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*[Introductory music playing]*

*Rosemarie Bartlett:* Welcome, everyone. I'm Rosemarie Bartlett with the Pacific Northwest National Laboratory and I'd like to welcome you to the US Department of Energy's NECC Seminar Series. In light of the NECC being postponed, this weekly series has been developed to share insights and spur discussion on a collection of timely and emerging energy code topics. Today's seminar will cover low-load homes. Looking ahead, the series will cover other timely topics such as virtual remote inspections, the 2021 IECC, advanced technologies, and even more. We hope you'll join us Thursdays at 1:00 p.m. Eastern time and keep the conversation going.

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So before we get started today, I'd actually like to find out a little bit more about you. So I'm gonna ask a polling question. So if you would be so kind as to answer. Select which one of these most closely aligns with your profession, and I'll give you a few seconds to answer that. Okay, thanks very much. I'll share the results. So everybody can take a look. Well, it looks like we have a pretty good mix of folks. Thank you so much for that.

With that, I'm actually going to turn it over to our moderator today, Jason Vandever of SPEER. He's gonna give us an intro into the video. So, Jason, would you take it away?

*Jason Vandever:* Sure, thank you, Rose. I met the speaker today, John Sedine, at the ACA conference –

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in San Antonio here, where I live, back at the first part of March in 2019. It was actually at the very beginning of Texas Tech's magical run to the championship. I had to throw that in there since they went through Michigan and Michigan State on the way, and it's pretty clear from John's accent that he's a Michigan man. But he's also very knowledgeable in all things air conditioning. You will see his accolades and the boards he's sat on are pretty extensive. And I sat in this presentation back at the ACA conference and knew that I had to get him to do a webinar for SPEER. And he was kind enough to do that and we'll be running a replay of the video for you today.

And we've had a lot of – you know, in Texas the 2015 energy code is the minimum – baseline energy code for the state, so it –

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doesn't take too many improvements to a 2015 energy code home to make that home a low-load home. I mean, it really doesn't. And so we've been having a lot of problems in Texas. You know, what do you do when a 2,100-square foot home only needs a ton and a half of cooling, you know? At 600 CFM? Well, that's not going to work right. And so I recruited John and he was kind enough to do this for us.

Only also if you're interested in more HVAC-related videos, we also have a small-duct, high-velocity that merges really well with the ACCA LLH, a really good zoning, HVAC zoning kind of one-on-one video, J, S, and D, flex duct basics, but just all around the HVAC SPEER. We have a lot of those on our YouTube channel so feel free to subscribe and check those out.

With that I will go ahead and turn it back over –

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to Rose to get us started and I'll be monitoring the Q&A panel throughout. I think we'll hold those to the end and then the presenter, John, will be on at the end with us. So we'll talk soon.

*Rosemarie Bartlett:* So with that I'm going to launch the video. Here we go.

*John Sedine:* As Jason said, this is our presentation I did in early March for ACCA in San Antonio, and it coincided with ACCA's release of Manual LLH which shows HVAC design for low-load homes and something we've been working on for a couple of years because we knew that they'd been needed for a long time. There is some marketing stuff in here a little bit for contractors 'cause that's who the audience was at the time, so that's why it's What You Need to Know About Low-Load Homes to Bid Them and Win Them. As Jason said, I'm in Michigan.

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We have pretty good code enforcement here, and so basically we're under the 2015 code as well, so.

So today I'm gonna tell you a little bit of who I am, why ACCA wrote the manual, what it is and what it isn't, review some marketing thoughts, give you an overview of what's in the manual, and then try and answer any questions you have. The disclaimer is this presentation's an overview of the contents of Manual LLH and has some marketing topics that many of you may already know but sometimes we forget, so it's a helpful reminder. And it's not intended to be a design presentation, so we aren't gonna try and do actual designs today for sure.

I've been in the business for 41 years. I bought the –

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company in 1994 that I worked for and been an owner for 24 years, and I just passed it on to my son who's a PE and is now the owner of the company. I served as chairman of ACCA in 2010. I chaired Technical Services Committee as well as I sit on the Courts Committee and the QA Committee. As you can see, I've been part of most every ACCA manual and standard there is, as well as I sit on the joint ASHRAE/ACCA 183 standard, which is for commercial heat gain and heat loss in commercial buildings.

