MISSION
Empowerhouse is a community-based approach to building affordable, solar-powered housing that addresses all aspects of decent life.

To accomplish this mission, we have assembled a multi-disciplinary team that is establishing strategic community partnerships, and developing technological innovations that will serve as a catalyst for developing affordable, energy-efficient housing on a broad scale. We are exploring the policy implications of this effort in order to recommend viable solutions to decision-makers and advocates for change.

TARGET CLIENT
Empowerhouse’s GoldStarCat is the unique opportunity to have the speculative client be the actual homeowner after the competition. Working with Habitat for Humanity of Washington, D.C. and Department of Housing and Community Development, The Herons (301) 725-0020 to design Empowerhouse for a family to inhabit in their neighborhood of Deanwood in Washington, D.C. The family will be motivated based on habitat for humanity’s three main criteria:

* Need: The family to have experienced overcrowding, dangerous surroundings, environment, hosting, electrical, plumbing, structural deficiencies and/or unsafe roof handset.
* Ability to Pay: The family must satisfy reasonable income requirements that may vary from project to project.
* Willingness to Sweat: The family must maintain house in “sweat equity” towards the construction of their home, attend homeowner education workshops, and, demonstrate a willingness to maintain the home and property after purchase.

Working within the habitat for humanity selection criteria, Empowerhouse provides the family with a safe, comfortable, and self-sustaining new home.

Conversations with community stakeholders and residents have informed us of the aspects of decent life that they find most important. The front porch is a social extension of the home into the neighborhood. Additionally, a large kitchen for family cooking is an essential focal point for the home.

The final location of the home is determined on the south side of South Flax with the north side of the house facing the street, and the south side facing Mount Sinai Park. The lot, too narrow to accommodate more than a limited number of south facing windows, drives the investigation into creating a passive house. This site challenges led us to focus on a light sleep into the center of the home through a light well above.

Empowerhouse will be constructed of prefabricated panels that remain labor and overall construction costs. Habitat for Humanity of Washington, D.C. will likely utilize this method of construction in many of their projects in the future. While the specific home is designed for one family to be in, the design model may be adaptable to other family types and sizes and sites across Washington, D.C. This house will be the model for a newly replicable energy efficient house that will strengthen Washington, D.C. neighborhood of Deanwood’s existing efforts to create community empowerment and resident community. We aim to bring our knowledge of efficient housing to our community.

Most importantly, Empowerhouse will provide the clients with an ability to produce all of their own energy, reduce their drinking water use, and grow their own food. These benefits will not only save the client significant capital throughout the life of the home, but will empower the homeowner with the means for creating a sustainable life.

The initial investment the homeowner will need to be in this house will be repaid within the first two years through the long term cost savings in energy bills, as well as provide the enjoyment of participating in an affordable and sustainable life.
ARCHITECTURAL NARRATIVE

Our architectural design stems from strategies which create a comfortable living environment focused on a whole-life approach while engineering habitat for humanity’s current building practices with high-performance energy efficient technologies.

Designed to be built on a specific urban lot in the residential neighborhood of Ward 7 in Washington, D.C. after the Solar Decathlon competition, Empowerhouse is designed to be the model for net zero energy home with living spaces in the southern part of the house, the living area sharing the common social elements of the house. The rear of the house is divided horizontally into three parts. A central "wet" module, containing the mechanical equipment, bathrooms, and storage, and the front of the house at the end, while the living "dry" module, containing the living area, office, light loft, and bedroom, is opened and airy. The rear wall of the home, accented by the thick wrapper aimed to meet passive house standards, wraps the house to become both floor, and facade as it extends beyond the front and rear of the house to embrace the neighborhood beyond.

The circulation through Empowerhouse is single and direct. Upon entering the home on the south, you are straight through a central corridor to the rear entrance and back. This axial connection pats the outdoors into the interior living space and the rear of the house with the light loft, bedroom, and access corridor. The main staircase is located on the exterior in the living area, kitchen, office, and light loft above. At the rear, the house space is a convenient and comfortable porch for outdoor living.

Our lighting strategy contains natural daylight, efficient and cost effective supplementary light sources, and occupancy and daylight sensors to ensure high-quality light for a variety of activities throughout the home. General lighting is provided by low-cost, high efficiency linear fluorescent and LED light sources that reflect off of the vertical and horizontal surfaces of the house, using the architectural form as the luminaries. Focused activities are provided for with additional task lighting. These two systems are independent, however, complement each other to create a light environment that is both energy efficient and comfortable for the user.

Highly efficient active systems, together with naturally lit, open living spaces, create a compact, livable home, wrapped in a thick insulating envelope.

ENGINEERING NARRATIVE

Energy efficiency is a primary design driver for Empowerhouse. Not only is energy performance important for success in this measured arena of the Solar Decathlon competition, it will be crucial for providing the increased home owners with a sustainable and affordable home. By maximizing the need for mechanical systems to heat and cool the house, the team was able to design a non-renewable, useful, and efficient house that will help alleviate the end-user's energy costs in the future.

Empowerhouse has been engineered for peak heating and cooling periods in Washington, D.C. To meet the efficiency goals for the house, the house incorporates Passive House principles for energy usage and system design. Passive houses are super-insulated, air tight buildings. In winter, they minimize heat's heating load by maximizing solar gains (through windows), and thermal gains from people, electronic, and appliances. Conversely, the house's cooling load is minimized through the use of strategies using glazing standards and shading devices. The light values of passive houses provide the opportunity to save energy, meaning that from without an energy recovery ventilation system, the passive house can be engineered with a mechanical ventilation system that can be successfully managed by high efficiency fans.

