

NINA MOINI: One of the state's greenest university campuses is getting even greener. The University of Minnesota Morris was able to reach carbon neutrality when it comes to the electricity that powers its campus, thanks to two wind turbines named Bert and Ernie. Now it's taking steps to decarbonize how it heats its buildings. That's led Morris to a new thermal battery that it began piloting last month. It's believed to be the first campus in the United States to use this technology for heating. Joining me for more on how it all works is Troy Goodnough, the Sustainability Director at the University of Minnesota Morris. Thanks for being with us, Troy.

TROY Thanks for having me.

GOODNOUGH:

NINA MOINI: Just to start, so we're all on the same page, would you tell us exactly what carbon neutrality is and why it's such a big mission, a part of Morris's mission to reach this goal?

TROY Great question. So the big goal is, we know that climate change is a big issue facing human beings. And so one of our goals is to stop putting carbon dioxide in the atmosphere. And so we're looking for ways we can not burn carbon.

NINA MOINI: So how are you going about that?

TROY So the University of Minnesota Morris has been working on moving towards carbon neutrality for a long time. And in fact, this is a larger goal of the University of Minnesota system as well. For the University of Minnesota Morris, we already get all of our electricity in a carbon-neutral way, with 60% of that electricity coming from on-site renewables.

So we have multiple technologies, but probably the most prominent that people would see when they come into Morris from the highway is the two large industrial wind turbines, which we call Bert and Ernie, which are sitting on the ridge of the Pomme de Terre River. And they provide, like I said, over 60% of our annual electricity. So there are many times of the day and across the year where 100% of our electricity is essentially coming from renewable sources.

We also have-- and this is a mouthful. We also have a 500-kilowatt solar agrivoltaic field at the edge of our campus, which is a solar electricity field that is basically also producing green electrons for the campus. And so that's a big way we're getting electricity to the campus. But the big elephant in the room is this heating question.

NINA MOINI: I do want to get to the heating, but I got to know who picked Bert and Ernie for the names.

TROY Yeah, yeah, yeah. Well, we've got a lot of sustainability rockstar students at Morris, and rockstar University of Minnesota Morris alums. It was a student named Sidney Bauer. And in fact, if your listeners go to the Bell Museum, there's a really wonderful exhibit about climate adaptation in Minnesota. And one of the featured heroes is Sidney Bauer, who lives here in Morris.

NINA MOINI: Amazing. So why is heating a particularly difficult area to decarbonize?

TROY Heating is the big elephant in the room. In fact, the Morris campus, we use about three to four times more energy
GOODNOUGH: for heating than we do electricity for all sources. And that's just because, number one, we need a lot of it; number two, we've generally heated ourselves in the most cost-effective way by burning things and burning fossil fuels. And so this is the conundrum-- is how do we create reliable, affordable, cheap way of heating ourselves without having to burn fossil fuels, which is also where we began the chat and contributes to climate change impacts?

NINA MOINI: So let's talk about the thermal battery. How does it work?

TROY You bet. So really big picture-- one of our goals is, most of us, a lot of us use natural gas to heat. And so the goal
GOODNOUGH: is to think about are there ways that we cannot use or use less natural gas for heating? So the really cool thing about our campus is that Bert and Ernie actually produced way more electricity than the campus needs. So we only use about half of the power that comes from Bert and Ernie.

So then half of that power, we sell to the utility as green electricity. So the question that we've been thinking about is, what if we reallocated some of those electrons towards the purpose of greener heating? And so that led to this current project.

And so the current project is a thermal battery, which basically takes green electricity and runs it into essentially a cement, these limestone pellets, which get very hot. And then that's holding heat. And then essentially we can run-- whatever we want hot, we can run air through there to heat it up from those hot pellets that were heated up by green electricity and make hot air.

And this particular project is a little bit more technical and interesting because this particular solution by Cash Energy also acts as a thermochemical battery. So it also has this reaction that's interesting, where the cement also can go through a chemical reaction to also make even more heat. So it's a special type of thermal battery.

NINA MOINI: OK, have you thought about the winter-- I mean, when there's obviously a greater demand for heat?

TROY Yes. So this demonstration is helping us learn. So it's part of a larger strategy, which the goal is to figure out
GOODNOUGH: what kinds of technologies can we use in the state of Minnesota to basically get green heat. And so part of your earlier question was, could we imagine hooking a system up like this to our district energy steam system? The answer is yes. That's what we're exploring right now-- is what are some of these technologies that would allow us to make green steam to hook up to our larger steam system?

NINA MOINI: As you look into the future, what other factors do you consider, or what else do you think it would take to fully perhaps heat the Morris campus in a more sustainable way?

TROY Yeah. So I mean, we know that for our campus, which is really a city within a city, we need a million therm of
GOODNOUGH: energy every year to heat our campus. So the question is, where can you get that energy? And for us, what's really remarkable-- it's exciting because 20 years ago, wind and solar were not really the cheapest energy in the upper Midwest--

NINA MOINI: Sure.

TROY --to install and operate. But it is today. And so right across the border in South Dakota, now the cousins of Bert
GOODNOUGH: and Ernie are much bigger. So in 20 years, we're getting turbines that are built that are about the same footprint, are putting out three times the amount of power. So this is where what we see as a future, where we're going to capture even more of the wind resource in Minnesota, even more of the solar resource in Minnesota, and thermal battery storage, as well as electrical storage technology, is going to just play a really big role in the future. So we're going to be talking about storage a lot. In the same way we talked about wind and solar the past 20 years, the next decade is going to be all about a conversation about storage.

NINA MOINI: And just lastly, Troy, I like what you're saying about having these brand-new ideas, and it sounds like you're saying bring them more into the mainstream and not have them be thought of as super novel ideas or super pricey ideas. What do you think it's going to take over time to change some of that perception for people to lean in more to these types of solutions?

TROY Yeah, fantastic. Yeah, so a couple of things about how these things work. And I think sometimes we forget about-
GOODNOUGH: - remember when calculators were expensive and the VCR and Betamax and LaserDisc and 8-track. And so everyone thinks like, well, it's expensive now, but that always doesn't seem very interesting to me because if we follow the same process of innovation, we get the same results. It's a repeatable thing.

We rarely reflect back and say, well, how did that happen? And so, yes, electric cars have been a little bit more expensive or a lot early on. Of course, they were, but then they won't be. So I think this is where-- what I'm really thankful about is we've got a tech incubator in Minnesota called Grid Catalyst run by Nina Axelson. So Nina's, basically her firm grid catalyst, did this some matchmaking with between us and cash energy.

NINA MOINI: Oh, nice.

TROY And so found, basically was like, hey, it looks like there's a group of people who are interested in advancing this
GOODNOUGH: technology and exploring cold heating options. And so the first step is to do-- the first step we always do, which is to test the technology, kick the tires, and then start scaling and then start reproducing. And that's what we're going to do.

And by the way, I would say already across the US-- I mean, if you look at California, they're way ahead on a bunch of things having to do with storage. But already large thermal batteries are being used to power everything from ethanol plants in California to distilleries making whiskey in Scotland.

NINA MOINI: Well, Troy, thank you so much. I really enjoyed learning about all of this technology. Thank you.

TROY Thank you for the invitation.

GOODNOUGH:

NINA MOINI: Troy Goodnough is the Sustainability Director at the University of Minnesota Morris.