I've been very active on the court side of it. I've belonged to the Mechanical Inspectors Association of Michigan since 1998. I've sat on their board and I do a lot of training with them. I currently serve on the ICC Plumbing Mechanical Fuel Gas and Swimming Pool Council, so I'll be at the hearings at the end of April –

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in Albuquerque. And I sat on the 2009 and 2012 Mechanical Code Technical Committee through those code cycles, as well as the 2012 code cycle for _____ the Uniform Mechanical Code.

Our company started out doing HUD homes in the late '70s and the '80s. From there we moved on to doing more multifamily type work: elderly retirement communities, some extended care facilities, apartment housing around college campuses. We did a lot of development for the Marriott when they were promoting their like extended care – or extended stay type motels. So I've worked in most every state east of the Mississippi and west of the Mississippi I guess Colorado and I think Missouri's over there –

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as well. So I have worked in a lot of states and under a lot of codes.

And we've known for years that low-load homes were a problem because we were doing apartments, and of course apartments have always been a low-load issue because most of them only have one exposure. So this is something that's kind of near and dear to my heart and kind of recognizes a problem that we've had for a long, long time.

So why did ACCA create the manual? Actually the industry said it was needed, Wrightsoft in particular. We had people starting to come to us saying, "Hey, we're getting these 2,000, 2,500-square foot homes that only need a ton or a ton and a half of cooling, and our programs don't deal with that really well because of the airflow issues and the associated dark design with that, as well as equipment selection, because that –

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brings up" – when you have a low-load home it brings up some real equipment issues.

We're finding that the new building codes make many new homes low-load homes, which is kind of what I said. We're also finding that impacts of oversizing is worse than ever, and that's largely due 'cause a lot of people don't believe their Manual J calcs are right so they just do what they did before. I consulted recently on a 115-unit apartment project that had 78 2-bedroom units in it. Historically they put 50,000 furnaces in them. They were kind of through the _____ combination unit. And this winter they have 78 units that have a problem because they were so oversized that the runtimes were so low that they developed water issues in the heat exchangers and the draft inducers, and now they're probably gonna go back and switch out 78 300-pound –

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through the wall units for smaller ones to deal with that. And we've also seen some other cases with 90 percent furnaces as well that have been an issue, and we're seeing more and more people doing the job twice now 'cause they don't believe what's going on.

Those that do size it right encounter air delivery issues and they don't know how to handle it. We'll talk about that a little more. And there's a lack of small equipment offerings that satisfy design needs, CFM capability, latent capacity, those kind of things. Those of us that have been in the apartment market, we've known that for years. But things were more forgiving then than they are now so you could get away with oversizing and you can't do that so much.

We also find that there's more need for supplemental dehumidification. The ratio for latent load to sensible load is higher in low-load homes.

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So what happens is say in a 2,000-square foot home, the latent load pretty much stays the same and it's the sensible that drops. So the problem is when you go to look for equipment selection, while the equipment now will handle the sensible load, it won't handle the latent load, which never used to be a problem before. But as we go to smaller equipment because of that difference in ratio it creates some conflicts, especially in the southern market.

And, after all, it's what ACCA does for contractors. We try to write manuals for contractors so they can do the job right.

So what is Manual LLH and what it isn't. It's really based on today's homes. And we started out for those homes that conformed to the requirements of 2015 and now greater in the IRC. A typical Energy Star home built four years ago in Michigan had a HERS –

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score in the low 60s, and that was an Energy Star home. And in the 2015 code in my market they wanted a HERS score of 52 to 54, which that's a big departure from that. And the 2018 IRC is looking for scores typically in the low 60s and that happened through that period in the code cycle that everybody said, "2015 is hard to comply with," and so they raised it up into the low 60s if you're doing that type of scoring for the home to make it a little more usable. So what in fact this has done now is made Energy Star homes also obsolete because the requirements in the 2015 code and the 2018 code are more stringent than it was for Energy Star homes, so now EPA's trying to decide what they're gonna do with that program.

The manual's not aimed at helping a –

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designer build a high-efficiency home or design a high-efficiency HVAC system or a net-zero home or anything in between. It's basically an application manual that augments existing design guidance to deal with the unique low-load home challenges related to equipment, low latent capabilities, low airflows. You're gonna have room mixing problems, increased home ventilation in some cases, and higher than normal latent loads. It doesn't promote any specific design criteria over another. You're gonna hear some manufacturers like for high-velocity systems and mini-split systems think that they're gonna win the HVAC market with their product. We don't promote that. We know that there's a number of different ways that you can accomplish a low-load home and get it to work properly.

