ZERO ENERGY HOME DESIGN COMPETITION

2017

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1 INTRODUCTION

The competition is based upon a real-world scenario, where a builder is developing a new high performance house product line or needs to update an existing product line (house plan) to a high-performance house design. College teams are posed with a design problem and are asked to either create a new house design that satisfies the project requirements.

This is an exciting time—a time when zero energy ready houses have become achievable and cost-effective. By definition, these high-performance houses are so energy-efficient that renewable power can offset all or most of their annual energy consumption.

The Objectives of this contest are to:

1. *Design a zero ready house for a specific neighborhood.*
2. *Inspire and develop the next generation of building professionals.*
3. *Advance and enhance interdisciplinary building science, smart home and renewable energy related curricula in universities.*
4. *Go beyond regular materials and resources that are introduced in the typical classroom, Learning the material in class then getting to apply it in a real-world application*
5. *Provide real-world scenario for architecture, Electrical & civil undergrads to work in interdisciplinary teams & learn how to cooperate.*
6. Provide a summer training opportunity to undergrads (12 Weeks)

2 PARTICIPATION

Participants in the "Zero Energy Home Design Competition" have the opportunity to provide creative solutions to real-world issues in our nation's housing industry. Invited teams will complete the required submissions and attend the competition event where they will present their designs to a panel of expert judges and compare their efforts with other teams.

2.1 TASK OVERVIEW

- Read this "Zero Energy Home" Guide and form a multidisciplinary team.
- Complete the registration phases
- Attend the ZEH orientation session
  (19/06/17 – 02:00 pm @ Hall 4, New Building "Credit", Faculty of Engineering, Ain Shams University)
- Start self-learning all background knowledge to start your design.
- Attend optional ZEH workshops.
- Submit all materials for evaluation by the announced deadlines.
- Submit your questions to ihub@eng.asu.edu.eg or in the ZEH17 Facebook group.

2.2 ELIGIBILITY

Students who major in architecture, engineering, building science, construction management, interior design, marketing, management, landscape architecture, and other related fields from an accredited Egyptian University can participate in the contest.

1- *Architecture (Graduating 2018, 2019, 2020)*
2- *Civil (Graduating 2018, 2019)*

3- *Electrical (Graduating 2018, 2019)*
4- *Mechanical (Graduating 2018, 2019)*
5- *Business & commerce fields (Graduating 2018, 2019)*

2.3 REGISTRATION

- The applicants will fill the Personal online form.

2.4 TEAM FORMATION

- Applicants should start creating a team (3 – 10 Members).
- The team should be multidisciplinary (Civil, Architecture, Mechanical & Electrical).
- Having business undergrads is recommended but not obligatory.
- Each team should have an academic mentor.
- The mentor should be an Egyptian graduate holding at least BSc degree in any relevant engineering field.
- Teams will fill an online "Team formation form".
- Mentors should provide *a photo copy of their National ID that mentions he is an Engineer. An engineering syndicate membership card can be added as supplementary proof of occupation.*

2.5 TIMELINE

- *Orientation Session: 19/06/17*
- *Registration Deadline: 16/07/17*
- *Team Formation: 19/06/17 – 16/07/17*
- *Design Concept submission: 27/07/17*
- *Project Progress Report: 17/08/17*
- *Final Submission: 14/09/17*

