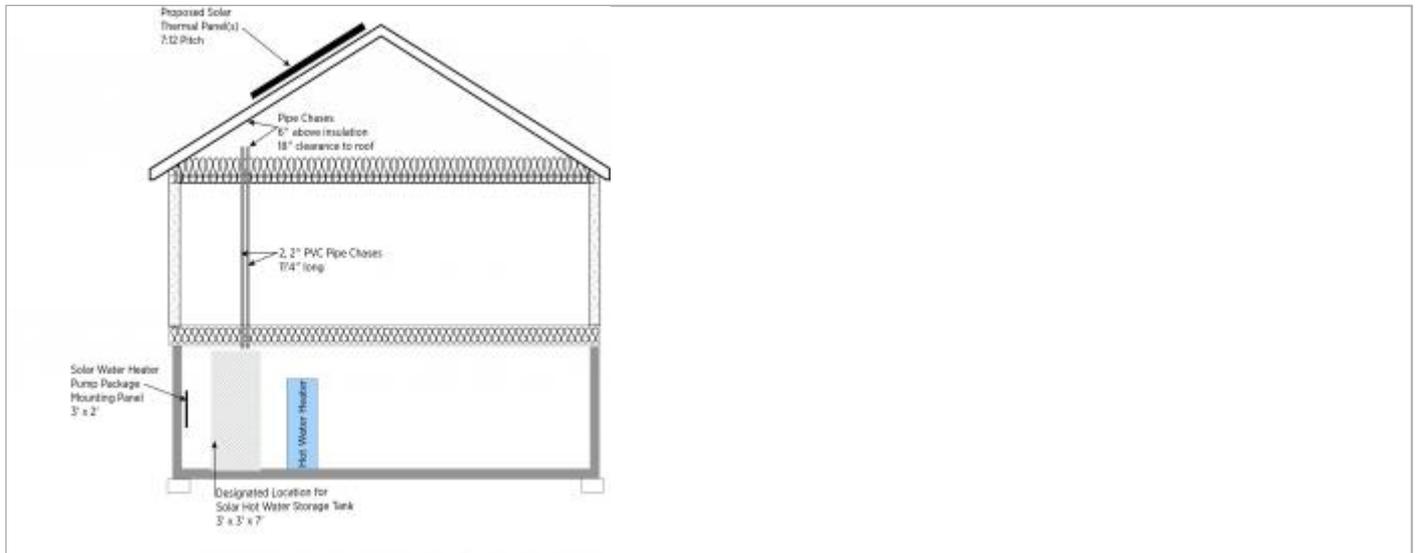


Architectural Drawings for Solar Thermal Systems

Last Updated: 07/21/2014

Scope



Provide an architectural drawing and riser diagram for the homeowner showing the planned location for future solar hot water and photovoltaic system components. Space requirements and layout for solar water heating and photovoltaic system components should be taken into account early in the design process.

DOE Zero Energy Ready Home Notes

The U.S. Department of Energy (DOE) [Zero Energy Ready Home National Program Requirements](#) includes in Exhibit 1, Mandatory Requirements, Item 7 Renewable Ready, that all homes must meet the requirements in the Consolidated Renewable Energy Ready Home (RERH) Checklist.

The RERH Checklist requires builders to:

Provide architectural drawing and riser diagram of RERH solar PV system components and solar hot water components. (RERHPV Guide 3.5) (RERHSWH Guide 3.6)

Alternative: Provide home buyer with the following information:

- List of renewable-ready features
- Available free roof area within +/- 45° of true south
- Location of panel or blocking for future mounting of PV and SWH components
- Location of Riser
- Location of Breaker or slot for future breaker in electrical service panel
- Copy of the Consolidated RERH Checklist
- A copy of the RERH Solar PV Specification Guide
- A copy of the RERH Hot Water Specification Guide.

