

# 150 Best Sustainable House Ideas



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# Introduction



Interest in sustainable architecture is increasing as people become more concerned with the deteriorating environment and dwindling fossil fuel supplies. In residential architecture, as in any other building category, measurement tools have triggered changes in the design process, and these changes are in turn changing construction methods.

Around the world, environmental and energy-efficiency concerns are being addressed by institutions such as the United States Green Building Council (USGBC), the creator of the LEED (Leadership in Energy and Environmental Design) requirements for sustainable buildings, and BREEAM (Building Research Establishment's Environmental Assessment Method) established in the UK. The requirements not only focus on energy use but also on issues such as water efficiency, carbon emissions, and materials use, all with the goal of improving environmental quality.

The types of environmentally friendly construction measures are continuously being upgraded in response to an ever-worsening environmental situation and rising energy costs. There seems to be a



growing movement towards net-zero buildings—buildings that have zero net energy consumption and zero carbon emissions annually. Over the years, rules for building homes have changed, and today it is no longer acceptable to design without considering the context of the location. Houses need to respond to their immediate environment in order to reach quality efficiency levels.

The design process for sustainable homes starts with a series of questions: How is the building going to respond to the site's orientation, wind exposure, and solar gain? How will it maximize natural light? How can the builders reduce construction waste? How can the house provide heating and cooling with a minimum production of CO<sub>2</sub>?

In order to achieve sustainable goals, buildings can no longer be a composition of different systems. Rather, they need to be conceived as an integrated whole with building elements, including the structure, mechanical equipment, and materials, strongly connected to each other and serving more than one function. For instance, the structure may not only support its loads, but may also serve as a heat sink for passive heating and cooling.

The effort to maximize sustainability does not end when a building is complete. Humans need to see a sustainable building as a living structure that is part of a larger good, and encourage their communities to be environmentally conscious.





## One Wybelenna

Architects: **Shaun Lockyer Architects**

Location: **Brookfield, Brisbane, Australia**

Photography: © **Scott Burrows**

This project was born out of the remnants of a Robin Gibson cottage that existed on the site. The design, inspired by the work of both Gibson and architect Richard Neutra, is a contemporary reinterpretation of modernist design. The house enjoys a long, linear plan with the rooms arranged to soak up the winter sun. A natural palette of zinc, tallow wood, slate, and travertine creates a robust and timeless aesthetic.





The structural method, stone masonry, and landscape are key aspects of the design and were considered from the outset, as was the environmental design strategy.



**001** The environmental, economic, and aesthetic benefits of green roofs are widely recognized. These benefits include the protection of waterproofing, water retention, and thermal insulation.





The new guest pavilion sits on the original footprint of the Gibson cottage and reuses the original stone. The planning of the house prioritizes solar orientation and views.

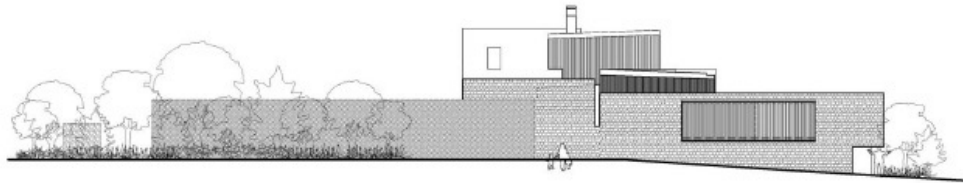




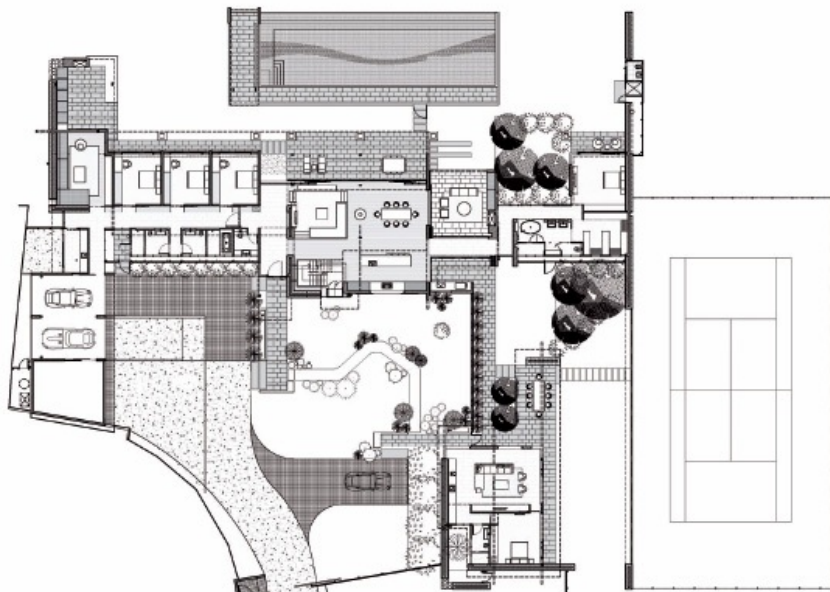




South elevation



East elevation



First-floor plan



The layout is defined by stone blades that bisect the house and delineate living zones and pavilions.



**002** Energy-efficient light bulbs use less energy than incandescent bulbs, which are highly inefficient. There are two types of energy-efficient light bulbs: compact fluorescent and light-emitting diodes.





The house has been thermally engineered. In addition to green roofs, it features a number of sustainability initiatives, including 15 KW of solar power, skylights, and low-E glass throughout.



**003** The use of reclaimed timber gives a space a sense of history. Most reclaimed timber is obtained from old barns and warehouses and is used in homes for siding and flooring.







## **Big Little Rock**

Architects: **Minarc**

Location: **Biskupstungur, Iceland**

Photography: © **Minarc**

Big Little Rock is a modest house made to blend in with the surrounding landscape. Its simple eco-friendly design focuses on functionality and creates a healthy living environment for its occupants. While concrete, wood, and glass predominate and unify the construction style, conscious effort was made to use materials in their most natural form. The project also embraces history with shapes found in traditional mud houses.





**004** A steel roof can contribute to the overall thermal efficiency of a home, lowering the costs of energy use and minimizing environmental impact.



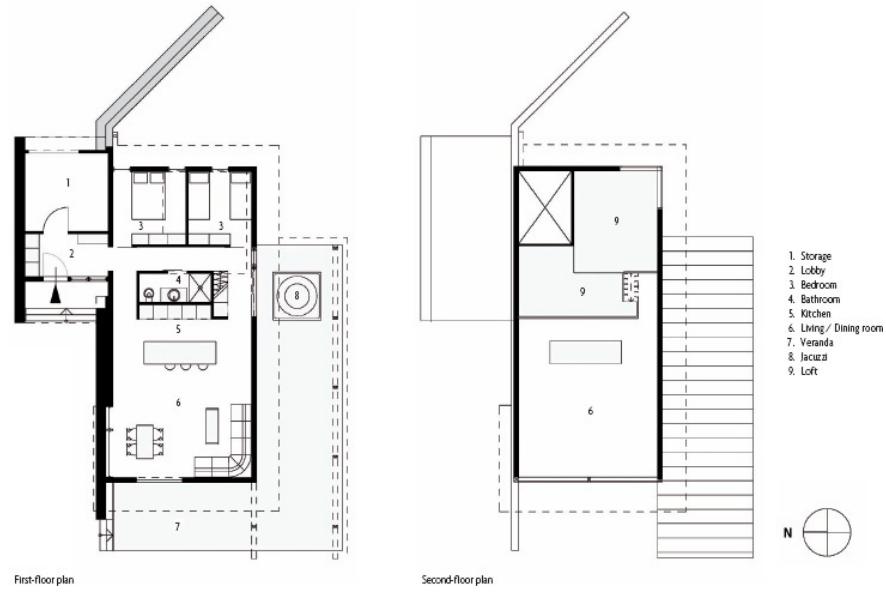
**005** Green roofs prevent thermal insulation from buoying up during heavy



rainfall and protect it against UV radiation.



**006** Porches, carports, and breezeways can be created to take advantage of the unique environmental characteristics of a location.



**007** In warm climates, sliding doors are a good solution for cooling a home, while offering the possibility to spill indoor activities outside.





## Villa L—Paradox of Uniting Diversity

**Architects:** Powerhouse Company, RAU

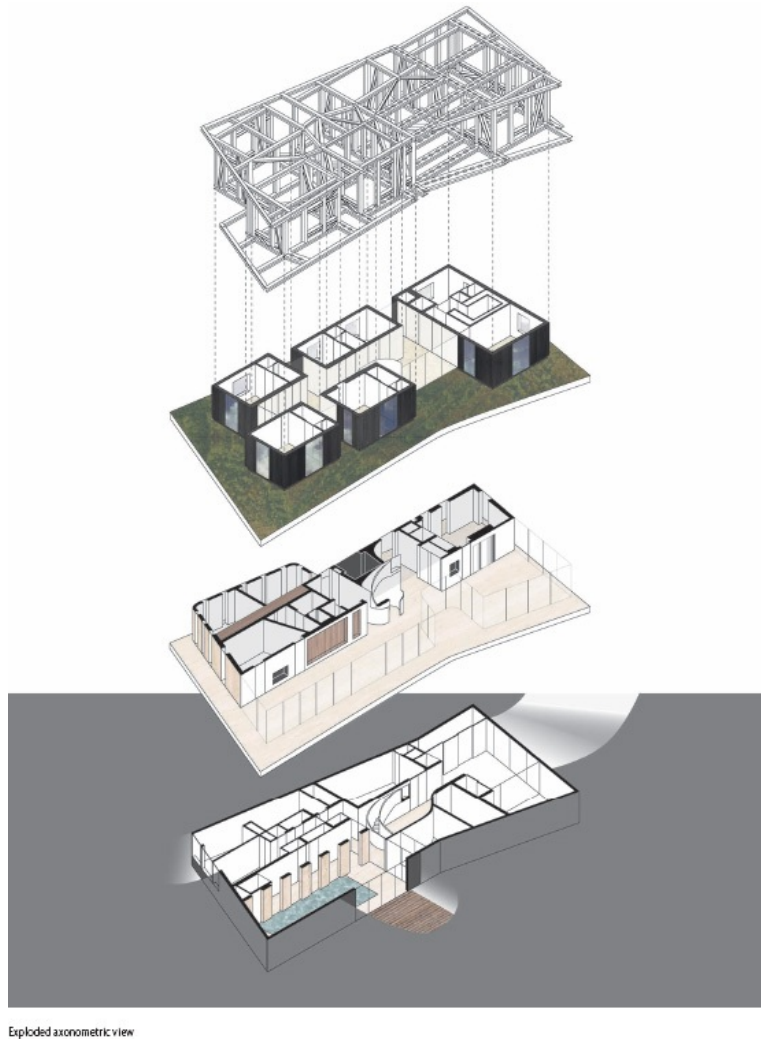
**Location:** Utrecht, the Netherlands

**Photography:** © Christian van der Kooy

Villa L is a spatially diverse three-story construction, where every floor—one is partially buried in the ground—has its own identity. To respond to the desire for a functional division of space, the house has an open plan, oriented towards the sun and the views of the garden. The house incorporates innovative sustainable measures, including hot- and cold-water storage and extensive use of photovoltaic panels.





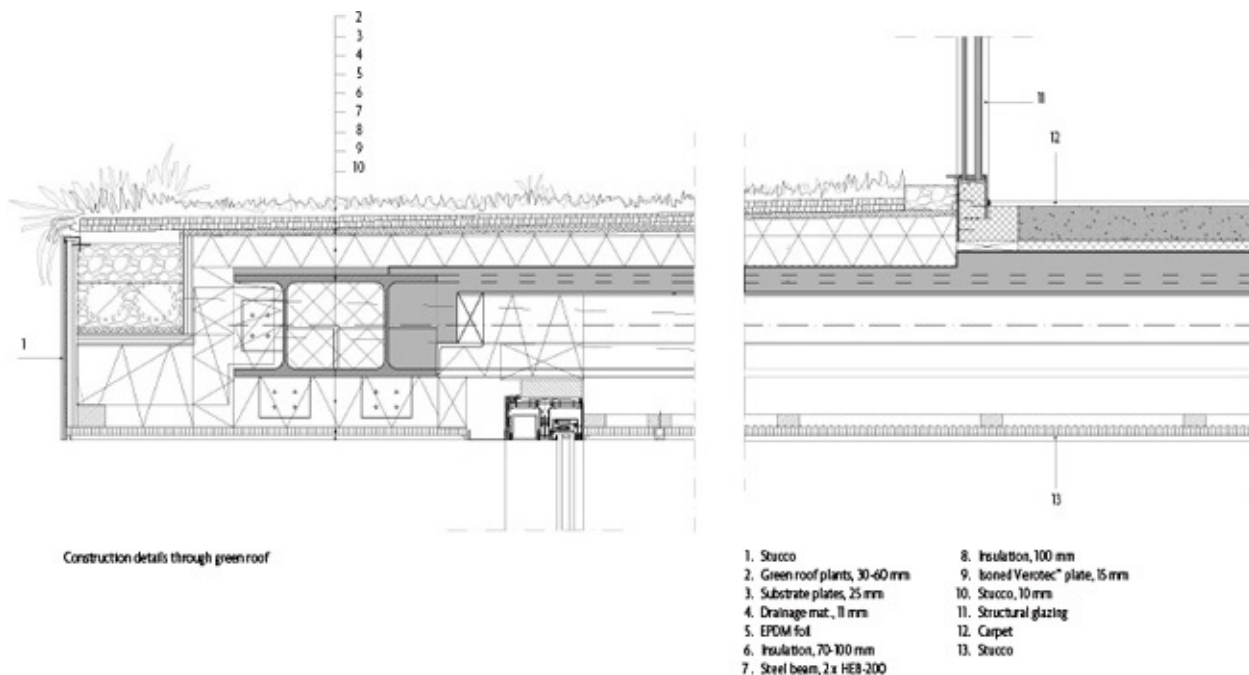


The second floor is a green plinth on top of which stand independent volumes accommodating various bedrooms. In that respect, every room is a world of its own, providing not only privacy, but also views.





**008** The use of green roofs in construction offers benefits such as reducing heating and cooling costs, decreasing storm water run-off, and filtering pollutants and CO<sub>2</sub>.



**009** Different vegetation types with varying growth patterns can have different insulation properties affecting the level of heat transfer to and from the vegetation layer through the roofing system layers.

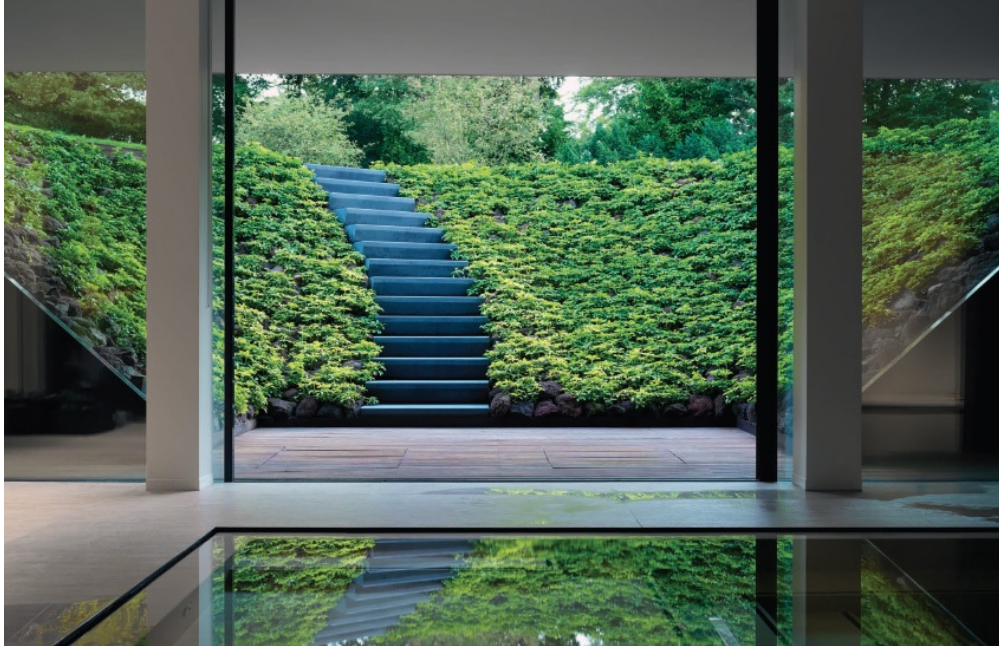




A small pavilion that can be used as a guesthouse stands in a secluded corner of the garden. Its mirrored glass skin reflects the surroundings making the structure almost invisible.



The excavations at the basement level allow the pool and guestrooms to have glazed façades and direct access to the garden. The basement also contains a dedicated area for high-end energy-saving systems.



**010** A slim window frame optimizes day lighting and thermal performance. To minimize heat loss, a good solution is to inset the window frame behind the exterior insulation layer.









## **Tarifa House**

Architects: **James & Mau**

Location: **Tarifa, Spain**

Photography: © **Erika Mayer**

The site is located on a slope looking at the valley that dominates the Strait of Gibraltar. The design is guided by the particularities of the zone's climate and by the rules that dictate the vernacular architecture of Andalusian pueblos blancos (whitewashed hill towns) with patios and narrow streets. The goal was to create not simply a house but a complex that would promote outdoor activities as much as indoor ones.





The various modules are unified by a large canopy, which provides protection from solar radiation; thus creating a microclimate.

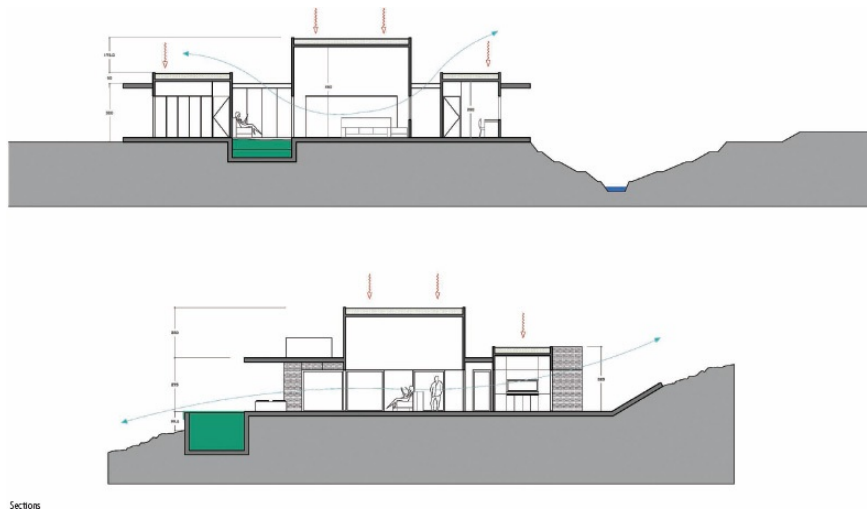


**011** Reduction of material costs, minimization of onsite waste, and reduction of construction time are advantages of modular home design.





**012** Modular construction is generally sturdier than its conventional counterpart because each module is engineered to withstand the rigors of transportation.



**013** A breezeway is used to channel air between two structures, thereby producing a cooling effect. This effect can be reinforced with the presence of a shallow pool.





Sustainable materials and renewable energies like biomass and solar thermal energy are used for both heating rooms and heating water.



1. Entry hall
2. Coat room
3. Toilet
4. Terrace
5. Kitchen / Dining room
6. Bathroom
7. Bedroom
8. Living room
9. Reflecting pool
10. Terrace with permeable roofing
11. Swimming pool

Floor plan



**014** Modular dwellings allow the separation of functions and promote a dynamic use of outdoor spaces.



## **Yin-Yang House**

Architects: **Brooks + Scarpa**

Location: **Venice, CA, USA**

Photography: © **John Linden**

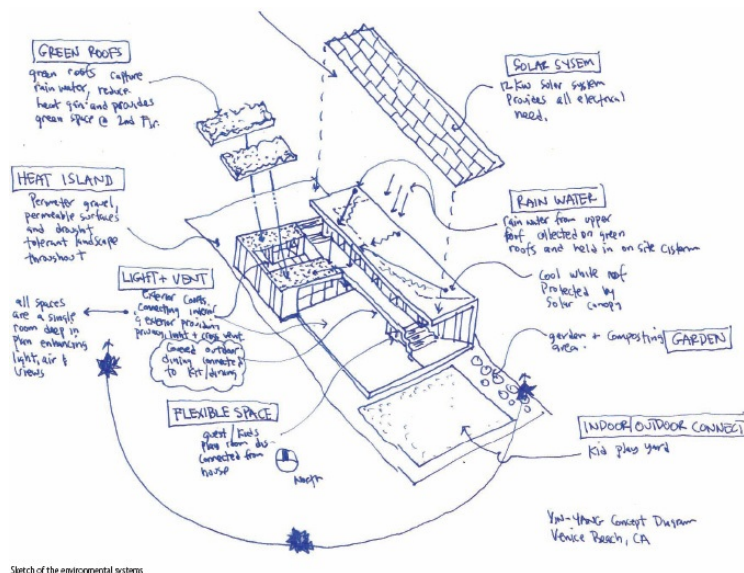
Yin-Yang House is a net-zero energy single-family home for a growing family. Facing the street, the construction looks very enclosed; but once inside it shows that it is actually a series of courtyards that integrate with the interior of the house. The design is aimed to emphasize common spaces and promote interaction among family members.





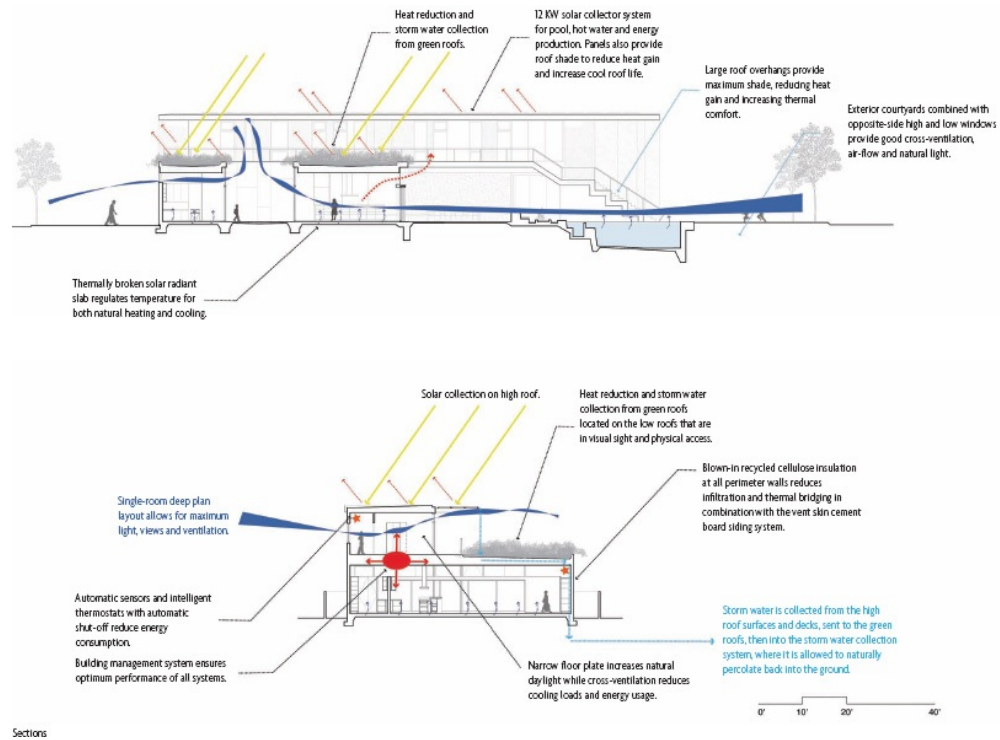


**015** When remodeling or building a house from scratch, consider the following principles of sustainable living: optimization of solar energy, improvement of indoor air quality, and use of high-performance materials.



Sketch of the environmental systems



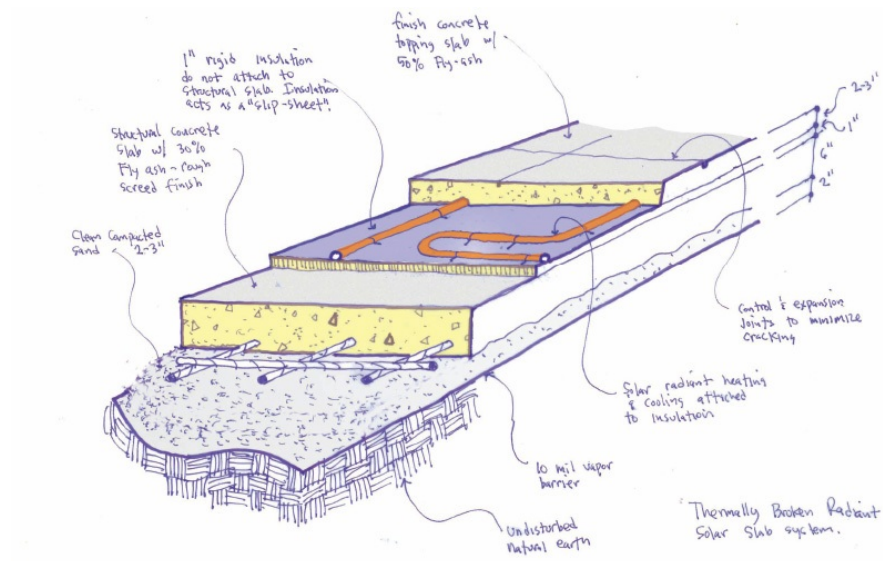


The active systems in the home include a 12 KW solar photovoltaic panel system, which doubles as a sunshade device.

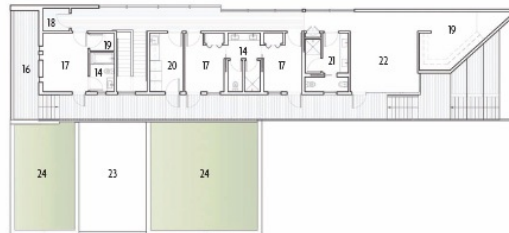




**016** Blown-in cellulose insulation and radiant floor heating contribute to an energy-efficient climate control system.



Detail sketch of radiant floor



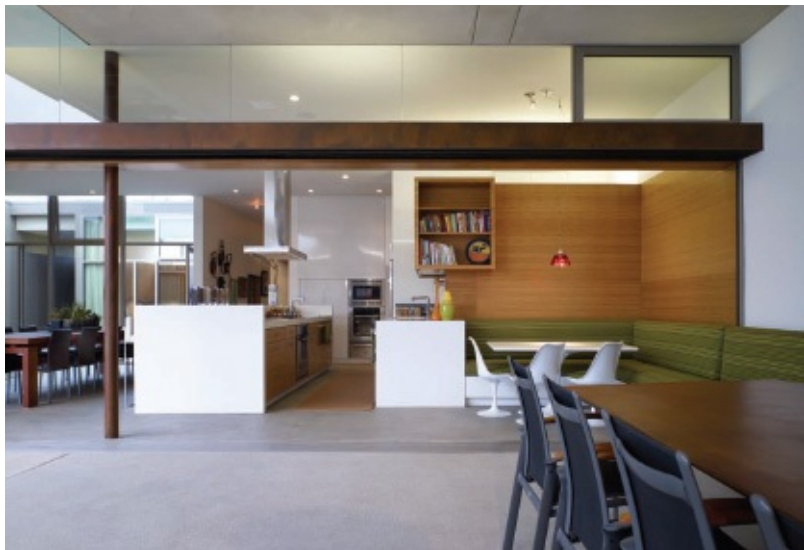
Second-floor plan



First-floor plan

- |                |                   |                     |
|----------------|-------------------|---------------------|
| 1. Entry       | 10. Covered patio | 19. Closet          |
| 2. Office      | 11. Planter       | 20. Laundry         |
| 3. Garage      | 12. Rec. room     | 21. Master bathroom |
| 4. Mudroom     | 13. Patio         | 22. Master bedroom  |
| 5. Courtyard   | 14. Bathroom      | 23. Open to below   |
| 6. Pantry      | 15. Shower        | 24. Green roof      |
| 7. Kitchen     | 16. Front balcony | 25. Mechanical room |
| 8. Dining room | 17. Bedroom       | 26. Pool            |
| 9. Living room | 18. Storage       |                     |

Eco-friendly materials like bamboo, composite stone, and recycled tile countertops and bathroom finishes are some of the house's environmental strategies.





## **Stony Point House**

**Architects:** Hays + Ewing Design Studio

**Location:** Stony Point, Charlottesville, VA, USA

**Photography:** © Prakash Patel

The owners of this home expressed interest in having a house that encouraged an appreciation of their three-acre wooded property and also served as a quiet space to support their contemplative, Zen-like lifestyle. The house and outdoor spaces are terraced into a hillside, taking advantage of the views. Unlike traditional, passive solar strategies, the length of the house is oriented exactly on solar north. The larger living spaces all open onto expansive terraces to the south and west.





East-west section



West elevation

The butterfly roof's deep overhang and tree canopy are to the west. They provide an optimal sunscreen in the summer and allow heat gain as needed in the winter.







Second-floor (entry) plan



First-floor plan

- |                   |                    |                  |
|-------------------|--------------------|------------------|
| 1. Living room    | 7. Master bathroom | 12. Laundry room |
| 2. Dining room    | 8. Guest bedroom   | 13. Wine cellar  |
| 3. Kitchen        | 9. Bathroom        | 14. Closet       |
| 4. Billiard room  | 10. Library        | 15. Deck         |
| 5. Office         | 11. Glass studio   | 16. Terrace      |
| 6. Master bedroom |                    | 17. Pool         |

**017** The evaporation of water has a cooling effect in hot and dry climates. A shallow pool in a breezeway is an effective cooling system, as the wind circulates through the breezeway and into the buildings on each side.



**018** Open-plan spaces with openings on opposite walls provide natural breezes with a pathway through the room.





**019** High clerestory windows on the eastern side of the house bring morning light into it. The inverted truss is steeply sloped to accentuate the lighting effect.



## Citriodora

Architects: **Seeley Architects**

Location: **Anglesea, Australia**

Photography: © **David Seeley, Zoe Economides**

Unadorned materials and simple, pragmatic detailing were used for the construction of the Citriodora house. The site rises moderately from the street, sheltered in the lee of a hill with two neighboring houses close by. A stand of lemon-scented gums occupies the northeast corner of the property, hence the name of the house. The climatic conditions, exposure, and building regulations provided both opportunities and constraints that informed the design material selection and detailing.

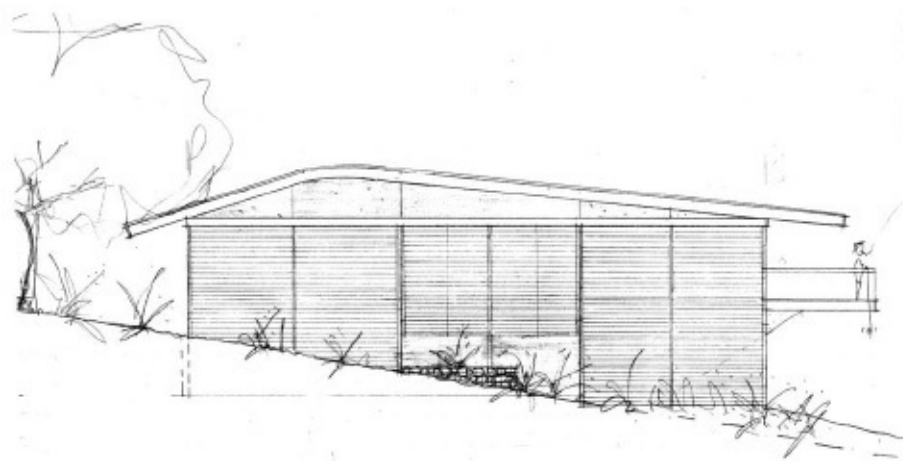






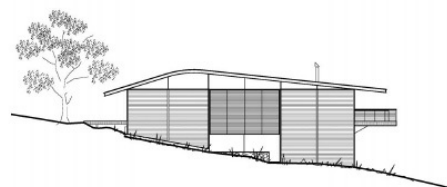
The airborne salt spray and wind required special design consideration. As a result, the roof mimics the form of the wind-pruned coastal vegetation.





