

# THE ENERGY ADVOCATE

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## CO<sub>2</sub> Residence Time

In **TEA** June 2008, we discussed the residence time for CO<sub>2</sub> in the atmosphere, showing that by various definitions and calculations, the residence time could be anything from about 5 years to thousands of years.

As we have shown (**TEA** April, Oct. 2010), atmospheric CO<sub>2</sub> concentration increases as water warms and decreases as water cools. There is also the atmospheric CO<sub>2</sub> greenhouse effect, according to which there is more heating of the earth with more atmospheric CO<sub>2</sub>. Curiously (and unnoticed by the IPCC, which ignores the oceanic control of CO<sub>2</sub> concentration entirely), identical equations (save for unknown coefficients) apply to both processes.

Now consider the sudden injection of CO<sub>2</sub> into the atmosphere by some process (burning coal or erupting volcanoes, for example). How much heating does that CO<sub>2</sub> produce? The answer depends upon how long the CO<sub>2</sub> remains in the atmosphere. If all of it goes into the ocean overnight, there is negligible heating. If it remains for thousands of years, the heating is persistent. Absent any other effects, the persistent heating from a doubling of CO<sub>2</sub> concentration would raise the temperature of the earth by 1.1 °C.



Figure 1: Eruption from Mount. St. Helens. Photo from <http://www.worldtravelattractions.com/mount-saint-helens-eruptions/>

Volcanoes are emitters of CO<sub>2</sub>, but their worldwide output is normally about 10% as much as combustion produces, at least for the volcanoes on land. Most volcanoes are on the ocean floor, and largely unnoticed. Some persist for decades and some engage in occasional violent eruptions. But we will look

at a few surface volcanoes that erupt violently for a short time.

Norwegian geologist Tom Segalstad presented a talk at the Fourth International Conference on Climate Change, 2010, in Chicago [1] in which he provided some data about CO<sub>2</sub> emissions from volcanoes. “The Icelandic 934 AD *Eldgjá* eruption must have released more than 15 times today's anthropogenic annual amount. ... The 6 month long Icelandic 1783 *Laki* eruption must have released more than 12 times today's anthropogenic annual amount.”

The atmospheric quantity of carbon in CO<sub>2</sub> is about  $750 \times 10^{12}$  kg, and the annual emissions from combustion amount to about  $6.4 \times 10^{12}$  kg. In other words, the annual emissions are equal to about 1.2% of the amount in the atmosphere. When the Icelandic eruptions occurred, there was about  $550 \times 10^{12}$  kg of carbon in the air, so the two Icelandic eruptions should have increased atmospheric CO<sub>2</sub> concentration by about 17% and 14% respectively.

If the CO<sub>2</sub> remained in the air for (say) hundreds of years, it would still be there. It isn't.



Figure 2: Lava from Hawaii Volcanoes National Park flows into the ocean. Photo from <http://www.fukubonsai.com/bi3a.html>

- [1] Fourth International Conference on Climate Change, sponsored by the Heartland Institute, Chicago, 2010. See [www.heartland.org](http://www.heartland.org) for videos of all talks.

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### Volcanoes

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For our purposes, there are two types of volcanoes: those that violently explode, sending pyroclastic (broken by heat) ash far

into the upper atmosphere (Fig. 1, Mt. St. Helens, a very *minor* eruption compared to others), and those which produce flows of lava (Fig. 2). Clearly, the lava is hot enough to “explode”, but it doesn't do so. The reason is simply that lava is a viscous liquid, not a gas.

But ash is not a gas either. Why does it explode? Segalstad explains, “A mantle melt may have up to 8 wt.% CO<sub>2</sub> at ~125 km depth. Surface lava can only hold 0.01 - 0.001 wt.% CO<sub>2</sub> dissolved.” In other words, under pressure, the mantle contains a high CO<sub>2</sub> concentration, and the CO<sub>2</sub> must go somewhere when the pressure is relieved. The expanding gas is what propels the ash to the atmosphere, and is likely involved in fragmenting the rock into dust.

In lava volcanoes, bubbles of gas form beneath the viscous liquid and spew the lava around as the bubbles come up to the surface, but the eruptions are very mild compared to those producing pyroclastic flows.

Figure 3 shows a 75-year running average of CO<sub>2</sub> concentration assembled from Law Dome in the Antarctic [2]. The 1783 *Laki* eruption presumably added 14% to atmospheric CO<sub>2</sub> concentration. If the CO<sub>2</sub> remained in the atmosphere, there would be a sudden increase that persisted to this day; without the 75-year averaging, it would appear as a step. With the 75-year averaging, it would show up as a rounded shoulder, but still a pronounced increase. In any case, the full increase should be visible shortly after the eruption.