- *Final Assessment: 21/09/17*

3 DESIGN CONTEST

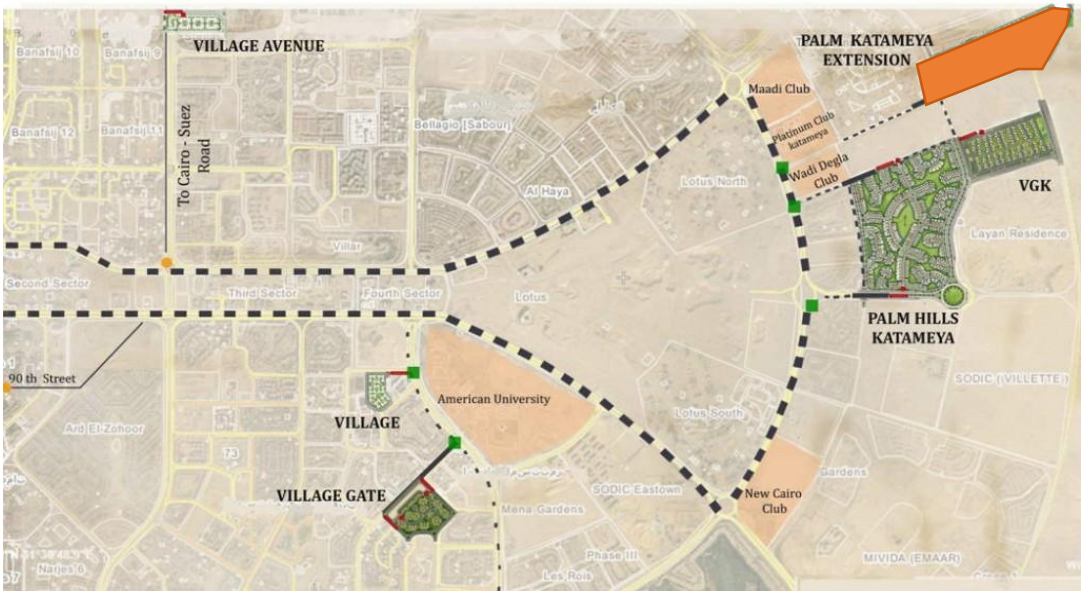
3.1 Requirements & Guidelines

In this project, teams will design residential units to be built in a prestigious, residential community set on a sprawling 434,000 m^2 in New Cairo, near to the AUC campus. This project is an extension to Palm hills Katameya existing project. Each team will choose design one of the following:

1. Standalone Villa
2. Twin Villa (a villa that shares a wall with its adjacent villa)

The guidelines for the design are as follows:

1. Foot print of the building should not exceed 40% of each plot area/building
2. The lot land areas are
    a. 500-600 m^2 for each standalone villa
    b. 400 m^2 for each twin villa
3. Allowed heights of the buildings are ground floor – first floor – penthouse.
4. Penthouse = 25% of building footprint
5. The villas should be designed to accommodate 4-5 people
6. Parking spaces that need to be provided should be
    a. 2 parking spaces for the standalone villa
    b. 1 parking space for the twin villa
7. *Each team defines a specific location, villa type, and neighborhood characteristics as context for the house design and its relationship to surrounding houses and the community.*



3.2 Evaluation

Projects submitted to "Zero Energy Home" will demonstrate competency by applying principles of building science and best practice solutions. The teams will be assessed on their project report submissions, including the design and technical documentation, project plans, reports on required analyses, and the quality of their project presentations. These submissions should demonstrate the teams' ability to design, analyze, and plan for the construction of quality, high-performance houses.

3.3 ASSESSMENT CRITERIA

1. ***Architectural Design (10 Points):***
   - i. *Quality of the architectural design and project aesthetic*
   - ii. *The design's responsiveness to the site; natural comfort; careful integration of residential building systems; and connection to the outdoors*
   - iii. *How well the design approach responds to relevant national, regional, and local programs and knowledge*
   - iv. *The general success of the team's approach to integrate high-performance house*

v. *and building science principles within an architecturally appealing design*
vi. *Effective design and specification of materials, products, and building elements.*

2. ***Interior Design, Lighting, and Appliances (10 Points):***
   i. *The interior design's functionality, attractiveness, and enhancement of the occupants' quality of life*
   ii. *Extent to which the interior design complements the exterior architecture*
   iii. *Environmental sustainability of materials used for finishes and furniture*
   iv. *Appropriateness, effectiveness, and attractiveness of the house's floorplan to the intended occupant*
   v. *Resource efficiency, resiliency, and attention to local resources*
   vi. *The overall approach to lighting including specified equipment and control scenarios and analysis of artificial lighting and daylighting for specific rooms*
   vii. *The overall approach to, and specification of, appliances that are energy efficient, appropriate for the needs of the occupants, and responsive to modern techniques and capabilities.*

3. ***Energy Analysis (10 Points):***
   i. *Comprehensive energy efficiency and optimal interaction of efficiency features across design elements*
   ii. *The appropriateness of the technology options chosen for the location and climate*
   iii. *The opportunities, tradeoffs, and house design modifications needed to incorporate renewable energy systems sufficient to achieve zero annual energy use and offset nonrenewable energy sources*

iv. *Design and component analyses for active renewable energy systems that are necessary to achieve zero energy use across all nonrenewable energy sources used in the house.*

4. ***Constructability (10 Points):***
   - I. *How effectively the drawings and associated documentation communicate the design and would enable successful review and construction by industry professionals, including trades, suppliers, fabricators, code reviewers, and purchasers*
   - II. *The proactive design and detailed approach to prevent common problems in construction, which often occur at transitions or discontinuities in control layers (e.g., water, air, thermal, vapor)*
   - III. *Level at which typical construction practices by readily available labor are considered as part of the design process*

