January 31, 2012

Revised for Public Presentation scheduled for February 11, 2012.

My name is Wayne D. Mackey, Jr. I am a retired nationally certified Workforce Development professional and a 100 percent disabled Vietnam War veteran. I graduated from Shippensburg State Teachers College in 1968 and retired from the PA Department of Labor & Industry in 2003. I have never had any formal training in building performance. What I have learned over these past four years came from doing online research and watching TV shows like “Renovation Nation,” “This New House,” and “Energy Now.” I have attended the past three “Energy & You” seminars at Wilson College and every local Home Builders Show for the past four years.

Over the past four years, my wife Diane and I have reduced our 33-year-old total electric home’s energy consumption by 82 percent. As a result of our home’s verified energy performance, we will be awarded a letter from Affordable Comfort, Inc. (www.affordablecomfort.org) certifying that we are the fifth home in the U.S. and Canada to officially meet the Thousand Home Challenge (www.thousandhomechallenge.org).

To meet the Thousand Home Challenge, a household must either verify a one-year energy reduction of 75 percent, or meet an absolute performance goal (not based on percentage) that takes into consideration household size, family members, climate, and heating source. Since our reductions were spread over a number of years, our performance goal was based on the second option to qualify. For an all-electric 2,500 square foot home in Chambersburg, PA, the Thousand Home Challenge threshold allowance is 6,488 kWh per year. During our monitoring year ending May of 2011, our household net energy consumption was 2,696 kWh, exceeding the threshold by more than 3,500 kWh! We are well on our way to meet the Thousand Home Challenge for the second year. (see Mackey case study: http://thousandhomechallenge.com/case-studies)

Our story began in July 2007, when Brian Roche, WGAL TV reporter, announced that the electric utility rate caps would be removed, beginning as early as January
January 31, 2012 for some residential consumers, and that our electric bills could go up as much as 40 percent. Considering that both my wife and I might be retired by that time, we decided to start doing something immediately to offset potential cost increases and simultaneously reduce our home’s carbon footprint. Also, Diane was diagnosed with a severe lung condition, which meant we needed to do something to improve the indoor air quality of the house.

We recognized that we first needed to establish a baseline to track the impact of our improvements. I contacted the Borough of Chambersburg’s Utility Billing Office to request a copy of all of our electric bills back to January 2005. They were very supportive, and within a week we had our utility history. I listed the monthly use and cost on a spreadsheet and continued to track them each month, taking special notice of what effect, if any, each new energy saving purchase had on usage and cost. (See Handout, “Energy & You – Mackey – 2-11-2012”)

Our first purchase was a new Evolution Series (SEER 18) (Seasonal Energy Efficiency Ratio) 2-stage air source heat pump manufactured by Bryant and installed by Travis Arnsperger, owner of Climate Control in Fayetteville, PA. [www.climatecontrolpa.com](http://www.climatecontrolpa.com). The new heat pump came with a super air filtration system for helping to clean the indoor air and a UV light. We felt this was essential as an investment considering Diane’s lung condition. The initial results were promising. This single purchase reduced our summer air conditioning costs by an estimated 30 percent. We also received a $1,000 rebate from the manufacturer. From that point on, we knew we were heading in the right direction. In 2010, we received a $1,500 federal tax credit. (www.Energy Star.gov) This single efficiency purchase in September 2007 has reduced our home's carbon footprint, and will continue to do so, for the next decade or more.

Next, we did a very simple and cost effective thing, replacing most of the incandescent light bulbs in our home with CFLs and LEDs. As actor Ed Begley, Jr. says in his book, “Ed Begley’s Guide for Sustainable Living,” "start by picking the lowest hanging fruit.” In other words, do the things that cost the least but will still make a big difference in your home's overall energy use. We may not need to replace these lights for years to come. As they say, hindsight is always 20/20. I
strongly recommend having a professional energy audit done prior to making any efficiency improvements by a Building Performance Institute certified professional (www.BPI.org).

In late 2008, I purchased all new “Energy Star” rated kitchen appliances for my wife, Diane, for Christmas. I had referenced Consumer Reports for their top picks, regardless of price or manufacturer. Efficiency and quality were my paramount considerations.

As Diane would later point out to me, all of the things we had done so far were regular household maintenance and replacements that all older homes need periodically to be kept up to date. We honestly believed that we had done enough by this time to have reached a 40 percent reduction in our electric bills, clearly offsetting the anticipated 40 percent increase in electric bills. We thought we were done.