Description

A renewable energy-ready home (RERH) is one that is built with the wiring and plumbing conduit and other components in place to facilitate the future installation of solar photovoltaic panels and/or solar water heating panels. Some energy-efficiency programs, like the U.S. Department of Energy's [DOE Zero Energy Ready Home Program](#), require homes to be [renewable-energy ready](#).

When constructing a home to be renewable energy ready, develop architectural drawings and plumbing riser diagrams that summarize the installed system equipment (pipe chase, etc.). The drawings should accurately represent the installed elements of the system during the final inspection of the house and be included in the homeowner education packet.

To meet the requirements of the DOE Zero Energy Ready Home program, the builder should provide a basic architectural drawing to the homeowner summarizing where the equipment is located within the house (see Figure 1). The builder should also provide the homeowner with a plumbing riser detail of the solar water heating system components. This diagram should have sufficient detail to clearly identify:

- Pipe chase size and type
- Length of chase from the designated roof/attic termination point to the utility room
- Designated location and allotted space size of future hot water tank
- Designated location and allotted space size of pump package mounting panel.

How to Create an Architectural Drawing for Solar Hot Water:

1. Create a plumbing riser diagram like the one shown in Figure 1 that includes all of the following components of the solar hot water system.
 - proposed location and square footage for the solar hot water panel array on the roof (preferably directly above the utility room).
 - Pipe chase from attic to utility room with size, type, and location clearly indicated
 - utility room space that contains
 - 3' x 3' x 7' extra space for a solar hot water heater
 - a 3' x 2' plywood panel mounted on the wall adjacent to solar hot water tank location for balance of system components
 - a solar bypass valve on the cold inlet to the existing water heater
 - access to the plumbing and wiring chase that extends to the proposed solar thermal panel array on the roof.

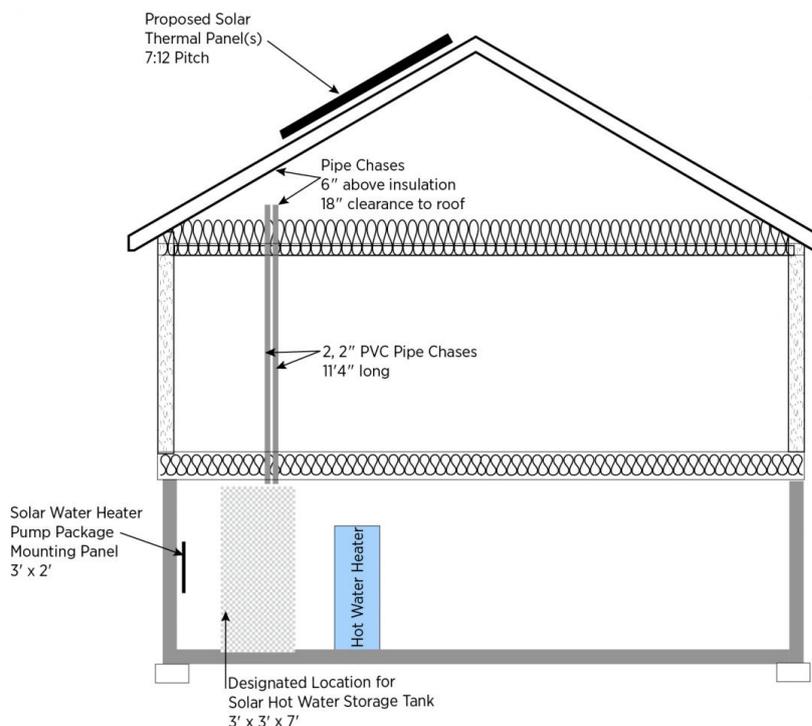


Figure 1. Provide the home owner with an architectural drawing showing the location of existing and future solar water heating system components. https://www.pnnl.gov/sites/all/themes/pnnl_btp/images/REF_icon.png

Ensuring Success

Ensure adequate utility room size and location for solar water heating and photovoltaic system components early in the house design process.

