S U N D I A L

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Established to Promote the Use of Our Sun's Renewable Energy to Preserve Our Environment

October 2011

President's Corner: "Sunshine" on page 2.

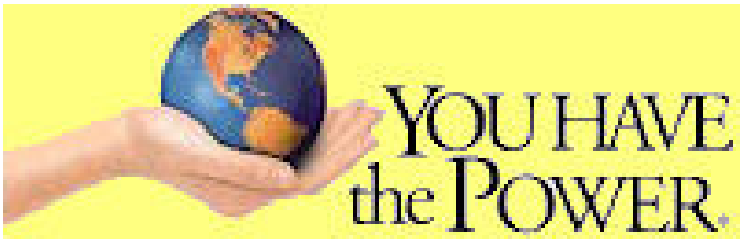
Inside this Issue:

What can we do about choking on our own pollution?

October is Energy Awareness Month. How much do you know about where your energy comes from?

Just flip a switch, and your electricity is right there at your fingertips. Well, usually it is. For days after the April 27th tornados, for millions of Alabamians, the power just wasn't there. We were left scrambling for propane, gasoline, charcoal, ice, and other energy sources. Of course the stores nearby had no electricity to make ice or fill propane bottles, and there was no electricity to tell the store's computers to tell the gas pumps, check the customers' credit cards and to turn on the pumps. Lowe's Home Improvement stores ran emergency generators to allow a few sales. One enterprising Walgreen's manager in Jones' Valley let customers in one-per-escorting-employee at a time to pay cash for hand calculated purchases. Mostly, the downed transmission lines from Brown's Ferry Nuclear Plant to most of North Alabama kept most of us at the dark. We had to drive to Chattanooga daily for ice, fresh food, and other essential supplies.

As the power outage dragged on, many people resorted to gasoline generators. My daughter, who has worked overseas for many years, said of our neighborhood, "It sounds just like Baghdad around here."



Others began to take a fresh look at other ways to generate their own power. I ran our home for five days off a 45-watt photovoltaic kit and a large marine battery. We didn't have much light in our house, but it was more than most homes in the neighborhood had. We even had enough power left over to recharge electronic devices and even run a small refrigerator with an inverter.

About that refrigerator, I have been teaching for years that conservation is the first step of going solar or converting to any renewable energy source. When you have a family of two or three living on 45 watts, conservation first is essential. I went into the generator-powered Lowe's and bought a small Energy Star model which drew only 0.7 amps. A 125 amp-hour marine battery will run that for a while. We also used 12 volt-direct current (DC) compact fluorescent lamps (CFLs) and 12-volt light emitting diode (LED) fixtures.

Now I'm not suggesting you try to run a home on 45-watts of power, but conservation efforts can save you a lot on installing solar power. Check the ASA "Photos" webpage for how Craig Warren cut his AC load from four tons to three before installing a geothermal system.

Even if you never get to converting to renewable sources, conservation still saves. Conservation is a source of renewable energy. See "Where does our electricity come from?" on page 2.

come from?

Ever hear electricity described as "the clean energy?" In the 20th Century, electric companies used that advertising claim to lure customers away from the "dirty" natural gas for cooking and heating.

But "clean" electricity has a dirty little secret. Almost half of the US consumption comes from coal, and that's about as dirty as it gets. See the discussion of the Christmas 2008 coal ash spill in the "President's Corner" below.

Even scarier than fuel source is the age of many of these plants. Some coal plants are more than 50 years old. Back in the 1950's, clean air was something you left the city to breathe.

Lately there has been a huge shift to natural gas, but how clean is that?

Well, it is cleaner than coal, but it does consume oxygen from the air and changes it to carbon dioxide. Do we need air that is

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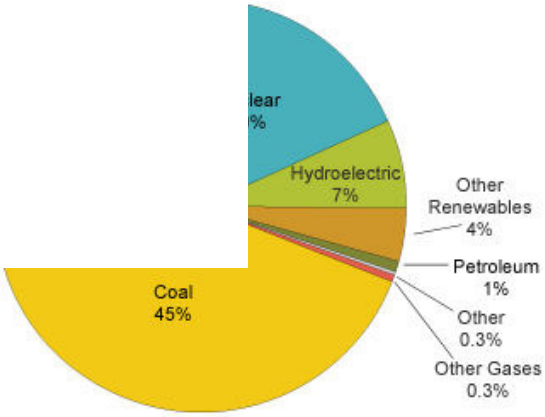

