STATE OF CALIFORNIA – THE RESOURCES AGENCY
BEFORE THE
CALIFORNIA ENERGY COMMISSION (CEC)

In the matter of,	)
	) Docket No. 13-IEP-1P
	)
Preparation of the 2013	)
Integrated Energy Policy Report	)
(2013 IEPR)	)

Staff Workshop on Assembly Bill 2339 Requirements
Geothermal Heat Pump (GHP) Systems
Potential for California

California Energy Commission
Hearing Room A
1516 9th Street
Sacramento, California

Thursday, March 21, 2013
10:00 A.M.

Reported by:
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Joe Loyer, Mechanical Engineer

Also Present (* Via WebEx)

Presenters

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APPEARANCES (CONT.)

Panel: All Panelists from the Day

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P R O C E E D I N G S

MARCH 21, 2013 10:05 A.M.

MS. KOROSEC: Good morning, everyone. We're going to go ahead and get started. Today's workshop is being broadcast through our WebEx conferencing system and parties do need to be aware that you are being recorded.

We'll make an audio recording available on our website in a couple of days and we'll make a written transcript available in a couple of weeks.

We plan to break for lunch around noon. There's a list of restaurants within walking distance of the building on the table out in the foyer.

And we also plan to take a couple of short breaks in the afternoon.

We have four sections in today's agenda. We'll provide time for Q&A and public comments in each one. And in each of the sessions we'll take questions or comments first from those of you here in the room, followed by people who are participating on the WebEx, and then, finally, from the people who are phone-in, only.

When you're making comments or asking questions we ask that you please come up to the center podium and use the microphone so that we can make sure that people participating remotely can hear you, or we do have a traveling microphone, too, if needed.

And, also, it's helpful if you can give our court reporter a business card after you're through speaking so we can make sure that your name and affiliation are correct in the transcript.

For WebEx participants, you can use the raised hand function to let our coordinator know that you have a question, and we'll open your line at the appropriate time.

And for those of you who are phone-in, only, we'll open all of the phone lines for questions or comments after we've taken the questions from the online participants.

Please state your name slowly and clearly so that we make sure we capture it in the record.

We're also accepting written comments on today's topics until close of business on April 12th. And the notice for today's workshop, which is on the table in the foyer, and also available on our website, explains the process for submitting documents to the IEPR docket.

Just some very brief context for today's workshop, every two years the Energy Commission publishes its Integrated Energy Policy Report, which is then submitted to the Governor and Legislature. The recommendations in the report represent California's official energy policy and are meant to ensure reliable, affordable, and environmentally benign sources of energy for our citizens and to support the economy.

In 2012, Governor Brown signed Assembly Bill 2339 into law, which requires the Energy Commission to evaluate barriers to deployment and use of geothermal heat pump and geothermal ground loop technologies, recommend strategies to overcome those barriers, and include the results in the 2013 Integrated Energy Policy Report.

So, with that brief introduction, I'll turn things over to Joe Loyer, our CEC staff member who's our organizer and our MC for today.

MR. LOYER: Now, is it working? Is that better? I'll try and -- oh, there it goes, okay.

Yeah, this is actually my first time using this mobile microphone here, so if I cut in and out, I apologize.

I am Joe Loyer, California Energy Commission. I'm a mechanical engineer here and I'm so far the first staff -- not the first staff. I'm the current staff, but we have many staff that have been involved with ground source heat pumps.

And we've been looking at them for quite a number of years as part of our Zero Net Energy Building Code, at possibilities and how to incorporate them into code.

I think one of the things we want to say first off is welcome. Thank you for coming. It’s a relief to see some people that are not going to be presenting today in the audience. Thank you very much.

And on the WebEx, thank you for tuning in, we very much appreciate it.

And we hope that this is going to be an insightful discussion, an opportunity to educate the staff, and to share technology, and positions, and maybe solutions.

One of the things that we need to recognize right now is that at the end of this workshop that’s not the end. We are going to have a working group. And if you are here today, there is a sign-up sheet in the front that have an option to join that working group.

And the objectives of the working group are actually to help the Energy Commission produce policy reports.

Now, essentially, what will happen is the staff will work with the working group to produce recommendations to the Commission.

The Commissioners will then review it and decide if these are going in the right direction, if this is supportable, if it’s something the Energy Commission can do.

And more importantly, almost as importantly at least is, is it something that is going to be useful to the industry?

And so, that’s why you should join the working group. If you have an interest in ground source heat pumps and seeing them folded into code, effectively, and seeing them used more effectively in California.

So, with that I’d like to turn it over to our first speaker for some introductory remarks, Sara Arce.

MS. ARCE: Can you hear me? My name is Sara. I’m actually with the Office of Assembly Member Williams. Good morning Commission staff, and GHP industry and interested stakeholders.

I’d first like to thank the Commission for giving me the opportunity to make some opening remarks on behalf of my boss, Assembly Member Das Williams. He wanted to be here to address you directly but, unfortunately, is in session or just got out of session, so he’s tied up in that.

When the California Geothermal Heat Pump Coalition approached my boss last year with their concerns and proposed legislation, he knew immediately that he wanted to help. He was familiar with the technology and was surprised to hear about the existing barriers in California.

As a Santa Barbara City Council Member, he was actually involved with the County of Santa Barbara's Courthouse Geothermal Project that installed a subsurface geothermal system to heat and cool their records office.

So, with the help of the Coalition behind us, we were able to pass AB 2339 last year, as Suzanne explained.

And so, the Assembly Member just wanted to express that he's very excited to see this bill being implemented and looks forward to following the work of the Commission and stakeholders to ensure that California's more fully -- or more fully realizes some of the benefits of this under-utilized technology.

So, thank you all for being here and for your work to help in this area. Thank you.

MR. LOYER: Thank you, Sara.

When we first saw the requirements for 2339, we were -- we were, I think, a little bit taken aback by our initial involvement and then we realized that this was a grand opportunity for us to really connect with the industry. And so we appreciate, actually, being named in 2339, we think it’s very appropriate that the Energy Commission is the lead agency in this. So, thank you very much.

Next, we have Hazel Miranda. She is our -- we like to call them our First Advisor to Commissioners.

And, Hazel, I’ll let you take it from there.

MS. MIRANDA: Okay, thank you. Good morning, everyone. My name is Hazel Miranda. I’m an Advisory to Commissioner McAllister and just wanted to thank everyone for being present today.

The Commissioner would like to thank CEC staff for all of their hard work in organizing this workshop, would also like to thank Assembly Member Williams, and his staff, for his interest and leadership on this issue, and for all stakeholders that are present today. Thank you for your time.

Geothermal heat pump systems, along with other technologies, will help us achieve our zero net energy and AB 32 goals.

I look forward to engaging -- hearing from all of you and engaging in constructive dialogue in helping us come to some policy recommendations that will ultimately be published in the 2013 Integrated Energy Policy Report.

Thank you. Thank you for being present.

MR. LOYER: Thank you.

Next, I would like to introduce Phil Henry, who I think everybody probably knows Phil. He’s been the driving force between 2339. And Phil is currently, at least, President of CaliforniaGeo, probably to remain so. Phil.

MR. HENRY: Good morning everyone. Thanks so much for taking time out of your day to take part today. I’ll move closer to the mic so you can all hear me here.

So, I’ll make my remarks -- I’ll keep my remarks brief, but I really -- I do want to just acknowledge some people and then we have a very full, jamb-packed day planned. We’ve worked hard, between Lisa Meline, myself, Joe Loyer, and Craig Hoellwarth have worked very hard in a -- in a planning group to put this together for you.

So, for starters, I’d like to acknowledge the leadership displayed by Assembly Member Williams. As Sara mentioned, he was quick to take on this task.

And publicly I want to acknowledge Sara Arce, who’s -- without her -- without her efforts we would not be having this conversation today. So, Sara, the industry thanks you. We very appreciate all you did for us last year and continue to do for the industry.

And I’d like to acknowledge the Commission. Joe spoke to this, briefly, this particular piece of legislation was -- it was a little hard-hitting, unprecedented, and took on some issues front and center, and the Commission has stepped up to the plate and very aggressively taken on this task, or set of tasks. And industry appreciates that effort.

The relationship that is coming out of this between -- between the geothermal heat pump industry and the Commission is unprecedented. It is a collaborative effort and the industry looks forward to having that continue.

And I want to thank Joe Loyer for his Herculean efforts putting all of this together. Thank you very much.

So, with that I'll close. I look forward to speaking with all of you.

MR. LOYER: Well, with that what we're -- what I'm going to do, now, is just kind of go over the agenda for the day.

What we have are basically three sessions, and then we're going to have a round table at the end of the day.

And Session One is titled here, "What are GHPs and how do they work?"

And you know, for most everybody in the room this is probably, maybe a little bit of old news. But for many of us here in the Energy Commission, it’s not.

We have a lot of information about how GHPs work, but we would always -- we always feel like we’re behind the eight ball in looking at what industry is doing. So, it’s always a good idea for us to have a basic synopsis of where the industry is and what they are doing with the technology.

And, in particular this one, I think it’s been around a long time and there have been many changes, really.

Session Two is going to be in the afternoon. So, we’re going to have a lunch break and then we’re going to go to Session Two; “What are the Potential Benefits for California.” And we have many presentations there and we will have an opportunity to talk to a panel at that point, as well.

Session One will also have a panel.

Session Three will be later in the afternoon, about three o’clock. “What needs to be done for California to realize the benefits of GHPs?” And we’ll be hearing from Energy Commission staff in Session Three.

And then we will have the Round Table, where we will have opportunities to talk to all the presenters and we will have opportunities to talk to presenters as the sessions progress.

If you do want to ask questions, we do ask you to step up to a microphone and identify yourself, so that everybody on WebEx can hear you, and that our court reporter can get your name correctly.

And if you are going to speak, it's not mandatory or anything, but it would be really nice for the court reporter to have your business card.

So, if you can, drop it off for her, and thank you.

With that, I think we are ready to go with our first presentation.

Lisa Meline, she's with Meline Energy Engineering Corporation and is currently the CaliforniaGeo Chair.

And, Lisa, you can use this microphone or you can use that one. And just so our other presenters know, you can also use the microphone and we have a remote clicker, if you like.

Ready?

MS. MELINE: Ready.

MR. LOYER: All right.

MS. MELINE: Good morning. Thank you for being here. My voice isn't usually this deep and sexy. I actually have a pretty good cold. So, I'll do my best and if you can't hear me, let me know. I want to make sure that I deliver all of this great information that we've put together for today's session.

I'm going to be addressing what I like to call "Geothermal Heat Pumps 101."

I want to talk about, first of all, what makes it a geothermal heat pump system. These four items that you'll see on the slide here, the extended-range water-source heat pump, ground heat exchanger, circulation pump and distribution, those are the key elements that I think of when I think about a building system, a building's mechanical system.

The extended-range water-source heat pump is one of the things that makes it a geothermal heat pump system, it's what's different from other types of systems.

And then, of course, there's the ground heat exchanger, the second bullet here, that's the kind of one kind of unknown factor that people are unsure of. They're not sure how to design it, how to manage it. And so that's what's different.

But the other two items on the list, those are pretty standard with building systems, building mechanical systems. Your piping systems, your duct work, you know, in-floor tubing, you know, nothing has changed there.

Here’s an example of what a geothermal heat pump system looks like. These are various configurations both water-to-water, water-to-air, they come in different boxes.

And, essentially, what I want to point out here is this how, in a lot of ways, it’s the same. It’s the similar footprint to a lot of the equipment that we’re used to seeing in buildings. And so, from that perspective it’s very similar.

Some things to point out about geothermal heat pump systems is that they are all-electric. A lot of people have the misconception that you’re just simply transferring water from pipe in the earth into a building and, magically, you’re heating and cooling. You do have to pay for electricity, but the dream about this type of technology is that you can produce that heating and cooling at a much lower cost, much -- you can do this much more efficiently.

They do not require hot water geothermal. That’s kind of a misnomer with the name. We call it geothermal heat pump. But we’re talking about low temperature energy, not hot water like you’re used to associating with electrical power production.

The systems can be open loop or closed loop. Here, in California, we primarily are looking at closed loop systems. There are opportunities to do open loop systems, which would be like a water well, injection well system, but those are much more challenging to permit. And since California, in a lot of locations, is desert, you know, it kind of doesn’t make sense.

So, the focus of my presentation will be closed loop systems.

And then, finally, it can be hybridized and I’ll talk about that a little bit later in the slide show.

So, basically, how does a heat pump work? As I mentioned, we take low pressure vapor, refrigerant, we add energy to that via a compressor. That’s where you’re paying for the power for your system.

That refrigerant is then pumped through a condenser where heat is given off and then that refrigerant comes out the other side as saturated liquid. It goes through an expansion valve.

And then on the other end of your system, at the bottom of your slide there, the evaporator, it absorbs the heat. In this case, in air conditioning mode, we’re going to be drawing that heat out of the air or the water that is part of the system.

So, this would be like your regular air

conditioning system, it's the vapor compression cycle. But with heat pumps, you have the opportunity to, with your expansion valve you put in a reversing valve here, and you can do both heating and cooling with the same box.

Here's another graphic for some folks who may not be familiar with the technology. If we start out looking at the item number one, this is essentially the geothermal heat pump. This is where we're exchanging the heat.

The example here is cooling mode and so we're going to be, basically, taking the heat out of the air, but we're really air conditioning. I mean, that's just the way the mechanical engineer in me wants to think about it.

But we have the box. We have the equipment inside the building. We have the ground loop that I have as diagram item number 3, outside the building in most cases.

And then we have number 2 here, the pump, which is circulating the fluid between the ground loop, the ground heat exchanger and the equipment in the building. And those are really the key elements.

The distribution system and all of that, as I said, is no different than what you're used to seeing.

You'll see to the left a water heater. One of the things that you can do, in certain locations it makes sense to add a super-heater feature, where what you're doing is essentially a heat recovery. You're pulling the heat out of the refrigerant before it dumps the heat into the fluid, to pre-heat water or other processes within a building.

One of the things that is different about geothermal heat pump systems is the way we talk about their efficiency. I'm not going to delve into this too deeply because Dr. Kavanaugh is going to be addressing this.

But, typically, when we're talking about geothermal heat pumps, we're talking about coefficients of performance when we talk about its heating efficiency and energy efficiency rating for cooling efficiency. And we never talk about SEER with this equipment.

The second item, as I mentioned, that makes these systems somewhat different from the mechanical systems we're used to dealing with is the ground heat exchanger.

So, what I'd like to do is talk to you a little bit about this. It is, you know, the renewable connection. The ground loop is in the earth. And the reason we do that is because we like to tap into that constant temperature that we see when we get below, say, 15 feet below the surface.

It's maintained a constant temperature for the most part year-round, the sun's shining, heat is being added. You know, we've got cool days and hot days.

We do get a little bit of heat from the core, which is what a lot of people think about with geothermal, but it's really negligible when you think about everything going on outside.

So, what we want to do is we want to take advantage of that constant earth temperature below our building, outside our buildings.

If you think about Sacramento, in particular, a design day is maybe 30 degrees in the wintertime. The deep earth here is about 65 degrees. And so if you're thinking about trying to draw heat, extract heat and bring it from the air or from the ground into the building, there's a pretty good advantage there. There's about a 35-degree advantage.

Likewise, in the summertime, when we're trying to reject that heat from our buildings the earth, again, is a 65 degrees, which is a much more favorable heat transfer than to the outside air, which is about 105 degrees during a peak summer day here in Sacramento.

So, we're taking advantage of transferring that energy in the most positive direction and taking advantage of that earth to do that.

So, you know, here’s just another picture of how that diagram I showed you earlier may be viewed.

So, how do we do that? There’s all different kinds of ground heat exchangers. The one that we see most frequently here, in our State, is the vertical loop system.

Basically, these are some different examples of how you might construct that. Basically, what we’re going to do is we’re going to drill a hole in the earth, we’re going to make a borehole at whatever depth the design engineer has specified. Typically, we would see that between, you know, 200 and 400 feet here. All kinds of different drilling conditions going on so, obviously, that’s part of the equation.

But in that borehole we would then insert high-density polyethylene pipe. That pipe will be pushed down to the bottom of that borehole. And then we would fill that borehole with grout because what we want to do is make sure -- we do that for two reasons. One is to make sure we have a good connection between that pipe and the borehole wall.

And the other is that we want to protect our groundwater. We want to make sure that we don’t create a pathway for either groundwater or cross-contamination between aquifers to a core. So, that is basically how that works.

We typically work with fused pipe. This is plastic pipe. They also use it in the gas industry. We want to fuse this pipe because we want it to last a long time. You know, we're investing in this ground heat exchanger, we want it to last the 50 years or so that a lot of the manufacturers will warrant it for.

And we don't want to have mechanical fittings. We don't want to have opportunities for failure and corrosion. So, this is the way that we recommend these systems, we actually specify them to go in.

And then, of course, once you're drilling all these boreholes you have to have a way of connecting them all together. So, we need to connect them together with this fused pipe like you saw in the photo prior to this.

We want to bring them through a trench and a headering system into our building. So, here's some pictures just showing you what that might look like out in the field. This is an example for a project down in Alamo.

Again, the plastic pipe is what we want to use on all of these systems. This is an example of how you might receive the pipe from the manufacturer. It's already come to the site on pallets at the correct depth or length that we need.

The U band or the fitting at the bottom of the pipe that brings them together so that you can transfer that water all the way down to that borehole, and then back up again, it's all ready to go and ready to be inserted into those boreholes.

And then, of course, we're going to be doing backfilling of that entire system the way you would normally do with any type of other, you know, buried piping system.

One of the things that's very important with these systems, and where I've seen a lot of problems here in our State, is that the systems are not properly flushed. It's really important that once you get this ground loop, this ground heat exchanger where it needs to be that the system be properly flushed of all the debris that is just part of being -- part of going through the construction process. It needs to be at a specified 2-foot-per-second velocity as a minimum and for a certain amount of time to get all of the air out of the system.

So, having said that, that's the basic construction of an example for a vertical loop system.

How do we design this? This is the part that baffles a lot of engineers and owners, you know, how do we do this? How do you design it? How do you know how much pipe to put in the ground?

Well, we need to know the properties of the earth, first, of where this ground heat exchanger is going to go. So, we need to understand what the deep earth temperature is, that's very important, the conductivity of the soil, which is the ability of the earth to move heat in and out of the surroundings and into that pipe, and then the thermal diffusivity of that particular formation or earth where we want to put this ground loop.

And how do we get that information? Well, that's a little bit of a challenge in California. We're a little different from a lot of other states.

But if you do have access to a well log, it is not public -- it is not available to the public, typically, but if you know some drillers that have some well logs in the vicinity of where a project is going to be, you can look at the type of soils and rocks that you might encounter in a certain location and kind of estimate connectivity from that.

There's experience. If you do a lot of work in this industry, you start to kind of become familiar with you might encounter in certain locations.

And if you just don’t know, you can always do a thermal conductivity test. And that’s something that we typically recommend for larger projects because it is -- it can be quite costly.

And so, the advantage is that if you have a better understanding of what your earth properties are, you can do a better design and try to keep the cost of that ground loop system down, which is typically what a lot of people will say is one of the biggest challenges with this technology.

So, basically, a thermal conductivity is, in a nutshell, you’re just putting in that first borehole. You’re putting in that first U band. You’re going to circulate water through that individual loop. You’re going to measure what that deep earth temperature is in the first moments of that test.

And then you’re going to apply heat. And what happens is when you apply that heat over time, after about eight or ten hours into that test you will be able to measure the differential temperature being seen in that system. And when you plot that on the log graph you get a slope of a line and that magically becomes your conductivity.

And there’s been a lot of research papers on how to do this test, there are different methods, but the line source method is the one that is more commonly used in the industry, currently.

Here’s an example of a well log. If you’re not going to do the thermal conductivity test, you can find information such as this and do an estimate, a weighted average of that conductivity.

And what else do we need to know? This is the part where the engineers have to determine what that ground loop size, depth, spacing, what water temperatures they’re going to define for the heat pump to determine what levels of efficiency they’re going to realize from that system.

And then, also, there’s a pumping piece that you need to know.

So, this is the design part. These are the things that have to be traded off in design to try to create the best, most efficient design for the particular site, any constraints it might have, and also the budget being provided.

Another way of doing this type of system, it’s not really a ground loop, we call it a surface water loop, but it’s another way of doing heat exchange with a body of water.

Here’s an example of a project over off the coast. Basically, the same plastic pipe is put into coils, put on a frame, and it is taken out into the middle of this pond. And, basically, obviously, you’re going to want to keep air in the pipe so you can get it out there, and then you fill it up with water and you sink it.

And what we’re able to do, then, is use that body of water as a heat transfer medium rather than the earth, itself.

And this is just to show you that if you happen to be in this business, it’s perfectly okay to have a kayak in your shop as part of your -- one of the tools you need of the trade.

So, again, here’s how that pipe might look as you would want to attach it to that frame and put it into that pond, or lake, or river, or whatever you’re looking to do here.

You can also use a plate frame or a plate heat exchanger. A lot of times you’ll see these on properties that have piers, or things leading out to their lake or pond, and so it’s a lot easier to just attach this.

There’s horizontal loops. A lot of times this is referred to as a trench system because you’re basically digging trench, typically about five feet deep. We don’t want to go much deeper than that because there are issues of shoring, you know, and safety of people working in these trenches.

And, obviously, this deviates from project to project, but you can put one pipe, two pipes, four pipes, Slinky pipes. There’s a lot of different ways of doing this and there are obviously tradeoffs within the design process.

But these are just examples -- you know, this is to give you an example of ways you might do this heat exchanger.

Here’s an example of a horizontal Slinky system. This is a project up in Grass Valley. This particular project, the ground heat exchanger was put in, the soil was removed, the ground exchanger was put in, the soil was put back and then a slab on grade was poured for like a big box retail store.

So, there’s all different ways that you can do the ground heat exchanger portion of the system.

Horizontal or directional drilling, this was mostly started by the fiber optics industry putting in cable, and things like that. It is also equally applicable to getting pipe in the ground, if you will.

The idea is that you are drilling a borehole down under the surface of the finished grade, 15, 35, different depths, whatever your drilling equipment has capability to do.

In some occasions you will drill down under and then come up on another side, say on the other side of the property or on the other side of a building, and this allows you to pull that U band pipe back through.

Or, in other cases, depending on the conditions, you might just drill down and leave that pipe buried at 10 or 15 feet. It just, again, depends on your particular site and the capability of the drilling equipment and the driller.

One of the things that’s really important to understand about this technology is that it really works best, and it really should only be designed for systems that both have heating and cooling demands over the course of a year.

The idea is that the ground is like a -- it’s like a heat storage device, right. So, in the summertime when you’re pulling heat out of your building and you’re rejecting it to the earth, you need to turn around and pull that same energy out of the earth and use it in your building later in the year.

The most ideal situation is to have a balance between heating and cooling, but we realize that that isn’t always possible. And so, you have to make sure that you accommodate for that in your ground heat exchanger designs.

And if you have a situation where you have a severe imbalance, you can also look at hybrid systems. Hybrid systems are good for a couple of reasons. One is that it is a natural partner for other renewable technologies like solar thermal, PV.

In this example that I show here, this is a solar hot water heating system where, obviously, solar is the primary heat source and then we use the geothermal heat pump as a backup to that.

One of the ways that we’re looking at getting to net zero is instead of having the solar thermal panels you might have PV panels that would be producing your electricity that would then operate your very efficient geothermal heat pump. So, there’s different ways of looking at that.

One of the things that we see mostly on large commercial projects is a hybrid system where you design the ground loop to take care of your heating requirement. It’s going to be your heat extraction; it’s sized for heat extraction.

Because, typically, with large commercial projects they tend to be cooling dominated, which means you’re putting more heat into the ground than you can take out. Even in colder climates you will often see this.

So, often, you know, if a lifecycle cost is done, it’s more cost-effective in some cases to use a cooling tower or fluid cooler as an additional heat rejection device in your hybrid geothermal heat pump system.

So, here’s an example of that. I know it’s kind of of a busy slide, but what I wanted to show is that there are different ways of applying this technology. It’s quite -- can be quite innovative.

Now, one of the things that I was asked to speak about, which is actually a really good way to segue into some other discussion we’re going to have in this session, is when we look at lifecycle costs we’re trying to determine the cost of a system over its useful lifetime. We’re looking at first costs, we’re looking at operational costs, we’re looking at maintenance costs.

This page here is form the ASHRAE 2011 HVAC Applications Handbook. And I know it’s kind of hard to see. I think if you’re looking at this on your computer screen, in your office right now, people that aren’t in this room, you’ll see that for commercial water-to-air heat pumps the 2005 data that’s published by ASHRE shows that the lifetime of that equipment is 24 years or better.

For chillers, if you were to, say, compare a geothermal heat pump system to a bore pipe central plant system, you would have a chiller. If you compared the lifetime of the chiller to that heat pump, it’s saying 25 years, so they’re very close according to this data in lifetime.

But what I also want to point out to you in this information is that’s 2005 data. And if you look at everything else in that chart, there really is very little information out there.

If you go back to the previous data that was quite extensive research that was done back in 1978, they show some different and older data. It’s dated, but that’s 30-year-old data.

So, what I’m really trying to show here is that even within ASHRE, which is the society that’s taking the lead on a lot of this research and providing useful tools to engineers, we just really don’t have a lot of that data.

I serve on one of the technical committees within ASHRE that deals with this technology and for the last ten years we, or really Dr. Kavanaugh and some of the people that have been on the committee longer than I have really been pushing to try to get this information, to try to get some research dollars to collect it. And we've just not really been successful.

But, fortunately, Dr. Kavanaugh has approached the Tennessee Valley Authority, the Southern Company, and with funding from EPRI has recently done quite a bit of research and gathering of this information, which he'll be sharing with you later.

There's also been a series of seven articles published over the last, probably, ten months within the ASHRE Journal that shares this information with the engineering community and any other folks who may be interested.

So, what I would like to do is just give you an example. This is the most recent and final of those seven articles within the ASHRE Journal. Dr. Kavanaugh allowed me to co-author this with him. Thank you very much, Steve.

But within that we talk about commercial GHP -- he says GSHP, I say GHP -- geothermal heat pump performance and how to achieve quality.

