What is this?

This pdf is my (Nick Maxwell's) notes on classes I lead about how to hurry up the end of global warming. Currently (as of 12/14/2024), these notes are not complete. I will update them as I go. I hope to have a reasonably complete version in a week or two.

If you're reading this looking for something in particular that is not here, email me at npmxwl@gmail.com.

If you disagree with something you see here, or if you have questions about anything here, or if you have suggestions for how to improve it, let me know at npmxwl@gmail.com.

How to Hurry Up
The End of Global Warming

npmxwl@gmail.com

Contents

Who is Nick Maxwell?

These days, I'm a climate action educator. In 2024, I got certified in climate action planning and in taking greenhouse gas inventories.

In 2024, I led the letters-to-the-editor work of a statewide campaign to protect Washington State's cap-and-trade program, the Climate Commitment Act.

I am now talking with congregations around the country to encourage them to divest from fossil fuels.

I write a monthly climate protection column for a collection of three local papers, the My Neighborhood News Network.

From me, you will hear about data, finance, and psychology, especially the psychology of decision making. I earned a PhD in the psychology of judgment and decision making, and taught Psychology, the Philosophy of Science, Statistics, and Research Methods at the University of Washington, Bothell. Since then, I have had a 20-year career in data science for businesses (Facebook, Zillow, MSN, Eddie Bauer, Weight Watchers, T-Mobile) and governments (King County and the City of Seattle). Some of that career was as a middle manager in a large multi-national organization: not in charge and, at the same time, not *not* in charge.

What Can You Do?

Here is the punchline of this report. Myself, I like to provide all the background and then spring the conclusion on the reader at the end. My spouse hates that. So, out of love and respect, here is the bottom line up front.

Tell your friends and family

Some of the global warming stoppers are things that you might not be able to do. If you do not drive, you're not going to switch to an electric vehicle. If you have no savings in the stock market, you're not going to switch to a divested mutual fund. That doesn't mean there is nothing for you to do about those things. You need to tell your friends and family about them. Even if you do not own a home, you can tell people who do own homes to get rid of natural gas.

The recipe

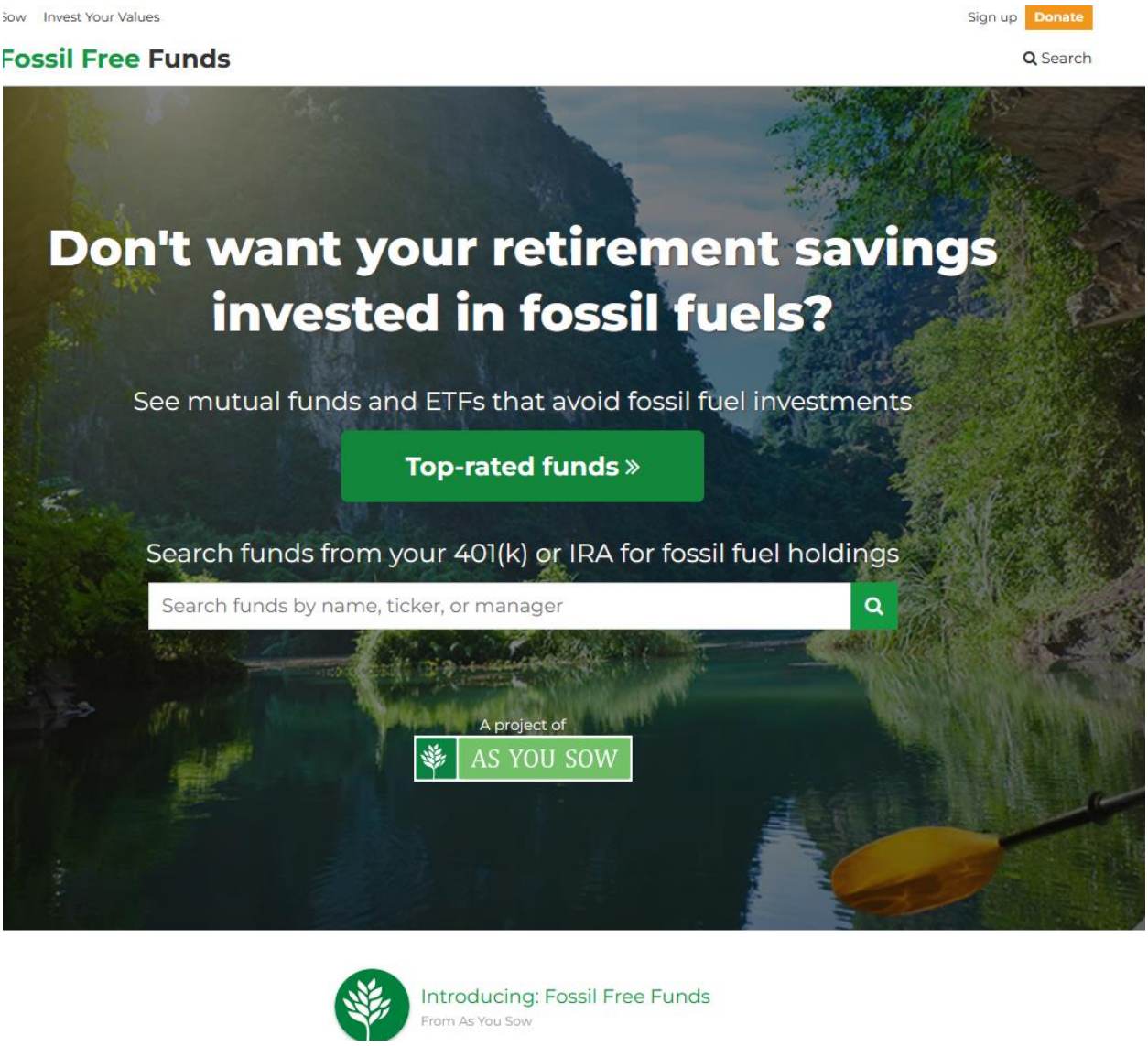
1. Divest from the fossil fuel industry
2. Drive an electric vehicle
3. Heat with heat pumps (& weatherize)
4. Push your governments to stop fossil fuels

That's it. Four steps to do your part. Here are some details on each step:

Recipe Step 1: Divest from the fossil fuel industry

This is one of those things that not everyone can do. If you belong to any organization, chances are your organization has something like an endowment that is invested in the stock market. Tell your organization to divest.

To find where to divest, go to FossilFreeFunds.org.



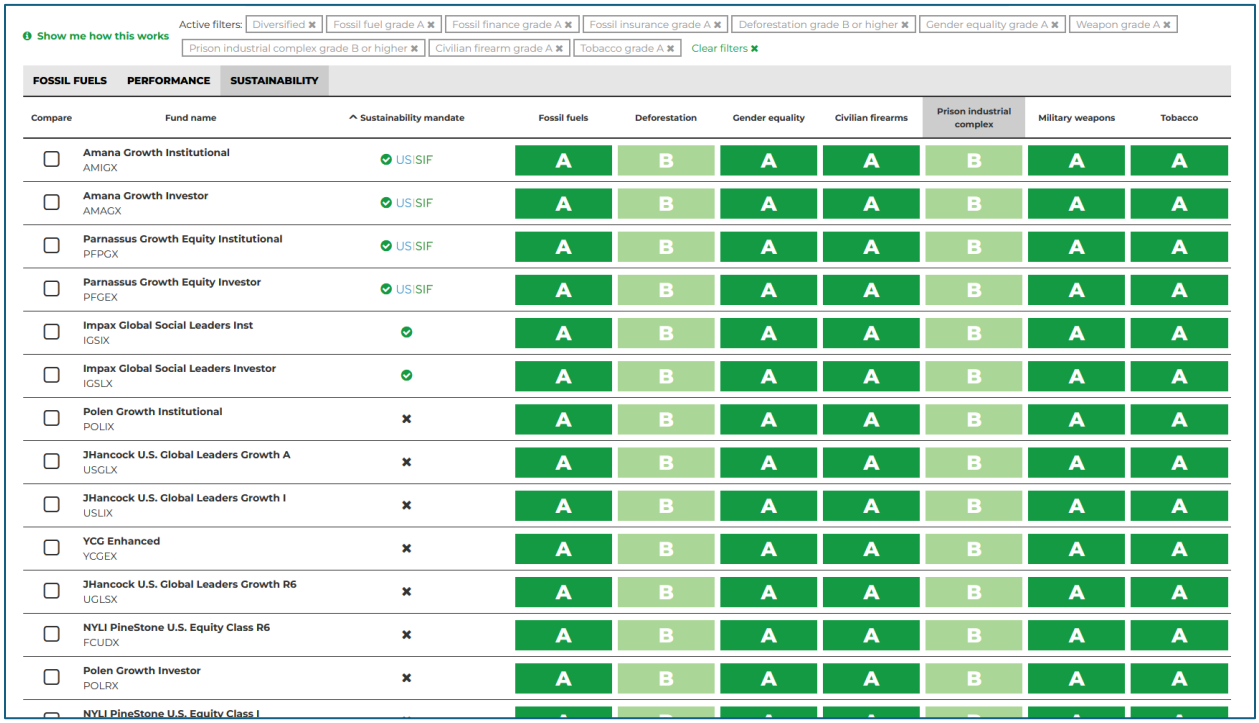
FossilFreeFunds.org homepage

A short explanation of why you need to divest:

- Global warming is caused by increases in the carbon dioxide in the air around our planet.
- The increase in carbon dioxide is caused by humans burning fossil fuels (gasoline, natural gas, and coal).
- The fossil fuels come from the fossil fuel industry that digs and pumps them out of the ground.
- The fossil fuel industry runs on financing: fossil-fuel industry people don't pay for wells, pipelines, or refineries out of their own pockets. They get loans. If they can't get loans, they cancel the projects. Watch the news for stories of cancelled fossil fuel projects. Usually the cancellations are because "favorable financing" was not available.

- Much of the fossil fuel financing comes from mutual funds and retirement savings, like yours. You don't want your money paying for new wells and new refineries. Divest, and get your savings out of the fossil fuel industry.

That's where FossilFreeFunds.org comes in. They will guide you to mutual funds that avoid financing for the fossil fuel industry that is overheating our planet.



Show me how this works

Active filters: Diversified ✖ | Fossil fuel grade A ✖ | Fossil finance grade A ✖ | Fossil insurance grade A ✖ | Deforestation grade B or higher ✖ | Gender equality grade A ✖ | Weapon grade A ✖ | Prison industrial complex grade B or higher ✖ | Civilian firearm grade A ✖ | Tobacco grade A ✖ | Clear filters ✖

FOSSIL FUELS | PERFORMANCE | SUSTAINABILITY

Compare	Fund name	Sustainability mandate	Fossil fuels	Deforestation	Gender equality	Civilian firearms	Prison industrial complex	Military weapons	Tobacco
☐	Amana Growth Institutional AMIGX	US SIF	A	B	A	A	B	A	A
☐	Amana Growth Investor AMAGX	US SIF	A	B	A	A	B	A	A
☐	Parnassus Growth Equity Institutional PFPGX	US SIF	A	B	A	A	B	A	A
☐	Parnassus Growth Equity Investor PFGEX	US SIF	A	B	A	A	B	A	A
☐	Impax Global Social Leaders Inst IGSIX	✔	A	B	A	A	B	A	A
☐	Impax Global Social Leaders Investor IGSLX	✔	A	B	A	A	B	A	A
☐	Polen Growth Institutional POLIX	✖	A	B	A	A	B	A	A
☐	JHancock U.S. Global Leaders Growth A USGLX	✖	A	B	A	A	B	A	A
☐	JHancock U.S. Global Leaders Growth I USLIX	✖	A	B	A	A	B	A	A
☐	YCG Enhanced YCGEX	✖	A	B	A	A	B	A	A
☐	JHancock U.S. Global Leaders Growth R6 UGLSX	✖	A	B	A	A	B	A	A
☐	NYLI PineStone U.S. Equity Class R6 FCUDX	✖	A	B	A	A	B	A	A
☐	Polen Growth Investor POLRX	✖	A	B	A	A	B	A	A
☐	NYLI PineStone U.S. Equity Class I								

