Commercial Windows Initiative

Market Progress Evaluation Report, No. 1

prepared by

Heschong Mahone Group, Inc

report **#E05-137**

March 23, 2005

NORTHWEST ENERGY EFFICIENCY ALLIANCE

www.nwalliance.org

529 SW Third Avenue, Suite 600
Portland, Oregon 97204
telephone: 503.827.8416
fax: 503.827.8437

Commercial Windows Initiative

Market Progress Evaluation Report #1

Submitted to:
Northwest Energy Efficiency Alliance
David Cohan

Submitted by:
HESCHONG MAHONE GROUP, INC.
11626 Fair Oaks Blvd. #302
Fair Oaks, CA 95628
Phone:(916) 962-7001
Fax: (916) 962-0101
e-mail: info@h-m-g.com
website: www. h-m-g.com

TABLE OF CONTENTS

TABLE OF FIGURES

1. EXECUTIVE SUMMARY

The Commercial Windows Initiative (CWI), a project developed and implemented by the West Wall Group (WWG), works with manufacturers, architects, specifiers, designers and developers to boost demand and market share for energy-efficient, factory-built commercial windows. CWI works with these parties to increase sales of already efficient products and encourage the design, manufacture and sale of new, more efficient products.

The market transformation hypothesis is that more high efficiency windows will be installed in commercial buildings if (a) an easily recognized identification mark (e.g., a label or a logo) is developed that helps users identify and select them, and (b) market actors are provided outreach and education on the value of high-performance windows. A program theory was that starting with a discrete portion of the commercial windows market, specifically factory-built windows in punched openings, would help to establish a foothold in the market that could then be expanded to all window types over time. While there is currently no ENERGYSTAR® standard for commercial windows, this project proposes such levels for the Northwest (and has begun work with U.S. EPA to develop such a national specification). A second level of market transformation could occur if the specifications that the identification mark is based on are eventually adopted into state codes to lock in the efficiency levels.

The specific market transformation goal of the program is an increase of at least 38% in the market share of high efficiency factory-built windows in the commercial punched openings market, from an assumed baseline of 12% to at least 50% by the end of 2005 and 70% by 2010. The CWI program began in September 2002 and is scheduled to run through August 2005. Key implementation tasks include:

- Establishing a steering committee of industry experts and market actors
- Defining a product specification in conjunction with Steering Committee, NFRC, and national labs
- Developing a recognizable and acceptable label, logo or brand for qualifying product
- Developing and implementing supply-side and demand-side marketing activities
- Investigating expanding CWI to include site-built commercial windows
- Tracking and reporting market share for qualifying products in years two and three.

The broad goals of the evaluation are to help the Alliance to assess:

- Whether the Initiative's design is likely to meet the Alliance goal of transforming the market for commercial factory-built fenestration products,
- Whether the Initiative's implementation is effective in accomplishing that goal,
- Whether the tracking process established by the implementer provides accurate estimates of market share and market share trends, and
- What potential modifications or realignment of the program are needed in order to meet its original or newly recognized goals (adaptive management), including the current proposal to expand the program to the entire commercial window market.

The evaluation included document review, attendance at presentations and meetings, interviews with three CWI staff, 17 targeted manufacturers and other market actors, analysis of WWG market share tracking procedures and data, and attempts to create a market share baseline.

In summary, the evaluation found that CWI accomplishments through the third quarter of 2004 include:

- Established Project Steering Committee
- Developed and gained consensus support for the following CWI technical specifications:

	U-factor (max)	SHGC (max)	VLt (min)
Metal Frame	**0.42**	0.40	0.50
Non-metal Frame	0.35	0.40	0.50

- Developed CWI marketing materials, including case studies, and ran promotional campaigns
- Created CWI web site
- Conducted over 50 "lunch and learn" sessions with architectural and engineering firms, utilities and construction companies

In addition to these specific accomplishments, the West Wall Group established a procedure for tracking market share of CWI-qualifying products. HMG reviewed WWG's process and data and independently collected and analyzed data to determine a baseline market share. While the procedures and efforts were valid, neither HMG nor WWG have a high level of confidence in either set of results due to missing and inconsistent data reported by the manufacturers. Further discussion of the approach and the results are provided in Section 2.3.9 and 3.2.