Side elevation study

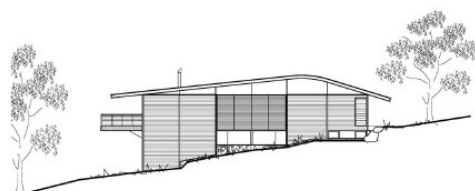
**020** Climate should determine the shape of the roof and the materials used in its construction.



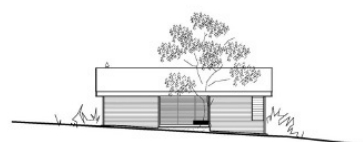
South elevation



East elevation



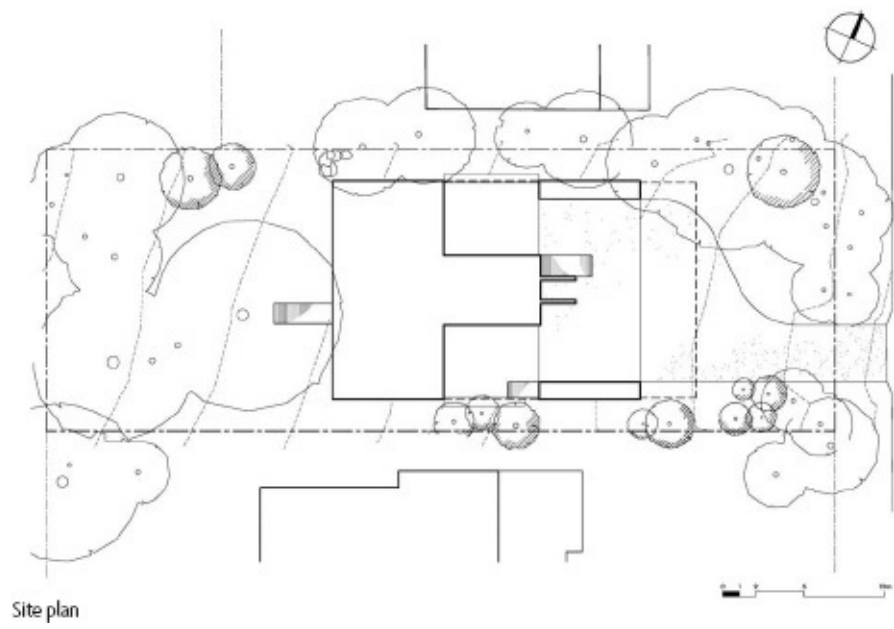
North elevation

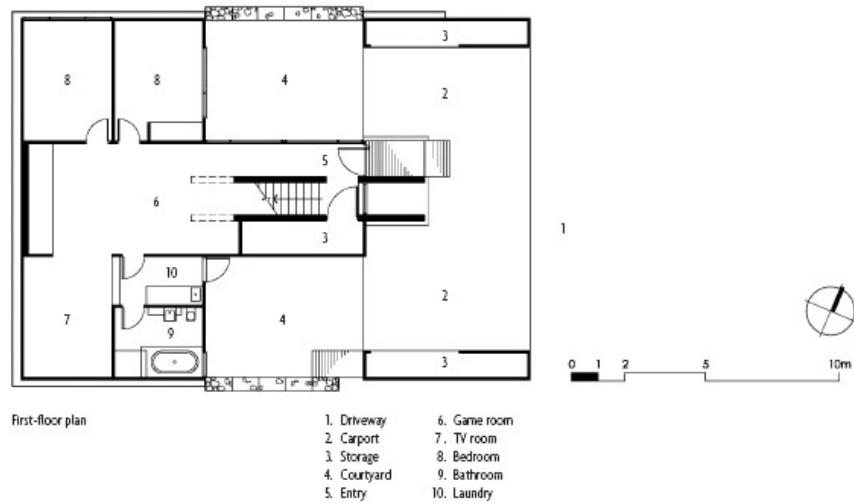


West elevation

The shape of the house and the materials used reference traditional timber construction and archetypal coastal homes.







**021** Adding clerestories to a kitchen can improve the level and distribution of daylight, creating a comfortable working space. Because the light comes from above eye level, glare is not an issue.



**022** Kitchen surfaces should be solid, non-porous, and durable. Good sources are sustainably sourced or reclaimed wood or bamboo, stone, tiles, and concrete with recycled content.





The refined aesthetic of the interior is enhanced by slender steel and LVL (laminated veneer lumber) beams, deep overhangs, and large expanses of glass.



**023** Consider using FSC (Forest Stewardship Council) certified wood ceiling panels in the design of your home. Wood panels provide a Class A fire rating and resistance to humidity.





## Ingoldsby House

Architects: **Seeley Architects**

Location: **Anglesea, Australia**

Photography: © **Shannon McGrath**

The Ingoldsby House is a sensitive response to a coastal site requiring special consideration. The core idea for this house sprung from the piers that dot the coastal region of Victoria. The result is a building that utilizes a robust post and beam structure and explores the contrast between mass and void. The house is an extroverted form containing the living rooms and an introverted form containing bedrooms and bathrooms sitting over a partial basement.







**024** The use of recycled timbers and long-lasting materials, the minimal destruction of vegetation, and the use of water storage tanks mitigate the impact of this new construction on the environment.





**025** Angling the louvers up allows natural light into the house. Angling the louvers down helps bring the cool air in without letting in much light or giving up privacy.



**026** High lighting and ventilation levels can be achieved through breezeways and louvered clerestories.

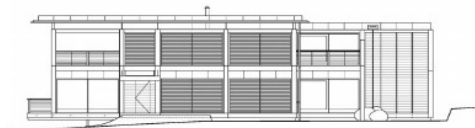


The materials were chosen for their durability and low maintenance

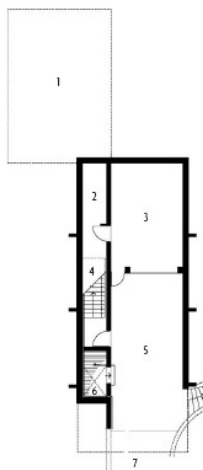
requirements. They help minimize the solid waste problems and contribute to the energy-efficient nature of the house.



East elevation

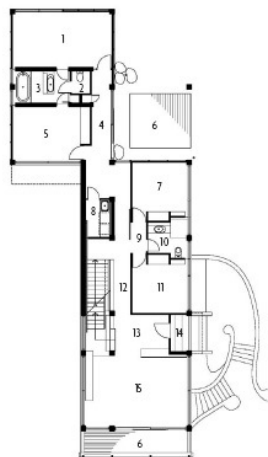


North elevation



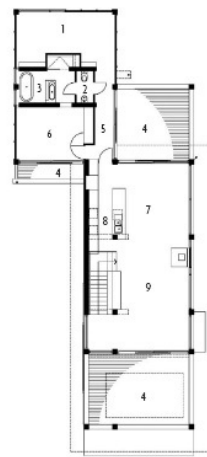
First-floor plan

1. Building above
2. Storage
3. Garage
4. Cellar
5. Carport
6. Shower
7. Driveway



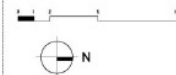
Second-floor plan

1. Bedroom
2. Toilet
3. Bathroom
4. Hall
5. Bedroom
6. Deck
7. Bedroom
8. Laundry
9. Vestibule
10. Bathroom
11. Bedroom
12. Hall
13. Entry
14. Terrace
15. Lounge



Third-floor plan

1. Study
2. Toilet
3. En-suite bathroom
4. Deck
5. Hall
6. Bedroom
7. Dining room
8. Kitchen
9. Living room



The design of the house promotes the notion of a coastal experience with a sturdy structure, weathered materials, and a connection between enclosed and open spaces.





## Essex Street House

Architects: **Andrew Maynard Architects**

Location: **Brunswick, Melbourne, Australia**

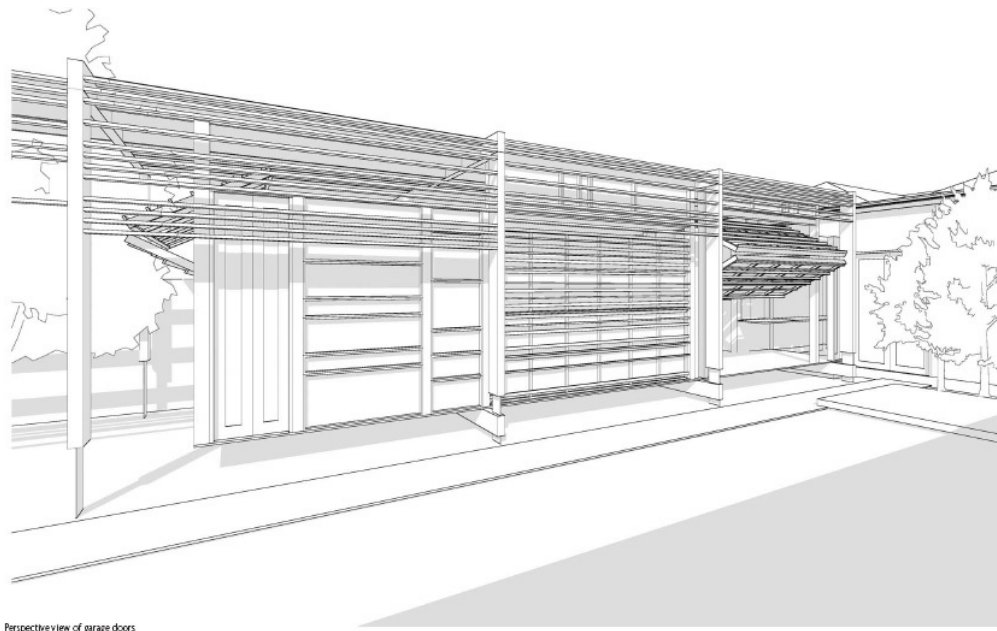
Photography: © **Andrew Maynard Architects, Peter Bennetts**

The Essex House project is a 500 sq. ft. addition to an existing 970 sq. ft. weatherboard house that sits at one end of a long and narrow plot. The addition has an elongated plan and extends along the southern side of the backyard. Walls are kept to a minimum with fully glazed garage-style doors that open the rooms to the outdoor space and wood slat screens that filter light. Sustainability is intrinsic to this design.



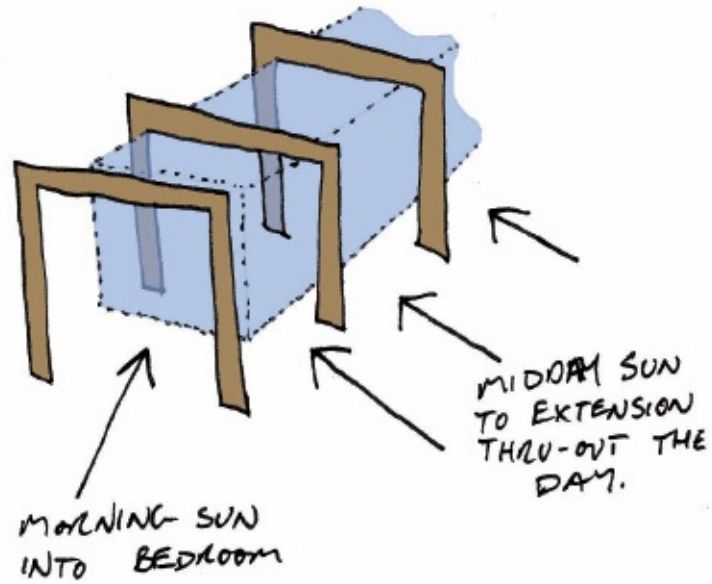


**027** The use of exposed structures that minimize the need for finishes and a building's carbon footprint analysis are two considerations of sustainable design that are gaining strength in residential architecture.



Perspective view of garage doors

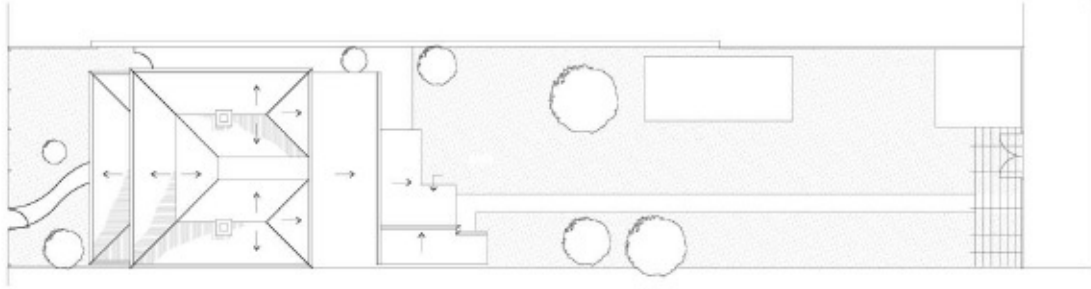




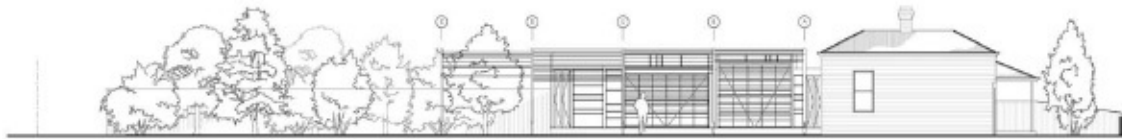
Conceptual sketch of the new structure



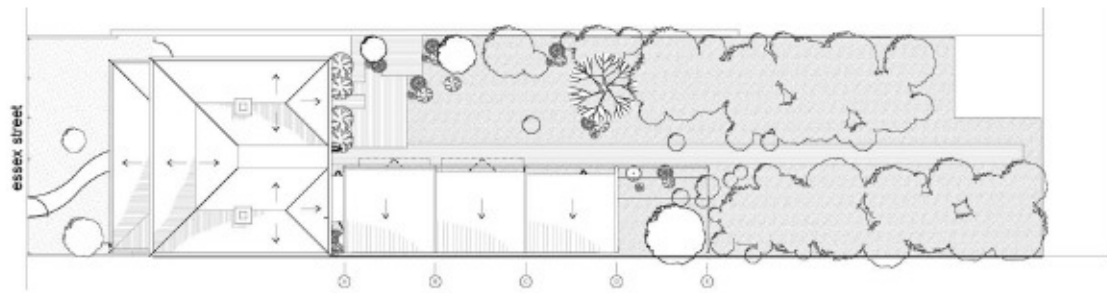
**028** A structure that is lifted off the ground allows for the landscape to regenerate after construction is completed and also, if need be, facilitates the removal of the building.



Existing roof plan



Proposed north elevation



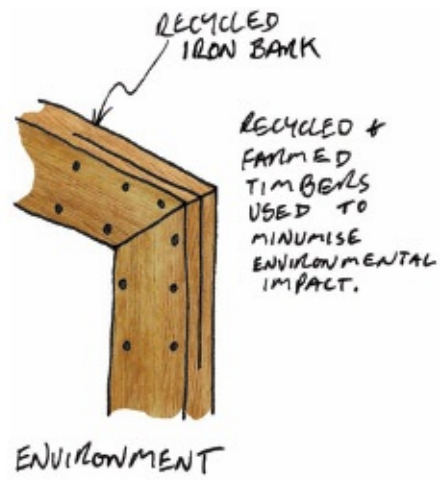
Proposed floor plan

**029** Swing-up-and-fold garage doors maximize solar exposure and allow interior activities to spill outdoors.









Corner detail of recycled gray iron bark portal frame

## Outside IN House

Architect: **Fernanda Vuillemier**

Location: **Puerto Natales, Chile**

Photography: © **Daniel Bruhin**

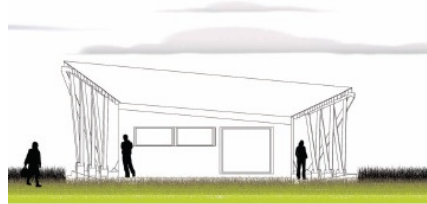
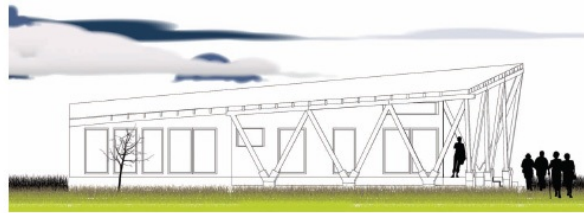
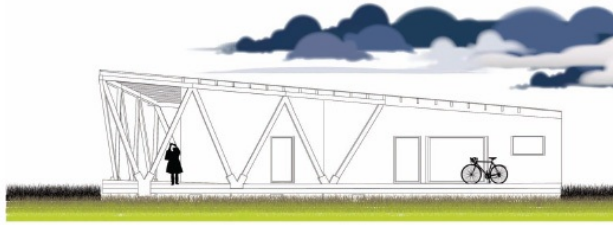
The design of this house integrates rustic materials and harnesses natural forces to bring exterior materials to the interior. Local building traditions and the availability of materials in the immediate vicinity yielded a wealth of ideas and inspiration. A thorough assessment of the sun path, views, and landscape features determined the best strategies to meet climate-appropriate comfort and sustainability requirements.







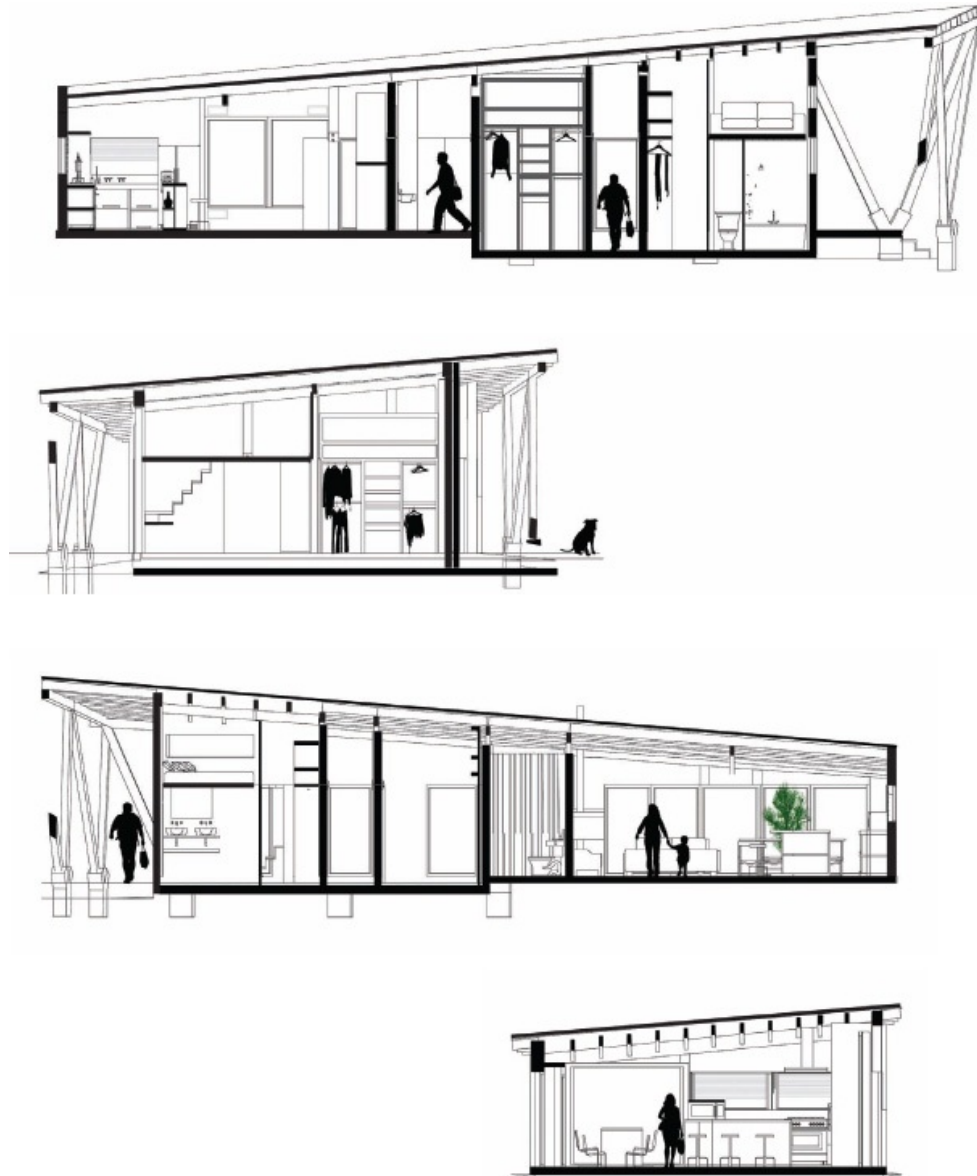
**030** A sloping roof directs the prevailing wind in one direction, and also facilitates the collection of rainwater.



Elevations







Sections

The house is equipped with passive solar features to absorb, store, and distribute solar resources for heating, cooling, and lighting.



**031** Raise the floor from the ground and insulate it properly to prevent it from absorbing moisture. Insulation is required to minimize heat loss through the ground.

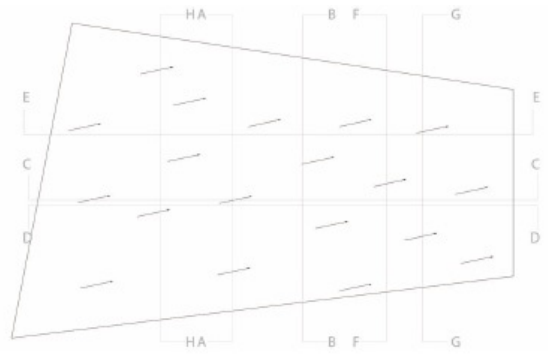




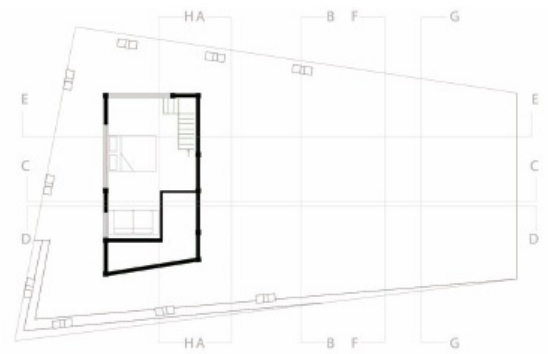
**032** The renewable and recyclable nature of wood and its minimal embodied energy make timber a good exterior wall cladding material.







Roof plan



Second-floor plan



First-floor plan

Functions that could be done outdoors were evaluated to determine how much the building could expand during the summer and shrink in the winter.





## **Villa Rieteland-Oost**

Architects: **Egeon Architecten**

Location: **Amsterdam, the Netherlands**

Photography: © **Chiel de Nooyer**

Villa Rieteland-Oost is a mix-use building that stands out for its size and all-wood skin. Its timber structure is clad in sustainably sourced cedar slats laid horizontally and vertically, with similarly covered shutters to camouflage the openings and make the overall appearance of the building more homogeneous. A spiral staircase tucked into a recess in the front façade leads directly to an office on the third floor.





An active façade adapts to the needs of the homeowners and the effects of the seasons. Shutters can either be open to let light and warmth into the house or closed to screen the sunlight out and keep the interior cool.





**033** Reclaimed wood is an eco-friendly material worth considering when building or renovating a home. One of wood's qualities to note is that it stores carbon; it doesn't release it into the atmosphere.



**034** A common characteristic of passive solar homes involves thermal mass in the floor beneath the south-facing windows, as it retains sun-produced heat.





**035** To optimize the advantages of a sustainable home, attention should be paid to details such as thermal bridging, high insulation values of the roof, and wall and floor assemblies.

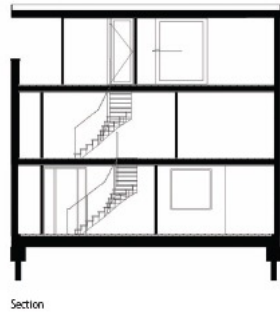
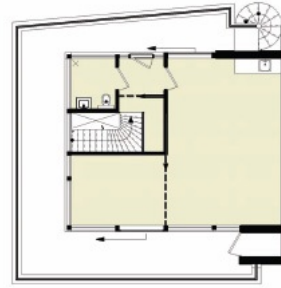


**036** Reclaimed wood makes construction more affordable. Not only is wood environmentally friendly, but it also enhances the aesthetic value of a home.





**037** Windows' sizes and proportions can vary depending on how well insulated a house is and how energy efficient its glazing is.



When untreated, wood is completely biodegradable at the end of its useful life.







**038** In cool climates, the thermal mass of concrete can absorb solar gain. This allows the minimization of the need for non-renewable heating energy.



## **Modernist Summer Hamptons Residence**

Architects: **Austin Patterson Disston Architects**

Location: **Quogue, NY, USA**

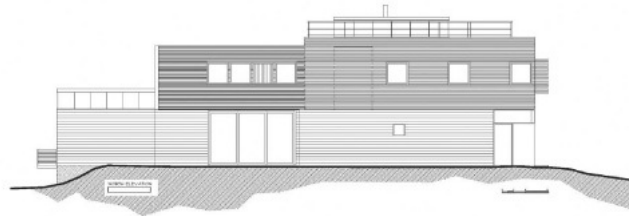
Photography: © **Peter Murdock**

As this house is used primarily in the summer, its main gathering spaces are outdoors. The large glass panels slide into the exterior walls so that the house can have a large porch. The solid volumes feature Port Oxford cedar used in two different exterior details: as solid siding and as horizontal slats. Aesthetically, this design decision achieves visual interest and functionally, and accommodates different levels of privacy.





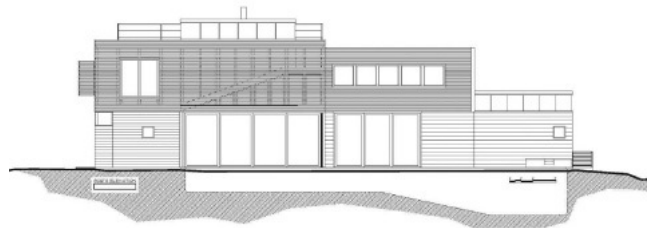




North elevation



East elevation



South elevation



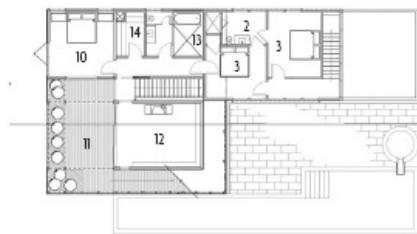
West elevation

The exterior walls of the house combine two cladding methods: horizontal tongue-and-groove siding and wooden-slat screening. Both provide different levels of privacy, while enriching the visual texture of the building.

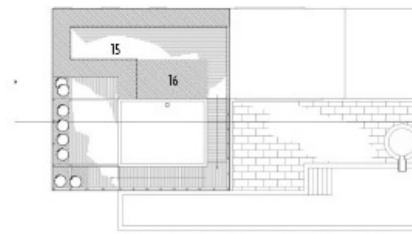




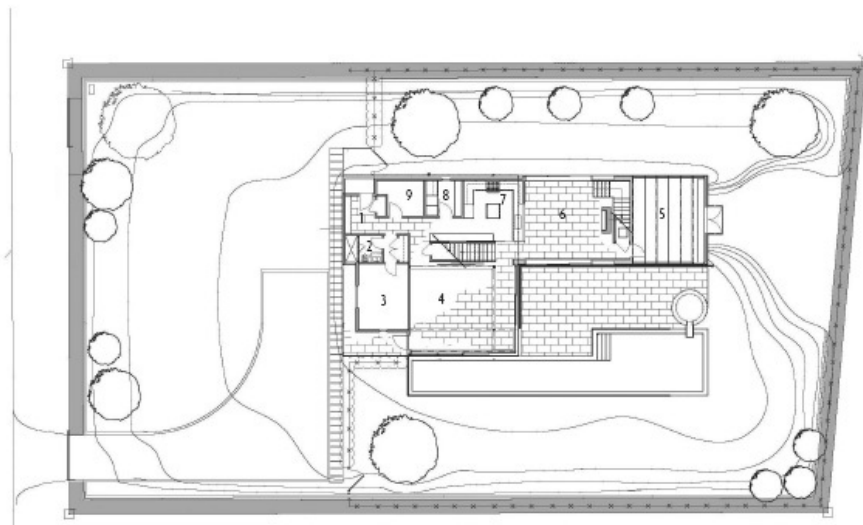
The two wings of the building embrace a courtyard. The interlocking volumes of the house and the L-shape swimming pool establish a relationship between solid and void, and interior and exterior.



Second-floor plan



Roof plan



First-floor plan

- |                           |                     |
|---------------------------|---------------------|
| 1. Mud room               | 9. Mechanical room  |
| 2. Bathroom               | 10. Master bedroom  |
| 3. Bedroom                | 11. Deck / Garden   |
| 4. Living room            | 12. Library         |
| 5. Studio                 | 13. Master bathroom |
| 6. Family and dining room | 14. Master closet   |
| 7. Kitchen                | 15. Roof deck       |
| 8. Laundry                | 16. Roof garden     |

**039** Wooden screens can complement the look of your house while providing solutions to privacy and security concerns.



**040** Environmentally certified and reclaimed wood is available in standard dimensional lumber. Using certified framing lumber, plywood, and reclaimed beams can save money.





The house has ground-source heat pumps and a highly insulated envelope with solar voltaic and solar hot water. It also incorporates LED and low-voltage lighting.







## Harpoon House

Architects: **Design for Occupancy**

Location: **Portland, OR, USA**

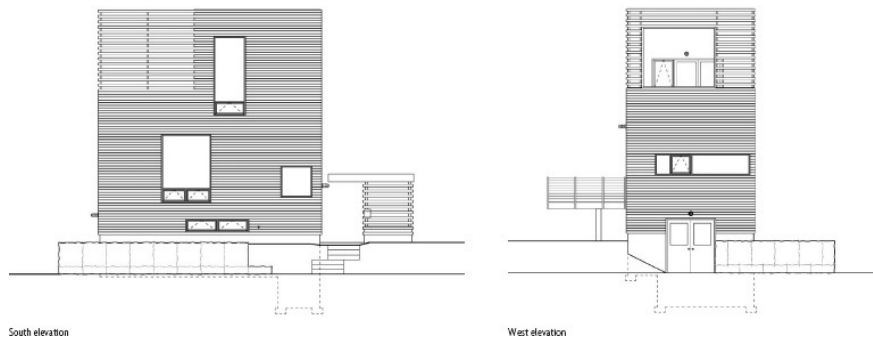
Photography: © **Matt Kirkpatrick**

Located on an urban infill lot, Harpoon House occupies a small footprint—rather than taking up the total area allowed for its construction—in order to have a generous outdoor space. The three-story home was built with sustainability as an organizing principle. By integrating the design of interior spaces with habitable eco-roofs, decks, and patios, Harpoon House was designed to encourage a fluid relationship between indoor and outdoor living.

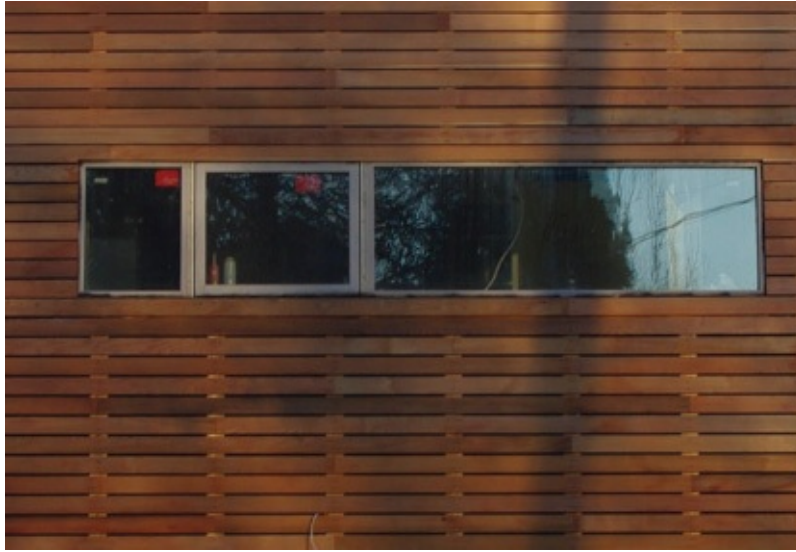




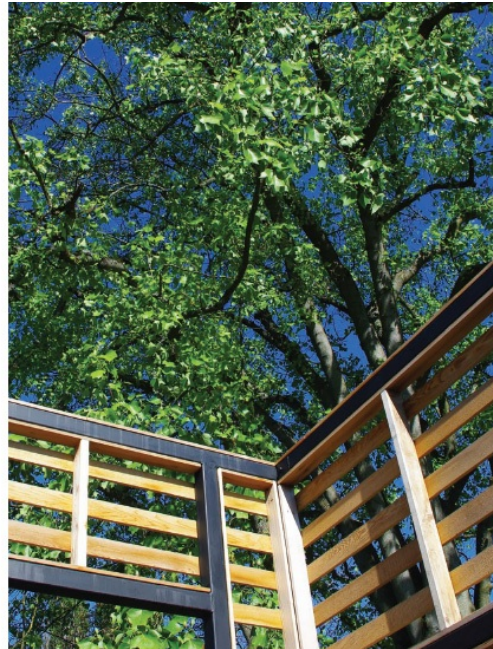
A ventilated wooden rainscreen made of untreated cedar slats is held off the concrete structure of the building. It serves as siding and as a screen where openings in the concrete structure occur.





