NEW YORK STATE OF OPPORTUNITY. | NY-Sun

NY-Sun PV Trainers Network

Solar Photovoltaic Systems and the 2016 NYS Uniform Code

Updates and New Requirements for Residential Installations

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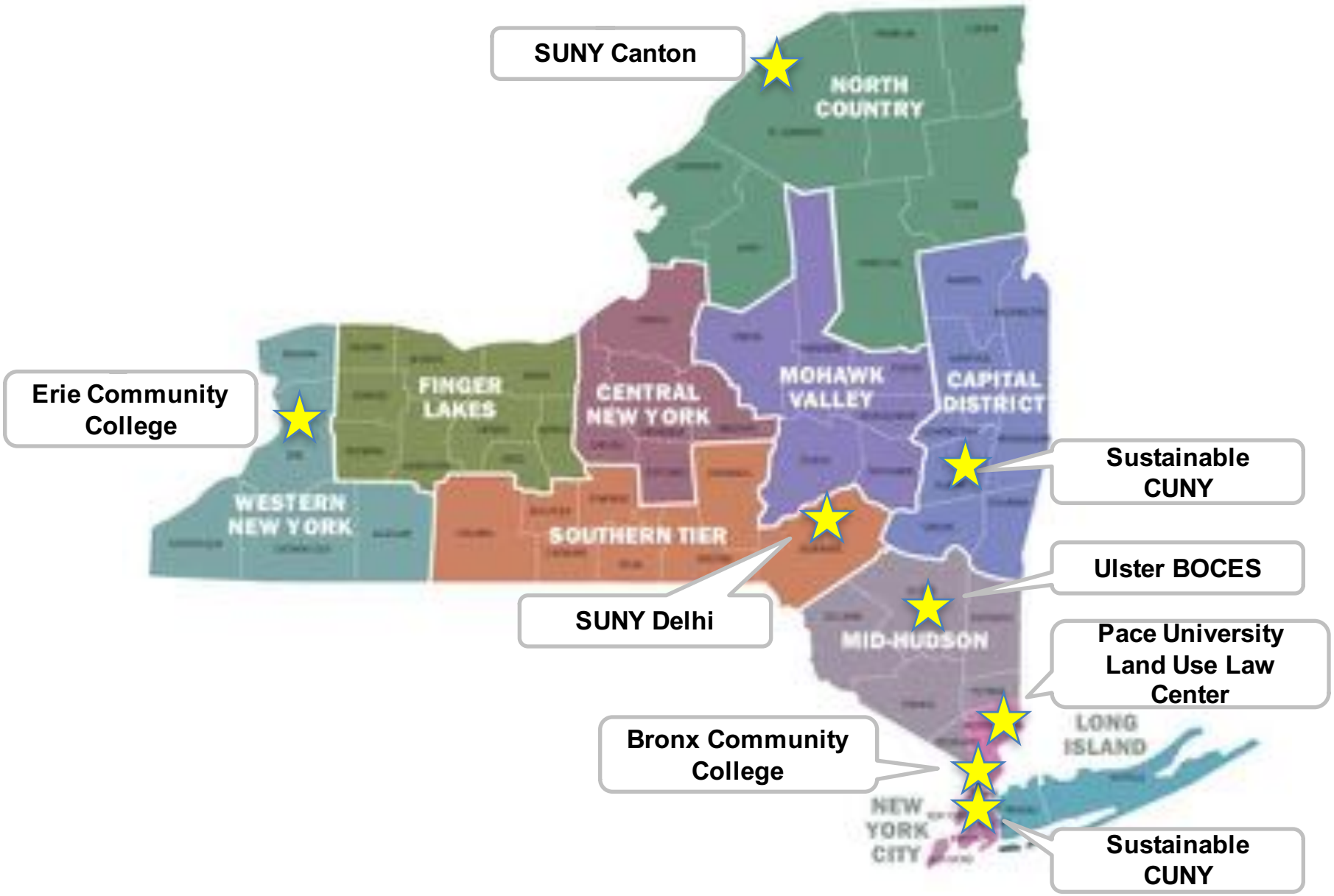
About the PV Trainers Network

The NY-Sun PV Trainers Network aims to lower the installation cost and expand adoption of solar PV systems throughout the state.

training.ny-sun.ny.gov

Program Covers Entire State



- Black font: Exact language of the NYS 2016 NYS Uniform Code Supplement

- *Blue font: Commentary*

- *Red font: Definitions, source references, important terms*

Presentation Overview

1. NYS Uniform Code update and implementation schedule
2. 2015 I-Codes and NYS Uniform Code Supplement (amendments)
3. 2014 National Electrical Code (NEC) significant changes
   - Article 690 Solar Photovoltaic Systems
   - Article 705 Interconnected Power Production Sources
4. 2015 International Residential Code (IRC)
   - Section 324 Solar Energy Systems
   - Section 907 Rooftop-Mounted PV Systems
   - Section 902 Fire Classification
   - Section R905.16 Photovoltaic Shingles
5. 2015 International Building Code (IBC)
   - Section 1507.17.1 through 1507.17.3
   - Section 1607.12.5 Photovoltaic Panel Systems
6. 2015 International Fire Code (IFC)
   - Section 605.11 Solar Photovoltaic Power Systems

NY State Uniform Code and Energy Code Implementation Schedule

Effective Date: April 6, 2016

Uniform Code Transition Period:

- Beginning on April 6th, regulated parties submitting a complete building permit application may comply with either the current Uniform Code or newly adopted Uniform Code.
- The transition period will last from April 6, 2016 until October 3, 2016. On October 3rd, the newly adopted Uniform Code will become fully effective.

Energy Code Effective Date:

- On October 3, 2016, the newly adopted Energy Code as described above will become formally effective.
- There is no transition period for the Energy Code.

