



**CALIFORNIA
ENERGY**
CODES & STANDARDS

A STATEWIDE UTILITY PROGRAM

2019 Title 24 Codes & Standards Enhancement (CASE) Proposal

Advanced Daylighting Design

December 15th, 2016

Mudit Saxena
Principal & Founder, Vistar Energy
MSaxena@vistar-energy.com



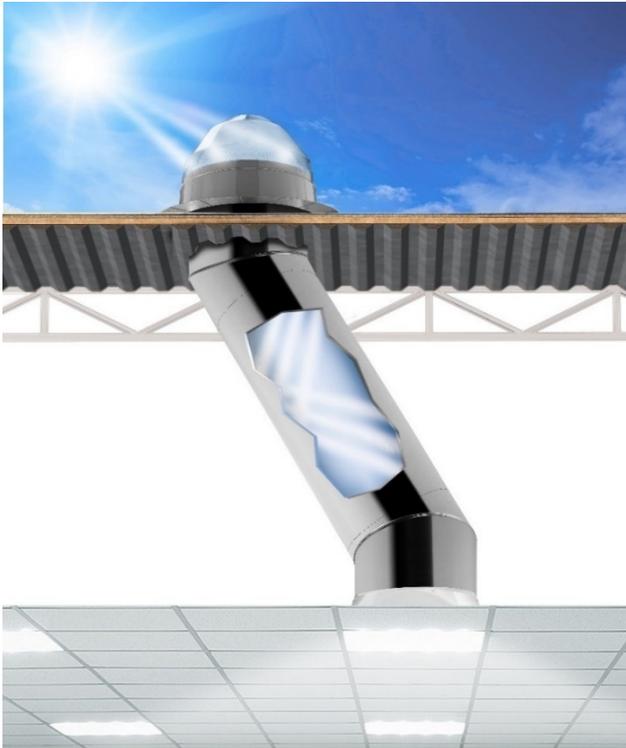
Proposed Code Change Overview

1. Update to the prescriptive requirements for Minimum Visible Transmittance (Min VT) for Tubular Daylighting Devices (TDDs) based on a new National Fenestration Rating Council (NFRC) Test Procedure
2. Update to the skylit daylit zone definition / user manual to ensure proper interpretation for skylights in atriums

The proposed code changes will impact all commercial buildings that comply using the prescriptive method and use skylights for daylighting.

Proposed Code Change Overview

1. Update to the prescriptive requirements for Minimum Visible Transmittance (Min VT) for Tubular Daylighting Devices (TDDs) based on a new NFRC Test Procedure

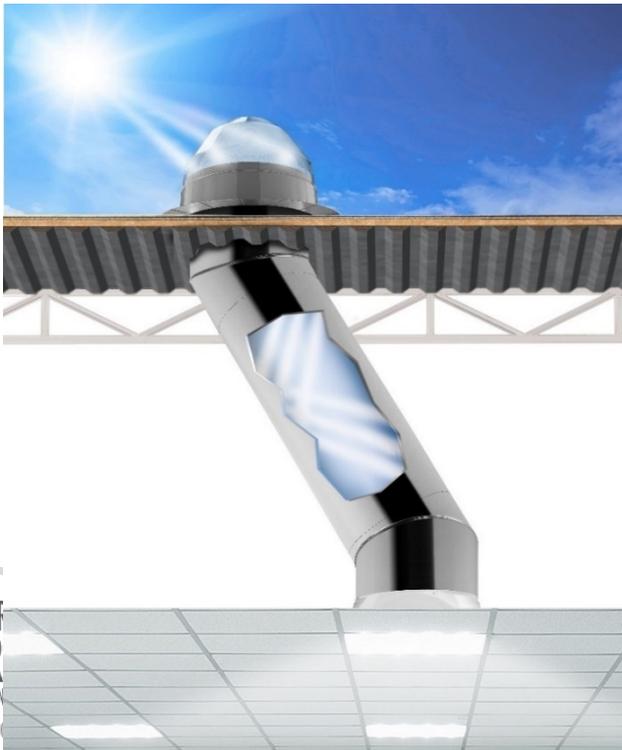


Proposed Code Change History

- NFRC recently developed a new procedure (NFRC 203) for determining Visible Transmittance (VT) of Tubular Daylighting Devices (TDDs) termed VT_{annual}
 - This new procedure calculates VT more appropriately for the complex geometry of various TDDs
 - Title 24 prescriptive requirements for Minimum VT needs to be updated to reflect these changes from NFRC

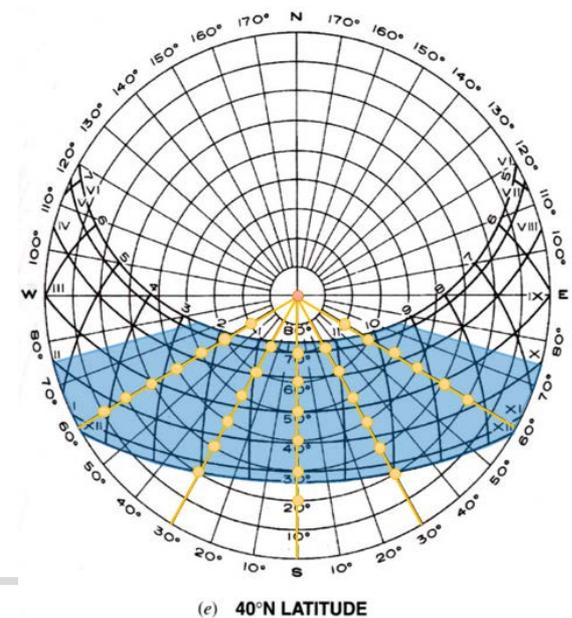
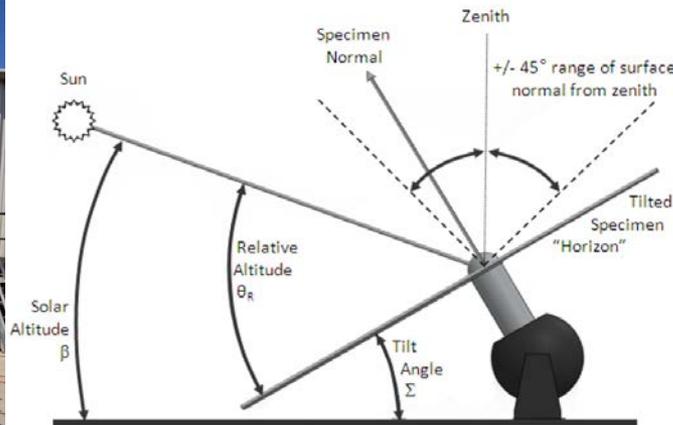
Context

- TDDs have optics designed to **selectively** transmit or reflect light and heat from **various sun angles**
 - A rating method that uses only **direct-normal angle** does not capture its performance at other angles



Context

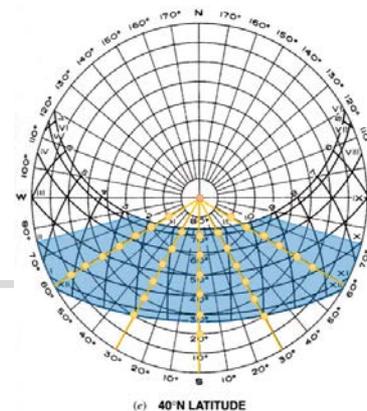
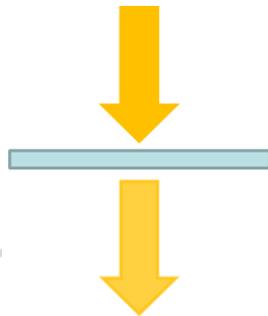
- NFRC 203-2014 – A new Test Apparatus and Methodology for Determining the VT_{annual} Product Rating for Optically-Complex TDDs
 - Rates a TDD product under **multiple different angles** of incidence



