

## Attached Awning Rating Feasibility Research Project Contract

---

### Agreement

THIS AGREEMENT is made and entered into as of August 17, 2009, by and between the National Fenestration Rating Council, Incorporated (hereinafter called NFRC) located at 6305 Ivy Lane, Suite 140, Greenbelt, Maryland 20770 and SunPine Consulting.

Whereas, in consideration of the mutual promises contained herein, it is mutually agreed as follows:

- 1) Contractor shall provide technical research services to NFRC referenced in the Request for Proposal (“RFP”) titled *Attached Awning Rating Feasibility Research Project*. The scope of the research services to be provided to NFRC (herein referred to as the “Scope of Work”) are defined by the proposal submitted by Contractor (the “Contractor Proposal”), a copy of which is attached hereto. The Scope of Work will proceed under the direction of the Project Monitoring Task Group and a designated NFRC staff member. The Scope of Work shall be performed in accordance with the schedule of deliverables referenced in the RFP.
- 2) **The attachment industry agreed to financially support SunPine Consulting for this project. NFRC has no financial obligation, but will monitor this project’s progress according the NFRC 703-Research Program Manual.**
- 3) The work product created by Contractor under the Agreement shall be deemed a “work made for hire” for NFRC under the U.S. Copyright Act and all right, title, and interest in the research, data, reports and other intellectual property created by Contractor in the performance of the Scope of Work, including any rights to seek patent protection for such intellectual property, shall be owned by NFRC, and Contractor hereby assigns to NFRC any right, title, copyright or other interest that Contractor may have in such intellectual property. Contractor further agrees to execute any other assignment or other instrument required to effect the assignment of all rights in such intellectual property to NFRC. Notwithstanding the foregoing, if federal funds are used under this Agreement, the federal government shall retain any rights in such intellectual property as mandated under the applicable federal procurement regulations and other laws that govern the use of such funds.
- 4) This Agreement may be terminated by a party if the other party materially breaches its obligations under this Agreement and fails to cure that breach within 30 days after written notice thereof. NFRC may at any time terminate this Agreement without cause upon 10 days prior written notice to Contractor provided that in the event of such without cause termination, NFRC shall pay Contractor for the portion of the Scope of Work that it completed prior to the terminations as reasonably determined by NFRC.
- 5) Contractor shall indemnify and hold NFRC harmless from any and all claims, losses, damages and liabilities incurred by NFRC that result from Contractor’s breach of this Agreement or any negligent or wrongful act of Contractor.
- 6) The Contractor shall keep the terms of this Agreement in confidence and will not disclose those terms without the prior consent of NFRC or as required by applicable law.

**Attached Awning Rating Feasibility Research Project Contract**

---

- 7) This Agreement does not constitute or create a joint venture, partnership, agency relationship, or formal business organization of any kind, and the rights and obligations of the parties shall be only those of independent contractors. This Agreement, including the attachments hereto, reflects the complete agreement of the parties on the subject matter of this Agreement and supercedes any prior oral or written understanding between the parties on that subject matter.
- 8) This agreement is not assignable or delegable by the Contractor without NFRC's prior written approval.
- 9) Bidder shall sign and comply, if applicable, with any of the exhibits and appendices that are attached hereto and incorporated herein by reference.
- 10) This Agreement shall be governed by and construed according to the laws of the state of Maryland.
- 11) Contractor shall signify acceptance of the terms and conditions of Agreement by signing two copies thereof and returning one fully executed copy to NFRC.

National Fenestration Rating  
Council, Incorporated  
By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

Bidder

By: Rose McCluney

Title: Owner, SunPine Consulting

Date: 17 August 2009

---

## Attached Awning Rating Feasibility Research Project Contract

---

### Attached Awning Rating Feasibility Research Project Contract

NFRC Project Number: 08-103-RP

#### **BACKGROUND:**

The NFRC Awning Task Group hopes to develop a methodology to rate non-coplanar exterior awnings, which are installed on the outside face of windows and doors.

Lawrence Berkeley National Laboratory (LBNL) is developing software titled, WINDOW 6, which will extend the capabilities of their existing software, WINDOW 5.2, to include additional algorithms for calculating the properties of fenestration systems that incorporate interior blinds and roller shades, Venetian blinds, between-the-panes blinds, and exterior insect screens, shade screens, and other coplanar exterior shading devices. Projecting shading products such as window awnings, however, are not included in this new software. New research is needed to identify and/or develop new methodologies for rating the energy performance of such products.

European standards have been developed for determining certain properties and benefits of projecting exterior shading products, but the standards are not directly applicable for use by NFRC at this time. Ross McCluney developed a generalized Awning Shading Algorithm and programmed it in Visual Basic for Windows (1986 and 1990)<sup>1</sup>. This algorithm could be considered as one methodology for rating the shading effectiveness of exterior awnings conforming to certain geometrical constraints, but it would need to be extended to include the diffuse transmittance of any translucent awning fabrics used. There are other similar methodologies that need to be identified and evaluated.

