Errata to
Advanced Energy Design Guide for K-12 School Buildings—Achieving Zero Energy (2018)

September 20, 2018

Shaded items have been added since the previously published errata sheet dated February 9, 2018.

Page 48: The caption for Figure 4-1 was updated to note that the images were generated with UCLA Climate Consultant Software, visualizing dataset WYEC2-C-00005 WMO 723940 California Climate Zone 5.

Page 56: The following reference should be added to the references list: **UCLA. *Energy Design Tools*. Los Angeles: University of California—Los Angeles. www.energy-design-tools.aud.ucla.edu/.**

Page 70: In How-To Tip BP19, the calculation for the roof area required for PV currently reads "227,700 ft^2 × 0.24 × 1.25 = 38,310 ft^2" but should read "227,700 ft^2 × 0.24 × 1.25 = **68,310 ft^2**" and the calculation for the percentage of roof area needed currently reads "54,648 ft^2 / 113,850 ft^2 = 60%" but should read "**68,310 ft^2** / 113,850 ft^2 = 60%".

Page 73: Figure 5-3 should be replaced with the below corrected graphic. In addition, in the second to last sentence of the paragraph discussing Figure 5-3, the text currently reads "This information can be quite useful as an intuitive starting point as one starts to evaluate appropriate building strategies for a specific project and, more specifically, how climate in which a building is located changes the HVAC heating and cooling loads" but should read "This information can be quite useful as an intuitive starting point as one starts to evaluate appropriate building strategies for a specific project and, more specifically, how **the** climate in which a building is located changes the HVAC heating and cooling loads."

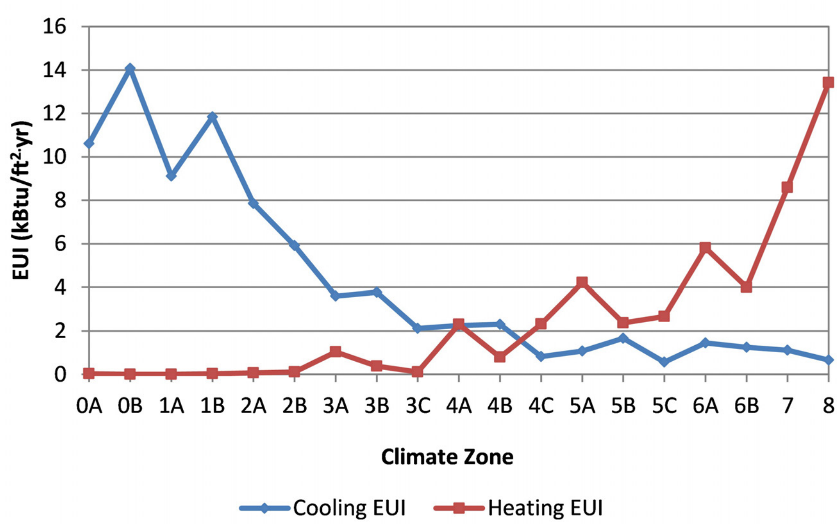

Figure 5-3 Heating and cooling loads by climate zone.

Page 168: In Table 5-28, six instances of "ASHRAE 189.1-2017" should be changed to "**IgCC/189.1 (ICC 2018)**".

Page 190: The following reference should be added to the references list: **ICC. 2018. *International Green Construction Code*. Washington, DC: International Code Council.**

Pages 196–197:

The text for How-To Tip RE6 should be changed to the following, with changes from the original text indicated in bold font:

PV systems **on commercial buildings can be configured many different ways often dependent on rate tariffs, regulation, and utility interconnection agreements. In a "sell-all" mode, all electricity is sold to the utility company and then electricity is purchased from the grid. In some cases, the PV system is on the customer side of the meter; PV energy can be used in the building. Any excess is "sold" to the utility and when there is insufficient PV power available, power is drawn from the grid or "purchased." Some rate tariffs use a net-metered arrangement where the "sold" price and the "purchased" price are the same. Some rate tariffs compensate the two directions differently. In most systems, the inverters turn off during a grid failure to prevent electricity from traveling to a grid that is not functioning. In limited cases, inverters can provide power to a school much like an emergency generator—but often batteries and emergency circuits must be designed for this application.**

For many schools to reach zero energy using photovoltaics, the interconnection point must be larger than for a typical school. This is because solar energy operates for few hours per day and to achieve the amount of energy required, high power amounts are needed. As soon as the system size has been determined, the utility should be engaged for discussions about electrical configuration, transformer sizes, and rate tariffs. The larger transformer may also impact fault currents and impedance on the **school's** electrical power distribution systems. If the school site is using a net metered system, the point of interconnection is usually made at the main switchboard for the school. The switchboard will need to be upsized **to** accommodate the power from the renewable energy system. Space for AC inverters will need to be accommodated, either on the roof, on the ground, or in the main electrical room. Bus connection ampacity sizing must take into consideration school demand load and PV load, plus 20%. **If the school has a maximum demand as part of the rate structure, strategies should be deployed to minimize the peak monthly demand or the value of the value of the PV will be diminished.**

Standoff mounting is often used for slant roof-top mounted solar systems. These standoffs are attached to the roof for support rails, to which the PV modules are mounted. Standoff arrays with panels typically add anywhere from 3 to 5 pounds per square foot; however, they can be designed to coincide with the roof structure. Be cautious that the thermal integrity of the roof is not compromised with the PV system.

Ballasted systems are much heavier than standoff systems **and** are used for flat-roof mounted systems. The roof must be specifically engineered for the number of ballasts, ballast locations, types, effect on roof structural sizing, seismic concerns, and wind loading. Uplift is a primary concern for PV arrays, especially in high-wind areas like tornado alleys or hurricane zones. The effect of the PV arrays and their attachment points must be considered when designing the roof and building structure. The typical tilt for a flat-roof-mounted system is **5 to 10°** to minimize uplift. For safety purposes, PV panels should not be mounted within 8 to 10 ft of the roof edge, depending on local jurisdictions and fire department requirements. Roofs may require fall protection railings for roof mounted equipment. Access to the roof should be more than a vertical ladder with roof hatch. Full walk-up stair access should be provided.

Roof mounted systems should be planned around the replacement of the panels at 25-year life, and for the roof replacement. The roof selection should be made with consideration that PV panels will be covering a large portion of the roof for the life of the PV system. Access should be provided to the roof for periodic maintenance of the PV.

Rack mounting for panels are typically used for ground mounted systems that do not use tracking. Rack mounting is not common on smaller projects and is commonly used for large utility scale generation projects over 1 MW.

A discussion of wind turbines as a renewable energy system are not included in this guide. While in Kansas, Iowa, South Dakota, Oklahoma, Nebraska, and parts of Texas wind power generates a significant portion of electricity produced-more than 20% of power production in some cases (Jossi 2017)-these are utility-grade turbines beyond the capabilities of most school systems to maintain. Wind turbines large enough to produce power for a zero energy school are **difficult to site on school property, especially in** urban and suburban areas.