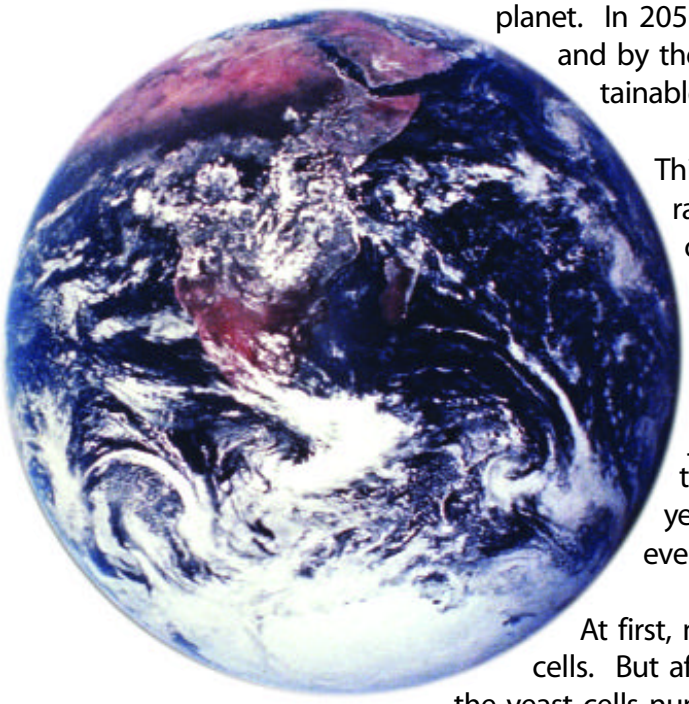
ENERGY EFFICIENCY & THE ENVIRONMENT

A position paper
by Robert J. Starr, President

The latter part of the 20th Century produced a greater awareness to the environmental challenges that our society and our planet are facing.

If the last century has produced an awareness of our environmental problems, the coming century is the one in which will have to face the task of dealing with these problems.

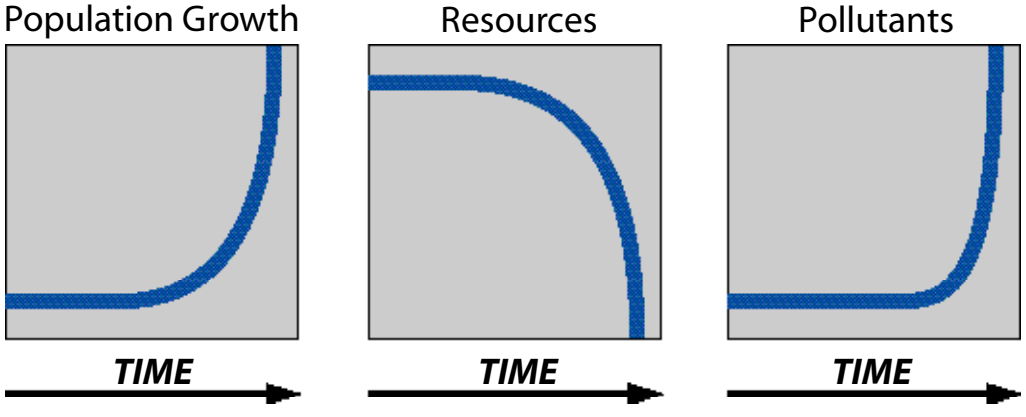
As a successful species, the human population has been increasing for thousands of years. The general rule has been that the human population on earth doubles every 40 years. This didn't seem like much of a problem a couple thousand years ago, but today, there are over 6 billion people inhabiting the planet. In 2050, at this rate, there will be more than 10 billion on the planet, and by the end of the century, 20 billion; and so on. This is not a sustainable situation.



This rapid increase in population is accompanied by an equally rapid depletion of resources as well as an increase in the levels of toxic pollution. One way to illustrate the problem, and see what could happen is to make gallon of wine.

We will start off with a gallon of grape juice. Then we will add a small starter culture of yeast. To the yeast, this grape juice is like the Garden of Eden. Resources are everywhere and things could not be better. Under these ideal conditions, the yeast do quite well and their population doubles in number every few minutes.

At first, not much happens because of the small number of starter yeast cells. But after a few days of doubling in population every few minutes, the yeast cells number in the billions. There is furious activity. The liquid is foaming and bubbling. The yeast organisms are using up their sugar resources at a terrific rate and putting out waste products (alcohol and CO_2) at a high rate too. The population keeps increasing. Clearly, the situation is not sustainable and something has to give.



At some point, all activity suddenly stops. All the yeast are dead. The juice is now wine. If the sugar resources ran out first, the yeast starved (the wine will be dry like a Cabernet). If there were some resources remaining, then the pollutants (alcohol) killed the yeast and there will be a little sugar left over. (the wine will be like a Chablis).

