Grand Challenge 5: How We Keep Cool and Stay Warm | Climate Project

Whether you live in sunny California or chilly Northern Michigan, being able to cool down or heat up buildings is important. Unfortunately, the way most of us do this is extremely bad for the environment and is simply unsustainable. Better solutions are out there and readily available, so what's stopping us?

0:09

Narrator speaking

Are you comfortable? Are the temperature and humidity in your room just right?

Photo of two people lying on the hood of a car; clip of three men standing in snow with British flag

I have a very specific comfort band. If the air conditioning is set above 70 in the summer, I am burning up. And in the winter, I start shivering if the heat dips below 72.

If you're comfortable, you're lucky.

Bar graphs of heat wave frequency and heat wave intensity, respectively

Climate change is making extreme heat and extreme cold events more common all around the world. And a lot of people lack access to sufficient heating and cooling.

But, I have some good news… And some bad news… Unfortunately, the good news is also the bad news.

Photo of AC units on sides of buildings

As long as global poverty rates decrease, more people will have access to technologies like air conditioning.

That's a good thing. Those people will live more comfortably and can escape extreme heat events.

Clip of smoke coming out of pipes

But, it's also a problem; the methods we use to heat and cool our buildings are a significant contributor to greenhouse gas emissions. The very thing we're doing to survive extreme temperatures are making those temperatures worse and more frequent.

1:09

Grand Challenges infographic; zooms in on "How we keep cool and stay warm"

Let's start with the numbers: keeping cool and staying warm accounts for about seven percent of the 51 billion tons of carbon emissions that humans produce every year.

Photo of an AC unit

Some of that comes from the energy we use to power air conditioners. Some comes from leaked refrigerants that air conditioners use to make our houses cold.

Photo of a fireplace

Some come directly from fuels we burn to heat our homes, like gas and wood in fireplaces.

Now, seven percent might seem small compared to other sources of greenhouse gas, but we have to consider every source of emissions if we want to get to net zero.

Households with AC bar graph

And heating and cooling are set to become more important in the future.

As the global climate gets more variable, parts of the world that never needed air conditioning or heating before will become desperate for them.

Photo of infrastructure

As a result, global demand for cooling is expected to triple by 2050.

1:57

Text: We can do this; transition music

When that happens, air conditioning alone will consume as much electricity as all of China and India combined do today.

Photos of cleaner technology

But, there's some good news in this Grand Challenge: we already have the technology to make our heating and cooling much cleaner. Getting started on solving this Grand Challenge is mostly about educating the public, and fixing public policies. We still need innovations (of course) and because so many of our clean heating and cooling solutions run on electricity, we'll need to decarbonize our electricity generation.

Text: To what extent is...; transition music

But, getting to zero in this Grand Challenge is within reach.

Text: HVAC

We call most of the technologies we use to warm and cool our houses "HVAC", for "Heating", "Ventilation", and "Air conditioning".

2:53

I know... sounds super boring, but it's actually some pretty cool technology.

Photo of a hand using AC

Text: How We Keep Cool and Stay Warm Solutions; photos of HVAC technology

Anyway, we're going to focus on HVAC in this video. But these technologies are just one of the pathways you can explore as you seek solutions to the Grand Challenge of How We Keep Cool and Stay Warm.

So, let's briefly describe some others. If you watched the video for Grand Challenge Number 2: How We Make Things, then you know that humans are going to have to build a lot more buildings in the next 30 years.

Text box: Building Design

We need to make sure those new buildings are designed with zero emissions in mind. We can design buildings to be better at keeping us cool and warm.

Text: Passive Solar; photo of passive solar construction

For example, passive solar construction uses extra insulation and heat from the Sun to keep buildings cool in the summer and warm in the winter.

Text box: weatherization; Photos of people doing construction on a house to make it more insulated

We can also update old buildings through a process called "weatherization" that replaces or improves walls, windows, and frames to make buildings less... leaky. That means they lose less heat or coolness to the air outside.

3:53

Photo of biofuels; text box: Cleaner Fuels; clip of trucks digging for fossil fuels

We can also replace fossil fuels with somewhat cleaner biofuels. Unlike fossil fuels, biofuels emit carbon that has been recently captured by plants. This is a small but important difference. Fossil fuels release carbon that has been stored underground for millions of years, so burning them adds carbon that hasn't been in our atmosphere for ages.

