Meeting Notes

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Daylighting Symposium

Meeting Information:

Meeting Date: April 29, 2019
Meeting Time: 8:00 am – 5:00 pm
Meeting Host: California Statewide Utility Codes and Standards Team

Presentations from the 2019 Daylighting Symposium are available here on Title24Stakeholders.com

Meeting Attendees:

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Meeting Agenda:

Topic	Presenter	Time
Welcome	Heidi Werner	*8:40 – 8:50*
Glare Management in Daylit Spaces	Neall Digert	*8:50 – 9:00*
State of Daylighting in California	Mudit Saxena Eric Shadd Chris Uraine	*9:00 – 10:15*
Valuing Daylight and View	Lisa Heschong	*10:15 – 10:45*
Case Study # 1: Daylighting Commercial Buildings: Case Studies and Simulation Models	Eleanor Lee	*11:00 – 11:30*
Case Study # 2: Dynamic Light-Redirecting Technology: One Look into the Future	Luis Fernandes	*11:30 – 12:00*
What's on the Horizon and What's Sunsetting?	Kevin Van Den Wymelenberg	*12:10 – 1:00*
Case Study # 3: Predicting the Performance of Automated Glare Management Systems to Inform Design	Daniel Glaser	*1:00 – 1:30*
Case Study # 4: Lessons Learned from Two Acclaimed Daylit Buildings	Daniel Huard	*1:30 – 2:00*
Case Study # 5: Integrated Daylighting and Glare Control System: Designed for Comfort and Productivity	John Crowley	*2:00 – 2:30*
Panel: What is working? What needs to change?	Michael Holtz Zack Rogers Andrew McNeil John Crowley Mudit Saxena	*2:45 – 3:30*
Working Sessions	Everybody	*3:30 – 4:45*
Recap and Next Steps	Heidi Werner	*4:45 – 5:00*

Key Points and Action Items

1. Daylighting has a strong correlation with improved productivity, cognitive ability, and health.
    a. Health is driving the demand for daylighting in buildings.
    b. People value daylighting and views over other features in high-performance buildings.
2. Daylighting controls save energy and can be cost-effective even with high efficacy lighting sources.
3. "Make new friends": We should be thinking about the advantages of daylighting that are less obvious. For example: daylighting and its effects on indoor air quality as evidenced from reduced microbial growth in spaces with higher daylight levels; daylighting and higher levels of occupant satisfaction with space, etc.
    a. Industries should be encouraged to work together to develop solutions (blinds, windows, PV, controls, interior design).
    b. Daylighting has value beyond reducing energy use, which building codes need to recognize.
    c. Engage people that might not normally participate in daylighting conversations.
4. We should not forget about installation, commissioning, and user experience.
5. How can we promote daylighting in existing buildings?
6. Daylighting is an essential tool to get to zero net energy (ZNE) and zero emission buildings (ZEB).
7. More education is needed for all market actors including architects, lighting designers, builders, building managers, and code officials.

Meeting Notes

Introduction — Heidi Werner

Key messages from presentation

- The Statewide Utility Codes and Standards Program has several sub-programs. This symposium is being sponsored by the coordination and planning sub-program that aims to encourage market acceptance by coordination with emerging technology initiatives, voluntary programs, and code and standards advocacy.
- During this session, we encourage people to share their ideas. The thoughts we hear today will not necessarily feed directly into a code change proposal for the building codes.
- Nothing we are discussing today replaces the California Energy Commission's rulemaking process for building code opportunities.
- Send comments or ideas to anyone on the Statewide CASE Team or to info@title24stakeholders.com.
- We encourage people to keep an eye on the following websites to track progress on proposed code changes for the 2022 California Energy Code:
    - Statewide Utility Codes and Standards Team's Title 24 Website: Title24Stakeholders.com
    - California Energy Commission's 2022 Title 24 Rulemaking website: https://www.energy.ca.gov/title24/2022standards/

No discussion on this topic

Glare Management in Daylit Spaces — Neall Digert

Key messages from presentation

- Daylighting drives people to act and communicate.
- Daily light and dark patterns drive our circadian cycle.
- Daylighting is the artful application of our daylight resource (sun and sky).
- Daylight analysis is dynamic and there should be processes to integrate codes and standards to apply savings that do not have a standardized process.