Context

- NFRC 203 procedure differs from the traditional NFRC 200 procedure

NFRC 200	NFRC 203
Products rated under direct-normal illumination (a vertical beam of light directed perpendicular to a test sample of glazing)	Products rated under 18 different angles of incidence and time-weighted averaged (angles represents the sun's actual movement through the sky for Middle America - 40° North Latitude)
Rating: VT	Rating: VT_{annual}



Context

- NFRC 203 makes it possible to compare performance of optically complex products

	NFRC 200	NFRC 203
Simple glazing products (like flat windows)	✓	✓
Complex optics products (like TDDs)	✗	✓

Context

- VT_{annual} is clearly displayed on the TDD product's NFRC label

	SOLATUBE International Inc. Tubular Daylighting Device Molded Single or Double Plastic Dome, Single Glazed Plastic Diffuser Thermal Opening Area= 0.1 m ² Part No. 501685 Rev. B STU-K-6		
	ENERGY PERFORMANCE RATINGS		
Product Description	Insulation at Ceiling		
	U-Factor (U.S/I-P)	Solar Heat Gain Coefficient (SHGC)	VT_{annual}
	Individual Option Number		
M74 DS-O Dual Dome with Prismatic Diffuser	1.06	0.28	-
	STU-K-6-00002-00001		
M74 DS-O Dual Dome with Prismatic Diffuser	1.39	0.29	0.52
	STU-K-6-00001-00001		
<small>Manufacturer stipulates that these ratings conform to applicable NFRC procedures for determining whole product performance. NFRC ratings are determined for a fixed set of environmental conditions and a specific product size. NFRC does not recommend any product and does warrant the suitability of any product for any specific use. Consult manufacturer's literature for other product performance information. www.nfrc.org</small>			

	SOLATUBE International Inc. Hybrid Tubular Daylighting Device Molded Single or Double Plastic Dome, Dual or Quad glazed Plastic Diffuser Thermal Opening Area = 0.33m ² Part No. 501703 Rev. C CPD # STU-K-3		
	ENERGY PERFORMANCE RATINGS		
Product Description	Insulation at Ceiling		
	U-Factor (U.S/I-P)	Solar Heat Gain Coefficient (SHGC)	VT_{annual}
	Individual Option Number		
750 DS-C Dual Dome with Optiview Diffuser	0.51	0.19	0.39
	STU-K-3-00007-00002		
750 DS-C Dual Dome with Prismatic Diffuser	0.51	0.21	0.39
	STU-K-3-00007-00001		
750 DS-C Single Dome with Optiview Diffuser	0.51	0.22	0.43
	STU-K-3-00006-00002		
750 DS-C Single Dome with Prismatic Diffuser	0.51	0.23	0.43
	STU-K-3-00007-00002		
330 DS-C Single Dome with Optiview Diffuser	0.51	0.32	0.37
	STU-K-3-00005-00002		
330 DS-C Single Dome with Prismatic Diffuser	0.51	0.34	0.37
	STU-K-3-00005-00001		
<small>Manufacturer stipulates that these ratings conform to applicable NFRC procedures for determining whole product performance. NFRC ratings are determined for a fixed set of environmental conditions and a specific product size. NFRC does not recommend any product and does warrant the suitability of any product for any specific use. Consult manufacturer's literature for other product performance information. www.nfrc.org</small>			

Current Code Requirements

Existing Title 24 2016 Requirements

– Table 140.3-B Prescriptive Envelope Criteria

CONTINUED: TABLE 140.3-B – PRESCRIPTIVE ENVELOPE CRITERIA FOR NONRESIDENTIAL BUILDINGS (INCLUDING RELOCATABLE PUBLIC SCHOOL BUILDINGS WHERE MANUFACTURER CERTIFIES USE ONLY IN SPECIFIC CLIMATE ZONE; NOT INCLUDING HIGH-RISE RESIDENTIAL BUILDINGS AND GUEST ROOMS OF HOTEL/MOTEL BUILDINGS)

Envelope	Fenestration	All Climate Zones				
			Fixed Window	Operable Window	Curtainwall or Storefront	Glazed Doors ²
Vertical	Area-Weighted Performance Rating	Max U-factor	0.36	0.46	0.41	0.45
		Max RSHGC	0.25	0.22	0.26	0.23
	Area-Weighted Performance Rating	Min VT	0.42	0.32	0.46	0.17
	Maximum WWR%	40%				
Skylights	Area-Weighted Performance Rating		Glass, Curb Mounted	Glass, Deck Mounted	Plastic, Curb Mounted	
		Max U-factor	0.58	0.46	0.88	
	Max SHGC	0.25	0.25	NR		
	Area-Weighted Performance Rating	Min VT	0.49	0.49	0.64	
	Maximum SRR%	5%				

Current Code Requirements

Existing Title 24 2016 Requirements

SECTION 110.6 – Mandatory Requirements For Fenestration Products And Exterior Doors

- (a) 4. Visible Transmittance (VT). The fenestration product's VT shall be rated in accordance with NFRC 200 or ASTM E972, for **tubular skylights VT shall be rated using NFRC 203**

Typical Practices

- Many TDD products rated with the **new** NFRC 203 procedure have a VT_{annual} lower than the Min VT threshold set for plastic, curb mounted skylights of 0.64.
- As a result ...
 - Architects/designers using the prescriptive code cannot use TDDs to comply with daylighting requirements
 - Performance method also does not provide TDDs with credit for solar angle based transmittance

Typical Practices

- Architects and designers use TDDs as an option for daylighting spaces
 - Where traditional skylights may not be appropriate
 - Spaces with dropped ceilings
 - Buildings with limited roof area available for skylights
 - Retrofit projects with existing plenums and duct work



Images credit: Solatube, Sunoptics

Market Overview and Analysis

Current Market

- TDDs have been available in the market since 2001 and have a well established network of dealers and installers.

Market impacts

- Expected to promote products with complex optics optimized for selective transmittance of solar angles

Market barriers

- Current prescriptive code Min VT requirement

Other market information sources we should know about?

Methodology for Analysis

Methodology for analysis

- Spreadsheet based analysis to compare performance of TDDs and traditional plastic curb mounted skylights
 - Determine an “equivalent” Min VT_{annual} threshold for TDDs

Data sources for analysis

- NFRC 203 testing data from various TDD manufacturers
- NBI PIER Skylight Photometry Data (HMG 2003) for traditional skylights
- Third party testing data on traditional skylights from manufacturers
- Other data sources?

Strawman Code Change Language

Existing Title 24 2016 Requirements

– Table 140.3-B Prescriptive Envelope Criteria

CONTINUED: TABLE 140.3-B – PRESCRIPTIVE ENVELOPE CRITERIA FOR NONRESIDENTIAL BUILDINGS (INCLUDING RELOCATABLE PUBLIC SCHOOL BUILDINGS WHERE MANUFACTURER CERTIFIES USE ONLY IN SPECIFIC CLIMATE ZONE; NOT INCLUDING HIGH-RISE RESIDENTIAL BUILDINGS AND GUEST ROOMS OF HOTEL/MOTEL BUILDINGS)

Envelope	Fenestration	All Climate Zones				
			Fixed Window	Operable Window	Curtainwall or Storefront	Glazed Doors ²
Vertical	Area-Weighted Performance Rating	Max U-factor	0.36	0.46	0.41	0.45
		Max RSHGC	0.25	0.22	0.26	0.23
	Area-Weighted Performance Rating	Min VT	0.42	0.32	0.46	0.17
	Maximum WWR%	40%				
Skylights	Area-Weighted Performance Rating		Glass, Curb Mounted	Glass, Deck Mounted	Plastic, Curb Mounted	Tubular Daylighting Devices
		Max U-factor	0.58	0.46	0.88	0.88
	Max SHGC	0.25	0.25	NR	NR	
	Area-Weighted Performance Rating	Min VT <small>/Min VT_{annual}</small>	0.49	0.49	0.64	0.XX
Maximum SRR%	5%					

Compliance and Enforcement- Market Actors

- Market Actor #1 – Architects / Designers
- Market Actor #2 – Code Officials / Plan checkers / Field Inspector
- Market Actor #3 – TDD Manufacturers
- Market Actor #4 – Title 24 Consultants
- Market Actor #5 – Compliance Software Manufacturer

- Others?

