

# **Distributed Renewables in Northfield's Future**

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Executive Summary

This paper explores strategies to support carbon emissions reductions through distributed renewable energy (RE) installations, with a specific focus on how the local Northfield, MN government can employ these strategies. We recommend that the leaders of Northfield focus on reducing barriers to information about investment by creating a transparent permit system and clear grant, subsidy, and tax credit information all hosted on an accessible web page. Coupled with this, we recommend one or two members of the city government become local experts of funding opportunities for RE investments. We recommend Northfield transition all of its public buildings to RE, through CSG membership, individual installations, or through Xcel programs. Using savings from current and future investments, we recommend Northfield establish a Sustainability Revolving Fund that assists community members and organizations in their transition to RE. Finally, we offer long-term project ideas that may be appropriate for Northfield in the future.

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## I. Introduction

Northfield has already taken significant and commendable steps to reduce its carbon footprint by transitioning to renewable energy (RE). But increasingly severe

storms and flooding remind us that this is not the time to rest on our laurels. Further decarbonization makes significant environmental and economic sense, putting it in the category of a “no-regrets” choice, a choice in which the co-benefits for the current generation are so great that the choice can be justified without being certain of future climate change.<sup>1</sup>

Municipalities across the country have been working to transition their community to renewable energy and have experiences to offer. Some of the most effective pathways to encourage development include setting a renewable goal, incentivising investments, crafting local ordinances that are accommodating for renewables, transitioning publicly-owned buildings, and taking an active role in large renewable projects. Public investment strategies, like transitioning buildings, are arguably more difficult to implement, but they offer local governments a direct way to make a significant impact.

Northfield must consider policies to support both private and public investment. Our recommendations for private investment are: make permitting information more accessible, and set up a revolving fund for renewables development. For public investment we recommend Northfield install solar on key public rooftops and consider the opportunity for a microgrid project. While we acknowledge a range of viable RE technologies can support Northfield’s decarbonization goals, we primarily focus our recommendations on solar PV investment because this technology is financially within reach for distributed generation for more people, and is more flexible (e.g. with generator capacity).

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<sup>1</sup> No Regrets: Circles of Climate Change Adaptation. *Principles and Best Practices for Responding to Climate Change*. <http://www.circlesofclimate.org/>

This paper contextualizes RE in larger conversations about climate change and GHGs before considering historical and sociopolitical contexts for RE in Northfield. The paper discusses state and local context for future growth in the renewables sector, followed by policy examples from other jurisdictions. Finally, the work concludes with recommended policies to support Northfield's renewables sector and concerns for implementing new local policies.

## A. Environmental and Economic Opportunities

Energy generation plays a major role in climate change. Emissions from the energy sector, which includes fuel collection and electricity generation and fugitive emissions, composed 28% of American GHG emissions in 2016. Breaking down the sector by source explains its size: coal is the largest source, fueling 30% of U.S electricity generation. In Minnesota, the percent is even higher as coal generates 44% of electricity needs. The City of Northfield consumes 5.5 MW of energy annually<sup>2</sup>, which proportionally suggests 2.2 MW are fueled by coal. This does not include any private residences or businesses. In reality, Northfield may have a higher reliance on RE than the average city in Northfield, but any reliance on coal means Northfield is implicated in these emissions.

The city also has the power to reduce their reliance on coal by implementing energy conservation and transition strategies. Many local governments utilize conservation strategies as a “low-hanging fruit” to begin supporting a decarbonized future; however, conservation alone cannot address the carbon footprint of the energy sector because communities need electricity to maintain their standards of living.

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<sup>2</sup> Community Solar Powerpoint Presentation to the City of Northfield.

Accordingly, transitioning away from fossil fuels to RE is the overarching strategy for achieving significant GHG emissions reductions from the energy sector. Two of the most well-known options for transitioning to RE from fossil fuels are solar photovoltaic and wind turbine generators.

Transitioning to renewable energy offers significant economic and social benefits in the form of job opportunities. According to Greg Mast of Clean Energy Economy Minnesota, from 2015 to 2016 clean energy and energy efficiency jobs grew four times faster than any other job type in Minnesota.<sup>3</sup> Additionally, because distributed renewables are local, the green sector jobs they create also remain local. All Energy Solar is a solar installation company that employs locally and they would look to benefit from increased demand as a result of policy changes. Sustainable community development can also strengthen community identity. Cooperider & Fry note the psychological benefits to individuals by pursuing sustainability within a larger social infrastructure (such as the community network required to develop a community solar garden), noting that “as people come together to accomplish ‘doing good’...they activate their...mechanisms for flourishing”.<sup>4</sup>

## II. Current Renewable Energy in Northfield

Northfield has made significant strides in transitioning to RE through private investments and projects in solar, wind, and geothermal energies that are visible throughout the city. St. Olaf and Carleton colleges have both lead the way in distributed

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<sup>3</sup> Simmons, Daisy. *Clean Energy Jobs Are Booming in Minnesota*.  
<https://www.yaleclimateconnections.org/2018/02/clean-energy-jobs-are-booming-in-minnesota/>

<sup>4</sup> Cooperider D. and R. Fry. *Mirror flourishing and the positive psychology of sustainability*. Journal of Corporate Citizenship. 46: 3-12

renewables for liberal arts colleges nationwide, but Northfield residents' interest in RE cannot be understated. Rooftop solar installations occur frequently and the public interest in clean energy is evident in the Northfield public officials and creation of governmental bodies like the Environmental Quality Commission and Energy Task Force. This section will provide a brief overview of the energy action plan made by the Energy Task Force in 2008, and of the progress Northfield has made in solar, wind, and geothermal installations, and the projects currently being considered.

## A. Northfield's 2008 Energy Action Plan

The Northfield Energy Task Force group was formed to research and recommend strategies for strengthening Northfield's energy system in the face of a changing climate. The culmination of the initial work of the task force is "With Hope: A Resilient Community, An Action Plan for Northfield Area Energy Sustainability".<sup>5</sup> The report addresses four charges from the City Council, the last of which resulted in a 10-point climate action plan. Their recommendations focus on developing a culture of energy efficiency and conservation through city programs and coordinating with Xcel Energy. The report offered many ways to improve awareness and implementation of energy efficiency and conservation programs within the city government and greater community. Additionally, some of the recommendations sought to guide future action, including establishing a RE targets for Northfield and the surrounding townships. This paper builds upon their work and many of their recommendations are also included here. Looking back on the recommendations laid out in the report's energy action plan

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<sup>5</sup> Northfield MN energy Taskforce. *With Hope: A Resilient Community: An Action Plan for Northfield Area Energy Sustainability*. 2008. <http://wp.northfieldsustainability.org/wp-content/uploads/2014/09/MASTERETFReport-7-23-08.pdf>

that have yet to be achieved reinforces the need for a concerted effort to decarbonize Northfield's energy systems.

## B. Solar

Between private investment by homeowners and businesses and community-ownership models, there is a wide range of solar investments in Northfield. Private installations and community solar gardens are two mechanisms for introducing local distributed generation.

### 1. Rooftop and Yard Installations

Homeowners and businesses that wish to install solar privately are required to obtain a building permit and an electrical permit. Many in Northfield contract All Solar Energy, a company based out of St. Paul for the installation.<sup>6</sup> Xcel uses net metering, meaning producers can sell the surplus energy their solar panels generate to the grid and offset the energy they consume.<sup>7</sup> In 2015, 27 Northfield area residents and businesses participated in Solarize Northfield.<sup>8</sup> The program is offered through All Energy Solar and allows Northfield residents to purchase PV solar panels in bulk for a at a reduced rate tiered by the number of participants. Northfield participants contracted 211 kWh of solar placing them in tier five (>200 kWh), the highest tier possible. This reduced prices by 7% or about \$1,400 per home. Over their lifetime the panels will

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<sup>6</sup> Private conversation with Steve Horsman

<sup>7</sup> Xcel Energy. *Net Metering*.