No discussion on this topic

State of Daylighting in California — Mudit Saxena, Eric Shadd, Chris Uraine

Key messages from presentation

- Daylighting, when done correctly, is still the most efficient way to light a space, despite advances in LEDs.
- Buildings need to provide comfort, function, and protect occupants' health and well-being. Daylighting in buildings provide a connection to outside which is linked to higher productivity and increased occupant health.
- The ZNE building we want to encourage and build in the future needs to be designed with the wellbeing of the occupant as its central focus, which leads to daylit designs.
- Tools are available to increase daylighting, including advanced daylighting technology, and simulation software.
- Codes need to set the correct daylighting goals and encourage effective designs. This can be achieved by increasing innovative prescriptive daylighting compliance options, and bringing Radiance into CBECC-Com.

- Statewide CASE Team develops cost-effective proposals based on stakeholder outreach, research, and analysis. They present proposals to the California Energy Commission.

Discussion

- Will Vicent: Do you have any early thoughts on how a process, like integrating Radiance, might be enforced? How would we verify that the designs created in Radiance would be installed?
    - Eric Shadd: Plan checker could check designs with plan in OpenStudio. Plan check may be sufficient because it is unusual in my experience for building space dimensions to be built differently than the approved plans.
- Jon McHugh: The current compliance software has some tools for evaluating daylighting. Energy analysts voted for two dimensional (2D) approaches to allow for easy data entry.
    - Mudit Saxena: What is the burden we are putting on user to use the three dimensional (3D) performance path and is it worth their time and effort? Designer and their team should decide - if they want full credit for daylighting then they would opt to model in 3D, taking on the extra burden.
- Jon McHugh: Power Adjustment Factors (PAFs) are conservative because they are not looking at every permutation of orientation. Looking forward to 2030 and ZNE buildings, are we anticipating that our standards use the simple approach of minimal compliance and that advanced implementations are used to reduce the size of the solar photovoltaic system?
    - Mudit Saxena: There are two paths for compliance: prescriptive and performance. PAFs (prescriptive) should continue to get stronger and encourage innovative daylighting designs. The performance path should allow people to experiment with daylighting to push for ZNE and that are occupant-centric. There is opportunity to advance both paths.
- Michael Holtz: There is a disconnect between Mudit's occupant-centered design presentation and the methodology that the California Energy Commission uses to demonstrate that a proposed code change is cost effective. Designers should have the flexibility to use any means to achieve the desired energy budget. There should only be a performance path and the prescriptive path should be eliminated. Designers are using software anyway to create the design drawings that are needed to comply with the code.
    - Mudit Saxena: There is a disconnect, and we are open to challenging the way we think about codes. Codes should reflect the change in the market. However, the process for changing the code is difficult and there are constraints on certain requirements.
    - Michael Holtz: As soon as you say a measure needs to be "cost effective", then you are tied into a certain regulatory process, which then directs you into a certain type of code requirement. We need to reexamine the cost effectiveness requirements and methodology.
    - Lisa Heschong: We should move from an energy metric to a carbon metric.
- Daniel Glaser: Software should also be performance-based. Meaning, we should be choosing software that performs well. California should think about performance-based software rather than only relying on open-source software.

Valuing Daylight and View **Lisa Heschong**

Key messages from presentation

- Daylighting provides resiliency – buildings can still function after fire, flood, earthquake, blackouts, etc. Provides higher leasing turnover and higher sales.
- Daylight and window views have health and cognitive benefits, and are inherently tied to circadian rhythm, eye health, cognitive mapping, and creative incubation. This affects occupant

well-being in a positive way. Hence, it is crucial that daylight be provided to us in our buildings by design.
- People are drawn to look out windows often (i.e. the view IS the task).
- Occupant comfort and convenience (horse) helps "pull" the energy savings and carbon reduction (cart), and it should not be the other way around.
- Need to think about how to continue daylighting conversation on a regular basis and who will lead that charge?