Compliance and Enforcement—Tasks

Market Actor	Task(s)	Success Criteria
Architect/Designer	<ul style="list-style-type: none"> - Design building envelope to meet Title 24, Part 6 - Specifies products 	<ul style="list-style-type: none"> - Design buildings that meet building owner's needs and comply with Title 24, Part 6
Code Officials / Plan Checkers / Field Inspector	<ul style="list-style-type: none"> - Check to ensure all components of building envelope meet code 	<ul style="list-style-type: none"> - Understand Title 24, Part 6 - Properly inspect everything
TDD Manufacturers	<ul style="list-style-type: none"> - Provide products that meet Title 24, Part 6 requirements - Educate distributors of the new code update 	<ul style="list-style-type: none"> - Develop products that meet Title 24, Part 6 requirements that are cost-effective
NFRC and Members	<ul style="list-style-type: none"> - Inform of change in code - Enlist for support in outreach 	<ul style="list-style-type: none"> - Properly understand technologies being rated - Understand Title 24, Part 6
Compliance Software Manufacturer	<ul style="list-style-type: none"> - Incorporate new technologies in compliance software 	<ul style="list-style-type: none"> - Properly understand new technologies and code
Title 24 Consultants	<ul style="list-style-type: none"> - Complete applicable compliance forms - Use compliance software 	<ul style="list-style-type: none"> - Understand Title 24, Part 6 language, software, and protocols

What are we not capturing?

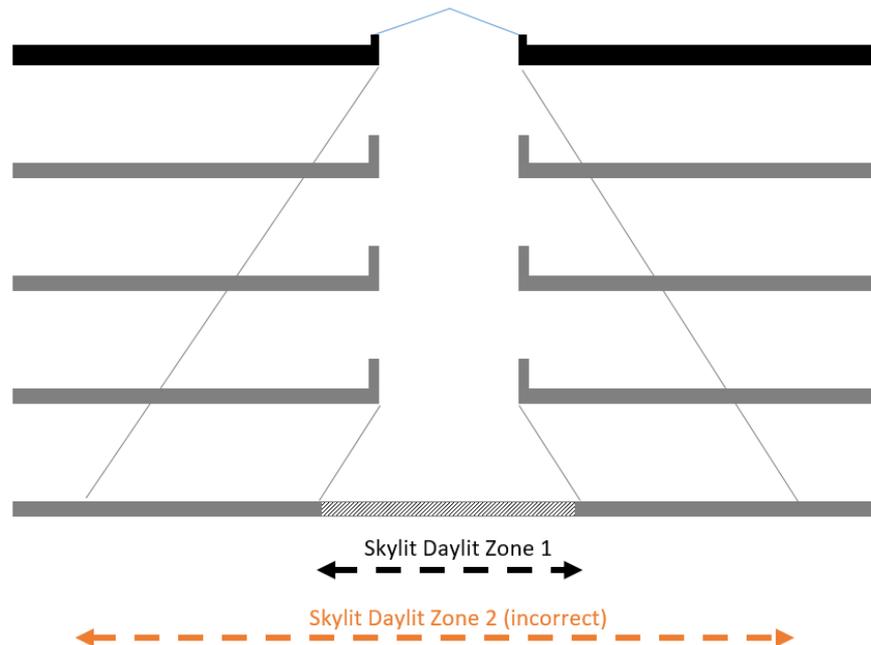
Compliance and Enforcement—Resources

Market Actor	Resource(s)
Architect/Designer	<ul style="list-style-type: none"> - Resources: Compliance manual, CEC hotline, EnergyCodeAce - Tools: Simulation tools like Lumen Designer, SkyCalc, Radiance, others?
Code Officials / Plan Checkers / Field Inspector	<ul style="list-style-type: none"> - Resources: CALBO training, classes
TDD Manufacturers	<ul style="list-style-type: none"> - Resources: NFRC Meetings
NFRC and Members	<ul style="list-style-type: none"> - Resources: NFRC Meetings
Compliance Software Manufacturer	<ul style="list-style-type: none"> - Resources: Conferences (ASHRAE, IBPSA, SimBuild), CABEC
Title 24 Consultants	<ul style="list-style-type: none"> - Resources: CABEC training, classes - Tools: CBECC-Com, EnergyPro/Compliance Software

What resources or tools are typically used for compliance?

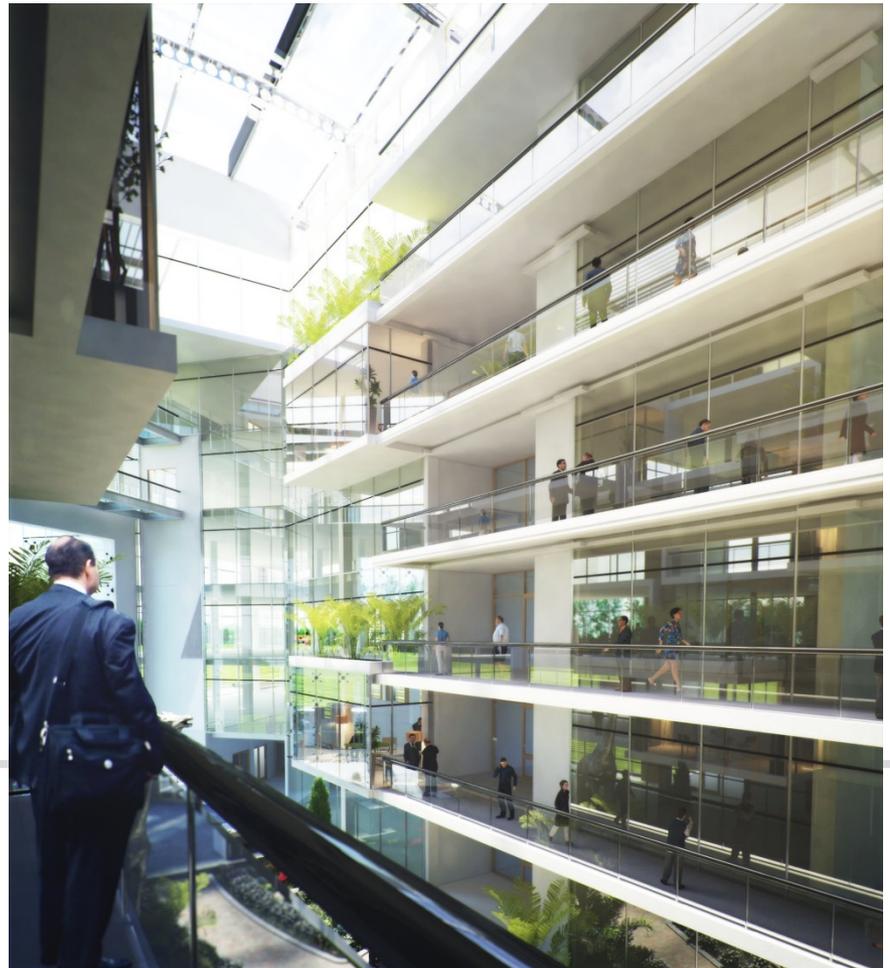
Proposed Code Change Overview

Update to the skylit daylit zone definition / user manual to ensure proper interpretation for skylights in atriums



Examples

Symmetrical atriums



Examples

Asymmetrical atriums



Proposed Code Change History

The skylit daylit zone definition in Title 24 2016 Code and the explanation in the User Manual do not consider the case of skylights in Atriums.