[https://www.xcelenergy.com/programs\\_and\\_rebates/residential\\_programs\\_and\\_rebates/renewable\\_energy\\_options\\_residential/solar/available\\_solar\\_options/on\\_your\\_home\\_or\\_in\\_your\\_yard/net\\_metering](https://www.xcelenergy.com/programs_and_rebates/residential_programs_and_rebates/renewable_energy_options_residential/solar/available_solar_options/on_your_home_or_in_your_yard/net_metering)

<sup>8</sup> All Energy Solar. *Solarize Northfield*. <https://www.allenergysolar.com/solarizenorthfield/>



offset approximately 4,300 metric tons of carbon dioxide and are expected to save collectively over one million in energy costs.

## 2. Community Solar Gardens

The City of Northfield made a significant commitment to distributed renewables by hosting a community solar garden through an Xcel and Fresh Energy program. Solar community gardens allow all utility consumers to partake in renewable energy and removes the financial hurdles and homeownership prerequisites that normally accompany solar installation. All Xcel consumers can become subscribers to the community garden and receive a credit on their monthly utilities bill; it is also open to businesses and not-for-profit organizations in a pay-as-you-go or pay-up-front model. Solar gardens consist of large arrays of ground-mounted panels; one such is located on Holden Farms just northeast of Highway 19. This garden began operating in 2017 under Webster Holdco LLC (Plant # 60830) and all subscriptions are currently filled.<sup>9</sup> Northfield's role in acquiring the garden was far from passive. The Northfield Area Community Solar group lead by Erica Zweifel and Mary Jo Cristofaro organized a wide range of events to from a happy hour, multiple informal question and answer sessions at local venues, to a love Love Your Planet Weekend event that had over a hundred attendees. The group also publishes a newsletter to keep subscribers and potential subscribers informed.<sup>10</sup>

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<sup>9</sup> Energy Information Agency. Form 860M, acquired in 2017.

<sup>10</sup> Northfield Area Community Solar. <https://www.facebook.com/northfieldareacommunitysolar/>

In August 2017, the City of Northfield passed a motion to approve a subscription for 40% of the Brasee community solar garden.<sup>11</sup> This followed a review of proposals from three developers with gardens in Rice and surrounding counties. The subscription is for 1.5MW, which covers approximately 27% of the City of Northfield's total power usage (5.5MW)--the subscription can only be applied within Rice County which accounts for approximately 2.5MW of the city usage.<sup>12</sup> When considering only the portion of Northfield that falls within Rice County, the subscription covers 88% of energy usage. The subscription is expected to generate savings of up to 2.3 million over the 25 year contract based on projected annual Xcel rate change of 2.75%.

## C. Wind

The visibility and public support of wind energy in Northfield is unique among small midwestern towns. Northfield currently hosts three utility grade wind turbines. The first was constructed at Carleton in 2004 and connects to the Xcel electric grid in Northfield.<sup>13</sup> Subsequently, St. Olaf and Carleton have each constructed turbines that power their campuses directly. Currently wind generates 30-40% of the Carleton's electricity needs and 33% of St. Olaf's.<sup>14,15</sup> While all three turbines are owned by the colleges, the initial interest to explore the potential for wind included a wide range of parties including the Northfield School District, the City of Northfield, and a community

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<sup>11</sup> Conversation with Erica Zweifel.

<sup>12</sup> Community Solar Powerpoint Presentation to the City of Northfield.

<sup>13</sup> Carleton College. *The History of Carleton's First Wind Turbine*.  
[https://apps.carleton.edu/campus/facilities/sustainability/wind\\_turbine/](https://apps.carleton.edu/campus/facilities/sustainability/wind_turbine/)

<sup>14</sup> Carleton College. *Carleton's Second Wind Turbine*.  
[https://apps.carleton.edu/campus/facilities/sustainability/second\\_turbine/](https://apps.carleton.edu/campus/facilities/sustainability/second_turbine/)

<sup>15</sup> Gorman, David (2006) *"Let the Wind Blow": St. Olaf wind turbine is in place*.  
<https://www.stolaf.edu/news/index.cfm?fuseaction=NewsDetails&id=3484>

organization called Northfield ReNew. Public polling at the time indicated that Northfield residents were in favor of a wind project.<sup>18</sup>

## D. Geothermal

Carleton College is in the process of installing a geothermal array that will connect to a heat pump in the new science building and provide heating and cooling. Geothermal technology uses the relatively stable temperature of the Earth to heat and cool indoor air in the winter and summer. Heat pumps are 17 times more energy efficient than traditional electric resistance heaters because they move heat around rather than generating it.<sup>16</sup> They can heat or cool a house using the same principles of thermodynamics involving condensing and expanding that a refrigerator uses.

## E. Xcel Renewable Subscription Programs

The Northfield School district purchases their energy needs in RE generated off-site through Xcel Energy's Renewable\*Connect program.<sup>17</sup> According to superintendent Dr. Matt Hillman, "Renewable\*Connect offers stable pricing for the school district and aligns with our vision for sustainability and our belief in stewardship. We are proud to say 100 percent of our electrical needs are now being met through sustainable resources." This approach helps mitigate the natural variability of the resources that impact private investments and offers a lower-risk investment in RE

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<sup>16</sup>U.S Department of Energy. *Covered Product Category: Residential Water Heaters* as cited by DuVivier.

<sup>17</sup> News Service. *Xcel Energy : Local Wind and Solar Energy Now Powering Northfield Schools*  
<http://www.4-traders.com/XCEL-ENERGY-INC-13806/news/Xcel-Energy-Local-Wind-and-Solar-Energy-Now-Powering-Northfield-Schools-25147071/>

St. Olaf is close to reaching carbon neutrality in a large part due to its subscription to Windsource. Windsource is a program run by Xcel that allows consumers to pay a small additional amount, about \$0.01/kWh, to their energy bill each month to purchase their amount electricity needs in wind energy. The energy is generated by two utility-scale farms in Minnesota and feeds into the general grid.<sup>18</sup> On its own, St. Olaf supports a large portion of those farms as it is the largest consumer of Windsource in the state.<sup>19</sup>

## F. Bioreactor

Several years ago, Natural Systems Utilities approached the City of Northfield, Malt-O-Meal, Faribault Foods, Carleton College, and the local garbage collection service and proposed an anaerobic digester. Anaerobic digesters use organic waste to generate electricity. The discussions ended when Faribault Foods changed ownership. While wastewater can also be used to fuel anaerobic digesters, Northfield's wastewater treatment plant is located too close to a river protected by the Department of Natural Resources.<sup>20</sup>

## G. Looking Ahead

Northfield Area Community Solar is currently trying to work with the Community Action Network to install solar on the apartment building they lease as transition

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<sup>18</sup> Xcel. *Windsorce for Residences*

[https://www.xcelenergy.com/programs\\_and\\_rebates/residential\\_programs\\_and\\_rebates/renewable\\_energy\\_options\\_residential/windsorce\\_for\\_residences](https://www.xcelenergy.com/programs_and_rebates/residential_programs_and_rebates/renewable_energy_options_residential/windsorce_for_residences)

<sup>19</sup> Vandervee, Kari. *St. Olaf Celebrates Carbon-Free Electrical Power*. <https://wp.stolaf.edu/news/st-olaf-celebrates-carbon-neutrality>

<sup>20</sup> Interview with Glen Castore.

housing. The Economic Development Authority of Northfield is also currently considering 530 acres of land just west of St. Olaf for development. 90 acres of the land is owned by St. Olaf and the remainder is owned by three different families.<sup>21</sup> While it is not currently in the plans, this site could be used for future renewable development.

