Jeff McCullough: Good day, everyone, and thank you for joining us today for today's webinar on Exterior Solid-State Lighting and talking about high performance parking lot lighting. My name is Jeff McCullough with the Pacific Northwest National Laboratory (PNNL). With me we also have Michael Myer also of the Pacific Northwest National Laboratory, and we thank you today for taking the time to be with us. So today's agenda is going to cover solid-state lighting in two primary areas. One is introducing you to the Federal Energy Management Program's (FEMP) Exterior Solid-State Lighting Initiative, and you will learn more about what that is and what the Department of Energy (DOE) is trying to do.

We will give you an update on the L Prize design competition. I think this is something you will find very interesting. And today's feature topic is high performance parking lot lighting. And then at the end of the presentation, we will have plenty of time for questions and answers. So with that, let me start by talking about the FEMP Exterior Solid-State Lighting Initiative, and what I should share with you is that FEMP desires to move solid-state lighting into the de facto position for exterior applications. And to that end, we are doing a number of activities to support that particular initiative. The one slide that I have before you now is talking about a partnership between the Federal Energy Management Program and the U.S. Army Corps of Engineers.

The U.S. Army Corps of Engineers is developing an exterior solid-state lighting policy where they are setting a minimum performance level for exterior lighting applications. And so they are currently working on that. We expect that to be a live document that is actually promulgated in January/February timeframe. So in supporting those efforts, FEMP is not only working with the Army on that, but we are also going to be developing what we are calling FEMP-designated performance levels. And you will see in the bottom right-hand corner of this slide some materials and resources that are being developed to support that, and I will talk more about FEMP designation here shortly.

And of course, no policy is complete without also coupling it with some form of outreach and training. And so FEMP intends to support that effort by doing webinars, training, media events and those types of things. But ultimately, the end goal is to get solid-state lighting into the de facto position, and so that is what we are trying to do. Let me share with you more details on this FEMP initiative. So I have already shared with you the exterior solid-state lighting policy piece with the Army Corps of Engineers. And again, that was expected back in December. In addition to that, we are also working on construction standards specifications.

For those of you that are in the A&E side of business, you know that when you go out and procure some materials or you are building a facility or doing some kind of a retrofit there are standard construction documents, and the format that is typically used is called CSI, Construction Standards International. And so that kind of structure has placeholders at four various technologies and applications and how they are executed. So supporting this Army policy we will be developing of these materials so they can be used in your construction procurements and construction efforts.

I also stated that FEMP is developing a FEMP designated performance level for outdoor lighting – exterior lighting. That effort will be taken or is currently underway and should be completed by the first quarter of 2012. That effort will set minimum performance levels for various types of exterior luminaries, and how we will develop that is by benchmarking, looking at not only incumbent technologies, but also the current lay of the land from a solid-state lighting perspective, and establishing cost-effective performance levels. Then FEMP will roll those out, and I will talk here in just a second on how we plan on doing that.

But suffice to say FEMP will be designating performance levels that entities can use in their lighting projects. So rather than maintaining a database or developing a methodology, if you will, for maintaining products and that kind of vetting process, we want to let you know that the Design Lights Consortium currently has a process underway. The Design Lights Consortium is a group of utilities and market transformation groups that are interested in promoting solid-state lighting, and they intend – they have a current product list that – it does include exterior applications, but in some areas the FEMP designated levels will actually be higher.

So rather than developing yet another database and another vetting process, FEMP will be using the Design Lights Consortium product listing, but will then have a means of differentiating between Design Lights Consortium specifications and FEMP designated performance. So we will be working on that, but essentially we will be using a process that will include the Design Lights Consortium and the FEMP qualified products list as a resource for FEMP activities. So in supporting this FEMP initiative, we are developing guides and training materials, FAQ sheets, etc. You can see on the bottom of this slide there is a link where you can go to to find these materials.

And so I direct you to go out there and take a look at them. I will be adding more and more content as we move forward, but that will be your resource for this particular initiative. One other effort that we are launching early in this year is a market assessment for exterior solid-state lighting, specifically federal market assessment. There has been a lot of work done on the private sector, but we know that we need to go out there and contact the agencies and determine what percentage of their consumption is lighting. So we will be undertaking that effort here this year. Okay – a little bit more about the Design Lights Consortium.

