INTRODUCTION

In spite of its cold and dark reputation, Minnesota has good solar 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 installations have been installed in Minnesota. Since 2005, the interest in solar energy has rapidly increased such that many communities have had to address solar installations as a land use issue. Solar energy components continue to improve in efficiency and decline in price; the U.S. Department of Energy forecasts that solar energy will start to reach cost parity with retail electric costs by 2016.

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

Solar energy issues

Local governments will need to address solar energy installations in their development regulation in the near future. Three primary issues tie solar energy to development regulations:

1) *Climate protection goals*. Local governments that have committed to meeting climate protection goals can meet some of their commitment by removing regulatory barriers to solar energy and incorporating low or no-cost incentives in development regulations to spur solar investment.
2) *Nuisance and safety considerations*. Solar energy systems have few nuisances, but visual impacts and safety concerns by neighbors sometimes create opposition to solar installations. Good design and attention to aesthetics can answer most concerns. But the misperception that solar energy systems are ugly and unsafe, rooted in poorly designed 1970s solar installations, have resulted in unnecessary regulation or outright prohibitions.
3) *Solar access considerations*. In fully built-out communities and large lot suburban or exurban areas, solar access is of limited concern. Solar access is, however, an important consideration in zoning districts that allow tall buildings or in developing communities where subdivisions should incorporate solar access provisions.

Model Solar Energy Standards

This ordinance is based primarily on the model solar energy ordinance created for Solar Minnesota, under a Million Solar Roofs grant from the U.S. Department of Energy.

Components of a solar standards ordinance

Solar energy standards should consider the following elements:

- Remove regulatory barriers and create a clear regulatory path to approving solar energy systems.
- Limit aesthetic objections by setting reasonable design standards for solar energy in urban neighborhoods, historic districts, and new subdivisions.
- Address solar access issues in subdivisions and zoning districts that allow taller buildings on smaller (urban density) lots.
- Encourage solar-ready subdivision and building design.
- Incorporate regulatory incentives that can spur private-sector solar investment.

Urban and rural communities

The model ordinance language addresses concerns that are primarily in cities rather than counties or townships. Issues of solar access and nuisances associated with solar energy systems are generally of little consequence outside urban density areas, where lot sizes are almost always greater than one acre. Counties and townships can address most barriers by simply stating in their development regulations that solar energy systems are an allowed accessory use in all districts. Aesthetic issues or solar access issues might come into play in lakeshore areas or conservation development areas, where homes are closer together or protected trees might limit solar access. The incentive potion of the model ordinance can also be applied in rural areas. However, most of the language in this model ordinance is directed to situations seen in cities.

Primary and accessory uses

This ordinance addresses solar energy as an accessory use to the primary residential or commercial use in an urban area. Solar energy systems are also sometimes the primary use, on "solar farms" that are large arrays of hundreds or thousands of kilowatts of ground or pole-mounted systems, or in the case of solar thermal power plants, such as seen in the desert southwest. These land uses have different issues and need to be addressed in a substantially different manner than discussed in this model.

I. Scope - This article applies to all solar energy installations in Model Community.

II. Purpose - Model Community has adopted this regulation for the following purposes:

A. **Comprehensive Plan Goals** - To meet the goals of the Comprehensive Plan and preserve the health, safety and welfare of the Community's citizens by promote the safe, effective and efficient use of active solar energy systems installed to reduce the on-site consumption of fossil fuels or utility-supplied electric energy. The following solar energy standards specifically implement the following goals from the Comprehensive Plan:

1. **Goal** – Encourage the use of local renewable energy resources, including appropriate applications for wind, solar, and biomass energy.
2. **Goal** – Promote sustainable building design and management practices in residential, commercial, and industrial buildings to serve the needs of current and future generations.
3. **Goal** – Assist local businesses to lower financial and regulatory risks and improve their economic, community, and environmental sustainability.
4. **Goal** – Efficiently invest in and manage public infrastructure systems to support development and growth.

B. **Climate Change Goals** - As a signatory of the Cool Cities program, Model Community has committed to reducing carbon and other greenhouse gas emissions. Solar energy is an abundant, renewable, and nonpolluting energy resource and that its conversion to electricity or heat will reduce our dependence on nonrenewable energy resources and decrease the air and water pollution that results from the use of conventional energy sources.

