

# Regulations

## 1. Administration

### *1.1 Rules and Regulations Authority*

The Solar Decathlon Rules and Regulations are issued under the authority of the Rules and Regulations Committee. Official printed or electronic communications from the Rules and Regulations Committee and/or Organizers shall be considered part of, and shall have the same validity as these Rules and Regulations. If there is a conflict between official printed or electronic communications and these Rules and Regulations, the information having the later date shall take precedence. Official communications will be made available to the teams via one or more of the venues indicated in Section 2, Official Communications.

If there is any doubt or ambiguity as to the wording or intent of these Rules and Regulations, the decision of the Rules and Regulations Committee shall prevail. Infractions of these rules can lead to warnings, point penalties and, in extreme cases, disqualification. Safety and good sportsmanship will not be compromised.

### *1.2 Effective Date of Rules and Regulations*

The Rules and Regulations posted on the Solar Decathlon Web site and dated for the year of the Event are the Rules and Regulations in effect. Rules and Regulations dated for other years are invalid.

### *1.3 Violations of Intent*

A violation of the intent of a rule or regulation will be considered a violation of the rule or regulation itself. Questions about the intent of a rule or regulation may be addressed to the Rules and Regulations Committee per the instructions in Section 2: Official Communications.

### *1.4 Rules and Regulations Compliance*

By entering a Solar Decathlon Project, the team, faculty advisor, and the members of the team as individuals agree to comply with, and be bound by, these Rules and Regulations and any procedures announced by the Organizers.

## 1.5 Organizer Authority

The Organizers of the competition reserve the exclusive right to revise the schedule of the Project and to interpret or modify (or both) the Rules and Regulations at any time and in any manner that is, in their sole judgment, required for the efficient operation or safety of the competition.

## 2. Official Communications

It is the teams' responsibility to stay current with official communications regarding the Project. Official communication between the teams and the Director, Project Manager, Organizers, Rules and Regulations Committee and Chair, Headquarters, Inspectors, Event Staff, Contest Officials, Chief Observer, Scoring Official, Protest Resolution Committee Chair, and any other Solar Decathlon staff and officials will occur through, but not be limited to, one or all of the following. (Teams will be notified of any changes in methods or venues for official communications.)

- *Solar Decathlon Yahoo! Group also known as "the Group"*: All official communication suitable for viewing by all teams will be posted on the Yahoo! Group (open to teams and Organizers only) (<http://groups.yahoo.com/group/solardecathlon/>). The Group includes a section for posting files. If files are too large, they will be posted on the Solar Decathlon ftp site or Web site, and the teams will be notified via the Group as to where they can locate the files. Teams must follow the Organizers' instructions (provided to each team in September 2003) to join the Group. The Group will be the primary venue for official communications, so the teams should check the Group often for new information.
- *Rules and Regulations Committee Chair Email*: For confidential inquiries regarding the Project, teams should email the Rules and Regulations Committee Chair ([sdrules@nrel.gov](mailto:sdrules@nrel.gov)). The Chair will route these inquiries appropriately, and the inquiries will be kept confidential.
- *Solar Decathlon ftp site*: The ftp site ([ftp://ftp.nrel.gov/pub/solar\\_decathlon/](ftp://ftp.nrel.gov/pub/solar_decathlon/)) will be used by the Organizers to make large files available to the teams. The Organizers may also request that the teams use the ftp site to make large files available to the Organizers. Notification of or requests for file transfers will be made via the Yahoo! Group or email.
- *Solar Decathlon Web site*: Space on the Yahoo! Group is limited. Files of a more permanent nature (e.g., the official Rules and Regulations) will be made available via the Solar Decathlon Web site (<http://www.solardecathlon.org/>). Notification of new or updated information on the Web site will be provided via the Group.
- *Conference calls*: The teams will be invited to participate in periodic informational sessions via conference calls. Invitations and instructions for participation in conference calls will be provided via the Group.
- *Meetings*: Before the Event, the teams and Organizers will have two meetings: a kick-off meeting in September 2003, and a meeting concurrent with the IEEE PV Specialists Conference in January 2005. During the Event, a meeting will be held the day before assembly begins on the Mall, and meetings will be held daily on the Mall throughout the Event.

- *Postings at Headquarters:* During the Event, a bulletin board (or other obvious venue for posting information) may be established at Headquarters. Teams will be notified via the Group or email if such a venue is established and the purpose for which it has been established.
- *Email:* For expediency and to protect confidentiality, the Organizers may choose to communicate with teams via the team email addresses provided to the Group. However, the bulk of official communication will occur via the Group and the Web site.

### **3. Communications Materials**

Communications materials refer to all content, graphics, and photographs that appear in any submissions to the Organizers and to any products (print, electronic, video or film, and merchandise) for fund-raising, marketing, advertising, educational, promotional, publicity, team identification, and public outreach purposes.

