



# ENERGY NEWS

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## Energy Engineers and Global Climate Change

by Robert Farmer, ©1998

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This is the final article in a three-part series. Previously we introduced the causal relationship between the man-made Enhanced Greenhouse Effect (EGE) and global climate change, and our scientific knowledge of EGE. Man-made greenhouse gases, caused primarily by the burning of fossil fuels and deforestation, have continued to accumulate in the atmosphere every day since the dawn of the Industrial Revolution over 200 years ago, and a "runaway" greenhouse threatens to throw our climate into chaos.

This final part, written while the 4th Conference of the Parties (COP-4) to the United Nations Framework Convention on Climate Change (UNFCCC) is in session in Buenos Aires, suggests that energy engineers are not only eminently qualified, but have a duty, to take the lead role in mitigating these risks of global climate change by building the energy infrastructure for a sustainable future.

### **What is the role for energy engineers?**

In the broadest context, energy engineers transform fuels into other more useful forms of energy—such as power for electricity and transportation. They also manage the efficiency of these energy

"flows". They have built the energy infrastructure upon which we all depend. From electric power plants, to automobiles, to industries and homes, the energy engineer has built them all. And, as the bulk of energy consumed in the world is fossil fuel-based, energy engineers find themselves squarely in the forefront for global climate change solutions.

They are qualified to deliver solutions because their practices do, and will, determine all present and future greenhouse gas emissions, and, by association, the future extent of the enhanced greenhouse effect. Their work will determine whether we stabilize the greenhouse effect or have a runaway greenhouse fed by the feedback loops that Arrhenius projected.

They are well-versed in the field of thermodynamics and the concept of thermal efficiency, without which there is no hope that we can arrest the greenhouse effect. And they're well prepared because environmental solutions to energy problems are not new to them.. The Clean Air Act, for example, has required that they innovate new "clean-burning" solutions so that society might remain healthy without impeding economic growth.

What is missing from their current arsenal of energy equations and solutions, is a new environmental efficiency component which must be used to solve the enhanced greenhouse effect. I call that new component "carbon efficiency".

Today's energy engineers need to know about the carbon content of the fuels and processes they are engineering. What is the carbon content of oil, and natural gas, and coal? What are the heat AND carbon values of these different carbon fuels? These questions have not been part of the lexicon of the energy engineering profession in the past, but they must now play a significant role as we seek solutions to the enhanced greenhouse effect.

Ultimately, carbon efficiency will be as often cited by energy engineers as thermal and fiscal efficiency.

### **Technology Solutions**

Within the climate change policy community it is generally acknowledged that solutions fall into two categories: climate change adaptation, and greenhouse gas mitigation.

Climate change adaptation is a damage-avoidance strategy. For example, communities and even countries, might build seawalls to protect against sea level rise. In these circumstances climate change is looked upon as inevitable and societies are taking active defensive measures.

Greenhouse gas mitigation, on the other hand, tackles emissions head-on and is the realm of the energy engineer. Mitigation is divided into sink-based solutions—the capture and disposal of carbon dioxide and the enhancement of forest sinks—and source-based solutions: energy conservation, efficiency improve-

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ments, fossil-fuel switching, renewable energy, and nuclear energy.

Energy conservation relates to the culture of waste, but efficiency improvements offer the greatest short term opportunity. Current power applications are woefully inefficient. Conventional power generation is at least 67% inefficient with all the carbon in every ton of coal ending up in the environment. Automobiles are worse.

Fossil-fuel switching is a carbon efficiency measure—for example, natural gas is cleaner to use than coal, because it contains much less carbon per unit of fuel value.

Renewables must become part of the future, especially for Floridians where we are virtually dependent on imported fossil fuels. The sun and hydrogen are particularly attractive because they are zero emission power producers.

Nuclear is a long term consideration but is bedeviled by seemingly insurmountable environmental penalties.

So what does this all mean?

Energy engineers have a duty to society. Consumers don't know BTUs from kilowatt hours, and they don't care. All they know is warm rooms, cold beer, getting from point A to point B. They are not informed in these matters. Poor energy applications will continue to result in poor energy choices, and an escalation of the greenhouse effect. Energy engineers must take the lead in educating the consumer and building the infrastructure of a sustainable future

And they must go beyond engineering solutions to global climate change. There is a host of environmental maladies directly attributable to inappropriate energy applications. Smog and ozone depletion continue to plague us, and we will inevitably have to deal with energy security issues brought about by a combination of fossil fuel depletion and increasing worldwide energy demand. Our only logical recourse is to sustainable

development practices.

Tomorrow's energy engineer will be very much in demand to deliver the future we all want to live in.❖



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His technical expertise includes large scale to small scale power generation, combined heat and power (CHP), marine and surface transportation, and alternative fuel applications.

A Florida resident since 1984, Robert was a member of the Energy Advisory Committee of Governor Chiles' Commission for a Sustainable South Florida.

He is a Regional member and Market Development Chair of the Gold Coast Clean Cities Coalition (a U.S. Department of Energy program), and a member of the Southeast Air Coalition for Outreach (SEACO, an initiative of the Florida Department of Environmental Protection).

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