SOLAR DECATHLON MIDDLE EAST

RULES

Version 2.0

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Contents

SOLAR DECATHLON

The Solar Decathlon is an international competition created by the U.S. Department of Energy in which universities from all over the world meet to design, build and operate a grid-connected, energetically self-sufficient house.

The houses use solar energy as the only energy source and are equipped with all the technologies that permit maximum energy efficiency. During the final phase of the competition teams assemble their houses, open to the general public, while undergoing the ten contests of the competition, reason for which this event is called Decathlon.

SOLAR DECATHLON MIDDLE EAST

The Solar Decathlon Middle East (SDME) was created through an agreement signed between Dubai Water and Electricity Authority (DEWA) and the Department of Energy of the United States of America, in June 2015, in order to organize a sustainable solar houses competition in Dubai, in 2018 and 2020.

The 2018 edition of this competition is organized by DEWA, in Dubai. The SDME ten contests will follow the lines of those in previous editions of the competition, although having the necessary customization to challenge the teams to adapt their designs to the heat, dust & high humidity that we experience in the Middle East.

The SDME 2018 Organization goal is to contribute to the knowledge and dissemination of industrialized, solar and sustainable housing, and therefore has the followings basic objectives:

- To raise awareness of the students participating in the competition on the benefits and opportunities offered by the use of renewable energy technologies, energy management and sustainable construction, challenging them to think creatively and develop innovative solutions that contribute to energy savings.
- To encourage professionals from different industries to select materials and systems that reduce the environmental impact of their buildings, optimizing its economic viability and providing comfort and safety of occupants.
- To educate the general public about responsible energy use, renewable energy, energy efficiency, and the technologies available to help them to reduce/optimize their energy consumption.
- To encourage the use of solar technologies.
- To promote architecturally attractive solar system integration, working on using the solar technologies to replace conventional construction materials in the building envelope such as the roof, skylights or facades.
- To clearly demonstrate that high performance solar homes can be comfortable, attractive and affordable.
- To increase public awareness about energy for residential use. The competition demonstrates that a beautifully and well-designed house can generate enough electricity to meet the needs of a household.

The Solar Decathlon Middle East will raise the prestige and visibility of the selected participating universities as they are part of the small group of top institutions that will compete in the world's most important Solar House Event. One of the main characteristic elements of the Solar Decathlon Middle East competition is its emphasis on sustainability, innovation and research. The participant teams work not only to develop and build their houses, but also to enhance the systems' integration and generation of knowledge on sustainable construction.

Solar Decathlon Middle East offers students a unique opportunity for learning, taking theory and putting it into practice, and doing so through a case study. Students working on the project will be challenged to use their innovation capacity, and their ability to design and build an energetically self-sufficient solar house. The projects are developed by multidisciplinary teams, giving the students the opportunity to learn not only about technical issues but also about teamwork, communication skills, a sustainable lifestyle and socio-economic issues in order to ensure the viability of their project.

These Rules have been developed and adapted from the U.S. Department of Energy Solar Decathlon Rules and the Solar Decathlon Europe Rules to meet the unique objectives and principles of the Solar Decathlon Middle East Organization. With this new edition to be held in 2018 in Dubai, these Rules have been developed to refine the requirements to be met by competing projects. The Rules are intended to encourage competition prototype houses that meet a triple challenge: energy, environment, and society. Therefore, the evaluation of proposed projects, via the 10 contests of the Decathlon, are intended to address different issues related to houses of the future. The Solar Decathlon Middle East 2018 Rules will focus on encouraging designs that address the following four principles:

Middle East Climate

The SDME 2018 embraces the goal of developing and promoting ideas, capacities and technologies that can be implemented for the benefit of the inhabitants of the Middle East region. Each project must be a good response to our cultural, climatic and social contexts, as well as a high-performance prototype that should successfully perform during the period of time during which it compares with others. All proposals should be focused on solving the issues and needs for the sustainable living in this region, where high temperatures, high humidity and dust condition our daily lives during most part of the year.

Innovation

For the Solar Decathlon, innovation must remain at the heart of the projects. It is embedded in all project areas such as architecture, construction, energy systems, furnishings, house appliances and etc. Innovative cultural relationship to research and development in the field of building industry: future urban designers, architects, engineers as well as social and financial managers are required to find the most adapted solutions for our specific context while sharing the most innovative ideas with colleagues from other countries.

Sobriety

While it is important for the designs to ensure the renewable energy supply, it is even more important to limit demand and thus energy consumption. This is to be implemented through a limitation of photovoltaic power installed, an important evaluation of energy efficiency and a strong incentive to «produce and consume wisely». Nevertheless, teams should also keep in mind that affordability remains another key issue for applicable sustainable architectural and urban solutions. The SDME Organization wants to point at the fact that, in the midst of a major economic crisis, the financial factor will be assessed as a determining aspect of each proposal.

Mobility

The question of energy coupling between positive-energy building and electrical transportation systems is to be addressed by the teams. SDME is not an international competition for electric vehicles but a testing ground for innovative solutions merging urban design, housing and transportation systems in a holistic approach.

The official language for the SDME 2018 Competition in Dubai is English.

SDME 2018 Rules

The Solar Decathlon Middle East Rules are designed to meet the Organization objectives and to promote a fair and challenging competition among teams.

The present document "SDME2018 Rules" describes what each team needs to know to be competitive in the Solar Decathlon Middle East.

It includes five sections:

SECTION 1.0 General Rules

Includes rules related with the general aspects of the Competition, describing the organization, the participating teams, the site, the houses, the Event final phase, and the general conditions.

SECTION 2.0 Contests

In this section the SDME2018 contests and sub contests are defined, including the scoring distribution, the contests evaluation criteria and the different procedures.

SECTION 3.0 Competition Deliverables

Includes detailed information concerning all the documents, drawings and other materials that the teams must submit to the Organization along with the submission dates and format requirements.

SECTION 4.0 SDME Building Code

This Code primarily exists to protect the teams and public health and ensure safety. Compliance with the SDME Building Code is a prerequisite for participation in the competition.

SECTION 5.0 Appendixes

It contains rules' complementary information.

Note that the information included in the present document may change*; details or complementary information will be added in the future. However, all the modifications will be clearly indicated in the SDME Rules new editions.*

Definitions

GENERAL DEFINITIONS

Assembly: The period of time between the arrival of trucks and the beginning of the contests on the Solar Hai.

Communication materials: All printed or electronic publications designed to convey information to the public supporting the Competition goals.

Competition: All aspects of the Solar Decathlon Middle East 2018 in Dubai related to the 10 contests and the scoring of those contests, along with the project development of the competition houses.

Competition Calendar: The timetable establishing the dates of the final phase of the competition and the daily activities assigned.

Competition House: The complete assembly of physical components installed on the Solar Hai, in compliance with the SDME rules.

Contest: The Solar Decathlon Middle East competition consists of 10 separately scored contests, each containing one or more sub-contests See SECTION 2.0

Contest week: The period of days on the Solar Hai when some or all contests are active.

Decision: The Rules Officials' interpretation or clarification of a rule.

Deliverables: Documentation and other materials requested by the SDME 2018 Organization to the teams along the project development, in order to verify compliance with the Competition Rules.

Disassembly: The period of time between the conclusion of public tours and the completion of the Solar Hai cleanup.

Electric and Photovoltaic Chart – Interconnection Application: A form submitted by the team's electrical engineer to the Site Operations Manager, which provides the technical details needed to determine the suitability of the team's electrical and photovoltaic systems for interconnection to the village grid.

Event: All the activities that take place on the Solar Hai including, but are not limited to, registration, assembly, inspections, contests, special events, public exhibits, and disassembly.

Event Sponsor: An entity selected by the SDME 2018 Organization to support the project and help ensuring its success.

Final phase of the SDME 2018 Competition: The period of days including assembly, disassembly and contest week periods.

Grid-Tie Assembly: The period of time during assembly after the house has been connected to the village grid (interconnected)

Inspection: Each of the inspections realized to all the Competition Houses on the Solar Hai for verifying compliance with the SDME Rules

Inspections Card: Official card indicating the teams' inspections' status.

Jury: The group of individuals selected by the organizers to make evaluations on a specific aspect of each team's project according to a contest.

Project: All activities related to the Solar Decathlon Middle East 2018 in Dubai from the initial meetings through to the conclusion of the event.

Protest Resolution Committee: The group of individuals selected by the organizers to resolve team protests during the competition. The Protest Resolution Committee consists of people who are familiar with the project, but not part of the organization or the teams.

Public exhibit: Areas of the competition site open to the public during designated hours.

Rule: A principle or regulation governing conduct, action, procedure, arrangement, etc., for the duration of the project.

Scored period: Any period of time during which a particular measured contest is in progress.

Scoring Server: Digital application that collects data from the central data logger server, includes forms for manually entering jury and task-based sub contest results, and calculates composite scores.

SDME portal: Solar Decathlon Middle East portal for Teams is the official communication tool of the competition.

Solar Decathlon Middle East Building Code: A set of design and construction standards set forth and enforced by the Solar Decathlon Middle East Building Official for the protection of public health and safety during the event.

Solar Hai: Competition Site, where the teams' houses are assembled along with the common areas needed for the Competition development. Hai, حَي in Arabic, refers to a district or a community in a city. It represents the sense of community that this competition brings and encourages amongst all participants.

Stand-Alone Assembly: The period of time during assembly before the house has been interconnected to the village grid.

Sub contest: An individually scored element within a contest.

(Juried) Sub Contest: A sub contest based on Jurors assessment.

(Measured) Sub Contest: A sub contest based on task completion or measured performance.

Village Grid: Bi-directional, AC electrical network system installed on the competition site which will measure constantly and individually the contribution and consumption in electrical energy of each house.

SDME ORGANIZATION FUNCTIONS

Communication: The project´s public outreach, communication activities and special events. Communications Area.

Competition Management: Enforcing the Rules and stating its content, conducting a fair and compelling competition, assigning penalties and scorings.

Competition Strategies Management: Planning, coordinating and controlling all the activities related to the Competition.

Competition Strategies Coordination: Writing the Rules, organizing and supervising the deliverables' reviews, and planning, coordinating and controlling the activities and functions of the Juries and Observers.

Event Organization: Dubai Water and Electricity Authority is responsible for the organization of the SDME 2018 Competition in Dubai, with the collaboration of the American Solar Decathlon Organization, the Department of Energy (DOE) of the United States of America.

HS Coordination: Evaluating the teams' Health and safety plans and consequently developing the Competition's Health & Safety Plan and supervising the houses' assembly and disassembly works at the Solar Hai.

Infrastructures Management: Planning, execution, development and control of all the activities related to the assembly, functioning and disassembly of the Solar Hai.

Inspection: Carrying-out the house's inspection and filling out the corresponding Inspection Card, according to the SDME Building Code.

Monitoring & Instrumentation Coordinator: The organizer responsible for the instrumentation system and the scoring server of the Competition. Competition Area.

Jury Coordinator: An organizer, liaison between the Solar Decathlon Middle East 2018 Organization in Dubai and the jury, responsible for accompanying the jury during the houses' visits, the deliberation process and the evaluation reporting. Competition Area.

Observer: An organizer assigned by the Competition Manager to observe team activities during contest week. An observer reports observed rules infractions to the Rules Officials and records the results of specific contest tasks, but does not provide interpretations of the Solar Decathlon Middle East Rules. Competition Area.

Office Services Manager: The organizer responsible for planning, coordinating, and directing a broad range of services that allows the SDME 2018 Organization to operate efficiently. Office Services Area.

Organizer: A Solar Decathlon Middle East employee, subcontractor, or observer working on the project.

Press & External Communications Coordinator: The organizer responsible for communication issues between the internal and external parties of the Solar Decathlon Middle East, acting as proxy between the participant Teams and the media.

Project Manager: The organizer responsible for the management of the project and responsible for mobilizing all of the necessary resources for the achievement of the objectives, with the final decision-making authority in all the aspects related to the scope, planning, costs, quality, resources, communication, risks, sponsorship, and acquisitions of the project.

Public Events Coordinator: The organizer responsible for planning, coordinating, executing and developing all the public activities and events related to the Competition and for the public outreach of the project. Communications Area.

Rules Official: An organizer authorized to interpret the rules. The Competition Manager is the lead Rules Official. Competition Area.

Scorekeeper: The individual selected by the organizers to operate and maintain the scoring server during the competition. Competition Area.

Site Operations Coordinator: The organizer responsible for the evaluation of the teams' Site Operations plans, consequently developing the Competition site operation plan and the coordination and supervision of the houses' assembly and disassembly works at the Solar Hai. Infrastructures Area.

Social Media & Marketing Coordinator: The organizer responsible for managing the social media platforms and producing the official SDME multimedia files (videos, photos, presentations and etc.). Also responsible for administrating the SDME Website and working toward the identification of the brand SDME as a recognizable name and logo. Communications Area.

Sponsorships and Exterior Relations Coordinator: The organizer responsible for developing and implementing a long-range corporate giving strategy, to identify, cultivate, solicit and steward relationships with business supporters, fostering a strong worldwide awareness and support. Communications Area.

Staff: Individuals working for the organizers on the project.

Universities Relations Coordinator: The organizer responsible for the communication with the participant teams, helping them come across the project development. Competition Area.

Team Members

Communications Coordinator: A team member responsible for the team's communications with the media and for developing all the communications materials. Works in conjunction with the SDME's Communication Organizers to coordinate the team's interactions with the media.

Construction Manager: A team member responsible for the planning and execution of the construction, transport, assembly, and disassembly of the house.

Contest Captain: A team member responsible for the team's primary strategies and coordination of Tasks Contests; is also responsible for demonstrating the compliance of appliances with the Rules.

Decathlete: A team member who is an enrolled student – undergraduate or post graduate studies, at a participating school or has graduated from a participating school within 12 months of the beginning of assembly.

Electrical Engineer: A team member responsible for completing the Electric and Photovoltaic chart and working in conjunction with the SDME 2018 Organization electrical engineer to interconnect the house to the grid on the Solar Hai. Must be a licensed professional, which approves and signs the house's electrical systems (drawings and specifications).

Faculty Advisor: A team member who is the lead faculty member and primary representative of a participating school in the project; also provides guidance to the team on an as-needed basis throughout the project. Responsible for signing the official document certifying the compliance of the codes of the country of origin.

HS Team Coordinator: A team officer who is responsible for developing and enforcing the team´s Health & Safety Plan during the competition phases, assembly and disassembly of the houses.

Instrumentation Contact: A team member collaborating with the organizers' instrumentation team to develop a plan to accommodate the equipment used to measure the performance of the home during the competition.

Project Architect: A team member responsible for the architectural design effort; license not required.

Project Engineer: A team member responsible for the engineering design effort; license not required.

Project Manager: A team member responsible for the planning and execution of the project.

Safety Officer: A team member responsible for the safety measures observance during the event.

Site Operations Coordinator: A team member responsible for developing and enforcing the teams' Site Operations Plan during the competition phases, assembly and disassembly of the houses.

Student Team Leader: A student team member responsible for the coordination among the team. Ensures that official communication from the organizers are routed to the appropriate team member(s).

Structural Engineer: A team member responsible for approving the house's structural systems; license required.

Team Crew: A person who is integrally involved with a team's project, but is unaffiliated with the participating schools; contractors, volunteers, and sponsors are examples of team crew.

Team Member: An enrolled student, recent graduate, faculty member, or other person who is affiliated with one of the participating schools and is integrally involved with a team's project activities; Decathletes, Faculty Advisors, and involved staff from a participating school are all considered team members.

1. GENERAL RULES

Rule1: SDME ORGANIZATION

1-1 Organization Chart

For the SDME 2018, the following governance structure will be used for taking decisions and solving problems:

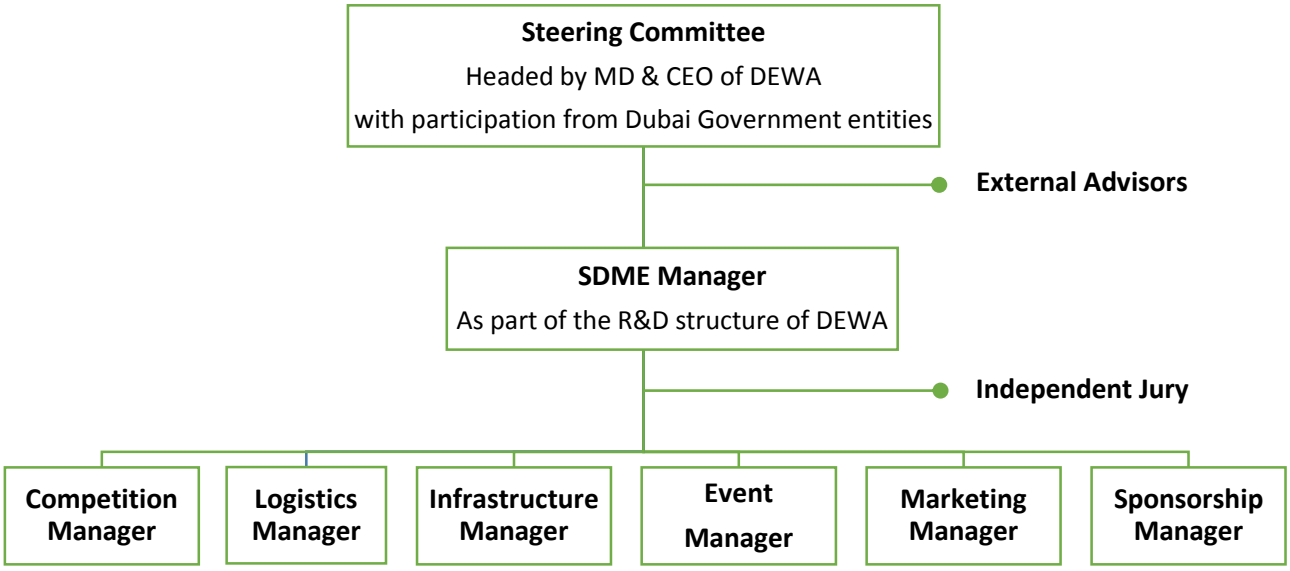


Figure 1: SDME Organization Chart

Rule 2: ADMINISTRATION

2-1 Precedence

If there is a conflict between two or more rules, the rule having the later date takes precedence.

2-2 Violations of Intent

A violation of the intent of a rule is considered a violation of the rule itself.

2-3 Effective Date

The latest version of the rules posted on the SDME portal/website for Teams and dated for the year of the event are the rules in effect.

2-4 Official Communication

It is the team's responsibility to stay continuously updated with all the official project communications. Official communication between the teams and the organizers will occur preferably through one or more of the following:

a) SDME website (www.solardecathlonme.com): is the main communication tool for the competition teams. The registered teams will be able to communicate effectively with the organizers.
b) Email: For expediency and to protect confidentiality, the organizers may choose to communicate with teams via team members' email addresses and the SDME Email (2018Solardecathlonme@dewa.gov.ae). The content of the communications sent to this email address will remain confidential, unless the team grants permission to the SDME 2018 Organization to divulge the content of these communications to the other teams. However, most official communication will occur via the SDME website.
c) Conference calls/workshops: SDME 2018 Organization may invite the Teams to participate in a conference call or a workshop. Invitations and instructions for participation will be provided via the SDME website and email.
d) Meetings: Before the event, the teams and organizers have an in-person meeting. Notification of the date and agenda of this meeting will be made via the SDME website and email. During the event, a meeting will be held the day before assembly begins. Meetings will be held on a daily basis throughout the event.
e) Postings at headquarters: During the event, a bulletin board (or other venue for posting information) may be established at event headquarters. Teams will be notified via the SDME website and email if such a venue is established and the purpose for which it has been established.

2-5 SDME Website and portal for Teams

The Solar Decathlon Middle East Website with its separate portal for Teams will contain all the necessary information and tools for communication between the teams and the organization. The portal is accessible only for the participating teams. All the Team Members must be registered. The primary usage of SDME portal will be:

- receive all official communications
- calendar updates
- request and receive information or clarifications
- submit questions
- upload and download files

It can be reached through the Solar Decathlon Middle East Website: www.solardecathlonme.com

2-6 Decisions on the Rules

The decisions on the Solar Decathlon Middle East Rules are interpretations of the rules contained in this document, the Solar Decathlon Middle East 2018 Rules. When the Rules Officials make a decision that may, in their opinion, directly or indirectly affect the strategies of all teams, the Rules Officials will add the decision to the Solar Decathlon Middle East Rules and notify the teams of the addition via the SDME Website.

Exception: if such a notification would unfairly reveal the strategies of one or more teams, the organizers may, depending on the circumstances, refrain from notifying the decision to all teams.

2-7 Self-Reporting

Teams shall self-report definite or possible rules infractions that have occurred or may occur.

a) The rules do not address every possible scenario that may arise during the competition. Therefore, a team considering an action that is not explicitly permitted by the rules should ask a Rules Official for an official decision before proceeding with the action. If the team does not ask for an official decision, it puts itself at risk of incurring a penalty.
b) The Rules Official and Director will act with discretion when determining the penalty for a rules infraction. Rules infractions observed by Rules Officials and organizers, i.e., not self-reported by the team, may be subject to more severe penalties than self-reported rules infractions.

2-8 Penalties

Teams committing rules infractions are subject to one or more of the following penalties, depending on the severity of the infraction:

a) Point penalty applied to one or more contests;
b) Disqualification from part of, or all of, one or more sub-contests;
c) Disqualification from the competition;
d) Disqualification from the competition requires prior notice to the team and an opportunity for the team to make a written statement on its own behalf.

Penalties will also be applied to Teams not fulfilling with all the Deliverables' requirements:

- For late submission1 : From 15 min after the deadline till 48 hours after - Up to 0.5 points From 48 hours after the deadline till 1 week later - Up to 2.0 points
- For contents missing1 : More than 5 % of the content required missing - Up to 2.0 points

Note: In case any participant Team delivers more than 1 week after the deadline or/and with more than 25% of the content required missing, the SDME 2018 Organization reserves the right to decide and apply a larger penalty, considering the special conditions of each particular case.

During assembly period, penalties will be applied to Teams not respecting:

- Security on construction site
- Respect of assembly and disassembly plan
- Construction site cleaning
- Waste management

An independent Penalty Referee, which nationality is different from those of the competing teams, will be appointed by the Organization to propose to the Competition Manager all penalties according to respect of the Rules.

This Referee shall determine the severity of rules infractions and classify them as minor or major and report them to the Competition Manager. The Competition Manager is solely authorized to apply point penalties or disqualify a team from the competition or from part of, or all of, one or more sub-contests for rules infractions. The Competition Manager shall notify all teams via the SDME official email address when a penalty has been assessed against any team. The notification shall include the identity of the team committing the infraction, a brief description of the infraction, including its severity, and the nature of the penalty, giving the teams the opportunity to protest.

Note: Teams will be assigned penalties for not realizing the daily tasks during the Contest Week, unless there is a clear explanation for not complying with the requirements.

2-9 Protests

Official written protests may be filed by teams for any reason. A filing fee of up to 10 points may be assessed to the team fi ling the protest if the protest is deemed by the protest resolution committee to be frivolous.

a) Teams are encouraged to communicate with the Rules Officials in an attempt to resolve issues and complaints before resorting to the protest process. Protests should be fi led only if the team and the Rules Officials are not able to resolve the dispute themselves; or if the team or the Rules Officials are too busy to engage in discussions that may result in resolution of the dispute without a protest.
b) Protests must be submitted between 9 a.m. and 7 p.m., and within 24 hours of the action being protested. The final opportunity to file a protest is 5 minutes following the conclusion of the final sub contest on the final day of contest week.

Exception: The results of one or more sub-contests may be announced during the final awards ceremony. The results of sub contests announced during the final awards ceremony may not be protested.

c) The protest shall be submitted to the Competition Manager Penalties Referee in a sealed envelope. It shall include the name and signature of a Faculty Advisor, the current date and time, an acknowledgement that a 10-point fi ling fee will be assessed, a clear description of the action being protested, and a succinct description of the protest.
d) The protest resolution procedure follows:
    I. The Competition Manager convenes the Protest Resolution Committee.
    II. The Competition Manager Penalties Referee submits the sealed envelope containing the team's written protest to the Protest Resolution Committee. Unless the competition manager is called by the committee to testify, he is not permitted to read the protest until after the protest resolution committee has submitted its written decision.
    III. The Protest Resolution Committee opens the envelope and reads the protest in private. No appearance by organizers or team members is authorized during the Committee's private deliberations. No right to counsel by organizers or team members is authorized.
    IV. The Protest Resolution Committee notifies the Competition Manager if it would like to call any individuals for testimony. The Competition Manager notifies individuals called for testimony. The committee may call the Competition Manager for testimony.
    V. Testimony is provided by individuals called by the committee.
    VI. The Protest Resolution Committee notifies the Competition Manager of its decision, and indicates how many points shall be assessed as a filing fee. The decision of the Protest Resolution Committee is final, and no further appeals are allowed.
    VII. If the decision involves changes to a team's score or a refund of some, or all, of the fi ling fee, the Competition Manager notifies the Scorekeeper of the changes, and the Scorekeeper applies the changes to the scoring server.
    VIII. The Competition Manager posts a copy of the written protest and decision on the SDME portal and/or email notification.

Rule 3: PARTICIPATION

3-1 Entry

The project is open to Colleges, Universities, and other post-secondary educational institutions. Only Institutions from countries that have commercial relationships with the UAE will be able to enter the competition or be part of the teams. Entry is determined through a proposal process. All proposals are reviewed, scored, and ranked. Based on the quantity and quality of proposals, a limited number of twenty teams will be selected for entry in competition.

Universities that have taken part in previous editions of the Solar Decathlon in United States, Europe, China or South America are welcomed to submit their proposal to participate in the Solar Decathlon Middle East 2018. However, as houses and projects of the previous editions of the Solar Decathlon will not be able to participate, teams will have to submit a new design proposal.

3-2 Team Officers and Contact Information

Each team must provide contact information for the Team Officers listed in the table 1 and must keep the contact information current through the duration of the project.

a) If a team's internal officer titles do not exactly match those listed in the table 1, each team shall still provide the contact information for the person fulfilling each of the areas of responsibility described (See Definitions – Team Members)
b) Teams must provide the contact information for one and only one person in each officer position; this individual is responsible for forwarding information to any "co-officers," as necessary.
c) An individual may have multiple officer titles.
d) The requested information must be included in the Press Release.

The Solar Decathlon Middle East 2018 in Dubai is intended to be a primarily student-run project. The only team officer who must be a faculty member is the Faculty Advisor. The structural and electrical engineers may be a post-graduate student, faculty member or working professional. It is highly recommended to fill all other team officer positions with students

Table 1: Team Officers and Contact

Team Officers Title	Name	Contact
Faculty Advisor		
Project Manager		
Construction Manager		
Project Architect		
Project Engineer		
Structural Engineer		
Electrical Engineer		
Student Team Leader		
Health & Safety Team Coordinator		
Safety Officers		
Site Operations Coordinator		
Contest Captain		
Instrumentation contact		
Communications Coordinator		
Sponsorship manager		

3-3 Safety

Each team is responsible for the safety of its operations.
a. Each team member and team crew member shall work in a safe manner at all times during the project in accordance with the requirements identified in the rules and approved team Health and Safety Plan.
b. Each team shall supply all necessary personal protective equipment (PPE) and safety equipment for all of the team's workers during the project.
c. During assembly and disassembly, a minimum level of PPE—hard hat (ANSI Z89.1 or equivalent, Type I, Class G or better), safety glasses with side shields (ANSI Z87.1 or equivalent), shirt with sleeves at least 3 in. (7.6 cm) long, long pants (the bottoms of the pant legs shall, at a minimum, touch the top of the boots when standing), and safety boots (ANSI Z41 PT99 or equivalent) with ankle support—shall be used by each team member and team crew member. Additional PPE or safety equipment shall be used if required for the task being performed.
d. Individuals under the age of 18 are not permitted to be on the competition site during assembly and disassembly.
e. Smoking is not permitted within the competition site at any time during assembly or disassembly.
f. Pets and other animals are not permitted on the competition site during assembly or disassembly with the exception of registered service animals.
g. Organizers may issue a stop work order at any time during the project if a hazardous condition is identified.
h. Failure to follow the procedures and requirements outlined in each team's Health and Safety Plan is considered a rule violation subject to Rule 2-8, and violations are subject to penalty points. All electrical work on the competition site shall meet electrical lockout/tagout requirements indicated in each team's approved Health and Safety Plan.

3-4 Conduct

Improper conduct will be not tolerated. Improper conduct may include, but is not limited to, improper language, unsportsmanlike conduct, unsafe behavior, distribution of inappropriate media, plagiarism or cheating.

3-5 Use of Likeness, Content, and Images

Team members and team crew agree to the use of their names, likenesses, documents, audiovisuals and/ or graphics, in any communication materials issued by the SDME2018 organizers, partners, event supporting institutions and event sponsors.

a) For the Competition dissemination, SDME2018 Organizers, event supporting institutions and event sponsors, may use the teams' information (content and images).
b) 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.

All materials provided by Teams to the SDME2018 Organization including, but not exclusively, the mandatory deliverables, must belong to the participant Teams, or the Team must have been authorized by owners of material subject to intellectual property regulations, such as background music or third party images. Therefore, the Teams must submit the SDME 2018 Dissemination Authorization conveniently signed by the Faculty Advisor, with each audiovisual file.

Exception: If a team submits content or images that it would like to be kept confidential, it should make that request, with an explanation, in writing to the recipient of the content or images. Every effort will be made to honor requests for confidentiality. All confidentiality requests expire at the date of the end of the SDME2018 competition.

3-6 Withdrawals

If a participant team, during the project development, ever thinks of withdrawing from the Competition due to any reason, they must communicate it to the SDME 2018 Organization before taking its final decision.

The SDME 2018 Organization will try to help the Team come across any problem. However, if the Team continues with the idea of withdrawing from the Competition, they must notify their decision to the SDME Project Manager with a letter signed by the Faculty Advisor. All written withdrawals complying with the previous items are final.

Rule 4: SOLAR HAI

4-1 Solar Hai Specifications

The Solar Hai specifications will be communicated through the SDME Website, including a detailed plan drawing indicating its limits, accesses, lots, and circulation areas.

The perimeter of the Solar Hai will be limited by setting out accesses, the allotted lots, established limits and internal paths. The SDME 2018 Organization will provide general lighting of the Solar Hai, as well as the supply of water, workspaces for each team with Wi-Fi connection, access to private cafeterias and public toilets.

4-2 Civil Liability

Each team is financially responsible for any damage it causes in and to the competition site. Therefore, teams must contract Compulsory Insurance for the Solar Hai.

4-3 Lot Conditions and attribution

The lots size is 20.0 m by 20.0 m. A stock area of 20.0 m by 10.0 m is available near to each lot during assembly/disassembly phases. Once realized the SDME Lot attribution by drawing lots process, the SDME 2018 Organization will notify the teams the specific conditions for each lot. Teams must design and plan all their site operations accordingly. For exceptional reasons beyond the SDME 2018 Organization, the lots size may vary.

In the Solar Hai, lots' perimeters will be clearly defined and signposted. Teams may not go beyond these limits under any circumstances. Lots must be cleaned and reestablished to its original conditions once the assembly and disassembly process is over.

As storage, unloading, assembly and disassembly will take place inside the lot's limit during the established period of time; each team will use part of their lot for storage and unloading during the Assembly and Disassembly Phase. This storage area will have to be freed during competition. The Organization will provide all teams with a secondary storage area for materials and equipment not in use during competition.

4-4 Footings

a) Low-impact footings shall be used to support all house and site components located on the competition site. As vertical elevation change may exist across the lot design and plan adjustable footings accordingly.
b) Footings shall be designed as to comply with the soil bearing pressure criteria specified in the Solar Decathlon Middle East Building Code.
c) Once the foundation has been laid out during the assembly, teams shall notify it to the appropriate Inspector in order to verify compliance. The assembly may not continue until this inspection has been passed.

4-5 Respect of assembly plan

Construction phase will be integrated in the competition. Indeed, respect of assembly plan submitted by each team can add bonus points according to the Table 2. The SDME 2018 Organization has the authority to determine the bonus points to apply at the end of the competition.

Table 2: Maximum Bonus for respect of assembly and safety plan

Respect of safety plan on construction site	**10**
Respect of planned deadline for wind-and-water tight	**5**
Respect of planned deadline for electrical connection to village grid	**5**
Respect of planned deadline for house delivery	**5**

4-6 Assembly period video recording

In aims of security, audiovisual-support for competition and communication, cameras will be installed by the Organization in order to record entire assembly period.

Images remain property of the Organization who can use them to verify safety conditions and communication purpose.

4-7 Construction Equipment

Cranes - The crane necessary for loading and unloading in the assembly and disassembly phases will be provided by the organization. The participant teams will only have to pay the crane's use hours' cost in accordance with the costs indicated by the SDME 2018 Organization. The organization will administer the use of the crane to guarantee its maximum efficiency, attending to the needs of each team.