#### ***3.1 Organizer and Event-Sponsor Use of Likeness, Content, and Images***

By entering the Project, Event, and Competition, all teams, Team Members, contractors, and volunteers agree to the use of their names and their likenesses in any communications materials that may be issued by the Organizers or Event Sponsors. By entering the Project, Event, and Competition, all teams and Team Members agree to the use of any content, graphics, and photos from any communications materials that they produce for the Project in any communications materials produced by the Organizers or Event Sponsors. Content and images (graphics and photos) may be made available to the general public via the U.S. Department of Energy's, the National Renewable Energy Laboratory's, and the Event Sponsors' Web sites with unrestricted use. Images and content, and any publications in which the images and content appear, may be viewable without restrictions on the Internet. Before August 9, 2005, if the teams submit content or images they would like to be kept confidential, they should make that request, with an explanation, in writing to the requestor of the content or images. For example, if a team would like to keep specific content or images in the design development drawings and submittals confidential, they should note that in a cover letter with the submission. Every effort will be made to honor requests for confidentiality. The Organizers and Event Sponsors will make all reasonable efforts to credit the sources of content and images, although they may be published without credit. To ensure proper usage of and credit for images, teams should submit photos and graphics by following the [Instructions for Submitting Images](#).

#### ***3.2 Event-Sponsor Recognition***

All communications materials produced by the teams or Team Sponsors concerning or referring to the Project will refer prominently to the Project as the Solar Decathlon. All communications materials produced by the teams will credit the U.S. Department of Energy, the National Renewable Energy Laboratory, and additional Event Sponsors as indicated by the Organizers. The Solar Decathlon will be recognized with text and logo wherever other logos are used. Information regarding current Event Sponsors, artwork for the Solar Decathlon, and Event Sponsor logos will be available on the Solar Decathlon Web site (<http://www.solardecathlon.org/>).

### **3.3 *Communications Materials on the National Mall***

All communications materials to be present or distributed on the National Mall will follow the [Guidelines for Sponsor Recognition on the National Mall](#). The National Park Service (NPS) is very concerned about the amount of printed material distributed on the National Mall. Teams are limited to one media/VIP kit and one brochure. The contents of the media/VIP kit must be in a binder or folder; they will be available to the media and visiting VIPs but are not to be distributed to the general public. Teams are limited to one brochure for distribution to the visiting public.

### **3.4 *Team Uniforms***

The only information or graphics that are approved to be visible from the front of the team uniform (jacket, shirt, hat, or other wearable item) shall be the institution and its logo, the team name and logo, the Solar Decathlon logo and Event Sponsor logos as indicated on the Solar Decathlon Web site (<http://www.solardecathlon.org/>). Team Sponsor logos are to be visible only from the back of the team uniform shirt or jacket.

## **4. Safety/Insurance**

Each team is responsible for the safety of its house, vehicles, and Team Members, and for obtaining all necessary insurance. Passing inspection or implementing changes suggested by the Director, Project Manager, Organizers, Rules and Regulations Committee, Event Staff or any other person associated with the Solar Decathlon does not release the teams from liability. Team members must behave in a safe manner at all times. All houses, vehicles, equipment, and tools must be maintained and operated safely at all times. A team may be disqualified and withdrawn from the Project at any time if they behave or operate their house, vehicles, equipment, or tools in an unsafe manner. Organizers and Event Staff may issue a stop work order at any time during the Project if they perceive any safety violation. The Director or Project Manager (or both) will make the final determination as to the severity of and penalty for (up to disqualification) a safety violation.

Each team's house must be equipped with proper personal protective equipment (PPE) to provide to all of its workers during the Event. At a minimum, teams must provide an adequate amount of hard hats; climbing harnesses; ear plugs; eye protection; work gloves; work boots; chemical-resistant gloves, aprons and eye protection for servicing battery banks; and protection from any other thermal, electrical, mechanical or fluid system that presents any kind of hazard.

## **5. Conduct**

Penalties, including disqualification from the Project, Event, and Competition may be imposed for improper conduct or for the use of alcohol or illegal substances. Improper conduct may include but is not limited to improper language, unsportsmanlike conduct, unsafe behavior, distribution of inappropriate media, or cheating. See Regulation 6, Penalties, about the process for qualifying, quantifying, and assessing penalties and for more information about disqualification.

## **6. Penalties**

Any team failing to comply with these Rules and Regulations during the Project will be penalized. Penalties range from official warnings to point penalties to disqualification from the Project, Event, or Competition. During the Project, it is the Project Manager's responsibility (in consultation with Contest Officials, Event Staff, Judges, Jurors, Inspectors, Observers, Organizers, or the Rules and Regulations Committee, depending on the nature of the infraction) to determine whether an infraction has occurred. If an infraction has occurred, the Project Manager shall qualify the severity of the incident and quantify the appropriate penalty. The Project Manager will submit all point penalties to Solar Decathlon Headquarters for posting. The Scoring Official will assess and post all penalties before the announcement of official scores. Disqualification of a team from the Project requires prior notice to the team, an opportunity for the team to make an oral or written statement on its own behalf, and, finally, the concurrence of the Director.

## **7. Protests**

Any team desiring to file a protest must do so by submitting an official written protest (signed by the team leader) to Solar Decathlon Headquarters within the time stipulated in Regulation 7.2, Time Limit. Protests may be filed for any reason, including disputing a penalty levied against any team, correcting point errors, or protesting the actions of another team. A "filing fee" of 10 points, which could be refundable, will be assessed against the team's Official Score. The Protest Resolution Committee Chair (in consultation with Contest Officials, Event Staff, Judges, Jurors, Inspectors, Observers, Organizers, or the Rules and Regulations Committee, depending on the nature of the protest) will evaluate the appropriateness of all team protests to determine which protests the Protest Resolution Committee should review. The decision will be based on the documentation submitted. No appearance is authorized. No right to counsel is authorized.