2016 NYS Uniform Code and Energy Code Update

- On March 9, 2016, the NY State Fire Prevention and Building Code Council completed major updates to the Uniform Fire Prevention and Building Code (Uniform Code) and State Energy Conservation Construction Code (Energy Code). The Uniform Code update incorporates the following documents by reference:
  - *2015 International Building Code (IBC)*
  - *2015 International Residential Code (IRC)*
  - *2015 International Existing Building Code (IEBC)*
  - *2015 International Fire Code (IFC)*
  - *2015 International Plumbing Code (IPC)*
  - *2015 International Mechanical Code (IMC)*
  - *2015 International Fuel Gas Code (IFGC)*
  - *2015 International Property Maintenance Code (IPMC)*

- ***The 2016 Uniform Code Supplement details NY State amendments to the 2015 International I-Codes (download from NY-DOS site):***
  - See: http://www.dos.ny.gov/dcea/noticadopt.html

2015 International I-Codes

Free public access to the ICC Codes:

- http://codes.iccsafe.org/New%20York%20State.html#2015

2014 National Electrical Code (NFPA 70)

- The requirements for solar photovoltaic (PV) systems and most other electrical installations are governed by the National Electrical Code (NEC), NFPA 70.

- Free online access to the 2014 NEC and other important NFPA standards:
  - http://www.nfpa.org/codes-and-standards/resources/free-access

References to NFPA 70 in the I-Codes

- **2015 International Residential Code (IRC)**
  - *Part VIII Electrical Systems: Equipment or components not specifically covered in Chapters 34-43, shall comply with the applicable provisions of NFPA 70.*
  - *R907.1 Rooftop-mounted photovoltaic systems shall be installed in accordance with this section, Section R324 and NFPA 70.*
  - *R324.3 Photovoltaic systems shall be designed and installed in accordance with Sections R324.3.1 through R324.7.2.5 and NFPA 70.*
- **2015 International Building Code (IBC) Chapter 27 Electrical**
  - *Electrical components, equipment and systems shall be designed and constructed in accordance with the provisions of NFPA 70.*
- **2015 International Fire Code (IFC) Section 605.11.1**
  - *Solar photovoltaic power systems shall be installed in accordance with Sections 605.11.1 through 605.11.2, the International Building Code or International Residential Code, and NFPA 70.*

NEC Article 690: Solar Photovoltaic Systems

I. General

II. Circuit Requirements

III. Disconnecting Means

IV. Wiring Methods

V. Grounding

VI. Marking

VII. Connection to Other Sources

VIII. Storage Batteries

IX. Systems Over 1000 Volts

X. Electric Vehicle Charging

Other Articles Referenced from Art. 690

Article 110 Requirements for Electrical Installations

Article 230 Services

Article 240 Overcurrent Protection

Article 250 Grounding and Bonding

Article 300 Wiring Methods

Article 310 Conductors for General Wiring

Article 450 Transformers

Article 480 Storage Batteries

Article 705 Interconnected Electric Power Production Sources

2014 NEC Significant Changes

- New **labeling requirements** to warn operators, fire fighters and maintenance personnel of hazards.
- New requirements for **rapid shutdown** provisions for emergency response.
- Specific **wiring** methods and wire management practices to improve safety and system durability.
- New requirements for determining **system voltages**, **conductor ampacity** and **overcurrent protection**.
- New requirements for the use of **listed disconnecting combiner boxes** and **PV-rated overcurrent protective devices**.
- Clarifying the options and requirements for **grounding** and **bonding**.
- New options and requirements for **utility interconnection**.

2015 International Residential Code (IRC) Section 324 Solar Energy Systems

R324.1 General. Solar energy systems shall comply with the provisions of this section.

R324.3 Photovoltaic systems.

- Photovoltaic systems shall be designed and installed in accordance with Sections R324.3.1 through R324.7.2.5 and NFPA 70.
- Inverters shall be listed and labeled in accordance with UL 1741.
- Systems connected to the utility grid shall use inverters listed for utility interaction.
  - **R324.3.1 Equipment listings.** Photovoltaic panels and modules shall be listed and labeled in accordance with UL 1703.

- *The requirements of R324.3 and R324.3.1 apply to PV systems only, and are also covered by the 2014 National Electrical Code (NFPA 70) sections 690.4(B) and 690.60.*

2015 International Residential Code (IRC) Section 324 Solar Energy Systems

- **R324.4 Rooftop-mounted photovoltaic systems.** Rooftop-mounted photovoltaic panel systems installed on or above the roof covering shall be designed and installed in accordance with Section R907.
  - *Section R907 of the 2015 IRC addresses requirements for Rooftop-Mounted PV Systems.*

2015 International Residential Code (IRC) Section 907 Rooftop-Mounted PV Systems

- **R907.1 Rooftop-mounted photovoltaic systems.** Rooftop-mounted photovoltaic panels or modules shall be installed in accordance with this section, Section R324 and NFPA 70.
  - *The requirements of R907.1 are also covered by the 2014 National Electrical Code (NFPA 70) Sections 690.4(B) and 690.60.*

- **R907.2 Wind resistance.** Rooftop-mounted photovoltaic panel or modules systems shall be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3).
  - *Section 907.2 specifies that roof-mounted PV systems shall be designed using component and cladding (C&C) loads specified in Tables R301.2(2) and R301.2(3). These requirements are also specified in the governing standard, Minimum Design Loads for Buildings and Other Structures, ASCE 7-10 Chapter 30 - Wind Loads - Components and Cladding (C&C). Similar requirements are contained in the 2015 IBC Section 1510.7.2.*

2015 International Residential Code (IRC) Section 907 Rooftop-Mounted PV Systems

- **R907.3 Fire classification.** Rooftop-mounted photovoltaic panels or modules shall have the same fire classification as the roof assembly required in Section R902.
  - *Section R907.3 requires fire classification for the PV module and racking assembly, to be the same as required by the IRC for the roof covering.*
- **R907.4 Installation.** Rooftop-mounted photovoltaic panels or modules shall be installed in accordance with the manufacturer's instructions.
  - *Also required by Section 110.3(B) of the 2014 NEC.*
- **R907.5 Photovoltaic panels and modules.** Rooftop-mounted photovoltaic panels and modules shall be listed and labeled in accordance with UL 1703 and shall be installed in accordance with the manufacturer's printed instructions.
  - *Also required by Sections 110.3(B) and 690.4(B) of the 2014 NEC.*

