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Comprehensive Planning for Solar Energy Systems

Cameran J. Bailey– Solar Advisor

December 12, 2017

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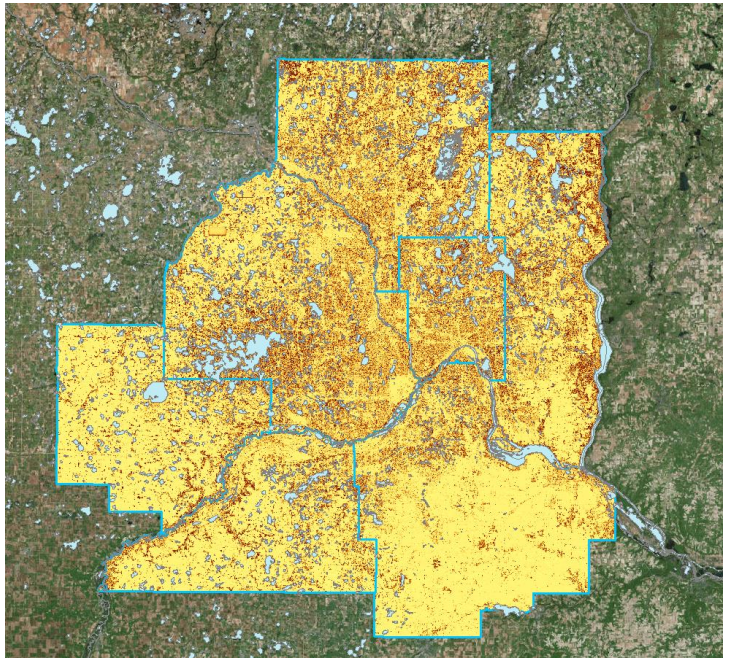
- ☑ **2040 Comprehensive Plan Minimum Solar Requirements**

1. Solar Resource Map
2. Solar Calculations

3. Solar Development Policies
4. Solar Development Strategies



Source: MN Solar Suitability Analyses App - https://solarapp.gisdata.mn.gov/solarapp/

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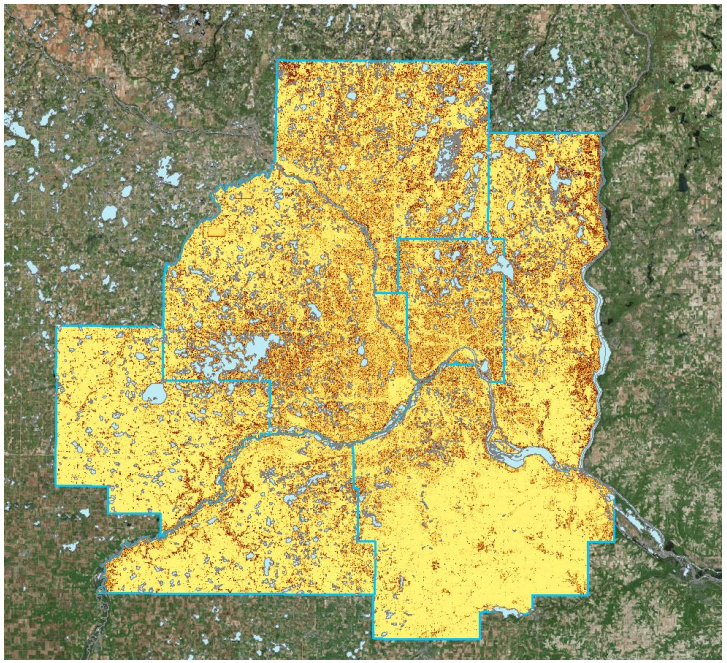

Source: MN Solar Suitability Analyses App - https://solarapp.gisdata.mn.gov/solarapp/

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☑ **2040 Comprehensive Plan Minimum Solar Requirements**

1. Solar Resource Map
2. Solar Calculations

3. Solar Development Policies
4. Solar Development Strategies

Foundational Categories

- **Permitting Process**
- **Planning, Zoning & Development**

Special Focus Categories

- Inspection
- Construction Codes
- Solar Rights
- Utility Engagement
- Community Engagement
- Market Development & Finance

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Comprehensive Planning for Solar Energy Systems

Eric Wojchik – Senior Planner
December 12, 2017

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Contents

Solar Energy System Requirements

- Solar Resource Protection
- Solar Resource Development
- How to Comply with the Requirements
- Go Further with Solar

Integration of Resilience into the Plan

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Metropolitan Land Planning Act

Statute 472,859, Subd. 2.

- ✓**Land use plan**. (b) A land use plan shall contain a protection element, as appropriate, for historic sites, the matters listed in the water management plan required by section 103B.235, **and an element for protection and development of access to direct sunlight for solar energy systems.**

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The Requirement of Planning for Solar Energy Systems

Solar Resource Protection

Solar Resource Development

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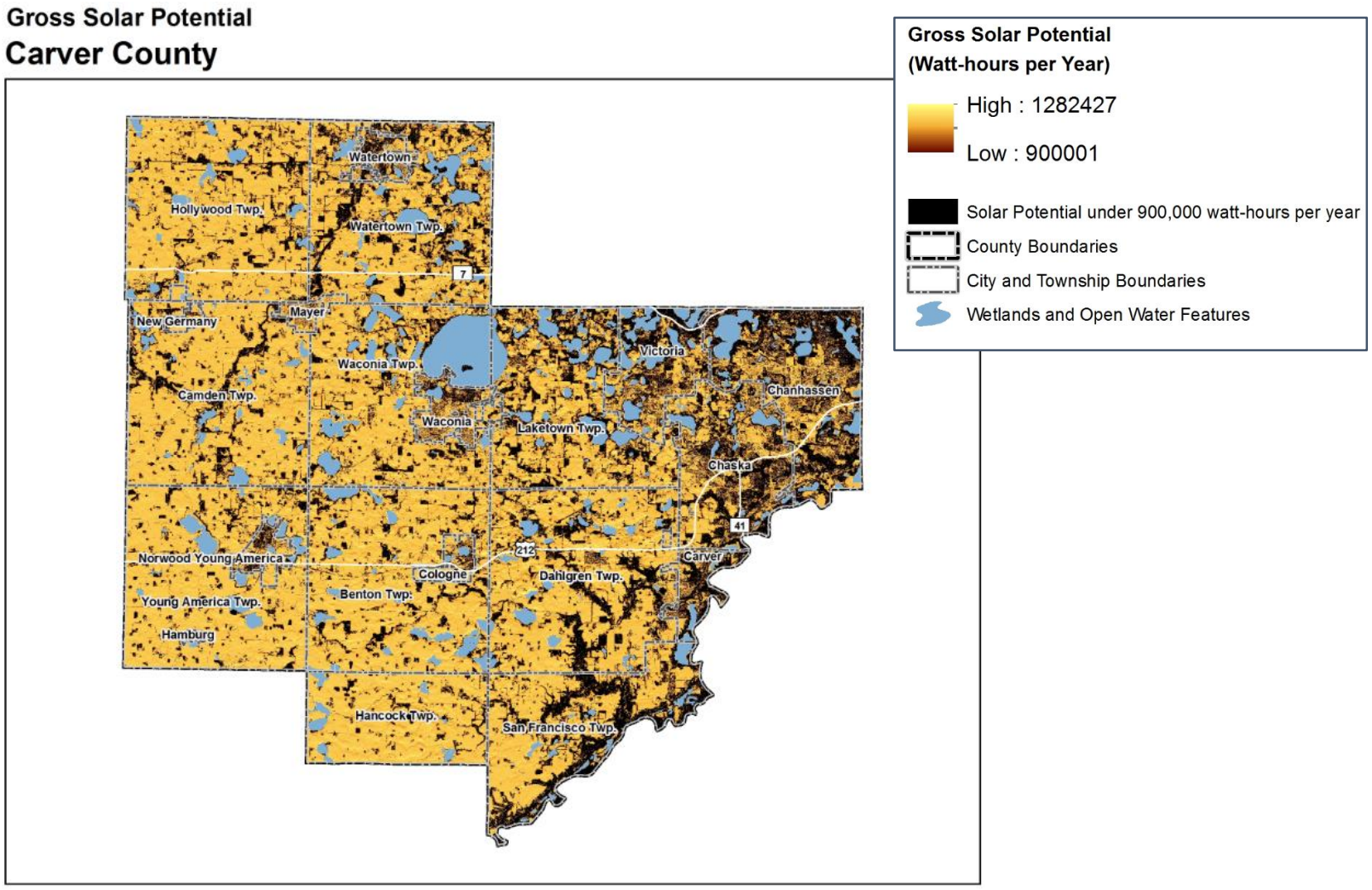
Solar Resource Protection Map



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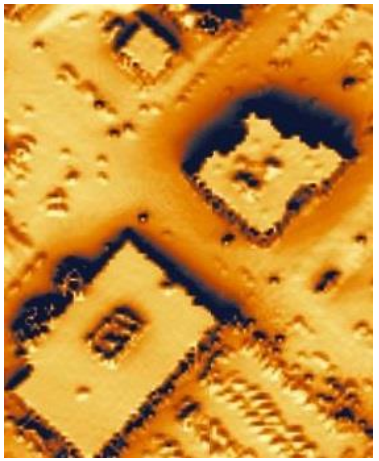
Solar Resource Protection Map

How does the solar map allow for the protection of access to direct sunlight for solar energy systems?

Answer: The map averages the hourly solar resource for 365 days a year. The map includes the shading affect which therefore accurately demonstrates the solar resources available at the community scale and, often times, at the site scale.



https://solarapp.gisdata.mn.gov/solarapp/

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Solar Resource Protection Map

Does the solar map take account of recent development?

Answer: One limitation of the map is that it represents a snapshot in time. Development beyond the year 2011 will not be depicted, but for the purposes of calculating a community's overall solar resource, the map provides sufficient information.