### ***7.1 Protest Decisions***

The decision of the Protest Resolution Committee is final, and no further appeals are allowed. The Protest Resolution Committee Chair will notify Solar Decathlon Headquarters of its decision, and Headquarters then will inform the affected teams. Based on its assessment and decision, the Protest Resolution Committee may refund some of or the entire filing fee to the filing team's score.

## **7.2 *Time Limit***

Except for the last day of the Contest Week, all protests must be filed within 24 hours of the action being protested. The latest possible time for filing protests is 7:00 p.m. on the last day of the Contest Week.

## **8. Team Requirements**

### **8.1 *Entry***

The Project is open to colleges, universities, and other post-secondary educational institutions. Entry is determined through a proposal process. All proposals will be reviewed, scored, and ranked. Subject to the quantity and quality of submissions, a limited number of teams, out of the total number of institutions that submitted proposals, will be selected for entry.

### **8.2 *Faculty Advisor***

Teams must have at least one Faculty Advisor who will provide guidance on an as-needed basis throughout the Project. The Faculty Advisor will be responsible for obtaining appropriate signatures on documents that require the school's or schools' concurrence or authorization.

### **8.3 *Registration***

All Team Members taking part in the Event must register. On-line registration and on-site (in Washington, D.C., and on the Mall) registration will be available for Team Members. Team Members are encouraged to register on-line, because on-site registration could cause delays in their access to their team's site on the Mall. When they register, Team Members must complete all required information and forms, and provide a photo for a photo ID badge. These badges are required for all access to the entire site on the Mall during certain times and to certain restricted areas. Badges must be visible at all times. Team contractors, volunteers, and visitors must register on site and complete all required information and forms. In some cases, team contractors, volunteers, and visitors may be issued a photo ID badge. Each participant (Team Members, contractors, volunteers, and visitors) must register individually; no group registration will be allowed. Visiting media must check in with Headquarters.

#### **8.4 Decathletes**

Only registered Decathletes will be allowed to compete in the 10 Contests and participate in Contest Activities. During the Contest Week, a team shall have a maximum of six Decathletes operating the house and two decathletes operating the car at one time. The same eight individuals do not have to remain Decathletes for the entire Contest Week. Decathlete status is transferable to other student Team Members. Teams will be allotted eight Decathlete badges for tracking purposes. In addition to meeting the Decathlete requirements, car drivers and passengers must be 18 years old or older and present a valid driver's license and evidence of insurance. The Faculty Advisor and any other non-student Team Members may not be Decathletes.

#### **8.5 Team Members**

Only post-secondary students (including current students or students who have graduated within 12 months of the Event) and faculty from the institutions selected by the Organizers to participate in the Project can be Team Members. However, teams are encouraged to seek assistance from experts in industry, research, and academia.

#### **8.6 Uniforms**

During the Competition from 7:00 a.m. to 10:00 p.m., and during special events specified by the Organizers or Event Staff, all Team Members present on the National Mall or the site of a specified special event shall wear uniforms representing their institution(s) (i.e., school, college, or university).

#### **8.7 House Transport, Assembly, and Disassembly**

Teams shall be responsible for the transport of their houses, the houses' contents, electric vehicles, and all equipment and tools necessary for the Event and shall be responsible for any damage to or loss of such items. Teams are responsible for procuring any equipment, tools, and supplies at the Event.

#### **8.8 Travel, Accommodations, and Lodging**

All teams are responsible for their team's transportation, accommodations, lodging, food and beverages (including drinking water) during the Event. Teams are responsible for making their own reservations and arrangements and for covering all necessary costs.

## **8.9     *Withdrawals***

Any team wishing to withdraw must notify, in writing, the Project Manager (before the Event) or Headquarters (during the Event). All written withdrawals signed by the team leader are final. The Project Manager or Headquarters may disqualify teams that do not meet Project requirements or that fail inspections during either the Project or Event. Any disqualification decision shall be in writing and, once presented to the team, the decision shall be final.

## **8.10    *Vehicular and General Liability Insurance***

The school, at the school's expense, shall maintain, for the duration of the Event, vehicular liability insurance with limits of liability for bodily injury of not less than US \$200,000.00 for each person and US \$500,000.00 for each occurrence; and limits of liability for property damage of not less than US \$40,000.00 for each accident and US \$500,000.00 for each occurrence.

The school, at the school's expense, shall maintain, for the duration of the Event, general liability insurance with limits of liability for bodily injury of not less than US \$500,000.00 for each person and US \$500,000.00 for each occurrence; and limits of liability for property damage of not less than US \$100,000.00.

The school, at the school's expense, shall maintain, for the duration of the Event, workers compensation insurance for non-volunteering employees of the school present at the Event with limits of liability as required by applicable law, and employer's liability insurance for liability for bodily injury of not less than US \$100,000.00 for each person and US \$100,000.00 for each occurrence.

The school agrees to furnish the National Renewable Energy Laboratory (NREL) or the U.S. Department of Energy (DOE), upon request, evidence satisfactory to NREL or DOE of such vehicular liability, general liability, workers compensation liability, or employer's liability insurance coverage.

