

# Global warming at the Boston Museum of Science

by Norman Rogers

Unlike the Field Museum in Chicago or the Franklin Institute in Philadelphia, The Boston Museum of Science does not have a large amount of exhibit space devoted specifically to climate change. There is considerable space devoted to energy and by implication to climate change. There is also a video exhibit featuring MIT professors that pushes the climate change party line. Comical, in your face, exaggeration, such as an exhibit claiming that poison ivy will spread wildly (Field Museum) or that rising water will envelop the Statue of Liberty (Franklin Institute) is not present at the Boston museum. Perhaps the Boston museum is just a little slower in getting with the program.



**Boston Museum of Science showing one of many windmills on the roof.**

The Boston museum's message on energy subtly guides the visitor toward energy solutions preferred by the global warming crowd.

# Renewables



Developing renewable energy technology is costly and requires power grid infrastructure. Can we make it a reliable and cost-effective source of power?

# Nuclear Power



Nuclear plants produce radioactive byproducts, but not greenhouse gases. Is nuclear power an environmentally friendly and cost-effective choice?

# Fossil Fuels



Fossil fuels are a finite resource, and burning them harms our environment. What role should they play as we plan our energy future?

# Conservation



We can make more energy-efficient technologies and reduce the amount of energy we consume, but not to zero. How much energy can we save through conservation?

**“Our Energy Options” as given by the Boston Museum of Science**

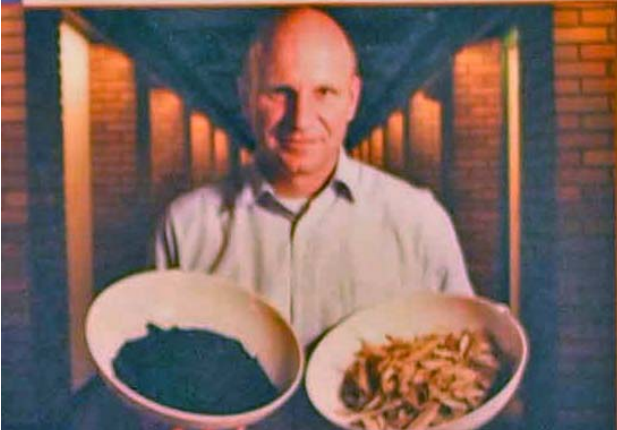


The panel on energy options above is clearly referring to electricity generation. The problem is that electricity generation accounts for only about 40% of U.S. energy consumption. The remaining 60% is oil-powered transportation and petrochemicals, plus the use of natural gas for space heating and industrial processes. Perhaps the museum ignores the other 60% because reducing CO2 emissions is much more difficult for transportation than for electricity. The transportation options are also politically unpalatable because the carbon reduction agenda will make automobiles limited in capability and expensive. Those lacking big bank accounts will be pushed in from the suburbs and on to public transportation.

Renewable energies, such as wind and solar power, bring challenges of intermittency, reliability, and high cost.

## Possible Solutions:

- **Geothermal, Tidal, and Hydropower** – Harness other renewable sources of energy that are more consistently available than solar or wind power.
- **Smart Grids** – Develop more efficient transmission of electricity through the power grid and help consumers make more informed choices about when to use power.
- **Scale Up** – Increase production and use of renewable energy to reduce the cost of manufacturing these technologies.



### one idea from chemistry

**Christopher Johannes Lehmann**, Associate Professor of Soil Biogeochemistry at Cornell University, is studying biochar, a material made from organic waste that absorbs carbon dioxide and releases a gas that can be used for energy production.

The museum's take on renewables.

If you examine the claims in the “renewables” panel above, there is a whiff of practicality when “intermittency, [lack of] reliability and high cost” are mentioned in conjunction with wind and solar energy production. This is followed by promotion of expensive and marginal renewable solutions. Consider geothermal and tidal power. Current technology limits geothermal and tidal power to special locations where local conditions are favorable. For example there is a [location](#) in California where it is possible to drill wells that yield high pressure steam from geothermal sources and a substantial power generating infrastructure takes advantage of it.<sup>1</sup> There are few such favorable locations. Scarcity of favorable locations also applies to ocean tide driven power plants. There are plenty of schemes for developing geothermal and tidal power, promoted more by professors than power companies

Hydropower is extremely practical but most of the best sites are already taken or face fierce opposition from environmentalists. No doubt a lot of power could be generated by turning off Niagara Falls or damming the Grand Canyon, but it is not likely to happen.

