

Alternative Energy on a Budget - Part 1

Solar panels are for rich people. High tech “energy efficient” homes are for rich people. Hybrid cars are for rich people. What about the vast majority of New Mexicans? What can NMSEA offer them? This is a fairly common theme in our organization. It surfaces regularly in Board meetings and in committee meetings and in private discussions. Turns out that it’s a tougher nut to crack than you might think.

One of the striking things about reviewing documents and reports generated by NMSEA in the 70’s and early 80’s is the strong focus on solar from the bottom up, ie projects and approaches that were meant to be available to almost everyone. NMSEA members championed passive solar building techniques and hands-on owner-builder do-it-yourself approaches that quickly spread across the country. But for a variety of very real reasons, many of those solar projects and initiatives have gradually faded into the sunset. Solar remains the exception, not the norm in rich and poor neighborhoods alike.

Today the alt-E emphasis seems to be on state-of-the-art grid-tied PV systems, active solar thermal hot water or radiant heating systems, and high-tech Prius hybrid or Tesla electric vehicles. “Tax incentives” are designed to drive “investment choices” that will jump-start the “Green Economy”. PV is proposed as the answer to Global Climate Change. A recent Solar Today article advised us to overlook financial justifications for PV and focus on “energy payback”. Expensive PV systems are starting to compete with Mercedes Benz and Santa Fe Style for status symbol cachet in one of the poorest states in the whole country. In 1989 Mother Theresa established a mission in Gallup, New Mexico. Think about it.

In most New Mexicans’ minds “solar energy” means “solar panels” period. High quality well installed solar PV, water or air panel systems work, but they’re expensive. These systems must be paid for out-of-pocket. Federal and state tax incentives don’t pay for solar energy systems, they reduce income taxes. A surprising number of New Mexicans pay little or no income tax. Average household incomes for 80% of New Mexicans have actually fallen in the past decade, not even considering the current economic crisis.

As for “investments” and “status symbols” – get real. PV and solar hot water systems are simply out of the question for most New Mexico families. So what are some viable solar related alt-E options for those who don’t have the kind of disposable income it takes to buy conventional solar energy systems?

Articles and magazine spreads and workshops touting energy saving ideas, strategies and home improvements are everywhere. Caulk and seal and insulate and change light bulbs and upgrade your old fridge. All worthwhile suggestions, and ones that NMSEA advocates in our own literature and workshops. Great energy related do-it-yourself projects can be found in back issue collections of Mother Earth News and Home Power magazine. But how about some ALTERNATIVE alternative energy ideas for New Mexicans on a tight budget?

About 10,000 years ago some enterprising folks in the Fertile Crescent came up with a way to capture & store solar energy that revolutionized human civilization – they planted gardens. Who plants gardens these days? I live in Albuquerque, but I spend a lot of time in rural New Mexico – gardens are an endangered species everywhere. If you want to harness solar energy, supply your family with healthy food, and save some serious money in the process, then plant a big garden. Extend the growing season with dark colored solar powered rock or adobe walls in your garden. There are all kinds of solar powered greenhouse designs that can be built from readily available materials. Dark colored rocks, or dark barrels or large diameter black plastic pipes filled with water can make a great temperature control system for a simple greenhouse. Instead of using expensive and energy intensive fertilizer, harness compost and mulch and earthworms. If you choose your plants wisely, you may be able to sell some of your bounty - legally.

Continuing the food theme, lifestyle changes are free and they can have a huge impact on the planet. To quote from a recent article in Solar Today – *“The average North American who quits eating meat saves a ton and a half of carbon dioxide per year. That’s equivalent to installing a 3.75 KW photovoltaic system in a sunny climate. And a lot cheaper.”* The good news is that just cutting back on meat consumption as well as on other items that take lots of energy to manufacture & distribute such as fast food and junk food and sodas can make a big positive difference in the health of the planet, in the health of your family and in the health of your bank account. Win-win-win.