## **9.     **Impound****

All houses and cars must be impounded every night of the Contests from 10 p.m. to 7 a.m. under the direct supervision of official Solar Decathlon personnel. No Team Members are allowed to occupy, move, or conduct maintenance on any part of the house or car during impound hours.

## **10. Technical**

### ***10.1 Americans with Disabilities Act (ADA)***

The public will have access to all the structures within the Solar Decathlon village at various times during the Event; therefore, all structures must meet [Solar Decathlon Accessibility Requirements and Guidelines](#). Teams are required to provide an accessible route through their houses for tour purposes. This does not mean that the entire house needs to be ADA compliant.

### ***10.2 National Park Service Regulations***

The National Park Service (NPS), the government agency that manages the National Mall, has established criteria that must be met by all teams building houses on the National Mall. Each team is financially responsible for any damage it causes to the National Mall.

#### ***10.2.1. Site Regulations***

On the grassy areas, teams will be permitted to use a forklift or similar small lifting equipment to aid in the Assembly of their houses. However, forklifts or other small vehicles used during Assembly may be driven on the grass portion of the National Mall only if these vehicles are driven on a plywood path (to protect the grass). Truck-mounted cranes, trailers, semi-trailer trucks, etc., are limited to the gravel paths and may not be driven on the grass at any time. NPS may permit trailers and semi-trailers to be driven on the grass portion if the vehicles are driven on a plywood path. Cinder block or similar pylons must support structures on the grass portion of the National Mall. Teams will not be permitted to build or place floors directly on the grass. The individual teams must provide all equipment, tools, and labor necessary to construct the house.

#### ***10.2.2. P.E. Stamp Requirement***

The NPS requires that engineering drawings be stamped by a Professional Engineer (PE) certifying that the structures are safe for the public to enter.

### ***10.3 Codes and Compliance***

Houses must comply with applicable sections of the following codes:

- 2003 International Residential Code (IRC2003)
  - Sections from the other 2003 International Codes may be applicable when an issue is not addressed by IRC 2003 or when IRC 2003 references one of the other Codes.

- The final chapter in each of the 2003 International Codes is titled “Referenced Standards.” In some rare cases, teams may have to refer to these standards. They are often available in university libraries.
- 2002 National Electrical Code (NEC2002)

Houses also must comply with the following documents created by the Organizers:

- [\*Solar Decathlon Accessibility Requirements and Guidelines\*](#)
- [\*Battery Requirements and Guidelines\*](#)

Each of the following Regulations describes requirements created specifically for the Solar Decathlon or requirements needing further elaboration:

### *10.3.1. Fire Prevention*

Each house will be required to have smoke detectors per IRC2003 requirements and a fire extinguisher with a minimum Underwriters Laboratory (UL) rating of 2A-10BC. All battery system rooms or rooms containing a battery system enclosure must have a smoke detector that is either audible from outside the room or has a remote indicator that shall be monitored by the team.

### *10.3.2. Electrical*

All houses must meet all applicable electrical requirements stated in NEC2002. Particular attention should be paid to Articles 690, 480, 445, 250, 310, 400, and 240, which refer to photovoltaic system design, storage batteries, generators, grounding, conductors for general wiring, flexible cords and cables, and overcurrent protection devices, respectively. Teams are also encouraged to read the following publication: Wiles, John C. (2001). *Photovoltaic Power Systems and the National Electric Code: Suggested Practices*, Sandia Report SAND2001-0674.

For detailed requirements specifically related to batteries, refer to the supplemental document, [\*Battery Requirements and Guidelines\*](#).

### *10.3.3. Structural*

The structural drawings and calculations included in the Construction Drawings and Submittals set must be stamped by a licensed professional engineer (PE). Obtaining the PE stamp is the responsibility of the teams, not the Organizers. The stamped structural drawings and calculations will be submitted by the organizers to the National Park Service for final approval. It is strongly recommended that teams involve a licensed structural engineer throughout the design process, because he or she could require structural design changes that could affect other aspects of the house. In addition to meeting applicable IRC2003 requirements, special attention must be given to the structural design challenges unique to the Solar Decathlon. These challenges include, but are not limited to, the following:

- Increased live loads because of the house tours
- Necessity for tie-downs because of the lack of a permanent foundation (tie-downs must not penetrate more than 18 in. (45.7 cm) into the National Mall topsoil)
- Use of low-impact footings to protect the National Mall grass
- Unique wind loading conditions because of roof-mounted solar systems
- Increased dead loads because of unusual mechanical and electrical equipment, such as batteries and water storage.

The following minimum loads must be used in the structural design:

- Wind: 90 mph (40.2 m/s) (3-second gust), Exposure Category C (if tie-downs are not used, you MUST show that there is no overturning or uplifting with a safety factor of 2)
- Railings: 200 lb (890 N) concentrated load applied in any direction at any point at the top of the rail
- Interior Floor, Decks, Ramps: 50 psf (2.39 kPa) live load
- Means of egress components: 100 psf (4.78 kPa)
- Roof: 20 psf (0.958 kPa) live load
- Soil: 1000 psf (4.79 kPa) load bearing pressure on top of the soil
- Additional structural design requirements at the post-Event house location (to be determined by the engineer of record).

#### ***10.4 Inspections***

Inspections will cover the inspection of sizes; of structural, electrical, and mechanical systems; and of a team's compliance with applicable sections of IRC2003, NEC2002, Rules and Regulations, [Solar Decathlon Accessibility Requirements and Guidelines](#), and [Battery Requirements and Guidelines](#).

