

# Responses to Inquiries

For the Final Report of

## Validation of WINDOW 6 and THERM 6 for Use in Determining the Solar Heat Gain Coefficients and U-Factors of Complex Glazing Systems Research Project

NFRC Project Number: 07-101-DR1

*Pertaining to:*

**NFRC Webinar**

July 6, 2011

1:00 p.m. – 3:00 p.m. EDT

*Submitted by:*

William C. duPont/Sunergy Consulting

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### **BACKGROUND:**

NFRC sponsored a research project intended to perform and coordinate data collection, research, and testing to evaluate the new features within WINDOW 6 and THERM 6, which has been developed by Lawrence Berkeley National Laboratory (LBNL). Some of the new features in this software are the capability to calculate the SHGC and U-Factor of glazing and shading systems including woven shades, Venetian blinds, and fritted glass.

The final report for this research project was presented by Webinar on July 6, 2011 between 1:00 p.m. and 3:00 p.m. EDT. Questions were asked during the presentation, which were answered verbally during the presentation. NFRC Staff received additional questions in the Webinar Chat window, some of which were answered during the presentation. This document attempts to list all of the questions presented with responses by the Principle Investigator (PI), which are presented in *blue italic font*.

### **QUESTIONS DURING PRESENTATION:**

The following questions were asked and responded to during the presentation. They may not be listed in the order that they were asked.

*Roger LeBrun/Velux America* — When reviewing the tolerance for the agreement between SHGC test and simulation results, Roger LeBrun expressed the opinion that the difference of –59.10 % was too extreme, and that the Outdoor Woven Shade should not be recommended as a product category that can be accurately simulated by WINDOW and THERM. *The criteria proposed by the PMTG states that below a SHGC of 0.4, the tolerance is  $\pm 0.06$ . Given that the measured SHGC was extremely low, 0.07, the difference between the simulated value of 0.029 is*

*-0.041, which calculates to be a high percent difference. It was for this reason that the criteria for both U-Factor and SHGC have two conditions used to determine the tolerances. If the values to be compared are above a set value (0.3 for U-Factor and 0.4 for SHGC) then the comparison is based on a percentage. If the comparison values are below the set values, then the comparison is performed on absolute differences. These absolute differences are related to the absolute precision of the test method, and cannot be reduced without justification.*

Charlie Curcija/LBNL — Charlie Curcija asked what is the reason for including Standard Deviation in each of the tables. *Admittedly, the five tables that only have two items in a table (e.g., Frit, Between Glazing and Outdoor Woven Shades) do not benefit from reporting the Standard Deviation. On the tables with three or more entries, the Standard Deviation highlights different aspects of the data. For SHGC and U-Factor results, the Standard Deviation helps identify the range of performance by the test specimens selected (where bigger Standard Deviations show greater diversity). For the %Diff and Diff. results, the Standard Deviation helps to show the degree of agreement (where smaller Standard Deviations show better agreement).*

Joe Hayden/Pella Corporation — Joe Hayden pointed out that the criteria for the acceptance of tested and simulated SHGC and U-Factor was incorrectly reported. *The slide showing the “Criteria for Recommendation” incorrectly reported the U-Factor tolerance between test and simulation to be  $\pm 0.3$  when it should have been  $\pm 0.03$ . In addition, it reported that the SHGC tolerance between test and simulation to be  $\pm 0.4$  when it should have been  $\pm 0.06$ . An effort was made to correct these values during the presentation, but after a number of iterations, the corrections were not correctly implemented. Thanks to Christian Kohler at LBNL, the erroneous values have been identified in red font in a small presentation titled, “NFRC WINDOW 6 Validation Research Project Report110914(Errors).pdf.” An updated presentations titled, “NFRC WINDOW 6 Validation Research Project Report110914(p1).pdf,” has been reissued that contains the corrected values.*

Chuck Anderson/NuWell Company — Chuck Anderson noticed that the %Diff. and Diff. values were not agreeing with the actual comparison of the test and simulation results in the same table. *Three U-Factor tables (e.g., Between Glazing Woven Shades, Between Glazing Venetian Blinds, and Outdoor Woven Shades) were found to contain simulated SHGC calculated using Standard Conditions instead of Actual Conditions. Although the associated %Diff. and Diff. values were correctly reported, the minimum, maximum, average and Standard Deviations associated with those columns also needed to be corrected. The erroneous values have been identified in red font in a small presentation titled, “NFRC WINDOW 6 Validation Research Project Report110914(Errors).pdf.” An updated presentation titled, “NFRC WINDOW 6 Validation Research Project Report110914(p1).pdf,” has been reissued that contain the corrected values.*

#### **QUESTIONS POSED ON WEBINAR CHAT:**

The following questions were posted on the Webinar Chat window during the presentation. They may not be listed in the order that they were asked. Responses to questions answered by other individuals have been paraphrased by the PI, and are identified in *green italic font*.

Not all of the comments typed into the chat window have been included in this document as some of the correspondence between NFRC Staff and the participant concerned administrative issues about the function of the Webinar, and the availability of the presentation afterwards.

Roger LeBrun/Velux America — “At some appropriate point, please ask LBL expert to talk about the applicability of the new algorithms dealing with shading layers for sloped products.” *Charlie Curcija responded that WINDOW 6 and THERM 6 contain algorithms used to calculate the U-Factors and SHGC of fenestration products at any tilt angle. These methodologies are currently used to determine the U-Factors and SHGC of skylights and sloped glazing at a 20° tilt for NFRC rating. William duPont added that the SHGC test and simulation results (at actual conditions) were compared at various tilt angles, ranging from 20° to 70°. The U-Factor test and simulation results are always determined when the product is in a vertical orientation.*

Ken Brenden/AAMA — “Should he have moved the decimal point on the U-Factors?” *This question was asked as the presenter was in the middle of trying to modify the presentation while he was giving it, which as you can see, only compounded the errors. We eventually figured it out after the presentation was over. See the inquiry by Joe Hayden above.*

“Will this presentation be made available to members on the NFRC website?” *Ray McGowan affirmed that the presentation will be available to the membership on an NFRC Web site after the meeting.*

Alex Krickx/Serious Materials — “There were some tables that had positive and negative values and they were averaged together... but I do think that the "% Diff" column is taking an average of all values. It should take an average of the absolute values  $AVG(|Value|)$  so that a -10% diff and +10% diff don't average to 0. I think it was in multiple tables. Anywhere the "% diff" was given for multiple U/SHGC values.” *This is a valid point. It was one of the reasons that I reported Standard Deviations, which is a better indication of variance, of both the percent differences ( $= [simulation-test]/test * 100\%$ ) and of the differences ( $= [simulation-test]$ ). I have always preferred to report the average (mean value) and the Standard Deviation as a pair of values as opposed to the variance alone (mean absolute value of the differences).*

David Chao/Oldcastle Building Envelope — “Fritted glass sample h[igh] and l[ow] density sent me please. Fritted glass is hot now please cover it in depth. Thanks” *William duPont received an e-mail from David Chao after the presentation asking for copies of the WINDOW 6 files with the properties of the frit glazing. Efforts will be made to get samples or copies of this information from LBNL.*