And with that, Steve, I'd like to turn it over to you.

Are we supposed to take questions or at the very end?

MR. LOYER: Given that we're so advanced in our schedule here, it's only 10:40, we can take questions now if you feel comfortable with that, Lisa, or if you want to wait until after Dr. Kavanaugh.

MS. MELINE: I think maybe it would be better if we got through all of the presentations because we might answer some of the questions as we move through.

MR. LOYER: That's a good idea. We'll hold questions until the end, then.

MR. KAVANAUGH: Okay, thanks for the opportunity. You can see I've come a little ways. Lisa was helping me on another project so we kind of traded off on this.

One of the things that was on the list of things to talk about was the difference in the rating procedures and how they fit together, possibly how you convert one to the other. So, we're going to talk about those things.

And because they are used quite a bit in performing these lifecycle cost analysis, and predicting energy use, and that sort of thing, so I just wanted to show you the guts of these things.

So, with that, okay, so what is SEER, seasonal energy efficiency ratio, it's a procedure that was developed, actually, in the seventies and promulgated in the mid-eighties by the Department of Energy.

The reason source of it comes from the Air Conditioning, Heating and Refrigeration Institute, and there's the standard number.

And there is a shortcut method to getting SEER, and that method assumes the outside temperature is 82. Not so hot. And the indoor conditions are 80 degrees, what we call dry bub temperature, the temperature on the thermostat, and 67 wet bub which is about 50 percent relative humidity, and that's not comfortable.

People do not set their thermostats at that point most of the time.

Going into a little bit more detail, for those of you that are engineers, and some of this I realize may be more on the engineering take, but we have a lot of, hopefully, engineers out there or people who work with heating and air conditioning systems.

And this revolves what's called external static pressure, which is the pressure that you have to deliver on the outlet of the heat pump to drive the air through the system.

And they've got three ranges of the heat pumps, and this is about a -- it's thousands of Btus per hour. This is up to about two tons, a little over two tons. this is a two, a three ton, a two and a half ton, a three ton size heat pump.

You see these numbers over here represent the amount of pressure in inches of water. And people that design these systems would actually be pretty crazy if they used this low of pressure.

The other thing is that they assume that the loss across the air filter is a really small amount. Typically, the filters we use today the numbers, even when they're clean, are like three, or four, or five times as big as that.

So, the next result of it is you've got a real small fan here and it will actually drop the SEER around two points. So, it's a 14 and you apply what a fan really would be doing, it would drop it down to a 12, okay.

There is no latent requirement, which I understand that doesn't bother people in California as much as it does the people in Alabama.

There's a cycling degradation. And my thought on it is if it's 82 outside in California and you want it 80 inside, you might as well just open the windows.

Now, the other thing that disturbed me is this is the shortcut that I just showed you. And so, what I have here is a listing of heat pumps from one manufacturer that shows the seasonal energy efficiency ratio for a 19 SEER product line and a 14 SEER product line. So, it's the three-ton units, the four-ton units, and the five-ton units.

And in order to get a 19 SEER series all you have to do is have one heat pump in that series that makes a 19 SEER. So, what they'll usually do is put a three-ton outdoor unit with a four-ton or five-ton indoor unit to get that 18 SEER.

But you can see here these are the actual SEERs for these heat pumps. And what I'm doing is comparing the 19 SEER product line with the 14 SEER product line using the same size indoor coil.

And you can see the SEER for this 19 is 17.6, not quite 19, but its EER when the outdoor temperature is 95 is 12.1, where the 14 SEER product line has got a SEER of 15, but it actually has a much higher -- or not a -- a higher EER at 95.

And as you see, as you go down in increase in size here, the discrepancy between the EER at 95, between the high-efficiency and the mid-efficiency system gets worse. So, the mid-efficiency heat pumps have a much better average EER at 95 compared to the higher SEER products.

So, that would drive the utilities crazy, if I was a utility. You've got a product that you're rebating that does better when it’s mild. And don’t you all have like brown-outs and black-outs here in California? Yeah.

So, basically, the high SEER products are hurting you worse than the mid-SEER stuff, okay.

Now, how does that happen? Okay, this is the long cut method. And this slide and the next two may get a little more technical, but I do need to put this information out there.

I see Joe, is it, is shaking his head, so he kind of -- I think he understands what we’re talking about. So, I’ll try to explain it.

What you have is what’s called a Bin calculation, Bin energy Calculation, and Bin being temperature points.

And what we have is the SEER requires a thousand hours, okay. And, again, the SEER calculation uses that 80 degree indoor temperature.

But of those 1,000 hours, 660 or 66 percent of those hours the outdoor temperature is either 77, 72, or 67. So, for 66 percent of the time the outdoor temperature is milder than the indoor temperature.

And here’s some points up here. Phoenix, Dallas you see. If you go up to the higher temperatures, you see only less than one percent is above a hundred and less than two percent is between 95 and 100. So, very, very little temperature points in these ranges when it really gets hot. So, keep that in mind when you're looking at SEER.

Now, the next one -- all right, now, this is the -- I have to admit, this is the most technical slide I have in here. So, if you don't completely understand my explanation in this short period of time, I can answer some questions.

But the real point is on the next slide. Okay, this is what is a graphical representation of what happens. On this line we have outdoor air temperature. Over here it says COP, but this will be the capacity of the heat pump in cooling.

So, as the temperature, this point right here is 72, as that outdoor temperature increases, this is the load line that goes up, up, up, up and it gets hotter and hotter until it gets to a hundred. So, you have a high load at this point, okay.

This is the same thing for the other side in heating, right here about 65 you have no load, and then as the temperature gets lower and lower that load goes up, okay.

This is from the ASHRAE Handbook.

Now, what I want to point out is if you set your thermostat at, say, 75 in cooling, and 70 in heating, there will be a five-degree outdoor temperature range where you have no heating or cooling requirement. It’s called the dead band.

All right, now, we’re going to flip over to here, to where the air conditioning industry who developed, essentially, this and their assumption is -- okay, we saw on the last slide that there is a load at 67, because they did the Bin temperature. Remember, they had the 67 on there and they’re including that very efficient operating point.

So, that would mean we go down five degrees, so the no-load point is 62. So, there’s no load at 62.

Now, if we were to follow this procedure over here, that means we would go back ten degrees and start at 52 because they’re asking us to set our thermostats at 80 in cooling and 70 in heating, so there would be a ten-degree difference, and that line would come up right across here.

Rather than the assumption is that we have the no-load at 67, okay.

Now, I’m going to flip, just a minute, so we should have a ten-degree band in here where we need no heating or cooling. But the calculation, we’re flipping over to heating seasonal performance factor. That’s the same thing as the SEER, but it’s for heating. It’s Btus per hour of cooling divided by the watts input.

But you’ll look over here and you’ll see that those three points, 62, 57, and 52, which shouldn’t even be heating or cooling, contain about 35 percent of the hours for which we calculate the heating efficiency, okay, and that’s when they’re most efficient.

So, I’m just saying -- and then for a commercial building you probably wouldn’t even need any heating at these temperatures.

So, again, remember that both SEER and HSPF assume very, very, very optimistic conditions when they’re calculated in their values.

The other thing is, these next two slides show you, and it’s becoming increasingly difficult to get information in order for people to conduct simulations, lifecycle cost analysis. This is all you have to report, okay.

I’ve kind of blown this up. This is off the AAHRI website, so you’d have to tell it what the capacity is, the EER, and the SEER.

Now, they also list the heating seasonal performance factor, the capacity with the outdoor temperature at 47, and 17, but they don’t tell you what the efficiency is. They don’t have to report the efficiency.

So, how are you going to figure out, if you don’t have the efficiency and the energy use, how much energy the systems are consuming?

Now, we have this environmentally acceptable refrigerant, R-410A, which everyone’s using these days. This is the refrigerant that we have no longer allowed to be -- equipment to be produced for, R-22, R-410-A.

The secret that I think they keep pretty silent is R-410A is not a very efficient refrigerant when things get hot.

As a result, the manufacturers used to report in their -- this is from -- I guess it’s from Carrier, the total capacity, the sensible heat capacity, which tells you something along the lines of how well it de-humidifies, and the kilowatts into the unit.

Okay, you see those three points? Okay, so nowadays, when you try to go get information about 410A what’s missing? It’s difficult to get this information from manufacturers. They don’t have to tell you. And when they do tell you, if it’s not at a rating point, you don’t really have a guarantee that they’re telling you all of the details.

So, again, look at that. Total capacity, sensible capacity, but no KW.

So, I'm wondering how these people are doing these models and these lifecycle cost analyses when we can't even get the data.

Okay, now, switching to ground source heat pumps. And, of course, you'd expect me to say great and wonderful things about this, which I do, but to some extent we've got good news. Is that rather than assuming a load in this stuff, we get this at different temperature points, 86, 77, and 59 for cooling. And for heating it's 68, 50, and 32.

But the bad news is they also kind of cheat on the conditions, just like the air source people. Okay, indoor temperature 80.6, the dry bub 66.2, the wet bub, those are nice metric round numbers and they go even worse than the air manufacturers -- the efficiencies that are reported, with no external fan pressure and no pump power.

At part-load, they do it at 68 degrees. You get your part-load cooling efficiency at 68. So, if inside the house is 80.6, the ground loop's 68, so you're kind of pumping heat down here, which is sort of like rating the miles-per-gallon of a truck going downhill. So, we've got to kind of watch that.

The other thing is that the manufacturers, this bothers me a lot, that they advertise their variable-speed, multiple-speed heat pumps have an EER of 50, okay.

So, here’s how that’s done. This is a product line where this particular heat pump at part-load, this is a four-ton unit, you can see it’s got an EER of 53.2. Isn’t that wonderful.

Okay, but let’s look at that. That’s with a water temperature of 59, okay, and air flow blowing over the coil at 1,500 CFM. This is, at part-load, about a ton-and-a-half unit, okay, and you’re blowing 1,500 CFM. So, that’s about 900 CFM per ton. It won’t work. No de-humidification and you’ll be blowing about 70-, 80-degree air on people in the heating, okay, so be advised.

Now, if we switch this to a rating system where you’re actually going to be looking at 86 degrees, which is most ground loops and cooling, and most ground loops and heating are going to run 50, or 45, in that range, okay. Here’s the single speeds, 3-, 4-, 5-ton, dual capacity, and the variable capacity.

And when I do the same thing I did to those air source units you can see the single-capacity units, which costs typically about a third of the cost of this unit right here, it’s got a higher EER average than this 50-EER system, okay.

In heating, the same thing, 4.9, when the water’s 50 degrees and at your full load versus 4.4 for the really high efficiency. This is kind of an in between model. It’s a dual capacity.

One other thing that I really wanted to stress is the real commercial applications in the ground source heat pump system. Really, the difference between what you can get with a commercial ground source heat pump and a traditional the improvement is, in my mind, much more significant than in the residential sector.

This is what you see with a lot of larger buildings, mid-sized buildings, chilled water, variable air volume system. And look at all the components. You’ve got the compressor, which is very efficient. You’ve got supply air handlers in the supply system. You’ve got fans in the return. You’ve got fans in a lot of these terminals in the different rooms. You’ve got a pump over here, and you’ve got a pump over here, and you’ve got a fan up here, lots and lots of equipment.

Ground source you’ve got a compressor, a fan here, and a pump here.

So, when we go to adding up and converting what they call KW per ton to EER, look at all this system. You’ve got all these different things. These are the fans which add heat to the system and take away cooling capacity in that mode. So, you're looking at 225 KW to get 142 net tons.

This is what the chiller puts out, but because of this heat this is all you get that's left. So, your EER ends up being 7.6.

Whereas in a properly designed ground source system here's the fan heat, much, much smaller fans. You still have a pump but it's not heating up. Just like these pumps, it doesn't heat in the building. And you can see when you add these up it's 146 KW for -- where did I put the net ton? Oh, there's the net tonnage. We both started out with 168 tons, but because we have smaller fans, smaller pumps we come up with 163 net tons. So, our EER is 13.4.

Now, a summary of this section, I really believe that SEER, HSPF and part-load ground source heat pump efficiencies, and KW per ton, they're for marketing purposes.

And any good engineer wouldn't use them for calculations.

You have a difficult time getting information, but for air source heat pumps the only thing we can really hang our hat on is the EER at 95 outside air temperature and then the heating capacity and COP at 17, and 47, of course. That's what you really ought to be looking at.

Ground source heat pumps I like to see 86-degree evaluation, and the 50 or 32 in heating.

And then, finally, the demand of the auxiliary components for non-unitary systems is -- it makes it very difficult to determine the efficiency of larger systems.

Now, what do I do now, Lisa, to get to the next -- am I over time already?

MR. LOYER: No.

MR. KAVANAUGH: Okay. Okay, this is the result of the field study that we did to try to identify characteristics of systems that work very well and, also, to try to get the improved future installations and get the costs down.

The sponsors were EPRI, the Southern Company Tennessee Valley Authority. We’ve actually been extended to start doing this in other parts of the country. That’s kind of why I’m here, Lisa’s helping me find some sites around here so that we can extend this.

You can see this -- if there’s not an ASHRAE member, there’s my website right there where you can go and read these if you’re bored to death and you want some more details.

We chose to use Energy Star as our indicator of energy efficiency because it’s not perfect, but it’s inexpensive, and it’s quick, and it creates a comparison from school to school, office to office, and it corrects for the primary things that make a difference in a building, like how many people, how many computers, how long it’s operated.

And what this means is that this particular building got an Energy Star rating of 84, which means it’s better than 84 percent of the buildings like it when you correct for everything.

A 75 will get you a little plaque.

Okay. We also at this time, this is very similar to the rating system that I was subjected to as a professor when they say, oh, you’re a good teacher and people would say, no, I don’t agree with that. I strongly disagree with that.

So, we came in and modeled that after “are you happy with your summer temperature, your winter temperature, the noise levels, the air quality, the lighting, the maintenance, and can you set your own thermostat.”

But, of course, this is the one we got the most comments, both negative -- mostly negative. Engineers not allowing -- I can’t imagine trying to teach eighth graders and not have control over my thermostat. But that's some of the things we asked in this thing.

I don't have a -- in the limited amount of time, we don't really have time to go into a lot of detail.

But this is the results of about 40 buildings and you can see an average building, with an Energy Start rating of 50 is right here.

And that most of them did very well. But just because it's a geothermal heat pump doesn't mean it's a good one. We had a one here, okay.

This one was at a utility office, these were schools that thought they were doing a really good job until we rated them.

But I do want to call your attention to this right here. Three of the engineering firms did almost all of these buildings and it's a very, very important point that there are good engineers out there, but there are some that aren't doing their jobs.

We broke this into four different kinds of systems. This is the most common, a large, central ground loop, multiple heat pumps inside the building. You bring it into a building and you pump the water all through the building.

So, the heat pumps, like Lisa showed, are the most common way of doing this. But I see an increasing number of folks just taking and hanging a ground loop onto a conventional chilled water system.

Do you remember the one with all the fans, with all the high KWs? I'm seeing this quite a bit in California, lately, okay.

So, let's look at what those did when we put them -- separated them out. So, these are ones with constant speed pumps. These are ones with variable speed drives on the pumps, which change the flow rate of the pump.

So, you can see we had some in the 90s, but it's just sort of an average. Remember, this is average. This is only slightly above average.

We did two chilled water systems with VAVs. Look at them. Now, this is an expensive system. Not only do you have the cost of that ground loop, but you've got all that cost of that chilled water system. Remember all those gizmos I had in there? So, it's a very costly system and, look, it only got 20s, so keep that in mind.

Now, this is the one-pipe system. These were actually retrofits, most of them that we monitored in central Illinois. They were, by and large, the lowest-cost systems that we surveyed. They're very simple. You just pump out to the ground loop, water comes back to the building, the little pump comes on and you suck the water out through the heat pump, and then pump it back into the same pipe and it goes around the building, okay.

Most people say, oh, well, that won’t work. You’re putting the hot water back into the same water that used to be cool or vice-versa and -- but the cost is low, so what about the performance?

We looked at five buildings -- or six buildings and they were all above 90. The average is about 95. The only one that fell below a 90 was this building that was built in 1938. So, a relatively inexpensive system, high Energy Star ratings.

I sort of created something that I was really hoping to get going, but it’s only among a few engineers. This is an engineer in Texas, and he’s got slightly better average scores than the proponent of the one-type, and they’re always going back and forth at each other, okay.

So, this is just a really simple system. They’ve been doing these in Texas. There’s over a hundred schools in Texas, probably close to 200 schools in Texas where they just simply put a heat pump in each classroom and connect the ground loop, usually two or three boreholes, to the one heat pump and you’ve just got a little, bitty circulated pump on and off, okay.

They do these in the classroom. They don't usually do these in the common areas, the larger areas.

But if you'll look at the results, like I said, his average was 96. And the one-pipe guy, his average was 95. You can see he actually had a hundred. He has four schools in Texas, in this one school district, which is 30 something schools, four of them received a 100. This one is one of the older ones. So, you can see really good results from that technology.

Another technology is a kind of combination of a central loop and individual loops, where you have a heat pump on this -- six heat pumps shown on here, and they have these little, bitty circulator pumps and a check valve. So, they're pumping back to a common loop here. And those had a mixed result, but there's some that did very well, one with a 97.

And then these didn't do as well, but that's because the schools that they were serving in weren't completely ground source, and then we had one kind of screwed up here.

I've got some numbers here and not going to -- but, typically, you know, in your area most of the ground loops are probably going to be over 200 feet of bore per ton to be successful. So, we've got a lot of dots on there that we normalized how well the things did with regard to the loop temperatures.

I had to write an extra paper when this appeared and what showed up was the buildings with thermostats actually had a higher Energy Star rating than the buildings with building automation systems, so it was kind of a -- I said, why did that happen? Don’t have a lot of times --

The other thing we did was we looked at the cost and one of the things that we’ve noticed is the cost for -- this is for the ground loop cost here, these dots with nothing in the middle of them. And this is the total system cost, which is the ground loop at the system.

So, you can see the ground loop costs right around $5.00 a foot, but we don’t have any from California in here. They’d be much higher. There would be some dots up here, probably.

But you can see it’s 26 percent of the total cost.

And I will tell you a little bit more later, there was another survey done in ’95 and the increases in costs are interesting.

So, here’s my summary slide. Most of the ground source heat pumps did very well, 61 percent of them got an Energy Star rating, 33 got above 90, one-third of them.

The Unitarian, the one-pipe did the best, with averages around 95 or 96. Central loops 61. And we've got some ground source heat pumps that don't work very well, okay.

Now, here's the last point I want to make. Since this 1995 survey the cost of the ground source heat pump systems inside the building have gone up 175 percent, okay.

Look at this, Randy, okay.

Outside the loop, since the '99 survey, Marc look at that number, you're doing good. Only a 52 percent increase since 1995, okay.

In my humble opinion, the largest factor for success was the quality of the engineering design. You don't have to put a lot of stuff inside the building to get these things to work, but you do need a very, very, very good ground loop. And I think that's it.

MR. LOYER: Thank you, Doctor.

MS. MELINE: Well, it's kind of tough following a pro there, somebody who taught for a living. In any event, I wanted to kind of wrap this up, to kind of follow on that discussion about Energy Pro -- or Energy Star.

There was legislation passed back in 2007, AB

1103, and what that required was that all nonresidential buildings greater than 5,000 square feet are supposed to be benchmarked.

There’s been some delays in that and the latest rulings are listed on the bottom of this slide. But, basically, what we’re trying to do is get building owners to rate their buildings using this Energy Star software that Steve was talking about. I believe it’s called Portfolio Manager. And they need to disclose the Statement of Energy Performance to the California Energy Commission.

Joe says maybe, maybe not.

So, in any event, you know, this is something that, you know, we’re supposed to be doing, anyway, we should be using Energy Star.

Now, I believe -- obviously, this is nonresidential, so we’re looking at commercial. It excludes, I believe, multi-family housing.

But right now, as the rules currently stand, pretty much any building greater than 10,000 square feet is supposed to be benchmarked.

The buildings that were 50,000 square feet or greater were supposed to -- it was supposed to be January, but they’ve let that slip back to July, so there’s some time. And then your smaller building --

smaller building owners are required to do that for buildings between 5,000 and just under 10,000 square feet by the beginning of this next year.

So, you know, really, when I was preparing for this I looked around a little bit and we're actually doing a pretty darn good job. They've got Los Angeles ranked first in the nation for benchmarking buildings. So, yay, the good news is that California is already doing this.

So, why am I bringing it up? Well, I think we probably want to do this on a greater scale and get some of these buildings that we have in California with the geothermal heat pump systems; we need to get them into the system and see how we're doing.

This is a colleague of ours, from ASHRAE. He's been doing a lot of schools in Illinois and Missouri. And here's something I pulled right off of his website. It's a discussion of this particular school. You'll see at the bottom there he got a 97 Energy Star rating.

Just to give you a little background on the building, itself, it was a school that was originally designed to have heat, only, with a steam boiler, and it was providing heat to each of the classrooms and all of the spaces with unit heaters, unit ventilators.

He went back in and retrofitted the system with a geothermal heat pump system, provided individual heat pumps for all of the classrooms and the different spaces, and provided both heating and cooling to that school, okay.

Granted, there was a huge energy savings, but what I want to do is give you a picture of that. If you look at this chart here you'll see this red line here, that was the energy consumption for the entire building, lighting, computers, heating, boiler. Obviously, I did convert the gas and electricity to one unit of measure. This is all in KBTUs, or 1,000 Btus per square foot of this particular school.

So, what you have here is the peak during 2006 was like 17 KBTU per square foot. The year after that, 2007, they peaked at 20. The year after they installed all of those geothermal heat pump systems and provided both heating and cooling to this school, check this out, why can't we do that here? That's amazing to me.

Now, granted, this is Illinois and Missouri, but I think that's really something that we should try to do here.

And so, I had mentioned that there were some projects that have been installed in the State of California. We're doing it o n a limited basis. We are doing some community colleges. This is up in San

Francisco -- or down in San Francisco. We're doing lots of residential but, unfortunately, they don't really fit into this Energy Star model that I'm talking about.

We've got a prison outside of Fresno. Restaurants, we've got some office buildings, wineries in the North Bay. And, yes, you can even do this up in Tahoe. I mean, this particular project, I've been up and looked at the ground temperature, and in the wintertime it's like 45 degrees. So, you know there's some efficiency going on in this building, but we're not capturing it.

I like to show this slide because this was a visitor's center and I actually have the energy data on this project but, unfortunately, museums and visitor centers aren't really covered by Energy Star. There's 12 different building types that do apply so, you know, we'd have to go out and seek those.

But this is a picture of when we were putting the ground loop in, geez, four years ago, now, almost. Hot, 105 degrees in April, out in the desert, here's how it looks now. This was a picture that was taken two years ago and that's my ground loop out there, under that beautifully landscaped, with recycled water, facility.

So, again, let's take a look at the data. Let's go collect this. Let’s look at some buildings. Both, you know, compare how these buildings with geothermal heat pump systems are benchmarked against other buildings that are already in the system, let’s see how we’re doing.

What I would like to propose is, you know, why do the Energy Star? I think -- I think we need to comply with the legislation that’s out there. I think it’s a pretty straight forward way to collect this data. It’s not perfect but, you know, we’re comparing like buildings against like data, in the same region.

I think we want to benchmark geothermal heat pump systems against other types of systems because there are other types of systems that are also efficient, right, but we need to know how we’re really doing.

And the problem that we’ve encountered, and as you see not just in California, but across the industries, we just don’t have data, so this is a way for us to capture some data to start seeing how we’re doing.

I would like to work on creating some kind of a project format with CaliforniaGeo being the repository of this information. And the reason for doing that is, well, that’s what we’d like to do as an industry is have that data available.

But we want to help the public make informed choices about, you know, how different systems perform. And, obviously, we would like to see more of this technology as an option for people to consider.

But, you know, they can also get an idea of which engineers, and contractors, and drillers are putting in the better systems.

In that article that I showed you previously, the first page that Steve and I -- well, mostly Steve wrote, I just kind of co-authored with him a little bit, gave some input, this is a format that he had proposed that engineers put together to showcase their projects and build a portfolio.

Now, there’s a lot of information here. It’s more information than what the Energy Star proposes because it has a lot of the cost data here, but I think this is a nice target. I mean, this is the kind of information that people want. They want to know how much does it cost, how much am I going to save. And so this, I think, should be the goal, this is where we want to head with collecting this data.

And I think that’s about all I have to say for that. So, thank you. Joe, I’ll turn it back over to you.

MR. LOYER: Thank you, Lisa. Thank you, Doctor.

I think what we'd like to do know, we are just running perfect on time, it's amazing. I think what we'd like to do now is sit our first panel, if we may. Unless we would like to open it up to questions, now. I think the panel would probably be the more appropriate way to do that. What do you think, Phil?

MR. LOYER: Well, I have them listed up here. It's, you know, quite a few. I would say about 15, 16. I'm seeing no raised hands. There is one call-in and I can unmute them.

But, first, let me turn to the room. Is there anybody who'd like to ask a question of either -- yeah, Dan.

MR. BERGOYNE: Dan Bergoyne, I'm with DGS. I had a question about the effectiveness of the heat pump in a hot climate, like in the Central Valley. You'd mentioned it's best if you have balanced heating and cooling needs, and how effective is it or how much effectiveness do you lose in a warmer climate, where it's mostly a cooling load?

MS. MELINE: So, that one example that I had on the slides, out in the desert, obviously, in a lot of those places the ground loop -- the ground temperature is warmer. So, as long as you're taking that into account with your design, you will be fine.

You can deal with the imbalance by putting more loop into the ground, which is obviously going to be, you know, a cost, or you can look at a hybrid system where you would -- in that particular case you could put a cooling tower, fluid cooler in to help with that heat rejection, which would bring that system into balance.

On that particular project the owner decided that they didn’t want to have to deal with the cooling tower. Obviously, one of them is water because it is out in the desert, and the other thing is that they have a lot of sand storms and things like that and they didn’t want to have to deal with the maintenance issues that are often created with cooling towers.

So, on that particular project we had a lot more borehole per ton in installed equipment capacity than you might have for that same facility, say, in the Bay Area. So, that’s how we would do that.

