

No Easy Choices

Global Warming is real. The only debate left is how much temperatures will change, how fast and what part is humanity's fault versus other causes. When people talk about global warming, normally they mean the average rise in temperatures caused by greenhouse gasses such as carbon dioxide, methane, and nitrous oxide. These gasses hold heat into the atmosphere much better than the Nitrogen and Oxygen that make up most of the atmosphere. Carbon dioxide and nitrous oxides occur when fuel is burned, be it oil, coal, wood. Methane or natural gas is released when oil is pulled from the ground or organic matter decomposes. Greenhouse gases have always been part of the mix, however; our activities are causing nearly a doubling of carbon dioxide in the air.

There is a direct link between our activities and the amount of greenhouse gases. That link is our energy choices. Turn on a light, greenhouse gas was produced to make the electricity. Drive to the store, greenhouse gasses come out your cars tailpipe. Turn off your furnace, lower greenhouse gasses. Light a fire instead, more than if you left the furnace on. Non-emitting sources? No such thing. But

there is still a choice, and there are better and worse ways to produce useful energy. The worst of course is burning fossil fuels, and even those are not equally bad. Choices... I'll come back to that.

Greenhouse gases are not in themselves 'bad.' They are responsible for making our planet livable. Without them, average temperatures would be nearly zero degrees Fahrenheit. Doubling of carbon dioxide from pre-industrial levels will raise temperatures about 5 degrees. Triggering many changes.

- ~2 foot sea level rise
- More storms and fiercer ones
- Loss of coral reefs
- Increase in tropical diseases
- 25% decline in species that cannot shift range
- Possible removal of Gulf Stream, causing ice age in Northern Europe

There is a theory that holds some hope that the changes will not be as bad as the worst-case scenario. Gaia theory tells us that our planet is a balancing system. A simple example is "Daisy World." In this metaphor there are only two types of plant life on the world, white daisies and black daisies. White daisies require warmer conditions and black daisies need cooler temperatures. White daisies reflect more light, causing cooling due to less absorbed

heat. The black flowers absorb the sunlight increasing the average temperature. Their affect on the climate is opposite of the conditions that each needs to thrive. This is an example of a self-limiting system, or self-balancing system.

Evidence suggests that even our much more complex climate system and the factors that contribute to global warming have aspects of this same type of balance. As carbon dioxide absorbs reflected sunlight, trapping heat like the glass of a greenhouse for which it is named, temperatures rise, more water evaporates from the oceans causing a heavier cloud cover. This prevents sunlight from heating the Earth as much - slowing the temperature rise.

Higher temperatures also cause more plant growth, using more carbon from the air. Seawater holds more carbon dioxide when it is warm, further slowing the rate that new carbon dioxide releases affect temperature. Stabilizing the amount of carbon dioxide would require a reduction to only 5% to 10% of present fossil fuel emissions

These simple mechanisms reduce the effect of humanity's negligence, giving us more time to clean up our act. But we have to

have the collective will to make it happen. And we have to find an effective way to make it happen.

Greenpeace has a ship called the Rainbow Warrior. The name is evocative, combining a symbol of peace and promise with militant overtones. In that boat, Environmental activists sail forth to wage the battle on behalf of Mother Earth. Greenpeace has taken a stand on many issues, they have been telling the rest of us about the dangers of global warming longer than almost any one else.

Greenpeace has missed the Boat.

Not intentionally, but they have taken stands that encourage global warming and - if followed - leave us no real alternative to fossil fuels. The co-founder of Greenpeace, Patrick Moore, has broken with the organization over this stance.

I'm sure many of you are thinking, but what about hydrogen, what about solar, what about wind, what about hydro. None of those burn fossil fuels. None of those emit carbon or nitrogen.

Greenpeace and the rest of the environmental movement is pushing

the use of these options, and they are good and should be a part of the mix of power that we use. Where the environmental movement as a whole has undermined their credibility in this regard is their adamant stance against nuclear power. Not only does nuclear energy have lower greenhouse gas emissions than solar or hydro, it is the only one of these sources that is available to replace coal, oil or gas in generating capacity.

Still, what about hydrogen.

Some of the pumped up rhetoric about hydrogen is completely misleading. The first thing to understand is that hydrogen is not found anywhere on earth in a usable form. It is the one of the most common elements on Earth, but it is bound up in water and more complex chemicals. It takes energy to free it. Therefore, hydrogen is nothing more than a storage system for energy. It replaces a battery in our current thinking. With that myth dispelled, the use of hydrogen to make power portable and cause no emission at the point of use opens up great new potential to those sources of power that we do have.

Wind turbines show great promise. They emit only a very small amount of greenhouse gases in their manufacture (curing resins to make the blades.) They really are a great clean energy source.

They do have some problems. They are noisy, they kill birds and bats, they work only where and when the wind blows. (Not on that hot, still day you really want the air-conditioner turned on.) The NIMBYs don't want them around, even if they are put nearly over the horizon at sea. (NIMBY is not in my back yard.) And what do you do when the wind blows and there is low power demand.

Solar has similar demand vs. production problems, plus it is very expensive. Making photovoltaic solar cells produces quite a bit of toxic waste, not quite as green of a choice as it seems.

Hydro emits quite a bit of greenhouse gasses as the cement cures in the building of the dam, afterwards it produces almost none. But it has other negative consequences. It floods huge areas and destroys wildlife by interrupting seasonal flows and migration routes. Hydro is limited also in the availability of suitable rivers. Nearly half of all suitable rivers are already utilized.

Like hydro, nuclear power's only emissions come from the construction of the site. Also like hydro, nuclear is the only option for large-scale power production. Some comparisons are in order. To generate the same amount of power as a nuclear plant it would take 600 large turbines, or about 30 miles of windmills. For solar it would take nearly 40 square miles of photovoltaic cells to equal the power of one nuclear reactor, at 10 times the cost.

NIMBYs also hate the thought of a reactor in their area. They are scared of the radiation. What most don't realize is that the radiation dose they get from the coal power plant of similar size is 4 times higher. For the most part the radiation from a power plant to a member of the public is less than the radiation from flying a couple times a year.

Where the environmentalists are correct is on the need to handle the spent fuel safely. The waste from a nuclear power plant will be highly dangerous for millions of years.

None of these options solves the problem of how we drive. In California, transportation accounts for ½ of the production of carbon dioxide. We have some technologies on the horizon that

should help. Hybrid Gas-electric cars, cylinder shut down, and smaller cars all have the ability to reduce the emissions for the miles we drive. The positive trend of telecommuting reduces the driving which is even better. And the hydrogen freeway is coming. Despite the negative comments I just shared, producing hydrogen at a central point where the emissions can be controlled is infinitely better than burning gasoline in a car. Better yet, produce hydrogen with excess energy from nuclear, or unmanageable peaks from wind power.

As I see it we need to focus our collective will. We need to make difficult choices. We must reduce our power hungry ways, build new nuclear capacity, expand the use of wind and heat our homes with passive solar designs.

The other option is to let the waters rise as the ice melts from the artic.