Jimmy: If you can cook beans, then you can cook anything.

Nancy: Jimmy Chaciga is standing next to two drums, a little smaller than oil drums, both swaddled in shiny foil covered insulation. We're in a high ceilinged laboratory, with metal test tables holding computers and wires strung everywhere. Inside one of the drums is a steel pot, big enough to hold 10-20 liters of water… or in this case, *beans*.

Nancy: But there's a lot of, this is quite a lot of beans.

Jimmy: It has a lot of beans. Now , this is enough.

Nancy: How many— two kilos?

Jimmy: I put only two kilos for this. And you see it's a lot of beans. It is. You see, like I told you, in Norwegian, you eat little, this would be consumed by 50 people. These beans here. But in Africa, I think 20 people will eat this.

Nancy: Jimmy is one of a group of PhD research fellows and academics from Africa and Norway who are trying to figure out how people in sub-Saharan Africa can cook without using charcoal and firewood. Just to state the obvious, cooking with wood is bad in many ways. It's terrible for women's health. It wastes women and children's time as they have to go ever farther to find wood to burn. It contributes to deforestation. It's a huge problem that *seems* like it should be easily solvable with enough smart engineering, yet it persists.

Despite at least four decades of research and funding to help people shift away from firewood and charcoal, 75 per cent of households in developing countries continue to rely on these resources for cooking. In Uganda, where Jimmy is from, it's estimated that the number is closer to 88 per cent.

In May last year, the International Energy Agency hosted a summit in Paris on Clean Cooking in Africa. One of the main sponsors, as it happened, was the Kingdom of Norway. In the end, the meeting resulted in international pledges of $2.2 billion dollars to help make clean cooking in Africa a reality. Norway pledged $50 million to the effort.

Here's how the president of the African Development Bank, Akinwumi Adsina**,** described the urgency of the problem at the Summit:

Akinwumi Adsina: 26:36
It is shocking that 1.2 billion people in Africa do not have access to clean cooking solutions. They rely on biomass, firewood, and charcoal to cook. These hardworking

women who cook for their families and their girls spend several hours looking for and collecting firewood and charcoal.
With bent backs, they carry loads of firewood and charcoal and walk several kilometers just to be able to cook a decent meal for their families, things we all take for granted.
And how can this be?
Why must we allow such a thing to happen? Africa loses 600,000 women and children annually from the effects of secondary smoke from partial combustion of biomass, firewood, and charcoal.
And that means we will lose 6 million people in 10 years if we don't change that.
And that's not acceptable.

Nancy: I'm Nancy Bazilchuk, and you're listening to 63 Degrees North, an original podcast from NTNU, the Norwegian University of Science and Technology. Today, I'm going to tell you the story of Jimmy's solar cooker – and what it takes to bring these alternative technologies to women in sub-Saharan Africa.

Jimmy: So my name is Jimmy Chaciga and I'm studying from Makerere University, a PhD student…with a collaboration with NTNU.

Nancy: Let me tell you a little bit about Jimmy. He's 39, and has had a passion for science since he was very young. He's got a big laugh and an easy smile, and he makes people feel at ease.

Both his parents died when he was young, and he was raised by his sisters. They taught him to cook!

He's been a public school science teacher and worked briefly as a graduate teacher, overall head of science, health and safety trainer at Uganda's largest sugar producer, now called Kakira Sugar Limited.

He's married and has two kids. He's enough of a science nerd that his children are named Einstein and Newton.

And…. he's driven.

Jimmy: My name is Chaciga. This name was given by my father. And the meaning was somebody who will replace someone. So I wanted to do something close to my father and to replace my father and do good to my community.

Nancy: Jimmy got a master's in Physics at Makarere University, and is working on his PhD with his solar cooker. Clean cooking has become his passion. It helped that NTNU has been collaborating with half-a-dozen African universities since 2007 to

develop education and research programs on small scale renewable energy technology.

The mastermind behind this effort is Ole Jørgen Nydal, a professor at NTNU's Department of Energy and Process Engineering. He spent the first 17 years of his life in Ethiopia and is well aware of the problems facing African households that are off the grid. Among the off-grid energy projects he has worked with with his African colleagues are projects as diverse as a solar cooker for cooking injera, the Ethiopian bread made from teff flour, to a solar-powered refrigerator.