2015 International Residential Code (IRC) Section 902 Fire Classification

- **R902.3 Building-integrated photovoltaic product.** Building-integrated photovoltaic products installed as the roof covering shall be tested, listed and labeled for fire classification in accordance with Section R902.1.
  - *Similar requirements to R902.3 are also contained in the 2015 IBC Section 1505.8.*

- **R902.4 Rooftop-mounted photovoltaic panels and modules.** Rooftop-mounted photovoltaic panels and modules installed on or above the roof covering shall be tested, listed and identified with a fire classification in accordance with UL 1703.
- Class A, B or C photovoltaic panels and modules shall be installed in jurisdictions designated by law as requiring their use or where the edge of the roof is less than 3 feet from a lot line.
  - *Similar requirements to R902.4 are also contained in the 2015 IBC Section 1505.9. The fire classification shall comply with Table 1505.1 based on the type of construction of the building.*

2015 International Residential Code (IRC) Section 324 Solar Energy Systems

R324.4.1 Roof live load.

- Roof structures that provide support for photovoltaic panel systems shall be designed for applicable roof live load.
- The design of roof structures need not include roof live load in the areas covered by photovoltaic panel systems.
- Portions of roof structures not covered by photovoltaic panels shall be designed for roof live load.
- Roof structures that provide support for photovoltaic panel systems shall be designed for live load, L_R, for the load case where the photovoltaic panel system is not present.
  - *Section R324.1 requires roof structures to be designed for the applicable live load, and exempts the roof live load requirements for areas covered by PV panels. This exception usually allows the dead load from PV arrays to replace the roof live load requirements, without exceeding the structural design limits for roofs.*
  - *Similar requirements are contained in Section 1607.12.5.1 of the 2015 IBC.*

2015 International Residential Code (IRC) Section 324 Solar Energy Systems

- **R324.5 Building-integrated photovoltaic systems.** Building-integrated photovoltaic systems that serve as roof coverings shall be designed and installed in accordance with Section R905.

- **R324.5.1 Photovoltaic shingles.** Photovoltaic shingles shall comply with Section R905.16.

  – *BIPV systems and PV shingles are custom engineered products that replace conventional roofing and building materials and have unique installation requirements. Section R905 of the 2015 IRC addresses Requirements for Roof Coverings. R905.16 specifically addresses photovoltaic shingles, which references back to R324 and NFPA 70. These products must be installed in accordance with manufacturer's instructions.*

2015 International Residential Code (IRC) Section R905.16 Photovoltaic Shingles

- **R905.16 Photovoltaic shingles.** The installation of photovoltaic shingles shall comply with the provisions of this section, Section R324 and NFPA 70.
  - *Similar requirements are also contained in the 2016 IBC Section 1507.17.1 through 1507.17.8.*

- **R905.16.1 Deck requirements.**
- **R905.16.2 Deck slope.**
- **R905.16.3 Underlayment.**
- **R905.16.4.1 Ice barrier.**
- **R905.16.4.2 Underlayment and high winds.**
- **R905.16.5 Material standards.**
- **R905.16.6 Attachment.**
- **R905.16.7 Wind resistance.**

2015 International Residential Code (IRC) Section 324 Solar Energy Systems

- **R324.6 Ground-mounted photovoltaic systems.** Ground-mounted photovoltaic systems shall be designed and installed in accordance with Section R301 (Design Criteria).
  - *Section R301 specifies the design loads for the mounting system and foundation based on the applicable wind loads, snow loads, live loads, dead loads, seismic loads, etc.*
- **R324.6.1 Fire separation distances.** Ground-mounted photovoltaic systems shall be subject to the *fire separation distance* requirements determined by the *local jurisdiction.*
  - *Local AHJs should be consulted during planning phases to determine separation requirements.*

2015 International Fire Code

- The 2015 International Fire Code (IFC), Section 605.11 addresses requirements for solar photovoltaic power systems.
  - *Requires minimum setbacks for roof-mounted PV arrays to allow firefighters safe access, pathways and areas for smoke ventilation.*

- The 2016 New York State Uniform Fire Prevention and Building Code (the "Uniform Code") has adopted by reference the 2015 edition of the International Fire Code (2015 IFC) with amendments.
  - *Portions of the 2015 IFC have been adopted in the 2015 edition of the International Residential Code (2015 IRC) with NYS amendments in SECTION R324: SOLAR ENERGY SYSTEMS.*

2015 International Fire Code Residential vs. Commercial

- The 2015 International Building Code (2015 IBC) Section 101.4.5 on fire prevention requires compliance with the 2015 International Fire Code (2015 IFC) for commercial buildings and other structures permitted under the 2015 IBC.

- The NY State Uniform Code Supplement has amended Section 605.11 of the 2015 IFC by the replacement of sections 605.11.1 through 605.11.1.2.5 in their entirety, and the addition of a new section 605.11.1.2.6.
  - *These NY amendments change the 2015 IFC setback requirements for rooftop mounted PV arrays based on new definitions for ACCESS ROOF, GROUND ACCESS AREA, and ROOF ACCESS POINT.*

- NY State has amended the 2015 International Residential Code (2015 IRC) in the 2016 Uniform Code Supplement to include sections 605.11.1 through 605.11.1.2.6 of the 2015 IFC for residential construction in Section R324 of the 2015 IRC.

