[SQUEAKING]

[RUSTLING]

[CLICKING]

ZEYNEB MAGAVI: A very, very warm welcome, but I am going to turn it over to our hosts here at MIT to do the first welcome.

CHRIS RABE: Cool. Can we move the slide one? Oh, I got it. OK, let's see. Do you want to talk about flying the plane?

ZEYNEB MAGAVI: Oh my gosh, I do. All right. We're going to get our-- this is actually the perfect slide for our little start here, which we coordinated and rehearsed. I love this picture, because it basically embodies everything that is the organization, HEET, and the process of moving forward in uncertainty.

So we are here today with this amazing course, which you're about to hear more about, building and fixing the airplane while flying it. So I really want to know how that picture came to be, but it stands. So to that end, I want to acknowledge that we've never done this before. It really can't-- it can't go wrong because of the people in the room.

And we're really excited to see where it does go. And we're also really excited to learn from it, as always. So for example, there is a lovely whiteboard outside during your coffee breaks that has two sides to it. One side is, who are the people and the ideas and the topics that we need to add to this conversation? Please put your ideas there. And the other one is just general feedback. Thoughts, ideas, learnings, changes, et cetera. Please don't hesitate to give us the gift of feedback.

And now for the part we probably should have started with, hi. I'm Zeyneb Magavi. I'm the Executive Director of HEET. And HEET is a nonprofit that has been focused on trying to solve climate change for a lot of years, from a community level in the beginning and scaling. So we'll talk more about the topic of geothermal networks in a few minutes.

But first, I want to just express a lot of gratitude to all of you for being present and here and offering yourselves to this conversation and journey that might look a little hazardous at times. And also, I want to just thank MIT, the amazing institution, and both Chris and Curt for being our hosts. And I want to turn it over to them to introduce themselves.

CHRIS RABE: Thanks, Zeyneb, So yeah, I'm so excited to welcome HEET here to MIT. My name's Chris Rabe. I'm the Education Program Director at MIT's Environmental Solutions Initiative. The education program mission is to better understand and expand climate education across both disciplinary contexts and institutional contexts. And I'd really like to make sure that our education, our projects and activities are connecting to real-world scenarios. So it's so exciting to be working with HEET and re-envisioning the way that energy can work.

This is a part of a few other collaborations. So we started a new course called Environmental Justice, Science, and Technology. And that has a massive open online version. And HEET participated with a really interesting lecture.

And then also, we're working on some K through 12 curriculum in this Day of Climate project through Open Learning. So it's just really exciting to be doing both the K through 12 space and the higher education space with HEET. So again, just so excited for HEET to be here. Thank you so much.

CURT NEWTON: Good morning, everyone. My name's Curt Newton. I'm Director of MIT OpenCourseWare, another of the co-hosts for this event. And we're thrilled to be participating in this, not just to host, but also because this is all going to flow out to the world. We're recording, as you know. We've got video set up here to capture and then share back with the world this important emerging knowledge.

We've had the pleasure at OpenCourseWare with serving this broader mission of unlocking and empowering people around the world, both learners and educators, for over two decades. You see a screenshot of the first engagement that we had with HEET, with Zeyneb, a January session workshop that we did about gas leaks. Part of the-- maybe the origin story for what we're getting up to here.

And what we do at OpenCourseWare is not just sharing this knowledge again, but to do so in ways that encourage practices of sharing and the feedback that gets set up through this, through this broader open knowledge ecosystem. So HEET, for instance, putting all of these resources in an open library and gathering together in a really nimble, generative way, create this knowledge new.

I'm recalling here at MIT in January 2020, just before all kinds of stuff got shut down, we hosted here some design charrettes to start this process. And just what a thrill it is to us to be part of this journey together.

And just to let you know, if you're not familiar with OpenCourseWare, the reach of this content is considerable around the world. 70% of our visitors come from outside North America. So the interest around the world that's developing in these technologies, we want to plug into that. Our website gets millions of visits every year.

And our YouTube channel where the videos also live is also a really important point of engagement. With over 5.5 million subscribers on our YouTube channel, it's the largest subscriber base of any educational institution out in the world. So rest assured that what we come up with today, flowing out to the world is going to reach a lot of people. And it's really going to, I think, further the work that we're all trying to get up to, so welcome.

ZEYNEB MAGAVI: But don't hesitate to talk after that. [LAUGHS]

ISABEL VARELA: Thank you. My name is Isabel Varela, Science Director at HEET. And I wanted to briefly share, this is the HEET team that is here to help you. If you have any questions, don't hesitate to reach out to us.

We've put together an incredible program. HEET takes the aim to look at for solving a problem. Identify all the stakeholders that need to be involved to make that change happen.

