House Ways and Means Committee
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Written Testimony
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One Page Summary

I am John Christy, Alabama's State Climatologist and Distinguished Professor of Atmospheric Science at the University of Alabama in Huntsville.

Global Temperature Impact of vehicle reductions of CO2 (California AB1493)

The EPA is considering allowing California and other states to determine their own rules for CO2 emissions. I calculated, using IPCC climate models, that if the entire country adopted these rules, the impact would be a minuscule 0.01 °C by 2100. And, if the entire world did the same, the effect would be less than 0.04°C by 2100, an amount so tiny we cannot measure it with instruments, let alone notice it in anyway.

Global Temperature Impact of 1000 Nuclear Power Plants by 2020

The scale of CO2 emissions is simply enormous. Again using IPCC climate models, if 1000 new nuclear power plants could be operating by 2020 (about 10% of the world's energy) this would affect the global temperature by only 0.07°C by 2050 and 0.15°C by 2100. We wouldn't notice it, but this dent could just be detectable by our instruments. However, these values are very likely overstated as they are based on current models.

Overstated warming in current climate models and surface data sets

Current climate model projections assume that climate is very sensitive to CO2. We've found however, that during warming episodes, clouds step up their cooling effect. When model output is tested this way, not one model mimics this cooling effect – in fact the models' clouds lead to further warming, not cooling as seen in nature. We hypothesize that poor cloud properties cause models to overstate warming rates. We've also found that current popular surface temperature datasets indicate more warming than is actually happening in the atmosphere because they are contaminated by surface development.

Energy and Life

We utilize energy from carbon, not because we are bad people, but because it is the affordable foundation on which the profound improvements in our standard of living have been achieved – our progress in health and welfare. I taught science in Kenya, Africa and witnessed first hand this simple rule – without energy life is brutal and short. Global carbon-based energy demand will grow as Africans and others continue to discover the benefits of technology, medicine, mobility and agriculture and start reaping the benefits of higher standards of living, just as we have. If the Congress deems it necessary to reduce CO2, the single most effective way to achieve at least a detectable reduction while growing the economy, is through the massive implementation of a nuclear power program. Other currently available alternatives simply cannot produce enough energy to be significantly noticed at a price and geographic scale that is affordable.

Written Testimony

Introduction

I am John Christy, Alabama's State Climatologist, Distinguished Professor of Atmospheric Science at the University of Alabama in Huntsville, and participant in many national and international climate science panels, including being one of several Lead Authors of the IPCC.

Global Temperature Impact of vehicle reductions of CO2 (California AB1493)

I want to bring a bit of hard-core metrics to the objectives described for the Hearing today. I have testified several times before House and Senate Hearings on climate issues, but also have testified in Federal Court on specific consequences of proposed legislative actions.

For example, the EPA is considering allowing California and other states to determine their own rules for CO2 emissions in which automobile manufacturers must meet a certain fleet-average (43 mpg in this case). This committee's objective is to understand what this auto-emission proposal, and other laws, might mean in terms of its impact on the climate system. I calculated, using IPCC climate models, that even if the entire country adopts these rules, the net impact would be at most one hundredth of a degree by 2100 (Fig. 1). The Federal Court accepted this analysis. And, even if the entire world did the same, the effect would be less than four hundredths of a degree by 2100, an amount so tiny we cannot even measure it with instruments, let alone notice it in anyway. Thus, this undoubtedly expensive proposition has virtually no climate impact. (I do not comment on other reasons for reducing transportation fuel usage.)

Global Temperature Impact of 1000 Nuclear Power Plants by 2020

The issue the Committee must come to grips with is that the scale of current world-wide CO2 emissions is enormous and growing in all parts of the globe. I also calculated, again using IPCC climate models, that if a Herculian construction effort could result in 1000 new nuclear power plants operating by 2020 – representing about 10% of the world's energy - this would affect the global temperature by only seven hundredths of a degree by 2050 and 15 hundredths by 2100 (Fig.1). Again, we wouldn't notice it, but this dent could just be detectable by our instruments. I remind the Congress that Sen. John McCain campaigned on a pledge of only 45 new nuclear plants, not 1000. The point here is that to date, proposed actions to "do something about global warming", all of which appear to make energy much more expensive especially for the poorest among us, will have little effect on whatever the climate will do – even if one assumes, as models today do, a relatively high sensitivity of temperature to CO2.