Either way, things did not turn out well for the yeast. Their bodies comprise the sediment at the bottom of the jug. The jug is now so toxic with alcohol that not even bacteria can live in it. They mindlessly devoured their resources, they mindlessly polluted their environment and they reproduced without control. But how can you blame them; yeast have no intellect. This is a natural situation, and we see it constantly in the natural world.

The human species is headed in the same direction as the yeast. But humans are very different from any other creature on the earth. We can think, we can plan, we can look ahead, and we can even make changes in how we do things. Humans are the most adaptable creatures that have ever lived on earth. **The big question is when and how are we going to make the changes that we need to make. How and when will we control our population, and live in a more sustainable manner, and do less damage to the environment? Will we react soon enough?**

Hand wringing and negativity is not going to solve anything. There is not going to be "one big thing" like nuclear energy or even solar energy that will get us out of this without individual effort. There are many ways that our environment is under stress today. We cannot discuss them all in this space, nor can we discuss the many remedies that are available to us. Accordingly, we must limit ourselves to a brief discussion of how human activities are affecting the solar energy that we are receiving and how it would be better to use the sun's energy directly in our home environment.

The direct use of solar energy can be a metaphor and an example for the countless other things we can do that are equally possible.

"We are surrounded by
insurmountable opportunities"

—wisdom from Pogo

Solar energy in one form or another forms the basis for everything that we do.

Our wood, coal, gas and oil resources were created using solar energy. A leaf is actually a solar collector; it converts solar energy into chemical energy. Solar energy in the red and blue spectrums powers the conversion of carbon dioxide and water into hydrocarbons. When we burn these hydrocarbons, we get the solar energy back again. When we burn our fossil fuels, we are consuming the product of millions of years worth of solar energy "savings".

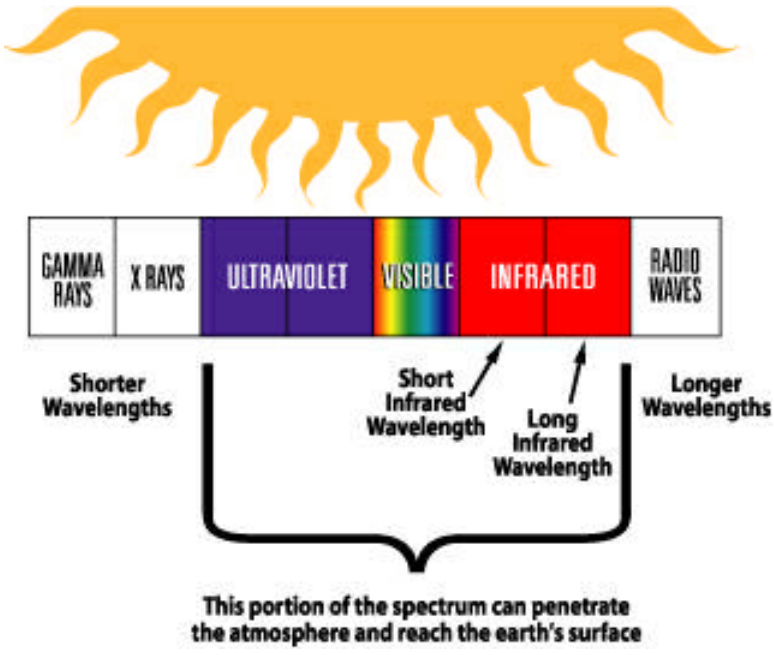
Even hydro and wind power are essentially solar energy in a different form. The sun evaporates water from the oceans and raises it aloft. When it falls back as rain, it can power our hydroelectric turbines. Wind is the result of uneven heating of the earth by the sun.

Without the sun, we could not exist at all and the earth would be a dark and lifeless place.

It is really an oxymoron to speak about solar energy and the environment. Solar energy, in all of its forms, **is** the environment.

THE SOLAR SPECTRUM – How we are changing it.

In the Fundamentals segment, we see that the sun's energy comes to us in the form of electromagnetic radiation. Some of this radiation is reflected and the rest is either absorbed or transmitted.



The solar energy that we receive must be like the "Baby Bear's Porridge", "neither too hot nor too cold, but just right". If it is not, life as we know it cannot exist on the earth. We depend upon a delicate and complex relationship between solar energy and our atmosphere to shield us from radiation that is harmful, and yet allow us to receive the types of radiation that we need. Life forms can adapt to changes in their environment by evolution, but evolution can take thousands or even millions of years.

The fossil record is full of the bones of creatures that became extinct because they could not adapt to changes in their environment fast enough.