And this two-day course reflects that. As you see, we have eight sessions for each day, and they vary from, what is the challenge that we need to solve? What are the policies that need to be implemented to do that? What are the learnings that we can get from the geothermal networks that are implemented today? What are the design principles that should be applied? And learn from case studies. We are excited that you're here, and we hope you get most out of this course and participate. Your participation makes the course more lively.

ZEYNEB MAGAVI: And--

ISABEL VARELA: We have an incredible lineup of 28 speakers that are here. Some of them have come from around the country to be here in these two days. And we have organizations represented from universities, gas utilities, regulators, design firms and community-based organizations. So thank you for all the speakers that are here and making this course happen.

CURT NEWTON: Just a quick note about the nature of the recordings that we're going to be doing. So what we'll be sharing with the world will be the talks, and just the videos of the talks. There's a really important Q&A interaction segment that will happen for each of the sessions, and we will not be sharing those straight out with the world. We want to have a frank, completely unconstrained conversation here in the room.

Our hope is, though, that we will be sharing some kind of notes and takeaways, some summaries and syntheses, from those conversations. But rest assured, unless you are a speaker up here, we're not expecting you to show up in these videos that we share on OCW. If you have any concerns or questions about that, please reach out to me. Be in touch. But hopefully, that's all right. OK.

ZEYNEB MAGAVI: Yeah. And our format is that each session is going to have a few brief presentations. Every single one of the speakers could likely speak for hours on any one of the topics, and we're so aware of that. But we also thought that the most valuable thing here in the room is the interaction between.

So for many speakers, there will be a longer recorded piece of content that's attached to the courseware. But in the room, we're going to keep the presentations brief so that we can get to that part of interacting between and talking and interacting with all of you. And we've got a Slido-- it's a little app that we'll introduce in a second-- for you to engage so we can get more voices involved more quickly so that we can get the conversation going.

And then I've said this already. I'm going to say it again. This is our first go at this. I love that you mentioned the previous wonderful events. The first one was a hackathon to design a tool to measure gas leaks. And the second one was a charette. And now we're trying this content. So you will be part of making it wonderful today, so please don't hesitate to participate. All right.

ISABEL VARELA: One last comment for housekeeping. We have breakfast in the morning outside. We'll have coffee breaks. We'll have lunch outside. Food is allowed to come here if you want to. Restrooms are here immediately to the right, and there's another one in the hallway to the left.

ZEYNEB MAGAVI: Thank you. And Isabel planned this incredibly. So-- [LAUGHS]

[APPLAUSE]

ISABEL VARELA: With the team. With the team.

ZEYNEB MAGAVI: Yeah, yeah, yeah. With the team. [LAUGHS] All right. So one of the things that we always do-- and I know Curt is always in on this-- it's open. So your backgrounds here in the room are all over the spectrum. We think that's beautiful and exciting. And one of the things we're going to try to do is make sure that we move between introductory and advanced. And it may be a fire hose, but that's why we're providing coffee.

So I get to start us off with two quick ideas for the entire two days, and then we have the most amazing panel to get going at a very high-scale level of the whole world. So our new tagline at the moment at HEET is think thermal together. It kind of embodies a lot of the pieces that we've been learning over the past few years as we move forward with networking, ground source heat pumps, or geothermal heat pumps.

And that idea of getting a problem solved by working together, that's always been there. But the piece where we realized, as we spoke about geothermal, that thermal energy itself wasn't always on the table in the climate solution space, that people weren't thinking, they weren't measuring, they weren't talking about thermal energy. So I'm going to just briefly start by getting us to take a moment to put on our thermal energy glasses, and then I'm going to do a little bit of housekeeping on language-- so that terminology, and then we'll move to our first panel.

So think thermal. Let's start with that part. This is an image. If you use a thermal camera, which actually, we've recently purchased for the sheer fun of it, if you use a thermal camera, you see things differently. Our eyes don't do that, which may be why we don't-- we ignore it so often.

But there is a huge amount of thermal energy in our Earth. And really, if you stop and think about climate change, what is climate change except a thermal energy regulation problem? And so if that's what it is, and we talk about the rising temperature in air, well, the kind of stunning thing is that there are a bunch of papers calculating how much thermal energy the Earth has absorbed since, say, 1960. And it's 630 times, approximately, all of the energy humanity uses every year.

So I was delighted to learn a new metric of energy, the zettajoule. Apparently, humanity uses half a zettajoule a year, all the energy we use. And every year, our oceans alone are absorbing five zettajoules. So that's a kind of stunning, gut-wrenching challenge.

