

Barott Zero Impact House



View of Home from the Southwest.

Sustainable Strategies, Technologies & Systems

The Barott Zero Impact House is located in Columbus Township in Anoka County, Minnesota just South of the Carlos Avery Wildlife Preserve and North of the Twin Cities Metro Area. Its sculptural shape mimics the softly rolling neighboring terrain and features large expanses of south-facing arched “Sun Gathering” windows and with broad curvilinear overhangs for seasonal solar control. The centerpiece of the plan consists of an orchid Conservatory that protrudes from the building’s otherwise monolithic glass-clad passive solar shell. Its open plan is arranged around the central three story high conservatory space which can be opened on two sides extending the dining and great room areas when desired. The Barott Zero Impact House will function as a smart house in which all major functions are autonomously controlled and can be monitored and programmed from a Website.

An experimental radiant heating, cooling, and snowmelt system with rainwater thermal storage cisterns and powered by a highly efficient ground source heat pump will be the high performance centerpiece of the building. Other emerging technologies include an advanced T-Mass foundation wall system which is like an inverted ICF (insulated concrete form) wall. This wall with exposed concrete on the interior behind the surrounding three foot high landscape berms, offers significant thermal storage. All exterior walls and roofs consist of prefabricated SIPs (structural insulated panels) and supported by a recycled steel frame. The windows are triple-glazed low-e windows made from FSC Certified wood from sustainable sources. Clerestory windows providing natural



View of facade from south



View from road to West

ventilation are operated automatically by the Smart Home Automation system. The first and second floor slabs housing the radiant heating tubes will have a highly polished finish eliminating the need for expensive floor finishes and maximizing thermal storage. The building also features many other alternative technologies such as high efficiency lighting, natural ventilation, and daylighting throughout.

Zero Impact Site Strategies and technologies

- Zero Surface Water Runoff 100% onsite management of stormwater
- Green Roof Technology Reduces runoff from roof by 70-80%
- Minimize Disturbed Area of Site Utilize existing road and contours
- Erosion Controls during construction and for extended period
- Restoration of natural landscape and use of native plants
- Permeable Paving Materials at driveway approach and turnaround
- On-site sourced fill

Selected High Performance Building Envelope Technologies

- T-Mass foundation and Structural Insulated Panels (SIPs) exterior wall and roof systems
- Green Roof system provides cooling through evapotranspiration
- Exterior roof decks with slip-resistant tile, snowmelt, and failure proof substrate
- Engineered steel structural frame with high recycled content
- High-efficiency triple pane low-e doors and windows
- Window frames made from FSC certified wood from sustainable sources

Selected High Performance Interior Finishes and other indoor environmental quality components

- Polished concrete floor finish
- Low toxicity, low VOC paints formulated for chemical sensitivity
- Water-based low VOC floor finishes
- Future-proofed removable wire chase baseboards
- Recycled glass content bathroom floor and countertop surfaces
- Whole house air filtration and circulation
- Integrated central vacuum cleaner system
- Daylighting throughout
- Electromagnetic field/Radio field (EMF/RF) Radiation shielding strategies

Water Conservation and reduced septic outflow goals

Supported by these Selected Strategies:

- Rainwater Harvesting system for plant watering, fountains and pools
- Low water consumption plumbing fixtures
- Grey Water Re-Use System for flushing toilets, laundry and exterior irrigation

Zero Energy Consumption and Greenhouse Gas Emissions goals Supported by these Selected Strategies:

High Performance Appliances and Equipment

- Commercial grade and Energy Star-rated appliances
- High efficiency Gas Range
- High efficiency range hood exhaust system with Waste heat recovery
- High-efficiency LCD and CFL lighting and control systems

