

# ideas

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## CANADA OH CANADA

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## Affordable Green Solutions

**E**coBuilders of Virginia operates on the premise that every home, no matter what the budget, deserves to be as energy efficient and healthy as possible; and its construction can help conserve our precious resources while achieving these goals.

How? With careful research and thinking outside of the box. Like any project, the more extensive the planning, the more cost effective the final result.

For example, our current project is a single-family, work force home. Built on a previously developed lot that is now vacant, it's surrounded by turn-of-the-century homes and new homes

that have been built to match the existing architectural style.

### Home Owner Perceptions

A recent study, "The New Home in 2015" by the National Association of Home Builders, found that those surveyed believe the average new home will continue to get smaller by mid-decade – to about 2,152 square feet. Of those respondents, 68 percent stated that homes will get greener by 2015.

Home owners, especially young first-time buyers, are increasingly demanding a healthy, energy-efficient home and are willing to pay a little more up front, realizing that they will be paying significantly

These neighboring new homes were built in 2000 to match the existing turn of the century homes on this street. A 3.5' tall crawl space, front porches, extra gables and extensions all add charm.



PHOTO COURTESY OF GAYLE JOHNSON

There can either be two full baths and three bedrooms, or one full bath and three bedrooms on this floor. Separating the functions of the bathroom allows several people to use the bathroom for different purposes at the same time, which is great for families in the morning.

PHOTO COURTESY OF DEBRA COLEMAN OF SUN PLANS INC.

lower utility bills and will be protected from rising utility prices in the future.

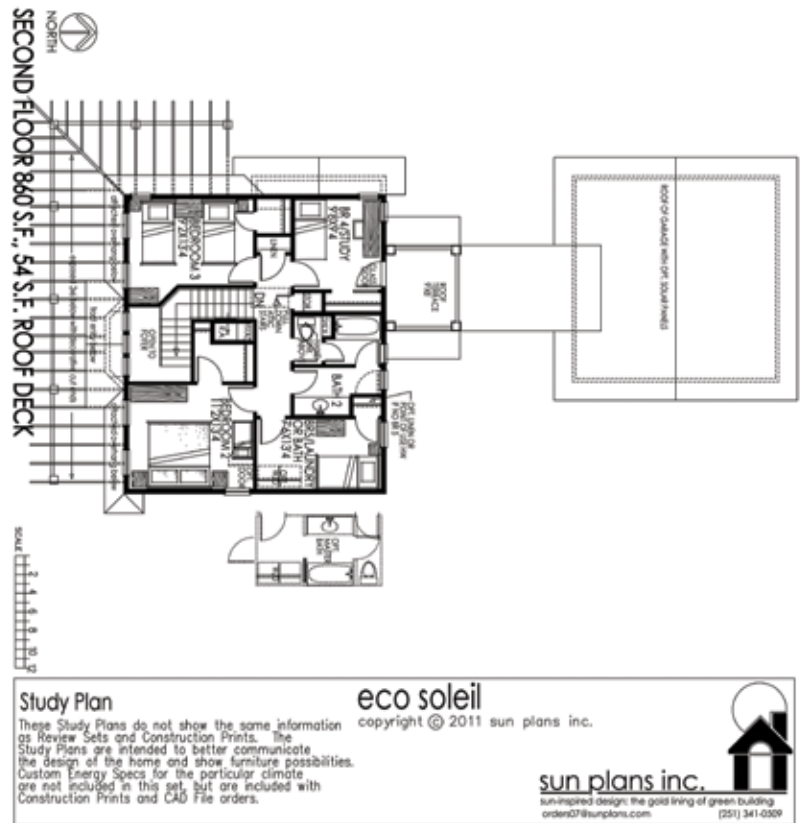
### Passive Solar Design

When designing a green home, the single most cost-effective step is to identify and use its passive solar potential. It costs no more to build a home that works with the sun to lower both heating and cooling loads – approximately 25 percent reduction in this project simply by correct placement of the windows.

Begin by identifying true south and note any buildings or trees that may block the warming winter sun or could help keep out the overheating late afternoon summer sun from the west. Then add landscaping to supplement shading on the east and west as necessary.

With a perfect site for passive solar, we approached Sun Plans, an architectural firm that specializes in passive solar design nationwide. Sun Plans created a 1,928-square-foot energy-efficient design that effectively uses available solar heat combined with an open, flexible design that can have either five bedrooms and two baths, or four bedrooms and three baths, with a master bedroom and bath available on the first or second floor. “Basically we incorporate common sense design strategies that let the sun warm and brighten the interiors – naturally,” says architect Debra Coleman.

The southern half of this home (32'x14') is on a slab, which provides thermal mass to absorb excess solar heat during the day and slowly release it during the night in the winter, and helps maintain even temperatures in summer. Western windows and doors are minimal to prevent afternoon overheating in the summer. Windows with a low solar heat gain coefficient (SHGC) on the north, east, and west block the summer sun, while windows on the south allow in as much sun as possible with glass with high SHGC. With no existing trees on the west side at this



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site, our landscape architect suggested a fast-growing, drought-tolerant river birch to provide shading.