Key Findings

Unreliable Data for Market Share Tracking and Baseline - The principal finding is that the foremost performance criterion for the Commercial Window Initiative does not appear to be easily nor accurately measurable. The data collected from manufacturers leads to untenable conclusions and it is now clear that

manufacturers' data alone will not be sufficient to establish CWI progress or energy impacts.

Program Theory Limiting Activities to Factory-Built Products for Punched Openings Needs Revision - Neither the supply side nor the demand side of the market make a clear distinction between factory-built and site-built products. (This may have contributed to some of the difficulty in obtaining reliable data on product sales.[1]) Additionally, the factory built products market appears already to have made a shift to vinyl products (partly because of its strong connection to the multifamily building market). The program is therefore likely to be more effective if it is expanded to all commercial windows.

Energy Performance Awareness in the Market is Low - In implementing the CWI, WWG learned that the architectural community and the manufacturing community were much less aware of energy performance issues than had been thought. Consequently, WWG had to revamp their messages to teach architects and manufacturers about the technical aspects of window specifications (including U-factors, SHGC and visible transmittance).

Products Developed to Meet the CWI Specifications - At least three manufacturers have said that they are developing products specifically designed to meet the CWI specifications. Their commitment to meeting the CWI specification is a clear sign of market impact by the program.

Manufacturers' Attitudes About CWI Have Improved Over Time - Many of the window manufacturers who had originally viewed the CWI with caution and skepticism, are now partners on CWI efforts.

Program Marketing Must Address Design Solutions – CWI staff spends much of their time with architects and manufacturers' representatives providing information about performance in the language that the recipients use. CWI staff have learned that the design community is interested in "design solutions" not in the advantages of the range of products that one or more manufacturers might have.

Key Recommendations

Expand Program Scope – The CWI Program should expand to include all forms of commercial fenestration products. This will allow CWI staff to present energy efficiency messages (via both specifications and outreach) to the design community more in parallel with how they approach commercial building design.

Change Program Metrics – The evaluation team suggests the Alliance develop and adopt new metrics for assessing program progress instead of tracking the trend in percent market share that CWI qualified products have over time. One

[1] This is not to say that confusion between site and factory-built products was the sole factor. It is not clear that even if the program solves this issue by expanding its focus to include all commercial glazing, that it would be possible to obtain a reliable estimate of various manufacturers' market share, or of qualifying products' market share.

example of a new metric would be the number of new fenestration products developed to meet the CWI specifications.

Change Approach to Determining Market Share – If the Alliance decides that changes in market share of CWI qualified products (one necessary element for estimating the energy impact of the program) must still be tracked, then HMG recommends that the data be gathered by Ducker Research. Ducker, through its strong pre-existing reputation and connection to the fenestration industry, has the best prospect for success in obtaining reliable market share data.

2. INTRODUCTION AND BACKGROUND

The HESCHONG MAHONE GROUP, INC. (HMG) was hired by the Alliance in January 2003 to evaluate the progress and success of its Commercial Window Initiative. This is the first of two Market Progress Evaluation Reports (MPERs) that will be produced. It provides an evaluation of the activities and achievements of the Initiative's first year and a half, through fall of 2004.

2.1 Background

In 1998, the Northwest Energy Efficiency Alliance launched the ENERGYSTAR® Residential Windows program with D&R International as the implementation contractor. The stated goal of the Residential Window program was to increase the awareness of and market share of ENERGYSTAR® residential windows.