But there is new information about the climate's sensitivity to CO2 increases.

Overstated warming in current climate models

Current climate model projections of temperature assume that the climate is very sensitive to greenhouse gases. While the thermal properties of the gases are well known (there is no doubt we are adding CO2 to the air) what is usually overlooked is the fact that the atmosphere is much more subtle and complicated than expressed in climate models. The real atmosphere has many ways to respond to the changes that the extra CO2 is forcing upon it.

My colleague Dr. Roy Spencer has shown that in the real world – the world of observations from satellites - that during warming episodes, clouds respond by stepping up their cooling effect (the basic effect of clouds is the cool the climate already). When climate model output calculated in the same way is compared with observations, not one model mimics this cooling effect – in fact the models' clouds lead to further warming, not cooling as it is in nature. We hypothesize that this poor representation of clouds in models is the reason we find the warming rates of model projections to have significantly overshot what has actually happened. (Christy et al. 2007, Spencer and Braswell, 2008, Christy and Norris 2009, Spencer and Braswell, to be submitted)

Figure 2 demonstrates that the projections made in 1988 of rapid temperature rises, based on a climate model which assumed high sensitivity to CO2, overshot the actual temperature trend by a significant amount.

Figure 3 indicates the most recent set of climate models is not faring any better. Surface temperature trends for various segment length from the most recent 5 years to 15 years shows that the observations are coming in at the lowest edge of the 95% range of the latest climate model projections, which is consistent with the statement that the mid-range of "best estimate" model simulations is too sensitive to CO2.

Overstated warming in surface temperature datasets

Surface temperatures in the few popular global datasets are often used as a proxy for global warming. Let me say I'm one of the few in this science who actually builds climate datasets from scratch. In several published papers I and others have shown that we have found two serious problems, somewhat related, that strongly suggest the warming of the past century is overstated.

First, the use of a few popular stations for which the data are easy to find, leads to too much warming when the averages are constructed. I have published research for North Alabama, Central California and in a few months East Africa, in which I went back to the original sources of data to augment the number of

stations by roughly a factor of ten – indeed, ten times more stations. This effort requires significant time in searching for and manually digitizing the records for scientific purposes. In each case, I've found that the data sets based on a few popular stations overstate the warming by up to a factor of three. (Christy 2002, Christy et al. 2006, Pielke et al. 2007, Christy et al 2009)

Secondly, we have demonstrated in several publications that as humans develop the surface through agriculture, urbanization and so on, that this leads, by complicated physical processes, to higher nighttime temperatures over time, but which are unrelated to CO2 emissions. Thus, the current, popular land-based mean surface temperature charts, which average the nighttime and daytime temperatures, and which are often shown to demonstrate warming, overstate the actual warming of the basic atmosphere. (Christy 2001, Christy et al. 2006, Christy et al. 2007, Pielke et al. 2007, Christy et al 2009).

Figure 4 shows the very different impact of surface development on daytime and night time temperatures in the example from Central California. Detailed temperature reconstructions were generated for the developed San Joaquin Valley of California as well as the adjacent foothills of the Sierra. The daytime temperatures of both regions show virtually no change over the past 100 years, while the nighttime temperatures indicate the developed Valley has warmed significantly while the undeveloped Sierra foothills have not. The popular land-surface temperature datasets average both day and night temperatures which means the contamination by surface development of the night time temperatures in all likelihood overstates the actual temperature change which is then erroneously attributed to the effects of increased CO2 concentrations. (Christy et al. 2006, 2009).

Energy and Life

Finally, we utilize energy from carbon not because we are bad people, but because it is the affordable foundation on which profound improvements in our standard of living have been achieved – our health and our welfare.

I was a physics and chemistry teacher at Nyeri Baptist High School in Kenya, East Africa and witnessed first hand this simple rule – without energy life is brutal and short. World-wide, carbon-based energy demand will grow as Africans and others continue to discover the benefits of technology, medicine, mobility and agriculture and start reaping the benefits of higher standards of living just as we have. Having lived in Africa, I don't see how one could halt the progress they need and will achieve. In my view, international rules to limit energy production will not halt the expansion of their energy use because of the tremendous benefits provided by energy that the energy-poor crave.

