

## Green Households – EAQAC Testimonials

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As a member of the sustainable business community my wife and I are very aware of our carbon footprint and the impact that being more energy efficient can have on our environment and our expenses. When we bought our home we wanted to create a plan to attack the 'weak points' in our home but we were not ready to spend a whole lot of money right after making such a large purchase. So our first step was making a list based on the biggest energy wasters -- leakage and lighting. Because our home had many of the original doors and windows and is over 50 years old, attacking the house envelope was a good place to start. We started replacing windows and sealing doors and created a three year plan for complete window and door replacement. We then decided that the lighting was next. We simply replaced our light bulbs and fixtures with more energy efficient equipment. With these two measures alone we were able to dramatically reduce the energy spent in our household and commit our household to a lifetime of sustainability.

Our Rockville home is part of a subdivision built in the early 1960s, a period of low energy prices and minimal concern for heating and cooling costs. The previous owners had installed a deck but meanwhile the windows and doors were drafty, the major appliances were all approaching 10 years old, and the attic had very little insulation. When we first moved in we had an energy audit via done by our power supplier and learned the single most effective investments we could make from an energy perspective were to add attic insulation and replace the HVAC system. Since then we've replaced the windows, added storm doors, and replaced the major appliances with more efficient ones. We recently had a much more thorough energy audit utilizing a blower door to test for leaks. The result was that the most effective measures we can take now are actually low cost caulking and similar measures to fill gaps and reduce air flow.

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We had my sister, a landscape architect, re-design our front yard and directed the contractor who implemented her plans to use all “green products”. In doing so, he used organic mulch, native grasses and plants, and fertilizers without nitrogen or phosphorous to protect the Chesapeake Bay where water from our residence ultimately drains. The difference is astonishing to look at and enjoy, and well worth the expenditure of extra resources. The only thing that was not “green” was the sod that partially covers the front yard as it is extremely difficult to find organically-grown sod products in this area. Next up: our heating and cooling system.

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**Green Living at the Our Residence**

We bought our 1957 split level rambler in 1995, and reducing our carbon footprint is part of every decision we make. We have tracked changes in our electricity and gas usage since 2004. The two high expenditure items we have undertaken are solar photovoltaics in 2008 (a 2.7 kW array) and in 2010 a geothermal heat pump. But I would like to detail the many smaller energy saving and green living efforts we have made.

## **House Envelope**

### Windows

Our house has 25 windows, including two “wall of windows”. We replaced all the windows with double paned, argon-filled windows in 2001. We chose the windows which had the lowest U-factor at that time. We have also caulked around the interior and exterior of the window moldings. Several windows have cellular, honeycomb blinds, to increase insulation.

### Doors

We have replaced all the doors in the house: A glass patio door, two side-entry doors and the front door. The front door, which was replaced in 2010, included two side windows and a transom, and has a U-factor of .19.

### Insulation

When we first moved into the house we put about 9” of insulation down in the loft, and then placed a floor above the insulation. We have recently added reflective insulation on top of the floor, and have constructed a movable barrier which fits over the stair-entry to the attic. In 2009 we had blown insulation over the cathedral ceiling, an area we had not been able to access. We also have insulation in the chimney flue, to minimize heat loss through the chimney. Small cracks and openings to the outdoors in the basement area were sealed with expanding foam insulation. The plug outlets located on outside walls have been insulated.

The extractor fans in the bathrooms and the kitchen have been changed so that they are only open when operating.

We have not insulated the area between the dry-wall and the brick exterior. We were advised against this by remodelers when finishing our basement and re-doing our kitchen. This is probably an issue we will revisit.

## **Energy Usage**

We have purchased 100% renewable energy since 2004.

### Appliances

Whenever we buy a new appliance, we ensure that it is Energy Star compliant. Over the last ten years we have replaced our washer, drier, refrigerator, tv, computers, printers, vacuum cleaner and attic fan.

### Lighting

There are no incandescent light bulbs left in the house. Almost all lighting is with CFLs, varying depending on location from 7 watt (candelabra-style bulbs) to 23 watt (replacing 100 watt bulbs). There are a few halogen light bulbs in floor and desk lamps, since we have not yet found CFL replacements for these. The basement rec. room also has

halogen ceiling lights. The exterior lights have been changed so that the fixtures take CFL floodlights. The sconces outside the front door are Energy Star rated, with “dawn to dusk” lighting due to sensors. We also have solar lighting along the path to the front door.

#### Power strips

We have power strips in many locations, to minimize phantom load when appliances are not in use. These are in place for three computers and peripherals, the three tv/dvd/cable box locations and music center. The main computer and the wifi terminal is on a “smart strip” which has a “constant on” for wifi, and a control plug, so that when the computer is turned off, all the peripherals turn off too (printer, hard drive backup, light).