D&R and the program evaluation contractor estimated that market share grew from about 10-15% in 1997[2] to an estimated 66% by the second quarter of 2001.[3] Awareness of ENERGYSTAR® windows also increased. The increase was significant among manufacturers and retailers, moderate among builders and minimal among homebuyers and remodelers.

About the time that the program was ending, the Alliance partnered with DOE (through Lawrence Berkeley National Lab) to sponsor a study of the nonresidential window market.[4] The report pointed out the vast opportunity for improvements in use of energy efficient commercial glazing. Since many of the same manufacturers in the Northwest who supply windows to the residential market also produce commercial windows, the D&R staff who had implemented the residential window program were well placed to design a program focused on commercial windows. At the end of the ENERGYSTAR® Residential Windows program several of the key D&R people who had worked on the program split off into their own company, West Wall Group. They submitted a proposal for a commercial windows initiative in 2001 which the Alliance accepted (with several modifications) and the program launched in 2002.

[2] NEEA. *Market Progress Evaluation Report* ***ENERGYSTAR® Windows Program, No.4***. November 2000. Prepared by Quantec. Page ES-2.

[3] NEEA. *Market Progress Evaluation Report* ***ENERGYSTAR® Windows Program, No.5***. January 2002. Prepared by Quantec. Page ES-1.

[4] NEEA. *Market Research Report:* ***A Characterization of the Nonresidential Fenestration Market***. November 2002. Prepared by Eley Associates.

2.2 Project Description

The Commercial Windows Initiative (CWI), a project developed and implemented by the West Wall Group (WWG), works with manufacturers, architects, specifiers, designers and developers to boost demand and market share for energy-efficient, factory-built commercial windows. West Wall Group works with manufacturers, architects and developers to increase sales of already efficient products and encourage the design, manufacture and sale of new, more efficient products.

Commercial glazing can be roughly divided into four types: curtain wall systems, store fronts, site-built punched openings and factory-built punched openings. CWI currently specifically targets factory-built windows in the commercial "punched opening" market.[5] Punched opening refers to the hole in a wall where a factory-built commercial window is installed. Both new and existing commercial and large multifamily buildings are included in the initiative's scope. Also, both metal and non-metal windows are included[6].

Approximately 28 million square feet of commercial glazing is installed annually in the Northwest. Punched openings represent 44% of the commercial windows market, with factory-built product going into about 32% of these openings. The current CWI market is therefore approximately 4 million square feet per year or about 14% of the total market. Approximately 40% of factory-built, punched opening windows are thought to be metal and 60% non-metal.[7]

The market transformation goal, as stated in the program proposal, is an increase of at least 38 percent in the market share of high efficiency factory-built windows in the commercial punched openings market, from an assumed baseline of 12% to at least 50% by the end of 2005 and 70% by 2010. As explained in detail elsewhere in this report, this goal is being re-examined due to proposed changes to the program scope and difficulties in validating the baseline and developing an acceptable sales tracking mechanism.

The focus and activities of the program are designed to shift over time from an initial supply-side focus to one that emphasizes the demand side (i.e. window specifiers including architects, engineers, and facility managers). The majority of effort in the first year of the program (through 2003) involved working with manufacturers, first to develop the criteria for the CWI specifications, and then to help develop marketing messages and educate manufacturers' representatives. Early contacts that WWG has had with architects and others on the demand side of the commercial window market were exploratory and intended to gain input on product specifications and advice on program approaches. Consequently, the

[5] Although the initial target of the CWI is factory-built windows for commercial buildings, the Alliance and the West Wall Group are considering expanding the focus to include all commercial glazing systems.

[6] Non-metal is a comprehensive term including vinyl, fiberglass, wood, and combinations of these materials.

[7] These figures are quoted in the CWI Statement of Work and are based on a NEEA Market Research Report (*A Characterization of the Nonresidential Fenestration Market*, prepared by Eley Associates, November 2002) and interviews with Nick Lamb, Principal of Ducker Research, 2002, and 2004.

current evaluation has primarily focused on the supply side and has not yet included interviews with architects and other demand-side market actors.

