Residential Solar Panel Installations

pwcva.gov/residentialssolar
Residential Solar Panel Installations

Agenda

- Introduction (Eric Mays)
- PWC Submittal Requirements (Jenna Goodman)
- Structural Requirements (Brian Byrne)
- Electrical Requirements (Tread Willis)
- Questions
Residential Solar Panel Installations

Current Situation

- Increase Demand for Residential Solar Installations
- Expansion of PWC Solar Contractors from 8 to 80+
- Corresponding Expansion of Consulting Designers
- Introduction of New/Unapproved Components/Technology
- Contractor/Designer Inexperience with Electronic Plan Submission & Plan Review Process

(NOTE: Most Virginia localities do not require a Plan Review or only perform a limited Quality Control Plan Review. Responsibility falls to County/City Inspectors.)
PWC Submittal Requirements for Residential Solar Projects

For additional information please visit www.pwcva.gov/residentialssolar
Prepare your documents for submission

- For all systems:
  - Structural calculations and/or research report by nationally recognized testing laboratory for the mounting system (and foundation if ground mounted)
  - Design snow load of 30psf and ultimate wind speed of 105mph

- For roof top mounted systems:
  - Roof plan showing location of panels and mounting system connections
  - Setbacks from horizontal ridge

- For ground mounted systems:
  - Location of panels, details for mounting system, connection to foundation, and foundation plans/details
Log into the ePortal

The customer ePortal is used for application of the submission of your project documents and payments.

If you are a new user, you must first sign up for the ePortal by clicking on “Login or Register” or click here.

*Please be aware registration must be approved by county staff after you submit which may not be instant. Please allow time for processing the ePortal request prior to needing to submit.*
Apply for a permit

In the ePortal, click on the “apply” card.

Search and select the “Building Residential Alteration/Repair” permit type and follow the prompts.

To avoid delays in your project, please ensure all requirements listed in the Residential Solar Energy System ePlan Checklist are included in the first submission and all items meet the requirements outlined in the ePlan Guide.
Upload documents

- Zoning approval if ground mounted
- Plans meeting the requirements outlined on the Customer ePlans Guide
- Structural Calculations signed, sealed, and dated by the designer
- Manufacturer information demonstrating the UL listing

*See the Residential Solar Energy System Checklist for a full list of requirements*
QC Process

The plans and documents will now be Quality Controlled by intake staff.

If there is additional information needed a QC Denial Letter will be emailed to the applicant and the letter will be available on the ePortal.

Once the submission is approved, the filing fees will be invoiced and are payable through the ePortal.

The submission will be routed for review after fees are paid. When plans are routed a “Plan Application Receipt” will be sent to the contacts. This is NOT a plan approval, but a QC approval. The expected due date for the plan review will be listed on this letter.
Fees

• Review Fees (filing fee) and permit fees can be found in the fee schedule located at pwcgov.org/BDD.

• Review fees (filing fee) will be invoiced after the submission has passed QC. Fees must be paid in full prior to the plans being routed for review.

• Permit fees will be invoiced to the PERMIT after approval of the drawings and prior to the permit being issued.

• All fees (permitting and review) are attached to the permit.
Plan Review

• If the system is not per the **County Typical Solar Energy System Plans**, plan Review time is 10 days for residential solar panels.

• If the reviewer needs additional information a comment letter will be sent to the customer via email and the ePortal.

• Once the requested information is re-submitted in the ePortal, it will go through QC again and be re-routed for a 5 day review after resubmission fees are paid.

• Once the review is approved, the submission will be sent to permits for processing.
Resubmissions

- All resubmissions must include the entire plan set, not just the corrected sheets.
- Resubmissions must be uploaded to the Plan Case (BPR). The plan case number will be viewable in your ePortal under “my plans” and the number will be noted on any QC Denial letters and/or Comment Letters.
2018 VRC Structural Requirements for Rooftop-mounted Photovoltaic Systems

For additional information please visit www.pwcva.gov/residentialssolar
R301.2 Design criteria and Policy 3.1.1

- Ground snow load = 30 psf
- Ultimate wind speed = 105 mph.