##### *10.4.1. Pre-Event Inspections*

Solar Decathlon Inspectors will visit each team at its institution and inspect the work in progress for compliance. Inspectors anticipate spending up to two days with each team for Pre-Event Inspections and identification of areas requiring corrective actions. The Organizers will work with each team to arrange appropriate dates and times for Pre-Event Inspections.

##### *10.4.2. Event Inspections*

Each team participating in the Event must present its house for inspection before the Contests to verify compliance. The order of Event inspections will be determined in a drawing. Teams that fail to present their house at their designated time will drop to the back of the queue and will risk not having enough time to complete the inspection process. In addition, spot checks for compliance may take place

during and immediately after the Contests. Modifications to the team's electric car beyond the manufacturer's specifications are not permitted. The top five overall finishing houses and cars may be impounded immediately following the Contests for a final Inspection.

After Event inspections, teams will have 24 hours to bring an identified violation into compliance, or the team will be subject to a penalty. Teams may not be able to compete in any Contest until inspections have been passed.

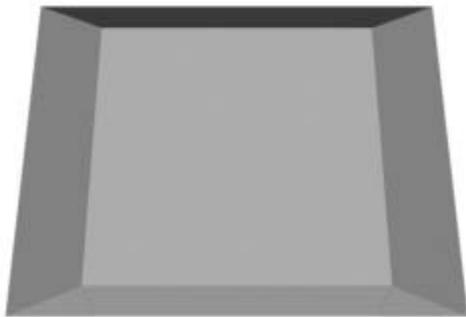
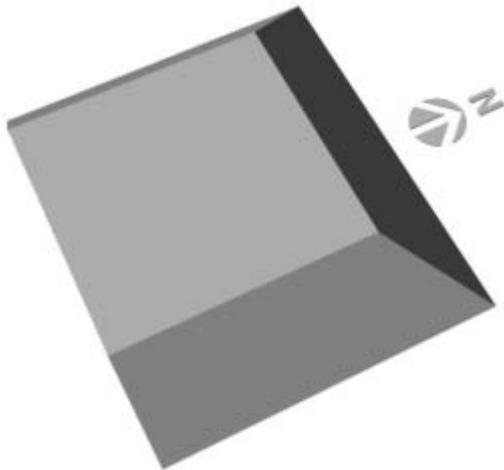
## ***10.5 The House and Site***

### *10.5.1. Team Lots*

Teams will be allowed roughly 5500 ft<sup>2</sup> (511.0 m<sup>2</sup>) of nearly level, unobstructed land and will have three to four days to assemble their houses on the National Mall. Assume that some minor leveling of the floor deck will be necessary. There are no limits on materials or type of construction as long as applicable codes are followed. The house can either be transported to the site already assembled or transported and assembled on site, as long as it does not damage the site. No digging will be permitted except for tie-downs needed to meet wind-loading requirements. Large stakes or screws, similar to those used for circus tents, may be used to anchor the structures. Screws or stakes used with tie-downs are limited to 18-in. (45.7 cm) vertical depth. The lot size will be 82 ft (25.0 m) east to west by 67 ft (20.4 m) north to south. Please refer to Figures 1 and 2.

### *10.5.2. Solar Envelope*

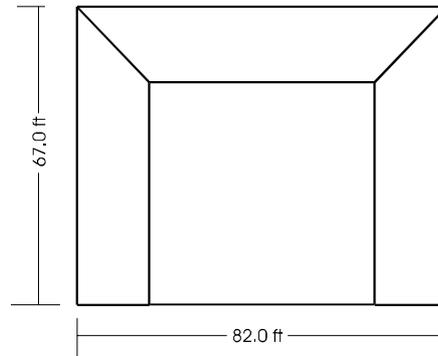
To protect a neighbor's right to the sun, each house and all items associated with the house must stay within the solar envelope shown in Figures 1 and 2.



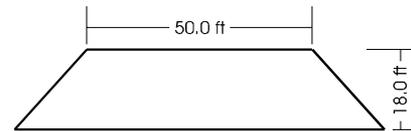
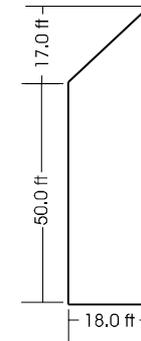
North Side View



Top View



East Side View



South Side View

Figure 1: 3-D view of solar envelope

Figure 2: Solar envelope dimensions

### *10.5.3. House Sizing*

Houses are restricted to a maximum of 800 ft<sup>2</sup> (74.3 m<sup>2</sup>) of total building footprint. The perimeter of the projection of the house onto a horizontal plane from plan view cannot contain an area greater than 800 ft<sup>2</sup> (74.3 m<sup>2</sup>). Any house component (e.g., ADA ramps, HVAC condenser, decks, porches, wastewater tank, supply water storage container, pressure pump) that is not part of the enclosed space and is not part of the solar array or energy storage system will be excluded from the 800-ft<sup>2</sup> (74.3 m<sup>2</sup>) footprint limitation but must be within the solar envelope. The house must have a minimum of 450 ft<sup>2</sup> (41.8 m<sup>2</sup>) of conditioned interior space measured as floor area from the inside of the exterior walls.

