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Solar with a capital “S”: Putting a photovoltaic focus on the Solar Decathlon

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While the previous three Solar Decathlons offered many worthwhile visions of green building designs powered by the sun, this year’s edition has an extra resonance, even gravitas compared to the earlier events. The temporary eco-village erected on the National Mall in the heart of Washington, DC, now occupies that hallowed ground with a green-conscious, solar-enthusiastic administration in the White House and especially a Steven Chu-led Department of Energy that take the creativity on display (which they help sponsor with $100K for each team) with more seriousness than the carbon-based cynics among their fossil fuel-beguiled predecessors.

The houses assembled these past few weeks and now open to public view feature an inspired and sometimes whimsical (and now net-metered) collection of architecture, building materials, energy efficiency features, and the like, but the competition has Solar with a capital “S” in its title for a reason. While I can’t be on the Mall to see the fruits of the 20 multinational university teams’ labors in person, it hasn’t stopped me from looking into what photovoltaics have been deployed.

The size of the PV systems on the houses ranges from the 4.1KW on the Rice University team’s ZERWO house (said to be sized for the building’s actual electricity load) to Team Spain’s ginormous 14.9KW installation on its B+W House. By my estimation, the total installed capacity of the entire village hovers just over 167KW, or an average of about 8KW per house. Most of the PV systems are designed to create more electricity than the individual houses require, with the intent of sending the surplus juice back to the PECO grid (and gaining points in the net metering part of the contest).

A breakdown of panel types reveals crystalline-silicon dominating, with Sanyo HIT (both single- and bifacial type), SunPower (220-305W), and BP Solar modules accounting for the lion’s share of the units installed. Certain projects boast blends of cSi and thin film, such as the 11.1KW combination of 40 SunPowers on the roof and about 250 Würth Solar’s GeneCIS on the side facades of the surPLUS home (shown at left) built by Team Germany/Darmstadt University (the defending Decathlon champions). Another clever cSi/TFPV blend comes from Iowa State and its Interlock House, which has a rooftop array of Sanyos and a pair of louvers equipped with custom amorphous-silicon flexible panels made by PowerFilm (who just happens to be an Iowan outfit).

The only pure-play, silicon-free TFPV system appears to be that plugged into Penn State’s Natural Fusion house, which uses 5.1KW OF Solyndra's cylindrical CIGS modules in a scheme called “Green Roof Integrated PV,” where the team has plants growing underneath the elevated panel racks. PSU also has a south-facing awning supposedly coated with an unspecified thin-film PV film.

Several teams have chosen to use tracking systems to increase the amount of energy garnered from their PV. The most outlandish is the Madrid side’s movable, pyramidal-base roof, which looks very cool but doesn’t have quite the air of practicality as the relatively simple single-axis tracker on the top of the University of Kentucky’s Sky Blue house.

Although building-integrated PV is a catchword at the competition, many contestants’ houses would be more appropriately classified as examples of building-applied PV, with the arrays positioned on top of the roofing rather than functioning as the roof itself. The University of Minnesota’s ICON solar house is more BIPV than BAPV though, using 30 BP Solar polySi modules as the actual roof cladding and 11 of those popular bifacial Sanyos as part of east porch vertical façade. Team Ontario/British Columbia’s North House, one of the spiffier (and more expensive) designs, sports fellow Canadians Day4Energy’s panels on the rooftop but custom PV forming the frames around the glass windows on three out of four sides of the structure.

Maybe in the next competition in 2011, those recently announced CIGS-based solar shingles from Dow might show up as someone’s BIPV roofing choice.

A glance through the list of inverters used reveals many of the usual suspects—SMA, Xantrex, Sunpower, Fronius—but a couple of newcomers as well, such as PV Powered and microinverter instigator Enphase. Five teams chose to deploy the Enphase devices, although Iowa State also employed a Xantrex inverter and Penn State used Xantrex and PV Powered units in addition to the module-level box. Most of the contestants, however, stuck with the SunnyBoys and other standard inverter products.

I’m not sure whether the solar decathletes care all that much about which PV panels provide the power and which inverters turn it into grid-usable electricity. But since some of them are actually living in the houses during the run of the competition, sleeping, eating, and bathing, using home and entertainment appliances, and no doubt trying to chill out while waiting for the next round of scores to be tallied, the kids probably enjoy watching the meter run backwards under that bright fall DC sun.

(DOE’s Solar Decathlon Website has lots of info about the competition and the teams involved, including the current score, as well as a raft of photo, video, and daily journal features for the curious.)

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