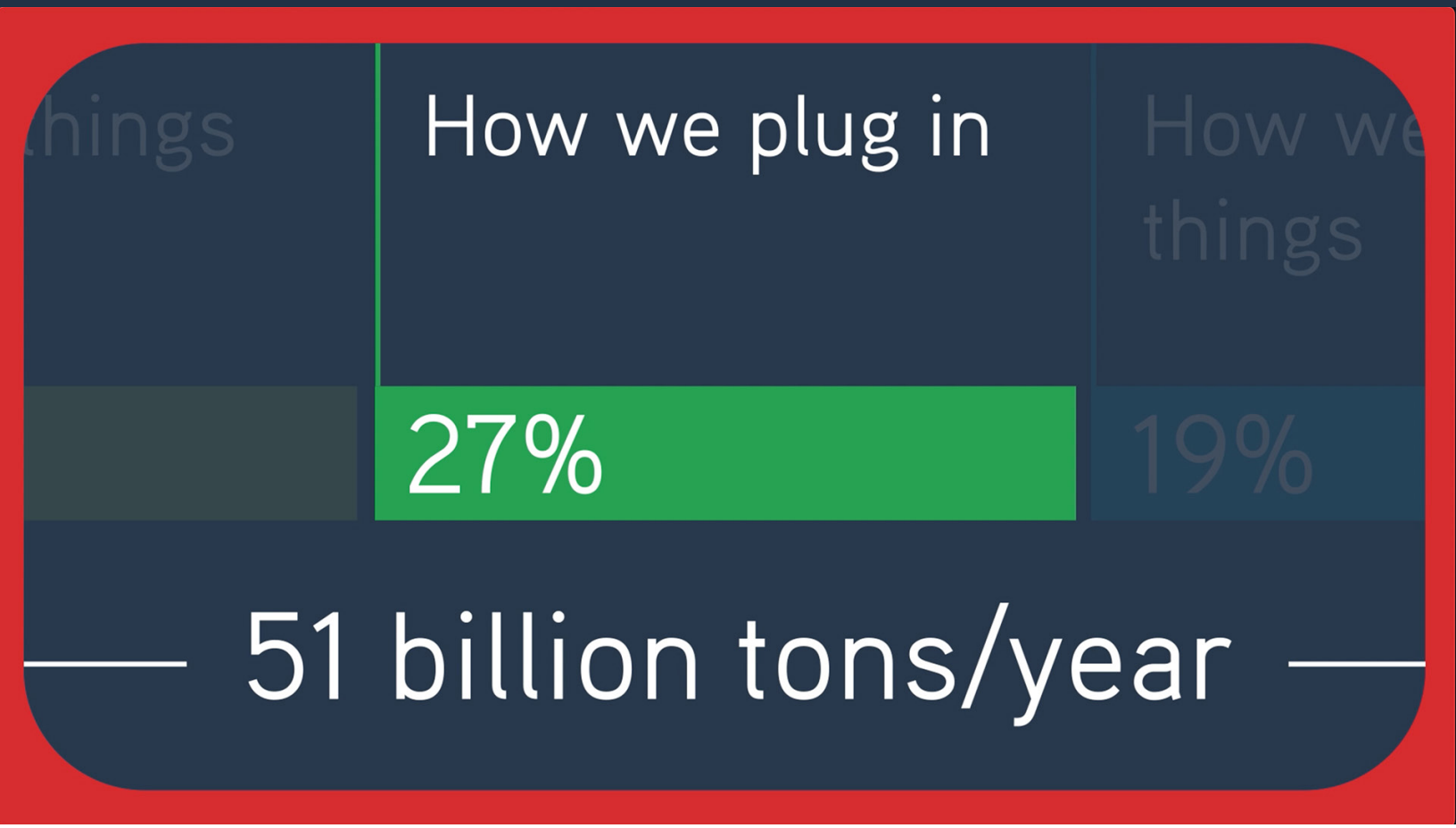

Grand Challenge 1: How We Plug In | Climate Project

From turning on a light switch to heating our houses, we use fossil fuels constantly in our day-to-day lives. Unfortunately, fossil fuels—while extremely cheap—only worsens the issue of climate change. And so, we need to find better ways to power the world's civilizations. Of course, this is no simple problem; it's going to take people of all jobs and skills to find a solution.