Selected High Performance Mechanical Systems

- On-site ground source Heat Pump System
- In-floor radiant Heating and Cooling and snow melt systems
- Passive Solar Heating with high thermal mass walls and floors
- On-site Solar PV panels (for hydrogen production and discreet DC tasks, e.g. water pumps)
- Solar Hydrogen Fuel Cell uninterruptable power source (UPS) technologies
- Solar Thermal Assisted Domestic Hot Water and Pool Heating System
- High efficiency computer monitored humidity control
- Centralized displacement ventilation
- Full fresh air dual core ERV-HRV system
- Passive solar high thermal mass floors and roofs
- H²O Thermal reservoir with water-to-water heat exchanger technologies
- Self-contained high efficiency conservatory environmental units

Selected High Performance Smart Home Automation System

- Demand-response distributed intelligence systems controls
- Environmental monitoring for Cooling and Humidity Control integration
- Supervisory control and data acquisition (SCADA) controls
- Web-based systems monitoring and control
- CAT 5e backbone ELAN and coaxial networking all rooms and equipment
- Computer operated solar shading systems
- Computer operated windows for natural ventilation
- Post Occupancy Period Performance monitoring of key systems

Other Alternative Technologies

- Biological (non-chemical) pool water treatment (*planned*)
- Locally sourced materials
- High-efficiency “view through” gas fireplace
- Retractable pool enclosure (*planned*)

Sustainable Strategy Summary for Barott Zero Impact House

LEED-H Checklist

Location and Linkages (LL) OR		1
2	Site Selection Avoid Environmentally Sensitive Sites and Farmland LL1	0
3.1	Infrastructure Site within 1/2 Mile of Existing Water, Sewer, and Roads LL1	0
3.2	Select an Infill Site LL1	0
4.1	Community Resources Within 1/4 mile of Basic Community Resources / Public Transportation LL1	0
4.3	Within 1/2 Mile of Green Spaces LL1	1
Sustainable Sites (SS)		5
1.1	Site Stewardship Minimize Disturbed Area of Site (If Site > 1/3 Acre)	Mandatory
1.2	Erosion Controls (During Construction)	Mandatory
2.1	Landscaping Basic Landscaping Design	Mandatory
2.2	Appl3 to 4 Inches of Mulch Around Plants	1
2.3	Limit Turf 5 3	1
2.4	Minimize Landscape Water Demand 3 2	1
4.2	Use Permeable Paving Materials	1
4.3	Design and Install Permanent Erosion Controls	1
Water Efficiency y (WE)		7
1.1	Water Reuse Rainwater Harvesting System	1
1.2	GreWater Re-Use System	1
2.2	Select High Efficiency Measures from List 5 3	1
2.3	Rain Sensing Controls	1
3.1	Indoor Water Use High Efficiency Fixtures (Toilets, Showers, and Faucets)	3
Indoor Environmental Quality(IEQ)		14
1	ENERGY STAR with IAP Meets ENERGY STAR w/ Indoor Air Package (IAP) IE2-10	Y
2.1	Combustion Venting Space Heating and DHW Equip w/ Closed/Power-Exhaust; & CO Monitor	Mandatory
2.2	Fireplaces w/ Outside Air Supply y and Closed Combustion IE1	Mandatory
3	Humidity Control Analyze Moisture Loads AND Install Central System (where Needed) IE1	1
4.1	Outdoor Air Ventilation Meets ASHRAE Std 62.2 IE1	Mandatory
4.2	Dedicated Outdoor Air System (w/ Heat Recovery) IE1	2
4.3	Third-party Testing of Outdoor Air Flow Rate into Home	1
5.1	Local Exhaust Meets ASHRAE Std 62.2 IE1	Mandatory
5.2	Timer / Automatic Controls for Bathroom Exhaust Fans IE1	1
5.3	Third-party Testing of Exhaust Air Flow Rate Out of Home	1
6.1	Supply y Air Distribution Meets ACCA Manual D IE1	Mandatory
6.2	Third-party Testing of Supply Air Flow into Each Room in Home	2
7.1	Supply Air Filtering >= 8 MERV Filters, w/ Adequate System Air Flow IE1	Mandatory
7.2	>= 10 MERV Filters, w/ Adequate System Air Flow	1
7.3	OR >= 12 MERV Filters, w/ Adequate System Air Flow	2
8.1	Contaminant Control Seal-Off Ducts During Construction IE1	Mandatory
8.2	Central Vacuum	1
8.3	Third-party Testing of Particulates and VOCs before Occupancy	1
9.1	Radon Protection Install Radon Mitigation System if Home is Located in EPA Region 1 IE1	Mandatory
10.1	Vehicle Emissions Protection No Air Handling Equipment OR Return Ducts in Garage IE1	Mandatory
10.2	TightlSeal Shared Surfaces between Garage and Home IE1	Mandatory
10.3	Exhaust Fan in Garage IE1	1
Materials and Resources (MR)		10
1	Home Size Home that is Smaller than National Average	-4
2.1	Material Efficient Framing No Extra Uses of Lumber for Aesthetic Purposes	Mandatory
2.2	Advanced Framing Techniques	2
3	Local Sources Materials Extracted / Manufactured / Produced within 500 Miles	3
4.1	DurabilitPlan Detailed DurabilitPlan; (Pre-Construction)	Mandatory
4.2	Third-party Verification of Implementation of Durability Plan	3
5.1	EnvironmentallPreferable Tropical Hardwoods, if used, must be FSC	Mandatory
5.2	Products Select EnvironmentallPreferable Products from List	4
6.1	Waste Management Max of 2.5 Lbs Per Square Foot of Construction Waste Sent to Landfill	Mandatory
6.2	0.5 Pts for Each Additional 0.5 Lbs Per Square Foot Reduction	2