C. **Infrastructure** - Distributed solar photovoltaic systems will enhance the reliability and power quality of the power grid and make more efficient use of Model Community's electric distribution infrastructure.

D. **Local Resource** - Solar energy is an under used local energy resource and encouraging the use of solar energy will diversify the community's energy supply portfolio and exposure to fiscal risks associated with fossil fuels.

E. **Improve Competitive Markets** - Solar energy systems offer additional energy choice to consumers and will improve competition in the electricity and natural gas supply market.

Comprehensive Plan Goals

Tying the solar energy ordinance to Comprehensive Plan goals is particularly important when the solar standards include regulatory incentives or solar requirements as described in the last section of this ordinance. If the Comprehensive Plan does not include goals that could address solar energy, and the community does not have some of policy foundation for encouraging private investment in solar energy (such as climate protection goals) the community should consider creating a local energy plan.

Climate Protection Strategies

Solar energy should be part of every community's portfolio for addressing climate change or energy transitions (also known as "peak oil") considerations. Local governments that are participating in the Cities for Climate Protection program, Mayor's Climate Protection signatories, or the Cool Cities/Cool Counties program can use private solar investment as a vehicle for meeting goals. Additional community benefits that improve sustainability are also spelled out in the findings section.

III. Definitions

Active Solar Energy System - A solar energy system whose primary purpose is to harvest energy by transforming solar energy into another form of energy or transferring heat from a collector to another medium using mechanical, electrical, or chemical means.

Building-integrated Solar Energy Systems - An active 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. Building-integrated systems include but are not limited to photovoltaic or hot water solar energy systems that are contained within roofing materials, windows, skylights, and awnings.

Grid-intertie Solar Energy System - A photovoltaic solar energy system that is connected to an electric circuit served by an electric utility company.

Solar Definitions

Not all these terms are used in this model ordinance, nor is this a complete list of solar definitions. As a community develops its own design standards for solar technology, many of the concepts defined here may be helpful in meeting local goals. For instance, solar daylighting devices may change the exterior appearance of the building, and the community may choose to distinguish between these devices and other architectural changes.

Off-grid Solar Energy System - A photovoltaic solar energy system in which the circuits energized by the solar energy system are not electrically connected in any way to electric circuits that are served by an electric utility company.

Passive Solar Energy System - A solar energy system that captures solar light or heat without transforming it to another form of energy or transferring the energy via a heat exchanger.

Photovoltaic System - An active solar energy system that converts solar energy directly into electricity.

Renewable Energy Easement, Solar Energy Easement - An easement that limits the height or location, or both, of permissible development on the burdened land in terms of a structure or vegetation, or both, for the purpose of providing access for the benefited land to wind or sunlight passing over the burdened land.

Renewable Energy System - A solar energy or wind energy system. Renewable energy systems do not include passive systems that serve a dual function, such as a greenhouse or window.

Roof Pitch - The final exterior slope of a building roof calculated by the rise over the run, typically but not exclusively expressed in twelfths such as 3/12, 9/12, 12/12.

Solar Access - A view of the sun, from any point on the collector surface, that is not obscured by any vegetation, building, or object located on parcels of land other than the parcel upon which the solar collector is located, between the hours of 9:00 AM and 3:00 PM Standard time on any day of the year.

Solar Collector - A device, structure or a part of a device or structure for which the primary purpose is to transform solar radiant energy into thermal, mechanical, chemical, or electrical energy.

Solar Collector Surface - Any part of a solar collector that absorbs solar energy for use in the collector's energy transformation process. Collector surface does not include frames, supports and mounting hardware.

Solar Daylighting - A device specifically designed to capture and redirect the visible portion of the solar spectrum, while controlling the infrared portion, for use in illuminating interior building spaces in lieu of artificial lighting.

Solar Energy - Radiant energy received from the sun that can be collected in the form of heat or light by a solar collector.

Solar Energy Device - A system or series of mechanisms designed primarily to provide heating, cooling, electrical power, mechanical power, solar daylighting or to provide any combination of the foregoing by means of collecting and transferring solar generated energy into such uses either by active or passive means. Such systems may also have the capability of storing such energy for future utilization. Passive solar energy systems shall clearly be designed as a solar energy device such as a trombe wall and not merely a part of a normal structure such as a window.