- Vertical obstruction are considered

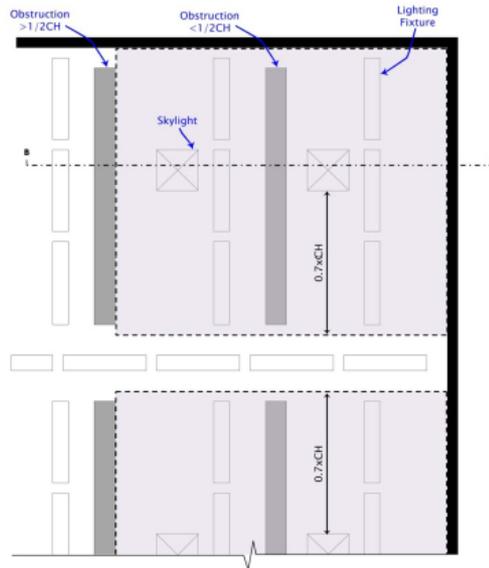


Figure 5-5 – Skylit Daylit Zone Diagram 1

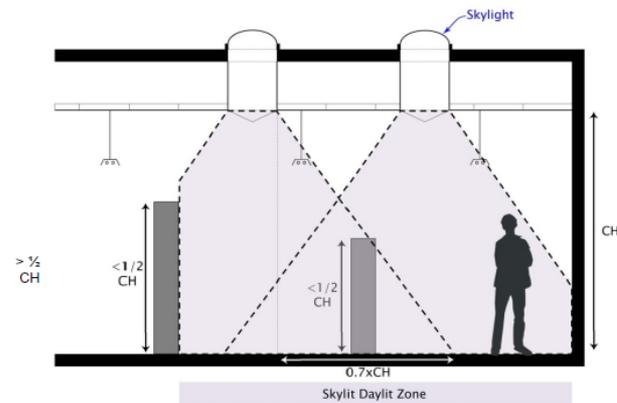


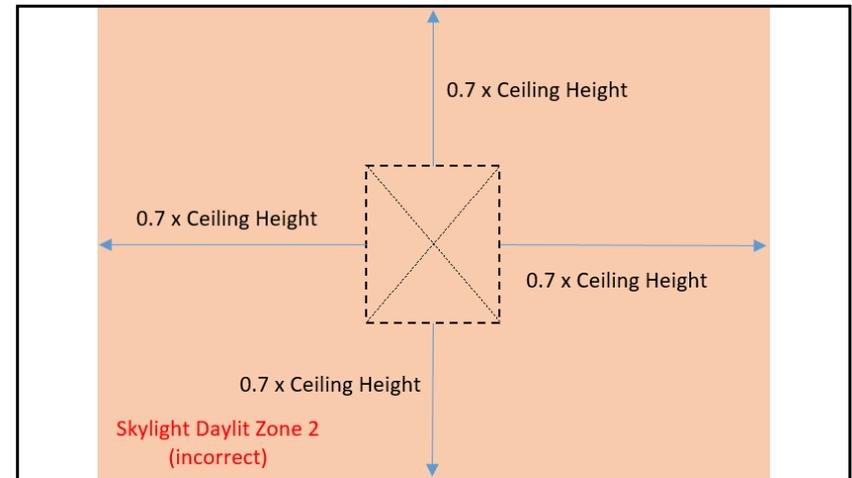
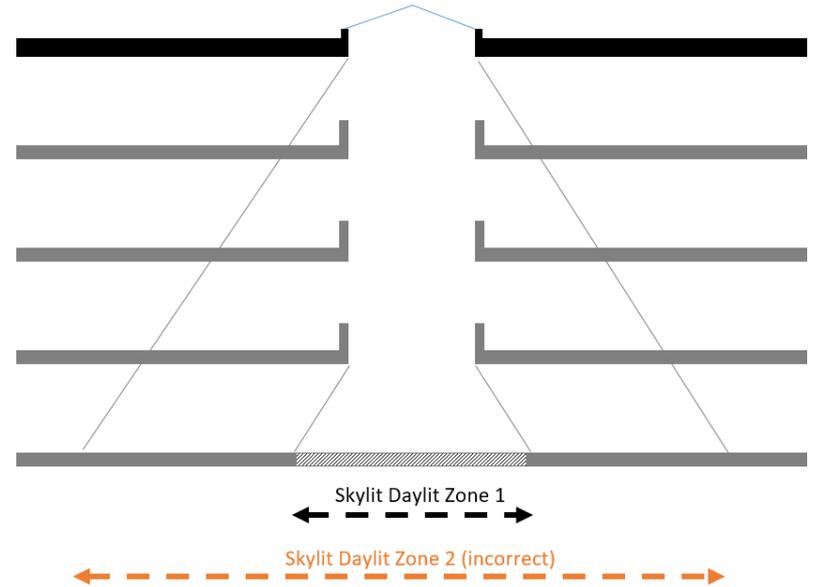
Figure 5-6 – Skylit Daylit Zone Diagram 2

Current Code Requirements

SKYLIT DAYLIT ZONE is the rough area **in plan view** under each skylight, plus 0.7 times the **average ceiling height in each direction from the edge of the rough opening of the skylight**, minus any area on a plan beyond a permanent obstruction that is taller than the following: A permanent obstruction that is taller than one-half the distance from the floor to the bottom of the skylight. The bottom of the skylight is measured from the bottom of the skylight well for skylights having wells, or the bottom of the skylight if no skylight well exists.

Context

- For a building with an atrium (example hotel or office lobby/common area, etc.)
 - **In plan view**, roof plan layered over the first floor plan may result in an incorrect skylit daylit zone (shown as Skylit Daylit Zone 2)

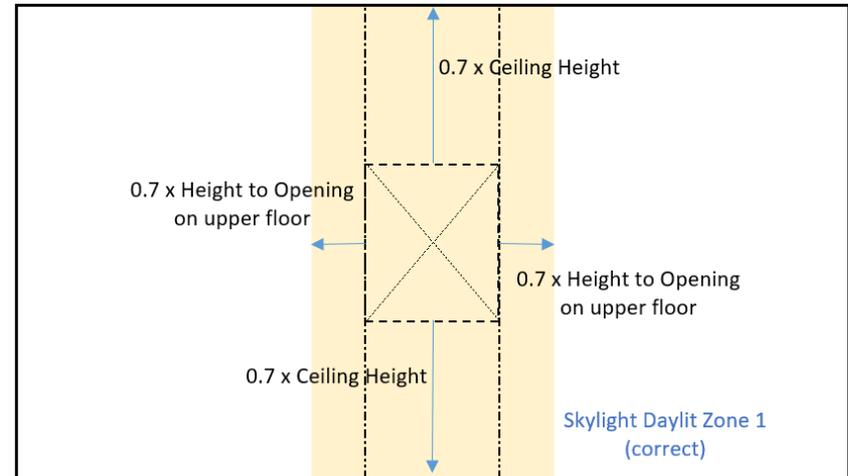
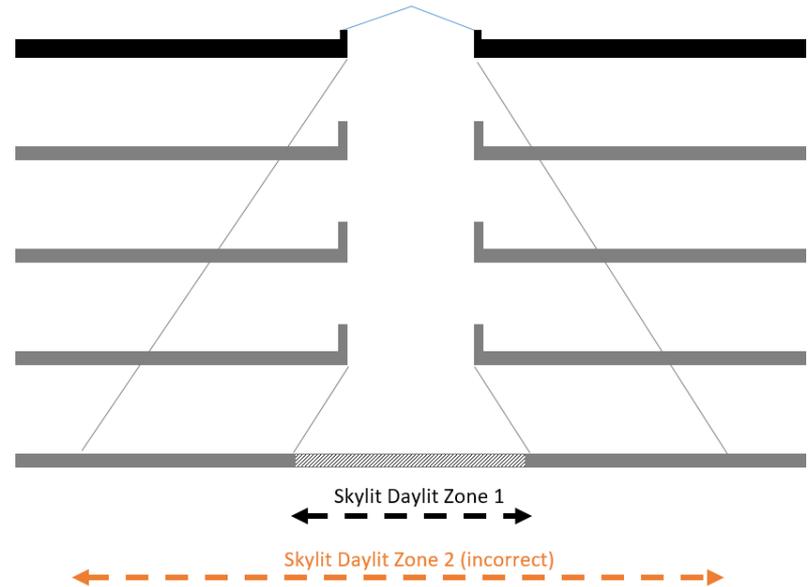


