



MEMORANDUM

TO: Sunfish Lake Planning Commission
Sunfish Lake City Council

FROM: Michelle Barness

DATE: November 25, 2015

RE: Sunfish Lake – Alternative Energy System Ordinance

FILE: 211.02

12/1/15 CC Mtg.
**Agenda
Item
6b**

The City Council considered a draft alternative energy system ordinance at the November meeting and tabled consideration of the ordinance to the December meeting to gather additional information on solar energy systems. Attached to this memorandum are graphics illustrating how solar energy systems work, two articles addressing different types of solar energy systems and solar energy mounting methods, and solar energy system images.

The City Council expressed the concern that the draft alternative energy ordinance limited the height of roof mounted systems to the maximum building height of the zoning district, which is 30 feet above average existing grade in all districts. As residents regularly build new homes or additions to the maximum building height limit, the Council questioned whether homeowners could still install the roof mounted systems given the building height limitation.

Pitched roof solar panel mounts are installed following the pitch of the roof, and commonly employ non-penetrating racks fixed in place, which set the angles at which the panels are held. Just a few inches are required between the roof and the panels to allow for temperature regulation, roof drainage, and so on. Panels on pitched roofs are not likely to conflict with the building height limit.

Flat roof solar panel mounting may require ballast mounting, where panels will be weighted to address potential issues with wind interference. These systems may be angled towards the sun, independent of the roof pitch, and may have a more difficult time adhering to the building height limit. However, many flat roof homes in the community do not reach the building height limit, in which case limiting roof mounted solar energy systems to the maximum building height is not anticipated to pose significant issues for homeowners wishing to install these systems. However, there may be a few instances when flat roofs do reach the height limit, and the desire to mount above the roof will result in conflicts.

To address this potential conflict the City Council may consider amending the Ordinance to allow roof mounted solar panels to exceed the maximum building height limitation of the zoning districts. Zoning Ordinance Section 1219.02 permits certain structures to exceed the building height by up to 5 feet. A draft ordinance amendment listing roof mounted solar energy systems within this section is provided for consideration, and the remainder of the draft alternative energy system ordinance was amended to reflect this exception. Should the City Council decide against allowing roof mounted solar energy systems to exceed the building height limitation, approval of the draft alternative energy system ordinance should be contingent on the ordinance being amended to re-instate the requirement that roof-mounted systems not exceed building height limitations.

Planning staff requests that Council reviews the attached information on solar energy systems, and the draft ordinance amendments, and make a motion whether to approve the amendments for incorporation in the Sunfish Lake Zoning Ordinance.

c: Catherine Iago, City Clerk
Tim Kuntz, City Attorney
Don Sterna and Eric Eckman, City Engineers
Mike Andrejka, Building Official
Jim Naves, City Forester
Ron Wasmund, Septic System Inspector

UNDERSTANDING DIFFERENT TYPES OF SOLAR AND MOUNTING SOLUTIONS

SUNPOWER®

You know it. We know it. There are A LOT of solar technologies. From silicon cells to mirrors and lenses to something called organic photovoltaic, you may feel your head is spinning to figure out what they all do. Don't worry. This bulletin will help make sense of it. We'll focus on the most popular solar technologies to get you started. These include:

- Solar photovoltaic (PV) panels
- Thin film solar panels
- Solar thermal panels

Additionally, we'll give you a quick overview of mounting technologies and when they make sense to use. So let's get rolling.

SOLAR PHOTOVOLTAIC PANELS: A PROVEN TECHNOLOGY

What It Is. The most common types of solar panels are made of crystalline silicon solar cells. These are the ones that you probably already associate with solar technology. You know. They're the flat, rectangular panels people have on roofs among other places, and they produce electricity. Crystalline silicon is one of the most common materials in use, but there are more than a few types of materials in use these days.

What to Expect. With no moving parts, solar PV panels offer reliable, long-term energy production. They've been around awhile, so a lot of the kinks have been worked out. Plus, these babies can produce a whole lot of electricity. The highest efficiency commercial solar panels offer efficiencies of up to 20%.

When to Buy. With better efficiency than thin film solar panels, conventional solar PV panels are usually the go-to solar technology. Why? Space. Most places don't have unlimited amounts of space. So if you want to get as much electrical juju as possible, you're going to most likely go with conventional solar PV.

