

Improving the usability of climate indicator visualizations through diagnostic design principles

Climatic Change

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Online Resource 2 contains the survey materials.

Consent

Thank you for taking the time to complete a survey created by Dr. Melissa Kenney's research team at the University of Maryland. In this survey you will be asked several questions about scientific graphics. The goal is to understand and improve effective scientific communication. The data and results of this survey may be used for research reports, presentations, publications, educational materials, or future studies. The questionnaire will take about 15 minutes to complete.

No identifying information will be collected during the study and there are no foreseeable risks or discomforts due to your participation.

You are welcome to contact Dr. Kenney at any time if you have questions about the survey at kenney@umd.edu. If you have any questions about your rights as a research participant, please contact the University of Maryland's Internal Review Board office at (301)-405-4212 or via email at irb@umd.edu. You can print this screen so that you have the contact information available.

By selecting "yes" below and then proceeding with the survey you are voluntarily consenting to participate in the survey and allowing your responses to be used for research purposes.

- ☐ Yes, I voluntarily agree to participate in this survey and allow my responses to be used for research purposes. I also confirm that I am at least 18 years of age.
- ☐ No, I do not wish to participate in this survey.

Screen

What is the approximate size of the screen you are looking at while responding to this survey?

- ☐ 3 to 6 inches (smartphone)
- ☐ 7 to 11 inches (tablet or ultrabook)
- ☐ 12 to 15 inches (laptop computer)
- ☐ 16 inches or more (external computer monitor)

End of Survey - Screen

Thank you for your interest in our survey. Unfortunately it is not feasible to participate in this study using a smart phone.

Numeracy

Imagine that we flip a fair coin 1,000 times. What is your best guess about how many times the coin would come up heads in 1,000 flips?

Imagine that we roll a fair, six sided die 1,000 times. Out of 1,000 rolls, how many times do you think the die would come up even (2, 4, or 6)?

In the BIG BUCKS LOTTERY, the chances of winning a \$10.00 prize are 1%. What is your best guess about how many people would win a \$10.00 prize if 1,000 people each buy a single ticket from BIG BUCKS?

In the ACME PUBLISHING SWEEPSTAKES, the chance of winning a car is 1 in 1,000. What percent of tickets of ACME PUBLISHING SWEEPSTAKES win a car? [Please do not enter a percent sign (%), only enter a numerical value between 0 and 100]

Which of the following numbers represents the biggest risk of getting a disease?

- ☐ 1 in 100
- ☐ 1 in 1,000
- ☐ 1 in 10

Which of the following represents the biggest risk of getting a disease?

- ☐ 1%
- ☐ 10%
- ☐ 5%

If Person A's risk of getting a disease is 1% in ten years, and Person B's risk is double that of A's, what is B's risk? [Please do not enter a percent sign (%), only enter a numerical value between 0 and 100]

If Person A's chance of getting a disease is 1 in 100 in ten years, and Person B's risk is double that of A, what is B's risk? [Please write your answer in a format corresponding to how the chance is given in the question text, i.e. x in y]

If the chance of getting a disease is 10%, how many people would be expected to get the disease out of 100?

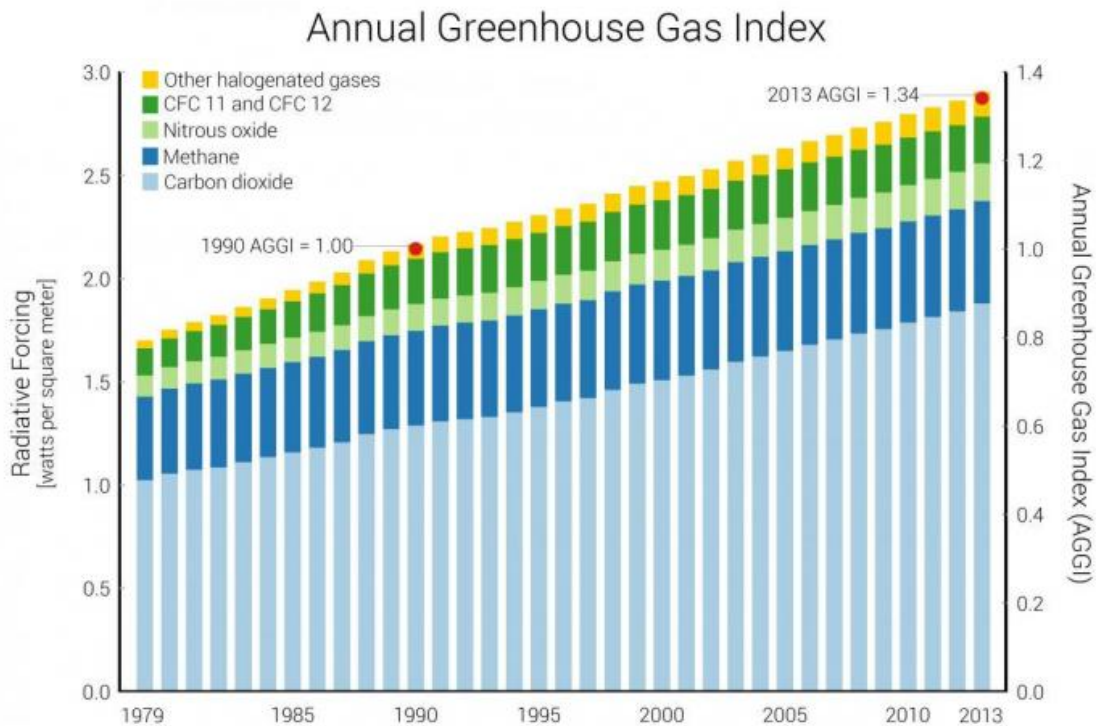
If the chance of getting a disease is 10%, how many people would be expected to get the disease out of 1000?

If the chance of getting a disease is 20 out of 100, this would be the same as having a what % chance of getting the disease. [Please do not enter a percent sign (%), only enter a numerical value between 0 and 100]

The chance of getting a viral infection is .0005. Out of 10,000 people, about how many of them are expected to get infected?

Annual Greenhouse Gas Index (original)

Please take a look at the following graphic of the Annual Greenhouse Gas Index (AGGI).



What do you think is the point conveyed by this graphic?

Which of the following statements best describes the trend depicted in the graphics?

- ☐ The warming influence of greenhouse gases has increased by 1.34% between 1990 and 2013
- ☐ The warming influence of greenhouse gases has increased by 34% between 1990 and 2013
- ☐ The warming influence of greenhouse gases has increased by 34% between 1979 and 2013

How easy was it for you to understand the presentation of the data in the graphic?