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It does detail a number of solutions that practitioners can employ when their Manual J calculations indicate a low-load home.

So just some marketing thoughts about Manual LLH for contractors, and we probably know a lot of these when we're doing marketing and we go in and do in-home sales. And of course one of the key ones has always been set yourself apart. You want to not be like everybody else in the flock. You want people to come to you and so you want to set yourself apart. So when you're there it's always good to use things like, "Our technicians are NATE certified," and tell them why it's important to them. Many times it's important to us and NATE doesn't have a lot of visibility out in the marketplace so you may have to explain it to them.

It's the same way with our company is an ACCA Quality Assured Accredited Contractor and here's why that's important to you.

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I'm a big believer in QA. I'm on the steering committee. We're a QA contractor, and we get a lot of work from that because not everybody in our market is and a number of entities now require you to be a QA contractor to do their work. And as part of that we can say, "Hey, everybody says they do it, but we actually do it, provide written documentation to prove it." We do a lot of work. We do a lot of big apartment projects, and we do a startup with every one of them and we leave that document with the equipment so we can actually prove that we do it. And if we have go to back to address an issue, we can pull out that document for that piece of equipment and know exactly how it operated on that day.

And as everybody says and some studies have shown, it's real easy for anybody to take a 95 percent AFUE furnace, for example, and turn it into a 70 –

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percent AFUE system by installing it improperly. So that's kind of a big deal and I think it's important contractors make a bigger point of that when they're selling to customers.

*Be the Expert in Your Market* – this book's available on Amazon. But the way to be the expert in your market is to be competent in Manual J or buy Manual LLH and be competent in it. Promote it on your website. Promote it on your Facebook page so that you can go to people and say, "Hey, I know this stuff." Hey, maybe you walk in with the book in your hand and say, "This is what I need to know to do the HVAC system in your home." So it's really important and it's really good promotion for you to be the expert in your market and having the manuals and knowing them is one way to do it.

And then of course you always want to do a –

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quality job at a fair price. And as a mentor of mine, Jim Isaac from Isaac Heating in New York always said, "Do a quality job at a fair price and the money will come." And of course this picture always reminded me when I looked at it that obviously this contractor did a good job, probably at a fair price. We know he did a good job because he put a nice-looking thermostat on the wall, and most importantly it's level and so it must be a quality job. But as we all know, just like with cars, it's under the hood what counts, not the polish on the outside.

So we don't want to say things that make you look like everyone else or actually mean nothing. As we all know, or most of us know in today's market, to say we do quality work is kind of meaningless 'cause everybody says it and nobody says they don't do quality work, so it doesn't really set yourself apart. And of course it never looks good –

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when we say, "Oh, hey, yep, we do that, too." So – and I'm sure you have some other favorites.

One of the big things is I think you don't want to get caught up in making it more than it is. We deal with a lot of things in HVAC and we all like to think we know them all and we're really smart about it, so when we talk to customers sometimes, even some that kind of know what's going on, we overdo it a little bit in trying to show them how smart we are and we make it more difficult than what it is because what we do really isn't rocket science. It's really not that complicated. It's 80 percent common sense and 20 percent knowledge, as is often said. But don't overcomplicate it because it's really not.

So what's in Manual LLH and why is it important? You know, why should I buy it? Why do I need it?

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You can see on the cover, basically it promotes the fact that we're a believer that you need Manual RS to pick your system, what kind of system you're gonna install in the home. You need to do a Manual J. You need to do a Manual S, a Manual D, a Manual T for distribution, Manual ZR if you're gonna do zoning. And if you've got like an indoor pool or an indoor hot tub in a house type thing, then that's PS – comes into mind. So basically LLH gives you the information you need to know to utilize the rest of these manuals in order to design a low-load home.

So we knew that when we wrote the manual that everybody pushes you to design or to write a manual that encompasses everything. It's everything to everybody. That's kind of why Manual J went from a 200-page document –

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when it was J7 to a 650-page document in J8. And we didn't want to do that because we already have those manuals and we didn't want to pick parts out of the already-existing manuals and yet make another manual. It typically takes ACCA four years to write a manual if it's gonna be an ANC standard, and LLH, because we narrowed the scope of what we were gonna cover, we were able to do it in two years, which is still a long time.

