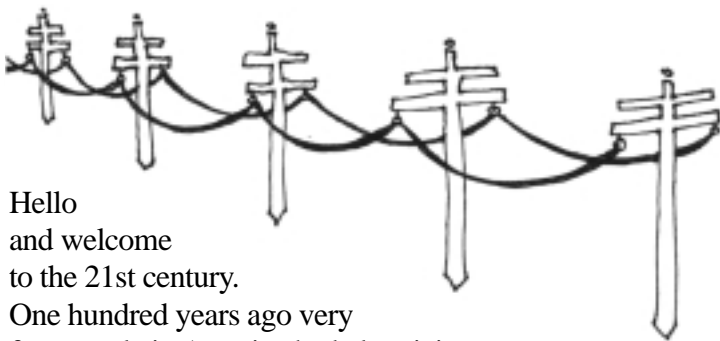


\$3.⁰⁰

Energy Conservation Primer

Mark Coleman & Wil Burlin

Taos Green Solar



Hello
and welcome
to the 21st century.
One hundred years ago very
few people in America had electricity
or any need for it. How things have changed!
Today it seems like everything we own runs on it.
We've grown so used to having unlimited power that
most people never think about it until something goes wrong
and there is a blackout. Or until we get the bill every month.

Energy prices are not going down and indeed they are
poised to go way up. This is mostly due to our dwindling
reserves of energy worldwide and the increase in demand.
There are several things that you can do about it and that
is what this booklet is about. We want you to think about
electricity, where it comes from and the impact it's usage
has, not only on your household, but on society and world
ecology.

In simple terms the less you use the less it costs you.
We have included several ways to reduce your energy
usage. On a larger scale we point out the effects that
reduction can have on global warming and the world that
we are leaving for our kids. Finally we offer some alterna-
tives to traditional power production that are available
today and that are on the horizon.

These are not all of the answers, but it's a start toward
energy independence for you as a consumer and for us as
a country.

What does energy cost?

We don't pay the true cost of energy, whether at home or at the gas pump. It's through increased taxes and environmental damage that the real cost shows up. Roughly we are really paying three times the pump or meter cost. Think about that!



PRICE VS. REAL COST

- **environmental crisis**
- **acid rain**
- **global warming**
- **CO₂**
- **smog**
- **military presence in the middle east**
- **government subsidies to power companies**
- **wasteful use of energy**



What energy crisis?

If you lived through the seventies you remember long lines at the gas pumps and the dire predictions for the future. Well the future is here. Day after day we hear about the electrical problems they are having in California. What you don't hear much about is why Californians are having trouble.

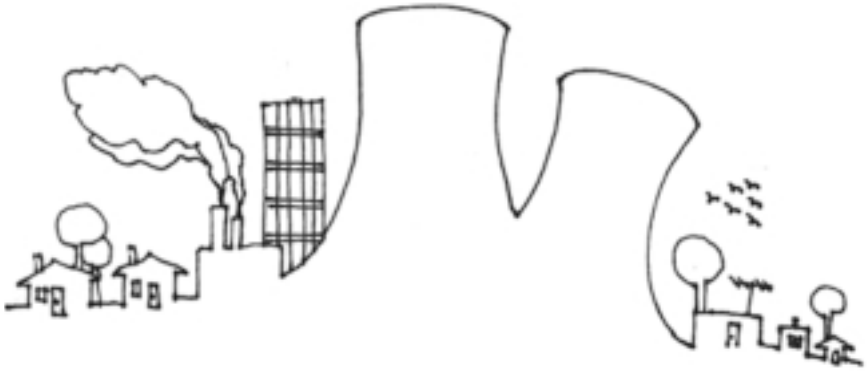
The reasons are complex but can be put simply: the power companies were allowed to purchase electricity at whatever cost they could negotiate but the amount that they could charge customers was capped. That worked fine until their buying costs went above what they could charge. Customers had no reason to lower their energy use because their electricity still costs the same. Energy use rose... Now it's a mess.

Electricity bills **will** go up, and soon. The state is buying power now to sell to the energy companies, but someone is going to pay. Either the ratepayers or the taxpayers. Electricity bills in San Diego went up 300% **before** the current "crisis." My bet is on the ratepayers. And there are thirty other states, including New Mexico, ready to deregulate just like California. And the truth is that electricity users don't pay the true cost of the resource. The cost of electricity will continue to rise.

