The Half Plan

by Gary Reysa

Reducing Your Carbon Footprint

Part One: Thermal Gains

Almost all human activities impact the environment, but it's only been in the past two centuries that we've witnessed a marked increase in the atmospheric concentration of carbon dioxide (CO_2) as a result of one main activity—burning fossil fuels for everything from home heating to electricity generation to transportation.

An average American contributes 40,000 pounds of CO_2 each year: the equivalent of making almost two complete trips around the globe in a 20-mpg SUV. Many scientists say that our overloading of the atmosphere with CO_2 is increasing the severity of storms and droughts, and having an impact on ecosystems worldwide. Although global warming's full-scale impacts are difficult to predict, researchers say that its probable effects—water shortages, coastal flooding, rising agricultural pest populations, and habitat disruption—will be far reaching.

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The good news is that taking steps to minimize your carbon footprint—the total amount of CO_2 you generate each year—can make a difference, both for the planet and for your pocketbook. Conserving energy and improving your home's energy efficiency will lower your heating and electricity bills, and driving a more fuel-efficient car can save you hundreds of dollars at the pump each year.

Cut Your Consumption

"Half" is my family's plan to reduce our energy consumption and greenhouse gas emissions by 50 percent. We took on more than 20 projects that fit our skill levels and particular household needs. You can follow our progress—and implement your own plan—over the next few issues of *Home Power*, where we'll describe seasonal projects we completed at our house, and give estimates of cost, economic return, and greenhouse gas reduction.

The CO_2 Reduction Plan

1. Conduct a home energy audit and make a list of potential projects to reduce your household energy use. Many utilities will send out a technician, often for free, to assess your home's efficiency—from basement to attic—and provide a report and recommendations for efficiency upgrades. Some utilities even offer rebates to offset the cost of certain projects, like replacing windows or installing a new furnace. If your utility offers blower door and duct blower tests, use that opportunity to find and seal all the locations where air is infiltrating.

If you're off the grid, or your utility doesn't offer audits, you can perform an energy audit yourself, using the online Home Energy Saver program (see Access).

2. For each project, estimate the cost, energy savings, time and degree of difficulty, and greenhouse gas reduction. For insulation upgrades you can use the Insulation Upgrade Cost Saving Calculator (see Access). Simply enter a few figures, and the calculator will determine your first-year and projected 10-year savings, and CO_2 emissions reduction.

For this article's projects, financial savings in fuel in the first year are based on the projected kilowatt-hours (KWH) saved, and multiplied by 10 cents per KWH—my cost for utility electricity. The projected 10-year fuel savings assumes a 10 percent rise in fuel prices each year. Converting all nonelectrical forms of the energy to KWH will allow you to compare energy savings for electricity, transportation, and heating projects on the same basis. Some handy conversion factors:

1 KWH = 3,412 Btu

1 gal. of propane = 92,000 Btu or 27 KWH

1 therm of natural gas = 100,000 Btu or 29.3 KWH

1 gal. of gasoline = 125,000 Btu or 36.6 KWH

1 gal. of heating oil = 139,000 Btu or 40.7 KWH

To estimate greenhouse gas savings for each project, I used the calculator at www.infinitepower.org. For transportation-related energy and greenhouse gas savings, I recommend the www.hybridcars.com calculator. (See Access for more resources.)

3. Using the results of your evaluations, list all the projects that have good payoffs—both economic and environmental. Prioritize projects according to CO_2 savings, and budget, time, and skill constraints.

4. Keep a file of your utility bills to review, so you can see what progress you are making. The bills can also be used to demonstrate your home's improved energy efficiency, if you plan sell it, and may be needed to claim rebates or tax credits.

Investing in energy-saving projects to reduce greenhouse gas emissions is a win-win situation—you can do something that is good for the planet and also earn a good economic return.

Window Dressing

Our home, with its large expanses of east-facing, double-glazed windows, doesn't make heating easy. To minimize heat loss and reduce air infiltration, we added two types of thermal shades. Both are accordion-pleated, but one style has an "Energy Track" on the sides (see photo), which prevents air from flowing around the edges of the shade. The shades' manufacturer claims R-values of R-2.8 without the track and R-4.3 with the track, giving total R-values of 4.8 and 6.3, respectively, for the windows in my home.

The energy savings for improving window R-values by using storm windows or thermal shades can be estimated using the Insulation Upgrade calculator (see Access). You will need to know the window area, the existing window's R-value, and the improved R-value. Single-glazed windows have an R-value of about 1; double-glazed windows about R-2; and double-glazed, low-E, argon-gas-filled windows about R-3. More exact values can be found at www.efficientwindows.org using their Window Selection Tool. A more precise method would be to use RESFEN, a free software program that provides an hour-by-hour heat loss simulation (see Access).

Project 1: Custom Thermal Shades

Up-front Cost: $1,086 (8 shades, various sizes, 140 sq. ft. total)

DIY Labor: 3 hrs.

DIY Difficulty: 3 (on a scale of 10)

Annual Energy Savings: 3,159 KWH or 117 gal. of propane*

First Year Energy Cost Savings: $258 (117 gal. of propane at $2.20 a gallon)

Projected 10-Year Savings: $4,109

Annual CO_2 Reduction: 1,525 lbs.

