St. Louis County Department of Public Works - Code Enforcement Division
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RESIDENTIAL SOLAR PV* or Thermal DEVICES CHECKLIST for a Permit – *Photovoltaic

(Per the 2015 IRC as amended by St. Louis County Ordinances for 1-& 2-Family Dwellings and Townhouses

This **Solar Photovoltaic or Thermal Devices Checklist** is based on St. Louis County's (SLCO) Policies and construction Codes amended and adopted by its Ordinances. See the list of Codes & their Ordinances below. It is not a substitute for those codes and ordinances, but serves as a guide to reading them. More information and explanation is provided in commentaries and interpretations published by St. Louis County and acknowledged code organizations.



List of Applicable Codes and Ordinances:

2015 International Residential Code (IRC) & Ordinance #27,654-Ch.1116 ("R" "G", "N", and "M" references and Appendix K - Sound Transmission).

2015 International Building Code (IBC) & Ordinance #27,654-Ch.1116\5 ("B" references).

2014 National Electrical Code (NEC) aka NFPA 70 & Ordinance #27,430-Ch.1102 ("E" references).

2015 International Fire Code (IFC), as referenced in the 2015-IRC = ("F" references).

For inquiries regarding the information provided in this guide, please contact:

St. Louis County Permit Processing (314) 615-5184
St. Louis County Zoning Review (314) 615-3763
St. Louis County Building Plan Review (314) 615-5485
Right-of-Way Owner
State (888) 275-6636
County (314) 615-8517
Municipality Call the project site's Municipality

St. Louis County's Municipal Contracts Matrix shows those municipalities that currently contract for its Code Enforcement services. The Matrix can be found on our web site at www.stlouisco.com/YourGovernment/CountyDepartments/PublicWorks.

▪And visit us online at www.stlouisco.com/YourGovernment/CountyDepartments/PublicWorks/Construction

NOTICE: Yellow-background lines in this checklist highlight 2015-IRC changes from the 2009-IRC. Sections from the Codes, their Referenced Standards, and St. Louis County Ordinances, are shown at ends of statements and are *italicized* in parentheses *(.)*.

Notices
Regarding Permits



- The applicant (property owner or the owner's authorized agent) is responsible for contacting those agencies that may have legal oversight separate from St. Louis County. Where their requirements conflict, the most restrictive shall govern. Contact them before starting any work approved under a permit issued by St. Louis County. Such agencies may include:
  1. The project site's Municipality - *submit their site plans approval with a building permit application.*
  2. The Local Fire Protection District – *may check for clearances and pathways around panels.*
  3. Subdivision Trustees - *may restrict or prohibit rooftop or ground-mounted solar panels.*

- Building permit issuance does not authorize construction access to the work site. If a driveway does not exist or cannot be used, the owner/contractor must apply for a permit with the owner of the Right-of-Way to construct somewhere else a temporary entrance into the work site. So, draw 1 or 2, as noted below, on the site plan *(SLCO Rev. Ord. DOT1105.040-4.c)*:

  1. Draw existing driveway with an arrow on it pointing into the lot and labeled "construction entrance";
     OR
  2. Show and label an alternate access with an arrow pointing into the lot and labeled "construction entrance". Note on the site plan: "A separate special use permit shall be obtained from the street right-of-way owner for a construction entrance before any construction accesses the work site".

- The Electrical and Plumbing work shall be performed in accordance with St. Louis County Codes and Ordinances by a Licensed Electrical Contractor or a Licensed Plumbing Contractor registered with St. Louis County Code Enforcement-Permits Processing.

- **The Licensed Electrical and/or Licensed Plumbing Contractors** may sign on to a Building Permit Application before it is approved and issued, as long as the proposed electrical or plumbing new work is provided in the drawings. Electrical and/or plumbing work provided in the drawings submitted with the application change the application status to an Integrated Permit.

- **Electrical work**, including the mounting of solar PV panels, the installation of electrical equipment, its components, and interconnecting wiring AC or DC, shall be performed and connected by a licensed electrical contractor.