As I am writing this, my solar tracker is following the sun through the sky pouring electrons into my battery bank and computer. When the sun goes down I will be able to continue writing powered by stored sunshine. This clean, nonpolluting power is available to almost everyone in the United States but is only being used by less than 1%.

Energy crisis?

What energy crisis?



How is energy produced?

Strip mining for coal

The environmental damage to the land and air is very high with this energy source. And coal reserves are dwindling fast, forcing more environmental damage for relatively less energy.

Burning natural gas

Burning natural gas creates more pollution than it does power. And with the rising prices of fuel, it is becoming more and more evident that cost *and* smog are on the rise. Furthermore, its depleted status puts this form of energy production low on our list.

Hydro electric dams

While hydroelectric dams seem like a harmless way to harness the awesome powers of nature, they are not a reliable source for renewable energy. With recent droughts, the hydroelectric producers have been rendered useless and have become a costly investment.

Nuclear power

Speaking of low on the list. Waste the electricity now and your great great great great grandchildren will still be cleaning up the mess. Nuclear power plants last about 25 years, their nuclear waste lasts thousands.

Oil production soars

depletion of world reserves at an all time high

In the next ten years, world oil production will reach its peak, an all time high in the depletion of the planet's petroleum reserves. Followed by an exhaustive effort to find more fuel, the country will eventually have to face the truth and come up with a better solution.

When production peaks, oil prices will skyrocket until consumer petroleum is no longer available. America's reserve is predicted to last no longer than 100 years, and the transition away from oil will be tough.

The energy that America, Japan, Europe and China plan to use in the next 100 years is directly proportional to the Middle East and the amount of oil they are willing to sell. Sixty percent of all the oil left in the world lies beneath five Muslim countries, explaining the conflict in the Gulf.

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Americans alone use 25% of all the oil depleted from world production, the US using three times more oil than any other nation in the world. In the Saudi deserts, the US military has fortified its airfields and is prepared to secure its wasteful use of oil through whatever means necessary. It seems inevitable that our youth will have to return to the gulf, fighting to protect the lifestyle that we have all become accustomed to.

Energy Independence

A real start to understanding energy use is knowing how much power things use. Many appliances use a lot of power but in short bursts. A microwave uses 750 watts per hour, but it only takes five minutes to cook a potato.

Common power usages per hour:

Refrigerators		Kitchen appliances	
22 cu ft auto defrost	490	Dishwasher	1500
Vestfrost efficient AC Ref.	90	Trash compactor	1500
Sunfrost DC Ref.	60	Can opener	100
usually run 10 hrs per day		Microwave	750
		Exhaust fan	50
AC jet pump, 165 gal.	500	Coffee pot	1200
DC house pump 1-2 hrs	60	Food processor	1200
		Toaster	1200
TV 25" color	130	Gas stove (glowbar)	200
Tv 19" color	60		
Satellite receiver	43	Computer and monitor	140
VCR	30	Typewriter	200
Laser disc	30	Sewing machine	150
Stereo	15		
CB system	10	Hair dryer	1500
Cellular phone	10-24	Whirlpool bath	750
Mini-fluorescent light bulb	22	Electric blanket	250
Electric clock	10	Garage door opener	300
Clock radio	10	Ozone air cleaner	40
Iron	1500		
Clothes washer	450	2-hp table saw	2250
Staber efficient washer	250	Grinder	600
Gas dryer (motor)	250	Drill	300

bigusers

heating

In the cold winter months, 60% of energy goes toward household heating, while another 15% goes toward heating domestic water.

Every year, home-heating systems pump more than a billion tons of carbon dioxide into the air. By turning down your thermostat as little as two degrees, you will reduce your yearly pollution by 500 pounds.

1. Insulate any way you can. An under-insulated attic may be the largest source of energy loss as heat rises up and through the ceiling, into and out of the attic. Walls are the second place heat looks to escape, especially in older homes where insulation could be worn or settled, or simply uninsulated. Insulated window blinds or curtains can also help contain heat at night. Remember even double pane windows have very little insulative value.
2. Keeping the warm air in is only half the battle. Keeping the cold air out by adding storm windows or caulking gaps around the outside of windows will stop the draft from entering your insulated home.
3. Consider alternative energy such as a woodstove to generate most of your household heat. Stove and ceiling fans can further help distribute the heat to all the nooks and crannies.
4. Setback thermostats can be installed and programmed to lower household temperatures according to your needs. By lowering room temperatures by five degrees for an eight to twelve hour period, you can save five percent on your heating bill.

hot water

The 15 percent of energy that used to heat water in an average home can be lowered considerably by using a simple formula of insulating and conserving. By maximizing household efficiency, you will save.