Alabama's affordable energy has led to increased economic development in some of the poorest parts of our nation – jobs, health care, educational

opportunities, and, yes, even tax revenue. However, paraphrasing what one manufacturer said to me, “Alabama is our last stop in the United States. If our energy costs rise, we will be taking all these jobs to Mexico or China – and building our products with even more emissions in less efficient plants than we create here.” The message here is that if energy costs rise, the price the American economy will pay, especially the poorest among us, will be high – yet there will be virtually no impact on emissions or climate.

Summary

From my analysis, the actions being considered to “stop global warming” will have an imperceptible impact on whatever the climate will do, while making energy more expensive, and thus have a negative impact on the economy as a whole. We have found that climate models and popular surface temperature data sets overstate the changes in the real atmosphere and that actual changes are not alarming. And, if the Congress deems it necessary to reduce CO2 emissions, the single most effective way to do so by a small, but at least detectable, amount is through the massive implementation of a nuclear power program. Other currently available alternatives simply cannot produce enough energy to be significantly noticed at a price and geographic scale that is affordable.

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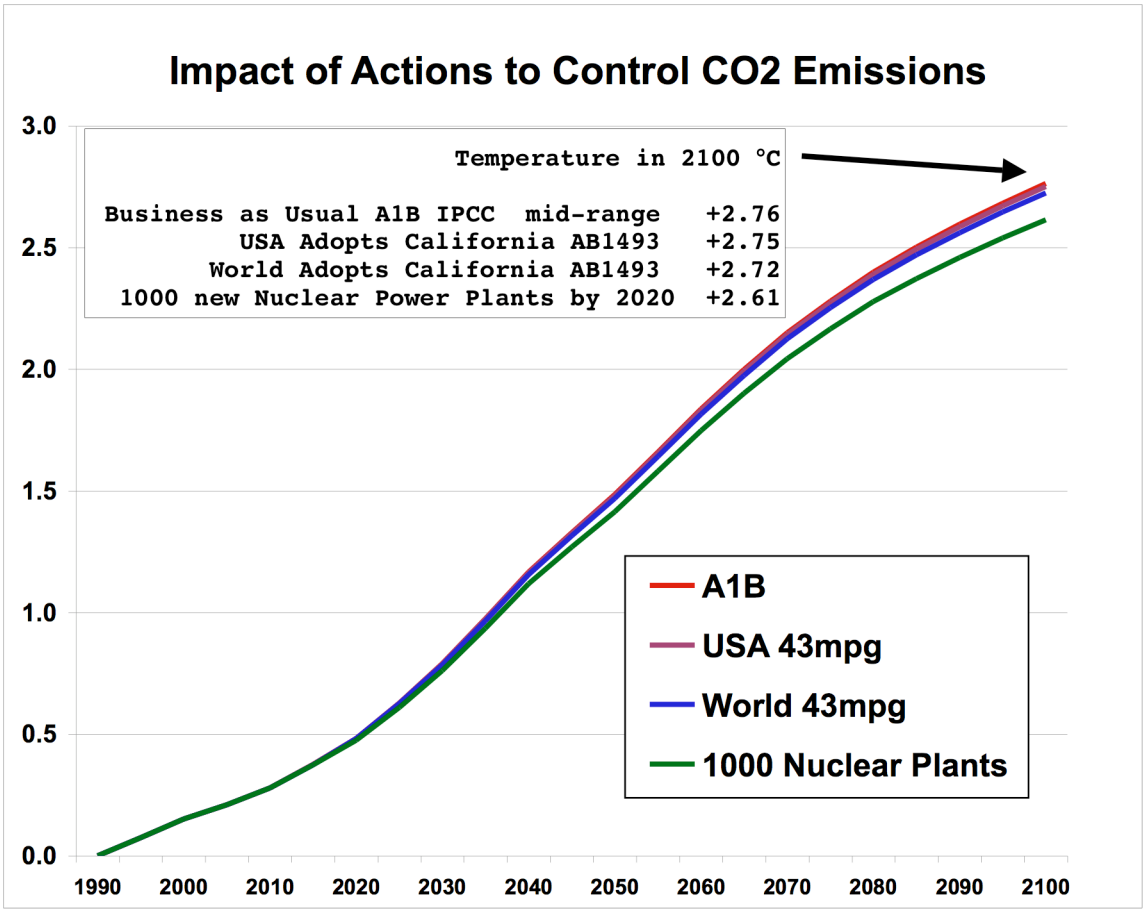