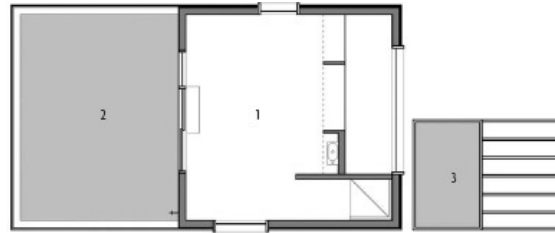


**041** Utility pipes can be concealed in the space between a rainscreen and an exterior wall. This eliminates the need to carve out panel insulation, which would result in thermal bridging.

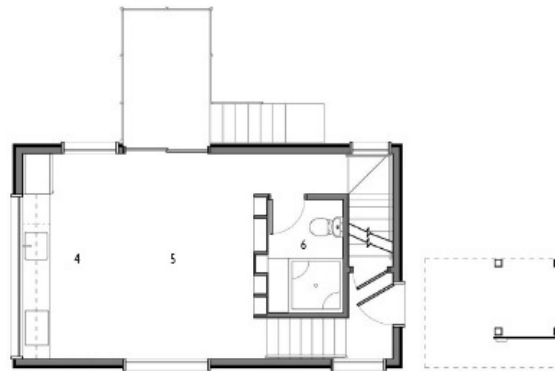




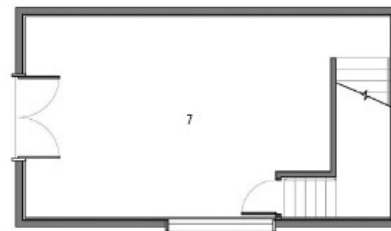
**042** A rainscreen is the weather-facing surface of an exterior wall used to minimize the forces driving moisture into the wall and manage energy transfer.



Second-floor plan



First-floor plan



Basement-floor plan

- 1. Bedroom
- 2. Roof garden
- 3. Eco roof
- 4. Kitchen
- 5. Living room
- 6. Bathroom
- 7. Storage and cellar

**043** Take advantage of a protected rooftop to grow your own vegetable and herb garden. Use containers and raised beds to avoid damage to the waterproofing membrane.





**044** A rainscreen provides additional protection from the elements. It can also double as a screen to shelter an outdoor space such as a balcony or a roof terrace.







## Peel House

Architects: **Taylor & Miller**

Location: **The Berkshires, MA, USA**

Photography: © **Taylor & Miller, Gregory Sherin**

This addition to an existing house provides a distinct visual separation of the two, while still unraveling its exterior surfaces to embrace the existing structure. The exterior surfaces of the building are made up of stacked cedar pieces that are assembled at surface intersections. The detailing of this allows for opaque areas and for partially transparent areas along the building's exterior.







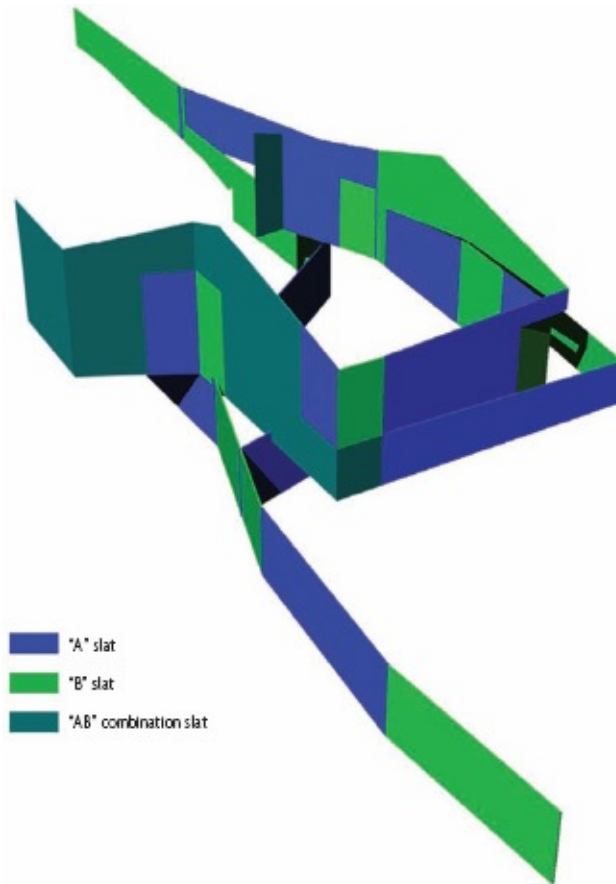
Partially transparent areas allow for sunshade, privacy, ventilation, and a connection to the natural environment.



**045** There is no need for the use of various materials to make the skin of a



building visually interesting. Wood is a versatile material that lends itself to any shape, size, and construction method.



- "A" slat
- "B" slat
- "AB" combination slat

Siding diagram



**046** Woodworking joinery techniques highlight the beauty of wood. Reclaimed timber already has character of its own.



**047** The selection of wood for siding can depend on the availability of resources; but cedar, fir, and redwood provide material for a sturdy siding resistant to the elements.



The wooden exterior of the building will weather into silvery gray tones, and it will slowly blend with the surrounding forest.





**048** Before choosing the type of wood to use in a project, it is important to learn about the environmental benefits of FSC (Forest Stewardship Council) certified wood.



The interior of the house boasts the same level of attention to detail as the exterior with joinery details that create focal points.





## **Pull House**

Architects: **Taylor & Miller**

Location: **The Berkshires, MA, USA**

Photography: © **Gregory Cherin**

A ranch home used to sit on this project. After the building was stripped down to its frame, the overall form was stretched longitudinally to house the necessary additional program. The house was built using sustainable materials and construction techniques such as reclaimed wood cladding for the exterior, bamboo for almost all interior surfaces, LED and fluorescent light fixtures, and low-VOC products.





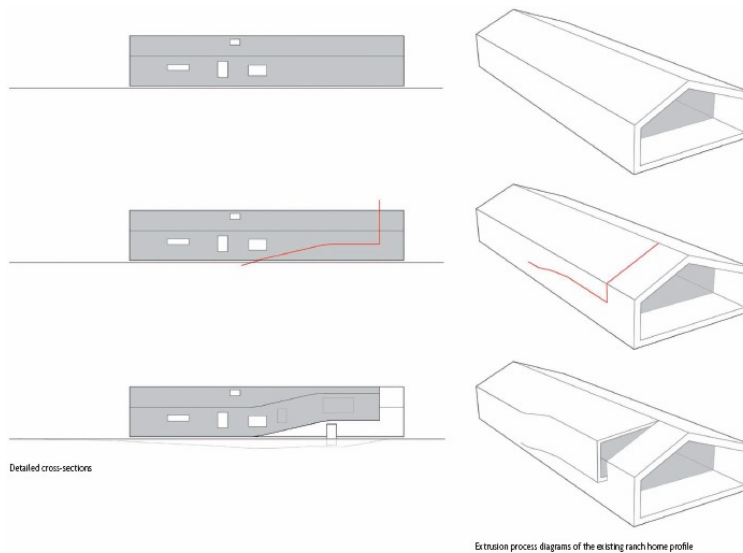
**049** Wood-clad homes are durable as long as the wall assemblies include an adequate vapor layer and insulation to prevent rot and other moisture-related issues.





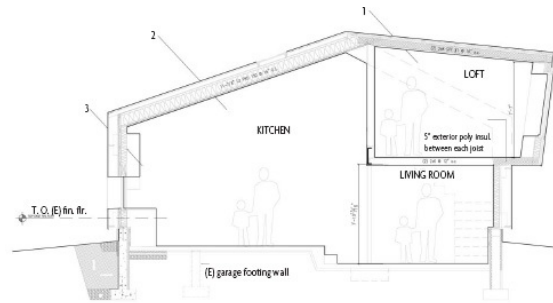


The area defined by a volumetric slice is pulled up and out of the extruded boundaries, creating a semi-private loft space that hovers above the living and dining areas.

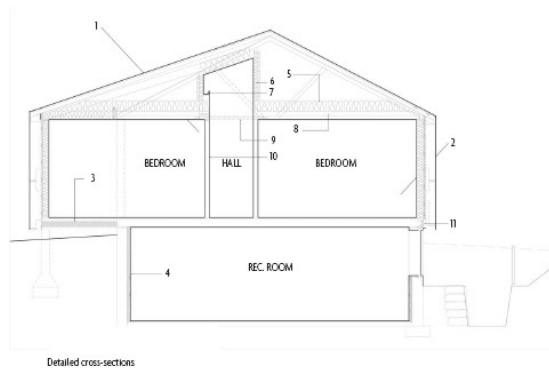


Punches of color highlight the openings along the exterior wall of the protrusion. More than a simple design statement, these colors reveal the volume of the walls, which house thick insulation.





1. NEW ROOF ASSEMBLY  
Cedar roofing over 1 x 4 sleepers over rubber membrane roofing over 5/8" CDX plywood over (2) 2 x 8 SPF rafters @ 16" O.C. with 7" extruded polystyrene insulation between each rafter under 1/4" wood paneling
2. NEW ROOF ASSEMBLY  
Cedar roofing over 2 x 4 sleepers over rubber membrane roofing over 5/8" CDX plywood over 11-3/8" TJI PRO 150 rafters @ 16" O.C. with Prop-R-Vent and (2) layers R-19 BATT insulation between each rafter with 1" rigid expanded polystyrene insulation over underside of rafters; tape joints under 1/2" painted gypboard; provide continuous vent @ ridge and eave
3. TYPICAL NEW WALL ASSEMBLY  
Cedar siding over 2 x 6 sleepers over rubber membrane roofing over 2" extruded polystyrene rigid insulation over 1/4" furring over 1/2" CDX plywood over 2 x 6 studs @ 16" O.C. with R-19 BATT insulation between each stud under 3 mil. Poly vapor barrier under painted gypboard



1. EXISTING ROOF ASSEMBLY  
Cedar roofing over 2 x 4 sleepers over rubber membrane roofing over 5/8" CDX plywood over tapered furring over existing roof with R-38 BATT insulation over existing loose fill insulation under 1/2" painted gypboard; provide continuous vent @ ridge and eave
2. EXISTING WALL ASSEMBLY  
Cedar siding over 2 x 6 sleepers over rubber membrane roofing over 2" extruded polystyrene rigid insulation over 1/4" furring over existing horizontal siding over 1/2" plywood over 2 x 6 studs @ 16" O.C. with R-19 BATT insulation between each stud under existing wood paneling under 3 mil. Poly vapor barrier under painted gypboard
3. 5' exterior poly insulation between each joist
4. New 2" polystyrene insulation over existing concrete foundation walls under 1/4" furring under 1/2" painted gypboard
5. New R-38 BATTs
6. R-21 @ walls above ceiling
7. Lighting trough
8. Existing loose fill insulation
9. Install new 1/2" steel rod cross-tie before cutting existing ceiling joist to raise hallway ceiling
10. New non-load-bearing partition walls
11. Bolt C9 x 20 A36 to existing rim with (2) 1-1/2" x 2" galvanized bolts @ 16" O.C. before cutting foundation wall for new basement access.

In contrast with the silvery finish of the white cedar exterior cladding, colorful touches at the window and door openings give a hint of the vibrant interior.

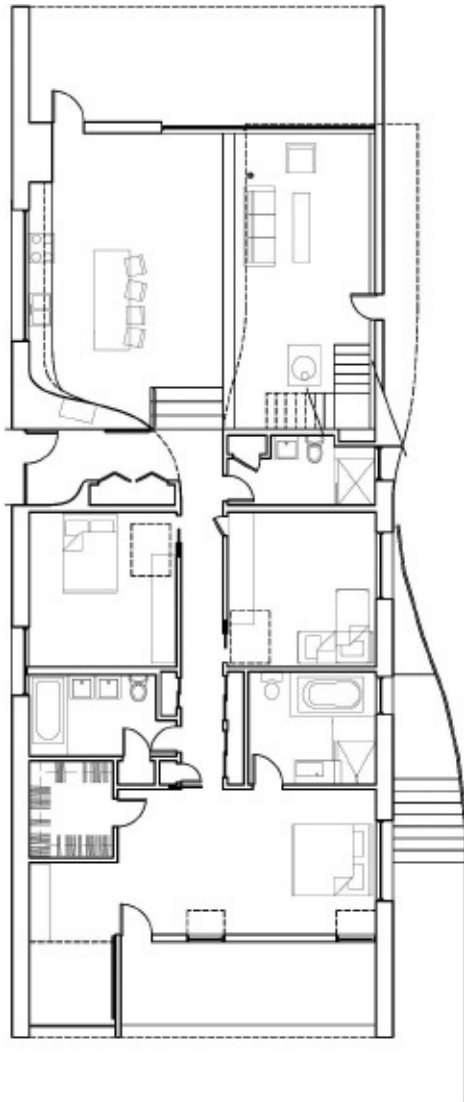


**050** Bamboo is a renewable, sustainable resource. It is a low-resin, open-grain

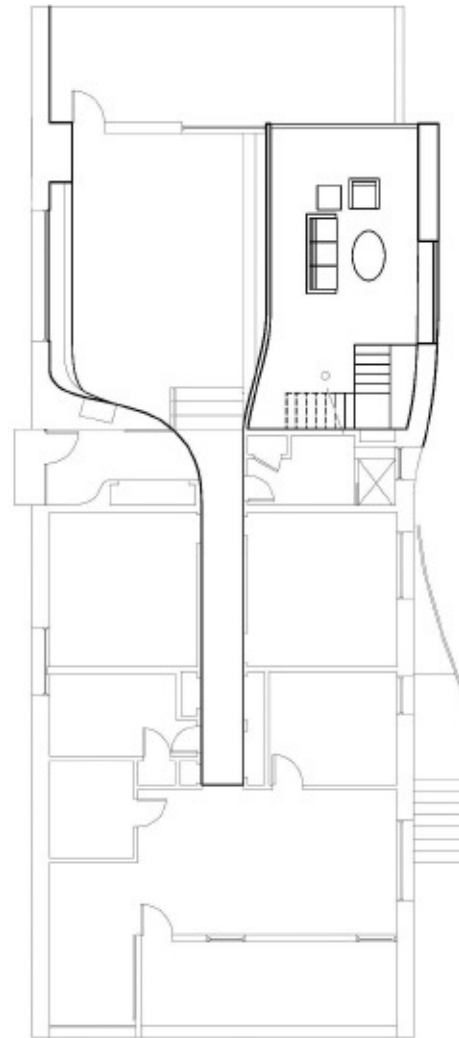


material that takes stains and finishes well. These qualities make bamboo a suitable material for interior applications.



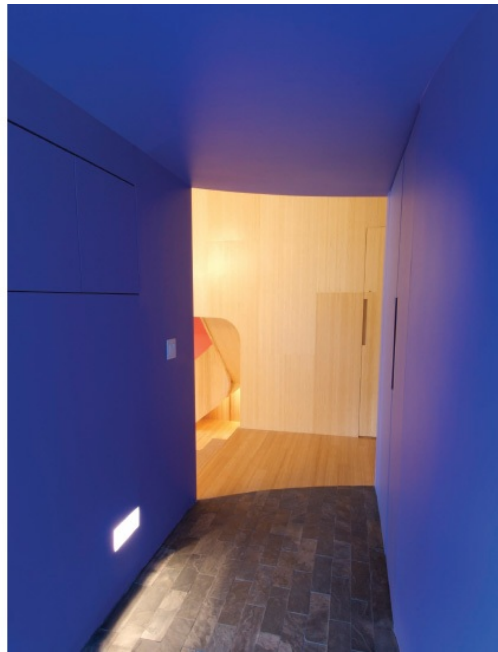


Main-floor plan



Upper "semi-private" living room floor plan

Two bamboo-clad walls organize the interior layout. They run parallel to each other forming a narrow passage that gives access to the bedrooms, and then funnel out to give room to an ample living space.







## Villa Nyberg

Architects: **Kjellgren Kaminsky Architecture**

Location: **Borlänge, Sweden**

Photography: © **Kjellgren Kaminsky Architecture**

This house has a circular plan with a central courtyard that allows occupants to enjoy daylight from different directions. Villa Nyberg is a well-insulated building that is largely heated by the energy generated from body heat and household equipment. The round shape of the house eliminates cold bridges and minimizes the enclosing wall area of the house, reducing heat loss.

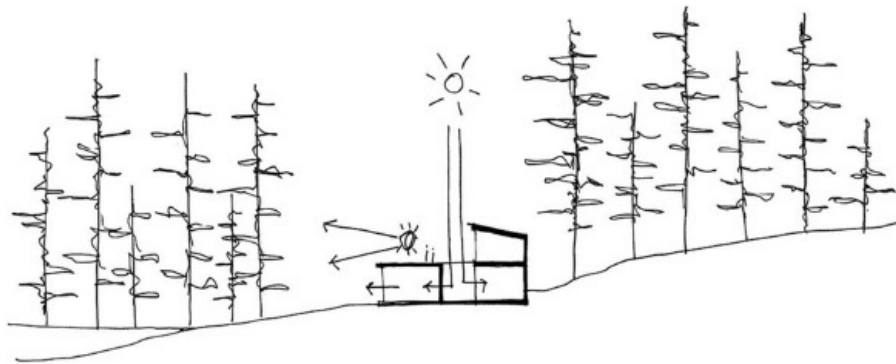








Site plan

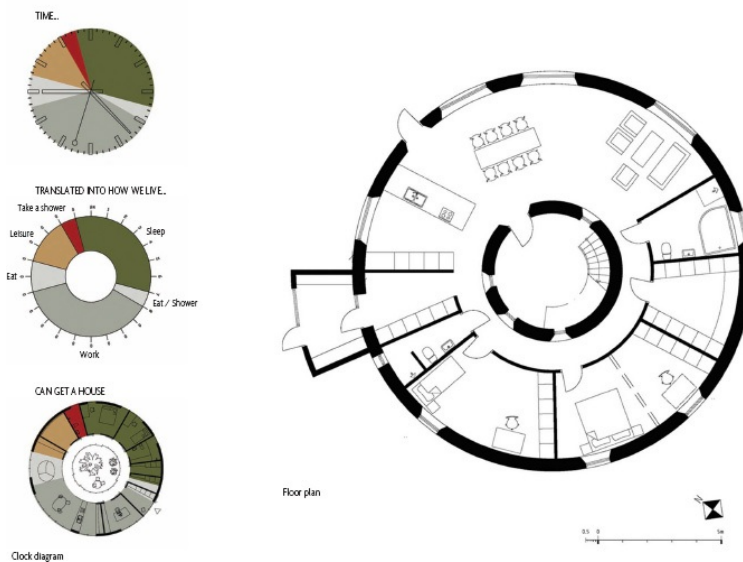


Sketch of sunlight optimization

Untreated-pine wood siding was used to facilitate the integration of the construction into the landscape. With time the wood will weather and turn gray, like the tree trunks of the surrounding forest.



**051** People and home equipment generate energy that contributes to the passive heating system of a well-insulated home.



**052** Exterior wall systems can wrap a building with a thermal protection layer that prevents energy loss through thermal bridges.





## 3716 Springfield

Architects: **Studio 804**

Location: **Kansas City, KS, USA**

Photography: © **Studio 804**

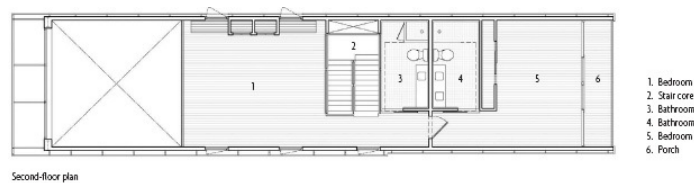
This project is an environmentally conscious modern home, which performs completely off the grid. As the first LEED platinum home in the Kansas City metropolitan area, the building serves as an example of sustainable living for people who want to live close to an urban center. The house features a combination of passive and active systems.



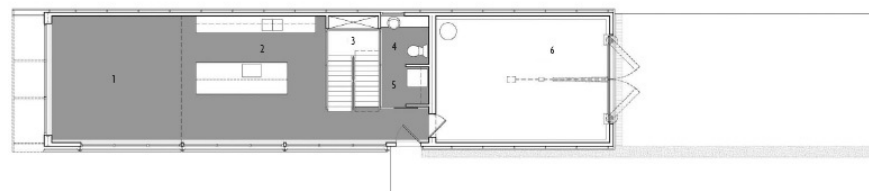




Wood was the natural choice for this building due to its economic value, ease of assembly, and speed of construction. FSC-certified wood was used in the framing and sheathing of all walls, the roof, and the floor.



Second-floor plan



First-floor plan



A rainscreen made of the FSC-certified tropical wood Cumaru wraps the entire house. It compartmentalizes the air cavity, thereby allowing rapid air-pressure equalization and minimal moisture intrusion.



**053** Landscape features such as trees, rock formations, water, and wind patterns can influence how a house performs. This knowledge will help you set the foundation for an energy-efficient home.



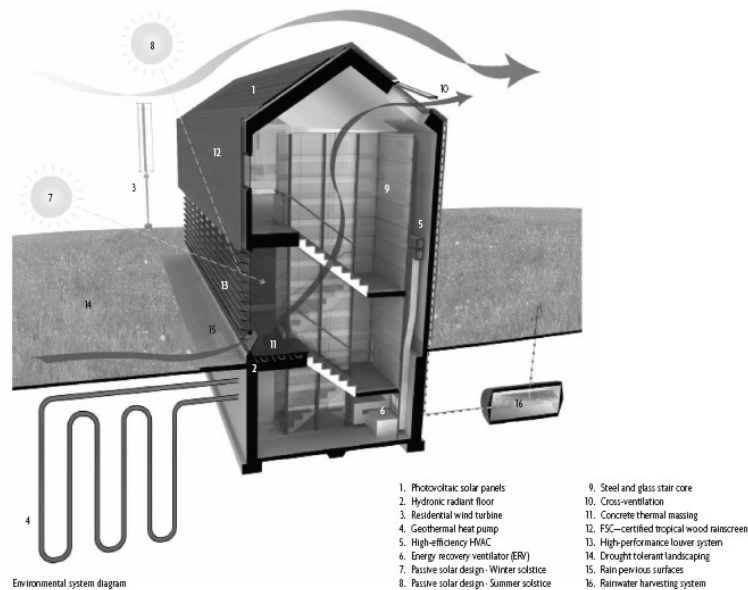


All countertops and bathroom surrounds are manufactured from a recycled paper composite material that is highly durable, low maintenance, and stain resistant.





**054** The use of renewable energy from the sun, wind, and thermal energy stored in the earth's crust can allow a home to rely less on non-renewable sources such as fossil fuels, coal, and natural gas.



FSC-certified Jatoba hardwood flooring is featured in the upstairs loft and bedroom spaces and continues to wrap the kitchen ceiling to achieve a visual link between spaces.





## **Prescott Passive House**

Architects: **Studio 804**

Location: **Kansas City, KS, USA**

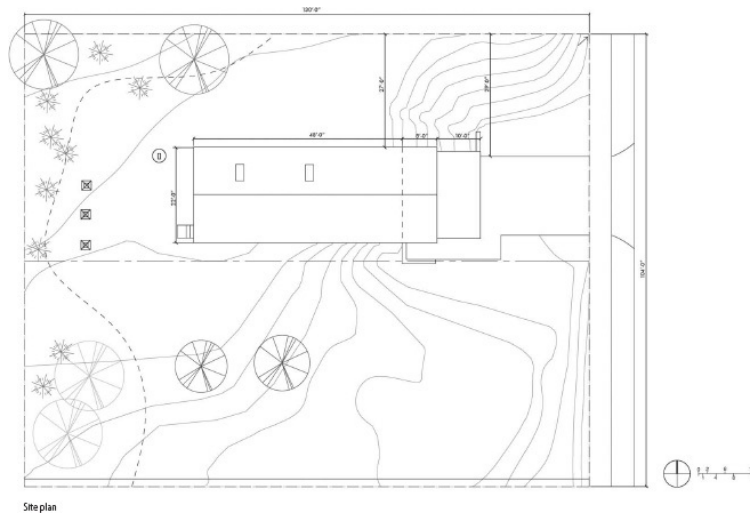
Photography: © **Studio 804**

This low-energy house is designed for the affordable-housing market. Its exterior is clad in a charred Douglas fir rainscreen with louvers that are angled to allow winter heat gain and block sunlight from penetrating the house in the summer. Designed to exceed both Passivehaus and LEED platinum standards, the residence uses low-cost passive strategies such as thermal mass, high-performance windows, high insulation, southern orientation, and an airtight building envelope.

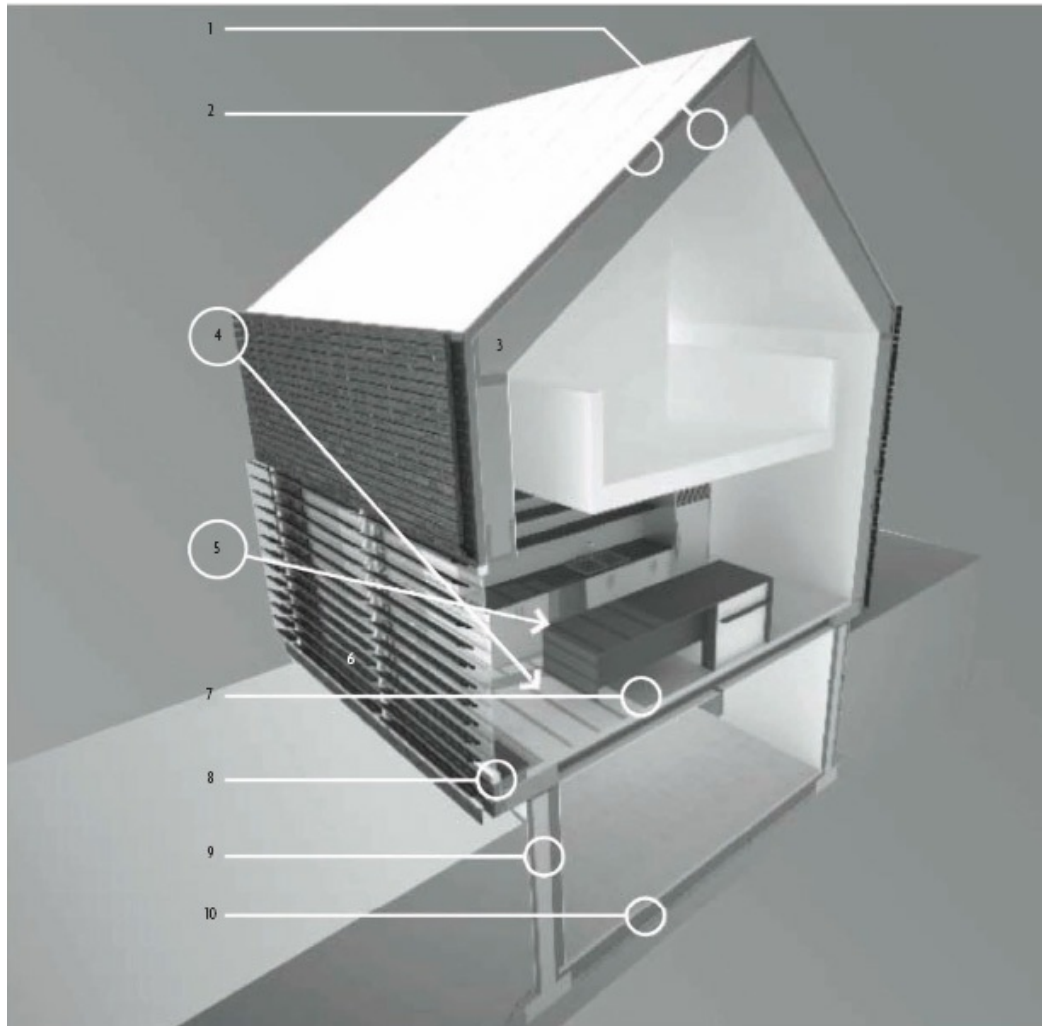




**055** An airtight building exterior can avoid a heat transfer between the interior and the exterior. This allows a home to retain the heat of an interior high-performance glazing.

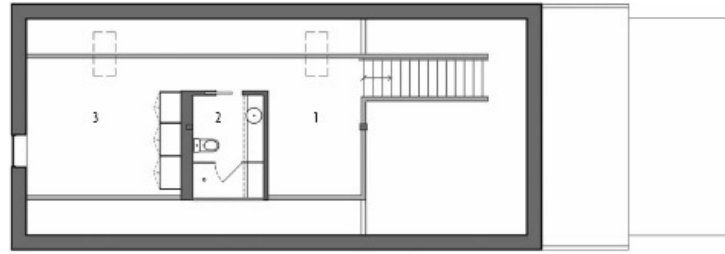






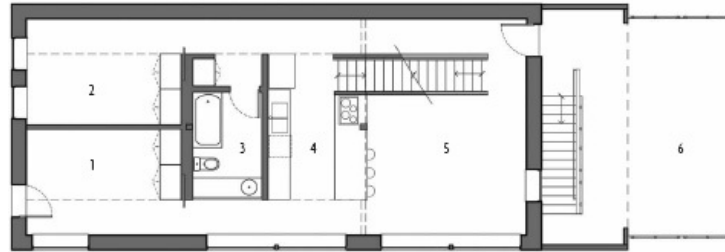
Environmental system diagram

1. 16" cellulose insulation
2. 3" extruded polystyrene (XPS)
3. The deep cavities provided by the engineered lumber framing allow for a super-insulated blanket to surround the house
4. Passive solar design, Summer solstice
5. Passive solar design, Winter solstice
6. External louvers are oriented at an optimal angle to block summer sun and allow the winter sun deep into the space
7. 4" concrete slab
8. Triple-pane insulated frame windows
9. ICF foundation walls with additional XPS insulation
10. 4" concrete slab above 6" XPS insulation



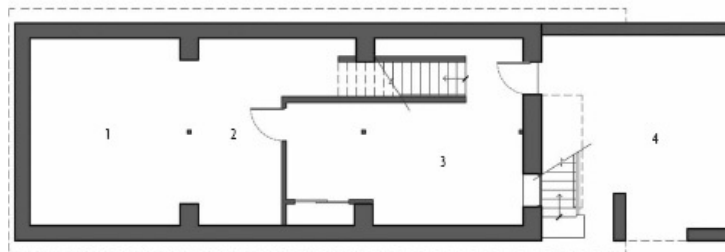
Second-floor plan

- 1. Flex space
- 2. Bathroom
- 3. Bedroom



First-floor plan

- 1. Flex space
- 2. Bedroom
- 3. Bathroom
- 4. Kitchen
- 5. Living room
- 6. Porch



Basement-floor plan

- 1. Storage
- 2. Laundry
- 3. Flex space
- 4. Carport

**056** A concrete floor can absorb and store heat for longer periods of time than other commonly used materials such as wood. This is due to its high density, which can also smooth out temperature variations.



**057** Skylights reduce the need for air-conditioning in the summer and provide solar heat in the winter. An alternative to conventional skylights is solar tubes, which use light-intensifying devices to direct light.





**058** Window size and orientation are design elements that can reduce the use of heating and cooling energy. Glazing technologies can provide insulating and solar protection.



## **MODERNest House 1**

Architects: **Kyra Clarkson, Christopher Glaisek/MODERNest**

Location: **Toronto, ON, Canada**

Photography: © **Steven Evans**

MODERNest is a new design and development initiative with a mission to offer affordable, sustainable, architect-designed houses in downtown Toronto neighborhoods. MODERNest sites are selected to provide easy access to good schools, public parks, transit lines, and local shops. House 1 is integrated with nearby houses through its scale and use of natural materials.







