



Our Green Home: 20 Years of Living Green...

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<http://www.the-mcelroys.com/>

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What is a Green Roof?

- Any roof with planned vegetation
- Usually low maintenance plant blend like sedum (desert, drought-tolerant plant)
- Composite underlayment with copper layer to keep roots from penetrating
- Lifetimes of 50+ years
- Cost varies from \$15-25/sq ft, or as low as \$6/sq ft if existing membrane used

Green Roof Pictures

Installed in June 2005, still doing great in 2014



Green Roof Financial Benefits

- Savings from avoiding new roof installation
 - Grass roof lasts 50+ years versus ~10 for asphalt
 - Vegetation/soil protect roof membrane
- Air Conditioning and heating savings
 - 20% AC savings in first month after roof installed
- Tax rebates
 - Federal tax rebate for homeowner, plus potential state property tax benefits
- Stormwater management savings
- Pays for itself in ~10 years

Green Roof Environmental Benefits

- Restoring vegetation
- Providing home for insects, animals
- Filtering air & water
- Lowering ambient temperature
- Minimize use of asphalt to make roof
- Eliminate fuel, labor, transport associated with standard roof replacement
- Fight global warming: plants take CO₂ out of the air, plus less electricity used for air-conditioning

Green Roof Morale Benefits

- Increases productivity of workers / students by 20% if they have a view of a green area
- Lowered sound inside building
- Satisfaction of seeing a physical thing you are doing for the environment
- Increased exposure to natural environment and season changes
- Beauty

Cost Considerations

- Extensive (relatively thin soil, short uniform plants) versus intensive (include trees, bushes, vines, garden, etc; thicker soil, higher cost)
- Pods versus mat
- Mature plants versus plugs



Installation Considerations

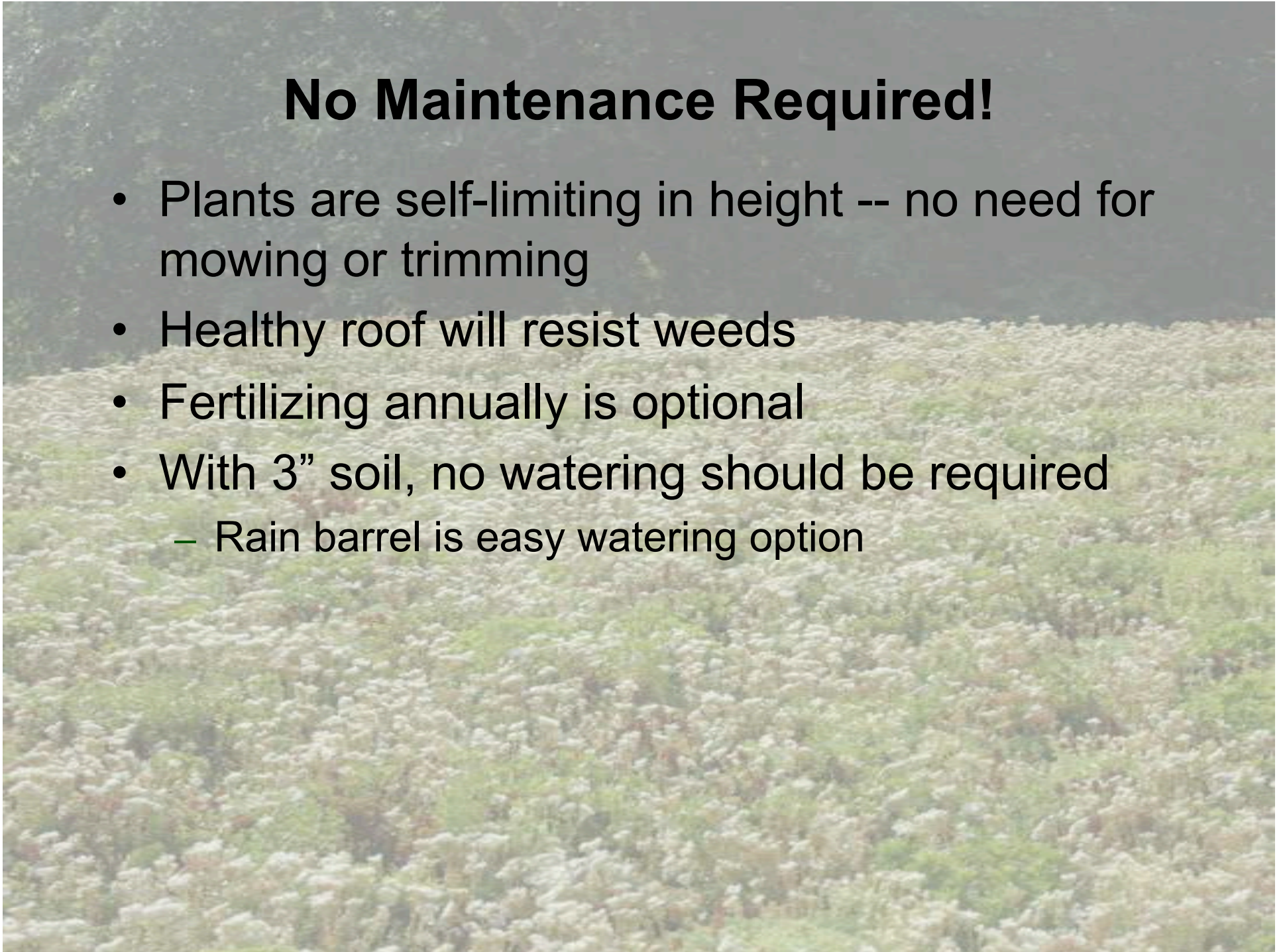
- Roof can be flat or angled, up to 45° angle
- Check load limit for roof structure (most roofs will be fine with 'extensive'-type roof weights)
 - Minimum weight 15 lb/ft², prefer 22 lb/ft² for thicker soil
 - Tapered foam to add small angle to flat roof
- Use contractor familiar with local green roofs
 - Evaluate plant type mix for sun/shade/moisture
 - Varied plant mix normally used, self-selects for local micro-climate