Lighting fixtures, and controls are optimized for low-energy consumption. High efficiency linear fluorescent and LED's are utilized for light sources. Additionally, wireless controls, and occupancy and daylight sensors maximize efficiency.
1. **STAIR AREA**: 40.5 S.F.
2. **FIRST FLOOR AREA**: (PER ANSI Z765‐2003) 868 S.F.
3. **TOTAL FLOOR AREA**: (INCLUDING BULKHEAD AND STAIR INHABITABLE SPACE) 950.0 S.F.
4. During Contest Week, finish square footage will not increase.

**Note**: Finished square footage calculations for this house were made based on plan dimensions only and may vary from the finished square footage of the house as built.
1. EXHIBIT SIGNAGE ON 6 FT. TALL TOTEMS. PRINTED FABRIC BANNERS ON THREE SIDES OF TOTEM
2. SYSTEM OF SIGNAGE INCLUDES A VARIETY OF SCALES FOR WAY-FINDING AND INFORMATIONAL SIGNAGE
3. EXHIBITION INCLUDES TWO VISITOR PATHS: A FULL EXHIBITION ROUTE AND AN EXPRESS LINE.
4. THE FULL EXHIBITION IS ADA ACCESSIBLE
1. **All Corridors / Passageways** meet ANSI 117.1 Accessible Code, the minimum clear width of the touring route shall be 36 in (915 mm) except at doors.

2. Thresholds at doorways shall not exceed 1/4 in. Raised thresholds and floor level changes at accessible doorways greater than 1/4 in shall be beveled with a slope no greater than 1:2.

3. The maximum slope of all ramps shall be 1:12.

4. Handrails provided on all ramps and stairs.

5. Handrails shall not be less than 34" and not greater than 38" above finish surface of the ramp.

6. Handrail grip size shall comply with R311.5.6.3 of the 2006 IES.

7. Vertical changes in floor surfaces shall be 1/2" maximum.

8. Maximum spacing between decking members shall be 1/2".

9. All signage on the National Mall site shall comply with Section 4.30 ADAAG.

10. All doors shall have a minimum clearance of 32".

11. Doors have the maneuvering clearance for 60" front approach.

12. During the competition the staircase to the loft will be cordoned off to inhibit public access.
INTERCONNECTION PLAN & COMPETITION INSTRUMENT LOCATIONS

1. INTERCONNECTION PLAN
2. COMPETITION INSTRUMENT LOCATIONS

079 DATALOGGER ENCLOSURE UNDER CABINET
080 INDOOR TEMPERATURE SENSOR
081 RELATIVE HUMIDITY SENSOR
082 FREEZER TEMPERATURE SENSOR
083 REFRIGERATOR TEMPERATURE SENSOR
084 HOT WATER DRAW LOCATION
086 TEAM PANEL BOARD LOCATION
088 ORGANIZER UTILITY PANEL
089 TEAM METER HOUSING
092 ORGANIZER PROVIDED SENSOR WIRE
093 GROUNDING SYSTEM IN ACCORDANCE WITH SOLAR DECATHLON BUILDING CODE
094 DEDICATED 1" DIAMETER CONDUIT WITH PULL STRINGS FOR ORGANIZER PROVIDED TELECOM CABLE
095 TEAM INVERTER LOCATION

PUBLIC TOUR PATH

AREA TO BE CONDED OFF DURING COMPETITION

TEAM POWER CABLE

ORGANIZER EThRT WIRE PULL STRING CONDUIT

GROUNDING ELECTRICIAN CONDUIT

INSTRUMENT KEY

1/4" = 1' - 0"

G-122

1. NDF Faculty
2. Parsons
3. Stevens
4. NS

8/13/2011 9:37:14 AM

PRODUCED BY AN AUTODESK STUDENT PRODUCT
EXHIBIT STRATEGY

The exhibit is displayed as a series of banners hung on upturned cedar-clad planters. The planters are interconnected by twine, controlling the public line before people may enter the frame. The planters are connected by informational banners on each, with experiential sequential 1-12. The theme of the exhibit is Empowerhouse, Community, Passive, Active, Elements, and Integration. Throughout the frame, small tags call out specific components for their material, performative, or otherwise sustainable properties.
**Client:** US Department of Energy Solar Decathlon 2011

**Website:** www.solardecathlon.gov

**Date:** November 23, 2010

**Design Development:** March 22, 2011

**Construction Documents:** August 11, 2011

**Final Construction Documents:** May 3, 2011

**As-Built Construction Documents:** August 11, 2011

**Building Address:** 25 East 13th Street, 2nd Floor, New York, NY 10003

**Copyright:** EMPOWERHOUSE

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**Architect:** Zavos Architecture + Design, LLC

**Address:** 323 West Patrick St., Frederick, MD 21701

**Phone:** (301) 698-0020

**Fax:** (301) 698-0920

**MEP & Structural Engineer:** Buro Happold Consulting Engineers

**Address:** 100 Broadway, New York, NY 10005

**Phone:** (212) 334-2025

**Fax:** (212) 334-5528

**Civil Engineer:** Vika Capitol, LLC

**Address:** 4910 Massachusetts Ave., NW Suite 214, Washington, DC 20016

**Phone:** (202) 244-4140

**Fax:** (202) 244-4196

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**Exterior Shading Diagrams**