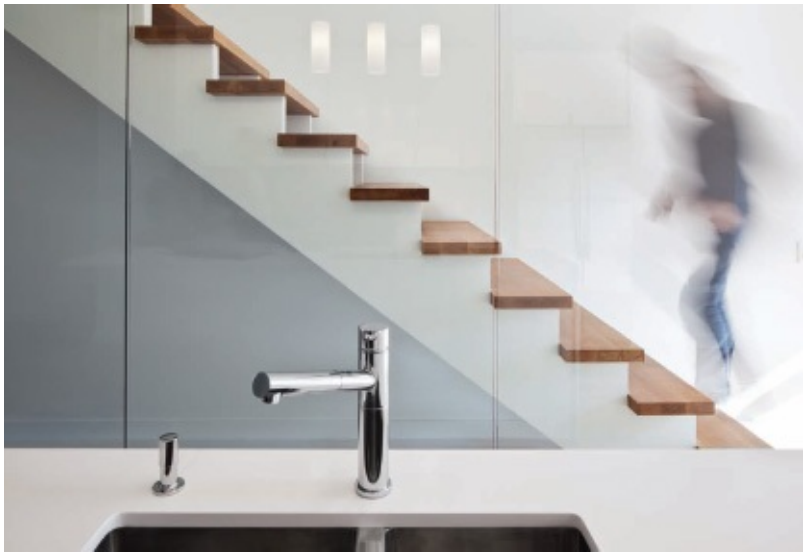


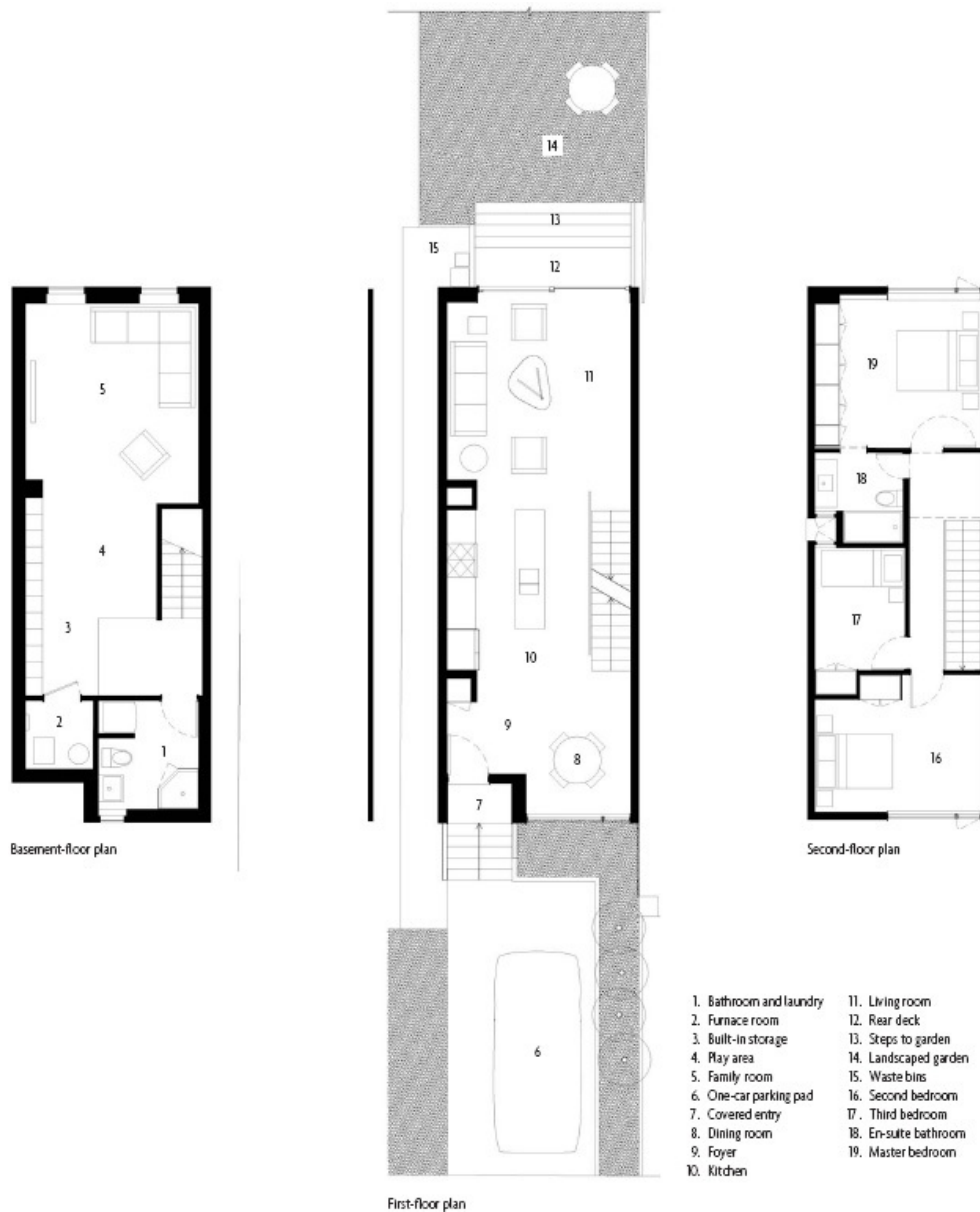
High-efficiency mechanical systems, low-E glass, and well-insulated walls combine to make House 1 a home with a modern spirit aspiring to revitalize the urban neighborhood.



**059** An open-riser staircase makes a good light and airshaft. When combined with carefully placed operable windows it provides efficient ventilation and good overhead lighting.







**060** Windows placed higher than eighty-three inches from the floor are called daylight panels. The closer a daylight panel is to the ceiling, the more efficient it is in bringing light into a space.



Locally made Douglas fir windows and sliding glass doors provide natural ventilation and a strong connection to the exterior landscape.





## **Gabion House**

Architects: **ColectivoMX**

Location: **San José del Cabo, Mexico**

Photography: © **Lifestyle & Editorial Photography**

The creation of this house embraced passive design, regional materials, and a local labor force. It also relied on sensible materials, defined as ones that embrace different textures and reinterpret their usage for the integration of indoor and outdoor spaces to maximize the usage of the space. The key characteristic of this home and the reason for its name is its rock walls, the “gabions,” which integrate the house into its arid environment while protecting it from the sun and wind.





**061** Gabion baskets have been traditionally used as retaining walls and as an erosion control solution. Today using gabions is a popular form of wall construction and provides ventilation and drainage.



The house is surrounded by a canopy-shaded deck, which allows for comfortable outdoor living.

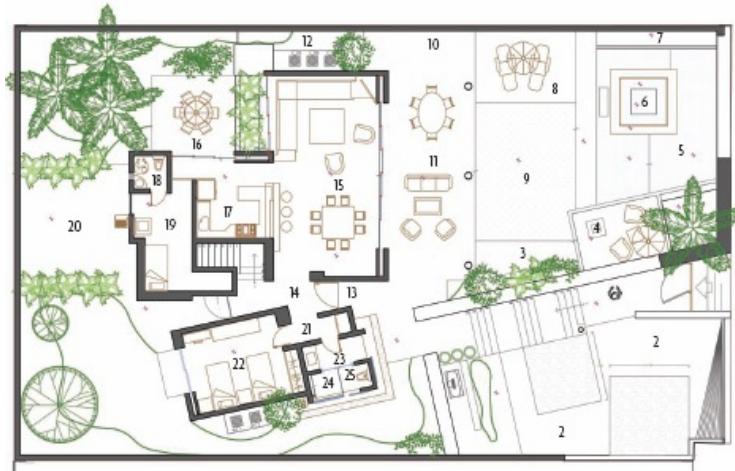


Sections



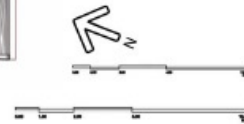


Second-floor plan



First-floor plan

- |                    |                        |                            |
|--------------------|------------------------|----------------------------|
| 1. Main access     | 11. Terrace            | 21. Vestibule              |
| 2. Garage          | 12. A/C equipment area | 22. Den / Office / Bedroom |
| 3. Stonewalloway   | 13. Access             | 23. Bathroom               |
| 4. Fire pit        | 14. Foyer              | 24. Shower                 |
| 5. Pool            | 15. Great room         | 25. Toilet                 |
| 6. Spa             | 16. Courtyard          | 26. Master bedroom         |
| 7. Desertic garden | 17. Kitchen            | 27. Master suite           |
| 8. Sand deck       | 18. Bathroom           | 28. Balcony                |
| 9. Grass garden    | 19. Laundry            |                            |
| 10. Grilling area  | 20. Service area       |                            |





Some walls are formed by a metal gabion-type framework filled with volcanic rock. Their purpose is to shield the house from the intense sun and heat, while allowing air to move through the space.





**062** To minimize the use of non-renewable resources, try to rely on the possibilities of natural materials.





**063** LED lights have a considerably lower environmental impact than compact fluorescent lamps and an even lower impact than incandescent lighting over the lifetime of the products.



## Off-the-Grid Home in Extremadura

Architects: **ÁBATON Architects**

Location: **Cáceres, Spain**

Photography: © **ÁBATON, Belén Imaz**

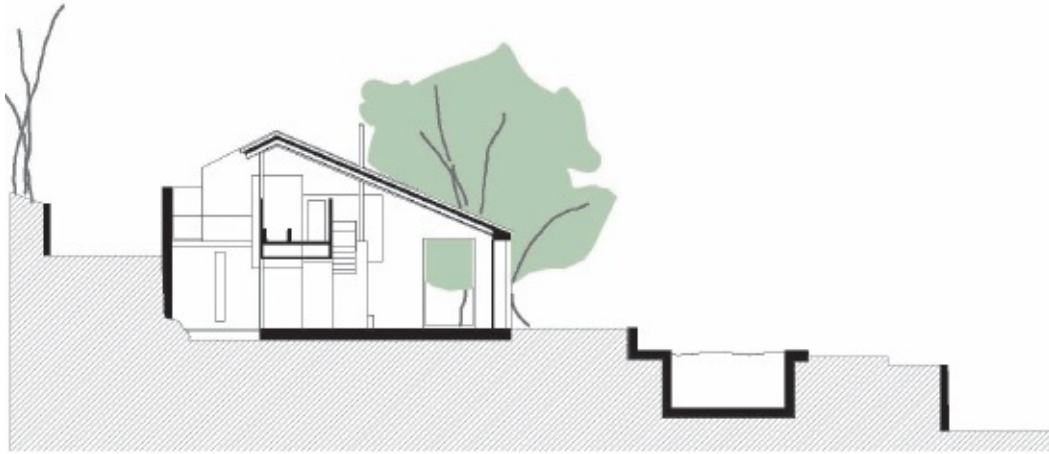
The ruins of an abandoned stable were the starting point of an extensive remodeling project that resulted in a self-sufficient family home. Far from any water supply and electrical grid, this stone building is located below two streams that flow all year round. They provide water for domestic use and hydroelectricity. The orientation of the house allows for sunlight to be the main source of heating during the cold months.







**064** Sloping sites can present the opportunity for innovative house designs with minimal excavation work, which would detract from the topography's character.



Cross-section



Longitudinal section

The crumbling stone walls and damaged timber structure were mostly replaced.  
Exposed concrete, steel beams, and limestone floors were built.



Patios and interior courtyards can be used as outdoor rooms. These spaces can be most effectively used when protected from wind and excessive sun exposure by tall walls and tree canopies.

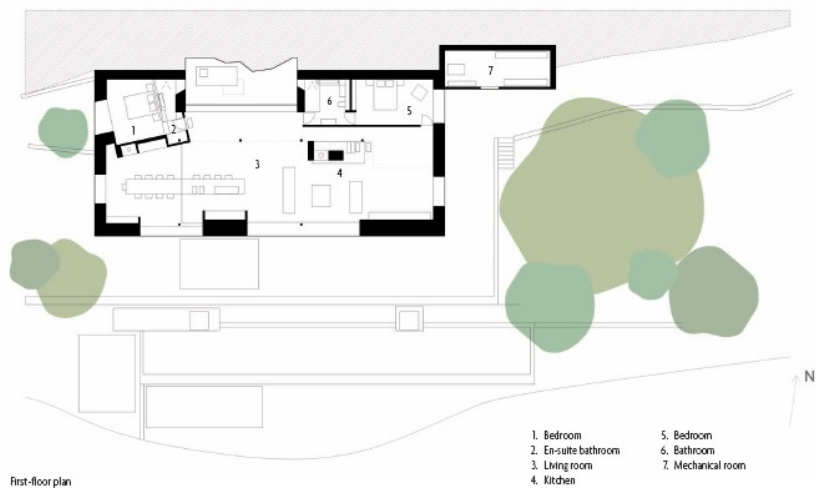
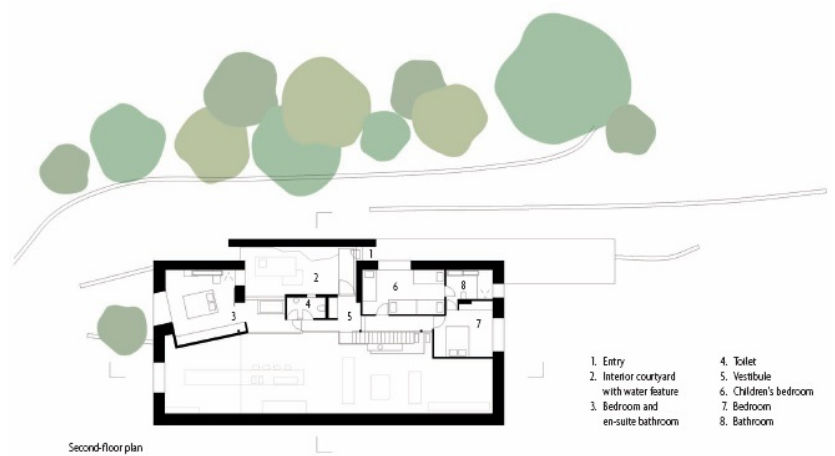




**065** Air circulation, evaporative cooling, and the earth's thermal mass are fundamental passive cooling methods for optimizing comfort.







**066** Consider orienting a home so that the side with most openings is exposed to breezes, and the opposite side, with fewer openings, draws these breezes through and out.







**067** Concrete floors and masonry walls provide thermal mass. Their performance is most efficient when exposed to winter sun and summer breezes.





**068** The use of natural, local materials such as stone can add to the sustainable nature of a home. Stone requires little processing and if locally sourced requires little transporting.





## **Green Orchard**

Architects: **Paul Archer Design**

Location: **Compton Greenfield, United Kingdom**

Photography: © **Will Pryce**

Green Orchard is a new 200 square meter carbon neutral house set within 2,675 square meter of landscaped gardens. The house replaces a dilapidated single-story dwelling with a contemporary low-rise four-bedroom home. Both the house and landscape were designed with a specific intent to reduce consumption and the requirement for energy. All living spaces are open-plan to give a greater sense of openness and to maximize views and sunlight.





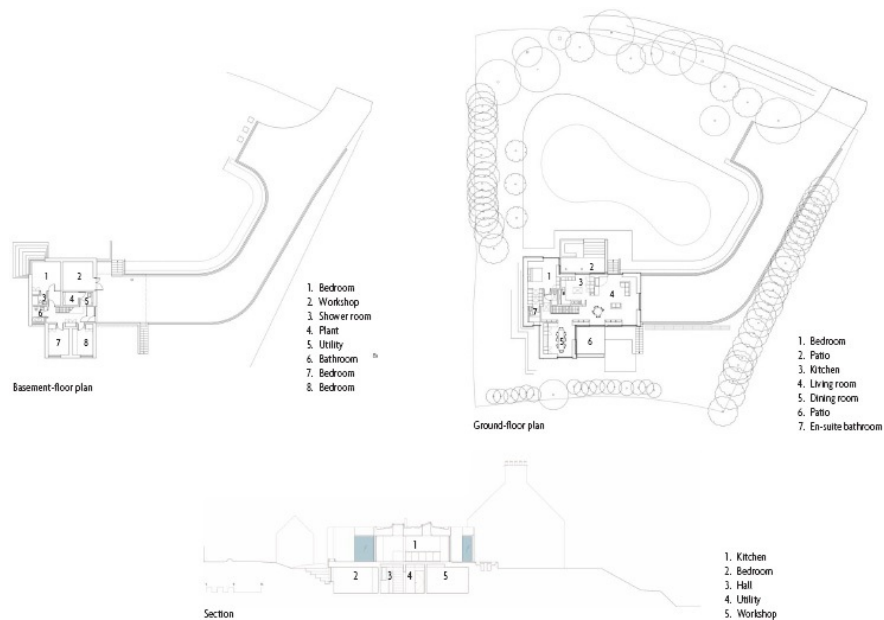


**069** Using building elements prefabricated in a workshop can minimize the production of construction waste.





**070** A green roof integrates architecture into the landscape. It also filters out pollutants and acts as an active insulator.



The skin of the building is made of bespoke highly insulated panels, which are electronically motorized to slide open. They allow the occupants to control and vary the thermal performance of the house.



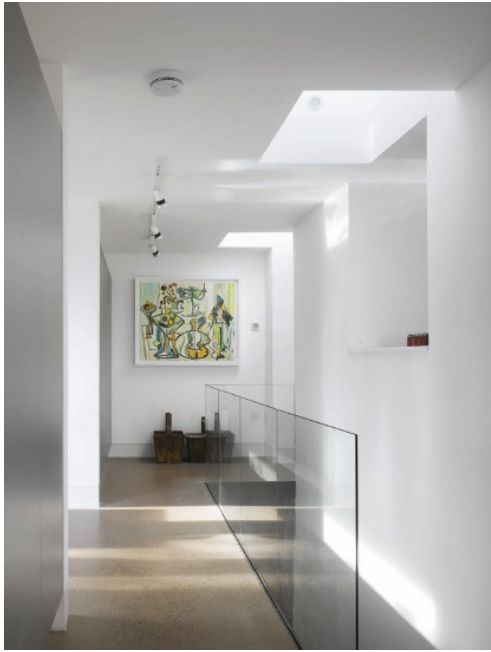


A wood-burning stove is the only heat source for the inhabitants. Thermal solar panels yield heating for 80 percent of the house's water. Photovoltaic panels provide electricity.





**071** The use of skylights can translate into significant energy savings. A home with a good spread of natural light will benefit from passive solar gain and a reduced requirement for artificial lighting.



## **Alan-Voo House**

Architects: **Neil M. Denari Architects**

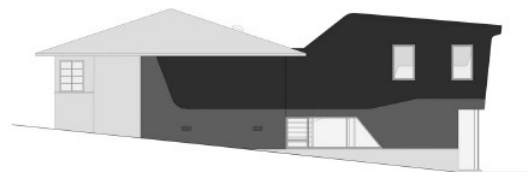
Location: **Los Angeles, CA, USA**

Photography: © **Benny Chan**

The clients for this house renovation asked that the area of their existing 1,000 sq. ft. house be doubled. It was determined that an extension could be attached to the existing structure. The addition has sculptural qualities and reflects the artistic personalities of the clients. It features a futuristic envelope with large expanses of glass and angular surfaces. The construction is proof that a high-tech look and sustainability can coexist.



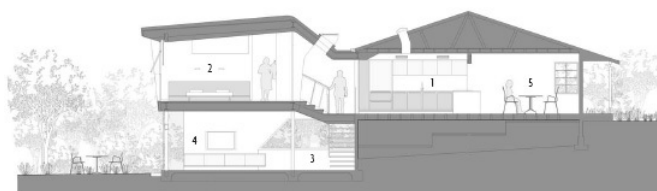




South elevation



North elevation

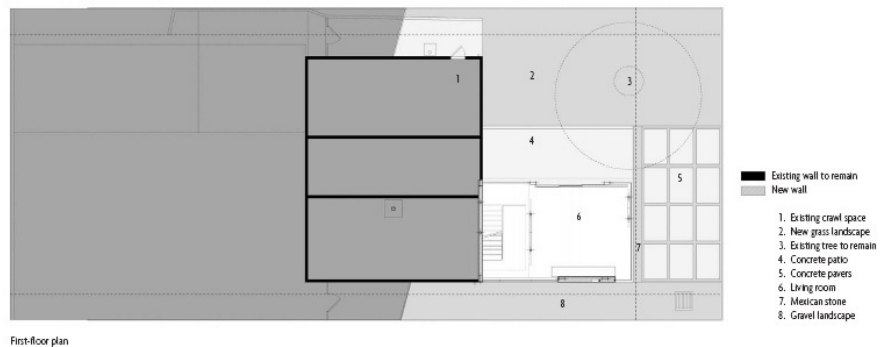


Section

- 1. Kitchen
- 2. Bedroom
- 3. Hall
- 4. Living room
- 5. Dining room

**072** The less partitions dividing a space, the more opportunities for light to reach

all corners of an interior.



**073** The building shape can assist cooling by providing self-shading through its deep overhangs and canopies.



The seamless integration of the extension with the existing house is enhanced by the long banks of cabinets and the appliances.





## Vista del Valle

Architects: **Zimmerman and Associates**

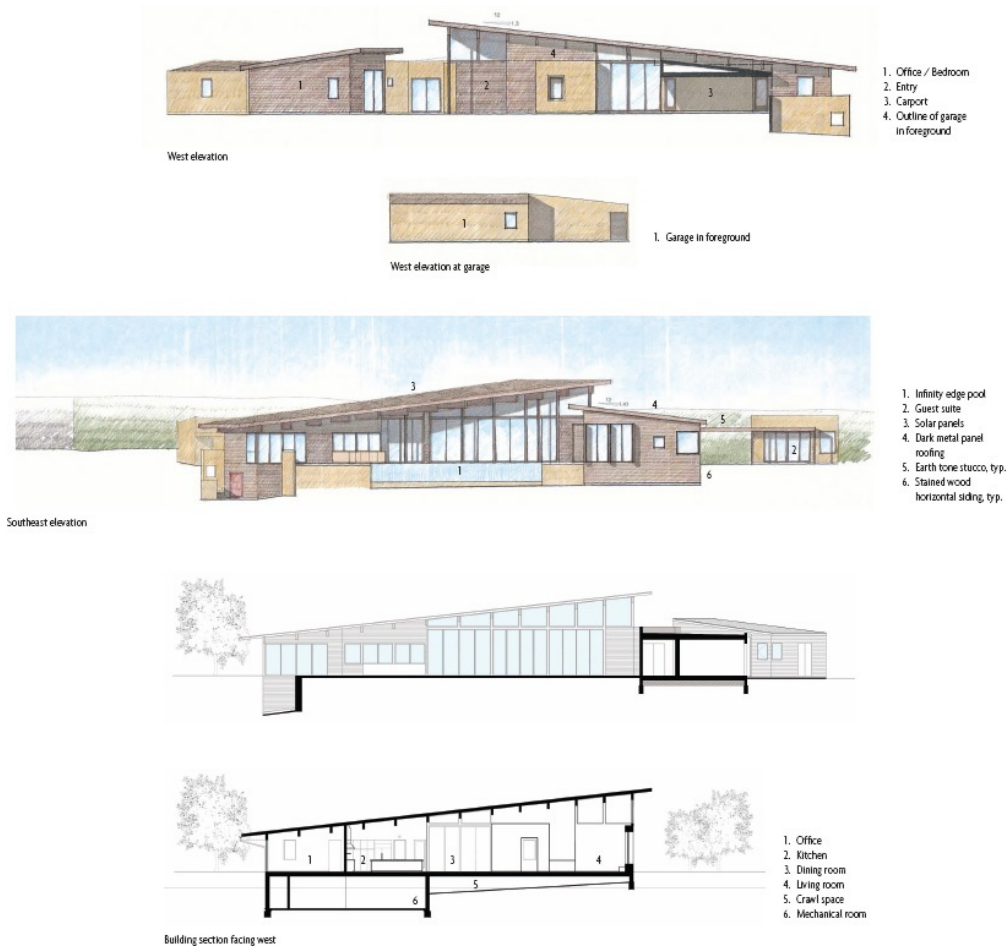
Location: **Sonoma, CA, USA**

Photography: © **Bruce Damonte**

The project's site-responsive design articulates modern forms, while utilizing warm, clean materials that enhance its inviting appeal. A particular design challenge was the preservation of views for neighbors. In response, the house was positioned low in profile on a steep site. The house remains modest in its form from the street, but still creates dramatically lit and inspiring interior spaces that extend out into the landscape.





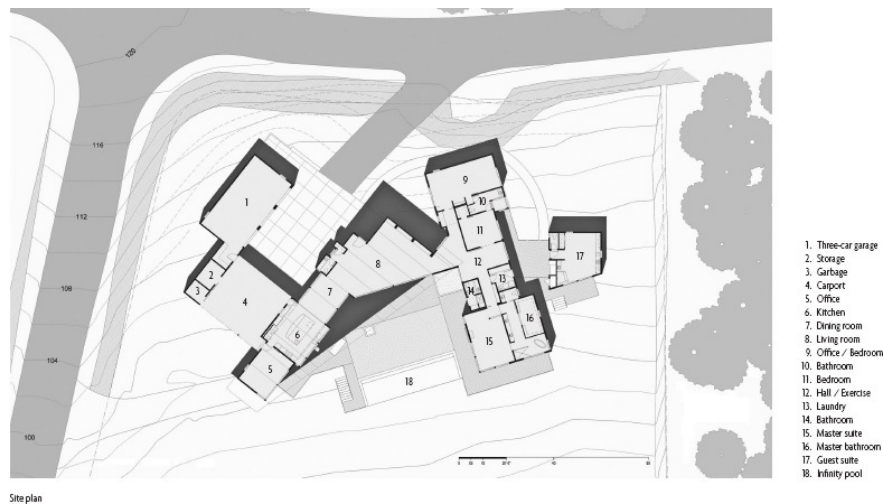


This 4,200 sq. ft. home complements the beauty of its surrounding landscape with exterior walls of light stucco and warm horizontal cedar siding.

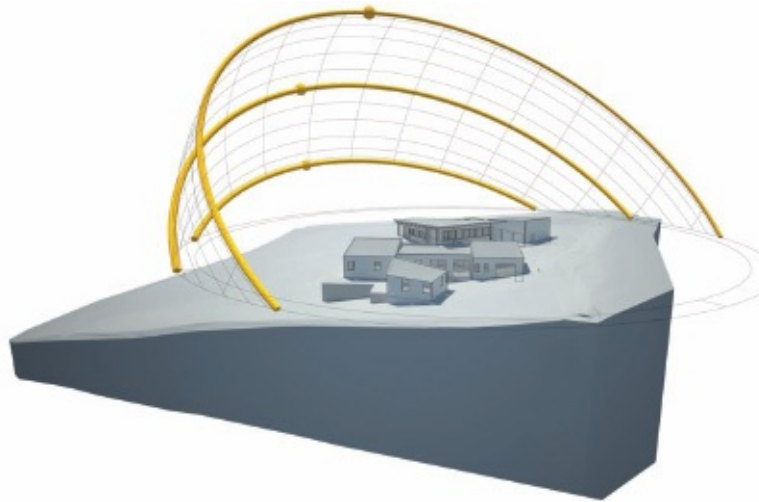




The multi-axis plan of this house makes optimum use of the topography and integrates the beauty of the landscape. A thorough study of the sun paths determined the orientation of the building.



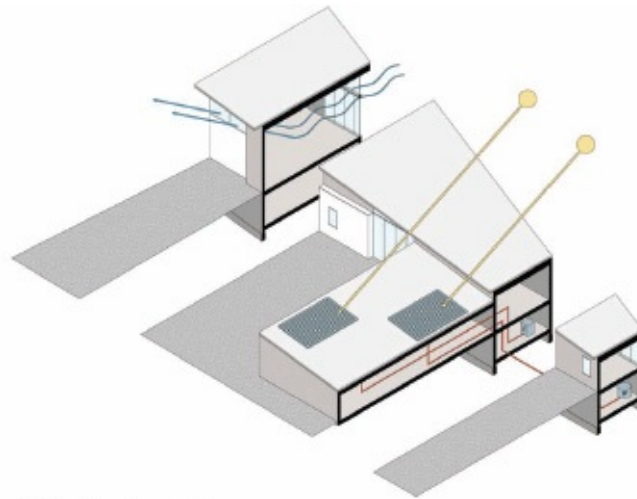
Site plan



Solar orientation diagram

The project includes a solar hot water heating system and radiant in-floor heating. There is no air-conditioning thanks to a planned solar orientation and passive ventilation.





Passive and photovoltaic solar energy diagram

A large roof overhang provides shade to the kitchen, living, and dining rooms, allowing the spaces to remain comfortable year-round.









## **Dutchess House #1**

Architects: **Grzywinski+Pons**

Location: **Millerton, NY, USA**

Photography: © **Floto + Warner**

The house was conceived of as a country home for occasional use, but it had to be equipped so that it could ultimately evolve into a primary residence. One of the main requests from the client was that the house be open to its beautiful surroundings, yet could be battened down and secured for extended periods. Special attention was paid to sight lines, exposures, seasonal variations in the quality and direction of light, and the flow and integration of interior and exterior spaces.





The house was built with ICFs (insulated concrete forms), strategically glazed with low-E assemblies and clad in high-albedo mill-finish aluminum. Deep eaves were designed based on solar studies.







The matte finish of the aluminum cladding highlights the color variations of the natural surroundings both throughout the day and throughout the seasons.

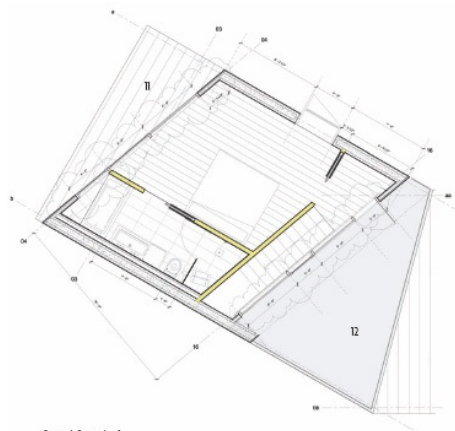




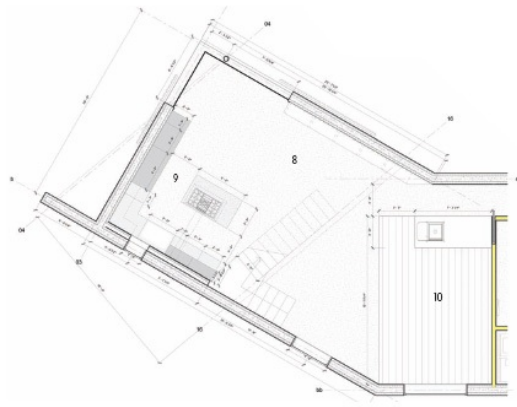


**074** A thorough study of the sun and wind paths will help determine the best design of screens and canopies with an emphasis placed on where their openings should sit.

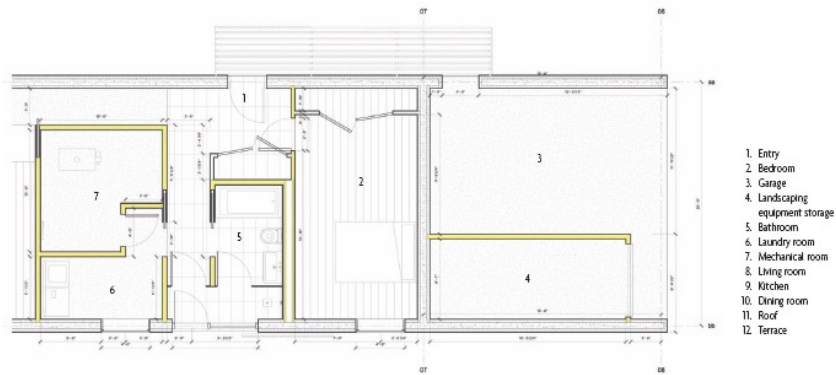




Second-floor plan 1



First-floor plan 1



First-floor plan 2

The home's low-flow fixtures, dual flush toilets, LED lighting, high-efficiency appliances, and sustainably grown lumber were designed to meet the highest sustainability standards.