1. You can save money by wrapping your gas or electric hot water heater in an insulative jacket. Wraps are readily available at hardware stores and can be installed by the homeowner.
2. Lower the thermostat to 110 degrees F, to optimize efficiency. And if you have an electric water heater, a timer can be installed to regulate heating cycles.
3. Too much heat is lost from the pipes coming directly from the hot water heater, and even more is lost in unheated crawl spaces. Pipe insulation greatly reduces heat loss in these areas. Users will spend less time waiting for hot water at the tap and it will lead to less waste. On demand hot water circulation is an exciting innovation in this area and can maximize efficiency.
4. Aerators at the faucet reduce hot and cold water flow while maintaining the original water pressure.
5. Low flow shower heads help reduce water use by up to 50 percent and you can shut it off to lather up.



kitchen

The kitchen of the modern house is the home of the big users. If energy is conserved and use of appliances is maximized, the kitchen can become an example of independent living.

Consider your appliances and how you use them. Many food preparations can be done without electricity, and meals can be cooked alternatively with a dutch oven, pressure cooker, or toaster oven, and three dishes baking at once save the cook's time and conserve energy too.

Refrigerators are infamous for using way too much energy. If replacing your old unit with a modern high efficiency model is not an option, keep your old fridge tuned up by cleaning the ventilation grilles and give it

some room from the wall to allow for ventilation. Use the energy saving feature if available or set the thermostat to the minimal requirement of 38 degrees.

New refrigerators don't have to be expensive to be efficient; check the Energy Guide stickers as well as the price tags. And last but not least, consider a smaller unit because with refrigerators, bigger is not better.





TYPE: Mini fluorescent

LIFE: 10,000 hrs.

COST: \$ 9.00

POWER USE: 18 watts X 10,000 = \$ 18

TOTAL COST: \$27

Incandescent

1,000 hrs.

\$ 0.75 X 10 = \$7.50

75 watts X 10,000 = \$75

\$82.50

lights

It is astounding that after 100 years in existence, the standard lightbulb is still wasting power at rates of 65, 75, 85 and 100 watts. Thomas Edison would be turning over in his grave if he knew about the available technology and the lack of its application in the multi-billion dollar light bulb industry.

Compact fluorescent bulbs use 70 percent less energy than incandescents without sacrificing any light. And while lasting up to ten times longer than conventional bulbs, the savings more than pay for initial costs.

Besides changing all of your bulbs, there are other things you can do. Use daylight for reading, working and living.

Evaluate your light usage. Low wattage task lighting can replace high energy general overheads.

Lighter colors on the walls reflect more light and skylights can be an added improvement to darker areas.