Understandability of Graphic

What do you find hard to understand about this graphic? Do you feel there is any information or explanation missing from it?

How much do you like the graphic?

Annual Greenhouse Gas Index
Rating

How much trust do you have in this indicator?

- ☐ High level of trust
- ☐ Some level of trust
- ☐ Low level of trust
- ☐ No trust

[Optional] Do you have any other comments about the graphic? Please share them here:

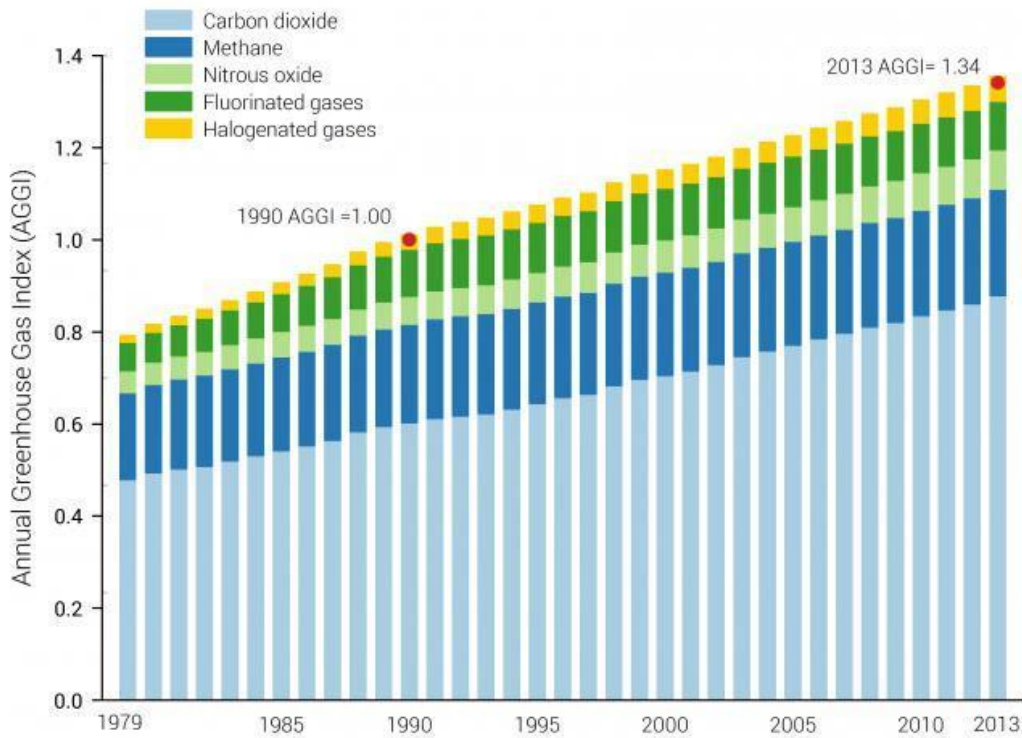
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Annual Greenhouse Gas Index (stacked, 1 axis)

Please take a look at the following graphic of the Annual Greenhouse Gas Index (AGGI).

Annual Greenhouse Gas Index



What do you think is the point conveyed by this graphic?

Which of the following statements best describes the trend depicted in the graphics?

- ☐ The warming influence of greenhouse gases has increased by 34% between 1990 and 2013
- ☐ The warming influence of greenhouse gases has increased by 34% between 1979 and 2013
- ☐ The warming influence of greenhouse gases has increased by 1.34% between 1990 and 2013

How easy was it for you to understand the presentation of the data in the graphic?

Understandability of Graphic

What do you find hard to understand about this graphic? Do you feel there is any information or explanation missing from it?

How much do you like the graphic?

Annual Greenhouse Gas Index
Rating

How much trust do you have in this indicator?

- ☐ High level of trust
- ☐ Some level of trust
- ☐ Low level of trust
- ☐ No trust

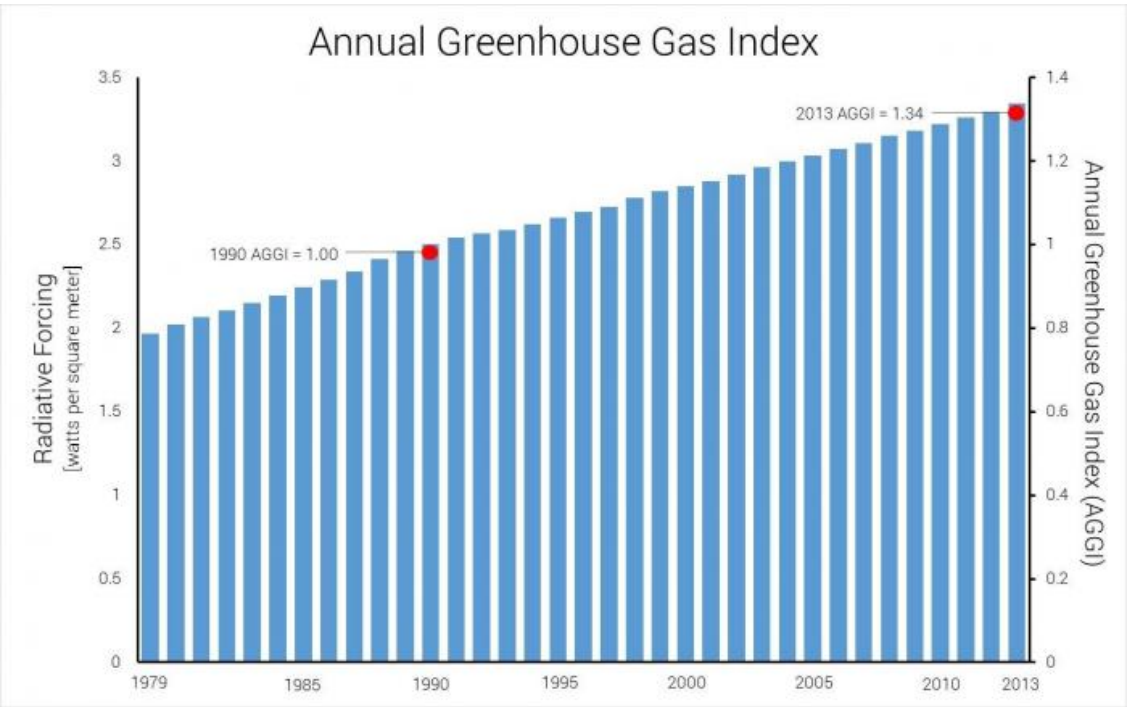
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Annual Greenhouse Gas Index (aggregated, 2 axis)

Please take a look at the following graphic of the Annual Greenhouse Gas Index (AGGI).