Human activities are making changes to the solar spectrum that we receive in at least two important areas.

Changes in the ultraviolet spectrum.

A layer of ozone in the upper atmosphere absorbs most of the ultra violet radiation that comes from the sun. Ultra violet radiation is a rather intense form of radiation, and life forms cannot tolerate too much of it. Ultra violet radiation is what degrades materials that are left out in the sun. It damages the DNA of all life forms. Too much ultra violet radiation gives us sunburn and skin cancer.

About 20 years ago, we began to realize that a class of chemical compounds called chlorofluorocarbons was inactivating the ozone layer that protects us from too much ultraviolet radiation. These chemicals, which were widely used for air-conditioning and as an aerosol propellant, are long lasting in the environment. We needed to stop using these chemicals and find substitutes immediately.

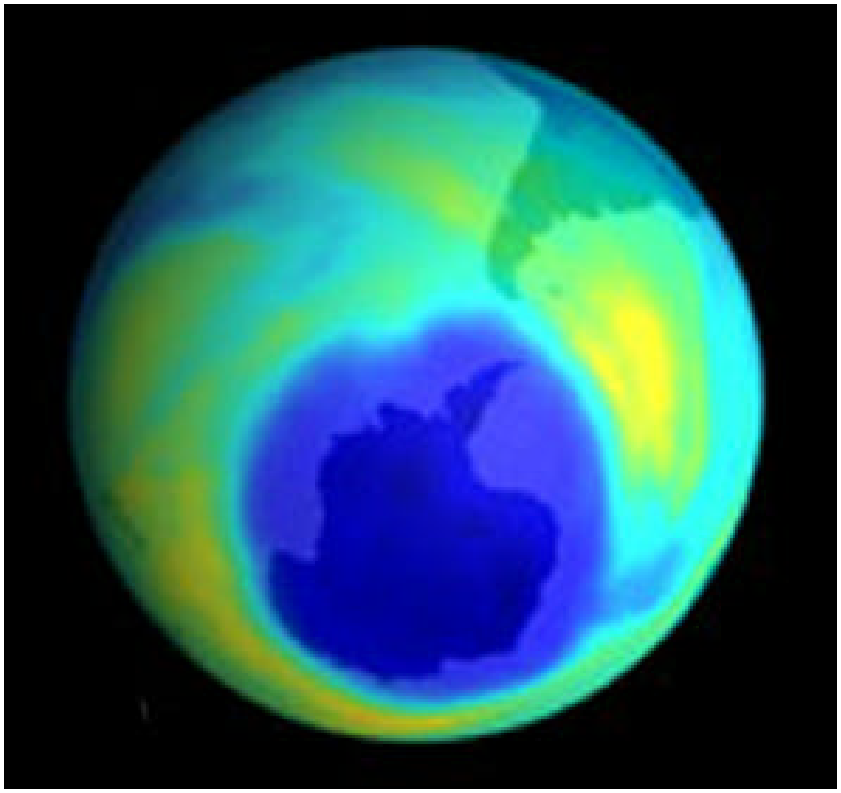
But, there was resistance to doing what needed to be done. Those who were making money selling these chemicals did not want to stop. Their lobbyists pressured government officials to do nothing about the problem. Some engineers did not want to redesign their earlier work. High government officials were more concerned about budget issues and non-interference with business than they were with an obscure environmental problem.

One official actually said that there wasn't much of a problem because "we could just use more sunscreen when we went out in the sun". He was willfully ignorant of the fact that the leaves on the trees and the plankton in the ocean cannot apply sunscreen. It is alarming that this individual held a very high position in our government.

Fortunately, this situation is turning out to be an environmental success story. The problem lent itself to a technical solution, and we are good at finding technical solutions to our problems. We just came up with another class of chemicals that did the same job as the chlorofluorocarbons did. We could have our air-conditioning, and our aerosols, and protect the environment, all at a reasonable cost.

But it is far more difficult to deal with problems that are expensive, or that require a social solution such as reproductive control and the waste of fossil fuels.

Most of our other problems will not be solved as easily as the ultraviolet problem.



Today, the hole in the ozone layer is 26 million square kilometers, about the size of North America.

The "Greenhouse Effect". The buildup of CO_2 in the atmosphere.

The amount of energy that comes through the atmosphere must eventually go right back out again. If it doesn't, the earth will overheat, and life will be impossible. The carbon dioxide that is produced when we burn fossil fuels is a material with properties like glass (see the Fundamentals section). It transmits short-range radiation coming in, but blocks the long-range radiation that needs to go out in order to stay in temperature balance.

The end result of burning all of our fossil fuel reserves in a couple of generations is the release of huge amounts of carbon dioxide.