THIN FILM SOLAR PANELS: A FLEXIBLE SOLAR SOLUTION

What It Is. Thin film has become really popular in recent years. These solar panels convert sunlight to electricity like conventional solar PV panels, but they are typically thinner and more flexible. Generally, the semiconductor layers on thin film solar panels are only a few millionths of a meter thick, although the name "thin film" comes from their production process and not from thickness.

What to Expect. Thin film is less efficient than conventional solar panels. It usually reaches 6% to 11% efficiency, so you better have lots of space available if you're going to produce enough energy to power your organization.

When to Buy. Thin film is great for buildings with special architectural needs that limit the installation of conventional solar panels. As we said, you're also going to need lots of free space to get as much energy production as conventional panels. Because you'll need more panels, you'll also need more time for installation and more budget for additional



UNDERSTANDING DIFFERENT TYPES OF SOLAR AND MOUNTING SOLUTIONS

balance of system (BOS) materials. The BOS is all the other stuff like cabling and mounting materials that go with the panels.

SOLAR THERMAL SYSTEMS: A COMPLEMENTARY SOLAR OPTION

What It Is. Solar thermal panels are a very different technology. They transfer the sun's heat, as opposed to generating electricity. Their most popular application is to heat water.

What to Expect. One popular type of solar thermal heating system uses pipes filled with water in conjunction with the panels. The sun's heat is conducted through the panels to heat the water in the pipes. There are generally two types of these solar thermal systems: active and passive systems. Active systems use pumps and controls to regulate the hot water. Passive systems do not. They're typically only used in mild climates where risks from extremes like freezing aren't present.

When to Buy. You shouldn't think either/or with solar thermal and solar PV. You'd be better off to think of these as complements. A solar PV system offsets electric usage, and a solar thermal heating system offsets gas. With both, you can potentially eliminate all your energy costs. The key component is to review your building's energy demands to figure out what makes the most sense.

OTHER SOLAR SOLUTIONS

If that wasn't enough, there are even more types of solar solutions. A number of concentrated photovoltaic (CPV) and concentrated solar power (CSP) solutions have grown in popularity. These solar solutions typically use mirrors and lenses to enhance the conversion of sunlight into electricity. CPV focuses sunlight onto photovoltaic cells to maximize electrical output. On the other hand, CSP technologies focus sunlight in different ways to create heat, and that heat is used to generate electrical power. And there are more beyond that, but most of those haven't become economically feasible for broad-scale deployment. In short, they are really, really expensive.

A BRIEF LOOK AT SOLAR MOUNTING SOLUTIONS

With the solar panel overview in the bag, let's take a moment to talk about where to put them and what holds them in place. Different solar technologies work with different mounting types, but in general there are three common solar mounting types:

- **Roof-mounted systems**

This is a great solution if your organization has plenty of open roof space. Self-ballasting roof tile systems are one option. Self-ballasting systems remove potential concerns about roof leaks because they do not require hundreds of screws to secure the system to the roof as other racking systems do.

- **Ground-mounted systems**

Excess land is the key component to whether or not to install a ground-mounted solution. In some cases, ground-mounted solar systems can turn otherwise unusable land into an energy-producing asset. For instance, Fort Carson turned a decommissioned landfill into a 2 MW solar system.

UNDERSTANDING DIFFERENT TYPES OF SOLAR AND MOUNTING SOLUTIONS

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- **Solar parking canopies**

Transforming parking lots into solar power plants maximizes the value of your land, and the solar parking canopies can offer shade to cars parked beneath them. It can be nice to not have to walk into a hot car at the end of a long day.

FIXED MOUNTING SOLUTIONS VERSUS SOLAR TRACKERS

Many of these mounting solutions can be set at a fixed-tilt or be built with solar tracker technology. Solar trackers follow the sun to enhance light capture and therefore increase your energy production. Some solar trackers can generate up to 30% more energy than traditional fixed-tilt systems.

With a wide variety of solar technologies and mounting solutions available, you are certain to find a solar option that works for your organization.

YOUR NEXT STEPS

Now that you've learned so much about solar power, we hope you can use it to navigate you through the selection process as you begin your solar project. Armed with the knowledge you will be confident to take the next steps for bringing solar power to your organization. Contact a SunPower sales representative at 1.800.SUNPOWER to request a custom evaluation of your site and find out how much money solar power can save for years to come!