What do you think is the point conveyed by this graphic?

Which of the following statements best describes the trend depicted in the graphics?

- ☐ The warming influence of greenhouse gases has increased by 1.34% between 1990 and 2013
- ☐ The warming influence of greenhouse gases has increased by 34% between 1990 and 2013
- ☐ The warming influence of greenhouse gases has increased by 34% between 1979 and 2013

How easy was it for you to understand the presentation of the data in the graphic?

Understandability of Graphic

What do you find hard to understand about this graphic? Do you feel there is any information or explanation missing from it?

How much do you like the graphic?

Annual Greenhouse Gas Index
Rating

How much trust do you have in this indicator?

- ☐ High level of trust
- ☐ Some level of trust
- ☐ Low level of trust
- ☐ No trust

[Optional] Do you have any other comments about the graphic? Please share them here:

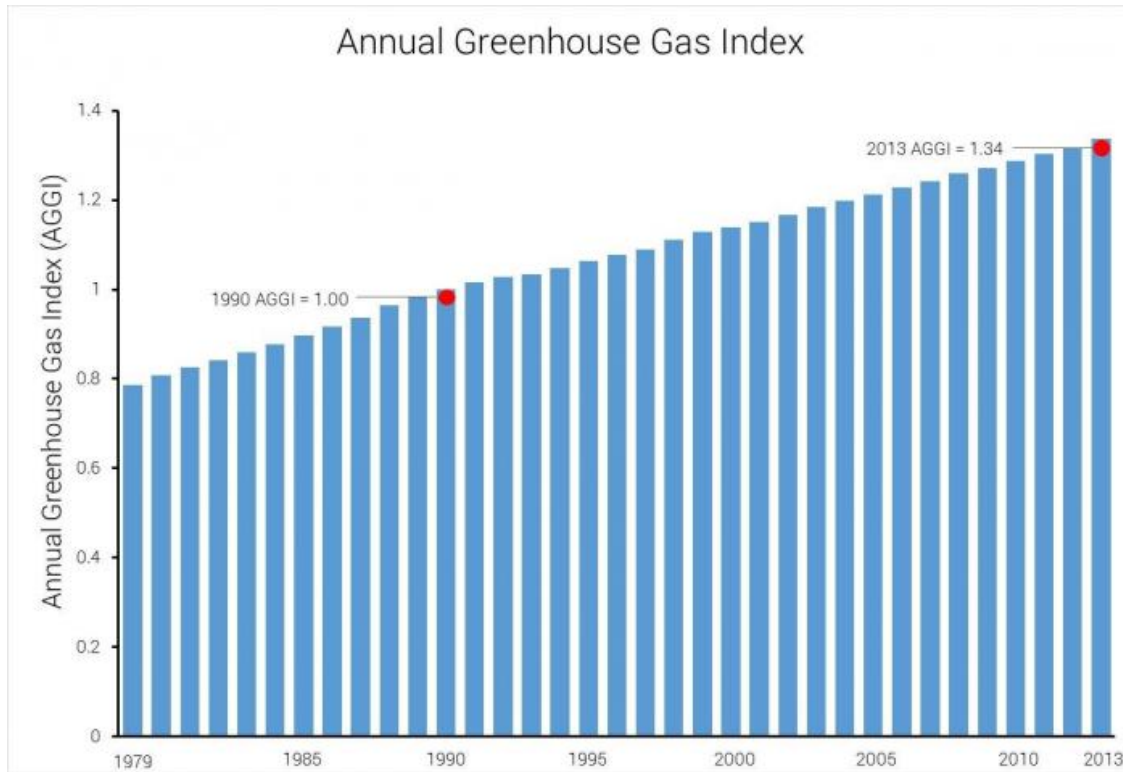
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Annual Greenhouse Gas Index (aggregated, 1 axis)

Please take a look at the following graphic of the Annual Greenhouse Gas Index (AGGI).



What do you think is the point conveyed by this graphic?

Which of the following statements best describes the trend depicted in the graphics?

- ☐ The warming influence of greenhouse gases has increased by 34% between 1979 and 2013
- ☐ The warming influence of greenhouse gases has increased by 34% between 1990 and 2013
- ☐ The warming influence of greenhouse gases has increased by 1.34% between 1990 and 2013

How easy was it for you to understand the presentation of the data in the graphic?

Understandability of Graphic

What do you find hard to understand about this graphic? Do you feel there is any information or explanation missing from it?

How much do you like the graphic?

Annual Greenhouse Gas Index
Rating

How much trust do you have in this indicator?

- ☐ High level of trust
- ☐ Some level of trust
- ☐ Low level of trust
- ☐ No trust

[Optional] Do you have any other comments about the graphic? Please share them here:

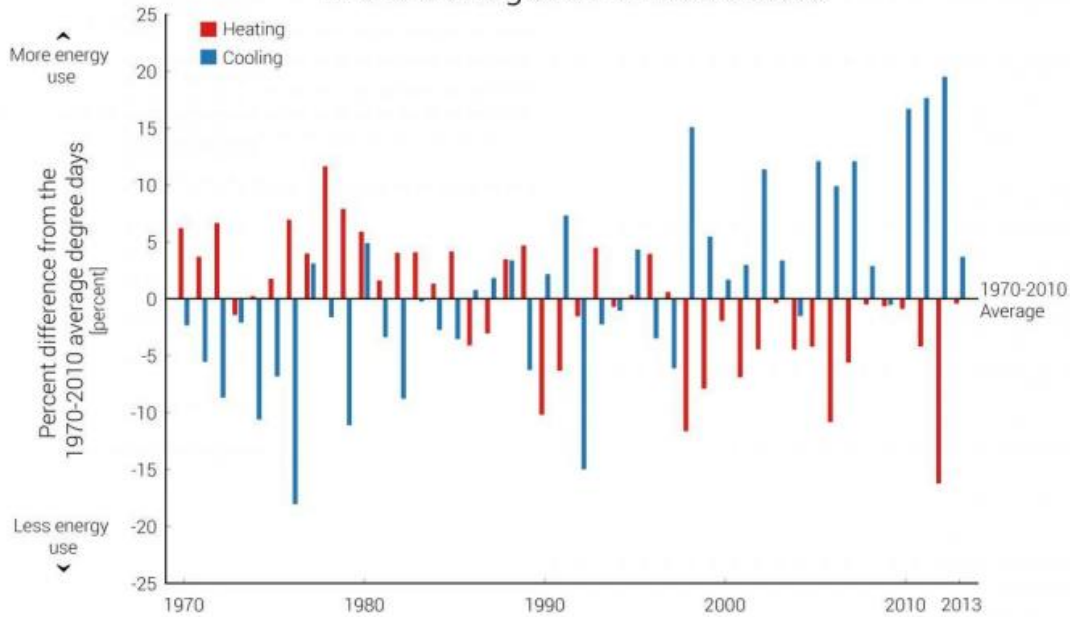
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Heating and Cooling Degree Days (original)

Please take a look at the following graphic of annual heating and cooling degree days in the contiguous United States.

