

## Transcript – Ways & Means S8E5 Bringing Water to Thirsty Fields with Help from the Sun

Lauren Rosenthal: From the Sanford School of Public Policy at Duke University, this is Ways and Means. I'm Lauren Rosenthal.

(Music)

Lauren Rosenthal: In Gololee Huluku village in the East Shewa region of Ethiopia, hundreds of small farms lie under a sunny sky. It's January, in the middle of the dry season, and it hasn't rained in months. That's not uncommon in this part of the world. For half the year, rainfall is extremely rare. Most farmers in the village use water pumps to irrigate the fields. They often draw from nearby streams, or shallow wells, both of which can dry up. And the pumps are powered by diesel fuel, which carries its own risks—the price of diesel can spike, as it did with the recent war in Ukraine.

Roba Chala voice + voice of translator: I am very worried about it right now. Fuel prices are high right now.

Lauren Rosenthal: Roba Chala grows crops like wheat, onions, and tef, the grain that's used to make the staple Ethiopian flatbread, injera. He lives in the village with his wife and four children. He has to travel a long way to get diesel fuel.

Roba Chala voice + voice of translator: It takes a day or two to go and purchase fuel in the city, and when you do, there is a long line. And when gas stations are out of fuel, we buy from resellers, which is very expensive.

Lauren Rosenthal: Roba's life could change this spring. A mini-grid of solar panels is being installed in his village, powering big new pumps that will bring deep groundwater to the surface. With solar-powered irrigation, he can grow a lot more.

Roba Chala voice + voice of translator: Because of the high price of fuel, we water only once a week. But, with solar power we can irrigate every two or three days, because when this solar power works, there will be enough water. So it's useful to us.

Lauren Rosenthal: In this episode of Ways and Means, solar mini-grids—how they could change lives for poor farmers in Ethiopia. And why that matters for the climate as a whole. This is the fifth episode in our "Climate Change Solutions" series, where we look at surprising answers to the question of what we can do to help cool a rapidly heating planet.

(Music)

Lauren Rosenthal: Rahel Bekele is a postdoctoral associate at Duke University's Sanford School of Public Policy. Rahel grew up in Ethiopia, and she traveled there recently to see the farms where solar mini-grids will soon be installed.

Rahel Bekele: Houses are not like those kinds of houses in towns or cities. Mostly they use mud and wood for the walls, and for the roofs, it's thatch. Most of the place is farmland. Different kinds of crops were growing. It was green. In some places, they were harvesting. The oxens were threshing the harvest.

Lauren Rosenthal: Growing up, Rahel didn't imagine she'd end up studying agriculture. Her family lived in the capital, Addis Ababa, a city of around four million people.

Rahel Bekele: After studying, having my first degree in economics, I became more conscious about the base of the economy. More than 80% of the population depends on agriculture.

Lauren Rosenthal: She became convinced that agriculture is the key to her country's future, and decided to become an agricultural economist—even though she didn't see a farmer in the field until she was in her 20s.

Rahel Bekele: I saw for the first time, I saw a man plowing on a plot, a farm plot, when I was a master's student. [Laughs]

Lauren Rosenthal: Today, Rahel works for the DREAM Project, which focuses on Renewable Energy for Agriculture. It started as a plan by the Ethiopian government to raise yields sustainably. Now it's an international project with an ambitious goal: to build the largest solar mini-grid irrigation project in the world.

(music)

Lauren Rosenthal: Rahel and her Duke colleagues are helping evaluate the project's success over the next three years. And the stakes are high. If the DREAM project succeeds, it could play an important role in addressing the global climate change crisis. As the world grapples with reducing carbon emissions, so far the emphasis has been on the major polluters: The U.S. and industrialized Asia and Europe. But in the coming years, the population is expected to surge in Africa.

Jonathan Phillips: If we look to 2100, the end of the century, something like 13 to 15 of the largest cities in the world are going to be in Africa, including the top three. How do we help them develop in a way that's not going to wreck the planet?

Lauren Rosenthal: That's Jonathan Phillips. He got his start in international development 20 years ago with the Peace Corps, and today, he co-directs the James E. Rogers Energy Access Project at Duke. Over the next three years, Phillips and his Duke colleagues will measure the DREAM project's benefits, to see whether it's worth scaling up. The project is being piloted in nine Ethiopian villages. Each village includes about 200 farms. Right now, the villages are dotted with diesel pumps, and most pumps serve just a few farms. The diesel pumps are being replaced by a few large solar-powered pumps, which will be shared by many farms. Ten villages were originally chosen for the pilot project, but one site dropped out due to political unrest in the region. There's a lot riding on the success of the nine remaining villages—if that success can be replicated in other countries. Here's Jonathan again.

Jonathan Phillips: If we can get 1.3 million Kenyan farmers to use solar rather than diesel pumps, we're talking about 6 and a half million tons.

