

# **Fifty Years of Global Warming**

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## Introduction

I spent a couple of years writing a blog on climate change called *Planet Restart*, the idea being we needed to push the “restart” button to begin a new way of thinking about how we should be living on the planet. I did it for my children and grandchildren because I knew in my bones that the climate was changing, and I wanted them to understand how this would affect every decision they would make.

I started out with a sense of foreboding and hope, but not a lot of knowledge. I ended up at the crossroads of doom and gloom, knowing a whole lot more than I wanted to.

Simply put, *if* the science is correct, then it is already too late ... too late to prevent a rise in average global temperatures that will bring with it serious consequences ... too late to avoid the displacement of millions of people due to rising tides and shifting rainfall patterns and increasingly erratic growing seasons ... too late to avoid the economic and social upheavals that will inevitably ensue.

These 65 essays reflect my personal journey to understand the three modern-day horsemen of the apocalypse who stalk mankind: climate change, peak oil, and population growth. What I found was not reassuring. But don't take my word for any of this. Learn about the issues and make up your own mind.

If you come to the same conclusions I did, then you really need to start thinking about how to prepare your children and grandchildren for a world that will be very different from the one they see around them today ... a world as challenging as anything that mankind has ever faced.

## Why Climate Change Is A Tough Sell in America

October 2009 – With apologies to David Letterman, I offer up my top 10 reasons why climate change is a tough sell in America.

**Climate change is not breaking news.** We Americans have grown addicted to stories that sweep over us like a giant wave. Climate change creeps in with the tide.

**Climate change is not easy to understand.** Weather is what you see out the window today. Climate change is computer models trying to guess what you will see out the window 30 years from now.

**Climate change is not easy to explain.** Weather is Al Roker. Climate change is Al Gore.

**There is no single plan to rally supporters around.** Pretty much everyone agrees that greenhouse gas emissions must be reduced. But which ones, by how much and how soon, through what methods ... these are all topics of intense debate.

**The pain is here and now; the gain is off in the distant future.** Doing something about climate change will cost billions of dollars right now. The ultimate benefit will be a more livable planet 30, 50, 100 years from now. That's asking for a lot to be taken on faith.

**The human brain is not wired to think in terms of centuries.** We pretty much live in the moment. Somewhere between the here-and-now and 100 years from now, we just stop listening.

**Future shock rocks.** We are being bounced from one crisis to the next like a ping-pong ball in a room full of mouse-traps. Sooner or later, we just reach the point where we just want to pull back into our shells and stop listening.

**Resistance is not always futile.** Controlling greenhouse gas emissions will cost big business some big bucks. If they can avoid or mitigate that future expense by financing extensive (dis)information campaigns, why not do it? Spending millions today beats spending billions tomorrow. It's not like the average politician is looking for a reason to believe.

**The political process is exhausted.** The battle over health care reform has given the political process a severe case of battle fatigue. It remains to be seen how much fight is left in both parties as they try to confront an issue as complicated and contentious as energy reform.

**Nation-states suck at solving global problems.** The world is a bunch of teenagers who have been sent to their rooms. Each room is a nation-state with a big sign on the door that says, "You are not the boss of me." Collective action does not come naturally or easily at this stage in our geopolitical development.

## Why Is It Getting Warmer?

October 2009 – Before we begin, let's clarify a couple of points. First, weather is day-to-day changes. Climate tracks those changes over very long periods of time. Second, global warming is the result of greenhouse gas emissions. Climate change is the result of global warming. The two are not the same.

Over the long run, changing climates can become drier or wetter, colder or hotter, depending on where you are. Day-to-day weather is subject to even more variables, so just because you have a cooler winter doesn't mean a damn thing in terms of the validity of climate change.

There are four basic agents of change that contribute to climate changes that lead either to **warming or cooling**. Each impacts the other, so the long-term trend line may be clear, even as the points on the line zig-zag back and forth.

**Greenhouse Gases (GHG):** These are the leading sources of global warming. Carbon dioxide (CO<sub>2</sub>) accounts for about half of them. Methane (the infamous cow farts), freon, and other assorted gases make up the rest. Two things to remember. Tiny amounts of CO<sub>2</sub> and methane can have a huge impact on trapping infrared light inside the atmosphere, which *is* the greenhouse effect. Second, they last a long time—thousands of years—once they are in the atmosphere.

**Sulfur Emissions From Burning Coal:** The good news is that this can and does offset the warming affect of GHG. The bad news is that sulfurs are relatively short-lived, maybe a few years at best. The irony is that countries are working hard to reduce sulfur emissions, which is good for reducing acid rain but which could end up accelerating the pace of global warming (assuming that it is real, of course).

**Volcanoes:** In a way, this is just more of the same—in this case sulfur—which is injected into the atmosphere during an eruption. The cooling effect can be quite massive, but as has already been noted, relatively short-lived. And of course, there is the fact that there is no way to know when a volcano will erupt.

**Variations in the Intensity of the Sun:** When sun spots are plentiful, the sun puts out more heat, which amps up the ultraviolet rays, which in turn amps up the ozone layer. When sun spots diminish, the net effect is a cooling of the atmosphere, which offsets other warming factors.

My feeling is that it doesn't matter why the earth is getting warmer. And it is no help to say that this has happened many times in the planet's history. All of that is true. The difference maker is *us*, all 6.7 billion of us, nearly 1 in 10 of whom live in low-lying areas of the planet directly threatened by rising sea levels and extreme weather. Never before have we as a race faced so potentially grave and universal a crisis where so many of us will be competing for resources and a safe haven. That is why it matters.

## Three Reasons To Believe

October 2009 – Climate change is very complex, and the science is still unfolding, leaving plenty of room for debate. But I have settled on the following three reasons to believe that there's something happening here. Taken together, they have led me to an inescapable conclusion: man-made emissions are forcing climate change.

**One: The Greenhouse Effect.** The insulating effect of atmospheric greenhouse gases (e.g., water vapor, carbon dioxide, methane, etc.) is well-documented, bedrock science going back to 1859, when [John Tyndall](#) conducted his pioneering experiments. The sun's energy arrives as visible light and leaves as infrared energy. Tyndall proved conclusively that [greenhouse gases](#) absorb infrared energy, blocking it from passing through the atmosphere to outer space. This in turn controls the temperature of the atmosphere.

**Two: The Industrial Revolution.** In 1829, [British coal production](#) was 15 million tons. In 2006, [world coal production](#) was 6.2 billion tons. At the turn of the 20th century there were about [8,000 cars in use](#) in the United States. At the turn of the 21st Century there were about 200 million cars in use on the United States, 450 million or so world-wide. Common sense tells us that burning all that coal and driving all those cars over the last couple of centuries has created a lot of CO<sub>2</sub> that made its way into the atmosphere.

**Three: Chaos Theory.** Small changes introduced into a system can lead to very big changes, the so-called butterfly effect. Again, [chaos theory](#) is bedrock science, demonstrated in thousands of experiments involving many different processes.

So, let's put it all together. If you start out with an atmosphere that contains a certain level of **greenhouse gases** that results in a given average temperature, and then the **industrial revolution** injects a massive amount of greenhouse gases into the atmosphere, **chaos theory** tells us that *something* has to change. Logic says that at least one component of that change will be warmer temperatures in the atmosphere because that is what greenhouse gases do.

Is it really as easy as 1, 2, 3? I think so. Just bear in mind that climate is the sum of many different processes, of which greenhouses gases are just one, so the net effect may be quite different depending on where you live. But have no doubt that there will be effects. We are already seeing early indicators that I believe will have hardened into long-term trends by the time my grandchildren are in their 30's.