

Zero Energy House 3:

35.009225, -83.327351

Highland Gap, North Carolina, USA

Michael Gamble

Georgia Institute of Technology

Site: Steeply sloped, 57 acre wooded lot on Highland Gap Road in North Carolina. A small creek cuts through the northern edge of the site and flows to the Ocoee River, less than 1/2 mile away.

Clients: Retirement age couple, downsizing.

Programmatic Strategy: Eccentrically zoned, compact vertical.

Formal Strategy: The overall form of the house is predicated on three factors:

- Eccentric pallette of center points based on site generated random/ natural placement of tree trunks
- Maximum solar gain derived from a carefully calibrated solar geometry
- Literal and rhetorical air flow capture.

Hot Side/Cool Side: The upper windward side of the house faces uphill and directly south. An array of framed solar louvers wrap the so called "hot" side of the house, generating enough electricity on average daily basis to light the house. The stair serves as a vertical ventilation shaft, using the hot side of the house to magnify thermal movement on warm days during the swing season. The louvered solar wall allows air to move freely up the interchangeable pressurized panel system.

The lower windward side of the house faces a small creek with the view extending towards a river basin. Air current in the mountains is predictable, but the orientation captures cool air traveling up the hill. Windows serve as soft articulated apertures to emphasize air flow across smooth ceilings and through unobstructed openings.

Energy Kit: Ultra efficient energy generating kit with positive energy generation over a 12 month cycle. PV: Monocrystalline silicon panels, moderately ventilated, south orientation and inclination of 45° on southern louvered wall. 0,12 ~0,18 Kpk KW/m2 with a minimum package density of 80%.

Cooling/Heating system: Multisplit system with COP = 2.9. Heat pump + radiant floors, estimated conservatively at COP = 1; mechanical supply and exhaust of air @ 0.35 ACH. Heat exchange plates and/or pipes; 20% exhaust air recirculation; tight envelope @ 0.4 ACH.

Sensor controlled lighting: Lighting intensity = 5 W/m2; evacuated tube solar collectors with direct flow system (hot water) 30 m2, facing south @ 30° inclination on roof.

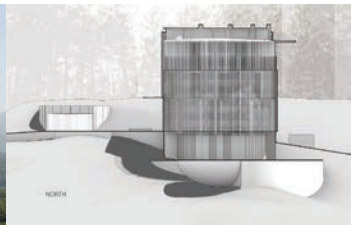
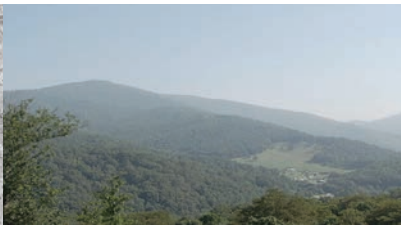
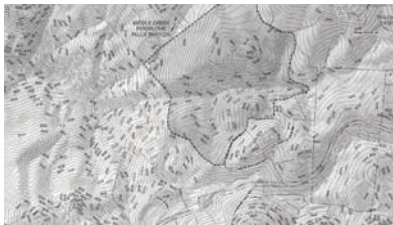
Water Conservation: Two 1000 gallon cisterns located at east and west side of house.

Energy Calculations; ultra efficient system with tested 95% energy generation balance over a 12 month cycle.

Structure: CIP reinforced concrete with tube steel bracing at pressurized wall system.

Wind Veil: 3/8" diameter stainless steel beads on the cool side.

Envelop: CIP reinforced concrete with tube steel bracing at pressurized wall system Interchangeable pressurized panel system Aluminum Clad SIP, Ground Source Heat Pump, BIP Solar Array, Reyeaeers Doors and Windows, Hydrotech Roof system, On Site Water Storage.



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Site | Heavily wooded, steeply sloped, 54 acres located in the highest, old field in North Carolina. A small creek runs through the center of the site and flows to the Middle Creek, less than 10 miles away.

Climate | Moderate, temperate, transitioning from humid to continental.

Formal Strategy | The overall form of the house is a circular structure, designed to maximize solar gain and provide a central, unobstructed space.

Heat/Cooling Side | The upper circular side of the house is light and airy, with a large array of solar panels on the roof. The lower side is more solid and provides a central, unobstructed space.

Energy | The house is designed to be a net-zero energy building, meaning it produces as much energy as it consumes.

Water | The house is designed to be a net-zero water building, meaning it produces as much water as it consumes.

Lighting | The house is designed to be a net-zero lighting building, meaning it produces as much light as it consumes.

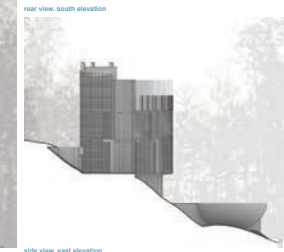
Mechanical | The house is designed to be a net-zero mechanical building, meaning it produces as much mechanical energy as it consumes.

Water Conservation | The house is designed to be a net-zero water building, meaning it produces as much water as it consumes.

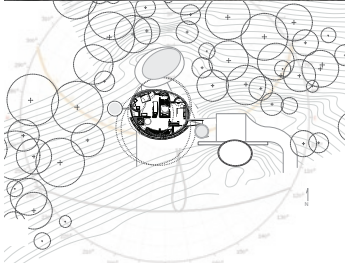
Envelope | The house is designed to be a net-zero envelope building, meaning it produces as much envelope energy as it consumes.



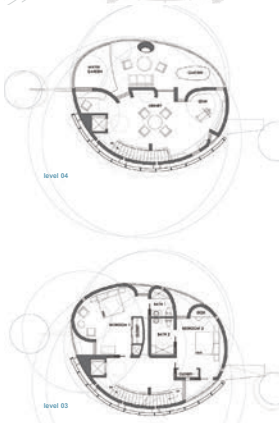
building section looking west



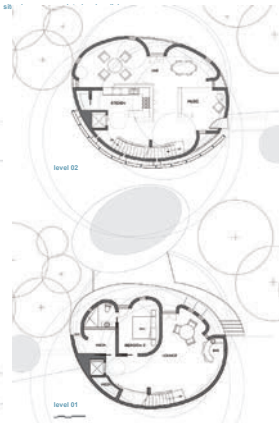
side view, east elevation



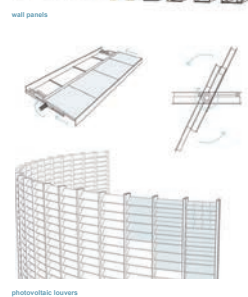
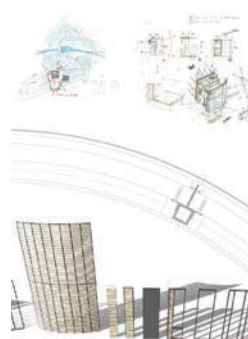
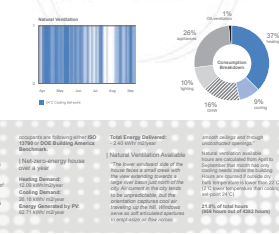
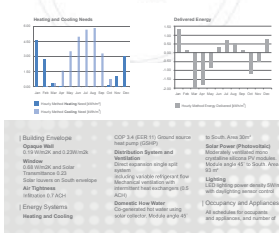
interior view, library and workout space



level 04

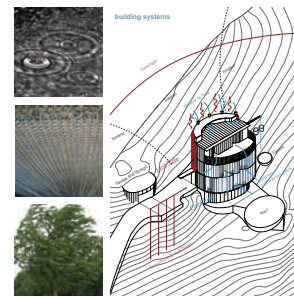


level 02



wall panels

photovoltaic towers



building systems