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Solar Photovoltaic Roof Mounted Systems

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Solar Photovoltaic roof mounted systems are the most common that exist. The second most common location is on the ground for those with a little space to spare. Within these two basic types are different designs/techniques of installations that depend on the client's needs and property style. Roof mounted solar PV systems are installed on the roof of the said property.

The system is usually installed on the south facing side for maximum solar exposure. The panels are either

aligned following the original slope (pitch) of the roof or with the use of specified racks that help provide proper sloping or pitching for the panels.

There are two types of roof mounts depending on the type of roof surface:



Translate » Roof mounts:

Panels are installed following the original pitch of the roof. Specific non-penetrating racks may be used in most cases to stop ‘voiding’ roof warranty or causing future leaks. These racks are usually fixed and set the angle at which the panels are held.

2) Ballasted mounts:



Commonly used on flat and wide roof surfaces.

The design is engineered to secure or ‘weigh down’ the array without any penetration. A support bracket connected to a wind deflector (last row) and a ballast pan holds the ballast and the panels. It is connected to the next row by a ‘connect tube’.

Other mount types include ground mounts that are very interesting and provide a lot more possibilities for the installer and client to be creative.

Which do you prefer?

To conclude, let's review some few points from the experts at Building Design & Construction on the “**do's and don'ts**” of PV roof rack installation.

1. DO use the proper flashing techniques for steep-slope roofs.
2. DO avoid improper flashing techniques for low-slope roofs.
3. DON'T allow for hunt-and-peck pilot holes on steep-slope roofs.
4. DO maintain the roof and PV system after installation.
5. DON'T consider initial payback alone: Factor in life cycle costs.
6. DON'T equate a non-penetrating rack system with zero roof penetrations.
7. DO ask about ballasted rack systems on low-slope roofs and the impact of movement, abrasion, drainage, and wind.

Hope this article has been helpful.

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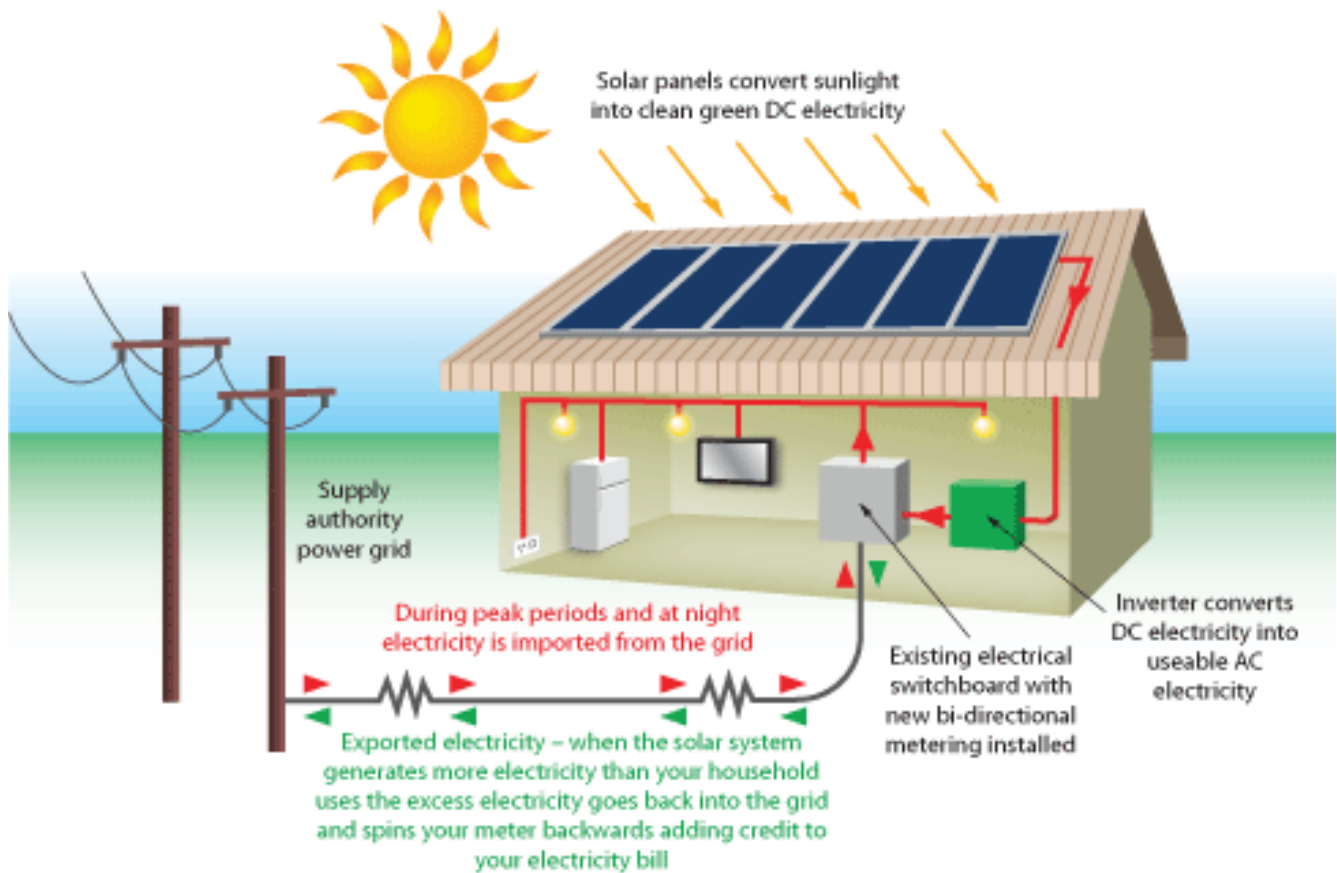
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What is a Photovoltaic Energy System?