But if you start to think about thermal energy, if you start to look at it, if you start to measure it, it's also an extraordinary opportunity. It's a massive amount of energy all around us that we have been ignoring. And we have the technology to tap it, which is what we're here to talk about today.

A recent report from the IEA had a rather stunning statement that kind of defines part of our two days, that "The technical potential of geothermal would be more than enough to meet all heat demand--" that's all heat demand, and they're not even talking about cooling-- "in Africa, China, Europe, Southeast Asia, and the United States." So I read that and I thought, well, what about those other places?

But I also want to just add into the conversation, not just that geothermal energy that's in the world all around us, but also the energy we waste. All that energy we do use, combust, burn, et cetera, the majority of it is wasted. And a large, large portion of that is thermal energy. So that is where we can think about yet another untapped resource all around us.

All right. So taking the optimistic part of, wow, there's thermal energy all around us, this is really exciting, what we're here to do today for two days is talk about the technology we believe is there and ready for us to tap it and turn it into a solution. Talking about that technology sometimes has some challenges. [LAUGHS] We try to bring everyone together. Lots of different groups have lots of different language. This is the HEET approach that we've been talking about earlier with many other events. You're now part of it being in the room. So coming together around what we mean when we say things is one way to start, get us all on the same page.

And the first thing we have is a little quick intro visual, which many of you may have already seen-- I apologize if you have-- explaining the technology of networking geothermal heat pumps in a very basic level. Tomorrow, you're going to get a very advanced level. For now, this is--

[VIDEO PLAYBACK]

NARRATOR: Right beneath our feet, the Earth is soaking up energy from the sun, and it's been doing this for a long time. Near the surface, the ground warms and cools with the seasons, but lower down, it stays at a constant temperature. In Massachusetts, that's 55 degrees Fahrenheit year round. This stored temperature is a source of renewable energy. It can be accessed to heat or cool a single building without using fossil fuels. But did you know we can also connect entire communities to that renewable source in the ground? How does it work?

It starts with underground pipes in the streets, sort of like gas pipes, but filled only with water. The water absorbs the ground temperature of the Earth and delivers it to buildings. Pipes connect buildings with different heating needs, so energy is never wasted. Instead, it's exchanged between buildings or stored in the ground until it's needed.

Inside, a heat pump moves heat in or out, according to the temperature you want. This system of pipes can connect like LEGO blocks, gradually moving us all from gas to geo, giving us cleaner air, efficient heating and cooling, and a healthier planet. The idea for this networked geothermal system run at a utility scale originated at HEET, a climate solutions nonprofit.

[END PLAYBACK]

ZEYNEB MAGAVI: All right. I'm going to really quickly go through language and then get out of here so we can start this amazing panel. The word geothermal, if any of you are thinking about Iceland and hot lava, that's the stuff on the left. This is one way to try to clarify that geothermal is like the last name of a family of technologies and energies both, and that the one we are talking about today is on the right.

It is-- networked geothermal heat pumps can provide heating and cooling is what is typically called shallow. You'll hear people use the word shallow. But for the usual person, 1,000 or 1,200 doesn't sound shallow, but I promise, that's shallow. And then it is ambient temperature. In other words, kind of the average temperature of the air and the ground. Not super hot in any way. And one of the things that's really critical about this type of geothermal energy is that it is everywhere.

You'll hear people talking about the word district. And certainly, this is a form of district energy. And the traditional naming system goes by generation. First generation, second generation. And the type we are discussing today primarily is fifth generation.

And the next more advanced level of this is, OK, so why are we calling it a network then? And our proposal, which is not universal, but there is kind of an emerging nomenclature, is that within fifth generation, if it has a single pipe, decentralized and renewable and combustion-free, then it is a thermal energy network.

And if that thermal energy network is tapping geothermal energy, which changes some of the outcomes, then you could also call it a geothermal energy network. That's what we're going to use, but you'll hear speakers use a lot of different terminology. I just wanted to give you a quick lay of the land.

And our last task before we begin is if you could please take out your phone, we have this QR code you can scan. And it should work pretty easily to get you on to Slido. And now you have your first quiz. We did say class, right? Don't worry. There's actually no test. But let's see how you do. Yeah, I made it too easy. So if you have any trouble getting on, Eric standing back there is happy to help.

ERIC: Yeah, you can also open your web browser and just go to slido.com and then type in the code key once you get it.

ZEYNEB MAGAVI: All right. I like watching them go out and back. [LAUGHS] That's how I think. All right. Are we good? Everyone on Slido now for the rest of the day? OK.

So yes, the group wisdom is prevailing. The type of geothermal energy we're discussing today is ambient, shallow, and everywhere, which is a lovely feature. All right. So we're going to take a second and begin our first conversation.