I shared with you that there is a qualified products list. This is essentially a screenshot from their website, but if you look at it they have a technical requirements table. The current version is 1.6, and I am showing you just the first six categories. And see there that those are outdoor lighting applications. It sets a minimum light output level, what we call a zonal lumen density – how much light in certain zones – a minimum luminaire efficacy, color metrics and then a lifetime or L_{70} performance level. So this is currently out there. You can go to DesignLights.org to learn more about them, but as I stated earlier, FEMP will be using this database – not necessarily these performance levels, but at least the database for the FEMP designation of exterior solid-state lighting products.

Okay – what resources are available to you now? One of the things that I would point out to you is that we are talking about parking lot lighting today. Tomorrow we are talking about parking structure lighting. But of course, another piece to all this is street and roadway, and I want to make you aware that DOE has a Municipal Solid-State Lighting Consortium, which is a street lighting consortium, that is well underway. And in fact, they have a performance specification that has been developed that you can go out and learn more about. I will also mention that there was a recent webinar by this effort and I – we know that this presentation will actually be placed on the Web so that you can go out and view it separately.

So I would encourage you to do that if you are interested in street lighting. This would be a great opportunity for you. In addition to this performance specification that has been developed by the consortium, there are also gateway demonstrations. These are high visibility efforts where DOE partners with various utilities or market transformation groups. They do a lighting retrofit whether it’s either retrofit or new construction, but specifically using solid-state lighting products. You can go to the main DOE SSL website and learn more about these, but there are excellent write-ups, cost-effectiveness, illuminance measurements – all kinds of analyses conducted that you will find useful as you consider solid-state lighting for your application.

Another resource available to you is the CALPER Program, and CALPER stands for Commercially-Available LED Performance Evaluation and Reporting. And what this is is that DOE goes out and purchases solid-state lighting products on the open-market, sends them out to independent third party test laboratories and has the results made publicly available. So it is an opportunity if you are interested to see how a specific product has performed or how the trending of the industry is moving. You can go to the CALPER website and learn more about these. I do want to be clear that CALPER does not test all products.

Certainly, there are a great number of products that are in the market, and we just simply cannot test everything, but we do try and select either specific applications of interest or products that have a high market penetration. So that is a resource to you that I would encourage you to go and take a look at. We have talked about these demonstrations – these gateway type projects. We have done them for parking lots. We have done them for parking structures. You will hear about parking lot today, but you should be aware that there are several of these demonstrations that have been done for exterior lighting that I know will be useful to you.

Another resource is DOE's Commercial Building Energy Alliance. There are specifications that have been developed not only for parking lots, but also for parking structures, and you will be hearing a little bit about that shortly from my colleague, Michael Myer. But this is also a resource for you. The Commercial Building Energy Alliance are groupings of large entities, and I will not go into too much detail as to what they are made up of. But suffice to say it is for these large building types. You have got, for example, a retail alliance, you have got a hospital alliance, and you have got a real estate alliance.

Underneath those are some names that you would recognize such as Wal-Mart, Home Depot, Cleveland Clinics, etc., etc. General resources – this is where I keep encouraging you to go to the main DOE Solid-State Lighting Program website where you can learn more about solid-state lighting. I think you will find that a great resource. And we have already talked about the Design Lights Consortium; DesignLights.org is that website. Okay – let me shift gears now and talk about the L Prize program. I recognize that it is not specifically an exterior lighting application, but it is a very exciting program that we want to provide an update for you today.

So what is the L Prize? It is the first "X Prize", if you will, for lighting. And when I say that, the term "X Prize" is used to describe incentives that are placed out there for innovation. And you have heard of things like there was an X Prize for the first person to go around the world in a hot-air balloon. There was an X Prize for the first private entity to launch a spacecraft and have it be recovered, etc., etc. So similar to that concept, there was a legislative mandate to the Department of Energy created by the Energy Independence and Security Act of 2007 that developed the first X Prize, called the L Prize, for lighting. And there are two key lamp replacements that were identified in that effort.

One was a $1 million dollar prize for the 60-watt A-lamp replacement. The 60-watt A-lamp, of course, is ubiquitous, and there are literally billions of them out there. So there was a $10 million dollar award designated for that effort. For the Par 38, or the parabolic aluminized reflector 38, which is kind of a spot flood light that is very common, and there is $5 million that has been set aside for that. And there is also then a future focus for a 21st century lamp. We do not know what that looks like. It may be a square lamp. It may be a luminaire. That has not been decided, but basically it is kind of setting the bar high for a future product. So as I said, there are cash awards available.