Examples of Ground Mounted Photovoltaic Systems:



Examples of Roof Mounted Photovoltaic Systems:

Flush Mounted Solar Panels – Sloped Roofs



Thin Film Solar Panels

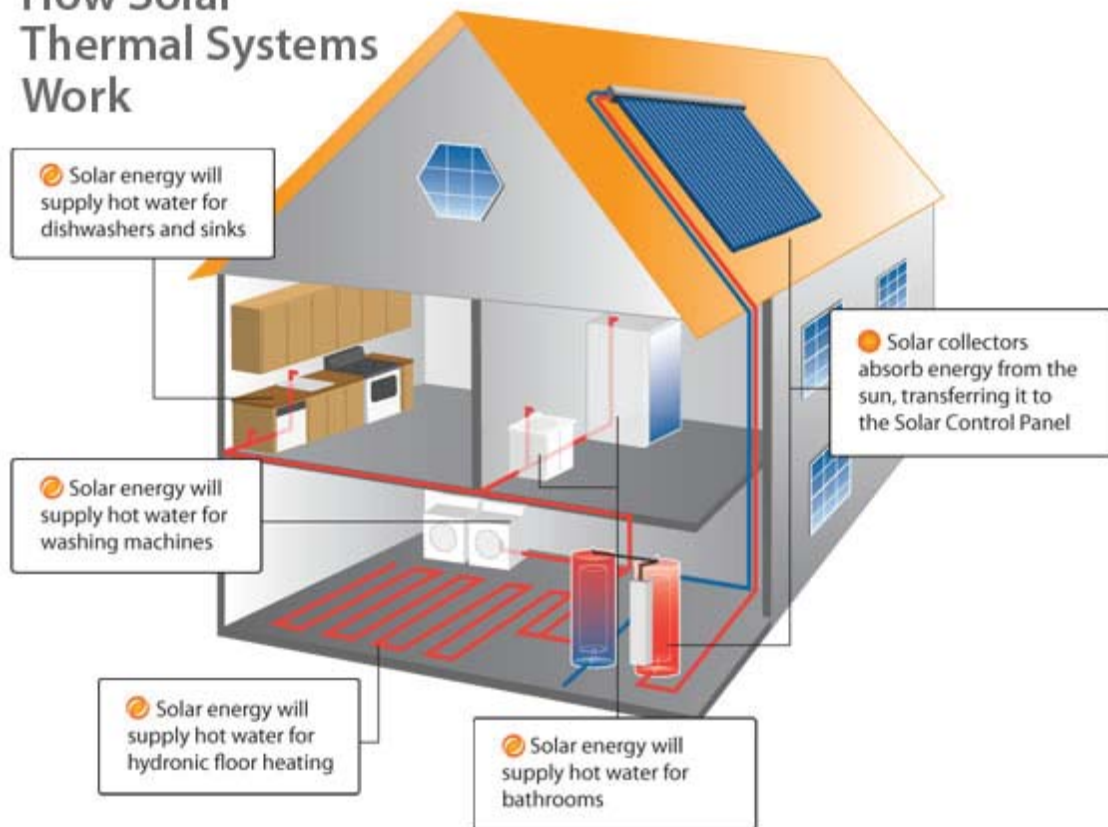


Ballasted Solar Panels – Flat Roofs



What is a Solar Thermal Energy System?

How Solar Thermal Systems Work



Examples of Roof Mounted Solar Thermal Systems:



**CITY OF SUNFISH LAKE
DAKOTA COUNTY, MINNESOTA**

ORDINANCE NO. 2015-_____

**AN ORDINANCE AMENDING THE SUNFISH LAKE CITY CODE,
ARTICLE XII (ZONING REGULATIONS), TO ESTABLISH
ALTERNATIVE ENERGY SYSTEM REGULATIONS**

THE CITY COUNCIL OF SUNFISH LAKE DOES HEREBY ORDAIN AS FOLLOWS:

Section 1. Section 1202.02 (Definitions) of Article XII (Zoning Regulations) shall be amended to add the following definitions:

Alternative Energy System: A ground source heat pump or solar energy system.

Ground Source Heat Pump System Related:

1. Closed Loop Ground Source Heat Pump System: A system that circulates a heat transfer fluid, typically food-grade antifreeze, through pipes or coils buried beneath the land surface or anchored to the bottom in a body of water.
2. Ground Source Heat Pump System: A system that uses the relatively constant temperature of the earth or a body of water to provide heating in the winter and cooling in the summer. System components include open or closed loops of pipe, coils or plates; a fluid that absorbs and transfers heat; and a heat pump unit that processes heat for use or disperses heat for cooling; and an air distribution system.
3. Horizontal Ground Source Heat Pump System: A closed loop ground source heat pump system where the loops or coils are installed horizontally in a trench or series of trenches no more than twenty (20) feet below the land surface.
4. Heat Transfer Fluid: A non-toxic and food grade fluid in accordance with Minn. Rules 4725.7050.
5. Ground Water Thermal Exchange Devices. A heating or cooling device that depends on extraction and reinjection of groundwater from an independent aquifer to operate, as defined in Minn. Stat. § 103I.005.