## Daylight

Architects: **Takeshi Hosaka Architects**

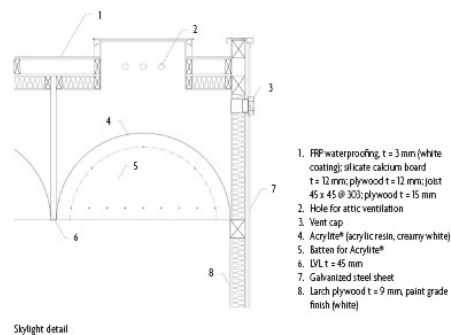
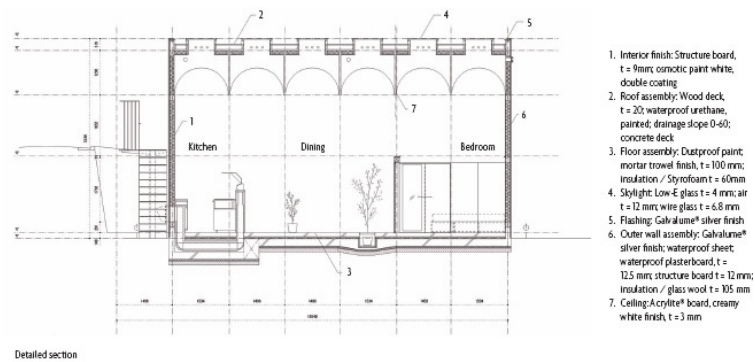
Location: **Yokohama, Japan**

Photography: © **Koji Fujii**

This single-story house is densely surrounded by residential and office towers. The site is nearly ten feet below street level, leaving the roof as the only light source. Hence, an orthogonal grid of skylights punctures the roof. For privacy purposes, a ceiling made of acrylic vaults under the skylight roof was designed. To enhance the expression of this vaulted ceiling, all interior walls are short of the ceiling.

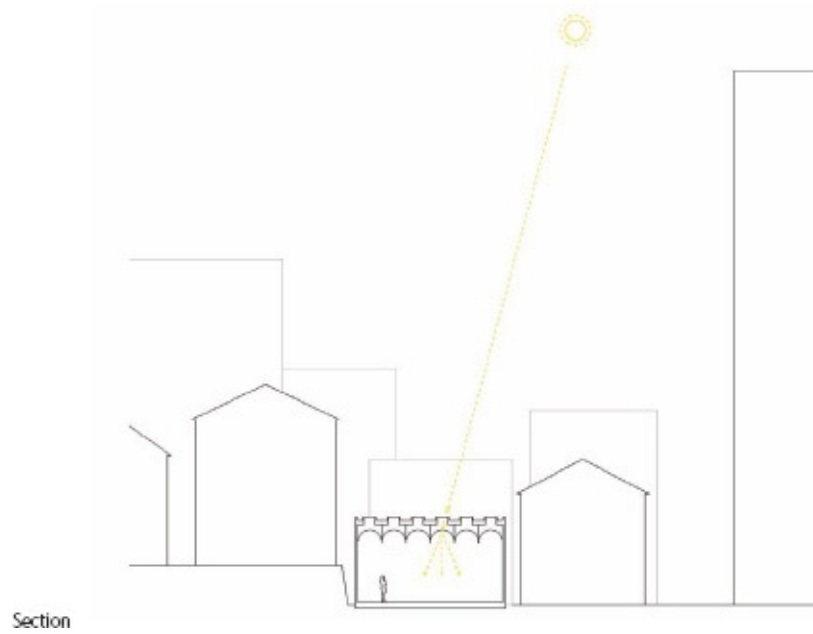


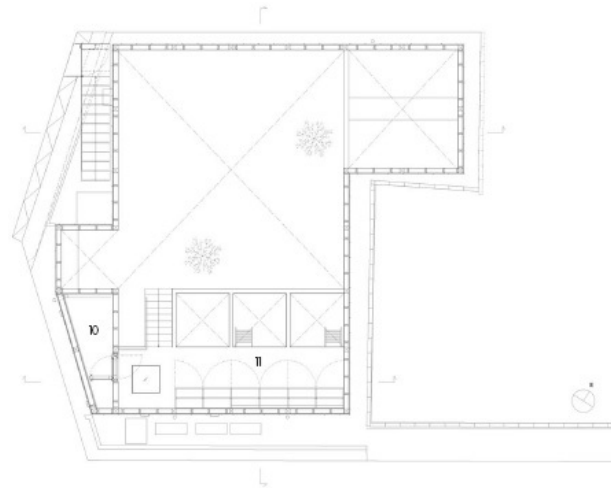




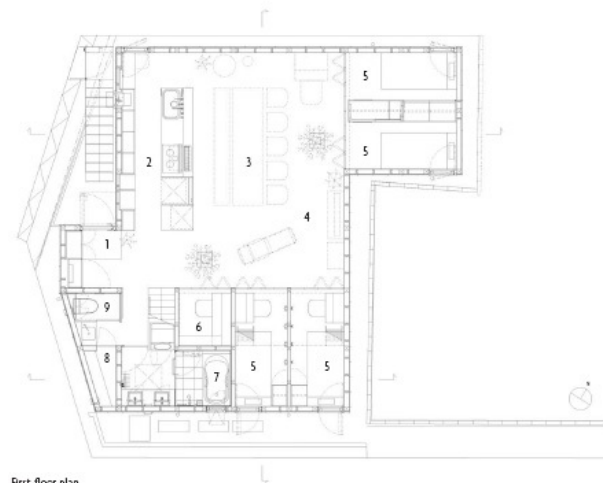
Each room has a window to allow for cross-ventilation. The air space between the roof and the acrylic ceiling exhausts heated air in the summer and serves as a

heat buffer in the winter.





Second-floor plan



First-floor plan

1. Entrance
2. Kitchen
3. Dining room
4. Living room
5. Bedroom
6. Study
7. Bathroom
8. Closet
9. Toilet
10. Balcony
11. Loft

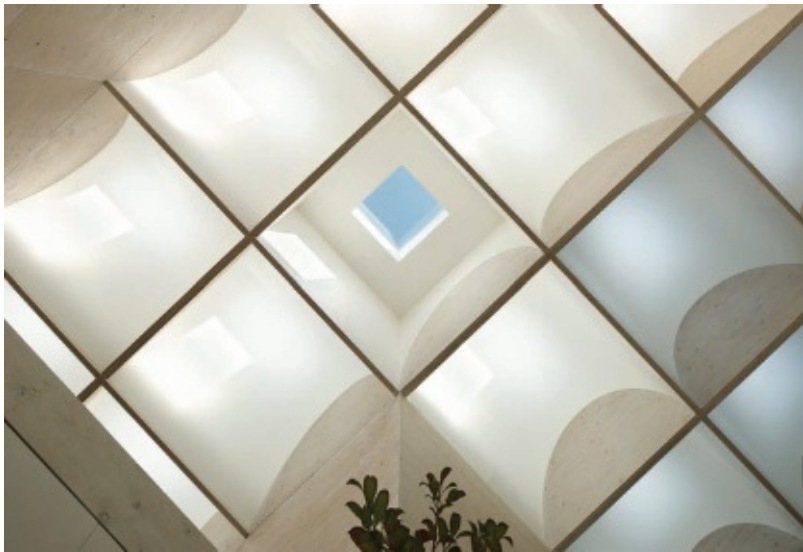
**075** Make the most of natural light coming from skylights with partitions that are short of the ceiling for even lighting.





**076** Translucent screens below skylights help distribute light evenly, minimizing glare and excessive heat gain.





## **Byoubugaura House**

Architects: **Takeshi Hosaka Architects**

Location: **Yokohama, Japan**

Photography: © **Koji Fujii**

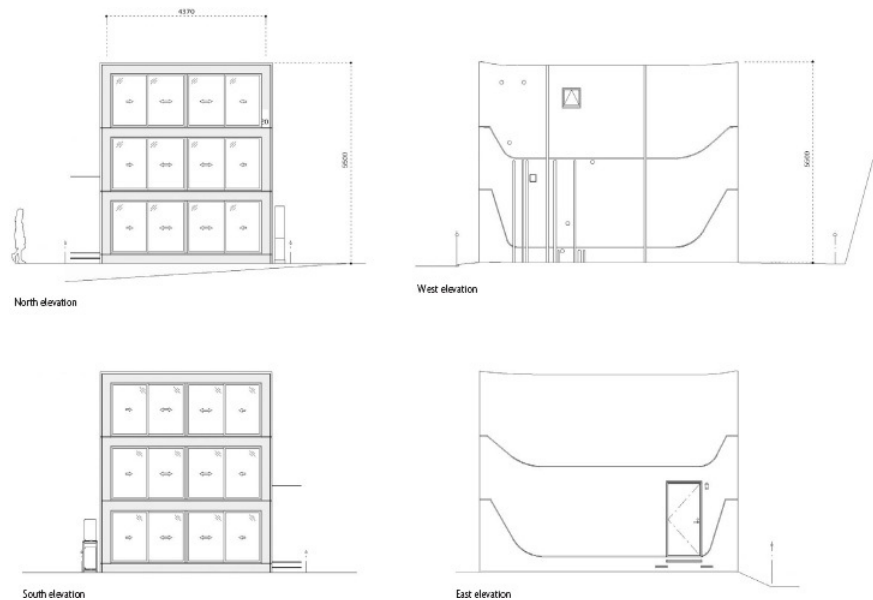
A house with a basement and two floors aboveground is sandwiched by existing houses to the north and south. On the east, the site faces a ten-foot retaining wall. In response, the slabs of all floors are bent upward near the façades to maintain the same window size on all floors. This design attempts to bring air and light to the partially underground basement.







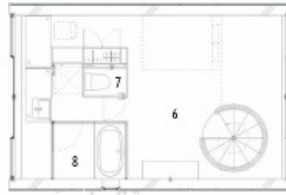
**077** It is important to understand the performance ratings of windows. Before choosing windows for your house, find out what type will work best and where they should be used to optimize energy efficiency.



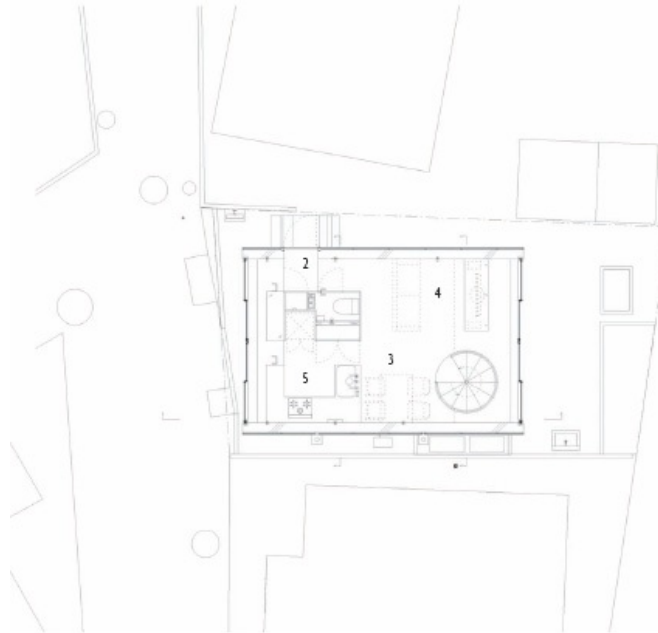
**078** Passive solar design decisions are based on building location and climate.

These aspects need to be taken into consideration when deciding the orientation and size of windows.

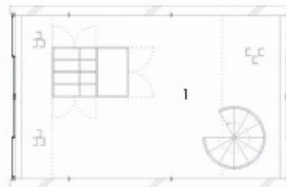




Second-floor plan



First-floor plan

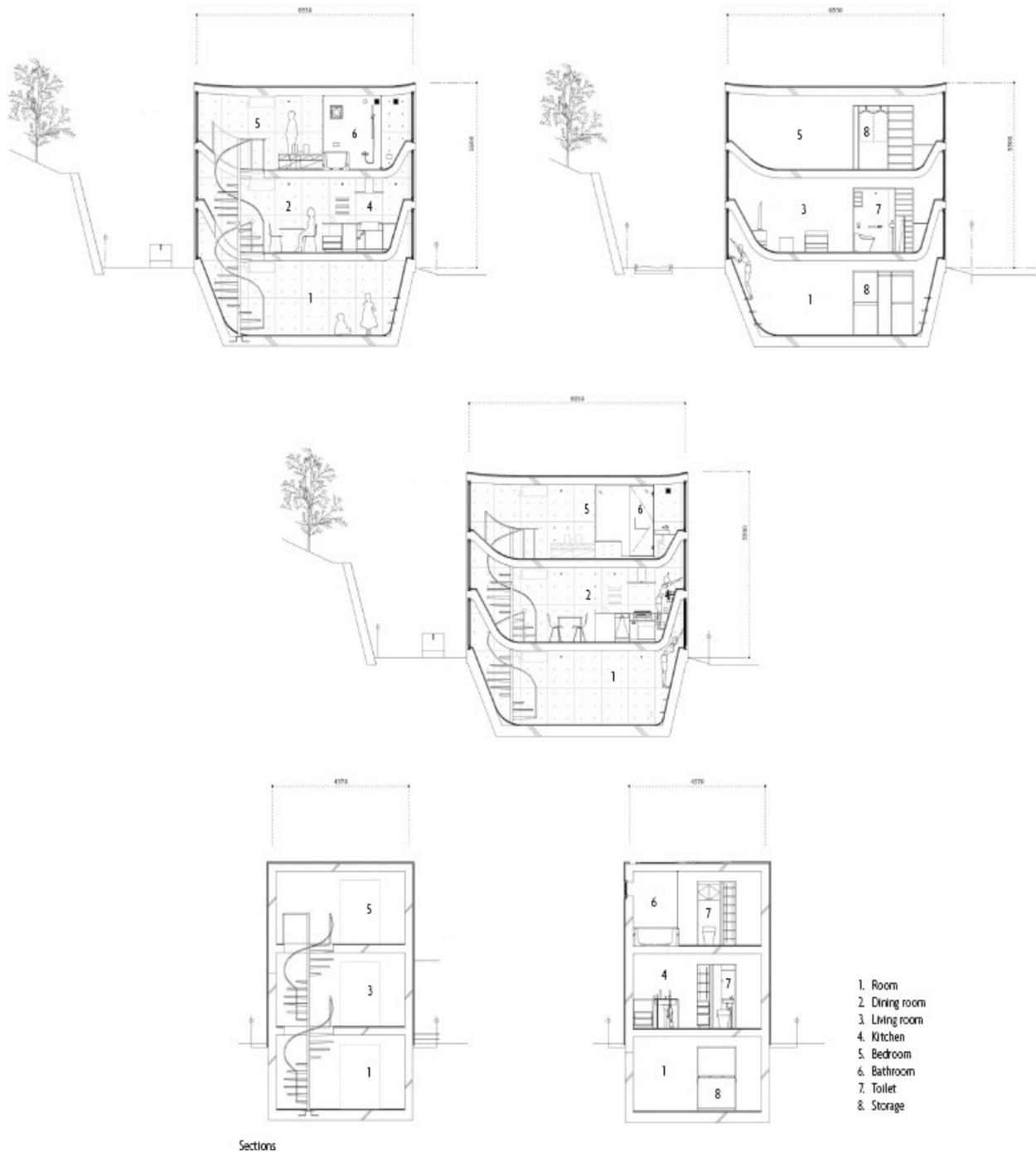


Basement-floor plan

1. Basement
2. Entrance
3. Dining area
4. Living area
5. Kitchen
6. Bedroom
7. Toilet
8. Bathroom







The floors slope up to windowsill height, which at the basement is aligned with the underside of the floor slab above. This design decision was meant to block the view from the street and ensure privacy.



In section, the building maintains the same floor-to-ceiling height, including the basement, which receives light from high above.







## Muallem Residence

Architects: **Malka Architects**

Location: **Israel Valley, Israel**

Photography: © **Oded Smadar, Eyal Malka**

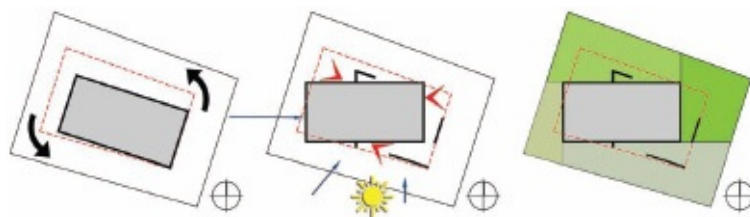
In planning this home, emphasis was placed on creating an optimal structure that complied with sustainable design principles. Three major advantages emerge from the positioning of the house on an orthogonal grid, not parallel to the rectangular plot: 1. This positioning achieves an optimal orientation towards the sun. 2. The skewed positioning of the house relative to the plot results in the optimization of the exterior spaces. 3. The positioning enables better views.





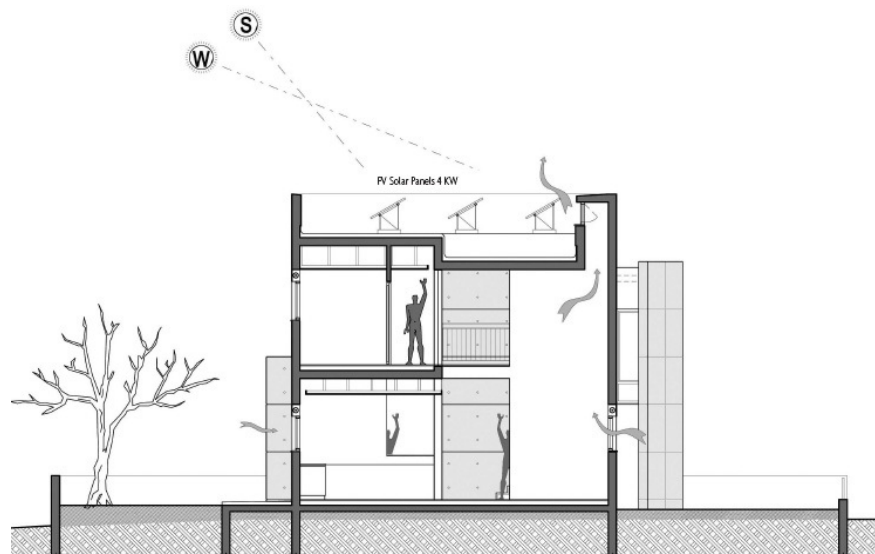
The concrete entry gate is an off-axis relative to the house and establishes a visual relationship with other buildings along the same street.





House orientation scheme

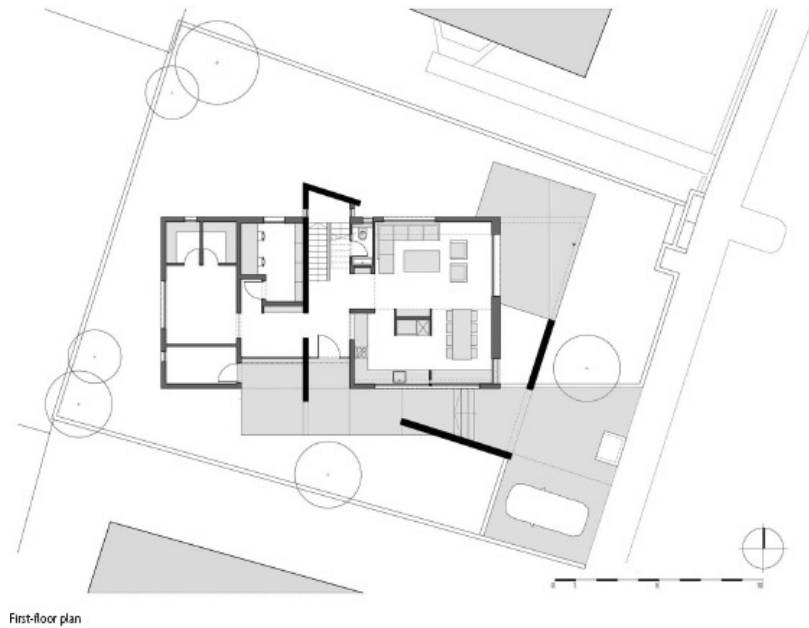
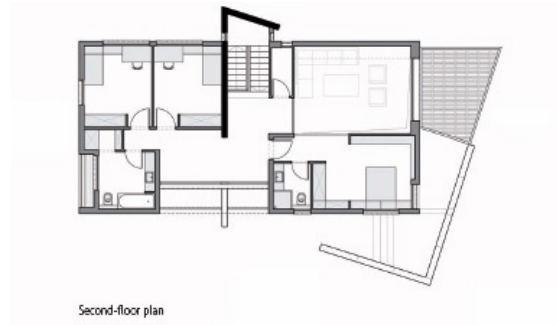
**079** Solar energy is a clean, renewable resource that can be used to heat rooms and water for bathing and cooking.



Section







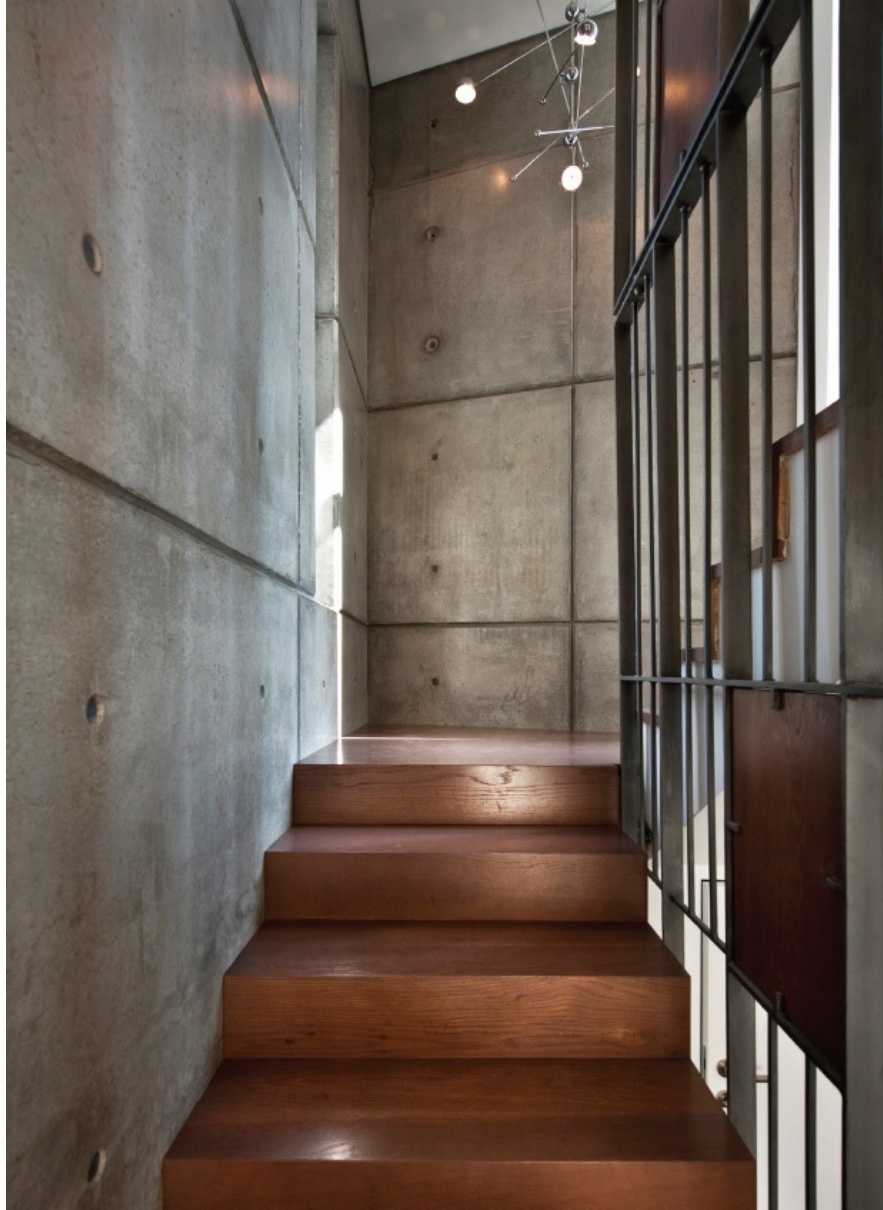
A “gray flow” system utilizes gray water from the washing machine and bathrooms to irrigate the garden. This system filters the water and distributes it around the garden via a drip-line system.



The house benefits from air-blocks on all four sides and the articulation of spaces allows a natural flow of air.









## **Lotheringen House**

Architects: **EFTYCHIS**

Location: **Irene, South Africa**

Photography: © **Emilio Eftychis**

In this house there is a constant interplay between the immediate environment and the structural expression and tectonics of the design. A courtyard joins the two wings of the house and accommodates the pool, which can be covered by a retractable wooden top, extending over the entertainment area. The deep porch along the north side is typical of South African outdoor living. It provides shade in summer and allows direct sunlight in winter.





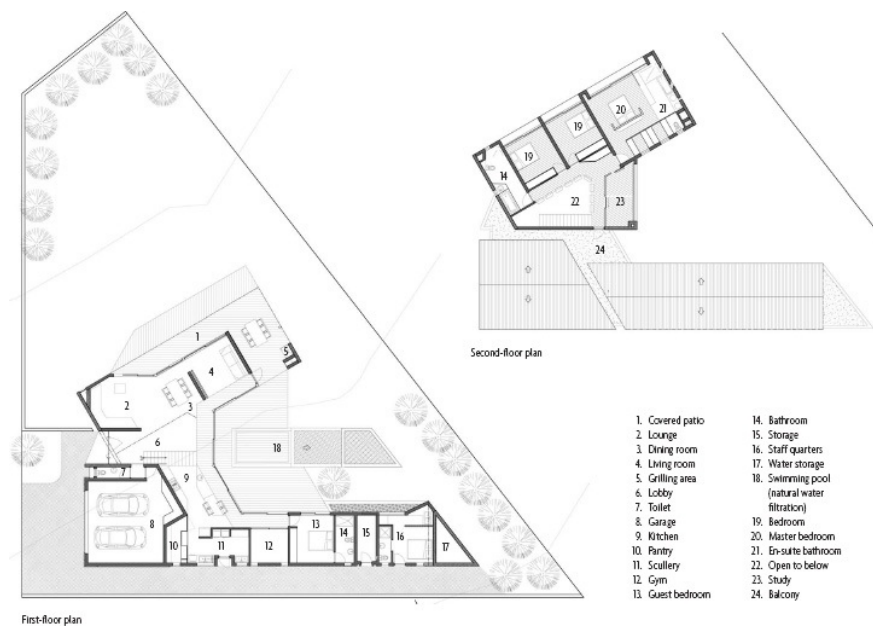


**080** Climate and ecological aspects that are intrinsic to a specific site should be taken into account to ensure climate-appropriate comfort.





The open plan of the living area on the ground floor allows for maximum uninterrupted space that extends into the courtyard, emphasizing the interplay of exterior and interior spaces.



Exposed concrete and corrugated metal cladding evoke the essentials of the understated design: simplicity and purity.



The bio-filters and sand contained in terraced enclosures filter the pool water, which is oxygenated by water lilies.









**081** Appropriate use of exposed internal thermal mass in combination with passive design elements will ensure that temperature remains comfortable thanks to thermal lag.



**082** For new constructions, consider orienting the kitchen toward the east or southwest, where morning sun will fill it with light.



## **House by the Pond**

Architects: **Stelle Lomont Rouhani Architects**

Location: **Water Mill, NY, USA**

Photography: © **Matthew Carbone, Frank Oudeman**

The overall design of this new house was a direct response to a series of environmental regulations, site constraints, solar orientation, and programmatic requirements. It consists of a two-story volume containing bedrooms and baths, and an open, lofty, single-story pavilion. The pavilion was conceived as a breezeway connecting the light and activity of the yard and pool area to the south with the views and wildlife of the pond to the north.



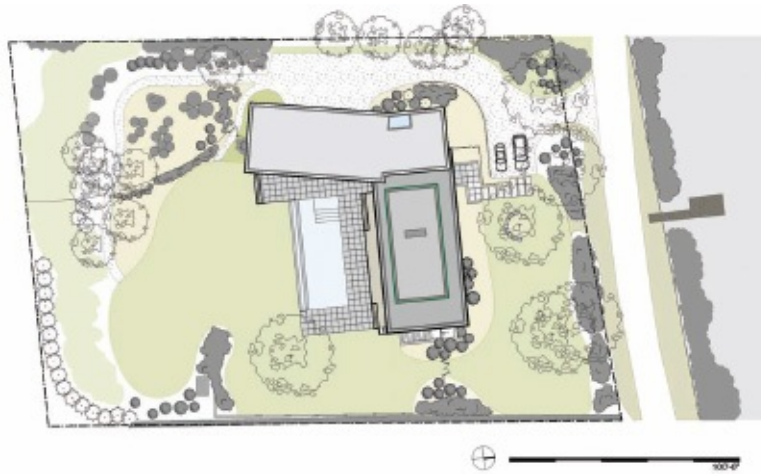




Native, low-maintenance, drought-tolerant landscaping was utilized to transform much of the site from its former suburban, overplanted state to one that calmly coexists with the new structure.







Site plan



North elevation



East elevation



South elevation



West elevation

25'-0"

**083** A sustainable home must make use of materials that are from sustainable sources, low maintenance, cost effective, and durable.



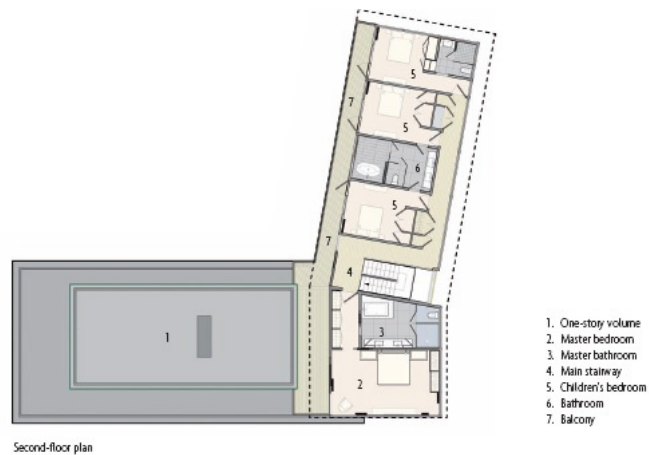
**084** A house can reduce its heating and cooling costs by using south-facing windows that absorb the sun's energy in order to warm the house in the winter, and large overhangs to keep it cool in the summer.



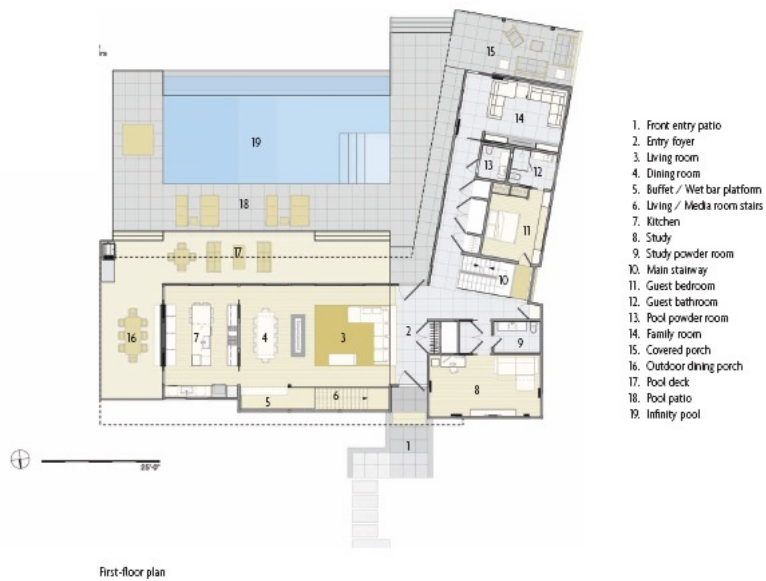


**085** Clerestory windows below deep overhangs bring in natural light, minimizing the need for summer air conditioning and allowing solar heat gain in the winter.





Second-floor plan



First-floor plan

An efficient heating and cooling system, highly energy efficient glazing, and an

advanced building insulation system resulted in a structure that exceeded the requirements of the energy star rating system.









