Final Scientific Report

FENESTRATION SYSTEM ENERGY PERFORMANCE RESEARCH, IMPLEMENTATION, AND INTERNATIONAL HARMONIZATION

Award Number: DE-EE0002048

Award Recipient: The National Fenestration Rating Council

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Executive Summary

The research conducted by the NFRC and its contractors adds significantly to the understanding of several areas of investigation. NFRC enables manufacturers to rate fenestration energy performance to comply with building energy codes, participate in ENERGY STAR, and compete fairly. NFRC continuously seeks to improve its ratings and also seeks to simplify the rating process. Several research projects investigated rating improvement potential such as

- Complex Product VT Rating Research
- Window 6 and Therm 6 Validation Research Project
- Complex Product VT Rating Research

Conclusions from these research projects led to important changes and increased confidence in the existing NFRC rating process. Conclusions from the Window 6/Therm 6 project will enable window manufacturers to rate an expanded array of products and improve existing ratings.

Some research lead to an improved new rating method called the Component Modeling Approach. A primary goal of the CMA was a simplification of the commercial energy rating process to increase participation and make the commercial industry more competitive and code compliant. The project below contributed towards CMA development:

- Component Modeling Approach Condensation Resistance Research

NFRC continues to implement the Component Modeling Approach program. The program includes the CMA software tool, CMAST, and several procedural documents to govern the certification process. This significant accomplishment was a response the commercial fenestration industry's need for a simplification of the present NFRC energy rating method (named site built). To date, most commercial fenestration is self-rated by a variety of techniques. The CMA enables commercial fenestration manufacturers to rate according to the NFRC 100/200 as most commercial energy codes require.

International Harmonization

NFRC achieved significant international harmonization success by continuing its licensing agreements with the Australian Fenestration Rating Council and the Association of Architectural Aluminum Manufacturers of South Africa (AAAMSA) to produce NFRC certified product ratings in their respective nations. NFRC worked in several other nations to introduce the NFRC ratings system:

- India
- China
- Japan
- Canada

- Thailand
- South Africa
- Brazil
- Korea

NFRC attended or hosted several meetings in each of these nations establishing academic, commercial, industrial, and governmental contacts. NFRC presented the NFRC process and then necessary infrastructure steps necessary to achieve harmonization with the NFRC labeling system. NFRC looks forward to continued work toward harmonization in these nations and potentially others.

Public Benefit

The public benefit NFRC offers is significant. ENERGY STAR, USGBC-LEED, ASHRAE 90.1, and IECC all reference NFRC 100 and NFRC 200 exclusively for fenestration energy rating compliance. NFRC operates a significant quality control program involving third party certification for all product ratings. Consumers can easily identify the most energy efficient products for their homes based on NFRC ratings. NFRC publishes all participating manufacturer ratings on its web site via a certified product directory accessible to the public and updated frequently.

The research performed under this agreement increase the commercial fenestration energy ratings in the market and will greatly increase them in the future. The commercial market currently has limited energy ratings with any certification. NFRCs efforts during this agreement and into the future will enable the commercial market to compete fairly, allow building owners and lessors to save energy, and allow energy code officials to easily evaluate code compliance. Research on attachment products enables manufacturers to rate these products and allows consumers make comparisons to other window products in the marketplace.

International harmonization efforts will enable American window product manufacturers to export products to harmonized economies. Currently, most economies around the world have unique window energy rating systems. NFRC continuously reaches out to all economies offering its ratings systems under a license agreement. Interested economies may pursue a license agreement with NFRC if interested. NFRC also is conscious of ISO standards affecting window energy ratings. NFRC observes most ISO standards and considers them first when moving forward with energy rating changes. Using ISO standards will also enable NFRC to harmonize with other economies using similar ISO standards.

NFRC Introduction

The National Fenestration Rating Council (NFRC) is a non-profit, public/private organization created by the window, door, and skylight industry. It consists of representatives from many aspects of the energy and fenestration sectors:

- fenestration product manufacturers and suppliers
- major trade organizations
- state energy officials
- research organizations
- utilities
- architects
- testing laboratories
- energy consultants
- public interest groups
- building and code industry representatives
- government agencies

On June 25, 1989, a group of fenestration industry professionals gathered at an ASHRAE meeting in Vancouver, BC to discuss the founding of the NFRC. The lack of a credible and fair energy rating system at that time had caused confusion in the marketplace. Industry experts agreed about the need for a third party to rate fenestration performance. Additionally, these experts agreed the administering entity needed to be comprised of a broad array of fenestration interests thus the diverse list shown above. This diversity ensures that no single interest in the industry is catered to unfairly. On December 4, 1989, the first NFRC meeting was held in Orlando, Florida to sketch out the details of the organization and its goals.

Today, the National Fenestration Rating Council lists over nine million fenestration product energy ratings. Over eight hundred manufacturers participate in the ongoing committee sessions to refine the energy rating process continuously for the consumer. Today, the National Fenestration Rating Council energy ratings are referenced by the International Energy Conservation Code (IECC) to which most state legislatures enact reference. The National Fenestration Rating Council continues to be primary energy rating entity for the nation.

The US DOE supported the 1989 foundation of the organization and provided initial funding. NFRC now operates independently and is fully funded by membership and participation fees. The US DOE continues to provide cooperative agreements with NFRC for research, international harmonization, and new rating development. The US DOE funding were and are instrumental in the NFRC's continued success.

NFRC is a consumer organization. Independent ratings are essential. A system of test labs, simulating labs and independent agencies exists to ensure these features. Simulating labs gather manufacturer supplied energy performance data for input into fenestration simulation programs. These simulations produce whole product U-factor ratings, visible transmittance (VT), and solar heat gain coefficients (SHGC). Next, manufacturers are required to confirm their simulated U-factor ratings by physically testing one product per product line every four years. An NFRC accredited testing laboratory performs these tests. U-factors indicate the heat loss of a window from

inside to out. The simulated and tested U-factor ratings are sent to an independent agency for comparison and validation. Once the ratings were compared and confirmed to be within the required tolerance, the manufacturer is then authorized to put an NFRC label on their product line. Note the legal liability for the rating lies with the manufacturer, not the independent agency or NFRC.

NFRC Process

Objectives

The National Fenestration Rating Council (NFRC) is a nonprofit, scientific and technical organization (501c3) comprised of fenestration organizations including, state governments, academia, manufacturers, utilities, and public interest groups. NFRC's mission is to establish a fair, accurate, and credible rating system for fenestration products and to enforce certification and labeling activities to benefit the public.

Below are the seven original objectives with summaries of each.

Research

NFRC's mission regarding a fair, accurate and credible rating system, as well as the Federal Trade Commission's requirement for a rating system that is open to innovation and has a sound technical basis poses significant research requirements. Also, the acceptance of the technical basis for the rating system by the international scientific community (and subsequently by the International Organization for Standardization) requires a high degree of technical excellence. Research is required to extend the rating system to address all key thermal and optical properties as well as the energy and peak load impacts of fenestration on buildings and the energy grid. New and improved simulation tools and test procedures are needed to address a broader scope of technologies. These tools are intended to be more accurate, more user friendly, less costly to use, and capable of interfacing with the design process.
Research is essential to develop new fenestration ratings and to expand NFRC's ratings into other fenestration areas such as attachments (blinds, shades) and daylighting (reduces energy by displacing electric lighting). NFRC operates an extensive research program requiring member input on all research RFP development, RFP awards, contractor performance, and finally implementing the results. All research is available to

the public as well. NFRC's research objectives are to develop new ratings and continue to enhance existing ratings.

Component Modeling Approach

The NFRC has been tasked with developing energy ratings and labels for windows and window systems per the Energy Policy Act of 1992. NFRC has successfully addressed this need in the residential market. NFRC is currently enhancing its non-residential rating system to better accommodate its unique requirements. The new commercial rating system entitled Component Modeling Approach (CMA) has been designed specifically to address the needs for this market. It allows each supplier of components (e.g., frame, glass, spacer, etc.) to provide its own validated component ratings while the final integrator can obtain whole product ratings by using component information and an approved integration tool.

NFRC has nearly completed the necessary software and rating procedures and will now begin to implement the rating system. NFRC proposes to continue its implementation efforts to ensure the commercial fenestration industry has a good energy rating tool to enable code compliance and reduce building energy consumption.