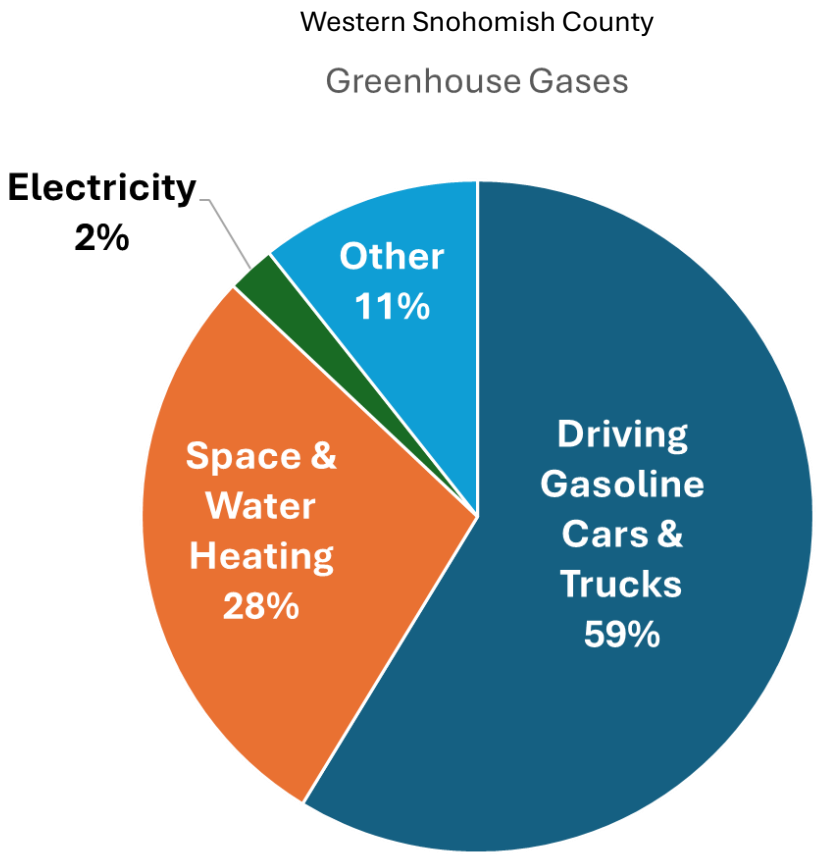
A FossilFreeFunds.org mutual fund list with ethics ratings.

Recipe Step 2: Drive an electric vehicle or ride public transportation

 [1]

[1] Public domain image from the U.S. Bureau of Labor Statistics: https://www.bls.gov/opub/btn/volume-12/charging-into-the-future-the-transition-to-electric-vehicles.htm

Where I live in western Snohomish County just north of Seattle, 59% of our greenhouse gas emissions are from driving gasoline cars and trucks.



These numbers are approximate: perfect data is not available and what is happening changes all the time. It might be better to say, "about 2/3rds of greenhouse gasses come from driving gasoline cars and trucks." Or you could understand that it's 59%, plus or minus about 7 percentage points.

Snohomish County is unlike many other places in the United States. Almost all of Snohomish's electricity comes from hydroelectric dams that release almost no greenhouse gas emissions at all.[2] That is why only 2% of Snohomish County's emissions come from electricity generation.

Some issues with electric vehicles

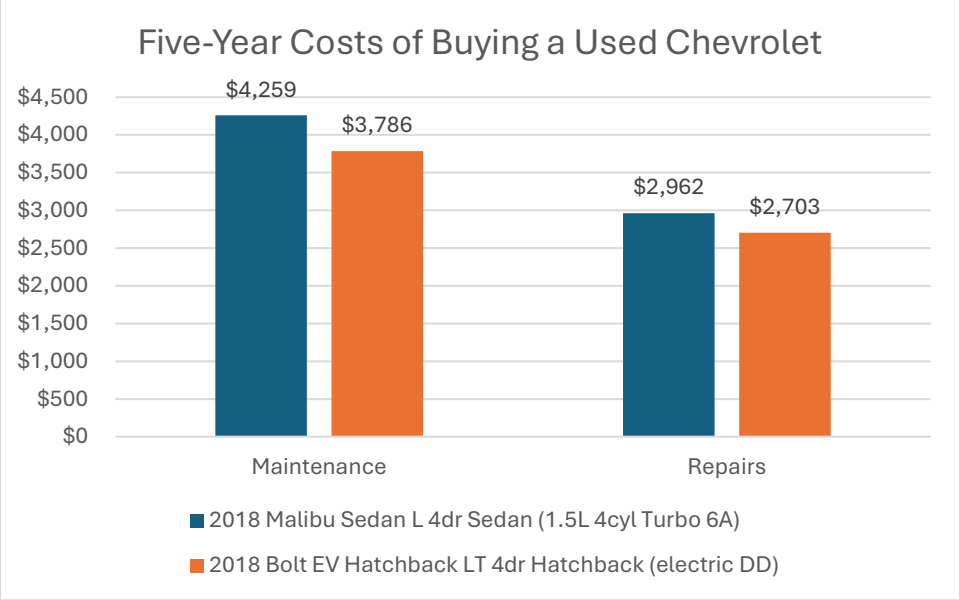
Savings: Cheaper to run and maintain

EV's are cheaper. You don't buy gasoline. A typical EV, like the Chevy Bolt, can go about 240 miles on a single charge of its 65 kilowatt-hour battery. In Snohomish, we pay about $0.12 per kilowatt-hour, so a battery fill-up costs $7.80. It costs $3.25 to drive a Bolt 100 miles.

[2] This does not account for methane emissions from the water behind hydroelectric dams. I don't yet know how much global warming that methane creates.

Gasoline in Washington State costs about $4.00 a gallon. A car that gets 30 miles per gallon, like a Toyota RAV4, needs 3.3 gallons to go 100 miles. That's $13.20 of gas. A lot more expensive than the $3.25 needed to drive the EV. Over a year of 15,000 miles, that's $1,980 to drive a gasoline car, or $487.50 to drive an EV.

Edmunds.com estimates that EV's are cheaper to maintain, because their systems have fewer and simpler moving parts. [3]



Prices: New EVs are more expensive, but not low-mileage used EV's.

New EV's cost about $3,000 to $10,000 more than similar gasoline cars. I mentioned this to a friend of mine who had recently bought a used Nissan Leaf. She disagreed. With her purchase, her gasoline costs went down and her loan payments went down as well. The reason her payments went down is that she bought a used car. An EV with 50,000 miles is likely to be a few thousand dollars cheaper than a similar gasoline car.

Range: EVs are inconvenient for road trips, but not for regular life.

Each year, about 30% of Americans take a road trip of over 250 miles.[4] A road trip of 250 miles is kind of inconvenient in an electric vehicle that can only get 240 miles on a single charge. You need to stop in the middle of your trip and charge up.

A typical EV built after 2017 has a range over 220 miles—way more than you need for a normal life at home. Outside of road trips people usually drive 15 to 60 miles a day—much less than you can add back to the battery overnight.

[3] https://www.edmunds.com/tco.html

[4] The *Atlanta Journal-Constitution* reports that only 33% take road trips over 250 miles. The *Vacationer* reports 34% in 2024. The Bureau of Transportation Statistics reports 22% in 2017.

Charging: Charge at home, if you can.

Most EV drivers are still folks who live in homes where they can plug in their EV from their driveway. That's easy and less hassle than having to get to a gas station.

Few apartment houses and condos provide electrical outlets at their parking spaces. That will change soon.

People who park on the street will probably have to depend on charging stations, which is a hassle.

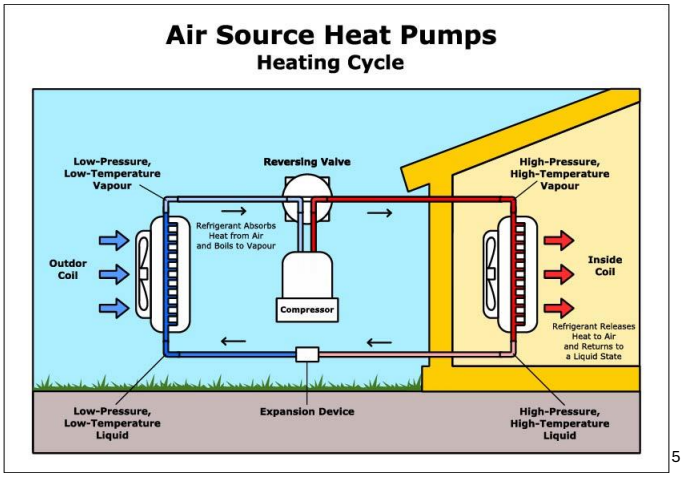
Used Minivans: There are not yet good used minivan options

If you live in Japan, you can buy an electric Honda Odyssey minivan, or an electric Toyota Noah minivan. In America, the only electric seven-seater options so far are the Kia EV9 (MSRP: $55,000) and the Volkswagen ID.Buzz (MSRP: $61,500). Both came out in 2024, and won't be available for used-minivan prices for years.

That brings up the question of how much you have to do right away. Al Gore said that adjusting how we live to stop global warming will be inconvenient. That is true, but that doesn't mean you have to endure extreme inconvenience. If you need a $10,000 vehicle that seats seven, you don't have to give up your gasoline minivan and walk everywhere with your kids trailing behind you. Wait ten years and get your $10,000 Kia EV9 then. Your delay won't make a big difference, especially if other people who face only slight inconveniences do their part. So do the things that are tolerably inconvenient.

Recipe Step 3: Get Heat Pumps

In western Snohomish County, about 28% of our greenhouse gas emissions come from natural gas burned to heat buildings and water.



[5]

A diagram of how heat pumps work

[5] Heat pump diagram public domain from https://www.energy.gov/energysaver/air-source-heat-pumps

If you currently heat your home or hot water with a resistance heater (like baseboard heating), you will save money with a heat pump. The planet won't be much affected by your switching from resistance electric to electric heat pumps.

If you currently heat with natural gas, you will stop a big chunk of your greenhouse gas emissions by switching to an heat pump no matter where you live. Electricity generation is switching to renewable energy (wind, solar, hydroelectric, and geothermal). You won't save a lot of money switching from natural gas to a heat pump. The savings of running the heat pump roughly balance out the cost of buying it. If you wait until your natural gas furnace or water heater must be replaced, the additional costs of a heat pump are only the difference between heat pump costs and natural gas furnace/water-heater costs. That pencils out better.

The idea is that you could run your natural gas furnace and water heater until it's time to replace them. Water heaters should be replaced after about 12 years. Natural gas furnaces after about 25 years. When it's time to replace them, get electric options. Buy only electic.

Buy only electric

Buy only electric appliances and vehicles.

Saul Griffith advocates for buying only electric, because the United Nations has asked that everyone stop burning fossil fuels by 2050. Your furnace and hot water heater will both need to be replaced before 2050. Same goes for your car or truck. If you buy only electric, you won't be buying or burning any fossil fuels by 2050.

Plan ahead

If you're going to replace your natural gas furnace with a heat pump, you'll need some time for shopping when your furnace conks out, and your furnace is going to conk out on a cold day in the winter. Plan to buy or borrow space heaters. Modern space heaters are safer than what was available 50 years ago. You can get a reliable heater for $150. For $450, you can buy enough to heat a 2,000 square foot home so your pipes don't burst and you're comfortable in most rooms. Once you're warm, you can start shopping for your heat pump and who to install it.

Natural gas clothes dryers are expected to last 15 years. If yours is over 10 years old, now would be a good time to get a heat pump clothes dryer. My family has a Whirlpool Duet that use a heat pump. It's running well after 10 years, partly that's because we hang up our laundry as much as possible. (At least I do. My spouse is not as onboard about this as I am.) For real data on dryer reliability, get a subscription to Consumer Reports.

Weatherize

When you put in insulation and seal cracks to stop drafts, it's called "weatherizing". Weatherizing reduces how much you spend on heating. In a badly weatherized home, you pay to heat it up, and then lots of the heat you bought slips out through cracks, the windows, and the roof, and you have

to pay for more heat to keep it warm. It becomes like filling a leaky bucket where you try to pour in water as fast as it leaks out.