## **Lynch Street House**

Architects: **Dorrington Architects & Associates**

Location: **Auckland, New Zealand**

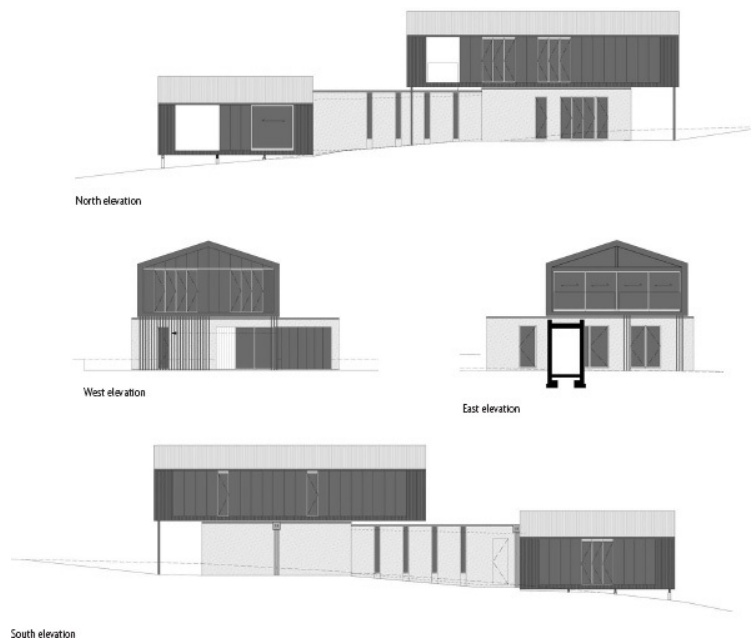
Photography: © **Emma-Jane Hetherington**

This house remodel harkens back to “old school” kiwi beachside cabins while being a thoroughly modern home. The original two-story 1970s bungalow on the site had little to offer aside from extensive views. The new house retains this quality and provides a modern family home fitting the client’s brief. Protection of the environment and the use of eco-friendly materials and systems are integral to the design.





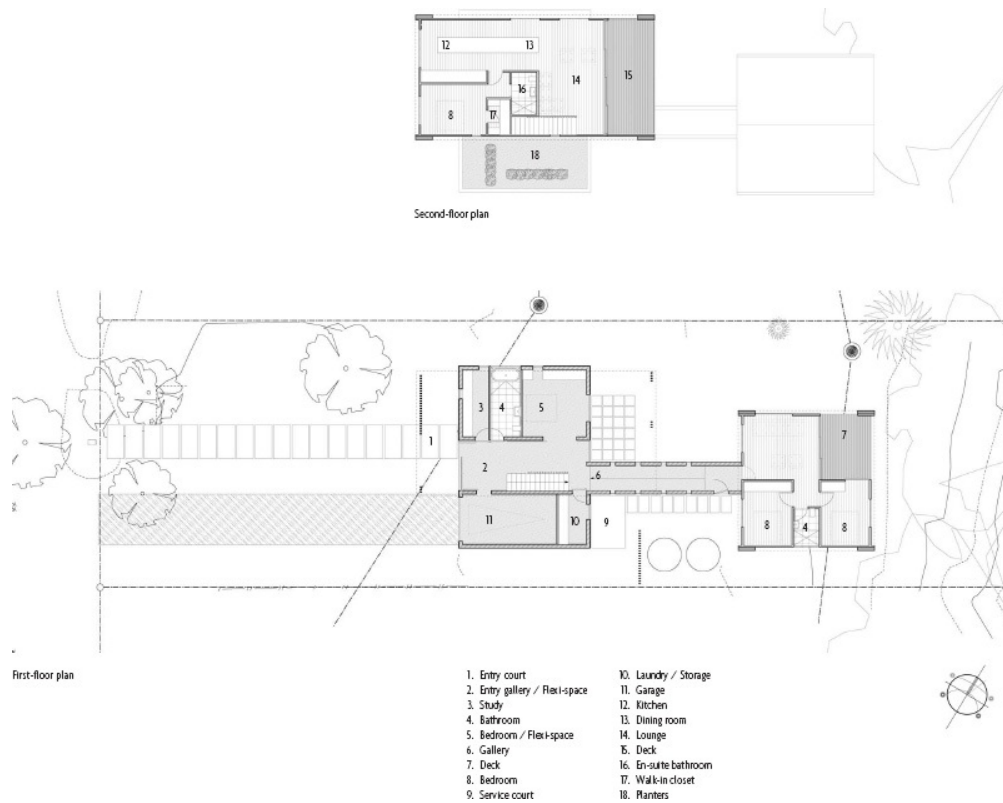
Materials were carefully chosen for energy efficiency, and the architecture itself complements this ethos.











The house is composed of a precast concrete ground floor, a gabled “boatshed” second floor, and a separate single-floor timber “boatshed” at the rear of the plot.



The house uses water collected off the gabled roofs. The roof also supports

panels for solar hot water and photovoltaic power generation, with excess electricity fed back into the grid.



The separate “boatshed” provides a distinct, private space. With its own separate entrance, it can be entirely closed off from the main house.





**086** In passive solar construction, walls, floors, and roofs take advantage of passive solar gain, collecting, storing, and distributing energy with minimal or no use of mechanical equipment.







## Mint House

Architects: **James & Mau**

Location: **Reus, Spain**

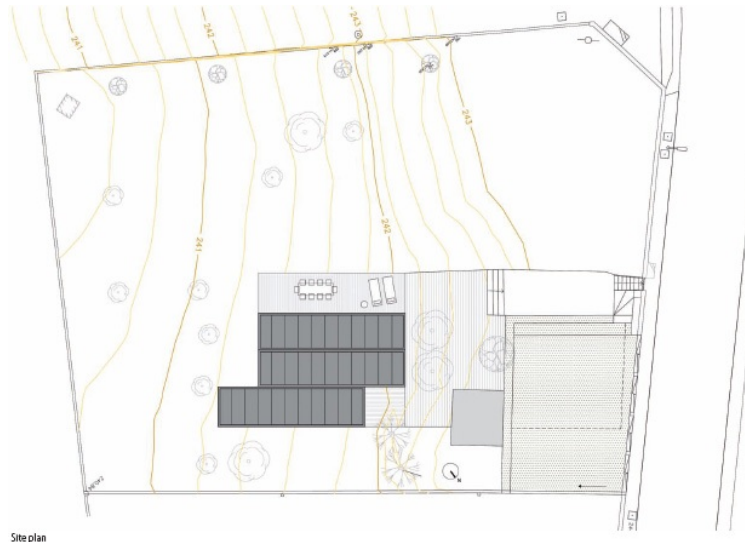
Photography: © **Luis Salazar**

Located in the countryside, the 100 square meters (1,076 sq. ft.) house is conceived as a weekend house, easy to use, efficient, and taking full advantage of its natural surroundings. The fluid transition between exterior and interior areas is one of the main characteristics of the project. The house is shaped as a functional cube or, in the words of the architects, a “living box” that can be opened, closed, switched on, heated, and cooled down easily and rapidly.





The project relies on a bioclimatic architecture, adapting the form and positioning of the house to its energetic needs: natural ventilation, passive solar design, intelligent façade system, and natural shade.



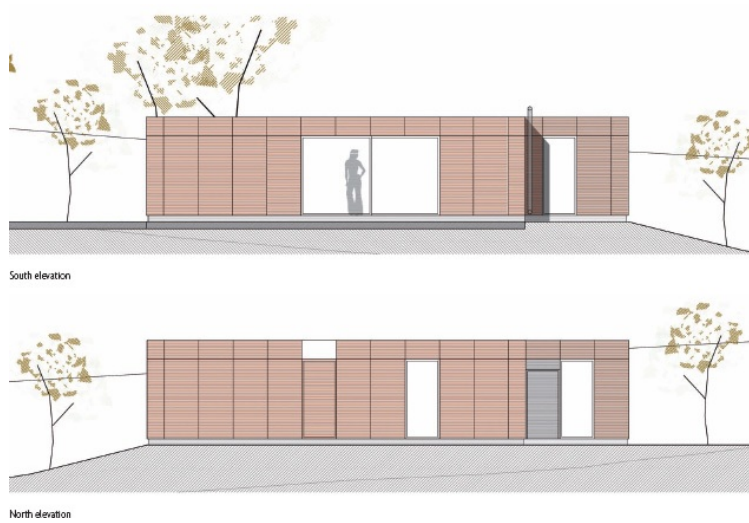
**087** Modular construction is cost effective because most of the construction takes place in a workshop. This minimizes on-site waste production and reduces mounting and dismounting time.





**088** A bioclimatic design, the use of eco-friendly materials, and the utilization of renewable energies contribute to a highly efficient sustainable house.



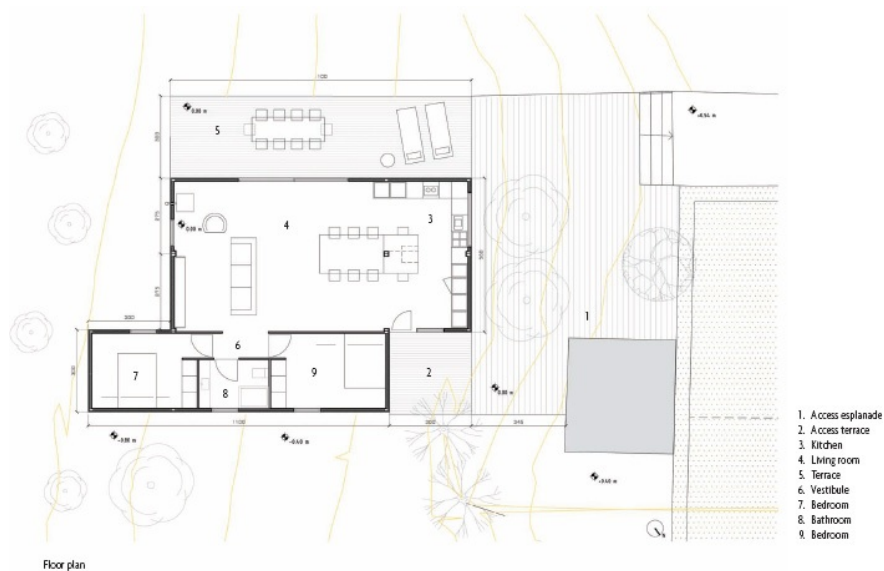


**089** An east orientation will benefit from the morning sun, but will leave the west wall more exposed to overheating. This factor should be taken into account when placing windows.





**090** Generally, to take full advantage of sun exposure, buildings should have their long sides oriented along an east-west axis. This means that most windows should face south.



**091** In addition to complementing a building's structure and defining its aesthetic appearance, exterior wall finishes make a major contribution to sustainability.



The shutters play an important role both for the aesthetic value of the house and its energy efficiency. The shutters, which are integrated in the façade, use perforated panels of Corten® steel.







## **El Tiemblo House “Raulinski”**

Architects: **James & Mau**

Location: **El Tiemblo, Spain**

Photography: © **Pablo Sarabia**

The project is based on a bioclimatic and modular design representing the key values of the Infiniski brand. Its prefabrication process allowed for a reduction in costs, time, and environmental impact; and due to its modularity, the house can not only be customized, but also be easily enlarged to satisfy the needs of its occupants. El Tiemblo House is composed of four recycled steel shipping containers forming an L-shape to take full advantage of the topographic setting, light, and views.





**092** While steel may not be the most environmentally friendly material, it does have some sustainable advantages: resource efficiency, recyclability, low waste production, and off-site manufacturing.



**093** Because steel is a fast, safe construction material, its use reduces work time, thereby lowering costs for the homeowners.





Complemented with a biomass heating system, the house achieves high energy efficiency during winter. In summer, climbing plants create a natural solar protection and a ventilated thermal envelope.



South elevation



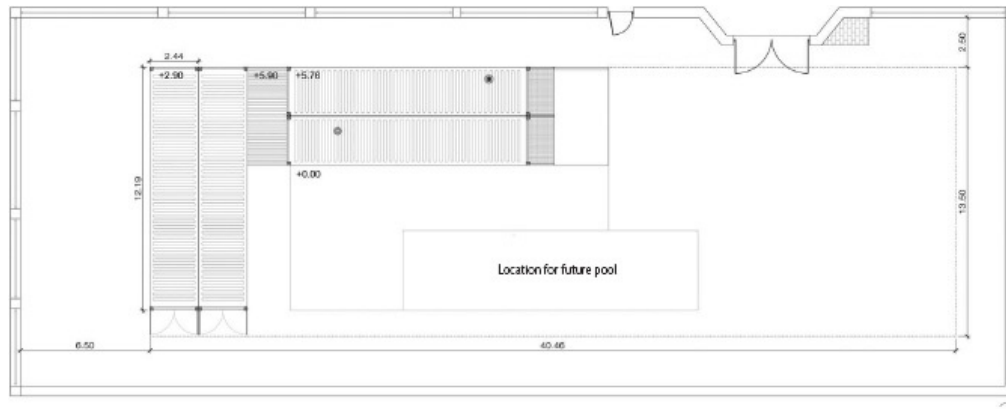
North elevation



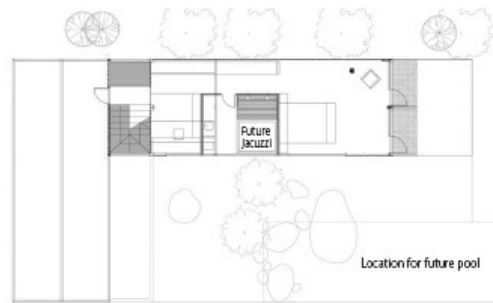


**094** Steel constructions are usually light, airy, and adaptable, and just as easy to take down as to build. This quality permits easy modifications of them.

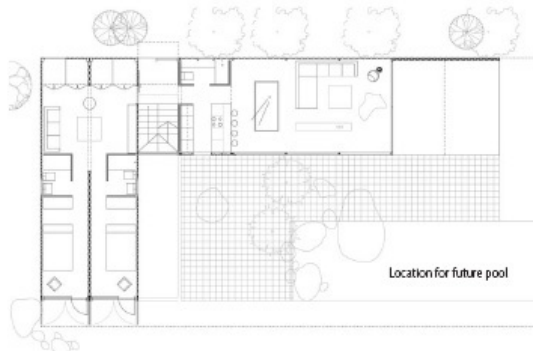




Roof plan



Second-floor plan



First-floor plan

The shape and size of the containers are no obstacle to creating comfort. Arranged on one floor or stacked up, the steel containers can be arranged in any desired configuration.





**095** The level of insulation in walls, floors, and ceilings can affect the amount of heat transfer in and out of the house.





## **Pinus House**

Architect: **André Eisenlohr**

Location: **Campos do Jordão, Brazil**

Photography: © **André Eisenlohr**

This house is located at 1,800 meters (5,905 feet) above sea level and is surrounded by forests of native pines. It does not alter the steep topography of the landscape, but actually enhances it. The climatic characteristics of the mountainous region where the house is located guided the design strategies to optimize energy use in a passive way and to minimize the environmental impact of the construction.







Eucalyptus, pine, garapa, and muiracatiara timber were harvested in areas of reforestation.



The body of the house was built off the ground by means of eucalyptus pillars,



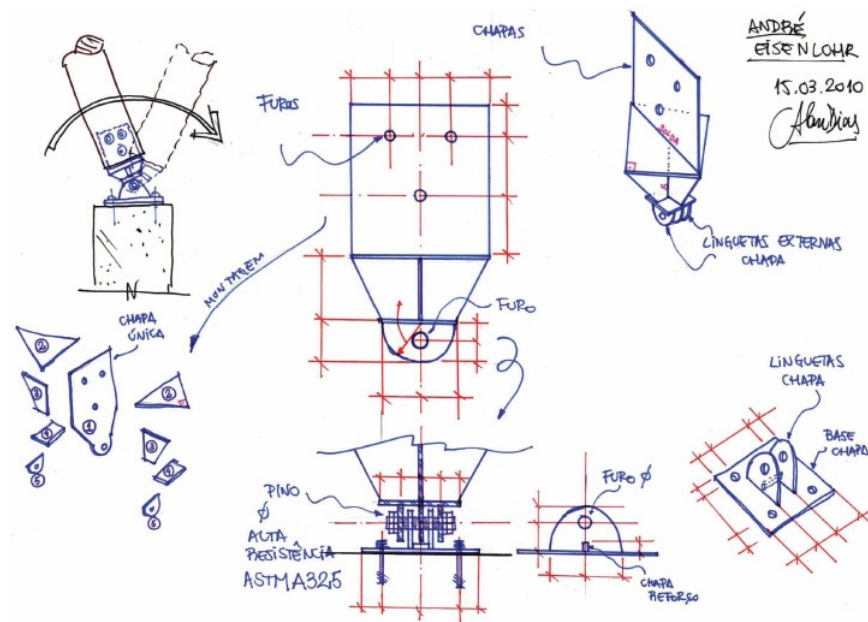
which prevent moisture from the soil affecting the floor.



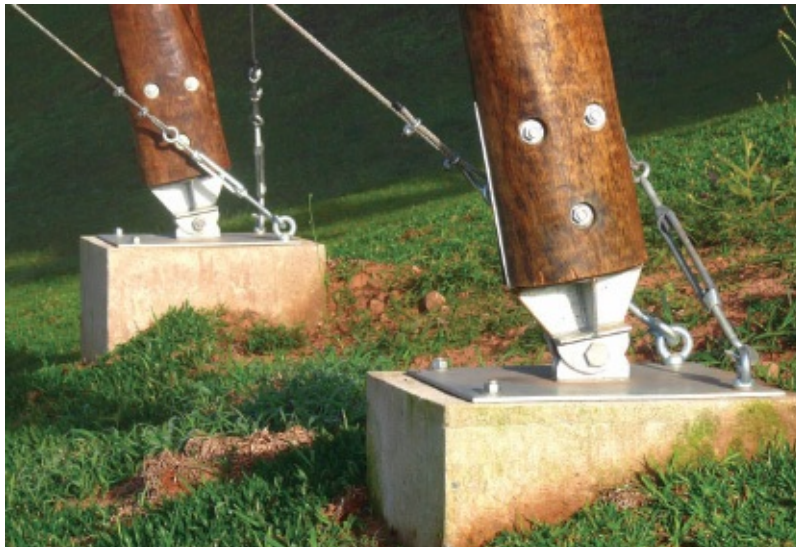
**096** The stilt construction method has a minimal impact on the landscape because of the small area of construction in contact with the ground. Also, because the house is elevated, surface runoff is not affected.



**097** Concrete footings can prevent ground moisture from rising through wood structural components by capillarity.

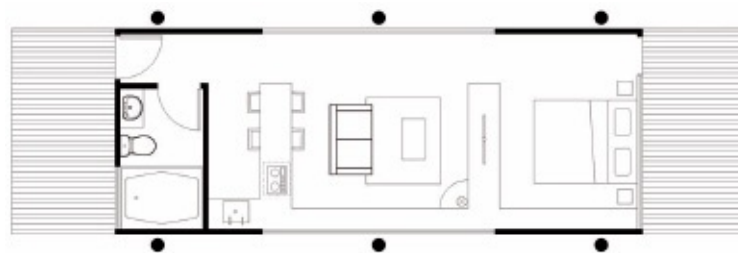


Footing and post socket details



The thermal insulation of the house is made of expanded polystyrene that was collected from various construction sites and reused.





Floor plan

**098** The wood residue generated during construction can be reused to produce OSB (oriented strand board) panels. These can be used to build interior partitions and furniture.





## **Eucalyptus House**

Architect: **André Eisenlohr**

Location: **Campos do Jordão, Brazil**

Photography: © **André Eisenlohr**

Located on a steep sloping terrain in a forest reserve, this 50 square meter (538 sq. ft.) house has large south-facing windows and a balcony. The design incorporates materials and construction techniques that minimize environmental impact. The use of energy-efficiency strategies such as passive solar energy and high thermal insulation give the house a unique appeal.



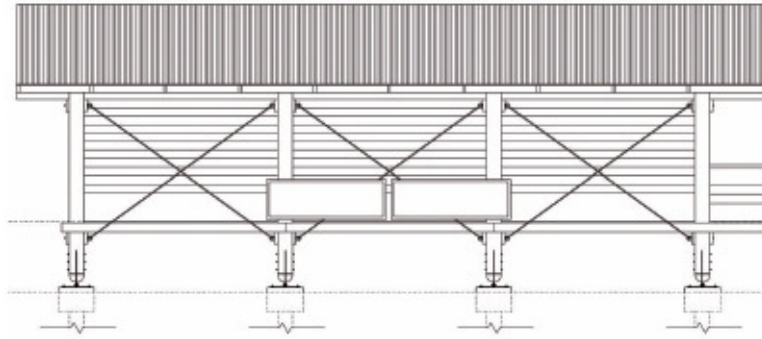




The wood structure of the house is reinforced with steel cables bracing the construction against lateral loading and overturning.

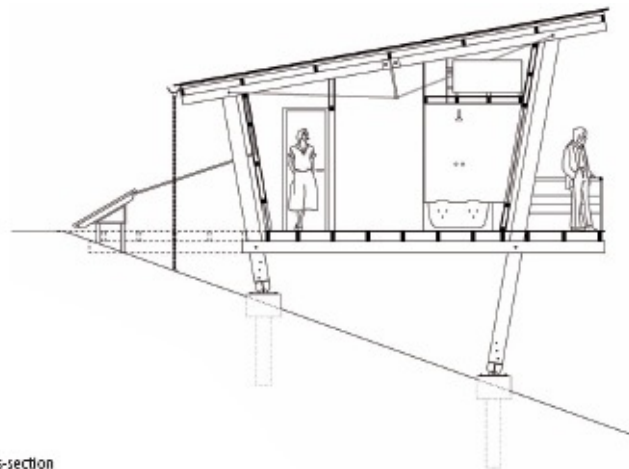






North elevation

**099** South-facing windows should be as large as possible to maximize solar gain.

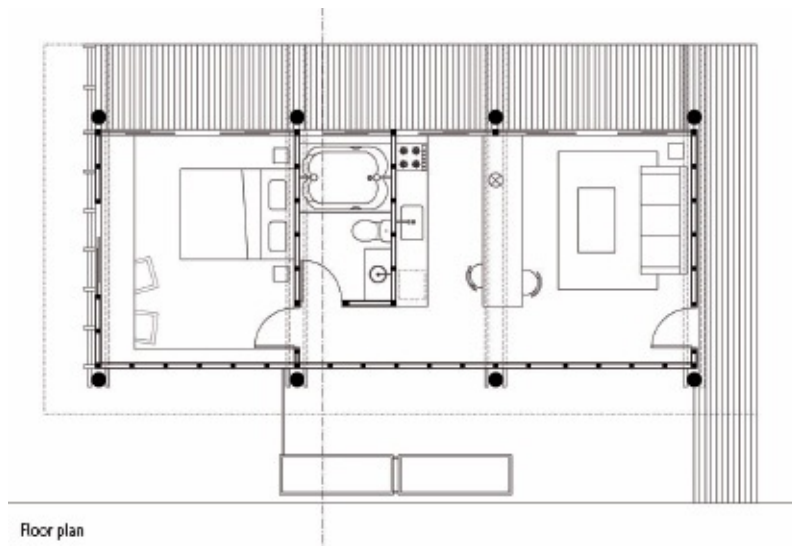


Cross-section

Most of the leftover material was reused for the production of the kitchen cabinets and countertops, as well as for furniture.



**100** Small houses are inherently energy efficient as they use fewer resources, both in their construction and maintenance than larger houses do. This translates into a lower environmental impact.



## **Douro Valley Sustainable House**

Architects: **Utopia Arquitectura e Engenharia**

Location: **Sabrosa, Portugal**

Photography: © **Utopia Arquitectura e Engenharia**

For the architects of this home it was important not to destroy the magnificent landscape of the Douro Valley, classified as a world heritage site by UNESCO and land of the extraordinary vines that produce the well-known Porto wine. Hence, the house, with a green roof, is completely integrated into the existing cultivated landscape. All the rooms have their views directed to the Douro River except the kitchen and the hall that lead to two sunken courtyards.

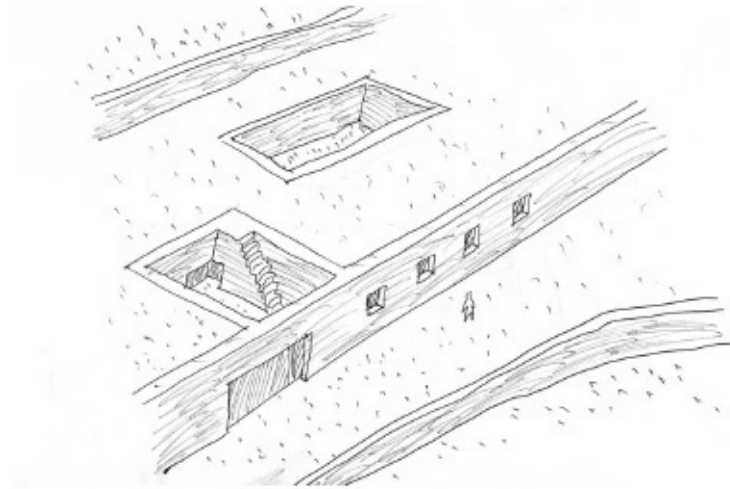






**101** Green roofs are an efficient and environmentally friendly design solution to facilitate the integration of a building into the landscape.





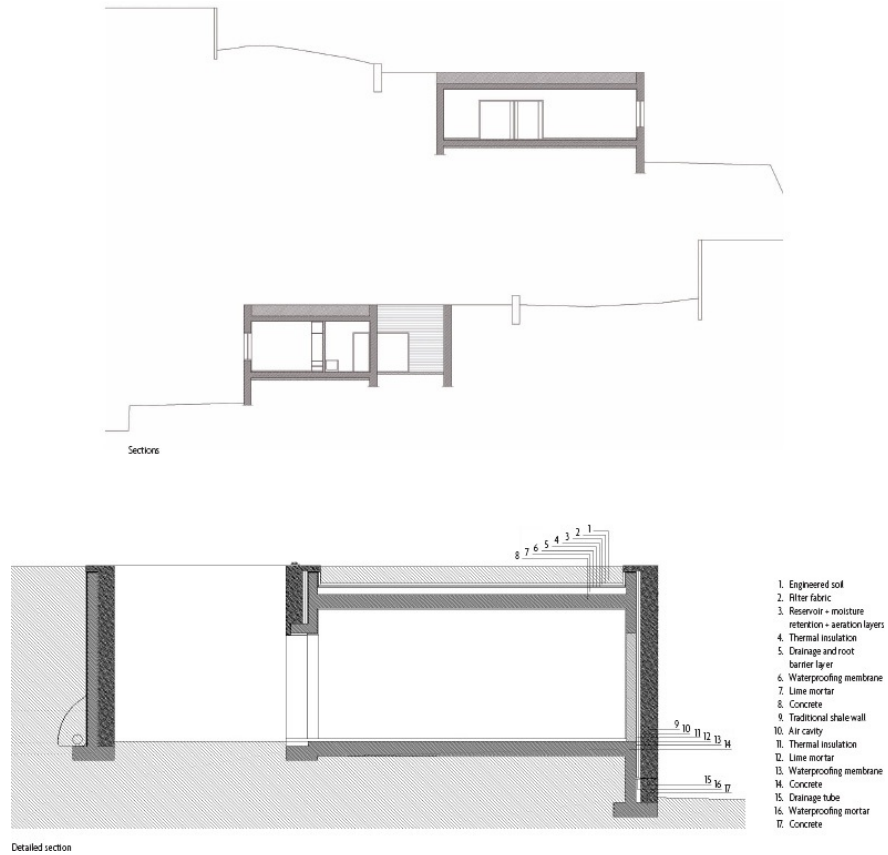
Design sketch

Shale extracted from the earth was used to build the thick exterior walls. This meant a reduction of carbon dioxide emissions on transportations. The green roofs are planted with indigenous grasses.









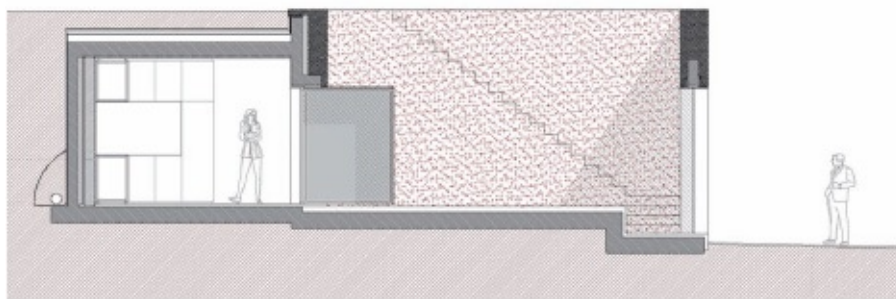
**102** The natural sloping profile of a site can be used to create sunken courtyards offering a shaded microclimate that will result in a cooling effect.



**103** Maximizing the surface of a building in contact with the ground helps minimize temperature swing, since the ground provides very low thermal amplitude.



Floor plan



Section through courtyard

**104** The reflectivity of interior finishes is an important factor to take into account early in the design process of a home in order to optimize energy use.





## **Oblio House**

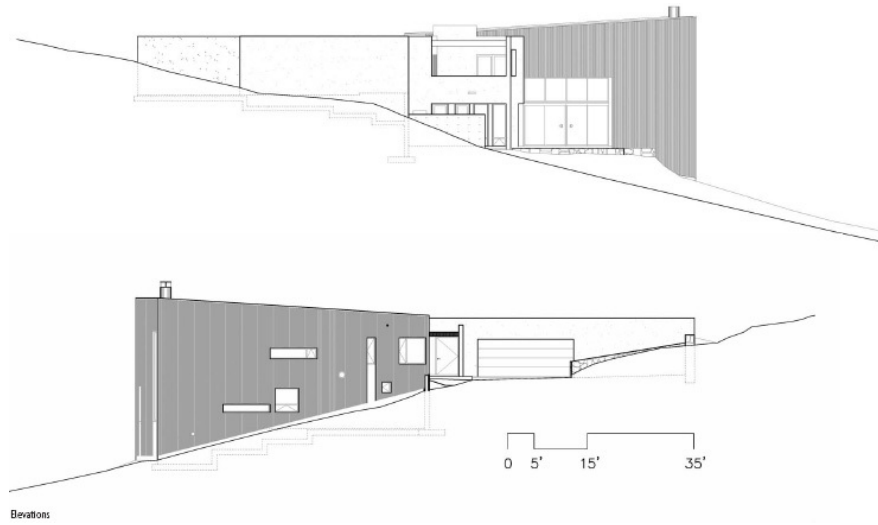
Architects: **Edward Fitzgerald / Architects**

Location: **Albuquerque, NM, USA**

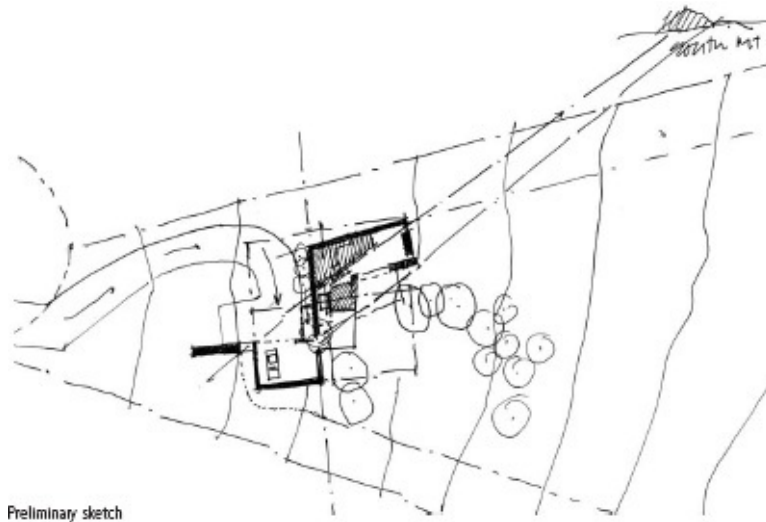
Photography: © **Robert Reck Photography**

Oblio House is a study on the relationship between circulation and topography, reinterpreting traditional vernacular styles of New Mexico in a contemporary manner. Built on a steep hill, the design organizes the house on two levels that step down the site. The house utilizes passive solar photovoltaic and hot water roof panels for electricity and radiant heating. Rainwater is collected in underground cisterns for landscape irrigation.