“The combination of mortgage and energy bills are typically the same as or lower than a conventional home. The mortgage payment may be slightly higher, but the energy bills will be significantly lower,” says Coleman. “A home that costs \$10,000 more could have a mortgage payment increase by \$47 per month (with a 30-year loan at four percent), yet the energy savings should be at least \$55 per month just at Energy Star standards. Incorporating sun-inspired

Seen from the corner, the open wraparound porch lets in the winter sun yet fits in well with the covered porches on surrounding homes. The extension of the kitchen with its gable adds visual interest from the side street, as well as providing extra space inside.

PHOTO COURTESY OF DEBRA COLEMAN OF SUN PLANS INC.



design strategies can increase energy savings beyond Energy Star by another 20 to 40 percent!”

### Affordable Design Options

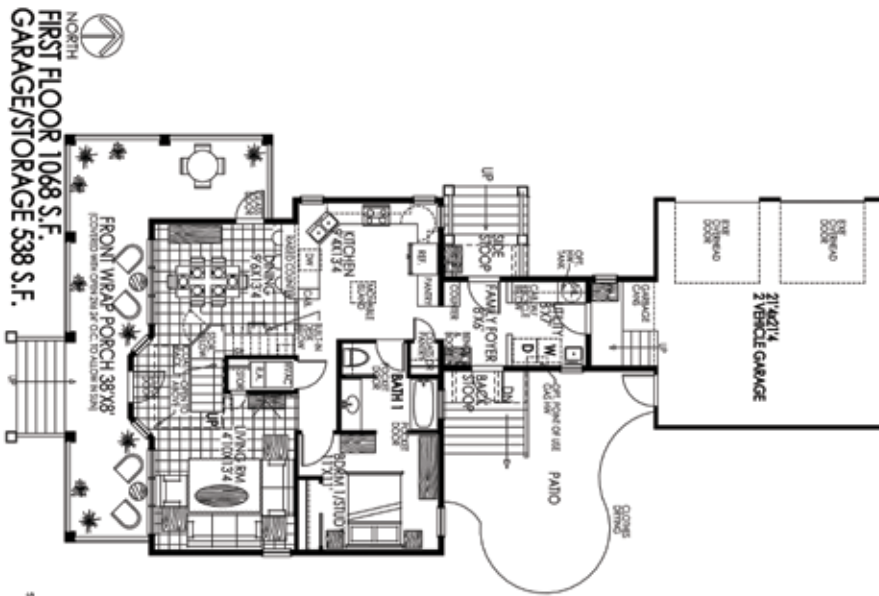
This project began as a relatively straightforward, affordable design; however, the site needed extra design requirements to blend with the surrounding historic homes, which have wraparound porches, decorative gables and architectural details, tall crawlspaces, and symmetrical windows.

We collaborated with the City of Norfolk’s Neighborhood Resource and Design Center to achieve a historic infill design with two-foot roof overhang – which keeps out the high summer sun – coupled with an open trellis which lets in the winter sun, instead of a traditional covered porch.

The windows on the southern front of the house are in symmetrical groupings, which echo the symmetrical single windows in the neighboring homes. A decorative gable was added in the center of the south facing front roof and a two-foot extension of the kitchen with its own gable offers interest on the west side, which also faces the side street.

While a more affordable design might be built directly on a slab, the surrounding homes all have approximately 42-inch crawlspaces due to proximity to the flood plain. The planned ICF (insulating concrete forms) foundation provides an ideal opportunity for a closed crawlspace and the new 2009 building code requires mechanical ventilation. We’re using the NAS system, created here in Tidewater, Virginia, to provide negative pressure in the crawlspace. It guarantees that no mold will grow and also provides a controlled air exchange as it pulls air from the home.

With the extra costs for the historic architectural details and the crawlspace, we have to consider options for downsizing the original plan in order to align with the buyer profile. Option A is the house as designed and includes a fully enclosed two-car garage. Option B includes a carport instead of a full garage. Option C is the home with only a shortened utility connector in back. This flexibility of design options allows this same plan to be used in a variety of price ranges for infill projects in historic neighborhoods.



### Study Plan

These Study Plans do not show the same information as Review Sets and Construction Prints. The Study Plans are intended to better communicate the design of the home and show furniture possibilities. Custom Energy Specs for the particular climate are not included in this set, but are included with Construction Prints and CAD File orders.

eco soleil

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sun-inspired design: the gold lining of green building  
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The first floor has great flexibility with the living room, dining room and kitchen open and flowing into each other. The bedroom could be a master suite or a family room or office. Separating the toilet from the rest of the bathroom provides a public powder room while maintaining privacy for the rest of the bath. The southern half of this floor is on a raised slab, which provides thermal mass to maintain a more even temperature.