To facilitate the loading and unloading, the elements of the house and the materials must be as "palletable" as possible. As far as possible, the crane's or alternative means' use will be administered with assigned turns. The exclusive use of these may be possible in two specific cases:

1. With the university's express request, under the Organization approval
2. For cranes' use incompatibility.

The exclusive use of the elevating machinery depends on the economic teams' resources and planning. Other machinery - a specialized company chosen by the Organization provides auxiliary resources for the elevation and movement of the houses and their constitutive elements (forklift, cherry-picker, scaffolding…). Teams will be offered special rent conditions for material available in a catalog.

Access and circulation of heavy vehicles – Truck-mounted cranes, trailers, semi-trailer trucks, etc. will arrive and will be parked in a Meeting Point near the Solar Hai. From there, they will be called in, one after the other, to guarantee the orderly entry into the Solar Hai, always through established paths and following the organization's schedule.

Circulation of these vehicles will be generally limited to designed circulation paths. However, under special circumstances approved by the Site Operations Coordinator, trailers and semi-trailers may be driven on the Competition Site.

The organization, in accordance with the Site Operations Plan of the Solar Hai, will determine a strict entry order of the teams' trucks to access the Solar Hai and proceed to the unload. This order will be done considering the trucks' order established in each particular Site Operations Plan. The above mentioned entry of heavy vehicles will be realized only and exclusively in the specific periods established in the Competition Calendar.

Only light vehicles will access the Solar Hai after this deadline, being continuously communicated and coordinated with the organization.

Teams will have to respect internal circulations which will be laid out for vehicles. Only one vehicle/transport per team will be permitted at a time in the Solar Hai. The rest of the vehicles/transports will have to wait for the previous one to leave the Solar Hai. This process will be coordinated between the persons in charge of the Site Operations Plan of the Village and those in charge of each team.

4-8 Generators

a) Generators are not permitted to power auxiliary equipment and construction lights necessary during assembly and disassembly.
b) Electrical power will be available on each team's lot in a specific Construction Site Box. Provided power will be limited and monitored.

4-9 Lighting at Competition Site

General lighting of lots will be provided by Organization during stand-alone phase and grid tied phase. Stand-alone house lighting devices remain in charge of each team during assembly phase.

4-10 Spill and Waste Products

During assembly and disassembly, teams must take their waste products to the disposal areas available in the Solar Hai according to separated wastes collection rules and construction site cleaning.

Depending on the degree of the fault, the SDME 2018 Organization may apply point or time penalties (stopping the works), or both. The penalty will be applied according to the Table 3.

Table 3: Maximum Penalties for waste management and construction site cleaning

Qualification of fault	Points penalty up to
Not cleaning construction area	5
Not respecting stock and work areas	5
Incorrect waste throw in waste disposal	5

The total score of bonus and penalties points (about security, planning respect, waste management and construction site cleaning) will be announce day by day for each team.

The release of water or other liquids in the Solar Hai must be realized according to the SDME 2018 Organization.

4-11 Working System

Each team will have to name a Construction Manager responsible for coordinating all its team's site operations. For the assembly and disassembly phases there is a specific period established in the Competition Calendar. During these two phases, teams may work 24 hours per day, always complying with the working shifts established by the Health and Safety responsible.

In compliance with the UAE Labour Law, the maximum number of ordinary working hours for adult workers shall be eight hours per day. The daily working hours shall be regulated so that the worker does not work more than five consecutive hours without intervals for rest, meals and prayer, whose total period shall not be less than one hour. Such intervals shall not be included in the working hours.
The working shift regulation must be considered to decide the number of team members. HS Officer or the HS Team Coordinator must be in the lot while any activity is being carried out inside.
During the construction works, the SDME HS Area may demand Teams the daily list of Team members for every shift, as well as the schedule for each one.

4-12 Transportation to site

Every team is responsible for the transportation to Dubai. Teams will have to consider the dimensional aspects, suggesting that the maximum load to be “palletable”.

The SDME 2018 Organization suggests the participant teams to contact transport companies during the development phase of the project to guarantee that the freight transport rules will be complied with UAE.

4-13 Electric Vehicles

Teams are expected to provide an electric vehicle within their solar envelopes during contest week.
a. The vehicle must be electric. Hybrid vehicles and non-electric vehicles are not permitted.
b. Movement of the vehicle on and off the competition site is prohibited one half hour prior to, one half hour after, and throughout all public exhibit periods.
c. The competition prototype house must include the infrastructure required to charge the vehicle.
d. Any vehicle used must be commercially available to all teams at the beginning of contest week.
f. The vehicle must have four wheels and, at a minimum, seat two individuals side by side.
g. The vehicle must be licensed, registered, and insured as required for operation on Dubai roadways.

Rule 5: THE SOLAR ENVELOPE

5-1 Solar Envelope Dimensions

To protect a neighbor's right to the sun, the house and all site components on a team's lot must stay within the solar envelope shown in Figure 2. The stock area available during assembly and disassembly phases is also noticed in Figure 2.

a) The official height of a site component or set of contiguous site components is the vertical distance from the point of highest grade along the outside perimeter of the site component(s) to the highest point of the site component(s).
b) Small weather stations, antennas, air vents, and other similar components may be specifically exempted from the compliance of solar envelope if all of the following conditions are met:
    I. The team makes a request to the SDME 2018 Organization for an exemption.
    II. The team can prove to the SDME 2018 Organization's satisfaction that the component is not significantly restricting a neighbor's right to the sun.
    III. The SDME 2018 Organization determines that the component is sufficiently unique in function and small in size to warrant an exemption.
c) Moveable or convertible house or site components shall not extend beyond the solar envelope.

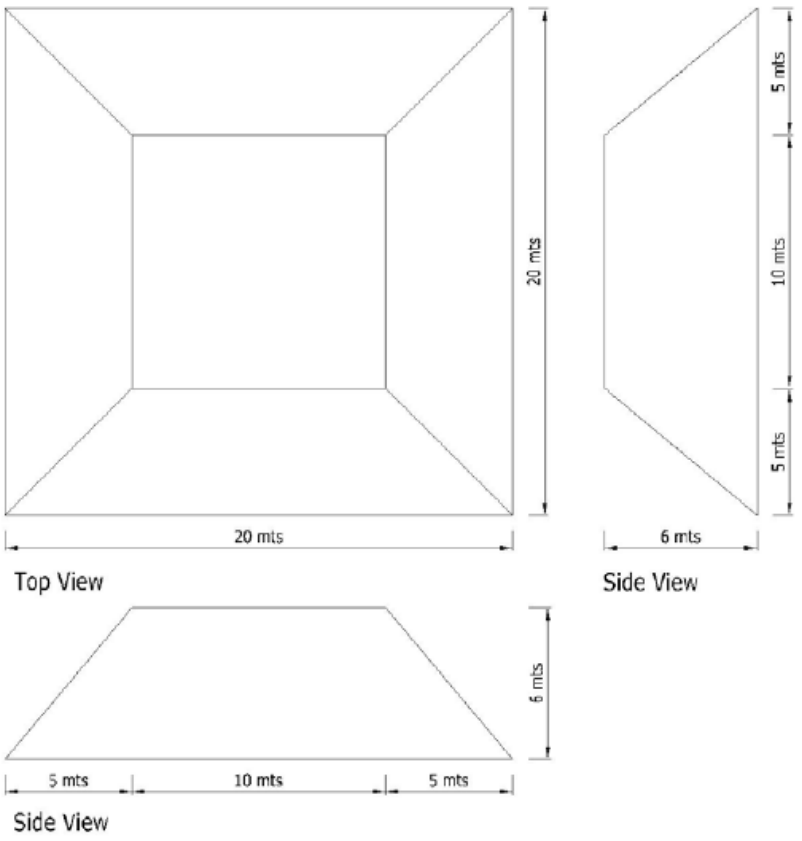


Figure 2: Solar Envelope Dimensions

Rule 6: THE PROJECT

6-1 Design Approval

Structural Design Approval - Each team needs to prepare full design calculation and drawings according to latest ACI (American Concrete Institute) for concrete structures, LRFD method for Steel structures or submit calculations according to corresponding structural materials used.

a) Computer simulations are favored and a report must be print out, signed and stamped by leading faculty advisor and the contestants bear the responsibility of structural integrity.

b) Structural drawings must be in CAD or Revit formats. All other formats will not be accepted.

Electrical and Photovoltaic Design Approval - Each team needs to submit electrical drawings and calculations for conventional and photovoltaic installations in CAD formats, according to DEWAs Shams Dubai standards available at: https://www.dewa.gov.ae/smartinitiatives/firstinitiative/publications/default.aspx

Codes Design Compliance - Codes used for calculations must be as mentioned above.

6-2 Finished Square Footage

Maximum Architectural Footprint

The total Architectural footprint as defined below cannot exceed 150.0 m^2

a) The footprint includes the house and all site components within the site boundary

b) Any infrastructure provided is not included within the footprint.

c) Any openings (Open-grid pavement, vegetation, etc.) within the footprint will count in the total architectural footprint.

d) Any other apparatus used for testing or showcasing will not count within the footprint or as per jury decision.

e) Teams planning to use particular components must submit their proposal request in advance to SDME 2018 for evaluation if will add value to competition.

Minimum & Maximum Measurable Area

The measurable area defined below shall be at least 45.00m2, but shall not exceed 90m2 for single floor housing unit and 110.00 m2 for multi-story housing units.

a) The covered and constructed surface remaining when walls, columns, stair shaft, under 1.80m high spaces and closets or any other storage or technical built from floor to ceiling, are excluded.
b) The interior surfaces of walls defining the building's thermal envelope from measurable area perimeter.
c) All primary living areas must be located within the measurable area (i.e. dining area, kitchen, etc.)
d) If the building has movable areas then it must be shown in printed media and in CAD drawings showing its contribution to the measurable area. Movable areas must be opened during jury tours

Multi-story housing units:

a) The larger of the two floors shall not exceed 70.00m^2 of measurable area.

b) All floors must be accessible by disabled and must follow Dubai Municipality disabled regulations.

6-3 Entrance and Exit Routes

a) The main entrance may be placed on any side of house. However, there needs to be an accessible route to and from the main street of the Solar Hai. Possible Exception: Teams provided with corner lots might have the exits towards a cross street which will be marked by SDME 2018.

b) Teams shall clearly mark the entrance and exit routes between solar envelope on submitted CAD drawings and physical housing unit during jury and public tours.

6-4 Project's minimum requirements

Teams need to provide the following within their solar envelope in order to participate in all 10 contests of the competition:

- Appliances – See Contest 5 for specific details
- Workstation
- Public area for dinners – See Contest 5
- Public areas of the house (at least living room and kitchen) must be open to public tours and all areas of the house must be open for jury tours. All must follow Dubai Municipality requirement for disabled accessibility.

6-5 Competition Prototype Alternates

Competitors are open to use any unusual building material/Building Systems that shows adaptation to the Middle East region weather conditions. Supporting documentation of such materials or building systems must be provided.

Rule 7: ENERGY

7-1 Energy Sources

Global solar radiation incident upon the lot and the energy in small primary batteries are the only sources of energy that may be consumed in the operation of the house without the requirement of subsequent energy offsets, once the Contest week has started.

All other energy sources, such as AC grid energy, consumed in the operation of the house must be offset by an equal or greater amount of energy produced, or "regenerated," by the house.

7-2 Village Grid

The organizers shall provide the village with an electric power grid that provides AC power to or accepts AC power from the houses.

a) The organizers shall provide the necessary service conductors and connect the conductors at the utility intertie point.
b) A team must notify the organizers if its house operates with an AC service other than 50 Hz, 230V (phase-neutral).
c) The Low Voltage grounding means system of the electricity distribution grid in the Solar Hai follows a TT configuration (Note: the LV grounding means system characterizes the grounding means mode of the secondary of the MV/LV transformer and the means of grounding means the installation frames). This aspect should be carefully taken into account when designing the grounding means of the house and photovoltaic system.
d) There will be a General box in each of the lots with the necessaries protections for the electrical connection to the General grid of the Solar Hai. Each team has the responsibility of reaching with the

conduits the General Box. In any case, conduits will be left in the general connection box of the lots and the connection will be made by an authorized technical expert of the Organization. The individual branch must have a section of 3x16 mm2, insulation 0.6/1 kV and be free halogen.

e) The team is responsible for calculating the house electrical grounding necessities. The Organization will execute the grounding system of the Solar Hai with buried plates grounding connection points; in this way, each house will have one connection point, both for the electrical consumption (AC, alternate current) and for the electrical generation (photovoltaic system).

7-3 PV Technology Limitations

a) Bare photovoltaic cells must be commercially available to all teams by the beginning of the Final Phase of the SDME2018 Competition. Custom-designed PV modules will be permitted, provided that the manufacturer demonstrates that the PV modules have been manufactured in accordance with the relevant standards applicable (e.g. IEC 61215 for crystalline silicon terrestrial PV modules and IEC 61646 for thin-film terrestrial PV modules).

b) Encapsulated photovoltaic modules must be commercially available to all teams by the beginning of the Final Phase of the SDME2018 Competition.

c) Substantial modification of the crystal structure, junction, or metallization constitutes manufacture of a new cell and is not allowed.

d) Photovoltaic installation size is limited by the following rule: the maximum power of all power conditioning equipment connected to PV generation (DC/DC and/or DC/AC) is limited to 5 kWp. For DC/AC power conditioning (inverters), the maximum power to be considered is the nominal power, defined as the maximum output power without time limitations/constraints.

e) If technologies different from Photovoltaic are used for electricity generation, the limit of 5 kWp mentioned previously applies to the aggregate of electricity generation installations (Photovoltaic and non-Photovoltaic).

7-4 Batteries

Hardwired battery banks and large plug-in uninterruptable power supplies (UPS) are not permitted. Batteries include most commercially available energy storage devices, such as electrochemical batteries and capacitors.

a. The use of primary (non-rechargeable) batteries (no larger than “9V” size) is limited to smoke detectors, remote controls, thermostats, alarm clock backups, and other small devices that typically use small primary batteries.

b. The use of the factory-installed battery within the team’s electric vehicle is permitted for the operation of the electric vehicle only. Vehicle-to-grid power flow is not permitted.

c. “Plug-in” (non-hardwired) devices with small secondary (rechargeable) batteries that are designed to be recharged by the house’s electrical system (e.g., a laptop computer), shall be connected, or “plugged into,” the house’s electrical system whenever the devices are located in the house or within the solar envelope.

Exception: If not used in the operation of the house at any time during contest week, portable electronic devices used for mobile communications, such as cell phones and tablets, are permitted within the solar envelope without having to be plugged into the house’s electrical system.

d. Stand-alone, PV-powered devices with small secondary batteries are permitted, but the aggregate battery capacity of these devices may not exceed 100 Wh.

7-5 Connection of the houses to the Solar Hai grid

Once the final electrical inspection (including photovoltaic systems) has been approved, the houses will be officially connected to the Solar Hai grid. The Electrical Energy Balance of the houses at the beginning of the competition will be zero.

I. From the approval of the final electrical inspection to the beginning of the contests (Contest Week), in the electrical panels of the houses only the circuit breakers of the household appliances, the independent circuit breaker for contest 6.9 (Home Electronics) and the lighting circuit breakers can be activated.
II. The houses officially connected to the grid will not be allowed to use any thermal energy storage active system or conditioning active system until the beginning of the measured contests (during the Contest Week).

7-6 Thermal Energy Storage

Thermal energy storage devices located outside of the footprint shall be fully shaded from direct solar radiation.

7-7 Desiccant Systems

Teams must communicate to the SDME 2018 Organization if they are planning to incorporate a desiccant system. If a desiccant system is used, it must be regenerative.

a) To ensure that the desiccant has been fully regenerated by the conclusion of the Electrical Energy Balance contest, the desiccant material or device must be easily measurable.
b) In most cases, the material or device will be measured prior to and at the conclusion of the Electrical Energy Balance contest. In some cases, a measurement at the conclusion of the Electrical Energy Balance contest will not be necessary.
c) At the conclusion of the Energy Management contest, the weight of the desiccant material or device shall be less than or equal to its initial weight.
d) Some desiccant systems with very low moisture storage capacities may be exempt from this requirement.
e) Exemptions will be granted on a case-by-case basis.

7-8 Humidification Systems

If a team is intending to use a humidification system, must notify the Organization for approval all the system's characteristics, and the corresponding certifications of the different elements.

Rule 8: Liquids

8-1 Containers Location

a) Main liquids supply and waste liquid collection containers could be considered as infrastructure and hence could be placed out of measurable area.

b) Liquids thermal storage and collection tanks are considered as a part of the solar installation and must be placed within measurable area.

c) Liquids supply and waste containers design are responsibility of competitors and the same shall withstand weather conditions and could be shaded from solar radiation.

8-2 Water Supply

The procedure and requirements for water supply is as mentioned below:

a) SDME 2018 will supply non potable water for competition means as per planned schedule.

b) Housing units construction documents needs to clearly show fill locations, flow rate(s), dimensions of container(s), clearances, and openings providing easy accessibility.

c) Competition teams are responsible for water distribution within measurable area and inside housing unit. This includes all necessary pumps, tanks, valves, etc.

d) The organization will provide a unified water supply calendar and any other date/time needs to be requested in advance and subjected to approval or rejection.

e) Any water supplied by the organization prior to the competition will have to be emptied/discharged before jury tours.

8-3 Water Removal

The procedure and requirements for water removal is as mentioned below:

a) Housing units construction documents needs to clearly show water removal locations, flow rate(s), dimensions of container(s), clearances, and openings providing easy accessibility.

b) Water removal will only be provided under express requests from the organization and subjected to approval.

8-4 Team provided liquids

A competing team may provide its own liquids for the following purposes:

a) Personal hydration/consumption.

b) Food preparation.

c) Hydronic systems testing.

d) Small volumes of glycerol, deionized water or other working fluids for thermodynamic systems using working fluids other than non-potable water.

e) Assembly (e.g. hydraulic fluids), finishing (e.g. paint) and cleaning (e.g. mineral spirits).

8-5 Grey Water Reuse

Grey water could be reused for the following non-potable means:

a) Irrigation if odorless. Minor treatment could be applied to eliminate odor.

b) Heat recovery systems.

8-6 Rainwater Harvesting

A competing team may collect rainwater falling on its allotted site and use it for any of the following uses:

a) Irrigation

b) Water feature

8-7 Evaporation

Competing teams may use water for evaporation purposes.

8-8 Thermal Mass

Competing teams may use liquids as a thermal mass only if it arrives to the competition site in a sealed container and remain sealed until removed from competition site. The container must be isolated and stored liquid cannot flow through any of the housing unit system or infrastructure provided.

8-9 Grey Water Heat Recovery

Heat may be recovered from grey water as it flows from the drain to the waste water tank. "Batch-type" recovery is prohibited.

Rule 9: Vegetation

9-1 Placement

Use of potted vegetation is permitted, pots may be moved around the site until the start of the contest week from which will remain stationary until the end of contest.

9-2 Watering Restrictions

Grey water containing odor or speculated to contain organisms that may go septic shall not be used for.

Rule 10: Monitoring

A significant part of the scoring of the competition consists on the measurement of different items and on the correct performance of various tasks. The Monitoring system is responsible for controlling these measurements. All sensors, wiring, tripods and the rest of the material necessary for these tasks will be provided by the SDME 2018 Organization.

Monitoring is structured in two independent areas:

1. **Electrical:** Responsible for the monitoring of Contest 3: Energy Management, evaluating the houses' electrical energy self-sufficiency provided by solar active technology and their electricity use intensity.
2. **Instrumentation:** Responsible for the monitoring of Contest 4: Comfort Conditions and Contest 5: House Functioning, by locating sensors where appropriate and Contest 6: Sustainable Transportation.

There are two types of monitoring: Continuous Monitoring and Monitoring Tasks, depending on whether the measurements are continuous or punctual. The following table shows which measurements belong to each group.

Table 4: Monitoring Types

Electrical	**Instrumentation**	
Continuous Monitoring	**Continuous Monitoring**	**Monitoring Task**
Contest 3 - Energy Management	Sub-contest 4.1 - Temperature Sub-contest 4.2 - Humidity Sub-contest 4.3 - Air quality (CO^2) Sub-contest 4.4 - Air quality (VOC) Sub-contest 5.1 - Refrigeration Sub-contest 5.2 - Freezing	Sub-contest 4.5 - Natural Lighting Sub-contest 4.6 - Environmental Acoustics Sub-contest 5.3 - Clothes washer Sub-contest 5.4 - Clothes dryer Sub-contest 5.5 - Dish washer Sub-contest 5.6 - Oven Sub-contest 5.7 - Hot water draws Sub-contest 5.8 - Cooking Sub-contest 5.9 - Home electronics Sub-contest 5.10 - Dining Sub-contest 5.11 - Water Balance Contest 6 - Sustainable transportation

10-1 SDME Sensors' Location and Wire Routing

A summary of the sensor's location and wire routing is provided in this section. Extended information is included in the Technical Monitoring Procedures Document that will be available through the SDME website in future.

a) Instrumentation- The Organization will supply a list of all the SDME instrumentation devices necessary for the Monitoring System of the houses.
b) Sensors Location- The location of sensors is determined by the Organization, on the basis of Deliverable #3 Projects Documents.
c) Wire Routing- As sensors will be wired, there has to be a route for running wires from each sensor location to the data logger. The Teams are responsible to provide a wire routing that permits a quick and easy installation and removal of the SDME Instrumentation wires. This route must be clearly detailed in Construction Documents (Deliverable #4). This easy installation is mandatory to ensure the house to be monitored in order to enter the Competition. These wires and sensors are installed temporarily for the contest week.
d) Feed-through- All devices used for the monitoring will be located indoors in a specific monitoring panel room. Houses must provide feed-through to pass the power and ethernet wires from the exterior to the interior of that room.
e) Instrumentation Plan and Approval. Teams must submit instrumentation drawings showing the location of the SDME sensors, meters, and the wire routing. Teams must have the Instrumentation Plan approved by the SDME 2018 Organization to be able to participate in the Final Phase of the Competition. The procedure is as follows:

Before the final phase of the Competition:

1. The Organization determines and indicates location of the sensors on the basis of Project Documents included in Deliverable #3.
2. The Team integrates wire routing and Monitoring Panel in a Preliminary Monitoring Plan delivered to Organization two weeks after sensors' location definition sent by the Organization.
3. The Organization examines this document and eventually asks for modifications before approval of the Final Monitoring Plan. The approved Final Monitoring Plan is included in Construction Documents (Deliverable #4).
4. Final minor changes can be allowed by the Organization after submission of Updated Construction Documents (Deliverable #5).

"In situ", during the assembly period:

1. The SDME 2018 Organization will check the spaces provided for the wiring (channels, paths, holes, etc).
2. The Team will make the adjustments necessary so that the instrumentation system can be safely and robustly installed by the SDME 2018 Organization.
3. The SDME 2018 Organization will mark the location of the sensors
4. The SDME 2018 Organization will install the monitoring panel, power it and check everything is correctly installed.
5. The SDME 2018 Organization will wire the sensors to the monitoring panel.
6. The SDME 2018 Organization will verify the operation of the sensors.
7. Teams are responsible for the monitoring system integrity.

10-2 Blowerdoor test

At the beginning of competition phase, a blower-door test will be conducted for each house to control airtighness value. This test will respect the EN13829 norm. The objective is just to corroborate values

announced in Project Documents for those teams who are considering airtightness as necessary in their thermal strategies. For teams who are not considering airtightness as necessary, this test will not be performed.

10-3 Real life conditions experimentation

The Organization is currently working on the definition of a real life condition process using prototypes during the competition (24 hours/day). This rule is to be determined in future.

Rule 11: THE EVENT

11-1 Registration

All Solar Decathlon Middle East participants, attending the Final Phase of the Competition, must register through the online registration site, which will be available closer to the event. Only for special cases, registration will be on-site in Dubai, UAE. Due to safety concerns, the different categories of participants will have different types of access (such as to restricted areas or during 1/restricted times).

The following rules apply to registrants:

a) All registrants:
   I. Each event participant must register individually. Group registrations are not allowed.
   II. When registering, event participants must complete all required information and forms before access to the event is allowed.
b) Organizers, team members and jurors:
   I. Will be required to provide a photo that will be kept on file and used for security purposes.
   II. In order to avoid delays, the SDME 2018 Organization encourages using the online registration site and submitting the completed forms, information, and photos prior to the event.
   III. Once the SDME 2018 Organization receives all the information required, forms, and photos, an event security ID will be issued to all individuals and must be visible at all times.
c) Staff and team crew:
   I. Will be required to provide a photo that will be kept on file and used for security purposes.
d) Visiting media:
   I. Must check in at event headquarters.
   II. Will be required to provide a photo that will be kept on file and used for security purposes.

11-2 Use of the Solar Decathlon Middle East 2018 Logo

All communication materials produced by or in collaboration with the teams, before, during and after the competition, must refer prominently to the project as the Solar Decathlon Middle East 2018 in Dubai and shall credit the Solar Decathlon Middle East as indicated by the organizers. This includes all the materials and/or means in which companies and/or institutions refer to their collaboration with one or more teams by using their logo(s). The SDME Corporate Identity Manual includes specific instructions for this use.

The Solar Decathlon Middle East 2018 in Dubai shall be recognized wherever teams' logos are used. The possible combinations between SDME and teams' logos shall be described in the team's visual identity manual, and must comply with the SDME 2018's Corporate Identity Manual.

11-3 Teams' Sponsors and Supporting Institutions

Teams' Sponsors & Supporting Institutions are a very important aspect of the SDME 2018 Competition. For this purpose, each participant Team may select the companies and/or institutions that best serve the development of their purposes. However, both (the participant team, and the team's sponsors and supporting institutions) will have to comply with the SDME 2018 Rules and look over its fulfillment by third parties.

The relationship between SDME 2018 and teams' sponsors will always be done through the team's sponsorship contact. SDME 2018 Organization will not have direct contact with the teams' sponsors.

Teams' sponsors and supporting institutions may be recognized with text, logos, or both, but the text and logos must appear in conjunction with the Solar Decathlon Middle East 2018 in Dubai logo and the Event Supporting Institutions and Main Event Sponsors. However, all these possible combinations must comply with the SDME 2018's Corporate Identity Manual.

The Solar Decathlon Middle East 2018 in Dubai, the Event Supporting Institutions and Main Event Sponsors logos are available through the SDME Portal and can be requested via email.

Teams may include the logo of their teams' supporting institutions and sponsors in the following:

a) Before the competition: in any element, as long as you fulfill the SDME 2018 Rules requirements regarding use and size.
b) During the competition at the Solar Hai: Commercial or technical advertising in the house's interior is forbidden, except for the following cases:
    I. On the explanatory panels located inside the lot but on the houses' outside, on the waiting areas. Logos must not be bigger than 10% of the total panel surface, and included inside a vertical or horizontal strip.
    II. In the teams' website and/or other services for mobile devices that teams may provide, included in the Sponsorship's section. Additionally, it may be included inside a vertical or horizontal strip, with a maximum size of 10% of the screen's total surface.
    III. On the informational brochure, handout or any other object that may be given to the public-
    IV. On the back of the decathletes' uniforms.
    V. Off-the-shelf components that feature a built-in manufacturer's logo are acceptable and do not need to comply with the SDME and team's logo requirements.
    VI. In any vehicle and/or material, only during assembly and disassembly phases, g). In the team's Audiovisual #2.
    VII. Houses cannot be named after their sponsors, and houses' logos cannot directly refer to their sponsor's corporate identity («Direct reference» is subject to the SDME 2018 Organizers' interpretation). Teams may name house's areas after their sponsors. However, any reference to these spaces must comply with SDME 2018 Rules.

Communication materials or other products that exist largely for the recognition of sponsors are prohibited. "Other products" include but are not limited to signs, exhibits, posters, plaques, photos, wall art, and furnishings.

11-4 Team Uniforms

a) During contest week, workshop and special events specified by the organizers, all team members present on the competition site or the site of a special event shall wear uniforms representing their team.
b) Uniforms will help to identify team's members quickly and easily, and will be composed of a series of wearable items.
c) On the front part of teams' uniforms (jacket, shirt, hat or other wearable item), only the combined version of the team's logo and the SDME's logo may be visible
d) On the back part of teams' uniforms (jacket, shirt, hat, or other wearable item), team sponsor logos may be visible only if complying with the logos rules requirements.
e) A built-in clothing manufacturer logo may be visible on the front or back of the team uniform, or both or none of them.

f) Since the Solar Hai is a public space, Teams should maintain dress code required for public areas.
g) Each team will determine its uniforms' color(s) in Deliverable #1. In case of a too great similarity between two teams, the Organization will ask for a second choice. The objective is to avoid visual uniformity and facilitate SDME 2018 communication.
h) Uniforms design will be evaluated by the Communication jury.

11-5 Logistics

a) Each team is responsible for the transport of its house, the house's contents, and all necessary tools and equipment, and shall be responsible for any damage to or loss of such items.
b) Each team is responsible for procuring all necessary equipment, tools, and supplies.
c) Each team is responsible for transportation, accommodations, lodging, food, and beverages (including drinking water).
d) Each team is responsible for making its own reservations and arrangements and for covering all necessary costs.

11-6 Inspections

Each project shall be inspected for compliance with these rules and the Solar Decathlon Middle East Building Code.

a) A team shall notify the appropriate inspector when it is ready for an inspection. When two or more teams request an inspection simultaneously, the order of inspections shall be determined in a drawing.
b) Spot checks for compliance shall take place throughout the Final Phase of the SDME 2018 Competition.
c) The Competition Manager shall check each team's inspection status, as indicated on the team's official inspection card, to determine which houses are eligible to participate in the contest. All final inspections shall be passed by the end of the inspectors' workday for a team to be eligible to participate in the following day's contest.

Exception: Jury visits will proceed as scheduled regardless of a team's inspection status. However, jurors may be aware of the team's inspection status and may consider it in their evaluations.

d) Because open, partially functioning houses are preferable to closed, fully functioning houses, the organizers will direct the inspectors to require that an unsafe condition be corrected so public tours can occur even if, as a consequence, the house is ineligible for participation in the contests.

Rule 12: CONTEST WEEK

12-1 House Occupancy

Under normal circumstances, when the occupancy rule is in effect, no more than six people may be located in the house at any one time.

a) Toward the end of each day during Contest Week, the SDME 2018 Organization shall communicate Teams indicating the hours during which the occupancy rule is in effect the following day.
b) The house occupancy rule is automatically suspended whenever the Comfort Zone contest measurements are suspended.
c) During Dinner Party, the house occupancy rule is automatically suspended.
d) Jurors, observers, official competition photographers and writers, and others with authority to enter a house as an organizer are not counted toward the number of house occupants.

12-2 House Operators

Only Decathletes are permitted to operate the house and participate in the contest during contest week. All competition-related communications on the competition site shall be between the organizers and decathletes.

12-3 Late Design Changes

The final project assembled on the competition site shall be consistent with the design and specifications presented in the construction documents.

a) If there are known inconsistencies between the final project and the construction documents, the team is strongly encouraged to document these inconsistencies and submit the documentation to the SDME 2018

Organization as soon as possible after the inconsistency is known. The SDME 2018 Organization will then submit this documentation or a summary of the documented inconsistencies to the respective juries and inspectors at the appropriate time.

b) If undocumented inconsistencies are discovered during inspections, the SDME 2018 Organization will compile a summary of the inconsistencies and submit the summary to the respective juries at the appropriate time.

12-4 Public Tour

a) During Contest week, houses will be open to public tours during the times specified in the Competition Calendar.
b) Teams are required to provide an accessible route to all areas of the house and site that are available to the public during exhibition hours.
c) Teams are permitted to produce and distribute only one informational brochure or handout. Nevertheless those might be different for each of the target groups. No other handouts are permitted to be distributed. The handout material and its properties, like its recyclability, content and creativity, will be positively evaluated.
d) Teams shall develop signage that complements public tours by informing visitors about the team project and engaging visitors waiting in line.
e) Only organizers-approved vendors may provide food and beverage to the general public on the competition site.
f) The SDME 2018 Organization will inform all Teams of the specific location of the access to each lot before the Lot's Selection.

Additional requirements

Although teams have to design only one route for all public, they may plan different explanations for each of the target groups: General public, professionals (architects, engineers, technicians and specialized press), undergraduates, teenagers and children, as well as considering long and short tours, attending to the number of public waiting.

Teams will have to manage the waiting lines during public tours, and therefore design a specific area inside the lot for them to wait and include any entertainment activity. Information panels and/or equivalent electronic equipment (always using the house's energy) may be installed in this area.

Teams are encouraged to plan their route according to the accessibility requirements trying to avoid any difficult point, such as crossing of ways, narrowing, etc. In case this is not possible, teams will have to explain how these difficult points (as well as turns, entrance and exit accesses) are solved.