Clips of people using biofuels; text: How can heat pumps...; transition music

But by using biofuels, we capture carbon already in our atmosphere by growing plants and then return it when the biofuels are burned.

Narrator speaking on screen

But, let's get back to HVAC. Like I said earlier, the good news is that the HVAC technology we need already exists. Engineers have developed much more efficient units in the last few years. Some of these are heat pumps, which also make great air conditioners.

Confused? You're not alone.

Photo of a refrigerator

A lot of people don't understand heat pumps. And yet, more than 99 percent of households in the United States already contain at least one—we just call it by a different name: the refrigerator!

4:52

Text: Heat pump efficiency; graphic of a house with heat pumps; photo of a man installing heat pumps

Like your refrigerator, heat pumps use coolants and loops of pipe to absorb heat from one place and move it to another. So, in the winter, they absorb heat from the air outside and move it inside. They can do this even in freezing temperatures.

Photo of a man controlling a heat pump

In the summer, heat pumps reverse this process to move heat out of your house. Heat pumps are kind of like the electric vehicles of HVAC.

Photo of a furnace

If we can power them with clean electricity, they can replace old gas and oil furnaces, and inefficient air conditioners with a zero carbon option. And we already have the technology in hand.

But, there's a big difference: while electric vehicles are more expensive than gas-powered cars and have a high Green Premium, heat pumps can actually have a negative Green Premium, depending on where you live.

Clip of a man talking with a construction worker; text: Obstacles; transition music

That means it's cheaper to install a new heat pump, than to install a new natural gas furnace and electric AC—so why don't we all have one?

5:49

Narrator speaking on screen

Well, that brings us to the bad news: we have this technology readily available, but we aren't using it. Only 11 percent of homes in the United States have a heat pump.

Photo of a man reading a thermostat; text box: Cost and government regulations

The biggest problem is that our government policies are outdated. Since the 1970s, government regulations have focused on efficiency rather than emissions. And until recently, natural gas furnaces and appliances were much more efficient than the old electric models.

The other part of the problem is that consumers just don't have the information they need.

Text box: Lack of Awareness; Photo of an AC unit

For example, when buying a new AC unit, people often choose the cheaper option, not knowing that it's going to cost them more in the long run. The typical AC unit sold today is only half as efficient as what's widely available, and only a third is efficient as the best models.

Photo of F-gases

Unfortunately, there's another problem with HVAC systems: they contain refrigerants known as, "F-gases", because they contain fluorine. F-gases leak out little by little over time and they are powerful contributors to climate change.

6:47

Narrator speaking on screen

In fact, over the course of a century, they caused thousands of times more warming than an equivalent amount of carbon dioxide.

Text: AC Refrigerants

We're going to need innovations that either replace F-gases, use them more efficiently, or prevent them from leaking. These, and other innovations, are all within reach.

Text: Action Opportunities; transition music

And remember, the great thing about cooling and heating is that a lot of the innovations we need already exist. We just need the policies and practices to support them.

So, what can you do?

Photos of different types of cooling units

The first thing you should do is look around you to figure out what's appropriate for your community. What kind of heating and cooling do homes around you use? What about your school and public buildings?

Photo of a lit stove; photo of a wood stove

Is natural gas really cheap where you live? Do a lot of people have wood stoves?

7:35

Photo of money in an envelope; photos of people experiencing different climates

Does your state offer tax incentives for heat pumps? What's the weather like in your town? If it's hot, cooling is probably a priority. But if you live in Northern Michigan, maybe you'll want to pay more attention to staying warm.

Text: Action opportunities; a series of photos depicting different action opportunities; text boxes describing action opportunities

You can also make a big difference by writing to local officials to include higher standards for AC efficiency and building codes. You can raise awareness at your school and to homeowners in your community about the benefits and lower costs offered by heat pumps. And in the long term, you might choose a course of study, like architecture or mechanical engineering, that would allow you to design zero carbon buildings and HVAC systems.

OER Logo appears; outro music

What will you do to help us get to zero?