0:08

Go turn on the light switch. What happened? Did a light turn on? How cool is that?

Narrator speaking; clip of a hanging lightbulb

If you live in a wealthy country like the United States, you take it for granted that you can illuminate any room with a simple hand motion. Not too long ago, that was a fantasy.

Global primary energy consumption by source graph

Today, electricity is almost everywhere, and we use a lot of it. In 2019, humanity consumed 160,000 terawatt hours of electricity. And our usage is still climbing.

Photos of energy sources

If electricity still isn't sparking your curiosity, here is another shocking fact: electric power is incredibly cheap. That light switch you flipped— your whole room lit up using electricity generated hundreds or even thousands of miles away from you.

Text box: 0.008 cents

How much do you imagine that must have cost? Did you guess about eight thousandth of a cent? That's all. And if you leave that light on for an hour it will end up costing you about... half a penny.

1:06

None of this is necessarily a bad thing—we want people to have access to electricity and the clean water, education, refrigeration, internet and binge-worthy television that comes with it. But our reliance on electricity also comes at a high cost.

Infographic: How we plug in - Grand Challenges

The way we generate power accounts for 27 percent of the 51 billion tons of greenhouse gases humans produce every year.

That's why "How we plug In" is our first Grand Challenge. In fact, How We Plug In might be the most important Grand Challenge.

Photos of electricity usages

You see, all the processes we describe in other Grand Challenges use electricity. We use it to build, to move around, to grow our food, and to run our air conditioning and heating. So, if we're going to decarbonize those human activities, we need to produce more clean electricity.

How can we do this?

Photo of Los Angeles

Well, electricity can be generated in lots of different ways: for example, let's look at the city of Los Angeles, one of the largest cities in North America and where I live.

2:03

Photos of power sources

Most of LA's power comes from coal-fired plants, many of them decades old. Some of the power comes from newer sources including solar projects, both massive solar facilities like this one, and smaller panels on the roofs of people's houses—like this.

There are also a dozen wind plants, one geothermal plant, and a nuclear power generating station. A small amount comes from a landfill, where gases from rotting garbage are turned into fuels.

Photo of the Hoover Dam and a coal plant

And most of the rest comes from the Hoover Dam, a massive hydroelectric plant near Las Vegas. It's the coal plants that are the biggest problem in the case of Los Angeles.

Text: Electricity emissions in grams of CO_2

When you generate electricity by burning fossil fuels, like at these coal plants, you produce a lot of carbon emissions.

Global electricity generation pie chart; Text: We can do this; transition music

Unfortunately, today fossil fuels account for about two-thirds of global electricity generation. If we're going to get to zero, this needs to change.

2:59

Text: Renewables...; Text: To what extent...?

At least some of this change will come in the form of renewable power sources like wind, wave, and solar. These energy technologies are already available and using them as much as we can will help us dramatically cut down the amount of carbon dioxide and other greenhouse gases we produce to generate electricity.

Clip of the Hoover Dam

In a moment, we're going to focus on renewables as one important solution.

Text: How We Plug In Solutions; photo of a person plugging in a phone

But first, you should know that renewables are just one of the pathways you can explore as you seek solutions to the Grand Challenge of How We Plug In.

Text: Intermittency; photos of renewable energy sources

You see, renewable energy generation can't solve all of our problems; partly because of a complication called intermittency. That is, sometimes the sun doesn't shine and the wind doesn't blow. For those times when solar and wind aren't producing energy, we need to have stored energy available.

3:53

So, in addition to generating renewable energy, we must also be able to store massive amounts of electricity for the calm or cloudy days.

We're going to need better energy storage solutions, like batteries and hydrogen fuel cells. Now, not all carbon-free electricity has the intermittency problem: nuclear power is a carbon-free energy source that can deliver power anytime, almost anywhere.