Public tours and explanations must take into account those people with sensorial or motor disabilities, and will design it according to "Total Accessibility Criteria". Therefore, teams will have to plan all the necessary actions or systems to let them follow the same visit as the rest of the public, without any information loss, neither being split up or given special attention. However, only once the public tour and explanations have finished,

wheel chairs and strollers/push chairs (and people accompanying them) may have a different exit from the rest of the public.

During public tours, teams must provide access to the public areas of the house (at least living room and kitchen). As houses may have two different levels, and public tours may include visiting both floor levels, access must be granted for disabled people without making use of mechanical elements nor splitting the tour. Moreover, as it is mandatory to show the rest of the house, teams may make use of other means (such as models, videos, mirrors, drawings, photos) for this end.

Augmented reality systems and/or any other electronic systems to enrich the public visit are permitted, beyond those provided for people with sensorial disabilities. All auxiliary electric/electronic systems used during public tours (such as screens, beamers, audio guides, fans, music players) must be powered by the house's energy.

When planning their communication strategy during the Final Phase of the SDME 2018 Competition, teams must consider the following aspects:

- Most of the visitors coming to the Solar Hai will be English and Arabic speakers.
- Due to the climatic conditions in Dubai, teams are encouraged to plan shading areas, elements and/or devices inside their lot for the public waiting.

12-5 Houses' use during event

Each house can be impounded under the direct supervision of the organizers during a specific period of time. Team Members and team Crew are not allowed to occupy, move, or conduct maintenance on any part of the house during the Impound.

12-6 Interior & Exterior Lighting

House will have to keep all interior and exterior house lights on during specified periods of time. See the Competition Calendar for the specified periods.

a) All dimmers shall be adjusted to their highest positions and all other lighting control equipment shall be disabled or overridden so that the controlled lamps are fully and continuously on during the specified periods.
b) In case of technical problems, a team may notify it to the observer before turning selected lamps on or off, in order to avoid point penalties.

12-7 Safety during the Event

Each Team is responsible for the safety of the general public during the tours of their house.

12-8 House Configuration for Jury Tours

Teams shall show the juries, all possible configurations of the house during the jury tours.

a) House configurations that could affect the outcome of contests, but were not seen by the jury during their tours, are prohibited during contest week. Some examples of reconfigurable features are the following:
    I. A significant movable component, such as a room, wall, or bed.
    II. Shading devices, such as retractable awnings or operable shutters.
    III. Towel-drying locations.
    IV. Window coverings that may obstruct views or reduce light levels.
b) If there is insufficient time to do a live reconfiguration during jury tours, teams may use some other method, such as photographs or video, to show all reconfigurable features in their various

configurations. Reconfigurable features that will not actually be reconfigured at any time during contest week need not be reconfigured during jury tours.

c) All plug-in or portable appliances that may be used during contest week shall be in their fully deployed locations and configurations during jury tours. Also be aware that juries may request that plug-in, portable, or hard-wired appliances be turned on so they can evaluate noise levels or other characteristics of the appliances that may not be evident when the appliance is off.

12-9 Teams Activities at the Solar Hai

a) Only SDME approved activities are permitted at the Solar Hai.

b) Teams wishing to hold any kind of activity not specified in the Competition Calendar, in their homes, lot or any other area of the Solar Hai, must request the SDME 2018 Organization for approval. These include any event co-organized by teams and governments/supporting institutions/sponsoring companies from official receptions to product presentations.

c) The Organization has the authority to reject or approve any request, and may issue a conditional approval or suggest a change of date or time.

2. CONTESTS

CONTEST 1: ARCHITECTURE

Objectives

To assess the coherence of the design, the flexibility of space, the integration of technologies in architecture and the incorporation of energy efficient strategies. To assess the general coherence of the projects and its alternates in relation with spatial and environmental factor of The Middle East region.

It will be assessed on

The deliverables relative to the project, especially the Construction Documents, as well as the on site evaluation of the house.

How it will be evaluated

A multidisciplinary jury of renowned architects, designers and experienced practitioners, specialized in the different areas of this contest.

Concepts to be evaluated

The architecture will be assessed as: "the conceptual organization of space in relation to technologies sustaining it and the reflection over the future of housing according to the context (cultural, social, and spatial) and environmental factors of the Middle East region ", in accordance with the following parameter and concepts:

Jury scoring:

- Design coherence
- Perceptive evaluation, "in situ" verification
- Positive evaluation of the proposal considering spatial, lighting design including use of natural lighting, and effect on used HVAC system.

Evaluation criteria

Jury scoring:

- Proposal's coherence: Clarity in the conception of space and concepts. Synthetic, essential, simple and radical proposals will be assessed positively.
- Perceptive evaluation: "in situ" verification during jury tours: How architectural design intentions have been achieved in the constructed house.
- Positive evaluation of the proposals considering:
- Innovative Spatial Design: making the best use of space and transformable or multi-use spaces.
- Lighting Design: the lighting quality for the space definition and the comfort provision evaluating both day and night specific needs. The suitable use of lighting highlighting the house values will also be assessed. Effect of natural light on HVAC system
- Materials use: coherence of the use of matter and materials with the architectural concept and the local resources available in the environmental context of each project.

How the project and its alternates bring a relevant proposal regarding the cultural and environmental context of each project.

Scoring

A total of 100 points will be awarded by the corresponding jury for this contest.

CONTEST 2: ENGINEERING AND CONSTRUCTION

Objective

To assess the construction and engineering systems design merit and implementation. Teams will have to demonstrate the higher level of functionality of the house structure, envelope, electricity, plumbing, HVAC and solar system design and construction, its safety, viability and their adequate integration.

It will be assessed on

The deliverables relative to the project, in particular the Construction Documents, as well as the on site evaluation of the house.

How it will be evaluated

A multidisciplinary jury of engineers specialized in the different areas of this contest.

Concepts to be evaluated

Jury scoring:

- Assembly period coordination and management
- House's Structure
- Constructive design of the house.
- Plumbing System Design and Construction
- Electrical System Design and Construction
- Air Conditioning Design and Construction
- Solar System Design and Construction

Evaluation Criteria

Jury scoring:

- Assembly period coordination and management: Construction phase will be an integral part the competition. During assembly period on-site, houses construction works will respect Site Operation Plan (timeline, logistic, zoning, waste management, etc.), always valuing adequacy between the teams' objectives and means. To help jury evaluation, the team will compile the entire 24h/24 webcam recording of each house assembly phase in an audiovisual presentation of maximum 2'.
- Houses Structure: House structural concept and resolution: typology, materials, hypothesis, calculations, etc. will be assessed.
- Constructive design of the house. Constructive solutions for: envelope, interior divisions, and finishes, as well as the acoustic performance of the adopted solutions.
- Shading elements, their practicality in design, assembly, assembling time, durability and cost consideration.
- Plumbing and Electrical Systems Design and Construction: Concept, dimensioning and resolution of the different systems facilities and active services, also equipment selection and its suitability considering the house's needs. The water conservation will be positively evaluated considering low flow and water saving fixtures, grey water system, treatment and/or water reuse.
- Solar System Design and Construction: Functionality, design, implementation, robustness, and economic value of solar systems.
- Building Integrated Solar Active Systems (BIPV – Photovoltaic, BIT – Thermal, BIPVT – Photovoltaic and Thermal): The Solar Active Systems installation will be evaluated looking forward to a perfect integration in the house. It will be considered that the "building integration" exists when the modules are elements of the house's architectural composition.

Scoring

A total of 100 points will be awarded by the corresponding jury for this contest.

CONTEST 3: ENERGY MANAGEMENT

Objectives

Evaluate the houses' electrical energy self-sufficiency, management and reduction of energy consumption, electrical energy efficiency, efficiency of all the house components and their own solar energy consumption. Assess homes' energy consumption and energy balance. Assess network load management and limitation of peak power. The Teams must demonstrate to what degree the house design, including its systems definition, contributes to enhance the energy efficiency of the house.

It will be assessed on

The deliverables relative to the project, in particular on the Construction Documents, as well as the on site evaluation of the house. The collected data of the different electric energy flows, by the organization´s monitoring system during the competition period.

How it will be evaluated

A multidisciplinary jury made up of engineers specialists in the different disciplines. The evaluation of this contest is also based on the electric energy measurements.

Concepts to be evaluated

Monitored performance and Jury scoring:

- Load consumption per surface area.
- Positive electrical balance
- Temporary generation- consumption profile patterns correlation.
- House adjustment to network load state
- Efficiency of the House's Envelope
- Efficiency of passive or mostly passive systems
- Efficiency of the active systems (heating, cooling, ventilation, lighting and hot water)
- Energy analysis of the house and annual consumption estimation
- Embodied energy analysis
- Efficiency of the appliances and energy saving mechanisms
- Efficiency increase due to the house management

Evaluation criteria

Jury scoring:

- Efficiency of the House's Envelope: Construction of the house envelope, related to the energy efficiency of its materials and adopted solutions.
- Efficiency of HVAC systems: Concept, dimensioning and resolution of the HVAC systems facilities, passive and/or active strategies of the house will be evaluated, as well as its efficiency to fulfill the house's needs.
- Energy analysis of the house. Effective communication and synthesis of the Team's design and analysis process, focusing on the application of engineering principles, modeling, simulations and creative solutions. An overall description of the project geometric, envelope, air-tightness (verified on-site) and any singular element that could contribute to the house energy efficiency. The influence

of simulations in the decisions and changes to the house design will be evaluated, as well as the needs calculations, the thermal loads and the energy consumption of the house.

- Simulated thermal evaluation: Each house will be evaluated thanks to a specific tool of buildings thermal simulation (to be determined) in order to compare each house performances on a common basis, as a decision-support tool. Teams will be allowed to propose specific scenario (ventilation, annual comfort temperature and humidity, occupancy, internal gains). This evaluation will help the jury to evaluate projects in their original local environment.
- Embodied energy analysis. To evaluate the embodied energy, the water consumption and the residue generation of the construction process, a specific analysis will be proposed. The structure flexibility and possibilities for being reused, adapting to future technological changes will also be evaluated.
- Efficiency of the appliances: The appliances selections due to its technical specifications, according to the house's dimensions and foreseen use. The inclusion of energy savings method will be positively evaluated.
- Efficiency increase due to the house management: Strategies designed (human or automatically controlled) for a contribution to the energy saving of the house will be evaluated through their influence on inhabitants awareness raising and good habits development, daily tasks ease, building comportment efficiency.

Monitored

Sub Contest 3.1: Load consumption per surface area

This contest aims to evaluate the electrical energy efficiency of the houses fulfilling comfort conditions and functions. Some consumptions depend on the surface of the house (heating, refresh, ventilation, lighting) and others are fixed (hot water, appliances). In order not to penalize the houses smaller areas, the consumption of houses is estimated using the following formula:

$$E_L = \frac{E_V}{A} + \frac{E_F}{C}$$

Where E_v is the consumption of heating, cooling, ventilation, lighting, E_f is the consumption of hot water and appliances, C = average of measurable area of all projects (to be definitely determined after Deliverable #3 and then d on then indicated to all teams) and A = measurable area of the house.
The point distribution is represented by the following figure:

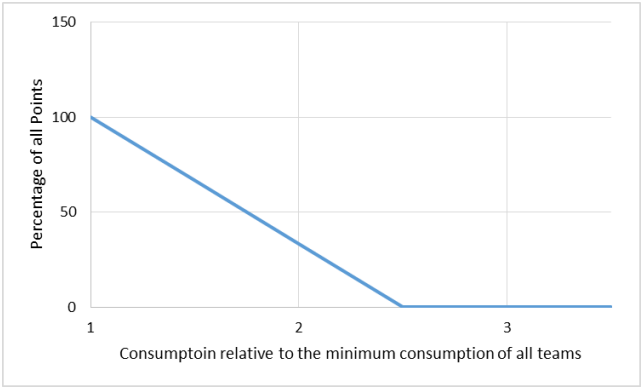


Figure 3.1: Load consumption per surface area sub contest point distribution

The above figure shows that all teams which consume 2.5 times more than the team which least consumes, will receive zero points. The rest will be given points in a linear manner.

Note 1: teams who, in order to reduce energy consumption, intentionally do not try to maintain comfort conditions by disconnecting or not fully using active systems integrated in their project, could be disqualified in this sub contest.

Note 2: passive strategies are nevertheless encouraged.

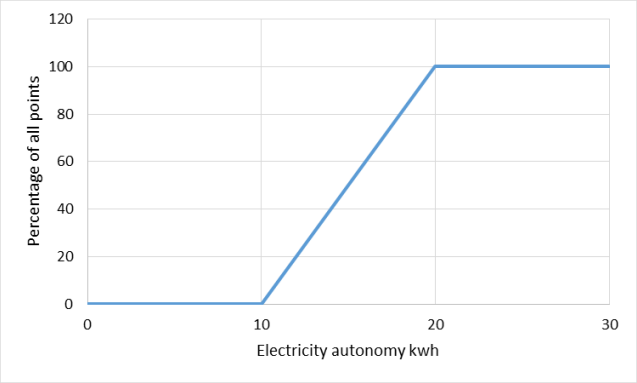
Sub Contest 3.2: Positive electrical balance

This sub-contest will evaluate the degree of self-supply of the house or electrical energy balance during the competition week. For a house to have a positive annual electrical energy balance the following relationship must occur:

$$E_{G\ yearly} - L_{G\ yearly} \geq 0$$

Where $E_{G\ yearly}$ represents the electrical energy generated throughout a whole year and $L_{G\ yearly}$ represents the electric loads' consumption throughout a whole year.

The point distribution is represented by the following figure:



Full Points:				Electricity autonomy	>	B	kWh
Reduced Points:	A	kWh	<	Electricity autonomy	≤	B	kWh
No Points:				Electricity autonomy	<	A	kWh

Figure 3.2: Positive electrical balance sub contest point distribution

Quantities A and B depends on the installed power:

$$B = \frac{X}{5} \times 56$$

$$A = B - 20 \times \frac{B}{56}$$

Where X = photovoltaic power in kWp

Note 1: teams who, in order to reduce energy consumption, intentionally do not try to maintain comfort conditions by disconnecting or not fully using active systems integrated in their project, could be disqualified in this sub contest.

Note 2: passive strategies are nevertheless encouraged.

Sub Contest 3.3: Temporary Generation-Consumption Correlation

One of the main advantages of distributed solar generation is that electricity is consumed in the same place where it is generated. This reduces the need for transmission lines and minimizes the electricity transport losses. This effect is maximized if electricity is consumed at the same time as it is generated.

This contest will evaluate the temporary correlation between the photovoltaic generation and the electricity demand during the competition week (daytime periods still to be determined). This correlation is the following: This contest will evaluate the temporary correlation between electricity generation and electricity demand during the Contest week periods where electricity generation is computed. This correlation is the following one:

$$\mathbf{E} = \frac{\mathbf{E}_{G\_L}}{\mathbf{E}_{L}}$$

Where $\mathbf{E}_{G\_L}$ is the electricity generated and simultaneously consumed by the loads, and $\mathbf{E}_{L}$ is the electricity consumed by the loads.

Note: $\mathbf{E}_{G\_L}$ will only be measured during the daily intervals in which all houses are free of shadows, but $\mathbf{E}_{L}$ will be measured 24h/24.

Scoring

A total of 140 points will be awarded for this contest in the competition.

CONTEST 4: COMFORT CONDITIONS

Objective
To assess the capacity for providing interior comfort through the control of temperature, humidity, lighting, the quality of the interior air, in addition to internal and external acoustical performance.

It will be assessed on
The collected data by the organization´s monitoring system during the competition period and the evaluation "in situ" in the Solar Hai.

How it will be evaluated
This contest is based on the measurements realized on the house during the Competition Week, supported by evaluation of a multidisciplinary jury of renowned architects, designers and experienced practitioners.

Concepts to be evaluated

- Temperature
- Humidity
- Natural Lighting
- Environmental Acoustics
- Air quality – CO2
- Air quality – VOC

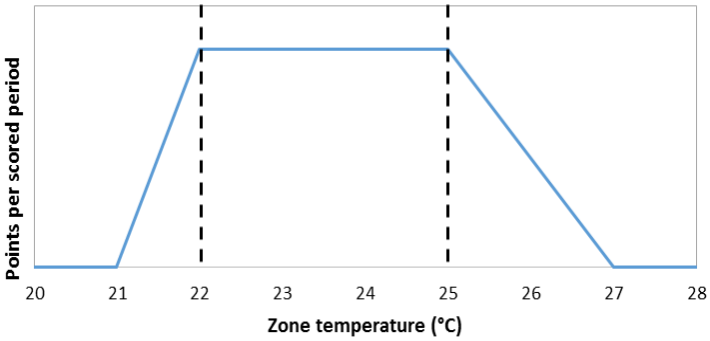
Jury scoring

- Structural and nonstructural building systems performance during weather simulation.
- General internal comfort during weather simulation.
- Perceptive evaluation, "in situ" verification

Evaluation criteria

Sub-contest 4.1: Temperature

The interior temperature will be constantly measured. Two temperature sensors (globe thermometers according to CE 7726 standard) will be located in the two main rooms of the house. In case it is necessary a third temperature sensor will be installed. All available points are earned at the conclusion of each scored period by keeping the time-averaged interior dry-bulb temperature between 22°C (71.6°F) and 25°C (77 °F) during the scored period.
a. Reduced points are earned if the time-averaged interior dry-bulb temperature is between 21°C (69.8°F) and 22°C (71.6°F) or between 25°C (77 °F) and 27°C (80.6 °F). Reduced point values are scaled linearly, as shown in Figure 4.1.
b. The zone temperature deviating farthest from the target temperature range is the zone temperature of record. The organizers will identify at least two thermal zones in each house and measure the temperature of each zone.



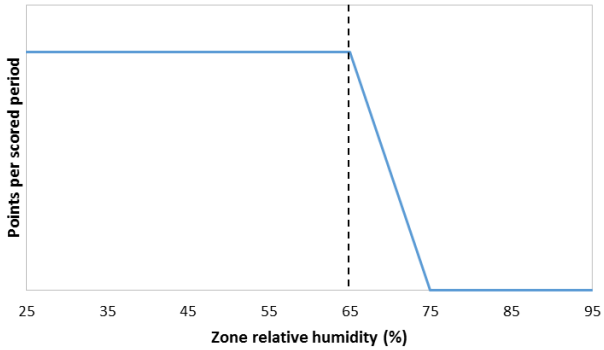
Full points:	22°C (71.6°F) ≤ Temperature ≤ 25°C (77 °F)
Reduced points:	21°C (69.8°F) < Temperature < 22°C (71.6°F)
or	25°C (77 °F) < Temperature < 27°C (80.6 °F)
No points:	Temperature ≤ 21°C (69.8°F)
	Temperature ≥ 27°C (80.6 °F)

Figure 4.1: Temperature sub contest point distribution

Sub-contest 4.2: Humidity

The relative humidity will be constantly measured. A humidity sensor will be located next to a temperature sensor. All available points are earned at the conclusion of each scored period by keeping the time-averaged interior relative humidity below 65.0% during the scored period. See the Competition Calendar for the schedule of scored periods.

Reduced points are earned if the time-averaged interior relative humidity keeps between 65.0 % and 75.0 %. Reduced points values are scaled linearly, as shown in Figure 4.2.



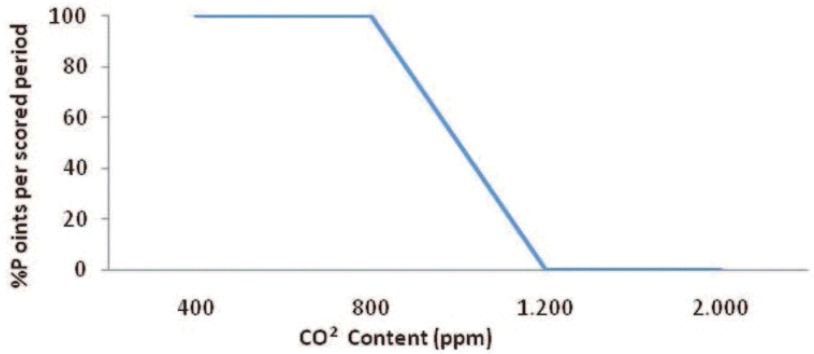
Full points:	Relative humidity ≤ 65 %
Reduced points:	65 % < Relative humidity < 75 %
No points:	Relative humidity ≥ 75 %

Figure 4.2: Humidity sub contest point distribution

Sub-contest 4.3: Air quality – CO2

The content in CO2 in the air will be constantly measured. In most cases, CO2 sensors will be located next to temperature sensors. All available points are earned at the conclusion of each scored period by keeping the content in CO2 below 800 ppm during the scored period. See the Competition Calendar for the schedule of scored periods.

Reduced points are earned if the content in CO2 is between 800 ppm and 1200 ppm. Reduced points values are scaled linearly, as shown in Figure 4.3.



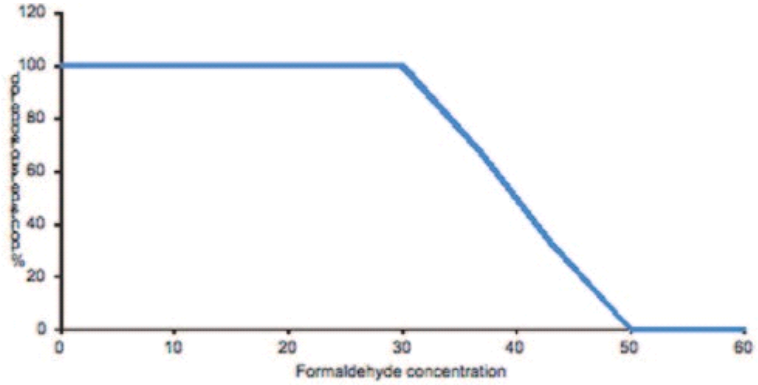
Full Points:				**CO^2 content**	≤	**800 ppm**
Reduced Points:	**800**	**ppm**	<	**CO^2 content**	<	**1200 ppm**
No Points:				**CO^2 content**	≤	**1200 ppm**

Figure 4.3: Air quality (CO2) sub contest point distribution

Sub-contest 4.4: Air quality – VOC

The formaldehyde concentration will be measured punctually. Two formaldehyde test-tubes (dosimeter with DNPH) will be located in the two main rooms of the house. All available points are earned by keeping formaldehyde concentration below 30 µg/m3 for a 5 days measurement (measurement according to ISO 16000 requirements). See the Competition Calendar for the schedule of scored periods.

Reduced points are earned if the formaldehyde concentration is between 30 µg/m3 and 50 µg/m3. Reduced points values are scaled linearly, as shown in Figure 4.4.



Full Points:				**Formaldehyde content.**	≤	**30**	**µg/m³**
Reduced Points:	**30**	**µg/m³**	<	**Formaldehyde content.**	<	**50**	**µg/m³**
No Points:				**Formaldehyde content.**	≥	**50**	**µg/m³**

Figure 4.4: Air quality (VOC) sub contest point distribution

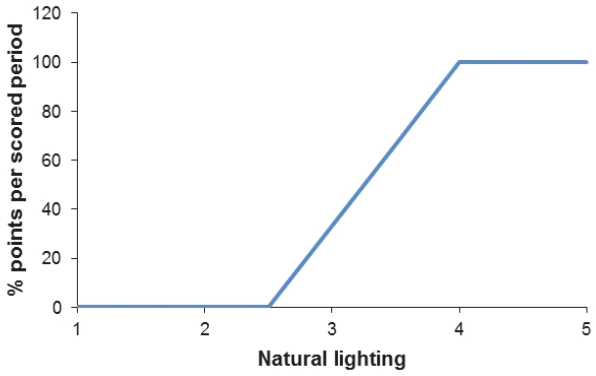
Sub-contest 4.5: Natural Lighting

The natural lighting level measurements will take place at the scored period in the Competition Calendar. Photometer(s) will be located in the living room. Light intensity of the area will be measured according to the spectral levels defined by the organization. All available points are earned by keeping the Daylight

Factor, ratio lighting level / exterior (direct and indirect) lighting above 4% during all the measurement periods (cloudy sky). See the Competition Calendar for the schedule of scored periods.

a) Reduced points are earned if the ratio is between 2.5% and 4%. Reduced points values are scaled linearly, as shown in Figure 4.5.

b) The measurement point height is 0.9m and the minimum distance to a window is 2m. Direct light-emitting devices and direct sunrays are not permitted on the sensor.



Full Points:				**Daylight factor**	**≥**	**4**	**%**
Reduced Points:	**2,5**	**%**	**<**	**Daylight factor**	**<**	**4**	**%**
No Points:				**Daylight factor**	**≤**	**2,5**	**%**

Figure 4.5: Natural light sub contest point distributing

Sub-contest 4.6: Environmental Acoustics

The internal and external acoustical performance will be assessed by testing structural and nonstructural elements acoustical reaction to extreme weather conditions in the Middle East region. The house will be evaluated during harsh weather condition simulation and HVAC system sound measurements.

4.6.1: Environment Acoustics

A sand storm weather condition will be simulated via placing large scale portable fans running to create wind speeds similar to what is usually experienced in the Middle East region. During simulation the jury will assess the following:

- Overall stability of building system.
- Noise created by the housing unit.
- Vibration of certain nonstructural element.
- Noise in the internal spaces of the housing unit.

Simulation will only be conducted during a jury tour and scoring will be at their scrutiny.

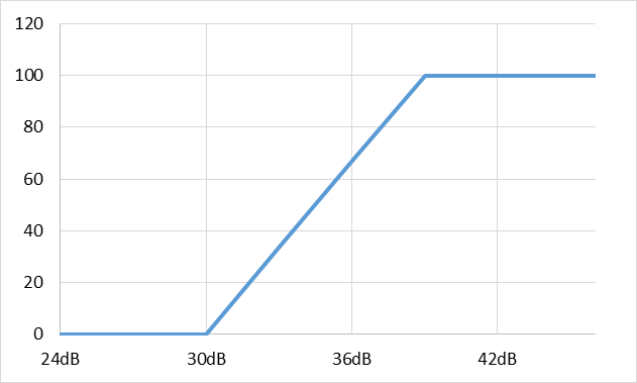
4.6.2 Internal acoustical performance

Since SDME 2018 encourages teams to address urban density issues, each team has to anticipate the sonic environment around the project (circulation of human sounds and acoustic sources between collective housing buildings, from inside to outside and vice-versa) and the circulation of sounds in the housing unit interior space (for example when someone wants to sleep while others want to listen to music or watch TV). These two aspects of living comfort cannot be measured on the SDME 2018 site, but they have to be discussed in the Architecture Design Narrative Report presenting the local development of the project on the site chosen by the team. This discussion will present coherent quantitative values based on a detailed acoustic study of the project.
The acoustic performances that will be measured on site, in Dubai, are:

- The sound insulation from the outside
- The reverberation time in the living room

The sound level of the HVAC system and all other active systems: inside and outside of housing unit

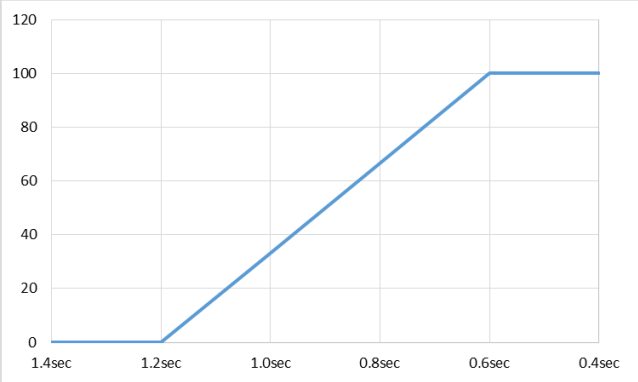
1) The façade airborne sound insulation will be measured.
The measurement will be done according to the global method proposed in ISO 140-5:1998.
The sound insulation Dls,2m,nT (dB) values for each of the 1/3 octave bands will be calculated between 100Hz and 5 kHz.Dls,2m,nT,w (dB) calculated according to ISO 717-1:1996 will be used as assessment parameter. All available points are earned at the conclusion of all the houses' sound measurements by having an acoustic value equal or above 42 dB. Reduced points are earned if the acoustic value is between 30 dB and 42 dB. Reduced points values are scaled linearly, as shown in Figure 4.6:



Full Points:				Acoustic values	≥	42	dB
Reduced Points:	30	dB	<	Acoustic values	<	42	dB
No Points				Acoustic values	≤	30	dB

Figure 4.6: Internal acoustical performance points distribution

2) The reverberation time with the mobile furniture in the living room will be measured
The reverberation time is measured according to the ISO 354. All available points are earned if the reverberation time is equal or below 0,8 second. Reduced points are earned if the reverberation time value is between 0,8 and 1,2 second. Reduced points values are scaled linearly, as shown in Figure 4.7



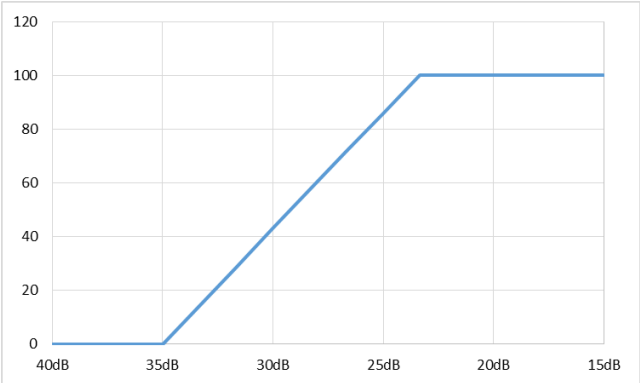
Full Points:			Reverberation time	≤	0,8s
Reduced Points:	0,8s	<	Reverberation time	<	1,2s
No Points:			Reverberation time	≥	1,2s

Figure 4.7: Reverberation time points distribution

3) The sound level of HVAC and active systems inside and outside will be measured.

The measurement of the sound level produced by all HVAC and active equipment in the living room will be done according to the ISO 10052: 2004.All available points are earned at the conclusion of the sound measurements by having an acoustic value equal or below 25 dB.

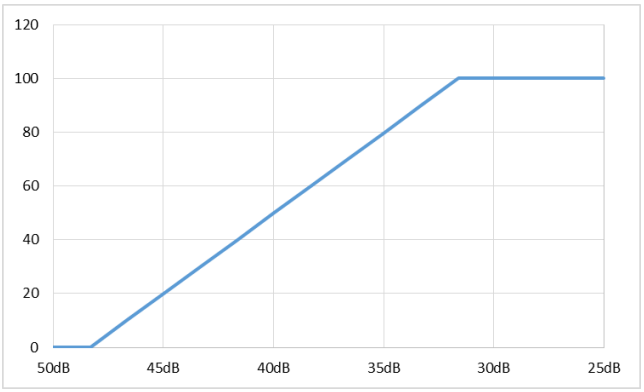
Reduced points are earned if the acoustic value measured inside is between 25 dB and 35 dB. Reduced points values are scaled linearly, as shown in Figure 4.8:



Full Points:				Acoustic values	<	25	dB
Reduced Points:	25	dB	<	Acoustic values	<	35	dB
No Points:				Acoustic values	>	35	dB

Figure 4.8: HVAC sound level inside housing unit point's distribution

The measurement of the sound level produced by all HVAC and active equipment outside will be done 5 meters in front of the emissive point or surface. All available points are earned at the conclusion of the sound measurements by having an acoustic value equal or below 35 dB. Reduced points are earned if the acoustic value measured outside is between 35 dB and 50 dB. Reduced points values are scaled linearly, as shown in Figure 4.9:



Full Points:				**Acoustic values**	**≤**	**35**	**dB**
Reduced points:	**35**	**dB**	**<**	**Acoustic values**	**<**	**50**	**dB**
No Points:				**Acoustic values**	**≥**	**50**	**dB**

Figure 4.9: HVAC sound level outside housing unit point's distribution

Scoring

A total of 120 points will be awarded by the corresponding jury for this contest.

CONTEST 5: HOUSE FUNCTIONING

Objectives

To evaluate the house functionality and the efficiency of the selected appliances, in order to maximize the performance of the house, while complying with the demanding standards of present day society. This contest tries to reproduce the average energy use in a modern home. The organization wants to encourage teams to think about innovative solutions meeting all appliances required performances; that is why evaluation will concern results rather than means. The usage of Electrical Vehicles for transportation will also be assessed under this contest.

It will be assessed on

The collected data by the organization's monitoring system during the competition week, the measurements realized "in situ" in the Solar Hai, and the successful completion of tasks.

How it will be evaluated

The evaluation will be based on the measurements realized on the house during the Competition Week and on the corresponding tasks completion, with the exception of the Dinner Sub-Contest in which each guest team shall assign an evaluation to the host team after each dinner party.