Because, in reality, the technology works pretty much everywhere in California except in Region 16, where you have a lot of hot water geothermal activity for power generation.

The tradeoff is what the design is, the cost of that design, the cost of energy and how much that system’s used. And so, those are the things that you have to look at and that’s kind of like part of that lifecycle cost.

You might want to be up here.

MR. LOYER: Okay, are there any other questions?

MR. OMAR: Reuben Omar, Mitsubishi Electric. I had a question regarding open loop systems and wanted to know a little more what are the challenges for those, since they seem to have at least a high potential for reducing the initial cost.

MS. MELINE: Well, the challenge with open loops in California is that typically you would get a well permit from the county. And you have to do something with that water, you have to discharge it, you have to put it back into the aquifer. Somehow you need to manage the discharge. And that’s a separate permit through the Regional Water Quality Control Agencies across the State, I believe there are nine total.

So, first of all, you have the issue of water and where are you going to put that water after you’ve used it and, second of all, the permitting is a challenge.

Now, I have done a couple of these projects. Typically, they have been around for a long time so they’ve been grandfathered and allowed, but they’re highly unusual, really, as a ground application, groundwater application here.

MR. LOYER: The question was have you looked at landscaping for possible use of that water?

MS. MELINE: Again, I actually just had a project permitted here in Sacramento, it was on the River Road, and it was allowed because the owner of this home was going to discharge that water into his landscaping. So, you can do it, but you have to go through the permit process and it’s up to that Regional Board to tell you whether or not they’re going to allow you to discharge that water and how to do it.

MR. KAVANAUGH: One of the things that you do with ground source heat pumps is you look at your site, okay. And I’m supposed to be the person who’s like the expert in closed loop systems, but my lab is heated and cooled with an open loop system. It was, at this particular site, a much, much better option.

The issues are, and part of your looking at the perspective is the local regulatory environment, which this happens to be one of the strictest that limits that, that’s really -- but from a technological stand point, the issue is that with a groundwater system the costs are significantly lower the larger the building gets, just the return on it.

The other issues that a lot of the times engineers don’t understand is they pump too much water out of the ground, okay. Typically, when we’re circulating through the interior of the building we want to see two and a half to three GPM per ton on the inside of the building.

Whereas with groundwater, if it’s way down deep and you’re trying to pump three GPM per ton your efficiency goes to pot, okay.

So, we like to see the groundwater isolated from the building water loop with a plate heat exchanger of some kind.

And at my particular application, where my lab is, it was really easy to do this, very hard to install a closed loop system.

So, you’ve got to look at what’s around you. But as far as groundwater systems, a little bit more maintenance, but not anything significant compared to closed loop systems.

MR. LOYER: Are there any more questions from the audience?

Okay, I don’t see any hands raised on line here, but there is one call-in user and I’m just going to de-mute them very quickly here.

Hello, your label is Call-In User 5. Do you have any questions or are you online?

Okay, well, that sometimes happens.

Anyway, I think at this point, if there are no further questions, we'll seat the first panel. Unless, what do you think, should we break for lunch early?

Okay. All right, well, then if there aren't any more questions, we can break for lunch.

Oh, I do -- I forgot, I do have one question from our Commissioner. And it's Commissioner McAllister. And, basically, he said, "What are the operating conditions and characteristics for both the site and building loads where ground source heat pumps is most appropriate?"

And I think we've answered that question very effectively with these presentations.

But I think the second part is, "Where in California do those conditions -- are they most prevalent?"

And I think one of the things that comes to my mind is when we talk about both the heating and cooling load requirements. And when we look at California, most of California is a cooling load. The Central Valley -- the Central Valleys are both heating and cooling. Our mountain regions are both really primarily heating, but both heating and cooling.

But when we look on our coastal systems, if we look in, say, the San Francisco Bay Area, particularly on the coast, we're primarily a heating dominated area there.

So, I think what the Commissioner would like to know is are there -- it's not really where is it applicable, but where is it really not applicable in California?

MS. MELINE: Well, you know, my first obvious response to that is areas where you don't have favorable ground condition and that's going to be, you know, like Calistoga, where you've got geothermal hot water below. You know, you just don't have the favorable ground temperature that you would, say, in the Sacramento Valley. So, that's kind of -- in most cases that's the only deterrent I would see as far as where you wouldn't do it.

Now, there are situations where it typically is more favorable, like locations where you look at the energy costs. So, places where your only options are all electrical power, all electricity, or electricity and propane, because propane and other alternative gas type fuels are much more expensive than natural gas. Right now, natural gas is very cheap.

So, when you have situations where you have natural gas and you have a lot of heating, it's a little bit more challenging to show significant savings, like you would see on the air conditioning side where you have -- you know, I can almost tell you, without doing an analysis, you're going to see at least a 30, 35 percent savings.

So, again, like Steve said, you have to look at the site, and the building, and how it's used, and the cost of energy, and there's a lot of things that factor into whether or not it makes sense. Because, really, it can work anywhere, just how well and how cost effective.

MR. KAVANAUGH: One of the other things she mentioned, the building, and you'll notice that most of the -- a large percentage of the sites we've monitored were schools, okay.

So, another thing that affects, in the commercial sector, the applicability is the building, itself. A school, in a cooling-dominated climate, often is not going to be used for 10, 12 weeks in the summer, so the load goes down.

But more importantly, if California's anything like Alabama, you know, if we can draw any comparisons between those two states, is that schools can be built. There seems to always be funding for building schools, okay. But there's not much in the way of operating schools. Those budgets are getting cut.

One of the things that we saw in our survey, that the HVAC technicians, they average about five schools per HVAC technician. That's humongous, one technician for every five or six schools, okay. So you don't have the budget to maintain and operate the schools, but you have the budget to do it.

So, what you do is you do a simple closed loop system, without a lot of these controls, or these fancy heat pumps or anything, just a simple system that can be maintained by one guy covering five schools.

MR. LOYER: Here you go.

MR. HENRY: Yeah, nice to have a microphone in my hand. To the Commissioner's question, there's two pieces of this from my perspective. One is where does the technology work, right, and I think we should figure out how to put to bed that that's not a fundamental issue. It works, essentially, pole to pole, with very few exceptions.

What the other side of the question is, is the economics. That's a budgetary issue. And only the project owner and the design team can really make that determination, you know.

It's somewhat akin to the old Pennzoil commercial. If you're doing heating and cooling, you know, you're paying for a maybe more expensive technology every month that you write out a check for the utility bill.

So, what it comes down to is how do you get the benefits that you need with certain budgetary restrictions. And fortunately, in California now, I think we're moving to an era where, as a society, we're starting to put dollars into making those investments that will serve us over the long term.

And there is actually a -- I'm not sure where it is in the approval process, but there's a PIER Program study, it's being done by the California Geothermal Energy Collaborative, right. I forget the title of it but, yeah, the preliminary -- it's a CEC-sponsored project.

The preliminary results suggest that when looking at just a model residence in all 16 climate zones, with the closed loop ground heat exchanger, the average savings was 44 point some percent. And there was some place where the savings kind of fell off the bottom of the curve, and that was in climate zone 16, I believe, and that was due to the high ground temp so --

MR. LOYER: Thank you.

Are there any more questions from -- yeah, please.

MS. GOLDBERG: Hi, Sandy Goldberg. I just wanted to make a comment on that issue. There are many counties, you'd be surprised, in California, where they do not have deliveries of natural gas, there's no infrastructure. Like Plumas, Sierra, Lassen, Shasta might be really excellent locations for ground source heat pump for heating, even if they -- well, they probably have cooling loads in the summer but, I mean, even if a school doesn't really need it for cooling.

MR. LOYER: I might just mention that we have year-round schools here in California. And I might also point out that just recently we've actually gone through -- in the Central Valley we've gone through some school closures that were fairly painful, and here in Sacramento, so, a few of us here that live here are aware of that one.

Are there any other questions or comments?

All right, with that let me just check online real quick. And I don't see any hands raised online.

Then we can, I think, break for lunch. I think it was a great session. And we can come back at 1:00 p.m. Thank you very much.

(Off the record at 11:35 a.m.)

(Resume at 1:00 p.m.)

MR. LOYER: Okay, we're coming back now. And we're going to start Session 2 here, and we're doing quite well on time.

So, I’m going to turn this over to Paul Bony, who is the Director of Residential Marketing, Development, and Western Regional Sales for ClimateMaster. Thank you, Paul.

MR. BONY: Thank you. And I’m going to talk about one of my favorite topics which, because it’s been the evolution of my utility curve before I went to work for a manufacturer, as we do more and more renewables, and more and more on efficiency that’s really driving us to net zero buildings which, of course, is a statutory requirement in California.

So, my topic today was “Geothermal Heat Pumps Systems Potential for California Net Zero Buildings,” which I thought was kind of boring.

So I changed that a little bit for you all today and I’m calling it, “Geothermal Heat Pumps a Key Ingredient in a Net Zero - Low Carbon Diet” because I had the low-carb diet at lunch today with -- so it would fit.

And we’re kind of here in the Gold Rush country, so I love Mark Twain’s quote on diet, “Part of the secret of success in life is to eat what you like and let the food fight it out inside.”

And I’m convinced that if we bring ground source heat pumps, energy efficiency, and on-site renewable generation together the food doesn’t even have to fight, it’s just going to work. So, that’s what we’re going to talk about for a few minutes today.

So, California’s at the cusp of this really exciting building, this kind of bringing together of building science, renewable energy, and ground source heat pumps where the efficient envelope, the super-efficient ground source heat pump equipment, and we’ll talk about that in a little more detail, and renewable energy systems are almost what we need in that diet to get to net zero.

But there are some other things that are going on in the space that will make that happen. One of which is these -- some financing tools I’m going to talk about, and then we’ll talk a little bit later today by how those can actually be brought to the table by utility companies.

And then some policy issues that if we just put that last ingredient in there we can really bake a net zero cake that really works for the State, and get to this point where buildings truly to produce enough energy on site -- as much energy on site as they consume.

So, quick definition, and I know there’s another workshop coming up in a month from now, but zero energy buildings use no more energy over the course of a year than they produce from on-site renewable sources.

And obvious to that is the fact that it’s really tough to produce natural gas, oil, and propane on site. So, you have to address the thermal loads of buildings to get to true zero energy.

And I’m convinced, and I’ve been doing this for 20 some years now, that we do have all the ingredients we need to get to zero energy buildings without a whole bunch of whiz-bang, incremental stuff for many common building types.

And the New Building Institute, about this time last year, did a study that say they agree with me, so I was happy to see that we’re on the same wave length there. That was a bit of post-lunch humor there, for those of you who are --

So, really, we’re coming to this point where ground source heat pumps and on-site generation like solar photovoltaic really are kind of peanut butter and chocolate together. They really do come together in a nice way.

The paybacks from ground source heat pumps actually help offset the cost of solar systems and you can -- you really can, by taking the thermal loads of a building offline with ground source heat pumps. Now, you have a footprint that's small enough that you can produce that net energy on site. And then the thermal loads are the piece that needs to be addressed.

And so that there is a limit to PV or on-site electric generation so -- so another study, if every home had PV, it still wouldn't be enough to get to net zero, because the PV doesn't address the single biggest use in the house, which is space heating, space cooling, and water heating.

So, now, you put ground source heat pumps on that so that heating, ventilating and air conditioning system gets its thermal energy from the ground, the PV generates the electricity.

And the other thing that ground source heat pumps do, because they're a water-based system, is they allow the ability to store and harvest thermal energy when you need it. So, you can actually move the thermal energy. You may have excess thermal energy and you can move it to another time of the day when you do need it.

So, that water storage and that ability to store and move BTUs is critical. And that becomes the perfect mix for net zero or near zero buildings.

So, how does that work? Well, you've heard earlier today if a ground source heat pump takes 50 percent of the total load of the building offline, obviously, you’re that much closer to getting to net zero.

And then, if you can use the grid as a battery that helps you move those peaks back and forth. And the most important thing is that you can offset the natural gas, or propane, or fuel oil, or other thermal loads.

We’re at this cusp where PV and solar thermal are coming together, and I’ll talk just a little bit about that. So, now, you’re actually -- you can use that rooftop space to not only make electricity, but to make thermal energy. So, in heating-dominated climates now you’ve got the best of everything. You’ve got renewable thermal energy combined with a ground source heat pump, combined with using the ground as a storage center, combined with on-site electric generation.

And this is just a picture of one of the net zero houses that’s out there that actually incorporates that.

So, you can’t get to net zero without a ground source heat pump. You can’t get there cost effectively. And we can talk a little bit -- you saw some of the data on SEER and EER, which is another one of my favorite topics.

You can’t have a real high needle peak on the summer and have enough PV to offset it.

But if you have a ground source heat pump with a high EER, that needle peak goes away.

And so, air source equipment, other compressor-driven technologies that aren't water based just don't have the cost-to-benefit ratio to match the on-site generation. And so, you've got to get away from that needle peak and ground source heat pumps by using the constant temperature of the earth to do that.

And you can't store energy in the air and get it back. However, you can store excess energy in the ground loop and take it back out later in the season, later in the evening, later in the day.

So, the loop, the water, the earth all come together to make this thermal battery that gets rid of those needle peaks and it really lets you manage your thermal loads better.

So, you know, when we talk about net zero it's important to realize that even if renewable energy supplied 80 percent of all of our electric generation in the country, it wouldn't be enough to meet the carbon goals that we've established because you have to address the thermal loads, okay.

And so, simple chart on that, and this chart's been around forever. Thermal loads, heating, cooling and hot water are about 20 percent of our society's carbon emissions and they're about 17 percent of the total -- you can see the primary energy consumptions there.

And one of the flyers I noticed that you have today shows how much natural gas is used for heating and water heating in California. And you can't get to net zero if you're using natural gas to generate those sources.

So, you put a ground source heat pump on a building and you can see that this is a national average here. the heating, and air conditioning, and water heating shrink from over 60 percent of the building's load to you take 49, 50 percent of those loads offline.

So, now, you're renewable on-site generation just has to address what's left. And I'm convinced that if we combine that with solar thermal, then that hot water use of six percent of what's left can go away, the remaining heating can go away because you've supplemented it with solar thermal. And, really, what you're left with is a little bit of electricity for the air conditioning and then your lighting, and appliances.

And then, so that kind of gets to these policy issues that need to change a little bit. So, we have to get our head around the fact that we're moving away from high-carbon generation sources, burning high-carbon fuels to make electricity.

We really need to wrap our heads around why would we use high-carbon sources to heat our buildings and heat our hot water when you can have -- if we have carbon-free electricity, we can have carbon-free space conditioning and we can have carbon-free water heating.

And so that's the last big policy gap to get to no carbon in our society.

I'm from Colorado, so I have -- I'm pretty confident with my math in Colorado, haven't done this for California, although it certainly would be an easy thing to do.

I want to share with you that if we took an average home in Colorado and we quit burning gas in the furnace to make heating, we would actually be able to use that gas in a high-efficiency turbine and end up with more kilowatt hours for the same amount of gas than the house would use with a ground source heat pump to 100 percent of the space conditioning.

So, let me stop there for a second. In heating-dominated climates, a ground source heat pump will cut summer kilowatt hour usages, it will cut summer peak demand usage by a lot, but it will use more kilowatt hours over the course of the year.

However, the gas that you would burn to make that space heating in Colorado, if you ran that through an efficient gas turbine, a combined cycle turbine, you would actually end up with more kilowatt hours from using the gas in the turbine than you do by making space heating in the house, okay.

So, it really leverages the use of that fossil fuel for generation instead of basically burning it and putting it up the chimney.

And then, this is my SEER/EER slide. Basically, it addresses that utility needle peak issue. When it’s 105 degrees in Sacramento, those high SEER units are delivering low EER performance.

And the ground source heat pump also decays a little bit because the water -- the entering water temperature is a little higher later in the season, but the order of magnitude is not near as great.

So, if you don’t want utility needle peaks, you have to use water source equipment, and SEER programs are not going to get you to eliminating those peaks.

If you want to have on-site generation, do you want to pay for a PV system that meets the hottest three days of the year, at an EER of 8 or 9, or do you want to base it on a ground source heat pump system that has an EER of 12, 13, 14. So, it’s really that -- that’s how ground source heat pumps eliminate and leverage those needle peaks that come from air source equipment.

So, Xiaobing Liu was going to be here today, and Phil's going to fill in for him. But Oakridge did a really nice study in 2010, on a national basis, and ground source heat pumps and when they look at it across the country reduced total energy consumption for heating, cooling, and domestic hot water by 45 percent, reduced peak energy demand by 56 percent, reduced consumer bills by 48 percent, and then reduced carbon emissions by 45 percent.

California's going to be a little different than the national average, but there's also multiple climate zones in California. So, Northern California and the Sierras, where I used to live, are going to be different than San Diego.

But at the end of the day, ground source heat pumps take about 50 percent of peak, 50 percent of total energy and save customers' bills by about 50 percent.

So, this is that nexus I was talking about. This is a Colorado-based company. The equipment on the right there is actually a solar PV/solar thermal piece of equipment.

So, that little array, four heads that you see there, so 16 panels, is a 10 KW thermal equivalent system, 4 KW of electric generation, 6 KW of thermal generation. And it takes up that much space. It's about a 10 by 10 array.

That is a single house worth of solar thermal and annual kilowatt hour production. So, that takes that last little bit of hot water offline, reduces that space heating in northern climates.

So, we're there. There are several companies in the states that are to the point where they're making electricity and solar thermal with the same equipment, so you pay for it once and you get both benefits.

And then this goes to the storage. It's not to scale. The loop field's on the far left. But, basically, water's a very cheap medium to store energy. So, if the wind's blowing at three o'clock in the morning, you can pre-chill water and store it in the tank to take it off in the afternoon, when the wind quit blowing and the renewable generation's coming offline.

But for every degree of reduction in entering water temperature in air conditionings you pick up about a percent of efficiency on space cooling.

Also, you can do that seasonally. The University of Colorado just received a couple million dollar grant from the National Science Foundation to start building the algorithms to use ground loops as the thermal storage medium for renewable energy.

Now, if you've paid for your loop, it's an embedded cost, why not pre-heat it, pre-cool it so that you can get greater efficiency when you need it later in the day or later in the season.

The Europeans do a lot of that. They actually have buildings with two loop fields. They have a loop that in the summer they're basically storing heat in it so that they can take it out in the winter. In the winter, they have another loop field that they're making colder so they can use that even colder loop water for air conditioning in the summer.

So, you're paying for your infrastructure once, you're using it twice.

And as the grid becomes -- has less and less carbon in it, so as we have more and more renewable energy, more lower-carbon sources for generation when we do space conditioning and water heating with low-carbon electricity, which is what ground source heat pumps use electricity to run, basically, that drives us to true net zero as a system.

Ground source heat pumps are scalable. These are Habitat for Humanity homes in Oklahoma City, little 1,300 square foot homes.

The solar panels on these houses were about half the size that they needed to be true net zero, but here are the results of those houses.

And, by the way, it incorporates everything that I think you need to get to net zero; super-efficient building envelopes, ground source heat pumps, and then some of the houses Habitat put PV on the roof.

The loops for these houses are actually under the furnace, one loop per house, directly below the ground source heat pump.

So, look at the energy savings as you follow down to the right is basically the houses they were building before, which was a standard air conditioner and gas furnace. Then they did shell improvements, and they put in a ground source heat pump, and ten they put a little PV on the roof.

So, if you can see, the PV in this case is generating 11 units of energy and the net is still 19. Now, combine solar thermal with that, so the water heating comes offline, and you can see each of those individually, so that’s six or seven units that would come off if you made solar thermal while you’re making solar electric. Those are almost net zero homes and they’re cost-effective, Habitat for Humanity, little houses in Oklahoma.

So, the takeaways on this kind of -- this little session are ground source heat pumps are the most efficient and cost-effective method to heat and cool a building, period.

They are renewable and they’re energy efficient. They can lever on-site solar and wind generation to a true net zero. They reduce utility peaks and improve factor. And in the next section I talk about, we’ll talk about how that’s important to utilities. And properly designed and installed they just -- they work.

So, I’m going to call this the intermission because I’m coming back after the next speaker, so thank you.

MR. LOYER: Thank you, Paul.

Let’s see, next is Marc Hoeschele. Mark, I’m not sure which one of these is yours so -- this one? And you can step back here and run it from here.

MR. HOESCHELE: Thanks, Paul. That was a good presentation and kind of provides an overview.

My presentation is a little more California-focused, which is, you know, appropriate for today’s session.

MR. LOYER: Marc, I kind of neglected to tell folks who you were and where you’re from. Sorry about that.

MR. HOESCHELE: Okay, yeah. So, I’m with the

Davis Energy Group and we're a small consulting firm in Davis that's been around for about 30 plus years, that does a lot of energy efficiency work. Have done product development work, a lot of utility work. The Department of Energy Building America Program is another key part of our current work. And have been active in geothermal, although not that much lately.

The work today I'm going to talk about is a 2010 study that we did for Pacific Gas & Electric that looked at geothermal technology as part of a zero net energy residential strategy.

So, to give a little background on Davis Energy Group and what we've done in the geothermal area, in the late '90s there were two Energy Commission projects that we worked on that did a lot of monitoring and modeling using DOE-2 on geothermal homes in the SMUD and Truckee Donner service areas.

And the monitoring, we did very detailed monitoring on system performance, both on the air side, the delivery side, and the water side of the systems. We used that data to calibrate ground loop models to be used in DOE-2.

And the second study was interesting, too, in that we dealt with some of the installations in both service territories that had issues and there was some remediation work done partway through the project so we could assess pre- and post-impacts of improvements at these sites.

We also, in the late ‘90s, did a large project for PG&E that had a wide range of activities. The Geothermal Demonstration Program which, you know, pulled together, again, a wide spectrum of research areas, and more field monitoring work, case studies, primarily residential, but also on commercial products, looked at loop optimization, and modeling, and so forth, and developed Title 24 recommendations. So, that was a pretty broad effort.

Over the years, we’re much less involved in design work, now, but we have done a few design projects, mainly residential, and currently working on a demonstration home that is going to be built on the West Village Campus -- or the University of California, Davis campus, and West Village is a zero net energy community, for those of you who aren’t familiar. It will house about 3,000 people when it’s complete. And so they’re about halfway through with construction there.

So, the main focus today is on this PG&E study from 2010.

So, in this work, when PG&E was starting a more detailed, technical look at ZNE technologies, we were hired to look at a few of the individual technologies that could be a component of a zero net energy home.

The original plans was to look at 25 various technologies, see how they fit, you know, as a component in terms of energy savings, source energy savings, customer economics.

The three we looked at were geothermal heat pumps, heat pump water heaters for domestic hot water and evaporative condensers, you know, that are more efficient cooling systems that have some traction out there.

The scope of the work included modeling the performance of these various system types, assessing the energy and demand impacts versus base cases. In this case we looked at both gas, furnace and heat pump as base cases, and evaluating the source energy impacts of these different options and, also, looking at customer economics under the current PG&E residential rates at that time.

And all of this was, you know, not taking into account any incentives in Federal tax credits because PG&E was looking at this as a longer-term piece and, you know, as the marketplace and the environment changes those incentives may or may not be there.

So, the methodology of the project, we did a literature review, collected performance data on equipment, get pricing data from people operating in the field, selected a modeling tool to be used in the evaluation, which was the eQUEST model, which uses DOE-2.2 as the engine, developing simulation inputs to drive the model and baseline energy consumption that are, you know, critical in getting the billing -- the billing information right with the tiered PG&E rates we're dealing with.

So, we worked with the Residential Plan Saturation Survey Data that the Energy Commission is involved in producing every few years.

And then, also, Department of Energy has a Building America Benchmark protocol which, again, kind of also provided a lot of background information on building up, you know, these lighting, miscellaneous appliance loads that are a big part of energy bills in California.

We looked at three PG&E climates, the Bay Area, San Jose, and Fresno. And the rest of my study is going to focus on San Jose and Fresno. I mean, the Bay Area, basically we're just dealing with heating down there and just to keep things simpler, I'm focusing on those two.

And then we looked at three home types. An existing building, early '90s vintage house, a Title 24 new home, and a Tier 2 new home and that's under the New Solar Homes Program, and that's roughly 30 percent better than Title 24 at the time.

So, the input assumptions, as we modeling these homes, single story, roughly 1,800 square foot home, consistent with the saturation -- the Residential Plan Saturation Survey for average home size in California, single-family home.

Uniformly distributed glazing on the house and then the three home types we talked about.

And then with each of those vintages of homes we have varying envelope characteristics in terms of windows, insulation levels, equipment efficiencies, and so forth.

For furnace efficiencies, 80 percent AFUE standard for a new entry-level furnace, and then for the Tier 2 we also looked at high-performance condensing furnaces.

And heat pumps air source, Federal minimums for the base case and then a higher efficiency for the Tier 2 case for the air source heat pump.

And then GHP, COP and EER assumptions as listed, and those values don't include the fan or pump energy.

So, you know, pulling back from Paul's information, kind of on a national basis, I mean

California has a, you know, slightly different energy picture, and especially as we're moving forward to ZNE, and just more efficient buildings as Title 24 enhancements are seen in the marketplace.

We see a much lower -- these are modeling breakdowns, then, from our modeled HVAC performance and then, you know, building up all the other loads from the various inputs.

In climate zone 4, which is the San Jose area, we're looking at heating and cooling, slightly under 30 percent of the total source energy budget of the house.

In the Fresno area, climate zone 13, it's 36 percent.

You know, the work we've been doing in zero net energy and high-performance buildings, I mean, increasingly the appliance and miscellaneous piece and lighting are the bigger pieces that are going to be challenging to address. So, you know, those are certainly key factors to look at.

The completion of the modeling, this graph, then, on the space conditioning source energy savings on the Y axis and then on the X axis we have the two climate regions. On the left San Jose, right Fresno, and then the three building types so, the Title 24 existing and the Tier 2 home.

The blue bars represent the source energy savings for the geothermal system relative to the gas furnace-based case, and the red bars to the heat pump-based case.

And as we go from the Title 4 and existing to the Tier 2, we do have an increased efficiency of the base-case system that is assumed, so we see slightly reduced impacts there.

For the gas furnace cases we’re looking at roughly 30 to slightly over 40 percent source energy savings. For the heat pump cases, a little bit higher, 35 to 45.