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disturbing than the
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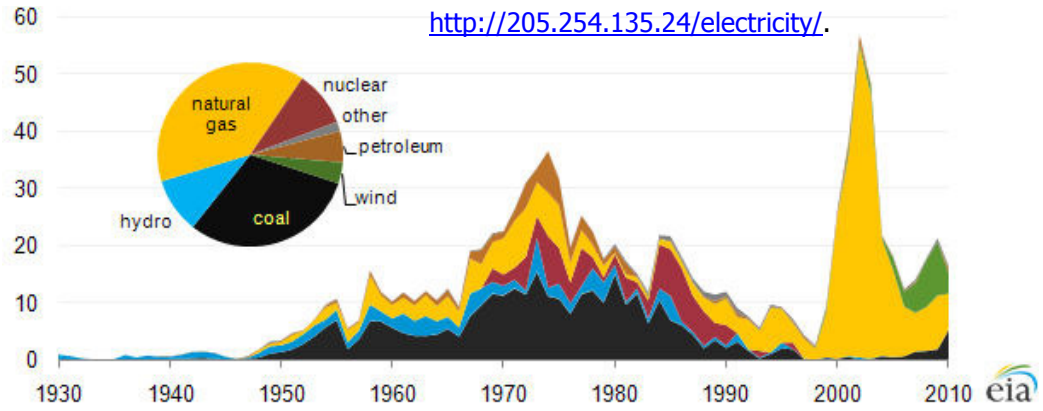
t the only bright spot in
pictures is the green
e from 2005 to 2010. Wind
r is a renewable energy

source, but who wants to live near a big windmill. Teddy Kennedy did not. Let's all make the next five years of the EIA chart show huge increases in solar power.

See more information on the EIA website at http://205.254.135.24/electricity/.



Source: US Energy Information Administration

President's Corner

Where do you get your power? What's behind that tiny switch that turns on the TV or starts the blades of the blender turning? You might be surprised. See the above article for more.

Residents of Kingston, Tennessee, got a real Christmas surprise in 2008. The Tennessee Valley Authority (TVA) Kingston Fossil Plant coal fly ash slurry dike ruptured spilling 1.1 billion US gallons of concentrated coal ash. Pollution was estimated to be eight times that of the Gulf oil spill. Sludge covered surrounding land up

feet deep and crushed
nearby homes.

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water. Coal as a fuel was
in the 20th Century, but it is
overdue for retirement.

plans to retire many of the
's coal plants replacing
with nuclear-generation
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ast year before the
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nuclear facilities here. Professional Engineers (PEs) have been discussing nuclear safety since March. Future nuclear plants are likely to be safer but a lot more expensive than are the reactors of today.

Expect a lot of study and discussion of US energy sources by Energy Awareness Week 2012. Let's all be thinking green!

Morton

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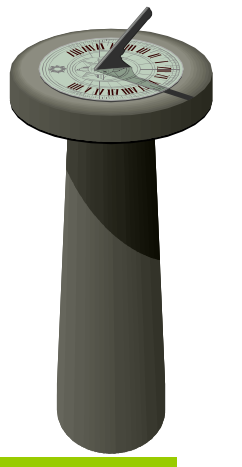