2016 NYS Amendments to the 2015 IFC and IRC: Key Definitions

- Section R202 of the 2015 IRC and Section 202 of the 2015 IFC has been amended with important new definitions as follows:

- **ACCESS ROOF.** A roof surface which provides access to the ridge or peak of an adjoining roof surface containing solar panels, modules, or arrays; and
  1) Is relatively free of vents, skylights, and other such obstructions, and
  2) Does not contain solar panels, modules, or arrays; or is a single ridge roof where the total edge width of the solar panels, modules, or arrays does not exceed 33% of the ridge length.
- **GROUND ACCESS AREA.** A ground area relatively clear of obstructions that can be used to establish ground ladders for gaining entry to the access roof or roof access point.
- **ROOF ACCESS POINT.** The beginning of the roof access pathway at the eave.

- *These definitions are key to understanding the requirements and exceptions for access and pathways for residential PV installations.*

2015 IRC Section R324.7 Access and Pathways

- **R324.7 Access and pathways.** Roof access, pathways and spacing requirements for solar photovoltaic systems shall be provided in accordance with Sections R324.7.1 through R324.7.6.
- Exceptions:
  1. Roof access, pathways and spacing requirements need not be provided where an alternative ventilation method has been provided, or where vertical ventilation techniques will not be employed.
  2. Detached garages and accessory structures.
- *Installers should consult with the local AHJs and fire officials during project planning phases to determine if R324.7 Exception 1 applies. Exception 2 exempts detached, non-habitable structures from access, pathways and spacing requirements.*
- *The same amendments are contained in the 2016 NY State Uniform Code Supplement for Section 605.11.1 of the 2015 IFC.*

- **R324.7.1 Size of solar photovoltaic array.** Each photovoltaic array shall not exceed 150 feet in any direction.

2015 IRC Section R324.7
Access and Pathways

R324.7.2 Roof access points. Roof access points shall be located:

1. In areas that establish access pathways which are independent of each other and as remote from each other as practicable so as to provide escape routes from all points along the roof;

2. In areas that do not require the placement of ground ladders over openings such as windows or doors or areas that may cause congestion or create other hazards;

3. At strong points of building construction, such as corners, pilasters, hips, and valleys, and other areas capable of supporting the live load from emergency responders;

– *(continued on next slide)*

2015 IRC Section R324.7 Access and Pathways

- **R324.7.2 Roof access points (cont.)**

  4. Where the roof access point does not conflict with overhead obstructions such as tree limbs, wires or signs;

  5. Where the roof access point does not conflict with ground obstructions such as decks, fences, or landscaping; and

  6. In areas that minimize roof tripping hazards such as vents, skylights, satellite dishes, antennas, or conduit runs.

- *ROOF ACCESS POINTS must meet six criteria for clear access. Because interpretation of these requirements may vary, local AHJ's and fire officials should be consulted prior to construction to determine if the requirements are satisfied.*
- *The same requirements are contained in 2016 NYS Uniform Code amendments to Section 605.11.1.1 for the 2015 IFC.*
- *The requirements of R324.7 apply to PV systems as well as solar thermal collectors mounted on rooftops.*

2015 IRC Section R324.7
Access and Pathways

- **R324.7.3 Ground access areas.** Ground access areas shall be located directly beneath access roofs and roof access points.
- The minimum width of the ground access area shall be the full width of the access roof or roof access point, measured at the eave.
- The minimum depth shall allow for the safe placement of ground ladders for gaining entry to the access roof.

- *GROUND ACCESS AREAS must be at a minimum the full width of the ROOF ACCESS POINT. The minimum width of roof access points will generally be 36 inches for single ridge roofs, and wider for hip roof layouts depending on roof angles.*
- *Safe ladder placement at the base requires ¼ the working height of the ladder, in addition to ladder access space.*
- *Check with local AHJ during planning phases to determine if R324.7.3 requirements are satisfied.*
- *The same requirements are contained in NYS amendments to Section 605.11.1.2.2 in the 2015 IFC.*

2015 IRC Section R324.7.4 Access and Pathways: Single Ridge Roofs

- **R324.7.4 Single ridge roofs.** Panels, modules, or arrays installed on roofs with a single ridge shall be located in a manner that provides two, 36 inches wide access pathways extending from the roof access point to the ridge.
- Access pathways on opposing roof slopes shall not be located along the same plane as the truss, rafter, or other such framing system that supports the pathway.
- **Exceptions:**

  1. Roofs with slopes of 2 units vertical in 12 units horizontal (16.6 percent) and less.

  2. Structures where an access roof fronts a street, driveway, or other area readily accessible to emergency responders.

  3. One access pathway shall be required when a roof slope containing panels, modules or arrays is located not more than 24 inches vertically from an adjoining roof which contains an access roof.

- *The same requirements are contained in NYS amendments to Section 605.11.1.2.3 of the 2015 IFC.*

2015 IRC Section R324.7.5
Access and Pathways: Hip Roofs

- **R324.7.5 Hip roofs.** Panels, modules, and arrays installed on structures with hip roofs shall be located in a manner that provides a clear access pathway not less than 36 inches wide, extending from the roof access point to the ridge, on each roof slope where panels, modules, or arrays are located.
- **Exceptions:**

  1. Roofs with slopes of 2 units vertical in 12 units horizontal (16.6 percent) and less.

  2. Structures where an access roof fronts a street, driveway, or other area readily accessible to emergency responders.

- *The same requirements are contained in NYS amendments to Section 605.11.1.2.4 of the 2015 IFC.*

2015 IRC Section R324.7.6
Access and Pathways: Roofs with Valleys

- **R324.7.6 Roofs with valleys.** Panels and modules shall not be located less than 18 inches from a valley.
- **Exception:**
  - Roofs with slopes of 2 units vertical in 12 units horizontal (16.6 percent) and less.

- *PV modules must not be located closer than 18 inches from valleys. The same requirements are contained in NYS amendments to Section 605.11.1.2.6 of the 2015 IFC.*

2015 IRC Section R324.7.7 Allowance for Smoke Ventilation

- **R324.7.7 Allowance for smoke ventilation operations.** Panels and modules shall not be located less than 18 inches from a ridge or peak.
- **Exceptions:**

  1. Where an alternative ventilation method has been provided or where vertical ventilation methods will not be employed between the upper most portion of the solar photovoltaic system and the roof ridge or peak.
  2. Detached, non-habitable Group U structures.