But we knew upfront we were gonna have to write a preface that said what was the basis. So in the manual on one of the first pages it tells you, "This manual basically is a typical home, could be in anybody's market." We said it's a single-story, 2,000-square foot, three-bedroom, two-bathroom home, slab on grade with an attached garage, meets the requirement of the 2018 IECC and IRC, and –

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it has an encapsulated attic and upgraded floor insulation. That's exactly kind of the scenario we were hearing from Wrightsoft and other people that do Manual Js, saying, "Hey, we're doing a Manual J based on the current code and we've got these issues; we need some help."

The introduction kind of defines what a low-load home is. Basically you're talking 1,500-square foot per ton, kind of the rule of thumb if you were gonna go by that. And of course rule of thumb is always a good measure to go by just to see, hey, am I in the realm of reality? So when somebody comes up with this doing a Manual J, he doesn't say, "Well, I'm not 500-square foot per ton so I must've done something wrong."

So being a low-load home doesn't necessarily mean it's energy efficient in today's market.

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Indeed many condominiums and apartments, which I've been talking about, that have only one and two exposures have always been low-load homes and have low heating and cooling modes. But 20 years ago or so when we did Manual J7, you know, it could've been 600 to 1,000 square foot per ton. Ten years ago as homes improved it went to 800 to 1,200 square foot per ton. And currently we're often seeing homes in the 1,000 to 1,400 square foot per ton and up to 2,000 square foot per ton depending on what the people decided to do with their home that's above and beyond the requirements of the code.

For those of us in the heating market, especially for, like me, in Michigan, you know, we probably care more about heating than cooling. So a low-load home might be a five BTU per hour per square foot home in Florida, in Homestead up to –

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15 BTUs per square foot in Duluth, Minnesota.

So Manual LLH is actually an application manual and not a design manual that you're probably used to. It deals with the unique HVAC design issues of low-load homes, identifies some equipment options and approaches that are available in today's market, augments the instructions provided in existing manuals, and it's not intended to be a standalone document. So you can't just buy Manual LLH and not have to buy J, D, and S, 'cause it will not work that way.

So everybody says, you know, kind of, "What's the big deal?" Well, the big deal is airflow. So this is basically a system shown in Manual D, and it shows –

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a furnace blower with 1,000 CFM and 36,000 BTU heating load and a 24,000 BTU _____ load. So this is a home from either middle American to southern America possibly. And so basically they selected in this example 1,000 CFM blower. Well, a typical home requires a half to one CFM per square foot of floor area in order to provide adequate air circulation for comfort heating and cooling. So if you've never not looked at that anytime you design a home, look at the CFM per square foot. So typically in a 2,000-square foot home, depending on the design of it and where it's located in the United States, it would require from a half CFM per square foot, which would be 1,000 CFMs, up to one square foot which could be up to –

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2,000 CFM of airflow in a 2,000-square foot home.

So the problem that comes in is if we take this same home and it's 2,000 square foot and let's say it only has a one-ton load, now we only have 400 CFM of air to try and provide adequate air circulation in a home, and it won't work. You will never get the air circulation in a home to provide comfort heating and cooling with that kind of CFM. So when we depart from this typical requirement, then we start having problems. The half CFM probably is a more northern market. One CFM is probably a more southern market because of course cooling requires more airflow than heating does. But that's where the big problem comes in and the first real big problem once we've done a Manual J.

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Then we do equipment selection and then we figure out, oh my, we have an airflow issue, and how are we gonna deal with that?

So Manual LLH is broken up into three parts. The first part talks about the design issues and the procedures. It's all about what is a low-load home. If you're gonna use zoning, what you have to be aware of. It covers Manual J calculations and how to know if it's a low-load home and issues with selecting heating and cooling equipment. It talks about moisture extraction equipment. That was a big issue when we titled that section because nobody wanted it to be just dehumidification, as well as it talks about outdoor air and its impact on the system, supply air, exhaust fans, and controls that may be different for a low-load home –

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than you would find in a regular home.

So part two is the example solutions, and basically there are six examples. Five of them are examples that people are using today effectively, and one of them, which is example four, is something that is a play on a zoning system called capacity deployment system that hasn't been proven out in the market yet but has received a lot of attention and a lot of discussion. So we knew that being _____ _____ that this is today's problem and it's a today's issue and there's not very many good solutions, these were the ones that we came up with that could be utilized if you ran into this type of home.