### *10.5.4. Vegetation*

Teams are permitted to bring potted vegetation to enhance the aesthetic or energy characteristics of their houses, provided that the vegetation does not violate the solar envelope. Vegetation will not be considered part of the solar array. Vegetation may be placed and moved around each team's lot until the end of the Assembly. After that, the vegetation will remain stationary until the conclusion of all the Contests and tours.

### *10.5.5. House Entryways*

Teams have the freedom to place the main entry to their house on any side of the house. However, teams must provide a walkway leading from the main street of the solar village to the main entrance of the house.

## **10.6 Energy**

### *10.6.1. Generators*

Teams may provide a generator from which they may charge their energy storage devices. Operation and refueling of generators is limited to times approved by the Organizers. Generators should be used only to complete Contests that teams would otherwise be unable to finish with power supplied by their solar array. However, teams will be assessed significant penalties for charging their energy storage devices with generators. In general, penalties will be greater in proportion to increases in the length of a generator's run-time and in the amount of a generator's energy production. Penalties will be applied during any part or all parts of Contests 5 through 10. Generators may be used only after notifying the Project Manager of the intention to use the generator.

Generators must be equipped with secondary containment systems that can accommodate all of the oil, fuel, and coolant that the generator contains at maximum capacities.

### *10.6.2. Solar Cell Technology Limitation*

Photovoltaics must be commercially available to all registered teams at a price not to exceed US \$5 per watt (watt peak at Standard Test Conditions [STC]) for bare cells (teams may pay extra for cutting, tabbing, or lamination of the cells). For encapsulated modules, photovoltaics must be commercially available to all registered teams at a price not exceeding US \$10 per watt (watt peak at STC). Substantial modification of the crystal structure, junction, or metallization constitutes manufacture of a new cell.

### *10.6.3. Energy Storage Location*

All energy storage devices (e.g., tanks, batteries, bladders, mass components) must be located within the 800-ft<sup>2</sup> (74.3 m<sup>2</sup>) footprint.

### *10.6.4. Flywheel Storage*

No flywheels of any kind will be permitted for electrical or any other type of energy storage.

### *10.6.5. Batteries*

Teams are allowed to use battery systems in their houses and cars for storage of electrical energy. The battery system for the car must be the car manufacturer's original equipment. Submittals of battery data shall be based on the manufacturer's published specifications provided by the team. Batteries must be available in sufficient quantities to be accessible to all participating teams. The battery modules may not be modified in any manner, for example, by using electrolyte additives; making case modifications; or adding, removing, or modifying plates. However, teams are permitted to add distilled water to vented (flooded) lead-acid batteries for maintenance purposes. Primary Batteries: The use of primary (non-rechargeable) batteries is limited to smoke detectors only. Secondary Batteries: The use of secondary batteries (rechargeable) for items such as laptop computers is permitted, provided that all laptops or similar devices used for Contest purposes are to be recharged from the house's electrical system.

### *10.6.6. Energy Collection*

Global solar radiation received by the house without artificial external augmentation is the only source of energy with which houses, tasks, and the electric car will be permitted to operate. Direct and diffuse radiation are considered forms of global solar radiation. All components used to convert global solar radiation to thermal, electrical, or mechanical energy shall be considered part of the solar array regulation. The following exceptions to the Energy Collection regulation apply:

- Energy stored in the house battery system or other Contest-related secondary batteries (e.g., laptop batteries, uninterruptible power supply systems) and the vehicle battery system when Assembly is completed.
- Use of a generator or other non-solar-power source to charge the electrical-storage system.

- Additional water associated with the supply and consumption of energy above and beyond the water supplied at the beginning of the Contest.

#### *10.6.7. Solar Array*

At any given moment, the solar array comprises all components that are involved in the conversion of solar energy for use by the house, for tasks, and by the vehicle. In addition to direct energy conversion components (such as photovoltaic cells), the solar array includes any reflective surfaces, shading surfaces, refractive lenses, solar thermal collectors, or any means of passive solar collection. The solar array cannot be outside the 800-ft<sup>2</sup> (74.3 m<sup>2</sup>) footprint in any way. The entire solar array must be integrated into the structural envelope, or skin, of the building.

#### *10.6.8. Thermal and Electrical Storage System Sizing*

Thermal and electrical storage systems sized for annual loads may be very large and costly in contrast to those needed for the purposes of the Competition. Therefore, teams are permitted to present a house containing thermal and electrical storage systems that are downsized from, or smaller than, the sizing indicated by annual simulation results.

### **10.7 Water**

#### *10.7.1. Quantity*

In drawings and submittals, teams must indicate all of the water that their entry requires during the Event.

#### *10.7.2. Supply*

Water will be supplied to teams at the conclusion of the Assembly phase. The intent is that all teams shall be ready to receive water before the water truck arrives on the Mall, so all team storage systems can be filled on the same day. Two gravity-fed water trucks will be available to fill the house's water storage systems. They will begin at the southwest and northeast corners and proceed counter-clockwise. The water trucks are restricted to gravel roads on the north and south sides of the Mall and are restricted in the height to which they can supply water. All water supply tanks must have easily accessible, 4-in. (10.2 cm) minimum diameter caps on the gravel road side of the house (north for teams on the north side of Mall, south for teams on the south side). All water tank caps must be less than 6 ft (1.83 m) from ground level. If teams have other water tanks higher than the 6-foot (1.83 m) cap limit, they are required to pump the water to the higher storage tanks from the tank of their own that meets the 6-foot (1.83 m) cap limit. The water trucks can NOT supply water higher than 6 ft (1.83 m).