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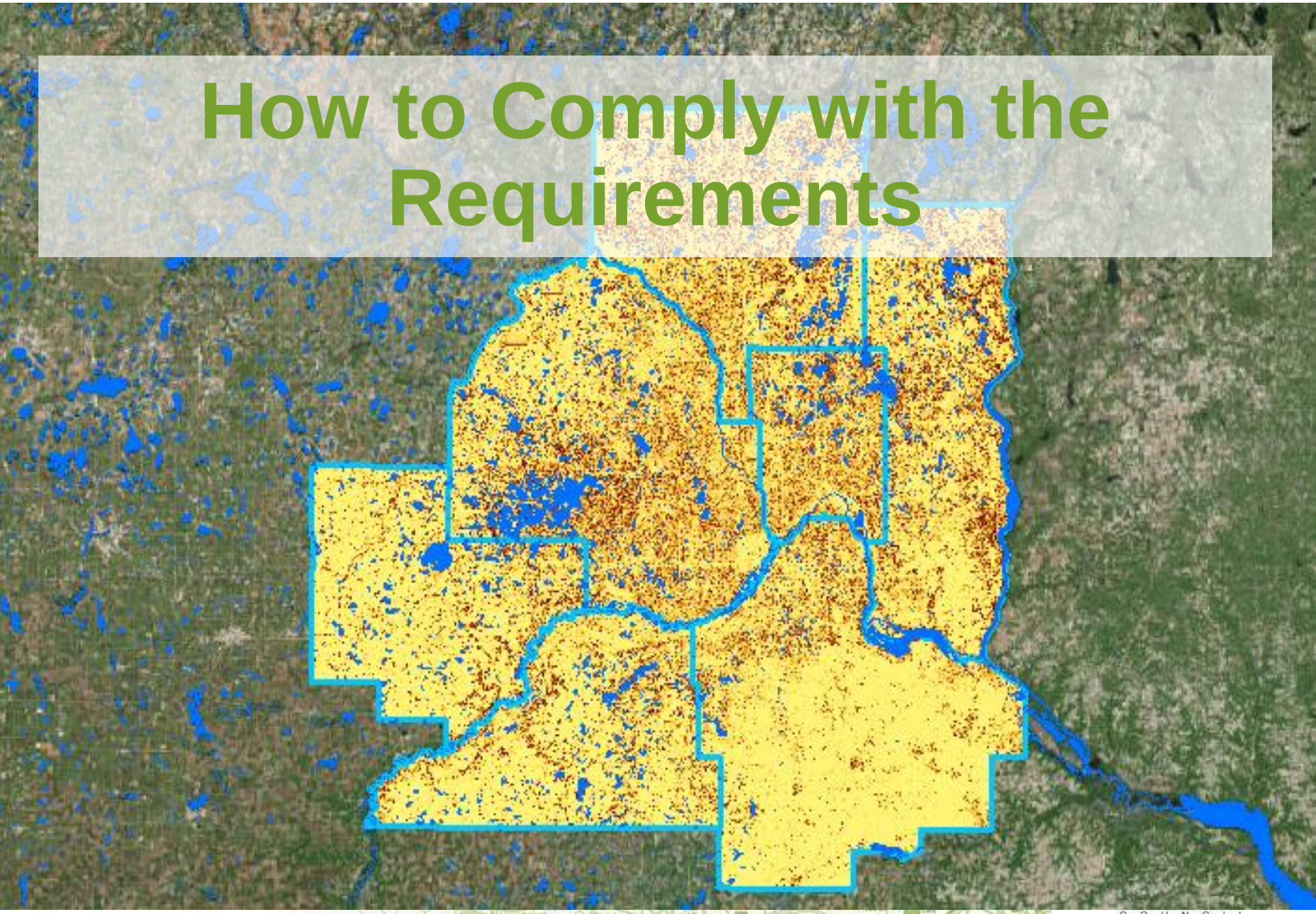
How to Comply with the Requirements



Minimum Solar Requirements

Communities with Land Use Authority - Solar Resource Protection & Development

- The Council will provide the following resources to communities to provide an 'element for protection and development of access to direct sunlight for solar energy systems' within the Comprehensive Plan:

LOCAL PLANNING HANDBOOK

Existing Conditions

Resource Protection

Map & Calculation

Desired Conditions

Resource Development

Policy & Implementation Strategy

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The Solar Requirement

What is the difference between the solar element requirement in the 2030 and 2040 Comprehensive Plan Updates?

Answer: The requirement is the same, but the need and ability to satisfy the statutory requirement has changed given new market realities and the fact that new data exists that will be made available to all metropolitan communities.

Does the Metropolitan Council require a minimum amount of solar resource development for metropolitan communities?

Answer: No, there is no minimum MWh requirement for solar resource development detailed within statue.

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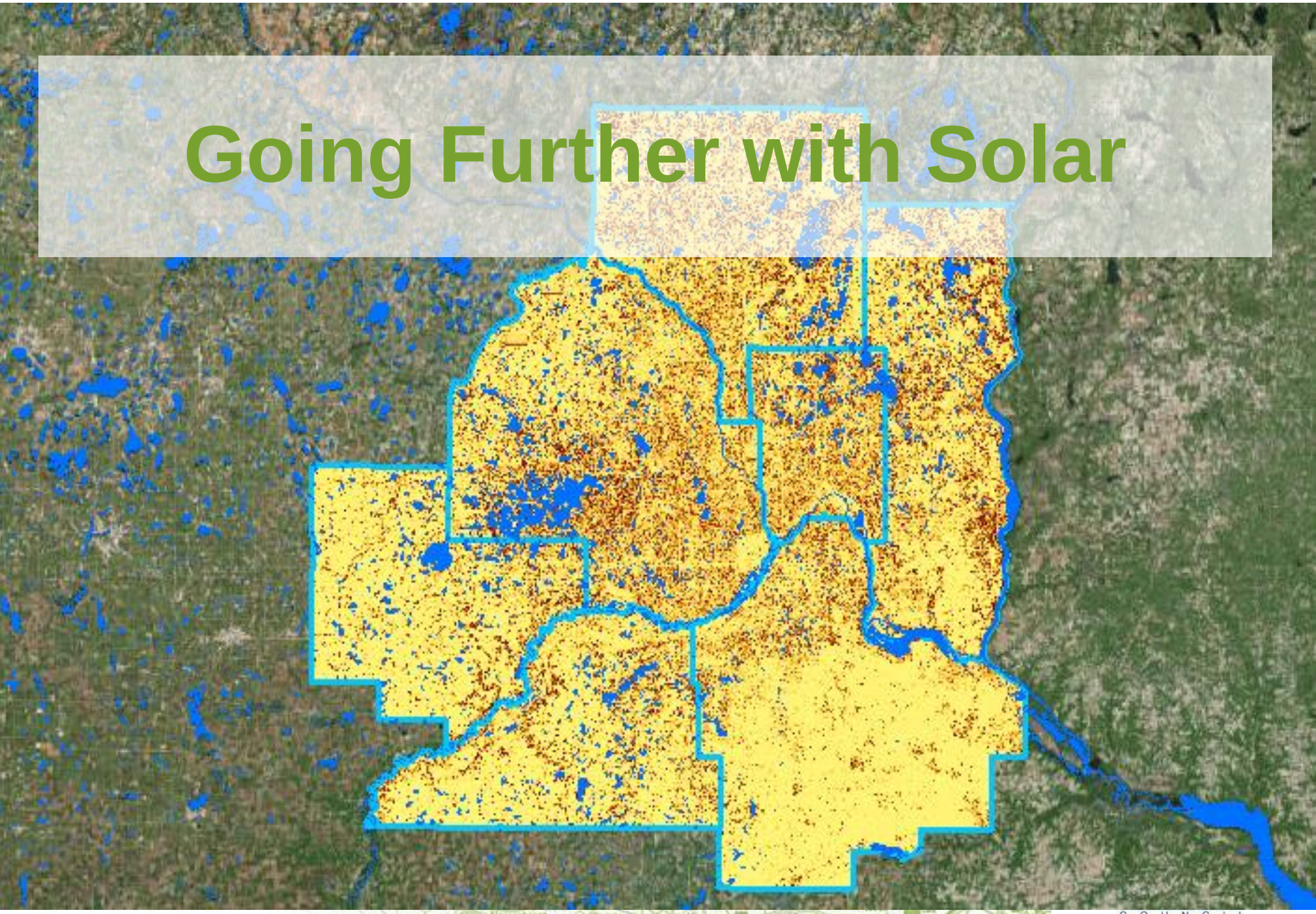
Going Further with Solar



Plan Elements

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Integration of Resilience

Resilience (Solar)

- Land Use
- Transportation
- Water Resources
- Parks & Trails
- Housing
- Economic Competitiveness
- Implementation

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Community Vision

Existing Conditions

Desired Conditions

Policies & Strategies

Implement & Evaluate

2040 Comprehensive Plan

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Comprehensive Planning Process

Existing Conditions

- Compile Community Baseline Data
- Consider Barriers to Engagement
- Assess Staff & Financial Resources
- Synthesize Information

Desired Conditions

- Community SWOT* Analysis
- Engagement – Public & Political
- Identify Short & Long-term Priorities
- Focus Prioritization

Policies & Strategies

- Vision & Goals
- Policies
- Implementation Strategies
- Evaluation

*Strengths, weaknesses, opportunities, & threats

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Policies & Strategies

Integration

Vision & Goals

Plan Elements

Policies

Implementation Strategies

Evaluation

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Policies & Strategies

Implementation Strategies

Encouragement	Incentives	Regulation	Lead by Example

MINNESOTA LoGoPEP

From Minnesota's Local Government Project for Energy Planning (LoGoPEP)

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Planning for Solar

Existing Conditions

Compile Data	Consider Engagement	Staff & Financial Resources	Synthesize Information
MN Solar App – Gross MWh & Rooftop Resource	Developers, Politicians, & Public	Existing Outdated Ordinance. No Staff Expertise	Matrix Depicting Existing Conditions

Desired Conditions

SWOT Analysis	Engagement	Short & Long Priorities	Focus Priorities
Public Buildings & Incentives in Commercial Mixed-use Developments	Council Work Session/Public Energy Workshop	Reduce Grid Reliance & Create PR Campaign	Planning Mechanisms & Set Measureable Benchmarks