And then lastly, part three is the appendices. It gives you more information about the moisture loads for type-A climate homes –

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which would be Charleston, South Carolina or Homestead, Florida, places that have typically real high moisture loads on the southern Gulf shores and where have you. It goes into more detail on HRV and ERV effectiveness 'cause a lot of times we'll select an HRV or an ERV based on airflow and not look at the effectiveness of it. And the effectiveness has a big impact, has more of an impact than the airflow does because you may need to pick a different one based on the fact that it's not as effective as a different kind. It talks more about ancillary dehumidification for low-load homes and how to select the right dehumidifier and how to utilize it. And of course one of the big ones is Manual D calculations for using nozzles, and the reason that that is, is that because of the low airflows –

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the typical ten by fours and ten by six ceiling diffusers that we're used to using do not function well down at the 50 and less CFMs. So you're gonna have to do something different if you're gonna use conventional equipment, and basically there are manufacturers now offering nozzles to be used with split-system air conditioning other than just the small, dark, high-velocity systems. Then it talks a little bit more about energy efficient home design and how Manual LLH applies to some of that.

So here again we're gonna go over the example solutions. You just have to understand in the example solutions these are low-load homes and it's based on using equipment –

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and technology that's available today. There's gonna be differences based on geographic and regional locations just because that's the way it is. We aren't all the same, and that's always a problem when we write a manual 'cause the person on the committee from Florida wants to write it for Florida, the person from Minnesota wants to write it for Minnesota, and everybody has to understand that there's a lot of diverse geographical differences in America and so it's got to apply to everybody, including some of those states that have microclimates. And it even gets a little more interesting. *[Audio drops out]* _____ located in a human climate.

One of the things that we kind of neglect when we do a design is when we design a home, it's based on an average and not a peak. So we're always gonna have temperature excursions, –

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some pressure excursions inside the home, as well as humidity excursions, and we want to limit the humidity excursions the most because that's what gives us our mold and mildew issues.

So the first example we have is a small-duct, high-velocity equipment – probably a lot of you are used to seeing it. This one was based on possibly installation in Homestead, Florida or someplace in a highly humid area. It uses nozzles, as they always have, to obtain adequate room air mixing, and of course if you put in small-duct, high-velocity equipment you want to install it according to manufacturer's installation instructions. And based on the location and the sizing of it, even with small-duct, high-velocity systems you can see that –

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an ERV was added in here to handle the outdoor air load because it's typically so humid. So basically an ERV would help us deal with the disparity in the ratio of sensible to latent, and if we have a real high latent and the small-duct heat pump we pick can't handle all of the latent, so putting the ERV in there to handle some of the outdoor air will help with that, as well as adding a dehumidifier. And of course there's a number of different ways of adding a dehumidifier. This one basically is a standalone unit and takes air from some of the rooms and dumps it in near the return. You could put it right into the ductwork if you desire. So there's a number of different ways that you could do this system.

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So second example – people are actually doing this. It's not the best way to do it, but some people have found that because there's a bigger variety of equipment sizes in ductless mini-splits, we're seeing people take an area like in a hallway. You'd never want to take a room, but we've seen applications where people have done this where they've put the _____ in a room. And then you put a cabinet blower in and basically you're putting the conditioned air into this _____, let's call it, and then you're sucking it back up through the return air which has an outdoor air intake because we *[audio cuts out]* _____ the current _____. You could have a one-ton system and that's putting 400 CFM of air in here, but because it's mixing it with the outdoor air and the –

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return air in the space, you could put the 800- or 1,000-CFM cabinet blower here and then use conventional air distribution if you so desired. And of course depending on location you may have to add a dehumidifier or an ERV or an HRV. So this solution may not be compatible with non-compact home designs and you could get large temperature departures obviously because of the way you're distributing the air here. So this one is at its place but it's not a solution in all applications.

For those of you that have done schools or hospitals or some commercial work, you're all familiar with a fan-powered mixing box. Basically we're showing here that we have a heating and cooling air handler and _____ may –

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be putting out 400 CFM per se, and then it has a second fan-powered mixing box that sucks in additional return air or indoor air and mixes it with the other air and then distributes it out to the rest of the home. This doesn't necessarily have to be one blower going into another blower. This system could be actually an air handler with a duct system, and then you come off at different points in the duct system to a fan-powered mixing box, which is what you would normally see in a commercial application like a school or a hospital type thing. And so we know that this type of system does work. A whole house dehumidifier or heat recovery equipment may be required as well.