- **A1: North side on Sept 22 at 5 PM**
- **A3: Sept 22 at 5 PM**
- **A5: South side on Sept 22 at 5 PM**
- **C1: North side on Sept 22 at 12 PM**
- **C3: Sept 22 at 12 PM**
- **C5: South side on Sept 22 at 12 PM**
- **D1: North side on Sept 22 at 9 AM**
- **D3: Sept 22 at 9 AM**
- **D5: South side on Sept 22 at 9 AM**

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**Notes:**

- This page contains exterior shading diagrams for a building project.
- The diagrams show different views of the building at various times.
- The project is part of the U.S. Department of Energy Solar Decathlon 2011.

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**G-901**
**GENERAL NOTES:**

1. The project shall conform to the 2009 International Building Code, along with the District of Columbia Building Code Supplement 1999. All loads shown are factored.

2. All structural work shall conform to the project specifications, all drawing notes, and applicable reference standards. The scope of work is not solely defined by these documents.

3. Typical details apply throughout the project, even if not specifically referenced in plan or details. Details of construction not fully shown or noted on the drawings nor called out in the specifications shall be of the same size and character as for similar conditions which are shown and noted.

4. Do not use scaled dimensions, use only written dimensions. Where no dimension is provided, consult the architect for clarifications before proceeding work.

5. See architectural drawings for site positioning and project datum reference.

6. The contractor shall be solely responsible for the conditions of the job site including safety of persons and property and the means and methods of construction.

7. Structural elements shall be centered about gridlines or dimension lines, unless otherwise noted.

8. All structural work shall be coordinated with architectural, mechanical, electrical, plumbing, etc. requirements. Refer to architectural drawings for dimensions not shown or plant. Discrepancies and/or interfaces shall be reported to the architect immediately.

9. Contractor shall be responsible for providing engineered designs and coordination of final support details of non-structural items identified in contract documents including, but not limited to:
   - A. Mechanical equipment attachments
   - B. Details shown in structural drawings are indicative in nature. Contractor to design, coordinate, and/or provide additional framing as required.
   - C. Openings shall not be made in any structural member unless specifically shown on the structural drawings or approved by the structural engineer.

10. Owner’s responsibility shall be deemed having been relinquished with the architectural documents as identified by the architect or inspector shall be responsible for the contractor’s expense. Contractor shall compensate owner for services arising from deficient work.

11. The contractor shall be solely responsible for any required rerouting of the site during construction.

**DESIGN LOADS:**

**BUILDING LOADS:**

1. Structural design of this building is in accordance with the 2009 International Building Code, along with the District of Columbia Building Code Supplement 1999.

   **A. Live Load**
   - 40 PSF (First floor designed for 100 PSF assembly LL)

   **B. Dead Load**
   - Joists and studs
     - 20 PSF
   - Deck
     - 20 PSF
   - Blocking
     - 15 PSF
   - Misc/Mech
     - 5 PSF
   - Interior partitions
     - 10 PSF

   **C. Wind Load**
   - Based on the wind speed
     - Exposure A
   - Importance Factor
     - 1.0

   **D. Snow Load**
   - No drift regions
     - 20 PSF
   - Drift regions
     - 40 PSF

   **E. Seismic Load**
   - Soil profile
     - 11
   - Site class
     - D

   **F. Roof Dead Load**
   - 15 PSF (Option panel)
   - 10 PSF (Framed)

   **G. Roof Live Load**
   - 20 PSF (Service)

**WOOD:**

1. All framing lumber and details of wood construction shall conform to the "National Design Specification for Steel and Wood Frames" (including supplements).

2. All engineered wood products are to be provided by Nordic Engineered Wood and are to meet all specifications of "Nordic Engineered Wood Residential Construction Guide" or approved equal.

3. Laminate lumber section are of grade 24F-1.9e LVL, per Nordic Engineered Wood, or approved equal.

4. Refer to "Nordic Residential Construction Guide" for all information including, but not limited to:
   - A. Foundation elements of joists
   - B. Connection/Joist blocking details

5. Plywood shear walls shall be APA grade stamped for the specific span, and shall be made with exterior glue, and shall be of the following thickness:
   - Floors/roofs: APA-rated sheathing exterior exposure I
   - Non-shear walls: APA-rated structural sheathing exterior exposure I

6. Plywood sheathing shall be glue and nailed to floor joists using APA-approved elastomeric construction adhesive and code required nails.

7. Details of wood framing such as nailing, blocking, bridging, etc. shall conform to the 2009 International Building Code or the "Nordic Residential Construction Guide" unless greater requirements are shown in details.