[6]

A very poorly weatherized home leaks the heat you put into it.

When you switch to a heat pump, you may be able to save by weatherizing and buying a smaller heat pump.

Recipe Step 4: Push your governments to stop fossil fuels

Get connected with groups that make it easy for you to email your representatives to tell them to legislate to stop fossil fuels. In Washington State, that means 350wa.org.

Here is some of the needed legislation:

- A national greenhouse gas cap & phaseout
- State and National new gasoline vehicle bans
- State funding for weatherization & heat pumps
- State utility-scale wind & solar electricity generation
- State: Utilities must buy electricity from rooftop solar
- State: Utilities must allow plug-in solar
- National electric rail & power lines over railways
- National: Ban natural gas leaks

[6] Public domain tent image from State of West Virginia

- State & National: EVs for Super-Commuters
- City: Permitting for heat pumps, weatherization, rooftop solar, & apartment/condo EV charging

That's it. That's the punch line of this pdf. If that's all you need, go and do your part to stop global warming. You might need more details and explanation to prepare you to recruit others to join you.

Are temperatures really going up?

Weather stations

How do we know temperatures are going up? Around the world, thousands of weather stations are recording the temperatures every day. Temperature measurements have been collected since the 1700's.

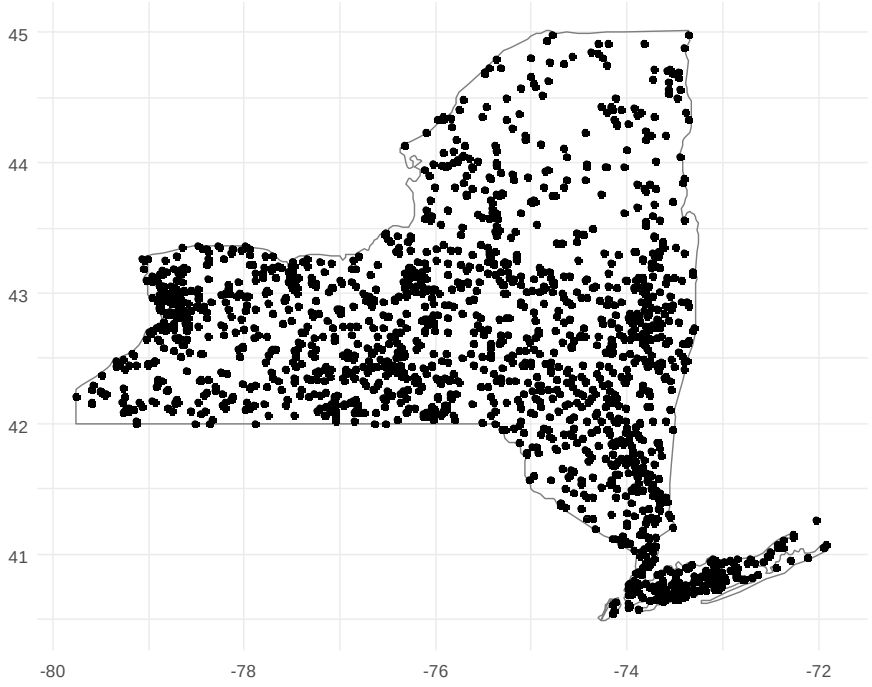
Modern measurements are collected from automated electronic weather stations.

Weather stations[7]

[7] Open source weather station image from the USDA.

A mountaintop weather station[8]

There is a weather station at Paine Field in Everett, WA. Another in downtown Everett. There is a weather station at Boeing Field in Seattle, and at Seatac airport.

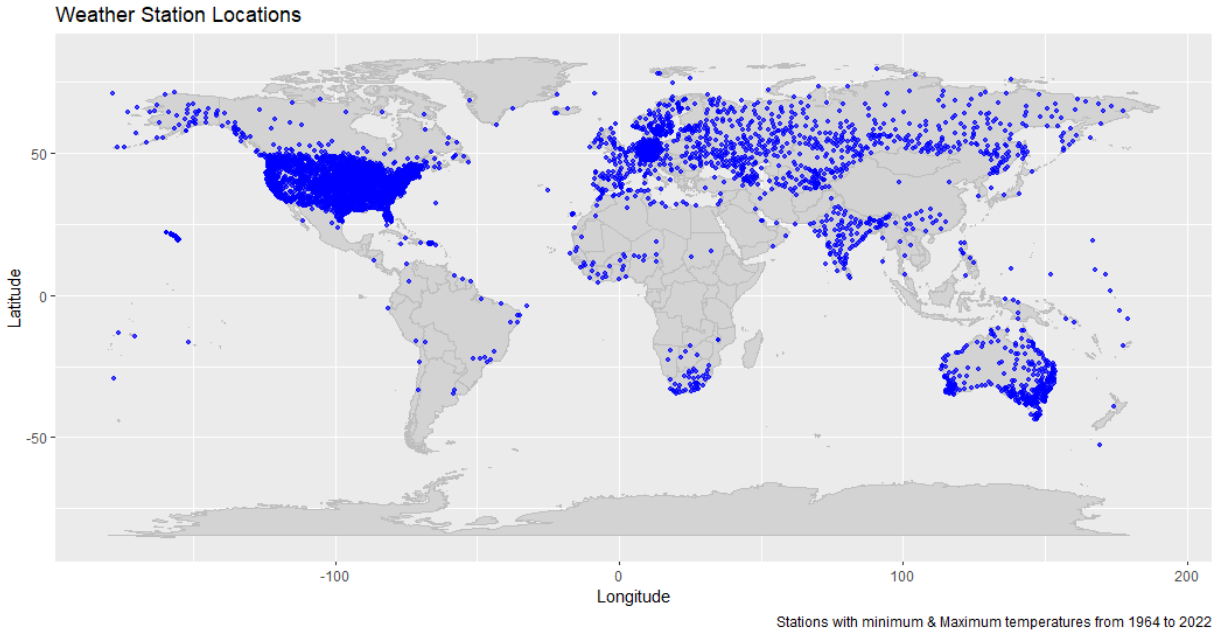


Locations of weather stations in New York State

In the 19th century, people who maintained weather stations walked out and collected readings on each day's weather and saved them in hand-written books. Today, weather stations are connected to the internet and can send readings multiple times a second. If you wanted to join in, you could buy a weather station for less than $200 and start collecting temperatures, wind speeds, and precipitation every second, if you wanted, and have all the data streamed onto the Internet.

[8] Open source mountain top image from the US Geological Service

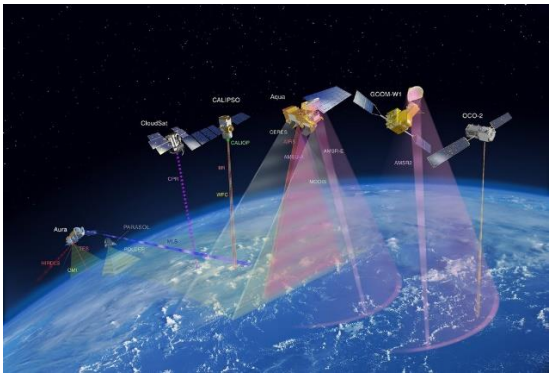
There is a consortium, NOAA's *Global Historical Climatology Network*, that receives data from thousands of weather stations around the world every day and provides that data online within less than a week. If you read that there was a deluge in Valencia in Spain, you could wait a week and see the rain gauge readings of the day of the deluge. Same goes for Rio de Janeiro.



Locations of stations sending temperatures to NOAA's Global Historical Climatology Network

Satellites

Since the 1960's, temperatures have been collected comprehensively by satellites that scan our planet. The number of satellites and the accuracy of their equipment improves all the time.



Satellites[9]

[9] Open source satellite image courtesy NASA

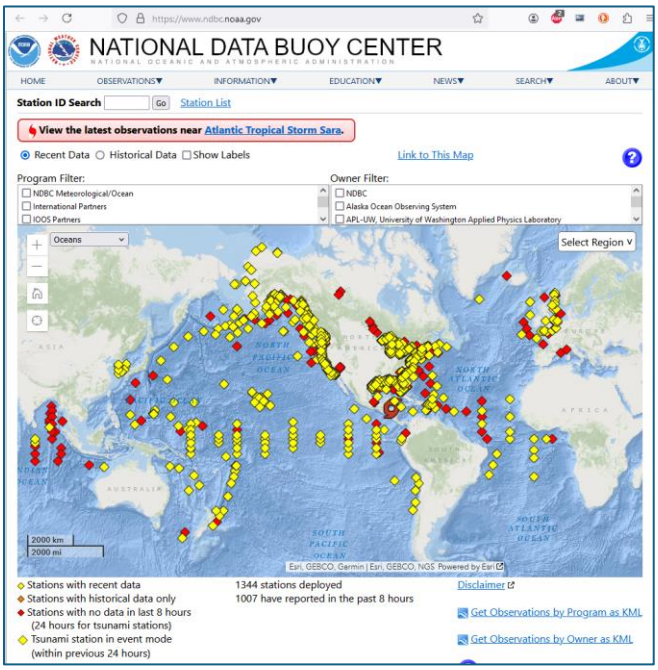
The satellites pose a small problem for comparisons before 1960 and after 1975: After 1975, satellites provide comprehensive counts of events like hurricanes. Before 1960, somebody had to see the hurricane to count it. The result is a jump in the count of hurricanes that is really only the introduction satellites. For things like hurricane counts, we can only compare 1975 and later to counts now. 50 years tells a lot, so it's not a big deal, but it's something to keep in mind.

Buoys

On the oceans, temperatures are measured with buoys.

A weather station on a buoy[10]

Weather-station buoys dangle sensors hundreds of feet below the surface, collecting temperatures, salinity, current speeds and other data that cannot be collected by satellite. The following map shows the locations of buoys that are currently in operation. They are not everywhere, but they tell us a lot about the oceans that we would not know otherwise.

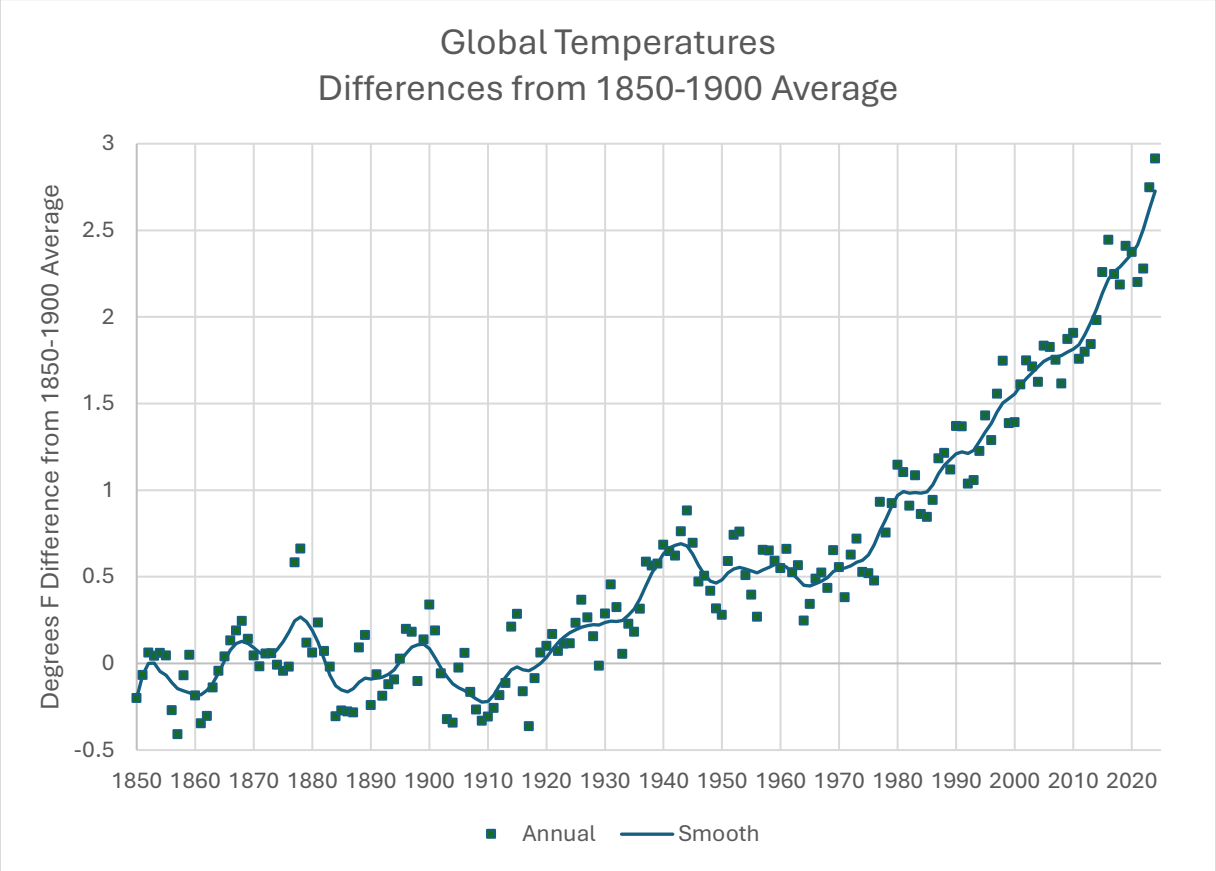


Locations of weather station buoys - www.ndbc.noaa.gov

[10] Open source buoy image courtesy NOAA

How much are temperatures going up?

