Is Global Warming Unstoppable?

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In a provocative new study, a University of Utah scientist argues that rising carbon dioxide emissions - the major cause of global warming - cannot be stabilized unless the world's economy collapses or society builds the equivalent of one new nuclear power plant each day.

"It looks unlikely that there will be any substantial near-term departure from recently observed acceleration in carbon dioxide emission rates," says the new paper by Tim Garrett, an associate professor of atmospheric sciences.

Garrett's study was panned by some economists and rejected by several journals before acceptance by Climatic Change, a journal edited by renowned Stanford University climate scientist Stephen Schneider. The study will be published online this week.

The study - which is based on the concept that physics can be used to characterize the evolution of civilization - indicates:

- Energy conservation or efficiency doesn't really save energy, but instead spurs economic growth and accelerated energy consumption.
- Throughout history, a simple physical "constant" - an unchanging mathematical value - links global energy use to the world's accumulated economic productivity, adjusted for inflation. So it isn't necessary to consider population growth and standard of living in predicting society's future energy consumption and resulting carbon dioxide emissions.
- "Stabilization of carbon dioxide emissions at current rates will require approximately 300 gigawatts of new non-carbon-dioxide-emitting power production capacity annually - approximately one new nuclear power plant (or equivalent) per day," Garrett says. "Physically, there are no other options without killing the economy."

Getting Heat for Viewing Civilization as a "Heat Engine"

Garrett says colleagues generally support his theory, while some economists are critical. One economist, who reviewed the study, wrote: "I am afraid the author will need to study harder before he can contribute."

"I'm not an economist, and I am approaching the economy as a physics problem," Garrett says. "I end up with a global economic growth model different than they have."

Garrett treats civilization like a "heat engine" that "consumes energy and does 'work' in the form of economic production, which then spurs it to consume more energy," he says.

"If society consumed no energy, civilization would be worthless," he adds. "It is only by consuming energy that civilization is able to maintain the activities that give it economic value. This means that if we ever start to run out of energy, then the value of civilization is going to fall and even collapse absent discovery of new energy sources."

Garrett says his study's key finding "is that accumulated economic production over the course of history has been tied to the rate of energy consumption at a global level through a constant factor."

That "constant" is 9.7 (plus or minus 0.3) milliwatts per inflation-adjusted 1990 dollar. So if you look at economic and energy production at any specific time in history, "each inflation-adjusted 1990 dollar would be supported by 9.7 milliwatts of primary energy consumption," Garrett says.

Garrett tested his theory and found this constant relationship between energy use and economic production at any given time by using United Nations statistics for global GDP (gross domestic product), U.S. Department of Energy data on global energy consumption during1970-2005, and previous studies that estimated global economic production as long as 2,000 years ago. Then he investigated the implications for carbon dioxide emissions.

"Economists think you need population and standard of living to estimate productivity," he says.

"In my model, all you need to know is how fast energy consumption is rising. The reason why is because there is this link between the economy and rates of energy consumption, and it's just a constant factor."

Garrett adds: "By finding this constant factor, the problem of [forecasting] global economic growth is dramatically simpler. There is no need to consider population growth and changes in standard of living because they are marching to the tune of the availability of energy supplies."

To Garrett, that means the acceleration of carbon dioxide emissions is unlikely to change soon because our energy use today is tied to society's past economic productivity.

"Viewed from this perspective, civilization evolves in a spontaneous feedback loop maintained only by energy consumption and incorporation of environmental matter," Garrett says. It is like a child that "grows by consuming food, and when the child grows, it is able to consume more food, which enables it to grow more."

Is Meaningful Energy Conservation Impossible?

Perhaps the most provocative implication of Garrett's theory is that conserving energy doesn't reduce energy use, but spurs economic growth and more energy use.

"Making civilization more energy efficient simply allows it to grow faster and consume more energy," says Garrett.

He says the idea that resource conservation accelerates resource consumption - known as Jevons paradox - was proposed in the 1865 book "The Coal Question" by William Stanley Jevons, who noted that coal prices fell and coal consumption soared after improvements in steam engine efficiency.

So is Garrett arguing that conserving energy doesn't matter?

"I'm just saying it's not really possible to conserve energy in a meaningful way because the current rate of energy consumption is determined by the unchangeable past of economic production. If it feels good to conserve energy, that is fine, but there shouldn't be any pretense that it will make a difference."

Yet, Garrett says his findings contradict his own previously held beliefs about conservation, and he continues to ride a bike or bus to work, line dry family clothing and use a push lawnmower.

An Inevitable Future for Carbon Dioxide Emissions?

Garrett says often-discussed strategies for slowing carbon dioxide emissions and global warming include mention increased energy efficiency, reduced population growth and a switch to power sources that don't emit carbon dioxide, including nuclear, wind and solar energy and underground storage of carbon dioxide from fossil fuel burning. Another strategy is rarely mentioned: a decreased standard of living, which would occur if energy supplies ran short and the economy collapsed, he adds.

"Fundamentally, I believe the system is deterministic," says Garrett. "Changes in population and standard of living are only a function of the current energy efficiency. That leaves only switching to a non-carbon-dioxide-emitting power source as an available option."

"The problem is that, in order to stabilize emissions, not even reduce them, we have to switch to non-carbonized energy sources at a rate about 2.1 percent per year. That comes out to almost one new nuclear power plant per day."

"If society invests sufficient resources into alternative and new, non-carbon energy supplies, then perhaps it can continue growing without increasing global warming," Garrett says.

Does Garrett fear global warming deniers will use his work to justify inaction?

"No," he says. "Ultimately, it's not clear that policy decisions have the capacity to change the future course of civilization."

SOURCE: University of Utah