On the other hand, if CO<sub>2</sub> has a *short* residence time, there should be no large effect. For example if the residence time were 5 years, 75-year averaging should show an increase of about 2%, which would not be noticeable on the graph in Fig. 3, given the other variations.

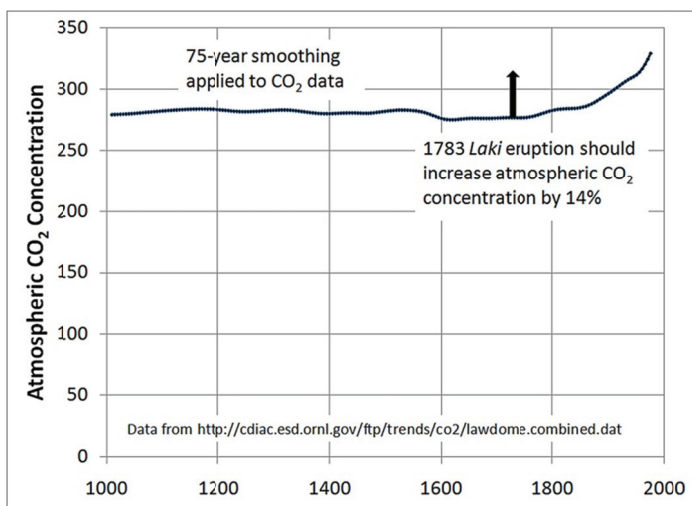


Figure 3: Historic CO<sub>2</sub> concentration, with 75-year running average. The burst from *Laki* in 1783 should have raised concentration (and probably did) by 14%. If the CO<sub>2</sub> remained in the atmosphere, there would be a pronounced increase, even with 75-year averaging. With a 5-year residence time and 75-year averaging, the change would not be noticeable.

Segalstad [1] points to numerous published estimates—35 of them, in fact—ranging from 2 to 10+ years, centered around 5-6 years. On the other hand, Rohde [3] compiled data from 4 *models* and 2 experimental papers and supposedly used them to construct the graph on the left side of Fig. 4. One of the experimental papers is not readily available, but the other [4] clearly points out that temperature rises before CO<sub>2</sub> concentration increases (Fig. 4, right graph).

Putting it all together, the length of time required for CO<sub>2</sub> to return to ambient levels following a sudden surge is in the range of 5 years. Beyond that, the equilibrium level of atmospheric CO<sub>2</sub> is determined by ocean temperature. The law that says that equilibrium exists is called Henry’s Law.

The law that tells the temperature dependence is called van't Hoff's Law. One searches in vain for mention of either law in the scribbles of the IPCC.

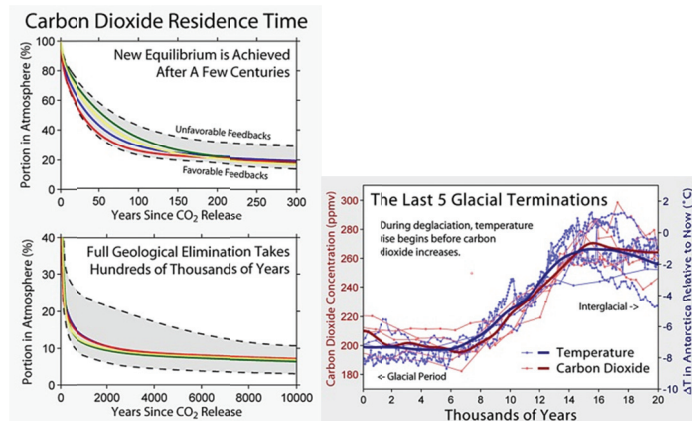


Figure 4: Left: Computer models of CO<sub>2</sub> residence time. Image created by Robert A. Rohde / Global Warming Art [3]. Right: Graph from Zachos [4], one of 6 references supposedly used by Rohde. The thin lines refer to 5 glacial terminations, and the thick lines are averages. In the colored original, it is clear that the temperature rises before the CO<sub>2</sub> increases.

- [2] <http://cdiac.esd.ornl.gov/ftp/trends/co2/lawdome.combined.dat>
- [3] [http://www.globalwarmingart.com/wiki/File:Carbon\\_Dioxide\\_Residence\\_Time.png](http://www.globalwarmingart.com/wiki/File:Carbon_Dioxide_Residence_Time.png)
- [4] Zachos, James, Mark Pagani, Lisa Sloan, Ellen Thomas, and Katharina Billups (2001). "Trends, Rhythms, and Aberrations in Global Climate 65 Ma to Present". *Science* **292** (5517): 686–693.