Since 1850

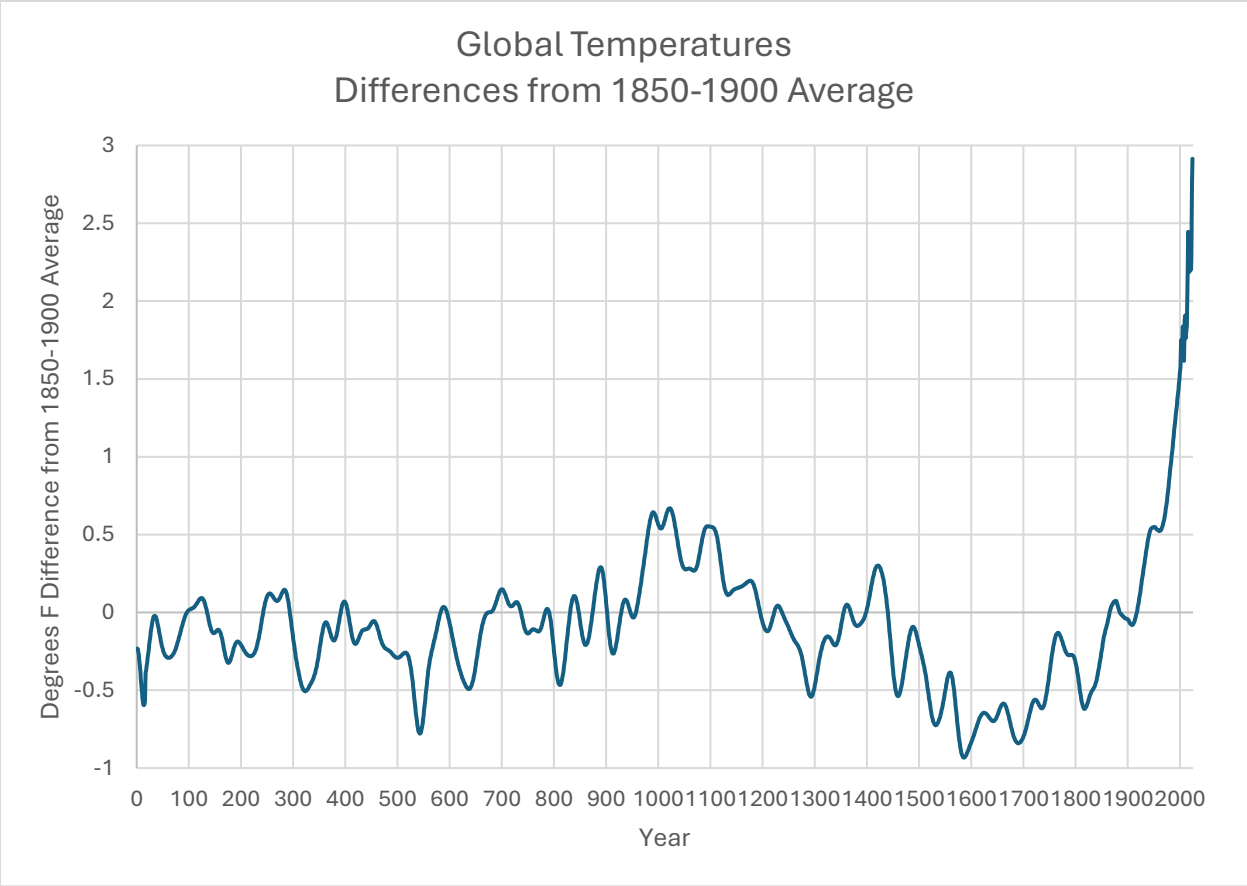


[11]

Average global temperatures have risen 2.7 °F since 1920 (1.5 °C). They held steady from around 1945 to around 1975 at about 0.8 °F over temperatures in the 1800's.

[11] Data from NASA and Berkeley University: Rohde, R. A. and Hausfather, Z.: The Berkeley Earth Land/Ocean Temperature Record, Earth Syst. Sci. Data, 12, 3469ï¿½3479, https://doi.org/10.5194/essd-12-3469-2020, 2020.

Since the 1st century CE



Temperatures are now 3 °F higher than they were in the first seven centuries of the common era. Our planet had a warmer era from 1000 to 1100 (technical name for this era: the "Medieval warm period" – who says scientists only speak in jargon?). If you visit national parks in New Mexico, you will see that there was a wave of village abandoning around the time of that warmer era. A theory is that extended droughts made it impossible to grow crops near the older villages.

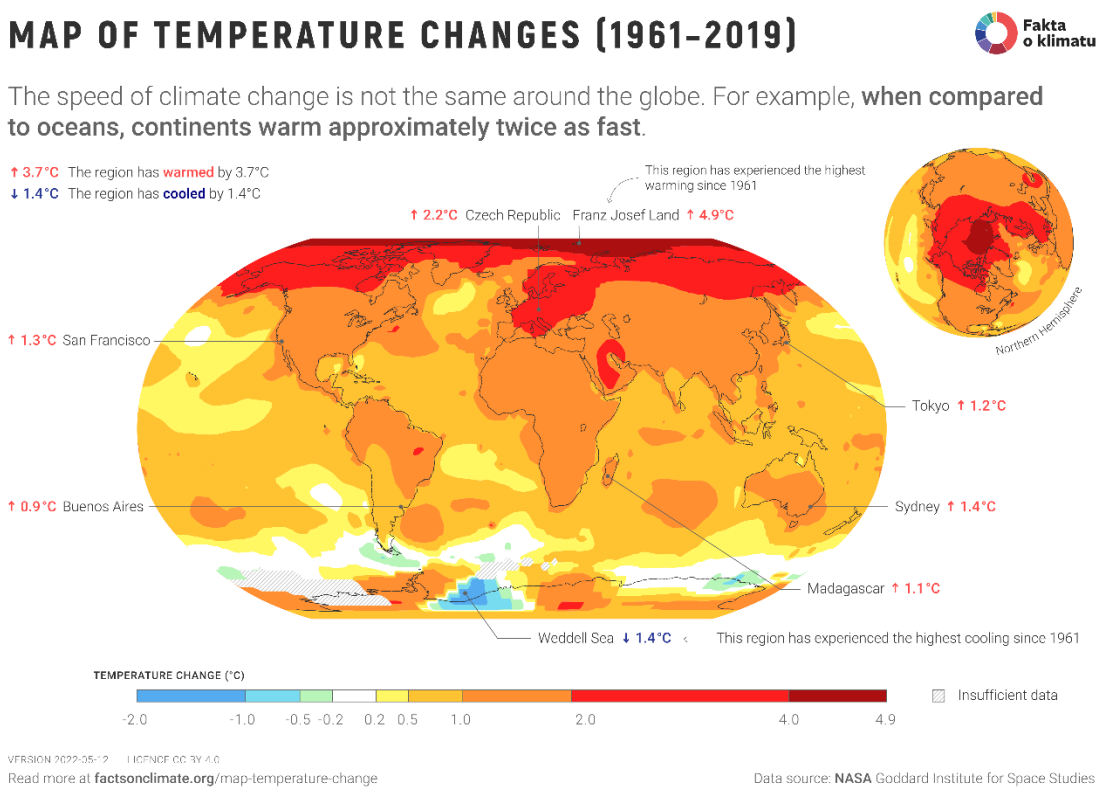
There was what is called the "little ice age" from about 1400 to about 1750.

Temperatures back to 1800 are based on historical records from weather stations and agricultural records. Records of temperatures in that era are validated by scientists looking at tree rings. Temperatures before the historical record are calculated from tree rings and archeological collection of pollen and shells. Trees and shells grow more in a hotter year and are thinner in a colder year.

Differences in how much temperatures have gone up

On *average,* temperatures have gone up 2.7 °F since 1850 to 1920. That doesn't mean you could take any temperature anywhere at anytime in 1750 and add 2.7 °F to get the temperature in 2024. Temperatures grew more in some places and times and less in others.

Locations



Changes in temperatures due to global warming[12]

As shown in the figure above, since 1961, the arctic has heated 8 °F. Most land locations are up 3 °F. Most ocean surfaces are up 1 °F. Global warming has been harder on Europe than other places. European temperatures are up 6 °F since 1961.

A general rule is that places that have had snow or ice cover have been heating more than other places. The reason for this is all about how snow and ice reflect sunlight. Because snow and ice are completely white, they absorb very little energy from sunlight. Instead they bounce back out to space the same kind of light that came in from the sun. That bounced light goes right by the global warming gasses (mostly carbon dioxide) and heads out to space.

[12] Map of temperature changes infographic by Fakta o klimatu, licensed under CC BY 4.0.

Snow and ice are white and reflect sunlight back to outer space without warming up[13]

What causes warming is when sunlight lands on things that are not white. Non-white surfaces absorb some of the energy of the light and heat up. Once they are warm, they start emitting a different kind of electromagnetic radiation: infrared heat radiation. If you have held your hand over a hot parking lot on a sunny day and felt the warmth coming off the blacktop, you have felt infrared heat radiation.

[13] Antarctic glacier snow and ice public domain image curtesy NASA

Asphalt heats in sunlight[14]

When snow melts two things can happen. If the snow and ice melts completely, as has happened in the Arctic Ocean and at the ends of many glaciers, the melting snow and ice reveal darker water, ground, or rocks that warm up and start sending infrared heat radiation back out toward outer space. That radiation is what global warming gases catch and sling back towards earth, warming our planet.

[14] Public domain image of heating curtesy NASA

Arctic water exposed by the melting ice cap is nearly black and absorbs light[15]

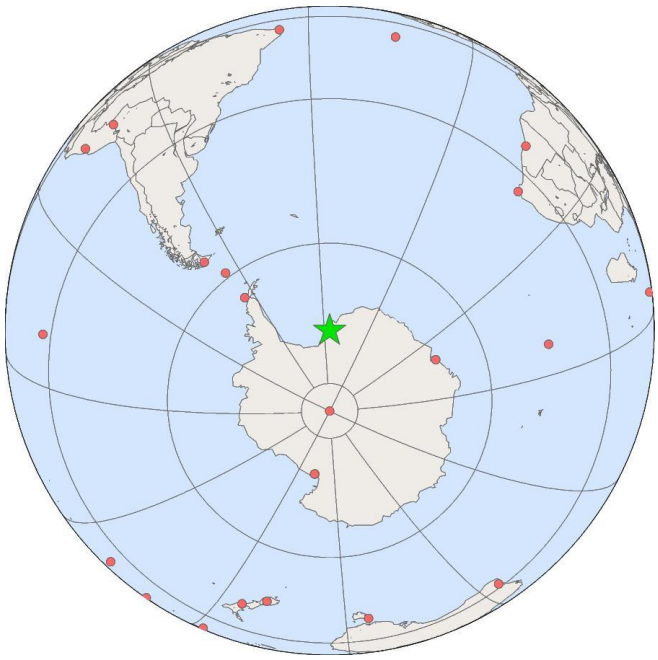
The other thing that happens with melting happens on glaciers. A glacier may lose a lot of its surface ice without melting away altogether. As the top ice melts, it leaves behind rocks and dust. The top of the glacier ends up covered in black. At that point, it's like a parking lot outside of a strip mall – heating up and sending infrared heat radiation out again.