Lauren Rosenthal: 6 and a half million tons, that's how much carbon emissions would drop if the 1.3 million Kenyan farmers who use diesel pumps switched to solar-powered pumps.

Jonathan Phillips: So, let's put that in perspective. I think all of the Tesla charging infrastructure and batteries in the world currently offset about 5 million. So if we can just get Kenyan farmers off of diesel,

we're already beating Tesla. And let's go over to India. If we can get one-third of Indian farmers off of their current diesel pumps and onto solar, that's something like 12 million metric tons. So twice the Tesla fleet.

Lauren Rosenthal: So replacing diesel pumps with solar-powered pumps could have a big impact on the climate. And electric pumps have another benefit. They can help the farmers themselves survive on a warming planet.

Marc Jeuland: Most of Africa is not emitting much in the form of climate-changing pollutants. But yet they're bearing a lot of the costs of climate change.

Lauren Rosenthal: Marc Jeuland is a professor at Duke's Sanford School of Public Policy who studies global health, economics, and the environment. He works on the DREAM Project with Jonathan Phillips.

Marc Jeuland: We are, in these surveys that we're doing over the next three years, trying to measure resilience in different ways, figure out how communities are better able to go forward despite being shocked by droughts, or other kinds of shocks that come with climate change.

Lauren Rosenthal: Global warming will hit tropical countries hard. Already, Ethiopia is being pummeled by drought. 2022 brought the worst droughts on record to some parts of the country. As the climate continues to warm, dependable water from deep wells will help farmers survive when the rain doesn't fall. During the long dry season, the solar grids can capture all that sunshine and use it to power the pumps. That will give farmers water for their fields when they need it most. That's not all. The solar mini-grids will also help farmers earn a lot more money. Let me explain.

(music)

Lauren Rosenthal: Diesel prices fluctuate a lot, and the uncertainty makes it hard for farmers to plan. Instead of a bunch of small diesel pumps owned by one or two farmers, the villages will be dotted with a few big solar-powered pumps. The new solar-powered pumps will draw a consistent supply of deep water that the farmers can share. With an abundant, affordable, reliable water source year-round, the farmers can fit more growing seasons in a year. They can switch from low-value cereal crops to more profitable crops, like tomatoes, avocados, or bananas. Duke's team has calculated how much the farmers could benefit. Some might see modest gains, while others could see their profits double or triple. And these boosts in profit are vitally important, because in the longterm this project is not meant to be a charity. Here's Marc Jeuland.

Marc Jeuland: You'll have these private developers who have a profit motive. They want to recover their investment costs by selling the electricity and the water. And then you would be able to scale it across the whole country, even though the government itself has limited resources.

Lauren Rosenthal: The farmers will pay for the electricity and the water, and pay down the capital costs of the mini-grids and pumps. The team is counting on higher profits so the farmers can cover the costs. The program needs to be self-sufficient. That's the only way it can hope to scale up and fulfill its world-changing potential. Jonathan Phillips and Marc Jeuland say these projects might also qualify for carbon credits, which could make the projects more attractive to international investors. Ideally, a local workforce will sprout up to install and service the grids and irrigation systems. And along with pumps,

the grids could power cold storage for fruits and dairy, or small processing plants to make things like tomato paste and avocado oil, which are worth more than the raw vegetables. The farmers will earn more and the country will get richer in a virtuous, carbon-free cycle. Now, you might be thinking: It's one thing for the industrialized world to bring money and know-how to Ethiopia to help make farms more productive, and the farmers richer. But how do we make sure we don't saddle them with the problems that come with our own farming systems? Problems like groundwater depletion, topsoil erosion, over-reliance on chemical fertilizers and pesticides. Here's Jonathan.

Jonathan Phillips: I, for one, would have a real problem with transferring sort of the Iowa, you know, let's bring Iowa to Ethiopia, and just sort-of copy a monoculture, dense kind of corporate-agriculture approach. And we are in no way trying to be a harbinger of that.

Lauren Rosenthal: Jonathan says the Ethiopian government is trying to build both financial and ecological sustainability into its projects. And the Duke team has set up observation wells to keep an eye on groundwater levels. It's hard to predict the steps Ethiopia will take as it modernizes its farming system. But as Africa's population rises dramatically over the next century, it's crucial that the agricultural sector keep pace. Rahel Bekele is the Ethiopian economist and Duke Sanford postdoctoral associate we heard from earlier in the story. Rahel says the DREAM Project is sort of her dream job—and she's highly motivated to work toward lifting Ethiopian communities out of poverty. She thinks irrigation is the best tool to achieve it. And she points to another way the DREAM Project could benefit rural communities.

Rahel Bekele: In developing countries, women spend a lot of time to collect water. If there is a water source around for irrigation, she can use it.