Concepts to be evaluated

Tasks completion scoring:

- Washing (10 Points)
- Clothes drying (10 Points)
- Dishwashing (5 Points)
- Oven (5 Points)
- Hot water draws (10 Points)
- Cooking (10 Points)
- Home electronics (10 Points)
- Water Balance (10 Points)

Monitored performance scoring:

- Refrigeration (10 Points)
- Freezing (10 Points)

Guests scoring:

- Dinner (10 Points)

Evaluation criteria

Sub-contest 5.1: Refrigeration

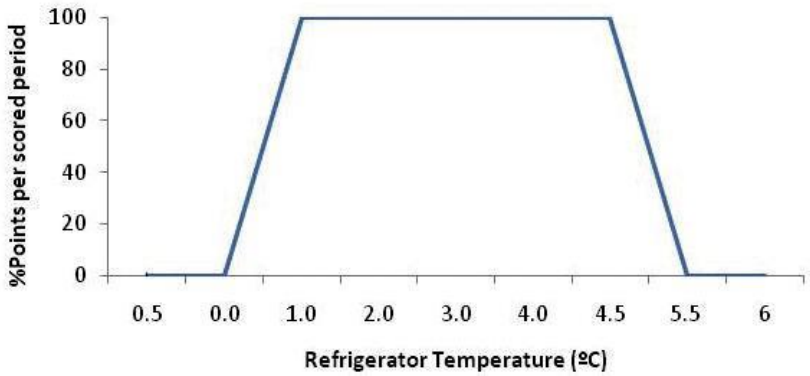
In order to simulate real life of the refrigerator the Organization will provide a load of water at ambient temperature that will be changed according a scenario to be determined. Moreover the refrigerator has to be used for storage of all food and beverages used during the dinner contest.

All available points are earned at the conclusion of each scored period by keeping the time-averaged interior temperature of the refrigerator between 1.0ºC and 4.5ºC during the scored period. A temperature sensor will be located inside the volume and will be continuously measuring.

a) Reduced points are earned if the time-averaged interior refrigerator temperature is between 0.0°C and 1.0°C or between 4.5°C and 5.5°C. Reduced point values are scaled linearly, as shown in Figure 5.1

b) The refrigerator volume shall be a minimum of 170 liters.

c) The refrigerator must be used to store food and beverages.



Full Points:	**100^{O} C**	**≤**	**Temperature**	**≤**	**4.5^{o}C**
Reduced Points:	**0^{O} C**	**<**	**Temperature**	**<**	**1.00^{o}C**
	4.5^{O} C	**<**	**Temperature**	**<**	**5.5^{o}C**
No Points:			**Temperature**	**≤**	**0.00^{o}C**
			Temperature	**≥**	**5.5^{o}C**

Figure 5.1: Refrigerator sub contest point's distribution

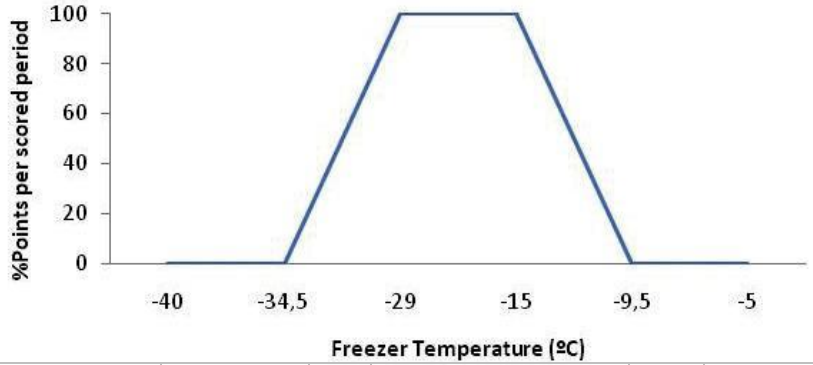
Sub-contest 5.2: Freezing

In order to simulate real life of the freezer the Organization will provide a load of water at ambient temperature that will be changed according a scenario to be determined. Moreover the freezer may be used for storage of all food and beverages used during the dinner contest.

All available points are earned at the conclusion of each scored period by keeping the time-averaged interior temperature of the freezer between -29.0°C and -15.0°C during the scored period. A temperature sensor will be located inside the volume and will be continuously measuring.

a) Reduced points are earned if the time-averaged interior temperature is between -34.5ºC and -29.0°C or between -15.0°C and -9.50ºC. Reduced points are scaled linearly, as shown in Figure 5.2.

b) The freezer volume shall be a minimum of 57 liters.



Full Points:	**-29^{O} C**	**≤**	**Temperature**	**≤**	**-15^{o}C**
Reduced Points:	**-34^{O} C**	**<**	**Temperature**	**<**	**-29^{o}C**
	-15^{O} C	**<**	**Temperature**	**<**	**-9.5^{o}C**
No Points:			**Temperature**	**≤**	**-34.5^{o}C**
			Temperature	**≥**	**-9.5^{o}C**

Figure 5.2: Freezer sub contest point's distribution

Sub-contest 5.3: Clothes Washing

All available points are earned for washing laundry by running a clothes washer through one or more complete, uninterrupted, "Normal" (or equivalent) cycle(s), during which a temperature sensor placed inside the clothes washer must reach 43.5°C at some point in the cycle. The sensor will be continuously measuring during the washer cycle.

a) Half of the available points are earned if the temperature sensor reaches 41.0ºC, but does not reach 43.5ºC.

b) A load of laundry is defined as organizer-supplied bath towels.

c) The clothes washer shall operate automatically and have at least one wash and rinse cycle.

d) One or more complete, uninterrupted, "Normal" (or equivalent) cycle(s) in an automatic clothes washer shall be used to wash the laundry.

e) On several days during contest week, two loads of laundry shall be required to be washed. Teams have the option to combine double loads and wash them in one clothes-washer cycle.

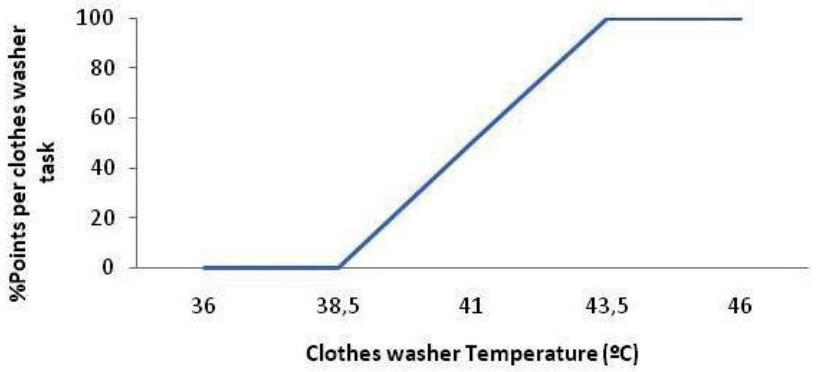
f) The drying function in a combination washer/dryer shall be disabled until the completion of the wash cycle.

g) Cycle "interruption" includes the adjustment of supply temperature or flow in a manner not anticipated by the manufacturer or addressed in its operation manual.

h) Cycle completion shall be confirmed by the observance of an audible or visible signal.

i) The organizers will consult the operation manual to identify appropriate cycle settings. "Normal" or "regular" settings shall be selected, if available. Otherwise, settings most closely resembling typical "Normal" or "regular" settings shall be selected.

j) Only water may be used for clothes washing. No other kind of soap or similar products may be used during contest.



Full Points:	**43.5^{O} C**	**≤**	**Temperature**		
Reduced Points:	**41^{O} C**	**≤**	**Temperature**	**<**	**43.5^{o}C**
No Points:			**Temperature**	**<**	**41^{o}C**

Figure 5.3: Clothes washer sub contest point's distribution

Sub-contest 5.4: Clothes drying

All available points are earned by returning a load of laundry to a total weight less than or equal to the towels' total weight before washing. Clothes drying shall be completed within a specified period of time.

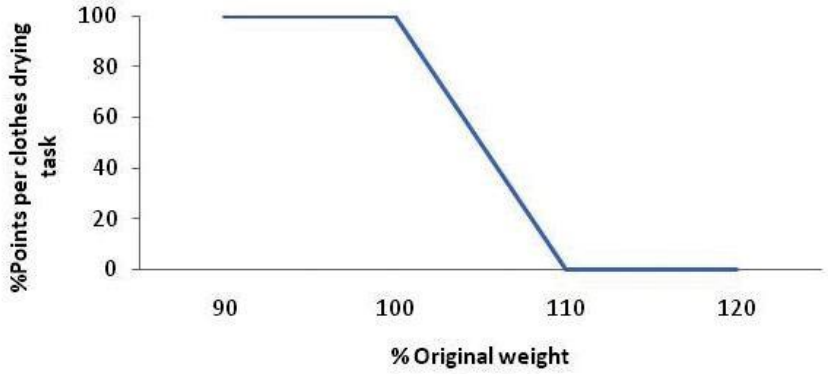
a) Reduced points are earned if the "dry" towel weight is between 100.0% and 110.0% of the original towel weight. Reduced point values are scaled linearly, as shown in Figure 5.4.

b) A load of laundry is eligible for clothes-drying points only if the load experienced a complete, uninterrupted cycle in an automatic clothes washer. However, scoring points in the Clothes Washer sub-contest is not a prerequisite for scoring points in the Clothes Dryer sub-contest.

c) 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.

d) To use drying methods different to the drying machine, the team must clearly indicate and explain it in the project documents and the drying place must be showed to the Architecture jury.

e) On several days during contest week, two loads of laundry shall be required to be dried. Teams have the option to combine double loads and dry them in one clothes-drying cycle, but each load will be scored separately.



Full Points:			**Weight**	**≤**	**100%**
Reduced Points:	**100%**	**<**	**Weight**	**<**	**110%**
No Points:			**Weight**	**≤**	**110%**

Figure 5.4: Clothes dryer sub contest point's distribution

Sub-contest 5.5: Dishwashing

All available points are earned by running a dishwasher through a complete, uninterrupted, "Normal" (or equivalent) cycle within a specified period of time, during which a temperature sensor placed inside the dishwasher must reach 49.0°C at some point during the cycle. The sensor will be continuously measuring during the washer cycle.

a) Half of the available points are earned if the temperature sensor reaches 46.0°C, but does not reach 49.0°C

b) The dishwasher shall operate automatically, have at least one wash and rinse cycle, and have a minimum capacity of six place settings according to the manufacturer's specifications.

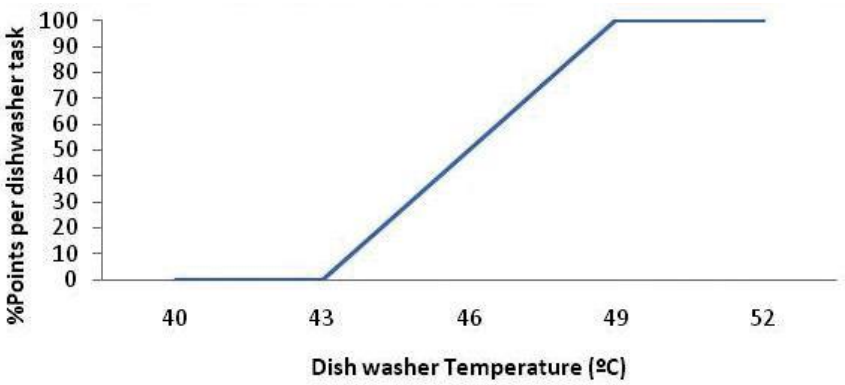
c) If the dishwasher has a heated drying option, this option shall be disabled.

d) Cycle "interruption" includes the adjustment of supply temperature or flow in a manner not anticipated by the manufacturer or addressed in its operation manual.

e) Cycle completion shall be confirmed by the observance of an audible or visible signal.

f) The organizers will consult the operation manual to identify appropriate cycle settings. "Normal" or "regular" settings shall be selected, if available. Otherwise, settings most closely resembling typical "Normal" or "regular" settings shall be selected.

g) The dishwasher may be run half loaded; the load may be soiled or clean.



Full Points:	**49^0C**	**≤**	**Temperature**		
Reduced Points:	**46^0C**	**≤**	**Temperature**	**<**	**49^0C**
No Points:			**Temperature**	**<**	**46^0C**

Figure 5.5: Dishwasher sub contest point's distribution

Sub-contest 5.6: Oven

All available points are earned at the conclusion of each scored period by keeping the oven temperature above or equal to 220°C during specified scored periods. A temperature sensor will be located inside the oven and will be continuously measuring every time it is turned on.

a) Reduced points are earned if the time-averaged interior oven temperature during specified scored periods is between 180ºC and 220°C. Reduced points are scaled linearly, as shown in Figure 5.6.

b) The oven volume published in the manufacturer's specifications shall be a minimum of 55 liters.

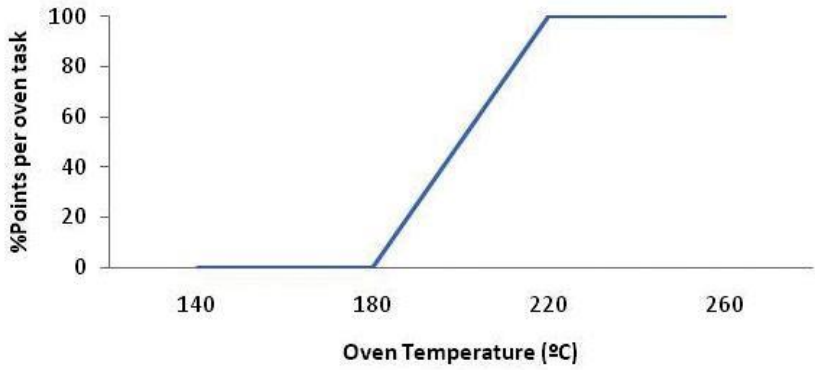
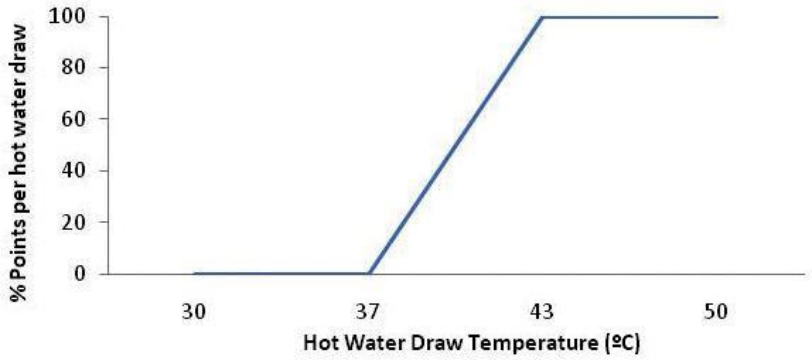


Figure 5.6: Oven sub contest point's distribution

Sub-contest 5.7: Hot water draws

Hot water draws will occur during the times specified in the Competition Calendar. For each draw, at least 50 liters of hot water shall be delivered in 10 minutes to qualify for points. All available points are earned be delivering an average temperature of at least 43ºC. An average temperature below 37ºC earns no points. For temperatures between 43ºC and 37ºC, points are scaled linearly, as shown in Figure 5.7.

a) These hot water draws are designed to simulate most of the washing and bathing tasks that would take place in a typical day.
b) The schedule of hot water draws will most likely vary from one day to the next, just as it does in a typical home.
c) The maximum number of hot water draws for one day will not exceed three, but they may occur consecutively.



Full Points:			**Temperature**	**≥**	**43^{O}C**
Reduced Points:	**37^{O} C**	**<**	**Temperature**	**<**	**43^{O}C**
No Points:			**Temperature**	**<**	**37^{O}C**

Figure 5.7: Hot water draws sub contest points distribution

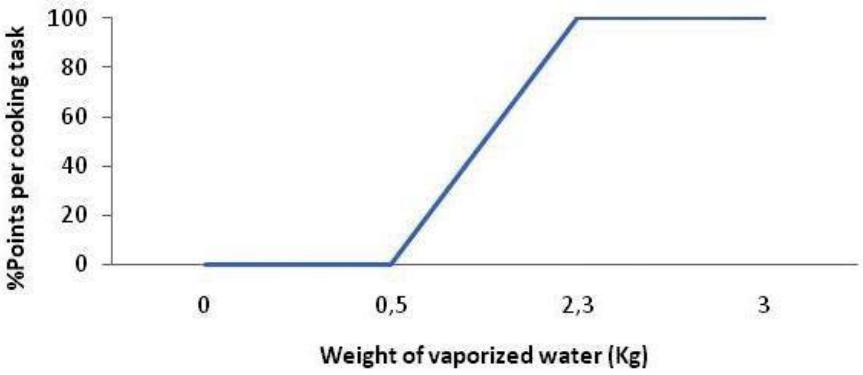
Sub-contest 5.8: Cooking

All available points are earned by using a kitchen appliance to vaporize 2.3 kg of water within a specified period of time.

a) Reduced points are earned if between 0.5 kg and 2.3 kg of water are vaporized. Reduced point values are scaled linearly, as shown in Figure 5.8.

b) Any kitchen appliance may be used, but it must operate in its Normal configuration as it is vaporizing the water.

c) The water shall be vaporized in a single pot and the starting water weight shall be at least 2.75 kg.



Full Points:			**Weight**	**≥**	**2,3kg**
Reduced Points:	**0,5kg**	**<**	**Weight**	**<**	**2,3kg**
No Points:			**Weight**	**≤**	**0,5kg**

Figure 5.8: Cooking sub contest point's distribution

Sub-contest 5.9: Home Electronics

All available points are earned for operating a computer, TV and a DVD player (or video player equipment) during specified periods of time. See Event Calendar for details regarding the number of points per home electronics task and the time periods designated for home electronics tasks.

a) The TV shall be a minimum of 21 in. (48.3 cm) according to the manufacturer's stated display size. The computer display shall be a minimum of 17 in. (43.2 cm) according to the manufacturer's stated display size. The computer may be a notebook, laptop, or desktop computer. The computer and video displays shall be able to be operated simultaneously and controlled independently of each other.

b) The functions of "Screensaver", "Stand by", or another mode that reduces the energy consumption of these devices have to be disabled during this sub-context period.

Sub-contest 5.10: Dining

Each team shall host three dinner parties during contest week. Dinner parties will feature a pair of guest decathletes from three neighboring houses, and each pair of guest decathletes shall assign a score to the host team after each dinner party.

a) To maintain consistency of this sub-contest, guest teams shall use the scoring chart that the observers will give to them (one per guest team) when entering the house for the dinner party. The guests must give the chart back to the observer, once completely filled out at the end of the dinner.

b) Each guest team shall assign a score to the host team after each dinner party. The quality of the meal, atmosphere, and overall experience needs to be considered in the evaluation as excellent, very good or good

c) There will be 8 messmates, 2 hosts and 6 guests (2 per team). Each host team shall prepare dinner for guests and team members.

d) Non-decathletes are prohibited from preparing the meal or instructing decathletes in any way on the competition site.

e) All meals have to be prepared in the houses with fresh ingredients stored in the refrigerator. Take-out and prepared over-the-counter food items are not permitted. Meals have to contain at least one main hot dish. The meal shall be served and eaten in the conditioned space at the eating area designated in the Construction Documents.

f) Before and after the dinner portion of the party, the host team is permitted, but not required, to serve hors d'oeuvres and/or beverages, which may be served outdoor.

g) Teams are required to submit detailed dinner party menus to the organizers. The organizers will review each menu for compliance. If corrective actions are required to meet all safety requirements, a team must submit an updated version of the menu.

h) Teams hosting dinner parties shall comply with the following safety requirements:

1. The use of fi re for cooking is prohibited.
2. All water used for cooking and drinking shall be drinking water purchased in sealed containers.
3. All dishes and cookware shall be washed with hot water and soap and rinsed prior to use.
4. Normal domestic wastewater may go into the wastewater tank. all
5. All beverages and food must be stored properly and according to the instructions on the packaging, e.g., beverages and foods marked "refrigerate after opening" must be refrigerated appropriately after opening.
6. To help prevent allergic reactions among dinner party guests, teams shall create a list of ingredients for each of the items being served at each meal. Common food allergies include milk/dairy products, eggs, peanuts, tree nuts (walnuts, cashews, pecans), fish, shellfish, soy, and wheat.
7. Outdoor cooking and grilling equipment may be incorporated into the competition house, but the use of such equipment is prohibited on the competition site because of fire safety reasons.

Sub-contest 5.11: Water Balance

To complete a whole house functioning, water management takes an important part of the process. To enhance this reality, water consumptions of each team will be measured during competition. The team with the lowest water consumption will achieve the maximum points. The points for the rest of the teams will be determined linearly in relation to the water consumed by the winning team.

Scoring

A total of 100 points will be awarded for this contest in the competition.

CONTEST 6: SUSTAINABLE TRANSPORTATION

Objective

Sustainable Transportation contest in the Solar Decathlon Middle East simulates the driving patterns of a typical household. In this contest, teams should drive an electric vehicle charged from their house electric system several times during the competition.

It will be assessed on

The collected data from the team's electric vehicle.

How it will be evaluated

This contest is based on readings from the electric vehicle odometer after completing the transportation tasks on the Competition Week.

Concepts to be evaluated

Measured kilometers driven using the electric vehicle.

Evaluation Criteria

Electric vehicle driving tasks will occur at the times specified in the competition calendar. Teams shall complete each task in no more than 120 minutes to qualify for points. All available points are earned by driving at least 40 kilometers (25 miles). For driving between 0 kilometers and 40 kilometers (25 miles), points for each task are scaled linearly, as shown in Figure 6.

a. These driving tasks are designed to simulate most of the transportation requirements that would take place for a household.

b. The schedule for the commuting tasks varies from one day to the next.

d. The vehicle must be driven by a decathlete who is licensed to operate a motor vehicle and accompanied by at least one passenger, who shall also be a decathlete.

e. Both the driver and the passenger must wear a seat belt and follow all applicable driving laws.

f. The electric vehicle may only be charged from the house electrical system. Any charging from alternate locations is considered a rules violation.

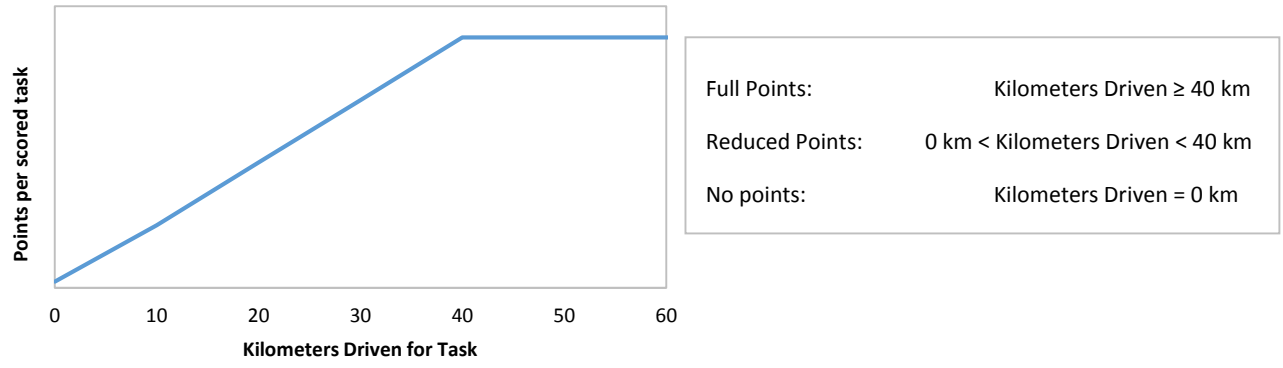


Figure 6: Transportation contest point's distribution

Scoring

A total of 100 points will be awarded for this contest in the competition.

CONTEST 7: SUSTAINABILITY

Objectives

To evaluate the skillful and the environmental sensibility of the teams (house design, techniques, systems and components) to attain the maximum reduction of negative environmental impact, during the house components manufacturing, the construction phase, the building's life cycle and demolition. Water Conservation initiatives incorporated in the design will also be evaluated.

It will be assessed on

The deliverables relative to the project, in particular in the Sustainability Report included in the Project Manual, as well as the assembly and functioning of the house in the Solar Hai.

How it will be evaluated

A multidisciplinary jury of professionals specialized in the different areas of this contest.

Concepts to be evaluated

- Sustainability in Architecture.
- Sustainability in Engineering and Construction.
- Sustainability in Energy Management.
- Sustainability in Urban design, Transportation and Affordability.

Each of these four items will correspond to 20 points. Each of the four components of this Innovation jury will have to detail its scoring, write and transmit it to the competition manager, at the same time they define the scoring for their own contest.

Evaluation criteria

Sustainability in Architecture:

To evaluate the passive strategies (to reduce energy consumption and resources of the proposed solutions: bioclimatic principles, eco-efficiency), the optimization of natural lighting (making optimal use of daylight) and the materials selection (emphasizing its ecological aspects and its possibilities for being reused and/or recycled). To evaluate the sustainability in the collectives alternates, such as the mean of transportation associate to the proposal.

Sustainability in Engineering and Construction:

To evaluate the Life-Cycle, the water consumption and the residue generation of the construction process, from the materials manufacturing (including energy) to the final set up (selective demolition plan, reusability). The structure flexibility and possibilities for being reused, adapting to future technological changes will also be evaluated. Then, Live Cycle Analysis simulations will be evaluated thanks to a specific tool (to be determined) in order to compare each house performances on a common basis, as a decision-support tool.

Sustainability in Management:

To evaluate the degree of local self-supply and adjustment strategies of generation-consumption. To evaluate the active strategies and systems which improve hydrothermal efficiency, artificial lighting efficiency and air quality, minimizing the associated energy consumption to the proposed solution. The high efficiency equipment (heating, cooling and ventilation, among others) maintenance will also be evaluated. To evaluate the high efficiency of the electric appliances selected for each house.

Sustainability in Urban design, Transportation and Affordability:
To evaluate the factors that directly influence the sustainability of the production of the houses, the degree of flexibility of use, maintenance requirements, optimization of assembly and disassembly, as well as the sustainability of the mobility strategy directly related to the houses and its context. The economic viability of industrialization will be evaluated, taking into consideration, the different possibilities of the model and system extension for one with major density and improved sustainability conditions.

Scoring
A total of 80 points will be awarded by the corresponding jury for this contest

CONTEST 8: VEGETATION AND HARDSCAPING

Objective
To measure the constructed surfaces ability to stay cool in the sun by reflecting solar radiation and emitting thermal radiation. To assess the functionality and the variety of planted species.

It will be assessed on
Computing the SRI (Solar Reflective Index) and roof surface temperature based on solar reflectance and thermal emittance using ASTM standard E 1980. Reflectance is measured according to ASTM E 903, ASTM E 1918, or ASTM C 1549. Emittance is measured according to ASTM E408 or ASTM C 1371.

How it will be evaluated
SRI can be calculated based on the pitch of a roof, its weight, its solar reflectance and its thermal emittance (emissivity).

Vegetation will be evaluated based on the planted species and their variety.

Concept to be evaluated

- Cool Roofs.
- Pavement.
- Light colors on the outside of buildings.
- Vegetation

Evaluation criteria

Sub Contest 8.1: Cool Roofs

There are generally two categories of roofs: low-sloped and steep-sloped. A low-sloped roof is essentially flat, with only enough incline to provide drainage. It is usually defined as having no more than 2 inches (5 cm) or vertical rise over 12 inches (30 cm) of horizontal run, or a 2:12 pitch. These roofs are found on the majority of commercial, industrial, warehouse, office, retail, and homes.

Low slope roof:

Table 5.1: Cool roof (LSR) sub contest point distribution

Full points	SRI ≥ 79
Reduced points	59 ≤ SRI ≤ 79
No points	SRI ≤ 59

Steep slope roof

Table 5.2: Cool roof (SSR) sub contest point distribution

Full points	SRI ≥ 29
Reduced points	19 ≤ SRI ≤ 29
No points	SRI ≤ 19

Note: If Green Roof area ≥ 51 %, full points will be earned.

Sub-contest 8.2: Pavement

- Porous asphalt systems earn credits for storm water management.
- The ability to recycle asphalt pavement and the use of asphalt with high percentages of RAP (Reclaimed Asphalt Pavement) make asphalt eligible for credits under the materials and resources heading.
- Light-colored asphalt pavements earn credits for urban heat island mitigation.
- The fact that asphalt pavement material is produced locally earn credits for materials and resources.
- Availability of warm-mix asphalt which supports sustainable development.

Full Points: Achieving at least 3 above mentioned features.

Reduced Points: Achieving 2 above mentioned features.

No points: Achieving 1 only or no feature.

Surface testing: Reflectance and Emittance will be tested by Hemispherical Directional Reflectometer, Solar Reflectance Index will be calculated by SRI Calculator.

Sub-Contest 8.3: Outdoor light colors

For housing units, at least 75% of the area of externally painted/cladded walls must have a minimum light Reflective Value (LRV) of 45%.

Example:

Table 5.3: Outdoor light colors sub contest point distribution

Wall (Reference Name/NO.)	Total external area (%)	LRV (%)	Points earned
1	≥ 75%	LRV ≥ 45 %	**Full points**
2	75%	39 % ≤ LRV≤ 45%	**Reduced points**
3	≤75%	LRV ≤ 39 %	**No points**

Sub Contest 8.4: Vegetated Areas

Vegetation located on housing unit roof or external areas must be of native/adaptive species. Whether plants were in pots or in portable planting units they must be from Dubai Municipality identified native/adaptive species provided in Section 9.5 from Dubai Landscape Regulations:

http://www.ehss.ae/forms/regulationen-9.0landscaperegulationsrev.02,nov14.pdf

To enhance biodiversity, 5 different species must be used to get full points. If vegetation area is less than 20% of total site area no points will be earned.

Table 5.4: Vegetated areas sub contest point distribution

Full Points:	5	≤	Native/Adaptive Species		
Reduced Points:	2	<	Native/Adaptive Species	<	4
No Points:			Native/Adaptive Species	≤	1
No Points:			Vegetated Area	≤	20%

Scoring
A total of 100 points will be awarded for this contest in the competition.

CONTEST 9: COMMUNICATION

Objectives
To assess the teams communication capacity to find creative, effective and efficient ways (adapted to each target group, avoiding any exclusion) of transmitting the Competition relevant topics (sustainability, innovation and energy efficiency) as well as those ideas that define the team's and project's own identity.

It will be assessed on
The deliverables relative to the project, as well as all the actions developed throughout the whole project development until the competition in Dubai. These include the different events organized (activities involving interaction with the public, i.e. Public Tours) and the material submitted (information transmission by any mean: audiovisual, electronic, written, etc. such as a documentary, media impacts or web sites). The jury will also assess how teams have planned to share their experience and put it to good use after the event and what will be the prototype's second life

How it will be evaluated
A jury of communication professionals shall assign an overall score to the team's communications plan, dissemination actions and its core message.

Concepts to be evaluated

- Effectiveness
- Efficiency
- Creativity

Evaluation criteria

Effectiveness: Clarity of the message chosen and its effective presence in the communication actions. Adequacy of the solutions designed for each target group and its pedagogic adaptation.

Efficiency: The audience reached compared to the resources invested. This assessment will not be only quantitative, as certain groups or geographic scopes require a greater effort.

Creativity: A consistent development of the team's Visual Identity and its ability for being put into any context without losing its essence. Originality and artistic value of the actions.

Scoring
A total of 80 points will be awarded for this contest in the competition.

CONTEST 10: INNOVATION

Objectives

To evaluate the innovation degree of the house in the preceding contests, focusing on emergent or radical and revolutionary changes in the house, in its systems or in its components, which increase its value and/or improve its performance and efficiency.

It will be assessed on

The deliverables relative to the project, as well as the assembly and the functioning of the house in the Solar Hai.

How it will be evaluated

The five juries will evaluate this contest as an independent concept.

Concepts to be evaluated

- Innovation in Architecture.
- Innovation in Engineering and Construction
- Innovation in Energy Management.
- Innovation in Urban design, Transportation and Affordability.

Each of these four items will correspond to 20 points. Each of the four components of this Innovation jury will have to detail its scoring, write and transmit it to the competition manager, at the same time they define the scoring for their own contest.

Evaluation criteria

Innovation in Architecture: evaluating to what degree, the proposed solutions and those built by the teams, provide new spatial and functional concepts, new languages in the formal use of materials, use of textures, and the appropriate use of light, in the individual scale as well as collective.

Innovation in Engineering and Construction: evaluating the innovation concepts in the house's structure and **systems.**

Innovation in Energy Efficiency: evaluating the active and passive innovative technological contributions maximizing the energy efficiency of the house; innovative ways to improve the hydrothermal, environmental, illumination and acoustic efficiency of the house, thus promoting the livability of the house, as well as facilitating the perfect functioning of the house and its equipment will be assessed.

Innovation in Urban Design, Transportation and Affordability: of the houses, assessing the novelty of the proposals in housing production, especially those that can be adapted to multifamily buildings. New ways of business, promotion and commercialization of the product with main goal to make the proposals affordable to the broadest possible spectrum of the population. The innovation in urban form will also be assessed.

Scoring

A total of 80 points will be awarded by the corresponding jury for this contest.