### III. Recommendations

In its CAP, Northfield has a significant opportunity to position itself as a leader in RE by developing a data-driven RE target and selecting strategies to support private and public investment. As a framework for all of the specific strategies, Northfield should select an aggressive RE target. As part of the Sierra Club's Ready for 100 initiative, 100 cities across the country pledged to be 100% renewable energy by 2050, with many aiming for 2030 or 2035. 5 cities have already achieved the goal.<sup>22</sup> A specific RE target can help cities effectively maintain motivation for clean energy investments.

When determined by a collective body of interested citizens, local government, and local businesses, a widely publicized commitment can also encourage a team effort toward the goal and increase accountability. Cities also can set additional short term goals to act as benchmarks: Del Mar has committed to transitioning to 50% renewable energy by 2020 and 100% by 2035.<sup>23,24</sup> Other cities have set additional goals for

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<sup>21</sup> *ibid.*

<sup>22</sup> Sierra Club. *100% Commitments in Cities, Counties, and States*. <https://www.sierraclub.org/ready-for-100/commitments>

<sup>23</sup> The benefit of short term goals is evident on a national scale emissions between the United States and Germany. While both countries have relatively similar long term goals of 80% emissions reductions by 2050, Germany has much more ambitious short term goals. While short term goals are certainly not the only contributor, Germany has made much more progress so far in emissions.

<sup>24</sup> City of Del Mar. *Del Mar Climate Action Plan*. <http://www.delmar.ca.us/DocumentCenter/View/2421/Final-CAP---Adopted-6-6-16-2> 3-9

transportation and heating to complement their goals for increasing reliance on renewably generated electricity. Cornish, New Hampshire has committed to 100% renewable electricity by 2030, and 100% renewable transportation and heating by 2050. More locally, Minneapolis committed to 100% renewable energy for municipal buildings by 2022 and 100% for the entire community by 2035.

Northfield's Energy Task Force already documents annual emissions, so this process could be used directly to inform an RE target or modified to obtain as comprehensive an analysis as possible.<sup>25</sup> A data-driven target based on energy consumed and currently generated by RE within Northfield will also help the city achieve decarbonization by establishing an overarching timeline, just as the Act did with the 2020 goal. Additionally, the city can turn to the target as a beacon and guideline when considering future policies or mandates, just as the 2013 legislation that promoted solar garden development.<sup>26</sup> RE targets also offer great publicity opportunities to garner support from within the community.

Using its RE target as a starting point, we recommend strategies for incentivizing investment, and for increasing both private and public installations. Regarding private investment, we recommend the city establish an online hub for information regarding how to transition to RE geared towards residential community members and businesses. We recommend Northfield install a solar panel on a city building such as the public library, which can act as a demonstrated commitment to the CAP as well as an educational tool for sustainability, physics, and engineering students. Additionally, we recommend the city transition other buildings to RE through a community

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<sup>25</sup> 05-2017 EQC Meeting Minutes. (Those for 2018 were not yet posted.)

<https://weblink.ci.northfield.mn.us/weblink/DocView.aspx?dbid=0,0,0&id=168250&page=1&cr=1>

<sup>26</sup> Eleff, Bob. *2013 Solar Energy Legislation*. <http://www.house.leg.state.mn.us/hrd/pubs/ss/ssssolarleg.pdf>

installation, or even through Xcel Energy's Renewable\*Connect program. Further, the city can use the CAP to document potential future strategies that can complement or extend the initial work to support RE. For example, we recommend that Northfield consider establishing a microgrid that could protect institutions like the hospital.

## A. Incentivizing Renewables

Local governments have ample options for incentivizing renewables. A commonly discussed strategy is a simple tax of carbon dioxide emissions to encourage widespread reductions. Carbon taxes are often discussed as a punitive strategy that is economically inefficient in that it makes no effort to minimize the cost of reductions for market participants; however, it is a comprehensive strategy in that it promotes 100% emissions-free production and treats all market participants as equally problematic for their emissions.<sup>27</sup> Governments can also offer tax credit to encourage smaller entities to invest, or make investments free from sales tax or property tax.

### 1. Create a Revolving Fund

Other municipalities have offered additional municipal incentives or tax credits to encourage renewable development. Since property taxes in Northfield are determined by county and a large enough incentive might be difficult on the city budget, we recommend Northfield create a Renewable Revolving Fund. A revolving fund finances upfront costs and is replenished from the savings accumulated from the project. This strategy has been successful in the city of Montpelier, Vermont. In 2016, they

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<sup>27</sup> Carbon Tax Center. *What's a Carbon Tax?* <https://www.carbontax.org/whats-a-carbon-tax/>

established a Net Zero Revolving Fund to fund renewable energy and energy efficiency projects as part of their broader goal to “Produce or offset all of their energy needs from renewable sources by 2030”. The fund has \$3,000 and is administered by city staff and the energy advisory committee. To apply the strategy to Northfield, it is necessary to consider who would administer the fund and how it would be funded; since the Economic Development Authority of Northfield currently administers the Downtown Development Revolving Fund and a City-Wide Revolving Fund, they may be the most experienced group to implement a Renewable Fund.<sup>28</sup> The initial source of funding will determine the size and capability of the fund. We recommend Northfield initiate a sustainability revolving fund with the savings the city is expected to earn from its solar garden subscription (\$70,000 to \$80,000 over the contract period) and add additional savings from projects affiliated with the CAP.<sup>29</sup> While this would remove these savings from other programs, the revolving fund could create a sustainable funding source for Northfield’s future projects.

## B. Strategies to Support Private Investment

Municipalities have significant influence on the transition to renewable energy by private investors. Municipal codes, permitting policies, and the presence or absence of financing programs can be a deciding factor for individual homeowners and businesses looking to go solar. To promote renewables many municipalities focus their efforts on solar energy, as it is the most attainable form of distributed generation for commercial and residential consumers. Routes available to local governments to increase privately-

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<sup>28</sup> City of Northfield. *EDA Grants and Loans*. <https://www.ci.northfield.mn.us/753/EDA-Grants-Loans>

<sup>29</sup> Interview with Erica Zweifel



owned solar include crafting solar-friendly laws including permitting, land-use policies, and zoning codes, and offering financial incentives or financing options. Both of these routes are most effective when the updates and incentives are communicated to the community in an accessible way.

## 1. Making Local Ordinances Solar-friendly and Accessible

Local permitting processes have been blamed for adding an average of \$2,516 to residential solar installations in the U.S. or about half the cost of a system.<sup>30</sup> This means municipalities like Northfield play a large role in making solar attractive. Costs that do not include the price of the technology are called “soft costs”. While the effect of soft costs on the quantity of solar installations has not been proven in studies, many national, state, and local governments operate with the logic that any additional permits costs or procedures that impede installation are detrimental. Germany even ventured to remove all permit requirements for solar unless it is proven to be warranted.<sup>31</sup> The U.S. does not have a national law on solar permitting and is unlikely to in the near future. Instead solar codes and permitting are regulated at the state and local levels.