2.3 Program Activities

The CWI program began in September 2002 and is scheduled to run through August 2005. Implementation tasks include:

- Establishing a steering committee of industry experts and market actors
- Defining a product specification in conjunction with Steering Committee, NFRC, and national labs
- Developing a recognizable and acceptable label, logo or brand for qualifying product
- Developing and implementing supply-side marketing activities with manufacturers and distributors
- Developing and implementing demand-side marketing activities for developers, architects, specifiers, glazing and general contractors
- Coordinating with BetterBricks
- Seeking out and leveraging existing utility programs
- Investigating expanding CWI to include site-built commercial windows
- Tracking and reporting market share for qualifying products in years two and three.

The accomplishments and status of each of these tasks is discussed in the following sections.

2.3.1 Establishing a Steering Committee

One of the first steps that West Wall Group took in launching the CWI program was to assemble a steering committee of interested and capable industry members who represented a diverse set of interests and industry perspectives. The committee included six people in the glass industry, eleven in the window business (both metal and non-metal), consultants, interested associations, and agencies. Over time, various others were added, and some committee members' interest and involvement waned. West Wall Group had prior experience with all members of the committee; mostly through its earlier Residential ENERGYSTAR® Windows program, but also through a long history of working within the National Fenestration Rating Council (NFRC)[8] and on

[8] The National Fenestration Rating Council was established around 1990 to adopt fair, accurate, and credible window performance ratings. NFRC also accredits labs to provide ratings in accordance with its procedures and produces a directory of certified products.

energy efficiency issues related to fenestration. The list of original Steering Committee members is included as Appendix Section 6.1 . In addition to the committee, WWG also received a significant amount of valuable input from ad hoc groups of industry members.

The process of gaining the committee's input was fairly flexible and fluid. Generally, the committee was asked to respond to fundamental or first order questions to give WWG and the Alliance the foundation on which to build program elements. Then the Steering Committee was asked to comment on what WWG had created using the committee's input. In other words, the Steering Committee played an advisory role wherein every member's voice was heard, rather than the role of a voting body wherein a unified (or majority only) voice determined WWG's decisions.

2.3.2 Development of CWI Specification

The critical initial task in the program was to establish the technical criteria that would define qualifying products to be promoted by CWI. The most important factors affecting energy use are U-factor, solar heat gain coefficient (SHGC), and visible light transmission (VLT). U-factor measures a window's overall conductance of heat flow. It is the inverse of R-value (a measure of a material's ability to resist heat flow). The lower the U-factor, the less heat flows through the window. Windows with a low U-factor do a better job helping to maintain the temperature differential between the inside of a building and the outdoors.

SHGC is the percentage of solar radiation that passes through a window assembly (the entire window, not just the glass). Solar radiation that enters through a window is absorbed by the furniture, floor and other elements inside the building. This energy is then released by the building elements as heat. Through this process, solar radiation increases cooling energy use during the summer and decreases heating energy use during the winter.

VLT is a measure of the amount of visible light that enters relative to the area of the window system (not just the glass). A high VLT means that the window allows a significant amount of light into the space. Windows that have a low VLT are generally considered too dark for residential use but have found acceptance in certain commercial applications. If the VLT is too low, then a considerably greater amount of energy for electric lighting may be needed (compared to a space with windows that have high VLT).

A preliminary step in defining the qualifying criteria came during the program planning process when WWG and the Alliance created draft specifications in order to estimate the program's savings potential. In the fall of 2002, WWG sent these draft values, shown in Table 1, to the Steering Committee members and asked for comments.

	U-factor (max)	SHGC (max)	VLt (min)
Metal Frame	0.40	0.40	0.50
Non-metal Frame	0.35	0.40	0.50

Table 1: Initial CWI Specifications

The committee came to near consensus that the values were "about right," however metal manufacturers had concerns about using U-0.40 instead of U-0.042 for metal frame products, particularly in light of possible impacts from concurrent revisions to NFRC's U-factor rating procedures.[9] At a Steering Committee meeting in February 2003, some metal manufacturer members publicly voiced this concern.