But--Mother Nature, in her infinite wit and wisdom, had another surprise in store for us. She gave us two additional opportunities to make lemonade out of lemons, and, ironically, they made the most dramatic reductions in our overall energy usage. They hit our home out of nowhere.

On Sunday, August 19, 2008, we had the worst hail storm the southwest part of the Borough of Chambersburg we had ever seen. That fact was affirmed by both of my wife’s parents, who were fast approaching their 80th birthdays. Several previous storms also took down several large branches on three Bradford Pear trees in our southeast facing back yard, and we decided to have them cut down. We replaced them with 23 arborvitae. For the first time in memory our backyard was now bathed in glorious sunshine making it suitable for a solar photovoltaic array and a solar domestic hot water system.

After a suitable settlement was reached with our homeowner’s insurance agent in December 2008, additional insulation was blown into our attic. Within a few hours in the early spring of 2009, it went from R 11 to R 49, helping to both reduce our carbon footprint and save energy.
By mid-spring of 2009, we replaced all of our 30-year-old windows with triple pane windows. We purchased them from West Shore Windows and Doors, located in Mechanicsburg, PA. (www.westshorewindows.com) The windows have several coats of Low E glass, and have an SHGC (Solar Heat Gain Coefficient) of .23 and a U factor of .18, far exceeding even the Energy Star guideline of .30. The new windows helped reduce moisture condensation and street noise dramatically. We used part of the insurance settlement to purchase them.

At the very same time we were replacing all of our windows, we also replaced our old aluminum siding. Before doing this, we had two craftsmen install a one-inch thick Styrofoam rigid foam board to all of our exterior walls. “The 2x4 framed walls had an R-11 batt initially; and a quarter-inch thermoply was used as sheathing. However, due to their age, there was shrinking and exposed gaps between their seams. Adding the foam increased the R-value by 5. It took them about three weeks, working full-time, to do the exterior insulation and siding. They were able to coordinate their work with the window installer to ensure the tightest possible fit between their respective products. We replaced all 11 of our home’s windows. The cost of the one inch board was $3,380. We purchased the styrofoam insulation board from Joe Burkey (now deceased), the owner of The Burkhaus Distribution Center located in Thomasville, PA. He asked if I would take photos periodically while the siding contractor installed the insulated board so that he might later use them for advertisement purposes. If it wasn’t for his request, I would not have a well-documented project.

On December 23, 2009, only after we made the above energy efficiency changes, did my wife Diane and I install a 5.4 KWh solar photovoltaic array to the backyard facing roof of our home. It reduced our carbon footprint dramatically. We took advantage of the generous PA Sunshine Rebate and the 30 percent federal tax credit at the time of purchase--up to 65 percent off the installed price of the PV system. A $42,000 project became a $17,000 project. Since we installed our PV system, we have recouped more than $11,000 of the purchase price over these past 25 months, leaving just $6,000 remaining through direct reductions in our electric bills, SRECs, and referral bonuses.
In February 2010 we were inspired by the “Energy & You” seminar at Wilson College and began to seek bids from solar thermal installers within a 50-mile radius of Chambersburg, PA.

On May 21, 2010, a solar domestic hot water system was installed on the roof of our garage. It is an Energy Star appliance that has reduced our electric utility bill used to heat water by over 70 percent. It was installed by Bill Mooney, a master plumber of Appalachian Energy of Gettysburg, PA. (AppalachianEnergySystems@comcast.net). The solar arrays are considered appliances and are not subject to increasing property taxes.

On February 2, 2011, we had Energy Smart Home Improvement of Boiling Springs, PA, perform air sealing in the basement.

A pre-procedure blower test showed a CFM50 (cubic feet per minute at 50 Pascals) air infiltration reading of 1,630 CFM50. A post blower test reading was 1,425 CFM50, representing a reduction of 12 ½ percent. By closing the door between the first floor and basement, we got a reading of 1,350 CFM50. They also inserted a chimney balloon into the chimney to close off any down drafts from the outside. We stopped using the fireplace years ago because of the dust it made inside the house and it wasn’t healthy for us to breathe.

Together, all of the above energy upgrades and investments in renewables have made deep cuts in our home’s energy consumption over the past four years. Had we continued using energy in 2010 at the same rate that we had used it in 2005, we would have paid $3,065 for electricity, or $7.95 per day, every day. In ten years, without any further rate increases, that would amount to over $30,000. As a result of the improvements, we only spent $1.13 per day in 2011, or about $430 a year for all of our home’s energy needs. This includes charging an electric vehicle and driving it 1,000 miles.