Falcon Heights, Minnesota (pop. 5,500) offers an example of how municipal governments can use local regulations to promote solar development. When Falcon Heights reviewed their solar ordinance they identified several barriers to investment in their permitting and land-use policies. With the help of Minnesota Green Step Cities, a network of municipalities, including Northfield, that support best-practices for

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<sup>30</sup> SunRun Home. *The Impact of Local Permitting on the Cost of Solar Power Report*. <https://grist.files.wordpress.com/2011/07/solar-report-on-cost-of-solar-local-permitting.original.pdf>

<sup>31</sup> K.K. DuVivier. Chapter 19. Distributed Renewable Energy. In *Legal Pathways to Deep Decarbonization in the United States*, edited by Michael B. Gerrard and John Dernbach, forthcoming from Environmental Law Institute

sustainable development, Falcon Heights was able to make their solar ordinance more accessible.<sup>32,33,34</sup> They eliminated requirements for conditional-use permits and allowed solar systems to be a permitted accessory in all zones. According to their planning director, one of the most effective components of the project was a series of workshops in partnership with Metro Clean Energy Resource Team that covered solar basics and allowed solar owners to share their experiences with their neighbors. They also recommend that other communities hoping to do the same use the model solar ordinance provided by the Minnesota Solar Challenge and using the MN Solar App, an interactive geospatial program maintained by the University of Minnesota.<sup>35,36</sup>

There are many nonprofits dedicated to helping municipalities to improve their local solar permitting. Green Step Cities offers a “Grow Solar” Local Government Toolkit, which curates resources focused on supporting rooftop solar installations.<sup>37,38</sup> The Solar Friendly Communities, is a cohort of municipalities in Colorado similar to Green Steps that identified twelve best practices for solar permitting.<sup>39,40</sup> Our recommendations draw from both of these resources and tailor the best practices to fit Northfield.

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<sup>32</sup> Green Step Cities. *Best Practice Action 1. Renewable Energy*.

[https://greenstep.pca.state.mn.us/bestPracticesDetail\\_actions.cfm?bpid=25&aid=868](https://greenstep.pca.state.mn.us/bestPracticesDetail_actions.cfm?bpid=25&aid=868)

<sup>33</sup> City of Falcon Heights. *Ordinance NO. 13-05*. <https://greenstep.pca.state.mn.us/viewFile.cfm?id=1681>

<sup>34</sup> Clean Energy Resource Team. *Government Best Practices: MN Solar Challenge*.

<https://www.cleanenergyresourceteams.org/solarchallenge>

<sup>35</sup> Metropolitan Council. *Falcon Heights*. <https://metro council.org/Local-Planning-Handbook/Local-Planning-Highlights/Solar-Falcon-Heights.aspx>

<sup>36</sup> MN Solar App. <http://solar.maps.umn.edu/app/>

<sup>37</sup> Grow Solar. *Local Government Solar Tool Kit*. [https://www.growsolar.org/wp-content/uploads/2012/06/MinnesotaToolkitAug2017\\_Award-Banner.pdf](https://www.growsolar.org/wp-content/uploads/2012/06/MinnesotaToolkitAug2017_Award-Banner.pdf)

<sup>38</sup> SolSmart. *What is SolSmart*. <https://www.solsmart.org/how-we-help/what-is-solmart/>

<sup>39</sup> Solar Friendly Communities. *12 Best Practices: A Roadmap to a Solar Friendly Community*. <http://solarcommunities.org/12-best-practices/>

<sup>40</sup> Department of Energy. *A report on the impact of Solar Friendly Communities*. <https://www.energy.gov/sites/prod/files/2016/04/f30/Developing%20Solar%20Friendly%20Communities%20COSEIA%205690.pdf>

Northfield follows several of the best practices already; they offer system owners the ability to file a solar easement protecting their sunlight access to their solar panels and allow rooftop solar in all zones where buildings are permitted. There are detailed requirements for solar in the city ordinances. Smaller rooftop systems are regulated as accessory structures and require only a work and electrical permit. And community solar and commercial solar projects greater than 100 kW are restricted to agricultural land and are allowed under a conditional-use permit. Given this we have three recommendations for Northfield: congregate all solar information on one page in the city website, train with SolSmart, and consider adopting a simplified permit for rooftop solar developed by a nationally-recognized board of engineers.

## 2. Comprehensive Website

We recommend Northfield assemble all solar resources in single location on the Northfield website like the city of Rochester, MN.<sup>41</sup> The page would include a link to the Northfield Municode which we found to have the most up-to-date codes regarding solar installation. It should also have information of Xcel's interconnection standards and available rebate programs. Xcel's Solar Rewards program offers monthly payments to the system's owner in exchange for Renewable Energy Credits, which are linked to the energy produced by the system.<sup>42</sup> Northfield residents and businesses are also eligible for the federal Solar Investment Tax Credit which allows solar system owners to deduct 30% the cost of installing solar from their federal taxes. And the credits roll over if the

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<sup>41</sup> City of Rochester. *Solar Photovoltaic Systems*.  
<http://www.rochestermn.gov/home/showdocument?id=9666>

<sup>42</sup> Xcel Energy. *Solar\*Rewards*. [https://www.xcelenergy.com/vgn-ext-templating/v/index.jsp?vgnextoid=58f3ac65d8464510VgnVCM1000008d8298aaRCRD&vgnextchannel=58f3ac65d8464510VgnVCM1000008d8298aaRCRD&vgnextfmt=default&vgnextlocale=en\\_US](https://www.xcelenergy.com/vgn-ext-templating/v/index.jsp?vgnextoid=58f3ac65d8464510VgnVCM1000008d8298aaRCRD&vgnextchannel=58f3ac65d8464510VgnVCM1000008d8298aaRCRD&vgnextfmt=default&vgnextlocale=en_US)

owner does not have enough tax liability to claim the full credit. However 30% only applies if construction begins before 2019. After 2019, the credit is reduced to 26% in 2020 and 22% in 2021.<sup>43</sup> Northfield residents also qualify for Property Assessed Clean Energy (PACE). PACE is a program that helps homeowners finance renewable energy improvements. The program's approach is unique because it links the cost to the property and not the property-owners. Traditionally, homeowners who did not anticipate owning their property long enough for the savings to surpass the upfront costs might be hesitant to make expensive property improvements. With PACE the debt of the upfront cost is paid off as part of the property tax and can be transferred to new owners.<sup>44</sup> Northfield has information about PACE on their website already but it is located under the Economic Development tab and thus may be tricky to find. Additionally, panels installed before 2017, may still qualify for the Made In Minnesota rebate which offered between \$0.14-\$0.21/kWh for installations that used panels made in Minnesota. The program was repealed in 2017, but projects started during the programs four years can continue to receive incentive payments.<sup>45</sup> Finally, in Minnesota, solar installations are exempt from sales tax.<sup>46</sup> This page on solar could be just one link in a larger page on the city website for all renewable resources.

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<sup>43</sup> Solar Energy Industries Association. *Solar Investment Tax Credit (ITC)*.

<https://www.seia.org/initiatives/solar-investment-tax-credit-itc>

<sup>44</sup> ENERGY.GOV Office of Energy and Renewables. *Property Assessed Clean Energy Programs*.

<https://www.energy.gov/eere/slsc/property-assessed-clean-energy-programs>

<sup>45</sup> MN Commerce Department. *Made in Minnesota Incentive Program*.