Ole Jørgen: Well, if you're living in your house, what do you need? You need hot water. You can install a hot water system from the sun, and you're okay. You need to charge your phones, you need to have a TV or a refrigerator. You can run it from PV and a battery, but for cooking, there's no solution.

And this is really what happens all over.You still cook on firewood and charcoal.

Nancy: A lot of early clean cooking technologies relied on parabolic mirrors that would concentrate the sun's rays on a pot or a frying surface. But that's not much use when the sun goes down, which is when most people want to eat dinner.

Ole Jørgen: Solar cookers have been around for a very long time, and they're not in use. So why is that? And we believe the storage option is one reason you don't want to cook necessarily. When you have the sun, if the cloud comes, you cannot cook anymore. So, the question we ask is not, what can you transform to of existing technologies, but what can you develop new, which is not there? And, it's a different types of thinking. Very few are actually doing that as far as I can see.

Nancy: Storage!!! Jimmy's technology addresses this exact problem.

Jimmy: Here we have this, we have our system here for cooking, which we can use for either household or institutional cooking. Okay.

Nancy: (voiceover a little as he describes it,maybe fade him out a little…)

Now, in this way, we have two tank system here. One tank is for energy storage tank. And the other one here is only for, for cooking. This is the cooking unit. Okay. So in the cooking unit, we have the chambers, the heating chamber, where we have some oil at the bottom of the cooking pot. Yep. That oil is heated by DC power from solar. And then we have this pot where we cook your food. Yes. Wow. It's soft. Huh?

Nancy*: So we're looking at a second steel drum*

Jimmy: *Yes. It goes to the drum. Yeah. So in the drum here on top here, the oil on top here get heated up. Okay. In this drum we have the oil. Yeah. And we have the rock pebbles the granite type. Yeah. The hard rocks……*
And then we fill the void, void between the, between the rocks with the oil basically to store heat

Jimmy: After the sun has gone down, you can cook for another four hours on this system.

Nancy: BINGO!

Jimmy: And you see, the thing is, if you have a system, a solar cooker which is able to boil beans, then you should be able to boil any other thing. That's why we want to concentrate on beans. And in Makarere, they always say, Jimmy, you are doing your PhD in cooking of beans.

Nancy: But is a PhD in cooking beans enough? Well … maybe not. People like the late Steve Jobs are evidence of this.

When Apple first introduced its iPod in 2001, there were lots of other small music players out there on the market. Apple developed this very successful advertising campaign that said the iPod enabled them to carry “1000 songs in your pocket.” And even though the developers were very secretive about the pilot testing, you can bet they did a mountain of in-house testing before the launch.

The moral of the story is that you can have the greatest idea in the world, but unless you find a way to test it out in the real world and finally get people interested in actually using it, you’re lost.

Ole Jørgen says this has been a major problem for developments like Jimmy’s cooker.

Ole Jørgen: So … we have the pilot, we have tested it, we're happy with it, but we haven't done the piloting to show us that we can do upscaling, with a rollout and large numbers. So we are in what's called the death valley.

It's difficult to see what opportunities we have for piloting, even humanitarian Innovation Norway, they have funding schemes for new ideas, and they have funding schemes for rollouts, but not in between.

So if you come … and ask for … piloting of a system to really explore how it would work in a real environment, there's no funding for that.

Nancy: It’s also tough for Ole Jørgen, as an engineer, to also focus on how to bring the different cooking options to market.

Ole Jørgen: But it's a very good question. We've asked ourselves how to go towards implementation. And from my own standpoint, it's a sort of new thinking I'm not used to. I'm a professor. I'm happy going in the lab, testing new things, one after the other. If it works, I'm happy, fine. But then the implementation part is actually what we're looking at now. And I don't find it easy… But it's a question how to do it. Do you team up with existing business entities, or do you make new ones?

Nancy: One obvious approach could be to involve the technology transfer offices at the different African universities, but Ole Jørgen says his African university partners have not had much success with this. I had the chance to talk to one of Ole Jørgen’s first ever students, who is now a professor in South Africa.

Ashmore:I am Professor Ashmore Mawire,I work at the Northwest University, the Department of Physics, but I'm the director of a research focus area called Material Science, Innovation and Modeling.