8. Where beams are flush framed to header, use approved type beam hanger.

9. No beams except as shown in details, shall be cut or notched without approval.

**REFERENCE SOURCES:**

- Columbia Building Code Supplement 1999

**SPECIFICATION SHEET DETAIL:**

**NOTE:** All structural dimensions are furnished in written form. Wherever no dimension is provided, consult the architect for clarifications before proceeding work.
FOUNDATION PLAN

06 05 23.D29 LUS26
06 11 00.F9 2X6 JOIST
06 11 00.G6 2X8 TIMBERSIL JOIST
06 11 00.I2 2X12 PRESSURE TREATED LUMBER
06 11 13.A1 3/4" X 9 1/2" NORDIC GLULAM BEAM

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S-101
1. ALL DIMENSIONS TO EDGE OF FRAMING U.O.N.
2. SEE SHEETS A‐101, A‐102, A‐501, A‐502, A‐601, A‐602 FOR WALL TYPE TAGS AND REFERRING SHEETS.
3. USE WALL TYPE ASSEMBLY INFORMATION.

S-102
1. ALL DIMENSIONS TO EDGE OF FRAMING & CRAN

S-103
1. MAXIMUM HOUSE FOOTING LOAD: 2000 PSF
2. MAXIMUM HOUSE FOOTING LOAD: 2000 PSF
3. MAXIMUM DECK/RAMP FOOTING LOAD: 250 PSF
4. TIE-DOWNS LIMITED TO 18 INCHES VERTICAL DEPTH

BEARING PRESSURE PLAN

S-121
1. Plywood layers of all footings to be screwed together.

2. (4) 3/4" earth anchors driven through four exterior footings, vertical to not more than 18".

E.T.O. DECK

TEAM
Parsons
Stevens
ADDRESS
25 East 13th Street, 2nd Floor
New York, NY 10003

CONSULTANTS
Architecture + Design, LLC
323 West Patrick St.
Frederick, MD 21701

CIVIL ENGINEER
OF RECORD
Vika Capitol, LLC
323 West Massachusetts Avenue, NW
Suite 214
Washington, DC 20016

GENERAL SHEET

GENERAL NOTES:
1. Foundation details to be reviewed by MEP & structural engineers.
2. Foundation details are public domain.

REFERENCES:
- Foundation details
- Footings details
- Joist hangers
- Timber base
- Lumber
- Carpenter's rules
- Weathered cedar decking
- Pressure treated lumber
- Nordic glulam beam
- Design specifications
- Code requirements
- Manufacturer's specifications
- Site conditions
- Weather conditions
- Construction sequence
- Construction documents
- Construction plans
- Construction specifications
- Construction details
- Construction notes
- Construction drawings
- Construction requirements
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1. BATHROOM MEDICINE CABINET WITH 6" DEPTH RECESSED INTO WALL 3".
2. MEDICINE CABINET CARCASS COMPOSED OF WHITE MELAMINE TO MATCH KITCHEN.
3. ALL 4 DOORS OF MEDICINE CABINET FACED WITH REFLECTIVE GLAZING. THERE IS NO DOOR PULL HARDWARE.
4. BATHROOM SHELVING TO APPEAR FLOATING WITH NO FRAME ON EASTERN EDGE. DETAIL TO BE DISCUSSED WITH EMI.
5. BATHROOM SHELVING COMPOSED OF MAPLE VENEERED PUREBOND PROVIDED BY COLUMBIA FOREST PRODUCTS.

A402 BATH ENLARGED PLAN AND ELEVATIONS
1. All cabinet hardware including hinges and drawer slides by EMI except pulls.

2. Design K9 to accommodate pull-out trash with openings in the top for two trash cans - typical Rubbermaid product as included in spec sheets.

3. K10 to include lazy Susan provided by Hafele (see spec sheet attached).

4. K11 top drawer to tip down for sponge holder under the sink.
INTERIOR WEST ELEVATION

INTERIOR NORTH ELEVATION

PRODUCED BY AN AUTODESK STUDENT PRODUCT
A1  ROOF TO BEAM AT COLUMN from C-SECTION 301 C

A3  COLUMN TO FLOOR from C-SECTION

BUILDING ENVELOPE DETAILS

A-504
A-524

KITCHEN CASEWORK

SECTION NOTES

DATE: AUGUST

DESIGN DESCRIPTION

PRODUCED BY AN AUTODESK STUDENT PRODUCT
**MANUFACTURER**

**MARCH**

**TYCO**

**MODEL**

**3**

**21 13 13**

**FIRE**

**K = 4.9, 1/2" ORIFICE, 160 DEG F RATING**

**TFP443**

**REMARKS**

**6**

**TYCO**

**4**

**DN25**

**TFP425**

**4901-9820**

**5**

**21 13 13**

**MAY**

**DESIGN**

**NOV.**

**K = 4.2, 1/2" ORIFICE, 162 DEG F RATING**

**FINAL SHEET**

**NOTES**

**TEAM**

**Stevens**

**1"**

**25**

**13th**

**Street,**

**2nd**

**Floor**

**New**

**10003**

**GENERAL NOTES:**

ACCORDING TO R313.1 OF IRC 2009, THE HOUSE SHALL HAVE AN AUTOMATIC FIRE SUPPRESSION SYSTEM DESIGNED AND INSTALLED ACCORDING TO P2904.1.1 REQUIRED SPRINKLER LOCATIONS. SPRINKLERS SHALL BE INSTALLED TO PROTECT ALL AREAS OF A DWELLING UNIT.

**EXCEPTIONS:**

- CLOTHES CLOSETS, LINEN CLOSETS AND PANTIES NOT EXCEEDING 20 FEET (2.1 M) IN AREA, WITH THE FLOOR SMALLEST DIMENSION NOT GREATER THAN 3 FEET (36 IN) AND HAVING WALLS AND CEILINGS COVERED WITH FIRE RESISTANT SHEET MATERIAL.
- BATHROOMS NOT MORE THAN 55 SQUARE FEET (5.1 M²) IN AREA.