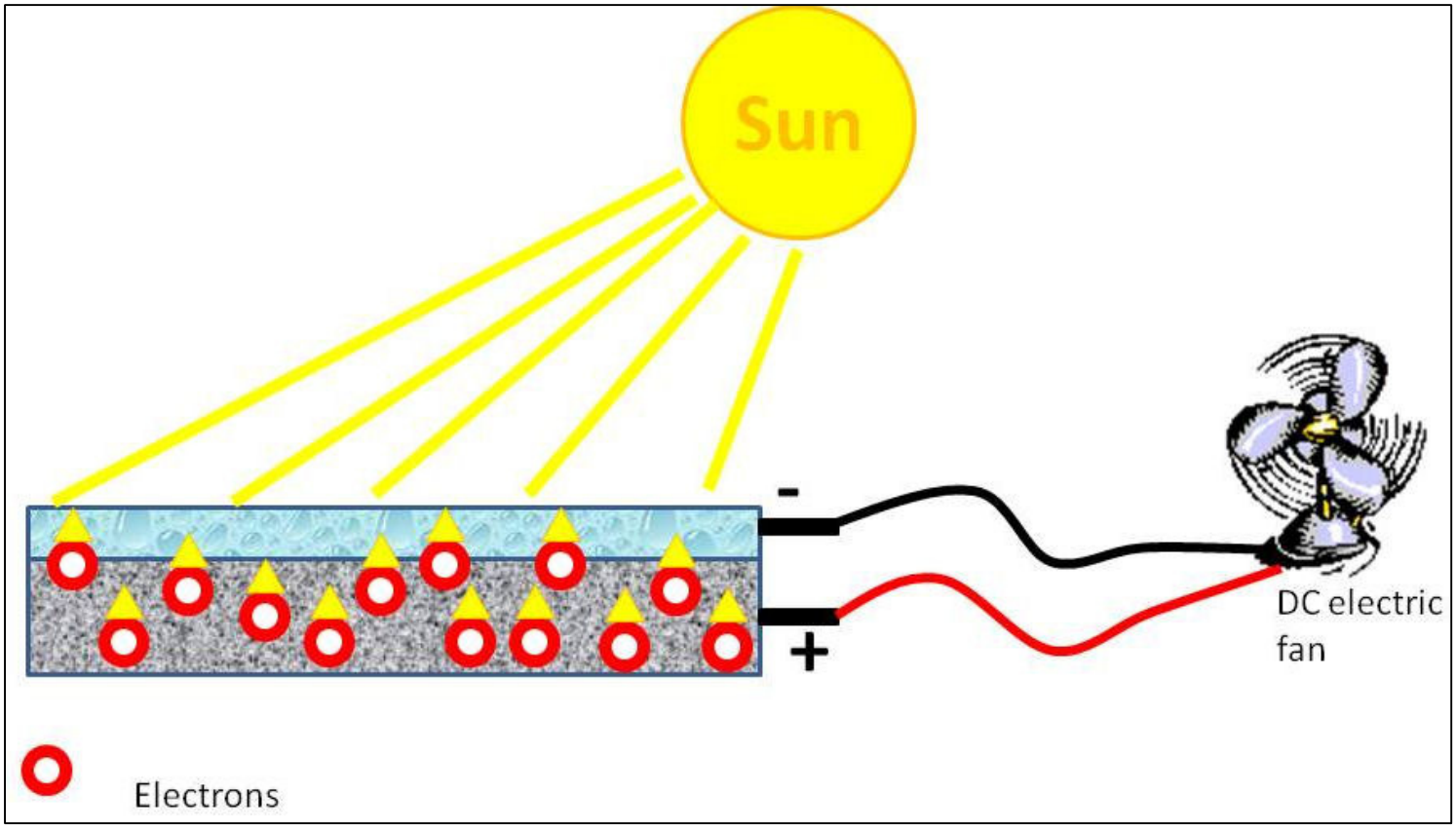
Kids' Pages—How does the sun make electricity?

First, let's consider the question, "What is electricity?"

Electricity is the movement of electrons along a wire or other conductor. When they have the chance, electrons generally move from areas that are crowded with electrons (negative charge) to areas that don't have as many electrons (positive charge).

Electricity can also move through a semi-conductor. A semi-conductor is a material that under normal conditions blocks the flow of electrons. Silicon, or common sand, is the most common semiconductor material used for photovoltaic (PV) or solar cells, transistors, and other electronic components.

We're not speaking of grains of sand like you find on the beach. Semi-conductors are heated and cut into very thin wafers. Heat and light can cause a semi-conductor to conduct the flow of electrons. Light is actually nuclear energy coming 93 million miles from the sun.



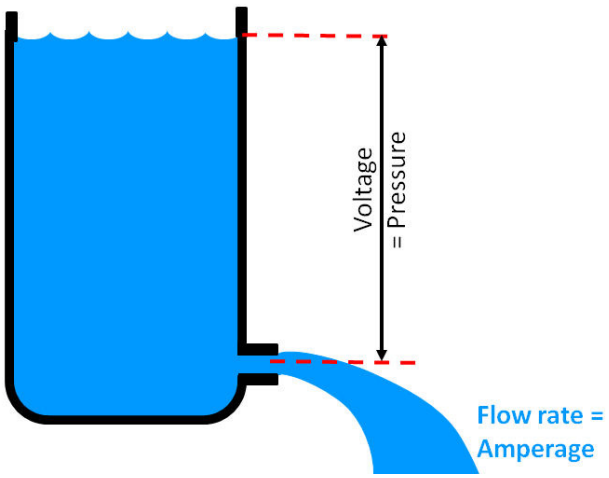
The picture above makes the thin silicon wafer in the diagram look rather thick. In fact, a solar cell is about half as thick as the average human hair.