No discussion on this topic

Case Study # 1: Daylighting Commercial Buildings: Case Studies and Simulation Models — Eleanor Lee

Key messages from presentation

- A lot of progress is needed to meet greenhouse gas emissions goals, and daylighting can help achieve them.
- Daylighting devices are still complicated and there are pros/cons to all technologies. Choosing depends on client needs and application.
- Health is driving performance today. We want to enable industry to use whatever tools are out there to achieve highest performance.
- Ways to help drive daylighting industry include provide feedback loop to industry on products, development of standardized product database, development/validation of occupant.

Discussion

- Neall Digert: When looking at traditional shades, we look from top down. However, sometimes glare comes from the ground up (for example, opaque hardscape outside is causing glare).
    - Eleanor Lee: Just finished a study where lower shade was transparent and upper portion was louver. It did cut glare.

Case Study # 2: Dynamic Light-Redirecting Technology: One Look into the Future — Luis Fernandes

Key messages from presentation

- Building automation is becoming more occupant focused.
- Dynamic light-redirecting blind system being developed at LBNL that modifies blinds geometry to maximize daylight and minimize glare.
- Prototype developed uses a variable slat geometry instead of a variable gap, but the same effect can be achieved with either strategy.
- Nothing precludes some blinds from being mounted in the exterior or interior. There are a lot of advantages to exterior mounting. Also, could mount within Insulated Glass Unit (IGU).

Discussion

- Mudit Saxena: Before commercialization, any plans for increasing slat angle (instead of changing distance between slats or increasing slat widths)?
    - Luis Fernandes: Ideally, more attracted to changing spacing between slats, but both configurations scale. One issue is you're not using all the slats all the time, so some slats would need to be stored and managed.
- Daniel Glaser: What is good daylighting?
    - Luis: Want to have enough daylight without any glare. We were looking at getting as much useful daylight as deep into building as possible without glare.

- Lisa Heschong: Your metric of performance seems to be deeper daylight penetration, but what about occupant reaction to this? Specifically, opaque at the upper level so can't see the blue sky, etc.
    - Luis Fernandes: Nothing comes down into eyes of occupants. Area (7-9 ft) is precluded by shading systems so if we are limited to just improving existing buildings, this is an improvement (seeing blinds versus just seeing opaque window).
    - Eleanor Lee: When it's overcast, the system will retract. We found that people enjoy outside views. We found that there was some aversion to (permanent) view obstruction.

What's on the Horizon and What's Sunsetting? **Kevin Van Den Wymelenberg**

Key messages from presentation

- Daylighting designers are healthcare providers.
- Air inside is often more toxic than other air.
- We have been working with biologists and architects. Some companies are developing architectural probiotics.
- Research on the bactericidal effect of daylighting has a long history. A recent study shows daylighting may be killing stuff that doesn't look like us, encouraging things that look like us.
- We've been looking to technology to solve indoor environmental quality issues but need to work with nature, not try to create impossibly sterile environments.
- People value daylight and views over anything else inside a building.
- California leads the United States and the United States arguably leads the world in many aspects.
- There are many studies that show daylight reduces hospital stays, increases sales and increases school performance.
- In 2016 only six buildings met the AIA 2030 challenge. In 2017 that increased to 11 (only 175 out of 20,000+ architectural firms reporting).
- Illuminating Engineering Society (IES) and others should talk about daylighting as an equity issue.
- What is sunsetting?
    - Energy-efficiency driven market
    - Single-point quality metrics
    - Lighting as only supporting function
- What is on the horizon?
    - Carbon driven market
    - Climate-based annual quality metrics
    - Daylighting as equity and health issue (Bridges between health care spend and construction/energy spend
    - High Dynamic Range (HDR) based analysis and simulation, blinds and electric lighting in control loop
- Research needed in human factors affecting/affected by daylighting: blinds operation, visual comfort, circadian rhythms, delight.