phantom loads

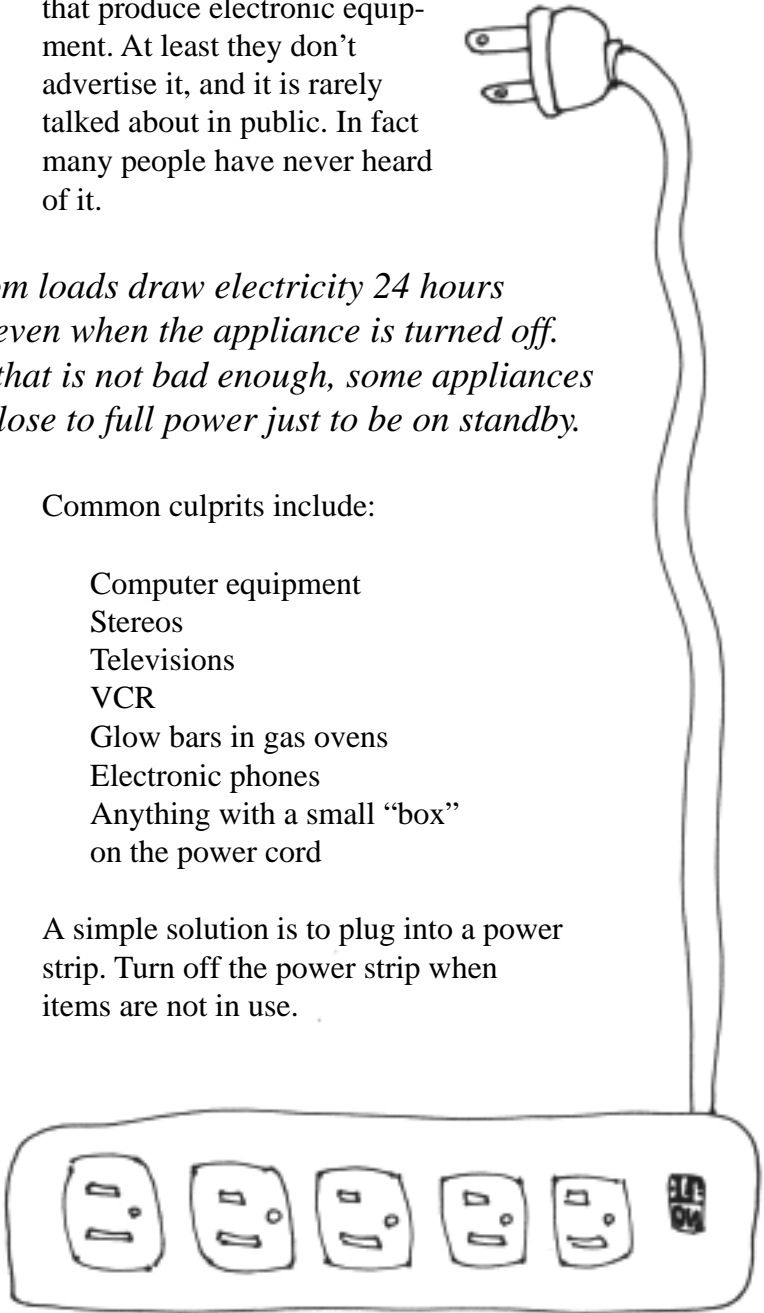
It is a secret among companies that produce electronic equipment. At least they don't advertise it, and it is rarely talked about in public. In fact many people have never heard of it.

Phantom loads draw electricity 24 hours a day, even when the appliance is turned off. And if that is not bad enough, some appliances draw close to full power just to be on standby.

Common culprits include:

- Computer equipment
- Stereos
- Televisions
- VCR
- Glow bars in gas ovens
- Electronic phones
- Anything with a small "box" on the power cord

A simple solution is to plug into a power strip. Turn off the power strip when items are not in use.



What can I do?

If you are concerned with the state of the world, then you can do something about it. The first step is to be aware of what is going on around you.

What is your local power company doing about the power crisis? What are your neighbors doing about the increased rates? What are you doing to prepare for the deregulation of utility companies?

The second step is to discover all the different areas in your life in which you waste resources. From lighting four burners in the morning just to get things going, to letting tap water go down the drain until it gets hot, its the little things that add up.

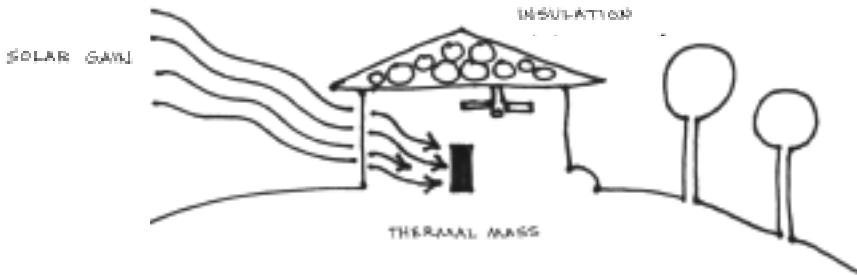
Third, try to cut back. Lower the thermostat a few degrees. Change out your lightbulbs. Turn off the water while brushing your teeth. Get a power strip for your stereo.

And finally, after you have tried these three steps and you feel good about conserving, take it a step further. Look into renewable energy to supplement the power you use lower your dependence on the grid.

With passive and active solar, wind generators, grid intertie and backup power, there are many of things you can do to increase efficiency at home.

