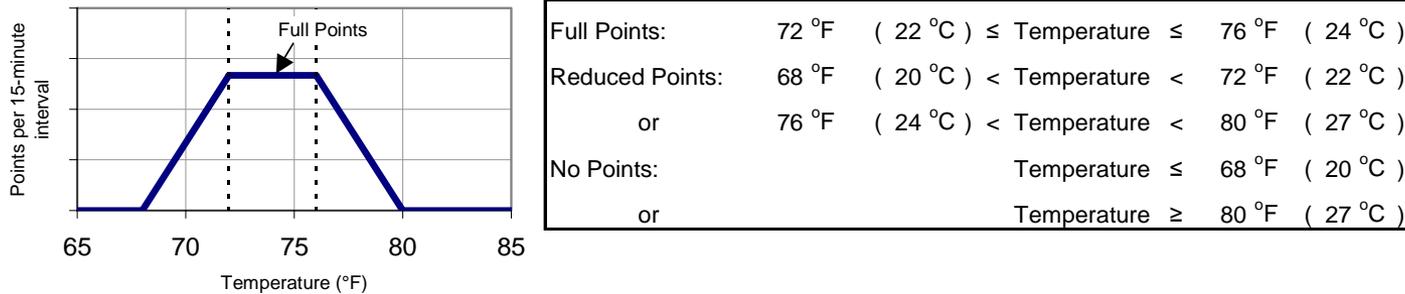


## Contest 5: Comfort Zone

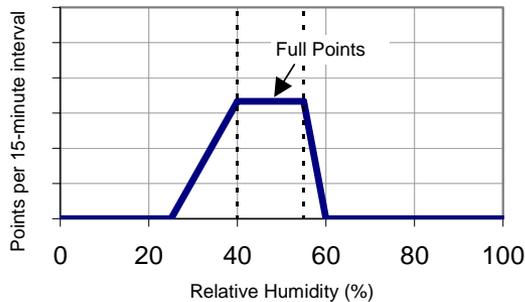
### **Temperature Control (40 pts):**

Teams earn the maximum number of points per scored 15-minute interval by keeping the time-averaged interior dry-bulb temperature between 72.0°F (22.2 °C) and 76.0°F (24.4 °C). A reduced point value is added to the team’s score for every scored 15-minute interval that the time-averaged interior dry-bulb temperature is between 68.0°F (20.0 °C) and 72.0°F (22.2 °C) or between 76.0°F (24.4 °C) and 80.0°F (26.7 °C). Reduced point values are scaled linearly, as shown in the graph below. The number of points possible per 15-minute interval is not indicated on the y-axis of the graph. Teams can earn a total of 40 points for this Contest Activity, but the number of points per interval cannot be calculated until the total number of 15-minute intervals is known. Scoring will be suspended during hours that the houses will be open to the public for tours, so the total number of 15-minute intervals and the number of points per interval will be determined when the exact hours for public tours have been determined.



### **Humidity Control (20 pts):**

Teams earn a maximum number of points per scored 15-minute interval by keeping the time-averaged interior relative humidity between 40.0 % and 55.0%. A reduced point value is added to the team’s score for every scored 15-minute interval the time-averaged interior relative humidity is between 25.0% and 40.0% or between 55.0% and 60.0%. Reduced point values are scaled linearly, as shown in the following graph. The number of points possible per 15-minute interval is not indicated on the y-axis of the graph. Teams can earn a total of 20 points for this Contest Activity. The total number of 15-minute intervals and the number of points per interval will be determined when the exact hours for public tours have been determined.