The above silicon in the solar cell has been altered. The top and bottom surfaces have been contaminated with chemicals causing an excess of electrons in the bottom layer and a shortage of electrons in the top.

Light energy coming in from the sun excites the electrons in both layers. Electrons from the rich, bottom layer flow upward to fill the electron holes in the top layer. This creates an imbalance and there is an electrical pressure we call voltage between the two layers.

Solar cells can only produce about a half volt potential and a fraction of an amp current. This isn't very impressive, but neither is a single grain of sand. Put enough grains of sand together, however, and soon you can fill a bucket. Put enough buckets of sand together, and you can have a vast beach. Engineers combine solar cells to get more voltage and more current.

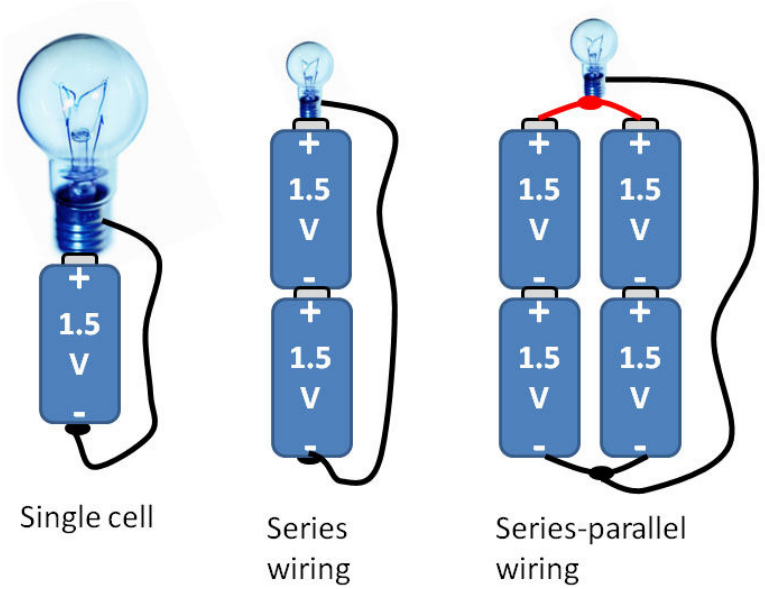
The "AAA" batteries you use in toys and games have a potential of only 1.5 volts. So do the bigger "D" cells. So if they are all the same voltage, why do we need different sizes?



To understand volts and amps, let's compare electricity to the water in the tank to the left. The higher the water level, the higher the water pressure. Pressure is like voltage in electricity. The more water pressure, the stronger the water flows out; the higher the voltage, the stronger the electricity flows.

Amperage, or the flow of electric current, is like the water flowing out of the tank. How fast water can flow out is relative to the size of the pile leading out. The capacity of a wire to carry electricity, or ampacity, is relative to the size of the wire.

Now consider simple flashlights such as these below. A tiny penlight flashlight might have a single "AAA" battery. It won't produce a very bright light, nor will it shine for very long.



A slightly bigger flashlight might be powered by two penlight batteries. The positive battery contact is usually that flat knob on the top center of each battery; the flat surface on bottom is the negative contact. When we put batteries into the flashlight, there is usually a spring in the bottom to make contact with the negative end of the battery. When we insert the second battery, the negative contact touches the positive contact of the bottom battery. When we connect negative to positive, we call this "series wiring" as shown on the center of the picture to the right. Series wiring adds the voltages of each battery, so the voltage here is 3.0 volts, but the amperage remains the same as for a single battery. This flashlight will burn much brighter than the first, but it will only shine about as long as the first light did.

When we connect batteries with one wire from positive to positive to the load and the second wire from negative to negative to the load, it is called parallel wiring (see figure). The voltage remains the same 1.5 volts of each battery, but the amperage is doubled. The figure to the far right shows series and parallel wiring combined. The "string" of two batteries in series gives us 3.0 volts for a brighter light. The two or more series strings are then connected in parallel giving us the brighter light of the series wiring and the long-lasting light of the parallel wiring.

As we said above, solar cells produce only about half a volt. We have to wire three in series together to equal the voltage of a single "AAA" battery (or a "AA" battery or a "D" cell for that matter). Solar modules, consisting of many solar cells, usually have 24 or more cells in each series string to produce 12 or more volts. These strings are then wired in parallel to create the higher amperage houses and big pieces of equipment need.