Policies & Strategies

Vision & Goals	Policies	Strategies	Evaluation
Become Solar-Ready Through Incentivizing Solar Development	Increase Provision of Solar Energy Systems in Public & Commercial Sites by 50% by 2040	Create Ordinance based on Grow Solar Local Gov Toolkit	Create Standards; Track MWh & Cost Savings
Educate the Public on the Cost & Benefit of Solar	Provide Technical Assistance Support for the Public	Become SolSmart Certified by 2019	Monitor Program by Annually Reporting to Council
Become an Energy Convener for Stakeholders	Engage to Advance Solar Tech in the Community	Convene Annual Energy Planning Event	Coordinate Feedback on Policies & Events

Solar Ready Communities

Comprehensive Plans that:

- ✓Identify and define solar resources
- ✓Acknowledge solar development benefits and desired co-benefits
- ✓Identify solar development opportunities and conflicts in the community

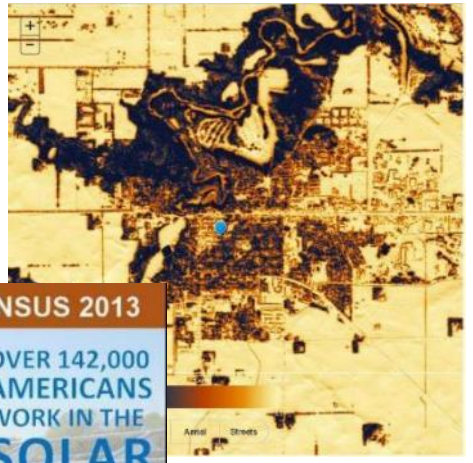

Photo credits: Fresh Energy/Giving Tree

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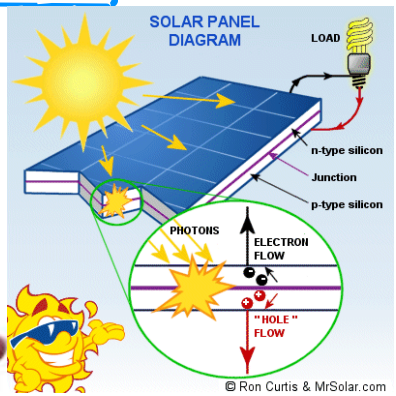
Five Principles for Solar Ready Communities…

1. **Comprehensive Plans** that describe solar resources and encourage development
2. **Development Regulations** that explicitly address solar development in its varied forms
3. **Permitting Processes** that are predictable, transparent, and documented
4. **Public Sector Investment** in the community's solar resources
5. **Local Programs** to limit market barriers and enable private sector solar development



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Resources

LOCAL PLANNING HANDBOOK

http://metrocouncil.org/Handbook.aspx

PlanIt

Comprehensive Planning for Solar Energy Systems
http://www.metrocouncil.org/Handbook/PlanIt.aspx

Resilience Plan Element

https://metrocouncil.org/Handbook/Plan-Elements/Resilience.aspx

Community Pages

http://lphonline.metc.state.mn.us/commportal

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Questions?

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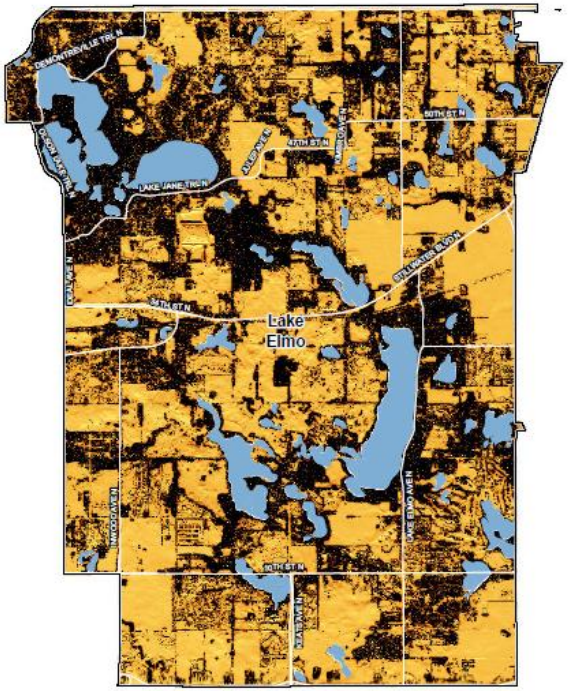
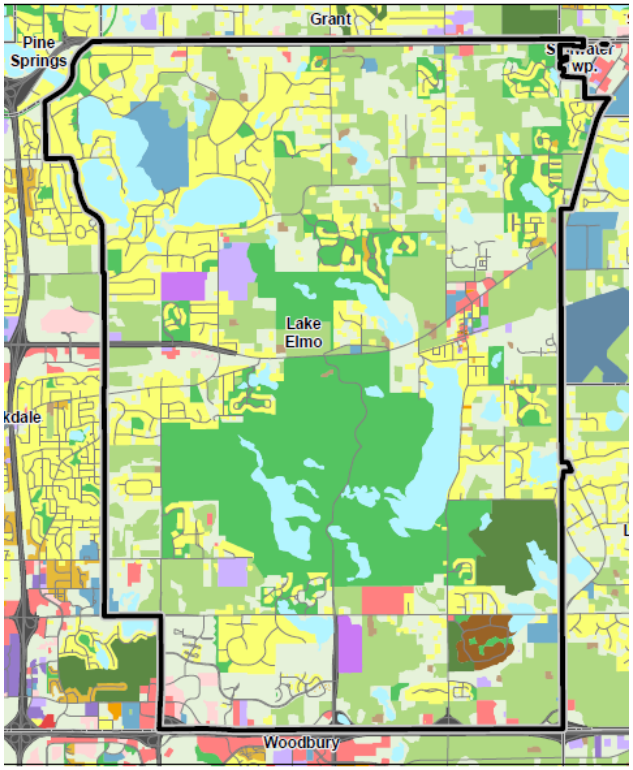
Solar Mapping Exercise

Hopkins

Lake Elmo



Oakdale



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Solar Mapping Exercise

Intended Outcomes of Exercise

Solar Goal

- (1) Goal by Community Type
- (1) Goal by Plan Element

Solar Mapping Exercise

Intended Outcomes of Exercise

Solar Goal

- (1) Goal by Community Type
- (1) Goal by Plan Element

Solar Policy

- (1) For Accessory Solar Development
- (1) For Solar Farm/Garden Development

Solar Mapping Exercise

Intended Outcomes of Exercise

Solar Goal

- (1) Goal by Community Type
- (1) Goal by Plan Element

Solar Policy

- (1) For Accessory Solar Development
- (1) For Solar Farm/Garden Development

Solar Strategy

- (1) Supporting Accessory Solar Development
- (1) Supporting Solar Farm/Garden Development

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Solar Mapping Exercise

Intended Outcomes of Exercise

Goal (a)	Question(s)/Concern(s):
Goal (b)	Question(s)/Concern(s):
Policy (a)	Question(s)/Concern(s):
Policy (a)	Question(s)/Concern(s):
Strategy (a)	Question(s)/Concern(s):
Strategy (b)	Question(s)/Concern(s):

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Solar Mapping Exercise
Round 1 – Solar Goal

Solar Goals by Community Type

1. Urban Goal – Balance between the benefits of urban forests and the benefits of enabling solar development.
2. Urban Goal – Create local community solar garden opportunities for residents and businesses who have limited on-site solar resources or do not own land or buildings.
3. Urban Goal – Redevelopment projects will evaluate on-site solar resources and incorporate solar development into designs.
4. Suburban Goal – Encourage residential solar development that maintains community character.
5. Suburban Goal – Increase energy resilience of critical facilities such as police, fire, and emergency and hazard response centers.
6. Suburban Goal – Fairly balance the development rights of land owners with solar resource with the community character rights of adjacent landowners.
7. Suburban Goal – Protect access to solar resources in new developments and subdivisions, enabling individual land owners to choose to self-generate energy.
8. Agricultural Goal – Encourage solar garden or farm development on marginal farmland rather than prime agricultural soils.
9. Rural Goal – Enable solar garden development that enhances the community's and landowners' ability to limit non-rural housing or commercial development.

Solar Goals by Plan Element

1. Economic Goal – Increase use of local energy resources to capture job creation opportunities and diversify local economic base.
2. Housing Goal – By 2030, all new housing has solar generation or is built to "solar-ready" standards.
3. Land Use Goal – Encourage solar garden development on closed landfills and brownfields.
4. Resilience Goal – Encourage investment in electric grid infrastructure and solar development that makes electric service more reliable and resilient to weather-related disruptions.

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Solar Mapping Exercise
Round 1 – Solar Policies

Solar Policies - Distributed (Accessory) Solar Development

1. City encourages development of distributed solar energy systems that are in keeping with the community's character and use community solar resources.
2. City supports the development of zero net energy buildings and use of local renewable and energy efficiency resources.
3. City sets a local renewable energy standard to meet 10% of community-wide electric energy use with on-site renewable energy.

Solar Policies - Solar Farm/Garden (Principal) Solar Development

1. City encourages development of community solar gardens on lands outside the MUSA that retain community character and capture co-benefits such as creation of pollinator habitat.
2. City will develop solar resources on its closed landfill sites and buffer lands around industrial uses.
3. County supports the use of local solar resources, but discourages utility scale solar development that diminishes preferred agricultural use of prime soils or conflicts with rural residential priorities.

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Solar Mapping Exercise
Round 1 – Solar Strategies

Solar Strategies - Solar Farm/Garden (Principal) Solar Development

1. Adopt solar zoning and permitting best practices for accessory use solar development.
2. Become certified as a "solar-ready" community under the Department of Energy's SolSmart program.
3. Participate in a community solar garden project for a set amount (i.e., 30%) of public facilities' electric energy use.
4. Sponsor a community solar garden on a public building or land, for the benefit of city residents and non-profit institutions.
5. Enable and promote PACE financing for local energy efficiency and solar energy projects on private buildings.

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Solar Mapping Exercise
Round 1 – Questions/Concerns

Goal (a)	Question(s)/Concern(s):
Goal (b)	Question(s)/Concern(s):
Policy (a)	Question(s)/Concern(s):
Policy (a)	Question(s)/Concern(s):
Strategy (a)	Question(s)/Concern(s):
Strategy (b)	Question(s)/Concern(s):

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Solar Mapping Exercise
Round 2 – Solution Resources

In this section, record strategies or resources noted by Brian Ross that may address some of the questions or concerns you just identified in Round 1.