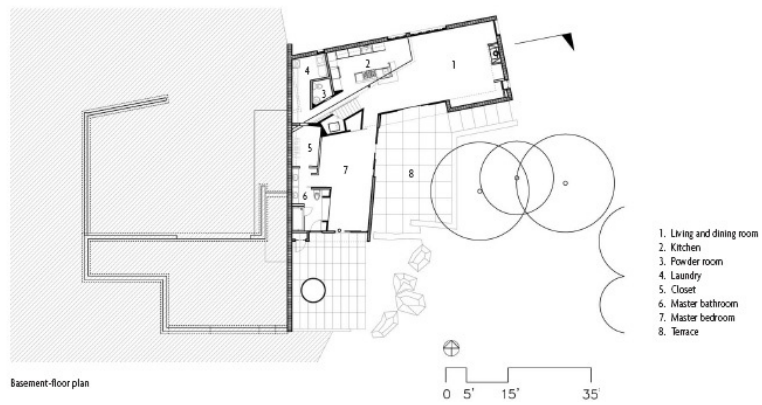
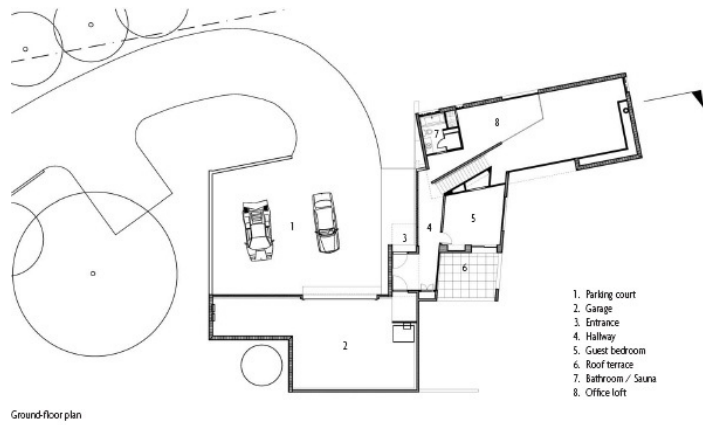




Preliminary sketch

**105** Two wings forming an angle create a protected outdoor area that minimizes the boundaries between interior and exterior.





The house has polished concrete floors, insulated concrete forms (ICF), and recycled wood stud framing. Exterior finishes include stucco, a corrugated metal roof, and wall panels.



**106** Window size and spacing, type of glazing, reflectance of finishes, and location of interior partitions should be carefully evaluated to make the most of natural lighting.



**107** Low-flow technology has fitted bathroom fixtures with devices that decrease the amount of water used by pushing air into the stream of water.





## **HUF House ART 5**

Architects: **HUF HAUS**

Location: **Cologne, Germany**

Photography: © **HUF HAUS**

HUF House ART 5 is an example of the successful range of energy-efficient homes that HUF HAUS strives to develop, taking into consideration land conditions, climate, and budget. HUF House ART 5 is a modern post-and-beam structure with generous amounts of glass that makes for a unique living space surrounded by nature.





The basement of the HUF House ART 5 accommodates an innovative energy storage solution. The equipment runs with a high-performance lithium ion battery.



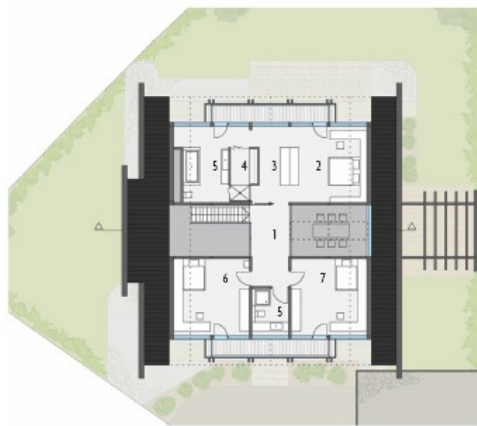




**108** There are general limitations in the amount of glass that can be used in the construction of a home. This amount can be exceeded, however, if the increased use of glass can improve energy efficiency.



**109** When it comes to interior finishes, it is best to choose products and materials that minimize the amount of harmful substances you are exposed to.



- 1. Gallery
- 2. Master bedroom
- 3. Dressing area
- 4. Sauna
- 5. Bathroom
- 6. Bedroom
- 7. Bedroom

Second-floor plan



First-floor plan

- 1. Carport
- 2. Pergola
- 3. Dining room (double height)
- 4. Living room
- 5. Office
- 6. Hall (double space)
- 7. Mechanical room
- 8. Bathroom
- 9. Entry
- 10. Kitchen

**110** Using natural lighting strategies and choosing energy-efficient light fixtures can help reduce electricity use and lower energy bills.









## **Mineral Lodge**

Architects: **Atelier d'Architecture Christian Girard**

Location: **Villaroger, France**

Photography: © **Nicolas Borel**

This is the site of a ruined farm where all that remained when the project began were outside walls and an adjacent chalet. Thinking creatively, the architects realized these elements offered the chance to build a structure that was both a vernacular architectural presence and would fulfill a contemporary desire for sustainable architecture informed by recent technological developments.





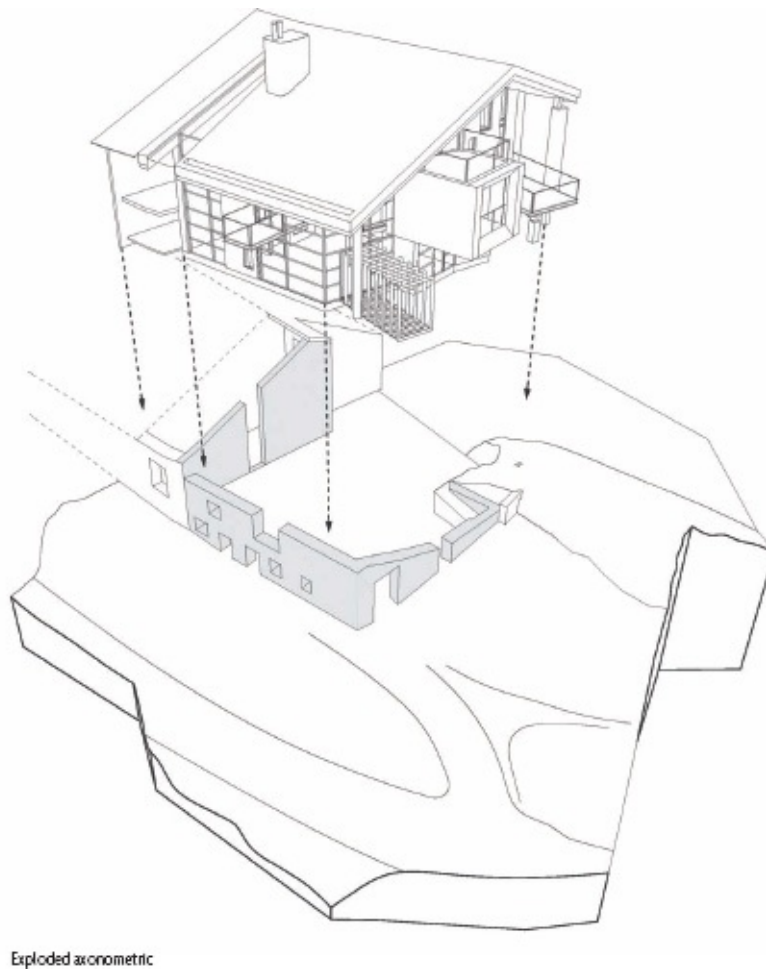
Earthquake and avalanche protection methods were integrated into the structural design of Mineral Lodge, which is located high up in the French Alps.

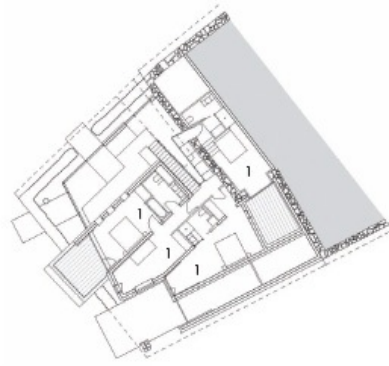






Mineral Lodge is equipped with geothermal heating provided by a heat pump. It circulates water in three 150-meter-deep drills in rock where temperature is stable all year around.





Third-floor plan

1. Bedroom



Second-floor plan

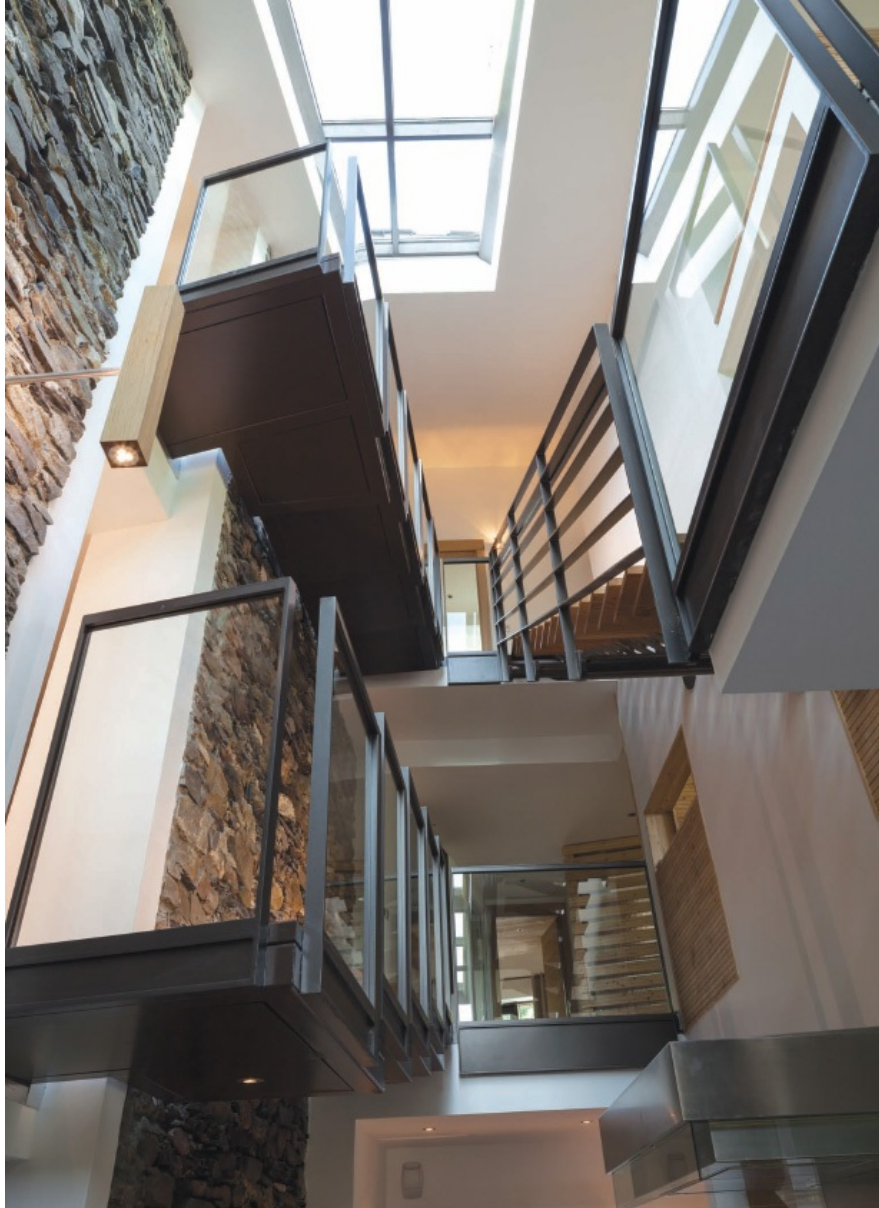
1. Gallery  
2. Multimedia room  
3. Living room  
4. Bedroom  
5. Sauna



First-floor plan

1. Entrance  
2. Dining room  
3. Kitchen  
4. Heat pump room  
5. Ski racks  
6. Garage

The new construction allows light into the house through windows made of high quality glass and frames.



**111** Effective use of daylight depends on a range of factors, including the sun's altitude and azimuth; the relative occurrence of overcast versus sunny weather; the season; and levels of pollution and haze.





## **Broad Oaks Showhome**

Architects: **Bob Burnett Architecture**

Location: **Christchurch, New Zealand**

Photography: © **Bob Burnett**

The architects and owners of this house infused it with both New Zealand and Japanese influences. The design of the building took into consideration the sloping terrain, orientation for best views, sun exposure, and protection from prevailing winds. With energy efficiency and cost effectiveness in mind, the architects utilized new materials and techniques to ensure that the house would be comfortable all year round.



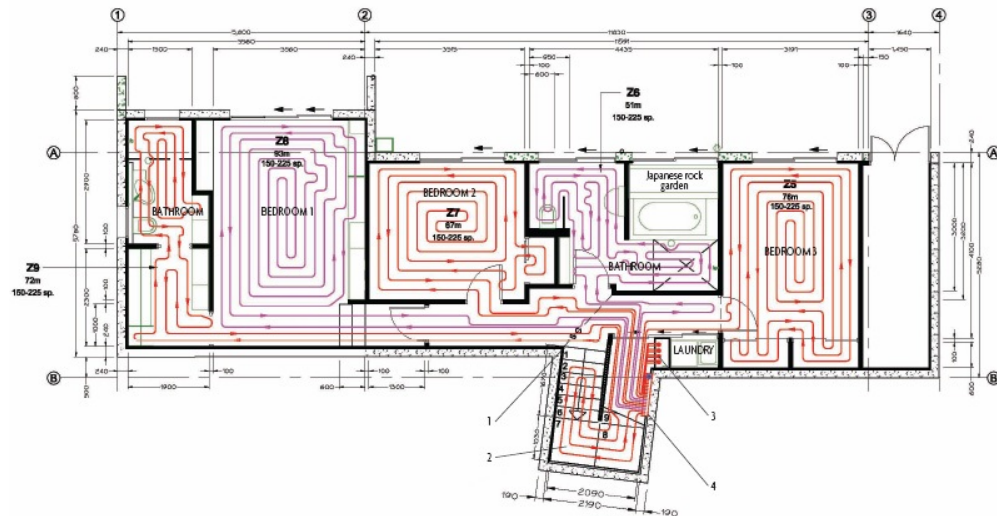


**112** To reduce energy costs and to contribute to global energy efficiency, windows are a good place to start. Double-glazed windows with argon gas low-E glass provide good insulation against heat transfer.





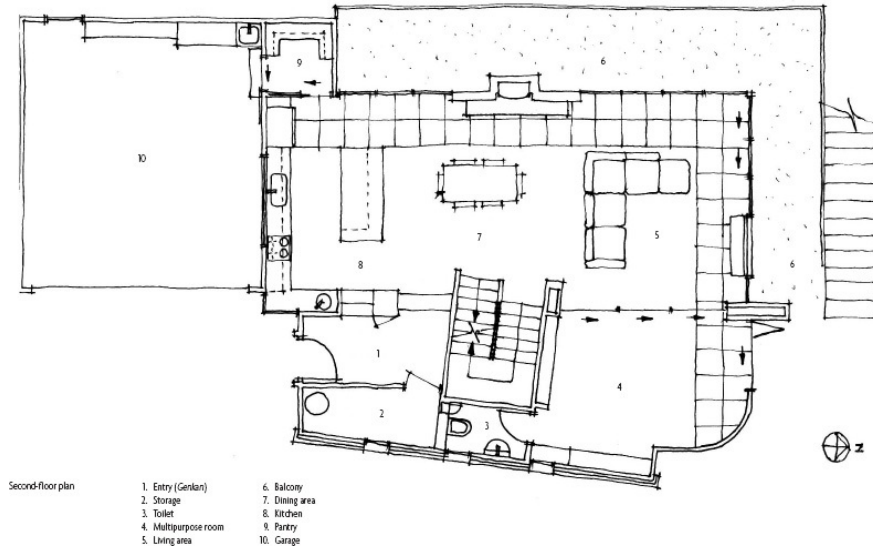
The lower and intermediate floors are concrete and have water reticulated under-floor heating. This hydronic system was installed with energy efficiency in mind, as it uses little electricity and can be powered by solar water heaters.



First-floor radiant heating plan

1. Dashed lines indicate saw cuts (Dip tube below mesh when crossing cuts)
2. Heat under stairway (Ensure builder marks any structural post positions)
3. 8 x 0.6 mm O.D. tubes to feed zones Z1-Z4 on floor above rise up riser space to upper-floor slab (installer to liaise with builder)
4. Under-floor heating control panel 1,000 x 140 x 750 H (1,010 x 140 x 760 H trim size), mounted on wall @ 1 m off FFL, typ.





The house interior is lined with GIB Ultraline® Plus gypboard, which is manufactured in New Zealand for New Zealand's climate conditions and provides additional density and rigidity.



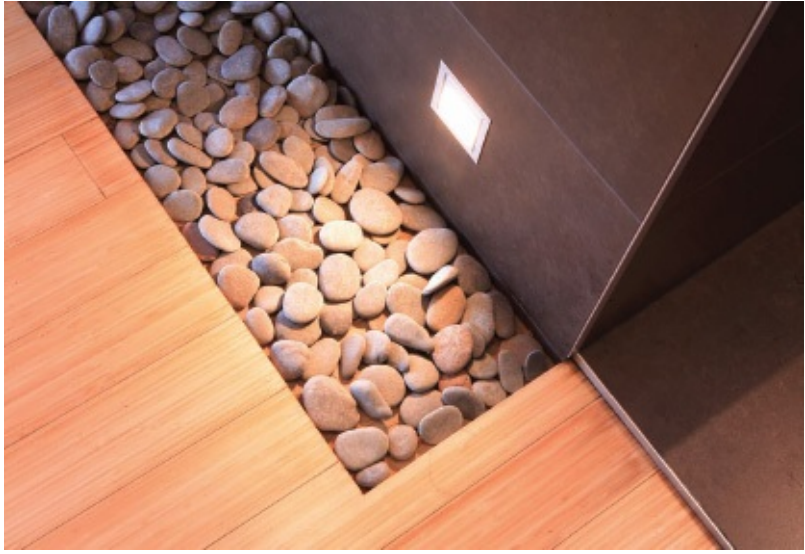






**113** Bamboo flooring is produced from a fast-growing renewable natural material that has antibacterial properties and is water resistant. These qualities make bamboo a sustainable alternative to hardwoods.





## Bridge House

Architects: **123DV Modern Villas**

Location: **Rotterdam, the Netherlands**

Photography: © **Christiaan de Bruijne**

Bridge House is a long, narrow, two-story building with a design made to look like the lower level is submerged and only revealed through a saddle. The upper level is completely visible and bridges two man-made mounds. The project deals both with architecture and with landscape design. Taking into account sustainable principles, the house can generate its own energy, making it possible for the occupants to go off-grid at any time.



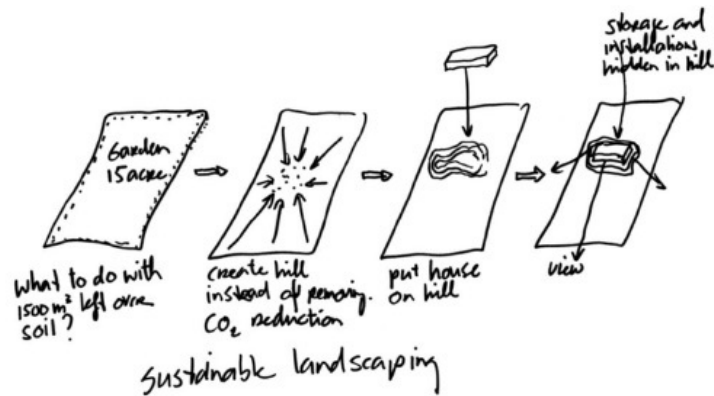




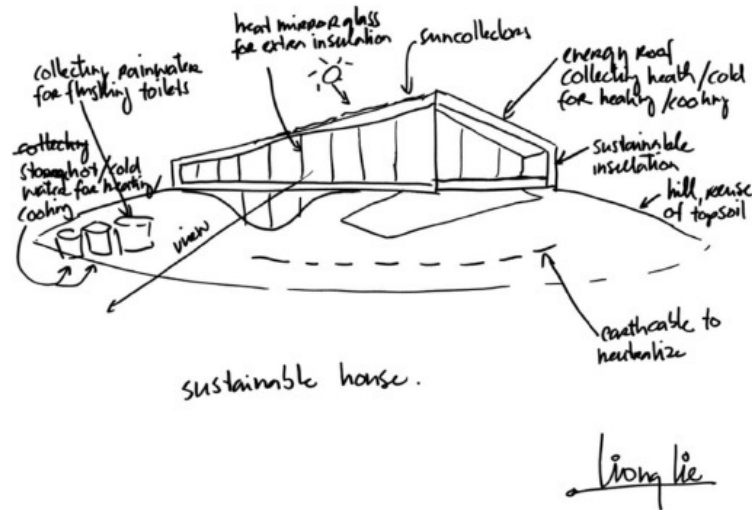
The house uses Heat Mirror® insulating glass. This unique material acts as an efficient and environmentally friendly temperature regulator, cooling the house and preventing excessive heating.

**114** Heat Mirror® insulating glass is composed of a heat-reflective coating with two internal air chambers to mitigate conductive and radiated heat flow.



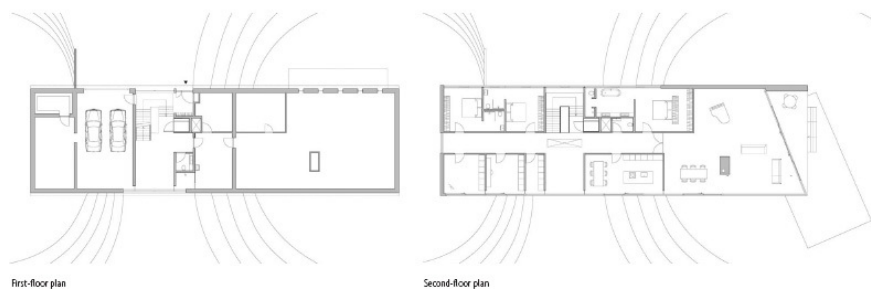
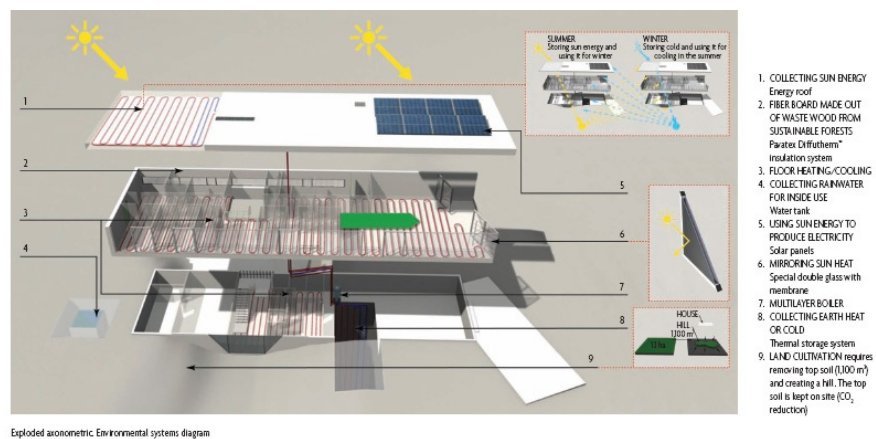


Sketch of sustainable landscaping



Sketch of environmental systems

The practical and sustainable features include roof and floor heating through thermal energy storage, reuse of rainwater, a septic tank, and photovoltaic panels on the roof.



**115** Perfecting the use of glass windows encourages sustainability, as a high percentage of energy flows in and out of a building through its windows.





**116** The well-designed placement of windows, skylights, and artificial lighting is critical to minimize energy consumption. When done incorrectly, occupants deal with glare and thermal discomfort.





**117** Large sliding doors on opposite walls provide ample cross-ventilation to cool a house on warm days. Both light sources combine to make an evenly lit interior.



## House M

Architects: **Philipp Architekten**

Location: **Balingen, Germany**

Photography: © **Philipp Architekten, Udo Geisler**

A sloping terrain at the foot of a hill made this a challenging site to accommodate a house and simultaneously integrate it into the landscape. Yet the architects were able to do this and give the home panoramic views. The structure, which is entirely built with timber panels, also meets the requirements for both winter and summer insulation and for healthy living conditions. The design of the house reflects the occupants' passion for art and graphic design.





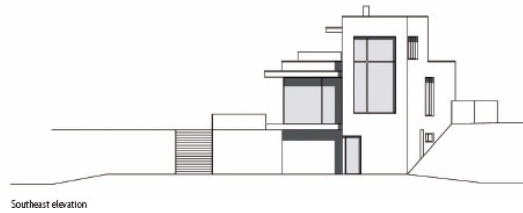
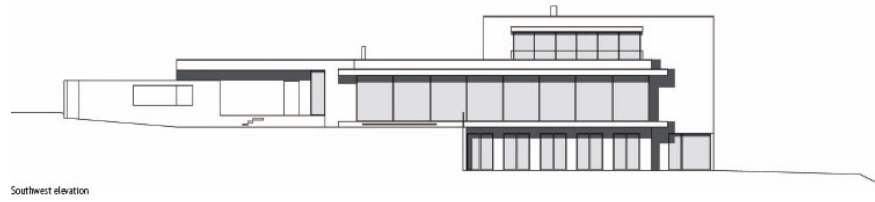
**118** Deep overhangs serve as solar protection, creating a microclimate around a house and allowing outdoor activities to take place in comfortable conditions.



**119** Choose naturally occurring flat areas or gently sloped parts of a site to



minimize disruption of the landscape.



**120** Carefully evaluate topography, building proportions, setbacks, landscape design, vehicle access, and energy-efficiency possibilities.



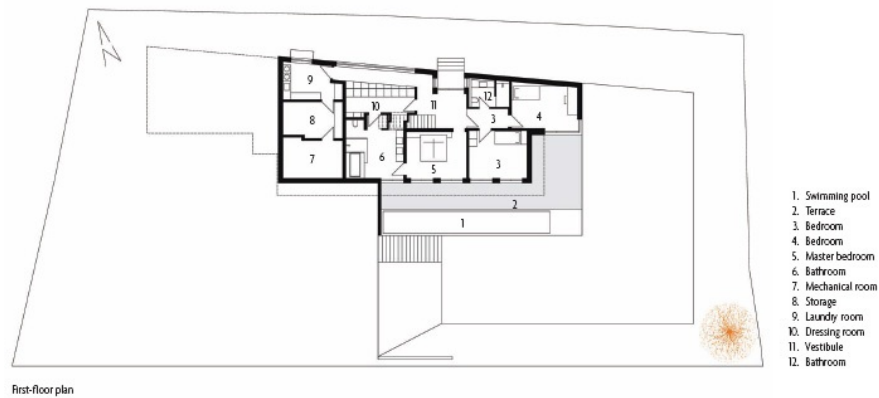
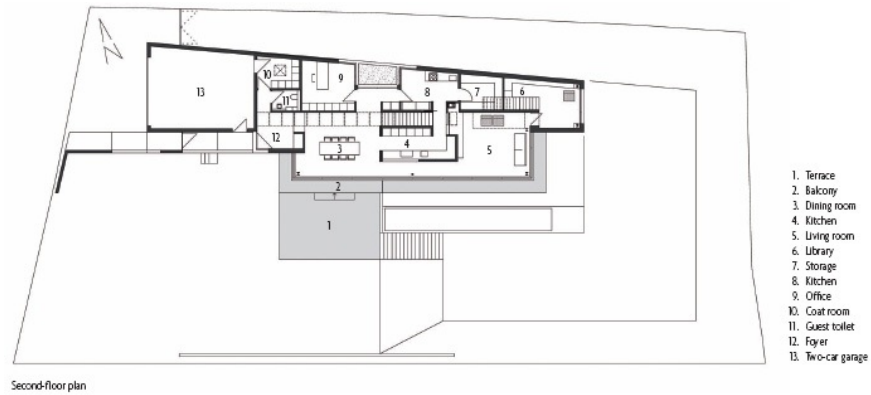
**121** A rectangular building with one of its façades facing south can allow for high solar heating, sunlight, and natural ventilation.



**122** Organize the interior layout of the home to make the most of daylight, locating the most-used rooms on the south side and the least-used rooms on the north side.







**123** Using energy-efficient light bulbs will optimize artificial lighting and reduce electricity costs.



## House P

Architects: **Philipp Architekten**

Location: **Waldenburg, Germany**

Photography: © **Johannes Kottjé, Victor Brigola, Oliver Schuster**

Located on a mountain ridge in southern Germany, House P is formed by a central glazed cube. A wood-paneled core within this glass cube has utilitarian functions and acts as the backbone for the second floor. A minimalist approach, featuring white plaster finishes, was brought to the design of the house. This minimalist aesthetic extends from beyond the walls of the house to the design of the landscape.





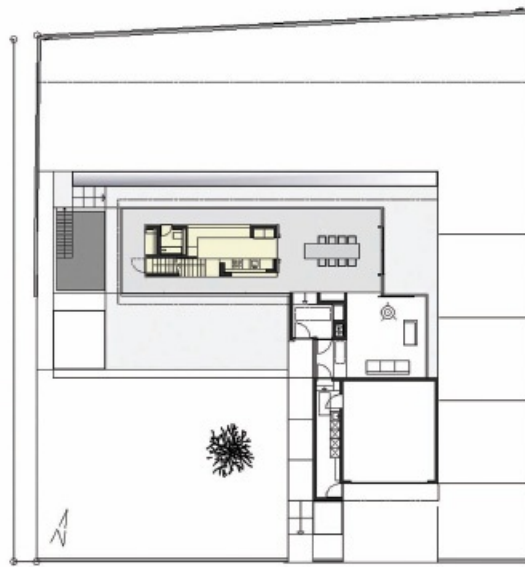


**124** Color can play an important role in passive cooling. Light-colored surfaces reflect light and heat, while dark colors absorb radiant energy.





Second-floor plan



First-floor plan



Basement-floor plan



**125** The presence of water can produce a cooling effect. That is why water features are in courtyards located in hot, dry climates.

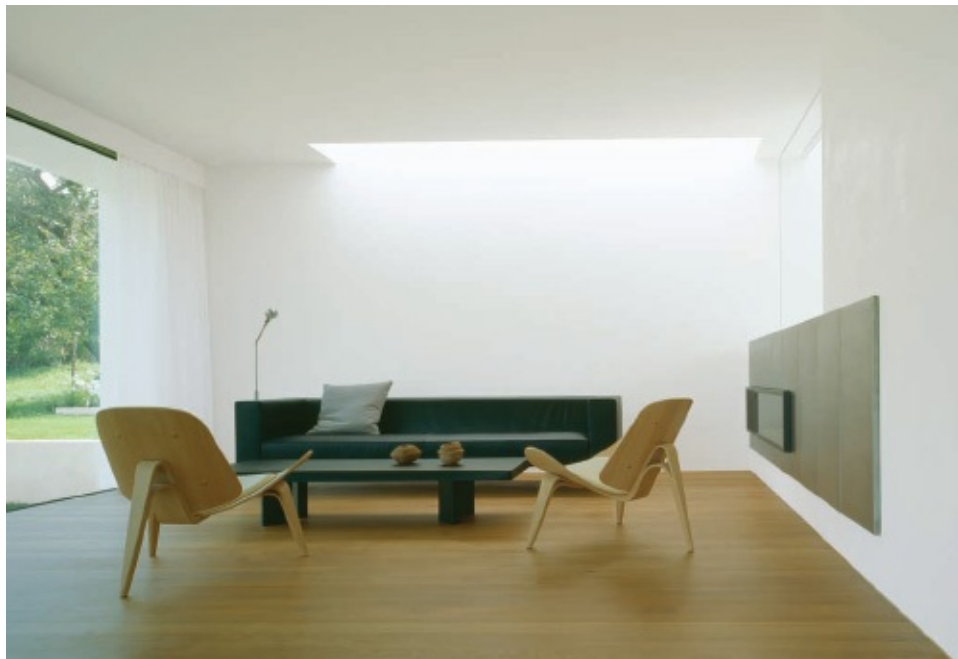


**126** Shading by means of deep overhangs is perhaps the simplest cooling form. Other cooling options involve the strategic planting of trees, vines, and shrubs.





**127** High levels of insulation in walls, ceilings, and a roof, energy-efficient windows, and low levels of air infiltration contribute to the optimization of energy performance.