Full Points:	40 %	≤	Humidity	≤	55 %
Reduced Points:	25 %	<	Humidity	<	40 %
	or		55 %	<	Humidity
				<	60 %
No Points:			Humidity	≤	25 %
	or		Humidity	≥	60 %

### ***Introduction to Comprehensive Assessment of Indoor Environmental Quality***

Conditions within a building are comfortable when all aspects of indoor environmental quality (IEQ) are addressed. The U.S. Green Buildings Council (USGBC) defines IEQ as “issues related to indoor air quality (IAQ)” and other matters, including “daylighting and lighting quality, thermal comfort, acoustics, occupant control of building systems, and access to views” (*LEED-NC Version 2.1 Reference Guide*, page 239). The USGBC LEED rating systems further address the following measures for providing good IEQ:

- Protect occupants from pollutants and high CO<sub>2</sub> levels.
- Provide for effective delivery and mixing of fresh air.
- Prevent IAQ problems resulting from the construction or renovation processes.
- Reduce the quantity of indoor air contaminants that are odorous, potentially irritating, and/or harmful to the comfort and well being of installers and occupants.
- Avoid exposing building occupants to potentially hazardous chemicals that adversely impact IAQ.
- Provide a high level of thermal, ventilation, and lighting system control by occupants.
- Provide a thermally comfortable environment.
- Provide a connection for the building’s occupants between indoor spaces and the outdoors by introducing daylight and views.

The IEQ Panel of Judges will consider the IEQ aspects outlined by the USGBC that are related to thermal comfort and IAQ and are applicable to the Solar Decathlon houses. The LEED-NC Version 2.1 criteria principally apply to commercial building construction. The Panel will consider only those aspects that are applicable to both commercial *and* residential building construction. The Lighting Panel of Judges will evaluate those aspects related to lighting quality, daylighting, and views (see [Contest 8: Lighting](#)).

*Note: The IEQ Engineering Panel will assume that the houses have been designed for Washington, D.C.’s climate.*

***Comprehensive Assessment of Thermal Comfort (20 pts):***

“Thermal comfort is that condition of mind, which expresses satisfaction with the thermal environment” (*ASHRAE Standard 55*). Individuals judge comfort through a “cognitive process involving inputs influenced by physical, physiological, psychological, and other processes” (*2001 ASHRAE Handbook of Fundamentals*, page 8.1). An individual’s metabolic rate/physical activity and clothing combined with the air temperature, mean radiant temperature, air velocity, and air humidity are all factors that determine that individual’s perceived thermal comfort.

The IEQ Panel of Judges will evaluate thermal comfort according to the following criteria:

- Thermally comfortable conditions are achieved by integrating technologically and/or economically innovative, low-energy strategies with minimal distractions to the occupant (e.g., avoiding excessive air movement and noise).
- Control of thermal comfort systems is user-friendly and responsive to the user’s desires.
- Uniform thermal conditions exist throughout the house.
- Convincing evidence is presented demonstrating that comfortable thermal conditions will be maintained during all times of the day and year.

***Comprehensive Assessment of Indoor Air Quality (20 pts):***

Sources releasing gasses and particulates into the indoor environment are “the primary cause of indoor air quality problems in homes,” according to the U.S. Environmental Protection Agency (EPA) (<http://www.epa.gov/iaq/pubs/insidest.html#Intro>). These sources include building materials, occupant activities, HVAC system control and effectiveness, combustion devices or activities within the house, and other introduced pollutants. The health effects of IAQ issues on occupants could be immediate, could occur years after exposure, or might not occur at all.

The IEQ Panel of Judges will evaluate indoor air quality (IAQ) according to the following criteria:

- Excellent IAQ is achieved by integrating technologically and/or economically innovative, low-energy strategies with minimal distractions to the occupant (e.g., avoiding excessive air movement, noise, and odors).
- Control of IAQ systems is user-friendly and responsive to the user’s desires.
- Strategies for maintaining excellent IAQ effectively minimize pollutant sources.
- Convincing evidence is presented demonstrating that good IAQ conditions will be maintained during all times of the day and year.

<b>Contest Activity</b>	<b>Points Available</b>
Temperature Control	40
Humidity Control	20
Comprehensive Assessment of Thermal Comfort	20
Comprehensive Assessment of Indoor Air Quality	20
<b>TOTAL</b>	<b>100</b>