Residential Code Enforcement Program

NFRC's comprehensive energy rating system can be completely undone by a simple lack of code enforcement. Many industries struggle to comply with government code mandates, yet when the actual products are put in a home, codes may be poorly enforced resulting in increased energy consumption for the consumer and frustration for the entire fenestration community. NFRC proposes to conduct code enforcement training and implementation in selected areas of the US to better ensure good code enforcement.

International Harmonization

NFRC's role in globalization is a recent success. Australia and South Africa have licensed the NFRC ratings system and they are actively putting the rating system in place. This international harmonization success enables the global fenestration industry to reduce their rating costs and improve building energy conservation. NFRC is currently working in China, India, Jordan/Middle East, Japan, Korea, and several Asian Pacific Countries to harmonize their fenestration rating efforts with NFRC. NFRC proposes to continue to work in those countries to complete harmonization.

The NFRC is supporting the Asia Pacific Partnership (APP) Project 6 (Role Enhancement of Building Energy Codes, subtask: Develop/Harmonize Window rating procedures and/or labels) through its continued international harmonization efforts. Continued DOE support of NFRC in its international activities will ensure success of APP and universal harmonization efforts.

Consumer Website Development

NFRC has established the nation's most comprehensive database of fenestration energy ratings called the Certified Product Directory (CPD). It maintains about 2.7 million product ratings. Consumers and code officials may access this database at any time and it is continuously updated with new window ratings. The CPD functions well as

a performance confirmation tool, however, it does not function well as a consumer shopping tool. Manufacturers rate all potential combinations of a window product yet only produce a subset of those combinations so consumers must make direct contact with window manufacturers to learn of the actual product offerings and their associated ratings. NFRC proposes to develop a consumer friendly database where actual products in the marketplace are easily searched enabling consumers to become better educated. The Alliance to Save Energy project, Efficient Window Collaborative, has a similar website based on manufacturers voluntarily offering actual product listings in a searchable database, but the information is limited. NFRC would work with EWC to develop a new, more consumer friendly web site.

New Attachment and Daylighting Ratings

Tremendous energy savings are possible with simple fenestration products like shades, blinds, awnings, and strategically placed fenestration (daylighting). Consumers are eager to purchase these products, but have no mechanism for comparing the potential energy savings. Manufacturers are eager to develop an energy rating system to enable consumers to become education and also enable consumer friendly programs like ENERGY STAR to use the ratings. NFRC proposes to conduct research and develop technical procedures for fenestration attachments and daylighting devices. NFRC has already begun research on new attachment energy ratings software and physical testing for visible transmittance (daylighting related).

Further Advancements and Outreach

Continue efforts to make the NFRC rating system more robust in regard to new technologies and after-market accessories/modifications as well as to improve rating accuracies. Study whole-building fenestration integration and influences on other building systems during the design and field implementation phases. Promote the system, educate users, and deploy strategies for more widespread use of the NFRC rating system, both nationally and internationally.

Project Activities

NFRC and its contractors conducted numerous activities to accomplish this agreements goal. Four of the seven original tasks were funded. Summaries of work on each task are shown below.

Task 1-Research Activity Summary

The table below summarizes each research project and the conclusion reached during this agreement period.

Task	Project	Status
Task 1.1:	Window 6/Therm 6 Validation Research	The contractor reported all testing is complete and simulations have begun.

Task 1.2:	Develop WINDOW 5.1 or 6.0 and THERM 5.1 or 6.0 output report file to meet the NFRC upload/reporting need for CPD 2.0	RFP was never developed; this project did not go forward.
Task 1.3:	Update NFRC spectrum reference to ASTM G197.	Membership voted on this proposed change, but did not approve it and never went forward with the spectrum change.
Task 1.4:	Component Modeling Approach-Condensation Resistance Research	This project was completed and presented to membership. Significant funding is required to modify the Component Modeling Approach Software Tool (CMAST). Membership may consider the implementation at a future date.
Task 1.5:	Complex Product VT Rating Research	The project was converted to a *request for services* rather than a fully funded research project. LBNL conducted a VT measurement inter-laboratory comparison among three manufacturers. The manufacturers/LBNL completed testing a reference tube and compared results. This project was successful and lead to the development of a measurement capability.
Task 1.6:	Development of VT testing procedure at global spectrum (Direct and diffused) to enable a more comprehensive fenestration rating for designers and manufacturers.	An RFP was never developed. This effort did not go forward.
Task 1.7:	Development of improved U-Factor and SHGC ratings through adoption of ASTM G197 (diffuse and direct spectrum) to increase the accuracy of current fenestration ratings.	Membership did not approve the ASTM G197 spectrum change and is considering alternatives.
Task 1.8:	Develop intermediate tool to provide energy data file for NFRC rated products necessary to develop an annual energy rating for fenestration that greatly simplifies the rating for easier public use.	This project never went forward.

Task 2 – Component Modeling Approach (CMA) Ratings Program

NFRC proposes to continue CMA implementation efforts to ensure the commercial fenestration industry has an effective, user friendly energy rating tool to enable code compliance and reduce building energy consumption. This shall include commercial fenestration rating systems development and implementation to include marketing, education, software development, and training; conducting a pilot project; coordination with utility conservation programs; and CMAST modifications for residential and attachment use. The NFRC shall continue towards full implementation of its new CMA ratings program for use in the commercial fenestration industry.

Task 2.2-Hershong Mahone Group (HMG) Outreach efforts

Subcontractor Heschong Mahone Group of Sacramento, California recently completed tow outreach projects related to the roll-out of the Component Modeling Approach. These projects were awarded in 2009 and completed in 2010 and ran concurrently. One dealt with outreach and education for the Building Codes Community in the State of California and involved training provided by HMG to code officials as they began to deal with enforcing the Title 24 Energy Code which contains specific provisions referencing NFRC's CMA Program as an acceptable means of compliance. The other project dealt with outreach and education for the energy service providers (public utilities) and related stakeholders such as energy consultants. The energy service providers in the State of California administer training for programs able to save energy; they also administer above-code incentive programs such as *Savings by Design.*' One key deliverable of the energy services providers' project was to determine the benefit the CMA Program provides to building owners looking to participate in the *Savings by Design* program. A report summarizing these findings was generated, and the findings proved to show significant benefit using the CMA Program versus other compliance options.

Task 2.4-Component Fee Waiver

NFRC provided financial incentive for component manufacturers to begin uploading performance data into the CMAST data libraries. One of the first tasks was to fill the software with thermal simulations of common frame components. NFRC charged frame component suppliers $7.50 to $15 per component depending on their membership status.

CMA Final 2014 Status

NFRC began this program in early 2010 and achieved the following as of December 29, 2014:

- 395 Label Certificates
- 59 Approved Calculation Entities (ACEs)
- 9 ACE Organizations
- 4210 approved frame components

- 512 spacer components
- 31 frame manufacturer participants
- 8 spacer manufacturer participants
- 2800 glazing Components
- 45 glazing participants

The Cornerstone Professional Group (CPG), an NFRC subcontractor, continues to provide support and improvements to NFRC's commercial fenestration energy rating simulation tool named Component Modeling Approach Software Tool (CMAST). CPG will provide consulting services in an effort to assist with the ongoing management of the existing application suite and to redesign the core application architecture. Some of the tasks accomplished this quarter are:

- Continued to resolve general user issues
- Continue updated sync design

The Component Modeling Approach Program continues to seek greater participation and has been challenged by poor commercial building energy code enforcement and poor market understanding of the CMA. Other methods in the marketplace, not sanctioned by the national energy codes, are widely accepted making CMA implementation difficult. The NFRC continues to support and implement this program as required by EPAct 2005.

Task 3 – Improve Residential Code Compliance

Enhance residential energy code enforcement to include training, energy code seminars, site visits, and collaborations with the Alliance to Save Energy's Building Code Assistance Project and the Responsible Energy Code Alliance to promote enforcement of existing codes. Initial focus shall be on Southeastern states by coordinating with various code officials to better inform fenestration market players and suppliers on enforcement of the pertinent State codes.

This task was never funded. No activity will be reported.

Task 4 – International Liaison and Harmonization

Appendix B contains summaries of several international tasks and events performed by country. Many of the efforts listed below were general in nature with the common intent of promulgating NFRC rating harmonization in all countries. Many of these efforts were preliminary and may take years to achieve true harmonization. NFRC continues to support harmonization efforts in any interested economy. NFRC also maintains strong relationships with Canada, Australia, and South Africa providing technical support for commercial and residential window energy ratings.