## GWIGC

During January, global-warming-induced global cooling has dumped 6 feet (almost two meters, a new record) of snow on Connecticut, according to meteorologist Art Horn. In Florida, manatees have died from hypothermia [5], and have sought refuge at warm-water discharges of power plants. We read that literally thousands of dead crabs have washed up on shore in Great Britain, victims of hypothermia [6].

These cold events are weather events, of course; *climate* is usually understood to involve 30-year averages, and *global climate* involves 30-year averages around the globe.

In case that's too complicated, you can use the distinction common to climate alarmists: cold events are weather, warm events are climate. Therefore “climate change” is warming. And of course *warming climate* can cause cold *weather*.

- [5] Ludmilla Lelis, “Cold weather prompts record high total of manatee deaths,” *Orlando Sentinel*, January 05, 2011.
- [6] “40,000 ‘devil’ crabs wash up on Kent coast after dying from hypothermia in freezing sea,” *Daily Mail Reporter*, Jan. 5, 2011.

## Gilding the Lily

We have often recommended Darrel Huff's classic book, *How to Lie With Statistics*, which he wrote to inform the unwary reader of techniques used by masters of propaganda. Herein we use one of his graphical methods to show how climate sirens distort data. Figure 5 shows atmospheric CO<sub>2</sub> concentrations since 1832. Top left: data on scale starting at zero, with IPCC Lead Author and prominent climate alarmist Kevin Trenberth's picture overlaid. Top right: graph clipped

at 250 and 400 ppmv. Bottom: graph stretched vertically. Huff refers to this end product as a “Gee-Whiz” graph.

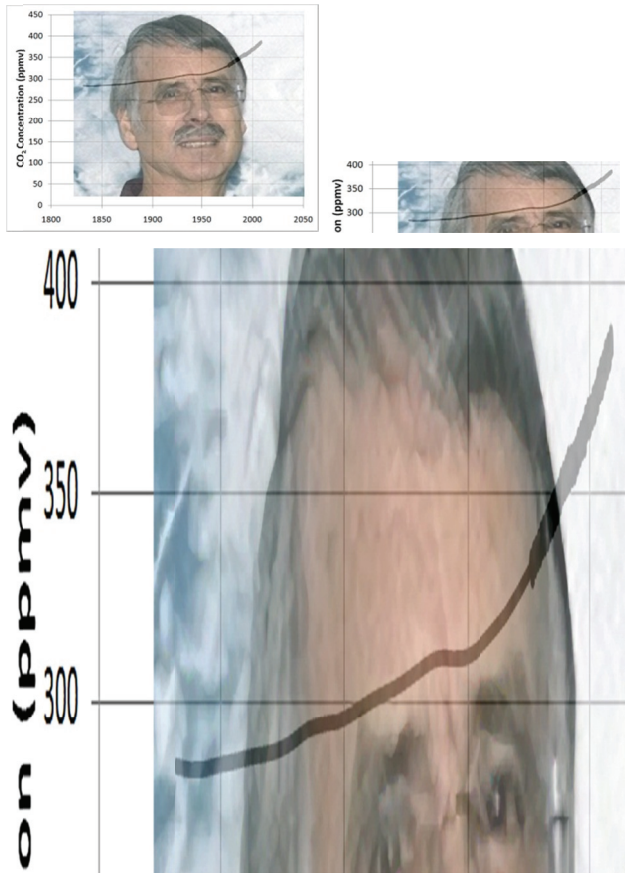


Figure 5: CO<sub>2</sub> concentration, 1832-present. 20-year averages till 1978, then monthly data till 2009. Steps in making a Gee-Whiz graph. Draw. Cut. Stretch.

Evidently, a Gee-Whiz graph is not enough for Kevin Trenberth, so he appends *fictitious* what-if “data” (See Fig. 6) showing *soaring* levels in no time at all. I’ve told him fifty-million times not to exaggerate!