3. COMPETITION DELIVERABLES

Deliverable Submission Instructions

Each team should follow the defined schedule in sending the deliverables in the stipulated format, at the specific due dates and following the guidelines of the SDME 2018 Organization. For scientific dissemination reasons, all the deliverables should be in English.

Deliverables are considered to be on-time if they are received by the SDME 2018 Organization by 5 p.m. in Dubai (Dubai Time) on the respective due date. In the SDME 2018 Competition, there are two different ways for submitting the deliverables: shipped or electronic; depending on the materials or documentation required.

Teams not sending the deliverables on time, or not fulfilling with all the content requirements, will be subject of penalties. All the deliverables submitted are property of the SDME 2018 Organization.

Shipped Submission

The hard copies documents, along with the model and the audiovisuals are the only deliverable materials required to be sent to SDME address (to be stated soon).

Please do not submit physical copy of any other deliverable.

Electronic Submission

All electronic files shall be uploaded to the SDME 2018 website.

Computer Generated File Requirements

Any and all electronic fi les generated from a computer (drawings, specifications, renderings, etc.) shall be submitted as a PDF meeting the following criteria:

I. Embed all fonts.
II. Maintain a minimum resolution of 300 dpi.
III. The different sections shall be indicated with bookmarks

a) Whenever possible, utilize the “Save As” or “Export” to PDF functions within a CAD, 3-D rendering, or illustration application to produce a PDF.
    I. Utilizing the native application’s PDF functions usually produces a smaller, cleaner PDF with fonts defined and illustrations and drawings retained as vector objects.
    II. Available options for PDF creation vary between applications — be sure to always select the option to embed all fonts and keep image compression at a minimum of 300 dpi.
    III. If there are color options, choose no conversion if available. If not, select RGB conversion as that will typically yield a smaller file than CMYK.

b) If an application does not support a direct-to-PDF function, create a postscript file by printing to a postscript printer with the “print to file” option selected. Use this postscript (.ps or .prn) file to create a PDF using Acrobat Distiller’s high-resolution job settings.
    I. Creating a PDF from scans, or by outputting the drawings into a raster image format (.jpg, .tiff, .png, .gif, etc.) and then creating a PDF from the images, is NOT ACCEPTABLE.
    II. All-raster PDFs are large fi les at 300dpi, are of unacceptable quality at lower resolutions, and are not scalable without degradation.

c) For logos, submit the PDF file AND a text file containing the following additional information:
    I. Name, phone number, and e-mail of person submitting the logo PDF.
    II. A list of all PMS or CMYK numbers used in the logo PDF.
    III. A PNG version, with same size and resolution of the PDF logo.

Multimedia File Requirements

Teams may submit photographs, graphics or videos in each deliverable, to complete the information submitted or give further details.

a) Photographs shall be submitted in the native format of the camera, such as JPEG or RAW, if available.
b) Every file conversion or image resampling from the original results in image degradation, so keep conversions to a minimum.
c) Color photos must be in RGB, 8-bit color.
d) For multimedia fi les to be properly credited, the following information shall be included in each file's metadata or in a text file accompanying the files:
    I. Name, phone number, and e-mail of person submitting the file
    II. Multimedia file editor's name and affiliation.
    III. For photographs, please indicate date and location

File Naming Instructions

The required file-naming convention for all electronic files follows:

[TEAM ABBREVIATION]_[DELIVERABLE ABBREVIATION]_[SUBMISSION DATE (YYYY-MM-DD)].[EXTENSION]

Example #1: A set of Updated Constructive Development Project Drawings submitted by University X (AAA) to the organizers for follow-up review on April 12, 2018, would have the following file name:

AAA_PD#4_2018-04-13.pdf

Example #2: A set of three multimedia fi les submitted by University X (AAA) to the organizers on May 16, 2017, would have the following file names:

AAA_MF_1_2018-05-16.pdf

AAA_MF_2_2018-05-16.pdf

AAA_MF_3_2018-05-16.pdf

List of Team Abbreviations

Team Name	**Abbreviations**
University X	AAA
To be determined	To be determined

List of Deliverable Abbreviations

Deliverable Number	**Electronic Documentation Name**	**Abbreviations**
Deliverable #1	Press Release #1	PR#1
	Project Manual #1	PM#1
	Project Drawings #1	PD#1
Deliverable #2	Press Release #2	PR#2
	Audiovisual #1	AV#1
Deliverable #3	Press Release #3	PR#3
	Project Manual #3	PM#3
	Project Drawings #3	PD#3
	Workshop Documentation	WD
Deliverable #4	Press Release #4	PR#4
	Project Manual #4	PM#4
	Project Drawings #4	PD#4
Deliverable #5	Press Release #5	PR#5

	Project Manual #5	PM#5
	Project Drawings #5	PD#5
	Simulation Input Report #1	SIR#1
Deliverable #6	Press Release #6	PR#6
	Project Manual #6	PM#6
	Project Drawings #6	PD#6
	Solar Hai Documentation	VSOL
	Audiovisual #2	AV#2
Deliverable #7	Press Release #7	PR#7
	Project Manual #7	PM#7
	Project Drawings #7	PD#7
	SDME 2018 Official Dissemination Materials	ODM
	Simulation Input Report #2	SIR#2
Any Deliverable	Multimedia fi les	MUL

Documents formatting requirements

Project Drawings and Hard Copies Drawings

ISO “A3” (297 mm X 420 mm) sheet size

Packaged into a single PDF file

Consistent with the Project Drawings Template

Project Manual and Hard Copies Manual

ISO “A4” (210 mm X 297 mm) sheet size

Packaged into a single PDF file

Consistent with the Project Manual Template

Press Release

ISO “A4” (210 mm X 297 mm) sheet size

Packaged into a single PDF file

Revision and Evaluation Criteria

The deliverables will be reviewed by the SDME 2018 Organization during the previous phases of the Competition in order to verify the Rules compliance. Moreover the organizers are to help the teams to understand the rules and comply with them.

Specific juries of each contest will evaluate the delivered documentation by the teams following their criteria, guidelines and basic parameters previously established in the SDME Rules.

DELIVERABLE PHASES

Schematic Design Documentation

Deliverable #1 primary objective is to verify the work that the teams are generating among the various fields to develop in the project. It is also designed to identify, as soon as possible, any aspect or design which does not fit or match with the sense of the Competition.

In the Schematic Design Documents the project must be defined as a functional machine, demonstrating the advances, targets and goals of their original proposal, in compliance with the Solar Decathlon Building Code and the Solar Decathlon Middle East Rules, or at least the intend of accomplishment. Therefore, it is not

mandatory to include for this deliverable, all the sections included neither in the Project Manual nor in the Project Drawings. Note: The proposals sent with this deliverable can be subject of complete revisions by the teams in following deliverables.

Dissemination Materials

The second deliverable of the SDME 2018 Competition is intended to compile materials from every participant team, in order to start organizing different events and activities, to contribute to the SDME goal of Disseminating Knowledge and Project Diffusion. Dissemination Materials will be verified as to comply with the SDME Rules.

The materials submitted by the participant teams in this deliverable will be used by the SDME 2018 Organization for the different dissemination activities planned.

Design Development Documentation

At this stage of the Competition, projects will have to include an extensive description of the Project details and specifications, of the materials, constructive systems, equipment, footing, structural and trades report, and details drawing. Teams will have to consider all the remarks made by the SDME 2018 Organization in the previous Deliverable, and design and plan accordingly.

This deliverable will be used to prepare the sessions that are going to be held during the Workshop in Dubai. Therefore, teams are encouraged to submit more specific documentation, in order to receive much more detailed feedback, apart from submitting the Workshop Documentation specifically required.

Construction Documentation

Deliverable #4 aims to have all the necessary information to define the Construction of the Solar Hai, and to foresee all the elements required for that purpose.

The Construction Documentation the following important functions:

- The Construction Documents shall demonstrate compliance with the Solar Decathlon Middle East 2018 Building Code and the Solar Decathlon Middle East Rules so that the inspectors will be able to grant final on-site approval by simply verifying that the constructed project on the competition site was accurately represented by the Construction Documents.
- The Construction Documents shall clearly describe a team's proposed assembly and disassembly procedures. The Site Operations Manager will review the teams' procedures to identify and address potential conflicts among the teams. Each team is encouraged to consult the Site Operations Manager as the relevant sections of the Construction Documents are being developed.
- The Construction Documents shall provide a residential contractor with all the information needed to generate an accurate, detailed cost estimate and to efficiently construct the building as the design team intended it to be built. The Construction Documents must be comprehensive because the design team shall assume that the contractor has had no prior communication with the design team, has no prior knowledge of the design, and has little or no experience building high-performance residences.

The objective of Deliverable #5 is to obtain additional information and update the documentation sent in Deliverable #4 based on the requirements made by the SDME 2018 Organization, including changes and design adjustments from the last deliverable. Deliverable #5 is the most important deliverable of the SDME Competition before the Final Phase of the SDME 2018 Competition.

This deliverable is planned in order to organize the documentation being sent to the Juries, and to not have any teams' documentation mistaken. Since the juries have a very limited opportunity to evaluate the constructed projects on the competition site, the Construction Documents provide the only means for a team

to give a detailed presentation of its project to the juries. In the weeks leading up to contest week, each juror shall evaluate sections of the teams' Construction Documents relevant to the juror's respective area of expertise.

Design Adjustments Documentation

Late design changes "The final project assembled on the competition site shall be consistent with the design and specifications presented in the construction documents".

The Design Adjustments Documentation Deliverable will be opened to the participant teams from the day after Deliverable #5 due date. Therefore, if there is any change in your project, after Deliverable #5 – Updated Construction Documentation, you must send it to the SDME 2018 Organization, as soon as possible.

The corresponding missing and/or revised information will be passed on to the building inspections group, who will verify that the constructed house corresponds to the house design, at the Competition Site, and will not penalize your team for any incongruity. However, there will be neither feedback nor revision done if teams do not request it specifically. Please do not send the complete documentation again, but just the part of it being changed, attaching to the documents a brief description of the changes that have taken place.

Deliverable #6 also includes the Solar Hai Documentation, with information required to prepare the Solar Hai Visiting Guide and the Jury Reports.

As Built Documentation

The objective of deliverable #7 is to have the "as-built" drawings and specifications of the participant houses, with an extensive description of the details and specifications of the materials, constructive systems, equipment, structure, plumbing, HVAC, etc.

Teams must record any changes of the Project Documentation during the fabrication, construction or assembly process and reflect them in the As-built Documents.

Deliverable #7 is the last Deliverable of the SDME Competition, and it will be issued after the Final Phase of the SDME 2018 Competition, so it will define the house as it was built in the Solar Hai, as well as the team's strategy during the Contest Week. This deliverable includes the Simulation Input Report, which is the document that compiles the houses' technical data that will be the base of the future Scientific Strategies Plan (SSP) database.

SHIPPED DELIVERABLE MATERIAL

Hard Copies

- Electric Drawings and Calculations
- Structural Drawings and Calculations
- Certificate of Country of origin Code compliance

Architectural Model

Teams must submit an architectural model of their houses to the organization within Deliverable #2. The detail level will be chosen by the team, according to the model scale and to their competition strategy. The model will be metric scale 1:25, base dimensions of 80 cm x 80 cm. It is possible to include lighting in the model but the SDME 2018 Organization may not guarantee that it will be switched on in all the exhibitions.

The model must be built and packaged with appropriate materials, in order to withstand handling and transportation. Along with the model, a methacrylate display case, 5 mm thick must be included, following the indications given by the SDME2018 organization.

To make transportation and exhibition assembly easier, and contribute to the exhibition homogeneity, models will be sent with the display case inside a plywood box, according to the design proposed by the SDME2018 Organization.

Teams may replace their model by shipping the new model to the address specified in Rule 26.1, only after having communicated that decision to the SDME 2018 Organization via the SDMEWAT, and specified if they wish to have the old model back to their university (at the university's expenses) or being discarded by the SDME 2018 Organization in Dubai.

Project Description Poster- Teams must submit a poster describing their project. This poster will be shown with the model in exhibitions, or independently in events, to disseminate the SDME 2018 Competition. The requirements for the model, display case and poster design and packaging will be specified through the SDME Portal/Website.

The project description poster may be updated whenever the Team wishes to, after having communicated that decision to SDME 2018 Organization.

Audiovisual

Audiovisual #1- For Deliverable #2, teams must produce an audiovisual presentation to show the goals of the teams, explain their projects, the technologies to be used and those sustainable concepts applied. These audiovisuals will be used for the SDME Competition dissemination.

Audiovisual #2- For Deliverable #6, teams must produce an audiovisual presentation to show its final achievements, explain their houses, the technologies used and those sustainable concepts applied. These audiovisuals will be used during and after the Solar Hai to disseminate the SDME Competition. Audiovisuals #1 and #2 may be replaced at any time after having communicated that decision to SDME 2018 Organization via the SDME Portal. The SDME Organizers will verify compliance with the SDME Rules and replace it as soon as possible.

Technical Requirements:

- Maximum length: 5 minutes
- Language: English. Other spoken languages might be used in punctual interventions, but they must be subtitled or doubled in English.
- A written version of all spoken parts must be given to the organization in English.
- Format: Full HD 1080p o 1080i(1920×1080 px).
- VIDEO:
  Encoding: Mp4 compression H.264.
  Frames per second: 25 ó 29.97 fps
  Minimum Bitrate: 4000 (more is better)
- AUDIO:
  Encoding: MP3 (MPEG-1 Audio Layer 3) or Ogg Vorbis Frequency: 44.8 or 44.1 Khz.
  Number of channels: 2 channels stereo Minimum Bitrate: CBR or VBR 128kb/s
- Recognition of all team sponsors and supporting institutions must be limited to a maximum of 1 minute or 20% of the total time (whichever is less).

TEAM WEB PAGE

Preliminary Web Page

A preliminary Web site URL to a site consisting of at least three pages shall be submitted with Deliverable #1. The sites should offer then, at least, basic information about the university or universities that support the

team, as well as the webmaster, communications, and sponsorship manager contacts. Solar Decathlon Middle East logo must be included and linked to the competition's webpage.

Web Site Page

The final URL for the team Web site shall consist of considerably greater content than the Preliminary Web site submitted, and must comply with the following requirements. The organization will continuously monitor the team's websites, asking for those chances necessary to comply with the competition's rules and proposing improvements on them.

The final Web site URL shall be evaluated by the Communications Jury during the competition.

1. Encoding

Teams' websites must comply with the W3C encoding guidelines, as well as the international accessibility standards WCAG 2.0 (http://www.w3.org/WAI/guid-tech.html). Websites have to pass the W3C test for HTML 4.01 Transitional or XHTML 1.0 Transitional (http://validator.w3.org/).

- File names do not contain uppercase letters, spaces, or special characters (e.g., & or $).
- Forms include text labels that correspond with form controls and markup to associate the two.
- Equivalent alternatives are provided for all multimedia. Pages requiring an applet or plug-in must provide a link to a page where the applet or plug-in can be downloaded.

2. Compatibility

The website will be compatible with the following web browsers: Internet Explorer (version 6 onwards), Firefox, Safari and Opera.

- Pages must display correctly (e.g., no horizontal scrolling is necessary to view the full width of the page) in 1024 x 768 resolution (800 x 600 resolution is also acceptable).
- The website will be accessible by mobile devices such as smart phones and tablets. If that would be not possible an alternative dedicated version must be developed, in a way that users are diverted automatically by an automatic device detection system.
- That website will be compatible will the most popular mobile systems, including, at least, those made by Apple and RIM and devices based on Android and Symbian operating systems.
- Other: Scripts/applets/dynamic pages (CGI, JavaScript, Java, etc.):
  Every script works correctly in the standard browser set.
  Content produced by scripting languages is accessible or has an accessible alternative.
  Pages requiring applets or plug-ins must provide a link to an accessible page where they can be downloaded. If a timed response is required, the user can request more time to complete an operation.
  Back button functionality is not impaired.

3. Style
   - It must have an attractive design that invites navigation
   - With contents that will make it dynamic, combining images and/or videos/demos that accompany the text.
   - Page information conveyed with color is also available without color, and foreground and background colors provide sufficient contrast. Graphic style is consistent throughout the site.
   - Basic Elements of content:
     The objective of the page and its identification with its creator must be clear from the beginning.

Brief description (with the possibility of extending it) of the key identifi cation data: who, what, description, objectives, etc.
It is recommended that it be regularly updated.

4. Language

The entire website's content must be available in English, and optionally, in any other language.

5. URL

Teams must have their own internet domain, using either a geographical (.ae, .fr etc) or a generic .com or .org one.

6. Contact

At a minimum, an e-mail contact to the Webmaster is provided as a graphical or text link on the home page of the site. Additionally, the webpage will include a press and a sponsorship contact.

7. Sponsors' Recognition

Teams' websites will contain a specific section where supporting institutions and sponsors will be named or represented by their logos, linking to their web pages. We encourage teams to ask those institutions and business to put the combined version of SDME + team logo, with the "Team sponsor" or equivalent heading, in their homepages, linking to the website of the team which they are supporting.

8. SDME Brand & Organization Recognition
    - The SDME logo must appear in every section of the web, linking to the SDME Competition URL http://www.solardecathlonme.com, specifying "participant team". Moreover, the SDME Organizer's logos (level 2) must appear in these situations foreseen by the SDME Corporate Identity Manual.
    - Teams' web page must include a section for the publication of all the Press Releases the SDME 2018 Organizations sends to the teams. In this same section, teams may include any complementary information they find appropriate (for example, news, blog).
9. Advertising

Advertisements are forbidden in team's websites. Sponsor's logos may be freely placed but commercial messages are not allowed.

10. Current Legislation Compliance

Contents as images, files or codes employed in programming, have to be copy left authorized to teams or owned by them. If forms or any kind of user information storage is enabled, it must comply with team's (or it server's) country law.

ELECTRONIC DELIVERABLE DOCUMENTS

Press Release

The SDME 2018 Organization will use the information provided by the teams in this document for the SDME2018 Competition dissemination. Therefore, this will be the part of every deliverable which will be made public, and shall, at least, include the following elements:

- List of team members.- Team Officers, students, teachers and other collaborators indicating their studies / specialty. Moreover, students shall specify the university course they are attending, and teachers and other collaborators shall mention their degree, research field and teaching areas, making

special emphasize in those aspects, which the team consider most relevant. Please keep this information updated within each deliverable and make sure to include all the Team Officers

- Project description.- Teams must include an essay from 500 to 1500 words, explaining the progress made in the project, as well as updated information on the dissemination activities realized since the previous deliverable. The target publics for these documents are international mass media journalists, so it is important to use a clear structure, and include complete, updated and easy to understand information. Among others, teams should focus on:
    - Team's organization and objectives.
    - Project development and current state.
    - House's description and relevant items (technologies, materials, etc).
    - Dissemination activities and current impact.
- Collaborating institutions and sponsoring companies.- Short description of each of them, identifying their field of work and defining the collaboration established with the team. Please keep this information updated within each deliverable.
- Project images.- Within each deliverable, teams must provide new high quality images (300 ppp .jpg) all free of rights, for their publication in printed media and/or television. These images must show the progress of the project. Among others: sketches / drawings, render, working models, interesting devices in the project, pictures of parts of the house, of the daily work of the team and of the dissemination activities realized may be included. An updated group photo of all the team members must be included with each deliverable. These images must be included in the Press Release document and submitted also as independent multimedia files.

Teams must keep the requested information updated from one deliverable to the next. Additionally, teams may include any other material they wish the SDME 2018 Organization to use for the SDME 2018 Competition dissemination, which complements the aforementioned information. The Teams' Press Releases will be published through the SDME website.

Project Drawings Template

The Project Drawings must be consistent with the SDME Project Drawings formatting template and guidelines. In order to have the Drawings of the Deliverables organized and named, it involves the basic principles to follow. It is not necessary to include all the Drawings mentioned. In case there are particular drawings that do not fi t in this Template, those must be located where appropriate (you may ask the SDME 2018 Organization through the SDME Portal, if necessary). If you have drawings corresponding to two different sections, put it in the most general one and indicate its final location.

To name the drawings a code will be used. The code is as follows:

- 2-3 letters; The letters indicate the corresponding block – GE-General; AR-Architecture; IN-Interiors; etc.
- 3 numbers; The numbers rank each block into three different levels: the first establishes the sub-blocks (plan, section, elevation, etc.) the second number identifies the different items existing inside each sub-block (footing, first floor, second, etc.) the third digit lists the specific drawings inside each item.
- e.g.: The drawing AR-104 – correspond to: AR to the Architectural block 1 to the Elevation sub-block 0 to the Site item 4 to the specific drawings – Southern Elevation

Therefore as each team, depending on their project and its particular characteristics, may need of more or less drawings inside concrete sections, the last number is left for the specific drawings each team considers. The SDME Project Drawings formatting template and guidelines are included in the following list.

1. GENERAL (GE)

GE-001 Cover sheet
GE-101 Sheet List. (This is the “table of contents” or “index”. It is not too useful in a bookmarked PDF, but it is essential in printed copies.
GE-201 General Symbols. (Define symbols and list notes used throughout the entire drawing set.)
GE-301 General Abbreviations. (List of abbreviations used throughout the entire drawing set). GE-401 Exterior Renderings.

2. ARCHITECTURAL (AR)

AR-001 Solar Hai Plan. (Site plan including the lot location inside the “Solar Hai”).
AR-011 Site Plan. (Showing Solar Envelope and Architectural Footprint compliance).
AR-021 Floor Plan
AR-031 Roof Plan
AR-041 Reconfigurable features.- (Plan showing the exterior moveable components, the Solar Envelope and the Architectural Footprint).
AR-051 Maximum & Minimum Measurable Area. (Show compliance with minimum & maximum measurable area).
AR-101 Site Elevation. (Site elevations showing Solar Envelope and Architectural Footprint compliance).
AR-111 Building Elevations

Sections

AR-201 Longitudinal Sections
AR-211 Transversal Sections
AR-301 Window Schedule and Details (Included thermal transmittance)
AR-311 Door Schedule and Details (Included thermal transmittance)
AR-321 Floor Construction Details (Included thermal transmittance)
AR-331 Roof Construction Details (Included thermal transmittance)
AR-341 Wall Sections and Construction Details (Included thermal transmittance)
AR-351 Partitions Details

3. BIOCLIMATIC ANALYSIS (BA)

BA-001 Bioclimatic drawings (passive design strategies)

4. INTERIORS (IN)

IN-001 Floor
IN-101 Reflected ceiling
IN-201 Elevations
IN-301 Furnishings
IN-401 Kitchen Plan (Furniture and Appliances)
IN-411 Kitchen Elevations (Furniture, Appliances and Details)
IN-501 Bathroom plan (Fixtures and Accessories)
IN-511 Bathroom Elevations (Fixtures and Accessories)
IN-601 Interior Renderings

5. STRUCTURAL (ST)

ST-001 Foundation Plan and Details
ST-011 Structural Floor Plan(s)
ST-021 Structural Roof Plan
ST-101 Structural Longitudinal Sections

ST-111 Structural Transversal Sections
ST-201 Structural Blow ups
ST-301 Structural Details

6. FIRE PROTECTION (FP)

FP-001 Fire Protection. (Detection, alarm, suppression and egress).

7. PLUMBING (PL)

PL-001 Plumbing Plan. Supply and removal (cold and hot water)
PL-011 Grey Water
PL-021 Drain / Waste / Vent
PL-101 Schematic diagram
PL-201 Supply and removal Isometric (cold and hot water)
PL-211 Grey water Isometric
PL-221 Drain/Waste/Vent Isometric

8. SOLAR WATER HEATING (SW)

SW-001 Plan SW-101 Isometric

9. MECHANICAL (ME)

ME-001 HVAC distribution Plan
ME-011HVAC equipment
ME-021 Heating
ME-031 Cooling
ME-041 Ventilation
ME-101 Mechanical room elevations
ME-201 HVAC System Schematic drawings
ME-211 Heating mode Schematic drawings
ME-221 Cooling mode Schematic drawings
ME-231 Controls
ME-301 Isometric Distribution

10. ELECTRICAL (EL) Please refer to Note 1 (below)

EL-001 Grid interconnection
EL-201 DC wiring diagram
EL-301 Power plan
EL-401 Lighting plan
EL-501 One-line Diagram
EL-601 AC Circuit layout

11. PHOTOVOLTAIC SYSTEM (PV) Please refer to Note 2

PV-001 Photovoltaic system: general
PV-011 Photovoltaic system: DC circuits
PV-021 Photovoltaic system: AC circuits
PV-031 Photovoltaic system: grounding system

12. TELECOMMUNICATIONS AND BUILDING AUTOMATIZATION SYSTEM (BAS)

BAS-001 Wiring plan
SECTION 3.0 DELIVERABLES
BAS-101 Schematic diagram
BAS-201 Equipment

13. **SDME INSTRUMENTATION DRAWINGS (ID)** Please refer to the Technical Monitoring Procedures Document.

ID-001 General Monitoring
ID-002 Monitoring panel room
ID-003 Electricity meters topology
ID-004 Electricity meters connection
ID-005 House appliances

14. **SITE OPERATION (SO) Please refer to Note 3**

SO-001 Outside Logistic. Solar Hai
SO-101 Inside Logistic. Approximation
SO-201 Load / Unload
SO-301 Assembly / Disassembly

15. **HEALTH AND SAFETY (HS)** Please refer to Rule 3.3, H&S section in Building Code and the H&S Plan Template in Appendix.

HS-001 Health and Safety Plan

16. **PUBLIC TOUR (PT)** Please refer to Note 5

PT-001 Site accessibility
PT-101 House tour floor plan
PT-201 House Tour General Information

Notes:

1. The ELECTRICAL (EL) drawings must include electrical layouts, a detailed electrical components information and complete electrical diagrams of the conventional electrical installation showing all elements and protections (including those of the interface between the Photovoltaic system and the electricity distribution network).

2. The PHOTOVOLTAIC SYSTEM (PV) drawings must include electrical diagrams describing all components (equipment), wiring and protections. The general diagram of the photovoltaic system (PV-001) shall include the interface with the electrical installation of the house and the electrical distribution network. Drawings reference numbers indicated show the minimum drawings required for approval. Additional drawings can be included, provided that they are placed on the corresponding sub-section, for example: for details of DC circuits, new drawings with reference numbers PV-012, PV-013,… up to PV-019 can be added; the same applies to details of the PV system as a whole (new drawings: PV-002 to PV-009), AC circuits (PV-022 to PV-029) and Grounding system (PV-031 to PV-039).

3. The SITE OPERATIONS (SO) shall describe graphically or textually the following aspects.

Outside logistic. Solar Hai: Brief description of the Solar Hai using the drawings that will be given to the contestants, the intrinsic conditions of the Village and the way to solve them will be identified.

Inside logistic. Approximation: detailed process of approximation of transport vehicles, up to their arrival at the lot. Indicating: Type and number of vehicles, order of entry, dimensions and load per axle of each vehicle, turn ratios, characteristics and dimensions of the load to be transported (with the weight of all the elements), way to proceed with the unloading, etc. Load/ Unload: Execution plan of loading and unloading operations. The lot, accesses, loading and unloading area, elements and materials stock area and footprint of the house in its final position will be signposted graphically.

Assembly/ disassembly: Plan for the assembly and disassembly. It will include graphics with the assembly and disassembly phases, work units, persons that will take part, necessary machinery, auxiliary resources, necessary timing, etc.

4. PUBLIC TOUR (PT) Illustrate the tour in detail, marking objects, furniture, obstacles during the tour and how will they be solved (dimensions, distances, ramps percentage, turning circle, heights). If there are any movable elements which are going to be shown to the visitors, include a sketch of the moving mechanisms and measures adopted to assure the safety of the visitors.

Project Manual Template

The Project Manual must be consistent with the SDME Project Manual formatting template and guidelines. In order to have the Project Manual of the Deliverables organized and named, it involves the basic principles to follow. It is not necessary to include all the sections mentioned. In case there are particular sections which do not fi t in this Template, those must be located where appropriate (you may ask the SDME 2018 Organization through the SDME portal or email, if necessary). If you have information corresponding to two different sections, put it in the most general one and made the appropriate reference of its location wherever corresponds. Note: Concerning only Contest Support Documents, SDME 2018 Organization will attach greater important to quality of information rather than to quantity.

The SME Project Manual formatting template and guidelines are included in the following list.

1. **COVER SHEET.**
2. **SUMMARY OF CHANGES**
3. **TABLE OF CONTENTS.**
4. **RULES AND BUILDING CODE COMPLIANCE CHECKLIST**
    1. Architecture Design Narrative
    2. Engineering and Construction Design Narrative
    3. Energy Efficiency Design Narrative
    4. Communications Plan
    5. Industrialization and Market Viability Report - See Rule 39 6.Innovation Report
    6. Sustainability Report
    7. DINNER PARTY MENU
    8. COST ESTIMATE AND PROJECT FINANCIAL SUMMARY
    9. SITE OPERATIONS Report
    10. HEALTH & SAFETY PLAN
    11. DETAILED WATER BUDGET
    12. ELECTRIC AND PHOTOVOLTAIC CHART
    13. CONSTRUCTION SPECIFICATIONS
    14. STRUCTURAL CALCULATIONS

Workshop Documentation

Public SDME 2018 Workshop Dissemination Brochure: Teams must submit the following information, which will be used for the SDME 2018 Workshop Dissemination Brochure:

- Text: Include the name of the house, of the team, and of the university. Also a brief description of the project, of approximately 200 words, explaining its main goals and innovative elements. This text will be published in French and English, both versions being provided by teams.
- Images: three photographs for the public dissemination of the project:
  House's render: 1 high quality rendering (minimum 300ppp .jpg) or vector (.eps or .pdf).
  House's Plan, vertical and cross sections: 1 clean vector file of the vertical section, plan and cross section, scaled 1/500 - 1/1000 (.eps or .pdf).
  Other relevant image: 1 high quality picture of the project (.jpg minimum 300ppp, or vector .eps or .pdf).

Teams project poster: Teams must submit a poster describing their project. This poster will be shown with the model in exhibitions, or independently in events, to disseminate the SDME 2018 Competition. The requirements for the poster design will be specified through the SDME Portal.

The project description poster may be updated whenever the Team wishes to, after having communicated that decision to SDME2018 Organization.

Teams description poster: Teams must submit a poster describing their team's organization. This poster will be shown with the model in exhibitions, or independently in events, to disseminate the SDME 2018 Competition. The requirements for the poster design will be specified through the SDME Portal.

The teams' description poster may be updated whenever the Team wishes to, after having communicated that decision to SDME 2018 Organization.

Solar Hai Documentation

The Solar Hai Documentation will include two different types of documentation:

Information to prepare the Solar Hai Visiting Guide:

Teams must submit information and material regarding their project, in order to prepare the Solar Hai Visiting Guide, which will be given to all professional visitors attending the Solar Hai. Therefore, to have enough time to produce the "Solar Hai Visiting Guide" it is extremely important to follow the indications given, as the descriptions and images must be exactly as specified.

Professional visitors must be able to understand the basic layout and characteristics of the team's project with just a brief reading of this guide thus making it mandatory to give information, which is as precise and accurate as possible.

This documentation will be published in French and English versions provided by teams.

Note: Please refer to the related information available through the SDME Portal for the specific due dates for the Information to prepare the Solar Hai Visiting Guide.

Jury Reports:

Teams must submit a brief report or summary for each one of the six Juried contests. These briefings intend to make juror's revision easier by giving them a short summary per participating team. Therefore, before the event begins, these reports will be given to the members of the juries associated with each of the contest activities. The jurors and judges use the reports and the documents submitted by the teams to preview what they would be evaluating at the event. The following reports must be submitted:

- Architectural Brief Report
- Engineering and Construction Brief Report

- Energy Efficiency Brief Report
- Communication and Social Awareness Brief Report
- Industrialization and Market Viability Brief Report
- Sustainability Brief Report

Apart from the relevant information, all of them must include a detailed description of all the innovative aspects considered in order to evaluate them for the Innovation Contest,

These reports give the teams the opportunity to emphasize the most important aspects of their proposal regarding the corresponding contests. Moreover, the following requirements must been met:

- The length, including all text, figures, tables or equations, may be no more than 4 pages (A4 sheets) per Juried contest.
- The body text and captions must be in 11 pt. (or larger) font size.

These documents will be published on the SDME 2018 website after the official award ceremony in order to provide first-hand information to share within the scientific community.

Simulation Input Report

One of the main objectives of Solar Decathlon Middle East competition is to generate knowledge about the industrialization and sustainability conditions of housing and to provide the best conditions to promote scientific advances and to disseminate the knowledge acquired. The main tool used to achieve this goal is the Scientific Strategies Plan (SSP). This plan is intended to compile, document and manage the technical information produced in the process of creating the houses' projects.

After the SDME 2018 competition, all the documentation generated in the Scientific Strategies Plan will be shared with Universities, Schools and Institutions with the aim of laying the foundations of future researches and publications in the field of sustainable building construction.

