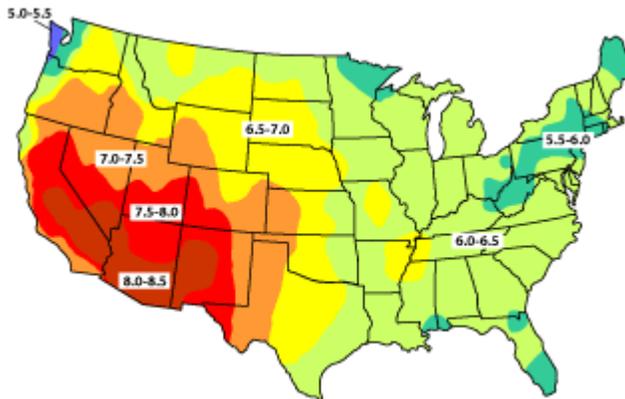


SUSTAINABILITY TIMES

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Potential for Solar Energy



Insolation Isograph for Continental U.S.

Average radiation received on a horizontal surface in the month of June. Units are in kWh/m²/day.

http://www1.eere.energy.gov/solar/images/map_solar.gif

One of the most important forms of alternative energy in the U.S. is solar energy. This energy source is inexhaustible, renewable, clean, and free. Utilities are beginning to generate electricity from solar installations. Wal-Marts are built with photovoltaic systems on their roofs. Homeowners are adding solar panels and receiving tax credits up to 40% for the cost of the system (30% federal and 10% state in New Mexico, for example).

So, isn't solar the answer to all our energy woes?

Unfortunately, the answer is no. If you live in the southwestern U.S., you can likely install a solar system that will give reasonable return for the cost of purchasing and installing the system, but if you live in the northeast or far northwest the system will be considerably more costly to get the same effect.

This difference is due to something called insolation, which is defined as "The actual amount of sunlight falling on a specific geographical location." (US Department of Energy, Energy Efficiency & Renewable Energy, Solar Energy Technologies Program.)

Insolation (incident solar radiation) varies by location, season, and weather conditions such as cloud cover and humidity. Insolation is measured by how much solar radiation lands on a square meter of the earth's surface in a day and can vary from under 1 kWh/m²/day to over 9.

Since the energy converted by a photovoltaic system is contingent on the insolation, the same installed system in different locations (as well as in different months) can have dramatically different levels of output.

Areas nearer the equator are favored over areas nearer the poles. Areas with lower average rainfall tend to have both less cloud cover and lower average humidity levels and are thus favored for insolation. Thus, in the United States, solar systems in the desert southwest have significantly greater electricity production than systems the same size in other parts of the country. Thus, the economics of the return on investment for systems in the southwest is the highest in the U.S. Companies located in California, Arizona, New Mexico, Nevada, Utah, Colorado, West Texas, or western Kansas will find good payback on solar systems relative to much of the rest of the country.

Of course, falling prices for solar systems as mass production reduces costs and technological advances improve efficiency will improve payback in all regions. Rising electricity prices in the future will also improve payback.

It's the Economy, Stupid!

By Paul McCright

When major national election campaigns are underway, we occasionally hear someone say, "It's the economy, stupid!" Of course, by saying this, that person is suggesting that voters will support those candidates they believe will be able to best improve the economy. Money does seem to make the world go 'round.

Environmentalists are sometimes guilty of forgetting these sayings. When you are convinced the future of the world is at stake, you should be forgiven a little single-mindedness. If we are all about to fry in the global heat wave, it is forgivable perhaps to demand that companies be forced to make the changes needed to solve global warming. For example, why should utilities be allowed to burn coal to make electricity? Force them to add solar farms and wind farms and switch to geothermal or hydroelectric generation. Hang the costs! Save the planet!

We at **ZWORC** would also love to see the end of dirty, polluting, coal-fired power plants. However, we also understand that demanding action (hang the costs) is not very realistic. Our society would come to a complete halt if coal-fired power plants were quickly shut down before the tremendous number of alternative-energy plants needed to replace the lost power can come online. Let's keep the survival of companies, industries, and society in mind as we determine how to make the changes needed to save the world.

A far more realistic plan of conversion to safer technologies is to simply stop new applications of bad technology. A good example is the utility industry. We do not suggest that fossil-fuel power plants be closed while they are still the backbone of our electricity production. Rather, let's simply prohibit any new power plants using fossil fuels from ever being built again in this country. That would mean that any new investments made by utilities to meet future power needs would have to be made into cleaner technologies such as solar, wind, and geothermal.

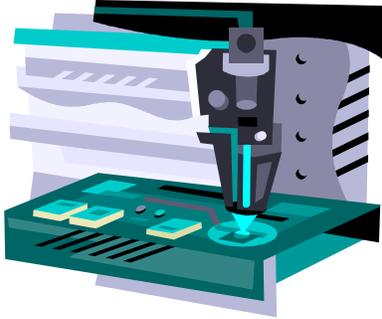
This policy would mean that future growth would be met with renewable energy, not fossil fuels. It would mean that fossil-fuel use would decrease as old power plants are removed from service due to age and condition. It would mean the phasing-out of nonrenewable energy and the phasing-in of new technologies. The percentage of electricity produced from fossil fuels would decrease gradually over an approximately 50-year period while the percentage produced from alternative energies would take over.