- *No parts of an array may be located closer than 18 inches to a roof ridge or peak.*
- *Exceptions are permitted for detached, non-habitable structures and where the AHJ and fire officials have determined that an alternate ventilation methods has been provided, or vertical ventilation will not be employed.*
- *The same requirements are contained in NYS amendments to Section 605.11.1.2.6 of the 2015 IFC.*

2015 IRC Section R324.7.4
Single Ridge Roofs - Summary

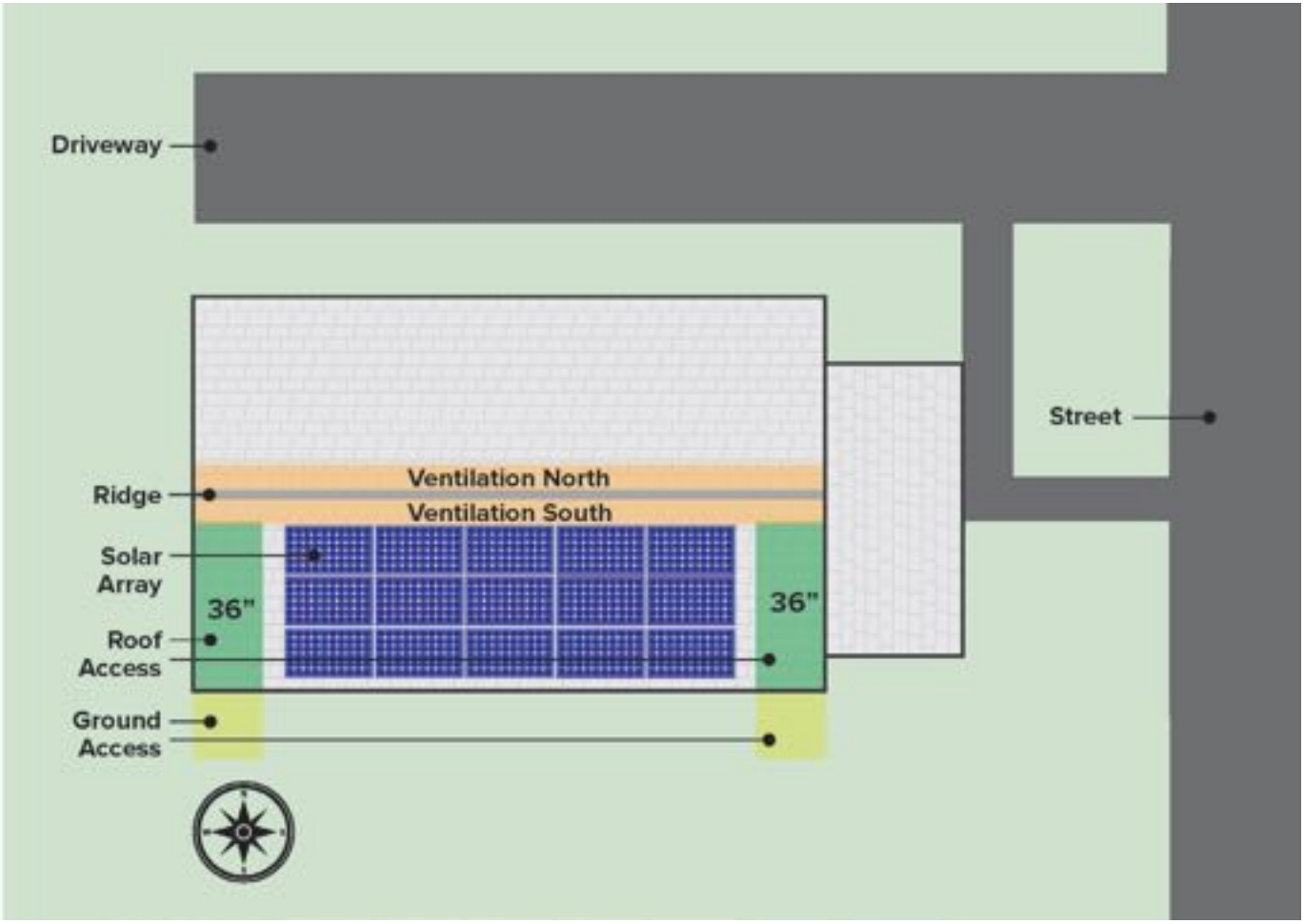
- *Arrays on single ridge roofs require two (2) access pathways, a minimum of 36 inches wide from the access point to the ridge. The pathways may be on the same slope as the array, or on the opposing slope, and must not be supported by the same structural member.*

- *Access pathways are not required for single ridge roofs where a clear ACCESS ROOF fronts a street, driveway or other readily accessible area to emergency responders.*

- *Only one access pathway is required when a roof slope containing arrays is located not more than 24 inches vertically from an adjoining roof which contains an ACCESS ROOF.*

Single Ridge Roof with Two Pathways on Same Slope as Array

Two pathways are required for single ridge roofs. If both pathways are located on the same slope as the PV array, array space is limited. Exceptions to Section R324.7.4 may permit alternate access, pathways and venting locations.