At the same time, the non-metal (primarily vinyl) product manufacturers argued that it was unfair for metal products to have a lower threshold to qualify as CWI Initiative products. Their arguments helped to balance the pressure from the metal window manufacturers who argued that their ("easier") criteria were still too difficult to achieve. Indeed, it seemed as if that counterbalance might have been the sole reason for the non-metal product manufacturers' arguments.

Still, WWG took the metal manufacturers' concerns seriously. They asked NFRC and its contractors evaluate some current products using the new algorithms. Charlie Curcija of the University of Massachusetts performed the analysis and concluded that it is possible for manufacturers to achieve a 0.42 with metal products, though none of the existing products he examined actually did.

Finally, based on all of the Committee input, in April, WWG and the Alliance settled on the following technical criteria:

	U-factor (max)	SHGC (max)	VLt (min)
Metal Frame	**0.42**	0.40	0.50
Non-metal Frame	0.35	0.40	0.50

Table 2: Final CWI Specifications

They also decided that qualifying products must have NFRC certified U-factor, Solar Heat Gain Coefficient and Visible Light Transmittance ratings.

New concerns arose shortly after the specification was "finalized" during follow-up interviews with committee members conducted by HMG. Several

[9] The actual rating for a window that appears in the NFRC directory and on the label is the result of computer simulations that are validated by agreement with test data on a subset of products within a product line. The NFRC sponsors periodic round-robin testing and comparisons – both between labs and between simulations and test results. This systematic testing showed discrepancies in results and thus provided evidence that the simulation procedures needed to be updated. Use of the new procedures provides U-factors that are higher or lower than the old ones – in some case by as much as 10%. The new procedures were about to be phased in as WWG was busy gaining consensus on the CWI specifications.

manufacturers stated that the CWI three-part combined specification might eliminate some of the potentially most cost-effective fenestration products for the commercial building sector. For example, one of the most commonly used glazing systems has a VLT of around 0.48, but has an excellent SHGC and U-factor. Based on this feedback, WWG decided to de-emphasize the visible light transmittance criterion by keeping it in the specification but tracking products based only on SHGC and U-value.

The final specification that was agreed upon was intended to be set high enough to change the market meaningfully while not being so aggressive that manufacturers lost interest. At the time it was finalized, many manufacturers had some products that already qualified; in a few cases, a manufacturer's entire line qualified though this does not mean that a product was available for all commercial applications, particularly high-rise construction. Qualifying metal products also existed but far fewer as a percentage of the whole market.

2.3.3 Developing a recognizable and acceptable label, logo or brand for qualifying product

Part of the CWI plan for increasing demand for, and consequently, market share of CWI-qualified commercial window products is to make them easy to refer to and specify by attaching a recognizable emblem to them. WWG explored issues of both design and application with potential partners (especially members of the Steering Committee), the Alliance, and relevant national organizations and agencies (e.g., U.S. DOE, NFRC, and the American Architectural Manufacturers Association (AAMA)). They began the brand development process late in 2002, introduced a draft brand in February of 2003, and a revised (final) brand in May/June of 2003.

Early on, the CWI team, in consultation with the Steering Committee and others, decided not to pursue use of the brand in product labeling, concentrating instead on its value in aiding participants to identify the program consistently. In part this decision was driven by the consideration that the CWI brand could be a "bridge" brand – to be eventually replaced by the more ubiquitous ENERGYSTAR® designation if DOE adopted CWI's criteria. DOE is still far from ready to take on commercial windows. Nonetheless, the CWI team, some of whom had directly participated in DOE's ENERGYSTAR® windows campaign, and implemented the Alliance's Residential ENERGYSTAR® Windows program, felt that for the commercial window program to gain traction, it would have to have a recognizable brand.