*Smart grids* is a scheme much beloved by the advocates of wind and solar power. A more accurate description would be “more and longer power lines.” The environmentalist love of wind and solar power has trumped the environmentalist hatred of power lines. When it is getting dark in Maine the sun is still shining brightly in the California desert. So, if it were possible to transmit the electricity 3000 miles solar power could be consumed in Maine during the evening. Similarly, if the windmills of Illinois are becalmed the wind might still be blowing in Texas and the smarty pants grid would move wind power to Chicago. Alas, sometimes the wind fails in both Texas and Illinois, so backup power plants, undoubtedly burning natural gas, would still be needed.

An example of smart grids or more and longer power lines is the Pacific DC Intertie from northern Oregon to Los Angeles (846 miles). It takes advantage of the fact that more electricity is needed in the Pacific Northwest during the winter for heating and more is needed in Southern California during the summer for air conditioning. The intertie carries as much as 3 gigawatts of electricity, a minor part of California electricity usage, but nevertheless it saves considerable money by making available cheaper hydroelectricity. The intertie was built during the 1960’s before environmentalists perfected tactics for paralyzing large infrastructure projects.

The above panel also says that as part of the smart grids scheme consumers will be given a chance to make “more informed choices about when to use power.” This means that consumers will be charged more unless they adapt to the times when it is convenient for the grid to deliver power, rather than have the grid adapt to the times when the consumers want to use power. It seems to be a feature of most green schemes that everyone should have his behavior controlled by green rules. Sorting garbage is the most annoying example.

The third “solution” in the above panel is “Scale Up.” The theory is that the bigger the scale of green schemes the cheaper they will become, benefiting from economies of scale. The problem with economies of scale is the law of diminishing returns.

The final “idea” in the panel is biochar. This scheme involves collecting all the waste plant material in the world, transporting it to biochar processing facilities where it will be processed into a useful type of fuel gas and a black powdery substance made mainly of carbon that must be transported back to the fields where it will be plowed under, thus sequestering carbon and improving the soil. This scheme makes powering the country with windmills seem to be the most sane and sober scheme imaginable.

Nuclear plants are very expensive and time-consuming to build, and there are concerns about safety and radioactive waste management.

## Possible Solutions:

- **New Designs** – Develop new reactors that are safer and easier to control.
- **New Options** – Develop nuclear fusion reactors to someday generate power along with nuclear fission reactors.
- **Long-Term Storage** – Investigate geologically stable sites to safely store radioactive waste for thousands of years.

**one idea from chemistry**

Ross Radel, Steven Wright and their colleagues at Sandia National Laboratories are developing more efficient and compact power conversion systems for advanced nuclear reactors.

**The Boston Science Museum’s take on nuclear power.**



Nuclear power is the one scalable and proven method of generating reliable power without emissions of CO<sub>2</sub>. The people who are phobic concerning CO<sub>2</sub> are usually phobic concerning nuclear power. Part of this is history. The environmental movement spent years opposing nuclear power and made it impossible to build new nuclear plants in the United States. After years of making nuclear power into a boogyman it is hard for them to reverse course and make nuclear power into your friend that prevents global warming.

The Boston museum has nothing very positive to say about nuclear power. In the panel above they say that nuclear power is expensive but they don't say that it's expensive because environmentalist campaigns have smothered nuclear power in layers of red tape. They say that there are concerns about waste management but don't say the environmentalists have successfully derailed every scheme for waste management as a part of the general campaign to destroy nuclear power. The "possible solutions" for nuclear power don't get at the real problem - environmentalist intransigence. The only solution they offer that makes any sense is developing new reactors. Some work is underway to do this. Mainly the work attempts to develop reactors that avoid environmental roadblocks. For example reactors that burn up the nuclear waste or that are smaller and can be assembled in factories and transported by truck. The suggestion to develop fusion reactors is blue sky stuff. No one is remotely close to knowing how to build a practicable fusion reactor. The "one idea from chemistry" in the panel is related to turbines to change heat into mechanical motion and is tenuously related to nuclear reactors unless you consider a reactor designed to support a future moon base to be an urgent matter.

The exhibit panel on fossil fuels (below) implies that unless we can do geo engineering or carbon sequestration, fossil fuels should be eliminated. Geo engineering is opposed by environmental groups. It involves schemes like fertilizing the ocean with iron to encourage the growth of algae or pumping sulfates into the upper atmosphere to reflect sunlight. It's unproven, science fiction stuff.