## **Hollis House**

Architects: **Silva Studios Architecture**

Location: **Poway, CA, USA**

Photography: © **James Jaeger Photography**

This seven thousand sq. ft. environmentally responsible home has views in all directions. The effect captures natural seasonal breezes, daylight throughout the home's interior, and drought-resistant native landscaping. It features 20 KW, PV (photovoltaic) solar technology, solar hot water, rainwater collection, and gray water collection. It is framed with recyclable steel, 100 percent cotton insulation (made from recycled blue jeans), and cabinets of sustainably grown Lyptus wood. It is fire resistant inside and out.







**128** The building planning and massing should make the most of the buildable area of the site with a minimal impact on the environment.



West elevation



North elevation



South elevation



East elevation

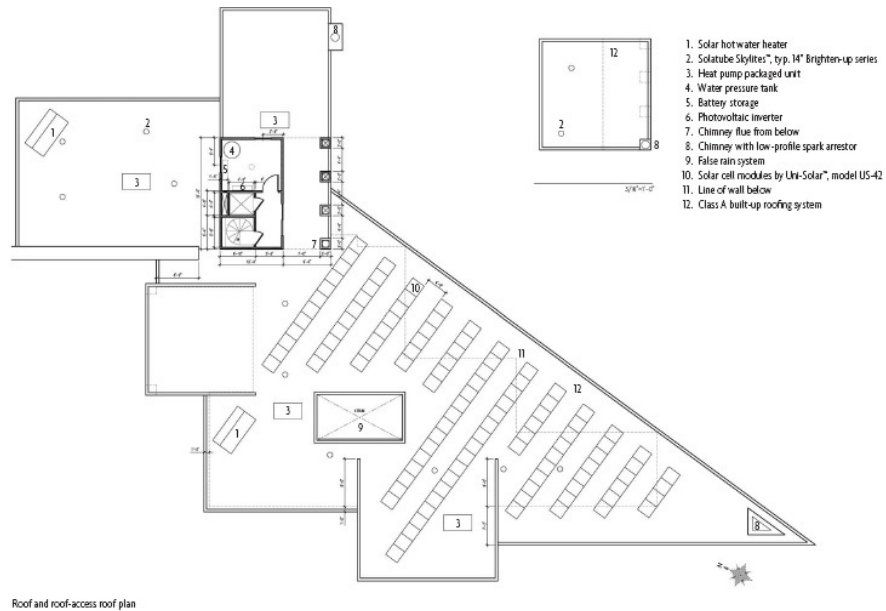
**129** The optimal size of canopies and overhangs depends on the site's location and climate.



**130** The selection of materials applied to exterior walls should be decided based on their environmental performance. The criteria can relate to their sourcing, maintenance, and disposal.



**131** Adopting energy-efficient strategies, such as the use of renewable energy, will lower energy costs and, as environmental awareness grows, will add value to your property.



**132** When deciding the orientation of your home take into account the location of landscape features on your site. These features may have an impact on how you harness sunlight.







**133** In a long narrow space, gallery kitchens are most efficient when oriented toward a bank of windows to optimize natural lighting.



## **Bio Domus D.01**

Architects: **Aroma Italiano**

Location: **San José, Costa Rica**

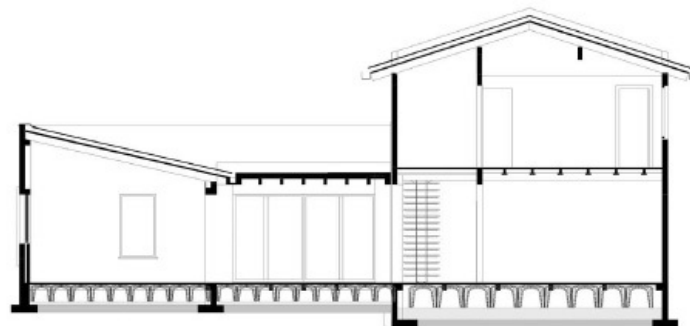
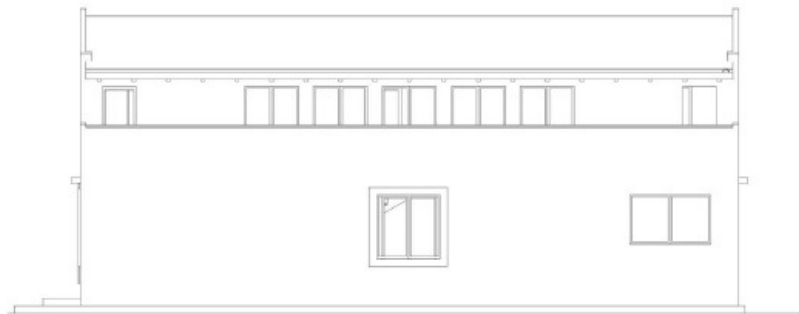
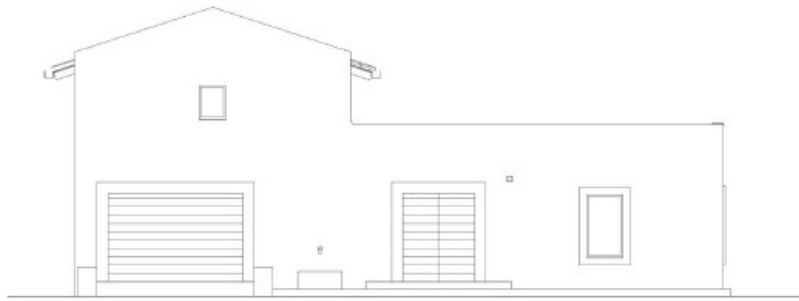
Photography: © **Aroma Italiano**

Bio Domus D.01 revisits Mediterranean architecture with a minimalist approach that follows concepts of bio-architecture. It embraces the eco-friendly practices of sustainable construction, permaculture (a branch of ecological design), eco-engineering, and environmental design based on sustainable architecture systems modeled after natural systems. It utilizes natural materials, as well as the energy-conscious practices of geometry, sacred geometry, and feng shui.





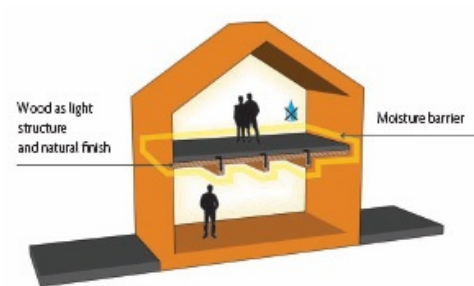
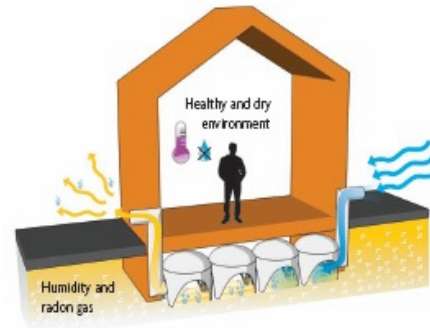
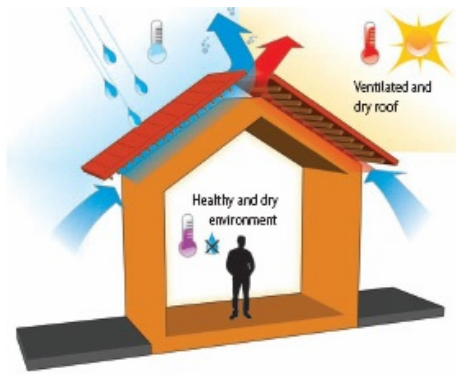




Elevations and section

The house is open, simple, and dynamic, inspired by the building concepts of the Roman *domus*: white surfaces, stone, open spaces, and a central courtyard with a water feature.





Environmental system diagrams

New technologies combine with traditional construction methods to create a unique house. The use of eco-friendly materials and systems allow energy saving, ensuring a long-lasting, healthy dwelling.









## Inside Out

Architects: **Takeshi Hosaka Architects**

Location: **Katsushika, Tokyo, Japan**

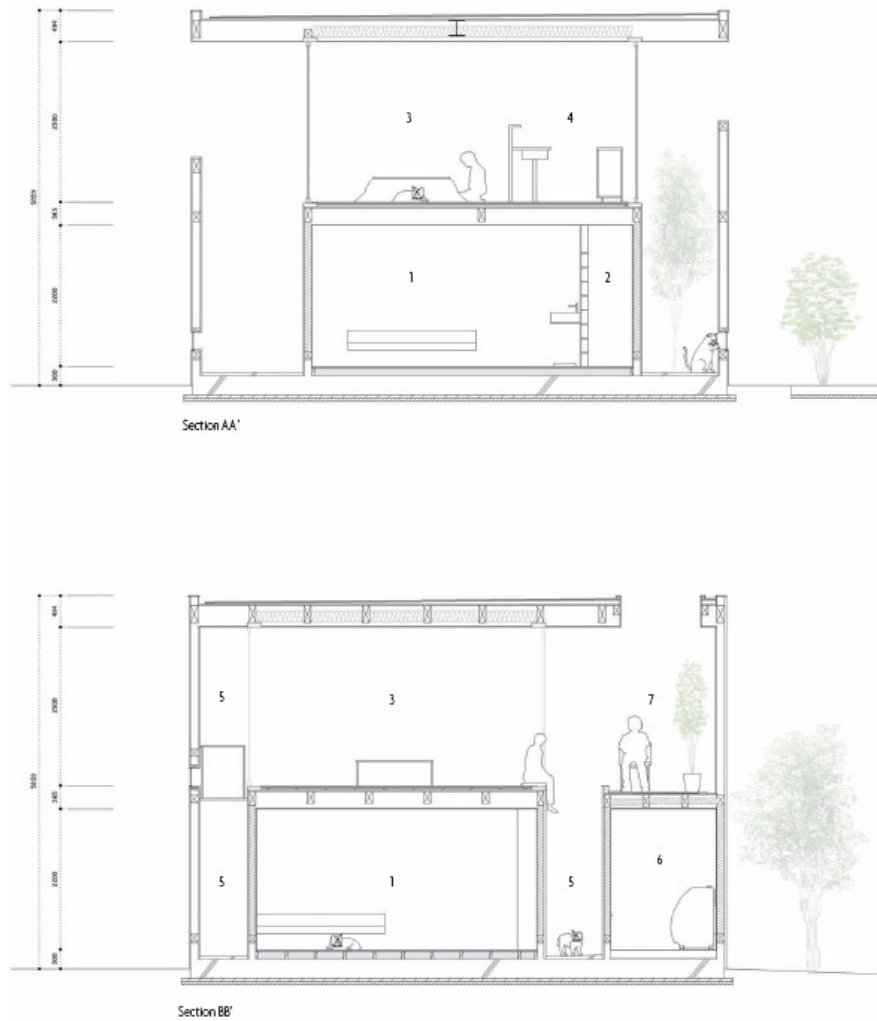
Photography: © **Koji Fujii**

The irregular quadrangular shape of the site dictates the overall footprint of the two-story high building. The design was conceived as a “house within a house” with an interstitial outdoor space separating them. The roof and wall sides of the volume have carefully designed openings that let light and air in, while the open space that surrounds the inner house serves as a temperature regulator.





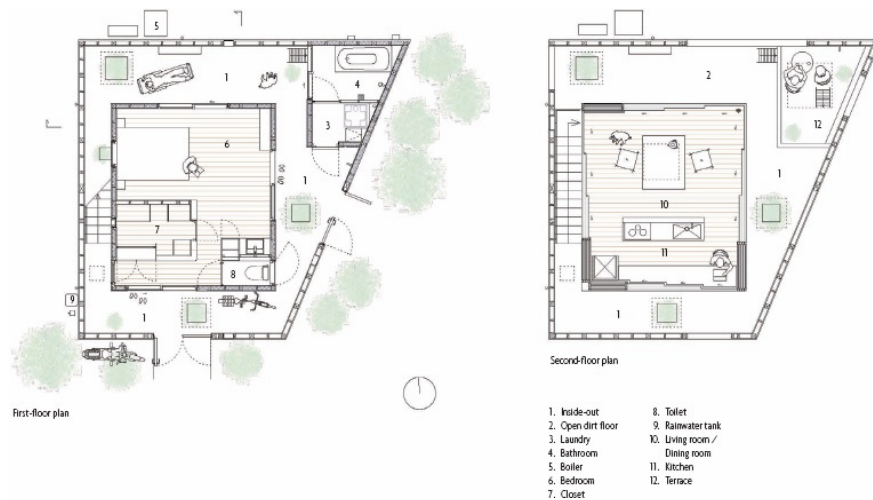




**134** The color and material of walls play an important role in how much of the sun's energy is absorbed and reflected. Dark colors absorb heat, while light colors reflect it.



**135** Courtyards are popular in parts of the world with dry and hot climates. Interior courtyards are used as climate control design solutions helping air circulation and allowing light into the interior of a house.



**136** Trees and plants complement a courtyard and provide humidity.





The inner walls of this house can slide to open spaces to the courtyard. The cool air of the courtyard is sheltered from the sun by the exterior walls and roof.



## **Herzliya Green House**

Architects: **Sharon Neuman Architects**

Location: **Herzliya, Israel**

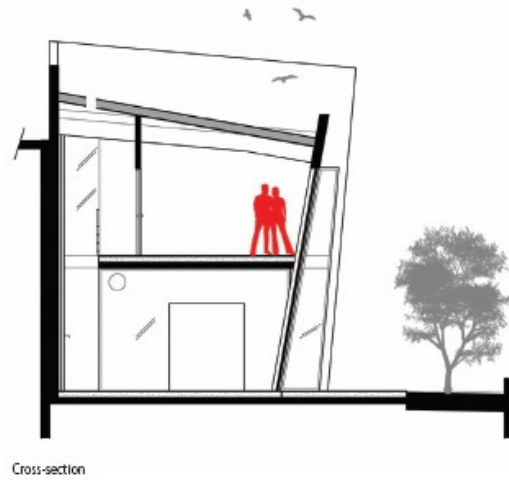
Photography: © **Sharon Neuman Architects**

This house in Herzliya is located on a long, narrow plot with an adjacent building to the west that blocks light and airflow. To deal with this situation, the architects planned a series of staggered blocks creating an irregular eastern façade. This strategy provided south and north light and natural ventilation. In contrast, the eastern wall has few openings.







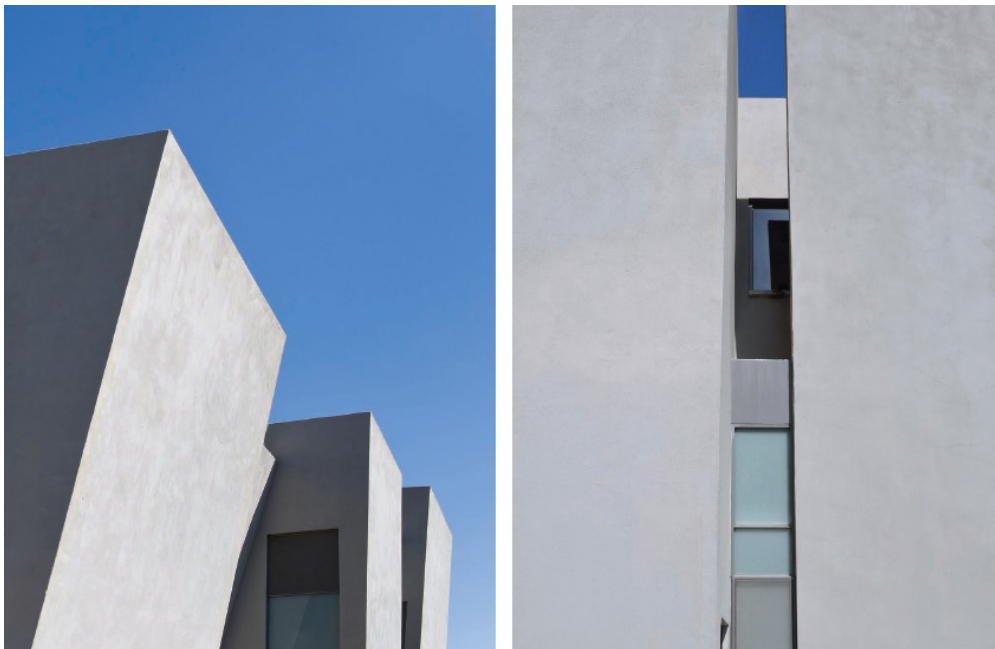


**137** A passive design approach can involve the structure of a building; including orientation, window and skylight placement, insulation, and building materials.





The house incorporates adobe blocks in specific places for extra thermal mass, a solar water heater, and a rainwater collecting system.







**138** Window geometry, size, and disposition can influence indoor lighting. Taller windows give greater penetrations and wider windows offer a better distribution of light.



**139** Slanted windows allow natural light in without the glare and summer solar gain. This makes the interior less dependent on artificial light and allows for energy conservation.



Aside from the aesthetic value, the all-white surfaces of this interior combined with good lighting, maximize the potential of the architectural features.



**140** The careful management of natural and artificial light can generate important energy savings, while preventing glare and minimizing heat gains.





## **Thomas Eco-House**

Architects: **Dan Nelson AIA, Matt Radach/Designs Northwest Architects**

Location: **Stanwood, WA, USA**

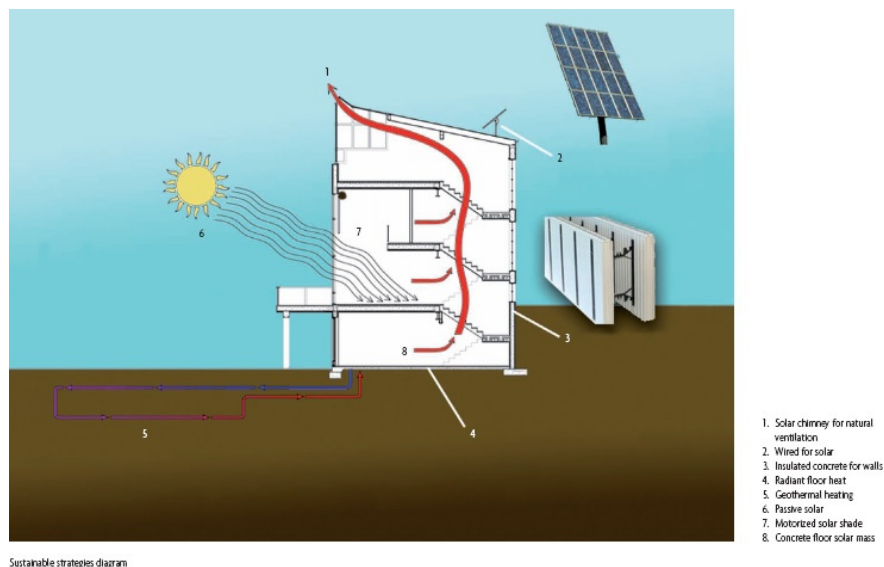
Photography: © **Lucas Henning**

This four-story home allows a large amount of living space, while maintaining a relatively small carbon footprint; it also takes advantage of the views that the site has to offer. The design process of the house was guided by the owner's interest in energy efficiency and a sustainable, low-maintenance design. The site is landscaped with native vegetation; it is irrigated in the dry summer months with rainwater runoff from the roof that is stored in a cistern.





**141** A sustainable home design is successful when every component, including structure, mechanical equipment, and materials used, is linked to produce a single organism.



**142** Light-colored interiors and open-floor plans optimize the use of artificial lighting in a sustainable manner.





**143** ICF (insulated concrete form) is a wall assembly with insulation layers on both the interior and exterior sides, creating a very efficient and airtight wall system.



**144** In home design, light and ventilation requirements determine the size of windows and whether they have to be operable or fixed based on a percentage of the floor area of a habitable space.





North elevation



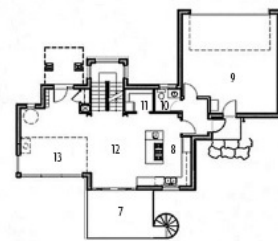
West elevation



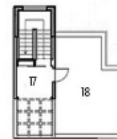
South elevation



East elevation

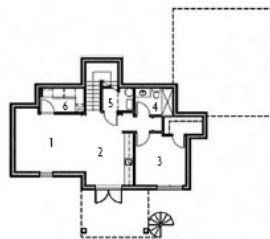


Main floor plan

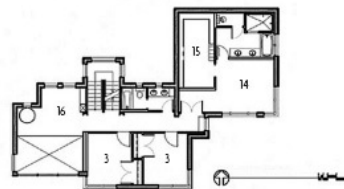


"Bubble" floor plan

- |                    |                    |
|--------------------|--------------------|
| 1. Media room      | 10. Toilet         |
| 2. Family room     | 11. Pantry         |
| 3. Bedroom         | 12. Dining room    |
| 4. Bathroom        | 13. Living room    |
| 5. Mechanical room | 14. Master bedroom |
| 6. Laundry         | 15. Closet         |
| 7. Deck            | 16. Loft           |
| 8. Kitchen         | 17. "Bubble"       |
| 9. Garage          | 18. Roof deck      |



Lower floor plan



Upper floor plan

In order to improve efficiency for heating and cooling, the house uses a geothermal heat pump tied in with a hydronic heating system that absorbs heat from the ground.







The glassed-in space atop the staircase has operable windows that, when opened, create a natural convection effect, pulling warm air up the staircase and out of the house.



## **Mooloomba House**

Architects: **Shaun Lockyer Architects**

Location: **Point Lookout, Australia**

Photography: © **Scott Burrows**

This house consists of a series of distinct pavilions around an east-facing courtyard. The courtyard breaks down the scale of the house and opens the spaces up to the easterly breezes. It draws the sun in and creates a private refuge from an adjacent public walkway. The house is set back from the street and its exterior spaces are landscaped so that with time, the boundary will be completely blurred, offering a dense, green edge to the public.







The use of hardwoods, graying cedar, fiber-cement, and playful colors reference the local community in a contemporary fashion.

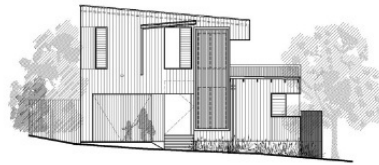


**145** It is important to optimize heat gain during the cold months, while keeping it to a minimum in the summer. Exterior shutters are highly efficient in this respect.



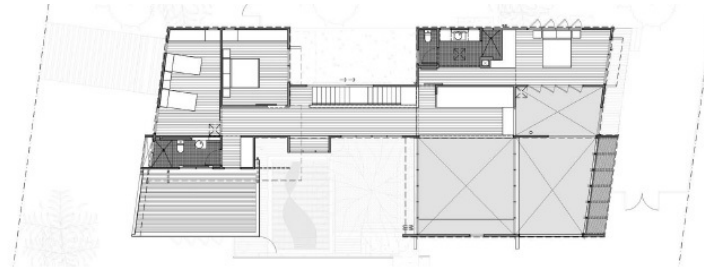
**146** Make the most of outdoor living with breezeways and screens that protect patios and terraces from prevailing wind and sunlight.



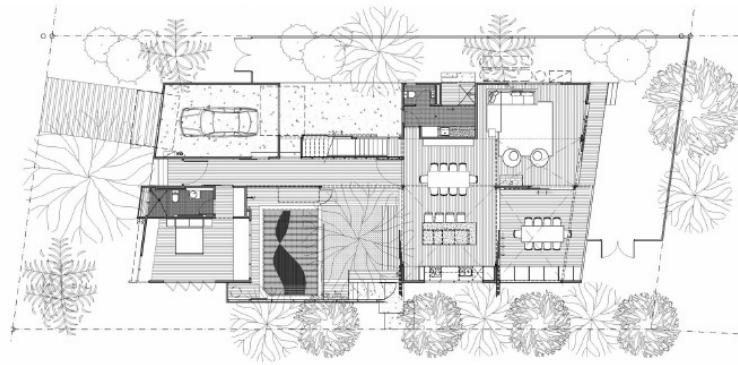


Elevations





Second-floor plan



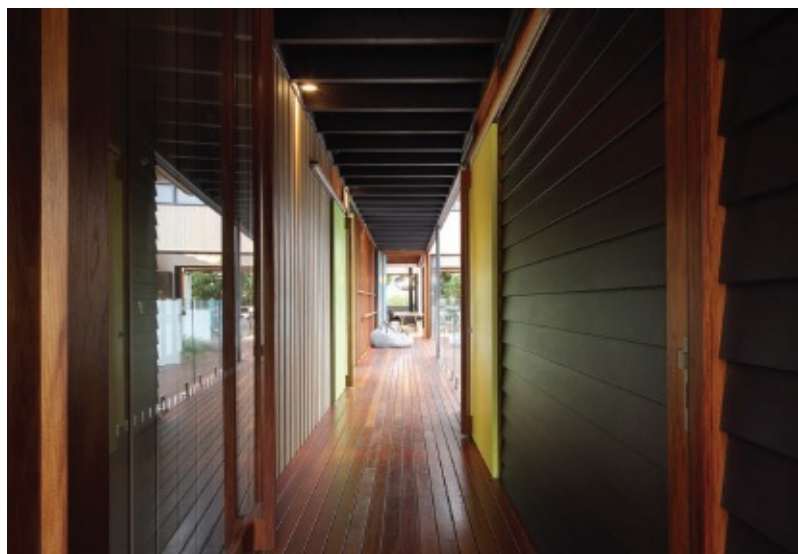
First-floor plan

**147** The thermal advantages of courtyards are considerable. Courtyards act as cool air containers in the summer and are wind protected exterior spaces in winter.





A slow-combustion stove provides economical heating in winter. Low-E glass, additional insulation, and FSC timbers have been used to bolster the performance of the house.



**148** Louvered glass windows have evolved over time to have better designs and mechanisms that allow for air tightness. Glass blades can be replaced with wood and aluminum blades.



## CorManca House

Architects: **PAUL CREMOUX studio**

Location: **Mexico City, Mexico**

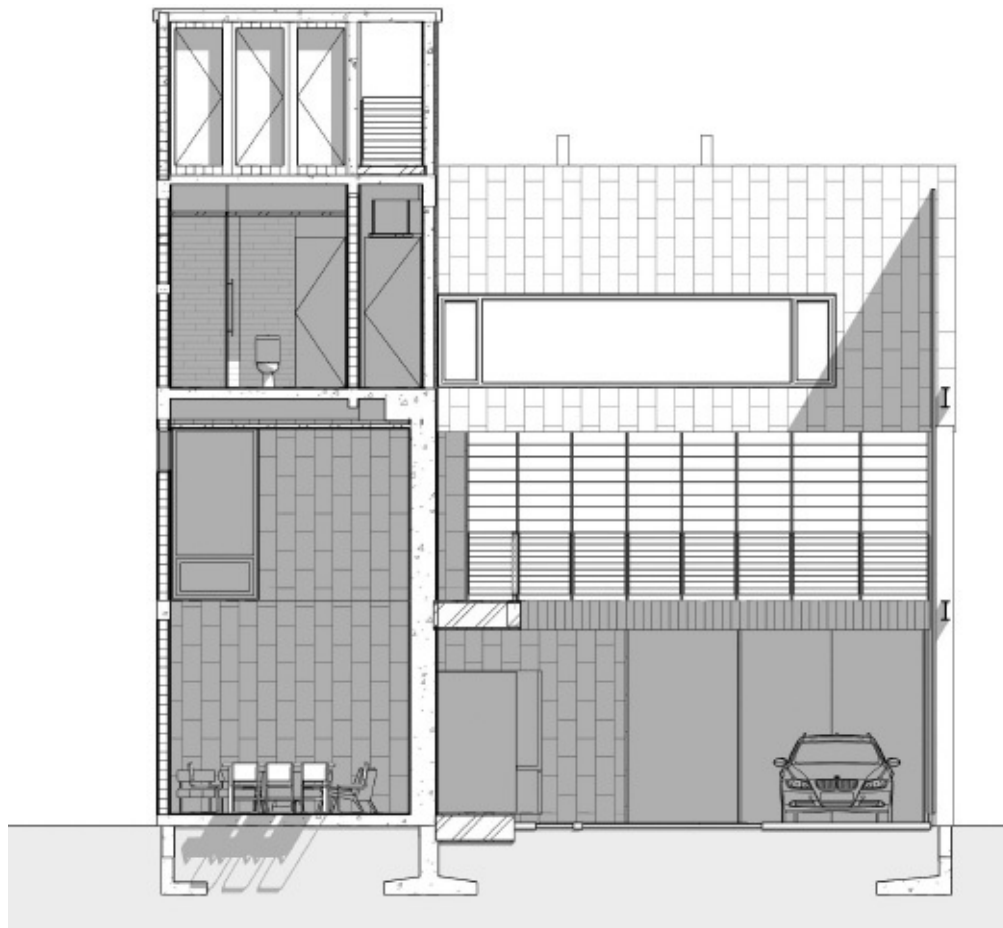
Photography: © **Héctor Armanado Herrera, PCW**

Built on a small plot of land, CorManca House is three stories with an interior courtyard and a U-shape terrace on the second floor facing a vertical garden. This vertical garden is used as a temperature and humidity control device, enhancing the microclimate of the residence. While the front of the building, clad in black slate, looks monolithic, the back features blocks of indoor and outdoor spaces articulated to make the most of natural light.









Section



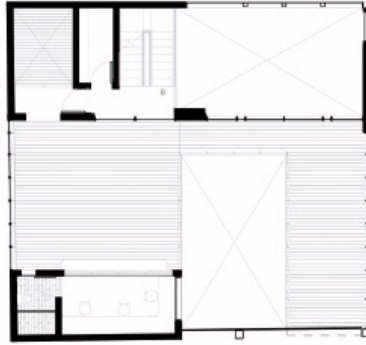
Rendering of front façade

The reduced footprint of the building forced a vertical construction that resulted in a three-story building.

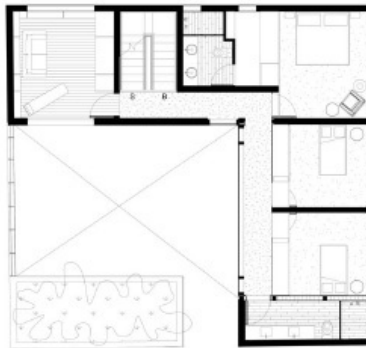








Third-floor plan



Second-floor plan



First-floor plan

Concrete and metal framing, a self-resistant caustic and thermal tie beam, and a concrete small vault form the structure of CorManca House. Finishes include low-VOC paint and recyclable materials.



**149** Vertical gardens are effective bio-filters, absorbing volatile organic compounds. They also contribute to cooling a home in the summer and adding humidity to the air during the dry cold months of winter.

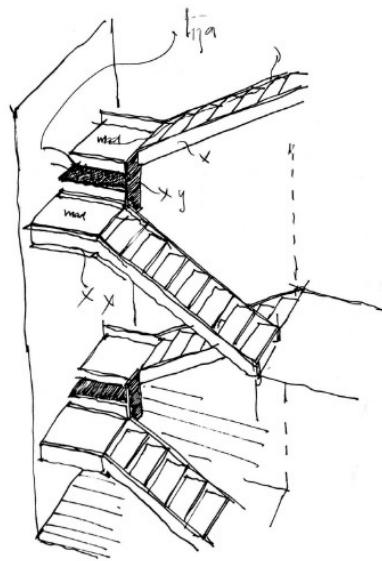


The terrace on the second floor compensates for the lack of a larger ground-floor courtyard. It is the focal area around which the house is organized and plays a social role.

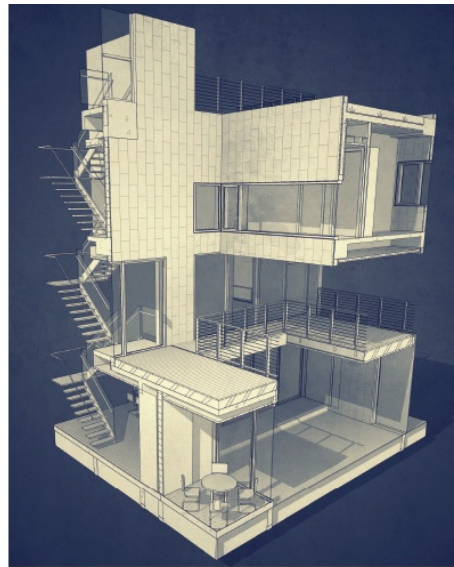




**150** An open staircase acts as a chimneystack, allowing air to rise to warm upper floors during the winter and vent through windows at the top during the summer.



Hand-drawn sketch of staircase



Partial axonometric view of the house





The dark slate wall captures solar energy and keeps interior rooms warm.



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