- **An electrical permit** - in addition to and separate from the building permit - is required to be obtained by the Licensed Electrical Contractor who will perform the electrical work approved under the building permit application. No drawings are required with the electrical permit application submittal *(SLCO Policy).*

- **Notice:** Once the electrical drawings and documents submitted with the building permit application are reviewed and approved by the St. Louis County Electrical Plan Reviewer, the licensed electrician is allowed to obtain an electrical permit.

- **Electrical work** may be integrated into the building permit, and not require a separate electrical permit, where the proposed solar panel/array system is not connected to the electrical grid and has no electrical wiring or electrical components either AC or DC. This may apply to solar thermal panel systems that capture the sun's heat and transfer it to either a holding tank or water heater, or to a coil placed in the return air ductwork or in ductwork that directly vents heated air into a room or space *(SLCO Policy).*

- **Structural alterations proposed** to the existing building must be drawn and submitted in 4 sets properly sealed by a Missouri registered Design Professional. Please be aware properly sealed

structural calculations may also be required by the Plan Reviewer, depending on the alterations proposed and adequacy and completeness of sealed drawings submitted.

- Only alterations as shown in approved and issued permit drawings shall be provided in the field. If the Field Inspector finds otherwise, a separate permit application submitted with properly sealed structural drawings and calculations shall be required for review of the outside-work scope alterations.

- **Properly sealed drawings means** the 1st sheet of each of 4 sets submitted is embossed or fresh-ink sealed, signed, dated by a Missouri registered engineer or architect, with subsequent sheets of each set bearing the design professional's mechanically reproduced seal. The 1st sheet, or the title block of each sheet, is to note the design professional's business address and contact number, and include the project address, owner name(s) and a description of the new work proposed. Any revisions to drawings are to be highlighted by clouding or by another easily recognized method.

- **Properly sealed calculations** means the cover sheet shall be fresh-ink sealed, signed, dated by the Missouri registered professional engineer, with subsequent pages sequentially number and totaled, starting with the cover as page 1. The engineer shall include on the cover his/her contact number and business address, as well as the project's description of work, the project address and the property owner name(s). The engineer shall provide/include in the calculations the Code Basis of Design for the analysis.
- **The Plan Reviewer** may determine the proposed work, construction, or conditions require additional drawings and information be submitted to Code Enforcement-Plan Review for review, beyond the minimum submittal requirements noted in this Checklist.

Submittal Requirements: Drawings, Notes & Zoning



The following are the minimum submittal documents required for a permit to install a **Solar Energy Device** on or near a dwelling in Unincorporated St. Louis County, and in those Municipalities that contract with St. Louis County for Residential Code Enforcement Services. Specific Code and Ordinance sections may be provided in *parentheses italicized (.).*
Notice: For this checklist, a solar energy device is either a photovoltaic panel system or a thermal panel system. A photovoltaic system converts sunlight energy into direct current electricity. A solar thermal system produces heat from sunlight, which is then used to heat water or air in the residence *(R324.1; R324.2; R324.3; M2301.1; E690).*

- **Building Permit Application** filled out, then signed and dated by the applicant.

- **Site Plans -** show and note the following, scale 1" = 20', 30', or 40'-0 typ. *(B107.2.1; SLCO Policy):*
  1. **For properties in Unincorporated St. Louis County:**
     Ground-mounted solar photovoltaic or thermal panel array systems:
     a. Lot lines, North direction arrow, lot number, subdivision name. Note the names of street(s) that adjoin the lot.
     b. Existing dwelling, other structures and features on the lot, including any retaining walls or swales. Label/identify each by the function it serves.
     c. Location and extent of any septic system and/or well existing on the lot.
     d. Show and label the location of the ground-mounted PV or thermal solar device.
     e. Dimension the distance(s) from the ground-mounted PV or thermal solar device(s) to lot lines and other structures *(R324.6.1).*
     Notice: The distances of the solar PV or thermal panel arrays must be measured perpendicular to the lot line(s). This is a St. Louis County requirement for accessory structures on residential properties. Ground-mounted installations of solar PV or thermal

panels are considered accessory structures.

f. Dimension an area clear and free of brush that extends a minimum of 10'-0" from each projecting side of the ground-supported solar panel array structure *(R324.6.1; F605.11; F605.11.2).*

g. Show with arrows water run-off direction(s) and show and label existing swales. The location(s) of the solar PV or thermal array system structure shall not obstruct swales or run-off.

h. St. Louis County may require noted on the site plans: **"**Siltation and erosion control measures must be provided to prevent siltation/erosion from leaving the construction site".