A surprising number of New Mexicans heat their homes with a renewable, solar sourced, environmentally acceptable and (in theory at least) carbon neutral fuel that was first harnessed at the dawn of human prehistory. It’s called wood. Most fireplaces are better at cooling a large house than heating it, but woodstoves are a different story. If you can figure out how to supply outside air rather than inside air for combustion, then you have an efficient and economical heat source. Modern high efficiency wood stoves are worth the extra investment because they generate more heat per cord while significantly reducing polluting byproducts. And of course the ashes go into that garden of yours.

Carbon capture & storage (sequestration) is a hot topic these days. Scientists and engineers are proposing all sorts of new technologies to save the earth from us. So sequester some carbon the old-fashioned way – plant a solar powered tree. In fact, plant lots of trees. Raise them from seeds or sprouts (in your solar powered garden) and spread them around in acts of random solar powered hopefulness. There’s no better expression of optimism for a sustainable future than planting a tree! And while you’re at it, you’re replenishing the stock of those trees that you burned in your wood stove. You can also sequester carbon by composting a good part of your household garbage – even newspapers, not to mention the leaves from all those trees – for use in that garden of yours.

In New Mexico, summer coolth is as important as winter warmth. Our flat tar & gravel roofs are solar thermal nightmares in July, and our unshaded west facing windows and house walls are solar furnaces in August. One of the most effective ways of saving the planet is to opt for a white roof. Send most of that energy back where it came from, stay cool, and save money on air conditioning all at the same time. The same goes for the sunny west-facing wall of your house. Paint or restucco it white or a light color. Add a healthy overhang or awning to west facing windows. Plant some of those solar powered trees so they shade the west side of your house. The flat roof on my old house is now white, and the un-shaded west wall was re-stuccoed Navajo White instead of Buckskin Brown like the other walls. The temperature difference in the summer is amazing.

Windows play a major role in home heating & cooling efficiency. If you can't afford to replace your windows, and you've already caulked & sealed them, then what else makes sense? Thermal shades or drapes can make a huge difference in comfort and energy bills, both winter and summer. Check out products from Window Quilt, Symphony Shades or Aindoway – or make your own. A few years ago I replaced my leaky windows with Energy Star rated units manufactured right here in Albuquerque. But adding Symphony Shades' thermal blinds was still a big improvement – and they look great.

Gary Vaughn

Alternative Energy on a Budget - Part 2

Here are some more ALTERNATIVE alternative energy ideas for New Mexicans on a tight budget:

Windows are a major source of energy loss & gain in your house. You can get the most out of your windows by following this 5 step program:

- 1) Wind down the wind
- 2) Add insulation
- 3) Control inside breezes
- 4) Make radiant "heat" work for you
- 5) Take full advantage of free light

If your windows slow down the wind but don't really stop it, then you're paying a lot to heat and cool the great outdoors. Hardware stores sell foam, plastic and metal weatherstripping for windows, as well as replacement "fuzzy" pile weather stripping. It's important to match the exact size & shape when you're replacing weatherstripping, and it can be challenging to "redo" all your windows, but you'll end up saving money and you'll also cut down on how much Arizona dust blows thru your house.

Well sealed windows can still transfer heat in three ways – by conduction, by convection and by radiation. If you touch a glass window on a cold day it'll be cold – much colder than the wall beside it. Because glass has a low resistance to heat flow (R-value), it conducts heat easily. Double pane windows increase that R-value by trapping a layer of air between the two panes. You can significantly increase the R-values of single or double pane windows, and thus cut conductive heat loss at night, by using thermal window shades & drapes like those made by companies like Window Quilt, Symphony Shades or Aindoway (or make your own).

A cold window conducts heat from the warm air next to it. When the warm room air just above the window is cooled by contact with the cold glass, the air becomes denser and falls toward the floor, pulling more warm air down to replace it. This simple convective "passive cooling" process can drop the temperature of a room quickly – sending your heating \$\$ right out thru the (closed) window. Conventional drapes & blinds that are open at the top & bottom can actually turbo-charge this effect. If you use venetian blinds, you can help or hinder this cool breeze depending on which way the slats are positioned when they're closed. You can check this out for yourself on a cold night if you use a stick of incense and watch how the smoke moves near your windows. Thermal shades & drapes have to fit snugly all the way around the window to prevent this convective (via air currents) heat loss. You also want to watch out for forced air ducts that blow hot air right across a cold window. Use a vent diverter to redirect the airflow away from the window.

