ROETZEL & ANDRESS
A LEGAL PROFESSIONAL ASSOCIATION

FIFTH THIRD CENTER
AT ONE SEAGATE
SUITE 1700
TOLEDO, OH 43604
419.254.5246 DIRECT
419.242.7985 MAIN
419.242.0316 FAX
tzaremba@ralaw.com
www.ralaw.com

DOCKET
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DATE July 01 2011
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July 1, 2011

Federal Express Delivery (ten copies)to:
California Energy Commission
Dockets Office, MS-4
Re: Docket No. 10-BSTD-01
1516 Ninth Street
Sacramento, CA 95814-5512

Re: Docket No. 10-BSTD-01
June 9, 2011 Staff Workshop – 2013 Building Energy Efficiency Standards

Dear California Energy Commission Docketing Office Staff:

Enclosed please find for docketing ten (10) copies of the Comments of Pilkington North America, Inc. and AGC Flat Glass North America, Inc. regarding Docket No. 10-BSTD-01, June 9, 2011 Staff Workshop – 2013 Building Energy Efficiency Standards. These same comments were transmitted to docket@energy.state.ca.us on July 1, 2011.

Please confirm receipt and docketing of these Comments. If you have any questions, please don't hesitate to call me (or my assistant Mary Wallace at 419-254-5259).

Very truly yours,

Thomas S. Zaremba

TSZ/mlw
Enclosure

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July 1, 2011

Re: Docket number 10-BSTD-01
June 9, 2011 Staff Workshop – 2013 Building Energy Efficiency Standards

Via email to:
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Re: Docket No. 10-BSTD-01
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Ladies and Gentlemen of the California Energy Commission and Staff:

Pilkington North America, Inc. ("PNA") and AGC Flat Glass North America, Inc. ("AGC"), two of the leading North America primary flat glass manufacturers, respectfully submit the following comments on the draft proposal set forth in the CASE Report for Nonresidential & High-Rise Residential Fenestration Requirements presented at the June 9, 2011 staff workshop ("CASE Report").

INTRODUCTION

The CASE Report proposes prescriptive values that would mandate the use of a high visible light transmission ("VT"), ultra-low solar heat gain coefficient ("SHGC") glass in every prescriptive application in every nonresidential and every high-rise residential building envelope built anywhere in California after the effective date of the 2013 Energy Efficiency Standards ("Energy Code"). Out of the hundreds of different types of coated, tinted and fritted glass available in the market, only a single glass type, a triple silver, low-emissivity soft-coat, would be capable of meeting the prescriptive values proposed in the CASE Report.

The CASE Report attempts to accomplish at least two things: First, it attempts to simplify the existing code and, second, it attempts to prescribe VT window values that will bring

"daylight" into the building in order to reduce the building's electrical lighting loads.[1] In effect, the CASE Report hypothesizes that a high VT, low SHGC glass can be pre-selected and mandated in the prescriptive path that will yield the correct amount of daylight necessary to reduce electrical lighting loads in virtually all applications. Unfortunately, that hypothesis is not correct. For reasons described below, the use of the high VT, low SHGC glass proposed in the CASE Report will likely ***increase,*** rather than decrease, electrical lighting loads. Since, windows typically have a useful life of 40-years, prescribing glass with the VT values proposed in the CASE Report will likely to result in hundreds, if not thousands, of buildings being built in California that will be burdened for several generations to come with higher interior electrical lighting loads than necessary.

DAYLIGHTING

There is **no** single glass type that, when prescribed for windows in commercial buildings, will result in reduced electrical lighting loads. The use of daylighting to reduce lighting loads is a complex mix of science and art that is not susceptible to the type of simplification attempted in the CASE Report.

The Illuminating Engineering Society of North America ("IESNA") is the recognized technical authority on illumination in buildings. It publishes the seminal work on lighting in the United States. Its opening statement on "Daylighting" provides:

> To use daylight effectively, the following factors should be taken into account:
>
> - Human factors, including physiology, perception, preferences, and behavior
> - Effects of daylight on all materials, including furniture, artwork, and plants
> - Controlled admission of direct sunlight
> - Controlled admission of diffuse daylight
> - Effects of local terrain, landscaping, and nearby buildings on the available light
> - Integration of building systems, including the electric lighting, fenestration, interior geometry and finishes,

[1] Windows can be used to reduce electrical lighting loads through the use of natural "daylight" but only when they are properly selected and configured in combination with other daylighting principles and coupled with properly designed and operating lighting controls.