Roof-or Wall-mounted solar photovoltaic or thermal panel array systems:

i. Show lot lines, North direction arrow, lot number, subdivision name, and name the street(s) adjoining the lot.

j. Show the existing configuration of the roof. Dimension the overall length and width of those roof planes upon which the solar panel array system shall be located.

k. In the roof plan, show, label and dimension each of the solar panel arrays. Dimension the panels' distance(s) from roof edges, ridges and valleys, and from another array.

2. **For properties in a Municipality,** submit new work site plans signed, dated and marked "Approved", and submit the municipality's approved zoning application form/receipt.

Ground-mounted solar Photovoltaic or Thermal panel array systems:

- **Structural Calculations** properly sealed submitted in 1 set where the ground-supported solar panel array system proposed has a surface area greater than 100 square feet or has a height greater than 10'-0". The set shall be retained in St. Louis County Code Enforcement records. The structural calculations shall justify the proposed panel system structure is adequate to resist expected forces, including lateral/wind forces, in compliance with the requirements of the 2015-International Residential Code and the 2015 International Building Code *(R301 esp. R301.1, R301.1.3, & R301.2.1; R324.1; R324.6; SLCO Policy)*.

- The **manufacturer's complete installation instructions** for the solar panel/array system structure, electrical requirements and installation, and other requirements, submitted in 1 set *(SLCO Policy).*

- **Construction-ready drawings and other documents** as listed below, submitted in 4 sets or as noted. The drawings shall be drawn to a scale, labeled, and fully dimensioned:

  1. **Foundation or Pier Plan,** scale1/4" = 1'-0 typical. Show, label, and dimension pier locations and their on-center spacing. Show and note pier and pier flare diameters and their required depth below grade.

  2. **Plan/Layout** of the solar panel array system, scale1/4" = 1'-0 typical. Show and label the full panel array system layout, with the overall length and width of the array(s) dimensioned, and the frame structure-on-piers shown below. Provide the dimensions of one of the panels. The Plan/Layout may be incorporated into the Foundation/Pier Plan.

  3. **Section-Elevation(s),** scale 1/4" to 3/4" = 1'-0 typical. Show solar panel array system structure and label its components and material. Note the grade, thickness, and dimensions of steel members. Show the system structure supported on piers or foundation. Dimension the maximum height of the solar panel array from grade, and note the slope of the panels. Show, dimension, and label piers and their required flares, and dimension their depth below grade.

  4. **Structural Plan/Section Connection Details,** scale 3/4" to 3" = 1'-0" typical. Show and label connection requirements including connector and fastener requirements for the following minimums:
     a. Pier-to-Post;
     b. Post-to-frame members;

c. Frame members-to-panels.

5. **General Notes of Construction** and other requirements including materials, reinforcing, protection from corrosion, and electrical for the piers, frame, and solar panel array system structure, respectively. The proprietary solar panel/array system and its manufacturer are to be noted in the notes and/or drawings *(B107.2.1; SLCO Rev. Ord. R106).*

6. **Electrical Plans,** including a1-line diagram that provides an electrical data summary of the solar panel system to be installed. Include the output voltage, current, and manufacturer of the equipment, the solar PV or thermal panels and their respective listing agency/ies.
Notice: Also see the Electrical Requirements section of this checklist for other items and notes required in the submittal documents *(E690; SLCO Policy).*

Roof-or wall-mounted solar photovoltaic or thermal panel array systems:

- **Structural Certification** required properly sealed on business letterhead effectively stating, where determined true by the sealing design professional, the existing structure with the addition of the solar panel system structure, is adequate to resist expected forces in compliance with the requirements of Section R301 of the 2015 International Residential Code and Chapter 16 of the 2015 International Building Code. Additionally, certification of a townhouse with solar panel wall or roof installations shall effectively state the seismic design forces in the townhouse, with the addition of the solar panel system, does not exceed 10% of the existing seismic design loads. The certification letter must include a subject line noting the project address, owner names, and a description of the work *(R301.1.3; R909, esp. R909.2; M2301.2.2.1; SLCO Policy)*.
OR
- **Structural Calculations** properly sealed, submitted in 1 set, for roof or wall-mounted applications. The set shall be retained in St. Louis County Code Enforcement records. Structural calculations are to confirm the existing roof and supporting building structure, with the addition of the solar panel array system structure, are adequate to resist expected vertical and horizontal forces exerted on it *(R909, esp. R909.2)*. *(R301.1.3; R324.4.1; R909.2.1; M2301.2.2.1).*

- **Notice:** Rooftop-mounted PV panel or modules systems shall be installed to resist the component and cladding wind loads required by the 2015-IRC *(R301.2, esp. R301.2.1; R907.2; Tables R301.2(2); R301.2(3)).*

- The **manufacturer's complete installation instructions** for the solar panel/array system structure, electrical requirements and installation, and other requirements, submitted in 1 set *(R907.4; R909.3; SLCO Policy).*

- **Construction-ready drawings and other documents** as listed below, submitted in 4 sets or as noted. The drawings shall be drawn to a scale, labeled, and fully dimensioned:
  1. **Roof Plan**, scale1/4" = 1'-0 typical. Show and note ridges and valleys, and other items existing on the roof such as roof vents, skylights, exhaust vents. Dimension the lengths and widths of the solar panel/array(s).
  2. **Structural Plan,** scale 1/4" = 1'-0 typical**.** Show, label, and dimension the spacing of the connection points of the panel system railing structure to the building's existing structure.
  3. **Structural Section(s) with Connection Details,** including connectors and fasteners for solar panel rail attachment to building structure shown and identified**,** scale 3/4" to 3" = 1'-0" typical:
     a. Show and identify the connector(s) and any additional components;
     b. Show and identify fastener requirements - type, size, quantity, and spacing;
     c. Show and dimension fastener's minimum required embedment into existing structure.
     d. Label existing structure material and size/dimensions, esp. depth.
     e. Label new work members and materials;
     f. Label existing building members and materials.

g. Include flashing and sealing details, required at new work penetrations ***(R909.3).***

4. **Electrical Plans,** including a1-line diagram that provides an electrical data summary of the solar panel system to be installed. Include the output voltage, current, and manufacturer of the equipment, the solar PV or thermal panels and their respective listing agency/ies.
   Notice: Also see the Electrical Requirements section of this checklist for other items and notes required in the submittal documents *(E690; SLCO Policy).*

5. **General Notes of Construction** and other requirements including materials, reinforcing, protection from corrosion, and electrical for the piers, frame, and solar panel array system structure, respectively. The proprietary solar panel/array system and its manufacturer are to be noted in the notes and/or drawings *(B107.2.1; SLCO Rev. Ord. R106).*

Content Requirements: Drawings & Notes



The following minimum requirements are to be included as applicable in the drawings and documents submitted with a permit application:

- Rooftop-mounted solar PV panels and modules shall have the same fire classification as the roof assembly *(R324.4; R902; R907.2)*
- In section details providing the rooftop-mounted solar panel/array system connections to the building structure, show and note the flashing and sealing requirements at the penetrations *(R909.3; M2301.2.9).*
- Rooftop-mounted solar PV panel/array systems shall provide roof pathways and access points in accordance with the International Fire Code *(R324.2; F605.11.1).*
- Rooftop-mounted solar PV panel/array systems shall be located at least 3'-0" from the roof ridge to allow for the local fire protection district's smoke ventilation operations *(R324.2; F605.11.1.2.5).*
  Notice: Panels may be placed up to the roof ridge where an alternative ventilation method is provided that has been approved by the Fire Chief of the property's local fire protection district.
- Solar thermal collectors and panels shall be listed and labeled in accordance with SRCC 100 or SRCC 600 *(M2301.3.1).*

Electrical Requirements



The following minimum requirements are to be included the drawings and documents submitted with a permit application.