6. Bored Geothermal Heat Exchangers: An earth-coupled heating or cooling device consisting of a sealed closed-loop piping system installed in a boring in the ground to transfer heat to or from the surrounding earth with no discharge, as defined in Minn. Stat. § 103I.005.

Solar Energy System Related:

1. Building-integrated Solar Energy System: A solar energy system that is an integral part of a principal or accessory building, rather than a separate mechanical device, replacing or substituting for an architectural or structural component of the building including, but not limited to, photovoltaic or hot water solar systems contained within roofing materials, windows, skylights and awnings.
2. Flush-mounted Solar Energy System: A roof-mounted system mounted directly abutting the roof. The pitch of the solar collector may exceed the pitch of the roof up to five (5) percent but shall not be higher than ten (10) inches above the roof.
3. Passive Solar Energy System: A system that captures solar light or heat without transforming it to another form of energy or transferring the energy via a heat exchanger.
4. Photovoltaic System: A solar energy system that converts solar energy directly into electricity.
5. Solar Energy System: A device or structural design feature, a substantial purpose of which is to provide daylight for interior lighting or provide for the collection, storage and distribution of solar energy for space heating or cooling, electricity generation or water heating.

Section 2. Article XII (Zoning Regulations), Section 1230 (Reserved) is hereby amended to read as follows:

1230. ALTERNATIVE ENERGY SYSTEMS

- 1230.01 Purpose
- 1230.02 Ground Source Heat Pump Systems
- 1230.03 Solar Energy Systems

SECTION 1230.01 PURPOSE: The purpose of this section is to:

- A. Accommodate alternative energy sources by removing regulatory barriers and creating a clear regulatory path for approving alternative energy systems.
- B. Create a livable community where development incorporates sustainable design elements such as resource and energy conservation and use of renewable energy.
- C. Protect and enhance air quality and decrease use of fossil fuels.
- D. Accommodate alternative energy development in locations where the technology is viable and environmental, economic and social impacts can be mitigated.