This research project proposes to evaluate existing standards and methods such as those cited above, and make recommendations for which methodologies can or cannot be easily adapted by NFRC. Based on that study, the research project would recommend procedures for rating the energy performance of projecting exterior fenestration shade products, which are not co-planar.

#### **OBJECTIVES:**

The intent of this research project is to first review existing standards relating to the energy, visual, and thermal comfort properties of exterior projecting shading devices, select from these any existing methodologies potentially suitable for NFRC use in rating these products, and then identify any new research which may be required to modify existing methodologies and/or develop and evaluate new methodologies for rating the energy-related performances of attached awnings.

The results from this research project will provide NFRC with descriptions of technical approaches to estimating the energy performances of various projecting exterior shading systems and proposed methods for calculation and/or testing of such products toward the goal

---

<sup>1</sup> McCluney, R., "Awning Shading and Algorithm for Window Energy Studies," *ASHRAE Transactions* (1986), V.92, Pt. 1, Paper No. 2964, pp. 430-438.

McCluney, R., "Awning Shading Algorithm Update," *ASHRAE Transactions* (1990), Vol. 96, Pt. 1, Paper No. 3302, pp. 34-38.

## Attached Awning Rating Feasibility Research Project Contract

---

of producing fair, credible, and technically accurate energy ratings for attached awnings. The purpose is to provide comparative energy performance ratings that are practical and fairly easy to incorporate into the existing NFRC fenestration system rating program.

### **SCOPE AND APPROACH:**

A two-phase approach may be required. In Phase I, described herein, existing standards and published methodologies will be evaluated for possible use or adaptation by NFRC. A variety of such methodologies have been published and used for many decades in estimating air cooling system loads for purposes of cooling equipment sizing and longer term energy performance simulations. Several early publications are listed below for reference. From this work, recommendations will be made for additional needed research to develop and validate any new methodologies that may be useful. The output of this Phase I contract will be a report of the findings and recommendations of this contract. This report will identify existing methods that may be included in a proposed procedure plus any additional research which the contractor believes will be needed to develop and evaluate additional methodologies.

Phase II, if needed, will be separately funded, and will pursue the work called for in a new RFP that will be written, based on the conclusions of this Phase I effort.

This research project will consist of six (6) tasks:

#### **Task 1: Search and Review Literature**

Search and review literature as referenced or as found published in the global scientific community which addresses the characterization and energy performance of exterior awnings and other non-coplanar exterior shading devices.

*Duration: 1 Month*

#### **Task 2: Definition and Categorization of Awning Products**

Define the types of fenestration attachment products, which will be considered as projecting awnings including a description of the cover materials typically used for those products. This list shall be reviewed and approved by the Project Monitoring Task Group (PMTG). Define and delineate which existing algorithms are applicable to each of these types of products, and what additional research is required to develop methodologies to rate all of the product types identified.

*Duration: 3 Months*

#### **Task 3: Determine Minimum Input Data**

Define the materials or data that an awning manufacturer will have to submit for testing or modeling to characterize non-coplanar fenestration attachment products for their optical properties, Solar Heat Gain Coefficient (SHGC), visible light transmittance (VT) and other rating indices if appropriate.

*Duration: 3 Months Concurrent with Task 2*

#### **Task 4: Propose Guidelines to Develop Product Evaluation and Rating Methodology**

Develop guidelines and recommend additional activities necessary to implement testing and modeling methodologies, which can be used by NFRC to rate these awning products. Identify any modifications to existing NFRC-approved software if necessary.

*Duration: 3 Months Concurrent with Tasks 2 and 3*

## Attached Awning Rating Feasibility Research Project Contract

---

### **Task 5: Justify Proposed Rating Methodologies**

Describe and evaluate the methodologies for determining the shading effectiveness and energy performance suitable for possible adoption by NFRC as an exterior awning shading rating indices. Describe each in detail and evaluate their technical and practical suitability. In addition, describe any further research needed to refine the recommended method into an NFRC rating standard. Write an NFRC Research RFP Summary Page for proposed future research. Include this information in the final report.

It is currently recognized that the indices eventually selected to properly characterize the energy performance of all fenestration attachments, including awnings, may be different from those that are currently used to characterize glazed windows. A workshop dedicated to addressing these issues and others presented in this research proposal has been suggested to be held at or near LBNL. The Principal Investigator for this research project should plan to be an active participant in this workshop, and incorporate the findings from this meeting into their recommendations and final report.

*Duration: 3 Months Concurrent with Tasks 2, 3 and 4*

### **Task 6: Report Conclusions and Recommendations**

Based on the findings from the previous tasks, produce a final report detailing the work performed, the results and analysis, and proposed rating methods for NFRC to evaluate for possible adoption into the current rating system. Where possible, the report will include language that may be integrated into existing NFRC documents to enable future ratings. Present oral and written final reports to the NFRC membership. A peer-reviewed paper will not be required.