These are all tied to federal purchasing and utility at energy efficiency programs. So let me just kind of move through that a little bit more with you here. So when you set these performance levels very high, obviously, you are challenging the industry to rise to the occasion. It spurs innovation, and so what has been done is setting performance levels that at the time are very, very high. So if you look off to the right here, for the 60-watt A-lamp replacement product, the efficacy has to be greater than 90 lumens per watt. Now, to put things in perspective, the typical incandescent A-lamp is about 15 to 18 lumens per watt.

A good Energy Star compact fluorescent lamp is in the 50- to 60-lumen-per-watt range. So you are almost talking twice as efficient as even a compact fluorescent lamp. It must use less than 10 watts, and it has to have greater than 900 lumens. The typical A-lamp has approximately 900 lumens of emission, and it has to have a life of greater than 25,000 hours. As you learn about solid-state lighting, you will know that LEDs themselves do not usually burn out. They simply get dimmer and dimmer over time. So the requirement here is that at 70% of their initial light output, and that period has to be at least 25,000 hours.

So it is not that the lamp fails at 25,000 hours; it is just that at 25,000 hours it needs to be maintaining 70% of its initial light output. It has to have very, very good color renderings – a color rendering index of greater than 90. As a reference, an incandescent lamp is 100. Most CFLs are in the 80 to 82 – 84 range. So this is very, very good color, and then the color rendering – sorry, the correlated color temperature needs to be similar to an incandescent lamp, and that's that 2,700 to 3,000 Kelvin. And I will not go through the Par 38 requirements, but suffice to say they are very, very high and will be a challenge for the industry to meet that requirement.

Well, the good news is that in August Philips Lighting has won the 60-watt A-lamp L Prize, and so there was a press release on that, and some of you may have seen this. And the image that I am showing you today is actually of the production version of the L Prize winner. It is a very impressive lamp. I will not go into the technology behind it, but suffice to say the reason for the yellow color to it is that it uses what is called a remote phosphor. So do not be fooled that if you power this thing up it is going to look like a bug lamp. In fact, because of the remote phosphor and then the color requirements, it indeed will look very, very close.

I mean, frankly, on a side-by-side basis, you would be hard-pressed to discern between the color of an incandescent lamp versus the L Prize lamp. So I just wanted to share that with you so that you understood that this is not a yellow lamp when it is energized. So what is happening now is that Philips has a strategy to implement this particular lamp. They are first going to target the commercial sector and so beginning in February 2012 the commercial market will have access to this lamp. And Philips has announced that they plan on making that lamp available to consumers in April 2012. We do not know if it that means it trickles down to your big box stores or your retail outlets.

I suspect it will, but we are not sure how they eventually will roll that out. But suffice to say it will be coming to you in 2012, and you as an end user can begin to consider these lamps. There have been case studies and demonstrations done on these lamps with the L Prize partners. These partners are utilities and market transformation groups. They receive a number of these lamps during the evaluation process and conducted surveys and the like. And suffice to say that the products were very well received. They had good dimming characteristics, for the most part.

They had good light output, excellent color, and so the surveys came back that these products were highly praised and definitely were something that should be promoted as we move forward. We would also like to make you aware of an audit tool. So if you are considering doing replacements either in your facilities or even in your own homes, you can simply use this tool, which helps you make those kinds of decisions. And I would direct you to the Philips website here. You can enter in some of the information for your facility, and it will then give you some economic analysis that you can begin to use in considering these lamps.

So you can also go to the main L Prize website that also is on the main DOE website, and you can learn more about the project in general. So with that, I will pause for a second and let Michael Myer come on and begin to present on high performance parking lot lighting. And then we will have a question-and-answer period at the end of that.

Michael Myer: Thanks, Jeff. I am going to spend the remainder portion of this presentation on the high performance parking lot specification. We will quickly discuss an overview of the specification: some illuminance, lighting power density, economics, reliability and then the specification in practice. Why lighting? It is always good to just kind of step back through and think about how much use it has. Lighting is usually the largest or second largest use of utility in a building. In this case – you can see by these graphics – residential is like 10%, and in commercial it happens to be 21%.