Some things may require behavior modification and some may involve spending money to save some, but it's all for a good cause





Passive Solar

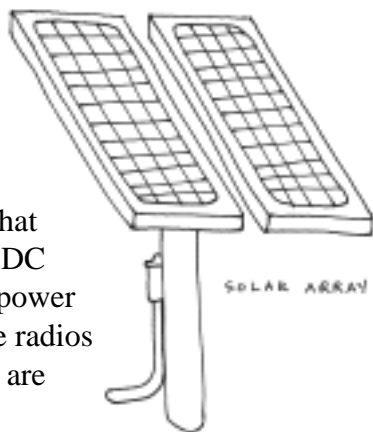
There are three components to effective passive solar design: Solar gain, thermal mass and insulation. Solar gain is the amount of sunlight that you can concentrate in one area. Thermal mass is the material that stores the sunlight during the day and releases it at night. Insulation holds the heated air inside, and cold air out.

By simply opening the drapes or insulated blinds on your south facing windows during winter days, when the sun is low in the sky, you can raise the room temperature. Heat gained from the sunlight increases as it passes through glass. Be sure to close the blind at night to hold the heat in.

If you are designing a house or a remodel, talk to your architect or designer about possible passive solar choices. The New Mexico Solar Energy Association has some excellent ideas on their website on passive solar design and retrofit.

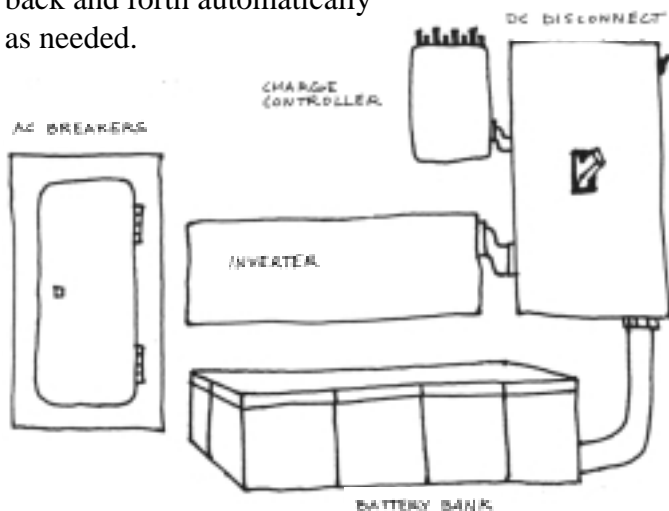
Active Solar

Active solar refers to systems that convert solar energy into electricity. In the majority of these systems sunshine is changed into DC electricity that is stored in batteries. In the simplest DC electric systems the batteries deliver power to lights and other DC appliances like radios and some televisions. These systems are great for cabins and vacation homes.



Most solar systems today add a device called an inverter that converts DC battery power to more conventional 120 Volt AC power that 99% of American appliances use. By using this type of set-up you can run a normal household on solar electricity without any basic changes in wiring of the house.

Many people who are connected to the grid add solar to supplement the grid. By expanding the solar capabilities they are able to run mostly on solar and use the grid as a back-up in a seamless system that switches back and forth automatically as needed.



Solar / Grid Intertie

Grid Intertie systems allow you to run your electric meter backwards as well as forwards by interconnecting a solar system to the power grid. Your home or business uses the solar power when it is available, either alone or with assistance from the power grid, and feeds excess power back into the grid. At night power comes from the grid. This way, you can use the grid as a battery, which lowers the cost of your system substantially because you never have to maintain or replace your batteries

Grid intertie systems also increase the amount of the solar energy which is actually used, because excess power is never wasted. In battery systems when the

batteries are full any excess power is lost. With grid intertie all of the power that you don't use during the day is sent to the grid. Your electric bill will only be for the power that you used over and above what your solar system produced. In New Mexico the power company gives you credit to be used later for power that you produce over what you use. This can be very helpful for a solar system that puts out more than enough power for your home in the summer but runs short in winter months.

“If your electric bill is \$100 per month or more you can pay back the cost of a grid intertie system in as few as 8 years.”

Grid intertie systems can be easily installed in new or retrofitted in existing homes. If your electric bill is \$100 per month or more you can pay back the cost of a grid intertie system in as few as 8 years at today's energy costs, which are expected to double in the near future.

back up power

During the Y2K scare we installed many back-up power systems in both homes and businesses. People were concerned about the reliability of their power suppliers. When Y2K passed without major disruptions we thought that we would see a lot of people wanting to sell off their back-up systems. To our small surprise not one person wanted to sell. On the contrary many wanted to expand their systems to cover larger power needs and to supplement the grid with solar.