No discussion on this topic

Case Study # 3: Predicting the Performance of Automated Glare Management Systems to Inform Design **Daniel Glaser**

Key messages from presentation

- New building codes should not think that computer modeling will be too slow and so code should be dumbed down. Modeling is advanced enough that code should reflect this.
- Ideally, the software allows you to try different design strategies and see how they work (e.g., standard glass, dynamic glass, overhangs, automated shades, redirecting films, light shelfs).
- Software can look at every hour of the day and find the absolute worst glare conditions. The tools now can look through the data for you. We are no longer limited by the time required to complete computations.

Discussion

- Will Vicent: To what extent have both spatial daylight autonomy and annual sunlight exposure been validated in the field and what work should be done in the future to validate those two metrics?
    - Lisa Heschong: Not enough, but spatial daylight autonomy has been validated by Christoph Reinhart at MIT.[1] Annual sunlight exposure is even more behind, but Kevin is leading the efforts on how it can be refined and improved. We are far away from being able to represent glare and visual comfort metrics in the field.
    - Daniel Glaser: We need to refine things and push forward today.

Case Study # 4: Lessons Learned from Two Acclaimed Daylit Buildings Daniel Huard

Key messages from presentation

- Four things that I see that need be improved:
    - Transparency
    - Sustainability
    - Resiliency
    - Wellness
- We saw great improvements in bi-facial solar PV generation due to reflective surface below plus more comfort from occupants.

No discussion from this topic

Case Study # 5: Integrated Daylighting and Glare Control System: Designed for Comfort and Productivity John Crowley

Key messages from presentation

- Case study included daylight redirecting devices for upper third of windows and shade/vision/glare control for bottom two-thirds.
- How do we deal with existing buildings? There isn't a lot of new construction every year, but most of our effort and attention goes into new buildings.
- Barrier of daylight seems to always be cost of implementation, lack of standardization.

Discussion

- Jon McHugh: Did you evaluate the baseline to see how often the blinds are being manually opened and closed? What is the human factor of how people are using shades?

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[1] Study found here: https://www.tandfonline.com/doi/abs/10.1080/15502724.2014.929007

    - John Crowley: Yes, we did consider this. We put in lighting and controls and did monitoring. We are installing shades now, which will allow us to see impacts of lighting and controls versus shades.
- Lisa Heschong: This is the first system I'm aware of that integrates solar PV, battery charging, and wireless controls. What are advantages and challenges?
    - John Crowley: One advantage is that in developing these PV arrays, we can start generating electricity even at low light levels. Though, developing a solar PV system that will trickle charge shades has been challenging.
    - John Crowley: People have been hesitant about wireless controls. However, wireless is now reliable up to a point where it can be used in such applications. Removing wires reduces the project cost significantly. There was $1 million savings from using wireless instead of using wired in a specific large building we are working on. Installation costs depend on location.
    - John Crowley: One challenge is how often do people move shades up and down.
    - Rahul Athalye: Does that $1 million include commissioning in the system?
    - John Crowley: The $1 million was the incremental labor and installation cost, which varies by location. The legacy product distribution model presents a challenge.
    - John Crowley: There is a mark-up in every step of the supply chain. Breaking out of the traditional supply chain model can reduce costs significantly but doing so is challenging.
- Luis Fernandes: Have you looked at how different flat finishes impact the daylighting?
    - John Crowley: This can be optimized, but most slats manufactured today are colored the same on both sides. We color one side to be matte white and one side to match décor of building.
- Mudit Saxena: Have you thought of collaborating with other companies who may have already solved these issues and refined parts of the system (e.g., wireless controls)?
    - John Crowley: We are completely open to collaborate and would love to learn how to leap frog beyond where we are. We welcome the expertise from others to make improvements.
- Mudit Saxena: What is your commercialization plan? How would you achieve scale?
    - John Crowley: Our strategy is to develop a kit of parts that can be used by a wide variety of end users. However, the bigger goal is to address how to break out of the traditional product distribution model.