First floor plan showing only skylight

PLAN

Context

- The rough opening on the upper floor needs to be considered to develop the correct skylit daylight zone (shown as Skylit Daylit Zone 1)



First floor plan showing skylight and opening on 2nd floor

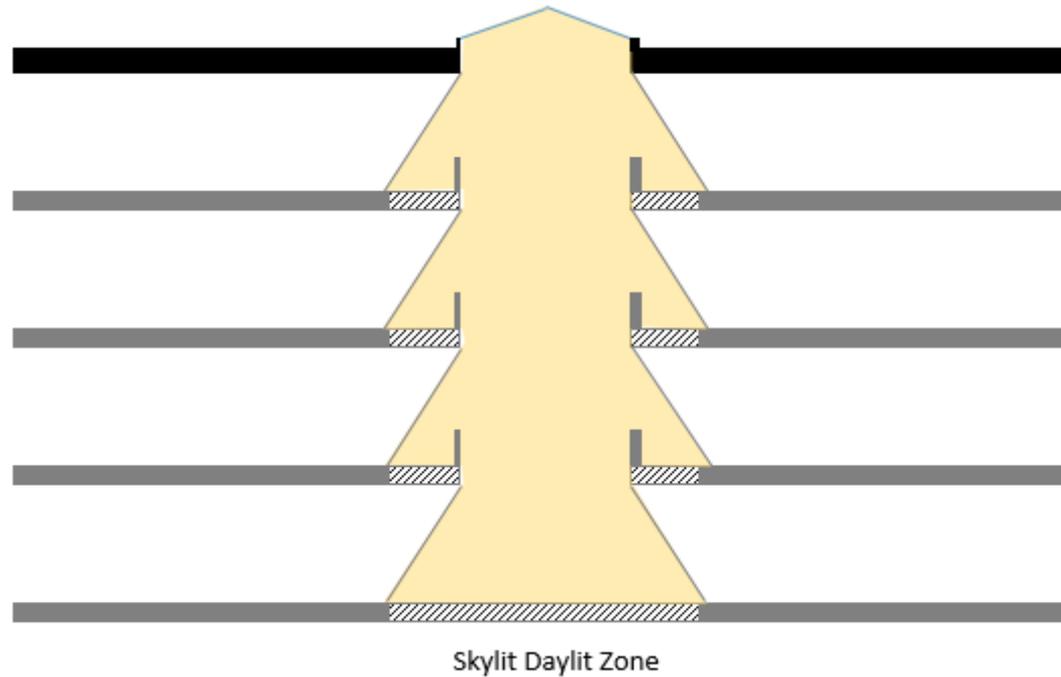
PLAN

Strawman Code Change Language

SKYLIT DAYLIT ZONE is the rough area in plan view under each skylight, plus 0.7 times the average ceiling height in each direction from the edge of the rough opening of the skylight, minus any area on a plan beyond a permanent obstruction that is taller than the following: A permanent obstruction that is taller than one-half the distance from the floor to the bottom of the skylight. The bottom of the skylight is measured from the bottom of the skylight well for skylights having wells, or the bottom of the skylight if no skylight well exists. **If a floor receives daylight from an opening in the floor above, then the edge of that opening is to be considered the bottom of the skylight well.**

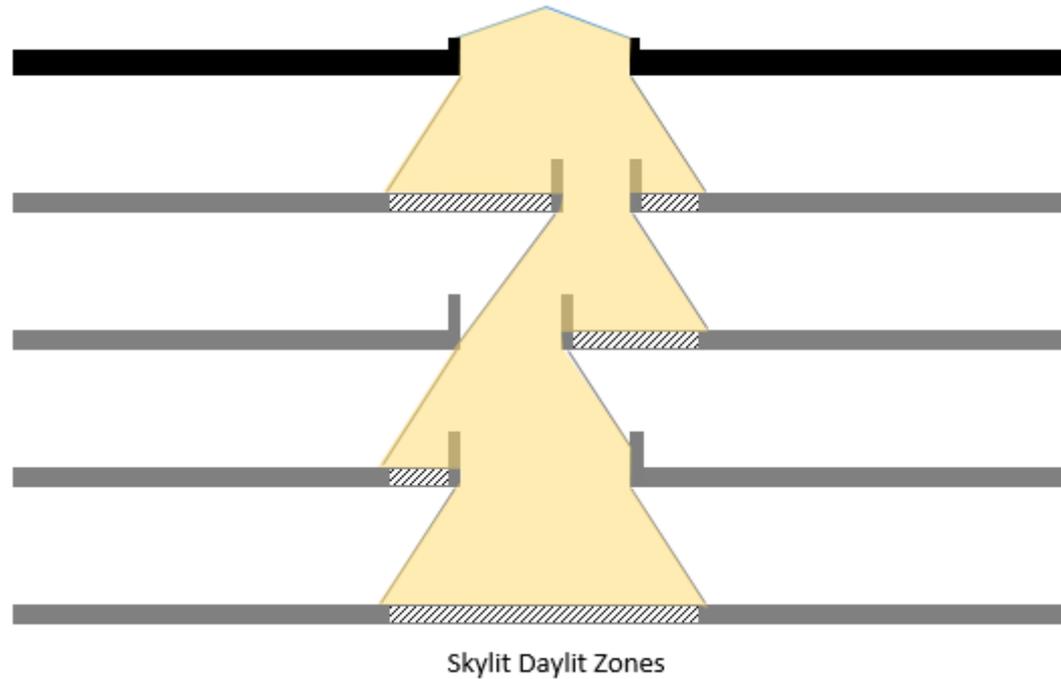
Code Interpretation

- Symmetrical Atrium Section



Code Interpretation

- Asymmetrical Atrium Section



Feedback Request from Stakeholders

- Are there Skylight/TDD performance data that we should review for our analysis?
- Should the skylight daylight zone definition be modified to include the atrium case and/or explained in the User Manual?
 - If you wish to provided information, please email CASE author **Mudit Saxena (MSaxena@vistar-energy.com)**

Thank you.