SECTION 1230.02 GROUND SOURCE HEAT PUMP SYSTEMS:

A. Zoning District Allowance. Ground source heat pump systems in accordance with the standards in this section are allowed as a permitted accessory use in all zoning districts.

B. Standards.

1. System Requirements.

a. Only closed loop ground source heat pump systems utilizing heat transfer fluids as defined in Minn. Rules 4725.7050 are permitted. Ground water thermal exchange devices as defined by Minn. Stat. § 103I.005 are not permitted.

b. Ground source heat pump systems located within public waters are prohibited.

2. Setbacks. All components of ground source heat pump systems including pumps, borings and loops shall be set back at least twenty-five (25) feet from all lot lines and the ordinary high water level of any public water body. Systems must otherwise comply with required well and boring setbacks as identified in Minn. Rules Chapter 4725.

3. Easements. Ground source heat pump systems shall not encroach on public drainage, utility roadway or trail easements.

4. Noise. Ground source heat pump systems shall comply with Minnesota Pollution Control Agency standards outlined in Minnesota Rules Chapter 7030.

5. Safety. Ground source heat pumps shall meet the requirements of the State Building Code.

C. Abandonment. If a ground source heat pump system remains nonfunctional or inoperative for a continuous period of one (1) year, the system shall be deemed to be abandoned and shall constitute a public nuisance. The property owner shall remove the abandoned system and restore vegetation upon the site at his/her expense after a demolition permit has been obtained. If the property owner does not remove the abandoned system within thirty (30) days after the system becomes abandoned, the City shall send a written notice to the owner and direct the owner to remove the abandoned system. If the owner does not remove the abandoned system within ninety (90) days after the date of the written notice, the City shall have the power under Minn. Stat. § 429.021, Subd. 1(8) to abate the public nuisance by ordering the abatement after a public hearing pursuant to Minn. Stat. § 429.031. The public hearing shall be preceded by mailed and published notices as required by Minn. Stat. § 429.031. If abatement has been ordered, the City may remove the abandoned system and charge the expense to the property owner. If the property owner has not paid the charges by the date set by the Council the

charges may be specially assessed against the property pursuant to the procedures of Minn. Stat. § 429.061. Removal of the system shall be in accordance with the following:

1. The heat pump and any external mechanical equipment shall be removed.
2. Pipes or coils below the land surface shall be sealed in accordance with applicable regulations. Heat transfer fluid shall be captured and disposed of in accordance with applicable regulations. The top of the pipe, coil or boring shall be uncovered and grouted.

D. Permits. A building permit shall be obtained for any ground source heat pump system prior to installation. Borings for vertical systems are subject to approval and permitting by the Minnesota Department of Health.

SECTION 1230.03 SOLAR ENERGY SYSTEMS:

A. Zoning District Allowance. Solar energy systems in accordance with the standards in this section are allowed as a permitted accessory use in all zoning districts.

B. Standards.

1. Exemption. Passive or building-integrated solar energy systems are exempt from the requirements of this Section and shall be regulated as any other building element.
2. Height. Roof-mounted solar energy systems may exceed the maximum height of the building by up to five (5) feet, according to Zoning Ordinance Section 1219.02. Ground-mounted solar energy systems shall not exceed sixteen (16) feet in height.
3. Setbacks. Ground-mounted solar energy systems shall comply with all accessory structure setbacks in the applicable zoning district. Roof-mounted systems shall comply with all building setbacks in the applicable zoning district and shall not extend beyond the exterior perimeter of the building on which the system is mounted.
4. Roof Mounting. Roof-mounted solar collectors may be flush-mounted or bracket-mounted. Bracket-mounted collectors shall be permitted only when a determination is made by the City Building Official that the underlying roof structure will support apparatus, wind, and snow loads and all applicable building standards are satisfied.
5. Easements. Solar energy systems shall not encroach on public drainage, utility roadway or trail easements.
6. Screening. Solar energy systems shall be screened from view to the extent possible without impacting their function.