Ideas to consider

- Small rain barrel / soaker hose for watering in a drought (2-3 times/year)
- Outdoor access/viewing area
- Minimize leaf fall areas
- Flowering plant mix to cover all seasons
- Native plant mix for even more environmental benefit

No Maintenance Required!

- Plants are self-limiting in height -- no need for mowing or trimming
- Healthy roof will resist weeds
- Fertilizing annually is optional
- With 3" soil, no watering should be required
 - Rain barrel is easy watering option



Lessons Learned

- I now wish we had done the whole back of our house, including the slanted portions
- We retro-fitted with rain barrel and soaker hose, because the roof gets stressed in severe drought
- We should have installed earlier (April instead of June)
- Thicker soil (growing media) will help roof survive drought
- Never fertilize when roof is dry

Links

- Our site, <http://the-mcelroys.com/>
- Local installer, Live Roof
 - <http://www.liveroof.com>
- Sidwell Middle School example
 - http://www.sidwell.edu/green_tour/
- Green roof reference, searchable database
 - <http://www.greenroofs.com/>
- Cradle to Cradle Design
 - http://www.mcdonough.com/cradle_to_cradle.htm
- NBC Nightly News green roof story (our roof)
 - <http://www.msnbc.msn.com/id/15223547>

Reference Books

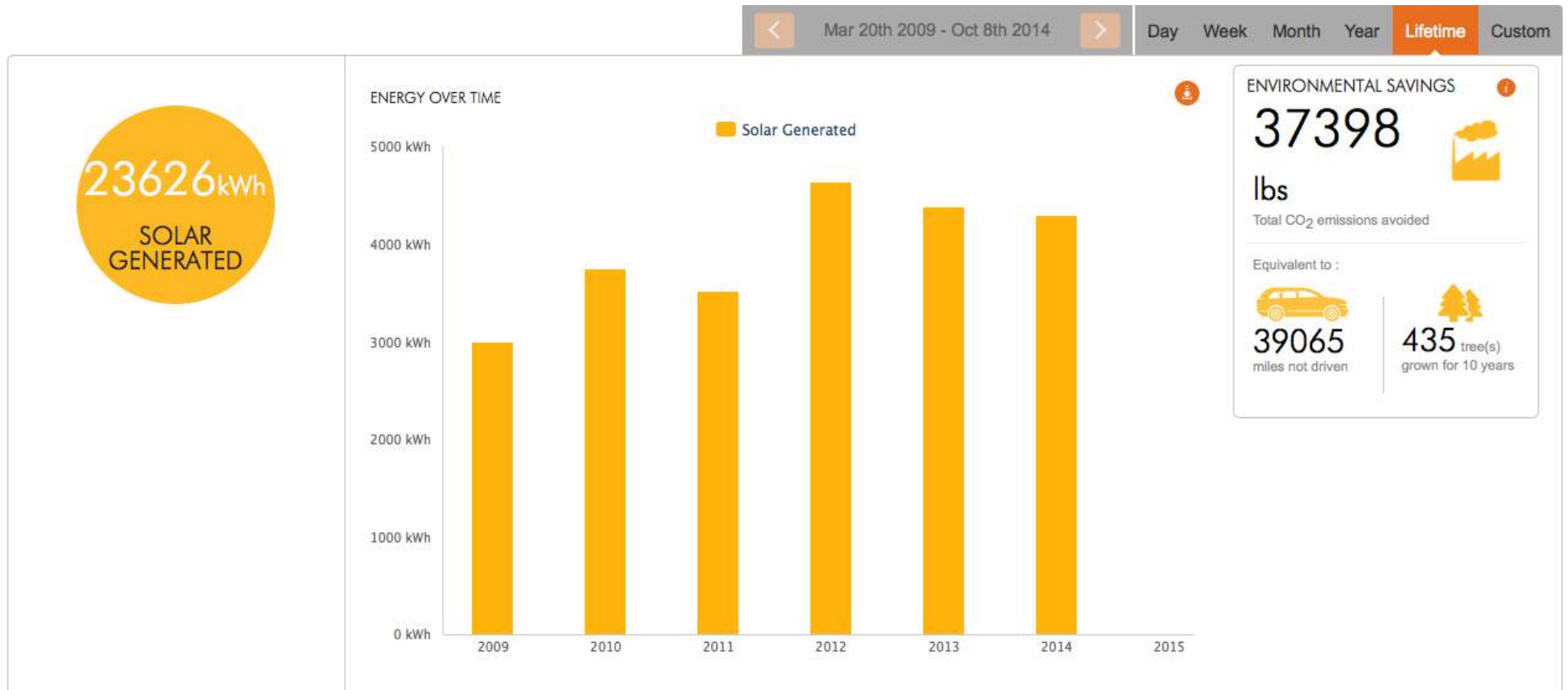
- *Green Roof Plants, A Resource and Planting Guide*, Edmund Snodgrass
- *Green Roofs and Living Walls*, Nigel Dunnett
- *Cradle to Cradle*, William McDonough
- *Natural Capitalism*, Paul Lovins
- *Bringing Nature Home, How Native Plants Sustain Wildlife in Our Gardens*, Douglas Tallamy







Sunpower Web Interface



Solar Payback Times

PV solar system

Cost: \$30,000
 Federal tax credit (30%) **\$9,000**
 remainder \$21,000

SREC income per year \$1,575
 Electricity offset income per year \$715
 Total annual income \$2290

Years to pay off investment 9
 Equivalent to 9% tax-free investment!!
 Plus, if you sell your house, you can make this back

The Good News:
 We paid \$10/W, cost
 is now \$2.50/W

4-5 SRECs per year

The Bad News:
 SREC market is
 much lower now
 than in 2009

Solar hot water

Cost: \$9,000
 Federal tax credit (30%) **\$2,700**
 remainder \$6,300

SREC income per year \$1,500
 NG offset income per year \$300
 Total annual income \$1800