The one slight flip flop here on the Tier 2 Fresno, the heat pump, the nature of the load patterns with the Tier 2 home causes the heat pump case projected to be slightly -- the source energy impact to be slightly smaller than the gas furnace case.

So, now, we get into some of the challenging things we find in California. And, you know, the primary barrier or what makes California unique is across the country on residential, retail rates, the relative ratio of those rates in California are -- you know, the electric, the gas ratio is among the highest in the country. So, that’s clearly a burden for the customer the way the rates are.

Low natural gas rates, which we're going to have for some period of time. How long, we're not sure.

But, so the impacts of that are reflected here on the left-hand side when we're showing the annual projected PG&E utility bill savings for the geothermal system, for the different housing types, and climate zones.

So, these are -- these rates are calculated using the tiered electric rates that PG&E has and, you know, utilizing the monthly energy used, both gas and electric that came out of the model.

So, we see in climate zone 4, in San Jose, the geothermal on the Title 24 and existing will actually cost slightly more to operate, and in Tier 2 a small credit but, essentially, no cost savings there.

Versus a heat pump, the savings are definitely more favorable. Tier 2 they're diminished because the space conditioning loads are reduced and the impact of the tiers.

Climate zone 13, in Fresno, where we have much higher cooling loads than in the San Jose area, the benefit of the cooling reduction is more apparent there as we see savings going -- for the existing and Title 24 going from two to eight hundred dollars.

On the right are the incremental GHP cost assumptions, again, no Federal tax credit or any other incentive shown in this, so that’s relative to the base case for that situation.

The lower end of the range would be the Tier 2 home incremental costs as the systems are smaller, and the high end are for the existing home cases, where the system is larger, and the ground loop.

So, conclusions from this study, for the climate zones we looked at, the three, heating and cooling is roughly about 30 percent of household source energy consumption for the buildings as modeled.

In terms of the performance side of things, we’re looking at, you know, reductions. The next three bullets are kind of looking at the different base case systems; we’re looking at reductions of 30 to 45 percent.

Source energy in heating and cooling, with corresponding whole-house source energy reductions of 7 to 12 percent and, you know, that’s diluted somewhat by the fact that the other end uses are a significant part of the energy bills in California homes.

Summer demand savings, 27 to 39 percent, higher -- higher demand savings for the new and existing homes that have higher peak demands than the Tier 2 homes.

And higher cooling loads clearly improve geothermal economics because then we’re not burdened by the relative, the natural gas to electric cost situation that we have in California or in PG&E specifically.

So, those favorable energy projections are kind of dampened by, you know, the situation that costs are high in California and savings are not that optimistic in many scenarios, so the economics are not good.

Now, clearly, there are -- you know, we were dealing with, you know, representing average consumption patterns, kind of a mid-point. And there are, certainly, you know, higher users in certain situations and then when you get to the electric heater or propane customers which wasn’t part of this study, there’s an entirely different set of conclusions.

But looking at the vast bulk of, you know, PG&E customers, these were the findings.

The tiered electric rates are clearly a problem. As -- you know, as we do want more load for the system to work against because from the load we get savings. As buildings get more and more efficient and they’re small, there isn’t much energy and costs to be saved.

The study also looked at PV, the relative -- you know, since the overall charter was how does a particular technology fit into the zero net energy picture, where PV is kind of a benchmark. And at that time we were assuming a $6.80 per watt cost for PV, which has come down considerably since then.

But even then, PV was more cost effective than GHP at that price point.

So, key barriers, kind of covered these. Again, the ratio of electric to gas in California is something that is a problem. Alternative rate structures that, you know, promote all-electric, efficient all-electric technologies like GHP can certainly improve that.

The low space conditioning loads, as we're looking forward, is going to be a challenge for your average-sized home, as space heating and cooling loads diminish due to other efficiency improvements.

And then, finally, the key driver on the -- or a key driver on the system costs are the high loop costs that we see in California for, you know, a variety of reasons. But, you know, those -- for the market to be successful, you know, those costs need to come down, increased volume clearly helps.

Alternative loop approaches to get ground loops in cheaper and, you know, community -- community-scale approaches where you can do a lot of infrastructure work early that will greatly reduce those costs and we'll all benefit from the technology and the overall economics.

And that is it.

MR. LOYER: And we'll be taking questions at the end of all of the presentations, so don't go any place, yet.

Next, Phil Henry is going to make a presentation of some of Dr. Xiaobing Liu's work, from the Oakridge National Laboratory.

And come up to the microphone.

MR. HENRY: So, Dr. Liu planned to attend and make this presentation. It would have been my preference if he was making it. He's the author and he would certainly have done a much better job than I'm about to do.

He, unfortunately, had some unexpected work project come up and so he just couldn't make it.

He did ask me to convey his interest in working with California's effort to bring GHPs into the mix, more so than what they are now.

I know there's been some outreach between the Energy Commission and Dr. Liu over the last several weeks, so I think there will be some good things to come in the future.

This -- let me just dig into it. We're going to go back out to the national level. You know, Paul -- Paul had some kind of a national perspective a little bit, a Colorado perspective. Marc was able to bring us back into some California-specific data.

And if we had the studies and the body of work to just present California data, that's all we'd be talking about today. Unfortunately, we don't.

There is some other work that's going on out there, that is making its way through the Energy Commission.

The California Geothermal Energy Collaborative did a study of kind of a California version of what Xiaobing has done, but not near as rigorous.

But it looked at the impact of installing GHPs across all 16 climate zones.

And like what Dr. Liu came up with from a national perspective, the results suggest that -- beg the question of why aren't we installing more?

And so, let's just move on here. I'm going to go right to -- right to -- there's been a lot of discussion today about, you know, what makes a ground source heat pump, and so rather than duplicate them, basically, just some key points.

The ground source heat pumps, geothermal heat pumps use renewable energy, they're highly efficiency, you can lessen the needle peaks, as Paul referred to, you can lessen the summer peak load and improve utilities' load factor.

And if we were installing more systems, we could put more people to work right here in California, and doing work that can't be imported. It has to be done on site.

In terms of the -- in terms of the scope, there are -- you can read the slide with me, but there are 86 million single-family homes, according to the 2008 census. On average, 73 percent of the energy consumed in our built residential market is for space conditioning and water heating.

It is by far the lowest hanging fruit we have to work on.

In terms of what the -- what the market has done, if you look at this chart you'll see -- you'll see it has a nice -- a nice sloping curve in terms of the number of shipments nationally. It looks like we're getting great progress, things are going forward.

And then the recession starts kicking in and now we have this drop.

And I think as the -- with the Federal tax credits staying in place, the economy improves, and the interest in effective solutions, zinging these solutions I think you'll see this curve go back to sloping up quite nicely very quickly.

In terms of size of the market, less than one percent of the single-family homes have ground source heat pumps in them. It's going to be a number way less than one percent when you look at the actual number, I believe.

There are a number of reasons that the Oak Ridge wanted to take this on, that Xiaobing wanted to take this on, and it was a lot about public awareness. You know, you can deploy -- you can deploy geothermals, heat pumps and have significant savings in primary energy usage. It is a good solution for lowering your carbon footprint in a building.

And, once again, you can lower that summer peak which is a big issue, a huge issue for the utilities in California. It's a huge issue for us, as you know.

And then don't forget, the ratepayer, the consumer can yield some financial benefit.

Additionally, and this doesn't get talked a lot about very much is there's a pretty good pent-up demand in the investment community, looking for sound ways to invest in what you might call green technology, clean technology.

And what's missing from -- the missing piece, I believe, in terms of why the venture capital money, the big investment money is not moving aggressively into this technology is we don’t have a sufficient -- we’re not giving them enough information. They like the technology, they want to get involved with it, but we can’t successfully demonstrate the financial case in a big picture. And this is one of the things that Xiaobing wanted to begin to address from a national perspective.

And then the last item is to help the DOE moving further along the process of developing a roadmap for geothermal heat pumps, and that’s been a very long-term project.

I’m going to skip a lot of the methodology. I’ll point you to Xiaobing’s study -- I’m sorry?

MR. LOYER: If I could just break in real quick. Xiaobing’s study is available on our website, as well as, all the presentations that we’re giving today, and a lot of other information, a lot of other studies that are centric around these issues. So, I just wanted to let everybody knew that they could get to this study very easily. So, sorry.

MR. HENRY: No, thank you. That’s a good point.

Similar to what Davis Energy did with the work that Marc just spoke to, Xiaobing used what -- you know, kind of what’s out there, what does the built environment exist of in terms of hot water, heating systems, air conditioning systems, and heating systems from a national perspective.

So, we're actually -- we're speaking to what's installed in the homes around the country.

And these next three slides are pretty interesting. On the Y axis you'll see a scale in quad Btus. And then I don't know if you can make out the colors, but where Xiaobing's mapping electric heat pump usage, electric heater, natural gas furnace, propane, propane furnace and then fuel oil furnace.

And then those four vertical bars are looking at the country in four quadrants, Northeast, Midwest, South and West.

And it makes sense that you'd see some higher heating demands in the Midwest and lower out West. That makes sense.

And then you go to the cooling side and you'll see that in reverse. In the South and West, particularly the South is quite high.

And then what's really interesting is when you go to look at the energy consumption for water heating that's pretty -- that gets levelized no matter where you are in the country because the amount of hot water you need is not a function of how cold it is, unless you're using it for heating. But for domestic uses, you know, you could be in New York, you can be in Hawaii, you can be in Maine and take the similar number of showers, similar number of dishes, similar number of occupants in the house, so it’s quite level.

And the amount of energy used is quite large, depending on which data you look at.

So, it’s an opportunity on a global perspective for getting some low-hanging fruit is what I would try to say, and it’s -- we tend to get hung up on space heating, space conditioning, ventilation, that sort of stuff and oftentimes forget about domestic hot water production. I’m suggesting we shouldn’t overlook it.

Xiaobing gets into describing a ground source heat pump system. We’ve had sufficient talk of that today. You won’t see anything different on this slide than what was presented earlier by Lisa Meline and Dr. Kavanaugh.

Now, looking, this slide speaks to -- you know, at the lower right, the ground water temperatures across the U.S. It’s fairly -- there’s a relatively small range. When you look at the climate zones, you know, there’s only a handful of them.

And then in the top left you have, as opposed to California 16. And then in the top left you have the U.S. Census regions and divisions.

The reason all three of these are here is Dr. Liu had to have data from all three of these sources to put this study together and this -- so, he’s speaking to where they came from.

Let me skip through. You’ll pardon me, I haven’t had enough time with Xiaobing’s -- this -- Xiaobing, with this slide, what he’s getting to here is the -- there’s the trend in -- the trend of energy consumption nationally. It’s not down. Even with increased existing energy efficiency measures it’s still a trend upwards. Right, it’s continuing to go upwards. And unless we do something different, it’s going to continue to go upwards at a similar rate.

If this was -- Xiaobing did this in 2002 and so from 2002 to, roughly, 2030, if we don’t do anything different we will add 2.2 quad Btu to our energy consumption, right.

If we deploy GHP systems in 100 percent of the single-family residences in this country, we will reduce the energy consumed in the same homes, from a national perspective, 4.2 quad Btu, which is a pretty large number, I think you would agree.

Now, I’ve said a hundred percent penetration rate. This slide speaks to various 20 percent -- various penetration rates of the technology from 20 to

100, and then looks at energy savings, CO_2 emission reduction, summer peak demand reduction, which is one of my favorite subjects, and then the dollars and cents piece, what’s the ratepayer is saving.

And so, and you can look at the slide, yourself. But even at a 20-percent reduction, so going from the current one percent penetration to a 20 percent penetration we’ll see nine percent -- we’ll see nine percent of that 4.2 quad Btu, right.

In terms of CO_2, we’ll see approaching a 10 percent reduction. And then another, better than 10 percent on summer peak demand and the consumer will have 10 percent -- will have a 10 percent savings on what they write the utility check for each month, which is also one of my favorite subjects.

And now with this -- now, if you want to see how -- we’ve talked about the national to California. We’re going back to California, you know, how do we compare around the country. Let’s take the big picture, how do we compare with the rest of the civilized world, right?

And so you’ll see two -- we have two curves plotted here. One is looking at the penetration of the technology in the new housing segment, and then the one to the right is the penetration into the built environment, either through retrofit or remodeling.

And you see a similar curve, and you see the same countries leading, Sweden, Switzerland, Finland, Austria. Certainly, Sweden is clearly the leader in terms of deployment.

And then I don’t know if you can see it on the screen there, but there’s two little red arrows down at the very bottom, almost at the X axis. In other words, just like barely above zero, that’s where the USA is.

You know, it would be an interesting conversation to have about why that is.

So, bringing it back to California, last year we had the opportunity to work with Environment California on a fact sheet they were putting together for geothermal heat pumps, and they reached out to our group for some help.

We were interested in, basically, and Xiaobing and I have talked about this quite a bit is, you know, somehow California-izing his National Retrofit Study to California.

And so, we set about looking at some of the data. And so the question that we wanted to get at is what’s the impact on the Governor’s 12 gigawatt by 2020 Executive Order of deploying geo, and maybe then how does it compare with solar PV. And the broader question is what happens if we do both, sort of thing.

And so, the assumptions that Xiaobing made was a solar energy system output in a day is equivalent to five full load hours, five hours per day. I won't go through and list all of these but he's taken published data from the solar PV industry, right, as he's done this work. He's pulled in the pertinent parts of his Retrofit Study, right. And then he has equated the savings component from GHPs as the renewable component, pulled that back into the comparison, which that's where the savings comes from is what's going on in the ground.

And he cut to the chase. If we -- of the 13 million single-family residences in California, if we put geothermal heat pumps in 23 percent of them, we would have -- oops, I thought this was on this slide.

Oh, yeah, we would be at -- thank you, yeah, I just missed my punch line. I'm still thinking about all the cuisine metaphors in Paul's thing, I'm starting to get hungry again, actually.

We would be at the Governor's EO, 23 percent of the homes. You know, that's pretty impressive. Is that attainable? We can discuss that. But the conclusion is geothermal heat pumps can play a role in realizing that specific Executive Order.

How am I doing on time over there? I'm doing good on time, okay.

Putting some numbers and going back to, you know, some key points, the ground source heat pumps reduce the peak demand, and in this study Xiaobing reports, 2.1 KW per unit. Right, that’s a significant number.

The consumer’s bill for space heating reduced by 48 percent and this is on a national perspective.

And in terms of reducing -- in terms of reducing a carbon footprint in California, in terms of meeting AB 32 objectives, 44 percent reduction. You know, pretty significant numbers, I would believe.

But we’re not going to get there unless we deploy these systems. And so, Xiaobing puts forth some action items to do. The third-party owned, geothermal plant, he’s talking about loop financing models. How do you get the most -- first, how do you get the incremental costs dealt with so the consumer, the project owner, the building owners can get the benefits without having to write a big check. Paul’s going to dig into that very aggressively in a few minutes.

The other area is in terms of regulation and in terms of incentives, you know, does our -- do appraisals on real estate accurately reflect the impact of having a geothermal heat pump system in it? Mostly not, in some cases more than others.

And how do we ensure that what's going in the ground, what's going in the -- into the building, the quality of the system is meeting some minimum thresholds, and that's what Lisa and Dr. Kavanaugh spent the morning talking about.

And then we get into -- then we get into some parts and pieces to make the technology happen. Engineers, designers, they need some tools. There's some great design tools, but there's some insufficient hard data verifying that the designs that -- the design methodologies are actually being played out in the field, right, and that's a missing piece.

We could use some more work in terms of are there any -- are there ways that we can lessen the cost to go put that loop in the ground, are there other approaches. We know what definitely works, but there's probably some things we can do moving forward, where we could get some more efficiencies, maybe lower some costs.

And then one of my favorite subjects is the smart operations. You know, I started in this industry a few blocks away from here, in high school, doing system balance, all right, and we were all about making sure, as you know -- the engineers in here, making sure that what was on the piece of paper that got built was actually working the way the engineer intended. Right, and it’s the idea of commissioning, and the post-retro-commissioning. You know, that’s smart operation.

And so, essentially, as you might guess, Dr. Liu concludes that, and I’ll paraphrase in a big way, it would be in everyone’s best interest if we deployed more geothermal heat pumps.

And although Xiaobing isn’t -- Dr. Liu isn’t here, he is interested in taking questions. For those of you who are attending remotely, he will respond to his e-mail. He’s very busy, but he is interested in speaking to this subject matter. And so with that, I think I am done. Thank you.

MR. LOYER: Thanks Phil, appreciate it.

MR. HENRY: Thank Xiaobing.

MR. LOYER: And thank you, Dr. Liu.

And now, we’re going to invite Paul back up and sort of finish this session off, and we have plenty of time, Paul, so stretch it out.

MR. BONY: It’s nice to follow Phil and have time.

All right, how do we get back to where we were? It should be right -- where’s the pointer?

Actually, I want to go to one slide here. I was going to give you a copy of that, too.

It’s a good thing we have time for all this technology. I’ll do this real quick.

Before I get into, you know, post-intermission here, one thing that I really didn’t have a chance to drive home, this is pretty much what California does. The utility peaks, and we’ve talked a little bit about that, the utility does not peak at noon. A lot of people think that’s the perception. It really peaks later in the evening.

This happens to be the Louisville, Kentucky. I have this slide because there were four utilities that I did a workshop for that all came together there on the river. Their peaks are somewhere between 6:00, and 7:00, 8:00 at night.

The chart on the right kind of shows that, really, roof-mounted PV isn’t doing anything at 6:00, 7:00, 8:00 at night, so if you think PVs are going to eliminate utility peaks, they’re going to carve out kilowatt hours when the sun shining, but they’re not going to dig that peak down.

And then if you have SEER-rated equipment, and I’ll go into that in a little bit more detail here in a second, if you’re basing your savings on high SEER equipment that’s really not working when it’s 100 degrees at 6:00, 7:00 at night, you've really just made the electric system worse off. You've built all the plant to maximum capacity at a point in time where high-SEER equipment and PV aren't doing anything for the peaks. I just didn't want to let that go by. That was a refresher real quick there for some of you.

The other thing, too, and this is a paper that just came out, years ago, a little bit of a history lesson, I really got into ground source heat pump. And there are a couple of things that we did here, in California, that were leader -- you know, industry-leading 20 years ago.

Once upon a time there was a ground source heat pump consortium, which was funded by the Department of Energy, and California received two of the like first 12 or 14 grants for ground source heat pumps. And I'll talk about what a lot of utilities across the country are doing with the programs that were developed in California for ground source heat pumps.

But the lady who was on staff then was Catherine Johnson, who's now Dr. Johnson, and she just released a paper called "Geothermal Heat Pumps, the Killer AP for the -- the Utility Killer AP for the 21st Century."

So, Joe, I'm going to give this to you. I could sign it because, you know, I'm right here in person and stuff.

(Laughter)

MR. BONY: And I brought a couple others.

But, basically, it’s a good segue into this. I was asked to speak because I was a utility guy and I got into ground source heat pumps as a utility demand-side planner, when my mission was what can we do to meet these regulatory requirements to have energy efficiency. And it was really before renewable energy came on board.

And my boss said, whatever you do, don’t raise rates. And so, that was kind of an intimidating challenge.

And so, really, the only two technologies that came out to work were lighting, and this was back before, you know, we had Federal laws that eliminated the Edison bulb.

But, basically, lighting that was on, on-peak, was a good opportunity because we could retrofit that on-peak lighting with CFLs at the time, and ground source heat pumps.

So, what I’m going to talk about today on this utility perspective really has been around for a long time, but the arguments have actually gotten better for geothermal.

And I am convinced, and it actually started here in California, the ground loop really, really looks like a utility plant. It has a long lifecycle. You heard earlier from Lisa that it's, you know, 50-year, 55-year warranties. I've got -- if we ever had more time, I can show you pictures of houses that have burned down and been wiped out by hurricanes and tornadoes and the only thing left is the ground loop, right. So, you build your house back and your ground loop's there.

A little bit of New York, they're actually -- they lost a lot of oil tanks when they had Hurricane Sandy come through. And they're saying, wait a minute, why are we going to put these oil tanks back in the beach that just washed out? Why don't we put in ground loops because they're going to be there and they're going to be weather proof.

So, ground source heat pump loops look, feel and act like long-term utility plant. And the problem with ground source heat pumps, as you've heard over and over again, is first cost.

It's kind of like if you bought a cell phone and the cell service company, you know, you picked said, oh, I tell you what, we want you to pay for the towers and all the infrastructure so you can use your cell phone up front, and then the minutes will be free.

No, they charge us by the minute and then the minutes come down with competition.

So, if we took a utility perspective that said who can invest in these loops over 25-, 35-, 45-year time horizons what would the first cost be for ground source heat pumps? And I would say the first cost barrier would then go away, and we'll talk a little bit about that this afternoon.

So, you know, and I've got this sense of humor thing, so why should utilities support ground source heat pumps? Well, somebody's got to row the boat, right. In our case we've got our consumers in the front, doing all the work, and the utility that gets all the benefits kind of sitting in the back of the boat, smoking a cigarette, and going along for the ride. We've got it totally backwards here.

But utilities can bring a lot of value to the table for ground source heat pumps. First of all, they're in the energy business, right, that's all they do.

They've got the patience. How long has PG&E or SMUD been around? I think, the last time I looked, a little over 100 years, so they've got a little track record there.

They have access to capital. There's economic incentives and we'll talk about that, where ground source heat pumps actually lower rates and have economic incentives for the utility because of their impacts on the grid.

Everybody gets a bill from their utility, right, so there's a way to message and there's a way to recover your costs.

And they've been doing these energy efficiency and renewable energy programs for 20 plus years. So, there's a natural fit between geothermal and utilities.

So, there's some good news and there's some bad news. So, the Federal Database attracts utility programs. When I put in ground source heat pumps I picked up 345 utilities that had some form of ground source heat pump incent.

Unfortunately, most of those are small rebates. If you're a consumer, a residential consumer, I guarantee you a $250 rebate is probably not going to make your purchase decision on a $30,000 ground source heat pump retrofit.

But if you want to have a -- in the old days I had a boss who said, basically -- I figured out early on if I had a brochure and a rebate I had a program, right. So, we need to kind of go beyond brochures and token rebates if we're going to make an impact.

So, there are really, probably, less than 50 active utility programs out there. And when I say active, there's an ongoing effort, there's somebody in the utility who's championed with promoting ground source heat pumps and it's part of what they want to accomplish.

The good news is that the few utilities, and I'll go through some examples with you this afternoon, that do have programs, and do have the vision, and do see why ground source heat pumps fit into the utility model are doing really well.

So, it goes back to, you know, why do we regulate utilities and why do we drag utilities into this energy efficiency and renewable energy business. Well, it's because we're trying -- right now we're trying to reduce greenhouse gas emissions and utilities are a real nice target to do that because a lot of greenhouse gas emissions come from gas, natural gas companies, and electric companies.

I think our focus as a society's been off a little bit, though, because especially for the electric companies it's been based on we're going to reduce kilowatt hour consumption because that, 15 years ago, was probably the easiest way to get to carbon.

However, when we get to an 80, 90 percent carbon-free kilowatt hour stream is that really where we're going to go for future carbon savings or do we really need to change the look to Btus, because carbon lives in system Btus.

And, you know, I remember a little bit of high school chemistry. The chemical equation for natural gas is CH_4, right. And when you oxidize it that means you burn it, you put some O_2 in it and now you get CO_2, unless you've got bad burner conditions and then you get CO, and you either get a headache and flu-like symptoms, or you wake up dead, so those are kind of your options.

But there's a lot of carbon in burning fossil fuels. And as we take carbon out of electricity, and I said this earlier today, now we can take carbon out of heating, cooling, and water heating because we're going to have low-carbon electricity, or on-site zero carbon electricity, and a compressor, and the renewable energy in the ground, and that's how we get the big chunk of carbon that we're not addressing out of the system.

And the utilities are a good way to do that.

So, we have this public interest theory, which basically said utilities are regulated monopolies, and it was more cost effective to have one regulated utility than a bunch of competing utilities.

That model's kind of breaking down when everybody can have distributed generation on their rooftop, right.

So, what's the role in the utility world where the whole regulatory framework is kind of being disrupted by distributed generation?

However, we still have this public interest in climate change, right. So, what are we going to do as part of the public interest to address climate change?

And utilities are still a focus target. There's not a whole lot of them, they're pretty easy to have oversight with. And so if we went after efficiency programs in the past, where we targeted lighting, we targeted appliances, we've targeted building shells, and we have had allowances and all kinds of formulas to incent utilities to sell less of their program, and the mechanism to pay for all of that was rates.

Now, having done utility program design, one of the -- I know for a fact one of the big balancing points is how much pressure do you put on rates to achieve those social objectives.

Well, what if you could get those social objectives, in this case carbon reduction and reducing consumers' total energy bills and not put pressure on rates; would that not be a win/win for the regulators, the consumers and the utilities.

Well, ground source heat pumps I think can get you there. And that's why 20 some years ago, as a utility guy, I gravitated towards ground source heat pumps as a DSM program because it, again, was one of those programs that the benefits to the consumer and the benefits to the utility, basically everybody won.

The only person who didn't win was whoever was selling the fossil fuel that we're replacing. And I guarantee if you're in the foothills buying propane and somewhere between $2.00 and $4.00 a gallon nobody's looking out for you in this regulatory arena right now if you're a propane customer with high thermal loads in the Sierras. And this is an opportunity to even address that market niche that hasn't been served.

And if we treat the loops like a utility plant, and I'll show you some examples of that, the utility now has the opportunity to invest in a renewable resource that they can get their authorized rate of return on, that improves their load factor and that takes pressure off of rates.

And the Feds just came out with a study that said the expected growth in residential kilowatt hour sales over the next 20 years is going to be less than one percent, less than one percent over the next 20 years.

And when I talk to utilities across the country, the single biggest pressure point they have right now is budget cuts driven by lack of increasing sales in kilowatt hours, right.

So, in the old days it was kind of a -- I don't know if you'd call it a joke, but the story was don't worry about the budget too much because when you have two, three, four percent annual growth in kilowatt hour sales your budgets are going to be okay just because of organic growth.