**FIREFIGHTER ACCESS:**

- FIRE HOSE STATIONS AND APPARATUS SPACE PROVIDE ADEQUATE ACCESS TO FIRE HOSE PLANET SYSTEMS.
- FIRE HOSE STATIONS AND APPARATUS SPACE PROVIDE ADEQUATE ACCESS TO FIRE HOSE PLANET SYSTEMS.

**FIRE PROTECTION NOTES:**

FIRE EXTINGUISHERS HAVE A MINIMUM RATING OF 2A-10BC.

**FIRE SUPPRESSION LEGEND**

**FLUSH HORIZONTAL SIDEWALL SPRINKLER**

**FLAT PLATE CONCEALED PENDANT**

**WATER FLOW ALARM GONG**

**WATER SUPPRESSION SYSTEM**

**FIRE DETECTION/SUPPRESSION SCHEDULE**

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>MANUFACTURER</th>
<th>SIZE</th>
<th>TYPE</th>
<th>MODEL</th>
<th>MASTERS FORMAT ML</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>WALL MOUNTED FIRE SPRINKLER</td>
<td>TYCO</td>
<td></td>
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**FIRE PROTECTION NOTES:**

**FIRE SUPPRESSION WATER DISTRIBUTION PIPES WERE SIZED BY DETERMINING THE AVAILABLE PRESSURE TO OFFSET FRICTION LOSS IN PIPING AND DESIGNING A WATER SUPPRESSION PIPING SYSTEM TO REQUIRE THE FLOW RATES FOR 10 MINUTES.**

**P2904.6 FIRE SUPPRESSION WATER DISTRIBUTION PIPES WERE SIZED BY DETERMINING THE AVAILABLE PRESSURE TO OFFSET FRICTION LOSS IN PIPING AND DESIGNING A WATER SUPPRESSION PIPING SYSTEM TO REQUIRE THE FLOW RATES FOR 10 MINUTES.**

**FIRE SUPPRESSION SYSTEM DESIGNED AND INSTALLED ACCORDING TO P2904.**

**SMOKE DETECTIONS AND NOTIFICATION SYSTEMS SHALL BE DESIGNED AND INSTALLED IN ACCORDANCE TO R314.1, R314.3 & R314.4 OF THE IRC 2009.**

**R314.3 SMOKE ALARMS WILL BE POWERED PRIMARILY FROM THE BUILDING WIRING WITH BATTERIES AS BACKUP.**

**R314.3 SMOKE ALARMS WILL BE TIED TOGETHER SO THAT WHEN ONE ALARM IS TRIGGERED ALL ALARMS WITHIN THE BUILDING WILL GO OFF.**

**FIRE EXTINGUISHERS HAVE A MINIMUM RATING OF 2A-10BC.**
1. SMOKE ALARMS WILL BE POWERED PRIMARILY FROM THE BUILDING WIRING WITH BATTERIES AS BACKUPS.

2. SMOKE ALARMS WILL BE TIE-D TOGETHER SO THAT WHEN ONE ALARM IS TRIGGERED ALL ALARMS WITHIN THE BUILDING WILL GO OFF.

3. FIRE EXTINGUISHERS HAVE A MINIMUM RATING OF 2A-10BC.

4. FIRE SUPPRESSION WATER DISTRIBUTION PIPES WERE SIZED BY DETERMINING THE AVAILABLE PRESSURE TO OFFSET FRICTION LOSS IN PIPING AND IDENTIFYING A PIPING MATERIAL, DIAMETER AND LENGTH USING THE EQUATION IN SECTION P2904.6.2.1 AND THE PROCEDURE IN SECTION P2904.6.2 OF THE 2009 IRC.

5. FIRE SUPPRESSION SYSTEM WILL BE SUPPLIED BY THE SAME PUMP AS THE MAIN DOMESTIC WATER SUPPLY.
### General Notes

Plumbing contractor shall coordinate all plumbing work with approved plans and other trades.

Expansion loops and riser clamps shall be provided for expansion of all water piping.

All connections to equipment of dissimilar materials shall be made with a dielectric connection.

An access door shall be provided for any valve or control device concealed in walls or ceilings.

The plumbing contractor is responsible for the location of drain pipes at the centerline of all fixtures.

---

### Water Supply System

P3003.1 Grooved and parallel water distribution system manifold. Hot water and cold water manifolds will be installed with grooved and, less than 3 inches (76 mm) diameter and less, the risers shall be approved multiple connection fittings and be designed in accordance with Sections P3003.1 through P3003.11.

P3003.3.1 Size of manifolds. Manifold was sized as 1.25" in accordance with Table P3003.1. Total gallons per minute is the demand for all outlets.

P3003.4.3 Support and protection. Plastic piping bundling shall be secured in accordance with the manufacturer's installation instructions and supported in accordance with Section P3004.2.3.

P3003.5.1 Valving. The valves shall be located at the manifold and will be labeled indicating the fixture served.

An accessible main shutoff valve shall be provided in the mechanical area or near the entrance of the water service. The service tee shall be located at the curb or property line in accordance with local requirements.

