distribution Demand	$ 0.50	$ 0.30	N
Energy Charge per kWh	June to September	October to May	
On-Peak Secondary	7.521 ¢	7.021 ¢	R
Off-Peak Secondary	5.602 ¢	5.602 ¢	R
Energy Charge Discount (before Energy Cost Adjustment and Energy Charge Credit) Primary	2.0 %		
Energy Charge Credit per Month			
All kWh in Excess of 400 Hours times the On-Peak Billing Demand	1.50 ¢		R

Energy Cost Adjustment: Bills subject to the adjustment provided for in Energy Cost Adjustment. See schedule X-1, Sheet No. E 63.

Non-Demand Billing Option: Customers with a measured 15-minute demand of less than 25 kW for twelve consecutive months will have the option of transferring to either the Small General Service (Schedule Cg-2) or the Small General Time of Day Service (Schedule Cg-1).

(continued)

ISSUED: December 26, 2017.
EFFECTIVE: For service rendered on and after January 1, 2018.
PSCW AUTHORIZATION: Order in Docket No. 4220-UR-123 dated December 21, 2017.

GENERAL TIME-OF-DAY SERVICE (continued)

Billing Demand Limit: In no month will the on-peak billing demand be greater than the value in kW determined by dividing the kWh sales for the billing month by 100 hours.

Definition of Peak Periods: Unless specified to the contrary in writing by the Company to any customers using this schedule and refiling this rate sheet not later than November 1 of each year, on-peak hours shall be from 9:00 a.m. to 9:00 p.m. Monday through Friday, inclusive (excluding holidays), for the twelve months beginning with the first full billing period following December 15. The holidays designated shall be New Year's Day, Good Friday, Memorial Day, Independence Day, Labor Day, Thanksgiving and Christmas, on the day nationally designated to be celebrated as such. When a designated holiday occurs on Saturday, the preceding Friday will be considered an off-peak day. When a designated holiday occurs on Sunday, the following Monday will be considered an off-peak day.

Off-peak hours are times not specified as on-peak hours.

Determination of On-Peak Billing Demand: The On-Peak Billing Demand in kilowatts will be the greatest Current Month On-Peak Period Demand, rounded to the nearest whole kW. The On-Peak Billing Demand will be adjusted for power factor, when customer's measured demand is greater than 100 kW for four of twelve months. When customer's measured demand remains below 100 kW for twelve consecutive months Power factor adjustment is discontinued.

Current Month On-Peak Period Demand: The Current Month On-peak Period Demand shall be the greatest 15-minute load, adjusted for power factor, which occurs during any on-peak hours. The Company, at its sole discretion, has the option of adjusting Current Month On-peak Period Demand if the Power Factor Adjustment provides a significant and unintended bill increase for a customer new to this service.

Power Factor Adjustment for On-Peak Period Demand: When the average on-peak power factor is less than 90%, the On-Peak Billing Demand shall be determined by multiplying the greatest 15-minute load during the on-peak period by 90% and dividing the product thus obtained by the Average On-Peak Power Factor expressed in percent.

Distribution Billing Demand: The distribution billing demand shall be the customer's greatest 15 minute load, regardless of time-of-day and not adjusted for power factor, which occurred during the past 12 months, including the current month. In no month will the distribution demand be greater than the value in kW determined by dividing the kWh sales for the billing month by 100 hours. N N N N

Average On-Peak Power Factor: The Average On-Peak Power Factor is defined to be the quotient obtained by dividing the on-peak kilowatt-hours used during the month by the square root of the sum of the squares of the on-peak kilowatt-hours used and the lagging reactive kilovolt-ampere-hours supplied during the same on-peak period. Any leading kilovolt-ampere-hours supplied during the on-peak period will not be considered in determining the Average On-Peak Power Factor.

(continued)

ISSUED: December 26, 2017.
EFFECTIVE: For service rendered on and after January 1, 2018.
PSCW AUTHORIZATION: Order in Docket No. 4220-UR-123 dated December 21, 2017.

GENERAL TIME-OF-DAY SERVICE (continued)

Commercial Load Control Rider: A monthly credit is available, on an optional basis, for company control of all or part of customer's load during company's interruption periods.
(See Rate Sheet No. E24.50)

Monthly Minimum Charge: The customer charge.

Term of Agreement: One year or longer as provided in General Rules and Regulations.

Late Payment Charge: A one percent (1%) per month late payment charge will be applied to outstanding charges unpaid 20 days after the date of billing.

Rate Code:

B15 General Time of Day Service

ISSUED: December 27, 2012
EFFECTIVE: For service rendered on and after January 1, 2013.
PSCW AUTHORIZATION: Order in Docket No. 4220-UR-118 dated December 27, 2012.