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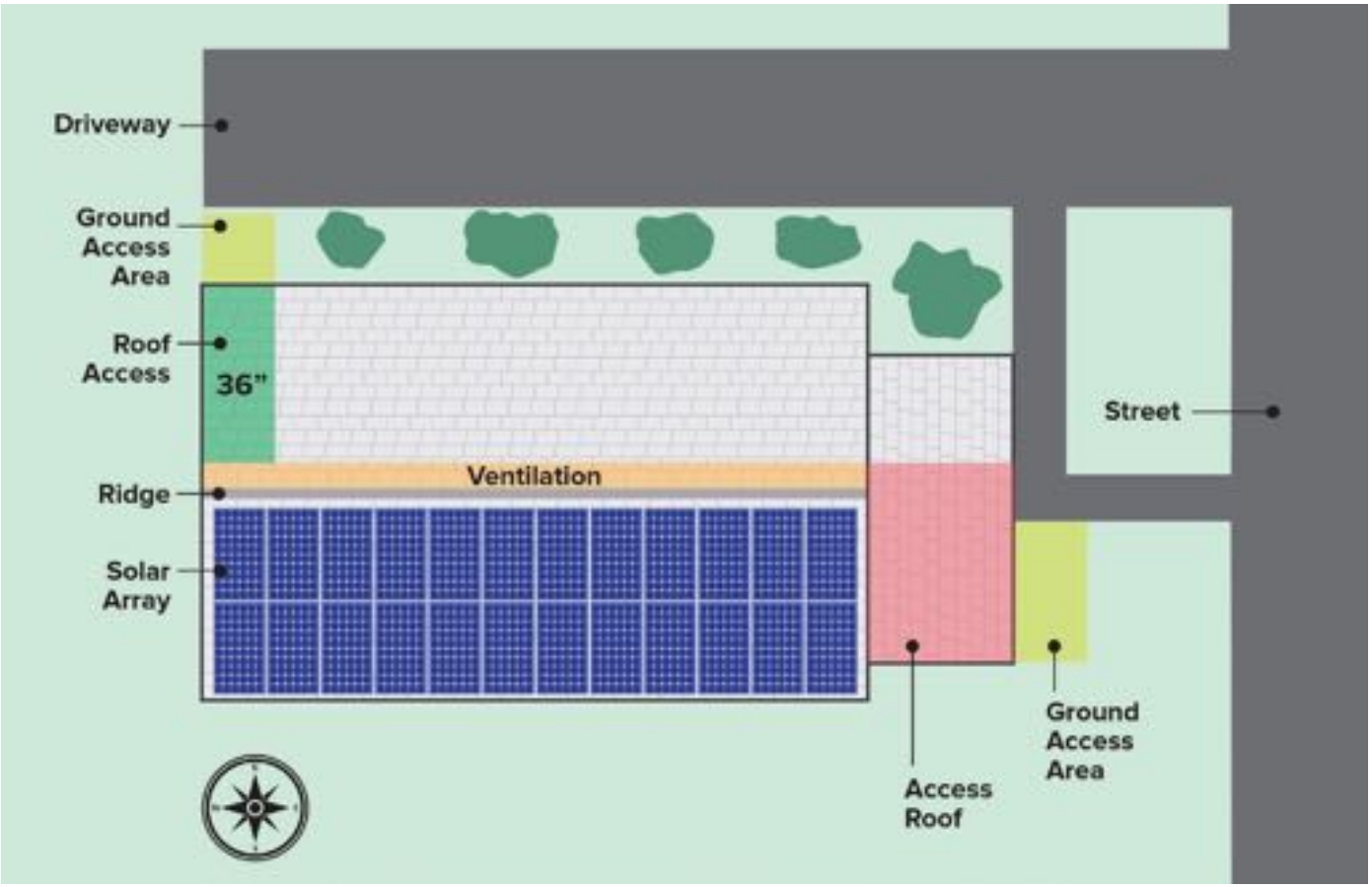
Single Ridge Roof with Alternate Access and Venting Locations

Alternate access, pathways and venting locations may be possible for single ridge roofs meeting exceptions to Section R324.7.4.



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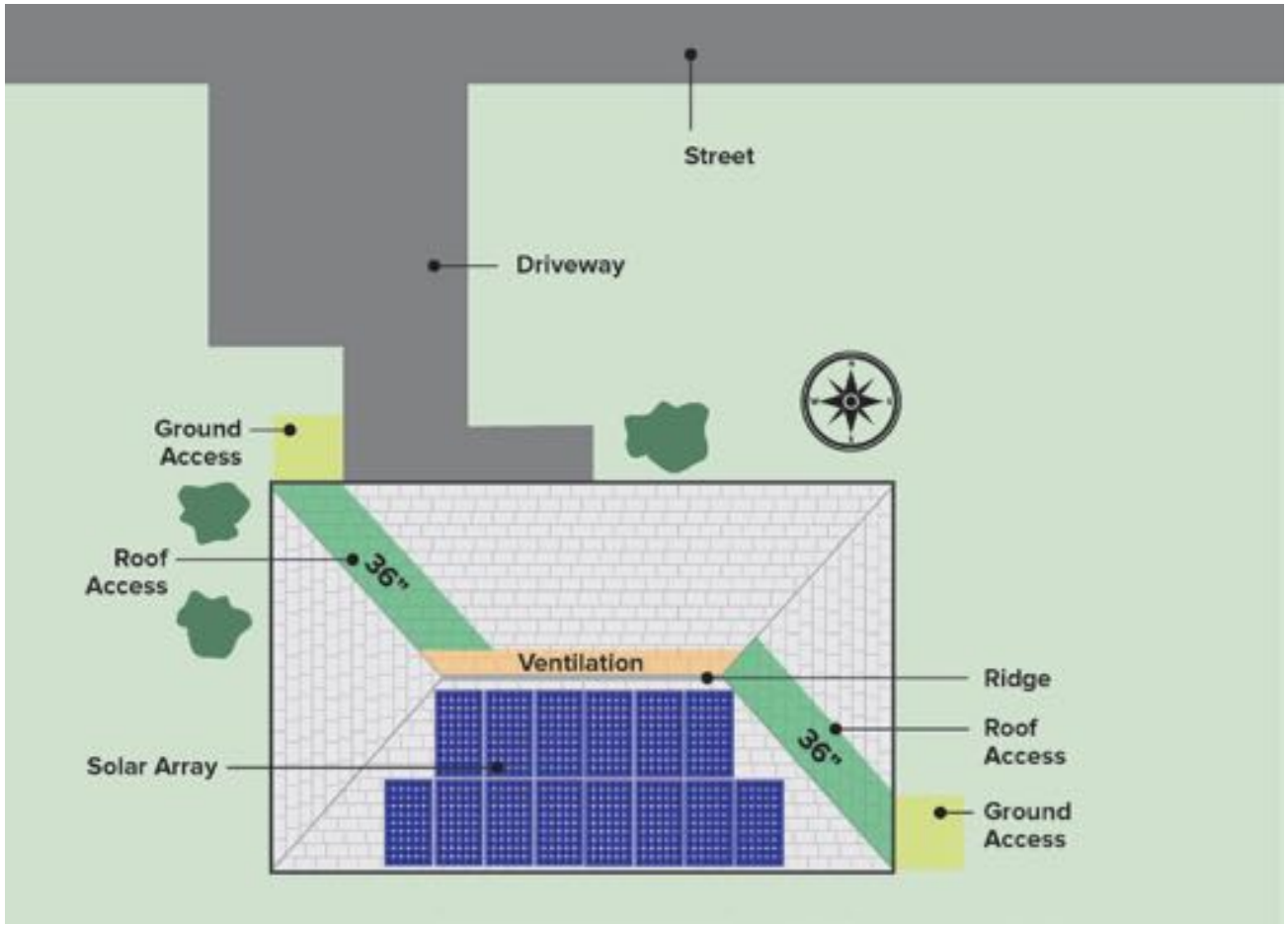
2015 IRC Section R324.7.5
Hip Roofs: Summary