A basic back-up power system takes grid power and stores it in batteries. When the grid goes down, an inverter instantly switches on and runs selected loads from the batteries until the power comes back on. Then the inverter re-charges the batteries for next time. We've installed this type of system in businesses too. Think about what a headache a power outage can be to a bank or supermarket, a retail store or an insurance office when the power suddenly goes off. A well designed back-up can keep things running for up to several hours until the grid comes back up.

Think about what a headache a power outage can be to a bank or supermarket, a retail store or an insurance office when the power suddenly goes off.

These simple systems can mean the difference between no lights and spoiled food and no worries. And a back-up power system is the heart of a solar electric system. Just add solar panels, all at once or a few at a time. And because they are connected to the grid these new solar systems can use the grid as a back-up to the solar.

Back-up power comes in many different sizes and prices. There is one for everybody.

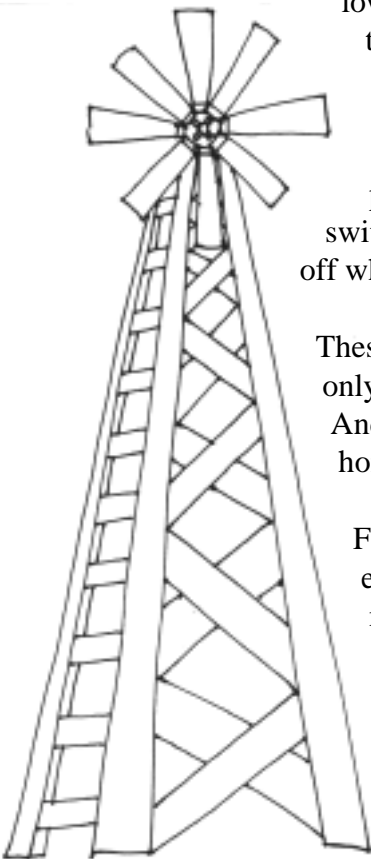
water wells

Across rural America a big change is happening in livestock watering. The old familiar windmill up on a wooden tower is disappearing, being replaced by solar water pumping systems. The older windmills were a constant maintenance problem. Besides the actual windmill, which needed to be oiled and balanced, the sucker rods that went down the well required constant supervision. And by their nature most of these systems were remote so a trip or two was required for each regular check-up.

Quiet, efficient DC water pumps driven by low or no maintenance solar arrays have taken the windmills' place. Usually the array of solar panels is on a passive solar tracker that follows the sun across the sky to maximize the power sent to the pump. A float switch in the stock tank turns the system off when the tank is full.

These systems can last up to 30 years with only minor repairs every 10 years or so. And they work just as well for remote homes.

For homes that plan on using solar electricity for all of their power, a normal 220 Volt AC well pump connected to a double inverter set-up is common. This allows excess solar power to be stored in batteries for other uses. Either way the sun is the best way to pump water in almost all of the United States.



closing

At Taos Green Solar it is our business to think about power. It is something that more and more people are thinking about nowadays. As California struggles with deregulation now and the rest of the states are looking on, poised to deregulate, we see that this is a complicated and expensive problem. We won't solve our energy crisis by simply not deregulating: energy resources are still running out. What each of us can do is "our part".

Understanding our own part in creating energy demand and thinking about how we can affect overall use is a first step. By following some of the simple ideas in this pamphlet you can start to lower your impact on the Earth and the cost of energy. The next step is to further educate yourself and others about energy use and finite natural resources. Talk to your neighbors and your congressman and state representatives. There are positive ways to move from carbon based energy generation to renewable power. But these changes won't happen unless we demand that they do.

We don't just vote every four years. We vote every time we buy something. If we buy energy wasters manufacturers have no reason to make energy savers. If we "sweep" our driveways with a water hose how will kids understand how precious and limited our water resource is? If we don't demand power from wind farms and bio-gas plants we will continue to get it from strip-mines.

Finally by supporting and buying solar and wind systems on an individual basis today we assure that research and development will continue and that prices will continue to drop. Ultimately it is the next generation that will benefit the most or pay the most for decisions that we make today. We want them to think back and say we made the right choices.

Thanks,

Mark and Wil

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