On June 24, 2011, we installed two super-efficient 9,000 Btu Fujitsu mini-split ductless heat pump units that have a SEER rating of 26 and a heating seasonal system performance factor of 12. These new heat pumps provide more control of either heat or cooling by targeting specific room and floor areas based on the
occupants’ preferences.

On September 21, 2011, we installed an additional 1.8 kWh PV array on our garage roof to provide the electricity for the new 2012 Chevy Volt we purchased a few days later. It is the equivalent of purchasing a gas pump for $7,400 that gives us the capability of driving on free sunshine for the next 25 to 40 years. We took advantage of a $7,500 federal tax rebate and a $3,500 grant from the DEP with the purchase of the 2012 Chevy Volt, a 30 percent federal tax credit, and a $1,350 grant from the PA Sunshine Program for the new PV array.

On December 1, 2011, we had J.K. Mechanical (www.jkmechanical.com) install an eMonitor that monitors and records all 30 of our home’s electrical circuits. I will demonstrate it at the “Energy & You” seminar on February 11, 2012 at Wilson College.

As the saying goes, hindsight is always 20/20. Looking back over the past four years of our home’s deep energy reduction project, the questions become: what, if anything, would I have done differently, and what, if any, surprises did we encounter along the way?

First and foremost, I would have had a home energy audit done by a BPI (Building Performance Institute) certified professional prior to beginning the project. There is no question about it.

Secondly, I would have insisted on using only products made in the United States, by American workers, even though those products would have been very difficult, if not impossible, to find in 2007. Fortunately, that isn’t as great a challenge today, as more and more people realize that the era of cheap energy is almost over, and that we are at the dawn of a new 21st century of renewable energy. However, there still are far too few American manufacturers who can match the energy efficiency performance and cost of some foreign manufacturers who have historically been severely limited by their lack of natural resources, and have no choice but to get the most out of their products’ performance.

Necessity is the mother of invention. Therefore, on occasion, we still must turn to
foreign manufacturers whose products clearly demonstrate their enhanced capabilities. A primary example is the Japanese-made Fujitsu ductless mini-split air source heat pump.

Undoubtedly, the most surprising thing I discovered was that, of the many homes that were damaged by the major hail storm on Sunday, August 18, 2008 in our southwest Chambersburg neighborhood, I saw only two other homeowners take it upon themselves to improve the energy efficiency of their homes when they had this chance. One woman stopped by the house to see the contractors applying the insulated board to the outside walls of our house and replacing the old windows. When I explained it to her, she told me that she tried to talk to her husband about doing the same thing, but that he didn’t want to spend the insurance money. Go figure.

We were also very surprised, even shocked, to learn how high the radon levels were. Before we air sealed the basement in February 2011, a friend suggested that we might want to have the radon levels checked. When we got the results back a few weeks later, we found that the levels were higher than what the U.S. Government recommends as safe. We hired a highly skilled contractor and, within a few days, we had the problem mitigated. An electric vacuum now runs 24 hours a day, 365 days a year, which adds about $3.00 a month, or $36.00 a year to our electric utility bill.

When I began this project, the most important and difficult thing I had to come to realize was how little I knew about energy and the adverse impact we were having on the environment. Before that, I had just paid my electric bill on time every month as I had done for many decades. Oh, yes, I grumbled about the bill going up year after year, but I didn’t realize that there was anything I could do about it. I took it all for granted. I didn’t even know that, as a resident of Chambersburg for the first 11 years, I was part of an electric co-operative. Nor did I fully appreciate all of the hard work and dedication that the employees of the Borough of Chambersburg Electric Utility do every day to keep the lights on.

Lastly, but most importantly, every house has unique structural characteristics. No
two are alike, and no two will require the same methods to resolve their energy-related problems. Every occupant in the house values and uses energy differently. The cheapest energy is the energy we don’t use.

Recommended websites

Affordable Comfort, Inc., (ACI) – www.affordablecomfort.org
Consumer Reports – www.ConsumerReports.org
DSIRE (Data Base of State Incentives for Renewable Energy) – www.dsireusa.org
Efficiency First – www.efficiencyfirst.org
Energy Start Most Efficient!
www.energystar.gov/index.cfm?c=most_efficient.me_index
Keystone Help – www.keystonehelp.com
NREL (National Renewal Energy Laboratory) – www.nrel.gov
PA Home Energy – www.pahomeenergy.com
RMI (Rocky Mountain Institute) – www.rmi.org
SunPower USA – www.Sunpower-usa.com
Top Ten – www.toptenusa.org/