Nancy: Ashmore says that researchers need to go into communities to make sure that the people they are designing cookers for actually need the technologies they are developing. For example, in South Africa, one critical need that communities have acknowledged is the need for a way to dry food without it getting contaminated.

Ashmore:You know, one of the challenges in Africa is that people do open sun drying. And the food or the agricultural produce is destroyed due to environmental conditions and things like that, isn't it?
So what we are trying to do is also we are developing a solar dryer with storage so that it can have 24-hour operation.
We are also into solar water heater, small scale for informal settlements.
We have a lot of informal settlements in Africa,
where there is no electrical grid, poverty and so forth.
So most of the things are addressing the actual needs of the poor African soul.

Nancy: He also thinks that governments themselves could be more directly involved in helping researchers pilot-testing technologies that work in the lab to see how they might work with the way people cook.

Ashmore:There needs to be a lot of engagement with the people, and people should understand the benefits. And there needs to be good motivation from us researchers to involve the people. We need to do needs assessment to see whether these people need it, and we need to convince them by training them. And we also need government intervention and industrial intervention to actually upscale the roll over of all of these solar cookers.

Nancy: Ashmore told me that unlike many other African countries, South Africa is pretty well electrified. But that doesn't mean that everyone can afford the electricity that is produced.

Ashmore: I mean, the irony, the thing in South Africa is that we do have electrical energy, 80% to cook our food, but it's getting expensive. If the benefits are well explained, and if we go to people, we convince them through our roadshows and we get funding, definitely people are going to adopt solar cookers because electricity is already high, the price. Most people cannot afford electricity as we speak, including myself, a professor.

Nancy: As you can probably see, this part of the clean cooking story is very complicated and difficult to resolve. I did contact NORAD, the Norwegian Agency for Development Cooperation, which will administer the $50 million US that Norway's prime minister promised at the May Clean Cooking Summit last year.

They told me that Norway, through Norad, has committed most of the money, roughly $37 million dollars to partnerships with organizations like the World Bank, the World Food Programme, the Norwegian Refugee Council and the Green Climate Fund. Norwegian embassies in Bangladesh, Ethiopia, and Mozambique will manage the remaining funds to support clean cooking initiatives.

They also sent me information describing the roadblocks that remain to bringing clean cooking to sub-Saharan Africa. Part of the problem is cultural: the households that most need an alternative to cooking with wood are almost always the poorest. So even tiny costs can be an issue, especially since women's work – collecting firewood – is considered "free". Another issue is that earlier efforts to bring solar cookers to local communities too often didn't sufficiently consider the wants and needs of those communities. Ashmore, for one, recognized this, and Jimmy, too.

Nancy: So where does Jimmy's project stand now? Will his PhD in cooking beans really result in Ugandans using his cooker? His plan is to first get support to put his solar cooker into kitchens in school or other institutions.

Jimmy: So I want to be one of those students who will take this idea to the community. And I'm very confident about it because when I was in Kampala, I tested this system on solar. We cooked. And even you see today, we have cooked beans. And you tested the beans.

Nancy: The cooker that he used to make beans for me is too big for a household, but would make a lot of sense for an institution, such as a school, where… .

Jimmy: If the public can see that so and so, such a system is in a certain school near the refugee camp, or in a community school, and they say, we are cooking beans out of this system and this is how it costs and these are the benefits of the system and the school and the teachers and even the pupils can see that, oh yeah, this is a thing.

Jimmy: And then we also size another one for a household. We install in about every 10th household in different places where the sun is extremely good. Even at the areas where, where the sun is very low, we can put one there and run the test so that these homes can be able to testify, this system we are using, it cost us this much, but we are paying maybe in installment or it has been given for us for a simple test.

Nancy: It's hard to say where this project will go now, but Jimmy has plenty of dreams and determination. And maybe you,my listeners, have some ideas? Because as he told me… /And as he told me

Jimmy: ….All dreams will come true when you follow the way which you have.

Nancy: I'm Nancy Bazilchuk and you've been listening to 63 Degrees North, an original podcast from NTNU, the Norwegian University of Science and Technology.

Today's guests have been Ole Jørgen Nydal, Jimmy Chaciga and Ashmore Mawire.

You can read more about the research discussed in this episode in our show notes.
Writing, recording, editing and sound design by me, Nancy Bazilchuk.
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