Years to pay off investment 4

PV payback time
 still ~8 yrs

4 SRECs per year

Solar Considerations

- South-facing roof best, must be within 45° of S
 - No shade 10-3 desired; take photos before installation
- 30% federal tax credit
- Financing available
- Cost drop: \$10/W installed in 2009 to \$2.50/W today
 - Can use co-op method for install at \$1.50/W
 - Suntern Solar
 - SREC market lower than in 2009

Our rainwater cistern & rain garden



Gardening / Water use

- 3000-gal rainwater collection cistern to use for sprinkler system, hoses, and toilet flushing
- Compost all food waste and yard waste
- Plant/landscaping with native plants
- Rake rather than use blower (goal)
- Minimized lawn area
- Mulch-cut lawn instead of bagging clippings
- No chemical fertilizers or herbicides etc on yard or garden beds

Our composters...



Benefits of composting



- Keep yard / food waste out of garbage dump
- Create homemade fertilizer – eliminates need for chemical and petroleum-based fertilizers
- Eliminate transport of yard and food waste out, chemical fertilizers in
- Regenerate poor soil, reduce need for water
- As alternative to using disposal, eliminate water wasted and reduce wear on disposal

Yard trimmings and food residuals together constitute 24 percent of the U.S. solid waste stream. That's a lot of waste to send to landfills when it could become useful and environmentally beneficial compost instead!



Eco-friendly lawn care

- Minimize mowed area!!
- How and why to avoid chemicals/fertilizers
 - Cut down fertilizer run-off into bay
 - Mulch cut
 - Use corn meal or other natural weed preventative
- How to decrease water use
 - Water early in am
 - Water only if lawn is stressed
 - Water infrequently but deeply
 - Rain barrel or cistern



Native landscaping



Goldenrod, milkweed, summersweet, sweetspire, swamp azalea, swamp rose, Joe Pye weed, beebalm, Culver's Root, wintergreen, blue star creeper, inkberry, beautyberry, spiderwort, wild petunia, thyme, passion flower, coral honeysuckle, St. John's Wort ...



Why Use Native Plants?

- Need less water
- Thrive in local conditions
- No need for chemicals
- Rescue natives from extinction
- Local insects thrive, providing food for birds and fledglings
- Re-create wildlife ecosystems/habitats
 - Hedgerow is a wonderful wildlife sanctuary
- For more, read *Bringing Nature Home*



Why Not Use Alien Plants?

- Can take over and destroy native plants and eco-system
- Can require large amounts of nitrogen fertilizer, herbicides, etc.
- Foreign diseases can be imported with plant, destroying native population
- Foreign pests can be imported with plant, and become runaway (no natural predators)
- Can require excessive watering
- No benefit to local ecosystem

Permeable Pavers

- Our driveway was originally:
 - Asphalt
 - Very bumpy with pine roots
 - Subject to major puddling
 - Caused heavy runoff to the Bay
- We installed pavers with permeable edges
 - Graded so runoff went to 4'-8' holes (French drains)
 - All runoff captured
 - No more puddling
 - It's beautiful!







Wetlands Buffer

- We live on the Lafayette River
- Much of our property is wetlands buffer
- We have marsh grass and native wetlands plants, rather than a seawall or rip-rap
- We encourage others to do this -- many benefits to health of the Bay





Energy

We...

- Use solar power!
- Drive an all-electric i3
- Telecommute 2 days per week
- Carpool to work intermittently
- Kids carpool to school
- Carpool to kids' activities where possible
- Use fluorescent or LED light bulbs
- Use LED Christmas lights (and replaced halogens with LED)
- Maximize time that we have heating and A/C turned off -- goal is 3 months in spring and 3 months in fall
- Use a whole house fan
- Don't dry clothes all the way in dryer -- hang dry after short time in dryer
- Turn oven off before end of cooking time
- Use just enough water to cover when cooking pasta (not 6 quarts!)
- Until December 2008, we bought 100% wind generated electricity from Pepco, with Dominion as our distributor. Then Dominion won an SEC case that pushed Pepco out of the Virginia market.