#### Hand-cranked appliances

To further reduce power use (albeit by a minimum amount) we have several hand-cranked appliances. We have a radio, which is used when gardening. We have several hand-cranked flashlights, for use during power outages, to avoid battery use and disposal.

#### Usage

We minimize electricity usage in many ways. Laundry is only washed in full loads, and unless extremely dirty, the cycle used is 30 minutes long. We have a rotary clothesline which is used when the weather is appropriate. Otherwise, clothes go in the dryer to decrease for a few minutes, and are then hung to dry. Lights are turned off when the room is not in use. For cooling, the thermostat is set to about 78 F, higher when the house is empty. The main computer is set to “sleep” after 10 minutes of inactivity, and to turn off after 20 minutes. We have a dishwasher, but it is rarely used, since we wash dishes by hand. The HVAC filter is cleaned every month.

To further minimize heating/cooling requirements, blinds are drawn against the sun in the summer (to the East in the morning, the West in the afternoon).

#### Hot Water

The change to a geothermal system included a new hot water tank. In summer, the water is heated purely by waste heat from the house, hence issues with washing in cold water and low-flow showers to reduce use of hot water are not really necessary. However, in winter, the water is heated by an electric element, so we will continue conservation methods as previously.

### **Outside issues**

We have five rain-barrels at three locations around the house. This water is used to water the garden, but also as a tool to manage run-off from the property. One rain barrel leads directly to a rain-garden, which we installed in the spring of 2010. The spigot is off during the rain event, during which the water collects in the barrel. The location of the rain-garden is such that it fills rapidly from run-off. During the next 24 hours, the rain is absorbed into the ground. After that, we open the spigot from the rain-barrel, and the water runs via a section of hose, through to a seeper hose which lies under the mulch of the rain-garden. This fully empties the rain-barrel, which is thus available for the next rain event.

#### Native plants

The use of native plants in landscaping helps to decrease watering needs, and also attracts

native birds and insects. Several areas of the garden have native species, including the rain-garden.

### Composting

All fruit and vegetable garden scraps go in the compost, along with leaves in the fall, and non-woody trimmings. The grass trimmings stay on the lawn.

### Lawn management

We have a manual push-mower and an electric mower, rather than a gas mower with associated air and noise pollution. Other outside tools, such as a trimmer, a strimmer and a chain saw are also electric. Only organic fertilizers are used (mainly corn starch as weed suppressant and fertilizer). Pesticides and herbicides are not used.

### **Transportation**

We are a family of five, with four drivers. We own three cars, but at least one (mine) is a Prius. My husband drives a VW Beetle to the metro which he takes to work. Occasionally he cycles or walks, but at almost two miles each way, and uphill on the way home, he usually drives. I drive as economically as possible: I combine trips, keep my tires inflated correctly, minimize a/c use and almost always drive to the speed limit. The third car is a Honda CRV, which is great for trips to Home Depot and the Transfer Station. It is also used by two teenagers, as needed.

Our worst eco-fault as a family is air-travel. One child is at university in Canada, another will start in Scotland in the fall. We visit family every summer in Europe. At least my husband's air travel is offset by his employer. We generally do not purchase carbon offsets for our flights, but I like to think that the renewable energy generated by our solar panels makes up for this to some degree. To date we have generated 2880 kWh. Coal, the source of most electricity, generates approximately 2 lbs of CO<sub>2</sub> per kWh. Therefore, our solar power has saved approximately 5760 pounds of CO<sub>2</sub>, which is roughly equal to two return flights from the US to the UK!

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I was formerly involved with environmental law and regulatory work, and now as an employee of the National Renewable Energy Laboratory, I and my family are keenly involved in addressing and building awareness of energy use. We also serve on sustainability committees at our children's schools, implementing anti-idling programs, energy consumption reduction contests, and waste reduction programs. Our 1970 home was leaky and inefficient when we acquired it in 2001. An unfortunate incident in which an enormous tree fell and cut through our house provided the perfect opportunity to upgrade our home. While we did expand the footprint slightly to allow for a mudroom and additional bedroom, we also took the opportunity to upgrade the utilities and appliances. We began with icynene insulation and decided to rip off the siding on the

other portions of the house to improve the insulation, which was minimal or nil or sagging terribly for this 1970 home. There is only one small portion we did not spray foam, and we see it when snow sits on our roof, its melts there about 3 days before there is even a hint of melting elsewhere on the roof. We replaced windows and our new lighting allows for more CFLs. Our construction company undertook the work, and abided by green construction efforts.

On the outside, we already live in a very shady neighborhood, and while the threat of large poplars crashing down on us (more have fallen since the incident noted above), we have planted additional native trees. We stopped wasting resources on flowers because the deer consume them all and have now resorted to ferns.

