Cornell University Three Minute Thesis (3MT) Competition

Katherine Adler, Civil & Environmental Engineering: “Making Waves to Competitively Produce Biofuel”

[Clock Ticking]

>> Narrator: Cornell University 2019 Three Minute Thesis finalist. Katherine Adler, Civil & Environmental Engineering: “Making Waves to Competitively Produce Biofueld.”

>> Adler: Did you hear the youth climate strike last week? Ithaca was part of a worldwide movement of teenagers making waves about combatting climate change. With my research I'm literally making waves to combat climate change by making algae biofield more competitive in the energy market. Algae has a lot of advantages over conventional biofield feedstocks like corn. For example, it takes up at least 10 times less area, it doesn't require good soil quality, and it provides nutritious coproducts. However, algae production is limited. One of the main limitations is the carbon supply. Algae, shown as little packmen in this cartoon, consumer carbon dioxide, or CO2, from the water around them to perform photosynthesis and grow. They deplete the CO2 from the water faster than it can be replenished by the air so algae producers using raceway tracks like these have to get CO2 emissions from a fossil fuel power plant in order to feed their algae. Not only does this cost more money, a significant amount, it also limits potential site locations of algae production by an order of magnitude. It also wastes a lot of CO2 into the atmosphere. What if instead we could get enough CO2 right out of the air? If we could get CO2 out of the air and into the water fast enough, algae production site locations would be way less restricted and we could have a cheaper carbon neutral energy source. So how do we do that? The Pacific Northwest National Lab used a chemical to double the CO2 uptake in an algae pond, but another two-fold improvement would be needed before algae production can be completely independent from an external carbon source. Therefore, our goal is to also double the gas transfer rate, but by using hydrodynamics instead of chemicals. We know that little waves increase air water gas transfer by stretching the water surface. So over in Hollister Hall we lower cylindrical dowels into flowing water to make waves like the ones you get off the front of a boat. Our preliminary results show that these waves improve gas transfer rate by 25 percent, and there's a lot of room for improvement. We can still adjust dowel size, spacing, and shape in order to reach that 100 percent improvement goal. This may seem like a small incremental change, but if we superimpose -- impose enough of these little improvements we can have a big impact on the energy portfolio of the world. Thank you.

[Applause]