Panel: What is working? What needs to change? **Michael Holtz, Zack Rogers, Andrew McNeil, John Crowley, Mudit Saxena**

- Neall Digert: Two questions: What is working? What needs to change?
- Michael Holtz (architect perspective):
    - Daylighting is the purposeful use of sunlight to meet the illumination requirements of occupants in an architectural space. Design equals building system performance and human performance, therefore, design needs to address both. The successful integration of daylighting into commercial buildings is still generally pretty poor. Architects tend to think that more glass equals better daylighting, without consideration of uniform daylight distribution and elimination of glare.
    - *What does work?*
        - There are a few top and side-daylighting products, such as the LightLouver Daylighting System, that effectively and uniformly distribute daylight while eliminating glare. Designers also have a number of excellent daylight simulation

tools that can help them develop an effective daylighting design, but unfortunately, are not used as often as they should.

- *What needs to change?*
  - Architects, engineers, and lighting designers need more education about daylighting. They are not well informed about basic daylighting design principles and how to apply them in commercial building design.
  - Codes should include mandatory performance-based daylighting requirements. This is a health issue, not just an energy issue.
  - Codes should focus on implementing daylighting in the existing building stock.
  - Need to consider code compliance through daylight simulation tools.
  - All of this is irrelevant unless we immediately address climate change. We must focus on reducing greenhouse gas emissions.

- Zack Rogers (energy engineer and modeler perspective):
  - *What works?*
    - Simulation software and tools work. There is room for further refinement but the software and tools we have are effective. We have the means to do the analyses that are required to develop intelligent daylighting design.
    - There are some proxy glare metrics that are working, but we need more research and development to establish better glare metrics.
  - *What needs to change?*
    - Passive and static solutions are simpler and should be used more. Dynamic systems with integrated controls are great, but passive strategies are a more resilient design.
    - We need more accurate estimates of energy savings from daylighting. Perhaps photosensor-based analyses could be useful?
      - John Crowley: There are lighting products that have integrated sensors. Could you use integrated sensors within lighting products to reduce redundancy?
      - Zack Rogers: Potentially.
- Andrew McNeil (adaptative fenestration manufacturer perspective):
  - *What works?*
    - Although daylighting is not required by code, there is a demand to incorporate daylighting into buildings. Rarely are there architects who do not want daylighting.
    - Daylighting products are readily available.
  - *What needs to change?*
    - Delivery system: struggling with the product distribution chain and mark-ups.
    - Interoperability: we would like more information about how daylighting products interact with HVAC and lighting system.
    - Customer education: it is important for customers to understand daylighting strategies and how to apply technologies appropriately. How do you bring people who are not deeply involved with the daylighting community?
- John Crowley (attachment mindset for adaptive control perspective):
  - *What is working?*
    - There is a lot of collaboration happening to turn decorative products into performance products. Industry is recognizing that the issues we are dealing with are much larger than the part (shading industry, window industry).