Well, the utilities are now hitting where because of lighting efficiency, appliance efficiency, energy efficiency, on-site generation they can't -- they can't rely on increased growth in kilowatt hour sales to drive their budget process.

However, ground source heat pumps can shore up their load factor so the growth doesn't have to come from new customers, it can come from that valley filling that I talked to you about earlier, also offset by the peak clipping. And when your load factor goes up and you have a more-revenue-per-dollar-invested plant that, by definition, keeps pressure off consumer rates.

So, this is a really nice report. I don't know if you guys have it on your website or not, Joe. But it was basically this -- do you have that one? You will, okay.

It was basically a study of this morphing that's going on in the utility industry. Sometimes, when I give this part of the presentation I call it "this is not your father's utility anymore" because the rules have changed that much.

So, we've really been working for the last 20 some years with demand side programs, and renewable energy portfolio standards and stuff to make some fundamental changes to the utility industry from a regulatory stand point.

And technology is starting to make fundamental changes. I mean, when you can install a rooftop PV for $3.00 a watt, and the panels are at 80 cents, now, when I first was looking at PV it was $10.00 a watt just for the panel. There's a lot going on that's changing the regulatory paradigm and the utility paradigm, and it's all kind of coming to a head, driven by California's leadership.

What is the utility's role in a world where all new buildings cannot -- have to be net zero by definition, gas or electric?

What's your role as a utility company in a net zero environment, right? What's your growth potential when at a point in time all new buildings won't need you, other than as a big battery for kilowatt hours, right.

So, this report basically says successful utilities are going to have to start thinking about how to position themselves for this new, low-carbon, distributed generation environment.

And that the modern utility’s going to have to, if they want to continue as a business entity, they’re going to have to come up with solutions to cope with climate change and the desire of customers to take a more proactive role in their energy choices.

That’s really polite language for saying to tell the utility company to take a hike, right, I want to be independent, I want to be grid independent. I want to be responsible for my own energy use.

However, new approaches, and this is how this report kind of closes out, new approaches to serving customers with less energy at the same -- will basically let the utility kind of move into a new field. And I can’t find anything other than owning that renewable, some piece of that renewable or distributed generation investment that would let utilities transition.

And what did I start out with, those ground source heat pump loops look like a utility plant, so I think it’s a really nice segue for a utility to stay in the utility model, make long-term investments, make long-term payment streams with their customers, and deliver low-carbon, high-efficiency energy services.

So, ground source heat pumps do everything that utilities are looking for. They clip peaks, and we’ve heard that a couple of times, now. And I’ll show you some numbers from real utility studies.

They improve load factor, they fill the valleys, they generate huge carbon reduction emissions, and I’ll walk you through some math on that. They basically give you a chance to interact with your customer for a monthly payment or a monthly transaction that goes through your billing process. They can do all of that without putting pressure on electric rates.

And in fact, and I’ve done it over several times, the utilities actually can help make rates go down, so who’s -- I don’t know anybody who’s against that.

And sort of the additional benefits is, you know, you’re providing a new service. If a utility knocked on your door, as a consumer, and said, we want to lower your total monthly or annual bills by a thousand dollars a year, we’re here to help. Sign here, we’re going to keep you as comfortable as you are now, we’re going to cut your carbon footprint by 50 to 60 percent, and you’re going to have a thousand dollars a year left over would that shock you? Would that make you like your utility company a little bit more than reading in the paper, oh, rates are going up another nine percent this year, or whatever?

What if a utility, and I used to have to do this, went to a hearing at the Public Utility Commission and the interveners were all there saying what a great guy you were. What are the odds of that, right? I mean, usually, somebody's picking on the utility rate case.

Well, ground source heat pumps can drive environmental goals and they can provide economic development. Phil kind of hit on it, we're not going to import boreholes and loops from overseas. We have to put them in with local labor right here and, you know, we're just not going to bring them in by the container ship in Oakland and roll them out, because you just can't do that with a borehole.

Utility economics, lost revenue, and the other thing that -- when the utilities don't get to buy power plants, what do they get their return on investment on? Remodeling the offices, right? So, loops give the utilities an opportunity to put capital in the ground, get their authorized rate of return on that capital and still grow their business.

And so, the National Rural Electric Cooperative Association, the American Public Power Association, the Edison Electric Institute have all said ground source heat pumps and the efficiency they provide are a no-regret strategy for utilities, so that's a pretty cool thing.

So, again, we've kind of seen this, you take the peaks off and you shove them into the valleys, and that helps utility economics.

So, let's walk through a couple of case studies of some folks I get to work with across the country. I've started out in Oklahoma. We are Oklahoma-based at ClimateMaster.

This was a joint effort. This was when the first Stimulus Grants came out. We worked with the Geothermal Resources Council and we got a grant for the Oklahoma Municipal Power Association. They're actually a division of state government, but they operate by a G&T, or a generation and transmission company for I think it's 13 cities in Oklahoma. So, think, they're the power supplier and transmission company for municipals, the biggest being the City of Edmond, in Oklahoma.

And they launched what they called the "Oklahoma Comfort Program." So, this was their dilemma. The OMPA is the red line. All but one of their top four cities, which are about 80 percent of their total load, were seeing a steady decline in load factor.

So, the utility was paying more for peak power and having less kilowatt over the course of the year, which was only putting pressure on rates.

So, the worse rate increase is one where you have to ask for more money and you don’t get anything for it, you’re just covering costs that have escalated on you.

So, they wanted to improve load factor and the only way to improve load factor is to cut your peaks and fill your valleys.

So, they did a kind of a paper study. Some of it was based on some of the work by Oak Ridge. And they came to the conclusion that they could save 500 watts or a half a KW per ton of ground source heat pumps.

Okay, so that kind of fits in Dr. Liu’s number. And that’s the peak shavings that didn’t include the valley filling that they were going to get.

So, they decided to do this ground source heat pump program to improve load factor by cutting peaks, they figured 500 watts a ton, and fill in their winter valleys because they have excess generation in the winter.

So, they came up with a -- they got $3 million in Federal Stimulus money. They were already offering an $800-a-ton ground source heat pump rebate, and they added $1,000-a-ton to that with the Federal money.

The program started a year later than they wanted to. Oklahoma really had its act together when the Stimulus money came out. The notice of the Stimulus came out, in 90 days Oklahoma had their notices out, 60 days later they had their awards out, a year later the Feds signed the contract with the State Energy Office to run their program.

So, we basically had two years to run a three-year program. They still used up almost all of the money that they were allocated for this program.

So, they were very happy that they got the load. Most of it, I was really surprised, it went about 50/50 to residential customers and commercial customers.

So, now, they've got more -- they've got a few thousand installations under their belt. So, what they've decided was rebates really weren't the ticket.

The data doesn't show it clearly, but they're convinced that the cost per ton of the ground source heat pumps went up mostly driven by things like better equipment going in than maybe contractor grade stuff. They can't say that contractors profiteered, but they're convinced that the rebates, a lot of the rebates were consumed by increased channel costs. They really can't zero it in and say, ah-ha, this is the case.

But what they realized is that $1,800-a-ton in rebates they could have given away residential loops, right. So, that would have been enough in Oklahoma, loops are about six bucks a foot. They could have given the loops away.

That kind of planted this seed in their mind, well, if we take the first cost of the loop offline and we recover our money over the next 30 years, what's it costing us to get the loop in? Nothing.

So, we can get all of these utility load factor improvements and we can get our money back over time, and it really isn't a program cost, it's a program investment. And most of the smart utilities get that. You don't need to give something away, you just have to make it -- you have to have that easy button for the customer to mash, so it's an easy transaction to go ground source heat pumps.

So, and I put this week, because they haven't quite announced it, yet. They actually want to go back -- now, I've told you they serve cities in Oklahoma. They basically want to take their own city's infrastructure and retrofit -- the member cities' infrastructure to ground source heat pumps. Why? That levers tax dollars because it costs operating costs for municipal facilities.

So, they're looking at offering seven-year loans. They're probably going to bump that to 15 years, at about a one percent interest, and they're going to target their member cities, city halls, recreational centers, jails, all the firehouses, libraries, and all that kind of stuff, first. So, basically, for them it's the gift that keeps on giving. The city's operating costs go down, they basically can lever their bonding authority, and there's some third-party folks that think they can bring some zero interest money to the table, that kind of stuff.

And then once they get that kind of institutional thing going and they get those -- we heard earlier today how important it is to have good designers, it kind of develops a little bit of maturity for the installation environment, a little bit of maturity on the design environment and then they can roll that back out into their regular consumer market. So, I think that's a really, really wise strategy on their part.

So, I'll stay with the Oklahoma theme. Even though I'm from -- I live in Colorado, I think I've gone back to my native Oklahoma because I’ve spent about three years working on these programs.

I am now ready to swim upstream to my mother’s native California to help you all, so do take me away from the Red Plains of Oklahoma, please.

But, basically, Western Farmers is what you call a G&T, a generation and transmission co-op. So, they make electricity and they deliver it to 20 some co-ops across Oklahoma, mostly the western two-thirds of the state.

So, about three years ago they wanted to increase exposure to ground source heat pumps to two markets. Their consumers, the people who pay bills to the member co-ops, and to the co-ops, themselves, because the G&T understood the value of ground source heat pumps, but they don’t think their member utilities did.

So, we started out with a sweepstakes. So, for those of you, anybody here who’s a utility person and you want to do -- you want to learn lessons, don’t do a sweepstakes. The odds of winning a $30,000 heat pump are not enough to get you to buy a $30,000 ground source heat pump, okay. And there’s all kinds of rules with sweepstakes.

But that’s okay, it got their toe in the water, it gave them a year to talk to their members about ground source heat pumps.

So, now, and this is one of the -- I think this is the coolest ground source heat pump program going and I'll share a little bit more detail with you in a minute.

Even as we speak, and I think tomorrow or Friday -- yeah, tomorrow is Friday, it's the last day, they're having a "Go-Go GEO Challenge" for all juniors and seniors in any -- any high school junior or senior in the State of Oklahoma. They posted their videos. I'll share the website with you. Today and tomorrow are the last days to vote. And they decided to use social media, you know, mom, dad, and grandpa, and the creativity of Oklahoma -- of America's youth to drive public awareness of ground source heat pumps, right, in these rural communities.

And then the utilities will come in with their programs that I'll talk about here in a minute, okay.

The other thing that's interesting about that program and, again, a great model for California, it was the first time, and I've been doing ground source heat pumps as a utility guy, and now as a manufacturer, for over 20 years, all three major manufacturers were partnered in that program, and we're all in the room here today, plus some, right. So, it's never been done before, very cool.

So, it's kind of like, you know, a rising tide floats all boat strategy.

That has led to -- they have about, I think the last count was seven utilities are getting ready to adopt a California idea, okay.

Plumas Sierra Rural Electric, here in California, up in the mountains, was the first utility in the country to offer ground source heat pump loops for a fixed monthly fee.

Last time I looked it was still the only utility company in California to offer ground source heat pump loops for a fixed monthly fee. And that program has been in place for about 15 years.

And when I go talk to our contractors that serve that area, they love it. Right, because the loops there, they don't have to sell the loop, the quality control's already in place. And they said -- and when I asked contractors what can we do to grow the market in Nevada or California, they say if we could just have more programs like that one they have at Plumas Sierra.

Now, as a utility person when was the last time contractors raved about your program? Right, I mean, isn't that your biggest fear is you're going to do something to aggravate the contractor community? You're going to make them mad by telling them what to do. What if they were saying do more of this; would you want to put your budgets there?

So, that was a California idea and now there's probably going to be seven, eight utilities in Oklahoma that will be doing that by year end.

So, and the nice thing about the utility programs where they take the first cost off the table is it can come in different flavors. It can come in loop leasing, which is what Plumas Sierra does. It can come in loop financing. It can come in whole system financing. And I'll talk a little bit about on-bill financing and on-bill collection. It can come from partnering with third-party people.

And I have four of these, this whole paper that Dr. Johnson did is about how utilities can form partnerships. So, you may not want to be the bank, you may not want to be the implementer, but you can still form the partnerships where all that comes together in a model where everybody wins, including the contractor community.

So, and this, in levering this co-op financing, the Feds, through the Rural Utility Service, in the next, you know, it will probably be about 90 to 120 days, the Rural Utility Service is going to offer their standard loans, that would normally go to poles, wires, transmission lines for efficiency measures, and it specifically mentions ground source heat pumps as an enabled technology.

Okay, now, that’s what I’ll talk a little bit about in a minute.

But, basically, the equipment, the loop, the utility can basically borrow the money from the Feds, write a business plan. They can input that money into a third-party partnership. They can invest that money, themselves. But, basically, the Feds are all in on the rural utility side for promoting ground source heat pumps.

And I haven’t seen the final language, yet, the draft that they’re basically negotiating, is through the RUS and the Office of -- the OMB, Office of Management and Budget. The last draft I saw basically said they could make those funds available to all flavors of utilities, so IOUs and Municipals.

And that money right now, last time I looked, 30-year funds were under three percent to do that, okay.

And then the “kahuna” of them all, several of those companies, the utilities are looking at loop tariffs where, basically, they own it, it’s a flat monthly fee.

There’s one co-op, if you’re interested in their program, it’s Caddo Electric, C-a-d-d-o, a small, 16,000-meter co-op in Oklahoma, about the same size as Plumas Sierra. They actually are going to take that loop investment and put it in their general rate base because the theory is all the members benefit from the peak demand clipping, right. They’re going to collect the fee out of their general rate base so they figure they’ll have all their money back from their general rates in about five years.

And what is the expiration date of a loop tariff? Yeah, it’s like the old street lights we used to put up, or alley lights, right. We put the alley light up and if you paid me for 45 years for an alley light, we did okay.

So, how much does a ground source heat pump peak clipping program cost when the consumer pays for the whole cost of the loop in five years, and the revenue stream keeps coming, right? So, does that revenue stream put pressure on rates or take pressure off of rates? It takes pressure off of rates, right.

Does the customer mind paying $14.00 a month for a loop that otherwise would have cost, I don’t know, $9,000? No.

And at that low monthly charge the incremental cost between a ground source heat pump and a high-efficiency air conditioner, with that SEER rating that kills the utility, and a high-efficiency gas furnace is even, before the Federal tax credits, which we really haven't talked about, which are 30 percent -- as soon as they announced that thermal tariff, this Caddo Electric, they got a 250-home subdivision. Now, did I tell you they had 16,000 meters to start with? So, they got the biggest home builder in Oklahoma to open their next subdivision on that electric co-op's lines because of that thermal tariff.

So, that's the power of the utilities being able to own the loops.

The other thing that these utilities are doing is they're bringing in -- and we haven't talked too much about this today, they're bringing ground source heat pumps into their key account efforts. So, key accounts are the bigger customers, with the bigger bills. We haven't seen any examples and, hopefully, we can talk about it at the workshop next month.

With the tax credits that are available for ground source heat pumps, which include a Federal tax credit at 10 percent, 50 percent bonused depreciation in the first year, five-year accelerated depreciation, up to $1.50 a square foot tax deduction for an efficient building we're seeing commercial projects go ground source heat pump with paybacks of under two years, okay.

Now, if the utility were to finance the loop what's the -- how fast is the payback then? Well, it's instant, right, because the loop can be as much as 30 percent of the cost. And there's even bigger demand savings and valley filling opportunities in the commercial buildings than there are in the residential space.

A quick example, Western Farmers also serves four co-ops on the fringe of Eastern New Mexico, on the Texas border. They looked at the dairy industry. The dairy farmers, who take -- basically, they take hot milk out of cows, right, and they chill it and they throw that energy into the air, which is kind of hard to do in New Mexico in the summertime. Then they take gallons and gallons of propane and they burn that to make hot water, so they can wash the cow, so they can take the milk out of them.

Ground source heat pumps take the hot milk out of the cow, chill it, and dump it into the water so you're basically using the heat in the milk to wash the cow; less than two-year paybacks for the dairy industry, in New Mexico, if they convert to ground source heat pumps.

Now, I drove up from Southern California today and I drove by a whole bunch of happy California cows that I think could benefit from ground source heat pumps if Edison and PG&E wanted to go after that niche market.

Okay, so in just those four co-ops in New Mexico they identified 60 megawatts of demand reduction in about a half-a-dozen dairies.

And then those dairies support -- I didn’t know this. Did you know the largest cheddar cheese factory in the United States is in New Mexico? There you go. So, now, they’re looking at the demand savings at the cheddar cheese factory which, by the way, has to have hot and cold in the same factory, okay.

So, they’re basically training their staff, now, to go after these ground source heat pump retrofit opportunities using a design build model. So, basically, they cover the design build costs of the projects. What does that give them? Control over the design.

And then there’s that subdivision I talked about that the First Thermal Service got.

Here’s the “Go-Go Geo Challenge,” I just kind of snuck this in there. So, yeah, you have until midnight today to vote, so as soon as you run home. Some of these videos are ready for like prime time television commercials, some are not. So, you get to -- you get to pick, okay.

My personal favorites are the white board, Dorothy, and the rapper at the construction site, so those are the only clues I’m going to give you here. So, get online and check out some videos and you could -- you could sway that.

The votes are actually -- it’s kind of interesting that it’s a three -- it’s a combination of they wanted to do the social media, so I think 25 percent of the score -- it’s kind of like “Dancing With The Stars,” 25 percent of the votes come from your social media skills and how many friends and relatives you have.

The Girl Scout, who is plumbing the Girl Scout National Network for her merit badge, and maybe her silver or gold Girl Scout award is way ahead in the voting, okay.

And then the judges are Miss Oklahoma, the Secretary of Technology for the State of Oklahoma, and the Secretary of Energy for Oklahoma, so it’s kind of -- so, you have the social side, and the science side, and the industry side are the judges. And all that will happen in two weekends they'll announce the winner, so pretty cool thing.

So, go to the "Go-Go GEO Challenge" and cast your vote before midnight tonight, Central Mountain Time, so don't forget you're a time zone off here, two time zones off.

And again, just to reinforce that, if you look on the white board there, every video you get like a 30-second primer on why ground source heat pumps are cool. Three major manufacturers all supporting the same advertising and program with the utility and that's where we need to be to grow this industry, not only in California, but in the country.

This is some work that's about ten years ago, maybe a little longer now, where we got some national focus groups together. It was under a program called "CO-Z". CO-Z was a turnkey programmer, basically sign a contract with the utility for a flat monthly fee, get your ground source heat pump installed with the loop at a guaranteed temperature setting.

So, the focus groups, the company that ran the focus groups had also done focus groups for kind of a technology you might be familiar with, called anti-lock brakes. You know, anybody -- you step on the pedal and it keeps you from like skidding and dying in a fiery auto crash.

In the initial customer focus groups more people were interested in getting a single monthly price heating and cooling system from the utility than were interested in anti-lock brakes, when they focused grouped anti-lock brakes.

So, customers are more interested in having the utility help them with their energy bills than they are saving their families from a fiery auto crash is the only way I can summarize that data.

(Laughter)

MR. BONY: That’s huge. So, your consumers are basically saying lease me my energy-efficient green system for a flat monthly fee and I’m all over it. But if you ask me to come up with a $30,000 check, that’s kind of hard for me right now, right.

So, this is -- this was the first -- if you’ve not heard the term “on-bill financing,” or “on-bill collection,” where the utility basically puts the money up, you make the investment in energy efficiency. You can only buy stuff that has a positive cash flow. It was basically the response after Property Assured Clean Energy, or PACE, went belly up. I know California’s -- how’s your lawsuit coming on that, I haven’t read anything in a --

MR. LOYER: We're doing all right.

MR. BONY: Are you doing okay? I'm rooting for you, don't get me wrong.

But, basically, on-bill financing was the response when PACE got messed up.

The meter, the electric meter, or the gas meter, or the water meter becomes the anchor point for the payback of the loan. Okay, so you get the improvement, whoever lives in the building and pays the bill pays off the loan, so the risks of default are very low. And it decouples the consumer's desire to have a better building from an energy stand point, from the fear of being stuck with a payment that may follow them, while the next person in the building gets the benefit, okay.

A co-op in Kansas, Midwest Energy invented on-bill financing. And, basically, I like it for a couple of reasons and it's a great utility example. The utility can -- the utility, basically, won't loan you the money unless it's cost effective, right. So, you can't put the $30,000 Pella window package in that cuts your energy bill by 10 percent, right, you have to do stuff that -- but if your windows, if you need to replace some windows and you've done other things that really do provide energy savings, like putting insulation in a totally un-insulated attic, or putting in a ground source heat pump system, you can spend up to your payback.

In this case, they leave about a 10 percent buffer.

It’s a huge opportunity for the program to help their consumers. And if the utility doesn’t want to be the bank, then you just change the name a little bit and instead of calling it on-bill financing, you call it on-bill collection. The utility gets an administrative fee; some third-party investor puts up the money.

And ground source heat pumps, wherever I do the math, at somewhere between six and seven and a half percent interest, ground source heat pumps provide a positive cash flow.

Do you know how many insurance companies and pension funds would love to get their money out of a one percent interest bearing account to get into a six or seven percent return fund that’s basically insured by the electric meter, right, so another opportunity for utilities to play in the space.

And then this report came out before Dr. Liu’s report and it basically said -- it was this whole primer that said, wow, having the utility own the loop really does make sense. Why don’t we -- you know, customers don’t buy power plants. When we offer a line extension as a utility we make them pay for the poles and the wire, but we don’t make them at least pay for the power plant upstream. So, why do we think people are going to make this 50-year investment in renewable energy infrastructure up front, when we don’t do it with any other utility service?

So, they created, basically, the term, the ground loop utility, so it gives you the opportunity -- I called it you could by your energy efficiency by the drink, not by the bottle, once upon a time.

And the utility can keep the carbon credits because it’s their money, so it has all these opportunities for the utility, again, to convert the incremental costs for a ground source heat pump into a life -- into a levelized payment stream that takes that first cost out of the hands of the consumer. So, the consumer gets total -- lower total energy bills, the utility grade service, the utilities there to make sure that the quality control’s in position, this works for residential and commercial, and it levels the playing field.

And then, when you throw tax credits on top of that, it actually makes the playing field tilted towards ground source.

The Feds like this so much this actually went in the last Farm Bill we passed, which was when Secretary of Interior Salazar, who's no longer the Secretary of Interior, was actually a Senator from Colorado, the RUS already lets co-ops borrow money to own loop fields, and they have had for almost eight years, now.

And the Federal tax credits on commercial, we talked about that earlier. Basically, if you're doing a commercial building and you have a tax appetite, and you're not putting in ground source heat pump, you're leaving money on the table. I mean, because you're going to get the best equipment, the longest lifecycle benefit, and you're probably going to have a payback of five years or less and, in most cases, shorter than that.

So, that came out of the -- the ability for the RUS to loan money to co-ops for the loops came out in 2007. That was actually the committee language that made it happen and thanks to former Senator Salazar for that.

There is the Federal tax credit, so residential gets a third, the Federal tax code you get 10 percent, plus, plus, plus, plus, plus.

This is what we're doing in my home state of Colorado. They're actually, in this legislative session, we think we're going to introduce a renewable thermal energy standard. So, it brings all the red-headed step-children to the party, ground source heat pumps, thermal solar, solar thermal, and biomass, basically, the burning of biomass to make electricity or heat, okay.

And it's focused on Btus, not kilowatt hours. Again, why? Because the carbon lives in the Btus, not necessarily the kilowatt hours.

The United Kingdom, I don't know if you've got any of their stuff in there, but they basically have a ground source heat pump initiative. Why would the UK want to go all ground source heat pumps?

Well, when the North Sea gas started to run out, their choices were to get gas from Russia. Now, maybe from Pennsylvania, you know, if we can get that shale gas into tankers and ship it out of New Jersey.

But, basically, they didn't want to have their economy be dependent on important natural gas when they lost their reserves out of the North Sea.

So, they call theirs the "Renewable Heat Incentive." They're basically buying renewable heat, including ground source heat pumps, as a national policy.

Maryland is probably the leader in state policy in their HB 1186, which was signed about a year ago.

They basically, as part of their RPS, and they were concerned that they weren't going to have the conditions to meet their RPS with renewable from photovoltaic and wind. So, now, they're converting the energy savings from ground source heat pumps into Btu equivalents, and the utilities can apply those Btu equivalents towards their RPS requirements, okay.

And then their homeowners actually can get RECs for ground source heat pump systems. That started in January of this year. So, that's that legislation. There's a workshop actually coming up on that in a couple of weeks.

So, there's all the folks when they signed the bill. And it started, I want to point that out, it started out with a meeting like this.

Yeah, I've got -- I've got a minute left, I'm watching the clock there, okay.

The exciting thing is now Baltimore Gas & Electric, which hated the RPS, is going wait a minute I can cut my peak, fill my valley, and get my RPS credits, right. So, suddenly, the utility that was saying we hate RPS is going, well, let's take another look at this, so that's pretty huge.

There -- and I put this up because you're going to talk about barriers and stuff, first-cost hurdles are their barrier they identified. Effective legislation, which is what they think they’ve done. And now they’re focusing on increasing awareness in the whole community from consumers, commercial building owners, architects, engineers, and their workshop is going to be at the end of this month if you’re interested, and you want to fly to Maryland.

Wyandotte Municipal Services, a small version of SMUD, implemented their ground source heat pump tariff as utility-owned loops in August of 2010. Why? They own a coal plant and if they lose the coal plant, they use the coal generation that feeds the plastic plant, which is the largest employer in the city.

And by the way, the cogen steam goes to the hospital, which is the second largest employer, and et cetera, et cetera.

So, basically, they think if they converted all of their homes to ground source heat pumps, they would offset the carbon emissions from their coal plant, which drives their whole utility-scale and community-scale model.

New York City is going to pass pro grounds for a C pump legislation probably next month. For health, basically, particulate emissions, they have a lot of fuel oil they still burn in New York and they want to get rid of that. So, the city council's already passed some pro grounds for a C pump language and they're going to basically authorize a city study to identify retrofit sites for ground source heat pumps, if the legislation they're bringing up next month passes.

And in closing, there's just a couple of policy things we need to take care of. Fuel switching is a big one, right. So, why is converting electricity to natural gas good if the electricity doesn't have any carbon in it, right?

And why can't -- why isn't switching 500-percent efficient electric ground source heat pumps that can be powered by renewable energy bad, especially if you're a propane or a fuel oil customer and you have no other option?