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 generating, or water heating.

Solar Heat Exchanger - A component of a solar energy device that is used to transfer heat from one substance to another, either liquid or gas.

Solar Hot Air System - (also referred to as Solar Air Heat or Solar Furnace) – An active solar energy system that includes a solar collector to provide direct supplemental space heating by heating and re-circulating conditioned building air. The most efficient performance typically means vertically mounted on a south-facing wall.

Solar Hot Water System (also referred to as Solar Thermal**)** - A system that includes a solar collector and a heat exchanger that heats or preheats water for building heating systems or other hot water needs, including residential domestic hot water and hot water for commercial processes.

Solar Mounting Devices - Devices that allow the mounting of a solar collector onto a roof surface or the ground.

Solar Storage Unit - A component of a solar energy device that is used to store solar generated electricity or heat for later use.

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 well lower than the principal structure. Communities may want to consider allowing taller systems if set back farther, for instance, an extra foot of height for every additional two feet of setback. Communities may also consider allowing higher systems if the size of the panel is less than allowed, for instance, an additional foot of height for every 10 sq. ft. of reduction of surface area.

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.

Mounted Solar Energy Systems

This ordinance sets a threshold for solar panels that they be no more than 5% steeper than the finished roof pitch. Mounted systems steeper than the finished roof pitch change the appearance of the roof, and are exposed to additional safety considerations in regard to the wind and drift load on structural roof components.

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. (Administrative Variances).

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 considered to be mechanical devices and are restricted consistent with other building-mounted mechanical devices.
2. Ground- or pole-mounted solar energy systems shall not exceed 20 feet in height when oriented at maximum tilt.

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-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. Exterior piping for solar hot water systems shall be allowed to extend beyond the perimeter of the building on a side yard exposure.
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.

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.

1. **Building Integrated Photovoltaic Systems** - Building integrated photovoltaic solar energy systems shall be allowed regardless of whether the system is visible from the public right-of-way, provided the building component in which the system is integrated meets all required setback, land use or performance standards for the district in which the building is located.
2. **Solar Energy Systems with Mounting Devices** - Solar energy systems using roof mounting

devices or ground-mount solar energy systems shall not be restricted if the system is not visible from the closest edge of any public right-of-way other than an alley. Roof-mount systems that are visible from the nearest edge of the street frontage right-of-way shall not have a highest finished pitch more than five (5) percent steeper than the roof pitch on which the system is mounted, and shall be no higher than twelve (12) inches above the roof.

3. **Coverage** - Roof or building mounted solar energy systems, excluding building-integrated systems, shall not cover more than 80% of the south-facing or flat roof upon which the panels are mounted, and shall be set back from the roof edge by a minimum of one (1) foot. The surface area of pole or ground mount systems shall not exceed half the building footprint of the principal structure.

4. **Historic Buildings** - Solar energy systems on buildings within designated historic districts or on locally designated historic buildings (exclusive of State or Federal historic designation) will require an administrative variance, as provided in this ordinance.

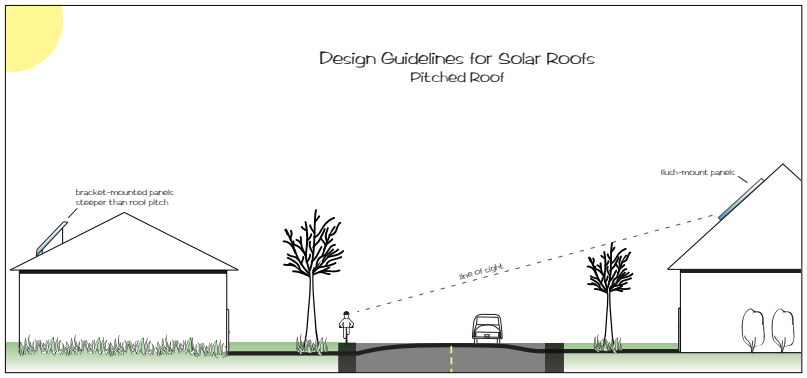
D. **Approved Solar Components** - Electric solar energy system components must have a UL listing and solar hot water systems must have an SRCC rating.