Storm windows, which are common up north but not in NM, mount on the outside of conventional windows. They trap a layer of air (a good insulator) on the outside of the existing window, thus increasing the R-value and decreasing the window's conductive heat loss. Convective heat loss is reduced too, because the inner pane of glass will be warmer so it won't drive those inside air currents as well. Storm windows have largely been replaced in new construction by modern double pane windows, but there are still lots of old single pane windows (and poor quality double pane windows) out there that could benefit from the addition of old fashioned storm windows.

Clear plastic mounted on the inside of the window frame has a very poor R-value, but it traps a layer of insulating air just like a storm window. The nice thing about storm windows and plastic layers is that they don't significantly reduce light during the day. A tight fitting storm window or an interior clear plastic layer over an old single pane window can cut winter time heat loss thru the window in half.

Dual or even triple wall clear polycarbonate panels are often used for greenhouse glazing. They're tough & easy to work with; they allow sunlight in; and they have much higher R-values than glass or sheet plastic. But they're not cheap. They're a good choice for use on the inside of fixed non-opening windows where light is desired but the view isn't important.

Any warm object will "glow" or radiate – that is it'll emit electro-magnetic energy. That's how incandescent light bulbs work, and that's what night vision goggles & scopes (and rattlesnakes) "see". A warm room will "transmit" heat by emitting infra-red radiation right out thru your windows. In the summer the radiant energy will move from the (hot) outside to inside, heating the room. In the winter the radiant energy will move from the (warm) inside to outside, cooling the room. Normal window glass allows infra-red radiation to pass thru and to radiate easily. The new "low-E" (low emissivity) windows include special film coatings & layers that significantly reduce this transfer of infra-red radiation, thus keeping some of the radiant "heat" out during the summer, and keeping more of the radiant "heat" in during the winter. If you need to replace a broken window, consider "upgrading" to double pane glazing with low-E film.

Many larger home improvement stores sell low-E films that can be applied to the inside of existing windows – much like the after-market film that can be installed on car windows. It's possible but not easy to do a perfect job of applying this film yourself – or you can hire a specialized company to supply & install the film for you. Properly installed & cared for, this add-on film can be well worth the effort – and it's a whole lot cheaper than new windows. Use it on your sunny west windows to stay cooler in the summer, and on your north, east and west windows to stay warmer in the winter.

The "radiant heat" effect on our comfort level is readily apparent in our homes. In the winter, even when the air temp in our house is at 70, we often feel chilly. The reason is that we're usually surrounded by much cooler floors and walls. Our own radiant energy is warming them! Radiant heating systems that produce relatively warm (68 degree) floors or walls will often "feel" comfortable even when the air temp is much lower than 70. In that case we're being warmed directly by infra-red radiation from the walls & floor instead of by the surrounding air.

A radiant heating system can save you money by allowing you to significantly reduce the air temperature in your house. Fortunately we all have access to radiant heat that's "too cheap to meter" - it's called sunlight. In the winter you want to maximize your house's "solar gain", ie the amount of sunlight that enters you house from south facing windows. Hopefully you have some "thermal mass" such as tile floors and adobe or heavy plaster walls to soak up some of that sunlight, transform it into heat, and then act like a "radiator" at night. Ask any house cat how well that works.

In the summer, all that free radiant heat will drive up your cooling bills. Keep as much direct sunlight out as you can from south & west facing windows by using window overhangs & awnings, reflective & thermal blinds, and free shade from deciduous trees, vines and bushes.

We pay a lot of money and burn a lot of dirty coal to generate the electricity it takes to run our light bulbs – even after we've switched to more efficient CFLs. We may be stuck with light bulbs at night, but during the day here in NM there's plenty of free light for the taking. "Daylighting" is the term used to describe the methods of replacing artificial light with natural light during the day. Of course that's what windows are for, but figuring out how to supply lots of natural light while avoiding unwanted heat, glare and privacy issues is non-trivial.