Notes:

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MAKING COMMUNITIES "SOLAR READY"

METROPOLITAN COUNCIL PLANIT WORKSHOP
SOLAR PLANNING, DECEMBER 12, 2017




Brian Ross, AICP, LEED GA
Senior Program Director

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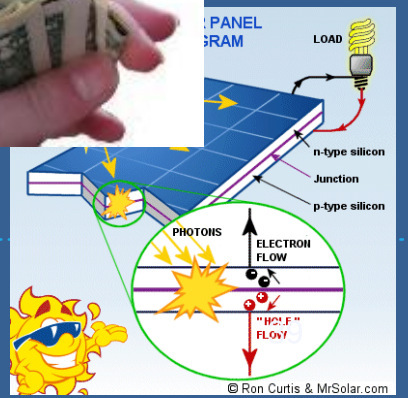
Five Principles for Solar Ready Communities…

1. **Comprehensive Plans** that describe solar resources and encourage development
2. **Development Regulations** that explicitly address solar development in its varied forms
3. **Permitting Processes** that are predictable, transparent, and documented
4. **Public Sector Investment** in the community's solar resources
5. **Local Programs** to limit market barriers and enable private sector solar development



Solar Ready Communities

A. Comprehensive Plans that:

- ✓ Identify and define solar resources,
- ✓ acknowledge solar development benefits, co-benefits, and development opportunities and conflicts in the community.

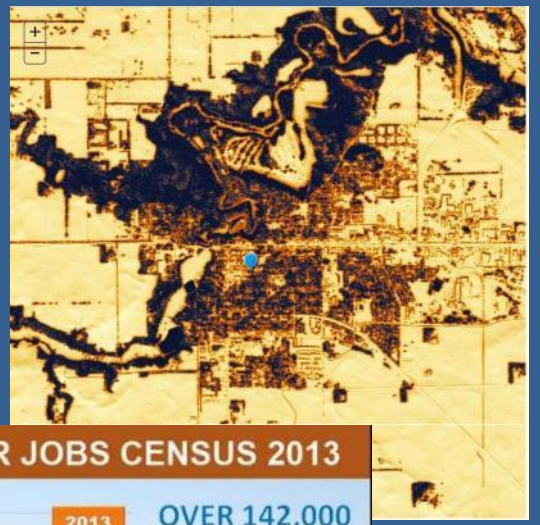
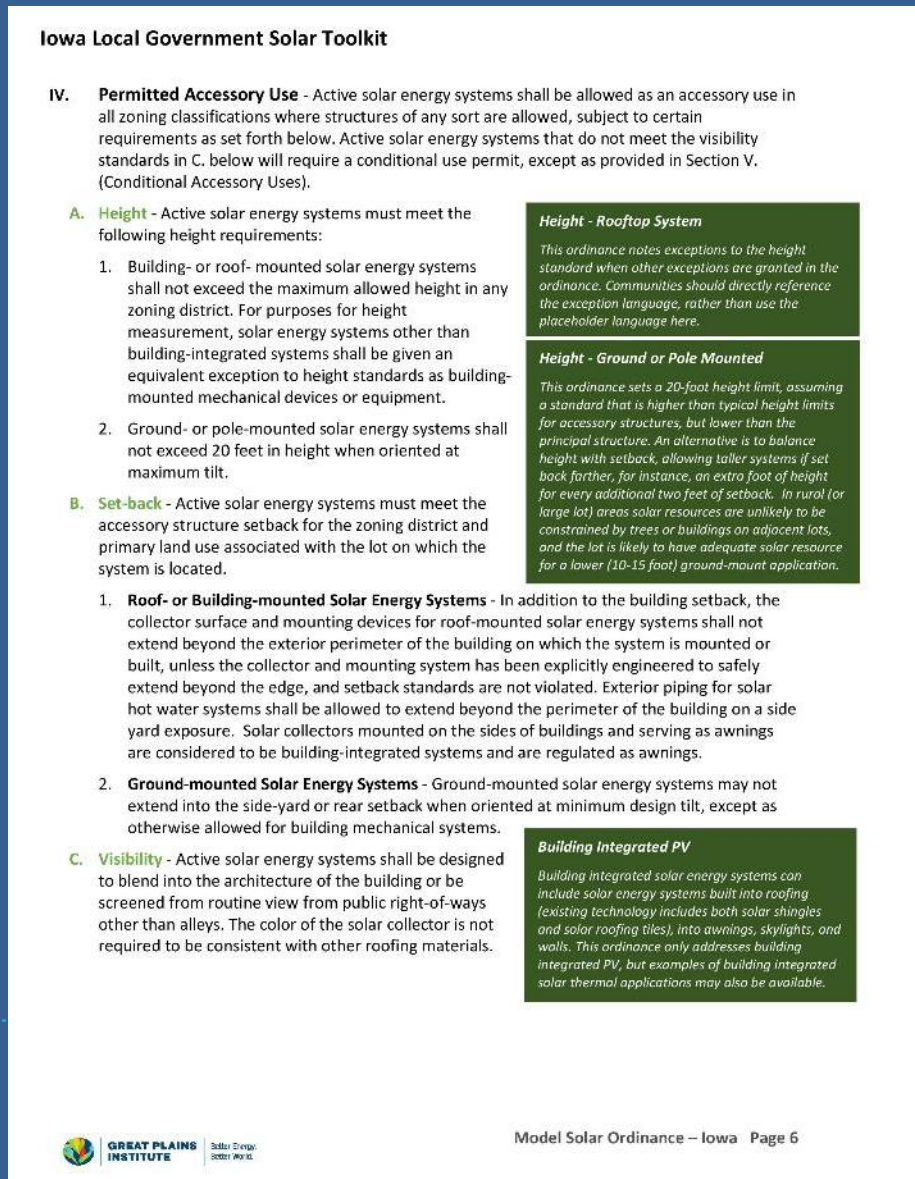


Photo credit: Fresh Energy/Giving Tree

Solar Ready Communities

B. Development Regulations that:

- ✓ explicitly address solar development in its varied forms,
- ✓ creates as-of-right installation opportunities, and
- ✓ set clear and predictable standards for balancing solar resources with other resources and capturing co-benefits.



Iowa Local Government Solar Toolkit

IV. **Permitted Accessory Use** - Active solar energy systems shall be allowed as an accessory use in all zoning classifications where structures of any sort are allowed, subject to certain requirements as set forth below. Active solar energy systems that do not meet the visibility standards in C. below will require a conditional use permit, except as provided in Section V. (Conditional Accessory Uses).

A. Height - Active solar energy systems must meet the following height requirements:

1. Building- or roof- mounted solar energy systems shall not exceed the maximum allowed height in any zoning district. For purposes for height measurement, solar energy systems other than building-integrated systems shall be given an equivalent exception to height standards as building-mounted mechanical devices or equipment.
2. Ground- or pole-mounted solar energy systems shall not exceed 20 feet in height when oriented at maximum tilt.

Height - Rooftop System

This ordinance notes exceptions to the height standard when other exceptions are granted in the ordinance. Communities should directly reference the exception language, rather than use the placeholder language here.

Height - Ground or Pole Mounted

This ordinance sets a 20-foot height limit, assuming a standard that is higher than typical height limits for accessory structures, but lower than the principal structure. An alternative is to balance height with setback, allowing taller systems if set back farther, for instance, an extra foot of height for every additional two feet of setback. In rural (or large lot) areas solar resources are unlikely to be constrained by trees or buildings on adjacent lots, and the lot is likely to have adequate solar resource for a lower (10-15 foot) ground-mount application.

B. Set-back - Active solar energy systems must meet the accessory structure setback for the zoning district and primary land use associated with the lot on which the system is located.

1. **Roof- or Building-mounted Solar Energy Systems** - In addition to the building setback, the collector surface and mounting devices for roof-mounted solar energy systems shall not extend beyond the exterior perimeter of the building on which the system is mounted or built, unless the collector and mounting system has been explicitly engineered to safely extend beyond the edge, and setback standards are not violated. Exterior piping for solar hot water systems shall be allowed to extend beyond the perimeter of the building on a side yard exposure. Solar collectors mounted on the sides of buildings and serving as awnings are considered to be building-integrated systems and are regulated as awnings.
2. **Ground-mounted Solar Energy Systems** - Ground-mounted solar energy systems may not extend into the side-yard or rear setback when oriented at minimum design tilt, except as otherwise allowed for building mechanical systems.

C. Visibility - Active solar energy systems shall be designed to blend into the architecture of the building or be screened from routine view from public right-of-ways other than alleys. The color of the solar collector is not required to be consistent with other roofing materials.

Building Integrated PV

Building integrated solar energy systems can include solar energy systems built into roofing (existing technology includes both solar shingles and solar roofing tiles), into awnings, skylights, and walls. This ordinance only addresses building integrated PV, but examples of building integrated solar thermal applications may also be available.

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Solar Ready Communities

C. Permitting practices that:

- ✓Reduce time spent on acquiring permits and conducting inspections
- ✓Make the permit process transparent and predictable to both staff and applicants
- ✓Ensure the permit process reflects industry best practices
- ✓Establish a permit fee that appropriately covers local government review and inspection costs

Solar Ready Communities

D. Public Sector Investment in the community's solar resources to demonstrate viability, community commitment, technological elements.

Photo credit: Bruce Schnaak Photography, City of Saint Paul, City of Minneapolis

Solar Ready Communities

E. **Local Programs** to remove or limit market barriers (lack of information, financing, workforce) that prevent capture of the economic, environmental, and social value of the community's solar resources.