Task 5 – Develop an NFRC Consumer Website

NFRC shall develop a new online, user-friendly database by modifying its existing products database to enable consumers to select commercially available window products while matching those products with appropriate trade names and models. This will enable consumers to better evaluate products for more educated purchases. The database shall also be searchable against design and performance parameters such as window style, U-factor, SHGC, and VT.

This task was not funded. Activity will not be reported.

Task 6 – New Attachment, Illumination, and Daylighting Ratings

Original Task: Product energy ratings shall be expanded to include attachments (e.g., blinds, shades, tubular daylighting devices) to better characterize as-installed energy efficiencies for the public and enabling code bodies with third party ratings. Research and develop of technical procedures for fenestration attachments and daylighting devices shall be conducted as well as development of attachment energy ratings software and physical testing for visible transmittance for daylighting related aspects.

This task was not funded and attachment activity will not be reported. The US DOE issued a FOA titled, *Certification and Rating of Attachment Fenestration Technologies (CRAFT)*, which NFRC bid on unsuccessfully. NFRC no longer is pursuing attachment ratings.

Task 7 – Further Advancements and Outreach

Original task: Continue efforts to make the NFRC rating system more robust regarding new technologies and after-market accessories/modifications as well as to improve rating accuracies. Study whole-building fenestration integration and influences on other building systems during the design and field implementation phases. Promote the system, educate users, and deploy strategies for more widespread use of the NFRC rating system, both nationally and internationally.

This task was briefly funded at the beginning of the agreement period.

In October 2009, The Potomac Communications Group (PCG), an NFRC contractor, worked on several outreach activities:

- Participated in a conference call with Marc LaFrance and representatives from QuestFore regarding a media event to promote the EC window/dimmable lighting demonstration project
- Edited two demonstration and DOE window program fact sheets
- Developed a EC window/dimmable lighting demonstration project

- Revised conference room poster for DOE
- Drafted Window Film, Construction Canada and e-glass Weekly articles
- Facilitated Jim Benney (NFRC CEO) interview with US Glass Magazine
- Developed NFRC Board of Directors press release
- Assisted NFRC with response to recent aggressive blog comments
- Assisted NFRC to promote AIA California chapter newsletter with Component Modeling Approach article

Summary

The three primary, funded tasks in this agreement were fenestration research, Component Modeling Approach Development, and International Harmonization. NFRC completed several research projects increasing its rating capability by adding some integral attachment products and considering improved spectrums to increase the overall rating accuracy. NFRC developed a new commercial window energy rating system, the Component Modeling Approach, bringing in over 40 commercial frame and spacer participants, 8,000 components, 8,500 unique product ratings, and over 400 commercial project label certificates. NFRC reached out to over ten different countries seeking window energy rating harmonization, training fenestration experts on NFRC simulation and testing methods, and providing building energy code information. These harmonization efforts increased NFRC awareness in each of these countries and efforts continue to assist interested economies to pursue NFRC ratings, especially in South Africa. NFRC continues to pursue these tasks under EE0005542 less the international task.

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opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof."

Appendices

Appendix A-Research

Submitted separately:

- Window 6/Therm 6 Final Report/Presentation
- Complex Product VT Report
- Component Modeling Approach Condensation Resistance Rating Research Report

Appendix B- Summary of International Projects

NFRC worked on numerous international tasks and maintained its license agreements with South Africa and Australia. NFRC briefly had a license agreement with India, but they chose to terminate the agreement prior to any implementation of a rating system in India. The primary countries where NFRC worked to harmonize ratings were:

- India
- China
- Japan
- Canada
- Thailand
- South Africa
- Brazil
- Korea

India

Establishment of Regional Energy Efficiency Center at CEPT in India: Commissioning of the 1st phase. (Feb 2010)

With assistance from NFRC and US-DOE, the Center for Environmental Planning and Technology (CEPT) University have completed the first phase of the project to establish Regional Energy Efficiency Center which includes commissioning of, hot plate meter, spectrophotometer, and air leakage chamber. They also now have a full fledge simulation laboratory. With this first phase capacity they will be able to provide conductivity (R-value), U-factor, SHGC, VT and air leakage numbers for Indian code, ECBC, compliance. Mr. Shah of WinBuild represented NFRC.

Net Zero Design Charrette in Ahmedabad, India-June 8-9, 2010

The charrette was organized and sponsored by Environment Canada as part of the Asia Pacific Partnership on Clean Development and Climate, specifically the collaboration between Canada, United States and India. WinBuild Inc. of USA also collaborated with Environment Canada to organize the Charrette. The objective of the charrette was to take the first steps to design net zero buildings using the skills and knowledge of multidisciplinary teams of participants in a structured, integrated design process. About thirty-five people took part in the charrette. The charrette dealt with two different projects. One project was a single-family house to be built on the outskirts of Ahmedabad by Kesar Built Systems. The second project is by Tata Housing Corporation and it will be a rest and recuperation facility associated with the main cancer treatment hospital in Kolkata. As next steps, WinBuild will work with the Indian team to construct the demonstration homes.

Regional Energy Efficiency Center in India

WinBuild Inc worked with Carli Inc to commission the Air Leakage chamber and train personal at the Center for Environmental Planning and Technology, CEPT, university for its operation. WinBuild Inc. also encouraged CEPT to measure cool roof paints performance using spectrophotometer and FTIR. The samples were paints on wood, metal surfaces which were brushed and spray painted. This process will help CEPT finalize standard sample procurement procedure.

Ministry of New and Renewable Energy Meeting

WinBuild Inc met with Dr. Ashvini Kumar of MNRE, to brief him about the Net Zero Energy Charrette, cool roof project and the regional energy efficiency center at CEPT. Mr. Shah informed Dr. Kumar about the pilot project in Sanand. Dr. Kumar emphasized the need for the demonstration project and assured MNRE active participation. MNRE will provide financial support to CEPT and IIIT Hyderabad to participate in the program for active monitoring and data collection. Mr. Shah agreed to provide the project proposal to MNRE through US-DOE.

Net Zero Energy Home Demonstration Project-India

Buildings consume over 33% of the national energy and associated GHG emissions in industrialized and developing countries. India is experiencing an explosion in construction activities and therefore it is important to influence the construction practice to reduce its energy use. For this reason, and as part of the Asia Pacific Partnership (APP), Canada and the US are taking an active role demonstrating Net Zero Homes via a pilot project in collaboration with Kesar Built System, a private limited real estate developer. A Developer/Government/Industry/Educational Institution/Research expert consortium will target increasing the Net Zero Building and Retrofit energy efficiency knowledgebase and capability within the Indian residential housing sector.

The proposed project includes:

- Demonstration project involving construction and monitoring of three similar houses:
    - Net Zero Energy
    - Retrofit
    - Base (standard) building construction)
- Evaluate these buildings' energy and economic performance.
- Increase institutional capacity and self-reliance within Indian residential housing market to build Zero energy homes.
- Ensure greater Indian energy infrastructure security.
- Increase education and research institutional capacity.
- Increase energy efficiency and renewable technology adaptation and trade.

NFRC has partnered with Kesar Built Systems to develop a demonstration project and has begun to obtain the necessary items to complete the project.

Measurement of Solar Reflectance Index (SRI) of cool colored surfaces- Center for Environmental Planning and Technology (CEPT) Study

The study was carried out to build the human resources development at Center for Environmental Planning and Technology. The skill set for accurate measurements is essential for harmonization and implementation of the fenestration energy labeling program. A second phase the study is to help and compare results with the US national laboratory measurement results. The second phase of project is still pending.

The objective of the study was to determine the effect of base material (wood or Aluminum) and method of coating (brush or spay) on the measurement accuracy of surfaces reflectance and emittance.

Glazing Society of India (GSI)-Web Portal Work

To support implementation of the fenestration rating and labeling program, NFRC co-funded GSI, for the development a web portal. Web Portal is to aid in the promotion of energy performance rating for glazing and fenestration products. GSI provided a detailed report to NFRC on the development and of the web portal. As result of the cooperation GSI has agreed to become NFRC partner country member and to adopt harmonized rating program with North America.