Shale gas, I know California's got kind of worried about becoming dependent on gas from outside of the area.

And then the whole CO2 emissions, I would -- if there's any university professors in the room, or retired university professors in the room, I want to see the study that says how much unburned methane is escaping from an unturned residential furnace, and then we'll multiply that times 21 times to get the CO2 emission equivalents for that.

So, in closing, you know, we can always count on the regulators to do the right thing after exhausting all other options, and I think we've gotten to the final option here.

And I'm just a few minutes over but, you know, I was really into it and I didn't want to quit so --

(Laughter)

MR. BONY: Thank you.

MR. LOYER: Thank you, Paul.

Well, at this point we'll be taking questions. And we're just a little bit over, but we'll take questions from people in the room, first. So, are there any questions for this panel?

MR. SPLITT: Yeah, I'll ask some questions.

MR. LOYER: Yeah, just state your name for everybody online.

MR. SPLITT: Okay. I'm Pat Splitt from App-Tech in Santa Cruz. I'm an energy consultant, also design hydronic systems, including, occasionally, ground source heat pumps, when I can figure out how to do it.

But the only question I had for this period is for Marc, and that was in the comparison of the different levels of building performance, where he was comparing Title 24 to the Tier 2.

The basis for Tier 2 is being 15 percent better than Title 24, which means you have to model the system with the residential compliance software, and there's no way of inputting COPs and EERs. So, I'm just trying to figure out what the point of the whole exercise was if it's not possible to install that system in California right now.

MR. HOESCHELE: I'm on here.

MR. LOYER: Okay.

MR. HOESCHELE: So, your question is how did we -- how did we model the Tier 2 or what did we assume, or just modeling the geothermal system?

I'm just repeating what I said before. So, I can't look and talk at the same time. So, the -- I mean, I actually didn't do the modeling; the author couldn't make it here. But my understanding is, you know, we ran the package of measures under Title 24 and then ran -- and all this -- I mean, so that was done in compliance software.

And then the geothermal was run in the eQUEST-02. So, we're not -- we're kind of modeling so-called real performance, not how Title 24 would model it.

MR. SPLITT: But the reference for Tier 2 is that somewhere you had to show that it exceeded Title 24 by 15 percent. And the only way to do that is to model it with compliance software. And the compliance software cannot take an input of EER and COP.

So, when you listed the barriers, this seems to me to be the biggest barrier at all, is that we can't model it.

MR. HOESCHELE: Right. No, it certainly is a barrier for Title 24 with the way geothermal's handled.

MR. SPLITT: Okay. Well, I think some of it should have gotten in there that you really made an assumption that you couldn't verify.

MR. HOESCHELE: Well, I can't speak to the exact answer since I didn't do the math.

MR. SPLITT: Well, but since he's not here I'll speak for him.

MR. HENRY: It does seem that that study, as you just said, Marc, speaks to -- it takes a Title 24 compliant structure as a given and then applies ground source heat pumps to it, and then you look at the savings. That's what it seemed. From reading that study, that was my understanding.

And then that subject, I think, will come in detail in the next session.

MR. LOYER: Yeah, and I was just actually -- Marc, do we have that study on our website, yet? Have you given that to us, yet?

MR. HENRY: Oh, do you want to speak to this?

MR. HOESCHELE: Well, you have the microphone.

MR. HENRY: Yeah, and a big voice. So, that study is not available as of yet. Davis Energy is working to get authorization from PG&E to make that study available to the public so, stay tuned.

Dave Springer indicated that probably wouldn't be a problem. It's a great read.

MR. LOYER: So, the question is whether there was any hot water in that study.

MR. HOESCHELE: No.

MR. LOYER: No. And the answer is no.

Are there any other questions? No, all right.

MR. HOELLWARTH: Oh, Craig Hoellwarth, California Energy Commission.

In Paul's discussion there was a lot of talk about utility programs related to policy. The states have policies toward utilities. Is there anyone here from the Public Utilities Commission or anybody online that can enter into the conversation, once we have it? No.

MR. LOYER: And I'm not seeing any hands raised online or any indication from anybody online so --

Okay, are there any other questions that we can get to at this point? You mean comments into the process? Yes, yes.

MS. BROWN: So, it's a little awkward to speak with my back to the crowd here. My names -- I'll to look this way. My name's Elise Brown. I'm with the California Geothermal Energy Collaborative at UC Davis. And this is really awkward. No, that's fine.

Anyway, I just wanted -- I was made aware of this workshop because of the list serve, and I think that you may be in a different division, but I wanted to make the Commission aware of some of the work that we've done on geothermal heat pumps.

The CEC funded -- so, I'm part of the Energy Institute at UC Davis, and the California Renewable Energy Center there. We're the Geothermal Collaborative. We do work on geothermal electric, but also on geothermal heat pumps.

And last spring we submitted, though it hasn't been published, yet, but we submitted a pretty exhaustive study of geothermal heat pumps and their efficiency in the 16 California climate zones. So, that has been modeled and it's sitting at the CEC.

I'm sure I can give you our contract manager's name and I'm guessing he'd be willing to share that with you. I can't, as you understand.

So, you know, we had great results. It was found that in all -- well, in 15 of the 16 climate zones geothermal heat pumps were certainly more efficient than traditional HVAC.

In the climate zone that it was not more efficient it was equal to, and that was in El Centro where it's just really hot all the time.

So, and we not only modeled efficiency, but we also modeled CO2 savings, NOx savings, and SOx savings, as well.

So, that is there and I just want to remind you that we're a resource.

If you're looking for national data, we are working with the DOE right now on a national report for the 30 most populous metropolitan areas, a similar sort of study. But we're doing or modeling not only residential, but also commercial buildings in that.

And working with PG&E -- to just sort of ground truth our data in Davis, and Lisa is helping us with the engineering on that.

So, just wanted to make you aware that we are resource, and available, and close, and happy to participate.

MR. LOYER: And I think the study you're referring to is through our PIER Program, if I'm not mistaken.

MS. BROWN: It is. It is.

MR. LOYER: Okay. Yeah, we did get an early draft of that but, you're right, it's not ready for release yet, as far as I understand, yet, so --

MS. BROWN: Yeah. Well, it just needs to be published. I don't know what's holding it up.

Okay, so that's all. Thanks.

MR. LOYER: Any more questions or comments? Yeah, Dan.

MR. BERGOYNE: Dan Bergoyne with the California Department of General Services. I just wanted to get a little clarification whether the ground source heat pump also provides the domestic hot water supplies. I'm seeing nods, so I'm assuming that it's not only heating and cooling, but also domestic hot water.

And then the cost of a -- there was discussion about the cost of a retrofit for a home, as an example, and I heard numbers of $30,000 being thrown out. Is that a typical cost for a retrofit of a standard home? Good, good, because my utility bill is about $1,500 a year, gas and electric combined, and at a 50 percent savings at $750 a year, that would take a lot of years to pay for a heat pump system, so I'm just kind of -- and, you know, a lot of the examples I'm seeing are on the residential side but, you know, it seems to me and I've heard a lot more examples in California of heat pumps on the nonresidential side, and I'd be interested to see more cost studies and savings information on the non-commercial side.

MR. LOYER: And I think, and Paul and Phil, you can jump in here as well. We have, actually, a couple of studies, I think, that show the cost savings for commercial side applications.

I'm not so sure they're in California, though. I think these are both -- the ones I'm thinking of are both national studies.

I would, just as a -- just based on my very imperfect knowledge of the ground source heat pump, and their application, I would guess that the -- if we can make it cost effective for a residential application, it should be fairly reasonable that we're going to make it cost effective for a non-res application as well, even more so. It should be much easier for a non-res application. But yeah, you know.

MR. KAVANAUGH: Just a comment. And as you know, most of the work I've done is in the commercial arena but, you know, my heart's in residential, okay. Right now in Alabama, a three-ton, 13 or 14 SEER heat pump system goes in at about $6,000, $6,500, okay.

So, if you're looking at a ground loop that costs $2,000 to $3,000, that does not add up to $30,000.

But I will tell you there are systems going in where customers are paying $30,000 for their ground source heat pumps, three and four ton systems. So, where's the math? I don't know.

When you have to pay $7,000 or $8,000 just for the heat pump there's the problem, a huge problem. And our goal should be to make mass-produced heat pumps that cost pretty much the same or less than a 13 or 14 SEER split system heat pump. That should be our goal. And when that is done on a widespread basis for schools, and residences, modest homes then we'll be much less than half of what $30,000 is. But you are seeing $30,000 three and four ton heat pump systems going in, in the residential sector.

Why? Don't know.

MR. LOYER: And were there any other questions, any other hands?

Let me just check the online crowd here and see if there are any hands raised here. And seeing none, and I don't have any phone-only call-ins, so I think about a five-minute break, and then we'll go into the session three. All right, thank you.

(Off the record at 3:06 p.m.)

(Resume at 3:20 p.m.)

MR. LOYER: All right, we're going to get stared again. We need to wrap up session three so we can get to the Round Table.

I'll be a little more booming. We're running a little bit late, folks, so --

All right, welcome back, we're going to start session three here.

Session Three's title, "What needs to be done for California to realize the benefits of ground source heat pumps?"

And I think this is the session most everybody's been waiting for, this and the Round Table I think promise to be very entertaining, if nothing else.

MR. HENRY: Yeah, absolutely. Absolutely.

MR. LOYER: Oh, go ahead.

MR. HENRY: We're running a bit behind and I know, I want to make sure there's plenty of time for the two presentations that follow behind. It's important information.

And I'd rather cut mine short than rush either of the two of them.

So, if there's something that needs more discussion or I didn't convey, or I skipped over in the barriers piece, it's because of expediency. Approach me afterwards, or bring it up in the strategic planning session, or if you feel like relaxing a bit we're going to adjourn to de Vere's, over on L Street, after the workshop. And for those of you attending remotely, I know a number of you are probably in town and attending, maybe after your work is over you can come down and continue the discussion.

So, with that, I was tasked with speaking to the barriers and, to some extent, perhaps, how they relate to, you know, why we needed a piece of legislation in the first place.

And AB 2339 simply -- came about simply because everything industry had been doing for the last many years was just not working. And so, rather than beat my head -- you know, continue to beat my head against the wall, so let's figure out what we can do differently.

Well, one thing that we hadn't been successful at is having a statewide discussion on the technology, it hadn't happened.

And two, we hadn't -- I was not aware of any legislation in California that focused on the technology. And so, we got together last January 31st, put forth the idea to do it differently, and that resulted in 2339 being signed into law.

It resulted in, even before it was signed into law, starting a statewide conversation and here we are today continuing that conversation.

So, the basic question coming out of the last session is if geothermal heat pumps are so great, why does California rank at the bottom of the list in terms of per capita deployment?

You can look at Dennis Murphy’s Project Negatherm, he digs into this pretty aggressively and in a very refreshing way. And you can read what’s on the slide, but the short version is we are not a leader in this technology, period.

California is historically a leader in matters that have to do with energy and in this particular technology we are behind the curve, way behind the curve. And my goal, my mission in life is to change that.

Here’s the real answer to why we’re at the bottom, the barriers. The barriers. And when I was putting together this particular slide there was one on the net that actually had a fellow with a -- you know, rubbing his head and the caption was, “God, it felt so good when I stopped banging my heat against the wall.”

And I experienced that last year when we hired a lobbyist and sponsored legislation, it felt very good and continues to feel good.

Taking a different approach has evolved a relationship between industry and the Energy Commission into a collaborative effort towards some common causes, and that’s very, very refreshing and proving to be fruitful.

So, when you look at or examine the issue of barriers to this technology there’s two excellent pieces of work. One is the report by Patrick Hughes. It’s kind of a long title, “GHPs Market Status Barriers to Adoption and Actions to Overcome Barriers.” It was published in 2008. I don’t read much because I don’t have time. I read this cover to cover many times, right.

And it quickly became the benchmark, the benchmark treatise on this subject for the industry.

And then the second piece is the PIER Program Project Negatherm. There’s Project Negatherm for Ground Source Heat Pumps -- Improving Geothermal Borehole Drilling Environment in California.” And the principal investigator is in the audience, Dennis Murphy, sitting back there in the back.

So, both of these are up on the website. I encourage you to dig into them. They’re quite lengthy and you’ll probably enjoy the read.

And then in terms of barriers, themselves, I put them into two basic groups. One is barriers that are endemic to the technology and in many ways endemic to --

in some ways endemic to any new or emerging technology, right, but we’re going to focus on GHP.

And then the one that -- the barrier that I do -- that I work on every day, trying to address, the class of barriers that is the basis for the need for AB 2339 are the barriers that are self-inflicted. We’re actually creating them.

It’s not -- they’re not coming about because the sun comes up in a different way in California or there’s something out of our control. They’re self-inflicted barriers and, predominantly, they’re regulatory and systemic barriers.

You can go to AB 2339.org, which was a website put up to assist in the outreach in the AB 2339 effort and you can get some good information on that, on the bill, itself, and what it took to get it through legislation.

So, starting with Patrick Hughes’ report, he proposed -- he lays out five or six barriers. Now, we’ve talked about these indirectly and directly today. One is the high first cost, oftentimes high -- perceived high first-time cost to consumers. Paul talked quite a bit about some solutions to overcome that; lack of consumer knowledge or confidence in the systems on the part of the consumer, specifically; lack of policymaker or regulator knowledge and trust in the GHP systems.

And I just want to stop there for a second. I didn't have this in but it occurred to be driving into town this morning, is when a consumer or someone hears factual data on the technology for the first time, somewhere in that conversation, it happens almost every time, there's a little ah-ha moment and they get it.

GHP is a pretty cool technology. And so when it -- and I've experienced that countless times in the last dozen or so years that I've been in this industry.

The same thing occurred a few blocks away in the Capitol Building, right. The legislators heard about the technology, had to read about it, had to get briefed by staff, right, and then make a decision either in committee, or in the Senate floor, or the Assembly floor, right.

And their way of saying I get it or I don't get it is a yea or nay vote, right.

In all the committee hearings, all of the floor votes in the Assembly and the Senate, there was one no vote, right.

So, that tells me there's a common message there, right. There's opportunity for folks to get it, we just need to get the word out and then get out of the way of industry and let market forces come to bear. And that was really the whole point of AB 2339.

There are certain limitations in the design and business infrastructure, limitations on the installation infrastructure, very big in California. That is a big part of the high drilling costs in the State. And then lack of new technologies and techniques to improve GHP system costs and performance.

And if you have a conversation with someone who has been in this technology -- I'd love to see what Dr. Kavanaugh has to say, he's been in the industry for a long time.

But in all the conversations that I've had with the very old-timers, these same items right here are on the list they had 20 plus years ago. You know, this is not new information. You know, we're still trying to attack fundamental barriers to the technology.

And I'd like to see California take a leadership position and get all of these addressed in a big way, and show the rest of the country how you can get business done in the State. That's my objective.

There's one -- there's one item that is kind of hinted at in Patrick's report, talked to a little bit, but for whatever reason he doesn't come out and say it.

I'll say it, a big barrier -- and this could really go over in the self-inflicted side, I think, we've talked about it today, we heard quite a bit from Lisa and Dr. Kavanaugh on this topic, and the -- and that's the level -- that's the level of skills that exist in the professional engineering community in this state, in other states, and in Canada. And I've worked in all of those areas.

I've dealt with projects on the planning side, conceptual side, and I've dealt with on the forensic side, all right.

And the fact is that a PE behind your name does not quality you to design a geothermal heat pump system. It does not, right. That PE needs some specialized information. It's not that these systems are complicated or rocket science, because they're not, but it requires paying, I think, more attention to conservation of resources, looking at the entire system as a system, and recognizing what you don't know and reaching out and getting that information.

And when an engineer reaches out and gets the information, and then does the design, you get a high-performing project.

When you don't, the manufacturer's probably going to get a call and say these heat pumps don't work, or the driller's going to get a call, these loops don't work or, man, I knew it didn't work in California. Well, it's because the fundamental design was inadequate.

I don't know if I can hit that one any harder.

Specifically, the rest of this will be about the regulatory and systemic piece.

In my dealings with the Energy Commission over the years I've been told things like GHPs don't work, they don't work in California, and I've been asked where is the industry, right.

The GHPs do work. They do work in California and this workshop is about changing that conversation to a factual-based conversation, clearing up misconceptions, and figuring out how we move forward in a constructive way.

As far as the industry goes, industry was one of the barriers in California. No doubt about it.

And as we decided back in that meeting on January 31st, where we decided to sponsor legislation, we also decided to organize the industry.

And the first step was forming a lobby coalition called CalGeo. CalGeo sponsored the legislation a few months later, May 21st -- yeah, another 21st there. The California Geothermal Heat Pump Association was incorporated and we've been organizing that ever since.

So, we can check that off the list of barriers, at least I hope we can.

Now, we get into something that was of big interest to the folks on the Capitol. This is a big issue for anyone in the industry. This is the basis for, part of the basis for the high, extremely high loop installation costs. This is a major reason and why so few people have heard about it. It's a major reason for drillers and contractors not getting into the industry.

And in this State right now we have a, what I call, a regulatory quagmire when it comes to permitting and installing loops.

And there's two reasons for it, okay. One is the geothermal heat exchange wells that the DWR put forth were put forth as draft, back in 1999, and that's all the State has, right, they're still drafts.

The good news is and Julie will -- Julie Haas will be updating us on this, is that DWR has taken action on that issue and said we're going to fix it. And last year they went on record to say we're going to fix it, we're going to rewrite the standards and we're going to have it done in summer of 2013, and they've been working hard on doing that.

And CaliforniaGeo supports their effort. We're trying to assist their effort in any way we can. We took our version and with Lisa's lead, Lisa Meline's lead and generated our own standard to help that process. And so, I'm very optimistic that we soon will have a well-vetted working standard of construction for boreholes in the State, very optimistic.

That's going to leave us with another problem, right, and that is the current definition of a borehole in California's Water Code starts the confusion that exists around this. It refers to a borehole as a well, right.

These are not wells, these are boreholes. You might think that's a minor issue, you know, get off your bandwagon, Phil, but when you go out to the counties and the various permitting authorities that are trying to get their head around how to permit, how to inspect, how to regulate, and they go back to the primacy documents and the standard is not really a standard, it's a draft, and the code says -- calls it a well, it's a pretty high likelihood that when they go to generate a price, and it's a permitting and inspection protocol, that they're going to charge a well permit price per borehole on that five-borehole in the house, at $600 to $1,200. That's, you know, getting up -- that's approaching a third of the cost of the loop. It's kind of hard to be cost effective.

So, this year I think we'll see huge changes in this particular picture with DWR at the helm.

Another fundamental barrier, the fact that the technology is not included in the IEPR and virtually any other place, as CEC materials, other than some very valuable studies from in the ‘90s, we’re just not included anywhere, right.

And, particularly, the IEPR, which means we don’t get a seat at the table, we don’t get to be in the discussions around on-bill financing programs, right. We don’t get to -- if it wasn’t for this workshop, and the visibility, and the mandated inclusion of the technology in the 2013 IEPR, we’d probably not have a seat at the table when it comes down to SB 758 implementation. We sure the heck wouldn’t be part of the party in the Prop. 39 implementation.

Both areas we can play a significant role. We’ve heard a lot about how that role -- what that role can be today.

So, we’ve got to have a seat at the table, we deserve a seat at the table, and we will have a seat at the table, we have it now, so another part of 2339.

Another huge barrier and it’s come up in a few different talks today is the tier grade structure that we live under. It absolutely dis-incentivizes geothermal heat pumps.

You know, so you get a residential customer that says I want to do the right thing. You know, I don't mind, you know, paying a lot up front to get these benefits, right. So, they get the system installed, let's take a PG&E customer, and so they see their utility bill, electricity bill go down in the summer, which is cool. It's very cool especially when you're in the very high heat conditions, right.

You see your gas bill go down next to nothing, depending on what you continue to burn gas for.

But you see your electricity bill go up in the wintertime. Now, it doesn't matter -- it doesn't matter whether you look at the summer or the wintertime usage, we're up in the higher tiers, right. It's painful. It's doubly painful on a geothermal heat pump system.

And how we solve that? You know, maybe GHPs or similar technologies get a preferential rate. Or maybe the tiered rate structure goes away in California. That would be a novel idea.

And then this next barrier is one Pat Splitt was speaking to Marc about, and that's the status of the Title 24 compliance software, and the ACM, and the whole modeling picture.

I'm not going to dig into this very much, others will be able to speak to the current state of affairs right now. It is a huge problem when a design engineer can’t properly demonstrate the impact, not fudged impact, but the actual impact on Title 24 compliance when they install a geothermal heat pump system. That’s something we need to get fixed right away.

And then the HERS rating and inspection protocols, they just, to my knowledge, and correct me if I’m wrong here, they’re not defined for GHP, right.

So, let’s say we’re successful, we’re in the IEPR, we get the tiered rate structure fixed, the Title 24 compliance issue is fixed and we’re installing a bunch of system. Well, how do they get inspected, right?

You know, if the HERS rater goes out to the job, a residential project, perhaps, and starts pulling out refrigerant gauges, checking refrigerant level in that packaged heat pump that’s going to be a huge mistake.

We need to get protocols in so they know how to go do their job. And if those are properly developed, the building officials can also use much of that -- much of those protocols and that body of work to develop their own local inspection programs for the technology.

How are we doing on time? God, I’d love to get into this one but I’m just -- let’s talk about this one later.

Okay, I think I can get this one in and close.

So, there’s been discussion, recent discussion on what is -- are geothermal heat pumps an energy efficiency measure or are they a renewable energy technology?

My position is they are both an energy efficiency measure and a renewable energy technology. And we heard today the work that’s being done in the GHP system is based on that, what’s in the ground, in that loop, that’s the renewable piece.

And I’m hoping there will be a paradigm shift within the Commission, and elsewhere, on this issue and not let it continue to be a barrier. Somehow we can coexist and be both.

And it’s interesting that AB 2339 started out being directed to the PUC and was quickly redirected to where it intended it to be, and that’s to the Energy Commission.

And what had happened in that process, the PUC came out both feet against the bill, all right, which we expected.

But in that process we had good conversations with them and they went on the record with some very important things and I’m just going to highlight them, okay.

The technology could be characterized as both a renewable distributed energy resource, as well as an energy efficiency resource. That's the PUC's position, right.

Since geothermal heat pumps impact heating, and cooling, electric and gas loads for a building they should be assessed in the energy efficiency potential studies to determine whether they provide cost-effective energy savings. If they are deemed cost effective, that goes in that present value and TDV that we'll be talking more about. If they're deemed cost effective then they would be included in the utility energy efficiency goals.

That's two proceedings at PUC that they're saying we fit in, all right.

And then, last but not least, if enacted -- skip that part of it. Qualify review within the CPU's existing customer distributed generation and energy efficiency. They're restating what they said in the previous two, so we fit in both. We fit in both, that's the point.

That analysis is not available online anywhere, but you can get that through the Capitol and we can figure out how to make that available, as well, okay.

So, just to quickly go through it, increasing deployment of GHPs will reduce the need for fossil fuel powered peak generation, improve the utility load factor, provide on-site consumer energy savings without the need for rebates, all right, provide all the benefits that drive the desire for renewable energy standards without putting pressure on electric rates or ratepayers' energy bills, and increase in-state jobs.

Fundamentally, removing these barriers will enable market forces, business climate to come to bear and grow the industry. There you go.

I know I said I was going to be short, but I just couldn't stop.

MR. LOYER: Thanks, Pal.

All right, if I could ask Rob Hudler, if he's still in the room? Oh, very good, yeah.

MR. HUDLER: And I'm there.

MR. LOYER: So, go ahead and introduce yourself.

MR. HUDLER: Okay, so I'm Rob Hudler. I am in the Building Standards Office. I've been there since 1984, so I've got a little bit of history.

MR. LOYER: Into the mic, please.

MR. HUDLER: Oh, into the mic, it doesn't carry, that's true.

So, what I want to try to do today is cover, you know, basically where Title 24 is at as far as the rule sets and how we look at mechanical systems.

It doesn't carry my voice. That's not good, I can’t take that.

And then, also, then to really talk about what paths exist within the standards that will allow us to introduce some of these new approaches.

So, before I start getting into the actual content I’d like to go back into history so we sort of have a perspective of where we were.

And, you know, 1984, Commission is rolling along, we develop our first -- or our second set of standards, second generation of standards in which we create these performance-based programs.

We are using 286 computers. We’re using basic DOS language things. And so, the rule sets are very, very simple. And our logic is based on what is being built them, you know, the basic 1,600 square foot simple house.

And at that time, of course, we also had appliance regulations, which the manufacturing industry did not take kindly to, and so pretty soon we had Federal preemption laws.

And this is probably one of the key issues that we have to realize is that all local agencies, including states, are preempted from having different references than the Federal standard. So, the SEER became our reality, okay, as far as the beginning of the process.

Now, as time evolved because, obviously, the Commission didn’t like SEER, we tried to find some ways to fudge with that. And so, what we essentially did is we created some rule sets that introduced the EER in a very basic way.

And the way we did that and, again, there’s all sorts of real fancy equations in front of this, but within the RACM rule set, and I’m going to use the REV set because it’s the most basic and it’s probably the easiest for us to go through.

We essentially developed this rule set that said, you know, if you’re below 82 degrees, the EER and the SEER are essentially the same. So, if you have a piece of equipment that is rated with an EER, you can use that in replacement of the SEER, okay.

And that’s, obviously, in some cases not a good story, but at least for the ground source heat pump situation there’s some benefit there. Not much because we’re talking relatively cool temperatures.

In the temperature range between 82 and 95 degrees we basically are taking the reference number, or the SEER-13, the Federal number, and slowly slide it down until we get to the 95 degree temperature, which is the test temperature for EER. And so, the overall efficiency then is adjusted to that point.

And then beyond 95 we just simply say it's the same number. So, it's a very, very simple logic, okay.

And so, from the stand point of if you could simply use your number, you guys wouldn't be in too bad of a shape. But there's another problem, we also introduced the HERS rating system. And one of the measures that require HERS verification is EER. And if you can't do the HERS verification that means your EER is a 10.

So, this is just a real basic little graph. So, the lower line here is showing basically the curve of what happens to a very minimal base system that, you know, it's going along and there's a slight degrade in efficiency, and then it pretty much flattens out.