When you combine heating and cooling it is usually overshadowed by the combined. But for the most part, lighting is dominating usage, and parking lots – we do not think about them often, but they often operate all night long, and there is a lot of energy being used, and there are lots of new potential out there for LED lighting to save energy through both the use of more efficient equipment and positive control. It is also good to talk about, "What is a performance specification?" Performance specification is different than other types of things. This was adopted by an end user or a site, such asWal-Mart, Walgreen's or GSA – and it outlines that the product must deliver X – in this case the lumens or foot-candles and the amount of uniformity – for Y, and Y is the energy.

Which could be watts per square foot or it could be kilowatt hours. It depends on how you want to write your metric. This is done differently than the technology specification. And the technology specification can be done much more easily through an RFP or a mass procurement. Technology specifications are more incentivized by utilities and energy efficiency programs. Typically, they say, you know, "It's a light bulb, and it must have this efficacy." Energy Star or the premium TAs are good examples of technology specifications.

They are just looking at the actual lighting device itself, how much power is going in and how much light are you getting out. They are not taking in the performance of the system as a whole; that is what the performance specification is doing. So illuminance – what is illuminance? Well, illuminance is the amount of light falling on the ground. It is ultimately what is important when you are doing a parking lot because it is how people see, and it is really what they are getting out of it. So rather than focusing on just how much light is leaving the fixture, we are focusing on how much light is there in the parking lot for people to see by.

Parking lots are governed by RP20, which is the IES, the Illuminating Engineering Society of North America – their recommended practice for parking facilities. They set a minimum – that is a very important distinction between other things. Many other IES recommendations are for averages, but in a parking lot it is a minimum. Currently, the table shows the current recommendations is an RP20, which is a 0.2 foot-candle minimum, horizontal, or for enhanced security 0.5 foot-candle minimum. The RP20 is being revised, and if the lumen values do go up or down, the performance specification would probably also change as well. Just to step back into why – what is the difference between minimum and average?

A lot of sites actually require something like a 3 foot-candle average or a 5 foot-candle average, but average is very misleading as shown by the two rows at the bottom of the table or at the bottom of the slide. You have an average where it is 18 foot-candles, 0.3 foot-candles, 7 foot-candles, 2 foot-candles and 3 foot-candles. It averages out to 6 foot-candles, but it is a very non-uniform layout where you have a real hot spot, which is 18 foot-candles. Compare that to the one below where you actually have 4 foot-candles, 0.8 foot candles, 2 foot-candles, 3 foot-candles and 2.5 foot-candles, it averages also out to

2.5, but yet the minimum is higher, and in that case the bottom row is a much more uniform layout.

And your eye adapts to the brightest source in the area, so you are striving for a more uniform layout for your eye adaptation. That is one of the reasons why they focus on minimums. So as I said, the performance specification requires lighting in the parking lot. So because the way this performance specification was developed, people wanted to exceed the RP20 requirements, so they went with 0.5 foot-candles or 0.75 foot-candles or 1 foot-candle horizontal. What I should also mention is that there are what are now known as lighting zones. A lighting zone is really just the zoning or ambient light environment.

So the idea is that if you were in Times Square, you would be in a lighting zone 4, but if you were in rural Kansas, or Yosemite actually would be a better example, you would be in lighting zone 0. The idea is that in the more dense area, you need more light because your eye has adapted to more light already, and so the idea here is that as your lighting zone increases the minimum also increases. But again, these illuminance values will probably change in response to RP20 when that new revision comes out. But this shows what the minimum requirements are at the moment. Currently, the specification doesn’t assess a parking lot in not just one type of space.

It says, “Okay, well, if you have perimeter parking, you have front aisle parking which is really the parking nearest the building where people currently conflict between cars and pedestrians are highest. That is where people are quite literally parking, getting out of their car, walking into the building, and then you have your loading dock and your rear drive as well as your general parking. Each of these zones has different needs and different requirements and should be treated differently. Your perimeter parking probably could have and use a little less lighting because it is on the periphery and that is usually the last spots taken and you have less conflict. Your front aisle parking typically needs more lighting because it is a higher conflict zone with people and pedestrians and cars.