- Electrical work shall comply with the requirements of Articles 690 and 705 of NFPA 70 *(R907.1; R909.1).*
- Identify the manufacturer and model of the proprietary solar panel/array system proposed for installation (SLCO Policy).
- Photovoltaic panels and modules shall be listed and labeled in accordance with UL 1703 "Standard for Flat-Plate Photovoltaic Modules and Panels'. The racking portion of the solar panel/array system

shall also be labeled and listed for compliance with UL 1703 for bonding and grounding provisions *(R324.3.1; R907.5).*

- Inverters shall be listed and labeled in accordance with UL 1741 Systems connected to the utility grid shall use inverters listed for utility interaction (R324.3).

- Note markings are required as follows on interior and exterior direct current (DC) conduit, enclosures, raceways, cable assemblies, junction boxes, combiner boxes and main service disconnects :
  1. Capitalize markings with a minimum 3/8" height white letters on a red background.
  2. The lettering material shall be reflective and weather resistant .
  3. The lettering shall state "Warning: Photovoltaic Power Source".
  4. Markings shall be placed every 10'-0" of straight length.
  5. Marks shall be placed within 1'-0" of turns/bends above and below all construction penetrations."

Plumbing/Mechanical Requirements



The following minimum requirements are to be followed, or provided in documents submitted with a permit application, for the installation of a solar thermal panel/array system.

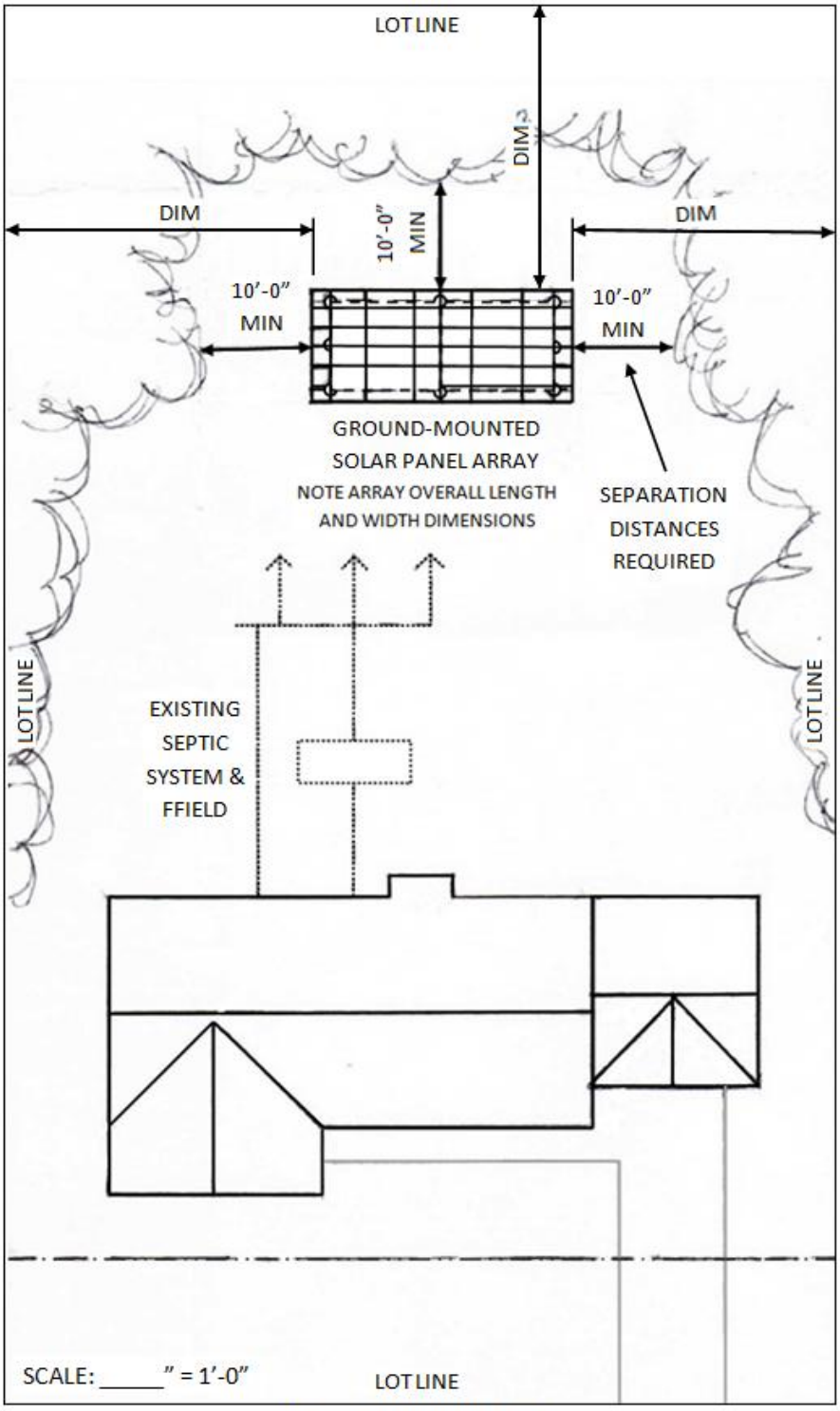
- A solar thermal panel system shall be provided in accordance with the requirements of the 2015 International Residential Code, Chapter 23-Solar Thermal Energy Systems, and the International Fire Code *(R324.2; M2301.1).*

