Plain Script: Ocean Acidification

{*Cue Introduction Slide*}

Welcome. My name is {*name*}, and I'm an educator here at {*institution*}.

{*Cue local fossil fuel reduction initiative video*}

Did you know that we have solar panels on our roof? There are many aquariums that do. {*Start video}* In this video, you can watch the installation of the Seattle Aquarium's solar panels taking place over the course of several weeks. You can see in the center of the screen that amidst the bustle of the city the appearance of the roof is slowly changing as each panel is added to the array. We/they worked with the/our local energy company to update the way we use energy - a practical step toward protecting the health of our ocean. {*Pause until video ends*}

Wait a minute… what do solar panels have to do with the water around us? {*Pause*} Scientists have discovered that burning fossil fuels like coal and oil causes a serious problem called Ocean Acidification. Now that we know about this problem, as concerned citizens, we have a responsibility to be a part of the solution; for future generations and for the health of the ocean!

{*Cue Anthropocene Transportation Visualization*}

This image shows many ways in which our fossil fuel energy system has helped to connect people around the world. The green, blue, and red lines trace land, air, and sea transportation routes. Burning fossil fuels such as coal, oil, and natural gas helps us to move around our planet, power the places we live and work, and create global connections.

There is no doubt that our current energy system has done a lot of good, but our heavy use of fossil fuels has also created rampant carbon dioxide accumulation in our atmosphere and in the ocean.

What does that really mean?

{*Cue CO2 Accumulation Visualization*}

Some carbon dioxide, or CO_2, is needed for life processes. We can call this regular CO_2. But CO_2 is not just something that plants breathe in and we breathe out. It's also something that gets put into the atmosphere when we drive our cars or burn any kind of fossil fuel. And these things are putting a lot of CO_2 into the atmosphere and ocean. We can call this rampant CO_2 because there is too much of it and it's getting out of control.

{*Start visualization*} You can see this in the image on the screen behind me. The cloud forming around the Earth represents the increase in CO2 in our atmosphere.

Of course, CO_2 is actually invisible. This cloud is simply a way of visualizing what we otherwise would not be able to see.

But, all of that CO_2 doesn't just stay in the air…

{*Cue Ocean Acidification Video*}

{*Start animation*} Now we are looking at a video that shows how the ocean naturally absorbs much of that rampant CO_2. As the ocean absorbs this excess CO_2, it reacts with sea water, changing the ocean's chemistry. This process is called ocean acidification.

How do we know this is happening?

{*Cue CO2 Data*}

At the Seattle Aquarium, they are working with scientists at the National Oceanic and Atmospheric Administration to monitor CO_2 in the atmosphere and ocean. Here is a graph of daily changes in CO_2 seen from one of NOAA's Seattle monitoring stations.

OA has been well documented through global observations conducted over several decades by hundreds of researchers. It has been linked to human-caused CO2 in the atmosphere that has been released primarily by fossil fuel combustion.

{*Cue Species Impacted by Ocean Acidification visual. Click 5x – images fade in*}

Many marine species that live in the Pacific are being affected by ocean acidification now. Studies of the Olympia oyster showed that survival and growth decreased with exposure to OA in laboratory and field settings. The same appears to be true for other native species like pteropods (a type of swimming snail), red sea urchins, northern abalone, and turban snails.

What do all of these animals have in common? {*Pause, solicit response from audience if possible*} They all have a hard shell.

Did you see any animals with shells today? What did you see?

So, what does ocean acidification actually do to those animals?

{*Cue "Home" Building Video*}

Think of an animal, like a snail, building its shell like someone who is building a brick home. Each colored piece seen here represents calcium carbonate, an essential molecule or brick, which many marine animals use to construct their homes. Ocean acidification reduces the amount of building material, or calcium carbonate, available to animals in the ocean. So while our snail is stacking those bricks, some of them are being taken away. It takes more time and energy for our snail to build its shell and the shell becomes weaker. We are already seeing the effects of ocean acidification right here and around the world.

{*Cue Pteropod Shell Images*}

Here is a microscope image of what we just saw; this is what happens to shells when they are exposed to these conditions. You can see the shell of the pteropod exposed to ocean acidification on the right, and has visible damage, making it harder for the animal inside to survive.

How widespread is this problem?

{*Cue Aragonite Saturation Visualization*}

In this video, you'll see another representation of how the invisible chemistry of the ocean is changing. The blue areas show plenty of carbonate available for animals to build their shells. {*Pause*} As time passes and CO2 is added to the ocean, the color changes to orange, indicating that there is no longer enough carbonate for these animals. The loss of these organisms affects the whole ecosystem.

And we are all connected to this ecosystem…

{*Cue Ocean Food Web*}

You can see here how shell building animals, like pteropods, are connected to other species. If these animals struggle to survive it could cause shifts in the ocean food web. This may threaten the balance of the global food web system of which we are all a part. But, we don't want to wait to see how bad it gets. We must take logical steps now to ensure that we will have a healthy ocean in the future. {*Pause once animation stops*}

As we have already seen, humans are amazing innovators. We created an energy system that improved our lives but which we now know is causing major problems in our ocean. The key to getting our ocean back to functioning the way it should is to get away from using fossil fuels for energy.

What actions really make a difference?

{*Cue visual that represents local or global OA solutions*}

Fortunately we innovative humans have already created other energy systems that do not rely on fossil fuels; systems such as solar, wind, wave, and geothermal energy. Our next challenge is to implement these renewable energy systems on a large scale, replacing our fossil fuel based system with one that will provide us with the same power but without the negative impacts of rampant CO2.

That's why the Aquarium of the Pacific has installed solar panels on all our newer construction, to raise awareness that solar energy systems already exist and are a viable way to power our lives.

{*Cue Renewable Energy Solutions Visual*}

We need to change our actions not just at the individual level, but at the neighborhood, city, state, and national level. The more people who take action to tell our energy companies and governments that renewable energy is important to us, the more likely it is that we will see large scale shifts towards a system where renewable energy is the key rather than fossil fuels.

We have created a system which provides us with great power, but with great power comes great responsibility – the responsibility to replace fossil fuels with more renewable energy sources to ensure a healthy ocean and a healthy planet for our future.

And that is how the solar panels on our roof are connected to the water beneath us!