Light shelves are reflective surfaces mounted on the upper part of the outside or inside of windows to "bounce" sunlight across the ceiling of a room, thus greatly reducing glare as well as the need for artificial light. High transom windows can also be used for daylighting. Skylights are popular and effective, but you have to be careful about heat gain in the summer and heat loss in the winter. You can maximize winter radiant gain and minimize summer radiant gain thru rectangular skylights by using Zomeworks' Sunbender. Some skylights are now available with double pane low-E glass. The new circular tube type skylights are also very effective (and easier to install). Natural light has a lot going for it in addition to saving money on the electricity bill. Plants and the other living things in your house will thank you for the improvement.

Gary Vaughn

Alternative Energy on a Budget - Part 3

Here are even more ALTERNATIVE alternative energy ideas for New Mexicans on a tight budget:

Part two of this series dealt with windows and how to manage their energy loss and gain. Windows come in handy for managing another important resource – fresh air. In the winter we try to keep the warm air inside and the cold air outside. In the summer we try to keep the warm air outside and the cool air inside. Unfortunately, the importance of "fresh" air tends to get overlooked.

It's not hard to find studies that show that the air quality inside our homes & offices is often far worse than the air quality outside. In our desperate quest to save energy (money) by sealing, caulking and completely eliminating air leaks, we can easily create a serious problem with indoor air quality. In the winter, all those vapors, fumes, odors, sneezes and coughs get re-warmed and re-circulated over and over, day after day. If you insist on cooking with natural gas, things can get even worse. In the summer, we tend to leave our windows open more often so the indoor air quality generally

improves - unless we choose to use refrigerated air conditioning, in which case we're back to living inside the same recycled stale air bubble.

What to do? Exhaust fans can be helpful, but they're not nearly as effective as you might think. And unfortunately, in the winter they blow out the warm inside air and replace it with cold outside air, while in the summer they blow out the cool inside air and replace it with warm outside air. Bathroom exhaust fans should be put on a timer so they don't run any longer than necessary. A small exhaust fan left on continuously can drive winter heating bills thru the roof. The vent fan mounted above your stove is a lot better than nothing, but as you have noticed many times, cooking fumes will still fill the house. Gas stoves are supposed to be a chef's first choice, but where do all the gas combustion byproducts go? Gas water heaters have to be properly vented – gas stoves don't. If your lungs are as sensitive to such things as mine are, then the gas stove has got to go.

Swamp coolers definitely push a lot of outside air thru a house. Traditional swamp coolers use thin pads and offer lots of opportunities for hot & dusty outside air to sneak around the wet pads. If the cooler pads are dense and deep like those used in some of the newer "Master Cool" type evaporative cooler designs, they will not only cool more effectively but they will also filter out most of the outside dust and pollen, so they really can provide a continuous "flush" of relatively clean, cool and fresh summer air.

Maintaining healthy indoor air quality in the winter is a challenge. Only the hardiest NMSEA members use a swamp cooler in the winter. The newer high-tech energy efficient homes & buildings use "heat recovery ventilators" – devices that use a heat exchanger to remove much of the heat from the outgoing stale air so that the already-paid-for heat can be used to warm up the incoming fresh air. But very few NM homes have or ever will have a heat recovery ventilator.

Effective fresh air management on a budget requires judgment and good timing. Open windows regularly to let in fresh air, but only when temperatures are such that that makes sense. Use vent fans on timers and keep them on only as long as necessary. Avoid home furnishings that have a chemical smell. Be very selective about what cleaning products you use inside your home.

One of the most pleasant & effective ways to maintain fresh indoor air is to fill your home with plants – especially broad-leaf plants. Philodendrons have been shown to be particularly good at cleaning the air – and ANYONE can grow philodendrons! Recall from your 5th grade science class that green plants plus water plus carbon dioxide plus SUNLIGHT = PHOTOSYNTHESIS. Photosynthesis means fresh oxygen. Fresh oxygen is your friend.