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One quick note about an ERV and HRV, there is a difference between the two. One handles moisture better than the other. They're definitely not interchangeable and Manual LLH covers that in a little more detail, and that's good reading because we often ERVs and HRVs misapplied.

A capacity deployment system basically is – what is shown here is basically a three-zone system. If you have a home that has really good diversity, you can break it up into zones because, as we all know, each zone is gonna peak at different times of the day. So for this system, in a capacity deployment system what we do is if this were a one-ton system –

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and we had the requirement, we could break this up into three one-ton zones and we only let one zone at a time be a caller. And there's no modulating of the other systems, so you could have up to a one-ton load at a time. So this would work in like my home for sure because my whole west wall is glass and it faces west. And so at 4:00 in the afternoon the whole load of the home is pretty much right there in the living room area on the west side of the house. But the best design is no more than three zones and no zone being smaller than 25 percent of the full load. Nobody has actually proven this in the field, but theoretically and mathematically, you know, this should work and may be an application that you could utilize as long –

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as you have good diversity in the home.

Engineered bypass air – this would be a play on a mixing box. The difference is you're paralleling two blowers so you could have – if the first one is 400 CFM for your air handler system and you only needed another 400, you would have a bypass air handler that would bring in outdoor air or the other one could be. You'd just have a second air handler that you'd put in parallel and then basically Y them together to the distribution system to do that. The advantage to this is you would only need two blowers, where in the mixing box system maybe you could get by with two blowers but if you were to take off and use smaller mixing boxes, then you might have to have five or six mixing boxes –

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along with the air _____. With this one you just have the two blowers. And then of course, you know, you could need additional dehumidification or heat recovery equipment. And a big note, which they cover in here with this bypass system, is if you're gonna use two blowers in parallel, the steady pressures must be equal to the design pressure drop of the entire duct system. And if you're going to use modulating blowers in there, then they both either need to be staged or modulated in the opposite direction, and the manual goes into great detail over that.

And then probably what most of us are looking at and probably what would be the most prevalent system used is using standard equipment with nozzles. So Manual LLH will tell you –

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how to use or adapt Manual D towards the different pressures, the pressure drops that we'd have in this type of system, as well as it goes into detail about picking supply air nozzles and sizing them correctly per Manual D. And it uses conventional return air ducts, but it's going to have specialized nozzles. And there is a number of manufacturers that do make these now. They are available. Some of them are pretty snazzy looking. And we're starting to use these as well because a lot of the developers in the upscale market we're in like the look of them. And if you Google it you'll find a number of different manufacturers. We've settled on one –

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that we use a lot. We're happy with it and our customers like it. And so this is more the direction we're headed in. So as time goes on, in order to deal with the low airflow issues, we think that this example will probably be the most utilized, next to probably small-duct high-velocity systems possibly. But now that this manual is out and it shows you how to use nozzles on a conventional system, we think this probably will take up more of the market and be more accepted.

One of the reasons this works now is that more upscale equipment from manufacturers can handle higher static pressures. You know, some residential equipment where we're used to only being able to handle 0.5 inches of static can handle up to 0.8 or a –

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whole one inch of static. So not every furnace will work with this system or air handler will work with this system. You need to pick one that'll have higher static ability.

We also met with AHRI a month or so ago with a number of the major manufacturers, and they recognize that this is an issue with their equipment, regardless of who the manufacturer is, Carrier, Goodman, Amana, Reeve. They were all there. They understand this is an issue and they're all working on smaller size equipment options with stronger blowers, so in the next couple of years we're pretty confident that we're gonna see more equipment offerings come out of the major manufacturers that we typically use to deal with the –

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airflow issues, the difference between the latent and the sensible. They know they're going to have to start making that equipment a little bit differently and have more offerings with stronger blowers. But that's not available today, so this is something that you can buy the manual and you can utilize today if you run into a low-load home that has low airflow issue.

*Rosemarie Bartlett:* Well, that was a really informative video and we're lucky enough to have John Sedine with us to help answer some questions that you've had that have come in. So with that, Jason, over to you.

*Jason Vandever:* Sure, okay. So, John, there's a few in here. I've answered a few along the way, just some of the easier ones, but I've saved the tougher ones for you, of course, because you've forgotten more about air conditioning than I will ever know, I am sure.