As the ice on top of a glacier melts, it leaves behind rocks, dirt, and soot.[16]

[15] Exposed Arctic Ocean water image public domain curtesy U.S. Global Change Research Program
[16] Public domain dirty glacier image curtesy NASA

Places like Germany, Russia, and Minnesota that have snow only part of the year, the same process happens. The winter snow melts away more than it used to, causing more local heating, and old snow that stays melts repeated in the winter days, getting covered with a layer of soot.

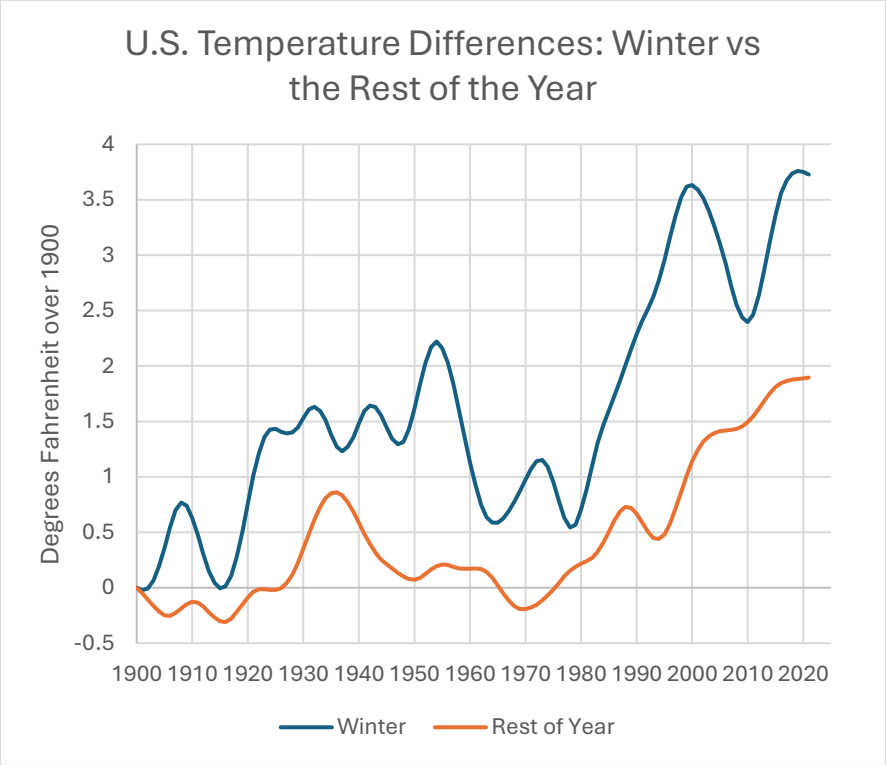
Some places have seen lower temperatures. The Weddell Sea just north of Antarctica is 3° F cooler because Antarctic glaciers are melting ice water into the ocean there. On average, most ocean temperatures of locations around Antarctica are unchanged due to global warming being roughly balanced by ice water from melting glaciers.



Location of the Weddell Sea that is cooling down with global warming[17]

[17] Public domain map showing the Weddell Sea curtesy NOAA

Winter vs the rest of the year



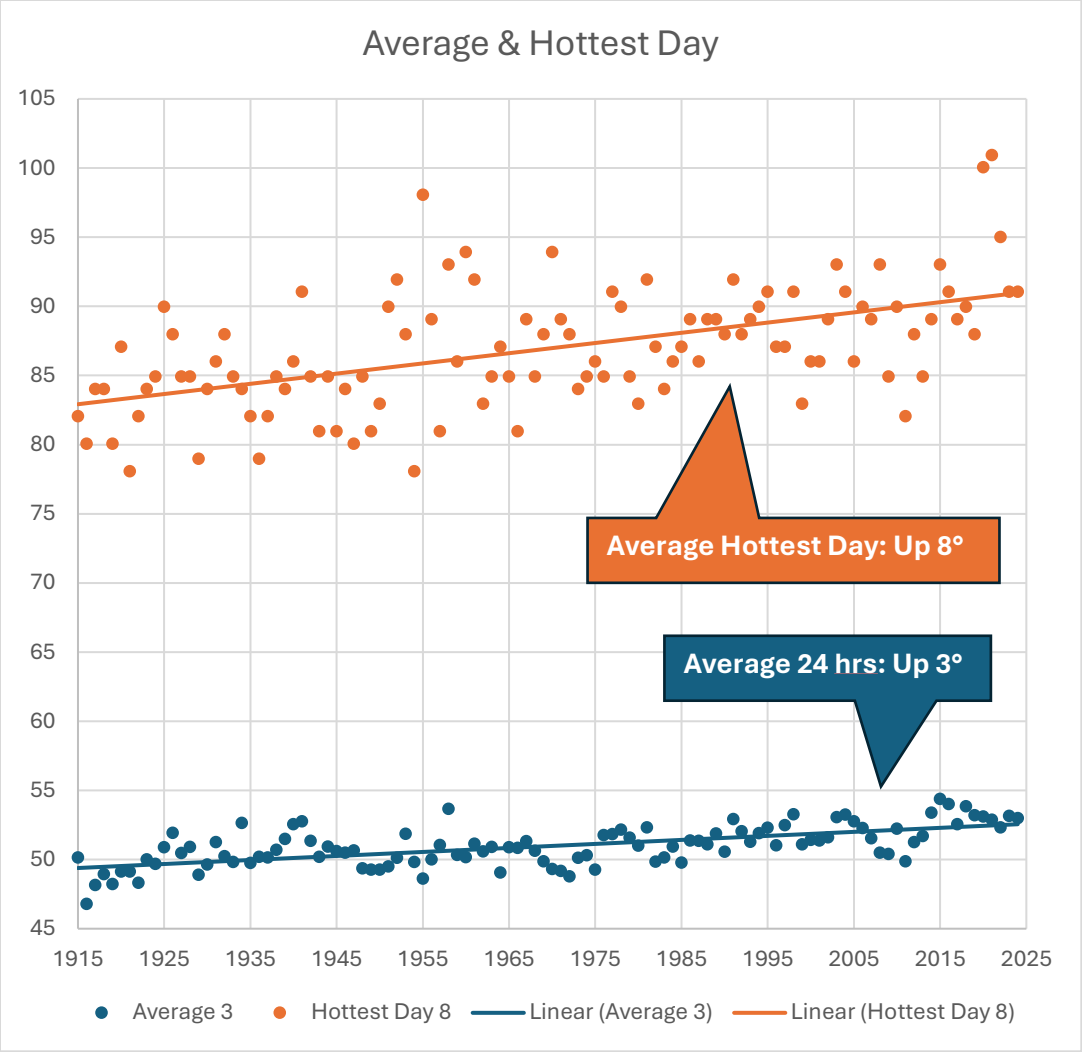
Temperature Changes in Continental U.S.

This is one of those effects of snow melting. Since 1900, average *winter* temperatures in the continental U.S. have risen 3.7° F. Spring, Summer, and Fall temperatures have risen 1.9° F.[18]

Heat Maximums

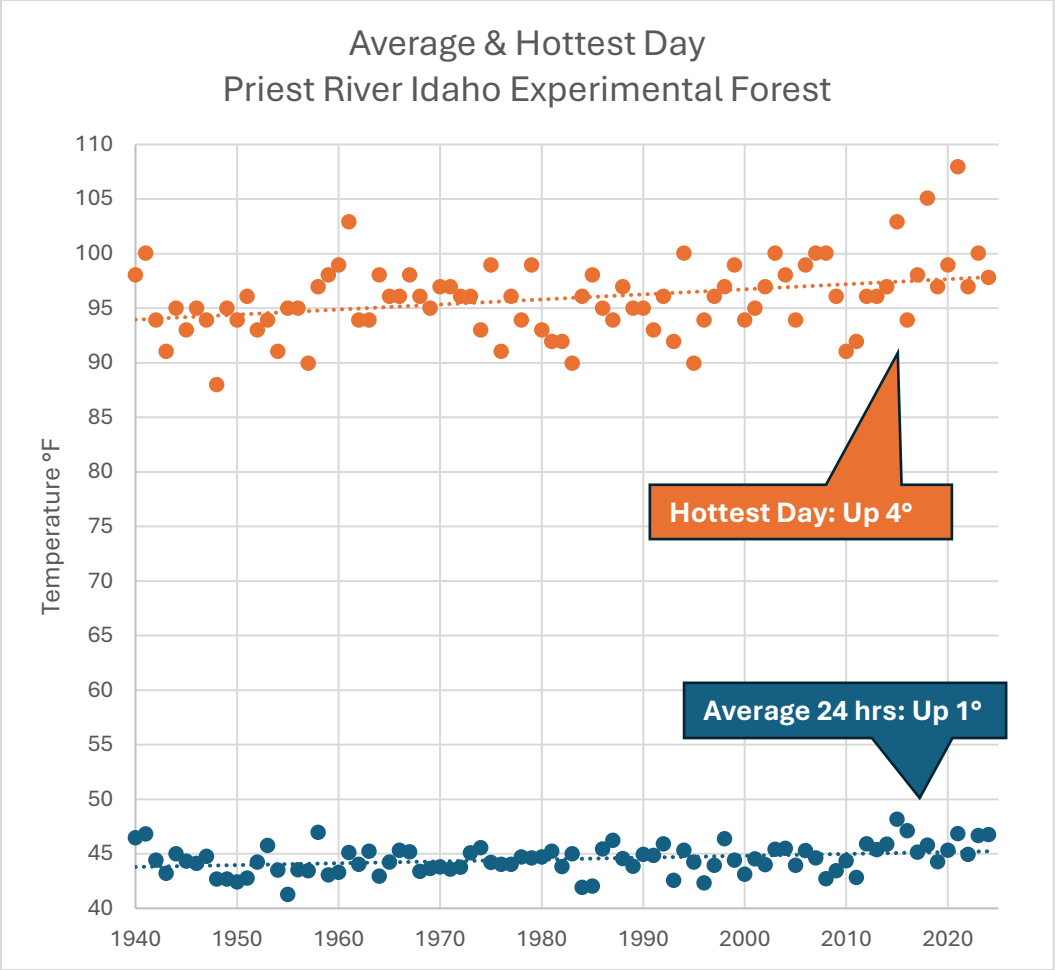
The hottest days in each year have increased in temperature more than the annual temperatures average from all 365 days of the year.