Annual Heating and Cooling Degree Days in the Contiguous United States



What do you think is the point conveyed by this graphic?

Which of the following changes were observed for the heating and cooling degree days from 1970 to 2013?

From 1979 to 2013...

- ☐ Heating degree days and cooling degree days **both increased**
- ☐ Heating degree days **increased** while cooling degree days **decreased**
- ☐ Heating degree days **decreased** while cooling degree days **increased**

How easy was it for you to understand the presentation of the data in the graphic?

Understandability of Graphic

What do you find hard to understand about this graphic? Do you feel there is any information or explanation missing from it?

How much do you like the graphic?

How much trust do you have in this indicator?

- ☐ High level of trust
- ☐ Some level of trust
- ☐ Low level of trust
- ☐ No trust

For this question please select a rating of 3 stars below.

Heating and Cooling Degree Days
Check

[Optional] Do you have any other comments about the graphic? Please share them here:

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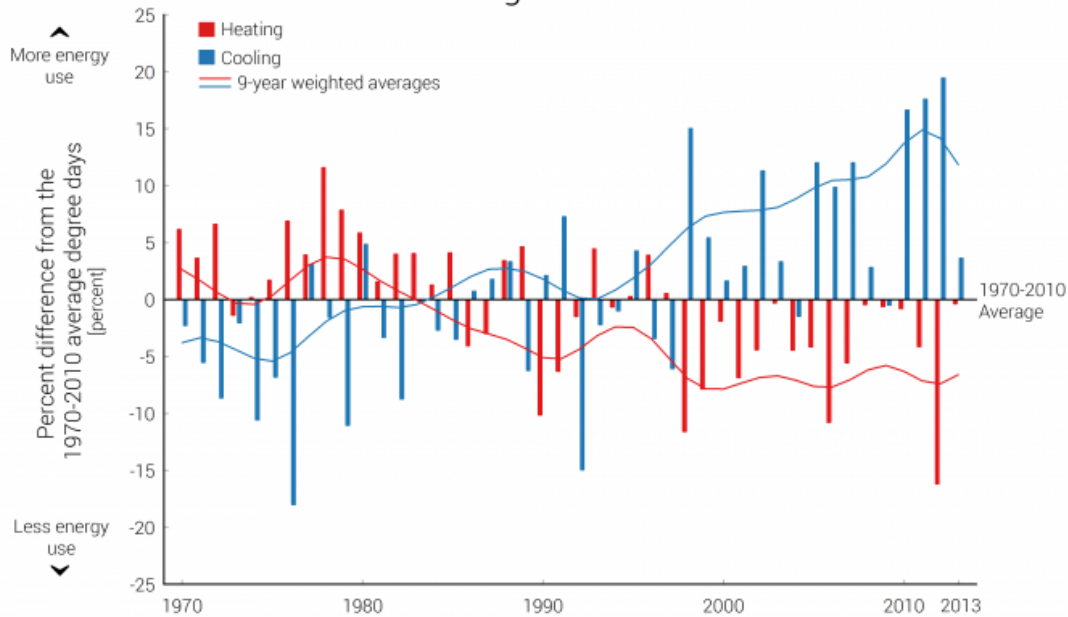
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Heating and Cooling Degree Days (trendline)

Please take a look at the following graphic of annual heating and cooling degree days in the contiguous United States.

Annual Heating and Cooling Degree Days in the Contiguous United States



What do you think is the point conveyed by this graphic?

Which of the following changes were observed for the heating and cooling degree days from 1970 to 2013?

From 1979 to 2013...

- ☐ Heating degree days **increased** while cooling degree days **decreased**
- ☐ Heating degree days **decreased** while cooling degree days **increased**
- ☐ Heating degree days and cooling degree days **both increased**

How easy was it for you to understand the presentation of the data in the graphic?

Understandability of Graphic

What do you find hard to understand about this graphic? Do you feel there is any information or explanation missing from it?

How much do you like the graphic?

How much trust do you have in this indicator?

- ☐ High level of trust
- ☐ Some level of trust
- ☐ Low level of trust
- ☐ No trust

For this question please select a rating of 3 stars below.

Heating and Cooling Degree Days
Check

[Optional] Do you have any other comments about the graphic? Please share them here:

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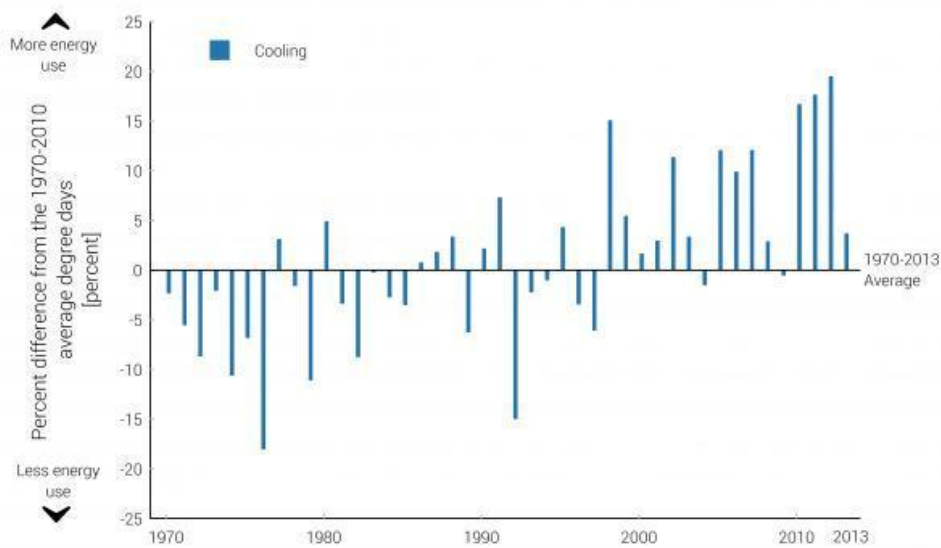
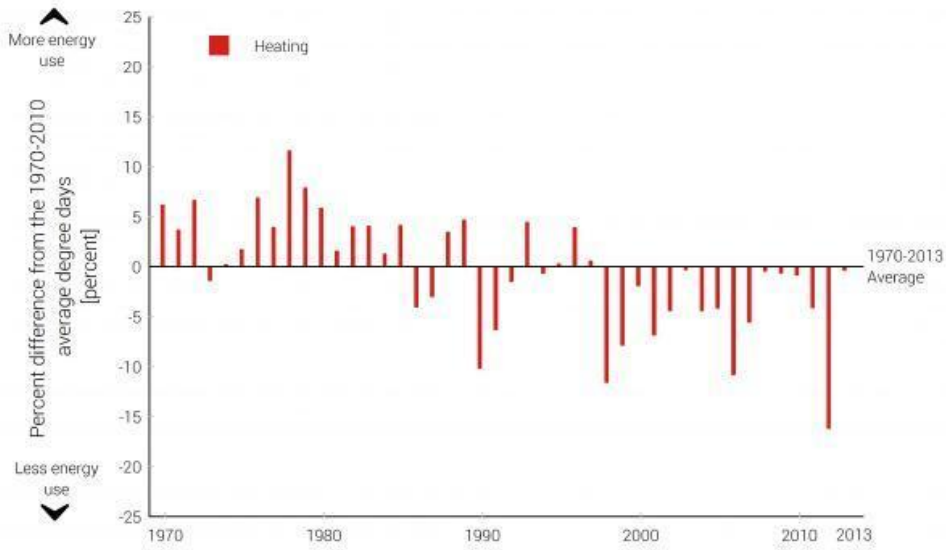
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Heating and Cooling Degree Days (separate graphs)

Please take a look at the following graphics of annual heating and cooling degree days in the contiguous United States.

Annual Heating and Cooling Degree Days in the Contiguous U.S.



What do you think is the point conveyed by this graphic?

Which of the following changes were observed for the heating and cooling degree days from 1970 to 2013?

From 1979 to 2013...

- ☐ Heating degree days and cooling degree days **both increased**
- ☐ Heating degree days **increased** while cooling degree days **decreased**
- ☐ Heating degree days **decreased** while cooling degree days **increased**

How easy was it for you to understand the presentation of the data in the graphic?

Understandability of Graphic

What do you find hard to understand about this graphic? Do you feel there is any information or explanation missing from it?

How much do you like the graphic?

Heating and Cooling Degree Days
Rating

How much trust do you have in this indicator?

- ☐ High level of trust
- ☐ Some level of trust
- ☐ Low level of trust
- ☐ No trust

For this question please select a rating of 3 stars below.

Heating and Cooling Degree Days
Check

[Optional] Do you have any other comments about the graphic? Please share them here:

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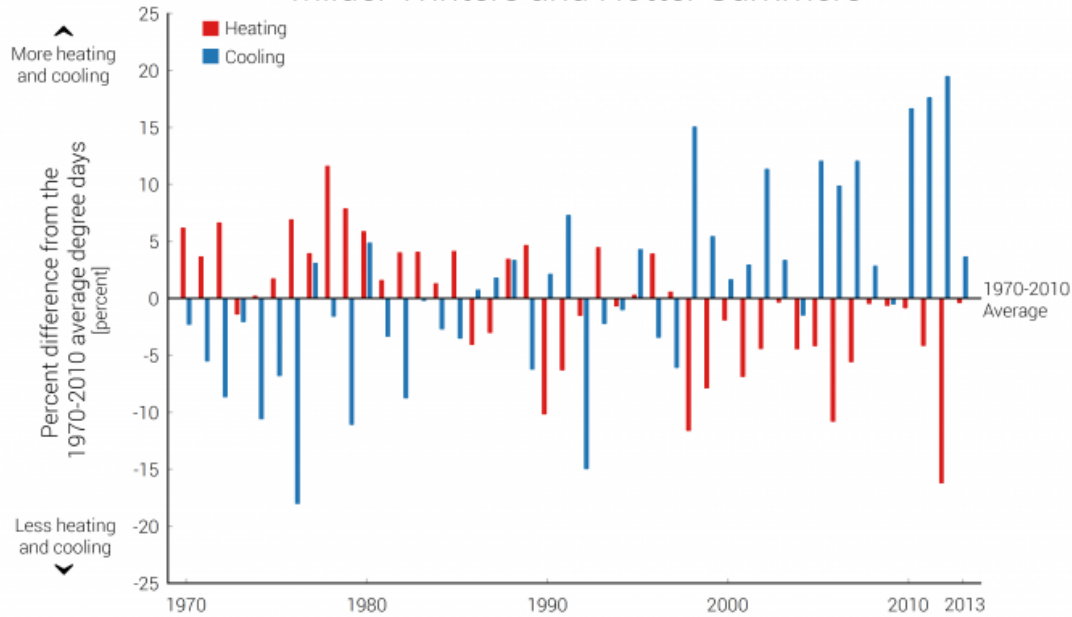
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Heating and Cooling Degree Days (descriptive title)

Please take a look at the following graphic of annual heating and cooling degree days in the contiguous United States.

Warming Climate Leads to Milder Winters and Hotter Summers



What do you think is the point conveyed by this graphic?

Which of the following changes were observed for the heating and cooling degree days from 1970 to 2013?

From 1979 to 2013...

- ☐ Heating degree days and cooling degree days **both increased**
- ☐ Heating degree days **increased** while cooling degree days **decreased**
- ☐ Heating degree days **decreased** while cooling degree days **increased**

How easy was it for you to understand the presentation of the data in the graphic?

Understandability of Graphic

What do you find hard to understand about this graphic? Do you feel there is any information or explanation missing from it?

How much do you like the graphic?

Heating and Cooling Degree Days
Rating

How much trust do you have in this indicator?

- ☐ High level of trust
- ☐ Some level of trust
- ☐ Low level of trust
- ☐ No trust

For this question please select a rating of 3 stars below.