The second scheme in the panel, carbon sequestration, proposes to sequester the CO<sub>2</sub> emitted from coal power plants by pumping it down wells and storing it indefinitely in porous underground formations. The problems with this are extensive. Either the coal must be burned in pure oxygen or the CO<sub>2</sub> must be separated from the nitrogen in the stack gases because nitrogen is difficult to compress compared to CO<sub>2</sub>. A substantial amount of the power generated is diverted to compressing the CO<sub>2</sub>. If the underground formation springs a leak people for miles around may be suffocated. Carbon sequestration is the type of scheme that environmentalists would normally entangle with unmeetable standards and endless lawsuits. A cynic might think that carbon sequestration is being temporarily promoted to divert political opposition from coal interests. By pretending that carbon sequestration is practical the coal people may be fooled into thinking that the environmental lobby cares about the owners of coal mines and coal miners. Do sharks care about the creatures they eat?

The final suggestion in the panel below, the “one idea from chemistry,” promotes a scheme invented by a Canadian scientist to scrub CO<sub>2</sub> directly from the air, after which it would presumably be sequestered underground. The scientist, David Keith has also signed a petition to the U.S. government urging that \$30 billion per year be spent on climate research<sup>2</sup>. Of course the recipients of the \$30 billion would be scientists such as himself. The petition does not say how much Canada should contribute.

Burning any fossil fuel raises concerns about global climate change and other environmental consequences.

## Possible Solutions:

- **Geoengineering** – It may be possible to control the Earth's climate intentionally, but the repercussions of these interventions are unknown.
- **Carbon Capture and Storage** – Develop technologies that prevent carbon dioxide from entering the atmosphere by capturing it as it is emitted from power plants and then storing it underground.

**one idea from chemistry**

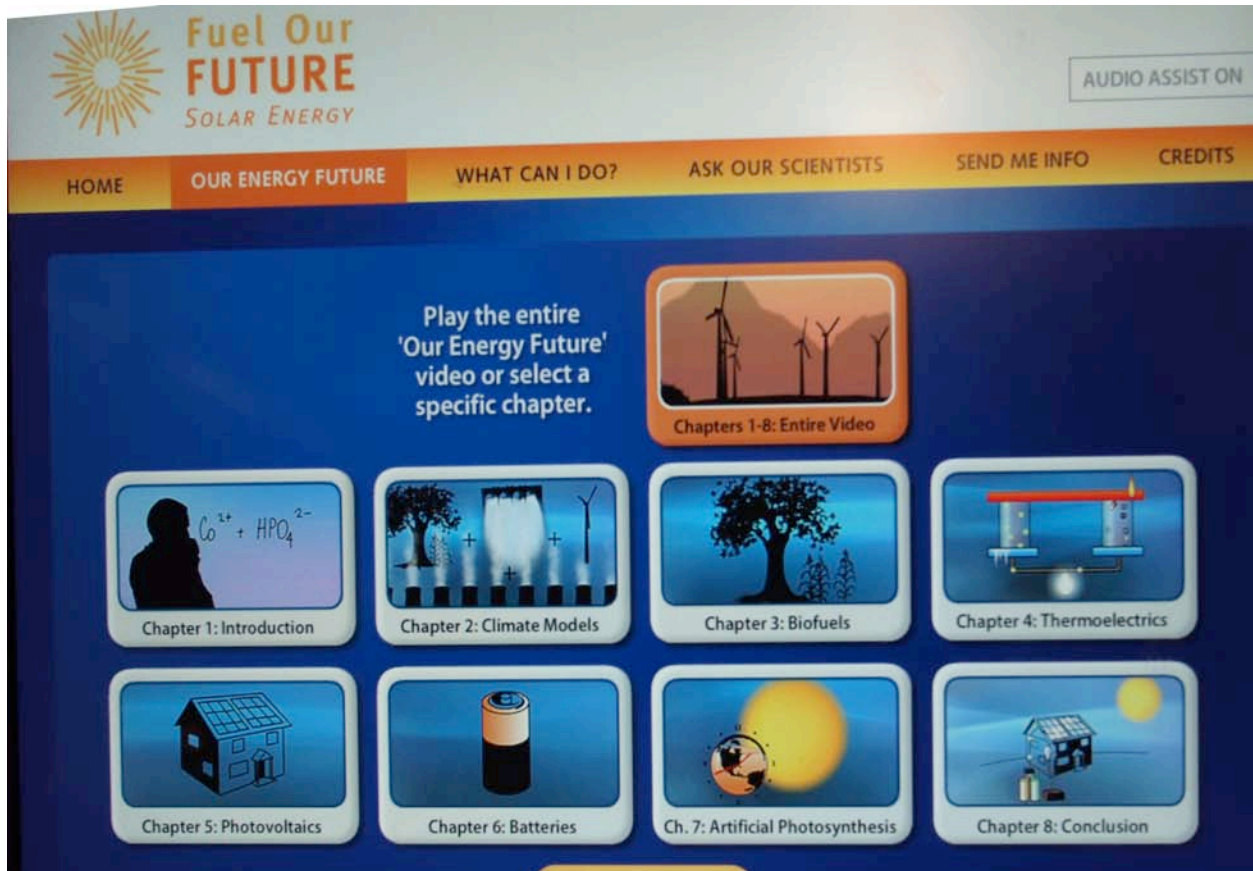
David Keith and his colleagues at the Institute for Sustainable Energy are developing a type of air scrubber that removes carbon dioxide from the atmosphere and stores it underground.