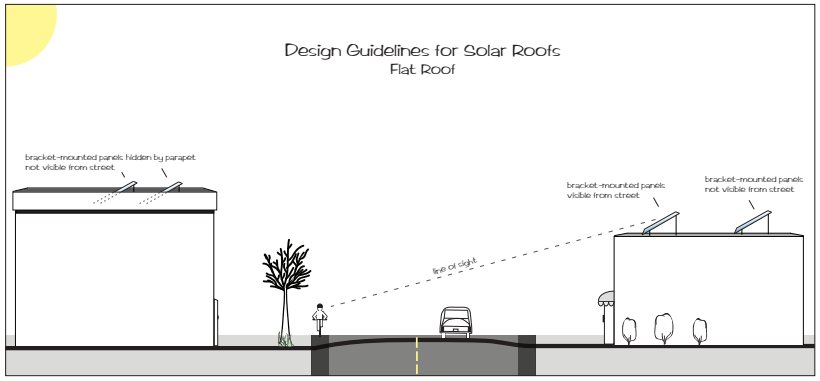
E. **Plan Approval Required** - All solar energy systems shall require administrative plan approval by Model Community zoning official.

1. **Plan Applications** - Plan applications for solar energy systems shall be accompanied by to-scale horizontal and vertical (elevation) drawings. The drawings must show the location of the system on the building or on the property for a ground-mount system, including the property lines.

   a. **Pitched Roof Mounted Solar Energy Systems** - For all roof-mounted systems other than a flat roof the elevation must show the highest finished slope of the solar collector and the slope of the finished roof surface on which it is mounted.

   b. **Flat Roof Mounted Solar Energy Systems** - For flat roof applications a drawing shall be submitted showing





the distance to the roof edge and any parapets on the building and shall identify the height of the building on the street frontage side, the shortest distance of the system from the street frontage edge of the building, and the highest finished height of the solar collector above the finished surface of the roof.

2. **Plan Approvals** - Applications that meet the design requirements of this ordinance, and do not require an administrative variance, shall be granted administrative approval by the zoning official and shall not require Planning Commission review. Plan approval does not indicate compliance with Building Code or Electric Code.

F. **Compliance with Building Code** - All active solar energy systems shall meet approval of local building code officials, consistent with the State of Minnesota Building Code, and solar thermal systems shall comply with HVAC-related requirements of the Energy Code.

G. **Compliance with State Electric Code** - All photovoltaic systems shall comply with the Minnesota State Electric Code.

H. **Compliance with State Plumbing Code** - Solar thermal systems shall comply with applicable Minnesota State Plumbing Code requirements.

I. **Utility Notification** - No grid-intertie photovoltaic system shall be installed until evidence has been given to the Planning and Zoning Department that the owner has submitted notification to the utility company of the customer's intent to install an interconnected customer-owned generator. Off-grid systems are exempt from this requirement.

Administrative Variance

This model language uses an administrative variance process to balance between aesthetic design considerations and the building owner's choice to use the property for generating renewable energy. Administrative variances allow staff to departures from the design standards when such departures are necessary in order to allow for efficient harvest of solar energy, without having to get Planning Commission approval or pay additional fees. The administrative variance standards spell out the conditions that staff would use to judge if the system genuinely could not be designed consistently with Section IV. (such as a lack of solar access except on the front of the building), and the metrics by which staff would judge screening or visual integration with the building. Some communities will have other means to allow this, or will have a conditional use permit process that does not create burdensome additional regulation.

V. Administrative Variance - Model Community encourages the installation of productive solar energy systems and recognizes that a balance must be achieved between character and aesthetic considerations and the reasonable desire of building owners to harvest their renewable energy resources. Where the standards in Section IV. A., B., or C. cannot be met without diminishing, as defined below, the minimum reasonable performance of the solar energy system, an administrative variance may be sought from the zoning official. An administrative variance shall be granted if the administrative variance standards are met.

A. **Minimum Performance Design Standards** - The following design thresholds are necessary for efficient operation of a solar energy system:

1. **Fixed-Mount Active Solar Energy Systems** - Solar energy systems must be mounted to face with 45 degrees of south (180 degrees azimuth).