- Plumbing Plan Review and approval is required for any change to the potable water supply system, proposed as part of the installation of a solar thermal panel system. Backflow protection will be required for a potable water supply connected to a solar thermal panel system *(SLCO Policy)*.

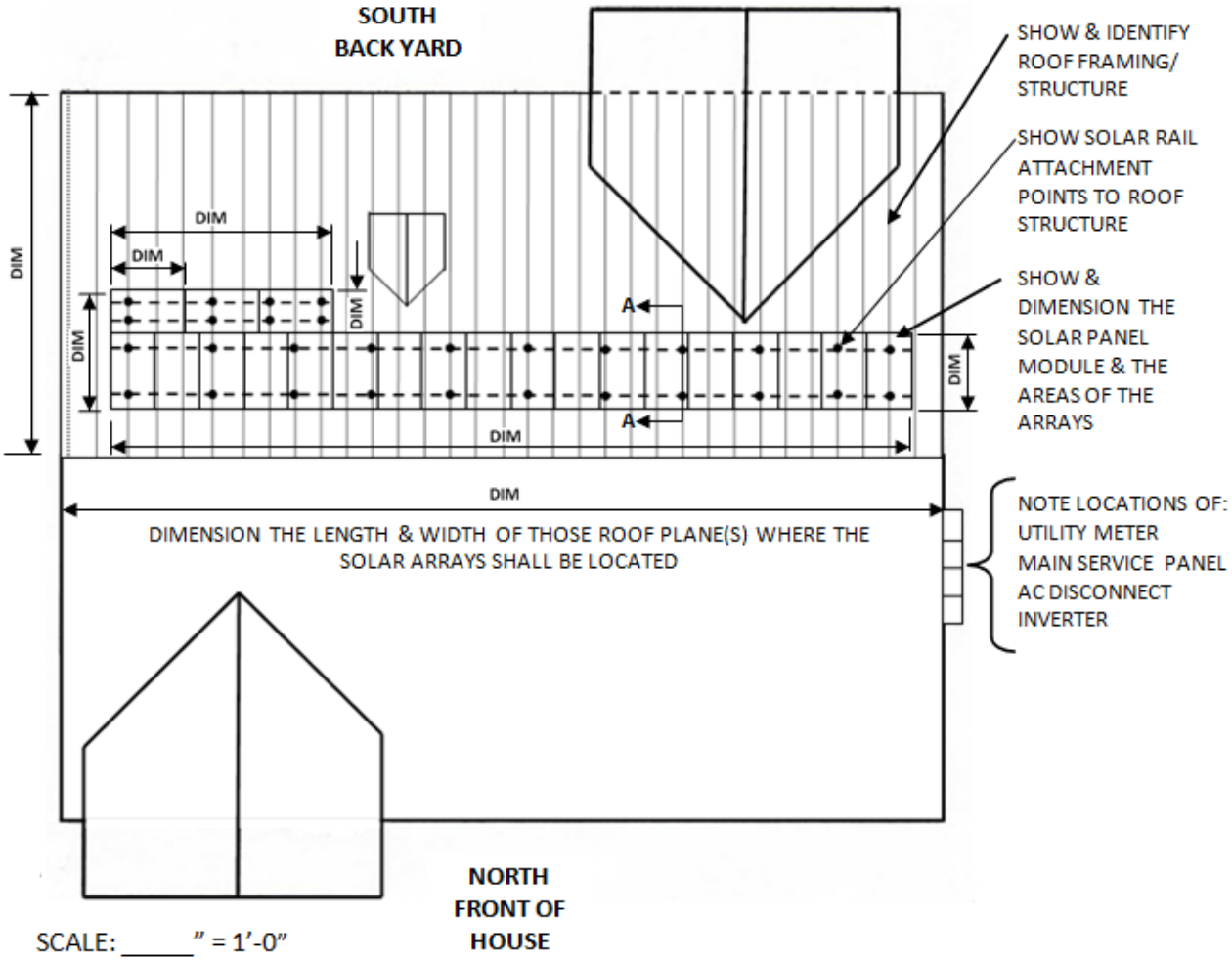
- Solar thermal panel system piping shall be insulated in compliance with the 2015 International Residential Code Chapter 11-Energy Conservation, and exterior insulation shall be protected from exterior degradation *(M2301.2.5).*