- *Arrays on hip roofs require one (1) access pathway, a minimum of 36 inches wide from the access point to the ridge, on each roof slope where arrays are located.*

- *Access pathways are not required for hip roofs where a clear ACCESS ROOF fronts a street, driveway or other readily accessible area to emergency responders.*

Hip Roof Installation with Alternate Venting and Pathway Locations

Alternate locations may be possible for venting and access pathways on hip roofs meeting exceptions to Section R324.7.5.



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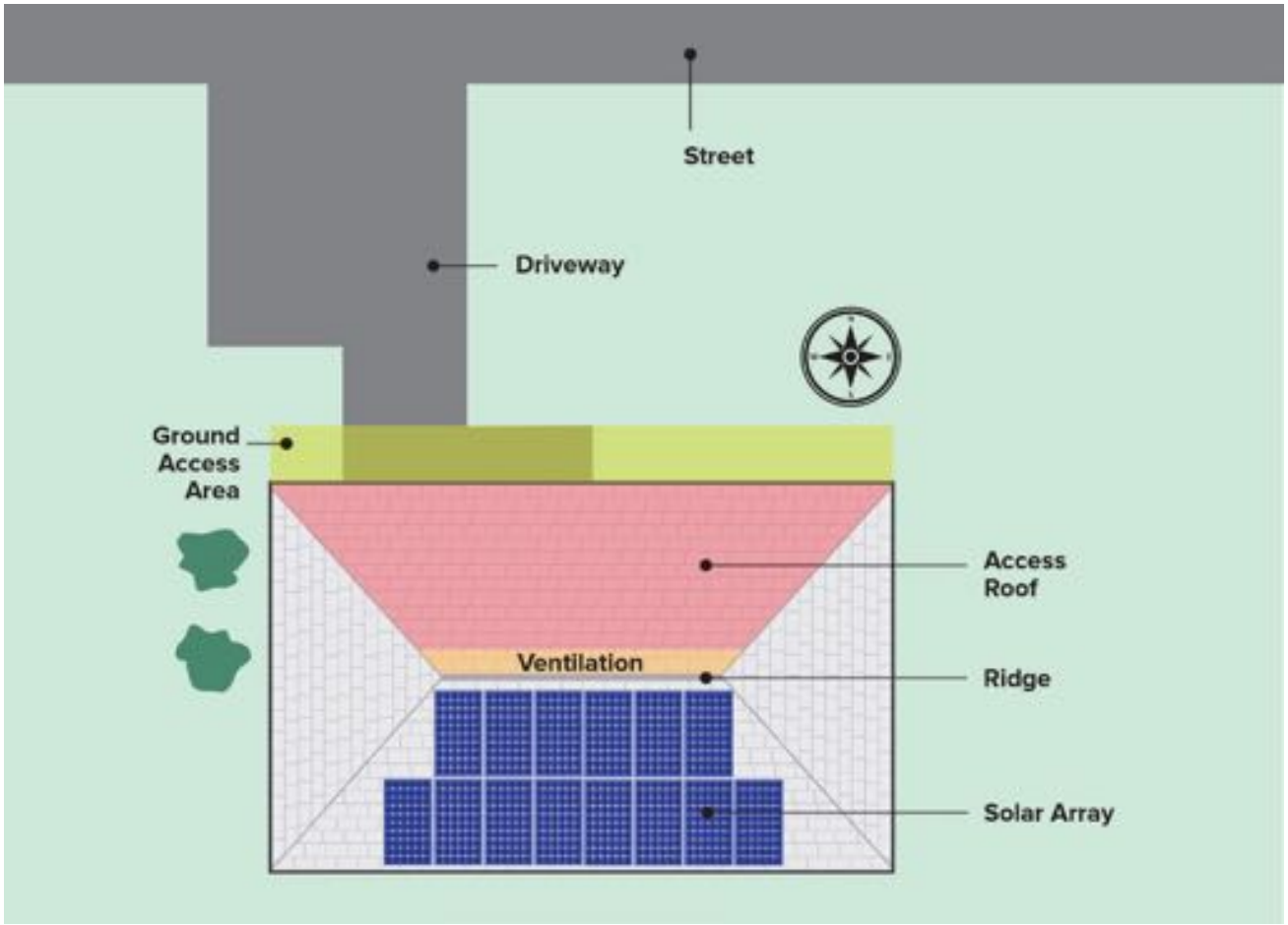
Hip Roof Installation Where an ACCESS ROOF Fronts a Street or Driveway

Section R324.7.5 Exception #2 generally applies to any residential structures where an ACCESS ROOF fronts a street, driveway, or other area readily accessible to emergency responders.