The direct use of solar energy

In the average residential building, most of the energy that is consumed is used to meet very simple thermal needs. The energy for meeting these needs, such as for making domestic hot water, or for space heat, or for drying clothes can be provided by a number of ways. You can use oil, gas, wood, coal, electricity, nuclear energy, etc.

But you can also use the suns energy directly to meet these needs. Solar energy is free and egalitarian. It can be controlled by no one. Enough solar energy shines upon the typical house to meet its energy needs many times over.

It makes little sense to pump oil out of the ground in some unstable and unfriendly country, and then spend more energy to transport it half way around the earth, and then spend more energy to refine it, and then use it for something that we could have used the sun directly for.

There is no sense in using fossil fuels that are the product of millions of years of solar energy "savings" for simple tasks that we could use the sun directly for. If we will think a little about what we are doing, we can live more sensibly without giving up our way of life. We can even save **MONEY** in the process.

We can reduce consumption to a small percentage of what we would use, with techniques that are here right now.

Existing structures can be retrofitted with high efficiency heating and cooling systems and underfloor radiant heat. Solar can be added where possible. These measures can often reduce fossil fuel consumption by 80%.

In new construction, there are even more options. Some new buildings can actually create a surplus for use by others.

What is the use of a house if you haven't got a tolerable planet to put it on?

—Henry David Thoreau

Our physical environment is a system.

Our physical environment is highly complex, and everything is related to everything else. You cannot change one thing without changing many other things.

Marine resource biologists are humble people. The more research they do and the more data they collect, the more apparent it becomes that no one really knows what will happen to a species when the environment changes even a little. When the population of a marine species crashes, the scientists often find that the reason is something that no one ever thought of. Often, they cannot find any reason at all.

When you change the environment, It's like Forrest Gump's box of chocolates; "You just never know what you are going to get."

Solar politics

We can see that we do have some fairly serious problems, but also that we have at least a good chance of solving them if we commit ourselves.

We can also see that there are formidable obstacles to making these commitments as a society. Change is never easy. Government can either be helpful or be a hindrance.

Some of the obstacles to energy efficiency are:

1. Restrictive building codes. Conservative interpretations can and do stop innovation in its tracks, regardless of merit or necessity.
2. Powerful special interest groups. These special interest groups often oppose change. If our government is more concerned with these groups than they are with the welfare of all the people, necessary changes may not be allowed to occur.
3. Apathy and laziness. This is a particular problem when it occurs among architects, engineers, contractors, politicians, and code officials.

"We have met the enemy, and he is us."

—More wisdom from Pogo

Individual actions

On a planet where 6 billion people live, it is easy (and understandable) to say that individual actions don't mean anything. It is also frustrating to take political action when it seems that not enough other people are listening.

But it is truly surprising what an individual can do when the time is right. After the first energy shocks in the 20th century, many people went right back to sleep. Now, our energy and environmental problems seem to have settled in for good.

For what it's worth, my opinion is that now, the time is right. We are constantly being reminded that our problems can no longer be ignored.

The effects of global warming have become clear. Fossil fuels are again rising in price. California has had serious electrical price and supply problem. The events of September 11, show that we are too dependent upon the energy resources of other nations. Three recent past Presidents of the United States have had skin cancers removed. This is powerful stuff. There may never be a better chance than now.

There are many things that the individual can do. Even people who think they have no power can surprise themselves. You can always apply energy efficiency to your own life, and set an example. Remember, even if you don't change the world, you will at least **SAVE MONEY** for yourself and your family.

Out of the countless things that the individual can do help move to a sustainable future, we have space to emphasize one.

We must never again build another school that is a monument to apathy.

This is one place where one individual can truly turn things upside down. A new school should be the ultimate in efficiency and environmental awareness. It should use solar energy, because solar energy is proven cost effective in the long run.

You will not be an individual for long. This is one process where you will find plenty of people who are concerned about what happens to the next generation. Any excuses you get will not stand.

Like a stone thrown in the water, there will be a ripple effect that goes much further than your action. If you can compel change in one school, your State may compel change in all subsequent school projects.

If the architect will not change, get rid of him, or make him accept consultation. The United States Green Building Council is an excellent resource for responsible architects and architecture.
http://www.usgbc.org

This is too good an opportunity to pass up.

"It is not incumbent upon us to do everything that must be done, it is only incumbent upon us to do our part."

—from ancient scripture

The spirit of this publication is that we can live more logically, more responsibly, more deliberately, and more sensibly. We do not have to squander all of our fossil fuels and leave nothing but problems for the next generation. We are smarter and more caring than yeast. We have a unique position in the universe. Our human characteristics of intelligence, fore-sight, and love of our land and of our progeny might help keep us from ending up like the yeast. But we need to start now.

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