Heating and Cooling Degree Days
Check

[Optional] Do you have any other comments about the graphic? Please share them here:

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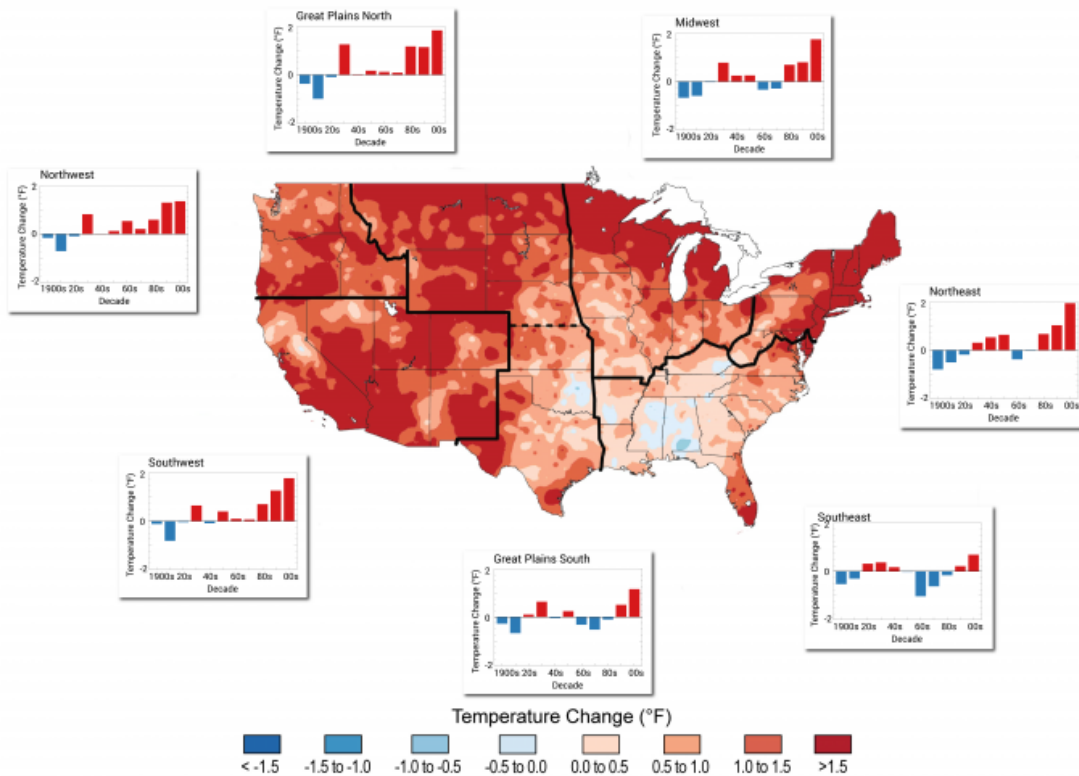
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US Temperature Change (original)

Please take a look at the following graphic of US temperature change.

Observed U.S. Temperature Change



What do you think is the point conveyed by this graphic?

Which of the following statements best describes the trend depicted in the graphic?

- ☐ All regions have experienced an increase in average temperatures, with the Northeast showing the greatest increase and the Southeast showing the smallest increase.
- ☐ All regions have experienced an increase in average temperatures, with the Great Plains North showing the greatest increase and the Southeast showing the smallest increase.
- ☐ All regions, except for the Southeast, have increased average temperatures, with the Northeast experiencing the largest increase in temperature.

How easy was it for you to understand the presentation of the data in the graphic?

Understandability of Graphic

What do you find hard to understand about this graphic? Do you feel there is any information or explanation missing from it?

How much do you like the graphic?

U.S. Temperature Change Rating

How much trust do you have in this indicator?

- ☐ High level of trust
- ☐ Some level of trust
- ☐ Low level of trust
- ☐ No trust

[Optional] Do you have any other comments about the graphic? Please share them here:

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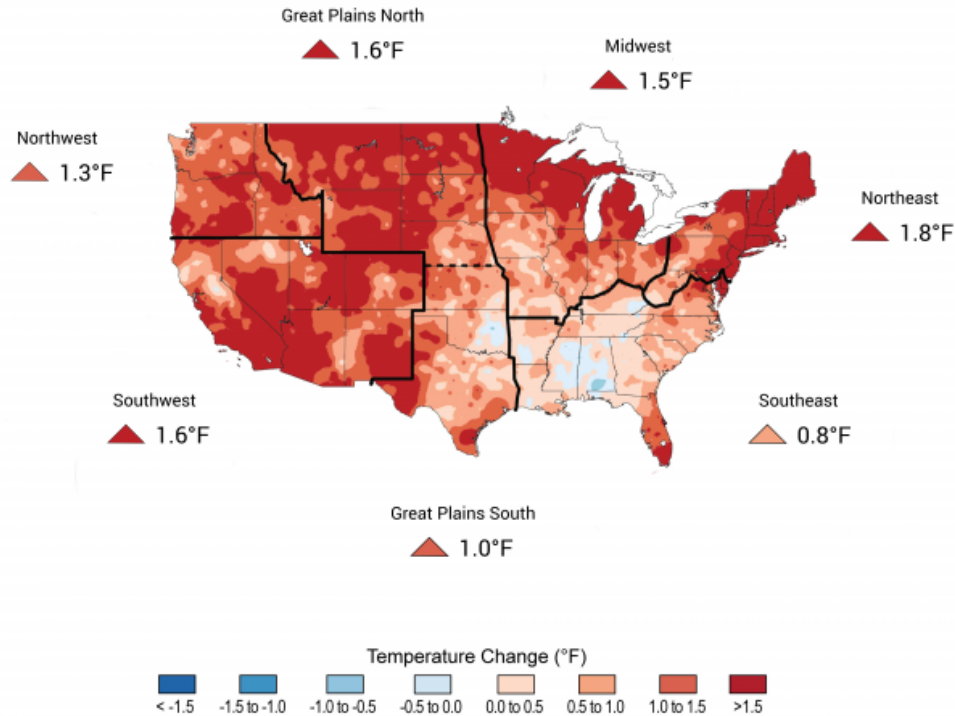
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US Temperature Change (temporal agg)

Please take a look at the following graphic of US temperature change.

Observed U.S. Temperature Change



What do you think is the point conveyed by this graphic?

Which of the following statements best describes the trend depicted in the graphic?

- ☐ All regions have experienced an increase in average temperatures, with the Northeast showing the greatest increase and the Southeast showing the smallest increase.
- ☐ All regions, except for the Southeast, have increased average temperatures, with the Northeast experiencing the largest increase in temperature.
- ☐ All regions have experienced an increase in average temperatures, with the Great Plains North showing the greatest increase and the Southeast showing the smallest increase.