Figure 1
Four realizations of temperature through 2100 from the IPCC best estimate model projections assuming business-as-usual emissions (A1B) and a climate sensitivity to CO2 of 2.6°C/2xCO2 (mid-range case). Red: base temperature projection of a warming of +2.76°C with purple being the result if the entire U.S. adopted the California AB1493 rule (43 mpg fleet average), which changes the temperature by only 0.01°C – this is indistinguishable from the Red curve. Blue: net result if entire world adhered to California AB1493 (net change of only 0.035 °C). Finally Green: net effect of replacing 10% of the energy by 2020 with 1000 nuclear power plants (1.4 GWt each) – a cooling of 0.15°C. However, the assumption of the "mid-range" sensitivity of 2.6 is very likely too high, so that actual impacts of these initiatives would be much less than the tiny amounts shown here.

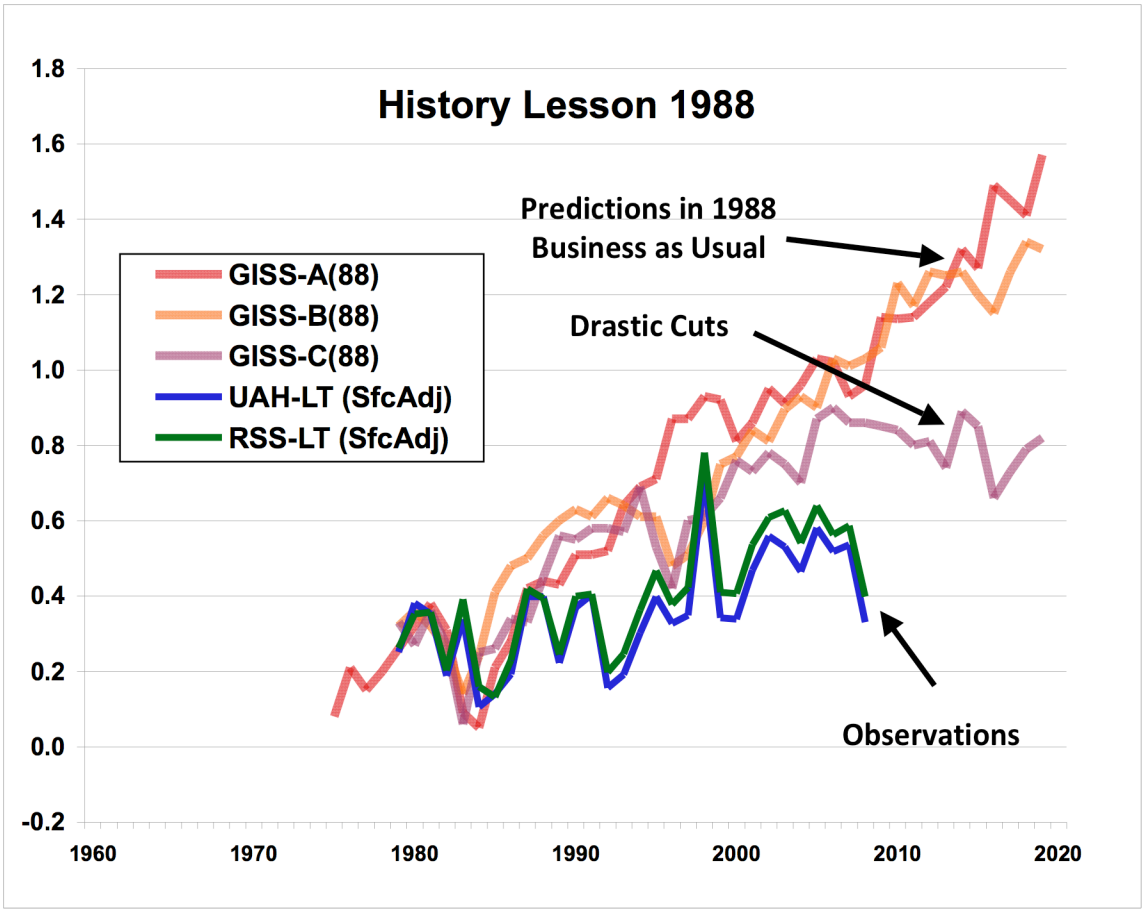

Figure 2
"GISS" A, B, and C are model projections of global surface temperature from James Hansen in Senate testimony in 1988. "A" and "B" are two "business-as-usual" model projections of temperature which assume emissions similar to what has happened (though in actuality these estimates were a bit less than occurred). "C" is a model projection in which drastic CO2 cuts are assumed. "UAH" and "RSS" are two independent global satellite atmospheric temperature measurements (1979-2008) from the University of Alabama in Huntsville and Remote Sensing Systems adjusted to mimic surface temperature variations for an apples to