The SSP consists on the Simulation Input Report (SIR), plans and reports submitted by the teams that take part in the competition. The Simulation Input Report is the document that compiles the houses' technical data that will be the base of the future SSP database. It contains two main documents: technical fi les in excel format and fi les. SDME 2018 Organization would like to make decathletes aware of the importance of this document and, consequently, invites you to be rigorous and to fill it in completely.

SDME 2018 Official Dissemination Materials

The SDME 2018 Official Dissemination Materials will be used for the SDME Official Book, among other publications in magazines, brochures, webs, etc.

Details to be determined.

SUMMARY OF CHANGES

Changes and additions to the Project Drawings and Project Manual listed in the Summary of changes will be reviewed. Anything not listed here is assumed to be unchanged from the previous version of the Project Drawings and Project Manual and will not be reviewed.

As always, an important question to ask before submitting is, "Will the information be easy for the reviewers and jurors to find?"

Most users of the document will be reviewing it electronically and will navigate using the PDF bookmarks and hyperlinks. For the benefit of the reviewers and jurors, Teams must use the basic bookmarking structure and section titles supplied by the SDME 2018 Organization.

Remember that some users will print the document, so make sure that the printed version is also easy to navigate, i.e., clearly numbered sections and/or pages are essential. Also remember to design the margins appropriately. For example, the SDME2018 Rules PDF document is intended for electronic and printed viewing, so we included PDF bookmarks and hyperlinks, as well as margins and end-of-section blank pages designed for double-sided, spiral-bound, portrait printing. A similar approach is recommended for the Project Manual. It might be a good idea to do a "test print" of some or all of the document to make sure everything prints successfully and looks OK in a 3-ring binder

CONTEST SUPPORT DOCUMENTS

The Contest Support Documents will be used to justify the Teams' strategies towards the 10 contests of the Competition, as well as describing the projects objectives in the different aspects considered in each of the Contests. The following rules describe the specific content required for each Contest Support document.

ARCHITECTURE DESIGN NARRATIVE

Architectural and Urban Concepts

The architecture (and urban, if applicable) design narrative must include a complete description of the architectural (and urban, if applicable) concepts taken into consideration in the project design. Therefore, it is necessary to explain the process, from the primitive idea up to the final project design. In the same way, the project materials and construction shall be described, as well as all the concepts and architectural elements included. Moreover, the concepts, which will be evaluated in accordance with the criteria established in Contest 1 – Architecture, must be included.

Summary of reconfigurable features

This summary will be used before, during, and after jury tours to verify that the team complies with corresponding rules. Be sure to include references to relevant drawings and/or specifications.

If you are not sure whether something is considered a "reconfigurable feature", include it in this summary, just in case. The Competition Manager will review the summary and notify the team if any of the listed items are not considered "reconfigurable features".

Lighting Design Narrative

The lighting design narrative shall describe both the use of natural and artificial lighting, to fulfill the house light needs. The calculations of the lighting systems and the energy efficiency shall be included. The lighting quality for the space and comfort definition will be positively assessed, evaluating the night and day specific needs. The lighting use to highlight the house's architectural values will be also evaluated.

ENGINEERING AND CONSTRUCTION DESIGN NARRATIVE

The engineering design narrative shall include a description of the following aspects:

- Structural design
- Constructive design
- Systems design: plumbing, electrical and photovoltaic
- Electrical Production Simulation

Structural Design

Teams shall explain the structural design of the project, from the initial premises to its consequent project development, describing the materials used, its objectives and the main reasons for the final adopted solution. The calculations are to be included in the Structural Calculations section in the Project Manual.

Constructive Design

Teams shall explain the constructive design of the house, from the initial premises to its consequent project development, describing the materials used, its objectives and the main reasons for the final adopted solution, as well as explaining the acoustic performance of the adopted solutions (defined as follows):

Acoustic performance of the adopted solutions: Materials, characteristics, calculations, simulation (with reverberation time). The report contents are:

Estimate indoor reverberation time: In order to complete the reverberation time estimation, you must include the most significant internal coating materials absorption coefficients and the calculations carried out. The reverberation time may be estimated theoretically or through acoustic simulation. The absorption coefficients and the reverberation time must be shown for the following frequencies: 125 Hz, 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz.

The specifications and technical data of all the materials are to be included in the Construction Specifications section in the Project Manual.

Plumbing System Design

Teams shall submit a general description of the design criteria adopted for the plumbing system of their house. Moreover, a detailed description of the plumbing systems of the project, shall be included, including detailed calculations of the needs. Teams must describe the water cycle of the house, explaining the recycling and/or reuse of rainwater, greywater, etc. Details shall be included of the accessibility of the installation for maintenance and repair tasks, the effectiveness of the insulation and the control systems.

Electrical System Design

Teams shall submit a general description of the design criteria adopted for the electrical system of their project. Moreover, a detailed description of the electrical systems of the project, shall be included, including detailed calculations of the needs and expected energy contribution by the installation. Details shall be included of the accessibility of the installation for maintenance and repair tasks, the effectiveness of the insulation and the control systems.

Photovoltaic (and other electric solar) Systems Design

A document about the solar Photovoltaic system (and other electric solar systems) must be written, containing at least the following aspects:

- General description of the Photovoltaic system (and other electric solar systems) and design criteria followed.
- Design and specifications of: Photovoltaic generator(s) (including characteristics of the Photovoltaic modules used), inverter(s), cables and wiring methods, protection, earthing system, interface with the electricity distribution network.
- Maintenance plan, with specific recommendations for the different components: Photovoltaic modules/ generator(s), supporting structure, inverter(s), cables and wiring methods, protections and earthing system, etc.
- Inverters certificates, which demonstrate compliance with the requirements stated for grid interconnection, modules and interface protections as per SHAMS Dubai Regulations: http://www.dewa.gov.ae/smartinitiatives/firstinitiative/publications/default.aspx

Electrical Energy Balance Simulation

A detailed report about the electrical energy balance of the household will be prepared for typical generation and consumption conditions. It must include at least the following aspects:

- Introduction: Description of the methodology for the estimate of the electrical production and the environmental benefits.
- List of the electric loads (house-hold appliances, lights, etc) used in the household, including the main technical characteristics given by the manufacturer, and the estimated consumption for their use during the Contest Week.
- Photovoltaic (and other electric solar) system description: brief summary explaining PV generator(s) (types of modules and wiring) and inverter(s). Further detailed information (e.g. characteristics) to include in the Project Manual, Contest Support Documents, Engineering and Construction Narrative, Photovoltaic System Design
- Description of the tools used for the simulations. These could be commercial software or tools created by participating teams, in which case the algorithms used must be included.
- Results of the simulations:

The electrical energy balance analysis consists of an annual, monthly and contest week estimates of the electricity demand by the electric loads, the electricity generated by the photovoltaic installation and the electricity extracted from the electricity grid (in case the solar generation is not enough). A critical analysis of the results must be included.

An Energy Payback Time analysis (time needed for the PV installation to generate the energy used to construct all of its components, for typical solar radiation and temperature conditions of Paris) as well as the CO2 reduction associated to a standard year of use must be included. (More information is available in the website of the International Energy Agency – Photovoltaic Systems Programme - Task 10 – www.iea-pvps.org, report IEA-PVPS-T10-01:2006).

Simulations Requirements:

a) The simulations will be done in an hourly base.
b) For the electrical energy balance simulation of the PV installation, solar radiation and temperature data from a Typical Meteorological Year of Paris will be used (file “PARIS-TMY.csv”). Teams may use other weather data fi les, provided that they indicate the reference.
c) For the electricity demand, the average consumption for the whole contest week will be considered as a constant consumption for the whole year. For the contest week simulation, the consumption profile of each day will be used.
d) Monthly and yearly results, as well as the results corresponding to the Contest week, will be presented, both in numeric and graphical forms.

Format Requirements

There are no restrictions on the simulation tools that can be used for this analysis, but all such tools should be clearly identified.

Solar Thermal Design

Teams must include detailed need estimations and expected contribution of the system, and information about the supporting structure, storage system, backup energy source, the accessibility of the installation for

maintenance tasks, the effectiveness of the insulation and control systems. Moreover, the cost of the installation shall be clearly indicated.

Building Integrated Solar Active Systems

Building-Integrated Solar Active Systems (BIPV, BIT, BIPVT) are materials that are used to replace conventional building materials in parts of the building envelope such as the roof, skylights, or facades. They are increasingly being incorporated into the construction of new buildings as a principal or ancillary source of electrical power, although existing buildings may be retrofitted with these modules as well. The advantage of integrated solar active systems over more common non-integrated systems is that the initial cost can be offset by reducing the amount spent on building materials and labor that would normally be used to construct the part of the building that these modules replace.

Teams shall explain the house "Building Integrated Active Solar System" concept and selection criteria, how the active solar systems fulfill energetic and aesthetical functions, and the economic impact of the integration in the house's design, according to the following items:

- Aesthetical Integration: How the "Building Integrated Active Solar Systems" enhance the house's aesthetical values.
- Constructive Solution: Quality and consistency of the constructive details, and how adapted are the modules to the structure, to the modularity and to the other conventional materials of the house
- Energy Balance positive impact: Impact of the integrated modules in the cooling and the heating loads, and how it may affect the energy balance of the house.
- Additional properties: Conformity of the systems performing architectural functions, like weather protection, thermal insulation, noise protection, modulation of daylight etc, always considering the functioning requirements of the systems.
- Maintenance: Specific conditions for operating, maintaining and repairing the systems.

Cost of the installation: including its economic justification considering the savings for replacing conventional materials, electrical energy production and possible extra energy saving costs by the influence of the systems integration in the house general performance (architectural function).

ENERGY EFFICIENCY DESIGN NARRATIVE

Technical Project Summary

From Deliverable #3 and onwards, Teams must submit the following information, as a summary of the House's technical characteristics:

1. Project Dimensions

Gross area (m2) Gross Volume (m3)

Surface area (m2) Net floor area (m2)

Conditioned Volume (m3)

2. House envelope

Insulation types and thickness (m)

Walls area and Thermal Transmittance (m2) (W/m2.K)

Floor area and Thermal Transmittance (m2) (W/m2.K)

Roof area and Thermal Transmittance (m2) (W/m2.K)

Glazing area, Thermal Transmittance & Glazing Solar gain (m2) (W/m2.K) (SHGC)

3. HVAC Systems

Heating system (Type, capacity (Kw) and COP) Cooling system (Type, capacity and (Kw) COP) Refrigerant (Type)

Heat Recovery Ventilation or Energy Recovery Ventilation (Type, capacity and Efficiency)

4. Domestic Hot Water

System (Type, capacity)

Solar thermal Collectors area (m2) Storage Tanks (capacity)

5. Electrical Energy production

PV Modules (Type)

PV panels area (m^2) Installed PV power (kWp)

Estimated energy production (kWh/year) Other systems (Type)

Other systems installed power (kWp)

6. Energy consumption

Estimated energy consumption (kWh/year)

Estimated electrical consumption per conditioned (kWh/year per m2)

Energy Use Characterization (% of total energy consumption)

Heating (%)

Cooling (%)

Ventilation (%)

Domestic Hot Water (%)

Lighting (%)

Appliances and Devices (%)

7. Energy Balance

Estimated energy balance (kWh/year) Estimated CO2 emissions (Tn/year)

8. List of Singular and Innovative materials and systems

Appliances Report

From Deliverable #4 and onwards, teams must submit a list with detailed description of the appliances characteristics, provisions and specifications to be evaluated. Moreover, Teams shall send to the SDME 2018 Organization the manual of all the appliances required for Contest 6: House Functioning development. Note: Teams intending to use energy saving programs during the Final Phase of the SDME 2018 Competition must communicate it to the SDME 2018 Organization.

Comprehensive Energy Analysis and Discussion Report

From Deliverable #3 and onwards, Teams must submit the Comprehensive Energy Analysis and Discussion Report, consisting of two sections:

Section I – Projected Performance of Final Housing unit Design: Minimum requirements

1. .Introduction
   a) Energy analysis objectives and methodology
   b) Climate Data and Weather Analysis
   c) Team Energy Strategy
2. Housing unit and Systems' Description
   a) Overall description of the project geometric, envelope, air-tightness and any singular element that could contribute to the house energy efficiency.
   b) Passive design strategies and Energy efficiency measures (EEM) analyzed (EEM is a design, operation or technology change for the purpose of reducing energy consumption)
3. House and HVAC Simulations (Annual and for the two completion weeks)
   a) Brief simulation descriptions, tools used (capabilities and limitations).
   b) Housing unit modeling assumptions, including internal gains, occupancy behavior patterns, ventilation and comfort temperature.
   c) Housing unit energy loads
4. Results and Discussions
   a) Housing unit energy performance on both, whole-house basis and system-by-system basis. Heat gains and losses by the building envelope.
   b) Predicted indoor temperatures in passive analysis
   c) HVAC systems selection criteria, description and simulations
   d) Predicted Heating and cooling loads and HVAC energy demand
5. Conclusions

Notes:

1. Monthly and yearly results will be presented in both, numeric and graphical form.
2. Team could include parametric of CFD studies realized for a house system or element optimization. Specific simulation related with a singular component of your project, experimental works or any other information that have helped the team in the house energy performance optimization.

Section II – Influence of Energy Analysis on House Design and Competition Strategy:

The objective of this report is to summarize the schematic energy analysis supporting the development of the Team's original project design. During the period of time since the first analysis until the final deliverable of the construction project, it is likely that Teams have continued to use energy analysis tools and techniques to iteratively "fi ne-tune" the housing unit design, to develop detailed system designs, and perhaps even to develop competition strategies. In this section, the teams must describe how the energy analysis was used to improve the project thermal performance and its energy efficiency since the previous deliverable. Discussion should highlight key features of the house design that were affected by energy analysis and simulation results:

1. Influence of the energy analysis in the project design (Project design optimization)
2. Influence of the energy analysis in the HVAC systems (System optimization)

COMMUNICATIONS PLAN

Introduction

Communication is one of the main strategies in any activity done by teams, and is made up of five basic elements: source, message, media, receptor and response. So, the first thing to consider is the image we want to disseminate, the message, and how and whom we want to reach. As communication planning is a systematic process that cannot be left to improvisation or intuition, teams must develop a Communication Plan, identifying the message(s) to transmit, adapting it to the different target groups.

Some of the basic activities that have to be carried out are the following:

- Analyze the starting point situation
- Establish our objectives, what do we want
- Decide to whom is our communication for
- Think about the idea to transmit
- Fix the budget for communication actions
- Set timing and resources in a plan
- Choose the means and the frequency to use them adequately
- Develop a media plan
- Measure the impact

Planning Process- A plan is the result of an entire process, and it attends to the specific needs of each team. The Communications Plan is the document that articulates the communicative policy of a project and orients it towards materializing its vision of the future.

Carrying out the correct planning for the Communication implies an analytical and methodical process from which a rational choice of the objectives to be achieved can be deduced. It also means the selection of possible alternatives for action in order to be able to achieve them.

It is most likely that no two teams will have identical needs, which is why it is important to be able to count on the support and assessment of people trained in the subject (professionals or students with Communication skills) to design a communications plan which is adjusted to the needs, resources and objectives of each team. These people could be:

- Students and Teachers of advertising, Journalism, Marketing or Public Relations
- Communications Department of the Faculty
- Consultants or Communications Agencies
- Students and Teachers of Graphic Design, Web sites.

Communications Plan Content- The Communication Plan is the result of the above described process. Consisting of the following documents, it must be updated within each deliverable, explaining the project development and progress:

1. Communication Project.- Defines the message and establishes the target public and the specific approach to each of these groups, with calendar dates and planning, as well as budget for all these actions, filling in one single descriptive page for each action.
2. Public Tour Description.- Describes the communication strategy which will be used for showing the project to public in the Solar Hai.
3. Visual Identity Manual.-Defines the “personality” of the project, establishing the physical and visual identity of the project for media appearances.

4. Sponsorship Manual.- Includes the information and advantages offered to sponsors and those interested in joining the team's project.
5. Material for the Project Dissemination.- Teams shall send an Appendix to the Project Manual, including all the communication material generated up to the moment of the deliverable.

Communications Project

The Communication Project must be submitted in Deliverable #3 and onwards, explaining the team's intentions, plans and activities already realized to disseminate the project during its development. However, in Deliverable #6, teams must only describe what was really realized and its results.

The Communication Project must include the following aspects:

- Abstract.- Synopsis of the Plan: 1 – 2 pages
- Analysis of the Situation.- Includes the information necessary to understand and put in context the Plan, defining its strategy, stating the introduction, and broadly setting out the conclusions of the analysis, describing the most relevant factors. Teams may also include a SWOT plan (Strengths, Weaknesses, Opportunities and Threats).
- Definition of the Communications Objectives.- Includes the team's goals aimed to achieve with the Communication Plan. There could be a single objective, which encompasses everything proposed by the Plan. However, it is much more common, to have a main objective supported by other specific objectives, which cover other areas; media dissemination, finding sponsors, awareness.
- Identification of the Target Groups.- Identify the groups of people to whom the team's communication is addressed. It is clear that one of the target groups will be the communications media, although they are not the final target group. A correct and precise definition of each target group is essential when identifying messages and channels of communication appropriate to achieve our objective. At least teams must consider the SDME target groups: children, teenagers, young people, Professionals and General Public.

Regarding the means of communication, in order to make the information distribution process easier, it will be helpful to draw up lists, identifying to whom we must address our project.

- Message/s establishment- In general, our communication's strategy will revolve around an axis message. However, when dealing with different target groups, it is also necessary to define the main message to transmit specifically to each of these groups.
- Actions' description- Describe all the activities to be carried out during the project development. Teams are encouraged to include a timetable (where, at a simple glance you can schematically have a complete panorama of the work to be carried out), and a budget (including the cost of each action and each element used). For example: cost of brochures, insertions in the press, communications agency fees or similar, if it is used, merchandising costs, etc.

For classifying the actions, teams may use the following structure:

- Previous to the competition: addressed to three different scopes: university, city and country; and for the target groups identified. Nevertheless international activities may be included.

Team's participation in events organized by themselves, or by others.

Information on the project produced in any format, by the teams or by third parts, from an article in a newspaper up to a collaboration with an art creator.

- During the competition:

Public tours

Leaflets/object to be given to the public Audiovisual #2, to be shown at the Solar Hai.

- Tracking Table of the Communication actions.- Teams must include a table defining all the following actions:
    - Project appearances in national media (from the team's country of origin) and/or international media if identified.
    - All the materials generated for the team's dissemination, either done on teams' or third parts' stands, different than media ones.
    - Events organized or with confirmed celebration in the future.

Teams must include the latest version (including ALL the information, not only that added after the latest deliverable) of the tracking tables of the communication actions in each deliverable.

Public Tour Description

Teams must describe the route proposed for the Public Tours at the Solar Hai, from Deliverable #3 and onwards, indicating: access and exit of the lot (it must be located in the main road side); access and exit of the project; where the waiting lines will be formed and controlled; the housing unit tour itself (a single route for all visitors).

For this end, teams must submit drawing/s showing the route and contouring: intersection paths' circle diameter, width of doors, corridors, crossings and narrowings, demonstrating compliance with the accessibility requirements.

A complete visit description is required, indicating the stops established along the visit and how will the house's highlights be explained (if different explanations are planned for the different target groups, please include a brief description of each). Moreover, teams must explain the types of visits' routes (if there is one decathlete going along with the visitors or if they are positioned in specific points), the time length, the languages available and the number of people per group.

Teams intending to realize life demonstrations of the project's mobile elements (in case existing), must include sketch/s showing the adopted measures in order to guarantee public safety. If teams plan any measure for sensorial or motor disabled, it must also be described.

Teams must plan entertainment for the public while waiting the line (indicate any type of activity planned and its organization).

In order to verify compliance with the rules, teams will have to submit, before the final phase of the competition, the design of the brochure (or) handout (or any other) object to be given out to the visitors. In the same way, any additional information sources must be described, indicating its format (such as posters or electronic means), location and content.

All this information may be explained either with drawing/s and/or on a written document.

Team Visual Identity Manual

The first thing to be taken into account is the "personality" of the team that wants to be reflected in the teams' image of the brand. Once it is defined, it is important to consider the following aspects at the time of developing the brand (branding):

- Simplicity
- Practical – that it can be used in any kind of media
- Consistent – in all of the elements that are used

- Unique - that it does not resemble any other brand
- Memorable – that it is easy to remember and identify
- Reflexive – that it reflects the objectives and values set out
- Connective – that it connects with the public to whom it is directed

The way a company is perceived is through its corporate image. The corporate image might consist of one or more elements, which together or independently, achieve the same function, accentuate the graph and the soundness of the company's identity, as well as determining its characteristics and values.

Teams must submit to the SDME 2018 Organization in Deliverable #3 and onwards, a PDF version of the manual and an annex .eps, including the vectorial versions of all the different components. The manual must be consistent with the SDME 2018 Organization's manual, which will be available in the SDME Website/Portal, and will include the design of, at least:

- Name of the house and of the team.
- Team's logo in its three possible versions (isolated, combined with the SDME's logo, and combined with the team's supporting institutions and sponsors, in vectorial format, and colored and gray scale variations).
- Rules of use and possible compositions, and if the team has a Legend or Motto.
- All the team's supporting institutions and sponsors' logos
- The chosen typography

In each deliverable, the Visual Identity Manual must be updated, containing all the information submitted in the previous deliverables, as well as the developments realized. Before the final phase of the Competition, teams must also include their uniforms design, in order to verify compliance with the SDME Rules.

Sponsorship Manual

The sponsorship manual shall include:

- Supporting institutions and companies' tracking: consisting on a list of sponsoring/collaborating institutions and companies indicating their names, field of work and type of collaboration with the team, as well as the contact details of the person of the team in charge of the communication with the company or entity: full name, telephone and e-mail address. This contact information will be used by the SDME 2018 Organization in order to assess the companies' implication impact in the competition in their R&D (Research& development) activity in an international professional network. This information must be included from Deliverable #3 onwards
- Presentations used to raise sponsorships

URBAN DESIGN, TRANSPORTATION AND AFFORDABILITY REPORT

Design Report

The teams shall present this report for Deliverable #1, indicating the Market target towards which they expect their project to fi t and Market studies and potential user's characterization to figure out in which field and what context the project should be viable.

Construction Report

The following four items must be included in the Urban Design, Transportation and Affordability Report of Deliverables #3, #4, #5, #6 and #7:

- Market Viability of the product
- Individual or collective housing building concept

- Mobility strategies
- Affordability strategies
- Market viability of the product.- In first place, the target market must be defined: the project's population sector and their needs. To define a market, the most common variables are:

Buyer related:

Socio-cultural aspects (if it satisfies their prospects)

Economical aspects (if it is affordable for the buyer)

Age (if it does fulfil the basic needs of people of that age)

- Location related: Geographical situation (if it adapts to climate, topography, etc.)

The target market may be distinguished as much for geographical features as for social aspects. In order to adapt the product to the potential customer's specific needs, this differentiation shall be detailed enough. However, as a very exclusive market may limit the product running, be careful not to go too far.

Once the target market is identified, we shall make sure the project satisfies its needs and prospects, and is affordable. The project shall be a product adapted to its potential customers' prospects for size, aesthetic, closings, spaces, distribution, equipment, etc.

Usual market viability's characteristics: appeal, spatial distribution, flexibility, innovative components, etc., as well as the project's ecologic and economical benefits must be commercially exploited. Environmental advantages, renewable energies' use, high-energy efficiency, the use of green, recycling or recyclable materials, among others shall be highlighted. On the other hand, the economic benefits to make the project's commercialization become viable shall include information regarding its energy expenses' reduction: explain how and how much money is saved due to the appropriate house's design, the high energy efficiency of the systems and the inclusion of renewable energies.

Individual or collective housing building characteristics:

Teams must explain their choice regarding density according to the local context of the project. They must describe all elements that can help the jury to better understand the spatial strategies developed by the project. In case of an urban setting, teams will explain the densification strategy and the spatial solution chosen to achieve a balanced ecosystem. They will present development perspective on a thirty years period of time.

In case of a rural setting, teams will explain how they avoid urban sprawl, how they optimize infrastructures, and what kind of spatial organization is foreseen for the future of these territories on a thirty years period of time.

In both cases, it is highly recommended to put the project in historical and cultural heritage perspective. Teams should also emphasize the evolutivity and the flexibility characteristics of the project in respect of environmental qualities.

Mobility strategies.- Teams must demonstrate how their location strategies and associated transportation systems can reduce both costs and energy impact of their proposals. They must describe how different kind of transportation means are used according to what use. They must indicate how they take into account all generations and population classes. They should indicate how they imagine that energy resources produced by the project can meet living and transportation needs.

Affordability- Teams must explain their strategies toward global cost of the project (building cost, maintenance, transportation...) and related performance of the project on twenty years and fifty years period of time.

The question of affordability for the greatest number of people needs to be addressed. According to local context, teams will explain how the financial system (bank loans, cooperative housing, social public housing, etc.) and the building industry (prefabrication, self-construction, traditional building production, etc.) are organized and what business model is considered. They must indicate the targeted population class(s).

INNOVATION REPORT

Objective

The objective of the innovation report is that the teams reflect in a document, in a systematic and organized way, all those innovative elements or systems, used for the design, development, construction and management of the proposals.

Contents index and structure

The report structure shall correspond to the following index, including all elements that refer to the innovation of the proposal. In case that the required documentation has been already mentioned in another section of the deliverable, it will not be necessary to incorporate again this information in the report. However it is recommended to indicate it in the corresponding section of the deliverable.

1. Innovation in Architecture: new spatial and functional concepts at all scales (urban scale, building scale, living unit scale), new languages in the formal use of materials, use of textures, and the appropriate use of light.
2. Innovation in Engineering and Construction: innovation concepts in the project's structure and systems' (plumbing, electrical and photovoltaic) design and construction.
3. Innovation in Energy Efficiency: the active and passive innovative technological contributions maximizing the energy efficiency of the project; innovative ways to improve the hydrothermal, environmental, illumination and acoustic efficiency of the housing unit, as well as facilitating the perfect functioning of the project, and innovative aspects of house's appliances and equipment. Innovation concepts in house functioning. Innovative concepts in coupling building and mobility solutions.
4. Innovation in Communication and Social Awareness: new initiatives proposed to attract the attention of the general public as well as specific public.
5. Innovation in Urban Design, Transportation and Affordability: innovative solutions for denser urban areas or rural areas. Innovation in strategies developed to make affordable habitats and their means of transportation in their local context.

SUSTAINABILITY REPORT

Objective

The objective of the sustainability report is that the teams reflect in a document, in a systematic and organized way, those elements related to the sustainability of the proposals, in such a way that they can be visualized as a whole and make a holistic vision possible as to how this variable has been integrated into the work that has been developed.

Contents index and structure

The report structure shall correspond to the following index, including all elements that refer to the proposal's sustainability. In case that the required documentation has been already mentioned in another section of the deliverable, it will not be necessary to incorporate again this information in the report. However, teams must indicate it in the corresponding section of the deliverable.

1. **Introduction**: Sustainability concept applied

Sustainability is a complex and multidimensional concept, which in the formulation of the proposal the teams will have analyzed, reflected on it and translated it in their approach and strategies, obtaining both quantitative and qualitative results evaluable by the judges. It will be requested that the sustainability of their proposal in terms of the architectonic conception be explained in 20 lines.

2. **Bioclimatic Strategies:** Passive design strategies

This section must include a brief description of the bioclimatic strategies (passive design strategies) integrated in the proposal, schematically representing its functioning. Some aspects to consider are:

- Project's envelope, taking into account the level of insulation, air tightness, finishes and construction.
- Glazing orientations, types and sizes. Solar protections to minimize the interior overheating. Daylight controls to provide evenly distributed and sufficient natural lighting.
- Distribution of the interior spaces according their heating and cooling requirements, and the use of thermal buffers spaces.
- Passive heating strategies using direct and indirect solar gains, as well as the use of thermal energy storage.
- Passive cooling strategies, i.e. natural ventilation, thermal mass with night ventilation, evaporative cooling and night radiation.
- Use of semi-passive systems to maximizes the effect of passive strategies with very low energy consumption.
- Improvement of the microclimate around the building, through the bioclimatic design of exterior spaces. And the application of strategies to reduce the urban heat island effect.

3. **Water**

The strategies related to the management of water will be described in accordance with the following classification, highlighting which alternatives have been evaluated in the development of the work and justifying the choice that has finally been carried out for the project:

- Strategies for the reduction of consumption
- Recycling, reuse
- Rain water
- Grey water system
- Treatment of waste water

4. **Solid Waste**

The management of the solid waste will be described in the following sections:

- Assessment Plan.- Descriptive document of the final destination of the different types of material involved in the construction process, highlighting the percentages (in mass) of their final destination, which will be the garbage tip, an incineration system, recycling or reuse.

The final destination of the waste generated by the work will be specified, as will be the waste once the home has come to the end of its useful life.

- Management of Domestic Waste.- Description of the solutions contemplated for the management of the domestic waste from the house.

5. **Materials**

The description of the materials will be made, highlighting the following sections:

- Materials selection. Description the constructive materials selected, making specific reference to the presence or absence of renewable materials, recyclable, reusable and possible toxic substances identified.
- Enclosure description. Description of the enclosure's character: design and composition, in order to reduce energy demands.
- Maintenance Plan. Description of the necessary tasks and the frequency in which the correct maintenance of the home must be undertaken.
- Incorporated Energy- Calculation of the energy incorporated in the materials of the project, which allows establishing an energy/constructed m2 factor.
- Incorporated CO2- Calculation of the CO2 incorporated in the materials of the project, which allows establishing an CO2/constructed m2 factor.

6. **Solar Facilities**

Regarding the solar facilities, the documentation will reflect the following elements:

Description of the time calculation of the energy recovery, (the time it would take for the facility to generate the energy necessary to manufacture its components, under solar radiation and temperature conditions of an average year).

Calculation of the CO2 emissions savings associated to a year of functioning as well as the CO2 emissions savings associated to the PV panels' production.

Description of the accessibility for the maintenance of the facilities.

7. **Equipment**

It will include a description of the characteristics of the project's equipment (appliances, lighting, HVAC and Hot water equipment), making reference to its contribution to the project's sustainability.

8. **Transportation**

Teams are must explain their strategies toward transportation and its relation with housing and energy efficiency.

DINNER PARTY MENU

Teams will have to submit the dinner menu, indicating:

- Name of the courses and drinks
- List of ingredients and quantities per course
- Food preparation
- Enclosing an image of every course
- Cost evaluation of the menu
- Energy consumption for cooking evaluation
- Nutrition data compared to guest needs
- Local content of ingredients (according to local context)

CONTEST WEEK TASKS' PLANNING

In the general timetable of actions teams will include the planning given by the Organization for the realization of the tasks sub-contests during the Contest Week. This timetable will help the team and the SDME 2018

Organization to provide the resources needed and plan it in advance.

COST ESTIMATE AND PROJECT FINANCIAL SUMMARY

Teams will have to submit the Cost Estimate and the Business and Fund Raising Plan, including updated information and details, from one deliverable to the next. This section should provide a clear understanding of the costs associated with the project and the need for fund raising, how that fund raising is planned, and whether there are available or obtainable equipment, instrumentation, and facilities.

- Business and Fund-Raising Plan: Teams are required to submit plans that describe their overall project, including a projected budget and fund-raising plan. The plan should include a description of each team's interactions with other departments involved in fund raising (e.g., the school's development office), identify key sponsors, and describe the means by which these sponsors may be reached.
- Cost Estimate: Teams must provide complete, current, and accurate cost or pricing. A project summary budget is required according with the price cost proposal form (available in the SDME Website). The following guidelines help teams fill in the cost estimate table.
- Direct Materials: Direct materials are normally purchased parts, purchased items or services (e.g., welding, minor fabrication etc.), raw materials, standard commercial items, interdivisional transfers at other than cost, etc. All direct materials should be identified separately on an attached sheet with the quantity, unit price, and total amount provided. Further, price/cost proposal should indicate whether the unit price for each direct material item was determined and documented using written vendor quotes, catalog prices, prior invoices, engineering or shop estimates, or some other method with an explanation provided. Provide supporting documentation (cost or pricing data) such as the written vendor quotes, copies of the catalog page indicating the price, or prior invoices for all direct material items.
- Material Overhead: If accounting system includes material overhead, propose such indirect costs in this area. Indicate the rate(s) used and provide an appropriate explanation.

Direct Labor: Direct labor should indicate the hours, hourly rate, and total for each individual or category of labor proposed.

- Labor Overhead and Fringe Benefits: If accounting system includes labor overhead, propose such indirect costs in this area. Indicate the rate(s) used and provide an appropriate explanation. If fringe benefits are not included in direct labor and are not a portion of the labor overhead, identify fringe benefits in this area and provide the same type of information concerning fringe benefits as required for labor overhead.

Lower-tier Subcontractors: Identify each proposed lower-tier subcontractor and obtain a cost proposal containing the same information and in the same format from each proposed lower-tier subcontractor. Consultants: Identify each proposed consultant and the estimated budget of their services.