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Let's see. Darren asks, "Why would ACCA recommend an approach in LHH standard that has not been demonstrated in the field?

*John Sedine:* Well, I'm gonna make – you got my audio okay?

*Jason Vandever:* Yes, we hear you fine.

*John Sedine:* Okay. Well, I'm one of them lucky people that live in a rural area and my internet is spotty, to say the best, under these conditions. So – but to answer your question, why would the ACCA recommend an approach that hasn't been proven in the field yet, _____ _____ _____ is actually a _____ _____ _____ _____ maybe a different _____ for _____. That's partially why it was in there. And there are some people that have used that method but ACCA –

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wasn't able to verify it at the time we wrote the manual. So the thought was _____ _____ kind of _____ _____ _____ _____ _____ _____ that's why we said we didn't recommend any of these, one over another. It was just here are some things that people are doing and some things that people are talking about.

*Jason Vandever:* Gotcha. That's – yeah, I can tell you live in the country. You're a little spotty on the replies so I'll try to kind of preface some of these answers before I hand them over to you. Thomas says, "So is mixing – is a mixed climate aligned with cooling because it is the larger airflow? Same for heat pump, considered the 1 CFM per square foot CFA." What were you saying about the mixed climate aligning with cooling?

*John Sedine:* Well, the mixed air temperature –

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with the volume and the velocity of air – you have to be cognizant of all of that because typically in a low-load home you aren't moving enough air to establish human comfort, so you have to add more airflow to that to boost it up to get it to circulate through the house. And typically more CFMs of air are required to move cooler air than hotter air, so hence, you know, usually you have higher airflows with AC than you do with heating, and that poses a problem.

*Jason Vandever:* "And with higher airflow," this next question from Bill is perfectly timed, "you experience noise issues when installing nozzles."

*John Sedine:* Well, you will if you don't size them correctly and use the right nozzles, or –

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and you don't air balance the system. So it all goes back to the design in every respect, from the Manual J to the Manual D to the Manual S and to Manual T. You have to do every one of those functions or you're gonna have issues. So normally when there's noise issues, either the D wasn't done right or the T wasn't done right or there was no air balance.

*Jason Vandever:* And Armando – more of a comment, that "certainly in Texas we can't get HVAC guys to do J, D, S, and T, and now we're gonna throw LLH at them?" Well, Armando, I think LLH would be for those guys that are doing it right and need a little guidance getting the home where they need to be because it is such a low-load home.

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Darren wants to know, "Can you talk a little bit more about the difference between – the nuanced difference between LLH being an application manual versus a design manual?"

*John Sedine:* Well, basically when you look at the installation instructions for any piece of equipment, that's an application manual. So you're trying to apply it properly, so when you buy a furnace or an air conditioner you have an installation manual but it doesn't do a Manual J for you. It doesn't design the ductwork for you, doesn't tell you how to do the air balance. So that's the difference. So basically Manual LLH is kind of a design manual assuming you've done a J, a D, an S, and a T calculation, and then you're using LLH for –

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the application or design of the system after you incorporate all those items into it, but understanding that none of the J, S, D, or T takes into consider the low airflow issues or the design issues mostly attributed to higher latent loads versus smaller sensible loads that we see in low load homes. So it's added information to better utilize the other four manuals.

*Jason Vandever:* Yeah, that makes sense. Darren also wants to know, "Please exchange what is meant by non-compact home, i.e. square footage, _____ height, land use. Also what constitutes large temperature departure, like a few degrees, three or four or five?"

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*John Sedine:* Well, that's a real good question. A large temperature departure would be a temperature departure either up or above or below the setting of the thermostat that the person that's feeling that temperature departure would have an issue with it. So typically we hope that temperature stays within plus or minute two or three degrees, but as we all know that if like in my house you're sitting in the living room at 4:00 and the sun comes in through the glass window and you're sitting in front of it, there's gonna be a big temperature departure because you're getting all that solar radiation hitting you directly. So that's kind of the big temperature departure, is anything that you wouldn't expect above or below the plus or –

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minus two degrees.

A non-compact home wouldn't be the typical homes, what we've been seeing built lately, the 3,000, 4,000, 5,000-square foot homes, open concept. A compact home would be like the older homes we used to see that there was a door on every door opening. So, you know, the dining room was separate from the living room, was separate from the kitchen, was separate from all the bedrooms, that kind of thing where you didn't have an open concept. So anything you wouldn't consider open concept would probably be a compact home.

