Residential PV Required

Modify the 2021 International Energy Conservation Code as follows:

Add new definition as follows:

POTENTIAL SOLAR ZONE AREA. The combined area of any low-sloped roofs and any steep-sloped roofs oriented between 90 degrees and 300 degrees of true north where the annual solar access is 70 percent or greater. Annual solar access is the ratio of “annual solar insolation with shade” to the the “annual solar insolation without shade”. Shading from obstructions located on the roof or any other part of the building shall not be included in the determination of annual solar access

Add new text as follows:

R404.4On-site renewable energy.
The building shall comply with the requirements of R404.4.1 or R404.4.2
R404.4.1One- and two- family dwellings and townhouses.

Install an on-site renewable energy system with a nameplate DC power rating measured under standard test conditions, of no less than 2kW.

Exceptions:

1. A building with a permanently installed domestic solar water heating system with a minimum solar savings fraction of 0.5.
2. A building in climate zone 4C, 5C or 8.
3. A building where the *potential solar zone area* is less than 300 square feet.

404.4.2Group R Occupancies.

Buildings in Group R-2, R-3 and R-4 shall install an on-site renewable energy system with a rated capacity of not less than 0.75 W/ft2 multiplied by the gross conditioned floor area.

Exceptions:

1. A building with a permanently installed domestic solar water heating system with a minimum solar savings fraction of 0.5.
2. A building in climate zone 4C, 5C or 8.
3. A building where the *potential solar zone area* is less than 300 square feet.

R404.4.3Renewable energy certificate documentation.
Documentation shall be provided to the code official that indicates that renewable energy certificates (RECs) associated with the on-site renewable energy will be retained and retired by or on behalf of the owner or tenant.

Revise as follows:

TABLE R405.2 REQUIREMENTS FOR TOTAL BUILDING PERFORMANCE

Portions of table not shown remain unchanged.

SECTION[a]	TITLE
General	
R404.4	On-site renewable energy

TABLE R406.2 REQUIREMENTS FOR ENERGY RATING INDEX

Portions of table not shown remain unchanged.

SECTION[a]	TITLE
R404.2	Interior lighting controls
R404.4	On-site renewable energy
R406.3	Building thermal envelope

a. Reference to a code section includes all of the relative subsections except as indicated in the table.

R406.3.2 On-site renewables are included. Where additional on-site renewable energy, above the minimum requirements of R404, is included for compliance using the ERI analysis of Section R406.4, the *building thermal envelope* shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2015 *International Energy Conservation Code*.

TABLE R406.5 MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX
0-1	~~52~~47
2	~~52~~46
3	~~51~~41
4	~~54~~45
5	~~55~~51
6	54
7	53
8	53

Reason:

On-site electricity generation using photovoltaics is a key technology for reducing greenhouse gas emissions associated with Commercial and Residential buildings. According to the most recent assessment by the National Renewable Energy Lab (NREL) the cost of installed photovoltaics in 2020 was 3% lower than in 2019 and 65-70% lower than the cost of similar sized systems in 2010. With the continued drop in cost of installing on-site PV the cost per kilowatt hour of PV generated electricity is at parity with grid purchased electricity in many States throughout the country.

The Solar Energy Industries Association 2020 Solar Market Insight Year in Review reported a 10% increase in installed on-site residential solar PV capacity in 2020 compared to 2019, which was down from the 16% increase in 2019 compared to 2018. More recently in the SEIA 2021 Q3 Solar Insight Report they reported that new installed residential solar PV is on track to grow an additional 21% in 2021 with installed capacity expected to reach 3.9GW. The demand for Residential on-site solar PV is expected to grow despite the phaseout of incentive tax credits. The continued growth of Residential solar PV demonstrates that is it is a an effective technology for reducing the energy cost and greenhouse gas emissions of buildings.
This proposal describes requirements for prescriptive solar PV that must be installed at the time of construction. Analysis by PNNL shows that on-site renewable electricity generation is cost effective across all low-rise multifamily buildings and most single family and one or two unit townhouses. The analysis was done using each of PNNL's Residential prototypes in each climate zone. The capacity requirements were established by calculating the highest on-site solar PV capacity that limited electricity export back to the grid. The threshold used for determining these capacities was a grid export limit of less than 0.5% of total annual building electricity consumption. A review of the hourly results showed it was unrealistic to set a hard limit of zero overproduction. When calculating cost effectiveness, no credit was taken for electricity that was exported back to the grid. The calculation of grid exports was done on an hourly basis. The proposed requirements reduce purchased energy from the electrical grid which will help reduce greenhouse gas (GHG) emissions and energy costs for building owners.

The approach used for this proposal requires that building owners incorporate a modest amount of cost effective on-site solar PV. This approach addresses the management and dispatch challenge faced by Utilities when distributed solar resource export large amounts of unused electricity back into the grid by setting the required capacity to minimize exports. Where solar-PV is required by this proposal, no less than 99.5% of the generated electricity will be used directly by the building. Distributed generation also helps reduce transmission losses and the burden for new transmission infrastructure to centralized renewable resources.

On-site solar PV provides substantial benefits to the consumer and society by helping to reduce GHG emissions associated with electricity generation. PV market growth combined with a cleaner grid will support goals of reduced GHG emissions established across the U.S. and others by federal agencies, as well as many states and local governments.

Cost Impact:
The code change proposal will increase the cost of construction.

For this analysis of residential building solar PV cost effectiveness was calculated using the life cycle cost methodology (https://www.energycodes.gov/methodology) established by the U.S. Department of Energy (DOE) and Pacific Northwest National Lab (PNNL) for determining the cost effectiveness of the building energy codes. The DOE methodology accounts for the benefits of energy-efficient home construction over the life of a typical mortgage, balancing initial costs against longer term energy savings. The methodology provides a full accounting over a 30-year period of the cost savings, considering energy savings, the initial investment financed through increased mortgage costs, tax impacts, maintenance costs,

replacement costs and residual values of energy efficiency measures. The installed cost of solar PV was based on costs reported in the U.S. Solar Photovoltaic System and Energy Storage Cost Benchmark: Q1 2020 published by NREL in 2021. Installed costs were scaled based on solar PV capacity from 2kW up to 200kW and applied based on the calculated capacity required for each prototype in each climate zone.

The proposed solar PV capacities were shown to be cost effective for R occupancies in each climate zone except for climate zone 8 and for single family residences in all climate zones except 4C, 5C and 8.