Other illuminance requirements – so these are for the different zones. As I said, the perimeter has less light because of its location in the parking lot. The front aisle, because of its pedestrians, has higher, and then the entry drive and loading areas also have a lower requirement as well because of their location and the potential for less conflict. Lighting power density – so what power density is, for those who are not familiar with it, is just watts; so you sum up all the fixtures on the site, divide by your area, and you get watts per square foot: the common metric used in most energy codes. In this table, we are comparing the CBA specification, which is the second column, to ASHRAE IES Standard 90.1 2007, Standard 90.1 2010, California Title 24 2008.

As you can see, the CBA specification is – saves energy compared to all these codes. And as I said, they often have these zones now, so that is why you are seeing the different rows. Standard 90.1 2007 only had one value in all the zones whereas 90.1 2010 and California Title 24 started allocating parking lot energy codes by zones. “Why is performance back?” is a good question to ask. This is a computer rendering for a parking lot for a building using 400-watt Pulse Start Metal Halide. You will see that the average is about 4.8 – 5 foot-candles. The max is 15. The minimum is 0.2.

The max-to-min ratio is 75 to 1 and the power density is 0.1. So it is still saving 0.1 watts per square foot. So comparatively, it is still saving a lot of energy. But as I said earlier, that your eye adapts to the brightest spot in the area. Notice when you look at this you see those bright spots under each of the fixtures, and that is why you have that stark contrast. That is where that 15 foot-candles is coming from. Whereas in contrast with this one – this is an LED design, so it is a 217-watt LED fixture. The average is 0.2 foot-candles, the max was 3.5 and the minimum was 0.3, and the max-to-min is about let us say 12 to 1.

And the power density is 0.6 watts per square foot. So it is saving more energy, and it is providing a more uniform lighting, so your eye actually can see better in this type of environment. Notice there really are no hot spots in here. You do have some pole shadowing. That is what those little dark dashes are here and there is the pole shadowing itself from the light. So the performance specification provides for not only energy savings, but also good lighting quality, and so that is why a performance specification is helpful.

But it is more than just LEDs. You should also consider using controls. This slide compares two recommendations from FEMP technology ideas; one about exterior LED controlled bi-level garage/parking lot/pedestrian lighting. It has a weighted score on the far right-hand column, and it compared federal energy savings, cost-effectiveness and probability of success. So obviously, the people that did the ranking found that exterior LEDs had a high-ranking success. The first three columns are ranked from 0 to 5. The last column was ranked 0 to 100, always the high number being on the high end.

So they feel that LEDs have a good probability of success in the exterior environment and some energy savings potential. They also felt that controls bi-level also have potential. We did a study – an actual field demonstration of control of an LED parking lot. So this a bi-level controls, is a retail site – and it is very important to know that. I think a commercial or an office site might be a little different where you have less occupied hours as well as more known occupied hours as well. So this is one day and time; starting at the left-hand side of this graph is 6:00 p.m., and on the right-hand is 12:00 a.m.

And what you are seeing is the actual current draw. This is in November of 2010, so it is about a year old, but that really is not as important. But it is near the shopping – the peak in the shopping season for the holidays. But what is important to see is that from about 6:00 p.m. to about 9:00 p.m. the fixtures stay in their high operating state for almost the entire time. And then at 9:00 p.m. there is less traffic, and so the sensor is turned off. And then they turn back on – one of them turns on, and then they both turn on to full.

And you will see what you can – what is called the “split state,” which is circled in red, where one sensor turned one fixture on, and then another fixture turns another one on, and that is why you see that stair-step function. But what is interesting is that roughly by 10:30 p.m. they are operating at the low state again. So rather than lighting a parking lot all night long at full intensity, they are actually saving a lot of energy by using the bi-level control system where when the occupancy sensor detects no motion it goes into the low state. They have found that about 45% of the time it was operating in low state, and about 55% of the time it was operating in high state.

Again, this is for a retail center. For an office building that was 9:00 a.m. to 5:00 p.m. or 9:00 a.m. to 8:00 p.m. it would probably have more energy savings than this where the retailers were busy up until 9:30 p.m. or 10:00 p.m. There is some probability of success issues that we should discuss with controls. This graph shows a plan with a parking lot. The circles that you see are the actual zones or what the occupancy sensors can see. The amorphous shaded area is 0.2 foot-candles. So that just shows what the minimum amount of light is. So first it shows that you are never without light, but it does show that it is possible to enter the parking lot and not trigger some of the sensors.