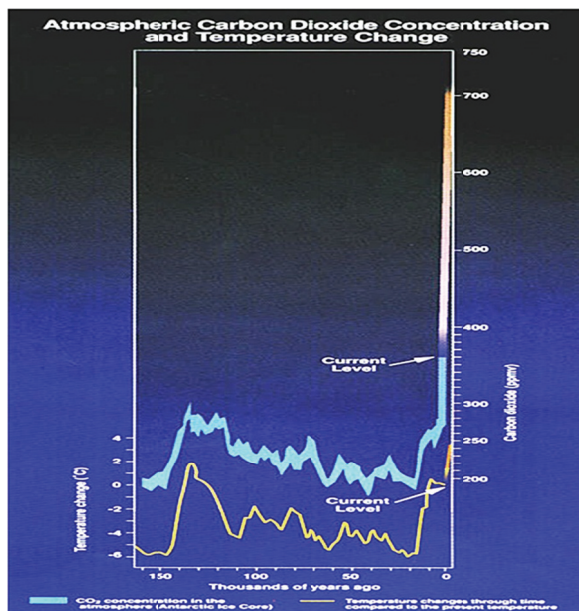


Figure 6: CO<sub>2</sub> graph from Trenberth’s Lecture 33 at the University of Arizona. See [www.atmo.arizona.edu/students/courseslinks](http://www.atmo.arizona.edu/students/courseslinks). Notice that the graph starts at 200

ppmv, not at zero. The hockey-stick shape is vastly enhanced by his fictitious what-if data.

## The Real Extremist

If Kevin Trenberth seems a little extreme, how about James Hansen, who testified on behalf of graffiti artists who did thousands of dollars of damage to smokestacks at a coal-fired power plant at Kingsnorth [TEA October 2008].

Now consider James E. Hansen, director of the taxpayer-funded NASA Goddard Institute for Space Studies. Last week, blogger Marc Morano discovered a Nov. 24 *blog post by Mr. Hansen calling on China to lead an international effort to impose fees on carbon-dioxide emissions, then lead the World Trade Organization to allow import fees on goods from any county [sic] - with the U.S. being the target - without such fees.* The goal would be to punish America, causing “continual descent into second-rate and third-rate economic well-being,” until the “fossil-money- ‘democracy’” no longer “rules the roost in Washington.” Mr. Hansen also praised communist Chinese leadership for “tak[ing] the long view ... in contrast to the West with its [lamentably] short election cycles.” [7, emphasis added]

...His anti-democracy disposition is real. Mr. Hansen supports American courts forcing carbon-dioxide limits on the public without presidential or congressional action. [7, emphasis added]

[7] NASA extremist advocates U.S. decline: Radical green James Hansen pushes Chinese war on American economy,” *The Washington Times* editorial, January 19, 2011.

## EPA Follies

The EPA has “revoked the permit—approved and functioning—of one of the nation’s largest coal mines for unacceptable environmental impact, calling it ‘mountaintop removal.’” [8] The coal mine is Arch Coal’s Spruce No. 1 Mine in West Virginia, and the revocation is “the EPA’s first-ever *ex-post-facto* shutdown of an in-work industrial operation with a valid permit.”

A friend acquainted with the company says that Arch Coal has \$200 million invested in the project. Given the *ex-post-facto* nature of the revocation, Arnold [8] wonders, “How could anyone, employer or employed, ever trust the federal government again?”

Peter S. Silva, the EPA official who pulled the permit did so in the very week of Obama’s State of the Union address in which he said, “To reduce barriers to growth and investment, I’ve ordered a review of government regulations. When we find rules that put an unnecessary burden on businesses, we will fix them.”

Of course, there is no chance they’ll find such a rule in the Arch Coal revocation. Silva did not act according to an existing rule, but rather to one that he made up. The day after the damage was done, he resigned from the EPA and skipped town [8].

[8] Ron Arnold, “EPA revokes permit for mine, official resigns rather than face criticism,” *Washington Examiner*, 01/20/11 at <http://washingtonexaminer.com/local/dc/2011/01/epa-revokes-permit-mine-official-resigns-rather-face-criticism#ixzz1CXh6he7v>

## Parasites

In the spirit of never letting a good tragedy go to waste, some financial parasites have decided never to let a good non-problem go to waste. A group met at Georgetown University

on April 21, 2010 to discuss ways to get rich from the alleged climate crisis. Conference title: Creating Roadmaps to a Post Carbon Future. Keynote address: “Creating Climate Wealth” by Sir Richard Branson, founder of The Virgin Group.



**BREAKING BARRIERS TO DEPLOYMENT**  
— Georgetown University McDonough School of Business Washington DC, April 20th - 22nd

The 2011 version of this shindig will be held May 3-4 in Washington, DC. For only \$3,000 you can learn everything there is to know about “Island Nations, Shipping, Sustainability, Grid Management, Demand Response, Biofuels, Algae, Distributed Generation, Energy Efficiency, Renewable Fuels, Green Economy, Smart Grid, Sustainable Agriculture, Carbon, Mitigation, Roadmap, Industry, Capitalism, [and] Non Profit[s]” You’d better sign up now while vacancies remain.