Lauren Rosenthal: On top of that, while most of the power from these mini-grids will go to water pumps, there will be enough left over to wire up homes in the villages. That means a big jump in the standard of living, particularly for the villages' women. Think refrigerators to keep food from spoiling, and clean electric cookstoves to replace polluting, labor-intensive ways of cooking, which we talked about in a previous episode of *Ways & Means*. Wired homes could have electric heat and lights. And televisions. Which we think of as mostly entertainment machines, but which could also, give weather reports. Which are important for farmers!

Rahel Bekele: Refrigerator, radio, television... it's not common in rural areas of Ethiopia. They don't have any access to know the weather forecast. You can guess [laughs] what difference can apply here.

(music)

Lauren Rosenthal: Once the solar panels are standing, the pumps are churning, and the water and electricity are flowing, the Duke team will have three years to see how life changes for the villagers. Can they grow more crops? Will their profits rise enough to pay for the grids and pumps? Can they upgrade their homes? Will they sock away savings, and become more resilient? The project comes with big risks, and a lot could go wrong. The grids, pumps, and irrigation systems are all vulnerable to breakdowns. And agriculture always comes with its own risks, like pests, or trouble with the soil. But Marc Jeuland is worried about other potential pitfalls. Marc got his start in the Peace Corps, spending three years working on water and sanitation in Mali.

Marc Jeuland: Through my Peace Corps experience, I became disenchanted with what I had originally trained as, which was engineering, and just this sort of technology-based approach to problem-solving. And it became very clear to me that many of the problems were not technological problems, they were actually social and institutional problems.

Lauren Rosenthal: Marc says one potential complication is electricity poachers.

Marc Jeuland: There's always a possibility that some people will try to free-ride on the system. You could imagine people not paying for electricity, or not paying for water, and somehow getting it still because of political connections or other things.

Lauren Rosenthal: Rahel Bekele is less concerned about this for the DREAM Project's small pilot sites. She says in medium- and large-scale projects, there's a risk of free riders, but in small communities it's different. They have long historical traditions of sharing resources and ensuring there are no poachers.

Rahel Bekele: I really like about studying the irrigation system in Ethiopia as a whole is people mobilize themselves, and form associations, and they have written bylaws and the distribution amount, the payment amount, everything is written on that law. If one has violated the rule, he will or she will be penalized. That's the way it works.

Lauren Rosenthal: Marc Jeuland and Rahel Bekele agree on another complicating factor: the political situation in Ethiopia. Here's Marc.

Marc Jeuland: So there's political instability, obviously, which may not be wars—it could just be changes in priorities. And right now, electrification is a big priority for the Ethiopian government. But, you know, governments change priorities sometimes...

(music)

Lauren Rosenthal: With so many national and international players involved in the DREAM Project, it's taking longer than expected to get the mini-grids installed. In the fall of 2022, Rahel talked to quite a few frustrated farmers.

Rahel Bekele: "They were even, to be honest, they were very disappointed with us, because it has taken a long time, more than three years!"

Lauren Rosenthal: Other farmers are excited about the changes, though. Like Miheret Ageze. He lives in the northwest of the country, near Lake Tana, the source of the Blue Nile. In his village, Andega Kebele, 350 farmers irrigate using well water and a nearby river. He's been farming there for 30 years. He supports his family of ten by growing tef, wheat, and sorghum.

Miheret Ageze voice + voice of translator: I have been irrigating from groundwater. I share a pump with another farmer. But the pump breaks down a lot.

Interviewer: Do you think you will irrigate more, and your produce will increase?

Miheret Ageze voice + voice of translator: Yes, we are happy if we get solar pumps. If we get solar pumps, our produce will increase. I think it will make us rich.

(music)

Lauren Rosenthal: Richer Ethiopian farmers, electrified homes, a more self-sufficient nation and a cooler atmosphere: The DREAM Project carries big promise. Again, when everything is up and running, this handful of Ethiopian villages will make up the largest solar irrigation system in the world. If it works, this technology could be used in lots of other places. And that's another reason we in the United States should care about what's happening in these remote Ethiopian villages. The lessons learned might benefit us, too. As we learn to adopt more creative solutions to our own energy needs, we may have Ethiopian farmers to thank.

(outro music)

Lauren Rosenthal: We'll have a link to this project on our website – We're at [ways-and-means-show-dot-org](http://ways-and-means-show-dot-org). Ways & Means is produced by Carol Jackson and Alison Jones. This episode was produced by Marc Maximov. Thanks also to Hannah Otos and Kirsten Khire along with Duke students Akshay Gokul and artist Joy Liu. Our engineer is Johnny Vince Evans. And I'm your host, Lauren Rosenthal. Thanks so much for listening.

Announcer: The Sanford School of Public Policy at Duke University offers master's programs with a focus on energy and the environment. Choose from a master of public policy, master of international development policy, or an international master of environmental policy based at Duke Kunshan in China, a master's program with a focus on energy and the environment. Find out more at [sanford-dot-duke-dot-edu](http://sanford-dot-duke-dot-edu). Season 8 of Ways & Means is made possible thanks to support from the office of the Provost at Duke University.