P3107.2 Connection at the same level. Where the fixtures drains being common vented connect at the same level, the drain shall be sized in accordance with Table P3107.3. The drain shall be sized in accordance with the requirements of this section.

---

### Sanitary Drainage

P3104.5 Waste stack size. The waste stack shall be sized based on the total discharge to the stack and the discharge within a branch line in accordance with Table P3104.5. The waste stack shall be the same size throughout the length of the waste stack.

P3113.3 Venting. Individual vents, branch vents, circuit vents and stack vents shall be permitted to terminate with an individual vent, the individual vent shall connect to the trap or trapped fixture being vented. Where a single vent is used to ventilate two or more traps or two or more trapped fixtures, the vent shall be sized in accordance with Table P3113.3.1.

---

### Vents

The plumbing contractor is responsible for the location of drain pipes at the centerline of all fixtures.
1. SEE PROJECT MANUAL FOR WATER BUDGET.
2. ALL SUPPLY LINES TO BE 3/8” PEX TUBING.
3. PEX MANIFOLD INCLUDES SHUTOFF VALVES TO EACH SUPPLY LINE.
4. THE SUPPLY TANK HAS A 28" OPENING ON TOP AND A 12" CLEARANCE ON TOP FOR THE DELIVERY OF 1000 GAL OF WATER.
5. GREY WATER SHALL NOT BE USED THROUGHOUT THE COMPETITION.
6. WATER TANKS HAVE A 28" OPENING AND A 12" CLEARANCE ON TOP FOR REMOVAL OF GREY WATER AT THE END OF THE COMPETITION.
1. SEE PROJECT MANUAL FOR WATER BUDGET
2. GREY WATER TANK HAS A 24" OPENING AND A 12" CLEARANCE ON TOP FOR REMOVAL OF GREY WATER AT THE END OF THE S.D. COMPETITION
3. GREY WATER SHALL NOT BE USED THROUGHOUT THE S.D. COMPETITION.
4. TOILET SHALL BE CAPPED OFF FOR THE S.D. COMPETITION

Drawing sheet notes:
### PLUMBING SCHEDULES

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<tr>
<th>WORK</th>
<th>DESCRIPTION</th>
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<th>MANUFACTURER</th>
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<th>MASTER FORMAT</th>
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**List of Consultants**
- **ARCHITECT OF RECORD:** Zavos Architecture + Design, LLC
  - 323 West Patrick St.
  - Frederick, MD 21701
  - (p) (301) 698-0020
  - (f) (301) 698-0920
- **MEP & STRUCTURAL ENGINEER OF RECORD:** Buro Happold Consulting Engineers P.C.
  - 100 Broadway
  - New York, NY 10005
  - (p) (212) 334-2025
  - (f) (212) 334-5528
- **CIVIL ENGINEER OF RECORD:** Vika Capitol, LLC
  - DC CBE #LS94893122010
  - 4910 Massachusetts Avenue, NW Suite 214
  - Washington, DC 20016
  - (p) (202) 244-4140
  - (f) (202) 244-4196

**NOTES:**
- **TOTAL SHEET NUMBER:** P-601
SECTION M1306 CLEARANCES FROM COMBUSTIBLE CONSTRUCTION

HEAT PUMP EQUIPMENT

SHALL BE CAST IRON, GALVANIZED STEEL, COPPER, POLYBUTYLENE, POLYETHYLENE, ABS, CPVC OR PVC PIPE OR NAIMA FIBROUS GLASS DUCT CONSTRUCTION.

5a. BE NOT LESS THAN 6 SQUARE INCHES PER 1,000 BTU/H (13 INSTALLATION. JOINTS AND CONNECTIONS SHALL BE MADE AS LISTED IN TABLE M1601.1.1 (2). GALVANIZED STEEL IN ACCORDANCE WITH THE MATERIALS SPECIFIED IN SECTION M1307 DIAMETER AND SHALL NOT DECREASE IN SIZE FROM THE APPLIANCE INSTALLATION DRAIN PAN CONNECTION TO THE PLACE OF CONDENSATE DISPOSAL.

5b. DUCT SYSTEMS SHALL BE CONSTRUCTED OF MATERIALS WHICH HAVE A FLAME SPREAD INDEX NOT GREATER THAN 250.

5c. DUCT INSTALLATION SHALL COMPLY WITH SECTIONS M1601.1.2 FACTORY-MADE DUCTS.

5d. Duct insulation shall be approved for air flow rates in accordance with the applicable provisions of Sections M1601.1.1.1 and M1601.1.3 above-grade duct systems.

5e. Duct insulation materials shall conform to the following requirements:

a. Duct coverings and linings, including adhesives where used, shall have a flame spread index not greater than 75 and a smoke developed index not greater than 40 when tested in accordance with ASTM E 84 on a 6 ft (1.8 m) high specimen prepared and mounted according to procedures of ASCE 215.

5f. Duct installation shall comply with sections M1601.1, M1601.2, M1601.3, M1601.4, M1601.5, M1601.6, M1601.7 and M1601.8.