apples comparison with the model projections (factor of 1.2, CCSP SAP 1.1, note all datasets are based on the 1979-1983 reference period). All model projections show high sensitivity to CO2 while the actual atmosphere does not. It is noteworthy that the model projection for drastic CO2 cuts still overshot the observations. This would be considered a failed hypothesis test for the models from 1988.

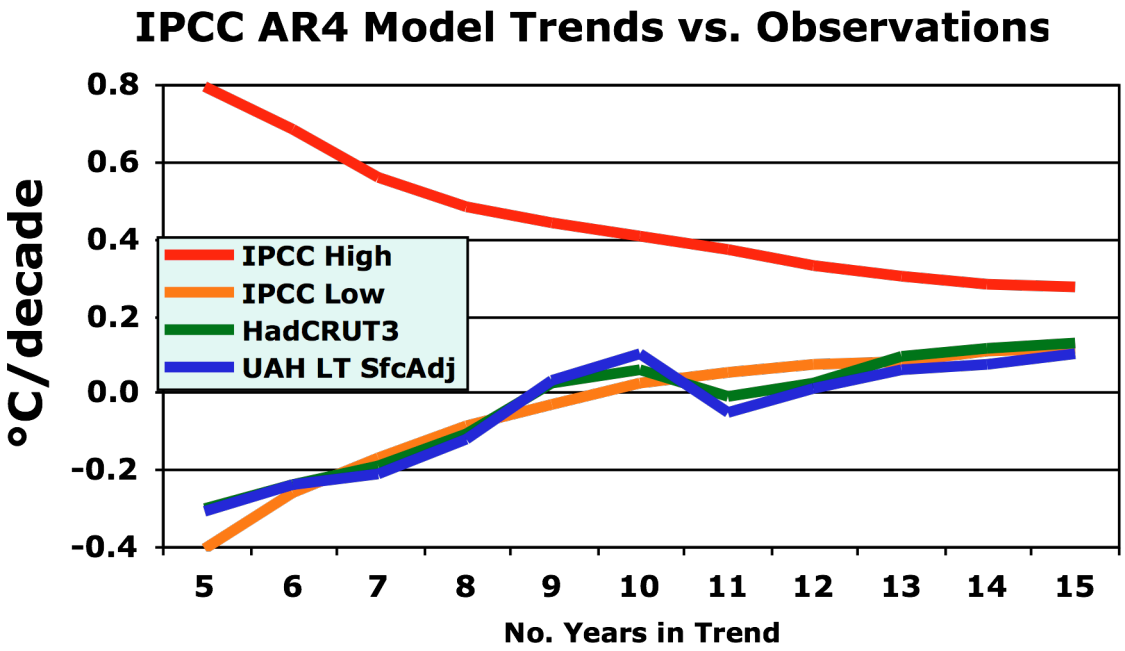

Figure 3.
Red and Orange: the upper and lower significant range (95% of model runs are between the red and orange lines) of global temperature trends calculated from 21 IPCC AR4 climate models for multi-year segments ending in the model year of 2020. Thus, at unit "10" this is the trend from model year 2011 to 2020, or the 10 years ending in 2020 which among the models produced a 95% range between +0.02 and +0.40 °C/decade. Blue and Green: Global temperature trends calculated from observations for segments ending in 2008 from satellites (blue – University of Alabama in Huntsville) and green (surface – Hadley Centre for Climate Change). Chart adapted from Dr. Pat Michaels U.S. Senate Testimony, 12 Feb 2009. The two main points here are (1) the observations are much cooler than the mid-range of the model spread and are at the minimum of the model simulations and (2) the satellite adjustment for surface comparisons is exceptionally good. The implication of (1) is that the best estimates of temperature trends of the IPCC models are too warm, or that they are too sensitive to CO2 emissions.