In the case of a moderately efficient ground source heat pump you can see you can start -- you started very high in the curve, but then it takes this incredible dive down because it's trying to get all the way down to the EER 10, and then it matches the same line.

So, the issue is to fix that what we would need within this logic is to be able to find some method for EER verification, you know, for the ground source heat pump, and that's probably a relatively simple thing to do, okay.

But if we go back to this logic here in the previous slide, what we're seeing is that our whole logic is based on an air source system, okay.

And so, writing new rule sets and coming up with another 30 equations in front of this, so that we can do the calculation, could be a pretty monumental task.

But there is the possibility that we might be able to find an interim answer to be able to get to where we need to be.

So, the question is what is that? So, within the Administrative Regulations in Title 24 there's a Section 10-109. And, essentially, it's the compliance option. And it says, if the Commission does not have a way of modeling or addressing a system, that industry can come forward and talk to the Commission, and we can come up with a procedure to approve that new technology, whether it be modeling rules, a prescriptive approach, whatever we may end up doing, okay.

And the typical pathway of doing that -- well, since I have been lead on it, though I'm leaving soon, so I don't have to worry about it anymore, is I'd ask for all of the technical information I could get, I'd look at things, write up some responses, make a determination in combination with you of what was feasible, okay.

If it was feasible, we would go into the formal adoption process. The applicant pays a fee, they write a technical report, they have some interaction with the CEC. We write our own report. We go to a public meeting in which all your worst enemies show up and we have wonderful discussions. And if we get through to the end, we get full approval and then implementation into the standards as a compliance option for that cycle.

And then once that cycle of the standard is over in three years, or six months, or however much time we have, it’s incorporated into the standard completely.

In looking at where this industry’s at, and at least my personal analysis, I think that trying to sit down and do a comp up for either HERS verification or some kind of EER approval is the very fastest route to do.

And I think that within that, considering the technical issues I’ve heard, my personal recommendation would be that we do not do a HERS verification, but rather we take more of a nonresidential approach and actually have the designing engineer sign off on the EER approval.

Now, beyond that, if you go back to this graph, you can see that there’s this little TVV impact line up above there. And that may be very thin, it may be very wide. I'm not going to try and answer that question here because, again, we're talking about a lot of very complex modeling rules.

But the bottom line is that I think, you know, particularly for res, because res is relatively simple, we do need to start looking at introducing modeling rules that will address the issue of how ground source heat pumps should be dealt with, okay.

Now, you'll note the absence there related to the heating side. And the reason I did that is because right now the heating modeling rules basically take the COP/HSPF of a system, and it is constant, irregardless of the outside air temperature, okay.

And in the 2013 modeling rules we will change that approach to where the system is reactive to outside air. And, you know, we don't have those formulas, yet. But, irregardless, it still will not have the ability to look at a ground source system, and so a new set of rules will be required to look at that.

On the nonresidential side I think we're in a lot better situation because in switching to Energy Plus there's technically already modules out there for doing ground source systems, and so I think we're okay.

Again, the reference issue of the fact that we have Federal preemption and what we use for the reference in the standard building is something that is going to potentially be challenged. And that’s something that we’ll have to work out over a period of time.

So, you know, I could get into all sorts of fancy equations and details on this but, in a nutshell, that’s where the Commission stands.

Any questions?

MR. LOYER: Just one more time, Rob --

MR. HUDLER: Yes.

MR. LOYER: -- why don’t you go over the final conclusion of where the Commission stands, just to make sure it’s --

MR. HUDLER: Okay, do you want the --

MR. LOYER: Just that last --

MR. HUDLER: Related to the rule set or the preemption.

MR. LOYER: No, the rule set.

MR. HUDLER: Okay, so going back to the rules, we’ll go back to the rule set. That one right there? You’re sure, now?

Again, our logic is totally based on an air source system. That irregardless of what type of system you install, the EER/SEER and, technically, you know, HSP/SCOP is all based on an outside air temperature number. There is no availability of the programs to be able to look at using ground or water temperature -- or ground water temperature as a reference on the performance scale.

And by including those, obviously, what you'd end up in this curve is essentially a straight line, as far as efficiency performance.

MR. LOYER: Great.

MR. HUDLER: Okay.

MR. LOYER: All right, I think for the moment I just want to remind everybody that we're going to entertain questions on all three presentations at the very end. So, take good notes and, Rob, we're going to lock the doors so --

(Laughter)

MR. LOYER: I think next we have Julie -- oh, good, you're here. I don't have my glasses on so I can't see that far away. We have Julie Haas, who is here from the Department of Water to speak about her subject, which is the "Geothermal Heat Exchange Well Standards Update."

MS. HAAS: Thank you. Okay, hello, I'm Julie Haas and I'm a senior engineer with the Department of Water Resources.

And I've been asked to talk to you today about our current project to update the geothermal heat exchange well standards.

And Phil mentioned the different terminology that's used throughout the history -- I mean, the industry for this technology. This is one of the ways they're referred to.

And I'm using this terminology because this is what is in the California Water Code. Because of people's associations with wells as being water wells, and that's probably not the best way to visualize these systems, I will refer to them as the acronym throughout my presentation, GHEW.

So, the history, just to give you some history of the well standards, in general, they date back to 1949 when the Legislature recognized the importance of groundwater as a resource in California and directed, at that time it was the Department of Public Works, to investigate and report on recommended standards for constructing, maintaining, abandoning water wells.

And since then the Legislature has added different types of wells, requiring minimum standards, to protect groundwater quality. Water wells to begin with, then cathodic protection wells, monitoring wells, and then in 1996 GHEWs were added, and I'll talk a little bit more about what those are.

So, in 1999, in response to that, the Department of Water Resources published this draft standards and did not finalize them. And the only significant work that was done on the well standards since, in the interim, between the current project and when the 1999 standards were published, the Conference of California Directors of Environmental Health Water Well Technical Advisory Committee established a well standards subcommittee to work on making recommended revisions to the standards.

And they think they're still working on the revisions, they've spent at least two years. And that subcommittee represented local enforcing agencies and industry, as well as Lisa Meline was participating in that effort, as well.

And there should be one more line at the bottom. In 2012, my branch received support from Department of Water Resources management to begin updating the GHEW standards and that's the project that we're working on currently.

One of the reasons that we did get approval to begin updating the standards and finalizing them, eventually, was because of public interest.

So, these are the well standards documents, I didn’t really talk about them in detail. The two on the left cover water wells, cathodic protection and monitoring wells. The one on the right is the draft standard and that’s what we’re updating in this project, only that document.

The water code outlines the process for implementing well standards as follows: DWR develops the standards and recommends those to the State Water Resources Control Board.

The State Water Resources Control Board is responsible for adopting a model well ordinance based on those standards.

Cities, counties and/or water agencies, depending on who has jurisdiction in a particular area, then are required to adopt a local well ordinance.

And then a local enforcing agency administers and enforces that. That would be the -- sometimes they’re called a well permitting agency.

If there’s no local well ordinance adopted, then the model well ordinance goes into effect in a particular area.

And this is the process that applies to all of the four types of wells that we draft standards for or prepare standards for.

Why is groundwater important? Why is it

important to protect groundwater in California? It may seem obvious, but some of these statistics emphasize the importance of groundwater.

It provides 25 to 40 percent of the water supply in California during a normal year and even more in a drought.

About 43 percent of Californians rely on groundwater as a drinking water source. It's widely available throughout the State. In many areas there's no alternative.

And, generally, it's good quality when it comes out of the ground and requires little treatment. And it is a limited resource.

In general, well standards protect groundwater quality as follows: Every boring into the ground is a potential conduit for contamination. Remediation is expensive and can take a long time, hundreds to thousands of years, if not forever.

Standards are written to prevent wells from becoming conduits for contamination and they are a minimum for construction and destruction of wells to protect groundwater quality.

So, our project scope for updating the GHEW standards are pretty clearly defined by the California Water Code, and as follows: We're developing minimum standards for construction, maintenance, abandonment and destruction for the purpose of protecting groundwater quality.

The water code defines a GHEW, a geothermal heat exchange well. I've highlighted the key points in the definition here, but I'll just read the whole thing because I'm --

"As used in this chapter means any uncased, artificial excavation by any method that uses the heat exchange capacity of the earth for heating and cooling, in which excavation the ambient ground temperature is 86 degrees Fahrenheit or less, in which excavation uses a closed loop fluid system to prevent the discharge or escape of its fluids into surrounding aquifers or other geologic formations. Geothermal heat exchange wells include ground source heat pump wells."

So, it does not include hot geothermal, as was discussed before. Open loop systems are not included. They meet the definition of a water well, so water well standards apply. And the standards don't cover surface water systems.

So, this is just a simple schematic of a closed loop system.

So, just to summarize, in a GHEW fluid is circulated in a closed loop of pipe that transfers heat from or to the ground, taking advantage of the earth's relatively constant temperature.

And there are two basic types of ground source systems, vertical and horizontal.

Vertical can be subdivided if their series are parallel, although I don't think that's that common, necessarily.

And then horizontal can be further defined by how they're constructed. For instance, trench, excavation, or horizontal directional drilling. That's what the HDD stands for.

So, the ways in which -- just to illustrate a little further the ways in which standards protect groundwater quality for GHEW, proper grouting and sealing between the piping and the borehole can prevent contaminated water from entering the aquifer either from the surface or between aquifers.

And I just have a rough sketch here of how that -- so you can visualize how that might occur. So, if there's -- if you have an unsealed borehole, God forbid, that on the left there's a borehole that's a vertical loop, that's in construction, so there's no fill, and the blue is meant to illustrate contamination entering down into the aquifer through the opening there, or in between these two aquifers.

And then on the right, the contaminated water is entering through the fill and seeping down into the borehole, which is not sealed.

And so, then in this illustration it illustrates no seal -- oh, I’m sorry. So, this is contamination from an adjacent aquifer.

And then this third image is just showing if you have a seal, but it’s not effective, it’s cracked and there are voids, it can allow the same types of contamination.

So, other ways that standards can protect groundwater quality: Proper construction and destruction can prevent the release of heat transfer fluid into the aquifer.

And then identification in the field can prevent damage to loops or fluid leaks -- which could lead to fluid leaks.

And adequate setbacks can minimize impacts.

This slide is to help you kind of visualize what’s in the standards. This is not the table of contents, but it’s some of the elements that are covered in the standard so that you can start thinking about, you know, how does this affect me and then, you know, based on your experience what can you offer as input to us, as we’re developing standards.

So, location, setbacks, driller qualifications, that’s pretty much set out by the code.

Reporting requirements, similarly.

Definitions; borehole diameter, installation, sealing materials, circulating pipe, loop material and connections or adjoining, loop fluids, pressure testing, field identification, maintenance and destruction.

Limitations of the standards; DWR standards don’t ensure proper function, sizing or efficiency of a GHEW system. And they are not a manual for GHEW construction or destruction. They’re very much focused on standards to protect groundwater quality.

So, to date, just to report a little bit on our progress, what’s not shown on this slide is we did an initial outreach effort where we tried to contact as many stakeholders as possible through industry organizations, permitting agencies, anyone we felt would potentially be interested.

And if you’re a licensed driller in the State, you might have received a postcard recently because there was a glitch when we tried to use the California State Licensing Board’s list servers. And, apparently, the announcement didn’t go out, so we went back to paper.

So, in any case, we’ve done extensive outreach to let people know we're doing this project.

And then we had an initial stakeholder meeting at the end of November. Since then, we've kind of had our heads down doing research and preparing revisions, the internal draft version of the standards.

We completed a State survey, which was very rigorous. I have some notes here. It's been very helpful to me, as I prepare the revisions to the California standards.

And this is a tradition, for lack of a better word, and when the well standards have been updated in the past the DWR surveys what are other states doing, and what are counties doing, in addition to looking at other literature. And it helps us be thorough, reasonable, and practical and leverage the experience and expertise of a large body of people working in this industry.

So, I don't know if you're interested, it's a very large spread sheet that I built, and we looked at 22 elements, all 50 states, and just for GHEWs. And I found that 37 of the 50 states had standards or guidelines specific to GHEWs.

And I guess I can skip some of these other -- this other information. But it's been a very helpful thing to do.

We also have surveyed counties, and we did an initial just questionnaire, via e-mail, through the WWTAC, of local enforcing agencies and what standards are they using. And we didn't get a huge response, so we are following that up with phone calls, and we're about halfway done.

To date, we have had responses from 32 of 76 local enforcing agencies around the State.

Of those 32, 21 are using the 1999 draft standards, four are using their own, something other than the 1999 draft, and seven have not had a need so they're not using anything.

So, we will continue to do that survey. And of the four that are using their own, we will review them as we've reviewed the other states' standards.

We've also done extensive literature review and interviews with industry folks, and one of the authors of the Nebraska Grout Study. We've looked at the standards in depth over, and over again. Industry spec sheets, PPI, the Plastics Pipe Institute Guidelines and Technical Reports, ASTM standards, and other national and international codes and standards, and research papers.

As we compose the draft standards we do this -- we do an engineering evaluation, they're kind of tied together, and meet and hash out some of the details.

So, what's next, so we'll finish composing the draft and then the internal draft will be reviewed by an internal TAC for -- I don't know, it doesn't have a name, yet, but we'll have a group of engineers and hydro geologists review this internal draft and before it goes out to release to the public, as a public draft.

And then we plan to have a 30-day minimum comment period and two public workshops during that comment period to kind of talk to you about your reactions and explain our thinking.

So, and then, finally, it will be finalized this time around and we will present it to the State Water Resources Control Board, and we anticipate we'll do that this summer, the summer of 2013.

MR. LOYER: Thank you, Julie.

That brings us to the question and answer portion of this. And I think we want to do -- I think, Julie, you have to -- you said you have to go. So, do we have any questions for Julie right now?

MR. SPLITT: It's Pat Splitt from App-Tech, again, a couple of questions. Is there any depth limitation to where these regulations come in? Do I have to go down a certain depth before we have to go through and get it approved, and sealed, and --

MS. HAAS: Well, no, there's no depth regulation. But, first of all, we're -- there's no requirements at this time related to the standards that we're drafting. And I can't remember what's in the 1999 draft.

But, basically, if you have a current project, you have to work with your local enforcing agency to make sure that you're following their requirements. Does that make sense?

But for the draft that I'm working on right now, no, there's no depth limitation.

MR. SPLITT: The reason I ask is that there is some other systems that I work with, heat recovery ventilators, that now incorporate what used to be ground loops, earth tubes, where there are tubes sine wing around a lot and then opening up to the atmosphere, which is --

MS. HAAS: You mean they're natural formations, is that what --

MR. SPLITT: No, no, they're trenches and they put tubing in there, and they run -- they bring the outside air -- instead of bringing the outside air directly into the house they bring it from this opening in the yard, down through these tubes, and underground, and then into the house.

And there’s another system that, instead of having air, they have a loop, a brine loop which is, for all intents and purposes, exactly the same as one of these bores, but it’s just to transfer heat from the earth that then gets into the incoming air. But it’s a brine loop so they don’t have to worry about --

MS. HAAS: Is it in a conduit, I mean --

MR. SPLITT: There are all different types.

MR. DOCKERY: This is Randy Dockery with Gregg Drilling.

Your depth, minimum depth requirements are usually set by your local enforcement agency and it varies. But, generally, it’s anything deeper than five feet. A few of them like to go a little bit less, but anything usually deeper than five feet is going to have to be permitted.

MR. SPLITT: So, but will that be the case once your regulation comes out? Will they still have an option to modify it or you’re just going to say --

MS. HAAS: They have an option.

MR. SPLITT: Okay.

MS. HAAS: Yeah, they have an option to modify.

MR. SPLITT: Okay, that’s it.

MS. HAAS: Okay. And I refer back to the definition of the GHEWs often, and I encourage you to look at that because that’s what we’re following as we prepare the standards. And I don’t know, I can bring it up again.

MR. PENNING: My name is Kent Penning. I’m a contractor and wholesale distributer of geothermal stuff.

In your well drilling thing, can you please include in there some mention of direct expansion systems, where they put copper tubing in the ground with refrigerant, because that’s kind of an oddball application and a lot of people don’t know what to do about it.

MS. HAAS: Thank you for bringing that up. It’s something that I’m working on.

MR. PENNING: Anyway, that’s my comment.

MS. HAAS: I’m working on it, thank you.

MR. LOYER: Is there any other questions for Julie?

All right, thanks, Julie.

MS. HAAS: Thank you very much.

MR. LOYER: Any questions for Rob? I think there should probably be at least -- at least one person, yeah.

MR. SPLITT: Or if he just wants to stick around, we can do that in the next session, as well.

MR. LOYER: Thank you. You want to do that? Okay, sure, yeah, because we are running a little over, yeah.

In that case, I think why don't we go ahead and start the final panel. Are you ready for that?

Okay. Now, you notice I've arranged the desk here in a large U shape. All the microphones are active. So, if you would like to find a space, Paul, Shawn Melton, Sean Dillon, Marc, Randy Dockery, and Lisa if she's still here. Yeah, are you still able?

(Round Table participants assemble)

MR. LOYER: And if we have a -- I know there were a couple of other people that were maybe going to be here, maybe not. If we need more chairs, we have a microphone all the way on the other side, if we need that. There is fresh water.

MR. HENRY: Dennis Murphy is on the panel, as well, the Project Negatherm Principal Investigator.

MR. LOYER: All right, Dennis, yeah. Make your way up here, if you won't mind, sir.

Now, I think we were going to go over some of the topic issues here but, Phil, do you want to just throw it open to the public to ask questions and make comments to the panel?

MR. HENRY: Yeah, I think so, maybe that would be a good place to start.

MR. LOYER: Yeah.

MR. HENRY: Give folks in the audience a chance to weigh in.

MR. LOYER: I think so, yeah, particularly given the last presentations.

So, if you'd like to make your questions and comments, we have the whole panel here, yeah, and if anybody else has any comments?

All right, I think -- yeah, or anything that we have talked about today.

MR. SPLITT: Okay, it's Pat Splitt from App-Tech, again. I've got a couple of comments, two real short ones, so I'll just get those out of the way.

Just in my neck of the woods I attempt once in a while to do a ground source heat pump system, but I'm right on the coast in Santa Cruz and we have no cooling load, so it's a lot harder to justify.

If I get a customer just over the Santa Cruz Mountains, in Gilroy or Morgan Hill, then there's more of a chance of having to do that. I have two customers right now that are potential, but they're holding off because I can't figure out how to qualify them for a New Solar Homes Partnership Rebate.

So, one thing that's come up in the past for me, that I didn't hear the group mention, is the California Coastal Zone. And my neck of the words are right on the coast and as soon as they hear you're boring down, they want to get involved.

And as soon as a client hears the California Coastal Commission wants to get involved that's the end of the system. So, that's another agency that I think, if it's not on your list, you want to get on your list.

MR. LOYER: Yeah, the actually -- I think at one point I had taken a look at the possibilities of how many different agencies could possibly weigh in with a permit, or a requirement, or reporting, or an inspection and I came up with a God awful list.

And, yeah, the Coastal Zone, the Coastal Commission, yeah, that is going to be very problematic.

I think the key solution to that is just, from my basic experience in working with local ordinance and outreach, is to go to local jurisdictions and talk to the actual permitting agencies, and get them on board, and get them to understand what the product is, and what their responsibilities should be, and how they can use their own authority to hand out a permit.

Because most of the time I'm finding that there's resistance because the organization, itself, does not understand the technology and does not understand how they can possibly permit such a thing.

So, I think education and outreach is the real key. It may be a little ways off, but I think that’s one of the things that can be folded into the policy recommendations that we do make to the Energy Commission and the Commissioners.

MR. SPLITT: And the other quick comment is there was earlier mention of maybe we need some more data bases in California. So, one I would like to see is for the few jobs I work in, in my area, I have a well driller that I work with that’s very experienced and has a lot of information about zillions of wells that he’s drilled in our area. So, he has a lot of information on the ground conditions.

But once I get somebody out of my area I don’t have a clue, and it would be nice if there was some sort of data depository for -- that well drillers could upload their well information, so we’d build up a database over time of what the ground conditions were, that would easily accessible and understandable.

MS. MELINE: In the State of California, if you have a water well, it is not public knowledge.

But if you have a borehole or a thermal connectivity -- well, not a thermal connectivity test, but if you drill a borehole and there’s a drill log associated with that, you can get that from the county.

MR. SPLITT: Well, okay, but there’s a lot more well information and it would be nice if, you know --

MS. MELINE: But the way that the water code and the State of California currently deals with that --

MR. SPLITT: Well, we just talked to somebody that’s working on the water codes, right.

MS. MELINE: Well, I know, but I’m just letting you know that’s the way the law reads currently, that’s why their --

MR. SPLITT: But I’m just saying -- I just said that’s an idea and it would be nice if we had that.

MS. MELINE: Yeah, and I understand that. It is a source of frustration because California is different than a lot of other states where that information is made public through a database or some way. So, I know that the California Groundwater Association and -- Randy, you probably know more about this than I do. But I know that they have been really pushing to try to change that and so far have been unsuccessful.

MR. SPLITT: Okay.

MR. KAVANAUGH: So, the State of Tennessee has got an online -- or it’s actually put in place by the Tennessee Valley Authority. Their way of promoting, helping promote the technology was to, in commercial applications, subsidize the thermal test of the ground. And so, as a result of that, they've put all their test bores, which includes the thermal conductivity, the temperature, and the thermal diffusivity online. So, at some point, you know, you're doing quite a few tests in the State to do the designs, the proper designs on the larger systems, so if there's some way you could roll that in through CaliforniaGeo and put it online -- you just come up and it's got lots of little dots of all the places where you've done thermal conductivity testing and you click on it and you can see the full report.

MR. SPLITT: Yeah, okay, that would be good for me because I do very few of them so I, you know, have a hard time remembering what I did the last time.

MR. KAVANAUGH: Yeah, we've got to catch up to Tennessee.

MR. HUDLER: Yeah, also one comment, yeah, from a past life, the USGS groundwater has an extensive listing of wells for the State of California. That database may be acceptable, but having worked on it I can tell you the information is highly suspicious.

(Laughter)

MR. DOCKERY: There's also the Department of Oil, Gas and Geothermal keeps a very good database and you'd be surprised at the number of oil and gas wells that have been drilled in the last 150 years, the DOM site.

MR. SPLITT: Okay. Well, it might be nice, then, if the Geo organization put a list of those on the website so you could go to one place and at least get a list of where to look.

MR. MURPHY: One other suggestion, shout out to Gregg Drilling, actually on their website they document their work, and so that's something that's also worth checking out.

MR. DOCKERY: It's more just for water levels.

MR. MURPHY: Yeah.

MR. SPLITT: Okay, I wanted to just throw that out.

So, my main concern is back to, since I do a lot of residential energy compliance and residential design, is we can't really now input COP in EERS, even though for years and years people have been asking for it.

And I'm also working on air to water heat pumps, which have the same problem, they have COPs and EERs.

So, my concept was that we could, at least in the interim, just come up with a simple way of modifying the residential program so that we can input COPs and EERs. And if one COP is from an air to water, and another is from a ground source maybe there's, you know, little things that aren’t exactly coincident, but it’s better than nothing, and it will at least get people to actually legally put in these systems. I mean, we’re all putting them in anyway. Put them in legally and actually have a number, then, that people can start comparing and you can do your energy analysis, you can show that you’re 15 percent better than Title 24, you can get a rebate. It would be simple and we could just look at it, collect data and see how this goes for a couple of years, and then a lot of people are going to decide, well, this should be tweaked and that should be tweaked, and we could fix it later.

But I think we ought to start by doing something simple just to get it going so that -- I know it’s not hard to input those numbers. If you start worrying about the fact that, well, we’ve got this ground loop and geo systems that we don’t have any air to water, but the air temperatures vary more in the air to water, you know, in my mind I’m just going to say, well, all these pluses and minuses just for the initial jot they pretty much cancel out.

On average, your systems are going to look better because your EERs and COPs are better than the air to water, so I wouldn’t think you’d bother -- mind it so much.

But I'd like to get something just so I can actually have a little confidence that -- you know, right now what happens is I can go to a building department and I can convince them that it's okay to put this system in and that it's efficient, and so I get a building permit.

If that's all my client's concerned about, we're done. But these are super-efficient homes where he's also put in PV panels, he wants awards, he wants a rebate from the utility, and they want to have something, you know, that's official that says what this efficiency is.

And when we get the Title 24 report that says it's 15 percent better than Title 24 can we depend on it, or can you at least compare these from different calculations?

Right now, the way I justify my equipment that's going on, and the way anybody else does, you come up with different numbers. You know, you all came up with some scheme that makes sense in your mind and it made sense in the building official's mind, so for that instance it worked, but for the next guy you might have to come up with something different.

It would at least be a good step ahead if we could just start with some standard calculation and then go from there.

And the other thing that is important is in residential all the systems that I put in, in my area, I don't do cooling hardly at all, but every one of them is also domestic hot water.

And in residential there's a separate calculation if you have what's called a combined hydronic system. So, that's another calculation that you also have to have, be able to take the input of COP and EER. If you don't do that -- if you do that, you get an additional boost because you get a benefit of having one system doing two jobs.

So, I've been trying for years to get this and I really don't want to wait until 2015 or something because I'm putting in systems now. And in my mind, you know, they work fine, and they do work fine. People are living there, their houses are heated. It just is very frustrating.

So, maybe there's some way. I don't know if you guys would want to think about proposing something like that. I guess Rob was sort of suggesting that they'd do it for 2,000 bucks.

MR. HENRY: Yeah, so if I may? Can I address that?

MR. LOYER: Sure.

MR. HENRY: So, essentially -- essentially, if I understand you right, Pat, there would be some other technologies that would potentially benefit from addressing the issues that Rob was speaking to earlier. And so, I think, you know, you and I have had this conversation.

MR. SPLITT: Uh-hum.

MR. HENRY: I'm glad you're here vocalizing it, but at the risk of sounding too abrupt, I'd like to get his redirected back to the GHP side for a little bit, because that really is the focus of the workshop.

But I do want to acknowledge that there are industries with similar issues and we all can potentially benefit from it.

And the conversation about Title 24 and ACM is one -- is going to be ongoing, and lengthy, and I think we'll all looking forward to that.