[18] Source: EPA's Climate Change Indicators in the United States: www.epa.gov/climate-indicators

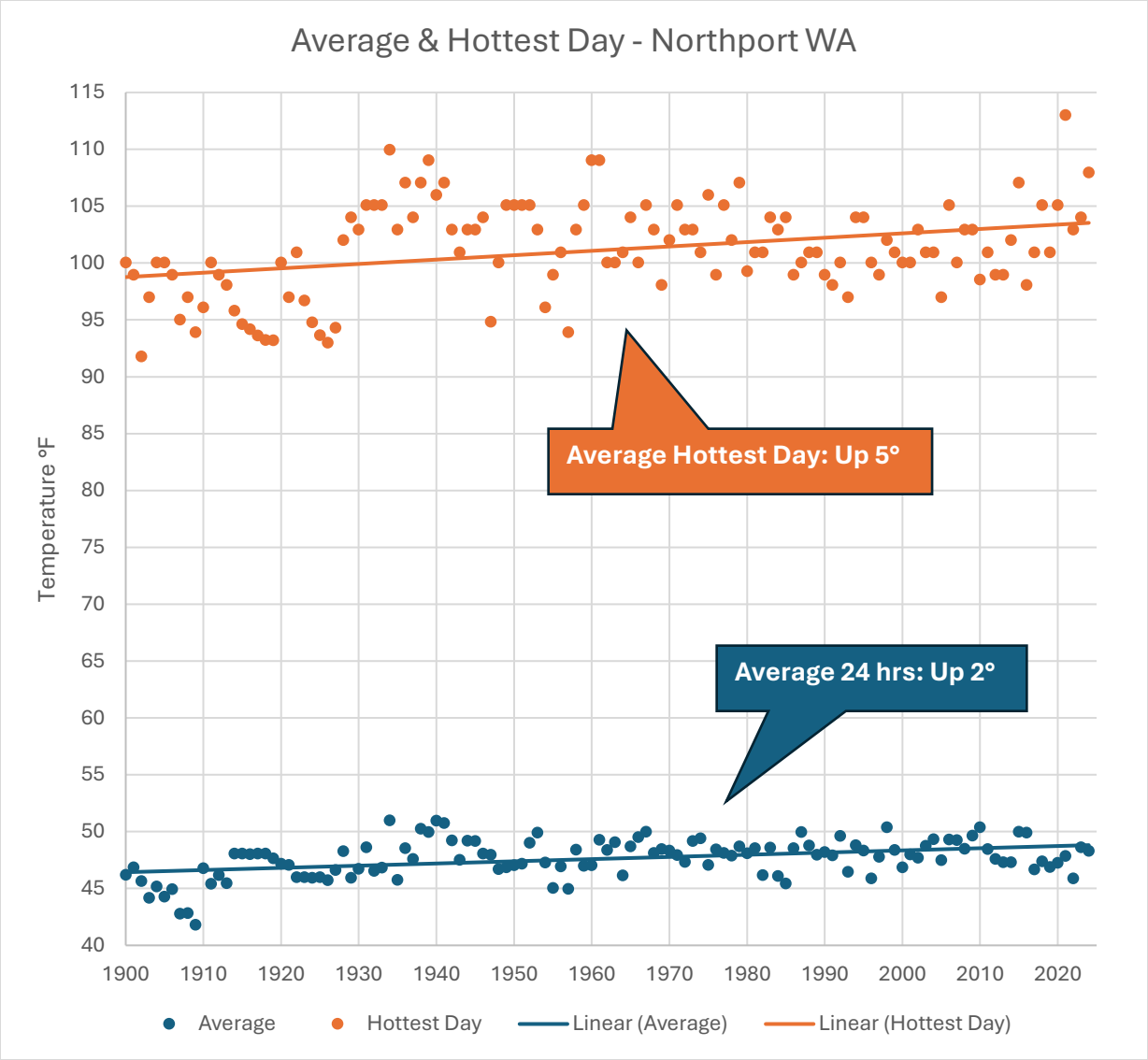


Temperatures from Everett WA weather station[19]

[19] Data from NOAA's Global Historical Climatology Network



Temperatures from a weather station in an isolated wooded mountain location in northern Idaho



Temperatures from a weather station on the Columbia River in northeastern Washington State

Heat islands

Global warming interacts with the structures that humans have built so that some locations become heat islands that get hotter than average locations.

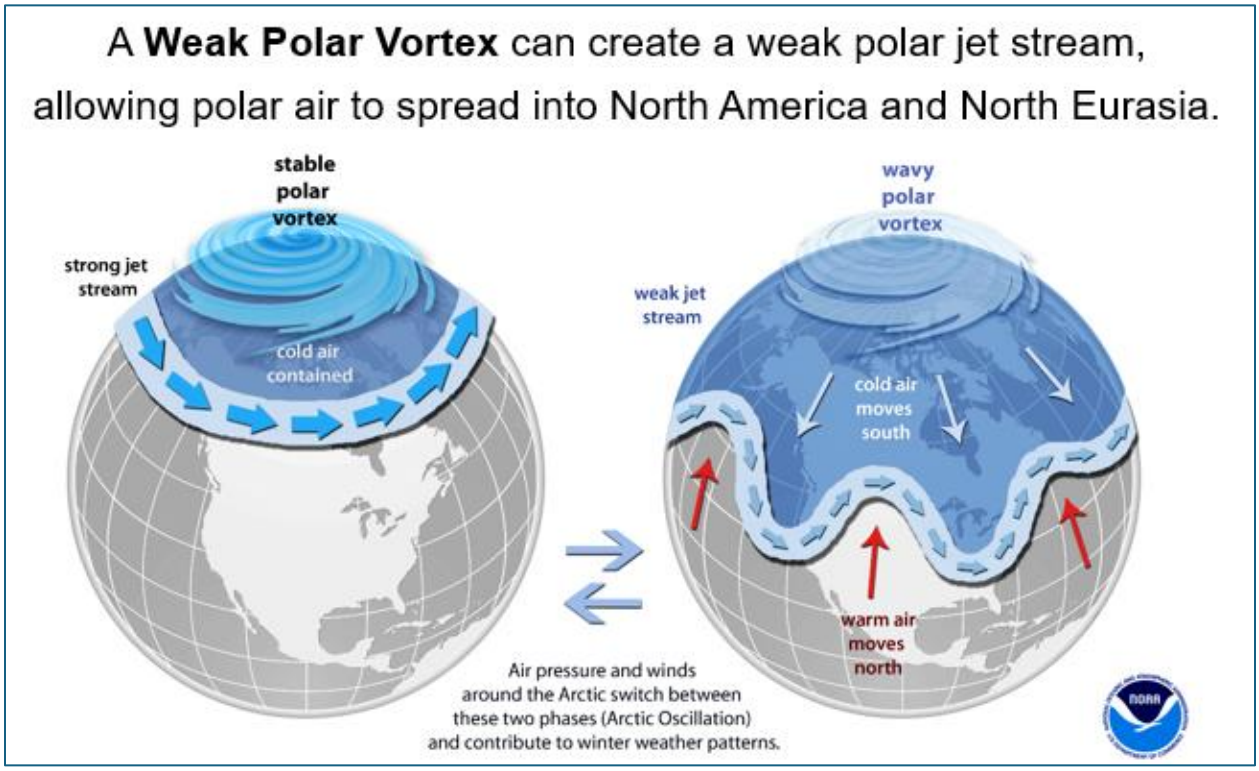
Heat islands are created by:

- Black surfaces of parking lots and roads
- Heat coming off gasoline and diesel engines on roads
- Buildings blocking winds
- Air conditioning releasing heat outside of buildings

Heat islands are diminished by evaporation from plants and bodies of water.

Polar vortexes

Global warming creates dramatic cooling at some times in some locations. In 2024, temperatures dropped to 10 °F in Alabama, which rarely sees temperatures below freezing. The cause was the arctic polar vortex slowing down.



Polar vortex slowdown causes arctic air to spread south[20]

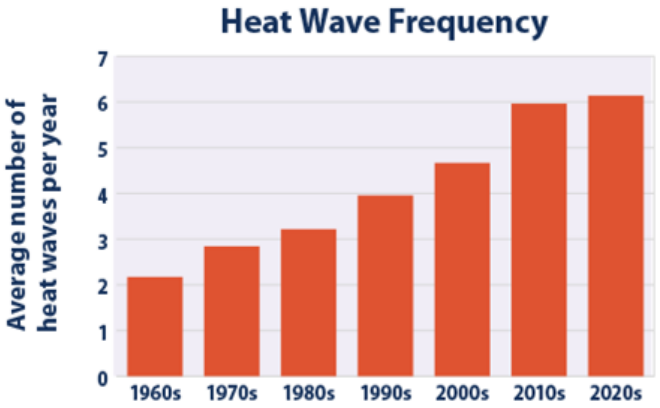
Before the late 20th century, the difference in temperature between the Arctic and areas to the south caused air to fall from the sky over the arctic. This falling created a spinning vortex, like the spinning water that appears as you empty a tub. The vortex creates the jet stream winds. Faster moving air pulls neighboring air in. That pulling effect keeps the vortex together over the arctic.

With global warming, the arctic has warmed more than the rest of the planet. The temperature difference between the arctic and elsewhere has gotten smaller. That has reduced how much air falls over the arctic and has slowed the vortex. The slower winds pull on the spinning winds less than they used to. The result is the arctic vortex is become less tightly wound around the arctic and arctic air is spreading south.

[20] Open source polar vortex image from NOAA

Heatwaves

Another consequence of the weakening polar vortex is that the jet stream is slowing down. Winds around the planet end up slower, and it becomes more common for a dome of air to remain over a single location for days. Normally, air is heated by the sun and then pushed along by wind. If air sits over a place like Phoenix Arizona or Idaho, it heats one day, starts the next day warmer than the last, and is heated some more. That result is a heatwave.



[21]

Heatwaves are becoming more common

[21] Heatwave chart public domain from https://www.epa.gov/climate-indicators/climate-change-indicators-heat-waves

Melting glaciers are heating neighboring locations

A melting glacier. All glaciers around the world are melting due to global warming[22]

Glaciers are melting and retreating from valleys. As a glacier gets farther away, locations in the valley heat up. This is a basic process that is worth considering: a glacier is a big block of ice. Imagine being at a party and someone brings in a huge five-foot tall block of ice. If you were standing next to the block of ice, it would be colder. The bigger the ice block, the more area would be cooled. A similar effect is happening with the polar ice caps. As they melt, they are cooling the entire planet. Whenever a glacier completely melts, its cooling impact goes away.

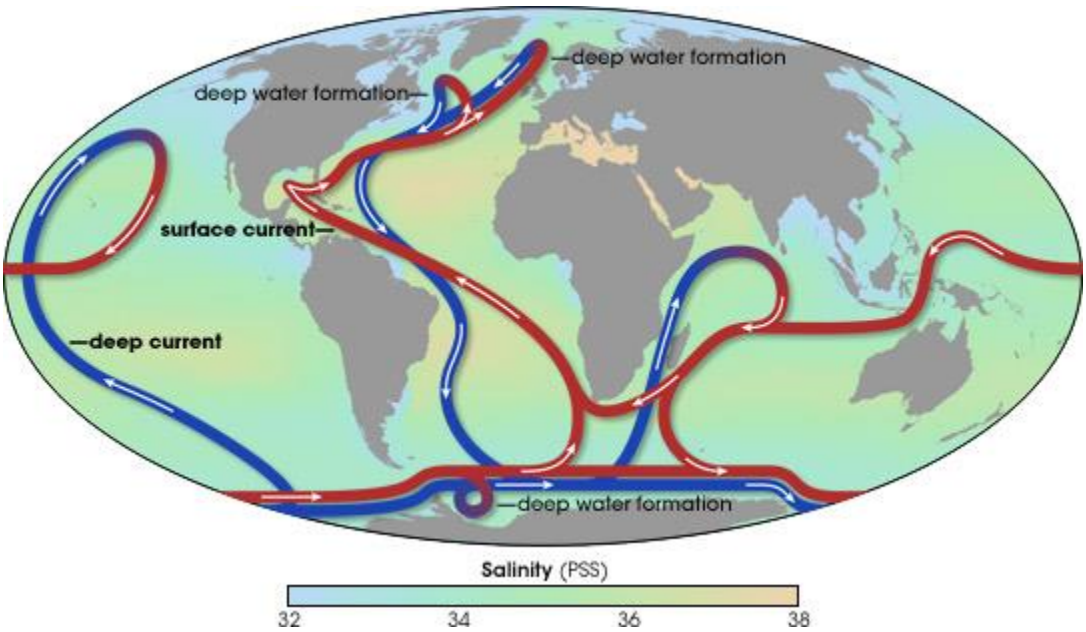
Thermohaline circulation shutdown would freeze Ireland, Britain, and Europe

The differences in warming listed so far, are differences that have already played out. Generally, I don't like to talk about what is coming, but the thermohaline circulation is too important to omit it here.

The thermohaline circulation is a collection of ocean currents that is driven by sea water freezing in the arctic. As the sea water freezes into ice, it leaves behind almost all of its salt. That makes the

[22] Glacier image in Public Domain curtesy United States Geological Survey

sea water in the arctic saltier. Saltier water is heavier and it sinks downward. Its sinking pulls other sea water from other locations. As more saltier water falls, the last batch of water is pushed away and heads south. The result is a flow of surface water towards the arctic in the north Atlantic, and a flow of deep water heading south. Eventually, it surfaces and heads back north again.