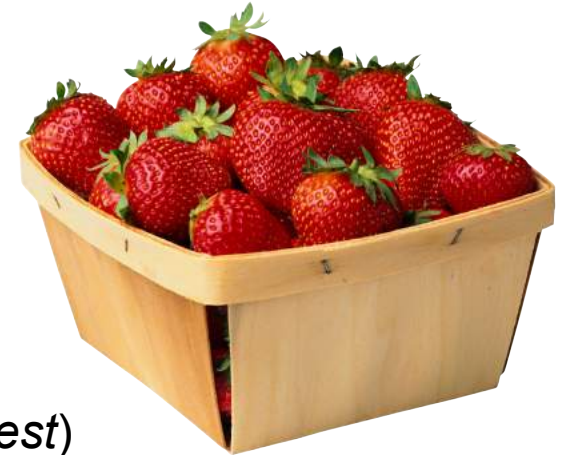


Recycling / Reuse

- Use all recycled paper products, including toilet paper, paper towel, napkins, copy paper, sticky notes
- Use compostable tree-free paper plates (don't use often)
- Use recycled toothbrushes that we send back for re-recycling into plastic furniture (Preserve toothbrushes)
- Recycle all feasible materials in our household
- Use scrap paper where possible
- Grocery shop (and other shopping) using cloth and string bags
- Re-use plastic grocery bags
- Re-use egg cartons (take back to store for re-use by poultry farm)
- Use reusable water bottles instead of disposable plastic: see <http://storyofstuff.org/movies/story-of-bottled-water/> for why to avoid plastic
- Use rechargeable batteries
- Save and re-use all bubble wrap and Styrofoam peanuts
- Recycle all home appliances and electronics at e-cycle days
- Save children's clothes/toys; offer to other families, then take to second-hand clothing store; buy some of kids' clothes from second-hand store



Food / Kitchen



- Small garden for growing some of our own food
- Buy organic where possible
- Milk (in glass) delivered from local dairy
- Don't eat imported shrimp (after I read *Stolen Harvest*)
- Eat low on the food chain
- Member of a CSA (community supported agriculture) to get produce from local farmers
- Started healthy snack program at my kids' school where we buy all organic whole-grain snacks, and serve fresh produce
- Grind own flour, use natural sweeteners
- Prepare food fresh, rather than canned, frozen, or pre-packaged
- Participate in soup kitchen for homeless (donate cases of fruit, eggs); save holiday candy for that rather than discarding
- Use non-petroleum, non-phosphate laundry detergent and dishwasher soap
- Buy bamboo products rather than wood or plastic

Recycling



- Aluminum Recycling Facts
 - Making one aluminum drink can from raw materials uses the same amount of energy as making 20 recycled cans
 - Recycling 1 kg of aluminum saves 8kg of bauxite, 4kg of chemical products and 14 kW of electricity
- Plastic Recycling Facts
 - Americans drink about 167 bottles of water each, but only recycle 23%, leaving 38 billion bottles in landfills
 - Bottled water costs \$1 - \$4 per gallon -- 90 percent of the cost is in the bottle, lid and label
 - The average American consumed 1.6 gal of bottled water in 1976. In 2006 it was 28.3 gal
 - It takes over 1.5 million barrels of oil to make a year's supply of bottled water - enough oil to fuel 100,000 cars
 - Plastic bottles take 700 years before they begin to decompose in a landfill
- Paper Recycling Facts
 - Americans use over 700 pounds of paper per year – each
 - More than 90% of US paper is from virgin trees – half of all logged trees
 - To make a ton of paper from virgin tree fiber requires 2-3 tons of trees (versus using 1 ton of recycled stock)
 - Manufacturing recycled paper takes less water and energy, and produces less air pollution
- Our rolling blue bins take all scrap paper, cardboard, aluminum, glass, plastics #1-6 (must have a neck)

Environmental Action

- Have a huge lending library of environmental books
 - Send environmental books to selected political leaders
- Annually submit shareholder resolution to Dominion Resources on renewable energy
- Invest in socially and environmentally conscious funds, invest in community notes, give to Heifer International and similar groups
- Kids ask for donations to charitable groups rather than birthday presents at their birthday parties
- Give blood
- Clean the Bay Day – cleaning up our local waterfront!
- Volunteer for elections where environmental issues are at stake
- Give environmentally related lectures to various groups like this one!