> manual and automatic control systems, and active climate control systems.[2]

Ignoring these factors and using a single, pre-determined, high VT glass in every application will very likely result in a high degree of discomfort glare at workspaces throughout the building.[3] Glare will, in turn, result in a greater reliance on interior lighting with a commensurate increase in the building's electrical energy use:

> Daylighting systems can produce discomfort glare. Very high luminance ratios are produced unless care is taken to balance and reduce luminances. *Increased interior electric lighting may be required to balance luminances and reduce glare produced by daylight, thus increasing energy use when daylighting is used. Glare is critically dependent on the luminance of the window*. (Emphasis added).[4]

Lawrence Berkley National Laboratory (in collaboration with the U.S. Department of Energy and the California Energy Commission Public Interest Energy Research), came to the same conclusion in evaluating high performance building façades:

> The classic problem that plagues sidelit perimeter spaces is that occupants sitting nearest the window will lower the shades to avoid … visual discomfort from glare. When conventional top-down shades are lowered, it tends to eliminate much of the useful daylight and view, causing occupants farther from the window to rely more on the electric lighting system. Often, shades are left lowered for days or weeks at a time, irrespective of sunny or cloudy conditions.
>
> The concept of *useful* or *efficient daylighting* is to be able to balance the luminance conditions in the overall space, lowering dark and light contrasts, so that daylit conditions are comfortable. High-performance façades in combination with thoughtful interior design are able to maintain comfort conditions and daylight

[2] Illuminating Engineering Society of North America *The IESNA LIGHTING HANDBOOK* p. 8-1 (9th Ed. 2000).

[3] The CASE Report acknowledges that glare is likely to result from its high VT glass mandate. However, rather than attempt to correct the glare by acknowledging the need to use different glass types in different applications, the Report attempts to shift the burden of solving the glare problem to the building's occupants: "Reflective glare on computer screens can be mitigated by occupant orientation, or low-reflectance computer accessories." CASE Report, p. 22. Unfortunately, building occupants are equally (or, perhaps, more) likely to combat glare by closing the blinds and turning on the lights, increasing the building's electrical loads.

[4] Illuminating Engineering Society of North America *The IESNA LIGHTING HANDBOOK* pp. 8-8 and 8-9 (9th Ed. 2000).

> efficiency so that electric lighting system use is minimized. (Emphasis in original).[5]

While simplicity is a desirable objective, the simplicity offered in the high VT glass proposed by the CASE Report will likely result in generations of buildings being built with excessive glare problems that building occupants are likely to solve by increasing their use of blinds coupled with an increased use of interior lighting. Or, building owners will solve the problem by using dark film retrofits. Either way, electrical lighting loads will not diminish, and may actually increase as a result.

ACHIEVING EFFECTIVE DAYLIGHTING IN CALIFORNIA'S ENERGY CODE

Effective Daylighting Is Best Achieved Through the Performance Path

The primary reason for the Energy Code to include a VT requirement is to use natural light as a way to reduce the use of interior electrical lighting. In order to develop a truly effective daylighting strategy, input from daylighting and electrical design professionals is needed from the very start of the building's design phase:

> Despite the dramatic advances in daylighting prediction, daylighting design still remains an art as much as a science. One reason is that discomfort glare is difficult to quantify and predict since it is highly dependent on the occupant's direction of view and task. Few studies have been conducted to derive models that could help with such predictions. Add to this the unpredictability of occupant behavior (e.g. in terms of blind operation) and it becomes apparent that in many cases experience is still the surest guide.
>
> In addition, some of the most effective daylighting strategies include a combination of shading, surface coloring and interior design features that is rather complicated to model in its entirety. Scientific tools can be a great help, but what really allows designers to push the envelope is innovation informed by experience.
>
> Finally, good daylighting design also relies on the art of teamwork among the different disciplines. For example, electrical and lighting engineers should be involved early in the process of

[5] Lawrence Berkeley National Laboratory Buildings Technology Dept., Environmental Energy Technologies Division *High Performance Building Façade Solutions* http://lowenergyfacades.lbl.gov/index.html p. 10 (2009).

daylighting design so that architects can take their knowledge and experience into account.[6]

The complexity of effective daylighting clearly suggests that reduced electrical loads through daylighting can most effectively be accomplished through the performance path. California's Energy Code should focus on strengthening the effective use of daylighting in the performance path.

Prescriptive Path Alternatives

If California is determined to include daylighting as a component of the prescriptive path, a way needs to be found to ensure that the objective of reducing the building's electrical lighting loads will, in fact, be achieved.

Currently, California's Energy Code uses Primary Sidelit Effective Aperture ("Effective Aperture") when windows (or windows together with skylights) are used to fulfill daylighting requirements in spaces affected by §143(c).[7] While Effective Aperture will most assuredly yield the greatest likelihood that the selection and configuration of windows in combination with lighting controls will actually yield a reduction in electric lighting loads, the concern is that it may be too complex to be easily administered or enforced by the building code officials. However, ways to overcome this problem should be explored, for example, requiring a registered design professional to certify that plans and drawings presented for prescriptive path approval comply with Effective Aperture requirements.