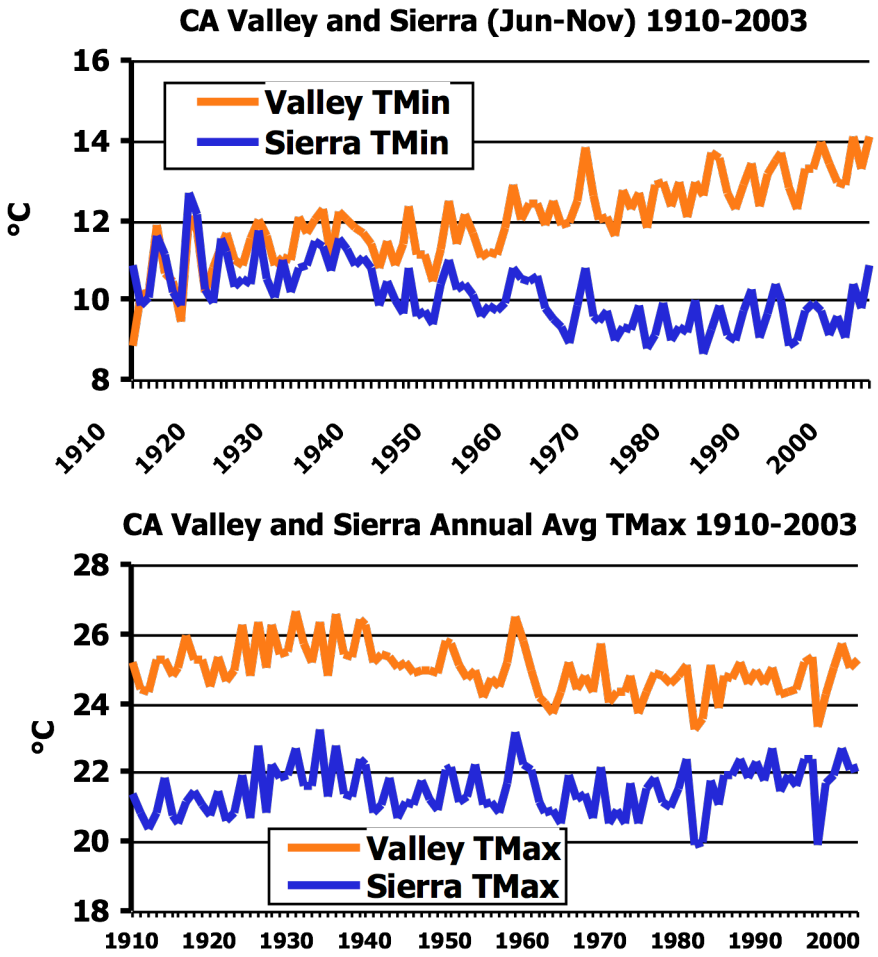

Figure 4
Top: Temperature change in Central California for the nighttime (TMin) temperatures in the developed Valley (orange) and the adjacent undeveloped Sierra (blue). Note the rapid rise in nighttime temperatures in the Valley as agriculture and urbanization occurred. Bottom: Daytime (TMax) temperatures in the Valley (orange) and Sierra (blue) showing almost identical trends near zero change. This study shows that using nighttime temperatures from stations where development has occurred leads to a spurious warming signal. The popular surface datasets today use the average of the day and night temperatures, thus are influenced by this warming that is unrelated to CO2. If daytime temperatures, which are much more representative of the atmosphere as a whole, are used then there has been no warming in Central California since 1910 according to these results (nor in Alabama nor East Africa). (Christy 2002, Christy et al. 2006, Christy et al. 2009)