Net Zero Energy House Report-Energy Efficient Sample Houses Report- Sanand, Gujarat, India

November 2010 till May 2011-Anil Vergis reported the following progress on the India Net Zero Energy House. Work on the site had commenced in late November 2010. The site is in the suburbs of Ahmedabad city. A team of contractors has been performing this work and it has progresses well since January 2010.

Figure: Architectural model made for the model house to be built at Sanad.
The foundation work for both houses i.e. the **BASE** unit and the **RETROFIT** work was carried out one by one. Substantial care had to be taken to ensure that all digging work was as per the architectural drawings.


Brick Machine

The brick machine will be assembled with a trial run for fly-ash brick scheduled at the end of July. In future, specialized brick design using energy efficient material will be experimented and then upon approval by the architect be used for the zero energy houses.


Figure: Showing plinth level work at Sanand site.

WinBuild-India Trip: May 19-31, 2011 and June 7-13, 2011

- May 26th – Ahmedabad: Meeting to discuss the future development of test center at CEPT. Participation of CEPT, US-DOE/ WinBuild, USAID, MNRE, GEDA, ORNL and Industry representatives
- May 27th – Ahmedabad: Follow up on the design and construction of demonstration project Net Zero Home (NZH) and a retrofit home which is to be monitored for three years.
- May 28th in Mumbai / May 29-31 Chennai: Meeting with GSI for initiating Cool Roof Rating council in India.

WinBuild Visit to India and Thailand May 19th – June 13th, 2011

Purpose of Travel:

- Meeting to discuss the future development of test center at CEPT. Participation of CEPT, US-DOE/ WinBuild, USAID, MNRE, GEDA, ORNL and Industry representatives – May 26th – Ahmedabad
- Follow up on the design and construction of demonstration project Net Zero Home (NZH) and a retrofit home which is to be monitored for three years. May 27th /June 8th
- Meeting with GSI for initiating Cool Roof Rating council in India. May 28th in Mumbai / May 29-31 in Chennai.
- Cool roof testing and monitoring procedures for Nainital project with IIIT-Hyderabad.
- Meeting with MNRE in New Delhi June 7th, 2011
- APEC - Building Material Testing and Rating Center workshop and simulation training in Bangkok June 3-5. Pre-workshop meeting was held on June 2nd with organizer and US-DOE.
- Meeting with USAID June 6th.

Below is a short description of meetings:

- Meeting to discuss the future development of test center at CEPT. Participation of CEPT, US-DOE/ WinBuild, USAID, MNRE, GEDA, ORNL and Industry representatives – May 26th – Ahmedabad
- Site visit at Sanand to follow up on the design and construction of demonstration project Net Zero Home (NZH) and a retrofit home which is to be monitored for three years. May 27th /June 8th. Block Brick making machine from Florida has arrived at site which is being assembled for use to make specialized brick for NZH.
- Meeting with GSI Chairman Mr. Subramanian on May 28th in Mumbai for initiating Cool Roof Rating council in India. Follow up meeting was held with Executive director Mr. Gohul to discuss the NFRC membership/ Web certification program and cool roof / May 29-31 in Chennai.
- Meeting with Dr. Ashvini Kumar, Director (Solar Thermal) of Ministry of New and Renewable Energy (MNRE) along with LBNL representatives:
  - Dr. Ashvini Kumar, Director (Solar Thermal), LBNL representatives Dr. Surabi Memnon and Dr. Marc Fischer, Mr. Bipin Shah (representing WinBuild Inc and NFRC), met at MNRE to discussed the following:
  - Cool Roof project in Nainital and Pantnagar.
  - Initiating Cool Roof testing center at IIIT-H
  - Funding request for monitoring of Net Zero Home (NZH) and Cool Roof demonstration projects in Ahmedabad
- APEC - Building Material Testing and Rating Center workshop and Round Table meeting in Bangkok June 3-4. Pre-workshop meeting was held on June 2nd with organizer.

- Basic training in THERM/WINDOW/OPTIC Simulation programs in Bangkok June 4-5
- Meeting with USAID June 6th.

Results of discussions with representatives of foreign government(s) and/or company(s)

- Meeting to discuss the future development of test center at CEPT. Participation of CEPT, US-DOE/ WinBuild, USAID, MNRE, GEDA, ORNL and Industry representatives – May 26th – Ahmedabad: CEPT presented the work currently done by them, highlights were training for building simulation. Establishment of primary testing facilities with assistance from US-DOE, USAID, NFRC and etc. CEPT mentioned that they have got new grant from MNRE to enhance their testing facilities and hire/develop human resources. For this they plan to establish an advisory body. CEPT request Mr. Shah to join the advisory committee. Later in the day, the group visited the ZHB building site at Sanad.

- Site visit at Sanand to follow up on the design and construction of demonstration project Net Zero Home (NZH) and a retrofit home which is to be monitored for three years. May 27th /June 8th. Block Brick making machine from Florida has arrived at site which is being assembled for use to make specialized brick for NZH. The machine will be used by CEPT and other institutions to develop new brick models. Bricks using fly-ash will be built in this machine for the ZHB house model. As this machine is portable, it meets the green building requirements and hence can save transportation of product.

- Meeting with GSI Chairman Mr. Subramanian on May 28th in Mumbai for initiating Cool Roof Rating council in India. Follow up meeting was held with Executive director Mr. Gohul to discuss the NFRC membership/ Web certification program and cool roof / May 29-31 in Chennai. Mr. Subramanian and Mr. Gohul said that they will put the proposal to their Board of Directors and are confident of its approval. After the approval is obtained GSI also will work with WinBuild to organize a cool roof conference where there will be an announcement of the cool roof rating council under GSI.

- Meeting with Dr. Ashvini Kumar, Director (Solar Thermal) of Ministry of New and Renewable Energy (MNRE):
  - Dr. Ashvini Kumar of MNRE informed Mr. Shah that the funding for further enhancement of CEPT center and hiring/ development of human resources was approved and funds sent to CEPT.
  - He also informed Mr. Shah that he will look for the NZH and Cool roof project funding proposal from IIIT-H. in principal he support the project.
  - He will also support the GSI and IIIT-H effort to initiate the establishment of the cool roof rating council. He further stated that he endorses the US-DOE project on cool roof at Nainital and Pantnagar.

- He especially requested Mr. Shah to stay engaged with Indian institutes and help them to develop the required infrastructure and human resources.

- APEC - Building Material Testing and Rating Center workshop and Roundtable meeting in Bangkok June 3-4. Pre-workshop meeting was held on June 2nd with organizer. Key APEC economies, Japan, Singapore, Vietnam, Australia, Thailand, USA, and Indonesia were represented. All agreed to the requirement for setting up of regional center and the much needed infrastructure in each economy for proper implementation of the codes. (see attached PPT which list the round table outcome)

- Basic training in THERM/WINDOW/OPTIC Simulation programs in Bangkok June 4-5: Mr. Shah provided basic software training to 17 participants from 6 economies.

- Meeting with USAID June 6th: Mr. Shah met with Orestes R. Anastasia (Regional Environment officer) and Mr. Khan Ram-Indra and briefed them about the just concluded APEC workshop and round table outcome. USAID is interested in working with involved parties.

INDIA NET ZERO ENERGY PROJECT STATUS REPORT, November 2011

This is a report on process and progress of India net zero energy integrated pilot project. A base model design and retrofit model for a single family has been prepared identifying local building materials and construction technique.

Project team

Architect	MS. Roshani Engineer
Structural Engineer	Mr. Ronak Patel
Site Engineer	Mr. Trivedi
Energy simulator	Mr. Mahabir Bhandari, IIIT-Hyderabad
Site coordinator	Mr. Satish Joshi Mr. Anil Vergis
Landscape consultant	Mr.Nupendrapal Khachar
Developer/	Kesar Builders
Project consultant	IIIT-H, WinBuild Inc
Overall Project coordination	WinBuild Inc.