Sensor manufacturers are working on that. One of the other problems we had with this site was the circled red one. So it is a symmetrical fixture – sensor shown by the circle, but the problem is that this fixture is located on the perimeter next to a – not a commuter road, but a feeder road. And so the problem is that all the traffic along that road kept triggering that sensor even though there was no one in the parking lot. So there is still a potential for success with controls; just something to think about. I think next time we would probably try to block the backside of that sensor so that it would not see the other road and trigger so much.

Where do LEDs make sense? Well, if you're operating your fixtures only four hours a night, there is a low probability of success. If you are operating eight hours a night, there is a medium probability of success. Twelve hours, a high probability of success. Really it comes down to you; the more you operate them, the more energy you are using, but also that conventional technology needs to be replaced faster, and so you are going to see the economics by not having to go out with a bucket truck and replace a lamp as fast, which leads us into maintenance. This is very important. It is probably the driving factor in how we determine the cost-effectiveness of most LED solutions.

LED lamp valves have to be monitored. There is a picture here on the right of someone who had replaced the lamp and then the door was not attached properly, and so it just swung open. So the fixture is probably going to fail faster than other fixtures. Maintenance as a real cost is not always known or factored in, and it is definitely something that people should factor in. The actual price of maintenance will vary by mounting height, geographical location. Real numbers that we have seen – about $220.00 is what it costs to get one or two people in a bucket truck out to a site to re-lamp or change a ballast.

RS Means, which is an estimator in the industry – and the estimating guide in the industry says about $65.00 per person per hour. We have seen in California it is about $225.00. In New Hampshire, which is the previous site with the retail site we did, they were actually seeing it was $400.00 to come out and do some of their maintenance. And so it is very important to know what these numbers are. We find that for most LED systems, the deferred maintenance is actually what drives the cost of lighting and not the energy savings. While it is great to save the energy, but since the cost of energy is so low because parking lot lighting typically offers at off-peak hours, you have to find other ways to incentivize them.

Continuing on about the economics, "Where do LEDs make sense?" this slide compares and contrasts three different fixtures: one being an LED fixture, the next being a typical metal halide shoebox, the third being a metal halide architectural fixture or something that is slightly more designed-looking than the shoebox. What you will see is that as you increase the number of lumens for the LED fixtures, the price goes up. So if you want 14,000 lumens for this manufacturer, it is going to cost you about $2,000.00, whereas with the metal halide shoebox you went from 16,000 lumens to 28,000 lumens and the price barely changed – about $60.00 really - $70.00.

It is important to know that conventional technology is very well economized and is mature, and so they can change that technology really easily and you do not see much of a price difference. LEDs, the more lumens you need, and therefore probably the more LEDs you need, the more expensive the fixture gets, which is also conversely one of the reasons why we encourage low illuminance is that if you do not need as much light you are not spending as much money on your fixture. The warranty was by far one of the biggest issues moving into the LED specification, and the specification includes warranty information about it.

People were very nervous about LED fixtures considering, the slide I previous showed, because of how expensive they are compared to conventional technology. Some of these companies have been around maybe one or two years, and they were claiming that the LED systems were going to operate 50,000, 80,000, 100,000 hours! And yet they would not give great warranties, so we and other people really pushed the industry to a five-year minimum warranty for LED fixtures. But other concerns surround, "What does it cover?"

And so our specification discusses light output, color, driver – and if you are not familiar with the term "driver," it is the device that actually operates the LEDs; it is like a ballast, but the driver is specific to LEDs – also luminaire and finish. So a five-year minimum is required in the specification, and actually the specification also does require a ten-year optional language if that is what a site desires. As far as LED reliability – how long will an LED system live/operate? This is a crazy slide with a lot of data points going everywhere.

What you can see in the first couple of bits is that if you look at the yellow lines, for these devices that were measured CALPER, they started – the yellow ones started out and actually went up in the output and then down in output, then went up a little bit in output. The blue and the gold one kind of do a rollercoaster. But the green ones kind of fail early; and when I use “fail,” we are using a requirement of L70 or 70% of initial lumens – sorry, 70% of output as the benchmark for life. So not all of these are the same, and it is really important to know about how the reliability of them are and how you project their life. So the specification actually addresses that.