During the construction period, we considered installing a geothermal heating and cooling system. The costs were too great to handle. Every year I make new inquiries about such systems. Recently I was referred to a geothermal contractor who provided a much more reasonable price for a horizontal system, something the other contractors were not willing to consider due to lot size. This contractor calculated that it could and would work. His reduced cost and the available tax incentives made this a winner for us. Despite being most pleased with the finished product, in that it works, I would never recommend the contractor for a variety of reasons. I have yet to be able to compare our energy usage this summer with prior summers, simply because the number of cooling degree days is exceedingly high this year, more than in any recent years for which PEPCO data is available, so it is difficult to compare our energy use. As part of our geothermal installation, we also installed an electric water heater that can use excess heat from the geothermal heat pump to heat water. However, we have not connected it to the heat pump yet because we do have a high efficiency gas water heater that is still functional. The electric water heater serves to “pre-warm” water, acting as an advance storage tank. The geothermal system is much quieter than the external heat pumps, and operate inside, so there is no neighborhood noise pollution.

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Statement of Energy Efficiency Measures Taken During Construction  
of a Silver Spring Home in June, 1994

Our Contractor oversaw the installation of both a high efficiency gas furnace 90+ with PVC vent and 13 SEER electric air-conditioning. Additionally, the house has R-38 blown ceiling insulation, thermal low-E windows” [argon gas filled] “and 6” walls” [with R-19 insulation]. Also, the home has a brick veneer and air space. We used an air infiltration package of foam and caulk. All HVAC equipment including the air to air exchanger was installed by a Laurel company. The HVAC equipment consisted of:

Carrier 58MXA100 High Efficiency 90+ gas furnace;  
Carrier 38BR048 13 SEER air conditioner;  
Honeywell ER90 Air to air exchanger;

(2) Lomancool thermostatically controlled roof fans.

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For our family, energy conservation has been a progressive improvement of our home over a fifteen-year period. We started this project when our kids had already left home and have continued it into our own retirement. We have been progressively building in more and more efficiency rather than trying to do everything at once. This has worked out well because we've been able to keep up with newer technologies. And, our budget has been able to absorb improvements. For example, we have only replaced functioning appliances or cars when the inherent lifetime of the appliance was reached. Then, we've selected the highest efficiency replacements.

We live in a brick and block rambler located inside the Beltway. The home was built in 1956 at a time when energy efficiency was not on the drawing boards of the post-war home builders. For instance, exterior walls are not insulated at all, except for a one inch gap between interior drywall and the home's masonry. That one inch gap is not insulated.

Fifteen years ago we renovated our kitchen. One part of that project was to insulate the exterior kitchen wall with R13 batts (permitted in the wider kitchen wall). Six years ago we replaced the original aluminum casement windows with the most efficient vinyl windows we could find (argon-filled, double-paned, low E, low U, low solar heat gain, etc.). Five years ago, we completely remodeled our walk-out basement. In the course of that project we demolished down to the masonry and reframed the basement with 2x4 framing wood, with the sill plates moved off the block walls by an inch. This permitted us to put R19 insulation between the block and the drywall. We were able to seal masonry holes and cracks to reduce infiltrating air. These changes alone have tightened our home to the safe indoor air quality limit of 0.33 ach.

Four years ago we increased attic insulation from R14 to R52, by blowing in fiberglass. Two years ago we replaced our gas hot water heater with a more efficient model-but only when the old hot water heater failed. Last year we installed CFL lighting in all places in our home that were capable of using such lights. This year, when we remodeled two bathrooms, we removed all exterior drywall and filled that one inch gap with R5 foam board insulation. We installed Energy Star exhaust fans. This year we also replaced our 20 year-old refrigerator with a new very efficient model that has halved our refrigeration demand. Before the end of this year we will be replacing our 80% efficient gas furnace with a 95% efficient model.

We have made one really important lifestyle change. Our built-out basement is now our "summer home." This little step has enabled us to increase the thermostat setting on our first level by 6°F because the summer home is inherently cooler.

In summary, we have insulated everyplace we could. We have upgraded windows and a refrigerator. We are about to replace and upgrade our furnace. We have maxed out on our

use of CFLs. And, we have found a way to be comfortable in summer by reusing our home in a lower energy manner.

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## Our House

I retired last year and my youngest child started college in the fall. We are thinking about whether to move or stay in the same house. Our house was built about 25 years ago in a small development that is six miles from where I worked. It was not the largest house that we could afford; rather it was the smallest house that served our expected needs. That reduced our taxes and electric bills and enabled me to pay off the mortgage before I retired. It feels very good not to have to make mortgage payments.