The brand (shown in Figure 1) is used on all CWI publications. The CWI web site also provides instructions (and restrictions) on how the brand can be used by partners in their advertising. The CWI brand (including the earlier superseded version) has also appeared on invitations to presentations, T-shirts, brochures, program pocket folders, the CWI Designers Guide, and many smaller "leave behind" items.

Figure 1: Commercial Windows Initiative Brand

2.3.4 Developing and implementing supply-side marketing activities with manufacturers and distributors

As mentioned previously, West Wall Group focused its marketing efforts over the first year primarily on the supply side of the market – window manufacturers and the glass and extrusion manufacturers who serve them. WWG's goals were:

- to find out what sort of marketing materials and assistance manufacturers required in order to sell high performance products[10]
- ensure that manufacturers were comfortable with the materials being developed under the Initiative
- deliver training to manufacturers' staff on how to up-sell to their high performance product lines
- identify projects with a potential for becoming foci for promotional materials, and
- to identify opportunities for marketing and promotional coordination.

To date, the CWI personnel have had over 150 meetings with individual manufacturer representatives. In addition, they conducted a major promotion and distributed a variety of marketing materials which are described below.

Step Up To The Plate

In spring of 2004, CWI staff created a promotion called "Step Up to the Plate," which encourages manufacturers' representatives to promote their high performance products, architects to design using them, and, just as importantly, allows WWG an easily-accepted vehicle for transferring marketing materials to manufacturers' sales forces. The culmination of the promotion was an all expense paid trip to a Seattle Mariners game for the most successful sales staff from each participating manufacturer. The point of the promotion was to have sales staff promote use of their company's CWI-qualified products in specific projects, and highlight the projects as energy efficient. CWI also coordinated the Step Up To The Plate promotion with its ongoing effort to highlight efficient projects through case studies, by recruiting potential case studies from sales staff involved in the promotion.

[10] The term "high performance" is used interchangeably with "CWI-qualifying" in the remainder of the report.

CWI staff met with participants at their facilities several times between the promotion launch in May and the Mariners game in September. Participating window manufacturers' staff received promotional items (e.g., sun glasses, shirts, pens) and informational packets (including CWI brochures, case studies, etc.) to use when making their sales calls and to share with clients with participating projects. At least once a month, CWI provided some marketing materials to each participant. CWI staff felt that the largest benefit was a diffusion of information about high performing windows, through the manufacturers' sales staff to architects and developers.

As part of the promotion, WWG rewarded those salespeople who signed up one project (Mariners tickets), at least three projects (additional reward: golf shirts for the sales person and his/her clients), and the most projects with CWI-qualifying products within their category (additional reward: special recognition plaques). The promotion was embraced by the salespeople of 16 window manufacturers who were allowed to bring someone from their highlighted project's design team with them. Over 75 people attended the game in September 2004. Special prizes were awarded at the event. These prizes went to sales people who brought in exemplary commercial building projects, as well as supplier, design, and utility company partners.

It is important to note that this promotion has been completely paid for by three suppliers to window manufactures who agreed to sponsor the event. Although this promotion was part of the CWI program, funds from the Alliance were used only for some labor costs. All direct costs were funded by donations from Cardinal, Tecton, and Mikron.

Marketing Materials

The CWI team has created a significant amount of materials that range from purely marketing to a heavy emphasis on educational concepts. The media from these materials also has a wide range – from pens and shirts to PowerPoint presentations and a web site.

The CWI web site (http://www.commercialwindowsinitiative.org/) is also a potentially powerful marketing tool. Staff is continuing to add content to the site. Among the useful items currently available are case studies from several recently completed and "on the boards" projects which illustrate the benefits that CWI-qualified products added; The web site presents data that show the engineering and economic aspects of CWI-qualified windows, and discussions with design and project development personnel exhibit the human dimension of energy efficient design. The web site also has a summary of the program benefits, specifications and goals.