### The Boston Museum of Science’s solutions for fossil fuels.

#### Limits to Growth reborn!

The video display “Fuel Our Future” (below) features talks by MIT scientists. Those of us who are old enough may remember *Limits to Growth* a study by MIT scientists published in 1972. That study used computer models of the world and predicted that by now we would all be dying of pollution and starvation. A new generation of MIT scientists have revived the idea of a computer model of the world. The predictions are

still grim, but doomsday has been moved forward. The new computer models modestly combine an economic model of the world with a climate model of the world.



**Video exhibit Fueling Our Future**



Flames emanating from the south pole eat away at the earth (chapter 2)



Ice sheets melt. Sea level could rise by 18 feet. (chapter 2)



## Ronald G. Prinn, MIT professor speaks in chapter 2 of the video exhibit:

“There are three big, big uncertainties in the climate system. One revolves around the way we simulate clouds and the big convective storm. The second revolves around the way we simulate the ocean. Not just the surface currents, but the overturn from top to bottom of the ocean. And the third is aerosols. These are suspended particles in the air, other than water droplets and ice crystals that we’re all familiar with. Very good examples of these are black carbon that comes out of the exhaust pipe of a diesel engine vehicle. That is called black carbon, it’s called an aerosol, and that actually warms the atmosphere, because it absorbs sunlight. When we burn coal, we produce a gas, sulfur dioxide, that converts into sulfuric acid, and these are also aerosols. They cool the earth, because they are bright white particles, and they reflect sunlight to space. The net effect of these aerosols is the third big uncertainty in doing climate forecasting. So how do we get around it? It means you cannot believe any single forecast that I might give you, and you’d be foolish to do so. But if I can give you four hundred forecasts where I’ve taken different assumptions in the economics and the technology side, and different assumptions to do with the clouds, to do with the ocean, and to do with these aerosols, then I can give you my best shot at the odds of various amounts of warming. One chance in four in getting greater than three degrees centigrade warming over the next hundred years -- should I worry about that? Well, when you warm the earth, you actually warm the poles at about twice the global average rate. With six degrees centigrade warming, for sure we will begin with the loss of water from those huge ice sheets. The last time the polar regions were [that hot] was about a hundred and thirty thousand years ago. Geologists call it the Eemian period, and you can estimate the sea level back at that time. It was four to six meters higher than it is today. ...”



What’s wrong with this story? The professor declares that climate models have big problems: clouds, the oceans and aerosols. He says that you’d be foolish to believe predictions from climate models. Then he says that if you run his computer program that combines a climate model and an economic model 400 times you will get a better result. This makes no sense. If you average a lot of wrong predictions you don’t get a better prediction. You get the average wrong prediction. Finally, it would take thousands of years for enough of Greenland to melt to raise sea level by 4 to 6 meters and it is speculation to suggest that such a process is under way.

<sup>1</sup> <http://www.geysers.com/>

<sup>2</sup> Energy Scientists Call for \$30 Billion Annual Public Investment to Overcome Global Warming and Oil Dependence - <http://itsgettinghotinhere.org/2007/12/20/energy-scientists-call-for-30-billion-annual-public-investment-to-overcome-global-warming-and-oil-dependence/>