Restrictions on Solar Energy Systems

One of the most common barriers to solar energy in developing areas are restrictive covenants in new subdivisions. The covenants are intended to maintain an the appearance of homes, property values, and saleability. If, however, the local government provides solar design standards that protect against poor design of solar accessory uses, it is reasonable to prevent the developer or homeowner's association from creating unwarranted restrictions on a sustainable source of energy.

2. **Solar electric (photovoltaic) systems** must have a pitch that is within 20 degrees of latitude, a pitch of between 20 and 65 degrees.
3. **Solar Hot Water Systems** - Solar collectors need to be mounted at a pitch between 40 and 60 degrees.

B. **Standards for an Administrative Variance** - A variance shall be granted by the zoning official if the applicant demonstrates that the following safety, performance and aesthetic conditions are met:

1. **Aesthetic Conditions** - The solar energy system must be designed to blend into the architecture of the building or be screened from routine view from public right-of-ways other than alleys to the maximum extent possible while still allowing the system to be mounted for efficient performance.
2. **Safety Conditions** - All applicable health and safety standards are met.
3. **Non-Tracking Ground-Mounted Systems** - Pole-mounted or ground-mounted active solar energy systems must be set back from the property line by one foot.

VI. Restrictions on Solar Energy Systems Limited - No homeowners' agreement, covenant, common interest community, or other contract between multiple property owners within a subdivision of Model Community shall restrict or limit solar energy systems to a greater extent than Model Community' solar energy standards.

VII. Solar Access - Model Community encourages solar access to be protected in all new subdivisions and allows for existing solar to be protected consistent with Minnesota Statutes.

A. Model Community has elected to allow solar easements to be filed, consistent with Minnesota Stat. Chapter 500 Section 30. Any building owner can purchase an easement across neighboring properties to protect access to sunlight. The easement is purchased from or granted by owners of neighboring properties and can apply to buildings, trees, or other structures that would diminish solar access.

B. Model Community may require new subdivisions to identify and create solar easements when solar energy systems are implemented as a condition of a PUD, subdivision, conditional use, or other permit, as specified in Section 8 of this ordinance.

Solar Easements

Minnesota allows the purchase and holding of easements protecting access to solar and wind energy. The easement must specify the following information:

***Required Contents** - Any deed, will, or other instrument that creates a solar or wind easement shall include, but the contents are not limited to:*

(a) A description of the real property subject to the easement and a description of the real property benefiting from the solar or wind easement; and

(b) For solar easements, a description of the vertical and horizontal angles, expressed in degrees and measured from the site of the solar energy system, at which the solar easement extends over the real property subject to the easement, or any other description which defines the three dimensional space, or the place and times of day in which an obstruction to direct sunlight is prohibited or limited;

(c) A description of the vertical and horizontal angles, expressed in degrees, and distances from the site of the wind power system in which an obstruction to the winds is prohibited or limited;

(d) Any terms or conditions under which the easement is granted or may be terminated;

(e) Any provisions for compensation of the owner of the real property benefiting from the easement in the event of interference with the enjoyment of the easement, or compensation of the owner of the real property subject to the easement for maintaining the easement;

(f) Any other provisions necessary or desirable to execute the instrument.

Source: Minnesota Stat. 500.30 Subd. 3.

Renewable Energy Conditions (previous page)

The community can use traditional development tools such as conditional use permits, PUDs, or other discretionary permits to encourage private investment in solar energy systems. This model ordinance notes these opportunities for consideration by local governments. In most cases, additional ordinance language would need to be inserted into the community's ordinances. For instance, a provision that PUDs incorporate solar energy would need to be included in the community's PUD ordinance, or if a condition of a CUP was to make the building solar-ready, this would need to be included in the conditional use permit section of the ordinance.

Solar Roof Incentives

This section of the model ordinance includes a series of incentives that can be incorporated into development regulation. Most cities and many counties make requirements or use incentives to ensure that certain public amenities are included in development. These same tools and incentives can be used to encourage private investment in solar energy. Communities will not want to use all these incentives, but should select which ones make the most sense in their community (or create some other incentive that encourages solar energy). As with any incentive, an important element of creating the incentive is to engage planning or economic development staff in the creation of the incentive, so that staff can assist the developer in taking advantage of the provisions.