The International Residential Code requires the locality to fill out Table R301.2(1) for Climatic and Geographic Design Criteria. Following is the completed table for Prince William County.

<table>
<thead>
<tr>
<th>Ground Snow Load (psf)</th>
<th>Wind Speed (mph)</th>
<th>Topographic effects</th>
<th>Special wind region</th>
<th>Wind-borne debris zone</th>
<th>Seismic Design Category</th>
<th>Subject to Damage From</th>
<th>Winter Design Temp.</th>
<th>Ice Barrier Underlayment Required</th>
<th>Flood Hazards</th>
<th>Air Freezing Index</th>
<th>Mean Annual Temp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>115</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>B¹</td>
<td>Severe</td>
<td>24&quot;</td>
<td>Yes</td>
<td>12/01/81</td>
<td>≤ 1500°F</td>
<td>55°F</td>
</tr>
</tbody>
</table>

¹(Seismic Design Category A may be used and supported with geotechnical report.)
R324.4.1 Structural requirements – Mounting System

- Engineering report or research report for the mounting system including rail, mount, and connections.
R324.4.1 Structural requirements - Calculations

- Structural calculations sealed by a Virginia engineer to show the roof is adequate to support the rooftop-mounted photovoltaic system.
R324.4.1 Structural requirements - Plans and Details

- Roof plan showing location and spacing of mount connections
R324.4.1 Structural requirements - Plans and Details

- Details for mount connections to roof framing

Blocking required for hip trusses
R324.6.1 Pathways

- Two 36-inch wide pathways on separate roof planes from the eave to the ridge
- One 36-inch wide pathway located on the street or driveway side of the roof
- One 36-inch wide pathway each roof plane with a photovoltaic array or an adjacent roof plane
R324.6.2 Setback at ridge.

- Panels occupying less than 33 percent of plan view roof area
- 18-inch wide clear setback is required on both sides of the ridge
R324.6.2 Setback at ridge.

- Panel occupying more than 33 percent of plan view roof area
- 36-inch wide clear setback is required on both sides of the ridge
R324.6.1 Pathways and R324.6.2 Setback at ridge

- Townhouse with photovoltaic arrays
- Two 36-inch wide pathways from the eave to the ridge
- Panels occupying more than 33 percent of plan view roof area
- 36-inch clear setback is required on both sides of the ridge
R324.6.2.2 Emergency escape and rescue opening

- 36-inch wide pathways required to emergency escape and rescue openings
R324.3.1 Equipment listings

- Submit certification for photovoltaic panels and modules listed and labeled in accordance with UL 1703.
- Submit certification for inverters listed and labeled in accordance with UL 1741.
- Systems connected to the utility grid shall use inverters listed for utility interaction.
R902.4 Rooftop-mounted photovoltaic panel systems

- Submit certification for rooftop-mounted photovoltaic panel systems tested, listed and identified with a fire classification in accordance with UL 1703 and UL 2703
2018 Electrical Requirements for Residential Solar Projects

For additional information please visit www.pwcva.gov/residentialsolar
Equipment Spec Sheets

- Provide spec sheets for all equipment being used.
- This includes panels, inverters, combiners, optimizers, etc.
- These spec sheets shall provide required electrical data in order to perform necessary calculations.
- Coordinate the equipment being shown on design drawings with the spec sheets provided.
- Make sure the spec sheets provided reference a Nationally Recognized Testing Laboratory.
Electrical Design of Photovoltaic System

- Starting at the array:
  - Identify on one line drawing/riser diagram all equipment to be used. (panels, micro-inverters, optimizers)
  - Identify string length and number of strings
From The Array to the Combiner Panel or Single Inverter

Circuit conductors shall be sized correctly and verified by calculations using all necessary corrections factors including ambient temperature, more than 3 current carrying conductors in a raceway etc.

Choose an appropriate wiring method, raceway or cable, and size raceway appropriately for the number of conductors.

DC circuits located in the interior of a building shall be installed in a metal raceway or MC cable.