Mudit Saxena: MSaxena@vistar-energy.com





**CALIFORNIA
ENERGY**
CODES & STANDARDS

A STATEWIDE UTILITY PROGRAM

2019 Title 24, Part 6 Codes & Standards Enhancement (CASE) Proposal

Advanced Daylighting Design

December 15, 2016

Eric Shadd
Determinant LLC
eric@Determinant-LL.Com



Proposed Code Change Overview

- Power Adjustment Factors (PAF)
 - If a qualifying technology installed, lighting power density (LPD) for compliance is reduced by this PAF. Example:
 - A space has 1 W/sf
 - Prescriptive maximum LPD for that space is 0.8 W/sf
 - The space also has a technology that qualifies for a PAF of 0.2
 - The space complies because $(1 - 0.2) * 1 = 0.8$
 - Determined by
 - Simulations where the technology is virtually installed show energy savings when compared to the baseline.
 - The fraction of savings becomes the PAF
- Envision all nonresidential buildings will qualify

Proposed Code Change Overview – Strategies Proposed (1 of 6)

1. Fixed slats

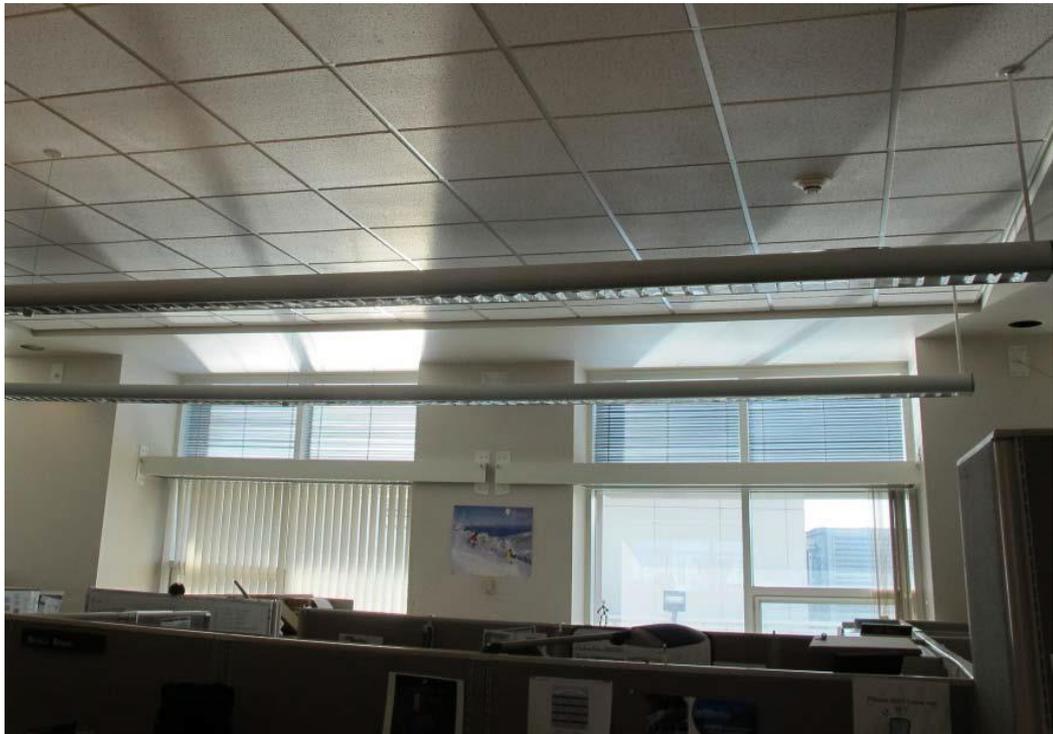
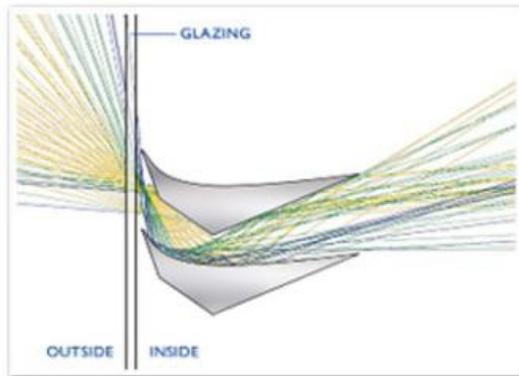
- Mitigates glare
- Distributes daylight
- Exterior
 - Solar gain (RSGHC)
- Interior
 - Wind loads
 - Vandalism



Proposed Code Change Overview – Strategies Proposed (2 of 6)

2. Daylight distribution devices

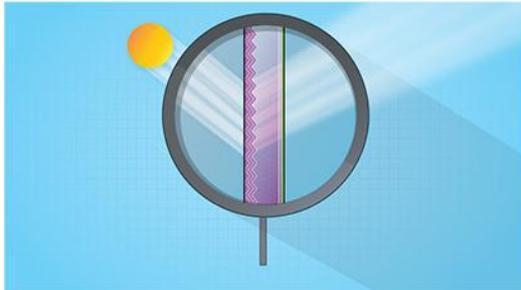
- Mitigates glare (at clerestory)
- Distributes daylight



Proposed Code Change Overview – Strategies Proposed (3 of 6)

3. Daylight redistributing films

- Mitigates glare (at clerestory)
- Distributes daylight



Proposed Code Change Overview – Strategies Proposed (4 of 6)

4. Automatic shades

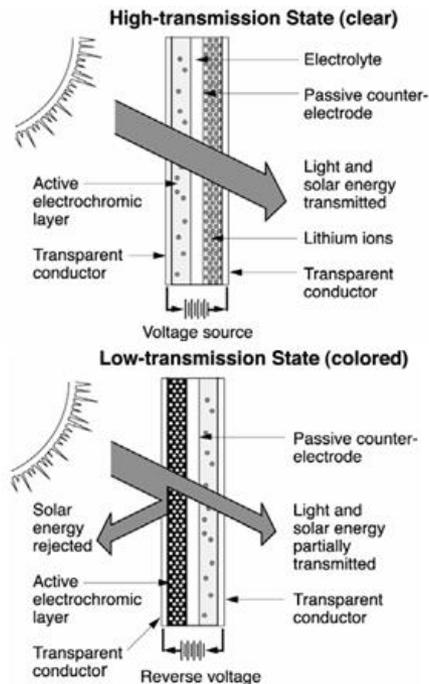
- Mitigates glare
- Maintains view



Proposed Code Change Overview – Strategies Proposed (5 of 6)

5. Dynamic glazing

- Mitigates glare
- Maintains view



Images courtesy California Energy Commission

Proposed Code Change Overview – Strategies Proposed (6 of 6)

6. Clerestory windows

- Daylight distribution (increases daylit area)



Proposed Code Change History

Why are we proposing these measures?

- Daylight distribution: Increase daylight level, area and/or hours
- Glare mitigation: Improve daylighting reliability

Current Code Requirements

Existing Title 24, Part 6

- PAFs given for certain types of lighting controls only.
- Solar heat gain credit for shading but no daylighting credit
- Dynamic glazing can meet prescriptive minimum but no credit
- Nothing for other proposed technologies (films, daylight distribution, automatic shading)

Existing Model Code

- No known requirements or daylighting credits for these strategies.

Typical Practices

Current practices

- Windows are bare and use conventional (i.e. non-dynamic) glazing
- Window setbacks are common

Trends

- Slats/louvers becoming more frequent (Bay Area only?)
- Other technologies are still “fancy”

Do you agree with this description?

Market Overview and Analysis

Current Market

- Well-established but not widespread
- No known utility incentives in CA (other than modeled)

Market impacts

- Expected increase in market share

Market barriers

- Cost prohibitive, but PAF = optional
- Affects aesthetic, but many choices and some like the aesthetic

Other market considerations/information we should know about?

