

## I Am One Of The Alarmed

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Americans can be divided into six groups, depending on their concern about climate change, ranging from the Alarmed to the Dismissive. I belong to The Alarmed.

I am an engineer. For more than 40 years I taught, conducted research, and published in engineering and science journals. I also was a consultant to major chemical companies and was employed by a large environmental engineering consulting firm. So how can I be among the Alarmed?

The birth of our granddaughter in 2005 focused my attention on global warming because I realized that if the scientists were right, she would experience significant human-caused climate change during her lifetime. To educate myself I first read two books, both written by scientists, that summarized the state of climate science. Then I began to read papers from the scientific literature, as well as additional books and documents prepared by expert groups convened by the National Academy of Sciences and the Intergovernmental Panel on Climate Change (IPCC).

I have a sound layman's understanding of climate science. That understanding convinces me that humanity faces dire problems if we do not move rapidly and efficiently to limit atmospheric emissions of carbon dioxide from fossil fuels. Since we are currently doing little, yes, I am alarmed.

An important finding in the latest IPCC report is that Earth's warming is directly proportional to the total amount of fossil fuel-derived CO<sub>2</sub> put into the atmosphere. This sets an upper limit on the CO<sub>2</sub> we can emit while staying within a given degree of warming, i.e., it sets a CO<sub>2</sub> budget. Governments worldwide have agreed to limit global warming to 3.6 degrees. At the current rate of CO<sub>2</sub> emissions, the budget associated with that limit will be reached in around 25 years, a very short time within which to make major changes in our energy economy. This is another cause for my alarm.

If we immediately start significantly reducing our emission rate we extend the time before the limit is reached. PricewaterhouseCoopers estimates that if we cut our emissions per unit of GDP by 6.2 percent a year we can achieve zero emissions by 2100 while staying within the 3.6-degree limit. Although this is a steep cut, it still gives me hope.

I love modern society and all the benefits that readily available and "inexpensive" fossil fuels have brought us. However, fossil fuels have only been inexpensive because their users don't pay their full costs. Rather, they are borne indirectly by society through the impacts of climate change. The artificially low price of fossil fuels makes it difficult for alternative energy sources, such as renewable and nuclear energy, to compete in the market place. Consequently, innovation is stifled and it becomes more difficult to move ideas from the laboratory into practice.

In spite of that, many innovative things are being done that can revolutionize our energy systems if given a level playing field to compete on. These include more efficient solar cells, better energy storage devices, wireless battery charging technology, and even carbon nanotubes capable of absorbing the sun's radiation and storing it in chemical form. Technical advances like these give me hope.

People worldwide aspire to a standard of living like ours and have every right to pursue it. However, if they do so with fossil fuels, we face disaster. Thus, we must put fossil fuels aside. This will be an enormous task, but we can accomplish it if we begin now. We must put a price on carbon. If done through a revenue-neutral fee and dividend approach, warming can be kept within 3.6 degrees and our economy can be strengthened. This also gives me hope.

Although I am willing to be called alarmed, it is time to quit the finger pointing and name-calling. It does no good to dismiss climate change as if it doesn't exist or to rail against nonexistent conspiracies, as this newspaper does. Neither does it do any good to think the problem can be solved easily. Rather, we need to put the past behind us and create an environment where innovation can flourish.

Mr. Grady lives in Harrisonburg.

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