

Is there a Pathway to a Sustainable Climate and Energy Future?

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Thank you for the opportunity to speak with you this morning.

Do you know how much energy you use?

Well, if you eat 2000 Food Calories every day, that provides enough energy to generate 100 Watts – about enough power to run that light bulb (*point to light bulb overhead*). And as we all know, if our Calorie intake exceeds our energy use, our body mass is going to increase, and only if our Calorie intake is less than our energy use, will our body mass eventually decrease (and that has nothing to do with Einstein's formula !). And for most of human history, that was all the energy that was available to us to do the world's work – our own body's energy, supplemented by a few draft animals.

But within the past few hundred years, humans have learned how to access the energy stored in the Earth over hundreds of millions of years of biogeochemical processes. We are now using that stored energy at a rate that provides each person in the world, on the average, with 2000 Watts of power – twenty times what we can generate from our own metabolic activity. Another way of looking at it is that the "Global Energy Bill" is now 108 *trillion* Kilowatt-Hours every year. 85 per cent of this energy comes from burning stored carbon: coal, oil, and natural gas. Think about that the next time you pay your utility bill.

But that is not the end of the story. In America – where, just as in Lake Wobegon, "Everyone is above average", we use energy more than five times more intensively than the rest of the world – about 11,000 Watts for every person in America. It is as if every man, woman, and child in America has their own 11 Kilowatt generator running for them 24 hours a day, 7 days a week, 365 days a year.

Meanwhile, in countries such as Ethiopia, North Korea, and Bangladesh, the average person there gets to use about 100 or 200 Watts of energy – not much more than their own body can generate, and one one-hundredth of what we use here in the U.S.

But the story does not end there either. Over the next fifty years, global energy use is forecast to increase by a factor of two to three over what we use now. And yet, there are still one and one-half billion people – one-fourth of the world's population – who do not have access to electricity or clean fuel for cooking and heating.

This is going to have a number of consequences.

First, all that carbon released by energy generation is eventually going to find its way into the atmosphere, mostly in the form of carbon dioxide. This, at least, is not subject to dispute. It is just a matter of bookkeeping: the carbon has to end up somewhere! How this increased level of carbon dioxide is going to affect the global climate is a more complex question, to be sure, but the scientific consensus is, as our National Academy of Sciences concluded in 2001, "*Global warming could well have serious adverse societal and ecological impacts by the end of this century*". At the very least, we are carrying out a huge, uncontrolled experiment with the Earth on which we live – and if the experiment goes bad, we cannot return it to the Manufacturer and expect to receive a free replacement !

The second consequence is the "collateral damage" caused by sulfur oxides, nitrogen oxides, mercury, and other pollutants released when fossil fuels are burned. These emissions have been significantly reduced during the past several decades, thanks to environmental legislation that is working, but they have not been eliminated by any means, and current regulatory trends appear to be reducing these controls to allow more pollution to occur.

The third issue concerns resource availability. I am not just referring to having enough oil and natural gas to keep on burning it up. When you go home today, take a look at your clothes; at the interior of your car; at your home furnishings and appliances; at the medicines in your bathroom cabinet; at the food on your table. Every one of these products is produced using oil, and when that oil is burned, it is no longer available as the starting material for these chemical, pharmaceutical, and plastic products.

The fourth issue is inter-societal equity. As I mentioned before, a society with 5 per cent of the world's population uses 25 per cent of the world's energy resources and generates 25 per cent of the world's greenhouse gas emissions. This is not sustainable, especially when mass media and the internet make it no longer possible to hide behind our borders.

And fifthly, there is inter-generational equity. We may think we are able to meet our own needs today, although a quarter of the world's population would not agree with this – but will future generations, meaning your own descendants in the not very distant future, be able to meet their needs as well?

So how can we as individuals and communities begin to respond to the looming challenges of global warming and dwindling resources? Is there a single guiding principle that we can use when making what may be difficult personal, economic, and environmental decisions?

Technically, economically, and politically, the answer is NO – there is no single strategy that will solve these problems. We need to start using every strategy that we can think of, along with quite a few that we haven't thought of yet, including

- efficient utilization of the energy resources we do have
- moving from coal, oil, and gas to renewable energy sources
- conservation, that is, using less energy to meet our needs (and perhaps re-defining what our needs really are)
- maybe developing technology for CO₂ capture and storage and everything else.

But ethically, I suggest there is a basic principle to help guide us towards a sustainable energy future, and it is the one in the little 3 page handout you received this morning. It appears as the famous saying of Confucius. It also appears in the Bhagavad-Gita, the sacred scripture of the Hindu tradition. Over the centuries and millennia, it has been restated in increasingly complicated form by philosophers and scientific writers. But it all comes back to the earliest and most concise statement:

"וְאָהַבְתָּ לְרֵעֶךָ כְּמוֹךָ",

"Love your neighbor the same as yourself."

How does this apply to energy and climate? This has been explained by a very wise person, Prof. John Harte, an ecologist at Berkeley, in the selection which I have included in your handout (I have also included some further comments by students at the "YES" course we give each summer, which we can talk about later over coffee). Prof. Harte suggests that science is able to tell us how we should apply this ethical principle to make the decisions needed in our modern society. As he notes, "to the early Hebrew and Christian (and Taoist and Hindu and Buddhist) philosophers, your 'neighbor' was literally that – the clan living in the next tent, and the actions you should not do to them were to take from them their sheep, or their wife, or their life." But now technology has made it possible to affect the lives of everyone else in the world, including those that we will never meet personally, and in ways that the biblical philosophers could not have imagined.

"But", as he continues, "we cannot stop there. *'Others' must include future generations that may be affected by our actions ...* Every barrel of oil that we pump from underground and burn is one less barrel for our descendants to use." And not necessarily for them to burn, but to use to make the products and materials that they will need in their lives. As Professor Ron Breslow of Columbia University once remarked, "*Our grandchildren will curse us for burning up their clothes, their medicines, their agricultural produce ... and they will be right*", unless we change the way we carry out society's business.

To continue, "*Every species and every acre of wilderness that we destroy is one less from which our descendants can benefit.*" The United Nations Millennium Ecosystem Assessment recently concluded that "*Human activities are putting such strain on the natural functions of Earth that the ability of the planet's ecosystems to sustain future generations can no longer be taken for granted.*" Up to one-third of existing bird, fish, amphibian, and mammal species could be threatened with extinction in the next fifty years. Could one of those species be us?

He concludes, "*Every child born today is a potential great-great-grandparent of a legacy of people who will, a century later, occupy space, consume resources, and also will want to create a legacy for their own great-great-grandchildren.*" So perhaps the interpretation of "Love Thy Neighbor" most appropriate for today should be something along the lines of, "In our actions, we must take account of every other creature with whom we share – or *will* share – this Planet, just as if they are all a part of our own selves, and as if we are a part of them" – because science and our spiritual heritage agree, every other creature on Earth is a part of ourselves ... and we are a part of them.