<https://mn.gov/commerce/industries/energy/solar/mim/>

<sup>46</sup> DSIRE. *Solar Energy Sales Tax Exemption*. <http://programs.dsireusa.org/system/program/detail/1218>

### 3. Review Permitting Process and Train Staff with SolSmart

The 2016 SolSmart program, a DOE Solar Energy Technologies office program, further compliments these efforts. Their main goal as an organization is to help communities reduce bureaucratic barriers to solar energy, and they promote the solar industry as an economic revitalizer. The program serves cities and counties across the nation, including some Minnesotan communities. For example, Rochester, MN coordinated with the National Renewable Energy Lab to review its permit process and reduce barriers to access.<sup>47</sup> A novel component of their approach included training inspection and permit staff in all aspects of the installation process to streamline the process further.

We recommend Northfield consider adopting the solar permitting package developed by the Solar America Board for Codes and Standards (Solar ABC). This is the closest to a standardized national permit that exists. Since the majority of small-scale solar PV systems share common characteristics the permit offers an expedited process for most standard installations.

### C. Strategies for Short Term Public Investment

Through public investment, Northfield can demonstrate its commitment to its RE target. Cities across MN have acted on their stated commitments to climate change mitigation by investing in RE for city buildings.<sup>48</sup> This directly reduces a city's carbon dioxide emissions and offers financial savings by reducing city electricity costs. While

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<sup>47</sup> SolSmart. *Rochester*. <https://www.solsmart.org/communities/rochester-mn/>

<sup>48</sup> MN GreenStep Cities. *Best Practice Action 5*.  
[https://greenstep.pca.state.mn.us/bestPracticesDetail\\_actions.cfm?bpid=25&aid=872](https://greenstep.pca.state.mn.us/bestPracticesDetail_actions.cfm?bpid=25&aid=872)

Northfield is a member of a local community solar garden, it can use additional investment to promote RE awareness and to continue decarbonizing city buildings.

## 1. Community Education Panel

One strategy that highlights both private and public investment is a solar photovoltaic installation on a public building such as the Northfield Public Library. This installation could be a public initiation of climate change action for the city and highlight Northfield's commitment to this issue. One reason to initiate the CAP through a solar installation is the relatively short period of time between declaring interest and installation, which can translate to a short lag-time between publishing the plan and announcing it to the community. At this initiation, the EQC and CAPAB can discuss the nuances of the plan and opportunities for community engagement, and promote sustainable growth and living in Northfield as a cause worth celebrating.

Aside from the potential for public engagement at an initiation ceremony, the panel could serve as a physical public outreach and education portal through regular programming hosted by the EQC and or the host institution. For example, the array could be accompanied by an educational plaque explaining the city's official commitment to sustainability geared towards Northfield's many visitors. The panel could also serve as educational programming geared towards the local schools, with workshop programming focused on physics and engineering behind photovoltaic solar panels, renewable energies compared to fossil fuels, general education about climate change, and more. Schools across the state have used solar panel installations as topic for energy education within and outside the classroom, including through public

presentation.<sup>49,50,51</sup> As the Northfield public school district has already purchased off-site solar through Xcel's Renewable\*Connect program, a public panel within the city could act as the energy education beacon for Northfield.

## 2. Additional Public Investment

We recommend the city of Northfield invest in another community solar garden membership for city buildings to account for more, if not all, of its energy use over other options for transitioning to RE. In particular, we recommend that the municipal ice arena is prioritized for a transition to RE because it requires significant amounts of energy to run and is already taking proposals for an additional rink.<sup>52</sup> Already, the rink uses 4,380 MWh annually, while the average American home used around 11 MWh in 2016.<sup>53,54</sup> (To be clear, the rink already uses almost as much energy as 400 homes.) Participation in a CSG would enable the city to transition quickly and with minimal effort as the city already has experience identifying solutions for funding its membership and multiple local CSGs are seeking participants.<sup>55</sup>

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<sup>49</sup> Magan, Christopher. *Lakeville school board debating solar garden plan that could save millions*. <https://www.twincities.com/2017/08/16/lakeville-school-board-debating-solar-garden-plan-that-could-save-millions/>

<sup>50</sup> Jossi, Frank. *Investment in solar grows dramatically in Minnesota schools*. <https://energynews.us/2017/11/14/midwest/investment-in-solar-grows-dramatically-in-minnesotas-k-12-schools/>

<sup>51</sup> Dunbar, Elizabeth. *Solar energy disparity emerges among Minnesota schools*. <https://www.mprnews.org/story/2017/04/20/solar-energy-disparity-emerges-among-minnesota-schools>

<sup>52</sup> City of Northfield Ice Arena Advisory Board. *Northfield-Ice-Arena---Phase 2*. <https://www.ci.northfield.mn.us/DocumentCenter/View/6373/Northfield-Ice-Arena---Phase-2-Presentation-12-6-17-Updated>

<sup>53</sup> City of Northfield. *City of Northfield Community Solar Garden Subscription Approval*.

<sup>54</sup> Energy Information Agency. *Frequently Asked Questions: How much electricity does an average home use?* <https://www.eia.gov/tools/faqs/faq.php?id=97&t=3>

<sup>55</sup> Xcel reports 4 gardens in Rice county alone with available subscriptions. *Solar Rewards Community*. [https://www.xcelenergy.com/programs\\_and\\_rebates/residential\\_programs\\_and\\_rebates/renewable\\_energy\\_options\\_residential/solar/available\\_solar\\_options/community-based\\_solar](https://www.xcelenergy.com/programs_and_rebates/residential_programs_and_rebates/renewable_energy_options_residential/solar/available_solar_options/community-based_solar)

Alternatively, the city could invest in RE for all buildings with on-site installations, however this includes additional risks and places maintenance responsibilities onto the city. These investments could occur sequentially and lower up-front costs depending on how the city would opt to pay for its CSG subscription, but would not offer the same opportunities for collaboration with private entities. Some websites, such as solar-estimate.org, offer great tools for estimating installation costs based on monthly electricity costs and thus offers flexibility for comparing full and partial transitions to RE for different buildings.<sup>56</sup> Without subsidization, solar panel pay-back period is often over a decade and depends on the building; however, there are programs that help support installation.<sup>57</sup> First, solar installations do not have sales tax. Second, Xcel offers a rebate program called Solar\*Rewards based off of installation productivity, currently at a rate of \$0.08 per kilowatt-hour. Xcel's incentive is an annual payment for ten years after the installation occurs and is treated as a payment for the renewable energy credits affiliated with an installation.<sup>58</sup>

Should it prefer individual installations, we also recommend Northfield prioritize installing solar photovoltaics onto the city building on Riverview Drive, near Perkins Specialized Transportation Company. If transitioned to RE, the building could act as an electric vehicle charging station and thus help decarbonize both Northfield energy and transportation sectors.<sup>59</sup> This repurposing will allow the city to address multiple CAP

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<sup>56</sup> Solar Estimate. *Solar Panel Calculator*. <https://www.solar-estimate.org/solar-panel-calculators>

<sup>57</sup> Solar Power Authority. *How much does it cost to install solar on an average US house?*. <https://www.solarpowerauthority.com/how-much-does-it-cost-to-install-solar-on-an-average-us-house/>

<sup>58</sup> Xcel Energy. *Solar Rewards for Residences*. [https://www.xcelenergy.com/programs\\_and\\_rebates/residential\\_programs\\_and\\_rebates/renewable\\_energy\\_options\\_residential/solar/available\\_solar\\_options/on\\_your\\_home\\_or\\_in\\_your\\_yard/solar\\_rewards\\_for\\_residences](https://www.xcelenergy.com/programs_and_rebates/residential_programs_and_rebates/renewable_energy_options_residential/solar/available_solar_options/on_your_home_or_in_your_yard/solar_rewards_for_residences)

<sup>59</sup> Personal conversation with Erica Zweifel.



decarbonization goals. Electric vehicles translate ‘fuel’ to engine function more efficiently than do traditional vehicles, and coupling electric vehicles with solar photovoltaics further reduces the emissions impacts of transportation.<sup>60</sup>

For either CSG or individual installations, we also recommend Northfield consider using some of its savings to address equity concerns within the community. Many families in Northfield cannot afford to transition to RE on their own, but with its initial savings from transitioning to RE the city could reduce this financial barrier. For example, the city could install solar panels on low-income and emergency housing, such as that offered through the Community Action Center.<sup>61</sup> Additionally, the city could offer support for solar garden membership to low-income families. Northfield is fortunate to have such strong nascent commitment to RE, and extend this opportunity to the entire community by incorporating a focus on equity into the later stages of its RE transition.