        - I have been impressed with the amount of information that is available to demonstrate the value of daylighting.
    - *What needs to change?*
        - Health and wellness is an enormous opportunity because that's what people relate to.
        - We need better education.
        - I've been impressed by all the information that makes the case of why daylighting is good, but I have been unimpressed with how that information gets deployed to help designers and industry understand how to implement daylighting.
- Mudit Saxena (codes and compliance perspective):
    - *What is working?*
        - Compliance rates are getting better
    - *What needs to change?*
        - We need higher rates of compliance. How do we do that? Do we need a new structure so that code compliance be further improved?
        - Neall Digert: The typical mindset is that codes and standards impede innovation, but the rigors of going through checks and balances of codes and standards has pushed everyone to collaborate. The question is how to shorten the checks and balances.
        - Mudit Saxena: Correct. Another way to think about it is not as another constraint but as an opportunity to innovate. Codes is an opportunity to encourage technologies and challenge designers. Reward the correct solution and simplify.
- Will Vicent: We have a consensus that there's a climate emergency, and a trend of designers in the industry being overwhelmed with compliance. What's the single thing we can do in daylighting to address climate?
    - Mudit Saxena: Codes are too complex. We should simplify them and make them more digestible. Codes should convey the desired outcome more clearly.
    - John Crowley: In commercial and residential sectors, there is an opportunity to harvest energy savings through exterior shading. There is a lack of awareness in how to implement exterior shading economically and effectively. We need a low-cost option to improve daylighting and reduce cooling demand that will benefit a broad swath of the community.
    - Andrew McNeil: There is an aversion in the construction industry to trying new things. How can you encourage the construction industry to try new things? More demonstrations to experience the solutions and eliminate the fear of doing something new. People need to experience and not be afraid.
        - Mudit Saxena: Codes have PAFs to encourage people to try new things. We need to continue this and bring more examples of daylighting for people to see.
    - Zack Rogers: Prescriptive code stifles innovation and is more complex to navigate. Move towards performance-based codes. For example, an energy use intensity target.
    - Michael Holtz: Take knowledge we have and use it. We need to address existing building stock. We need a climate change metric, and we need to get rid of cost-effectiveness requirements.

Working Sessions **Everyone**

Design and Application

Objectives and Discussion Topics:

- Identify topics or presentations that could become a case study
- Identify or refine changes to best practices
- Identify topics or concepts that should be future symposia topics

Discussion Notes:

- Anything that we want to learn more about?
    - Would be helpful to hear more about the retrofit project that John Crowley presented. There is funding within the current project to develop case studies.
    - More information about wireless controls
    - More information about exterior retrofit possibilities
    - More information about health motivators
    - Daylighting and resilience
        - Daylighting retrofit is also a resiliency and reliability retrofit
        - Earthquake preparedness
        - Might be able to get staff time on National Fenestration Rating Councilor collaboration with CSA International Well Building Institute
        - Resiliency is wonderful. How does this change the dialogue about daylighting?
            - Perhaps there is a code option of daylighting for egress.
        - If a space is daylit, including egress, then the space will have lighting if a power outage occurs in the day
    - We should change the way we are thinking about metrics.
    - Should we be thinking about illuminance within the space, or should we value the view out the window? The "task" that we are valuing is the view out the window.
        - If there is a window at eye height, the purpose or "task" is the view. It is okay to increase lighting to reduce glare and enhance the view.
    - Light from two angles; top-light + sidelight
    - Case studies
        - Need case studies that document successes and failures
        - HMG conducted a study 20 years ago that looked at top-lit spaces (funded by Southern California Edison). This study was replicated for sidelit spaces in the northwest (funded by the Northwest Energy Efficiency Alliance). It would be valuable to update that analysis.
- Key take away: education is needed – Architects, Lighting Designers, Interior Designers.
    - We need information on how to do daylighting. Are case studies the right approach? What about daylighting pattern guide?
    - Collect information from outside of the United States.
    - Consider a committee to reach these user groups.
        - Example: attend NeoCon and co-host an event with The Shade Store as an approach to access interior designers.
        - Codes and standards are effective as a convener. We bring groups of people together. If we can get the Utility Team to think about their stakeholder engagement not just "how do we get our code change proposal adopted", but as a means to work through design and technology challenges.
        - Health and wellness is a means to get people to care about daylighting.
        - Building ratings systems (e.g., Well) is another "hook" / marketing approach.
    - How much collaboration has happened with American Institute of Architects (AIA)?
- Best practices