Project information

Plot location	Plot no-36,37,38 Kesar week-end houses, Sanand, Gujarat, India
Plot Area	518.17 SMT
Ground floor built up	154.20 SMT
First floor built up	120.50 SMT
Terrace Built up	17.50 SMT

Air-conditioned Area Ground floor First floor	 39.35 SMT 52.85 SMT
Non-Air-conditioned area	

Materials to be used for base model (Based on current construction practice)

Walls	.23M brick walls
Slab	.15M R.C.C. slab
Internal Finish	Double coat plaster with distemper paint
External finish	Sand face plaster with cement paint
Windows	Aluminum windows with single glazing
Wiring	ISI copper wiring
Plumbing	CPVC pipes
Flooring-Rooms	.60 M x .60M. Vitrified tiles
Our side flooring	Kota Stone
Terrace	China mosaic with water proofing

Building Planning and Execution Report

Stage-1	Survey and data collection		
		• Site drawing, measurements, photographs • Soil investigation, Study of Climatic condition	Complete Complete
Stage - 2	Analysis	• Preparation of site plan and other site information • Design requirement and budget criteria	Complete Complete
Stage - 3	Preparation of Conceptual plan	• Design concept in consideration with space availability • Design lay-out with aesthetic appeal • Design discussion with client and get the approval	Complete Complete Complete
Stage-4	Statutory Approval	• Documents and drawings required for approval procedure • Obtain approval from client in terms of Design as well as budgetary aspect. • Obtaining approval from the authority	Complete Complete Complete
Stage - 5		• Pre-qualification of labor contractor	Complete

Stage-6	Preparation of Construction Documents	• Architectural working drawings • Service drawings Structural Electrical Plumbing Monitoring equipment • Detailed estimate	Complete Complete Complete Complete Complete

Building execution and simulation reports for Base model and retrofit model April 2011

Base House	• Physical model - used for display also	Complete
Base house	• Foundation trenches • Foundation brick work up to plinth level • Plinth beam and DPS course • Brick work above plinth	Complete Complete Under process To be started soon.
Retrofit House	• Foundation trenches • Foundation brick work up to plinth level • Plinth beam and DPS course • Brick work above plinth	Complete Complete Under process To be started soon.
Preparation of reports	• Simulation report for base model • Simulation of Retrofit model with modified features	Complete Complete.
Landscaping	• Landscaping for retrofit based on reports	Complete Work to be done in June ‘12.

November-2011

Base model and retrofit	• Lintel work • Brick work up to lintel • RCC Slab • Leveling of surrounding ground	Complete Complete Under progress Under progress
Retrofit model	• Lintel work • Brick work above lintel • R CC slab of Ground floor	Complete Complete Under process
Zero energy house	• Strategy to be finalized based on reports. And finalized materials and technologies to be adopted • Begin production of Hollow blocks on site	Under process Production of fly ash Brick started
	• Based on the reports construction	Line out for foundation

	to be started	work under process

Site Pictures:





China

NFRC has supported the hosting of *The International Energy Efficiency & Zero Energy Building Envelope Conference 2010* to be held on March 31-April 1st, 2010 in Beijing, China at Hotel Nikko New Century. NFRC was represented by Mr. James Benney and Mr. Shah. US-DOE was be represented by Mr. Mark Ginsberg who was a key note speaker. Several key US-Manufacturers like, 3M, CP Films, and Applied Material will be participating in the conference. Besides USA, the conference is supported by APP countries, namely Canada, China, Australia, India and Japan. Mr. Shah had a meeting with Mr. Chen Gyoi to follow up with the APP project and initiation of the cool roof project

Sun-shading International Forum Ningbo, China June 13-16, 2010:

WinBuild Inc. participated and presented at the conference, Performance *Determination of Awning and to Promote Energy Efficiency and Implement Codes*.

MOHURD, US-DOE and WinBuild Inc. meeting June 17, 2010

WinBuild along with the US Department of Energy, and the Cool Roof Rating Council (CRRC) Executive Director met with the Ministry of Housing and Urban-Rural Development's, (MOHURD), Research Institute of Standards and Norms (RSIN) and Center for Housing Industrialization, and China Building Materials Academy's, (CBMA), China Building Material Test and Certification Center in Beijing to discuss possible collaboration on cool roof technologies. Building upon our excellent collaboration on window rating and labeling activities, our interactions were highly productive. At the meeting discussed topics covered the status of cool roofs in the US and in China, along with a detailed explanation of the current CRRC process. WinBuild also discussed the Department of State project status and provided the update brief to MOHURD.

On October 15, 2010, the US DOE and Chinese MOHURD met in Shenzhen, China with key researchers and government officials from both countries to address the areas identified in the June 17, 2010 meeting in Beijing. The expert working group meeting was held in Shenzhen, China, a hot climate classified as a special economic zone with high potential for building stock growth and energy saving opportunity. Both the U.S. and China plan to involve manufacturers in future workshops to be scheduled in the spring of 2011. Mr. Chen from MOHURD and Marc LaFrance from the U.S. Department of Energy, Buildings Program (DOE) offered status updates on the mutual areas of interest with respect to the collaboration opportunities. Bipin Shah of WinBuild, who is also the NFRC international liaison facilitated discussions and helped the meeting progress toward accomplishing U.S. DOE strategic goals and concrete objectives. The US DOE invited researcher Dr. Ronnen Levinson of LBNL discussed the science and current research regarding simulated aging testing. He also presented findings and results from several case studies related to cool roof performance and market acceptance of products resulting from the advanced research DOE had conducted.

Sherry Hao provided an overview of the Cool Roof Rating Council (CRRC) third party testing and validation processes, methodologies, and results. She discussed the opportunity and benefits of weather farms in China's different climates for the purposes of labeling and certifying manufacturer claims.

Japan/Okinawa

Hawaii Study Tour-WinBuild attending August 21- September 1, 2010

US and Japanese interests put together a study to survey the current energy-related building programs and clean renewable energy facilities of Okinawa to gather baseline information to help determine the potential and prospective partnership programs between the US and Japan with special focus on an Hawaiian-Okinawan partnership to promote clean, sustainable islands. Mr. Shah participated as a building expert from US side and represented the US-DOE and National Fenestration Rating Council (NFRC).

The meeting resulted in the following recommended action items:

- Carry out computer simulation of the Naha City hall to determine the energy savings potential. Then carry out detailed energy audit/costing analysis of the building leading to retrofitting of the building. Retrofitting will involve American manufacturer participation.
- DesignBuilder software simulation training for American based architects and engineers
- Net Zero Energy building workshop in October 2010 in Okinawa.

U.S. PARTICIPANTS:

- USDOE – Office of East Asian Affairs: Kay Thompson, Japan Office: Ronald Cherry
- U.S. Embassy Tokyo: Edward Bruce Howard
- U.S. Consulate General, Naha: Claire Kaneshiro, U.S. Consulate General, Naha: Akinori Hayashi (Local staff)
- NREL: Kenneth "Ken" Kelly; SANDIA: Robert Hwang, Jason Stamp; Los Alamos National Lab: Rodman Linn
- Consultant to US DOE/NFRC: Bipin Shah

HAWAIIAN TEAM MEMBERS:

- DBEDT/SID: Andrea T. Gill, Estrella A. Seese, Maria L. Tome
- PICHTR: Maurice H. Kaya

JAPANESE TEAM MEMBERS:

- Kazuhiko Ogimoto – University of Tokyo, Professor
- Hironori Matsunaga – NEDO/Smart City e-solutions, Manager
- Shojiro Ishigaki – NEDO
- Tomoya Ichimura – Director General, NEDO
- Toshiaki Taguchi – Deputy Director, NEDO

- Shinichi Hosono – Director, Ministry of Foreign Affairs (MOFA)
- Satoki Kurokawa – MOFA
- Asako Ueno – Deputy Director, METI
- Kazuaki Koizawa – METI
- Satoshi Nakamura – Assistant Director, METI
- Yoshimi Yamauchi – Assistant Director, METI
- Hajime Asato – Director, Okinawa Prefecture Government
- Naoko Gima – Supervisor, Okinawa Prefecture Government
- Katsuyukji Ohama – Senior Staff, Okinawa Prefecture Government
- Tetsu Fukumine – Deputy Director, Okinawa General Bureau, Cabinet Office, Government of Japan
- Yasuo Yamashiro – Director, Kumejima Town Government

Japanese (Okinawa) Meetings

October 18, 2010: Meeting with Ministry of Economic Trade and Industry (METI) to discuss window rating program and possible collaboration to harmonize the American and Japanese program. Meeting was attended by, Mr. Marc Lafrance of US-DOE, Mr. Bipin Shah, WinBuild Inc. METI representative provided a status update on the window rating program which seemed to be not harmonized with the Northern American. METI agreed to provide contacts of their experts working on the development of the fenestration modeling simulation program WindEye. Mr. Shah will look into possible ways to have Lawrence Berkeley laboratories (LBNL) in the USA interact with these experts. Mr. Shah also met with the representative of IBMF (Imported Building Materials Forum is comprised of over 50 importers of various building products from North America and Europe) who had concerns of the Japanese authorities implementing window certification requirements which are does not have way to recognize NFRC labeling. The impact of the Japanese policy implementation would be that the high performance American windows will be classified as 1-star insulation value, out of 4, with no chance to use the NFRC U-factor ratings to be displayed as the Q-factor for Japanese code compliance (Japanese Q-factor is converted to the NFRC U-factor by multiplying by 5.678, the simply unit conversion). Mr. Shah requested them to ask the US parent companies to register a formal request to US-DOC and US-DOE for assistance. Mr. Shah also agreed to convey the concern to NFRC and work on a quick resolution.