In the nearly two years since the CWI launched, there has been a considerable amount of printed marketing materials produced. Most of the more current pieces are delivered to contacts in a pocket folder that itself is inscribed with the CWI marketing message. The folder can be customized depending upon its purpose, but generally contains several project case studies, a 5x8 card that

summarizes the specifications and program benefits, a list of recent attendees at *Design Intent* lunch and learn sessions (as well as a notice of upcoming sessions), and profiles of architects and developers who have taken leading roles in energy efficient design and construction.

One of the most robust printed pieces is the 5"X8" format *Designers Guide for Energy Efficient Commercial Windows*. The *Designer's Guide* includes:

- an overview of the CWI project,
- articles that discuss a window's impact on the energy efficiency of commercial buildings (one in a non-technical, marketing voice, and others a bit more technically),
- a description of the Design Intent sessions (described in Section 2.2.5), including the important information for architects that they are AIA/CES approved,
- profiles of projects that have employed better glazing systems,
- contact information for the Alliance, utilities, related programs, partnering associations, and
- window and glass manufacturers that do business across the Northwest.

2.3.5 Developing and implementing demand-side marketing activities for developers, architects, specifiers, glazing and general contractors

CWI staff met with approximately 150 different architects at firms throughout the Northwest region. Meetings begun in late 2002 were used to gain input on marketing messages, baseline understanding of high performance fenestration, and current project design practices in the field. There were also efforts to find projects on the drawing boards that could be used as case studies or promotional examples of the value of CWI-qualified products.

CWI also met with developers of commercial projects to determine their baseline practices and understanding of high performance windows, and to find some high visibility projects using CWI-qualifying product for use as case studies. CWI staff chose developers who would be most likely to adopt high performance technologies. These early meetings were meant to gather input and form alliances more than they were for marketing the Initiative.

Recently, WWG started taking marketing materials and presentations to the design and development community. They have presented at several hosted events (e.g., at the Seattle Lighting Lab, AIA meetings), as well as scores of "brown bag" (which they called "Design Intent Lunch and Learn") sessions with architectural and engineering firms. CWI also developed and presented several utility co-sponsored seminars with industry representatives assisting in the presentation. These seminars were presented with Clark County PUD and Seattle City Light/Seattle Office of Housing. The Design Intent/Windows on

Design Seminar, (the Seminar), is a presentation of the latest advances in energy efficient window technology and consists of three main sections:

The Program – this is an introduction to CWI, Better Bricks, and The Alliance. In this section, CWI staff talk about the importance of energy savings beyond a particular building, and how it relates to regional savings.

The Evolution of Windows – much of this discussion is around glass and the development of Low-E. CWI staff sometimes refer to this as "Not all Low-E is created equal" because of the generic nature most architects understand the "low-e" term to be. They talk about frames – vinyl, metal, fiberglass, and wood – and the performance differences between them, and discuss spacer technology.

Case Studies – Architects like to know things work, and showing projects where the CWI specified window was used provides greater confidence in considering something new or different. As the program has evolved, the number and range of projects CWI presents spans the spectrum of buildings most commonly designed.

Currently, the Seminar offers 1 AIA CES credit. CWI reports all attending architects to the AIA, and sends each architect a certificate of completion. Also, CWI works with regional chapters of the AIA to co-sponsor the Seminar presentation. When the AIA chapter co-sponsors the training, the course is called "Windows on Design," and is coordinated through the chapters to their members. This version of the Seminar usually is held at a representative building, and includes a presentation by a local architect and tours. This course receives 2 AIA CES credits, and is managed by the AIA chapters.

The message is tailored to the way that the design community thinks about projects – "give me solutions; don't sell me products."