7. Maximum Area. Ground-mounted solar energy systems shall not occupy more than twenty-five (25) percent of the rear yard.
8. Aesthetics. All solar energy systems shall minimize glare towards vehicular traffic and adjacent properties.
9. Feeder lines. The electrical collection system shall be placed underground within the interior of each parcel.

C. Safety.

1. Standards. Solar energy systems shall meet the minimum standards outlined by the International Electrotechnical Commission (IEC) ,the American Society of Heating, Refrigerating, and Air-conditioning Engineers (ASHRAE), ASTM International, British Standards Institution (BSI), International Electrotechnical Commission (IEC), International Organization for Standardization (ISO), Underwriter's Laboratory (UL), the Solar Rating and Certification Corporation (SRCC) or other standards as determined by the City Building Official.
2. Certification. Solar energy systems shall be certified by Underwriters Laboratories, Inc. and the National Renewable Energy Laboratory, the Solar Rating and Certification Corporation or other body as determined by the Community Development Director. The City reserves the right to deny a building permit for proposed solar energy systems deemed to have inadequate certification.
3. Utility Connection. All grid connected systems shall have an agreement with the local utility prior to the issuance of a building permit. A visible external disconnect shall be provided if required by the utility.

- D. Abandonment. If a solar energy system remains nonfunctional or inoperative for a continuous period of one (1) year, the system shall be deemed to be abandoned and shall constitute a public nuisance. The property owner shall remove the abandoned system and restore vegetation upon the site at his/her expense after a demolition permit has been obtained. Removal includes the entire structure including transmission equipment. If the property owner does not remove the abandoned system within thirty (30) days after the system becomes abandoned, the City shall send a written notice to the owner and direct the owner to remove the abandoned system. If the owner does not remove the abandoned system within ninety (90) days after the date of the written notice, the City shall have the power under Minn. Stat. § 429.021, Subd. 1(8) to abate the public nuisance by ordering the abatement after a public hearing pursuant to Minn. Stat. § 429.031. The public hearing shall be preceded by mailed and published notices as required by Minn. Stat. § 429.031. If abatement has been ordered, the City may remove the abandoned system and charge the expense to the property owner. If the property owner has not paid the charges by the date set by the Council the charges may be specially assessed against the property pursuant to the procedures of Minn. Stat. § 429.061.

E. Permit. A building permit shall be obtained for any solar energy system prior to installation.

Section 3. Section 1241.04 (R-1 District Accessory Uses) is hereby amended to add the following:

M. Ground source heat pump and solar energy systems as regulated by Section 1230 of this Ordinance.

Section 4. Section 1242.04 (INS District Accessory Uses) is hereby amended to add the following:

D. Ground source heat pump and solar energy systems as regulated by Section 1230 of this Ordinance.

Section 5. This Ordinance shall be in full force and effective from and after its passage and publication according to law.

ADOPTED this 1st day of December 2015 by the City Council of Sunfish Lake.

Molly Park, Mayor

ATTEST:

Catherine Iago, City Clerk

CITY OF SUNFISH LAKE
DAKOTA COUNTY, MINNESOTA

ORDINANCE NO. 2015-_____

**AN ORDINANCE AMENDING THE SUNFISH LAKE CITY CODE,
ARTICLE XII (ZONING REGULATIONS), SECTION 1219 GENERAL YARD, LOT
AREA AND BUILDING REGULATIONS, TO PERMIT ROOF MOUNTED SOLAR
SYSTEMS TO EXCEED THE MAXIMUM HEIGHT LIMITATION OF THE ZONING
DISTRICTS**

THE CITY COUNCIL OF SUNFISH LAKE DOES HEREBY ORDAIN AS FOLLOWS:

Section 1. Section 1219.02 (Height), of Section 1219 (General Yard, Lot Area and Building Regulations), of Article XII (Zoning Regulations) shall be amended to add the following:

11. Roof-mounted solar energy systems

Section 2. This Ordinance shall be in full force and effective from and after its passage and publication according to law.

ADOPTED this 1st day of December, 2015 by the City Council of Sunfish Lake.

ATTEST:

Molly Park, Mayor

Catherine Iago, City Clerk