The thermohaline circulation that brings warm surface water to Europe[23]

The thermohaline circulation brings warm surface water from South America up to Ireland, Britain, and Europe.

The impact of global warming on the thermohaline circulation has two parts: First, the arctic waters aren't as cold as they used to be. That means that icebergs grow less and the water doesn't get as salty. Less salty water means less sinking, and less thermohaline circulation. The second impact is that the glaciers on Greenland are melting and pouring ice water that has almost no salt into the arctic ocean at the top of the Atlantic. That freshwater mixes with the salt water, making it less salty, and, again, less salty means less sinking.

So far, scientists can see that the thermohaline circulation is slowing down. If it stops altogether, it will reduce temperatures in Ireland, Britain, and Europe. So far, Europe is heating more than anything is cooling it down.

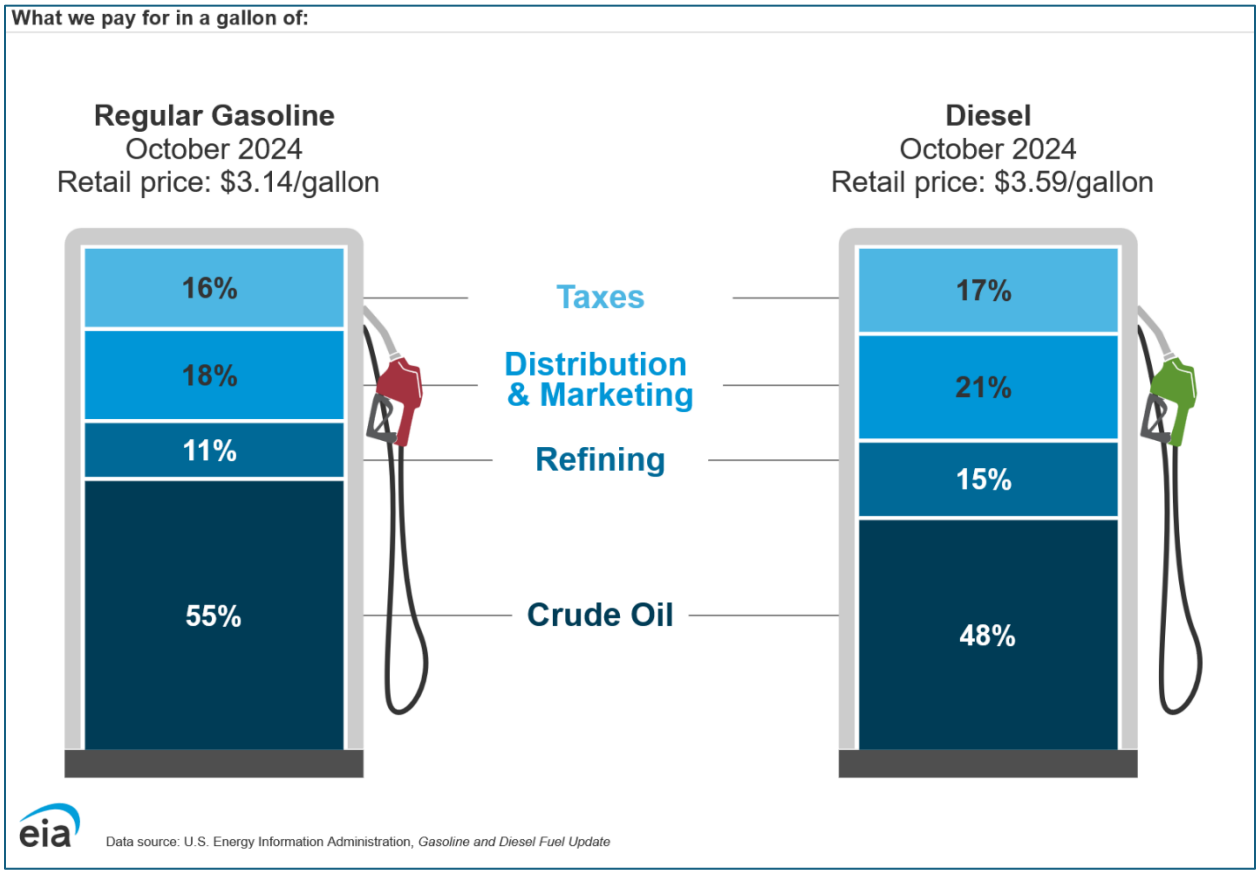
Global Weirding

Because the impacts of global warming are very different and not all related only to temperatures, Katharine Hayhoe has suggested we should say that what is happening is "Global Weirding", rather than "Global Warming."

[23] Thermohaline image public domain curtesy NASA

The Climate Denial Industry

Behold this amazing graphic from the U.S. federal Energy Information Administration:



A graphic from the U.S. Energy Information Administration showing the costs that go into creating the price of gas at the pump: Taxes, Distribution, Marketing, Refining, and Crude Oil.

The EIA has been updating the graphic shown above every month for over a decade.

The graphic shows that when you paid $3.14 for a gallon of gas in October 2024, 16% of your dollars when to taxes, 18% went to distribution and marketing, 11% went to refining, and 55% went to crude oil. That's 100% of the price you paid.

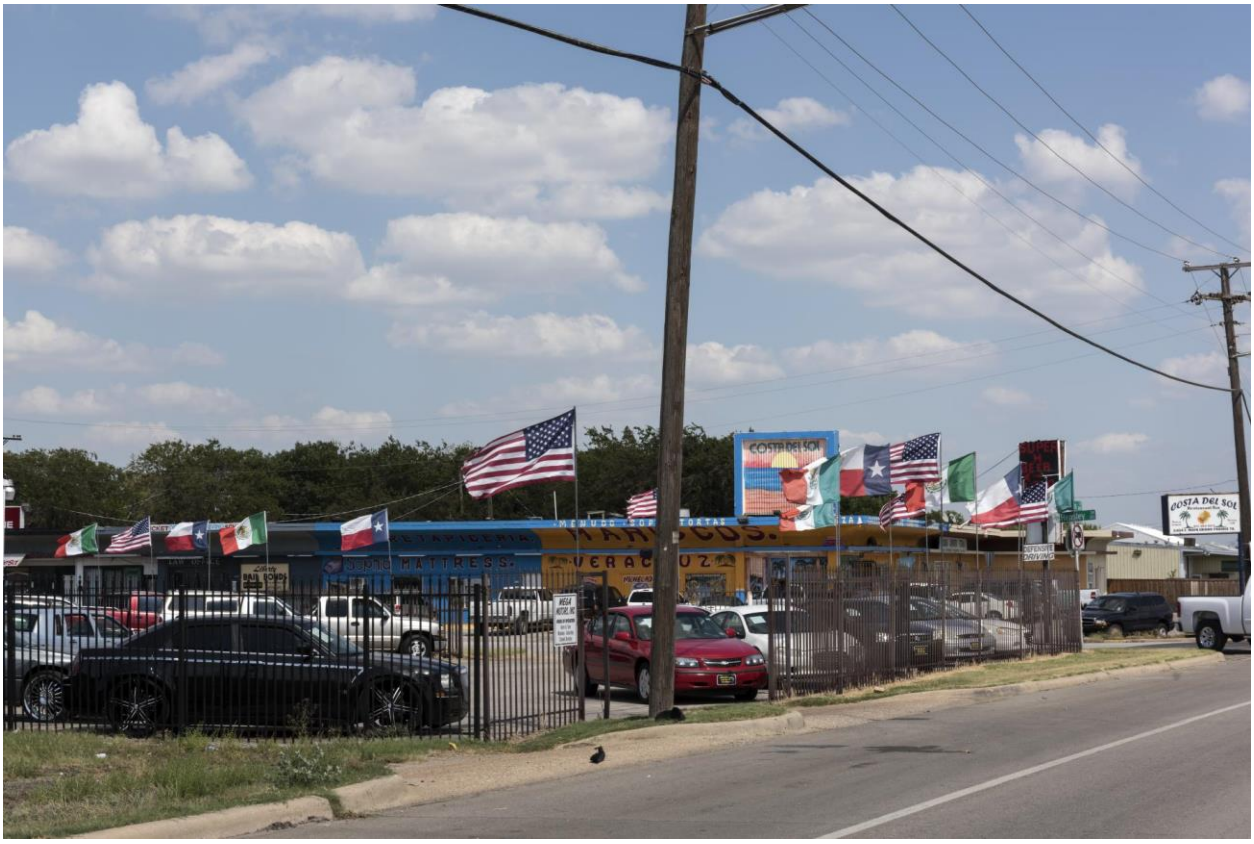
The graphic has been used to explain why oil companies cannot lower prices by reducing profits. As two researchers at the Federal Reserve Bank of Dalles wrote, "Don't look to oil companies to lower high retail gasoline prices." The graphic makes it clear why that is: according to the graphic, none of your dollars go to oil company profits. Your dollars pay for taxes, distribution, marketing, refining, and crude oil, but nothing for profits. I had to address this graphic recently in Washington State as people who wanted to roll back a cap-and-trade program claimed that the graphic proved oil companies had no profits to cut into to compensate for the cap-and-trade charges.

It would be sad if oil companies could make no profits off the sale of gasoline. But wait! "25 oil and gas majors made a $30 trillion profit between 1985 and 2018."[24] Well, whew! I was worried about those poor oil companies for a moment there. And if you think about it, of course they're making profits. It's just a misleading graphic.

But take a step back. How does it happen that a federal agency responsible for educating the country and the world about what is going on in energy in the United States ends up creating a misleading graphic and updating and publishing it monthly for over a decade?

Welcome to the Climate Denial Industry!

Used Car Sales



A used car lot, where you can expect a hard sell[25]

You know about sales staff. Even if you have never bought a car from a used car salesperson, you know what they are like. They have a job. The job is to get you to buy a car. The job requirements are a little light on helping you do the best thing for your life, and even a little light on avoiding misleading you.

[24] https://www.dw.com/en/should-major-fossil-fuel-companies-pay-for-climate-damage/a-70646285
[25] Public domain image of a used car lot curtesy U.S. Library of Congress

Imagine for a moment that you visit the lot, and in the middle of your visit, you decide, nope, you don't need a car. How would the salesperson respond? Would they congratulate you on your decision? No. They would do all they could to persuade you to buy a car. Along the way, they may bend the truth a little.

These notes are going to talk about people persuading you to buy. Because what they are selling is killing people now and will kill more people later, there is a sensible idea that their sales pitches are evil. What is not sensible is thinking that they are vicious devils. They aren't.

I recently spent four hours staring at election workers hand counting ballots in a close primary race. When you sit for four hours straight watching people work, you notice a lot about them and what is going on. It became obvious that, as they did their work, they did not care who won the election. It became clear that the eight names on the primary ballots lost all connection to human beings. These election workers got into the zone with the work and all that mattered was getting the count right. The counters worked in pairs. After they finished each stack, they compared their counts. The best thing that could happen for them that day was that their counts matched their partners' counts. This is a common way for work to be. You can lose a sense of the far away impacts of your work, and even of the impacts tomorrow, and you get into it and do your job.

A friend of mine is an emergency room doctor. He is part owner of the practice he works in. When a patient comes in with an ear infection, the practice earns this amount of money. When someone comes in with a broken arm, the practice earns that amount of money. At the end of the month, he and his partners tally up all the bills they submitted, and they each get a share. One day, I asked him, "What do you charge for an ear infection." "I don't know," he replied. "What about a broken arm?" "I don't know. I don't know any of the charges." I asked, "Don't you think about what you're making as patients come in." "No. I've never thought about it. I guess the work is too engaging. I just sew people up and save lives. During a shift, it doesn't occur to me about the prices." He's in the zone and he does his work.

It's the same with salespeople. They aren't chuckling to themselves about how bad they cheated the customer and how miserable the customer will be when they realize how bad the deal is. They have a task, and they are focused on that task and not thinking about what happens next.

