Hi, guys. My name's Kevin Salls. And this is direct contact membrane distillation. This is a method of getting clean water from contaminated water—water that's got salt or ground water solvents or other things in it using waste heat from other processes, which makes it very, very cheap and easy to use. For example, you could use waste heat from a boiler, from geothermal processes, or from really almost any other sort of low-grade thermal activity. And the way this works is by putting the water in direct contact with a membrane like this one.

And these membranes are really, really cool. They are hydrophobic, which means they push water away from them, so as the water flows across them, there's actually a very thin layer of air across both sides. We flow hot water across one side and cold water across the other. Because hot water has a higher vapor pressure than cold water some of the hot water becomes hot water vapor and it passes through the membrane to the other side where it condenses again and becomes cold water. This leaves the impurities behind like salts, calcium carbonate, and things like that and leaves us with a little more clean water than what we started with.

We have a direct contact membrane distillation unit that's made up of a bunch of tiny tubes of this material. Hot water is flowed through in one direction and cold water through in another. The overflow of the extra cold water comes out here and overflows down on the hill where we can measure it to find out how much flux or how much extra cold water we're producing every hour. The water is heated in this hot water bath. And this water doesn't have very many impurities in it. It just how salt, but it provides us a good base system to go off of.

Meanwhile, cold water is chilled here to chill this tank to about 17 degrees Celsius compared to the 35 degrees Celsius that we've got the hot water bath at. All of this information including conductivity, which tells us how much salt is passing through the membrane, the temperature of the water in all areas, and the mass of water produced is passed to the computer here where it's recorded in LabVIEW, which lets us export it to an Excel file and work with it later to track trends.

So we're going to mix up a fresh batch of salt water to add to our tank there because it's running a little low. So what I'm going to do is fill this with four liters of water. And I want to create a 1% salt solution by weight, which means I want to have 1 gram of salt for every 100 grams of water. Four liters of water is 4,000 milliliters of water. And 4,000 millimeters of water weighs exactly 4,000 grams. So I'm going want to add 40 grams of salt to it.

In order to officially mix our solution, I'm going to use what's called a stir rod. This bar here on the bottom of my flask is magnetic. And it's on top of this plate, which has another mechanism in it that's also magnetic. The mechanism spins causing the stir rod to also spin. And you can get it going pretty fast. You going to see it's actually going to generate a little vortex here. And that's going to let me get the salt mixed in nice and easily.
All right. So let's go ahead and weigh out our salt. I've put my weight plate on here, and then I've tared the scale, which means I centered it on zero grams. So the scale thinks that it's at zero grams right now. And that lets me efficiently weigh out 40 grams without having to account for the weight plate.

Now that we have our salt, was going to add in slowly. Stir it for a couple minutes to make sure all of our salt gets really dissolved. Now this water is cold compared to the water in the hot water bath. So when I add it, we're going to see almost an immediate change in flux. We're going to see our drip of water slow down almost immediately.

I already see on the graph here as I've added that cold water how it's impacted our flux. We can see it tapering off almost right away. Well, I guess the question we really have to ask ourselves looking at this is, so what? So we've got a way to make water clean. We dirty water in a lot of different ways. We get water that gets dirty because we use it for industrial processes. We get water that's contaminated because it's come out of the ground. But this is a lifelong problem. This is going to be a history wide, history long problem of getting these impurities out of the water, so that it can be used for whatever we need to use it for.

What's cool about this is that it's cheap. You can do it using heat that's just wastage from other processes-- heat that would be lost otherwise. You can do it using energy that otherwise wouldn't be used for anything. So what we see here is a way to continue sustaining the resources that we have. Sustainability is going to become more and more the focus of science and study and industry as we go on and on in our history.

We have a finite amount of resources on this planet and they have to be taken care of and they have to be used efficiently and effectively and they have to be cared for. This is just one more step, one more tool, one more way that we can use to keep those resources available to us for however long we are on this planet.