On top of that, nuclear plants generate energy using far less carbon producing construction materials like concrete, steel, and glass than other sources. And, despite common perceptions, nuclear is also a very safe power source, especially compared to fossil fuels like coal.

Of course, nuclear energy has challenges of its own, but research in this area is another important innovation pathway to pursue.

Aerial clip of London

Our last pathway recognizes that it's very unlikely all nations can quickly abandon their addiction to fossil fuel power—it's just too cheap.

4:49

Text: Can we solve...?; Transition music

So, one important area for research is finding ways to suck up and store all that carbon from fossil fuel power plants before it has a chance to enter the atmosphere. This process is called "carbon capture".

So, we have plenty of options to get this Grand Challenge to zero. But for now, let's focus on renewables.

Can we solve all of our energy problems by switching to renewables? Not really.... Maybe... in some places... with enough innovation and the right conditions...? It's complicated.

Photo of renewable energy source

First, the good news: we've gotten a lot better at generating power with renewables, and as it becomes more efficient and more widely adopted, renewable energy is also getting cheaper. For example, the cost of solar power dropped 90 percent between 2009 and 2020.

5:41

Text description; photos of energy sources; Text: Obstacles; transition music

In some nations, like the United States, we could realistically power most of our lives with renewables; we have plenty of rivers to produce hydropower, we have areas like the Midwest that benefit from strong winds, and the Southwest has almost year-long sunlight.

Renewables offer compelling solutions and they will be part of any plan that gets us to zero. But, renewables have two big problems: first, right now, they cost a little bit more than coal and gas.

Text: The Green Premium

In the United States, they cost about 15 percent more. We call this extra cost the Green Premium. The Green Premium in the United States is actually pretty low. Renewable generated electricity in this country would add only about 18 dollars extra to the average monthly utility bill. Many European Union countries are in a similar situation.

6:32

Narrator speaking

But in other countries, the Green Premium is a lot higher. Some countries don't have access to the same variety of natural energy sources as the United States does. And without financial resources, transitioning a country's infrastructure to renewables is out of reach. It's hard to escape the fact that fossil fuel electricity is just cheaper than renewable energy in most cases.

Photo of coal powered plants in China

As a result, many countries in Asia and Africa are following China's example: China pulled millions of its citizens out of poverty with cheap reliable electricity by building a lot of coal powered plants. Other countries also see fossil fuels as the path to prosperity. And fossil fuel plants are reliable too because they don't have the problem of intermittency.

One way to deal with intermittency without building coal-fired plants, is to invest in our electric infrastructure.

7:20

Photos of decentralized grids on either side of narrator

In the United States, we don't really have one power grid. Instead, we have several decentralized grids. There are a few reasons for this but one is that our electricity infrastructure was built with fossil fuels in mind. You can ship coal or pump gas long distances between grids with trains and pipelines, but if you have these disconnected electric grids, it's impossible to transfer the electricity produced by solar panels in sunny Arizona to cloudy Connecticut.

Text: LA Power transmission; photo of LA; photo of a transmission line appears next; text: Action opportunities; transition music

So we need to invest money in building really large systems for sharing electricity. For example, Los Angeles's energy is generated as far away as Washington and Wyoming and travels across 3,700 miles of transmission lines. We need to expand and connect our power grids so this kind of range is possible on a larger scale.

8:05

Narrator speaking on screen; text: Action opportunities; photo of a child working; photo of a city council meeting

Admittedly, all of these are big challenges. But there are things we can do in each case, like writing to our congressperson to ask them to support public funding for nuclear fusion. Or, speaking at a city council meeting about policies to incentivize people to use solar.

Photo of a young woman studying

Or even studying to become an electrical engineer to help build better batteries.

You'll need to consider which innovations are most needed and most possible in your community.

Which will get the most support from your neighbors? Do you live in a place with a lot of sun? What about wind? What power grid is your hometown a part of? Is there a power plant near you?

OER Project logo; outro music

Your advocacy might be the spark that convinces your legislature to mandate carbon capture. We all have a role to play in fighting climate change. Now, it's your turn—what will you do to help us get to zero?