Net Zero Energy Buildings in Sub-Tropics-October 20-21, 2010

WinBuild helped US-DOE and Japanese METI to organize the conference in Okinawa. Key American experts from National Laboratories and American manufacturers participated in the workshop. Mr. Shah presented information on the Indian Net Zero Energy Building project. Key METI representative, Japanese manufacturers, architects, and other building professionals participated.

Japanese-American Fenestration Energy Rating Harmonization

WinBuild developed a proposal to develop calculation procedure for American manufacturers to use Japanese environmental boundary conditions to determine an equivalent Japanese Q-factor (U-factor). Japan used the JIS-A4710-2004 test method presently. WinBuild coordinated effort to get American window samples sent for testing in Japan. US Fenestration manufacturers, the US State Department, and the US Commercial Department are participating in this effort as well to ensure a cost effective was for American Manufacturers to participate in the Japanese fenestration market.

The NFRC, WinBuild, International Building Material Forum (IBMF), and several American fenestration manufacturers are working towards a method to convert existing American, NFRC window energy ratings into a Japanese fenestration rating enabling American manufacturers to sell products to the Japanese market without retesting to the new Japanese standards. A report developed provides recommendations to the Japanese government on how American ratings might be converted. The report was translated into Japanese and presented to the Japanese government in July 2011.

Informal Bilateral U.S.-Japan Preparatory Meeting (Smart Buildings, Energy Smart Community Initiative (ESCI)) Washington DC Sept 14th, 2011

NFRC and WinBuild coordinated with US-DOE, Japanese Ministry of Economy, Trade and Industry (METI) and Thailand authorities for a September 14th workshop in Washington DC. Coordination includes invitation of key stake holders, agenda and discussion topics.

NFRC/WinBuild Meeting with METI in Tokyo, Japan-December 2011

NFRC/WinBuild and LBNL presented Japanese-American window energy rating harmonization recommendations and tried to convince the Japanese participants to adopt the recommendation to recognize NFRC ratings, however, the Japanese participants did not agree that the NFRC ratings would be conservative for all sizes, gaps and advance options.

The Japanese government has moved forward significantly developing their own rating program and did not want to retract their action since it meets a current ISO standard. This was clear from Mr. Dobashi (METI Director) opening remarks stating that ISO-15099 and ISO-10077 are both well understood ISO standards and Japan is free to choose either one. Merit and accuracy of the two standards were never on the table for discussion so the argument to purse the ISO 15099 based ratings (NFRC) could not be made. NFRC learned from this engagement that work with countries to develop standards right from the beginning is necessary and must be maintained until finalization. Current successes in India and China exist because of adopting this strategy. Also, the sash manufacturers supplying Japanese manufacturers seem to push for the ISO-10077 based rating standard. This may be because significant amounts of EU window profiles are being shipped to Japan.

WinBuild and LBNL tried to make the case for using NFRC conservative numbers only for advance windows, but this was also rejected. METI insisted that NFRC ratings be consistent for all sizes, glazing thickness and glass. This is a daunting task and even after this exercise, NFRC and LBNL believe METI will not modify their procedures.

South Africa

Simulation Training, February 14-18, 2011

Bipin Shah of WinBuild and Mr. John Lewis, NFRC staff, visited Protea in South Africa to provide Component Modeling Approach Software Tool (CMAST), WINDOW, THERM and OPTIC software training. Twelve attendees, selected by The Association of Architectural Aluminum Manufacturers of South Africa (AAAMSA-organization which administers the fenestration energy labeling program in South Africa), participated in the training.

Accelerate Energy Efficiency and Renewable Energy

NFRC is participating with the Global Cool Cities Alliance on a recent DOE FOA award titled, *EERE in South Africa (EE000837).* This two year, $450,000 award will enable NFRC to provide fenestration related information directly to South African energy efficiency experts and continue NFRC relationship with the South African NFRC licensee. Several NFRC members have joined this effort. NFRC met with the Denise Lundall of the South African National Energy Development Institute (SANEDI) to discuss the NFRC rating system and tour NFRC's accredited test lab, simulation lab, and inspection agency in York, PA. Ms. Lundall also spoke at the NFRC Membership Meeting in Victoria, British Columbia, Canada as part of an International Forum.

Brazil

Brazil-USA Building Envelope Energy Efficiency Technology Cooperation Workshop, November 1, 2011

On March 19th, 2011, President Dilma Rousseff and President Barack Obama discussed their countries' common interests in the development of safe, secure and affordable energy, including oil, natural gas, bio-fuels, and civilian nuclear energy, and agreed that the United States and Brazil should work together on these issues as Strategic Energy Partners to support economic growth, energy security, and the transition to a clean energy economy. To that end, the two Leaders today agreed to launch a Strategic Energy Dialogue, building on the work of the U.S.-Brazil Bi-national Energy Working Group. Such a dialogue and resulting partnerships among the two largest democracies and economies in the Americas will create jobs in both countries, make energy supplies more secure, and help address the challenge of climate change.

As result of these strategic dialogues, the *Brazil-USA Building Envelope Energy Efficiency Technology Cooperation Workshop* was held on November 1, 2011, in Sao Paulo. The event brought together key representatives from the U.S. and Brazilian governments, as well as private sectors, to discuss plans for developing a rating system that will help consumers to identify energy-saving building envelope products, such as windows, roofs, and insulation. High-level officials from the Brazilian Ministry of Mines and Energy (MME) and Associação Brasileira de Normas Técnicas (ABNT), Sao Paulo Municipal Government/City Hall, among many others agencies and organizations, participated. Approximately one hundred invited attendees were present at the event.

2011 US. Delegation Attendees

	Name	Title	Affiliation
1	Marc LaFrance	Program Manager	U.S. Department of Energy
2	Miguel Hernández	Vice-Cônsul	U.S. Consulate- Sao Paulo
3	Bipin Shah	President	WinBuild Inc / National Fenestration Rating Council / Cool Roof Rating Council
	Kurt Shickman	Executive Director	Global Cool Cities Alliance
5	Ken Mentzer	President	North American Insulation Manufacturers Association
6	Lisa Winckler	Vice President	Solutia Performance Films
7	Mark A. Gierke	Business Development	Huntsman Corporation
8	Vince Harkins	Director	Alcoa / Kawneer Global Special Projects
9	Marcus Bianchi	Building Science Leader	Owens Corning
10	Kathleen McInerney	Program Director	Brazil-U.S. Business Council
11	Rafael Lourenço	Manager	Brazil-U.S. Business Council

Dr. Volf Steinbaum, Assessor Especial, Secretária Municipal do Verde e Meio Ambiente, and Ms. Joo Hyun Ha, international relations, welcomed the deligation and briefed us about the energy efficency and sustainable work being planed for the Sao Paulo. Dr. Volf provide the group with the five program books below. The Guideline for the Action Plan book lists information on six action plans to be implemented for the city of Sao Paulo. Transportation, Energy, Construction, Land Use, Solid Waste, and Health. Energy efficiency in buildings is an important part of the action plan.

Dr. Volf metioned the city is planning to carry out pilot projects on new and existing buildings and requested the delegition to actively participate. He refered to Mr. Miguel Buclem who is the responsible person in charge of the building energy efficency within the committee. He also invited the deligation memebrs to two events organized by United Nations to take place in Sao Paulo and Rio de Janeiro.
Kurt Shickman invited the city of Sao Paulo to join the Global Cool Cities Alliance and the one hundred cool cities program. Dr. Volf discussed the one degree less campaign by the city. He also informed attendees about the IPT laboratory attached to University of Sao Paulo provides certification which is recognized by the city.