Local Government Solar Toolkit

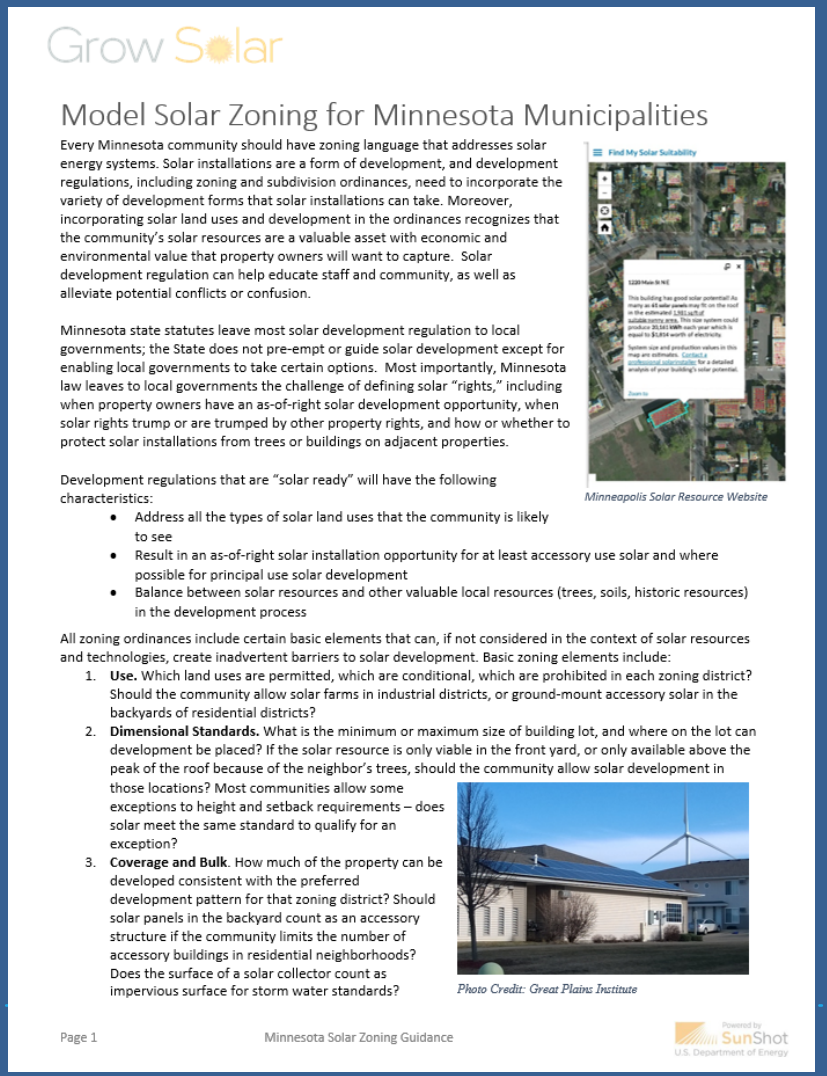
Local Government Solar Toolkits

Planning, Zoning, Permitting

http://www.betterenergy.org/publications/minnesota-solar-toolkit

Grow Solar Toolkit

1. **Summary of Statutes** that guide or enable local government actions regarding solar development
2. **Comprehensive Plan guidance** and local policy best practices
3. **Land use regulation guidance** and best practices to enable solar development
4. **Model zoning ordinance**
5. **Permitting guidance** and best practices to reduce soft costs
6. **Model solar building permit**



Grow Solar

Model Solar Zoning for Minnesota Municipalities

Every Minnesota community should have zoning language that addresses solar energy systems. Solar installations are a form of development, and development regulations, including zoning and subdivision ordinances, need to incorporate the variety of development forms that solar installations can take. Moreover, incorporating solar land uses and development in the ordinances recognizes that the community's solar resources are a valuable asset with economic and environmental value that property owners will want to capture. Solar development regulation can help educate staff and community, as well as alleviate potential conflicts or confusion.

Minnesota state statutes leave most solar development regulation to local governments; the State does not pre-empt or guide solar development except for enabling local governments to take certain options. Most importantly, Minnesota law leaves to local governments the challenge of defining solar "rights," including when property owners have an as-of-right solar development opportunity, when solar rights trump or are trumped by other property rights, and how or whether to protect solar installations from trees or buildings on adjacent properties.

Development regulations that are "solar ready" will have the following characteristics:

- Address all the types of solar land uses that the community is likely to see
- Result in an as-of-right solar installation opportunity for at least accessory use solar and where possible for principal use solar development
- Balance between solar resources and other valuable local resources (trees, soils, historic resources) in the development process

Find My Solar Suitability

Minneapolis Solar Resource Website

All zoning ordinances include certain basic elements that can, if not considered in the context of solar resources and technologies, create inadvertent barriers to solar development. Basic zoning elements include:

1. **Use.** Which land uses are permitted, which are conditional, which are prohibited in each zoning district? Should the community allow solar farms in industrial districts, or ground-mount accessory solar in the backyards of residential districts?
2. **Dimensional Standards.** What is the minimum or maximum size of building lot, and where on the lot can development be placed? If the solar resource is only viable in the front yard, or only available above the peak of the roof because of the neighbor's trees, should the community allow solar development in those locations? Most communities allow some exceptions to height and setback requirements – does solar meet the same standard to qualify for an exception?
3. **Coverage and Bulk**. How much of the property can be developed consistent with the preferred development pattern for that zoning district? Should solar panels in the backyard count as an accessory structure if the community limits the number of accessory buildings in residential neighborhoods? Does the surface of a solar collector count as impervious surface for storm water standards?

Photo Credit: Great Plains Institute

Page 1 Minnesota Solar Zoning Guidance

Powered by SunShot U.S. Department of Energy

Grow Solar Toolkit

- ✓ Existing conditions,
- ✓ Desired conditions,
- ✓ Strategies for getting there

Grow Solar

Local Government Solar Toolkit

PLANNING, ZONING, AND PERMITTING

Minnesota

APA MN 2017 Award Recipient

Grow Solar

Solar in Comprehensive Planning

Purpose

Comprehensive plans are the foundational policy document reflecting a community's priorities and values regarding development and local resources. Solar energy resources are an increasingly valuable local resource — solar development can bring environmental and economic benefits to a community through clean energy production, creation of local jobs and revenue, and improved property values. Communities are acknowledging this valuable resource and incorporating support and guidance for solar energy development into comprehensive plans, sending a strong message of commitment for sustained growth in the solar energy sector.

Communities are not, however, always familiar with the characteristics of solar resources and solar land uses. This document outlines considerations that communities should make and identifies elements that allow for clear priorities around solar energy objectives. Identifying how solar development can benefit the community will help decision-makers determine how solar resources and investments are integrated into the community in a way that balances and protects competing development or resources.

Downtown Solar Resource Map, Rochester, MN

Considerations

When addressing solar development in a comprehensive plan, it is important to acknowledge what makes solar work for a community as well as the inherent conflicts that may arise. Any comprehensive plan that includes a solar component should:

1. Address the solar resource and the different land use forms that solar development can take
2. Acknowledge the multiple benefits of solar development
3. Guide decision-makers on optimizing opportunities when solar development might conflict with other resources or land use forms

Each of these components can help a community identify how they wish to include solar as a resource and to be able to reasonably justify why and where solar development is supported.

Additionally, in Wisconsin, Statute 66.1001 Comprehensive Planning, outlines the elements that must be included in a comprehensive plan. Elements where solar goals and policies may be added include: *Issues and Opportunities; Utilities and community facilities; Agricultural, natural, cultural resources; economic development; and land use.*

Grow Solar

Solar Resource

The local landscape (e.g., topography, on-site obstructions, obstructions on adjacent land, potential future obstructions) defines whether or not a given site has a good solar resource. An adequate solar resource is a site that is unshaded for at least 6 hours a day, both now and into the future. Communities can map their solar resource using LiDAR data that is frequently available in urban areas, and in some states even in rural areas. Such a map can allow the community to measure the size of their "solar reserves" identify areas with good and poor resources for prioritizing development in a manner consistent with other land uses, and even distinguish between opportunities for rooftop and ground-mount solar development opportunities.

In addition to measuring and recognizing the solar resource, communities should recognize that a variety of methods exist to capture the energy and provide economic value. There are several different types of solar installations a community will want to consider: rooftop, accessory ground-mount, and principal ground-mount. A community can use the comprehensive plan to determine which of these technologies to support and/or promote.

Rooftop Solar, MREA

Solar Benefits

Communities can realize a number of benefits through solar development, including environmental, energy production, and economic development. Environmental benefits include helping meet local air quality or climate protection goals. Communities with renewable energy or energy independence goals can better achieve these through explicit support of solar energy development. Economically, solar development creates construction jobs for a variety of trades, financially benefits those who install systems on their properties with lower energy bills, and increases the property value of buildings within the local housing market.

Ground Mount System, CERTs

Land Use Conflicts

Like any development, solar may come into conflict with other land uses, and solar resources are often co-located with other important local resources. Recognizing these issues in the comprehensive plan can help to mitigate future problems.

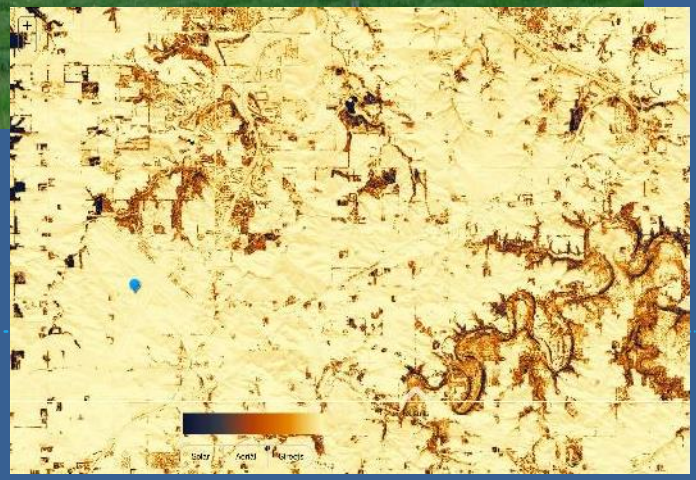
Solar Farm, CERTs

Solar Ready Communities

Solar Development Conflicts and Opportunities

Acknowledge perceived nuisances or potential conflicts between solar development and other resources, and synergies among different resources;

- Agricultural practices
- Urban forests
- Historic resources
- Airports
- Natural areas