More info

- <http://www.the-mcelroys.com/> has this and more
 - Book recommendation list
 - Excel sheet of solar costs and payback times, financing options
 - Information on selling solar renewable energy credits (SRECs)
 - List of all the things we do (and you can too!)
- <http://www.ceres.org/investor-network/resolutions>
 - Environmental shareholder resolutions

Encouragements – Get Active!

- Write your Virginia state congressmen and ask that the Virginia renewable energy standard be made mandatory. Push for incentives for electric utility efficiency
- Email your federal representatives and push for greenhouse gas emission cap
- Become a Dominion stockholder and vote on how your electricity is produced
- Comment on cases brought to the VA SCC
- **Read, read, read !!!**



Questions?

<http://the-mcelroys.com/>

Virginia State Executive Order for Roofing

COMMONWEALTH OF VIRGINIA



OFFICE OF THE GOVERNOR

Executive Order 48 (2007)

ENERGY EFFICIENCY IN STATE GOVERNMENT

Importance of the Initiative

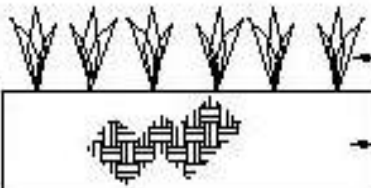



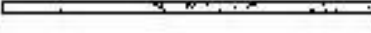

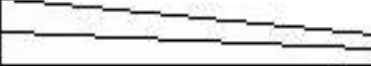

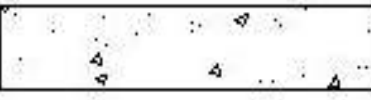
Commonwealth agencies and institutions spent over \$290 million in fiscal year 2006 for facility and transportation energy. It is critical that the Commonwealth use energy in the most efficient manner possible to save taxpayer money and provide leadership to all Virginians in using our natural resources wisely. Improvements in energy efficiency and protection of our priceless natural resources are inseparable goals. Reducing the amount of energy we consume will reduce the emission of greenhouse gases that are largely responsible for global climate change. State government has the capacity and responsibility to save taxpayer money while protecting our climate and natural resources for future generations.

The Commonwealth's citizens, businesses, and governments are also faced with managing the effects of more costly and less reliable supplies of energy, as well as the environmental effects of energy production and consumption. In response, the General Assembly enacted into law in 2006 a state energy policy and directed the Department of Mines, Minerals and Energy to develop the Virginia Energy Plan. This requires coordination of energy activities among many private organizations and state agencies and institutions.

By the power vested in me by Article V of the Constitution of Virginia, and Section 2.2-103 of the *Code of Virginia*, and subject always to my continuing and ultimate authority and responsibility to act in such matters, I hereby direct the Governor's Secretaries and all executive branch agencies and institutions to reduce energy

This executive order says, among other things, that all government buildings with over 5,000 feet of roof space must consider a green roof or solar panels when renovating their roof.

Green Roof Structure (lb/ft²)

| | <u>WEIGHT</u> |
|---|----------------------------|
|  <p>VEGETATION</p> <p>GROWING MEDIA (3.5")</p> | 18.0 |
|  <p>FILTER FABRIC</p> | .035 |
|  <p>TOP PLY (FAMOGREEN RET CU P4)</p> | 1.89 |
|  <p>BASE PLY (FAMOBIT P4)</p> | .80 |
|  <p>DENS DECK (1/4")</p> | .50 |
|  <p>INSULATION ADHESIVE</p> | .25 |
|  <p>TAPERED INSULATION (3"AVG.)</p> | .75 |
|  <p>INSULATION ADHESIVE</p> | .25 |
|  <p>CONCRETE DECK</p> | <hr style="width: 100%;"/> |
| TOTAL WEIGHT | 22.475 |