How easy was it for you to understand the presentation of the data in the graphic?

Understandability of Graphic

What do you find hard to understand about this graphic? Do you feel there is any information or explanation missing from it?

How much do you like the graphic?

U.S. Temperature Change Rating

How much trust do you have in this indicator?

- ☐ High level of trust
- ☐ Some level of trust
- ☐ Low level of trust
- ☐ No trust

[Optional] Do you have any other comments about the graphic? Please share them here:

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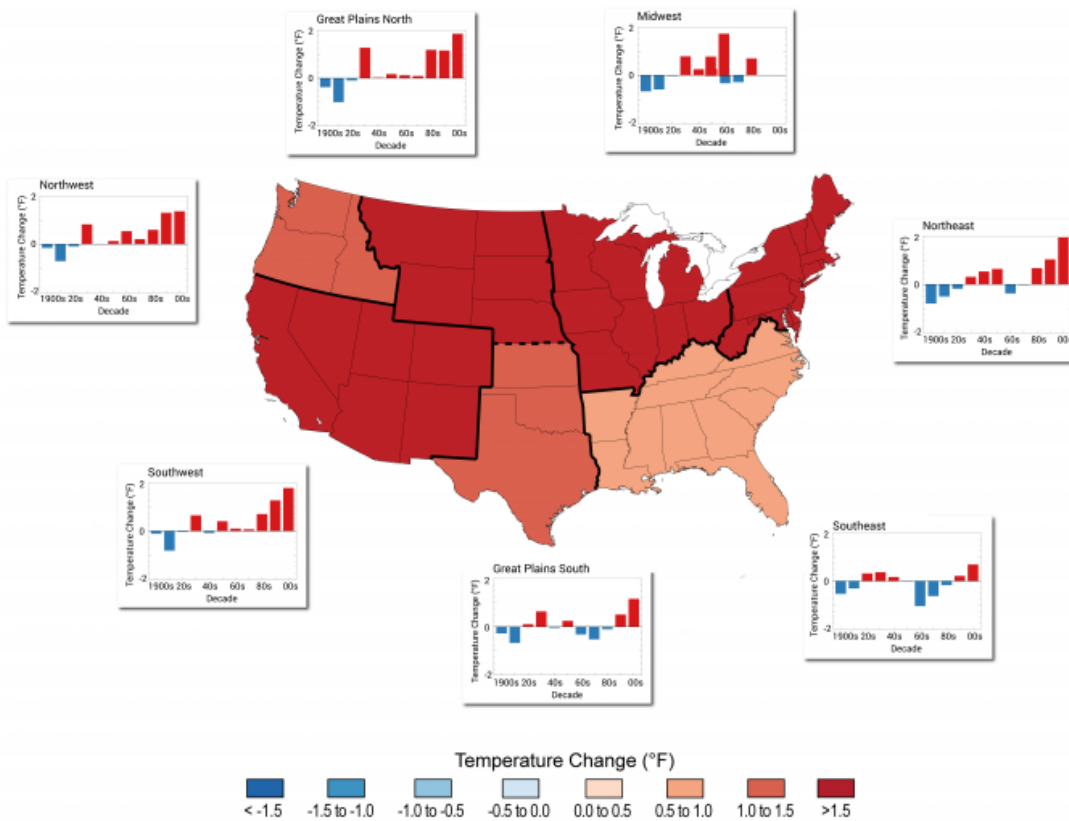
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US Temperature Change (spatial agg)

Please take a look at the following graphic of US temperature change.

Observed U.S. Temperature Change



What do you think is the point conveyed by this graphic?

Which of the following statements best describes the trend depicted in the graphic?

- ☐ All regions have experienced an increase in average temperatures, with the Northeast showing the greatest increase and the Southeast showing the smallest increase.
- ☐ All regions have experienced an increase in average temperatures, with the Great Plains North showing the greatest increase and the Southeast showing the smallest increase.
- ☐ All regions, except for the Southeast, have increased average temperatures, with the Northeast experiencing the largest increase in temperature.

How easy was it for you to understand the presentation of the data in the graphic?

Understandability of Graphic

What do you find hard to understand about this graphic? Do you feel there is any information or explanation missing from it?

How much do you like the graphic?

U.S. Temperature Change Rating

How much trust do you have in this indicator?

- ☐ High level of trust
- ☐ Some level of trust
- ☐ Low level of trust
- ☐ No trust

[Optional] Do you have any other comments about the graphic? Please share them here:

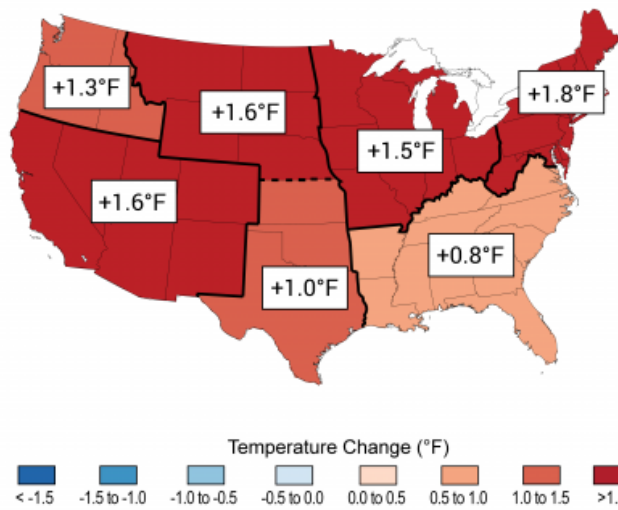
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US Temperature Change (temporal and spatial agg)

Please take a look at the following graphic of US temperature change.

Observed U.S. Temperature Change



What do you think is the point conveyed by this graphic?

Which of the following statements best describes the trend depicted in the graphic?

- ☐ All regions, except for the Southeast, have increased average temperatures, with the Northeast experiencing the largest increase in temperature.
- ☐ All regions have experienced an increase in average temperatures, with the Northeast showing the greatest increase and the Southeast showing the smallest increase.
- ☐ All regions have experienced an increase in average temperatures, with the Great Plains North showing the greatest increase and the Southeast showing the smallest increase.

How easy was it for you to understand the presentation of the data in the graphic?

Understandability of Graphic

What do you find hard to understand about this graphic? Do you feel there is any information or explanation missing from it?