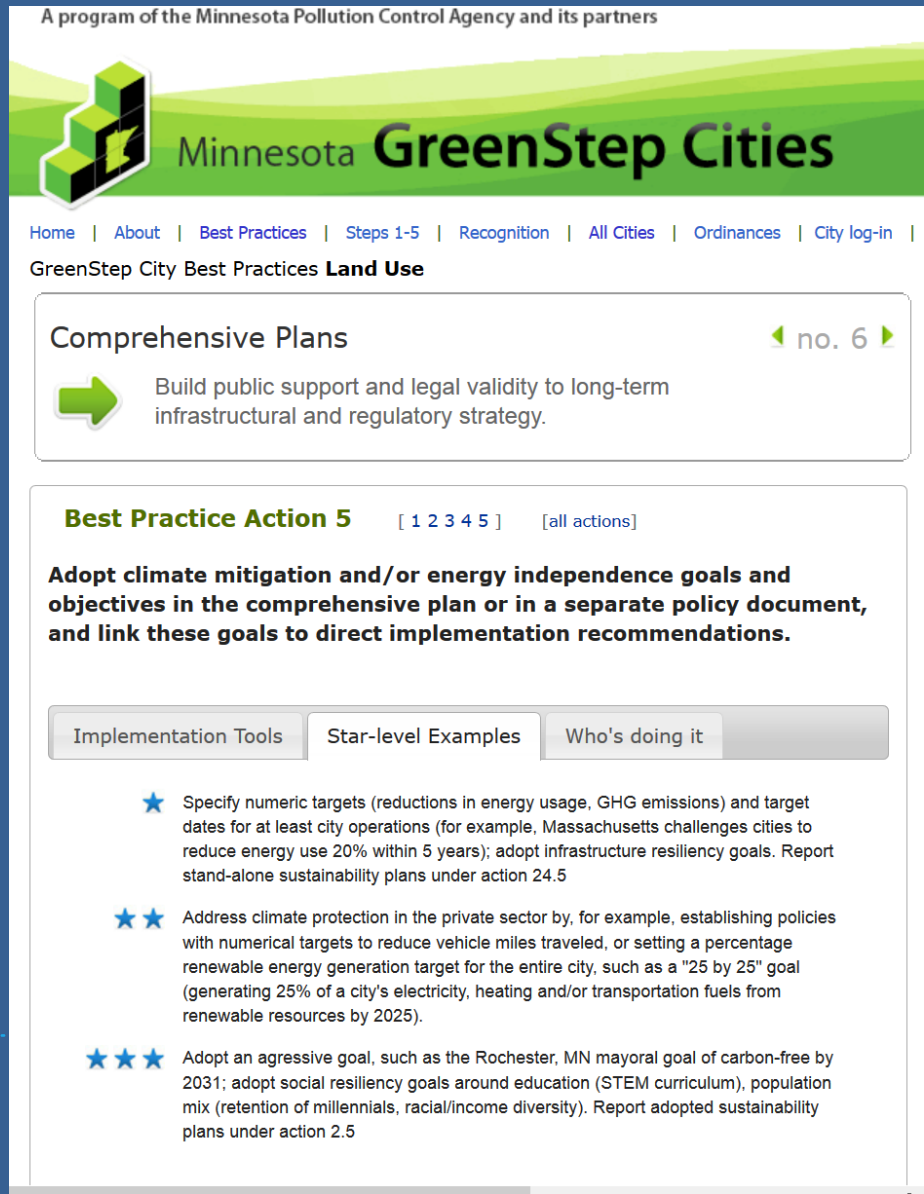


Planning Best Practice

GreenStep Cities

Comprehensive Plan Best Practice, Action #5:

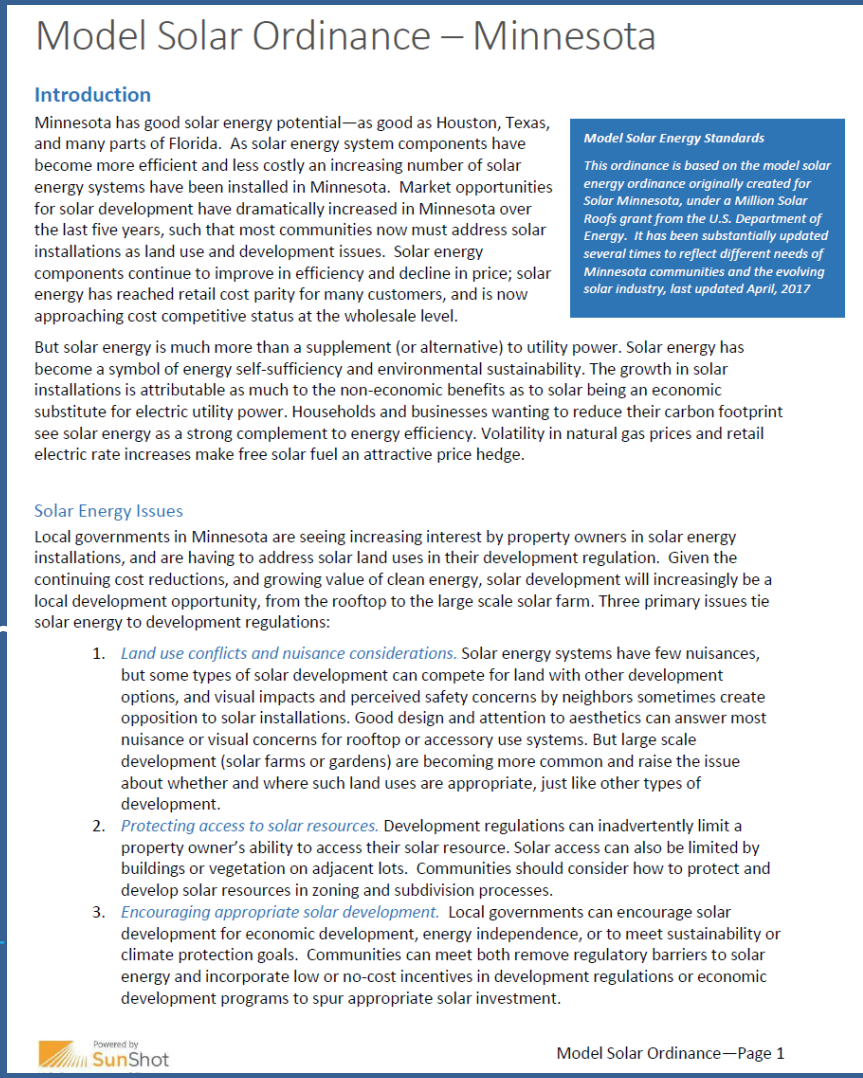
Adopt climate mitigation and/or energy independence goals and objectives in the comprehensive plan or in a separate policy document, and link these goals to direct implementation recommendations.



Solar Ready Communities

Development Regulations that:

- ✓ explicitly address solar development in its varied forms (small and large, accessory and principal),
- ✓ create as-of-right installation opportunities for accessory uses and consistent CUP standards for principal uses
- ✓ set clear and predictable standards for balancing solar resources with other resources.



Model Solar Ordinance – Minnesota

Introduction

Minnesota has good solar energy potential—as good as Houston, Texas, and many parts of Florida. As solar energy system components have become more efficient and less costly an increasing number of solar energy systems have been installed in Minnesota. Market opportunities for solar development have dramatically increased in Minnesota over the last five years, such that most communities now must address solar installations as land use and development issues. Solar energy components continue to improve in efficiency and decline in price; solar energy has reached retail cost parity for many customers, and is now approaching cost competitive status at the wholesale level.

Model Solar Energy Standards

This ordinance is based on the model solar energy ordinance originally created for Solar Minnesota, under a Million Solar Roofs grant from the U.S. Department of Energy. It has been substantially updated several times to reflect different needs of Minnesota communities and the evolving solar industry, last updated April, 2017

But solar energy is much more than a supplement (or alternative) to utility power. Solar energy has become a symbol of energy self-sufficiency and environmental sustainability. The growth in solar installations is attributable as much to the non-economic benefits as to solar being an economic substitute for electric utility power. Households and businesses wanting to reduce their carbon footprint see solar energy as a strong complement to energy efficiency. Volatility in natural gas prices and retail electric rate increases make free solar fuel an attractive price hedge.

Solar Energy Issues

Local governments in Minnesota are seeing increasing interest by property owners in solar energy installations, and are having to address solar land uses in their development regulation. Given the continuing cost reductions, and growing value of clean energy, solar development will increasingly be a local development opportunity, from the rooftop to the large scale solar farm. Three primary issues tie solar energy to development regulations:

1. *Land use conflicts and nuisance considerations.* Solar energy systems have few nuisances, but some types of solar development can compete for land with other development options, and visual impacts and perceived safety concerns by neighbors sometimes create opposition to solar installations. Good design and attention to aesthetics can answer most nuisance or visual concerns for rooftop or accessory use systems. But large scale development (solar farms or gardens) are becoming more common and raise the issue about whether and where such land uses are appropriate, just like other types of development.
2. *Protecting access to solar resources.* Development regulations can inadvertently limit a property owner's ability to access their solar resource. Solar access can also be limited by buildings or vegetation on adjacent lots. Communities should consider how to protect and develop solar resources in zoning and subdivision processes.
3. *Encouraging appropriate solar development.* Local governments can encourage solar development for economic development, energy independence, or to meet sustainability or climate protection goals. Communities can meet both remove regulatory barriers to solar energy and incorporate low or no-cost incentives in development regulations or economic development programs to spur appropriate solar investment.

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Model Ordinance - Agricultural Protection

(7) **Agricultural Protection** - Solar farms must comply with site assessment or soil identification standards that are intended to protect agricultural soils.

Agricultural Protection

If the community has ordinances that protect agricultural soils, this provision applies those same standards to solar development. Communities should understand, however, that solar farms do not pose the same level or type of risk to agricultural practices as does housing or commercial development.

Ground Cover/Natural Resource Standards

Grow Solar Toolkit

- ✓ Submittal requirements
- ✓ Structural guidance
- ✓ Standard electrical diagram
- ✓ Permit fees

Standardized Permitting Template

JOB SITE ADDRESS _____

NAME OF BUILDING OWNER _____

JOB VALUATION _____

Installation Contractor	Name	
	Address	
	City	State _____ Zip _____
	State License No. _____	Phone _____

Required Information for Permit:

1. Site plan showing location of major components on the property and a framing cross section that identifies type of support (rafter or truss), spacing, span dimension, and approximate roof slope. The drawings need not be exactly to scale, but it should represent relative location of components. PV arrays on dwellings with a 3' perimeter space at ridge and sides may not need separate fire service review.