Water will be supplied only once without penalty. After that, teams may request additional water, which may be subject to availability (indeterminable delay, depending on quantity needed) and a penalty. Teams should use a supply tank with enough capacity (plus an appropriate safety factor) to meet all their water needs throughout the Event. Contest requirements suggest a 250-gallon (946 liters) minimum; a team may require more, depending on appliances, cooking, and unforeseen events. No additives of any kind may be added to this water. This water is not for consumption at any time. To comply with Regulation 10.5.3: House Sizing, teams choosing to place their water supply storage container outside the 800 ft<sup>2</sup> (74.3 m<sup>2</sup>) footprint must prove to the Organizers in their Drawings and Submittals that the container is not part of “the energy storage system.”

### *10.7.3. Distribution*

Teams are responsible for distributing water within their houses. This includes all necessary pumps, tanks, lines, valves, etc. All pumping power to distribute water must come from the house energy system.

### *10.7.4. Rainwater Collection*

After Assembly is completed, teams may gather rainwater in their building footprints and use this water for any purpose. However, catchment system design and installation must be approved and stamped by a public health official. Because of Department of Public Health rules and concerns, unapproved catchment systems will not be allowed.

### *10.7.5. Thermal Mass*

Any water used for thermal mass must be contained in a stand-alone system, which will be sealed off after the initial filling. Teams may use water as thermal mass to substitute for more common materials such as concrete masonry units (CMUs), concrete floor slabs, or brick. Water used for this purpose cannot be mixed with any other substance. Water will be supplied for thermal mass purposes and will have the same requirements as those for supply water.

### *10.7.6. Evaporation*

Teams may use water for evaporation purposes. Evaporation must be included in the water use estimation. Teams may request additional water to compensate for evaporation after scoring begins; however, water delivery may be subject to availability (indeterminable delay, depending on quantity needed) and a penalty.

### *10.7.7. Watering Vegetation*

Water from the house water system may be used to water any potted vegetation associated with the house.

### *10.7.8. Wastewater*

All drains for appliances or sinks need to be routed back to a 350-gallon (1325 liters) minimum capacity drum to ensure that wastewater is not dispersed onto the National Mall turf or into storm drains. The wastewater drum must have a minimum 4-in. (10.2 cm) diameter cap, no higher than 6 ft (1.83 m) from ground level, that is easily accessible, on the gravel-road side of the house. All wastewater and water used in Contest 7: Hot Water must be stored in the wastewater drum. During the Event, dumping of water on the lot will not be permitted, according to NPS rules. Any dumping of water will incur a point penalty. All substances used in combination with water to clean the house, dishes, utensils, etc., must be nontoxic and preferably biodegradable. Teams could incur a point penalty for any toxic substances that are found in the wastewater drum. Teams will be required to provide the drum and support this drum so that it does not damage the National Mall turf. Teams are not required to place the wastewater drum within the 800-ft<sup>2</sup> (74.3 m<sup>2</sup>) footprint, but the drum must be located within the solar envelope.

### *10.7.9. Wastewater and Thermal Storage Water Removal*

During Disassembly, all wastewater and thermal storage water shall be removed by a wastewater truck in a manner similar to the way in which the water was delivered. The wastewater truck will be equipped with a pump to aid in removal. Two wastewater trucks will begin at the northwest and southeast corners of the Solar Village and proceed clockwise in emptying wastewater and thermal storage tanks.

## **10.8 Electric Car**

### *10.8.1. Pushing and Pulling*

In no case shall regenerative braking be engaged while pushing or pulling the car. Except for the following situations, the team's car may not be pushed or pulled during Contest hours:

- **Emergency:** In an emergency or breakdown situation, the car must be removed from the road. In this circumstance, the car may be towed back to Headquarters for inspection and repair.
- **Accidents and Re-inspection:** All accidents involving the car or support vehicles must be reported immediately to Solar Decathlon Headquarters. In case of an accident involving personal injury or property damage (or both), notification of the appropriate emergency medical services and public safety officials shall take priority. Notification to the school's insurer shall be made as soon as practicable. If a car is involved in an accident, it must be re-inspected by an Inspector before reentering the Contest. The Inspector may require that repairs be made before the team can resume the Contest.

- Impound: It may be necessary to push or pull the car to the impound area.

#### *10.8.2. NPS Rules*

Teams are permitted to drive the electric vehicles on National Mall turf to enable charging or parking within a carport or garage or area close to the team's house. When an electric vehicle enters or exits the National Mall, it must be "walked" (accompanied by a student Team Member on foot in front of the car). The electric car must be walked from the parking area, carport, or garage to the street and vice versa.

#### *10.8.3. Driver Requirements*

Only Decathletes are allowed to drive the team's electric vehicle for Contest 10: Getting Around Activities. All drivers at all times must have a valid driver's license and be 18 years of age or older.