Meeting at University of Sao Paulo (USP) and Sustainable Construction Brazilian Council

University of Sao Paulo is the largest university in Brazil and has 6,000 staff members and more than 100,000 students. Polytechnic School, a part of the university and under which the civil engineering department exists, has 600 staff members and 6,000 students. The school has graduate and doctoral courses.

Dr. Vanderley informed the delegation that Brazil market is unregulated and regulations are not followed. About 75% of the PVC pipe products in the market do not meet the required regulations. Currently under a program of the National Productivity and Sustainability organization (members supported by manufacturers) a nongovernmental organization has been purchasing products from the market place and verifying compliance. If they find noncompliance for more than twice, they then inform the government and take legal action against the manufacturer. These manufacturers who do not comply with regulation are fined and listed on a website.

Sustainable Construction Brazilian Council is an NGO working to integrate regulations in construction. They developed a six step online tool which has qualifying criteria. If a product fails to meet any 4 out of 6 criteria then it is not recommended for purchase to consumers.

Some facts provided during the discussion were:

- 70% of trade is retail sale,
- 50% black market,
- 70% buildings are constructed by small unskilled (non-qualified) people.

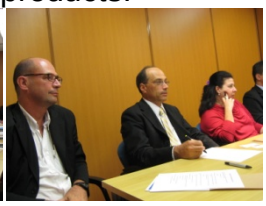
After discussion, Dr. Vanderley provided a tour of the laboratory which has equipment to carry out structural tests mainly on reinforced concrete. Recently, they have bought a reflectometer and an emissometer for testing cool roof products. Dr. Kai Loh mentioned they have a Japanese made spectrophotometer and that they do studies on cool paint pigments.

Meeting at Dow Laboratories: Dow Brasil S.A. Av. das Nações Unidas, 14171, Diamond Tower

Mr. Daniel Arruda and Mr. Vinicius Serves met with the delegation and provide information about the cool roof market in Brazil. They also provided information about the 1 degree less program which has the issue of verification, as no certification of product exist.

Meeting at Associação Brasileira de Normas Técnicas (ABNT) to discuss long-term objectives : Rua Minas Gerais,190, Higienópolis - São Paulo, Associação Brasileira de Normas Técnicas (ABNT) is the Brazilian National Standards Organization.

Mr. Eng. Eduardo Campos de São Thiago, Gerente de Relações Internacionais, Associação Brasileira de Normas Técnicas, welcomed the working group and provided information about the need for establishing a robust rating and certification program for building envelope products.

Key representatives from the U.S. and Brazilian governments, as well as the private sector, discussed plans for developing a rating system that will help consumers to identify energy-saving building envelope products, such as windows, roofs, and insulation. High-level officials from the Brazilian Ministry of Mines and Energy (MME), Associação Brasileira de Normas Técnicas (ABNT), Sao Paulo Municipal Government/City Hall, and many others agencies and organizations, participated.
Dr. Roberto Lambert (University of Santa Catrina, UFSC) briefed the group about the voluntary rating programs for commercial buildings developed three years ago and for residential buildings a year ago. For government buildings it is mandatory. He said that his university has developed the simulation tools, but the input is mainly default values. There is need for industry to provide tested and certified values for the program and requested the industry to help.

Paulo Leonelli (Ministry of Mines and Energy) and Dr. Roberto both stressed the need for establishment of infrastructure for testing and certifying building envelope products. There is a need for development of human resources skills through training and educational program.

Brazil Fenestration Expert Delegation to Washington DC/NFRC-July 2011

NFRC and WinBuild organized an educational field trip for Brazilian delegates to provide information about the operation of the NFRC rating program. The delegation was provided with a tour to an NFRC accredited testing laboratory and an NFRC accredited Inspection Agency both in York, PA. The tour also visited a participating NFRC rated window manufacturer in Laurel, MD.

Brazilian-Building Envelope Energy Efficiency Technology Cooperation Workshop

NFRC and WinBuild **p**lanned and coordinated a November 1 workshop titled the *Building Envelope Energy Efficiency Technology Cooperation* for American fenestration building envelop industry members and the Associação Brasileira de Normas Técnicas (ABNT) of Brazil.

Korea

On March 8-9, Su-Won Song and Joe-Sik Kang of the Korea Institute of Construction Technology (KICT) visited NFRC headquarters in Greenbelt, MD to learn more about the NFRC rating and labeling system. At the headquarters NFRC staff presented an overview of the NFRC Rating System emphasizing the ISO 15099 compliant methods as the primary basis for all window product ratings.

NFRC staff hosted the visitors on a comprehensive tour of the various NFRC accredited entities required to operate the NFRC rating system including,

- an NFRC accredited test and simulation laboratory in York, PA
- an NFRC accredited inspection agency in York, PA
- a participating window manufacturer in Laurel, MD
- An ENERGY STAR qualified home in Fulton, MD that included ENERGY STAR qualified window products.

On March 12-13, WinBuild, an NFRC contractor, hosted the two visitors on a tour of the Lawrence Berkeley National Labs window and daylighting labs. The tour included observing LBNL's spectrophotometers, window thermal test chamber, goniophotometer, daylighting building, and learning about the longstanding LBNL partnership with NFRC where spectral data are processed for use in NFRC approved simulation software.

Thailand

WinBuild will host the Thailand Energy Efficiency Workshop in September 2012, if approved. Below are some of the preliminary discussions and planning for the coming meeting.

ON May 18th, Bipin Shah of WinBuild met with the Director of Bureau of Energy Conservation Promotion at Department of Alternative Energy Development and Efficiency (DEDE), Ministry of Energy in Bangkok. Some of the matters discussed for the coming meeting are listed here:

- DEDE supports creation of Regional center at KMUTT

- DEDE has developed a requirement list for laboratory network. One main requirement is for all labs to be ISO 17025 certified. DEDE agreed to support KMUTT to achieve this certification. Mr. Shah of WinBuild also mentioned that information and documents will be shared to help expedite the ISO 17025 certification as has already recently been accomplished for an Indian Energy Efficiency lab.

- KMUTT plans to complete the first phase of laboratory development by implementing a spectrophotometer, FTIR, material conductivity meter and an air leakage chamber in the next 6-12 months. DEDE will recognize the the KMUTT lab to provide certification and testing reports suitable for building energy code compliance.

- DEDE will need more detailed information on equipment cost to fund phase 2. This phase requires procurement of a solar calorimeter, guarded hot box, and other equipment listed in the business plan.

Train the Trainer Workshop-May 21-24, 2011. Five Thai experts were trained by WinBuild Inc (NFRC International program contractor). These experts will then provide training for the attendees of the September 2011 APEC workshop with NFRC oversight (if proposal is approved.)

Regional Energy Center Establishment-**January 23-25, 2011: WinBuild-**Mr. Bipin Shah attended the planning group meeting for the establishment of Regional Energy Center in Bangkok Thailand with Dr. Paritud, Dr. Pattana of KMUTT University, Mr. Asawin Asawutmangkul (Ministry of Energy), Mr. Keetawit, and Mr. Sutti of Guardian Glass. Highlights for this meeting are listed below:

1. Mr. Paritud will organize the workshop for stakeholders (Govt. officials, manufacturers, Architects, Building professionals and etc.) from both domestic and our neighboring countries. The tentative time frame is June 2-3 for 1.5 days in Bangkok. This will be followed by Simulation programs (OPTIC, THERM and WINDOW) training. Dates will be finalized by February 1st, 2011.

2. by MoE, US-DOE, National Fenestration Rating Council (NFRC) and the private sector (Guardian, etc.) will sponsor the workshop. Invitees from overseas should support themselves for participation.

3. Mr. Bipin Shah will confirm with Mr. Marc Lafrance and Mr. Cary Bloyd the meeting date and will send the draft program to Mr. Paritud and will also discuss with potential overseas participants in the CEEDS workshop in Hong Kong and send the contacts to Mr. Paritud later. The workshop is now planned for June 3rd-4th in Bangkok, followed by simulation training June 5-7th.