Unfortunately, Northfield’s current grid infrastructure may require updates to host additional capacity near Division Street, the costs of which may be passed onto the city if they cannot participate in the Solar\*Rewards program (i.e. selling Xcel the RE credits).<sup>62</sup> The application to Xcel’s Solar\*Rewards program is often handled by the contractor alongside the applicant, so the city or EQC would not need to navigate the process alone. Even with the rewards program, the grid infrastructure may present significant roadblocks to RE development in Northfield because of the cost of upgrading infrastructure.

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<sup>60</sup> Anair, Don and Amine Mahmassani. *State of Charge*. [https://www.ucsusa.org/sites/default/files/legacy/assets/documents/clean\\_vehicles/electric-car-global-warming-emissions-report.pdf](https://www.ucsusa.org/sites/default/files/legacy/assets/documents/clean_vehicles/electric-car-global-warming-emissions-report.pdf)

<sup>61</sup> Community Action Center. *Creating Homes*. <https://communityactioncenter.org/programs/homes/>

<sup>62</sup> See microgrid discussion in Section IV.

Finally, the city could simply subscribe to RE through an Xcel program following in the footsteps of the Northfield public school district. This removes the direct connection to renewables in Northfield, but still helps the city decarbonize. To promptly transition, the city could opt for the Windsource program, which offers customers an opportunity to pay a small additional fee to support the costs of a RE generator (wind turbine or solar array). According to Xcel, this fee averages \$0.01 per kilowatt hour, and the minimum required commitment is 3 years.<sup>63</sup> Xcel also hosts the Renewable\*Connect program, which enables customers to use a blend of wind and solar energy. The RE credit for Renewable\*Connect goes to the customer, but the pricing is similar to that of the Windsource program.<sup>64</sup> This program is currently taking waitlist applications only.

Solar installations, and RE transitions generally, save hosts money on their electrical bills, but do not reap net gains initially because of notable up-front costs. For upfront costs, the government could opt to issue a bond for some or all of the amount required to install. The bond market often supports public infrastructure investment, but could be translated to support smaller renewable energy investments. This may be an attractive option for financing renewables in Northfield because bonds are often seen as attractive investments, but would require more intensive engagement with city members ahead of time to gain their approval. Northfield could model their bond off of the many used internationally as cities around the globe have introduced 'Green City' bonds to finance sustainable development projects, such as the bond offered in Cape Town,

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<sup>63</sup> The additional cost is \$3.53 for a 100 kWh block of wind energy minus the fuel cost, and thus fluctuates based on fuel cost each month. Xcel Energy. *Windsorce for Business- Pricing Terms and Conditions*. [https://www.xcelenergy.com/programs\\_and\\_rebates/business\\_programs\\_and\\_rebates/renewable\\_energy\\_options\\_business/windsorce\\_for\\_business](https://www.xcelenergy.com/programs_and_rebates/business_programs_and_rebates/renewable_energy_options_business/windsorce_for_business)

<sup>64</sup> *ibid.*

South Africa to finance cleaner transportation.<sup>65</sup> Another option is financing through the Property Assessed Clean Energy (PACE) mentioned above.<sup>66</sup> While many funding options exist, a single installation intended to act as an educational portal could even be designed to serve only a portion of the electrical needs of the building under consideration and thus offer a small cost relative to city energy expenditure.<sup>67</sup>

#### a. Key Issues with Implementation

Northfield has many options for publicly investing, but faces many barriers as well. Generally, these barriers are tied to Xcel Energy program availability including challenges surrounding interconnection in the downtown area. This is the largest concern facing Northfield with respect to public investment given Xcel's current role in managing Northfield's electricity needs and grid infrastructure. Many of the previously presented recommendations require approval and collaboration with Xcel for success, which may significantly extend the timelines of the projects should Northfield choose to pursue them.

Extending this concern, variability in state policy may alter the availability of certain Xcel programs. Much of Xcel's RE development can be linked to MN state legislation such as the renewable portfolio standards established through the 2007 Next Generation Act. Should the state government alter their commitment to increasing RE or opt not to increase the standards, Xcel would face no compliance-based motivation to continue accepting additional distributed capacity installations. Given previous

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<sup>65</sup> Climate Bonds. *Cape Town*. <https://www.climatebonds.net/standards/certification/city-cape-town>

<sup>66</sup> <http://pacenation.us/pace-in-minnesota/>

<sup>67</sup> Some solar calculators estimate an array as small as 5 kWh can require a decade to pay off due to the winter snow impacting panel efficiency. (solar-estimator.com)

pushback on unbounded distributed generator installations, this lack of pressure would most likely result in even more limits on program availability.<sup>68</sup>

While these barriers to public investment may slow the RE transition process for Northfield's municipal buildings, but do not negate the impact of transitioning city buildings to RE. Northfield can lead the greater community in transitioning fully to RE through these public investment strategies rooted in the CAP.

## D. Long Term Public Investment (Microgrid Project)

Aside from direct investment in RE, the city of Northfield also faces a significant opportunity to revolutionize its electric grid. The Northfield Economic Development Authority recently accepted development proposals for 530 acres west of St. Olaf.<sup>69</sup> We believe this land would be a strong candidate to host future renewable development. Its proximity to the hospital, St. Olaf, and Three Links Nursing home, in particular, make it a potential location for the development of a microgrid powered by renewables. A microgrid is a subset of a larger utility grid. It connects to the larger grid but can also run independently, or "island", in the event of a grid disturbance.<sup>70</sup> Implementing a microgrid connecting the hospital, university, nursing home would increase Northfield's energy resilience and decrease peak demand thereby increasing energy efficiency and reducing overall lower costs.

A microgrid project deserves serious consideration as a proactive step towards energy resilience and broader climate adaptation. As a warming climate increases the

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<sup>68</sup> Eleff, Bob. *Xcel Energy's Community Solar Garden Program*. <http://www.house.leg.state.mn.us/hrd/pubs/solargarden.pdf>

<sup>69</sup> Private conversation with Glen Castore

<sup>70</sup> Lantero, Allison. *How Microgrids Work*. <https://www.energy.gov/articles/how-microgrids-work>

frequency of severe storms it would be prudent to ensure that three of the most important electricity consumers in Northfield are protected from grid outages. Northfield has already experienced multiple outages due to extreme weather in this century alone and threats of brown-outs from extensive energy use as recently as May, 2018.