There are no windows on the two sides of our house that face the neighbors on our side of the road. Our neighbors elected to add windows to theirs, but we didn't want to spend the extra money to install windows that would further increase our electric bills. That also resulted in fewer windows to wash and, paid additional dividends after we discovered that we had noisy, nosey neighbors. We have a huge wooded lot behind our house and it borders on park land. The view of woods is beautiful throughout the year, and breathtaking when the leaves change colors. The woods also serve as our own carbon sink, and that reduces the carbon footprint of our home.

We live in an area with relatively high radon levels. Over the years cracks developed in our basement and when I discovered that the radon level in the basement had exceeded the allowable limit, I sealed all of the cracks, instead of installing an exhaust fan that would use electricity. I am particularly concerned about radon because I am a cancer survivor.

The current market value of our house is within the price range where houses in our area are selling at a slow but sure rate (so it turned out to be a good idea not to purchase a more expensive home). There are a lot of opportunities to purchase a newer home at bargain prices today, especially the newer, mini-mansions with lots of big rooms, many bathrooms, and spacious living areas. However, the taxes and utility bills for those properties would be twice or three times higher than what I can comfortably afford. So it would make more sense to purchase a house that is even smaller than the one we own, but look for property with more woods and fewer noisy, nosey neighbors. My wife has also grown tired of mowing our lawn, so we would want to be sure not to clear the woods on the property.

Whether we stay in our current house or move to a new one, I would like to do some things differently. For example, I would like to have a white roof and white siding that will reflect the sunlight back into space to reduce our electric bills and also the greenhouse effect. I have noticed that our front door gets so hot in the summer that you can fry eggs on its surface. Even without having to focus the sun's rays, it is possible to get 1 kilowatt per square meter. So instead of using an oven, or backyard barbeque, I would like to cook outdoors with a solar cooker, which I have seen in Sacramento, and can be purchased online. If I am going to spend money on gadgets, it makes me feel better to know that what I do with them is contributing to the environment.

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1) Home weatherization especially air-sealing.

Most people buy into the idea of home weatherization. But for lots of reasons, the idea often does not get implemented. For example, in an “energy working group” discussion at a leading “green” non-profit, we had been discussing home energy audits over the course of several meetings. It occurred to me to ask which of the participants had gotten a home energy audit. Surprisingly, I was the only one (out of 6 or 7 who owned homes). I decided to have an energy audit at the end of 2009, and found it very informative, especially with respect to detection of problems with home air-sealing. I undertook the remediation myself, so that I could save money and learn by the process. 30 years before, when we had moved into the house, I had done a pretty good job of doing what was practical in insulating our 1940’s era home. However, I was not well-informed about the importance of airsealing. The audit blower door test showed that air leakage in our house was 2.1 times greater than optimal. I found multiple major penetrations by very systematically looking for air leaks (all of which were well concealed). Some penetrations (more than a square foot in area cumulatively) were holes for pipes, wires and vents, that were created when building an addition. Others were part of the original design of the house (especially a shocking open shaft about a square foot in area cross-sectional area running from the basement to the attic and therefore a contributor to “heat stack” losses). I sealed those penetrations with insulating foam. I look forward to measuring the air leakage with a repeat blower door test. But analysis of energy utilization indicates the air-sealing resulted in a 10-15% decrease in energy utilization (which is about \$175 per year at current prices). An additional 15% improvement was achieved by upgrading to a high efficiency furnace. I have also learned how to install partially reflective “window film” to a few key windows which contribute to major solar heat load in the summer (but are oriented so that they don’t provide much solar heating in the winter). All the tasks are pretty straightforward for anyone inclined to do-it-yourself solutions.

2) Working together to help others with improving their home weatherization.

I am working together with a wonderful non-profit organization, Rebuilding Together Montgomery County (RTMC) in helping provide home weatherization for other family’s homes. RTMC’s mission is to assist low income homeowners in Montgomery County with modest home repairs that contribute to the occupants’ safety, comfort and economy. One of RTMC’s major activities is matching homeowners-in-need with groups of community volunteers (5-50 in a group, typically from businesses or houses of worship). RTMC helps the volunteers plan for the repairs, and implement them on a “project day”; (project day is a euphemism, since it usually takes lots of advance planning and often more than one day to accomplish the tasks). RTMC organizes about 50 such projects a year. In theory home weatherization has been part of the RTMC workscope. In practice, very little home weatherization had been done prior to 2009. Through a fortunate confluence of circumstances, RTMC is now doing much more in home weatherization. I have contributed to some of the change, but the process has greatly accelerated by an Americorp intern who joined their staff in fall 2009, Chris Somers. With the

encouragement of Eric Coffman (MC Department of Environmental Protection), RTMC applied for and received a \$75,000 EmPower grant from MEA; this grant will enable us to do much more weatherization in the fall of 2010. Part of the satisfaction of these projects is learning skills from others, and teaching others skills which they can apply at home.