Lessening the effects of or adapting to climate change will require coordinated action by citizens, corporations, and governments all over the world.

• CO₂ remains in the atmosphere for a very long time. This has two impacts:
  o Regardless of source, CO₂ disperses throughout Earth’s atmosphere, giving a relatively uniform concentration everywhere.
  o The atmosphere is a true “commons” in which all people share the impacts of CO₂ no matter how much or little they emit.

• CO₂ emissions = population × energy use.
  o Global population continues to grow.
  o People everywhere strive for better living standards, which means greater energy use.
  o To minimize the impacts, energy must be obtained with little or no CO₂ emissions.

• The amount of CO₂ being emitted globally is so large that no single country can solve the problem alone. All must work together.
  o Because the developed world has contributed more than half of the CO₂ currently in the atmosphere, it should lead the way to a lower CO₂ future.
  o Because the developing world has a large population deserving of higher living standards, its development must be fueled by new, greener, and more efficient energy technologies to avoid catastrophic warming.

• New and improved energy systems are required to reduce CO₂ emissions.
  o Improvements are needed in technologies that do not use fossil fuels, such as wind, solar, wave, geothermal, and nuclear power.
  o Power grids need modernization to take full advantage of wind and solar power. This is particularly important in the U.S., which does not have a national grid.
  o Energy storage systems must be improved.
  o Methods to capture and store CO₂ from fossil fuel power plants need further development to increase reliability and reduce costs.

• We must place a price on CO₂ emissions that reflects their impact on Earth. This will allow the marketplace to drive the development of new and improved energy systems.

Things You Can Do

• Educate yourself about climate change and energy systems.
• Talk about climate change and the energy transition to neighbors, friends, and family.
• Get involved!
  o Join an organization advocating for change in our energy policies.
  o Write letters to the editor.
  o Call or write your elected officials at all levels about the need for action to limit the emission of CO₂ from fossil fuels.
  o Vote for candidates who will act on climate.
  o Support efforts to put a price on carbon consistent with its global impacts.
• Drive less, but when you do drive, use a vehicle that has the best mileage possible.
• Use alternative transportation when possible.
• Reduce your use of energy at home.
  o Weatherize your home to minimize your heating and cooling energy needs.
  o Use Energy Star appliances.
  o Change to LED lights.
  o Adjust your thermostat.
  o Use less hot water.
• Eat less meat, especially beef, and cheese. Eat more plants. Reduce food waste.
• Install solar panels on your home.
• Plant trees.

The Need for Action on Climate Change Is Urgent!

https://www.pwc.co.uk/services/sustainability-climate-change/insights/net-zero-economy-index.html
https://www.ipcc.ch/sr15/
https://www.ipcc.ch/working-group/wg1/
https://www.ipcc.ch/working-group/wg2/
https://www.ipcc.ch/working-group/wg3/

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Driven mainly by fossil carbon dioxide (CO₂) emissions, Earth’s climate is changing.

- Evidence from diverse sources confirms climate change.
  - The current warming is unprecedented within the span of human civilization.
  - Oceans are warming.
  - Glaciers are melting.
  - Sea level is rising.
  - The Arctic ice cap is shrinking, the ice is thinning, and its nature is changing.
  - Weather is getting more extreme.
  - Ecosystems are changing more rapidly.
- Evidence for the role of CO₂ as the main cause of climate change is unequivocal.
  - Earth’s temperature is stabilized and regulated by the greenhouse effect.
  - The major greenhouse gases (GHGs) are CO₂ and water vapor.
  - Water vapor is responsible for 50% of the greenhouse effect, but its life in the atmosphere is short because it condenses as rain and snow. CO₂ is directly responsible for 20% of the greenhouse effect, but its indirect effect is much larger. Because it does not condense, it stays in the atmosphere for a very long time, thereby regulating Earth’s temperature. It is Earth’s thermostat.
  - The level of CO₂ in the atmosphere is increasing because of the burning of fossil fuels (coal, oil, and natural gas).
  - Earth’s temperature is directly proportional to the amount of CO₂ in the atmosphere.
  - Satellites show a reduction in outgoing (i.e., cooling) radiation leaving Earth at the wavelengths associated with CO₂ and other GHGs.
  - Land-based sensors show an increase in incoming (i.e., warming) radiation from CO₂ and other GHGs consistent with their increased concentration in the atmosphere.
  - Satellite measurements of top of atmosphere radiation confirm that GHGs are responsible for Earth’s observed warming.

We must stop releasing CO₂ to stabilize Earth’s climate.

- Although not without consequences, international agreements have set 2.7°F and 3.6°F as tolerable global average temperature rises above preindustrial (1750) levels. Greater increases will have greater consequences.
  - To have a 67% chance of keeping the temperature increase below 3.6°F, we can only release 1150 gigatonnes (Gt) of CO₂ to the atmosphere after 1 January 2020.
  - The global CO₂ release rate is currently 40 Gt/yr and increasing.
  - At the current discharge rate, we’ll reach our 3.6°F CO₂ limit by 2049!
  - To have a 67% chance of keeping warming below 2.7°F, we can only release 400 Gt of CO₂, meaning we will reach our limit by 2030.
  - The impacts at 3.6°F of warming will be substantially worse than those at 2.7°F, but the likelihood of meeting the lower limit is slim.
- Because of natural variability it will take ten or more years after CO₂ concentrations in the atmosphere start declining for a drop in temperature to be apparent. The effects on regional precipitation trends will only become apparent after several decades.
- The longer we wait to lower CO₂ emission rates, the longer it will take for Earth’s climate to stabilize.
- Achieving net zero CO₂ emissions globally requires deep emissions cuts across all sectors and regions, along with active removal of CO₂ from the atmosphere to balance remaining emissions that may be too difficult, too costly, or impossible to abate at that time.
- Pledges under the Paris Climate Agreement are insufficient to limit warming to 3.6°F.
- The global CO₂ emission rate must be halved by 2030 to keep alive the possibility of limiting the increase in global average temperature to 2.7°F. NDC pledges from Paris and Glasgow are well below that requirement and suggest an end-of-century temperature increase of 4.3°F.

Continuing to burn fossil fuels could be catastrophic for humanity, both financially and in suffering.

- The greater the amount of CO₂ emitted by burning fossil fuels, the higher Earth’s temperature will rise and the worse the impacts will be.
- The amount of CO₂ that would be released by burning all fossil fuel reserves far exceeds the safe limits on emissions. The results of burning all fossil fuels would be disastrous.

• About 89% of coal, 59% of natural gas, and 58% of oil reserves must be left in the ground to limit the temperature increase to 2.7°F.

• Fossil fuel reserves are currently worth around $27 trillion.
  - The reserves would have no economic value if left in the ground and studies indicate that would cause large financial losses.
  - Fossil fuel companies and their investors are understandably reluctant to embrace the move to carbon-free energy sources.
  - How to move away from fossil fuels without damaging the global economy is a difficult challenge that is undergoing extensive study.