Teams are required to include at least one passenger for all driving activities. During Contest 10: Getting Around Activities, that one passenger must be a Decathlete who has a means of communicating with the Decathletes remaining at the team's house. Teams must provide their own means of safe communication while operating the electric car. At all other times during the Event, that one passenger must be a Decathlete, Contest Official, member of the Event Staff, Judge, Juror, Inspector, Observer, Organizer, Rules and Regulations Committee member, or other person associated with the Solar Decathlon. Teams may have more than one passenger (provided they have one seat and safety belt per passenger), but at least one passenger must meet the requirements described here. All passengers at all times must have a valid driver's license and be 18 years of age or older.

#### *10.8.4. The Car*

Organizers will supply each team with an electric car. Proof of insurance must be kept with the vehicle at all times. Teams cannot alter the vehicles in any way. Teams may start the Contest with fully charged batteries in the vehicle, but any subsequent recharging must be supplied from energy generated by the house.

#### *10.8.5. Inspections and Accessories*

Before the team will be allowed to compete with its car, the car will be checked for compliance with the following manufacturer's specifications:

- Battery
- Tires
- Drive system
- Charging system

- Brakes
- 12 volt system (lights, horn, power plug).

The car also must have the following accessories installed at the Competition:

- Charge port locks
- Batteries sealed and marked to provide ready evidence of tampering after the start
- A logbook assigned to each vehicle that will provide written backup documentation to all vehicle activity
- Event decals supplied by Solar Decathlon Organizers.

### ***10.9 Desiccant Systems***

If a desiccant system is used in the house, it must be regenerative. To ensure that desiccant systems function in a steady-state fashion, the desiccant material or device must be easily weighable. The device or material will be weighed before and after the Contests. Teams will be assessed a penalty at the end of the Contests for having a desiccant material or device that weighs more than its initial weight.

### ***10.10 Thermal Storage***

All thermal storage devices (“mass”) must be made of stable, nontoxic materials. Material Safety Data Sheets (MSDS) must be submitted for all heat transfer fluids for approval. All liquid-based thermal storage systems must be marked with the NFPA’s Hazard Warning Diamond appropriate to the technology.

### ***10.11 Appliances***

The appliances used in Contest 6: Appliances must meet the following requirements or no points will be rewarded for the particular Contest Activity with which the appliances are associated.

#### ***10.11.1. Refrigerator/Freezer***

Each team must provide a refrigerator and freezer with a minimum of 15-ft<sup>3</sup> (0.425 m<sup>3</sup>) combined interior capacity. Any attached freezer compartment must have a separate door from that of the refrigerator compartment and a minimum of 3-ft<sup>3</sup> (0.085 m<sup>3</sup>) interior capacity. Teams must submit manufacturers’ specifications on the refrigerator’s interior volume based on the Association of Home Appliance Manufacturers (AHAM) standard, AHAM HRF-1-2001. For custom refrigerators, teams must submit volume calculations based on the same standard.

Teams may disable the automatic defrost function on their refrigerators and freezers, if it is deemed necessary to maintain temperature control.

Teams may use the refrigerator only to store a reasonable amount of drinking water or other beverages and food for the cooking tasks. The use of an integrated icemaker is allowed only after the Contest Week begins. Teams may not put any frozen or chilled items from outside sources in the refrigerator or freezer, because this would violate Regulation 10.6.6.

#### *10.11.2. Clothes Washer*

The “Clothes Washing Tasks” Contest Activity of Contest 6: Appliances requires teams to wash 12 large cotton bath towels on several occasions. Teams must use residential-sized washing machines that operate automatically and have both a wash and rinse cycle.

#### *10.11.3. Clothes Drying*

The drying method may include active drying (e.g., machine-drying), passive drying (e.g., on a clothes line), or any combination of active and passive drying. All drying methods that require the towels to be visible must be demonstrated to the Architecture Jury and Dwelling Panel of Judges as they tour the houses.

#### *10.11.4. Dishwashers*

Dishwashers must have a minimum capacity of six place settings according to the manufacturer’s specifications. A single place setting is defined as a dinner plate, a salad plate, a bowl, a cup and saucer, two forks, a knife, and a spoon. Dishwashers must operate automatically and must have a wash and a rinse cycle.

#### *10.11.5. TV Monitor*

The TV monitor must be a minimum of 19 in. (48.3 cm) according to the manufacturer’s stated monitor size. The computer and TV monitors must be separate devices.

#### *10.11.6. Computer and Computer Monitor*

The computer monitor must be a minimum of 17 in. (43.2 cm) according to the manufacturer’s stated monitor size. The computer and TV monitors must be separate devices. The computer may be a notebook, laptop, or desktop computer.

## Summary of Revisions

March 12, 2004

- Activated links to *Solar Decathlon Accessibility Requirements and Guidelines* and *Battery Requirements and Guidelines* documents.
- Revised Regulation 10.3 to achieve consistency with 2003 International Codes and 2002 National Electric Code.
- Moved battery-related requirements from Regulation 10.3 to the *Battery Requirements and Guidelines* document.
- Revised Regulation 10.5.5: House Entryways.

November 2, 2004

- Revised Regulation 10.2: National Park Service (NPS) Regulations regarding teams' financial responsibilities for any damage they cause to the National Mall.
- Added an additional minimum load to Regulation 10.3.3: Structural to be used in structural design for "means of egress" components.
- Provided clearer solar envelope drawings (Figures 1 and 2) in Regulation 10.5.2. Note that the dimensions have not changed.