So manufacturers claim 50,000, 80,000 or 100,000 hours. That translates to 11 to 20 to 23 years operating 12 hours per night. That is really hard to verify considering that we do not know of any systems that have been operating for 11 years. So the IES published a document in September called Team 21. It is a technical memorandum on how you project the lumen maintenance of LEDs. The specification walks the manufacturer through what documentation they need to provide, and what math they need to do to demonstrate how they are claiming the life they are claiming, and it provides an estimate.

You should still do some verification. And driver specification and additional driver metrics are coming as well. The specification has some of that, but we are definitely actively working on revising the driver specification as we speak. The specification has been in practice. It has been out and available for about two years now. The first site to use it was Wal-Mart in Leavenworth, Kansas, just down the street from the big garrison there. Maybe it is a base – I do not know the exact military term for the outpost there. It is 500,000 square feet of parking area.

They use 92 LED luminaires from GE. The pole height is about 37 feet. Average about 1.2 foot-candles; minimum 0.8 foot-candles, so it is very uniform; when I have been there it is kind of like a blanket of light. It has a payback between six to ten years. Wal-Mart has very specific cost relationships with GE, so we could not really figure out what the payback range was, so we estimated about that.

That is really important to note the cost of electricity is very low there at $0.06 per kilowatt hour, and so that is one – the payback had – had the cost of electricity been higher, the payback could have been even shorter. It is a 63% energy savings compared to Wal-Mart’s standard design, and that design came in at 0.4 watts per square foot.

It has also been used in another retail site. This one is in Manchester, New Hampshire. This is the same site you saw earlier with the retailer and bi-level sensors. It is about 150,000 square feet. They used 25 LED luminaires from Beta LED. Pole height is 33 feet. So you know, 33 feet here – Wal-Mart’s 37 feet – they are conventional pole heights – mounting heights. Here the minimum was 1 foot-candle and the average was 2 foot-candles. The payback here again ranged from 3 to 10 years.

The reason why the payback ranged so much was that they had some power quality issues, and in the process of renovating the lighting they also put a power cleaner device in, so if the power quality issues had not been factored in, it would be 10 years. If you factor them in, it would be on the three years. Cost of electricity here is rather high at $0.14 a kilowatt hour. They also coincidentally saw about a 63% energy savings compared to the previous installation and also 0.4 watts per square foot. And I mentioned the bi-level we saw that were operating about 55% of the time in the high state and 45% low state.

Another site is in Falls Church, Virginia, not far from the nation's capital – about 10 minutes from the capital. It is another retail site. It is a Safeway with an anchor. They are about 180,000 square feet. They used 55 Cooper luminaires. Again, pole height 33 – so these are all real designs. They have a minimum of 0.9 foot-candles and an average of about 2.9 or about 3 foot-candles. Their payback ranged because of the parameters. Their cost of electricity was about $0.095 per kilowatt hour, and we actually saw a 70% energy savings compared to their previous installation. Their previous design was a 30 year-old 1,000-watt fixture. They were spending a fair amount of money in maintenance, and so it has been pretty successful.

There are some federal sites doing this. I am going to mention the NAVFAC Engineering Service Center at Port Hueneme in California. This is near Oxnard. They did not actually use the specification at the time; it was still being developed. But they did their own demonstration of LED parking lot lighting. They saw light levels increased by 18% in some of their dimly lighted areas. Their lighting power was reduced 74% to 2.8 kilowatts from 10.88 kilowatts. The distribution was more uniform.

Kind of a theme – we keep saying "more uniform, more uniform, more uniform." One of the features they liked that it was instant-on: no re-strike or no strike problems. That is something you think about with metal halide or high pressure sodium is that those fixtures are coming on 20 to 30 minutes before you need them just because of the time it takes them to warm up. And if you have any power out that re-strike can be a while, whereas an LED can quickly turn on and off. The longer lamp life here – they are expecting about a 50,000 hours for the LED and the driver versus the 24,000 average for the high pressure sodium. So they have found that to be a pretty successful demonstration, and that information can be also found in a FEMP case study.

So here is our contact information. And I think we are going to now open it up for questions. I am the first name there, Michael Myer, and Jeff McCullough, who you previously heard, is the second name and email address.

[End of Audio]