PHOTO COURTESY OF DEBRA COLEMAN OF SUN PLANS INC.

### Green Building Standards

Germane to the initial design is identifying a target HERS rating, as well as any green certifications that we wish to achieve, such as LEED Platinum and NAHB Emerald. Though the USGBC's prestigious LEED certification might be considered too costly and time consuming for a single-family affordable home, the NAHB standard is easy to document and costs very little, while still offering an objective third-party verification that the home is built to specified green standards. As appraisers and real estate agents begin to realize the sales value of green building, it's increasingly important to get this objective third-party certification. Savvy home owners realize that a green home will have better resale value in the future and are asking for such objective verification. Energy-efficient mortgages, which take into account the lower utility bills of green homes, also look for such verification.

Since we actively participate in the 2030 challenge, which advances energy-efficient building practices so that all new construction will be net zero by the year 2030, this project aims for a HERS rating of at least 35, which means that the home uses 65

percent less energy than a conventional code home. To achieve this, effective insulation and air sealing are of paramount importance.

One important green option is building foundation and walls with insulating concrete forms, ICF, which offer vastly superior insulation and air sealing. ICFs cost more up front but save money by cutting construction time and labor, reducing stolen materials from the jobsite, and reducing waste and dump fees. ICFs retain thermal heat well, provide protection from the area's high winds, have a four-hour fire rating and no organic material to support mold growth or termites. To avoid expensive pitfalls, we team with another builder who has 10 years of ICF experience.

Another affordable green option is building with structural insulated panels, or SIPs. Like ICF, SIPs cut construction time and labor costs, provide superior air sealing and insulation, and superior resistance to high winds. SIPs cost less up front than ICF and have fewer long-term benefits but can provide a weather-tight home in a week. Both ICF and SIP construction provide huge savings for the home owner through vastly reduced HVAC requirements.

In order to achieve net zero, a home needs to produce **some of its own power with alternative energy.**

Facing 10 degrees east of True South with no trees to block the winter sun, this site begs for a passive solar home.



PHOTO COURTESY OF GAYLE JOHNSON

This house also has a truss roof with raised heels to allow for full cellulose insulation at the eaves. The heating and cooling system and ductwork is placed inside the conditioned space, which eliminates the need for more costly spray insulation on the roof deck or SIPs to frame the roof.

### **Built-in Photovoltaics**

In order to achieve net zero, a home needs to produce some of its own power with alternative energy. Large crystalline solar panels would look out of place in this historic neighborhood, so we decided to use the Englert metal roof with built-in photovoltaics, BIPV. The blue roof matches the color of the integrated solar panels, so from the street it just looks like a blue metal roof. It's a perfect solution for homes in historic districts where higher output solar panels would look out of place.

Photovoltaics are expensive and should only be used after the home is built with superior air sealing and insulation, but the 30 percent tax credits help make solar affordable. Additional benefits include

lower utility bills for the home owner, as well as quarterly payments from utility companies who have to buy alternative energy. These ongoing benefits help to justify a higher sales price for the expensive solar options.

### **Interiors**

How can this home still be affordable if building with more expensive ICF and BIPV? The answer: cutting costs in other areas. Using drywall returns instead of window and door trim saves on materials and labor costs and provides a clean, modern line. Affordable light and plumbing fixtures from IKEA continue the modern look. Tiles and other finishes from Habitat for Humanity's ReStore add a custom touch to affordable bathrooms. An easy-to-use, smart wiring system by Verve appeals to buyers, costing the same as conventional wiring by saving on labor costs.

With more home owners looking to conserve energy and lower their utility bills, those in the building industry are facing an ever-increasing



PHOTO COURTESY OF GAYLE JOHNSON

demand for energy-efficiency on a budget. Meeting that demand is more than possible, as long as companies are willing to think outside of the box to satisfy home owners. Home owners are increasingly willing to make the investment in a healthier, more energy efficient home, and, as seen in this project, it's more than possible to accomplish not only on a budget, but also working within strict design requirements. **smi**

**Gayle Johnson** first became engrossed with sustainable building during a visit to an off-the-grid, passive, and active solar home in the 1970s. After graduating from Oberlin College and Conservatory, she worked for Citizens for a Solar Washington while creating a two-story passive solar addition to a 1920s Seattle bungalow. Listed in Who's Who since 1995, in 2006 she did a green gut rehab of a 1950s home inspired originally by Frank Lloyd Wright's Norfolk residency. Now a LEED-accredited professional with USGBC and a Certified Green Professional with NAHB, Johnson is pursuing her dream to create net zero, passive solar homes. She can be reached at [nrgsvr@ecobuildersva.com](mailto:nrgsvr@ecobuildersva.com).

This original 1915 home shows how a traditional covered front porch keeps the warming winter sun out of the first floor. Situated on a corner lot, the extra gable and extension provide visual interest from the side street.

With more home owners looking to conserve energy and lower their utility bills, those in the building industry are facing an ever-increasing demand for energy-efficiency on a budget.