6a. A SEPARATE OVERFLOW DRAIN LINE SHALL BE CONNECTED TO A CONSPICUOUS POINT OF DISPOSAL TO ALERT OCCUPANTS IN THE EVENT OF DAMAGE TO THE DRAIN PAN. THE DRAIN PAN SHALL BE LOCATED UNDER THE COILS ON WHICH CONDENSATION WILL OCCUR. THIS PAN SHALL BE EQUIPPED WITH A WATER LEVEL DETECTION DEVICE CONFORMING TO UL 508 AND SHALL BE INSTALLED UNDER THE COILS ON WHICH CONDENSATION WILL OCCUR. THIS PAN SHALL BE EQUIPPED WITH A WATER LEVEL DETECTION DEVICE CONFORMING TO UL 508.

6b. A SEPARATE OVERFLOW DRAIN LINE SHALL BE CONNECTED TO A CONSPICUOUS POINT OF DISPOSAL TO ALERT OCCUPANTS IN THE EVENT OF DAMAGE TO THE DRAIN PAN. THE DRAIN PAN SHALL BE LOCATED UNDER THE FILTERS, BLOWERS, MOTORS, CONTROLS AND VENT CONNECTORS. LUBRICATION OF MOVING COMPONENTS SHOULD BE PERFORMED ACCORDING TO THE MANUFACTURER’S INSTRUCTIONS.

6c. AN AUXILIARY DRAIN PAN WITH A SEPARATE DRAIN SHALL BE PROVIDED FOR EACH COOLING OR EVAPORATOR COIL WHERE USED, SHALL HAVE A FLAME SPREAD INDEX NOT GREATER THAN 250. DUCT INSULATION MATERIALS SHALL CONFORM TO THE FOLLOWING REQUIREMENTS:

a. Duct coverings and linings, including adhesives where used, shall have a flame spread index not greater than 75 and a smoke developed index not greater than 40 when tested in accordance with ASTM E 84 on a 6 ft (1.8 m) high specimen prepared and mounted according to procedures of ASCE 215.

b. Duct installation shall comply with sections M1601.1, M1601.2, M1601.3, M1601.4, M1601.5, M1601.6, M1601.7 and M1601.8.

7a. THESE CAVITIES OR SPACES SHALL NOT BE USED AS A SECONDARY DRAIN OR AUXILIARY DRAIN PAN SHALL BE LOCATED UNDER THE FILTERS, BLOWERS, MOTORS, CONTROLS AND VENT CONNECTORS. LUBRICATION OF MOVING COMPONENTS SHOULD BE PERFORMED ACCORDING TO THE MANUFACTURER’S INSTRUCTIONS.
### Master Schedule

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<th>Unit Dimensions (in)</th>
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**SHEET PRODUCED BY AN AUTODESK STUDENT PRODUCT**

ALL JUNCTION BOXES SHALL BE PROPERLY SIZED ACCORDING TO NEC 314.16.

MINIMUM WIRE SIZE SHALL BE #14 AWG.

PROVIDE IDENTIFICATION OF ALL BRANCH CIRCUITS ON A TYPEWRITTEN DIRECTORY CARD IN THE PANEL DOOR.

EXTERIOR RACEWAYS AND WIRING DEVICES BELOW THE FIRST LEVEL FLOOR SHALL BE SELECTED FOR MECHANICAL PROTECTION.

EXTERIOR FITTINGS FOR RACEWAYS SHALL BE COMPRESSION TYPE AND LIQUITIGHT.

EXCEPT WHERE OTHERWISE INDICATED WIRE SHALL BE COPPER WITH 600 VOLT INSULATION. USE TYPE "NM" CABLE WHERE ALLOWED BY CODE.

MAXIMUM LOAD FOR ALL BRANCH CIRCUITS IS 80%.

FOR MECHANICAL EQUIPMENT DETAIL REFER TO MECHANICAL DRAWINGS AND EQUIPMENT SPECIFICATIONS IN THE PROJECT MANUAL.

ALL PANEL BOARDS SHALL BE PROVIDED WITH A FACTORY INSTALLED GROUND BUS FOR CONNECTING TO GROUND THE GREEN OR BARE GROUNDS WIRE IN ALL CIRCUITS.

CONDUCTORS SPECIFIED IN THE ELECTRICAL PLAN SHALL COMPLY WITH NEC TABLE 310.16 AND 310.17.

RACEWAYS BETWEEN PULL BOXES SHALL NOT CONTAIN MORE THAN THE EQUIVALENT OF FOUR QUARTER BENDS (360 DEGREES TOTAL).

ALL EXTERIOR RECEPTACLES SHALL BE WEATHER-RESISTANT, GROUND FAULT PROTECTED, AND EQUIPPED WITH "IN-USE" TYPE WEATHER PROTECTION.

THE EQUIPMENT GROUNDING ELECTRICIAN CONDUCTOR SHALL BE THE FIRST TO BE CONNECTED AND LAST TO BE DISCONNECTED DURING INSTALLATION, CE INSTALLATION, OR SERVICING OF PHOTOVOLTAIC MODULES AND INVERTERS.
E-103

ELECTRICAL PLAN ROOF

LP1-6/8
LP1-34
GFCI
120V DUPLEX OUTLET
120V DEDICATED DUPLEX OUTLET
120V GFCI DUPLEX OUTLET
240V SINGLE OUTLET
SMOKE DETECTOR
WATER PUMP
LIGHTING PLAN FIRST FLOOR
ALL PV SYSTEMS WILL BE DESIGNED AND INSTALLED IN FULL COMPLIANCE WITH THE 2008 NATIONAL ELECTRICAL CODE (NEC) AND THE 2011 SD RULES AND SD BUILDING CODE.