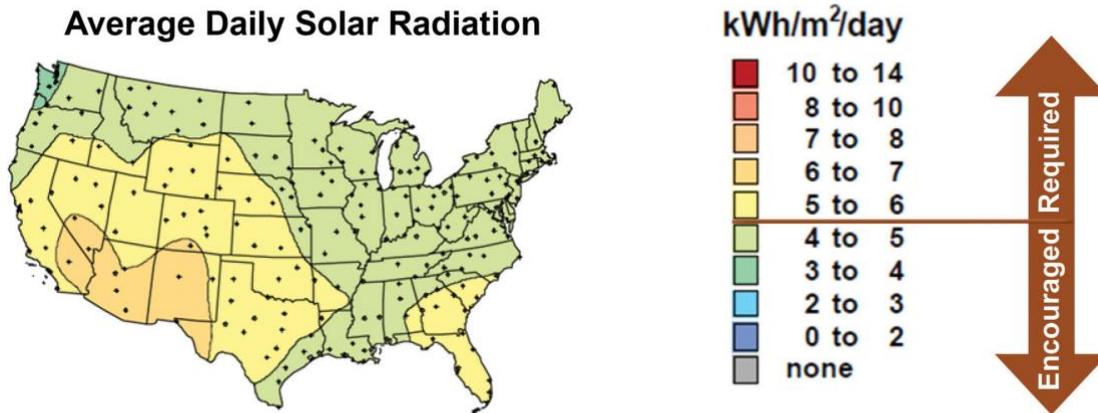
Confirm with local code officials early in the design process what steps are needed to guarantee that installation of solar water heating panels will meet with local codes, homeowner's association covenants, and historic district regulations. See the article on building codes and regulations related to [solar water heating systems at Energy.gov](#) for additional information.

Climate

The DOE Zero Energy Ready Home program's Consolidated Renewable Energy Ready Home (RERH) Checklist is required only under the following condition related to climate:

- Location, based on zip code, has at least 5 kWh/m²/day average daily solar radiation based on annual solar insolation using the [PV Watts online tool](#).

In climates where freezing temperatures are likely to occur, a closed-loop anti-freeze system with heat exchanger will keep outdoor water pipes from bursting.



Training

Right and Wrong Images

None Available

CAD

None Available

Compliance

The Compliance tab contains both program and code information. Exact code language is copyrighted and may require purchase from the publisher. While we continually update our database, links may have changed since posting. Please contact our webmaster if you find broken links.

[DOE Zero Energy Ready Home \(ZERH\) Program](#)

The DOE ZERH Consolidated Renewable Energy Ready Home (RERH) Checklist states "Provide architectural drawing and riser diagram of RERH solar PV system components and solar hot water components."

Alternative: Provide home buyer with the following information:

- List of renewable-ready features
- Available free roof area within +/- 45° of true south
- Location of panel or blocking for future mounting of PV and SWH components
- Location of Riser
- Location of Breaker or slot for future breaker in electrical service panel
- Copy of the Consolidated RERH Checklist
- A copy of the RERH Solar PV Specification Guide
- A copy of the RERH Hot Water Specification Guide"

Homes that already have a solar hot water system installed do not need to meet the SHW requirements of the Consolidated RERH checklist.

DOE Zero Energy Ready Home National Program Requirements Mandatory Requirement 7 (Renewable Ready) shall be met by any home certified under the DOE Zero Energy Ready Home program, only where all of the following conditions are met:

1. Location, based on zip code has at least 5 kWh/m²/day average daily solar radiation based on annual solar insolation using [PVWatts online tool](#), AND;
2. Location does not have significant natural shading (e.g., trees, tall buildings on the south-facing roof, AND;
3. Home as designed has adequate free roof area within +/-45° of true south as noted in the table below. Note that in some cases a house may have insufficient roof area for the Solar Electric RERH checklist, but it may still have the minimum roof area for the solar thermal RERH Checklist and would therefore have to comply with the Solar Thermal RERH checklist. In other cases, the home may only have adequate south facing roof for the Solar Electric or Solar Thermal RERH Checklist, but not both. In that case the builder can decide which one of those two checklists to apply.