   If location of the solar resource on the roof requires installation within three feet of sides or ridge, check with building official to determine if fire service review is needed.
2. Specification sheets and installation manuals for all manufactured components including, but not limited to, PV modules, inverter(s), combiner box, disconnects, and mounting system.
3. *If city manages electric permit process* - Electrical diagram showing PV array configuration, wiring system, overcurrent protection, inverter, disconnects, required signs, and AC connection to building (see accompanying standard electrical diagram).

Step 1: Structural Review of PV Installation Mounting System

1. Is the roof supporting the installation a pitched roof in good condition, without visible sag or deflection, no cracking or splintering of support, or other potential structural defect? ☐ Yes ☐ No
2. Is the roof a rafter system? ☐ Yes ☐ No
3. Is the equipment to be flush-mounted to the roof such that the collector surface is parallel to the roof?

   ☐ Yes ☐ No

   For truss systems, additional information may be needed to ascertain the truss' design loads. The SolarStruc tool (http://www.growsolar.org/wp-content/uploads/2012/06/Solarstruc-2.2.xls) allows contractors to calculate truss capacity for solar installations. Please contact the building official for standards on when structural analysis will be needed.
4. Is the roofing type lightweight? ☐ Yes (composition, lightweight masonry, metal, etc...) ☐ No
5. Does the roof have a single layer roof covering? ☐ Yes ☐ No

If "No" to any of questions 1 -4 above, additional documentation may be required. Documentation may need to demonstrate the structural integrity of the roof and all necessary structural modifications needed to maintain integrity. A statement stamped by a Minnesota licensed/certified structural engineer certifying integrity may be needed. Contact the building official to determine submittal requirements.

6. Identify method and types of weatherproofing for roof penetrations (e.g. flashing, caulk).

   _____

Mounting System Information:

7. Is the mounting structure an engineered product designed to mount PV modules with no more than an 18" gap beneath the module frames? ☐ Yes ☐ No

   If No, provide details of structural attachment certified by a design professional. Manufacturer's engineering specifications are sufficient to meet this requirement.
8. For manufactured mounting systems, fill information on the mounting system below:
   a. Mounting System Manufacturer _____
   b. Product Name and Model #_____
   c. Total Weight of PV Modules and Rails _____ lbs
   d. Total Number of Attachment Points_____ (attachment points must be equally distributed across the array)

      Attaching the rail to each rafter or truss that passes under the array, or to blocking installed between each support, may serve to mitigate for any structural uncertainties on older roofs or wind loading concerns. This approach was used by Minneapolis and Saint Paul based upon engineering studies conducted with their building stock. Contact the building official to determine requirements.
   e. Weight per Attachment Point (c÷d) _____ lbs
   f. Maximum Spacing between Attachment Points on a Rail _____inches (see product manual for maximum spacing allowed based on maximum design wind speed).
   g. Total Surface Area of PV Modules (square feet)_____ ft2
   h. Distributed Weight of PV Module on Roof (c÷g)_____ lbs/ft2

      If the outcome of e. is greater than 45 lbs or h. is greater than 5 lbs/ft2, a study or statement demonstrating the structural integrity of the installation, or a statement stamped by a Minnesota licensed/certified structural engineer, may be required. Contact the building official to determine requirements.
   i.

Step 2: Electrical Review of PV System

Please document the following information to be issued an electric permit. If the installation does not meet the following thresholds, additional information may be needed, as requested by the permit official.

1. PV modules, utility-interactive inverters, and combiner boxes are identified for use in PV systems.
2. The PV array is composed of 4 series strings or less per inverter.
3. The total inverter capacity has a continuous AC power output 13,440 watts or less
4. The AC interconnection point is on the load side of service disconnecting means (NEC 2011 705.12(D), NEC 2008 690.64(B)).
5. A standard electrical diagram should be used to accurately represent the PV system. Acceptable diagrams, in interactive PDF format, are available at www.solarabcs.org/permitting.

This section should be included in the permit only if the local government administers electric permits and inspections. Otherwise the electric permit is administered by the State of Minnesota Department Labor and Industry. In either case, the electric permit application can be a separate document, as in some cases the licensed electrician may be a different contractor. MnDLI provides a solar resources page for electric permitting and inspections for PV systems, including referencing the Solar ABCS.

Fill out the standard electrical diagram completely. A guide to the electrical diagram is provided at www.solarabcs.org/permitting to help the applicant understand each blank to fill in. If the electrical system is more complex than the standard electrical diagram can effectively communicate, provide an alternative diagram with appropriate detail.

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Step 3: Permit fee for residential installations

____ Fees $100
____ Additional inspection . . . . . $ 50.00
(Per inspection, when needed)

TOTAL FEE = $_____

RECEIPT NO. _____

DATE _____

Recommended fee for residential or small commercial solar installations is a fixed fee between $50 – 200, consistent with cost for services (permit processing, inspection) incurred by the government unit. Alternatively, the fee can be valuation based, but for a building permit should exclude the value of the solar collectors and electronics.

I HEREBY CERTIFY that I have completed and examined this application and certify that the information contained therein is correct. If a permit is issued, I agree all work will be done in conformance with all applicable ordinances and codes of this City and laws of the State of Minnesota.

_____
CONTRACTOR OR AUTHORIZED AGENT/HOMEOWNER

Resources and Reference Material:

- Minneapolis Solar Permit Checklist, http://www.minneapolismn.gov/www/groups/public/@regservices/documents/webcontent/convert_272925.pdf
- Saint Paul Solar Permit Checklist, http://www.stpaul.gov/DocumentCenter/View/76171
- Minnesota Department of Labor and Industry Solar PV Resources page (electric permits) http://www.dli.mn.gov/CCLD/ElectricalSolar.asp
- National Renewable Energy Lab: *Permitting Best Practices* http://www.nrel.gov/docs/fy13osti/57104.pdf
- Interstate Renewable Energy Council: *Solar Permitting Best Practices*: http://www.irecusa.org/solar-permitting-best-practices/
- Solar America Board for Code and Standards (Solar ABCs): *Expedited Permit Process*, with sample line drawings for all installation types: http://www.solarabcs.org/
- Sandia National Laboratories, *Empirically Derived Strength of Residential Roof Structures for Solar Installations*, http://prod.sandia.gov/techlib/access-control.cgi/2014/1420600.pdf
- SolarStruc Tool, http://www.growsolar.org/wp-content/uploads/2012/06/Solarstruc-2.2.xls
- Minneapolis Saint Paul Solar Cities Program, *Standards for Rooftop Solar Thermal Retrofits*,
- Minnesota Division of Energy Resources/Department of Labor and Industry, *Standardized Load Tables Characterizing Residential Solar Thermal and Solar Electric Installations for Residential Structures*, http://mn.gov/commerce-stat/pdfs/standardized-load-table-report.pdf
- Grow Solar Inspection trainings, http://www.growsolar.org/technical-assistance/training-program-development/

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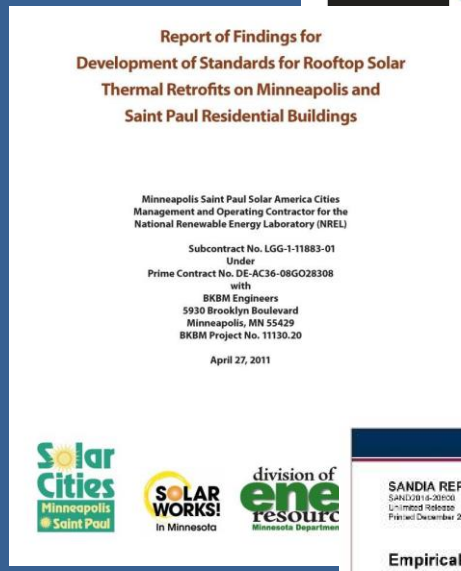
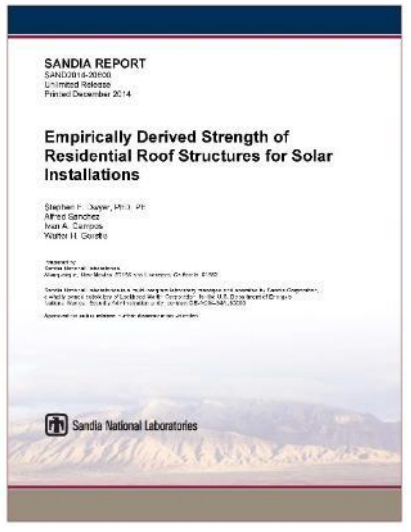
Standardizing Permitting

Structural engineering studies on residential rooftop solar installations.