How much do you like the graphic?

How much trust do you have in this indicator?

- ☐ High level of trust
- ☐ Some level of trust
- ☐ Low level of trust
- ☐ No trust

[Optional] Do you have any other comments about the graphic? Please share them here:

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6 Americas short

Recently you may have noticed that global warming has been getting some attention in the news. Global warming refers to the idea that the world's average temperature has been increasing over the past 150 years, may be increasing more in the future, and that the world's climate may change as a result.

What do you think? That global warming is happening?

Yes...

- ☐ ... and I'm extremely sure
- ☐ ... and I'm very sure
- ☐ ... and I'm somewhat sure
- ☐ ... but I'm not at all sure

No...

- ☐ ... and I'm extremely sure
- ☐ ... and I'm very sure
- ☐ ... and I'm somewhat sure
- ☐ ... but I'm not at all sure

Or...

- ☐ I don't know

Assuming global warming is happening, do you think it is...

- ☐ Caused mostly by human activities
- ☐ Caused mostly by natural changes in the environment
- ☐ Other
- ☐ None of the above because global warming isn't happening

How worried are you about global warming?

- ☐ Very worried
- ☐ Somewhat worried
- ☐ Not very worried
- ☐ Not at all worried

How much do you think global warming will harm you personally?

- ☐ Not at all
- ☐ Only a little
- ☐ A moderate amount
- ☐ A great deal
- ☐ I don't know

When do you think global warming will start to harm people in the United States?

- ☐ They are being harmed now
- ☐ In 10 years
- ☐ In 25 years
- ☐ In 50 years
- ☐ In 100 years
- ☐ Never

How much do you think global warming will harm future generations of people?

- ☐ Not at all
- ☐ Only a little
- ☐ A moderate amount
- ☐ A great deal
- ☐ I don't know

How much had you thought about global warming before today?

- ☐ A lot
- ☐ Some
- ☐ A little
- ☐ Not at all

How important is the issue of global warming to you personally?

- ☐ Not at all important
- ☐ Not too important
- ☐ Somewhat important

- ☐ Very Important
- ☐ Extremely Important

How much do you agree or disagree with the following statement: "I could easily change my mind about global warming."

- ☐ Strongly agree
- ☐ Somewhat agree
- ☐ Somewhat disagree
- ☐ Strongly disagree

How many of your friends share your views on global warming?

- ☐ None
- ☐ A few
- ☐ Some
- ☐ Most
- ☐ All

Which of the following statements is closest to your view?

- ☐ Global warming isn't happening.
- ☐ Humans can't reduce global warming, even if it is happening.
- ☐ Humans could reduce global warming, but people aren't willing to change their behavior so we're not going to.
- ☐ Humans could reduce global warming, but it's unclear at this point whether we will do what's needed.
- ☐ Humans can reduce global warming, and we are going to do so successfully.

Do you think citizens themselves should be doing more or less to address global warming?

- ☐ Much less
- ☐ Less
- ☐ Currently doing the right amount
- ☐ More
- ☐ Much More

Over the past 12 months, how many times have you punished companies that are opposing steps to reduce global warming by NOT buying their products?

- ☐ Never
- ☐ Once
- ☐ A few times (2-3)
- ☐ Several times (4-5)
- ☐ Many times (6+)
- ☐ I don't know

Do you think global warming should be a low, medium, high, or very high priority for the President and Congress?

- ☐ Low
- ☐ Medium
- ☐ High
- ☐ Very high

People disagree whether the United States should reduce greenhouse gas emissions on its own, or make reductions only if other countries do too. Which of the following statements comes closest to your own point of view?

The United States should reduce its greenhouse gas emissions...

- ☐ Regardless of what other countries do
- ☐ Only if other industrialized countries (such as England, Germany, and Japan) reduce their emissions
- ☐ Only if other industrialized countries and developing countries (such as China, India, and Brazil) reduce their emissions
- ☐ The US should not reduce its emissions
- ☐ I don't know

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Demographic Questions

Do you consider yourself a Republican, a Democrat, or an Independent?

- ☐ Republican
- ☐ Leaning Republican
- ☐ Leaning Democrat
- ☐ Democrat
- ☐ Independent
- ☐ Other (please specify)

Where on the following scale of *political orientation* would you place yourself?



In terms of *social and cultural* issues, how liberal or conservative are you?



In terms of *economic issues*, how liberal or conservative are you?

	Extremely Liberal					Extremely Conservative					
	0	1	2	3	4	5	6	7	8	9	10
Economic											

In what area of study did you complete your highest educational degree?

- ☐ Physical and Chemical Sciences
- ☐ Natural, Biological and Earth Sciences
- ☐ Social Sciences
- ☐ Behavioral Sciences
- ☐ Engineering
- ☐ Medicine/ Public Health
- ☐ Humanities
- ☐ Arts / Music / Performing Arts
- ☐ Business, Law, or other Professional Degree
- ☐ Education
- ☐ None
- ☐ Other (please specify)

What is the highest degree or level of school you have completed?

- ☐ Some High School
- ☐ High School Graduate or equivalent (for example GED)
- ☐ Some College
- ☐ Associate Degree (for example: AA, AS)
- ☐ Bachelor's Degree (for example: BA, AB, BS)
- ☐ Master's Degree (for example: MA, MS, MEng, Med, MSW, MBA)
- ☐ Professional Degree (for example: MD, DDS, DVM, LLB, JD)
- ☐ Doctorate Degree (for example: PhD, EdD)
- ☐ Other (please specify)

In which state do you currently reside?

What is your gender?

- ☐ Male
- ☐ Female
- ☐ Other

Please specify your Ethnicity.

- ☐ White / Caucasian
- ☐ Hispanic / Latino
- ☐ Black / African American
- ☐ Native American / American Indian
- ☐ Asian / Pacific Islander
- ☐ Other (please specify)
- ☐ Do not wish to answer

Including yourself, how many people live in your household?

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5 or more

What is your approximate *combined household income*?

- ☐ \$0 to \$19,999
- ☐ \$20,000 to \$29,999
- ☐ \$30,000 to \$39,999
- ☐ \$40,000 to \$49,999
- ☐ \$50,000 to \$74,999
- ☐ \$75,000 to \$99,999
- ☐ \$100,000 to \$124,999
- ☐ \$125,000 to \$149,999
- ☐ \$150,000 to \$174,999
- ☐ \$175,000 to \$199,999
- ☐ \$200,000 or more
- ☐ Do not wish to answer