As an alternative, the New Buildings Institute ("NBI") in combination with the American Institute of Architects ("AIA") developed a prescriptive "daylighting" formula for the International Energy Conservation Code ("IECC") that was adopted in its last development cycle for inclusion in its 2012 edition. The NBI/AIA formulation provides that:

1. No less than 50% of the conditioned floor area must be within a daylight zone;

2. Automatic daylight controls are installed in those daylight zones; and

3. The VT of vertical fenestration is greater than or equal to 1.1 times the SHGC (unless the fenestration is a kind which is not included in the scope of NFRC 200).

[6] *Word on Windows*, Efficient Windows Collaborative and the Alliance to Save Energy, *Daylighting – Powerful but Complex* p. 4 at 5-6. (Spring 2010)

[7] Effective Aperture is also used as a vehicle for reducing electric lighting loads in several of the high performance energy codes such as ASHRAE 189.1 and the final draft of the International Green Construction Code or the IgCC.

This formulation is unlikely to reduce the energy use of buildings as much as Effective Aperture, but it has a far greater potential of reaching that objective than the high VT, low SHGC values the CASE Report proposes for every prescriptive application.

CASE REPORT'S PROPOSED SHGC

Just as in the case of VT, there is **no** single SHGC value for commercial windows that will be energy efficient in all applications. Nevertheless, the CASE Report proposes the use of ultra-low SHGC windows (with SHGCs ranging from 0.17 to 0.25)[8] in all 16 climate zones throughout the State. ASHRAE 90.1, for example, prescribes a 0.40 SHGC in its climate zones 4-6 which are roughly the same as California's climate zones 12 and 16. This higher SHGC is warranted in these zones because they are colder, northern climates where free solar energy can be used to reduce the amount of fossil fuels burned for heating.

The CASE Report provides little, or no, justification for using ultra-low SHGC values in California's northern climate zones or its higher, colder elevations. In the absence of any significant technical justification, SHGC in California climate zones 12 and 16 should be set no lower than 0.40, not a maximum 0.25 as proposed in the CASE Report. Likewise, SHGC in California's higher elevations should be further reviewed for the potential of energy savings resulting from the use of glass with higher SHGC values.

Finally, it is important to remember that low SHGC windows are more, ***or less***, effective in reducing solar gain depending on their orientation. For example, low SHGC windows can help control solar gain on the west face of a building. However, those same low SHGC windows, while potentially costing more than higher SHGC windows, will provide little or no solar control when used on the north face of the same building. Moreover, while providing little or no solar control benefit, prescribing ultra-low SHGC windows on the north face of a building could adversely impact daylighting design.

The CASE Report does not take northern climate zones, high elevations or orientations into account in proposing ultra-low SHGC values. Further consideration should be given to each of these factors before adopting uniform, ultra-low SHGC values throughout the entire State.

CONCLUSION

Effective use of daylighting can be a powerful tool in California's effort to reduce the overall energy usage of its commercial buildings. PNA and AGC applaud the CASE Report's attempt to bring a simplified daylighting concept into the Energy Code's prescriptive path. However, daylighting is as much an art as it is a science and a mistake in the formulation of a prescriptive "daylighting" requirement could adversely affect energy conservation in California's future commercial building stock for generations to come.

[8] A 0.25 SHGC blocks a full 75% of the sun's heat energy from entering the building. Similarly, a 0.17 SHGC means that the window blocks 83% of the sun's heat energy.

For daylighting to be an effective tool of energy conservation, numerous factors must be taken into account and both daylighting and electrical design professionals must collaborate in the building's design from the very beginning. In short, daylighting will be most effective in reducing California's overall energy usage as a part of the Energy Code's performance path.

If daylighting is to be included in the prescriptive path, simplicity and enforceability could be achieved in the use of California's current Effective Aperture requirements if, for example, registered design professionals are required to certify compliance at the time building plans are presented for review and approval. Otherwise, the simple prescriptive formulation developed by NBI/AIA is a workable and enforceable alternative.

Finally, a uniformly ultra-low SHGC throughout the State is not technically supported or justified for northern climate zones, in higher elevations and certain orientations and should be further reviewed before the values proposed in the CASE Report are adopted.

Recommendations

PNA and AGC urge the California Energy Commission:

1- Not to adopt the VT proposals contained in the CASE Report.

Instead, PNA and AGC urge the California Energy Commission to:

2- Continue pursuit of effective daylighting requirements in the performance path;

- alternatively -

3- Use Effective Aperture in the prescriptive path, possibly coupled with a requirement that registered design professionals certify compliance at the time plans and drawings are submitted for approval;

- or -

4- Use the prescriptive daylighting formula developed by NBI/AIA found in the 2012 edition of the IECC;

- and -

5- Rather than adopting the ultra low SHGC values proposed Statewide in the CASE Report (i) prescribe a minimum 0.40 SHGC in California's climate zones 14 and 16 and (ii) study the use of higher SHGC values in higher elevations and different building orientations for potential energy savings.

Thank you for your time and attention,

/s/ Thomas S. Zaremba