MR. SPLITT: Okay, I'm all for just -- it's just I didn't want to reinvent the wheel and I think it would be exactly the same calculation on either side.

But one other thing to keep in mind, if we're just talking about doing ground source heat pumps and doing combined hydronic is there are two methods that you heat hot water. You can directly heat hot water if you're using a lot of hot water, but here's another system where in the cooling mode you do desuperheater to also heat hot water. And those have different efficiencies. And so, when you're talking about heating hot water you may have to think about those two different ways that you do it.

And in some areas there would be a lot of desuperheating, in my area there would be none. So, I don't know, it's just another variable that you have to define.

MR. HENRY: Were there any more questions from the group?

MR. LOYER: Just step right up to the microphone and make sure you state your name.

MR. PENNING: Hello, my name is Kent Penning, again. I wear three different hats. I'm a contractor down in the Santa Clara Valley. Also, I'm a distributer of geothermal equipment. I'm also an instructor at a trade school down in San Jose for people that put in these kind of systems.

I just had a couple of quick points that I wanted to make. To the gentleman with the CEC, thank you for foregoing the HERS requirements on these type of systems. I think that's a great incentive for making these systems more popular and more friendly to the contractor and the installation community. Simpler is better. Less paperwork is better.

The other comment I want to make is the CEC, my understanding is they hold the leash of the CPUC, which tells PG&E what to do.

(Laughter)

MR. PENNING: So, anyway, I would like to see PG&E have more flexibility for offering things like Paul was talking about, on-bill financing for the loops and, you know, geothermal systems.

We have also been doing some -- we're calling them geothermal systems, but we're connecting them to the HVAC systems, to pools.

UC Davis did a study, and the Santa Clara Valley is a real good place for that. Anyway, they've been working real well and I'd like those to be brought up as being classified and categorized as the same thing as a geothermal.

Another option, people that are primary candidates for these geothermal systems are the propane people out in the rural areas. And my understanding is oftentimes they're left out of the rebate programs and the incentives, and that's a great way to cut down on the CO2 emissions is by letting those folks enjoy some of the rebates and some of the benefits. Thank you.

MR. LOYER: Thank you. Would anybody else like to make some comments or ask some questions?

If I could ask the panel to basically turn to each other and, essentially, you know, considering some of the barriers that we've been talking about, I'd like to just ask the basic question. We've heard some solutions to financing for the loops. We've heard some solutions to lowering initial costs.

And we've not heard that many solutions to removing some of the policy barriers that we see the State sort of, for lack of a better term, accidentally engaging in.

And I think what I'd like to just ask is, you know, does anybody have a good solution for the State to take a look at their policies and make some policy recommendations?

And I ask this, while at the same time saying we are going -- this is not the end of the conversation. Today is not the last word that will be said.

We are going to have a working group, which I encourage all of you in the audience, online, and the members here of this board to engage in. And we will be talking about the policies that we will be recommending to the Commissioners going forward.

But are there any ideas on the table, now, that we want to discuss?

MR. DILLON: I don’t have to push this, do I? Push the button, no.

MR. LOYER: No, the green light is good.

MR. DILLON: Sean Dillon with WaterFurnace. Thank you, everybody, for coming. I want to start off by saying that one of the biggest hurdles I see, the additional cost with these systems, especially in a residential platform, is the ground loop.

The Federal tax credit is 30 percent, 30 percent of the cost of the system. And my understanding, or at least my belief, is that’s supposed to take away some of the pain of that outdoor heat exchanger.

And in California, and I cover the west, much like Paul and Shawn covers much of the country, there are not as many hurdles with the ground loop as there are in the State of California.

The additional cost is in the ground loop, it’s in the heat exchanger, typically.

If you were to take an air source heat pump and a furnace, providing both heating and cooling, versus one ground source heat pump which provides heating and cooling, that one ground source heat pump lasts twice as long, on average, as those two other pieces of equipment. It’s indoors, it’s protected from the elements, it’s protected from kids with bats, and lawnmower trimmings, and all of the other things, so you get twice the life.

But those costs are similar between those two pieces of equipment and one ground source heat pump providing heating and cooling, and in addition to hot water.

And one clarification, sir, in heating mode you can get some desuperheater, you can get additional domestic hot water. It does not have to just -- just be in the cooling.

But I think I see that as one of the biggest hurdles in the State is the ground loop heat exchanger, and the cost associated with that, as well as all of the regulations.

And I'm not saying that they're not good regulations because they're all meant to secure, as well as protect the resources in California and the water, but at the same time there's an over-protection that is inhibitive to these systems and all the benefits that these systems can give both the homeowners, consumers, as well as commercial applications, and utilities.

MS. MELINE: So, I think it would be helpful, Sean, if maybe, Randy, you could explain why is it that, for instance, in Texas you can get ground loop at $6.00 a foot and why it's like three times that here. It's not because you’re making a ton of money, right?

MR. DOCKERY: No.

MS. MELINE: So, can you explain to us all what those additional costs are?

MR. DOCKERY: It’s, you know, the old say, “death by a thousand cuts.” There’s a whole myriad of regulations that you have to comply with.

I guess, kind of where to start, the permitting process, itself, I think that was covered a little bit, is kind of hodgepodge. There’s no state standard for it. Some counties have adopted, some counties don’t even know what a heat loop is.

Pricing is anywhere from $20 or $30 a loop to upwards of $1,000 per loop.

The production drilling here, in many places because the geology isn’t -- you’re not capable of doing multiple holes in a day.

In Texas, a lot of places there, Oklahoma, up into Kansas, you know, those guys can do four or five, sometimes six loops a day. That drives your per-foot costs way down.

In California, in most places you’re going to get one, so your fixed expenses are fixed and it’s divided over less footage.

In California we are required to have total containment on our drill cuttings and spoils, we're not allowed to discharge anything onto the ground. That is a production inhibitor, as well as a cost. It adds quite a bit of cost to the project.

You know, the fuel costs are pretty much the same across the country. I mean, that's one of your big items, you know, you can easily burn a couple a hundred gallons of fuel a day.

And then, again, if you're drilling, and you're running at full throttle, and you're drilling a thousand foot a day, your fuel cost per foot isn't much less than if you're drilling only 300-foot a day. So, you know, that's a big one at four bucks a gallon.

And, let's see, then the disposal on the cuttings.

MS. MELINE: What about labor costs?

MR. DOCKERY: Labor costs, well, California does have, especially on State jobs, the prevailing wage is quite high. But average wages are also much higher than other parts of the country.

But, you know, you've got to pay the guys a wage they can live on. So, you know, I don't consider labor to be too far out of line. And, actually, in many places in the country, you know, operators are paid pretty much the same they are here. You know, the guys are paid well, but it's not considered a burden.

But back to what I was saying, disposal costs, you know, because of the total containment we're not allowed to discharge everything. It has to be contained and sent to the landfill.

Generally, most of your drilling methods here involve drilling with mud rotary, which the landfills won't accept liquids. And then the drill cuttings, themselves, are pretty wet so those have to be solidified, you know, either on site or at the landfill, and that is a pretty expensive proposition.

I know you used to be able to dig pits and bury them on site, but I know that -- I haven't seen that done in a number of years.

MR. DILLON: And, Randy, what's done in other areas, other states, other -- as far as with the drill cuttings.

MR. DOCKERY: Well, you know, I'd kind of like to sell the total containment because generally, in other states, these guys will build a berm around the entire loop field and get in there, and everything goes on the ground, but it's contained within the field.

And after it dries up it's either incorporated into fill or it's scooped up and hauled off.

But here, you know, generally, we're not allowed to discharge anything on the ground.

MR. HENRY: So, then it sounds like from the driller's perspective the biggest -- the largest piece that's different from the rest of the country is the production rate due to the geology. I mean, this is -- it's not the same as in Texas, right, so it's the production rate?

MR. DOCKERY: The production rate, yeah, the production rate.

MR. MURPHY: So, unless there's a motion to change the geology of California --

MR. DOCKERY: Yeah. I mean, there are --

MR. MURPHY: I'd like to just focus on one thing. I mean that the 73, 76, 78, I don't know if you include the Coastal Commission, 79 permitting authorities in California.

You know, the Balkans were created over hundreds of years of history and, you know, religious differences, and cultural differences. But we've almost willingly created a Balkans when it comes to this issue, and in terms of the permitting and the understanding.

In terms of -- I'll try to introduce a new concept, "state leadership." Consider a future where we had one agency -- I mean, for one thing, we have to separate boreholes from water wells.

I mean, you know, fundamental kind of thing. I mean, it sounds like a simple idea but, apparently, it's been kicking around since 1999.

But in terms of if there was one agency, or at least a kind of one clear directive that is actually understood and is out of draft mode, then -- and there was, perhaps, one pricing element. I mean, some states do this. Idaho does this. And, you know, it makes -- I would think it would make doing business and actually scaling geo a little bit easier.

You know, we can't do anything about the geology. And it's always going to be more expensive to do work in California. I mean, you know, the sanctity of groundwater is, you know -- well, there's a reason. And, you know, we're not going to be able to do the berms around the entire field. I mean, not in your dreams. And, you know, the wages and everything else.

But in terms of administrative, I mean, this is something -- I mean, we're talking on and off about CEQA reform and lessening regulations. I mean, at a very high level, you know, lessening regulation. You hear that a lot from the Governor, you hear it from Senator Steinberg about needless regulations.

Well, I would think this would -- you know, having 78 permitting authorities on something like this would seem to me to be a red flag in front of those bulls. So, anyway, just wanted to throw that out.

MR. DOCKERY: Yeah, to kind of add, I'm not originally from California. I moved here in 2000. I grew up in the southeast and worked, and I've been in the drilling industry for 34 years.

Now, I've drilled in about 38 states, including California. And, yeah, our regulatory environment is -- just to get a job started is incredibly difficult. You know, many states require the individual operator to be licensed. Not as in California, they require one person within the company to be licensed, and as long as you can trust that person to go out, they can drill.

And, you know, there's some states where you file a notice with the state, you know, just send a little card in and, you know, we're going to be drilling here, and you go do it. And someone from the State may or may not show up.

I've worked in states where they don't do permits or anything, you do completion reports when you're done and send them in. But they have a staff of people that basically drive around looking for a mast sticking up in the air.

And, you know, they find a drill rig, they'll come up, identify themselves and you have to show them your license in just one of the states that require individual licenses for operators.

If that person can't produce that license, they can actually take them to jail, and then they can also go back and do forensic work on wells and verify that, you know, grouting and all is done.

But there's a lot of different ways of doing it.

MR. HOELLWARTH: Joe, timing wise, are we planning to end at 5:00 or can we go beyond 5:00?

MR. LOYER: We really should end at 5:00, but we can go -- I mean, you know, ten minutes or so beyond would be find.

MR. HOELLWARTH: If people want to stay. Okay. Before we -- it's 15 minutes before 5:00, before we all get into other digressions, the purpose for the workshop is to kick off activities toward developing policies that can go into our State-required policy manual for energy, every two years, update every year.

From Dennis's comment and the discussion here, it sounds like most of the policy discussion is going to be around regulations. Is that the only policy item that we want to address in here, and I'd like to take some comments on that.

And then I've listened to the barriers that were brought up earlier today and I'd like to kind of touch on each one to say, you know, which are the things that are actions that we should be moving forward toward this idea of developing policies for the State?

Steve?

MR. KAVANAUGH: Were you here for my presentation?

MR. HOELLWARTH: Yes, I was.

MR. KAVANAUGH: Okay. And I stand by my first statement on my conclusion, that HSPF, SEER, and KW per ton are marketing tools. They are not a good engineer’s, in my opinion, and I think I have a little bit of experience in the area, should not be using SEER and HSPF, and KW per ton.

So, rather than making these folks pay 2,000 bucks and wait three years, I would strongly suggest you look real hard at those -- what those things really are, how bogus they really are, and go to something else.

It was said that this is mandated by the Federal Government, but the Federal Government also requires you to test, but necessarily report, COP at 17, COP at 47, EER at 82. No one reports EER at 82, but there is a test for it, Test B. Test A is at 95 which is, in my opinion, sufficient -- insufficient.

So, I encourage you to shift your whole thing to EER and COP, and that way you could also incorporate other technologies into your calculations, rather than using these two -- three extremely bogus numbers.

MR. HOELLWARTH: I think that would be a good start.

On another item, can the industry put anything together as a proposal for our policy change in that area, because that's something that could be addressed by whatever we decide as a group to develop these policies going forward. Okay, great. Well, whatever we have, that's fine. That's what we're looking for right now is direction on policy.

MS. MELINE: That's where we're going to be tomorrow.

MR. HOELLWARTH: Pardon me?

MS. MELINE: That's what we were going to do tomorrow, work on that.

MR. HOELLWARTH: Oh, okay.

MR. KAVANAUGH: But you do -- you know, you do have to fight the Federal Government on this. But, you know, it's not the first time that California's -- you know, I got weed eaters, you can't use weed eaters because of California, and very polluting weed eaters because of you all's leadership so --

MR. HOELLWARTH: Preemption is definitely on the agenda all the time for ways to get around that.

MR. LOYER: The Energy Commission is actually no stranger to a fight with the Federal Government, so --

MR. HENRY: Yeah, I've been there a couple of times.

MR. HUDLER: Yeah, I think the key, you know, is to try to make it a fight is an eight-year fight, and we probably don't want to get into an eight-year fight.

But again, the Federal regulation is for appliance certification, it's not necessary for modeling. Again, the certification, the SEER is a requirement for certification for sale of a device in the United States. It is not necessarily a number required for modeling purposes.

MR. KAVANAUGH: Yes, but you could switch.

MR. HUDLER: We have to be creative, but we could switch.

MR. SPLITT: What are you --

MR. HUDLER: Pat, yeah, I'm referring to the reference for the standard design. So, if I use a package air conditioner, it has to have an SEER of 13. That's what I'm staying.

MR. SPLITT: For the standard in the package.

MR. HUDLER: For the standard reference. So, that's what all this thinking is on. And I'm saying we can step away from that because that is only related to the requirement for certification for a device for sale. It's not necessarily saying that absolutely you have to use that in the modeling purposes.

MR. SPLITT: Especially if the unit is never rated in SEER.

MR. HUDLER: Right, and then there's that question, too. So, I think the door is open, it's just a matter that, you know, again, you know the ACM. There is not just one formula that needs to be changed, there is a humungous amount of work that needs to be done to get there.

MR. SPLITT: Thanks.

MR. HENRY: So, then it begs the question -- it begs the question, since it sounds like we're using -- you're using appliance rating, which is the -- you're using a modeling, a compliance and modeling system that's built on a requirement -- I'm trying to be careful of how I say this, built on a requirement that's pressed upon the appliance, itself.

And, quite honestly, that seems like not the best way to go. One could make an argument, you know, maybe it is better, similar to what Dr. Kavanaugh was alluding to is scrap it -- scrap it and start with what makes the most sense, at least for this technology, perhaps.

Because after seeing -- getting a better handle of the rule sets going on, and a number of the other points you brought up earlier, it’s like, you know, why throw smoke and mirrors at smoke and mirrors. You know, let’s get to the facts. That’s really what the industry wants to do, let’s just get a factual representation of what the technology -- what the technology does.

MR. HOELLWARTH: Anybody else? Let me just run through my list here and see if anything gets a chord that maybe we need to clarify or discuss further.

One of the barriers was common public -- or something to do with public knowledge in terms of the lack of understanding of the technology, in general, by the consumer or consumer organizations. Is that -- I mean, is that fair to say?

And that is something that probably is a shared responsibility, but that would be something that we would want to say, say that the Commission could. And, I mean, I think that we could look into definitions of terms, looking at how we describe the system.

And I think the term “factual” is important. I think it’s in probably the best interest of our consumers in the State to understand the system correctly and not to have somebody sell them something that isn’t correct.

I think Steve’s been saying get away from the marketing, the pure marketing approach and get into, you know, actual facts about the system that we all agree on, and that that’s the basis for our discussion. So, that’s something that we could go ahead on.

I heard something about engineers not being trained properly in these technologies. That’s something that you could bring up, I think, and carry forward.

We’re not in the business of training engineers, so I don’t see that as pretty much of a responsibility, or part of State policies.

But let me just keep going through here and then let’s come back. So, educating the public in terms of facts about the system is something I can see we could put on board.

The loop standards, I think, or the well standards that we talked about earlier, of course, are in another agency right now and I think Dennis’s comment is good that we’re going to look at trying to coordinate the different State inputs into this process.

But there are also local ones that have been brought up and Dennis alluded to 78 different permitting agencies, so we probably want to take that up as part of our discussion going forward.

MR. LOYER: I would also just like to add that's probably more like 578.

MR. HOELLWARTH: Yeah. Well, I think that we're not including in here -- if you get into the discussion of 15 percent beyond code, and that probably leads to the next issue and that is compliance software. If we're going to demonstrate 15 percent above, we have a number of programs. The New Solar Home Partnership was alluded to. But Joe's well aware of the 48 or 50 local standards that we have to approve that go beyond our minimum standards, and we need techniques for demonstrating 15 percent beyond for that, as well.

If you want to be included in that going forward, then geothermal heat pumps are going to have to have accurate algorithms, analysis techniques to demonstrate that to these localities.

And a very strong one that I heard was the compliance software and the basis for determining how good a geothermal system really is on a particular project. So, that should be on the agenda, I think, going forward. And we'll need some input from the industry on that.

Another item that Rob brought up was the HERS rating and inspection standards, practices. That's an area that is an area, I think, that we've talked with the industry about before in terms of clarifying what is required, how do you approve a ground loop for installation and getting a permit.

Now, because we’re just talking -- and I think I heard that we’re just talking about permitting a project, and that is not necessarily the problem. The problem is going forward how much better is it than another system? How do you compare it to other systems going forward?

In our HERS requirements we don’t have anything for geothermal heat pumps, so we would need help from the industry to really identify what’s required, what sort of certification’s in, who could certify, are there well logs that are required to be registered? What are the things we need to make sure that the ground loop is sized properly for the system and it’s going to work the way the consumer expects it to work or has been told that it’s going to work?

I think that’s a very important one.

We talked a little bit about renewable definitions in the State of California. Well, at the Energy Commission we really look at renewables as an electrical term, but it has a broader application --

MR. HENRY: That’s the slide I skipped over. That’s the slide I skipped over, Greg.

MR. HOELLWARTH: Yeah, I know, but it is one that maybe we have to clarify. I know our staff discusses that all the time. And that can be brought up by the industry in terms of how we're going to define renewables, one for electrical systems and maybe something going beyond that.

MR. LOYER: That's also a discussion that we're going to be having with other State agencies, the CPUC, as well as the ARB.

MR. HOELLWARTH: Right.

MR. LOYER: That's not just a definition that we're in charge of, although that one is ours, but it is something that we have to discuss with other agencies to get them on board.

MR. HENRY: Oh, can I just ask a clarifying -- sorry, Craig.

So, the -- in California, the responsibility for defining a renewable technology lies with the Energy Commission. Is that what I just heard you say?

MR. LOYER: No. Defining that lies with both ARB, to a large extent, and to the CPUC, to a much larger extent.

It is more like an agreement that the three agencies have to come to in order to make our various programs work.

We have responsibility for energy efficiency programs. The CPUC has a responsibility to make sure that what the utilities are offering as a rebate program for efficiency measures is in line with what we have for efficiency measures.

The 33 percent RPS has to be a definition that's not only agreeable with ARB, but with CPUC and us and, so far, have been on the generation side, only.

But there is -- and it's electric generation. But there isn't really a reason, technically, why not it couldn't, but it has not gone to that point of saying a non-generating renewable.

So, that's where it is right now. There's no reason that discussion -- and that discussion is always ongoing. There's no reason that discussion can't continue to go down the appropriate line.

MR. HOELLWARTH: And this is something that, you know, the industry could bring forward as a policy change, but you're going to have to have -- on all of these things, the industry's going to have to come up with data, case studies, information to justify, you know, the proposed change in policy or new policy that we want to include in the IEPR going forward.

Maybe one last thing was I know Paul talked a lot about utility programs and policies related to utility programs. That’s why I asked about the CPUC. We don’t have jurisdiction over utilities so -- but the CPUC does, and they’re a sister organization. So, we certainly can work with them in developing policies related to utilities, but we’d have to identify what that would be, and how we would justify that.

The utilities do conduct workshops on new technologies they recommend for consideration by the Commission in its standards on the -- every cycle that we go through, now, probably that will be the case.

So, I would suggest that the industry participate in those workshops, as well, to identify strategies or actions that you think should be considered for the standards, whether they be requirements or they be things like the ACM, ways of approving tools to be used with the standards.

So, there’s a lot of area there you can get into. One thing we didn’t talk about today, but we’ll probably have to talk about along the way, is California is unique in that we look at the peak power costs, I guess you’d say, or impacts through our TDV process, our time dependent valuations.

And so, I know Rob’s very familiar with this, but every hour of the year there’s a value for the power or the energy that you use. And that’s included when we do our analysis of a building, that 8,760 hours, what is the value of the peak power at that particular point in time.

So, that’s another thing to consider. We’re looking at that a little differently than you might look at source energy in other states, or other approaches. And we’d have to make sure that we’re in sync on those kinds of things.

That’s pretty much my short list. We didn’t have the CPUC here today, but we -- according to the legislation, we’re going to actively pursue that to make sure that the CPUC is involved in the process in some way and --

MR. LOYER: We do have good contacts over at the CPUC. They were not able to attend today, shockingly, because they are currently attending a workshop with the utilities, talking about energy efficiency measures.

MR. HENRY: Who picked this date?

MR. LOYER: I don’t know how that happened, but there you are.

And we will also be working with the California Air Resources Board, that’s also required within 2339.

I do have a contact over there and we will be having them on our working group.

MR. HOELLWARTH: And another thing, in the workshop today we got a lot of stress placed on residential buildings, or it seemed to be. I think we need to really develop the nonresidential side of things, as well, in terms of how the geothermal systems can impact that sector of our building systems.

MR. HENRY: I agree, both need to be developed, but in terms of the lowest hanging fruit and the shortest near-term opportunity or loss of opportunity, which is what I'm most concerned about, it's actually the nonres stuff.

MR. HOELLWARTH: There's terrific opportunity there, as I understand it, so I think we should be pursuing that end, as well as the residential, which seems to have a lot more barriers.

Joe, do you want to talk at all about our next steps going forward?

MR. LOYER: I can, briefly. We are a little over time. But, briefly, the next steps going forward are really going to be fun. We're going to put together a policy document.

We are going to start with Negatherm and we are going to build policy recommendations off of that work since, heck, we did in fact pay for it, so what the heck.

MR. HOELLWARTH: Yeah.

MR. LOYER: So, we’re going to start with the policy document there. This policy document is going to be open to any working group member to add to, detract from, make their recommendations, make their case for their recommendations.

And, essentially, what we’re going to get out of this, we’re going to have -- officially, we’re going to have no back and forth between the staff and Commission, Commission representatives, but we will be talking to their advisors as we are permitted to do.

There are, definitely, so what do they call this, the Chinese wall. There are definitely -- there is definitely a Chinese wall between us and the Commissioners. We are not their staff. We are staff, they are the Commissioners.

And so we will be running some ideas past their advisors, and their advisors will tell us, you know, that there’s no way we’re doing that or, yeah, that sounds good.

And from that point we’ll be putting together a short list of the policy recommendations that we want to go forward with.

Once we have that policy recommendation document together, we’ll be putting that -- that’s going to be about a 10-page document or so, you know, maybe more and maybe less. That will be potentially included in the IEPR. That work has to be done by June.

Once that document is in its draft form and given to the IEPR Committee to review and approve, they'll do some back and forth with us. At the very least, I'm thinking, several times we'll be talking to them.

And then at some point over the summer that document will finalize. It will be read or heard by the entire Commission at a Business Meeting, and I believe it is November and approved at that point. And then that will become the policy that we move forward with.

And so, I think in this particular context, in this particular effort we have -- you have a sort of unique opportunity to affect our policy, I think more than any other group has really been allowed to do.

We typically don't let industry affect our policy too much because we've had some bad experiences. So, we've had some bad dates in the past.

(Laughter)

MR. LOYER: And so, we tend not to do that too much. But in this particular case there are so many barriers that we need to overcome, there are so many nuances to the regulations -- not regulations, but the policies that we need to develop that I think it behooves us to include industry as much as possible. And to especially include people who have, so to speak, boots on the ground, who have experiences with actually putting the systems in, what the barriers they've had to overcome were, and then go right up the line to the major overall State leadership issues that we definitely have on this issue.

I think if we can fold both industry and then our three major State agencies into this discussion, I think we might end up with a good document.

I say that knowing full well I am in March and it's due in June. So, we will have to move fast.

MR. HOELLWARTH: Yeah.

MR. LOYER: But that is what's coming next.

MR. HOELLWARTH: And I think that -- let's put the stress on that, too. Any input we receive from the industry we need soon, and it needs to be well thought out. So, I'm going to suggest to take the time to really think it through, identify those key policies or issues that you want to bring forward that we can really work with our other agencies and our staff to really develop into an IEPR document.

I appreciate very much the folks that are here from outside the area, taking time to come down here, thank you much. It's been a long day.

I know it's not going to end here, it sounds like. Maybe Phil will have an announcement here as we close. But I wanted -- appreciate that.

We're looking for input from the industry, outside the state, inside the state. Keep in mind this is California, though, and while people are doing things around the country, it does usually have to go through some kind of filter for us to really take it on here.

Bill, do you want to --

MR. LOYER: Just for the record, I've requested anyone online to raise their hand if they'd like to make a comment, and no hands were raised, no comments were offered.

Phil?

MR. HENRY: Yeah, I'll just remind everyone we're going to adjourn to de Vere's on L Street, immediately following and we can continue the conversation over iced tea, or coffee, or food, chocolate milk.

MR. HOELLWARTH: What's the cross street?

MR. HENRY: It's between 15th and 16th on L Street, 1521 L Street.

MR. HOELLWARTH: Great. Thank you all for being here and look forward to hearing from you again sometime soon. Thanks.

MR. LOYER: Thank you all. And this is the official close to the workshop. Thank you.

(Thereupon, the Workshop was adjourned at 5:10 p.m.)

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