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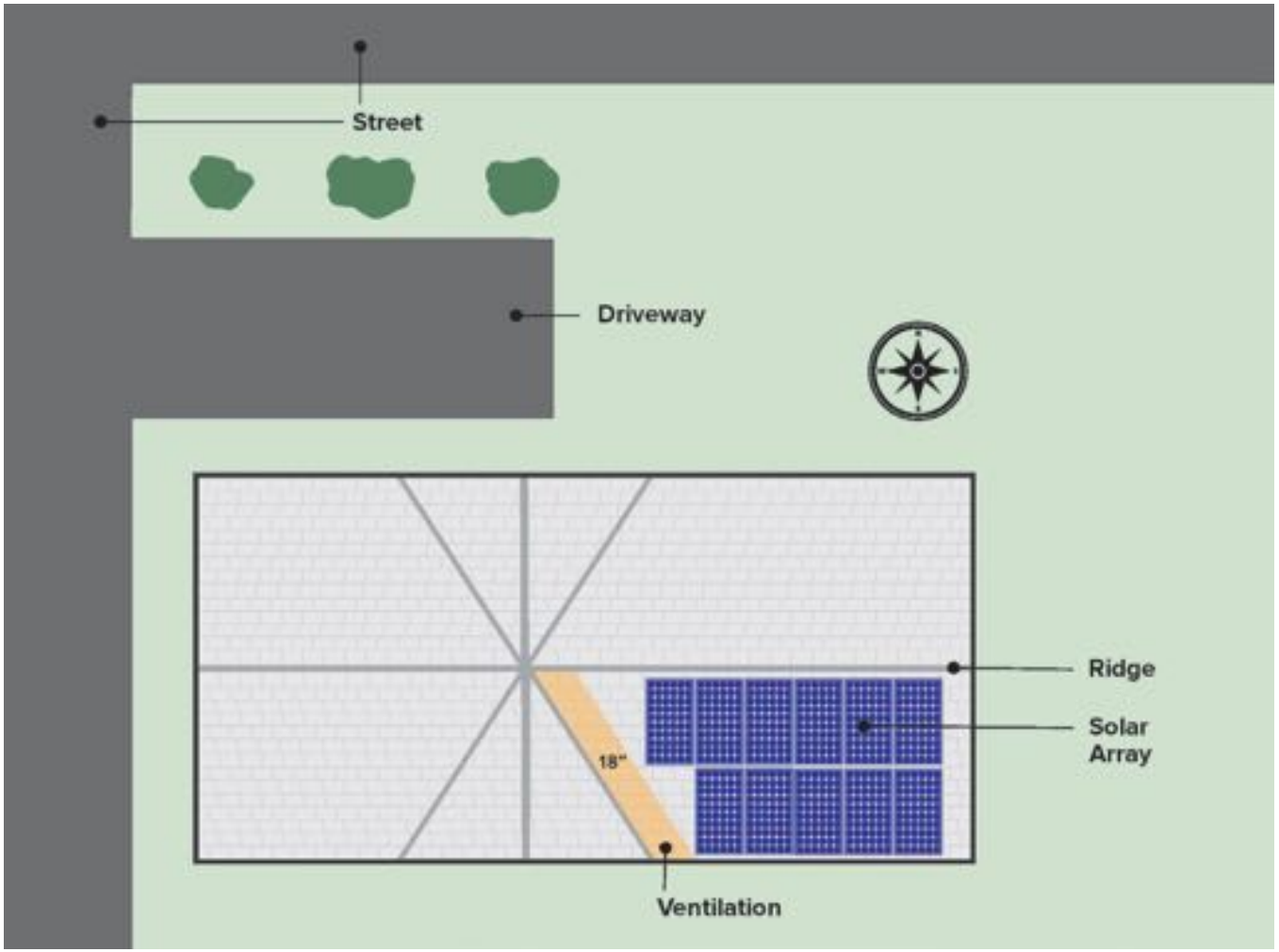
Roofs with Valleys

Section R324.7.6 requires any parts of PV arrays to be no closer than 18 inches from valleys.



Source: NYSERDA

References

2016 NYS Uniform Code Supplement:

- http://www.dos.ny.gov/dcea/noticadopt.html

Free Access to 2015 I-Codes:

- http://codes.iccsafe.org/New%20York%20State.html#2015

NY-SUN: Understanding the roof top access and ventilation requirements as described in Section R324 of the 2015 International Residential Code.

- http://www.nyserda.ny.gov/-/media/NYSun/files/Contractor%20Resources/Residential-roof-top-access-and-ventilation-requirements.pdf

PV Trainers Network Online Portal

training.ny-sun.ny.gov

Upcoming Trainings

July 19, 2016	Tuesday, July 19, 2016 08:30am - 03:30pm Solar PV Permitting and Inspection Methods |East Syracuse, Onondaga County
July 19, 2016	Tuesday, July 19, 2016 09:00am - 04:00pm Solar PV for Engineers and Architects |Orchard Park, Erie County
July 21, 2016	Thursday, July 21, 2016 06:00pm - 09:00pm Solar PV for Architects: Evaluation and Design Fundamentals | Port Ewen, Ulster County
August 01, 2016	Monday, August 01, 2016 09:00am - 04:00pm Solar PV Permitting and Inspection Methods – NYS Code Enforcement Officer's In-Service Training Conference | Bronx, Bronx County
August 03, 2016	Wednesday, August 03, 2016 09:00am - 04:00pm Solar PV Permitting and Inspection Methods | Bath, Steuben County
August 04, 2016	Thursday, August 04, 2016 09:00am - 04:00pm Solar PV for Engineers | Orchard Park, Erie County

Questions?

Contact us:
info@training.ny-sun.ny.gov
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Thank You!

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