Energy Use Reduced: Propane

*For details on the assumptions and calculations used to determine energy and dollar savings, see www.builditsolar.com/References/Half/Projects.htm

More Panes, More Gain

Oddly shaped windows are architecturally interesting, but can be a heat-loss nightmare, and difficult to insulate with any kind of conventional thermal shade or shutter. Customized interior storm windows made from triple-wall polycarbonate glazing can boost insulation values by an additional R-2.5, while still allowing daylight in and a (slightly distorted) view out.

Project 2: Insulating Panels

Up-front Cost: $450 (for 6 panels, various shapes, 134 sq. ft.)
DIY Labor: 8 hrs.
DIY Difficulty: 4
Annual Energy Savings: 2,700 KWH or 100 gal. of propane
First Year Energy Cost Savings: $220
Projected 10-Year Savings: $3,500
Annual CO_2 Reduction: 1,100 lbs.
Energy Use Reduced: Propane

A Perfect Storm

A smaller, but still significant, project was adding a glass storm door to the front door, which helped reduce the thermal losses for both conduction and infiltration. By replacing the glass with a screen in the summer, it also allows for better ventilation in warmer months.

Project 3: Glass Storm Door

Up-front Cost: $200
DIY Labor: 3 hrs.
DIY Difficulty: 4
Annual Energy Savings: 216 KWH or 8 gal. of propane
First Year Energy Cost Savings: $18
Projected 10-Year Savings: $270
Annual CO_2 Reduction: 100 lbs.
Energy Use Reduced: Propane

The DIY Scale of Difficulty

1	As easy as changing a lightbulb
2	Still easy, but a bit more time consuming
3	May involve installing more complex devices, making simple parts, some ladder work, or working in dusty or awkward places
4	Like 3, but a bit more complex or time consuming
5–7	Projects require some design and planning, and mechanical or carpentry skills
8–9	A good challenge for almost any DIYer
10	Nearly impossible for ordinary mortals

Wise Drying

The advantage of venting a dryer to the inside is twofold: you recover much of the heat that was added to dry the clothes (about 2.2 KWH per load); and you avoid bringing in cold outside air to make up for the air that the dryer is pushing outside.

To vent to the inside, you need 1) a dry climate, 2) an electric—*not gas*—dryer, and 3) a way to catch the lint in the dryer exit stream. (Gas dryers should never be vented inside, since the vented air contains combustion by-products. Electric dryers should only be vented inside if your climate is dry—be alert for moisture problems, such as mildew buildup and excessive condensation on windows and door frames.)

The simplest way to vent the dryer to the inside is to separate or cut the dryer vent pipe, and duct-tape a pair of pantyhose as a lint trap over the vent. To prevent cold airflow, block off the vent pipe leading to the outside. Be sure to regularly check the new lint trap for clogging and keep good air movement through the dryer. Once warmer weather has arrived, you can splice the cut pipe back together to vent the hot air outside.

Project 4: Dryer Vent

Up-front Cost: $20 (tubing and a lint filter)
DIY Labor: 2 hrs.
DIY Difficulty: 3
Annual Energy Savings: 630 KWH
First Year Energy Cost Savings: $63
Projected 10-Year Savings: $1,002
Annual CO_2 Reduction: 286 lbs.
Energy Use Reduced: Propane (reduces space heating needs)

Cold House, Warm Bed

In our frigid Montana climate, keeping warm can be a struggle—and heating bills can eat a household alive. Although we set the bedroom area thermostat to 62°F at night, the bedroom's forced-air furnace would still cycle off and on frequently.

Our solution was to use electric mattress pads (aka bed warmers), and heat the bed instead of the room. Unlike electric blankets, the power consumption for mattress pad heaters is very low (about 13 W each). Using the pad heaters at night allows us to turn off the furnace that heats the bedrooms. The savings in propane is considerable, the comfort is outstanding, and—even better—there's no furnace noise.

Project 5: Electric Mattress Pads (2)

Up-front Cost: $125 (for a king-size bed)
DIY Labor: 0 hrs.
DIY Difficulty: 0
Annual Energy Savings: 1,270 KWH or 47 gal. of propane
First Year Energy Cost Savings: $103
Projected 10-Year Savings: $1,624
Annual CO_2 Reduction: 510 lbs.
Energy Use Reduced: Propane

Resources

Carbon Calculators

HybridCars.com • www.hybridcars.com/calculator • CO_2 calculator for vehicles

Infinite Power • www.infinitepower.org/calculators.htm

Safe Climate • www.safeclimate.net

Window Information

Efficient Windows Collaborative • www.efficientwindows.org

Co-Ex Corp. • www.co-excorp.com/mac.html • Multiwall polycarbonate panels

RESFEN, Window Heat Loss Simulation software • http://windows.lbl.gov/software/resfen/resfen.html

Symphony Shades, with Energy Track • www.symphonyshades.com/comfortracks.html

Project Evaluation Software

Insulation Upgrade Calculator • www.builditsolar.com/References/Calculators/InsulUpgrd/InsulUpgrade.htm

HEED Simulations Software • www.aud.ucla.edu/heed/

Home Energy Saver • http://hes.lbl.gov/ • Online DIY home energy audit

Example Evaluations • www.builditsolar.com/References/half/projects.htm

Next Issue—Trimming Your Waste Line

Gary's family puts their household on an energy-slimming diet, and offers more tips on how you can cut your electricity use and reduce your household CO_2 emissions.

Your Solutions

What smart steps have you taken to reduce your carbon footprint? Write to us at footprint@homepower.com. If we choose to print your projects, you'll get a free *Best of Home Power* CD-ROM and a one-year gift subscription to send to a friend or family member.

Access

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