

Solar Decathlon 2005, Instrumentation and Monitoring

The Solar Decathlon organizers installed sensors and monitoring equipment in each house during assembly and removed the equipment during disassembly. (Some of the equipment was installed on prior visits to the teams' sites on their campuses during construction.) The locations of sensors and monitoring equipment were planned in advance through negotiations between the organizers and each team. Installation had to be completed on the Mall at least two days before the start of the objectively measured contests (October 10, 2005). Most of the teams, despite their very best intentions, were finishing construction of their houses during assembly on the Mall, which made installation of instrumentation a bit tricky. The monitoring group from the National Renewable Energy Laboratory (NREL), fortunately, is accustomed to working with the normal last-minute nature of construction, so they worked with the teams to install equipment as soon as the houses were ready. Before active scoring began, the organizers had to allow time to verify correct functioning of the monitoring systems and to correct any problems with the systems. The organizers attempted to accommodate the aesthetic and technical requirements of the teams when installing equipment. The needs of the competition required that the organizers located sensors and wires in architecturally pristine spaces, but the same sensors were placed in similar locations in every house.

Water flow rate

Contest: Hot Water

Instrument: Turbine flow meter, high temperature limit of 190°F (87.8°C)

Source: Omega Engineering, Inc., model FTB4105P

Accuracy: 1.5% of reading, from 0.2 gpm to 13 gpm

Location: Showerhead.

AC electric power

Contests: Lighting

Instrument: Watt-hour transducer with split core CT, pulse output

Source: Continental Control Systems, LLC, WattNode model WNA-1P-240-P

Accuracy: 0.5% of reading from 10% to 100% of full scale

Location: In Solar Decathlon meter box, mounted near house electric panel.

DC current

Contests: Energy Balance, and Lighting, if DC equipment was used

Instrument: Shunt, 500A

Source: Canadian Shunt Industries Ltd., model LB-500-50

Accuracy: 0.25%

Locations: Single negative conductor into main battery for Energy Balance, DC circuit for lighting.

DC voltage

Contests: Energy Balance, and Lighting, if DC equipment was used

Solar Decathlon 2005: The Event in Review

Web Site Resources: Instrumentation and Monitoring

Instrument: Voltage divider, 100:1, 0.5% resistors
Source: Constructed at NREL
Accuracy: About 0.5%
Location: Main battery positive to negative.

Lighting levels

Contest: Lighting
Instrument: Photometer, photovoltaic type with filter
Source: Licor, Inc., model LI-210 photometric
Accuracy: 5% of reading
Locations: Home office workstation.

Inside temperature and relative humidity (RH)

Contest: Comfort Zone
Instrument: RTD, variable capacitance RH, linear DC output
Source: Vaisala, Inc, model Humitter
Accuracy: 0.7°F (0.4°C) temperature, 3% RH
Location: In radiation shield, in main living area, 4–5 ft (1.2–1.5 m) above floor level.

Temperature

Contests: Appliances and Hot Water
Instrument: Type-T thermocouple, special limits of error
Source: Omega Engineering, Inc., part number TT-T-24S-TWSH
Accuracy: About 0.9°F (0.5°C)
Locations: Inside refrigerator and freezer, immersed in glycol solution; inside insulated container for shower tests.