*Jason Vandever:* Yeah, we don't really built many of those in Texas. It says – Thomas asks, "I am using 2018 IECC for thermal and using conventional air handler 16 SEER heat pump.

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Would you modify duct system to nozzle termination if hardware is accessible as easy way to begin a transition to LLH?"

*John Sedine:* Absolutely, and we've done some of that. But you have to search out for equipment that can handle a little higher static load, and then you have to find a company that builds nozzles that you're comfortable with. We have one company that we use and a number of people have that in play. The only time that really doesn't work real well is if you have like a system that's only got four registers on it. Then that can be an issue with nozzles and sizing. But if you have the amount of air you need for the space with a little higher static –

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drive in it, then you can design it and accomplish it and still be below the foot-per-minute necessary so that you don't have noise.

*Jason Vandever:* Mike asks, "Is LLH useful for homes with basements?"

*John Sedine:* It is useful for homes with basements. It depends on what part of the world you live in. I live in Michigan and we have basements, and typically a basement has no cooling load up here but it has maybe the highest heating load if it's non-insulated. So it makes it an interesting situation in Michigan, but yes, you can definitely have a low-load home with a basement.

*Jason Vandever:* And then I would be curious if ACCA recommends a code proposal for this. Mike wants to know –

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all I've seen in the code is J, S, and D. I haven't even seen it reference T. But Mike wants to know, "Do you see ACCA LLH being incorporated into the uniform or ICC codes?"

*John Sedine:* That's an easy answer and it's no. And I'm very involved in the code world. I've been a member of like the Mechanical Inspector's Association from Michigan in 1988 and then I've lived through BOCA and South Florida building code and IAPMO, and

IAPMO's still out there a little bit. I sat on their mechanical code for a couple code cycles. I've sat on the ICC codes mostly, the International Mechanical Code for like four code cycles, and I still sit on the International Mechanical Code IMC –

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committee, the major committee that oversees the fuel gas code, the mechanical code, the residential code, and the swimming pool code as well as the plumbing code. So I have those meetings all the time, and basically all the code bodies are trying not to add anything more than they need to in the code. They know the codes are getting unwieldy, and so they're pretty anti putting any more documents into the code as referenced if they can't see that it has a true, direct bearing that isn't found somewhere else. So their rationale for not putting LLH in there is the information is found in J, S, D, and T already, just maybe not in its full form. We've had the same problem with getting them to adopt the –

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one of our other code manuals for doing different systems, and they say the same thing, is that information's in Manual D so you don't need a zoning manual to be put in there as well. So I don't ever see it happening.

*Jason Vandever:* Okay. And I see Rose is back on the screen so I just have time for one more question. I can't leave Gil hanging. He's nice enough to do a J, S, and D webinar for SPEER in the next month. So Gil asks, "Many manufacturers show fan CFM above 0.5 static. I always believed that the certified CFM was the static that was actually tested in the factory. Many duct systems I have done a review on are 0.8 to 0.9 external static. Is that an issue? It does not seem to be one."

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*John Sedine:* Typically it's not because every manufacturer gives you extended performance data, whether it be on fans, the heating side, the cooling side when you select an air conditioner. And so they are pretty good at doing that testing because they know how important it is. A lot of upscale equipment like the furnace in my own home, basically when I turn it on it does a self-diagnostic and it determines what the static pressure is in the system, and if it's beyond the capability then it'll shut my system down and tell me I got a problem. So in all the years that I've been installing and doing consultation and doing that kind of work, pretty much the expanded data if they offer it is usually pretty accurate.

*Jason Vandever:* Okay. I have a few more, Rose, or are we out of time?

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I know you normally like to end right on time –

*Rosemarie Bartlett:* Yeah.

*Jason Vandever:* And I'll run 20 minutes over if I have good questions, but that's just me. So if we need to end, we can.

*Rosemarie Bartlett:* I'm sorry we do. I'd like to thank John very much and you as well, Jason, and thanks of course to everybody else for joining the Department of Energy's NECC Seminar Series. And as a reminder, we've got a great lineup of topics to cover during our future webinars and we hope you'll join us on Thursdays at 1:00 p.m. Eastern and keep the conversation going. Thanks, everyone.

*[End of Audio]*