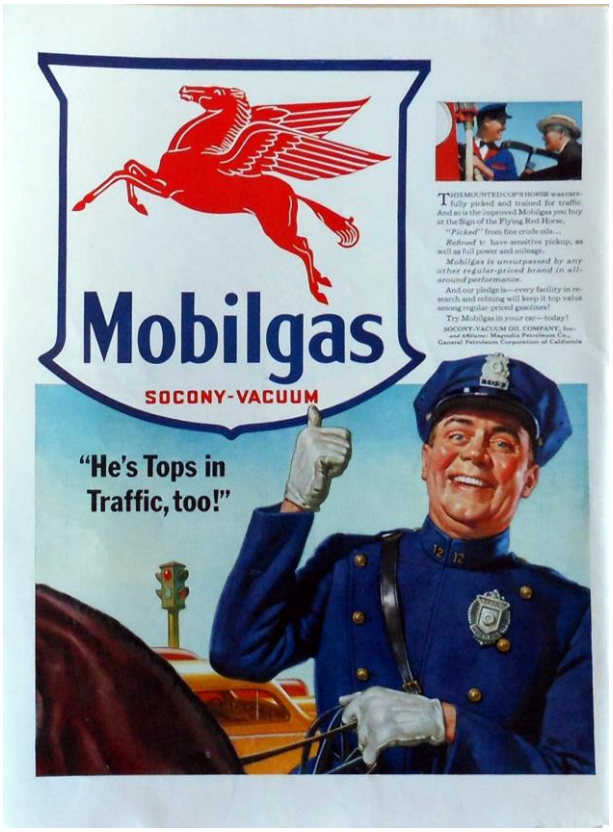
In 1961, Adolf Eichmann went on trial for having planned the killing of millions of Jews during the Nazi Holocaust. At his trial, Eichmann reported that his work was logistics—how many trains with how many cars had to go where and when, and things like that. He said, basically, he was just doing a job. The philosopher and reporter, Hannah Arendt, watched Eichmann at the trial and believed Eichmann. She concluded that, at least for some evil, evil is just banal. It's stupid and thoughtless. It's not wishing harm on anyone. It's just people showing up in the morning and doing their job. That goes for many of the people in sales. Even if they are selling something that is deadly, chances are they are not enjoying hurting people and they don't intend to hurt people. They are just doing their jobs and what joy they take out of their work is doing the work well.

I have talked with some engineers who have found places to dig oil wells and supervised that digging in third world countries. They had no intention of overheating our planet. They were hired to

do a job, and they did it. If you ask them about it now, they will tell you that if they didn't do it, someone else would have, and anyway maybe it wasn't the oil company's fault, because the car driving public made them dig the wells. It's an example of what Arendt called, "the banality of evil."

Sales people for fossil fuels sell fossil fuels

If you put together all the work of sales, you get "Public Relations", or "P.R." Fossil fuel P.R. includes advertising. We all know what advertising is about. Newspapers identify ads so we can put on our ad-consuming hats and not be misled, at least not too much misled.



An advertisement for Mobilgas gasoline[26]

Modern public relations is more complicated than just advertising. Most people are aware that social media (TikTok, Facebook, Twitter) includes what are called "influencers". These are folks who provide media content like blog posts or videos that include paid-for promotions.

[26] Public Domain copy of Mobilgas advertisement via Wikimedia Commons

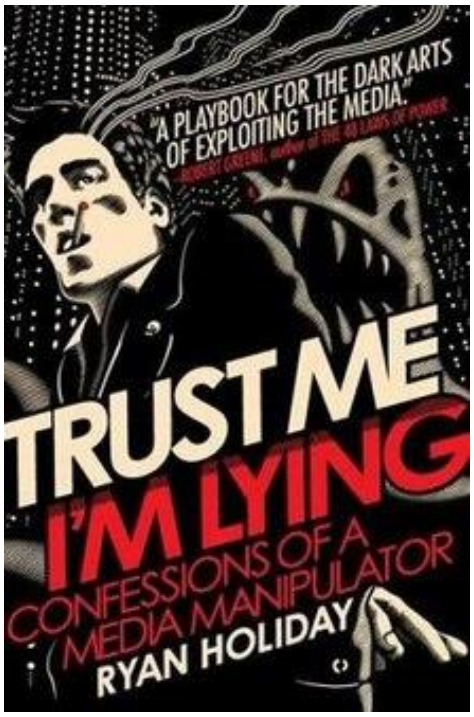
A video influencer with two guests promoting their books[27]

An important part of influencers is that their paid-for content is not highlighted to alert the consumer to turn on their consuming-advertising lenses.

Another part of the social media world is bots. Bots are automated posting software programs that respond to particular text in social media with messages advocating for some perception. For example, a bot on Twitter might watch for the term "fossil fuels" and reply to every posting including that phrase with variations on "We should all buy more gasoline." Much of the messages that people see on social media are generated by bots. This is because bot messages are very inexpensive public relations.

Public Relations have always targeted journalists. A couple of things are changing the relationships between P.R. and journalists. One issue is the Internet and the online world of blogs and "zines" (non-professions electronic magazines). Bloggers and other creators of online materials are not professionally trained journalists and they are susceptible to P.R. influence that would not affect a professional journalist (at least not one in 1975). In *Trust Me, I'm Lying*, Ryan Holiday describes simple steps that can be taken to get any story, however foolish, published in the mainstream media.

[27] Public Domain influencer image via Creative Commons Wikimedia



Trust Me, I'm Lying: a book explaining modern P.R. tricks

Holiday's recipe for getting any story covered starts with small bloggers, who are smalltime operators and very susceptible to influence. Once small blogs have picked something up, it can be pitched to blogs with larger audiences. That makes it possible to get small news outlets to carry the story, and then the large news outlets, *The New York Times* or *Washington Post* will carry the story because it was covered in the small news outlets.

The other modern issue affecting the relationship between P.R. and journalists is how social media and online classified ads have nearly destroyed the financial support of news media. The result is that journalists have been laid off. Those who remain are required to write huge quantities of articles in little time. The result is that journalists rarely have time to research anything and are very vulnerable to P.R. agents sending them pre-written articles to publish. Another consequence is that media outlets do not make much money and that makes them inexpensive to purchase. A well-funded P.R. campaign might buy some small media outlets just to take control of their editing and get their articles published.

The result is that journalism in 2025 is not like journalism was in 1975. It's actually not a lot different from journalism in 1875, before the invention of honest reporting.

P.R. Budget Guidelines & Fossil Fuel Sales

Guidelines for P.R. are that a corporation should spend between 1% and 20% of revenues on P.R., depending on what challenges the corporation faces. The fossil fuel industry—oil, gas, and coal—has more than $7.5 trillion in revenues each year. If you think they spend only 1% on P.R., that's a global P.R. budget of $75 billion. About $9 per human being per year. The small town I live in,

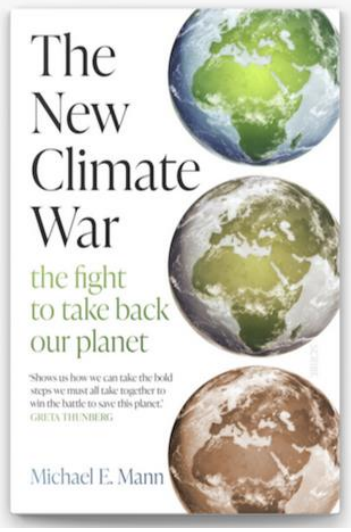
Edmonds Washington, is home to 43,000 people. If fossil fuel P.R. spend was spread evenly, it would be about $400,000 per year for my small town—enough for an office of three people working fulltime to get Edmonds residents to buy more gasoline, natural gas, and maybe even coal.

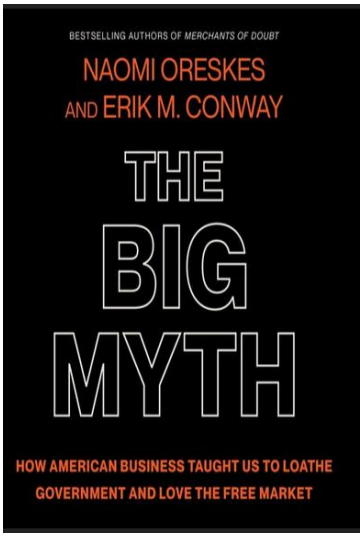
About six million people live in the Seattle metro area. Their portion of the fossil fuel P.R. budget is about 54 million. That's enough for a big office of hundreds of P.R. agents promoting fossil fuel burning in Seattle.

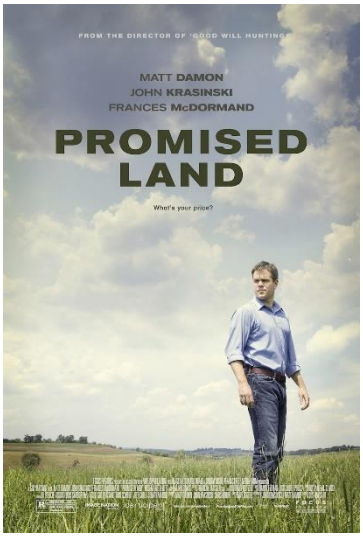
Where you can learn more about what the fossil fuel industry bought with their $75 billion annual P.R. spend

I don't have the time or space to present everything that the fossil fuel industry has paid for with their $75 billion annual P.R. spend that they have been spending every year for over 100 years. I will provide a few items. For a fuller picture, see Michael Mann's *The New Climate War*. It is quite readable. Michael Mann is himself a first rate climate scientist. For a longer exploration, see *The Big Myth* by Naomi Oreskes and Erik Conway. Oreskes and Conway wrote another book, *Merchants of Doubt*, that explored the climate denial industry along with the P.R. industry that attempted to keep people smoking. After digging into that, they realized that the cultural phenomenon they were revealing had deeper roots, going back to the 1910's. *The Big Myth* lays out that deeper history, highlighting the role of the National Association of Manufacturers, who remain influential lobbyists and P.R. flaks promoting fossil fuel burning. Perhaps in their next book, they will trace the story back to its earlier stage during slavery and Jim Crow. It is a story of White Southerners not accepting the results of the Civil War and promoting junk science to try to persuade people that African Americans ought to be enslaved.

There is a great movie that provides a great story that will provide a useful framework for you to understand what is going on: *The Promised Land*, with Matt Damon. There is another *The Promised Land* without Matt Damon. Not that one. You want the Matt Damon story. Among other things, it's a romance with a happy ending. (Not a lot of climate change stories with happy endings yet.)







The Crying Indian

Before I go further, I need to share the story of the "Crying Indian" "public service announcement" that was launched in 1971. It's not really an announcement in service of the public. It's an advertisement in service of a polluting industry. More about that in a bit.

The Crying Indian PSA starts with video of someone in Native American clothing paddling a canoe down a stream. The canoe pulls into a river with industry and gets to a grassy shore. The paddler climbs the shore and arrives at the side of a highway. A passenger in a passing car throws a bag of trash out that bursts at the feet of the paddler. The camera then zooms in on the paddler's face to show that he is crying one tear, and a voice over intones, "People star pollution. People can stop it."

It seems like a nice public service announcement designed to stop littering. Actually it isn't. The company that created the ad did so for the plastics industry and the ad is designed to get people to stop trying to get single-use plastics banned. The issue for the plastics industry at that point was that glass and aluminum cans could be recycled. Plastic usually cannot. Americans were getting the message (this was in 1970) that all the plastic that was being manufactured, used once, and then sent to a landfill was a problem. They were starting to get traction with national and local governments to get plastic bottles banned so that soda pop and other drinks would be provided in glass bottles and aluminum cans.

The issue for the plastics industry (which is a fossil fuel industry—plastic is made out of oil) was that people were collaborating and getting organized and lobbying, demonstrating, and voting together. When you do that, you have power. To stop this power, the plastics industry commissioned the Crying Indian ad to push the idea that collaboration is bad. The idea is that individual action is the answer. The disaster is that, without collaborative lobbying and voting, people lost the ability to influence legislators. You know how it turned out. More than 50 years later, we are awash in plastic. All because the voice-over said, "People start pollution. People can stop it." Meaning, "Don't ask your governments to stop plastic bottles."

That's it so far

This is as far as I've gotten getting my class notes into this PDF. Check back later for more complete notes.

- Nick, 12/14/2024