    - Is it best practice to dim-to-off if there is sufficient daylight?
        - Yes. It is okay to turn lights off.
    - ASHRAE allows dimming to 20 percent. There are significant energy savings associated with dimming all the way to off, but lighting designers were concerned about dimming all the way to off because people come into the room and try to turn the light on. When it doesn't turn on, people think something is broken and they complain to the maintenance facility. There are also claims that people like some lighting other than daylighting. What would help people understand when it is okay to dim-to-off and when it is appropriate to dim to some level other than off?
        - Bi-directional illumination from daylight is critical.
        - Education; there is not enough information.
        - Could look at case studies with auto-off based on occupancy.
- Supply chain issues – probably need to address this in some other way than a case study.
- Future symposium topics (especially to encourage new people to the table):
    - Health, wellness, and light.
        - Using and designing natural light to help circadian rhythm.
    - What is our goal? Symposium is a means to an end. What is the end? Are we chasing the problem? What is the problem?
        - The problem is that 63 percent of people say they do not have access to daylit space and one-third of office space has access to daylight.
    - Builder perspective; why aren't people buying into daylighting?
    - Daylighting and education
    - Retrofits – how do we daylight spaces in existing buildings?
    - Are we using the right metrics? When the daylighting community talks about metrics we lose the attention of other industry representatives (designers, architects, and interior designers).
        - Define the daylighting industry's metric circadian stimulus through daylighting.
            - Engage the Department of Defense
        - Part of the issue is too much light at night.

Codes and Standards

Objectives/Discussion Topics:

- Radiance into California Building Energy Code Compliance Commercial (CBECC-Com)
- Current daylighting requirements in Title 24
- What's working and what's not?
- Areas for improvement or alignment with ASHRAE, IECC and Title 24?

Discussion Notes:

- Codes and standards needs to:
    - Address grid harmonization
    - Reexamine payback and cost-effectiveness: need to account for non-energy benefits.
    - Examine ways to make daylighting mandatory in all building codes.
- Radiance needs to be incorporated into CBECC-Com.
    - CBECC-Com currently limits a number of creative daylighting designs to be modeled for compliance. This serves as a dis-incentive for such daylighting solutions, which are critical to achieve ZNE buildings, Bringing Radiance daylight modeling capability to CBECC-Com, this can be resolved.
    - How will Radiance be incorporated into CBECC-Com?

        - CBECC-Com may interface with other modeling tools.
    - Need a simple way for compliance checkers to confirm measures are installed properly compared to how they are modeled.
        - Need to determine which daylighting items need field verification and what doesn't.
        - Is there a way to develop software to make field verification easier?
        - One possibility is to have CBECC-Com output plans and elevations of spaces. The Plan Checker could match these dimensions with the Construction Documents.
    - How can you determine daylighting baseline to compare improved daylighting design?
        - Daylight metrics such as Spatial daylight autonomy (sDA) and Annual Sunlight Exposure (ASE) may be used for this purpose.
- Field Verification
    - Education of acceptance test technicians (ATTs) and inspectors is crucial
    - Need to support the development of daylight code compliance tools
    - New acceptance testing with procedural and metrics in line with other acceptance tests should be developed
        - Need to keep in mind that inspectors are already heavily burdened
        - Spot checks to encourage compliance. These spot checks have already been implemented for the daylighting devices in the 2019 Standard.
- Should daylighting for its health and wellness benefits be included in a different part of Title 24? Other than Part 6, which is an energy conservation code? Could it be part of CALOSHA?
    - No, since Title 24, Part 6 is an "energy efficiency" code and not an "energy conservation" code, it can have a health benefit as part of the code. Daylighting should follow the precedence set by minimum outdoor ventilation requirement, which is a health benefit but is included in Part 6, a minimum requirement for daylighting should be part of Title 24 Part 6.
- How do we account for human factors (closed blinds/glare)?
    - Good metrics exist on these, being worked on by IES.
    - What more resources are needed to get better data?

Recap and Next Steps **Heidi Werner**

Action:

- Respond to survey[2] that aims to collect a list of buildings where daylighting has been demonstrated well and should have a case study. Ideally there is data to document the results.
    - Demonstrate successes and failures.
- Continue to engage with the Statewide Utility Codes and Standards team as we develop code change proposals for the 2022 code cycle.
- Make the Daylighting Symposium a regular (annual) event
- Continue to share your ideas by sending input to info@title24stakeholders.com

[2] https://www.surveymonkey.com/r/WFTCJ7V.