Methodology for Savings Analysis

Criteria and constraints:

- Maximize useful daylight distribution
- Minimize glare
 - Occupied hours, not sunrise to sunset
- Account for
 - Overcast solar aureole (sunlight glare spreads out behind clouds)
 - Daylight savings time
 - Occupant behavior with blinds

Methodology for Savings Analysis

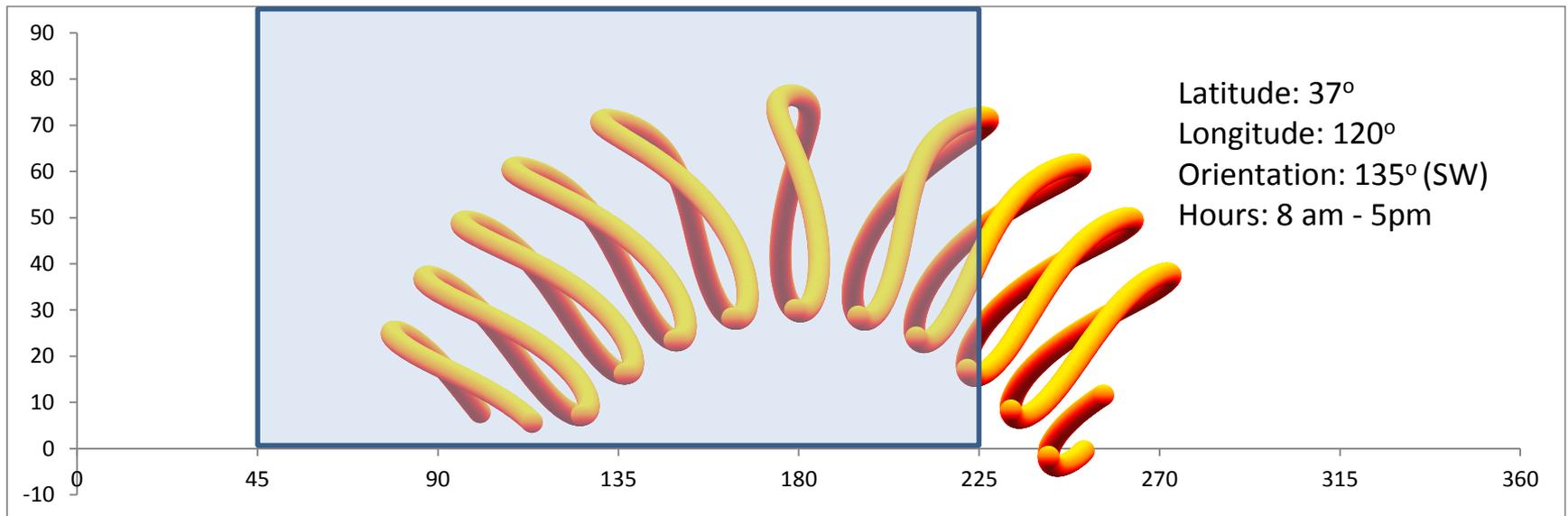
Methodology for energy and demand Impacts

- Model: genBSDF/Existing BSDFs, Window7, Radiance, EnergyPlus, OpenStudio, CBECC-Com
- Parametrics: Ruby, Python
- SOLPAS (NREL): solar position
- Spreadsheet: miscellaneous calculations
- Prototype Buildings
 - Based on DOE commercial reference buildings, CBECS 2012, CBECC-Com test buildings
 - Possibly > 1; consider building types w/highest forecasted sf
 - 2016 Title 24, part 6
 - Meet Prescriptive Requirements
 - Nonresidential ACM by building type
- Radiance data from Utility studies for some technologies

Methodology for Savings Analysis

Solar Position (SOLPAS plus some filters and math)

- Goal: Block high percentage of solar positions



Methodology for Savings Analysis

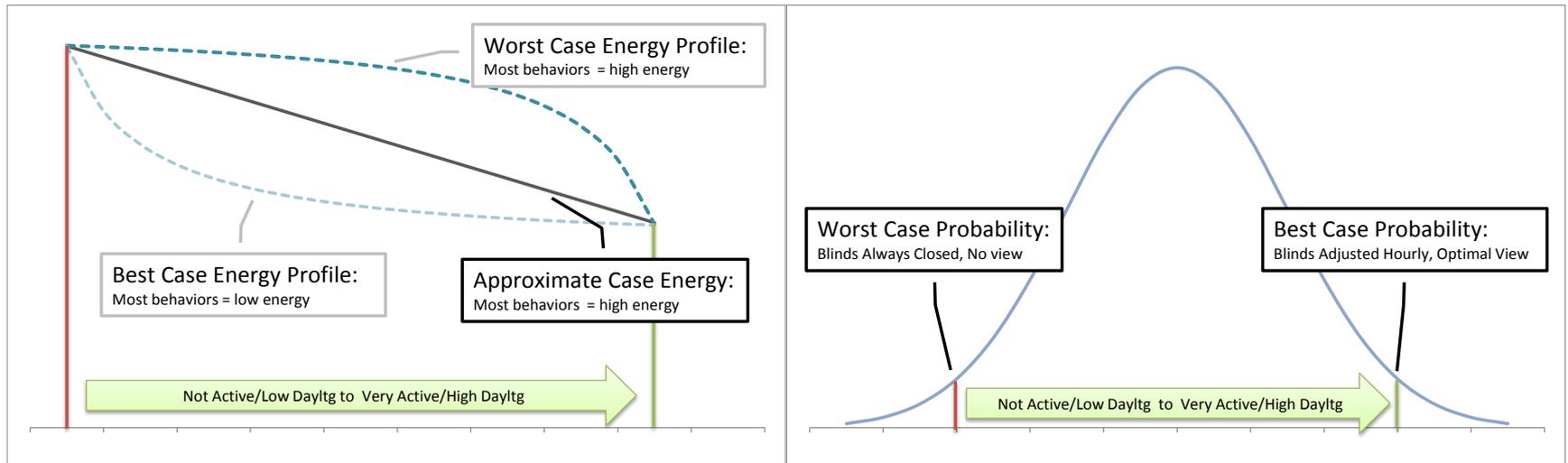
Blinds behavior

- University of Idaho meta-study
 - Study of the body of studies on occupant behavior and window coverings (hereafter blinds).
 - Span the U.S., Canada and Europe
 - Varying in orientation, type, etc.
 - How and why of blinds
 - Conclusion: *No agreement among studies*
- For our study we are interested in daylighting savings
 - Assume glare triggers blinds adjustment, but users prefer view
 - Still many hows and whys left

Methodology for Savings Analysis

Blinds behavior

- How can we approach? Use statistics.
 - There are a variety of ways to use blinds and a variety of blind and shade types; each case has an energy impact.
 - Each case also has a likelihood of occurring
 - Net energy impact is a probability-weighted energy impact of all behaviors