VIII. Renewable Energy Condition for Certain Permits

A. **Condition for Rezoning or Conditional Use Permit** - Model Community may, in an area where the local electric distribution system was installed more than twenty years ago, or where the local electric utility has documented a near-term need for additional distribution substation or conductor capacity, require on-site renewable energy systems as a condition for a rezoning or a conditional use permit.

1. The renewable energy condition may only be exercised for new construction or major reconstruction projects.
2. The renewable energy condition may only be exercised for sites that have 90% unimpeded solar or wind energy access, and for which the renewable energy system can reasonably meet all performance standards and building code requirements.

B. **Condition for Planned Unit Development (PUD) Approval** - Model Community may require on-site renewable energy systems as a condition for approval of a PUD permit, in order to mitigate for:

1. Risk to the performance of the local electric distribution system,
2. Increased emissions of greenhouse gases,
3. Other risks or effects inconsistent with Model Community's Comprehensive Plan.

IX. Solar Roof Incentives

Solar Roof Incentives - Model Community has identified the following incentives for development applications or subdivisions that will include buildings using active solar energy systems.

A. **Density Bonus** - Any application for subdivision of land in the ___ Districts that will allow the development of at least four new lots of record shall be allowed to increase the maximum number of lots by 10% or one lot, whichever is greater, provided all building and wastewater setbacks can be met with the increased density, if the applicant enters into a development agreement guaranteeing at each one kilowatt of PV or 64 square feet of solar hot water collector installed for each new residence.

B. **Vacant Lot Preference** - When Model Community disposes of vacant parcels of land that are under City ownership through auction, Model Community shall award a 10% bid preference up to $5,000 for every kilowatt of solar capacity that is to be incorporated into the fully-built out parcel, when awarding the bid. The bidder must also meet all land use and dimensional requirements, and must post a bond for the amount of the bid preference granted.

C. **Combined Building Code Permit** - On an existing building that is being retrofit with a solar energy system, Model Community shall charge no more than one permit fee for a solar energy system that meets the administrative approval requirements of this ordinance.

D. **Solar Access Variance** - On a site where the solar access standards of the subdivision ordinance are difficult to meet due to topography or road connectivity, the zoning administrator shall grant an administrative exception from the solar access standards provided the applicant meets the following conditions:

1. **Solar Access Lots Identified** - At least __% of the lots, or a minimum of __ lots, are identified as solar development lots.
2. **Covenant Assigned** - Solar access lots are assigned a covenant that homes built upon these lots must include an active solar energy system. Photovoltaic systems must be at least one (1) KW in capacity and solar thermal systems must have at least 64 square feet of collector area.
3. **Additional Fees Waived** - Model Community will waive any additional fees for filing of the covenant.

E. **Affordable Housing Offset** - On a site where 90% of the potential solar access is unimpeded, and the local electrical distribution system was installed more than twenty years ago, Model Community may substitute a requirement for grid-intertie photovoltaic systems or active solar thermal systems for up to 50% of the affordable housing requirement. For each unit of affordable housing for which a solar energy substitution is made:

1. The photovoltaic system must have at least 2 kilowatts (KW) of capacity with 90% unobstructed solar access.
2. The active solar thermal system must be sized and have sufficient solar access to generate 75% of the estimated domestic hot water load for a family of four.

F. **Commercial Parking Requirement Offset** - On a site where 90% of the potential solar access is unimpeded, and which has access to mass transit within a block of the development site or which has an approved Travel Demand Management (TDM) plan, or which has entered into a shared parking arrangement with another commercial business that has distinct peak parking profiles, Model Community may substitute a requirement for grid-intertie photovoltaic systems or an active solar thermal systems for up to 50% of the parking requirement, up to a maximum of 5 spaces. For each parking space for which a solar energy substitution is made:

1. The photovoltaic system must have at least one (1) kilowatt (KW) of capacity with 90% unobstructed solar access; or
2. An active solar thermal system must have at least 64 square feet of solar collector, and must have sufficient summer load to utilize collector output.