The east coast of the U.S has had even greater experience with severe storms and they have turned to microgrid pilot programs as one solution. Following Hurricane Sandy, Dannel Malloy, the governor of Connecticut, stated that, “Microgrids play a major role in our efforts to modernize and harden our infrastructure to withstand severe weather”.<sup>71</sup> Connecticut promptly began nine microgrid pilot projects, one of which began operating in February of 2018. In January of 2018, Milford, Connecticut signed an agreement with Schneider Electric to design and build a microgrid connecting five critical facilities.<sup>72</sup> This microgrid will be powered through a 400 kW combined heat and power (CHP) system connected to a 100 kW battery. The CHP system currently runs on fossil fuels, but has the option to add solar in the future. Milford financed the project through the Tax Exempt Lease Purchase, which allows it to garner more savings than it would through a traditional power purchasing agreement. It also received a \$2.9 million grant through Connecticut’s Department of Energy and Environmental Protection.

If microgrids were only useful during grid outages they would offer valuable insurance but little immediate use, luckily microgrids offer a lot beyond resilience. At all times of year they can use their smart integration with the grid to reduce peak demand. Peak demand is the half-hour or hour period during which the grid experiences the

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<sup>71</sup> Koch, Wendy. *Microgrids Increase Post Sandy*.

<https://www.usatoday.com/story/news/nation/2013/10/31/microgrids-increase-post-sandy/3305379/>

<sup>72</sup> Schneider Electric. *Schneider Electric to Design and Build Advanced Microgrid in Milford, Connecticut*. <https://www.prnewswire.com/news-releases/schneider-electric-to-design-and-build-advanced-microgrid-in-milford-connecticut-300587325.html>

greatest demand for electricity. Since traditional fossil fuel plants must run at all times to accommodate peak demand, reducing electricity consumption during this period specifically has much greater environmental benefit than during any other period. Additionally, since utilities typically charge consumers higher rates during peak demand this is also one of the main avenues through which microgrids bring cost savings. In 2016, Rutland, Vermont began operation of a microgrid serving their hospital, two college campuses, and emergency services.<sup>73</sup> The microgrid is powered by the 2.5 MW panels from Stafford Hill Solar Farm with 4 MW of battery storage. On a hot August day during the first year of operation the microgrid reduced peak demand enough to save its customers \$200,000 collectively in a single hour. When peak demand falls in the middle of a sunny day like that a microgrid can offset peak demand by providing surplus generated electricity to the main grid. Even when peak demand falls at dusk the microgrid is still able to reduce demand by disconnecting from the grid and supplying its customers from battery storage. There is also a potential to generate revenue through microgrids. When Milford completes its microgrid it will be able to sell the credits of its microgrid production to facilities outside the system through a statewide net metering system for government and agriculture facilities.<sup>74</sup>

#### a. Key Issues with Implementation and Design

Microgrids are a relatively new technology but there are still plenty of microgrids currently in operation that can serve as models for Northfield. The Lawrence Berkeley

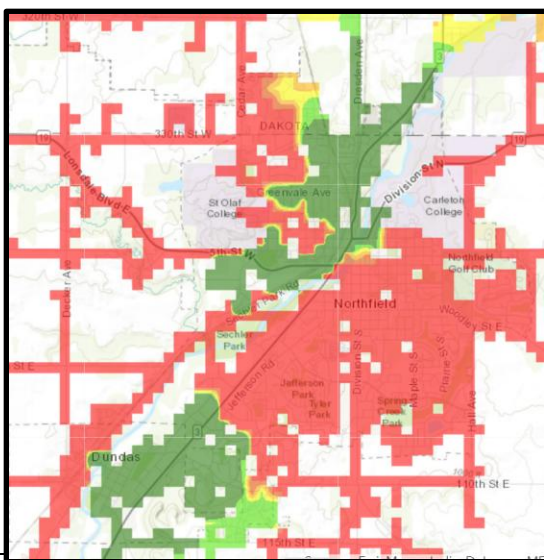
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<sup>73</sup> Clean Energy Group. *Stafford Hill Solar Farm and Microgrid* <https://www.cleanegroup.org/ceg-projects/resilient-power-project/featured-installations/stafford-hill/>

<sup>74</sup> Wood, Elisa. *Schneider Electric Moves Forward with Microgrid Projects in Connecticut, Maryland, Wisconsin, and California*. <https://microgridknowledge.com/microgrid-project-schneider/>

Institute National Laboratory issued a report, *Lessons Learned from Microgrid Demonstrations Worldwide*, that offers some best practice recommendations.<sup>75</sup> It found that microgrids were most effective when they include customer microgrids that operate downstream of one meter. Consumer microgrids face fewer regulatory barriers and would be something for Northfield to consider. The Lawrence Berkeley report also cautions against mismatching energy supply and end-use demands. If Northfield connects the microgrid to the hospital the distributed generation will need to offer high power quality and reliability, so it may need a fuel cell in addition to renewables when can be more variable in supply. These are just two of several points Northfield would need to take into consideration, but there resources and models to help.

Developing a microgrid would require changing the grid infrastructure to accommodate additional generation, which presents a significant barrier to its installation. According to a hosting capacity map shown below only the green areas of the distribution grid could accommodate additional distributed generation without any infrastructure upgrades.



<sup>75</sup>Lawrence Berkeley Laboratory. *Lessons Learned from Microgrid Demonstrations Worldwide*. <https://cloudfront.escholarship.org/dist/prd/content/qt9w88z7z1/qt9w88z7z1.pdf>

Xcel map of current grid infrastructure ability to accommodate additional generation without updates.<sup>76</sup>

Unfortunately, the 530 acres are in red. However, there are many different avenues for funding. A white paper commissioned by the Minnesota Department of Commerce and published in 2013 on the potential for microgrids in Minnesota, recommends the state adopt a pilot microgrid program.<sup>77</sup> This would be similar to the Connecticut program and would likely offer funding. More concretely, Northfield could consider Xcel's Renewable Development Fund (RDF) which provides financial support to, "...develop near-commercial and demonstration scale renewable electric projects or near-commercial and demonstration scale electric infrastructure delivery projects if those delivery projects enhance the delivery of renewable electric energy".<sup>78,79,80</sup> The University of St. Thomas has already paved the way. They currently using a grant from Xcel's Renewable Development Fund to finance the construction of a 0.25 peak MW microgrid on their St. Paul engineering campus.<sup>81,82</sup> When complete it will include PV, wind, and biofuel generation and battery storage.