This indoor air quality crisis could be an opportunity for NMSEA member inventors. Why not harness solar thermal air collectors to warm as well as filter and purify our indoor air? There's still a bit of germicidal UV-C radiation in sunlight. And catalysts such as titanium dioxide can harness UV-A rich sunlight to produce a potent and effective pollution clearing reaction. Get to work!

There's a big buzz these days about the health effects of vitamin D. Expensive supplements are flying off the shelves. The medical experts say that the cheapest & easiest & most effective way to get your daily dose of vit D is to expose some bare skin for about 10 minutes each day to a mysterious FREE form of energy called - - - SUNLIGHT. In our paranoia about skin cancer we have inadvertently caused a nation-wide vit-D deficiency! Avoid sun-burning yourself to a crisp, but by all means soak up some free rays every day. You'll definitely be healthier, and you can start working on rebuilding that sunny disposition of yours. I'm not kidding. SAD (Seasonal Affective Disorder – also known as winter depression) isn't much of a problem in sunny New Mexico (except for this winter), but it can be a serious issue for some people living in perpetually cloudy climes or under perpetually artificial light. Pure sunlight is the perfect antidote for the shadows in your mind.

The fact is that fresh air, exercise and sunshine work synergistically to make you a better person (in spite of the odds). And all three are free. Look for opportunities to leverage your wellness earnings. For example, using a solar powered clothes dryer (clothesline) costs almost nothing and it saves significant amounts of electrical energy – which means that your electricity bill will be lower, and also that less dirty coal will need to be burned, so the world will be a better place. At the same time, you get the free benefits of fresh air, exercise and frolicking in the sunshine. And the majority of NMSEA members who enjoy hanging out their wash while topless will also harvest an extra dose of vit D to counterbalance (but not cure) their lack of modesty.

One of the best ways to save tons of money and energy is to avoid falling for heavily marketed "revolutionary breakthroughs" and/or "discoveries" that are, in fact, utter nonsense. For example, there are several gizmos and gadgets that claim to be able to increase your gasoline mileage by XXX percent. Don't waste your greenbacks! There are regular magazine & newspaper ads for "revolutionary" electric space heaters that will cut your heating bill in half. FLIM-FLAM! Advertisements and "testimonials" promoting these and other similar products can be very convincing. Talk with your local technical guru before you mail your check.

There seems to be a popular belief that you can bolt a couple of small wind generators to your roof and kiss PNM good-bye. Wind generators are "winderful", and trying to kiss PNM could be lots of fun, but the basic physics of small wind generators says - FORGET IT!

Oh yes, let's build our own PV panels from scratch for half the cost of those over-priced commercial units! This can be a very enlightening science project for your kids – but don't get carried away. The chances of you or I producing even one panel much less a bunch of them that come even remotely close to the quality and reliability required for a real PV system – are less than zero.

OK, then let's buy the cheapest possible discount/salvage panels and wire and parts, and then assemble them into a super reliable world-class system. This plan may sound good in theory, but in practice it's always a loser. Paying extra for something that's more than worth it is the way to go.

And then there's my personal favorite – ignore the legally mandated building and electrical codes, trick “the man”, beat “the system” and save big bucks. The building & electrical codes are the MINIMUM acceptable standards required to keep things safe and sound. If you can't understand and meet minimal safety standards, then don't even dream of endangering yourself, your family, your property and your neighborhood - to say nothing about firemen and PNM maintenance personnel. Get the point?

How about “Install it yourself and save BIG”? That one actually has something going for it. It certainly is possible to successfully install your own PV or solar thermal system - more than a few NMSEA members have already done just that. But such adventures are not for the ill-informed or un-prepared. Neither Mother Nature nor high voltage PV systems “suffer fools gladly”. If you don't know what you're doing, you WILL regret it. Sign up for a NMSEA PV or solar thermal installation class instead. You'll save your big bucks in the long run.

Our three part energy saving series has come to an end – and I didn't even get to mention the “purrfect” use for solar powered heater cats! Part 4, anyone?

Gary Vaughn