Methodology for Savings Analysis

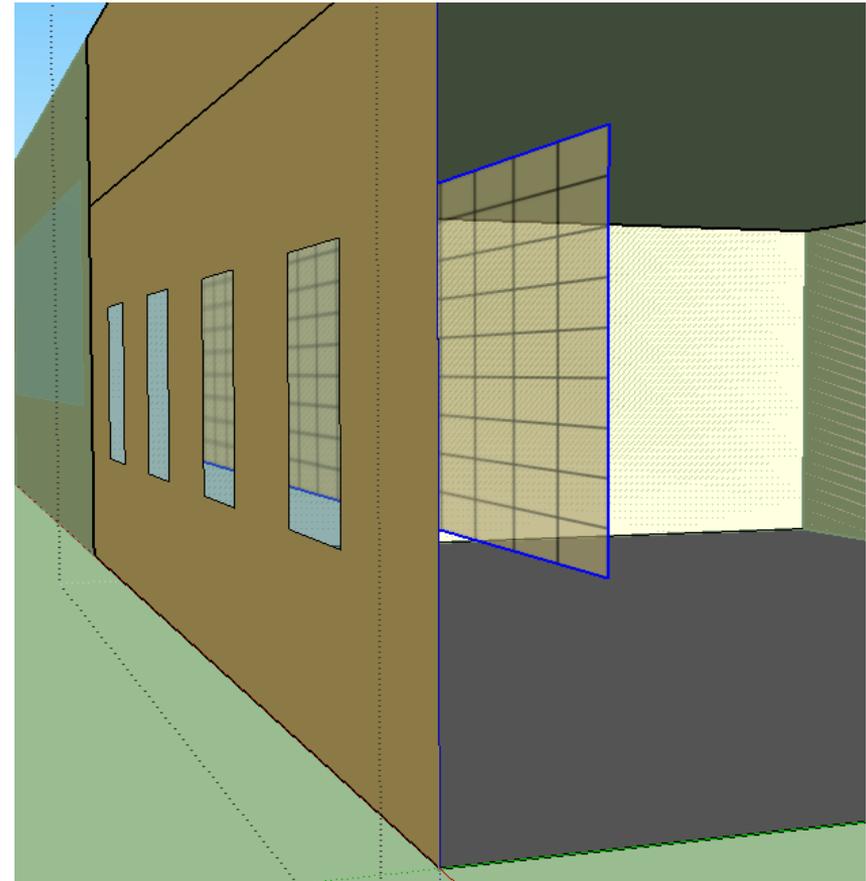
Glare Metric: Traditional metrics

- Formula with intensity, peripheral angle and area (solid angle) of daylight
- Shortcomings
 - Always a specific position in the space
 - Very old user surveys
 - Low number of test subjects
 - Luminaires above occupants eye level, not daylight to side of occupant
 - Luminaires at 100s of lux, not daylight at possible 100,000 lux
 - High window-to-wall ratios
 - Inherent to formula, best is 80% don't see glare
 - Improvements/newer/better metrics, but no universal acceptance

Methodology for Savings Analysis

Glare Metric: Proposal

- Check illuminance at the wall with windows
 - Conservative intensity (most intense location in room)
 - Can examine any occupant location, height, orientation, peripheral vision
 - Glare thresholds
 - Contrast ratio: > 10:1?
 - Absolute intensity: > 1,500 lux?
 - Offset from wall: 2 ft.?
 - Offset above floor: 3 ft.?



Methodology thoughts? Opinions?

Assumptions for Energy Impacts Analysis

Key assumptions

- Prototype building features close to average CA future construction features as mapped into 2016 Title 24, part 6 compliant buildings
- CA future construction forecast accuracy
- Blind statistical analysis is a reasonable approximation
- Proposed glare evaluation and thresholds are valid

Data sources

- Literature: Utility studies, LBNL, etc.
- Prototype: as above
- SOLPAS: as above
- AEDG, EDR, CHPS, WBDG, Advanced Lighting Guidelines, SMEs
- Stakeholder help with optimal control strategies
 - Electrochromics
 - Automatic shades
- Utility study Radiance data

Initial Data and Findings

PAFs (Very ballpark)

Fixed shades: 0.2

- Preliminary modeling runs

Daylight distribution devices: 0.2

- Advanced Sidelighting Products (SMUD)

Daylight redistributing films: 0.3

- Advanced Sidelighting Products (SMUD)

Automatic shades: 0.3

- Advanced Daylighting Blinds and Shades Assessment (PG&E ET)

Dynamic glazing: 0.1

- Advancement of Electrochromic Windows (LBNL, 2006)

Clerestory windows: 0.2

- Preliminary modeling runs

Compliance and Enforcement- Market Actors

- Market Actor #1 – Attachments Energy Rating Council (AERC)
- Market Actor #2 – Architects / Designers
- Market Actor #3 – Compliance Software Manufacturer
- Market Actor #4 – Title 24 Consultants
- Market Actor #5 – Manufacturers
- Market Actor #6 – Distributors
- Market Actor #7 – Installers
- Market Actor #8 – Code Officials / Plan checkers / Field Inspector

- Others?

Compliance and Enforcement—Tasks

Market Actor	Task(s)	Success Criteria
AERC	<ul style="list-style-type: none"> - Test and rate products 	<ul style="list-style-type: none"> - Certify performance (e.g. labels)
Architect / Designer	<ul style="list-style-type: none"> - Design building envelope to meet Title 24, Part 6 - Specifies products 	<ul style="list-style-type: none"> - Design buildings that meet building owner's needs and comply with Title 24, Part 6
Compliance Software Manufacturer	<ul style="list-style-type: none"> - Incorporate new technologies in compliance software 	<ul style="list-style-type: none"> - Properly understand new technologies and code
Title 24 Consultants	<ul style="list-style-type: none"> - Complete applicable compliance forms - Use compliance software 	<ul style="list-style-type: none"> - Compliance documents are properly completed and system is compliant
Manufacturers	<ul style="list-style-type: none"> - Provide products that meet the minimum PAF requirements - Educate distributors of the new code update 	<ul style="list-style-type: none"> - Develop products that meet Title 24, Part 6 requirements that are cost-effective
Distributors	<ul style="list-style-type: none"> - Stocks window coverings - Inform and educate Installers 	<ul style="list-style-type: none"> - Stock code requirement compliant products
Installers	<ul style="list-style-type: none"> - Install window covering products 	<ul style="list-style-type: none"> - Install cost-effectively and according to needs of building owner
Code Officials / Plan Checkers / Field Inspector	<ul style="list-style-type: none"> - Check to ensure all components of building envelope meet code 	<ul style="list-style-type: none"> - Understand Title 24, Part 6 - Properly inspect everything

Compliance and Enforcement—Resources

Market Actor	Resource(s)
AERC	- Test equipment
Architect/Designer	- Resources: Compliance manual, CEC hotline, EnergyCodeAce - Tools: Simulation tools like Lumen Designer, SkyCalc, Radiance, others?
Compliance Software Manufacturer	- Resources: Conferences (ASHRAE, IBPSA, SimBuild), CABEC
Title 24 Consultants	- Resources: CABEC training, classes - Tools: CBECC-Com, EnergyPro/Compliance Software
Manufacturers	- Resources: NFRC Meetings
Distributors	- Manufacturer's literature
Installers	- Manufacturer's literature
Code Officials / Plan Checkers / Field Inspector	- Resources: CALBO training, classes

Strawman Code Change Language

Title 24, part 6 Standards

- PAFs for technologies meeting certain requirements
 - Only when daylighting controls installed
 - AERC rating: reflectance, transmittance, etc.
 - “Fixed” technologies: Dimensions, location
 - “Controlled” technologies: Control strategy
 - Consider exterior permanent obstructions (similar to current skylights)
 - Clerestory extend down from ceiling

Title 24, part 6 Appendices

- Perhaps locate tables here for various technologies and combinations of technologies

Strawman Code Change Language

Alternative Compliance Method (ACM) Technical Manual

- Standard Building (baseline): maximum Prescriptive LPD
- Proposed Building (design): The energy modeler using CBECC-Com will be have two choices
 - Multiplier: As with previous PAFs, can be applied as multiplier on proposed LPD
 - Energy savings assumed equal to PAF
 - Short modeling time
 - Radiance: Similar to how overhangs are currently handled, can be modeled
 - More accurate savings
 - Longer modeling time
 - Radiance/OpenStudio integration already exists but needs enhancement
 - Simplification techniques
 - Cumulative database of parameters vs. results (start with Utility study data)

Feedback Request from Stakeholders

- Please provide feedback/input:
 - Do you have feedback on the products we are investigating?
 - Are there other products we should be looking at?
 - Optimizing: geometry, controls, etc.
- Email: eric@Determinant-LL.Com

Thank you.

Eric Shadd: eric@Determinant-LL.Com