- ✓ Minneapolis Saint Paul Solar Cities Structural Study
- ✓ Minnesota Standardized Load Tables for residential solar installations
- ✓ Sandia National Lab study on roof strength for solar installations.
- ✓ Solar America Board of Codes and Standards





Resources

ENERGY USE PROFILE

Regional Indicators Initiative:

Measured energy and emissions data for Minnesota cities

http://www.regionalindicatorsmn.com

Xcel Community Energy Reports:

Measured energy, emissions, and program participation data for enrolled cities in Xcel's service territory

https://www.xcelenergy.com/working_with_us/municipalities/community_energy_reports

DOE State and Local Energy Profiles:

Estimated city energy and emissions data for U.S. cities

https://apps1.eere.energy.gov/sled/#/

CLEAN ENERGY RESOURCES

Metropolitan Council Community Pages

Solar resource data for communities within the metro region

https://lphonline.metc.state.mn.us/commportal

Solar Suitability App:

Map of solar potential in Minnesota

https://solarapp.gisdata.mn.gov/solarapp/

Minnesota Wind Speed Maps:

Maps of Minnesota wind resource

https://mn.gov/commerce/industries/energy/technical-assistance/maps.jsp

ENERGY PLANNING AND ACTION

LoGoPEP Energy Planning Tools

http://www.regionalindicatorsmn.com/energy-planning

- A brief guide on how to incorporate energy and/or climate resilience in a city's **request for proposals**
- An energy planning **guide** and **workbook**
- An **example analysis of energy existing conditions**
- A **solar energy calculator** to assist in setting solar energy development goals
- A **wedge diagram tool** for energy and greenhouse gas reduction planning with an associated menu of feasible city actions

GreenStep Cities

Best practices to help cities achieve their sustainability and quality-of-life goals

https://greenstep.pca.state.mn.us/


REGIONAL INDICATORS INITIATIVE
ABOUT
EXPLORE THE DATA
SO WHAT?
ENERGY PLANNING
REGIONAL INDICATORS INITIATIVE
Measuring City-Wide Performance
Tracking the performance of Minnesota cities through key indicators is essential to assessing progress and promoting efficiency. Use this website to learn about the Initiative, explore the data, understand the results, and get involved.
ENERGY
BRITISH THERMAL UNITS
WATER
GALLONS
TRAVEL
VEHICLE MILES
WASTE
POUNDS
GHG EMISSIONS
CARBON DIOXIDE EQUIVALENTS

Local Government Project for Energy Planning

SOLAR ENERGY CALCULATOR June 2017

City Name:

Date:

User Input

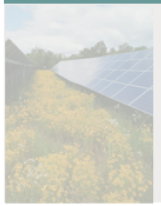
Electricity Use	MMBtu/year	tCO2e/year
Total Electricity Use	1,700,575	236,296

Statewide Electricity Goals	MMBtu/year	MWh/year
State Solar Goal of 1.5% by 2020	25,509	7,476
State Solar Goal of 10% by 2030	170,058	49,841
25% Renewables by 2025 RES	425,144	124,603

Solar Generation Potential	MW	MWh/year
Total Generation Potential	1,530	1,988,351
Total Rooftop Generation Potential	220	286,513
Top 10 Buildings Generation Potential	22	28,490
Public Buildings Generation Potential	-	

Local Government Goals		
Renewable Electricity Share	25	%
Renewable Electricity Generation	**124,603**	**MWh/year**
Renewable Electricity Capacity (Solar)	**95.8**	**MW**
Greenhouse Gas Reduction	59,074	tonnes CO_2e

Results

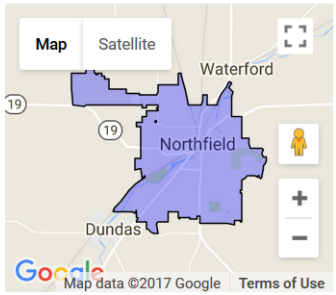


43% of the total rooftop solar resource is utilized, providing enough local renewable electricity to serve the equivalent of 16,405 households and resulting in a 25% reduction in greenhouse gas emissions from electricity use.

Instructions

1. Use Regional Indicators Initative data to enter electricity consumption and greenhouse gas emissions data under "Electricity Use."
2. Use the Solar Resource Calculation provided by the Metropolitan Council on your Community Page, the Minnesota Solar Suitability App or Google Project Sunroof to determine your solar resource and enter this into the "Solar Resources" section. Cities may need to conduct further GIS analysis to determine the solar resource of the top 10 buildings and public buildings.
3. Review Minnesota's clean electricity goals in the "Statewide Electricity Goals" section in comparison to your city's solar resource.
4. Set a citywide renewable electricity goal in the "Local Government Goals" section based on your city's solar resource and the statewide goals.

Cities-LEAP,
State and Local Energy Data



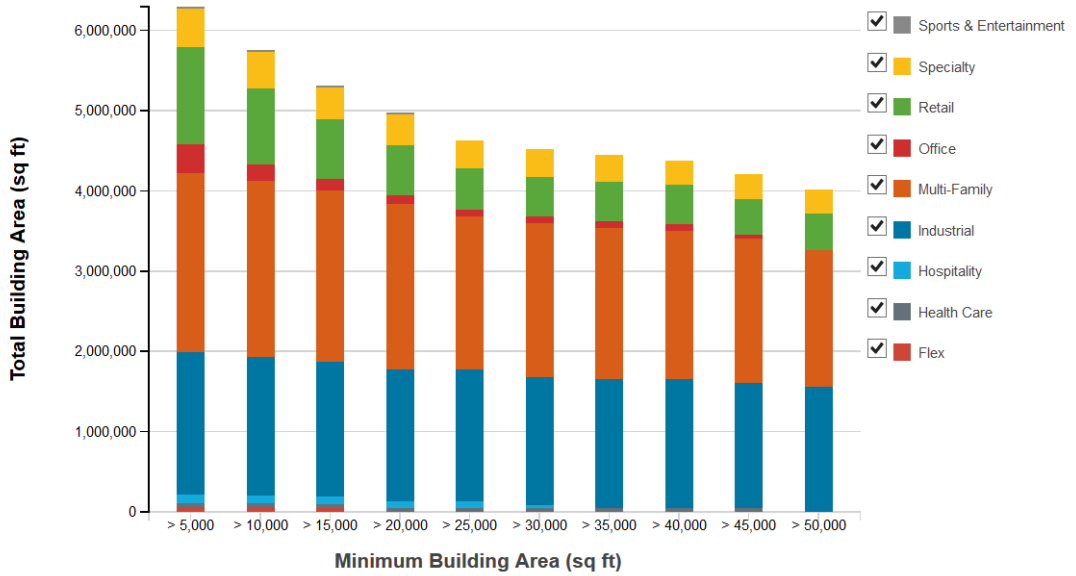
Source, API Download Data

Commercial Building Energy Benchmarking for Northfield, Minnesota

derived

The following chart shows commercial properties from CoStar Realty Information, Inc. (www.costar.com) by building area and property type. Cities can use this data to estimate the potential scope and impact of building energy benchmarking policies or programs.

Download Chart



Filter By

All

New Search

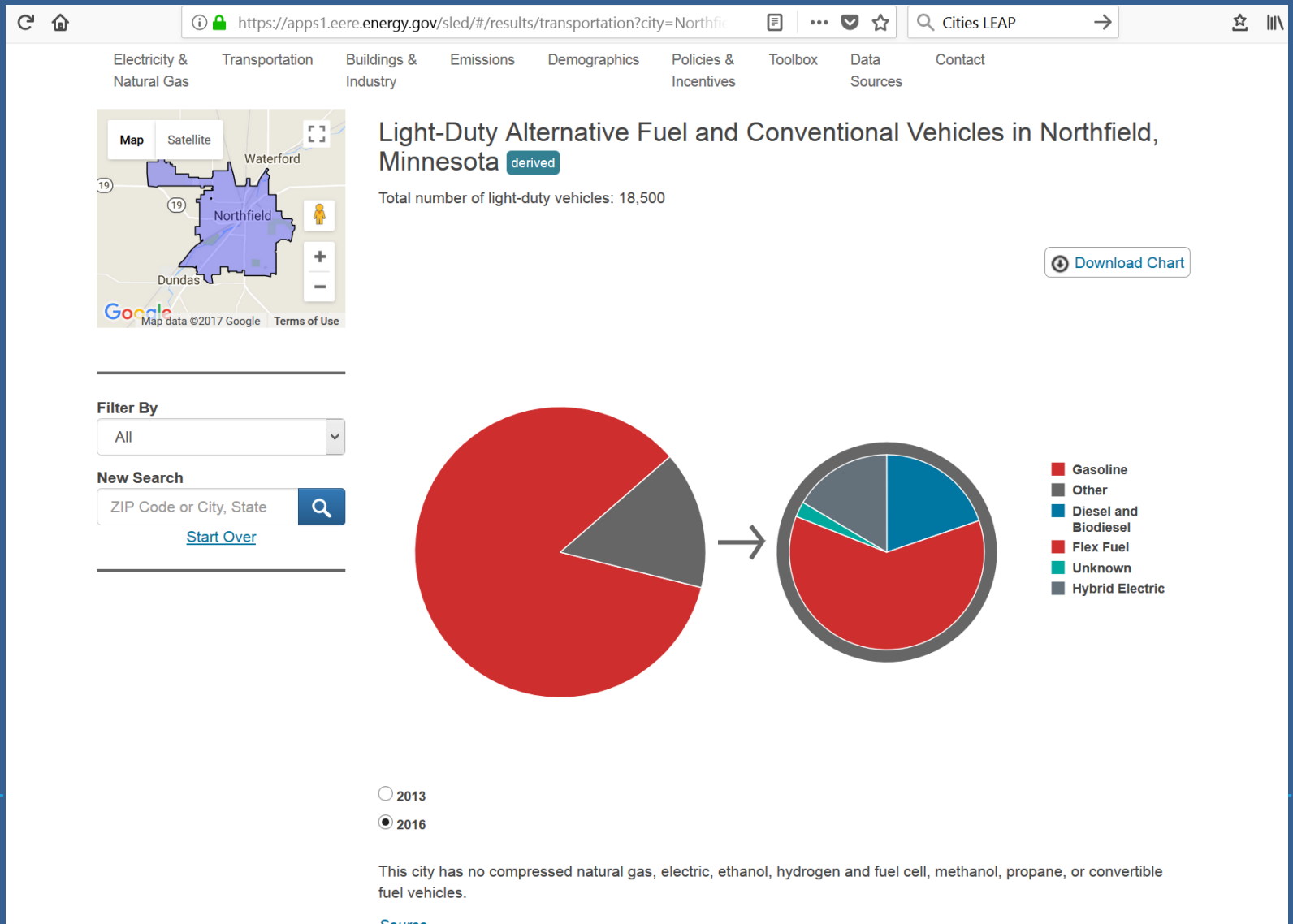
ZIP Code or City, State

Start Over

Building Area

Number of Buildings

Cities-LEAP,
State and Local Energy Data



THANK YOU!

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GREAT PLAINS INSTITUTE
Better Energy. Better World.

Solar Mapping Exercise
Round 3 –Resources Integration

Notes:

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METROPOLITAN COUNCIL

SOLSMART
NATIONALLY DISTINGUISHED. LOCALLY POWERED.

Goal (a)	Question(s)/Concern(s):
Goal (b)	Question(s)/Concern(s):
Policy (a)	Question(s)/Concern(s):
Policy (a)	Question(s)/Concern(s):
Strategy (a)	Question(s)/Concern(s):
Strategy (b)	Question(s)/Concern(s):

PlanIt

METROPOLITAN COUNCIL

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METROPOLITAN COUNCIL