PV MODULES, SOURCE-CIRCUIT COMBINERS, AND UTILITY-INTERACTIVE INVERTERS MUST BE SAFETY CERTIFIED (LISTED) TO THE APPROPRIATE UNDERWRITES LABORATORIES (UL) STANDARD (UL 1741 FOR INVERTERS AND COMBINERS, UL 1703 FOR PV MODULES) AND MUST BE TESTED AND CERTIFIED BY ONE OF THE FOLLOWING US NATIONALLY RECOGNIZED TESTING LABORATORIES (NRTL); UL, CSA, ETL, OR TUV NORTH AMERICA. THE EUROPEAN CE DESIGNATION AND TESTS BY LABORATORIES IN OTHER COUNTRIES ARE NOT ACCEPTABLE. (690.4)

DC CIRCUITS FROM THE PV MODULES TO THE DC PV DISCONNECT MUST BE IN METAL CONDUITS (RACEWAYS) WHERE INSIDE THE STRUCTURE. (NEC 690.31 (E)).

ALL PV STRINGS ARE TO USE MANUFACTURER PROVIDED CABLE BETWEEN MODULES.

THE DC GROUNDING ELECTRODE CONDUCTOR SHALL BE BONDED TO AC GROUNDING ELECTRODE CONDUCTOR AT THE GROUNDING ELECTRODE SYSTEM LOCATION.
ELECTRICAL PANEL SCHEDULE

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<td>Electric Space Heaters</td>
<td>8000 VA</td>
<td>8000 VA</td>
<td>8000 VA</td>
</tr>
</tbody>
</table>

SERVICE FEEDER CALCULATIONS

Load Balance = 37717 VA

Amps(22628VA/240V) = 94.3 Amps

10000 VA as per NEC 220.52(a)

21087 VA + 1200 VA + 1500 VA + 130 VA + 2880 VA + 864 VA + 179 VA + 4200 VA + 540 VA + 540 VA + 8000 VA + 540 VA + 540 VA + 540 VA + 8000 VA = 37717 VA
DC CALCULATIONS (CONTINUED)

PV INVERTER CIRCUIT BREAKER IN MAIN LOAD PANEL IS ADJACENT TO INVERTER AND FUNCTIONS AS AC MCB OPERATES IN MAIN BREAKER PANEL "MB1".

INVERTER CIRCUIT BREAKER: 30A 2P FRS "I1" TO "LP1"

INVERTER "I1" BACKFEEDS INTO MAIN LOAD PANEL "LP1" THROUGH A 30A CIRCUIT BREAKER.

MAX DC VOLTAGE = 500V

DC DISCONNECT: 2 POLE UNFUSED OPERATION AS DC DISCONNECTION

INVERTER CIRCUIT BREAKER SELECTED FOR INVERTER: 30A 2P FRS "I1" TO "LP1"

80% OPERATION CALCULATION: 1.25 x 22.4A = 28A per 215.2(A)

CONTINUOUS CURRENT CALCULATION: 1.25 x 8.91A = 11.2A per 690.8(A)(1)

80% OPERATION CALCULATION: 1.25 x 8.91A = 12A per 690.8(A)(1)

FREE AIR PORTIONS AT 61°C-70°C: 90°C CONDUCTOR DERATE AT 0.58 (NEC 310.16)

Ambient temperature in the mechanical room is assumed to be 40°C.

Continuous current calculation check. 1.25 Isc = 1.25 x 21.3A = 27A. 46A > 27A, therefore 2 POLE UNFUSED OPERATION AS DC DISCONNECTION

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PV SYSTEM IS CONNECTED TO THE MECHANICAL ROOM THROUGH A 30A CIRCUIT BREAKER.

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MASSACHUSETTS DEPARTMENT OF ENERGY RESOURCES

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**Sheet Notes:***

**1.** Stone truck Pulls in allowing telehandler to begin unloading large telehandler to begin unloading.

**2.** Lulls lifts the major rooftop elements, east side of lot now clear.

**3.** Interior finishing and appliances work begins. Water tanks installed and tested for use.

**4.** Exterior scaffolds and interior cladding west facade.

**5.** Interior cladding east and parapet units and PV supports.

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**Reference Sheet:**

- **LOT NUMBER:** 1
- **DATE:** 8/13/11
- **DESCRIPTION:** Arrival and assembly sequence

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**Construction Documents:**

- **CONSULTANTS ARCHITECT OF RECORD:** Zavos Architecture + Design, 323 West St. Frederick, MD 21701
- **ENGINEER OF RECORD:** Vika Capitol, LLC DC CBE #LS94893122010 4910 Massachusetts Avenue, NW
- **CIVIL ENGINEER OF RECORD:**

**References:**

- **CLIENT:** US Department of Energy Solar Decathlon 2011
- **WEBSITE:** www.solardecathlon.gov
- **MARKS:** 22, 2011, 2011, 2011
- **DATE:** 8/13/2011
WATER DELIVERY

1. Capacity of tank is 1000 gallons
2. Fill location is on the East side of the home, 1000 gallons requested at 90°

WATER REMOVAL

1. All water left in system and in potable water storage tank will be pumped into grey water tank for removal.
2. Removal of an estimated 900 gallons to be pumped from the grey water tank.

DATE: 8/13/2011
TIME: 9:40:40 AM

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