

Major cuts to surging CO2 emissions are needed now, not down the road, study finds

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In 2004 a very popular study aimed to address climate change by deploying wedges of different existing energy technologies or approaches. According to the study by Robert Socolow and Stephen Pacala, each wedge would avoid one billion tons of carbon (1 GtC) emissions per year after 50 years. The study showed that, at that time, seven wedges could stabilize carbon dioxide emissions relative to what would happen if things remained "business-as-usual."

A new perspective paper from a group including Carnegie's Ken Caldeira uses the wedge approach to estimate the size of the energy challenge posed by climate change today. It is published January 9 by *Environmental Research Letters*.

The perspective's authors showed that as a result of increased emissions, merely achieving what was considered "business-as-usual" in 2004 would require the development and deployment of 12 wedges. Stabilizing emissions at current levels would require another 9 wedges. Decreasing emissions to the level needed to prevent climate change would need an additional 10 wedges. Altogether, 31 wedges would be required to stabilize the Earth's climate.

"To solve the climate problem while providing the energy needed for modern industrial society, new energy technologies must be developed and deployed at an enormous and increasing rate," Caldeira said.

His co-authors are Steven Davis and Long Cao, both formerly of

Carnegie, now with University of California Irvine and Zhejiang University in China, respectively, as well as Martin Hoffert of New York University.

Truly addressing climate changes means not just stabilizing emissions, but sharply reducing them over the next 50 years, the authors said. This would require more than just improving existing technologies, they added.

"It's not enough to freeze greenhouse gas emissions at current levels. To prevent climate change, we need to stop dumping carbon dioxide into the atmosphere at industrial scale", said Caldeira. "The original study showed that we can solve a large part of the problem with existing technologies, but solving the whole problem requires new technologies deployed at massive scale."

Current technologies and systems cannot provide the equivalent amounts of carbon-free energy needed soon enough or affordably enough to achieve this transformation, the perspective says. Fundamental, disruptive changes to the global energy system are required.

"Most of the greenhouse gas emissions expected this century are expected to come from the developing world in the second half of the century. A central challenge of the first half of this century is to develop the energy technologies that will be needed in the second half of the century," Caldeira said. "Existing technologies just cannot provide the massive amounts of carbon-neutral power needed later this century. Solving the climate problem will be both difficult and necessary."

Provided by Carnegie Institution for Science

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