4. Mr. Shah to send the list of necessary equipment for the Central Lab to Mr. Paritud and Dr. Pattana.

5. Based on the information provided by Dr. Pattana, the working group chose KMUTT to set up the Central Lab due to the availability of HR and equipment. The working group planned the following to achieve the this target:

    a) Dr. Pattana requested the university to purchase the spectrophotometer. The lab already has a Guarded hot plate used for material conductivity measurement.

    b) Mr. Shah indicated for phase 1 of the laboratory a spectrophotometer, FTIR, guarded hot plate, and air leakage are needed. This equipment, with the help of simulation programs OPTICS, THERM and WINDOW, will help determine energy indices U-Factor, Solar Heat Gain, Visible Transmittance values. For air leakage, it is test only option to determine the performance value.

    c) Mr. Keetawit of Guardian will work with the association and industry to partially fund the purchasing of the spectrophotometer. Regional funding agencies such as ASEAN and APEC will also be approached. The date for purchase and make it operational is December 2011. Note: NFRC has sponsored an individual from KUTT to obtain Spectrophotometer measurement training at Lawrence Berkeley National Laboratory in the USA, Feb 2011.

    d) Mr. Shah will provide simulation training in OPTIC, THERM and WINDOW during the June 2011 workshop meeting. Tentative dates are June 4-6, 2011.

Mr. Shah will provide information on the spectrophotometer and necessary accessories to be purchased by Dr. Pattana.

Canada

January 11, 2011-Vancouver, British Columbia: Ray McGowan, NFRC staff, presented NFRC commercial fenestration rating program information to the British Columbia Glazing Contractors Association. British Columbia has adopted ASHRAE 90.1-04 and Vancouver has adopted ASHRAE 90.1-07. Each of these ASHRAE standards requires NFRC 100/200. Mr. McGowan provided details on how to comply with NFRC 100/200 using NFRC software and technical/certification documents. Several attendees expressed interest in received formal NFRC software training

enabling them to make NFRC 100/200 calculations to comply with the local energy code.

International Meetings, GSEP, IEA, APEC, and ASEAN Activity

NFRC and its subcontractors supported and attended numerous international meetings in various countries and in the United States. NFRC's common effort during all these meetings is to provide window energy rating information to enable other countries to achieve harmonization with the NFRC. Harmonization will enable US manufacturers to more easily sell window products in these nations and may also enable other countries to export their products to the United States. Below is a summary of various activities performed under this cooperative agreement.

Asia Pacific Partnership

Bipin Shah represented NFRC at the 9th Asia Pacific Partnership (APP) – Building and Appliance Task Force (BATF) – Vancouver Canada, March 23-26, 2010. He updated progress on Glazing Society of India project in India where NFRC is assisting. Project *Promotion of Cool Roofs and Development of Cool Roof Energy Performance Labeling and Certification* was endorsed by BATF and will be submitted to APP – PIC (Policy Committee) for approval. US DOE was represented by Mr. Mark Ginsberg.

Energy Efficiency in the 21st Century Conference-Istanbul, Turkey, June 3-4, 2010

NFRC and the Cool Roof Rating Council (CRRC) participated in the Energy Efficiency for the 21st Century Conference by hosting table top displays and presenting NFRC and CRRC information. This two-day conference, co-sponsored by the American-Turkish Council and the US DOE, focused on energy efficiency in Southeast Europe and the Caucasus. This effort supports the US DOE's efforts to establish the NFRC rating system in the Middle East/Europe/Turkey. US DOE, working with NFRC/WinBuild, is working with several Middle Eastern nations to establish a regional energy efficiency authority enabling interested residential and commercial building interests to pursue energy efficient building envelope materials. This activity contributed towards that goal. NFRC attended presentations on the Turkish energy situation to assess the potential for Turkish adoption of the NFRC fenestration rating system and to better understand the current fenestration/building energy ratings in Turkey. WinBuild Inc. participated and presented at the conference.

Asia Pacific Economic Cooperative

Cooperative Energy Efficiency Design for Sustainability (CEEDS) meeting in Thailand (September 5- September 11, 2010):

Bipin Shah attended the CEEDS workshop as US expert for buildings envelope and presented on September 9th of the workshop. The workshop provided an opportunity to gather APEC country building energy efficiency codes.

Dr. Wannarat Channukul, Thailand Energy Minister, presided over the opening ceremony of the APEC-CEEDS Phase 2 - *Building Energy Codes and Labeling Regional Workshop* held at SCG Experience Building in Bangkok where senior officials from the Asia Pacific Energy Research Center (APERC) based in Tokyo attended. More than 50 participants from APEC member economies including Japan, Mexico, USA, Singapore, Chinese Taipei, Hong Kong China, Chile, Malaysia, China, Philippines, Thailand and Viet Nam, 20 international expert speakers and 12 senior APERC researchers attended. The workshop was successful and its outcomes will be further discussed at the next CEEDS Phase 2 Workshop in Hong Kong China in January 2011.

Reception and Green Building Meeting in Washington DC, March 3-4, 2011

NFRC staff supported the March APEC reception in Washington DC providing meeting coordination and logistical support. NFRC staff also presented general NFRC information at the APEC Green Building meeting. The International Association of Plumbing and Mechanical Officials Group cosponsored this event providing $1500 toward the total expense.

Association of Southeast Asian Nations-ASEAN

Bipin Shah met with, Dr. Paritud, Prof. Patana, and a Guardian representative on September 7th to begin the discussion on establishing required infrastructure to support rating and labeling in ASEAN countries. Thereafter, Mr. Shah visited the School of Energy, Environment and materials King Mongkut's University of Technology Thonburi (KMUTT) University on Friday September 10th to access the current equipment in use for carrying out material thermophysical property measurements. Further, Mr. Shah spoke with Ratchaneekorn of SCG group (a leading building materials company in Thailand), who confirmed SCG interest in building infrastructure for implementing the code and participating in the group to initiate work in Thailand. Mr. Shah also discussed with Mr. Sarat Prakobchat (Ministry of Energy) who supported the objective to build required infrastructure to implement code.

Cool Roof Initiative Working Group meetings-October 4-8, 2010

Bipin Shah of WinBuild attended the Cool Roof Initiative Working Group Meeting and Net Zero Energy Sub-Tropic in Okinawa.

Cool Roof Conference and Meetings-Shenzhen, China-October 13-16, 2010

Bipin Shah and Jody Smith of WinBuild Inc. participated in the Cool Roof Conference. Mr. Shah was the meeting technical co-coordinator and Jody Smith helped in meeting proceedings and notes taking. The American group was hosted by the Institute of Building Research of Shenzhen and was given a tour of their state of an art passive building that demonstrated advanced energy saving technologies and equipment.

Lawrence Berkeley National Laboratory Spectral Data Measurement Training, February 12-18, 2011

NFRC worked with the University of California-Lawrence Berkeley National Laboratory to provide training for several international glazing experts. LBNL staff provided extensive training on spectrophotometers, Fourier Transform Infrared Radiation spectroscopy devices, and the International Glazing Database (IGDB). Dr. Charlie Curcija of LBNL led the training over 4 days at the LBNL. Below is a list of attendees:

Glazing Measurements Training at the Lawrence Berkeley National Laboratory at the University of California-Berkeley, June 2011

LBNL hosted a seminar for several international fenestration experts to learn optical property measurements using North American Standards. These measurements are integral to the National Fenestration Rating Council's energy rating system and enable international manufacturers to participate in the North American fenestration market.

Global Superior Energy Performance (GSEP)–Cool Roof and Pavement workshop

NFRC and WinBuild planned and coordinated with the US-DOE and Global Cool Roof Alliance a September 12-13, 2011 workshop in Washington DC. Coordination included invitation to key international Global Superior Energy Performance (GSEP) country experts, and preparation of an agenda and discussion topics.

International Energy Agency (IEA) Meeting-Paris, France-July 2011

Bipin Shah of WinBuild attended the IEA workshop on Policy Pathway*: Energy Efficiency in Windows and Other Glazed Areas* on 6th July, 2011. Mr. Shah presented NFRC information on how to develop a window energy rating system and North American and APEC region window energy ratings and energy codes. Discussions during the workshop led IEA to decide to re-scope this Policy Pathway. IEA will look at the whole building envelope and include a specific section on windows. The material presented for the NFRC rating systems will be used for this to assist on building envelope rating development.

NFRC International Licensees

NFRC continues to support its licensed partners in Australia and South Africa. Australia actively labels residential products using NFRC methods. South Africa continues to develop a window energy rating system basing it on the NFRC rating system. South Africa has received window energy simulation training, test lab accreditation, and energy code information from the NFRC.