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## Throwing a Sop

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In a *Wall Street Journal* opinion piece [9], President Obama threw a sop to opponents of his government-is-all philosophy. He declared that

For instance, the FDA has long considered saccharin, the artificial sweetener, safe for people to consume. Yet for years, the EPA made companies treat saccharin like **other** dangerous chemicals. Well, if it goes in your coffee, it is not hazardous waste. The EPA wisely eliminated this rule last month. [emphasis added]

*Other* hazardous chemicals? Where did *that* come from? Does anybody near the Oval Office understand the English language?

His words about regulatory agencies sound reassuring:

Over the past two years, the goal of my administration has been to strike the right balance. And today, I am signing an executive order that makes clear that this is the operating principle of our government.

This order requires that federal agencies ensure that regulations protect our safety, health and environment while promoting economic growth.

Then he went on to say,

The EPA and the Department of Transportation worked with auto makers, labor unions, states like California, and environmental advocates this past spring to turn a tangle of rules into **one aggressive new standard**. It was a victory for car companies that wanted regulatory certainty; for consumers who will pay less at the pump; for our security, as we save 1.8 billion barrels of oil; and for the environment as we reduce pollution. [emphasis added]

There is a lot of garbage here: “worked with” doesn’t mean that the automakers had any input. There are no “states like California.” He means “California,” period. It has the most oppressive transportation regulations. “One aggressive new standard” means that the EPA will adopt California’s regulations.

None of this will make gasoline cheaper at the pump; only increased supply—forbidden by this administration because of their failure to allow drilling offshore or in the Gulf of Mexico—can reduce prices.

“Reducing pollution,” in White House Newspeak, means reducing CO<sub>2</sub> emissions.

In his State of the Union address, Obama said,

Now, clean energy breakthroughs will only translate into clean energy jobs if businesses know there will be a market for what they’re selling. So tonight, I challenge you to join me in setting a new goal: By 2035, 80 percent of America’s electricity will come from clean energy sources.

How would Obama create a “market for what they’re selling”? Does he intend to coerce people to create a market? Nobody wants to pay for the piddle-power toys he’s promoting, so the plan is to allow *some* people to “buy” the expensive solar toys with other people’s money. Perhaps he also has a plan to make the sun shine at night. He continues,

Some folks want wind and solar. Others want nuclear, clean coal and natural gas. To meet this goal, we will need them all.

There must be some contentious discussions at the White House, with Steven Chu advocating nuclear power (in addition to junk like bio-fuels) and virulently anti-nuclear John Holdren arguing for breezes and sunbeams.

In any case, the 80% figure is straight out of the playbook of the carbon-credit sellers, except that the date has changed from 2050 to 2035. “Clean coal” does not refer to keeping emissions of fly ash and sulfates down. It is a code for carbon sequestration.

“We need them all.” Oh? *Why* do we need *wind*? *Why* do we need *solar*?

Make no mistake about it, the comment about saccharine was a sop—a pacifier—to make the anti-carbon agenda more palatable.

[9] Barack Obama, “Toward a 21st-Century Regulatory System,” *Wall Street Journal*, January 18, 2011.

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## Follow the ... Water

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A recent paper in *Science* [10] studied “the altitudinal distributions of 64 plant species between the 1930s and the present day within California. Using temperature records from nearby weather stations and water requirements of a reference crop, the authors were able to relate the optimum elevations of the plant species during that time period.

As it happened, the area warmed and dried out somewhat. According to global-warming orthodoxy, the plants should have migrated toward higher altitudes for the cooler temperatures. Instead, they descended to lower altitudes, where there was more water.

The title of the *Science* paper, however, gives one pause. My data may not be up to date, but I have never heard of a worldwide web for plants to distribute information about “climatic water balance.” How, then, does a California plant know anything about “Climatic Water Balance” as implied in the title? Plants respond to *very* local conditions, about as far as their roots extend and their seeds spread. The “climate change” jargon has become so pervasive that some scientists can’t even dream up intelligent titles for their articles.

[10] Shawn M. Crimmins, Solomon Z. Dobrowski, Jonathan A. Greenberg, John T. Abatzoglou, and Alison R. Mynsberge, “Changes in Climatic Water Balance Drive Downhill Shifts in Plant Species’ Optimum Elevations,” *Science*, Vol. 331, pp. 324-327, 21 January 2011

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