<table>
<thead>
<tr>
<th>QTY</th>
<th>CONDUCTOR INFORMATION</th>
<th>CONDUIT TYPE</th>
<th>CONDUIT SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (6)</td>
<td>#12AWG - Q CABLE (L1 &amp; L2 NO NEUTRAL)</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>(1)</td>
<td>#6AWG - BARE COPPER IN FREE AIR</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>2 (6)</td>
<td>#12AWG - THWN-2 (L1,L2) (EXTERIOR) / #12/2 ROMEX IN ATTIC</td>
<td>EMT, LFMC OR PVC</td>
<td>1&quot;</td>
</tr>
<tr>
<td>(1)</td>
<td>#6AWG - THWN-2 GND</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>(2)</td>
<td>#6AWG - THWN-2 (L1,L2)</td>
<td>EMT, LFMC OR PVC</td>
<td>1&quot;</td>
</tr>
<tr>
<td>3 (1)</td>
<td>#6AWG - THWN-2 N</td>
<td>EMT, LFMC OR PVC</td>
<td>1&quot;</td>
</tr>
<tr>
<td>(1)</td>
<td>#6AWG - THWN-2 GND</td>
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<td>N/A</td>
</tr>
<tr>
<td>4 (2)</td>
<td>#6AWG - THWN-2 (L1,L2)</td>
<td>EMT, LFMC OR PVC</td>
<td>1&quot;</td>
</tr>
<tr>
<td>(1)</td>
<td>#6AWG - THWN-2 N</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Combiner Panel and Junction Boxes

- Provide all necessary documentation for the equipment being used.
- Confirm the junction box has adequate volume for the number of conductors being installed.
- The rules of 705.12(B), load side connections, apply to the connections of the power production system to a panelboard dedicated for power production.
Rapid Shutdown Switch

Locate the Rapid Shutdown Switch with the required label at a readily accessible location outside of the building.

The Rapid Shutdown Switch shall be either the service disconnecting means, PV system disconnecting means or a readily accessible switch that plainly indicates whether it is on or off.

For most DC systems, the disconnect in the inverter also provides rapid shutdown.

For AC systems, typical rapid shutdown is provided by the AC disconnect.
These calculations demonstrate compliance with adjusted conductor ampacity, conduit fill, overcurrent protection, and string sizing. These calculations are verified by reviewers for compliance and accuracy. Please note the geographic design information as the high and low temperatures make a difference for these calculations and compatibility of equipment.
Interconnection: Load side connection

Load side connections shall comply with 705.12(B)

Typical connection type is a connection to the main panel busbar at a dedicated circuit breaker at the opposite end of the busbar from the main overcurrent device.

At this point, the required calculations are important to demonstrate compliance.
Interconnection: Line Side Connection

- For line side connections, the disconnecting means shall be service rated.
- Make sure the disconnect has the appropriate labels.
- If the disconnect also serves as the rapid shutdown initiation device, provide the required label at this location as well.
- Wiring methods for service taps shall be chosen from one of the 19 approved methods from 230.43.
Labels and Placards

- This reference sheet should include all labels and placards required for the proposed installation.

- Where required, please fill in required information such as nominal operating voltage, rated AC output current, etc.

- As shown, please provide a reference drawing stating where each label or placard is to be placed.
Energy Storage Systems

- Energy Storage Systems shall comply with Article 706 of the National Electrical Code.

- Know your equipment. Not all ESS are equipped with integral overcurrent protection creating a potential for comments during plan review, especially when the ESS is located more than 5 feet away or circuit conductors pass through a wall.

- If an ESS has less capacity than the calculated load, please reference 710.15(A) that the ESS has enough capacity to start the largest single piece of utilization equipment connected to it.
Common Electrical Comments

• If responsible party is a Master Tradesperson, make sure all electrical design sheets bear the name, address and license number of the individual.
• Please coordinate the equipment on the electrical design sheet with the equipment spec sheets provided.
• Required calculations from the checklist are missing. These calculations are reference in 690.8 of the NEC.
• If point of interconnection is a line side tap, the disconnecting means shall be service rated.
• For line side connections, please detail the connection to the Grounding Electrode System and properly size the Grounding Electrode Conductor per 250.66 of the NEC.
• Plans need to reference the appropriate code year. Any plans submitted from 7/1/2022 forward should reference the 2017 NEC.
Questions?