One more electrical term we need to discuss is the watt—it's probably the most common electric term you will hear on a daily basis. One watt is simply one amp of electric current flowing at a voltage (pressure) of one volt. To get watts, multiply volts by amps; to get amps, we divide watts by volts. Thus, a 240-watt bulb (not a usual size) running on 120 volt household current would use 2 amps.

So we take a single solar cell producing a weak and tiny surge of electricity, we combine it with many more cells to make a stronger electric current, and we wire those "series strings" in parallel with many other series strings to make a strong current with enough flow rate (amperage) to power that Xbox 360 and flat screen.

Of course solar cells produce only direct current, or DC, and your house runs on alternating current, or AC. Let's talk about that next month.

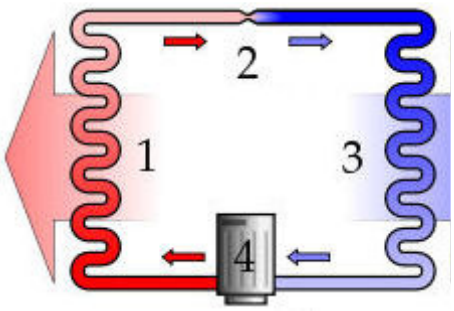
Study hard and learn all you can about renewable energy. The future belongs to you.

Twelve Ways to Save Energy-Number 12: Tap into the power of Mother Earth, consider a ground source heat pump.

Buy one, get four free! Now that's a barging even your favorite shoe store can't match.

Why did cavemen live in caves? Visit any Southern cave, and you'll know immediately. While temps in the Sunny South vary from below zero to triple digits, caves are generally 50 to 62°F year round. Geothermal, sometimes called ground source, geo-exchange, heat pumps capture this solar energy stored in the ground just waiting for us to use.

Heat pumps move heat from one place to another (diagram above right). Expansion in the evaporator



(2) cools the refrigerant, while the compressor (4) heats it up. In summer, we blow the cooled air inside (3), and in winter we blow the heated air (1) inside.

But, remember, air temperatures vary greatly throughout the year. By using the heat the sun stores in the earth's crust every day, we have a source of nearly constant temperatures just beneath our feet. Instead of taking heat from the highly variable air and trying to shed excess heat into the same medium, we can send our refrigerant into the ground to make a much more even exchange. We can have most of the advantage of living in a cave while enjoying the much better view upstairs.

Geothermal systems offer many economic benefits. The sun's heat underground is free, we need only pay for the electricity necessary to operate the compressor and pump the fluid through the ground loops, or about 20 percent of normal costs. If you get your electricity from a photovoltaic system, that is free as well. The current 30 percent federal tax credit applies not only to ground loops and pumps but to heat exchange unit and any ductwork necessary. For new homes, tax credits may pay for the entire extra cost of going geothermal.

It won't work in every situation, but consider geothermal options when building new or replacing a unit.

Check out your Board of Directors and other people who help promote a "green" lifestyle in Alabama in the "About Us" section of our webpage, www.AL-Solar.org.

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Solar Happenings:

Check them out in your area.

Saturday and Sunday, October 1 and 2, 2011, the National Solar Tour, all across Alabama, http://nationalsolartour.org/

Saturday, October 15, 2011, 10 AM, Firefly work party, 2117 Rothmore DR SW, Huntsville

Tuesday, October 18, 2011 11:30 AM, ASA BoD Meeting, ADTRAN Cafeteria, visitors welcome.

Saturday, October 22, 2011, 10 AM, Firefly work party, 2117 Rothmore DR SW, Huntsville

Saturday, October 29, 2011, 10 AM, Firefly work party, 2117 Rothmore DR SW, Huntsville

Tuesday, November 15, 2011 11:30 AM, ASA BoD Meeting ADTRAN Cafeteria, visitors welcome.

Tuesday, November 29, 2011, 6:00 - 9:00 P.M., HATS Annual Holiday Reception, SciQuest, Wynn Drive, Huntsville.

Tuesday, December 13, 2011 11:30 AM, ASA BoD Meeting ADTRAN Cafeteria, visitors welcome.

Saturday, January 28, 2012, 10 AM, ASA Annual Meeting and two technical presentations, Vestavia Hills Public Library, Birmingham area

Saturday and Sunday, October 6 and 7, 2012, the National Solar Tour, all across Alabama, http://nationalsolartour.org/

Please let us know what is happening in your area.

"…a passion to improve and expand all renewable energy technologies."

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