- Other Direct Costs: Include any direct costs not covered by one of the other cost elements in this area. A detailed list of each cost item including description, and estimated budget is required. An example of this type of costs could be general and administrative expenses, indirect expenses, security activities and services, cost of models, communications costs etc.

- Travels and costs for final phase in Dubai. The travels costs will be, for some universities, an important chapter of their budget. It must be defined the number of team members and the unit cost estimated of travels, transports, expenses allowance, lodging accommodations and miscellaneous expenses.

Assembly, transports, and disassembly processes. According with the house designed by the universities, it will be necessary an important amount for the transportation to Dubai, including trucks, assembly and disassembly processes.

- Insurance Policies: According with the MOU (Memorandum of Understanding) that will be signed between the SCHOOL or UNIVERSITY and the SDME 2018 ORGANIZATION, ""their respective officers, directors, employees, agents, contractors, subcontractors, and representatives (the "Released Parties") from any and all claims, losses, expenses, and demands, including those resulting from injury or death to any person or damage to any property, arising from the SCHOOL or UNIVERSITY's work on or participation in the Event or any activities incidental thereto".

Liability Insurance costs, transport insurance, accidents and medical insurances, must be included in the estimated budget of the project.

- Additionally, teams will have to clearly specify the Total Construction Cost of the House, indicating the items exclusively corresponding to the construction process and materials. Teams may do so underlining the items in the above mentioned cost estimate or elaborating a Construction Cost Budget apart.

All costs are given Value Added Taxes (VAT) included. Local expenses are calculated with local VAT rate. Expenses in France are calculated with French VAT rate (19.6%).

SITE OPERATIONS PLAN

Objective

The Site Operations Plan (SOP) is an executive document for planning, specific for each team, in which they must take into account all of the activities, resources, needs and deadlines. The Plan has to guarantee the assembly and disassembly of the house with logic, order and total safety. Every team must hand in its Plan to the organization, who will draw up the general Site Operations Plan of the Solar Hai that will harmonize the needs of all teams and avoid interference. The organization will revise all of the Site Operations Plans of the teams to verify their efficiency and identify possible conflicts between them.

The organization will develop a general Site Operations Plan of the Solar Hai; based on the information sent by the teams in their Site Operations Plan. This is why it is very important for the plans to be as specific as possible.

Content & Structure

The Site Operations Plan will be required from Deliverable #3 onwards and will have to comply with all the requirements specified Solar Hai rules/requirements. Information will be updated and specified along with the project development, including further details in each deliverable. The plan consists of the Site Operations drawings (to be included in the Project Drawings), the Site Operations Report (to be included in the Project Manual). The Site Operations report must, at least, include the following sections:

1. Precedents and aim
2. General Data
3. Site Operations Team Coordinator
4. Outside Logistic. Solar Hai
   I. Phases description
   II. Transport

III. Vehicles/Transports circulation

5. Inside Logistic. Approximation
    I. Phases description
    II. Deciding factors
    III. Infrastructures
    IV. Waste management
6. Load / Unload
7. Assembly / Disassembly
8. Timeline. Trucks and machinery needed entrance times, order, unload, interval between vehicles and assembly times associated.
9. Site Operations Chart (Teams must fill in this file, available in the SDMEWORKSPACE).
10. Assembly & Disassembly Chart.

HEALTH & SAFETY REPORT & SPECIFIC TERMS AND CONDITIONS DOCUMENT

The Health & Safety Report, as well as the Health & Safety Specific Terms and Conditions Document, are parts of the HS Plan of the project. Please refer to the Health & Safety section in Building Code.

DETAILED WATER BUDGET

The water budget information may either be split between the Project Drawings and this section of the Project Manual, or provided entirely in the Project Drawings. If the information is split, make sure this section of the Project Manual is clearly referenced on the relevant drawing sheet(s).

ELECTRIC AND PHOTOVOLTAIC CHART

In order to adapt the monitoring system for the Electrical Energy Balance contest, teams must provide the SDME 2018 Organization with the Electric and Photovoltaic Chart, from Deliverable #3 onwards. Teams, which do not send the required information, will not be allowed to include the following specific elements: DC Loads, hard-wired battery bank and battery inverter, and special grid voltage and/or frequency, fire protection on DC side.

CONSTRUCTION SPECIFICATIONS

The following structure organizes all the different divisions of the project construction specifications. If there are no specifications under a particular division, simply delete that division's bookmark

EVERY specification shall be clearly referenced on one or more relevant sheet(s) in the Project Drawings. Hyperlinks between references in the drawings and corresponding specifications in the Project Manual is greatly appreciated, but certainly not required because current software does not seem to facilitate this level of construction document integration.

Develop a clear, consistent method to differentiate competition house specifications (and drawings) from competition house alternate specifications (and drawings).

Apart from this information, Teams must submit the Fire Safety & Safety in Use tables (Teams must fill in this file, available in the SDME Portal).

STRUCTURAL CALCULATIONS

Structural calculations that have been stamped by a qualified, licensed design professional must be submitted. Only the printed version must be signed by a qualified, licensed design professional. By signing the structural calculations, the licensed professional certifies that the structural provisions of the Codes of their country of origin have been met by the design.

The structural calculations justification must have the following sections:

a) The structural solution adopted justification, including a description of the house bearing system and the list of codes used for the design and construction.
b) A description of the materials and its resistant properties.
c) Employed actions. Particularly, the different wind hypothesis of pressure/suction over the envelope will be detailed making use of sketches. Combinations made and safety factors used. Loads considerations during the house transportation, assembly and disassembly.
d) Calculations model (s) description. If it proceeds, identifying the software (program object and application field), and indicating the adopted simplifications, the methodology of the analysis done, specific models of singular areas where traditional material resistant theories can't be applied, edging or supporting conditions, type of connections, etc.
e) Tensional and distortional verification results, explaining the representation of the software or calculations results obtained, indicating the phases or hypothesis in which dreadful efforts are produced, and covering all the different phases (transport, assembly and use).
f) Deflection calculations and tabulated results. Applicable expansion, contraction, and crack-control measures.
g) Superficial footing design, indicating soil bearing pressure of each footing.
h) Structural fire resistance justification, according to the team's country of origin national codes.

For materials not being considered in the rules, teams must submit a document signed by a competent technician. This document justifies the resistant properties of the materials and the design, from a structural safety point of view, considering the actions indicated in their national rules.

4. BUILDING CODE

1. Introduction

Although there is some degree of overlap between the two, but it is important to note that some crucial distinctions between the Solar Decathlon Middle East Rules and the Solar Decathlon Building Code. The Rules primarily exist to promote a fair and interesting competition. The Building Code primarily exists to protect the public health and ensure safety. Failure to comply with the Rules may result in official warnings, penalties point, or disqualification from the competition. Failure to comply with the Building Code may prohibit the participation of the house in any aspect of the overall competition. Therefore, compliance with the Building Code is a prerequisite for participation in the competition.

2. Adopted Codes

The 2012 International Residential Code (IRC) of the International Code Council with amendments and the 2014 National Electric Code (NEC) of the National Fire Protection Agency (NFPA) have been adopted by reference as the Solar Decathlon Building Code and have the same force and effect as though fully set forth in the Solar Decathlon Rules, except as specifically amended by provisions that follow.

3. Building Planning and Construction

The building is intended to be representative of a single-family dwelling constructed in accordance with the provisions contained in the IRC. Because portions of the building will be open to viewing by the general public, the IRC is amended with specific provisions of the International Building Code (IBC) and the Architectural Barriers Act as appropriate. The following provisions are amended and emphasized as they constitute the highest degree of risk to the building occupants during public exhibition. Compliance with the letter or intent of the referenced codes is mandatory in addition to the items discussed in the paragraphs below.

3.1. Fire Protection and Prevention

a. Fire Protection Plan

   Each team shall provide a fire protection plan. This plan should indicate the location of fire extinguishers, how egress will be made from the unit, and who will be responsible (i.e., the team's health and safety officer) for public tour life safety during the event. Include a written operations plan for team-facilitated orderly and quick evacuation and fire mitigation. Successful demonstration of the plan will be required before any public tour of the building will be permitted.

b. Each house will be required to have smoke alarms per UAE Fire Code requirements and a fire extinguisher with a minimum Underwriters Laboratory (UL) rating of 2A-10BC. Smoke alarms shall be connected to the AC voltage side of the inverter and provided with independent, e.g., integral with the alarm, battery backup. All alarms shall be interconnected and all shall sound when one is activated (Refer to UAE Fire Code for more information).

c. Any building system component must have a minimum of 1 hour fire rated and must strictly comply with UAE Fire Code and Dubai Civil Defense compliant.

3.2. Means of Egress

The following means of egress components accessible to the public shall comply with Chapter 10 of the International Building Code.

a. Stair

Stairs are prohibited. All changes in elevation used as part of the public tour, accessible route, or means of egress shall be provided with sloped walking surfaces or ramps. Demonstration or mechanical equipment access stairs located within the interior of the dwelling and excluded from use by the public or any other individual during the public tours may be provided in accordance with IRC Section 311.4. Ladders or stairs that are not IRC compliant may be provided as "demonstrators". Stairs to habitable spaces excluded from use by the public or any other individual during public tours may be provided following specific approval by the Building Official.

b. Handrails

Handrails shall be provided on both sides of ramps (sloped walking surfaces in excess of 5% in the direction of travel) used by the public during the display. All handrails shall be designed in accordance with 2010 Standard for Accessible Design Section 505.

3.3. Interior Finishes

Interior finishes must comply with IRC Section R302.9 and Dubai Municipality Building Requirement. Synthesized building materials, such as those using plastics, must be provided with the manufacturer's test documentation indicating compliance with ASTME-84 or UL 723 demonstrating a minimum Class C. Exceptions:

a. Materials tested to EN 13501 with a minimum Euro-Class C
b. Materials tested to DIN 4102 with a minimum B1 classification
c. Other testing methods subject to approval by the Solar Decathlon Building Official

3.4. Glazing

The following hazardous locations are subject to human impact and require safety glazing. See IRC Section 308 for specific details and exceptions. For Photovoltaic modules containing glazing materials please refer to Shams Dubai requirement.

3.5. Roofing

All roofing materials shall comply with IRC Chapter 9. Photovoltaic and shingle modules must be evaluated in accordance with Shams Dubai Requirement and UL 1703. All modules must be designed for design wind loads.

3.6. Foam Plastic Insulation

Foam plastics used for building construction shall only be permitted if the foam plastic is isolated from the interior of the building with gypsum board 0.5 in. (1.3 cm) thick. This applies to foams typically used in structural insulated panel wall, floor, and roof systems. Provide documentation to demonstrate compliance (IRC, Sec. R316).

a. Gypsum board containing phase-change materials and other flammable performance enhancements may not qualify as the required thermal barrier unless specifically approved.
b. The thermal barrier specified in Section R316.4 is not required to be installed on the walking surface of a structural floor system that contains foam plastic insulation where the foam plastic is covered by a minimum nominal 0.5 inch (1.3 cm) thick wood structural panel or equivalent.
c. Exposed foam plastic located in attics or crawlspaces (interstitial space between the floor assembly and the competition site surface) shall be covered with an ignition barrier consisting of 1.5 in. (3.81 cm) thick mineral fiber insulation, 0.25 in. (0.64 cm) thick wood structural panels, 0.375 in. (0.95 cm) thick particleboard, 0.25 in. (0.64 cm) hardboard, 0.375 in. (0.95 cm) gypsum board, or corrosion-resistant steel having a base metal thickness of 0.016 inch (0.41 mm).

d. All insulation materials must be in accordance with UAE Fire Code.

3.7. Exterior Envelope

Drawings submitted for review shall contain section details of proposed wall assembly showing framing, sheathing, water-resistive barrier, flashing, and exterior cladding as applicable (IRC, Sec. R703).

3.8. Ceiling Height

Ceiling height shall provide a minimum of 7 ^{ft} (213.4 cm) of headroom in habitable locations and as otherwise specified in IRC, Sec. R305.

3.9. Skylights

IRC Section R308.6 regulates skylight glazing. Glazing is limited to certain types, and screening under the glazing may be required. Indicate which glazing products are to be used and provide sufficient details in the submitted plans to ensure compliance (IRC, Sec. 308.6). Glass PV or hydronic solar collectors used overhead without a solid surface underneath (such as a roof) will be regulated as skylights.

3.10. Energy Conservation

a. Design and construction for energy conservation cm) arc of either vertical edge of a door and less than 60 in. (152.4 cm) above the floor

Glazing within 36 in. (91.4 cm) of stairways and/or within 60 in. (152.4 cm) of the bottom edge of stair treads when the bottom edge of the shall be in accordance with the 2012 International Residential Code. Buildings shall be designed using the Climate Zone specified at the final location for the structure following the public exhibit in Irvine, California at the Orange County Great Park. For areas outside of the United States, determination of climate zone equivalency shall be provided in accordance with IRC Section N1101.10. Teams will be required to demonstrate compliance by using either the prescriptive method, UA Trade Off approach, or by performance modeling using RESNET or other approved software.

3.11. Fire Sprinkler System

Fire Sprinkler System must be designed in accordance with design requirement of UAE Fire Code and Dubai Civil Defense. Such systems shall be fully operational during the public exhibit and competition. Each dwelling will be individually required to provide site-stored fire water for sprinkler operations based on the sprinkler system design demand. Each dwelling's sprinkler will be required to be provided with a pump capable of the pressure and volume required for the fire sprinkler design. A test and valve shall be placed in an accessible location at the most remote point of the sprinkler system. This valve will be used to assist in charging the system with water, and will be operated by the team during the inspection period to demonstrate that the sprinkler system is charged and that the pump used for sprinkler pressurization is operating correctly. Pumps used for fire sprinklers may be dedicated to the fire sprinkler system or be used for both domestic and fire system purposes.

4. Accessibility

4.1. Accessible Route – Interior

An accessible route shall be provided within the unit to all spaces accessible to the public as part of the tour. Components of the accessible route used by the touring public must comply with 2010 Standard for Accessible Design and Dubai Municipality Accessibility requirement. Other accessible

features may be included in rooms such as kitchens and bathrooms at the discretion of the designers. If any of the features are available and intended for use by the public, they shall be accessible in accordance with the 2010 Standard for Accessible Design and Dubai Municipality Accessibility requirement. Voluntary accessibility provided outside of areas accessible to the touring public should comply with 2012 IBC Chapter 11 and ICC/ANSI A117.1-2009 for the level of accessibility desired.

4.2. Accessibility – Habitable Roof Deck and Interior Second Floor/Loft Levels

Solar Decathlon competition houses are intended to demonstrate single-family dwellings that would not normally be regulated by federal accessibility standards. However, these buildings are open to the public for educational purposes and must be accessible in all primary function areas. Therefore, any portion of the building where the public is permitted must provide an accessible route.

a. The Americans with Disabilities Act (ADA) requires an elevator to be installed in buildings (funded pursuant to Title II) where an accessible route is required to stories above the first floor (such as the roof deck, second floor, or loft). The 3,000 ft^2 (278.7 m^2) exception located in IBC Section 1104.4 Exc. 1 is superseded by this Federal regulation.
b. The ADA Technical Assistance Center has stated that it is acceptable to "demonstrate" a roof deck, loft, or upper level accessed via stairs, or other means of inaccessible access, as long as no member of the public, organizers, or competing teams is allowed to access the space during public exhibit periods. Any provided means of access shall be fully gated or cordoned off to inhibit entry. Adherence to these guidelines should remove any perception that the upper level is being used as a primary function and therefore subject to the accessibility provisions of the ADA.

4.3. Accessibility – Ramps

The following are the most important regulations and specific Solar Decathlon criteria regarding ramps:

b. A "ramp" is any sloping surface used as part of the circulation path that has a slope in excess of 1:20. Sloping surfaces less than 1:20 shall comply with 2010 Standard for Accessible Design Section 403 and Dubai Municipality Accessibility requirement. The slope of a ramp cannot exceed 1:12.
c. At the top and bottom of any ramp, a landing 60 in. (152.4 cm) long is required.
d. A 60 in. by 60 in. (152.4 cm by 152.4 cm) landing is required at any point where a ramp changes directions.
e. Handrails are required if the ramp's rise exceeds 6 in. (15 cm. Handrails shall be continuous and be provided with 12-in. (305-mm) extensions beyond the top and bottom of the ramp's sloping surface . Handrails with a circular cross section shall have an outside diameter of at least 1.25 in. (32 mm) and not greater than 2 in. (51 mm). If the handrail is not circular, it shall have a perimeter dimension of at least 4 in. (102 mm) and not greater than 6.25 in. (160 mm) with a maximum cross-section dimension of 2.25 in. (57 mm). Handails shall be uniform in height, not less than 34 in. (864 mm) and not more than 38 in. (965 mm) above the walking surface of the ramp.
f. Teams must design and provide a metal plate transition component between the access ramp and the walking surface of the competition site. Such plate shall be no greater than 1/2 inch (12.7mm) thick at the edge contacting the walking surface of the competition site. If the edge exceeds 1/4 inch (6.3mm) thickness, it shall be provided with a 1:2 bevel. If the connected ramp exceeds 5% slope, the transition plate and the ramp must be provided with handrails and edge protection. Both shall extend onto the transition plate with the handrails extending 12 in. (305mm) beyond the termination of the transition plate. The design of the transition plate shall accommodate the lateral loads placed on the handrails and extensions without relying on ground embedment for support.

4.4. Changes in Elevation

All changes in elevation (including even minor changes in areas such as door thresholds) must be considered along an accessible route. Changes not exceeding 0.25 in. (0.64 cm) are acceptable.

a. Elevation changes between 0.25 in. and 0.5 in. (0.64 cm and 1.3 cm) shall be beveled at a maximum of 1:2 slope.
b. Any change in elevation exceeding 0.5 in. (1.3 cm) shall be by a ramp with a maximum slope of 1:12 (2010 Standard for Accessible Design Section 405).
c. Sloped walking surfaces complying with 2010 Standard for Accessible Design Section 403 and Dubai Municipality Accessibility requirements shall be permitted.

4.5. Doors and Door Approaches

All doors shall comply with the 2010 Standard for Accessible Design Section 404 and Dubai Municipality Planning Department requirement.

a. Doors that can be fixed in an open position may be accepted as part of the accessible route if 32 in. (81.3 cm) minimum clearance is provided through the door opening with the door secured in the fully open position.
b. Doors without required maneuvering clearances that are intended to remain open during the public tour must be clearly identified on the plans and approved by the SDME Official.

5. Structural

The structural drawings and calculations shall be stamped by a qualified faculty and submitted for approval. It is strongly recommended that teams involve a qualified, licensed professional 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 IRC and local requirements, special attention must be given to the structural design challenges unique to the temporary exhibit. These challenges include, but are not limited to, the following:

a. Increased live loads because of public access to houses.
b. Necessity for non-earth-embedded foundations employing steel stake anchor embedment tie-down because of the lack of a permanent foundation and unique wind-loading conditions because of roof-mounted solar systems.
c. Increased dead loads because of unusual or concentrated mechanical and electrical equipment.

5.1. Prescriptive Requirements

a. Structural systems shall be designed in accordance with the appropriate prescriptive provisions of the IRC where practical. Engineered design may be employed using accepted engineering practice in accordance with the International Building Code. Alternate materials and methods shall comply with IRC Section 104.11 and Sec. CC2.6.
b. Structural framing: A detailed structural plan view drawing is required at a minimum. Successive plan sheets shall be provided and shall include foundation footings, anchorage details, floor framing, wall locations, and roof framing. All structural components shall be listed including sizes, species and grade, orientation of the structural components, and repetitive spacing (on-center distances). Include details on connections between joists and beams, floor systems and foundations, walls and floors, rafters and beams, etc. Specify proprietary hangers or other mechanical connections (IRC, Sec. R301.1).

5.2. Design Loads

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

a. Wind: 85 mph (38.0 m/s) (3-second gust), exposure category C (if anchorage design is not employed, the design must show that there is no overturning, uplifting, or sliding with a safety factor of 2).
b. Seismic: IRC Seismic Design Category (SDC) D_2 See IRC Section R301.2.2.
c. Railings: 200 lb (890 N) concentrated load applied in any direction at any point at the top of the rail.
d. Interior floor, decks, ramps: 50 psf (2.39 kPa) live load.
e. Exterior floor, decks, ramps used for tour staging and egress purposes: 100psf (4.79 kPa) live load.
f. Roof: 20 psf (0.958 kPa) live load.
g. Temporary Paved Surface: 6,000 psf (287 kPa) maximum load-bearing pressure. Additional structural design requirements at the post-event house location (to be determined by the licensed professional of record).

Structural plans shall indicate the design live loads [e.g., 40 psf (1.92 kPa) floors, 100 psf (4.79 kPa) means of egress components (ramps), 20 psf (0.958 kPa) snow roof live load] and the location, size, and weight of special loads such as liquid storage tanks and mass or trombe walls. These loads are considered minimums for the temporary event competition. Higher design loads may be mandated by the local authority having jurisdiction in the location where the house will be permanently sited. The design should accommodate the higher of the design values required by the Solar Decathlon Building Code or Dubai Municipality.

5.3. Exterior Construction

Structural plans shall include design details for any exterior appurtenances such as decks, stairs, ramps, awnings, canopies, and roof projections (IRC, Sec. R301.1). Deck structural framing shall include full details for house ledger connections, joist-to-beam connections, and beam-to-column/footing connections. Special design attention shall be paid to load path for deck foundation systems for concealed footing systems.

5.4. Specific Point Loads

Provide wind-analysis calculations for point-load connections demonstrating the components' abilities to withstand 85 mph (38.0 m/s) (3 second gust), exposure category C wind conditions. Provide point-load connection details for all solar panel connections to demonstrate that the connections will resist uplift (IRC, Sec. R301.1 and R905.16).

5.5. Foundation

Provide a foundation plan for temporary setup on the competition site. The design must accommodate all design loads, including gravity and lateral derived from wind and seismic. Plans shall include location and size of all temporary footings and required tie-down anchors (e.g., type, number, and installation configuration) to prevent wind uplift or overturning (IRC, Sec. R401.1 and R401.2) and to provide adequate lateral load transference for SDC D_2 design seismic forces. Please provide consideration for sloping or variable site conditions.

General Requirements:

a. All houses, decks, and other structures shall be provided with foundations sufficient to safely transmit gravity, lateral, and uplift loads. For purposes of design, the presumptive paved surface bearing capacity shall be 6,000 psf (287 kPa). Design wind speed shall be 85 mph (38.0 m/s) (3-second gust) with a C exposure.
b. Uplift design may employ uplift anchorage, dead-load analysis, or a combination of both. Anchorage embedment into the temporary site will be limited to the method and design

values indicated in Section 5.5(c). Teams are encouraged to configure their structures to take advantage of dead loads to resist wind uplift, and seismic- and wind-generated overturning and sliding. All designs shall be supported by calculations demonstrating the efficacy of the designed system. Foundation designs and calculations shall be approved prior to placement of the structure on the competition site.

c. Ground anchorage may be affected by use of minimum 1-inch (25.4-mm) diameter, A36 mild solid steel stakes driven a minimum of 36 in. into the existing pavement surface. Such stakes shall be driven vertically. Design stake capacity shall be assumed as:
    - 1,250 pounds vertical withdrawal (pull out)
    - 1,500 pounds horizontal shear
    - Or as determined by Calculation 5.5c, where both forces are applied.

Calculation 5.5c: $$\frac{\text{Actual Withdrawal Load (lbs)}}{\text{1,250 Pounds}} + \frac{\text{Actual Shear Load (lbs)}}{\text{1,500 Pounds}} \leq 1$$

Teams will be responsible for the design and structural qualification for the load transference mechanism between the stake and the building structure being anchored. Threaded rods may be used. Driven rods used in multiples must be spaced a minimum of 24 in. on center.

Teams are responsible for removal of the stakes at the conclusion of the event. Teams are not permitted to drive the stake below the surface of the existing pavement. All stakes must be removed from the site at the conclusion of the event.

Alternative ground anchorage methods may be permitted upon approval of the Solar Decathlon Building Official.

5.6. Alternate Materials

Alternate materials are permitted as follows:

a. Engineered lumber (e.g., TJIs, LPIs, and BCIs) pursuant to specific manufacturer's design data: The product selected must carry a current ICC Evaluation Services report. See http://www.icc-es.org/.
b. Structurally insulated panel systems pursuant to specific manufacturer's design data: The product selected must carry a current ICC Evaluation Services report. Also be advised that foam plastics must be thermally isolated from the interior of the dwelling (see Section 3-6 for more details).
c. Engineered trusses (floor or roof) must be designed in accordance with IRC Sections R502.11 or R802.10 as appropriate: Individual truss reports shall be provided for review and shall bear the seal of a registered design professional.
d. Alternate materials may be permitted if approved pursuant to approval by written request under IRC Section 104.11: It is the responsibility of the applicant to provide adequate proof to document the alternate as meeting the intent of the prescriptive code requirements. The organizers reserve the right to deny any alternate for failure to clearly demonstrate code equivalence.
e. Phase-change materials included within building components must be identified on the plans. Specifications for the material composition must be provided with fire-performance testing data. Be advised that phase-change embedment in gypsum board or interior wall or ceiling finishes may affect the ability of these materials to pass IRC required fire tests.
f. Unlisted electrical components intended to be used must be fully disclosed no later than 12 months prior to the start of the competition. Such unlisted components will be limited to 60 volts. Such components shall be fully described in a written proposal format with competent technical substantiation provided. The proposal is subject to approval by the

event organizers subject to stipulated minimum testing to ensure safe operation during the public event.

5.7. Structural Steel

Provide structural details for load-carrying structural steel assemblies. Include welded or bolted connections within the assembly and where attached to other structures (IRC, Sec. R301.1.3).

6. Electrical

6.1. Governing Code

The provisions of the currently active DEWA regulation (available upon request).

Exception: Electrical system design methods required by non-Dubai entrants for compliance in the jurisdiction of final placement may be permitted following review and approval by the Solar Decathlon Building Code Official. Such approval will require compliance with an approved national or international electrical code or standard. Teams seeking approval must submit two copies of the referenced code for evaluation prior to approval. If approved, such teams will be required to provide special inspection of the electrical system prior to placement of the structure in Dubai. Solar Decathlon temporary site final inspections of the visible electrical system will be performed by Solar Decathlon electrical inspectors using team supplied electrical test equipment suitable for the approved DEWA regulation-alternate electrical system.

6.2. Drawing Requirements

a. Electrical plan(s) must include layouts of proposed receptacles, switches, light fixtures, smoke alarms, ceiling fans, etc.

b. Provide details on the proposed PV system along with a key for symbols used in the drawings. Such details shall include information on the photovoltaic panels, distribution (e.g., wiring, inverters, switch gear, and over-current protection).

c. Provide a key for electrical symbols used in the electrical plans.

6.3. Tamper-Resistant Receptacles

406.11 Tamper-Resistant Receptacles in Dwelling Units

In all areas specified in DEWA regulations, all 230-volt receptacles shall be listed tamper-resistant receptacles

6.4. Outdoor Receptacles

Any receptacles used on the exterior of the building must be protected with ground fault circuit interrupters (GFCI). Enclosures provided must be suitable for damp locations.

406.8 Receptacles in Damp or Wet Locations

(A) Damp Locations. A receptacle installed outdoors in a location protected from the weather or in other damp locations shall have an enclosure for the receptacle that is weatherproof when the receptacle is covered (attachment plug cap not inserted and receptacle covers closed).

An installation suitable for wet locations shall also be considered suitable for damp locations.

A receptacle shall be considered to be in a location protected from the weather where located under roofed open porches, canopies, marquees, and the like, and will not be subjected to a beating rain or water runoff. All 250-volt nonlocking receptacles shall be weather-resistant type.

(B) Wet Locations.

(1) Receptacles in a Wet Location: 250-volt receptacles installed in a wet location shall have an enclosure that is weatherproof whether or not the attachment plug cap is inserted. All 250-volt nonlocking receptacles shall be weather-resistant type.

Exception: 250-volt receptacles installed in a wet location and subject to routine high-pressure spray washing shall be permitted to have an enclosure that is weatherproof when the attachment plug is removed.

6.5. Arc-Fault Circuit Protection

210.12 Arc-Fault Circuit-Interrupter Protection

(A) Definition: Arc-Fault Circuit Interrupter (AFCI). A device intended to provide protection from the effects of arc faults by recognizing characteristics unique to arcing and by functioning to de-energize the circuit when an arc fault is detected.

(B) Dwelling Units: All 230-volt, single phase, branch circuits supplying outlets installed in dwelling unit family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, or similar rooms or areas shall be protected by a listed arc-fault circuit interrupter, combination-type, installed to provide protection of the branch circuit.

Exception No. 1: Where RMC, IMC, EMT or steel armored cable, Type AC, using metal outlet and junction boxes is installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a combination AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

Exception No. 2: Where a branch circuit to a fire alarm system installed in RMC, IMC, EMT, or steel armored cable, Type AC, with metal outlet and junction boxes, AFCI protection shall be permitted to be omitted.

6.6. Ground-Fault Circuit Protection

Any AC receptacles located in kitchens or bathrooms shall be GFCI protected.

210.8 Ground-Fault Circuit-Interrupter Protection for Personnel

(A) Dwelling Units. All 230-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in (1) through (8) shall have ground-fault circuit-interrupter protection for personnel.

(1) Bathrooms
(2) Garages, and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use
(3) Outdoors
(4) Crawl spaces — at or below grade level
(5) Unfinished basements — for purposes of this section, unfinished basements are defined as portions or areas of the basement not intended as habitable rooms and limited to storage areas, work areas, and the like

Exception to (5): A receptacle supplying only a permanently installed fire alarm or burglar

alarm system shall not be required to have ground-fault circuit-interrupter protection.

(6) Kitchens — where the receptacles are installed to serve the countertop surfaces

(7) Laundry, utility, and wet bar sinks — where the receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink.

6.7. Equipment Listings

All electrical equipment shall carry an approved testing agency's listing or shall have been approved by the Solar Decathlon Building Official and Solar Decathlon electrical inspectors for temporary use during the event.

a. Unlisted PV modules may be used in a system with a DC bus voltage of no greater than 60 volts (open-circuit) at 32°F (0°C) if, and only if, such equipment has been evaluated and approved by the Solar Decathlon Building Official and Solar Decathlon electrical inspectors. PV cell and module mounting means are subject to increased scrutiny in custom, unlisted, building-integrated PV applications.
b. The use of unlisted PV modules and the installation of listed PV modules in an unapproved manner in a system with a DC bus voltage of greater than 60 volts (open-circuit) at 32°F (0°C) are prohibited. Listings shall be to IEC Standards specified under Shams Dubai standard and shall be approved by an international accredited testing laboratory.
c. The attachment of PV modules to any building material where the PV module is not listed for such an application is prohibited, regardless of the bus voltage.
d. All DC to AC utility-interactive inverters must be fully listed to UL Standard 1741.

6.8. Photovoltaics

All electrical connections, drawings and calculations for conventional and photovoltaic installations in CAD formats, according to DEWAs Shams Dubai standards (https://www.dewa.gov.ae/smartinitiatives/firstinitiative/publications/default.aspx).

6.9. Grounding

Each team shall provide a grounding electrode conductor from the dwelling's main service equipment to the organizer utility panel. The grounding electrode conductor shall be a minimum size of 4 AWG copper, either bare or insulated. The organizers will bond the dwelling grounding electrode conductor to the organizer grounding electrode.

Each dwelling shall *not* have or install a grounding electrode (commonly referred to as a ground rod).

6.10. Inverter Disconnect

Each team shall provide a disconnecting means located between the inverter and the solar array where panel-integrated microinverters are not employed. The disconnecting means should be capable of ready lockout/tagout to facilitate safe service of the inverter(s).

7. Mechanical

7.1. Drawing Requirements

Provide a key for symbols used in the drawings (IRC, Sec. R106.1.1).

7.2. Return Air

Return air shall not be taken from a bathroom, kitchen, or mechanical. (IRC, Sec. M1602.2). A separate isolated return shall be provided for the above.

7.3. Outside and Exhaust Air

a. Outside Air

Outside air shall not be taken closer than 10 ft (304.8 cm) from an appliance or plumbing vent, or discharge outlet of an exhaust fan [unless the intake is located at least 3 ft (91.4 cm) below the vent or fan discharge] (IRC, Sec. M1602.2, Item 1).

b. Screens

Outside air inlets shall be equipped with a screen with openings 0.25 in. to 0.5 in. (0.64 cm to 1.3 cm) (IRC, Sec. M1602.3).

c. Exhaust hood systems capable of exhausting in excess of 400 cubic feet per minute (0.19 m^3/s) shall be provided with makeup air at a rate approximately equal to the exhaust air rate. Such makeup air systems shall be equipped with a means of closure and shall be automatically controlled to start and operate simultaneously with the exhaust system. (IRC Sec. M1503.4)

7.4. Bathroom Ventilation

Bathrooms shall be provided with mechanical ventilation systems capable of providing 50 cfm (23.6 L/s) for intermittent ventilation or 20 cfm (9.4 L/s) for continuous ventilation, or with windows allowing a 1.5 ft^2 (0.14 m^2) opening for natural ventilation (IRC, Sec. R303.3).