Photovoltaic		Solar Water Heating	
House Size (sq. ft.)	Free South Roof Area	House Size (sq. ft.)	Free South Roof Area
≤ 2000	110	≤ 2000	40
≤ 4000	220	≤ 4000	60
≤ 6000	330	≤ 6000	80
> 6000	440	> 6000	100

[ENERGY STAR Certified Homes](#)

The ENERGY STAR Certified Homes National Program Requirements for Homes states that "Dwelling units in multifamily buildings with 4 or 5 stories above-grade are eligible to earn the ENERGY STAR if each unit has its own heating, cooling, and hot water systems, separate from other units, unless the domestic hot water is provided by a solar system. Then (Footnote 4), "Central systems for domestic hot water are allowed for domestic hot water if solar energy provides at least 50% of the domestic hot water needs for the residential units."

[2009 IECC](#)

Section 401.3 A permanent certificate shall be posted on or near the electrical distribution panel that lists types and efficiencies of water heating, heating, and cooling equipment, as well as insulation R values, and window U and SHGC factors.

[2012 IECC](#)

Section R 401.3 A permanent certificate shall be posted on or near the electrical distribution panel that lists types and efficiencies of water heating, heating, and cooling equipment, as well as insulation R values, and window U and SHGC factors.

2009 IRC

Follow the requirements for solar water heating systems found in the 2009 IRC Section M2301 Solar Energy Systems.

2012 IRC

Follow the requirements for solar water heating systems found in the 2009 IRC Section M2301 Thermal Solar Energy Systems.

2009 International Mechanical Code (IMC)

Follow the requirements for solar water heating systems found in the 2009 IMC, Chapter 14, Solar Systems.

2012 International Mechanical Code (IMC)

Follow the requirements for solar water heating systems found in the 2012 IMC, Chapter 14, Solar Systems.

More Info.

Access to some references may require purchase from the publisher. While we continually update our database, links may have changed since posting. Please contact our webmaster if you find broken links.

Case Studies

1. [Case Study: Rural Development, Inc., Wisdom Way Solar Village, Greenfield, MA](#)

Author(s): PNNL, ORNL

Organization(s): PNNL, ORNL

Publication Date: December, 2010

Case study about a 20-unit community of energy-efficient duplexes in Massachusetts that incorporated solar water heating and photovoltaics.

References and Resources*

1. [Building Codes and Regulations for Solar Water Heating Systems](#)

Author(s): DOE

Organization(s): DOE

Publication Date: June, 2012

Website with consumer and contractor information about building codes and regulations for solar water heating systems.

2. [DOE Zero Energy Ready Home National Program Requirements](#)

Author(s): DOE

Organization(s): DOE

Publication Date: August, 2015

Standard requirements for DOE's Zero Energy Ready Home national program certification.

3. [General Solar Thermal Specification](#)

Author(s): Aldrich

Organization(s): CARB, Steven Winter Associates

Publication Date: March, 2013

Brochure on specifications for solar thermal systems.

4. [Solar Hot Water for Homes](#)

Author(s): FSEC

Organization(s): FSEC

Publication Date: July, 2014

Website with information for consumers about solar thermal systems for homes.

5. [Solar Water Heating Specification, Checklist and Guide](#)

Author(s): EPA

Organization(s): EPA

Publication Date: May, 2011

Specifications to assist builders in designing and constructing homes equipped with a set of features that make the installation of solar energy systems after the completion of the home's construction easier and less expensive.

*Publication dates are shown for formal documents. Dates are not shown for non-dated media. Access dates for referenced, non-dated media, such as web sites, are shown in the measure guide text.

Contributors to this Guide

The following Building America Teams contributed to the content in this Guide.

[Pacific Northwest National Laboratory](#)