Such a policy would accomplish the gradual replacement of our generating capacity with clean, renewable energy and assure the long-term sustainability of the electric utility industry without creating an economically-damaging crunch time. It *is* the economy so let's not be stupid. It is also the environment so let's not be suicidal by continuing to ignore the problem.

Congress, are you there?

Waste Reduction Technique of the Month

Autonomation



Autonomation is different from, but related to, automation. Of course, automation is developing machines that can do certain tasks automatically, without direct human intervention. Much modern rise in industrial productivity per worker is based on careful implementation of automation. Autonomation takes this assignment of tasks to machinery a step further. In autonomation, machines are given 'human intelligence' so they can detect and prevent defects. Machines stop autonomously when defects are identified, asking for help. Sakichi Toyoda pioneered autonomation in the 1930's with the invention of automatic looms that stopped when a thread broke, allowing an operator to manage many looms without risk of producing large amounts of defective cloth. Autonomation is a pillar of the Toyota Production System.

Autonomation requires the incorporation of two additional technologies to the automated equipment. First, the machinery must be able to detect when a defect has been created by the automated system. Often the technology adopted is optic sensing, which is useful when departure from expected patterns constitutes a defect. Other detection technologies might be simple weighing of the units as they pass a certain point in the production system. This is very useful in filling tasks such as bottling or packaging. Testing of electrical circuits may also serve to alert the equipment to a defective unit.

Second, the machinery must be able to shut down safely when a defect has been identified and notify the human supervisor that a problem exists. This technology is simply an automatic switch to stop production combined with flashing lights, bells, buzzers, instant messages sent on a computer, etc. Of course, engineers must be sure that no safety issues are created by the unplanned and unexpected shutdown of the equipment.

Company engineers can easily coordinate with equipment suppliers to obtain such additions to automated equipment at the time of purchase or as a later retrofit.

Autonomation is known as a Lean Production Technique as it can prevent the creation of large amounts of defective units before the problem has been identified by inspectors. Sophisticated manufacturers have been incorporating autonomation for years. However, this technique also carries synergistic benefits into a Green Production System. Just as preventing defects saves time, materials, and money (Lean goals), it also saves raw materials and energy that may be used in producing defective units.

ZWORC advises that every producing company explore the opportunities for using autonomation to improve the company's economic picture and its environmental footprint.

Did You Know ... ?

There is some good news and some bad news about air pollution. The good news is that emissions of the six most significant pollutant categories (particulates, lead, sulfur dioxide, nitrogen oxide, carbon monoxide, and volatile organic compounds) dropped 41% in the U.S. between 1990 and 2006. However, the bad news is that during this same time period, greenhouse gas emissions in the U.S. have increased by 15%. (Data obtained 9/18/09 from the US Environmental Protection Agency, <http://www.epa.gov/air/airtrends/2008/report>)

Founder's Corner



A Synergy Example

By Gary Bergmiller

Recently I came across an excellent example of a policy change that contributes to both economic and environmental sustainability and I wanted to share it with you. More details may be found in Time Magazine's Sept. 7, 2009 issue.

In 2008 the State of Utah changed its policy on when its offices would be open. In order to reduce costs, the new policy called for non-essential state offices to be open only Monday through Thursday with employees working 10 hour days. After a year, the state determined it has reduced its energy use by 13%, a significant contribution to both economic sustainability and environmental sustainability. A side benefit is that employees saved an estimated \$6 million in gasoline, another environmental benefit of the changed policy. Customer service is seen as improved because state offices are now open in evenings so citizens can more easily find the offices open. And 82% of workers polled want to retain the schedule. So, this simple policy change resulted in monetary savings, reduction in energy use, increased customer satisfaction, and happier employees. What's not to like?

Let's hope the other 49 and the feds follow Utah's lead. If every organization looked at its policies with one eye on economic gain and one eye on environmental gain, we might find our society in a much stronger position.

Water Wars in Amargosa Valley

It should be clear to our readers that **ZWORC** supports the expansion of alternative energy use in our society as one of the most important actions that can be taken to assure a positive future for humans. However, we also understand the need to preserve fresh water, forests, and other environmental resources. Recently, a large solar generation facility was proposed for the very sun-rich desert area about 100 miles northwest of Las Vegas known as the Amargosa Valley. (Fun fact: This is also the location of the famous "Cottontail Ranch" brothel.) Anyhow, residents were ecstatic to welcome this new industry until they learned it would need 1.3 billion gallons of water annually as a coolant. This is 20% of the valley's available water. Allocating this water to the generating station might lead to the reduction of irrigated farming that is currently one of the valley's main industries. It is unfortunate that such trade-offs exist in the area of environmental responsibility. Other such trade-offs include using croplands to grow corn for conversion to biofuels versus using the corn for food. These situations underscore the complexity of problems our society is facing in this millennium.

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