8. Solar Mechanical

8.1. Drawing Requirements

Provide plan details for any proposed solar mechanical systems. Provide details on collectors, fluid distribution, heat exchangers, etc., along with a key for symbols used in the drawings (IRC, Sec. 106.1.1). Plans should emphasize compliance with IRC M2301. Calculations at arriving area for heating is required.

8.2. Cross Connection

Provide details for the solar hot-water system. Provide details indicating if potable water or other heat transfer liquids will be employed. If other than potable water is used, an approved heat exchanger shall be employed to isolate potable water from transfer fluids (IRC Section R106.1.1). Provide calculation for storage capacity of hot water to be provided and to ensure all loads during night are included in calculating capacity.

8.3. Access

Solar collectors, controls, dampers, fans, and pumps shall be accessible for inspection, maintenance, repair, and replacement (IRC, Sec. M2301.2.1). Payback period and life costs calculation to be provided. Local makes will be preferred.

8.4. Roof-Mounted Collectors

The roof shall be constructed to support all loads imposed by the collectors. If collectors are intended to serve as the roof covering, documentation shall be provided to determine compliance with the roofing provisions in IRC, Chapter 9. If the collectors will be placed over the roof covering, the collectors and supporting structure shall be constructed of noncombustible material or fire-retardant-treated wood equivalent to that required for the roof covering (IRC, Sec. M2301.2.2).

8.5. Pressure and Temperature Relief

Pressure- and temperature-relief valves shall be provided for components under pressure. Relief devices shall be installed in sections of the system so that a section cannot be valved off or isolated from a relief device (IRC, Sec. M2301.2.3). Pressure and temperature relief devices shall have the capacity to be removed and capped prior to inspection to accommodate the required 100 psi (690 kPa) system pressure test required by Section 8-13.

8.6. Vacuum Relief

A vacuum relief valve shall protect system components that might be subjected to pressure drops below atmospheric pressure during operation or shutdown. Plans shall indicate if this system is subject to vacuum conditions (IRC, Sec. M2301.2.4).

8.7. Expansion Tanks

Expansion tanks in solar systems shall be installed in accordance with IRC, Section M2301 in closed-fluid loops that contain heat-transfer fluid (IRC, Sec. M2301.2.6).

8.8. Solar Loop Isolation

Valves shall be installed to allow isolation of the solar collectors from the remainder of the system (IRC, Sec. M2301.2.8).

8.9. Maximum Temperature Limitation

Systems shall be equipped with means to limit the maximum water temperature of the system fluid entering or exchanging heat with any pressurized vessel inside the dwelling to 180°F (82°C) . This protection is required in addition to required temperature and pressure relief valves stated in IRC, Section M2301.2.3 (IRC, Sec. M2301.2.9).

8.10. Collector and Thermal Storage Unit Labeling

a. Collectors and storage units shall be listed and labeled to show the manufacturer's name, model number, serial number, collector weight, collector maximum allowable temperatures and pressures, and the type of heat transfer fluids that are compatible with the collector and storage units (IRC, Sec. 2301.3).
b. Identification of system components. All components of the solar hydronic system shall be identified with permanent identification labels. Such labels shall indicate the function of the component (i.e. panel loop supply or return, heat exchanger, domestic loop, etc.) and flow direction.

Exception: Domestic plumbing fixture supply and in-floor radiant heat loops.

8.11. Prohibited Heat-Transfer Media

Flammable gasses and liquids shall not be used as heat-transfer fluids (IRC, Sec. M2301.4).

8.12. Backflow Prevention

All connections from the potable water supply to solar systems shall comply with IRC, Section P2902.4.5 (IRC, Sec.M2301.5).

8.13. Pressure Test

All solar hydronic piping shall be tested hydrostatically at a pressure of not less than 100 psi (690 kPa) for no fewer than 15 minutes. Temperature and pressure relief devices that operate at or less than 100 psi (690 kPa) shall be isolated during the test by removal and capping.

Exception: Systems designed for pressures under 100psi (690kPa) may be tested at lower pressures when approved by the Solar Decathlon Building Official. Such testing must be approved prior to transportation of the structure to the competition site.

9. Plumbing

9.1. Drawing Requirements

a. Provide a labeled isometric diagram of the proposed plumbing system for review. Clearly indicate waste lines, vent lines, potable water supply, heat exchange equipment, and the type of any heat transferring fluid used other than potable water.
b. Provide a key for symbols used in the drawings (IRC, Sec. 106.1.1).

9.2. Water Closet Demonstration

Water closets are installed for demonstration only and shall not be connected to any portion of the sewage disposal system. The water closet may be attached to a PVC or ABS 10.2 cm to 7.7 cm (4 in. to 3 in.) water-closet flange provided with a capped end or with the test plug knock-out in place. No structural member shall be cut or otherwise damaged to accommodate the water-closet flange assembly. No water supply shall be extended to the water closet unless otherwise approved by the Solar Decathlon Building Official. Bowl openings should be provided with a concealed opaque cover to discourage use of the toilet during the temporary exhibit.

9.3. Plumbing Wall – Structural

Recommendation: Create a dedicated plumbing wall with thickness sufficient to allow pipe penetrations within the studs not exceeding 60% of the stud width in nonbearing walls (IRC, Sec. 602.6).

9.4. Shower Mixing Valves

Shower mixing valves shall be pressure balanced, thermostatic mixing, or a combination of the two, with the high limit set at 120°F (48.9°C) to prevent scalding (IRC, Sec. P2708.3).

9.5. Backflow Prevention

Backflow prevention is required to isolate the potable water supply from the solar systems. See IRC Section P2902.2 for permissible devices. Because this project uses supply tanks for potable water, the use of a separate and isolated fill system for the solar component may be deemed acceptable backflow prevention (IRC, Sec. P2902.2).

9.6. Water Heater and Heated Storage Vessel Seismic Support

Water heaters and other heated fluid storage vessels shall be anchored or strapped in the upper one-third and in the lower one-third of the appliance to resist a horizontal force equal to one-

third of the operating weight of the water heater, acting in any horizontal direction, or in accordance with the appliance manufacturer's recommendations.

9.7. Supply

No additives of any kind may be added to the water in the team's supply tank. This water is not for consumption at any time. Teams will be required to provide the tank and support this tank so that it does not damage the competition site.

9.8. Waste

All substances used in combination with water to clean the house, dishes, utensils, etc., must be nontoxic and preferably biodegradable. Teams may incur a point penalty for any toxic substances that are found in the wastewater tank.

9.9. Water Feature Safety

a. Water features shall not exceed a depth of 2 ft (61 cm).
b. For water features >1 ft but <2 ft (>30.5 cm but <61 cm), there shall be a representative from the team positioned at the water feature when open to the public to monitor the area and act as a lifeguard if necessary. During times when the area is not open to the public, the water feature shall be covered or guarded in a manner to prevent access.
c. To ensure safe access, a 44 in. (111.8 cm) accessible surface shall be maintained all around the water feature.
d. Visitor flow patterns shall be considered in the placement of the water feature.
e. The water feature should have sufficient circulation/treatment/measures taken to ensure the water does not become stagnant and a nuisance hazard.

9.10. Rainwater Harvesting

Teams may demonstrate or actively engage in harvesting and utilizing captured rainwater provided that the rainwater harvesting system meets the Dubai Municipality Green Buildings Regulations. Harvested Rainwater shall only be used for irrigation purposes.

10. Material Safety

10.1. Thermal Storage

All thermal storage devices ("mass") must be made of stable, nontoxic materials. For all heat-transfer fluids, Material Safety Data Sheets (MSDS) must be submitted for approval. All liquid-based thermal storage systems must be marked with the NFPA's hazard warning diamond appropriate to the technology.

Teams are not permitted to dispose of paint on the competition site, disposal of any hazardous waste shall follow Dubai Municipality solid waste regulations.

10.2. Material Safety Data Sheets (MSDS)

MSDS are required for all potentially hazardous materials to be used at the event, such as cleaning solvents, glycol, rubber cement, rubbing alcohol, etc.

11. Health and Safety

Under Preparation.

Appendix A Adaptive and Native Plants Species

1. Local Environmental Species Used “Cosmotic” Agriculture

Item	Scientific Name	Common Name	Arabic Name	Family Name
1	*Acacia arabica*	Arabian Gum	القرض	Leguminosae
2	*Acacia ehrenbergiana*	Salam	السلم	Leguminosae
3	*Acacia farnesiana*	Sweet Acacia	الفتنة	Leguminosae
4	*Acacia tortilis*	Ambrella Thorn	السمر	Leguminosae
5	*Aerva javanica*	Snow Bush / Kapok Bush	الأرا / راء	Amaranthaceae
6	*Atriplex sp.*	Salin Bush	الرغل	Chenopodiaceae
7	*Avicennia marina*	Mangrove	المانجروف أو القرم البحري	Avicenniaceae
8	*Boerhavia elegans choisy*	Showerka	شويرقة	Nyctaginaceae
9	*Colligonum comosum*	Arta	الأرطا	Polygonaceae
10	*Casuarina equisetifolia*	She Oak	الكازورينا	casuarinaceae
11	*Cometes surattensis*	Dhaffa	ظفة	Caryophyllaceae
12	*Convolvulucs virgortus*	Faghi	فاغي	Convolvuloceae
13	*Dodonaea viscosa*	Purple Hop-Bush	شحص	Sapindaceae
14	*Hamada elegans*	Ramth	الرمث	Chenopodiaceae
15	*Leptadenia pyrotechnica*	Markh / Broom Bush	المرخ	Asclepiaceae
16	*Leucaena leucocephala*	Lead Tree	ليكونيا	Leguminosae
17	*Lycium shawii*	Christmas Berry	العوسج	Solanaceae
18	*Moringa oleifera*	Horse Radish Tree	مورنجا / يسر	Uoringaceae

2. Palm Trees

Item	Scientific Name	Common Name	Arabic Name	Family Name
1	*Areca catechu; L*	Betal Nut Palm	أريكا	Palmae
2	*Arecastrum romanzafiannum*	Queen Palm	نخيل البندو	Palmae
3	*Bismarckia nobilis*	Bismarck palm	نخيل بسمرك	Palmae
4	*Butia capitata*	Wine Palm		Palmae
5	*Caryota mitis*	Fish Tail Palm	ذيل السمكة	Palmae
6	*Caryota urens*	Stinging	ذيل السمكة المفرد	Palmae
7	*Chamaedorea elegans*	Parlour Palm	كميدوريا	Palmae
8	*Chamaerops humilis*	European Fan Palm	كميروبس	Palmae
9	*Chrysalidocarpus lutescens*	Golden Can Palm		Palmae
10	*Cocos nucifera*	Coconut Palm	النارجيل	Palmae
11	*Cyrtostachys renda*	Sealing Wax Palm	نخيل الشمع	Palmae
12	*Elaeis guineensis*	African Oil Palm	نخيل الزيت	Palmae
13	*Howea forsteriana*	Kentia Palm	الكنتيا	Palmae
14	*Hyophorbe lagenicaulis*	Bottle Palm	نخيل القلة	Palmae
15	*Hyphoene thepiaca*	African Doum Palm	نخيل الدوم	Palmae

16	*Livistonia chinensis*	Chinese Fan Palm	النخيل الصيني المروحي	Palmae
17	*Livistonia dicipien*	Cabbage Palm		Palmae
18	*Lodoicea maldivica*	Coco-de-mer	النارجيل المجوز	Palmae
19	*Neodypsis decaryi*	Triangle Palm	النخيل المثلث	Palmae
20	*Phoenix reclinata*	Senegal Date Palm	نخيل البلح السنغالي	Palmae
21	*Phoenix roebelenii*	Dwarf Palm	النخيل القزمي	Palmae
22	*Phoenix canariensis*	Canary Island Date Palm	نخيل الكناري	Palmae
23	*Phoenix dactylifera*	Date Palm	نخيل البلح	Palmae
24	*Phoenix sylvestris*	Silver Date Palm	نخيل السكر	Palmae
25	*Pritchardia pacifica*	Fiji Fan Palm	برتشارديا	Palmae
26	*Ptychosperma macarthurii*	Hurricane Palm		Palmae
27	*Rhapis flablliformis*	Lady Palm	رابس	Palmae
28	*Roystonea elata*	Florida Royal Palm	نخيل فلوريدا الملكي	Palmae
29	*Roystonea regia*	Cuban Royal Palm	النخيل الملوكي	Palmae
30	*Sabal palmetto*	Palmetto Palm	ذيل الطاووس	Palmae
31	*Trithrinax paviflora*	Thatch Pole		Palmae
32	*Veitchia merrilli*	Manila Palm	نخيل مانيلا	Palmae
33	*Washingtonia filifera*	California Palm	نخيل كاليفورنيا	Palmae
34	*Washingtonia robusta*	Washington Palm	نخيل واشنطون	Palmae
35	*Wodyetia bifurcata*	Foxtail Palm	ذيل الثعلب	Palmae

3. Semi-Palm Trees

Item	Scientific Name	Common Name	Arabic Name	Family Name
1	*Beacarnea recurvata*	Pony Tail	الزلوع	Liliaceae
2	*Cycas media*	Australian Nut Palm	ذيل الجمل الطويل	Cycadaceae
3	*Cycas revoluta*	Sago palm	ذيل الجمل القزمى	Cycadaceae
4	*Encephalartos ferox*	Zululand cycad		Zamiaceae
5	*Horridus Encephalartos*	Ferocius blue cycad		Zamiaceae
6	*Pachypodium lamerei*	Madagascar palm	نخيل مدغشقر	Apocynaceae
7	*Pandamus utilis*	Screw pine	بندانس	Pandaceae
8	*Pandanus veitchii*	Variegated screw pine	بندانس مخطط	Pandaceae
9	*Ravenala madagscariensis*	Travelers tree	شجرة المسافر	Musaceae
10	*Strelitzia Nicolai*	Bird-of-paradise tree	عصفور الجنة الكبير	Musaceae
11	*Strelitzia reginae*	Bird-of-paradise	عصفور الجنة الصغير	Musaceae
12	*Yucca aloifolia*	Spanish bayonet	يوكا عادية	Agavaceae
13	*Yucca filamentosa*	Adams needle	إبرة آدم	Agavaceae
14	*Yucca elephantips*	Giant yucca	اليوكا العملاقة	Agavaceae
15	*Yucca brevifolia*	Joshua tree	اليوكا المعمرة	Agavaceae
16	*Zamia Pumila*	Jamaica sago	الزاميا	Zamiaceae

4. Trees and Bushes

Item	Scientific Name	Common Name	Arabic Name	Family Name
1	*Acacia arabica*	Arabian gum	القرض	Leguminosae
2	*Acacia farnes iana*	Sweet acacia	الفتنة	Leguminosae
3	*Acacia mangium*	Black wattle	أكاسيا ماتجيوم	Leguminosae
4	*Acacia saligna*	Golden wreath	الإكليل الذهبي	Leguminosae
5	*Adansonia digitata*	Boabab	التبلدي	Bombacaceae
6	*Albizi lebbech*	Womans tongue tree	ذقن الباشا	Leguminosae
7	*Araucaria excelsa*	Norfolk island pine	عيد الميلاد	Araucaiaceae
8	*Azadirachta indica*	Neem tree	النيم	Meliaceae
9	*Balanates aegyptiaca*	Jericho balsam	بلح العبيد	Zygophyllaceae
10	*Beaucarnea recurvata*	Pony tail	الزلوع	Liliaceae
11	*Bauhinia varigata*	Purple orchid tree	خف الجمل	Leguminosae
12	*Bombax ceiba*	Red kapok tree	شجرة القطن	Bombacaceae
13	*Callistemon viminalis*	Bottle brush tree	فرشة الزجاج	Myrtaceae
14	*Cassia fistula*	Golden shower	خيارشمبر	Leguminosae
15	*Cassia nodosa (javanica)*	Pink & white shower tree	كاسيا ندوزا	Leguminosae
16	*Cassia roxburghii marginata*	Red cassia	الكاسيا الحمراء	Leguminosae
17	*Casuarina equisetifelia*	She oak	الكازورينا	Casuarinaceae
18	*Ceratonia siligua*	Kharoob	الخروب	Leguminosae
19	*Chiranthodendron pentadactylon*	Monkey hand tree	يد القرد	Sterculiaceae
20	*Chorisia Speciosa*	Pink floss silk tree	كوريزيا	Bombacaceae
21	*Conocarpus erectus*	Button mangrove tree	دمس بورق عريض	Combretaceae
22	*Conocarpus erectus sericeus*	Silver tree	الدمس الفضي	Combretaceae
23	*Conocarpus lancifolius*	Land mangrove	دمس بورق رفيع	Combretaceae
24	*Cordia sebestena*	Geiger tree	المخيط	Boraginaceae
25	*Dalbergia sissoo*	Sissoo tree	السرسوع	Leguminosae
26	*Delonix regia*	Flam of the desert	البوانسيانا	Leguminosae
27	*Enterolobium cyclocarpum*	Ear tree	ودن العفريت	Leguminosae
28	*Eucalyptus citriodora*	Lemon gum	الكافور الليموني	Myrtaceae
29	*Eucalyptus camaldulensis*	Red gum	الكافور	Myrtaceae
30	*Ficus bengalensis*	Banyan tree	الرولا	Moraceae
31	*Ficus benjamina*	Weeping fig	فيكس بنجامينا	Moraceae
32	*Ficus elastica*	Indian rubber plant	فيكس مطاط	Moraceae
33	*Ficus infectoria*	Spotted tree	فيكس انفكتوريا	Moraceae
34	*Ficus religosa*	Bo-tree	فيكس لسان العصفور	Moraceae
35	*Ficus retusa*	Indian laurel	فيكس نتدا	Moraceae
36	*Ficus rubiginosa*	Rusty fig	فيكس روبيجنوزا	Moraceae
37	*Gliricidia sebium*	Madre de cacao	جليرسيديا	Leguminosae
38	*Jacaranda mimosifolia*	Mimosa-leaved ebony	جاكراندا	Bignoniaceae

39	*Kigelia pinnata*	Susage tree	المشطورة	Bignoniaceae
40	*Lagerstroemia indica*	Crape myrtle	التمرحنة لأفرنجي	Lytheraceae
41	*Leucaena leucocephala*	Lead tree	ليسونيا	Leguminosae
42	*Melaleuca genistifolia*	Fleece tree	ميلالوكا	Myrtaceae
43	*Melaluca guinguenervia*	Cajeput tree	ميلالوكا	Myrtaceae
44	*Melaluca leucadendron*	Papper bark tree	ميلالوكا	Myrtaceae
45	*Melia azedarach*	Pride of India	الزنزلخت	Meliaceae
46	*Millingtonia hortensis*	Indian cork tree	شجرة الياسمين	Bignoniaceae
47	*Moring oleifera*	Horse radish tree	الشوع	Moringaceae
48	*Peltophorum inerme*	Yellow flame tree	بلتفرم	Leguminosae
49	*Pithcellobium dulce*	Cats-claw	الصبار الهندي	Leguminosae
50	*Paulownia tomentosa*	Empress tree	بولونيا	Scrophulariaceae
1	*Plumeria spp*	Frangipani	الياسمين الهندي	Apocynaceae
52	*Pongmia Glabra*	Pongam	بونجاميا	Leguminosae
53	*Samanea saman*	Rian tree	زمان يازمان	Leguminosae
54	*Schinus molle*	California pepper tree	فلفل بورق رفيع	Anacardiaceae
55	*Spathodia campanulata*	African tulip tree	اسباثوديا	Bignoniaceae
56	*Schinus terebinthifolius*	Pepper tree	فلفل بورق عريض	Anacardiaceae
57	*Tabebuia argetea*	Silver trumpet tree	التابوبيا الصفراء	Bignoniaceae
58	*Tebebuia pallida*	Cuban pink trumpertree	التابوبيا الوردية	Bignoniaceae
59	*Tamarix aphylla*	Athel tamarisk	الأثل -العبل	Tamaricaceae
60	*Tamarindas indica*	Tamarind tree	التمر هندي	Leguminosae
61	*Tecoma stans*	Yellow bells	الصفير	Bignoniaceae
62	*Terminalia cattapa*	Tropical almond	اللوز	Combretaceae
63	*Thespesia populnea*	Portia tree	الشمسية	Malvaceae
64	*Tipuana tipu*	Rosewood	أبو المكارم	Leguminosae
65	*Vitex agnus castus*	Chaste tree	كف مريم	Verbinaceae
66	*Ziziphus spina*	Christi thorn	السدر	Rhamnaceae
67	*Petrea volubilis*	Queens wreath	بتريا	Verbenaceae
68	*Tecoma stans*	Yellow bells	صفير	Bignoniaceae
69	*Lawsonia inerme*	Henna	تمرحنة	Lytheraceae
70	*Nerium oleander*	Oleander	الدفلة	Apocynaceae
71	*Simmondsia chinensis*	Jojoba	جوجوبا	Buxaceae
72	*Scaevola sericea*	Beach Naupake	خس البحر	Goodeniaceae
73	*Hibiscus rosa-sinensis*	Chinese hibiscus	هبسكس	Malvaceae
74	*Hibiscus sabdariffa*	Karkade	كركديه	Malvaceae
75	*Thevetia peruviana*	Yellow oleander	تفيتيا	Apocynaceae
76	*Duranta rapens*	Sky flower	الدورانتا	Verbenaceae
77	*Acacia coriacea*	Wire wood	أكاسيا كوريكا	Leguminosae
78	*Acacia pendula*	Weeping myala	الأكاسيا المتهدلة	Leguminosae

5. Soil Covers

Item	Scientific Name	Common Name	Arabic Name	Family Name
1	*Rhoeo discolor*	Moses-in-the Cradle	روهيو	Commelinaceae
2	*Ruellia scumosa*	Ruellia	روليا بنفسجي	Acanthaceae
3	*Ruellia tuberose*	Ruelia		Acanthaceae
4	*Alternanthera versicolor*	Joyweed	المتيرة/ النتيرا	Amaranthaceae
5	*Agapanthus africanus*	African Lily	زهرة النيل	Liliaceae
6	*Atriplex sp.*	Salt bush	الرغل	Chenopodiaceae
7	*Scaevola aemula*	Fairy fanflower	زهرة المروحة	Goodeniaceae
8	*Myoporum parvifolium*	Creeping boobialla	بزروميا قزمية	Myporaceae
9	*Sesevium portulacastrum*	Sea pursalin	سيزفم	Aizoaceae
10	*Angelonia gardneri*	Blue wings	انجيلونيا	Scrophulariaceae
11	*Adenium obesium*	Flower of the desert	زهرة الصحراء	Apocynaceae
12	*Centratherum muticum*	Brazil button flower	زهرة البرازيل	Compositae
13	*Aptenia cordifolia*	Baby sun rose	ابتنيا	Aizoaceae
14	*Asparagus densiflorus*	Asparagus	اسبرجس	Liliaceae
15	*Carissa grandiflora (Prostrate)*	Natal plum	كاريسا	Apocynaceae
16	*Crinum asiaticum*	Poison bulb	كرينم	Amarylidaceae
17	*Hymenocallis narcissiflora*	Peruvian Daffodil	نرجس عريض	Amarylidaceae
18	*Gazania rigens*	Treasure flower	جازانيا	Compositae
19	*Lippia nodiflora*	Lippia	ليبيا	Verbenaceae
20	*Osteospermum fruticosum*	Trailing Arrican daisy	دايمورفاتكا بيضاء	Compositae
21	*Pennisetum setaceum*	Fountain grass	حشيش الشواطئ الأخضر	Gramineae
22	*Setcreasea purpurea*	Purple heart	ستكرسيا	Commelinaceae
23	*Verbena peruviana*	Verbena	فربينا	Verbenaceae
24	*Wedelia trilobata*	Wedelia	ويداليا	Compositae
25	*Sesevium Portutlacasstrum*	Sea Pursaline	سيزفم	Aizoaceae
26	*Portulacaria afra*	Elephant food	رجلة الصبار	Portulacaceae
27	*Pentas lanceolata*	Egyptian Star Cluster	بنتس	Rubiaceae
28	*Turnera unifoloa*	Brooklyn Bot	ترنيرا	Turneraceae
29	*Leucophyllum frutescens*	Texas Ranger	ليكوفيلم	Scrophulariaceae
30	*Iresine herbstii*	Beefsteak Plant	إيرسين	Amaranthaceae
31	*Iresine lindenii*	Blood leaf	إيرسين	Amaranthaceae
32	*Carpobrotus edulis*	Hottentot Fig	حي علم سميك	Aizoaceae
33	*Lampranthus roseus*	Ice plant	حي علم رفيع	Aizoaceae
34	*Asystasia gangetca*	Coromandel	اسستسيا	Acanthaceae
35	*Rosmarinus officinalis*	Rosemary	حصالبان	Lbiatae

6. Climbers

Item	Scientific Name	Common Name	Arabic Name	Family Name
1	*Allamanda cathartica*	Golden Trumpet	المندا	Apocynaceae
2	*Antigonon leptopus*	Coral vine	أنتيجونن	Polygonaceae
3	*Clerodendrum splendens*	Glorybower	طربوش الملك	Verbenaceae
4	*Doxantha unguis cati*	Cats claw	مخلب القط	Bignoniaceae
5	*Senecio confusus*	Mexican flame vine	السناتير المتسلق	Compositae
6	*Clitorea ternatea*	Butterfly Pea	كلتوريا	Leguminosae
7	*Cryptostegia grandiflora*	Indian Rubber Vine	كربتوستاجيا	Asclepiodaceae
8	*Quisqualis indica*	Rangoon creeper	كويس كولس	Combretaceae
9	*Ficus pomila*	Creeping Fig	الفيكس المتسلق	Moraceae
10	*Ipomoea patatas*	Sweet potato	البطاطا	Convolvulaceae
11	*Ipomoena palmata*		ست الحسن	Convolvulaceae
12	*Ipomoea pes-capree*	Beach morning glory	الحباي	Convolvulaceae
13	*Jacquemontia pentantha*	Jacquemontia	جاكومنتيا	Convolvulaceae
14	*Jasminum grandiflorum*	Jasmine	ياسمين بلدي	Oleaceae
15	*Tecomaria capensis*	Cape honeysuckle	تيكوماريا	Bignoniaceae
16	*Tristellateia austtralasiae*	Galphimia vine	ترستليتيا	Malpighiaceae

7. Green Landscapes

Item	Scientific Name	Common Name	Arabic Name	Family Name
1	*Paspalum Vaginatum*	Paspalum	بسبالم	Gramineae
2	*Cynodon dactylon L*	Bermuda grass	النجيل البلدي	Gramineae
3	*Tifway grass*	Bermuda hybrid	نجيل بلدي محسن	Gramineae
4	*TifGreen Grass*	Bermuda Hybrid	نجيل بلدي محسن	Gramineae
5	*Zoysia Japonica*	Zoysia Grass	زويسا	Gramineae
6	*Stenotaphrum Secondatum*	Buffalo Grass	النجيل الفرنساوي	Gramineae
7	*Lolium parenne*	Ryegrass	الجازون	Gramineae

8. Flowers

Item	Scientific Name	Common Name	Arabic Name	Family Name
1	Dianthus caryophullus	Carnation	القرنفل المجوز	Caryophyllaceae
2	Dianthus chinensis hybrid	Rainbow pink	القرنفل المفرد	Caryophyllaceae
3	Dianthus barbatus	Sweet william	القرنفل المفرد	Caryophyllaceae
4	Impatiens wallriana	Sultana	بلزمينا	Palsaminaceae
5	Ipatiens balsamina	Rose balsam	بلزمينا	Palsaminaceae
6	Nicotiana alata	Jasmine tobacco	دخان الزهور	Solanaceae
7	Salvia splendens	Scarlet sage	سلفيا	Lobiate
8	Antirrhinum Hybrid Tall	Floral snapdragon	حنك السبع	Scrophulariaceae

9	Antirrhinum Hybrid Dwarf	Floral snapdragon	حنك السبع	Scrophulariaceae
10	Celosia cristata	Cockscomb	عرف الديك	Amaranthaceae
11	Celosia plumosa	Feather celosia	عرف الديك	Amaranthaceae
12	Dahlia variabilis	Dahlia	داليا	Compositae
13	Delphinium ajacis	Rocket larksuper	دلفينم	Ranunculaceae
14	Gaillardia pulchella	Blanket flower	جلارديا	Compositae
15	Heliotropium peruvianum	Heliotrope	هاتروبيم	Boraginaceae
16	Limonium sinuatum	Statice	استاتس	Plumbaginaceae
17	Ageratum SP	Floss-flower	برجمان	Compositae
18	Viola tricolor	Pansy	بنسية	Violaceae
19	Petunia gandiflora	Petunia	بتونيا	Solanaceae
20	Petunia milliflora	Petunia	بتونيا	Solanaceae
21	Zinnia hybrid	Youth and old age	زنيا	Compositae
22	Lobelia erinus	Lobelia	لوبيليا	Lobeliaceae
23	Phlox drummondii	Dwarf annual phlox	فلوكس	Polemoriaceae
24	Verbena hybrida	Verbena	فربينا	Verbenaceae
25	Callistephus chinensis	China aster	الاستر	Compositae
26	Centaurea cryans	Cornflower	سنتوريا	Compositae
27	Coreopsis Sp.	Lance tickseed	عين العفريت	Compositae
28	Cosmos bipinnatus	Garden cosmos	كوزموس	Compositae
29	Fuchsia hybrida	Fushia	فوشيا	Onagraceae
30	Gazania splendens	Treasure flower	جازانيا	Compositae
31	Helianthus annuns	Sunflower	عباد الشمس	Compositae
32	Matthiola incana	Stocks	المنثور	Curiferae
33	Nemesia strumosa	Cape jewels	نميزيا	Scrophulariaceae
34	Lathyrus odoratus	Sweet pea	بسلة الزهور	Leguminosae
35	Alyssum maritime	Ice plant	اليسم	Curiferae
36	Catharanthus rosea	Madagascar periwinkle	ونكا	Apocynaceae
37	Portulaca grandiflora	Rose moss	رجلة الزهور	Portulacaceae
38	Dimorphotheca aurntiaca	Rain cape marigold	ديموفاتيكا	Compositae
39	Amaranthus tricolor	Josephs coat	أمرنتس	Amaranthaceae
40	Gypsophila elegans	Annual baby's breath	جيبسوفيلا	Caryophyllaceae
41	Iberis coronaria	Rocket candytuft	إبرس	Curiferae
42	Clarkia elegans	Orchid godetia	كلاركيا	Oenotheraceae
43	Calendula officinalis	Pot marigold	أقحوان	Compositae
44	Gompharena globosa	Globe amaranth	جمفرينا	Amaranthaceae
45	Tagetes ericta	Marigold	القطيفة أو المري جولد	Compositae
46	Brassica oleracea	Flowering kale	كرنب الزهور	Curiferae

9. Fruit-bearing Trees

Item	Scientific Name	Common Name	Arabic Name	Family Name
1	Citrus aurantifolia	Lime	الليمون المالح	Rutaceae
2	Citrus sinensis	Sweet orange	البرتقال	Rutaceae
3	Citrus reticulta	Mandarin orange	اليوسفي	Rutaceae
4	Ficus carica	Fig tree	التين	Moraceae
5	Carica papaya	Papaya	الفيفاي	Cariaceae
6	Mangifera indica	Mango tree	المانجو	Anacardiaceae
7	Psidium guaiva	Apple gwaiva	الجوافة	Myrtaceae
8	Ficus sycomorus	Sycamore fig ficus	الجميز	Moraceae
9	Olea europea	Olive tree	الزيتون	Oleaceae
10	Punica granatum	Pome granate	الرمان	Punicaceae
11	Ceratonia siliqua	Carob	الخروب	Leguminosae
12	Tamarindus indica	Tamarind tree	التمر هندي	Leguminosae
13	Annona squamosa	Sugar apple	القشطة البلدي(الشريفه)	Annonaceae
14	Manikara zapota	Chikoo	الشيكو	Sapotaceae
15	Terminalia catappa	Tropical almond	اللوز	Combretaceae
16	Citrus aurantium	Bitter orange	النارنج	Rubceae
17	Morus spp.	Mulberry	التوت	Moraceae
18	Musa spp.	Banana	الموز	Musaceae
19	Ziziphus spina credi	Christi thorn	السدر	Rhamnaceae
20	Pithcellobium dulce	Cats-claw	الصبار الهندي	Leguminosae
21	Grewia asiati	Phalsa	الفالسا	Tilliaceae

Reference: Public Parks & Horticulture Department – Dubai Municipality 2010