5. ***Financial Analysis (10 Points):***
   - i. *Quality of the construction cost analysis completed based on standard cost databases such as RS Means or standard cost data provided by DOE including federal, state, and local financial incentives for use of renewables or for energy efficiency upgrades*
   - ii. *Integration of the utility cost estimate based on the energy analysis*
   - iii. *Quality of the maintenance cost analysis*
   - iv. *Affordability of the design for the targeted market segment(s) (e.g., entry level, move-up) including the necessary household income required to purchase and live in the project house assuming a 30-year fixed mortgage.*

6. ***Mechanical, Electrical, and Plumbing Design (10 Points):***
   - i. *The approach to choosing and meeting performance objectives for the mechanical system equipment selection and integration*

ii. *The systems approach relative to the structure and climate including design principles, operation and control, the thermal conditioning for each type of space, and energy source options*
iii. *Consideration of the maintenance requirements, working to minimize overall costs*
iv. *Reasonableness of assumptions and technical justifications for prototype equipment that may not be commercially available*
v. *The potential for load monitoring and control of large appliances and general miscellaneous electric loads*
vi. *The application of advanced technologies to automate the control of energy use and provide energy information that can reduce energy consumption and costs.*
vii. *Selection of water conservation fixtures throughout the house*
viii. *The overall design principles of the hot water system including estimated loads, water heating equipment, supply piping, and layout to minimize wait time, losses, and wasted water.*

7. ***Envelope Performance and Durability (10 Points):***

i. *The design's consideration of major mechanisms that affect envelope durability and integrate the building science concepts of air transport, moisture management, and thermal and hydrothermal performance based on specific environmental conditions*
ii. *The level with which construction details and material specifications address the physical principles for air movement control based on air sealing and air barrier designs*
iii. *The level with which specifications address thermal control using insulation systems that are properly installed without gaps, voids, compression, and/or thermal bridging*
iv. *The level with which specifications address comprehensive water and moisture management including flashing details, water barriers, and*

capillary breaks to control bulk moisture; control of moisture movement through the wall system; and considerations for other potential moisture problems (e.g., condensation)

v. *The design's consideration of resiliency related to prevalent natural disaster risks for the project location.*

8. Indoor Air Quality and Ventilation (10 Points):
   - i. *The overall approach and details of the IAQ contaminant control and filtration solutions used to provide a healthy indoor environment*
   - ii. *The overall approach and details of ventilation systems for occupant health and comfort*
   - iii. *The appropriate consideration of materials and details to improve indoor air quality*
   - iv. *The approach of the design to limit the introduction of contaminants into the house.*

9. *Innovation (10 Points):*
   - i. *Overall approach to the design competition with regard to integration of innovations that improve the design solution*
   - ii. *Unique integration of building science principles in ways that are achievable, beneficial, cost-effective, and functional*
   - iii. *Smart consideration and development of unique design parameters in the submission that respond to a market need, such as regional and local issues*
   - iv. *Collaboration with industry partners to evaluate and provide feedback on innovations.*

10. *Presentation and Documentation Quality (10 Points):*
   - i. *Completion and quality of project submittals*
   - ii. *Quality of presentation package of visual aids and spoken remarks*
   - iii. *Timeliness of project submittals.*

3.4 Project Submittals: (listed in chronological order of submission)

A. Design Concept

B. Project Report

C. Project Presentations

D. Project Poster

***A. Design Concept Report** should include:*

A. Project Summary:

- *Project name*
- *Team name*
- *University name(s)*
- *Summary of goals, target market, and strategy*
- *Project data*
- *Key images*

B. Project approach

C. Summary of industry partners & expected form of support

D. Potential structural & mechanical systems

E. Floorplan, exterior renderings, or interior renderings (all optional)

***Design Concept** Evaluation Criteria:*

- *Quality of the formation of a team*
- *Quality of the formulation of a project approach*
- *Quality of a design strategy*
- *Level of content inclusion & completion*

- *Other factors, such as geographic or technology diversity*

4 PARTNERS & AWARDS

4.1 PARTNERS

We are proudly announcing that the main sponsors for ZEH Contest are:

i. Palm Hills
ii. Karm Solar

4.2 AWARDS

All the teams that will complete the whole program till the end & submit all the required reports will be given 12-week participation certificates. The team with the highest score will be awarded a money prize of 10,000 EGP.