Energy and Atmosphere (EA)		29
1.1	ENERGY STAR Home Meets ENERGY STAR for Homes with Third-party Testing	Mandatory
1.2	Exceeds ENERGY STAR for Homes, 2 Pts Per HERS Point > HERS 86 EA2-7	y
2.1	Insulation Third-party y Inspection of Insulation Installation, At Least HERS Grade II EA1	Mandatory
2.2	Third-party Inspection of Insulation Installation, At Least HERS Grade I EA1	1
3.1	Air Infiltration Third-party Envelope Air Leakage Tested <= 0.35 ACH EA1	Mandatory
3.3	Third-party Envelope Air Leakage Tested <= 0.15 ACH EA1	2
4.1	Windows Windows Meet ENERGY STAR for Windows (See Table) EA1	Mandatory
4.3	Windows Exceed ENERGY STAR for Windows b>= 20% (See Table) EA1	2
5.1	Duct Tightness Third-party Duct Leakage Tested <= 5.0 CFM25 / 100 SF to Outside EA1	Mandatory
5.3	Third-party Duct Leakage Tested <= 1.0 CFM25 / 100 SF to Outside EA1	2
6.1	Space Heating and Cooling Meets ENERGY STAR for HVAC w/ Manual J...	Mandatory
6.3	Exceeds ENERGY STAR for HVAC b>= 20%, w/ Manual J EA1	3
7.1	Water Heating Improved Hot Water Distribution System	3
7.2	Improved Water Heating Equipment EA1	3
8.2	ENERGY STAR Advanced Lighting Package	3
9.1	Appliances Select Appliances from List	2
9.2	Very Efficient Clothes Washer (MEF > 1.8, AND WF < 5.5)	1
10	Renewable Energy Renewable Electric Generation System (1 Point / 10% Annual Load Reduction)	6
11	Refrigerant Management Minimize Ozone Depletion and Global Warming Contribution	1
Homeowner Awareness (HA)		1
1.1	Homeowner Education Basic Owner's Manual and Walkthrough of LEED Home	Mandatory
1.2	Comprehensive Owner's Manual and Multiple Walkthroughs / Trainings	1
Innovation and Design Process (ID)		4
1.1	Innovative Design Provide Description and Justification for Specific Measure	1
1.2	Provide Description and Justification for Specific Measure	1
1.3	Provide Description and Justification for Specific Measure	1
1.4	Provide Description and Justification for Specific Measure	1
Total Estimated Score (Gold)		71