- Solar thermal panel system components shall be protected from freezing *(M2301.2.6).*

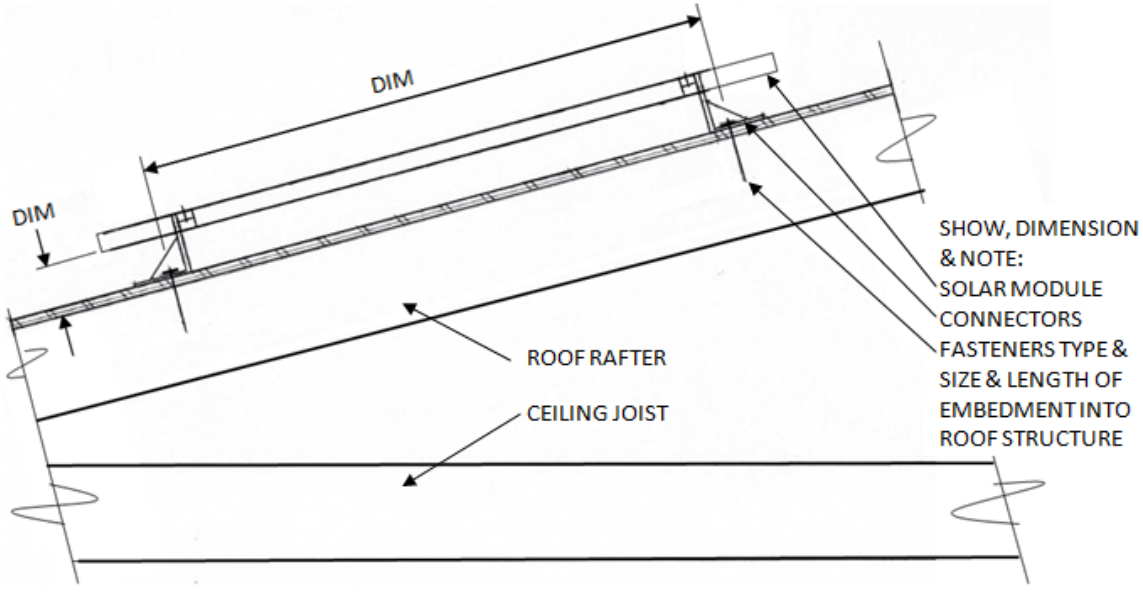
Notice: This Checklist's requirements apply to most simple **Photovoltaic & Thermal Solar Devices** on residential properties. However, the Building Plan Reviewer may determine the new work shown in the drawings requires additional information be provided for compliance with St. Louis County requirements that are in effect at the time this Checklist was last updated. St. Louis County Code Enforcement updates its construction codes every few years.



EXAMPLE SITE PLAN FOR GROUND-MOUNTED SOLAR PANEL ARRAYS



EXAMPLE PLAN OF ROOFTOP SOLAR PANEL ARRAY



EXAMPLE SECTION/CONNECTION DETAIL OF SOLAR PANEL/ARRAY TO ROOF STRUCTURE