*Duration: 1 Month*

## **SCHEDULE**

Month 1: Review and study literature, (Task 1)

Months 2 – 4: Evaluate existing methods and develop new methods, (Tasks 2-5)

Month 5: Write final report, and present findings to NFRC Membership, (Task 6).

## **DELIVERABLES**

The status of the project shall be reported orally to the PMTG during at least three conference calls. At the completion of Task 2, a conference call with the PMTG shall be scheduled to approve the written list identifying the categorization of awning products. Within 4 months from the start of this project, the Principle Investigator shall present to the PMTG the results from Tasks 1 through 4.

Before presentation to the NFRC Membership and finalization of the final report, the contractor shall present the results from Tasks 5 and 6 to the PMTG.

## **ESTIMATED COSTS**

Labor	Material	Total
\$20,000	\$0	\$20,000

**All costs paid by industry, not NFRC**

## Attached Awning Rating Feasibility Research Project Contract

---

### **ESTIMATED DURATION:**

The total project period is expected to be 5 months.

### **PARTIAL PAYMENT SCHEDULE:**

- 30% advance (after contract is signed)
- 30% upon completion of tasks 1, 2, 3, and 4
- 40% upon completion of task 5 and 6

### **POTENTIAL CO-SPONSORS:**

Professional Awning Manufacturers Association is willing to cover all the costs of Phase I.

### **PMTG:**

Recommended Project Monitoring Task Group members may include John Gant, Röss McCluney, William DuPont, Charlie Curcija, Christian Kohler, and Don Smallwood.

### **SOLE SOURCING:**

None

### **REFERENCES:**

- Budin, R., Budin, L.: A Mathematical Model for Shading Calculations; *Solar Energy*, vol.29, Pergamonn Press, 1982.
- Burns, P.J.: Building Solar Gain Modelling; *Passive Solar Buildings*, Balcomb, J.D., editor, MIT Press 1992.
- Quaschnig, V., Hanitsch, R.: Shade Calculations in Photovoltaic Systems; ISES World Solar Conference - Harare, Zimbabwe, 1995 (73 kB).
- Tabb, P.: *Solar Energy Planning*; McGraw-Hill, 1984.
- Quaschnig, V.: *Simulation der Abschattungsverluste bei solarelektrischen Systemen*; Verlag Dr. Köster Berlin, 1. Auflage September 1996.
- Quaschnig, V.: Höhere Flächenausbeute durch Optimierung bei aufgeständerten Modulen; 13. Sattler, M.A., Sharples, S., Page, J.K.: The geometry of the shading of buildings by various tree shapes; *Solar Energy* Vol.38 No.3, pp. 187-201, 1987.
- Petter Wallentén, M.Sc. in Physics and Maria Wall, M.Sc.: Architecture, Performance of shading devices in buildings - A collaboration between Lund University and Nordic manufacturers, <http://aesl.hanyang.ac.kr/resource/misc/bpnc99.pdf>
- Victor M. Gómez-Muñoz and Miguel Angel Porta-Gándara: Simplified architectural method for the solar control optimization of awnings and external walls in houses in hot and dry climates, <http://www.sciencedirect.com>
- Maria Wall and Helena Bülow-Hübe, Division of energy and Building Design, Lund Institute of Technology, Report TABK—01/3060: Solar Protection in Buildings, Parts 1 and 2. [http://www2.ebd.lth.se/ebdhome/avd\\_ebd/shade/MWB-HH\\_rap\\_3060.pdf](http://www2.ebd.lth.se/ebdhome/avd_ebd/shade/MWB-HH_rap_3060.pdf), [http://www.ebd.lth.se/fileadmin/energi\\_byggnadsdesign/images/Publikationer/Rapport\\_EBD-R--03-1.pdf](http://www.ebd.lth.se/fileadmin/energi_byggnadsdesign/images/Publikationer/Rapport_EBD-R--03-1.pdf)
- CEN, European Committee of Standardization, Standards 13363-1, 13363-2, 14500, and 14501.

## Attached Awning Rating Feasibility Research Project Contract

---

- Elite Software, SHADOW software, [http://www.elitesoft.com/web/hvacr/elite\\_shadow\\_info.html](http://www.elitesoft.com/web/hvacr/elite_shadow_info.html)
- Florida Solar Energy Center, AWNSHADE software, <http://www.fsec.ucf.edu/en/research/buildings/fenestration/software.htm>
- See also the more general listing of Building Energy Software Tools web page on the U.S. Department of Energy's Energy Efficiency and Renewable Energy web site at [http://apps1.eere.energy.gov/buildings/tools\\_directory/subjects.cfm/pagename=subjects/pagename\\_menu=other\\_applications/pagename\\_submenu=solar\\_climate\\_analysis](http://apps1.eere.energy.gov/buildings/tools_directory/subjects.cfm/pagename=subjects/pagename_menu=other_applications/pagename_submenu=solar_climate_analysis)
- *ASHRAE Transactions*. Additional historic references available in these publications.

### **NFRC RESOURCES:**

Staff time to coordinate and host PMTG meetings, conference calls, and update web site, etc.