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<sup>76</sup> Xcel Energy. *Hosting Capacity Map*.  
<https://xeago.maps.arcgis.com/apps/webappviewer/index.html?id=a04c42c922664381a2d35ba12305eb2e>

<sup>77</sup> Burr, Micheal, M.J. Zimmer, B. Meloy, J. Bertrand, W. Levesque, G. Warner, and J.D. McDonald. *Minnesota Microgrids: Barriers, Opportunities, and Pathways Toward Energy Assurance*. Prepared by Microgrid Institute for the Minnesota Department of Commerce, 2013 <http://mn.gov/commerce-stat/pdfs/microgrid.pdf>

<sup>78</sup> Xcel Energy. *Renewable Development Fund*.  
[https://www.xcelenergy.com/energy\\_portfolio/renewable\\_energy/renewable\\_development\\_fund/overview\\_and\\_history](https://www.xcelenergy.com/energy_portfolio/renewable_energy/renewable_development_fund/overview_and_history)

<sup>79</sup> Xcel Energy. *RDF 2017 Annual Report*. <https://www.xcelenergy.com/staticfiles/xeresponsive/Energy%20Portfolio/Renewable%20Energy/Renewable%20Development%20Fund/2017%20RDF%20Annual%20Report.pdf>

<sup>80</sup> *ibid.*

<sup>81</sup> Xcel Energy. *University of St. Thomas Microgrid Research and Testing*.  
[https://www.xcelenergy.com/energy\\_portfolio/renewable\\_energy/renewable\\_development\\_fund/educational\\_programs/university\\_of\\_st\\_thomas\\_microgrid\\_research\\_and\\_testing](https://www.xcelenergy.com/energy_portfolio/renewable_energy/renewable_development_fund/educational_programs/university_of_st_thomas_microgrid_research_and_testing)

<sup>82</sup> School of Engineering. *University of St. Thomas Microgrid Research and Testing Program - HE4-2*. St. Paul, MN: University of St. Thomas, 2017. <https://www.xcelenergy.com/staticfiles/xeresponsive/Energy%20Portfolio/Renewable%20Energy/2017-Annual-UST-Report.pdf>



## IV. Conclusion

Northfield's Climate Action Plan can take advantage of the existent community support for distributed renewables highlighted by the numerous private installations already feeding the local electrical grid. To do so, we first recommend Northfield establish an aggressive RE target to guide future discussion and provide concrete motivation throughout the CAP implementation process. We also recommend streamlining the permitting processes for RE installations and creating an informative, clear website run by one or two local experts. This information portal will streamline the process for investing and maintaining distributed RE sites across Northfield. As a city, we recommend that Northfield further commit to RE by transitioning more city buildings to RE through another CSG membership and or through on-site installations. With savings from its transition, we recommend that Northfield establish a revolving fund to support private investment and equitable access to RE.

Through these strategies, Northfield can support community efforts to transition the local electricity grid away from traditional fossil fuels towards RE. This transition will reap large-scale environmental and economic benefits including reduced GHG emissions, which can ease public health concerns such as respiratory diseases caused by air pollution. Additionally, this transition can reap local psychological benefits such as increased community pride and commitment to sustainable daily living. Citizens of Northfield have shown dedicated interest to sustainability, and through its focus on distributed RE among other topics, the City of Northfield can formalize and strengthen this commitment through the Climate Action Plan.

## Appendix A

Other opportunities to revolutionize Northfield's energy sector include turning to community choice aggregation or municipalization to regain control over Northfield's fuel sourcing. With respect to RE use, community choice aggregation (CCA) may offer Northfield a direct path to decarbonizing its energy sector. CCA offers municipalities the option to negotiate electricity contracts as a jurisdiction to ideally achieve lower electricity costs and pursue benefits of RE through economies of scale.<sup>83</sup> The 2013-2014 Minnesota state legislature appropriating funds for a feasibility study of CCA, hoping to identify if any of the programs implemented in other states would function appropriately here.<sup>84</sup> California, Massachusetts, Illinois, New Jersey, New York, and Ohio all offer CCA programs currently following the deregulation of the electricity sectors, and all offer opt-out options within their legislation. Major cities including Chicago and Cincinnati have implemented CCA programs that incorporate green

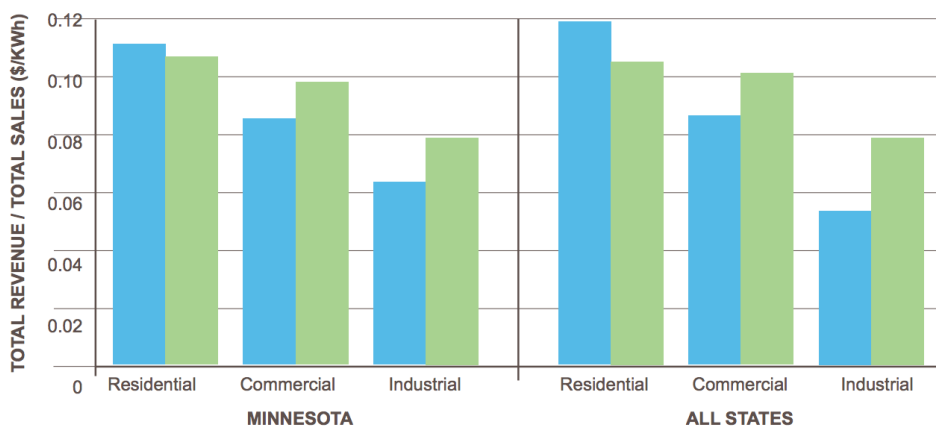
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<sup>83</sup> National Conference of State Legislators. *Community Choice Aggregation Policies*. <http://www.ncsl.org/research/energy/community-choice-aggregation.aspx>

<sup>84</sup> MN State Legislature. *SF 2405: Community Choice Aggregation Program Study*. [https://www.revisor.mn.gov/bills/text.php?number=SF2405&version=0&session=ls88&session\\_year=2014&session\\_number=0](https://www.revisor.mn.gov/bills/text.php?number=SF2405&version=0&session=ls88&session_year=2014&session_number=0)

technology options for residents.<sup>85</sup> CCA in Minnesota would require a redesign of the current electricity system including an unraveling of the strict electric utility territory boundaries.<sup>86</sup> Because of the significant state-level regulatory changes required to enable CCA, the Center for Energy and Environment does not consider the program a viable short-term option; however, this may become a more viable option in the future. Until that point, informal CCA programs can support interested residents just as Solarize Northfield did in 2015.

An interesting large-scale change available currently to Northfield is municipalization, wherein Northfield would form its own municipal utility. This option offers similar control over community energy use, but requires significant time and planning. With control over energy sources and programs, municipal utilities can design their own electricity rates and tend to be competitive with investor-owned utilities.<sup>87</sup> Municipalization would force Northfield to negotiate its own electrical sales and how to integrate current distributed RE, including managing how to integrate the current generators and the Northfield CSG.



<sup>85</sup> City of M  
<http://www.121587.pc>

<sup>86</sup> Ibid. 55.

<sup>87</sup> Ibid. 57.

Source: U.S. Energy Information Administration

cms1p-

Figure 2: Average Electricity Rate Comparison for 2011.<sup>88</sup>

At this stage, municipalization may reap more consequences than benefits in Northfield's RE transition because of the intensive use of Xcel's RE access programs, including a 10 year contract between Xcel and the Northfield public school district. Additionally, Northfield would need to take over management of the local CSG per MN solar garden legislation. Because of these complications, municipalization should be considered as a backup option for transitioning to RE if issues with current grid infrastructure and Xcel program availability prevent any local action.

However, if it were to become more reasonable as a recommendation, 'municipalizing' the Northfield electrical grid could open doors to a number of non-solar RE projects. Solar is a location-based RE with low regional variation--on a cloudy spring day, no buildings in Northfield generate electricity from the sun at capacity. By diversifying Northfield's fuel portfolio, it would build resilience and reliability into its electricity grid.<sup>89,90</sup> For example, Northfield could invest in a communal wind turbine instead of additional solar garden(s). If Northfield were in a place to create a municipal utility, it may also be capable of investing in other large-scale RE generators.

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<sup>88</sup> Ibid.

<sup>89</sup> Tabone, M. D., Goebel, C., & Callaway, D. S. *The effect of PV siting on power system flexibility needs*. <https://doi.org/10.1016/j.solener.2016.10.018>

<sup>90</sup> Grunewald, P. *Renewable deployment: Model for a fairer distribution*. <https://doi.org/10.1038/nenergy.2017.130>