Presenters for CWI have been struck by the degree to which the design community does not understand the technologies that lead to high performance products, nor the metrics for quantifying "high performance." They often do not know the difference between SHGC and visible transmittance, nor U-factor and low emissivity. Recognition of this on CWI's part has caused CWI to build more *instruction* into the Design Intent sessions. CWI staff recognize that architects and engineers have "thousands of things to specify correctly, and cannot JUST focus on windows." Fortunately, the A&E community appears to be hungry for information that will help them understand fenestration performance differences without having to become a window expert. Their feedback to the CWI staff is that so far, no one has really communicated this to them.

2.3.6 Coordinating with BetterBricks

BetterBricks is another initiative of the Northwest Energy Efficiency Alliance. It is a network of information and services designed to build awareness and demand for energy efficiency in buildings, provide pragmatic and comprehensive information about energy efficiency and its benefits, and support the marketplace's capability to deliver efficient products and services. The

Commercial Windows Initiative and BetterBricks coordinate on issues, outreach and activities whenever possible. WWG met with BetterBricks staff nearly every month to discuss opportunities for coordinated marketing and educational programs. The two entities made coordinated presentations throughout the four state Northwest region. The CWI web site is linked to BetterBricks', and vice versa. Additionally, the BetterBricks web site features CWI's *Designers Guide to Energy Efficient Commercial Windows*.

WWG and the BetterBricks staff are seeking opportunities for each to pull the other's expertise in to bear on projects that they are working with. For example, CWI worked with BetterBricks on a project in Boise, Idaho, called "Foothills Environmental Center." CWI provided design assistance in selecting the glass for the windows and also provided information about solar heat gain coefficient. Other examples include the Banfield Motel (Portland, Oregon) where CWI referred the design team to the BetterBricks advisor for assistance with the HVAC system; the Insight Architect Offices (Boise, Idaho) where CWI worked in conjunction with BetterBricks Lighting Design Lab to provide expertise on the glazing system: the Portland Towers (Portland, Oregon), where CWI referred the project to BetterBricks for design and modeling assistance.

One of the original CWI plans was to use the Alliance's BetterBricks contractors as the primary source of input from the demand side of commercial windows (design and development communities). For several reasons, this did not occur to the degree that West Wall Group had hoped. One important reason appears to be that the level of knowledge among those communities was considerably less than anticipated (see explanation in previous subsection). Instead of using the BetterBricks contractors, WWG went to individual architects and developers, gaining their input directly.

2.3.7 Seeking out and leveraging existing utility programs

In its first half year, the CWI contacted or met with nearly forty different utility program contacts to start exploring ways to cooperate on programs. In 2004, CWI made *Design Intent* presentations at Tacoma Power, Seattle City Light, Clark County PUD, Northwestern Energy (Montana), Puget Sound Energy, and Clallum County PUD. They also met with Tillamook PUD, Avista, Idaho Power and Light, Kootenai Electric Cooperative, and Eugene Water and Electric Board on other issues. The focus of many of these meetings (especially with Seattle City Light and Idaho Power and Light) was the identification of projects using high-performance windows that could be highlighted as case studies. CWI also facilitated connections between utilities and manufacturers to address specific project/building needs. The Seattle Office of Housing has adopted CWI specifications for the multifamily projects for which they provide incentives.

CWI also explored the possibility of coordinating on outreach and exploring opportunities for joint activities and marketing with utility programs. CWI recommended and assisted in the delivery of joint training sessions, project specific design assistance (related to windows) from CWI, and coordination with

BetterBricks (for additional assistance). Some of the Design Intent sessions stemmed from these discussions.

2.3.8 Investigating integrating site-built commercial windows

As stated in the introduction, CWI currently targets factory-built windows in the commercial punched opening market but the statement of work included an optional task to expand to other areas. This was originally intended as an activity that would be looked at toward the very end of the contract period. Instead, lessons learned during the first two years of the program and changes in the market have caused WWG to propose making this change to the program now. Background and detailed discussion are provided in Section 4.

2.3.9 Tracking and reporting market share for qualifying products in Years Two and Three.

One of the primary means for determining if the Initiative is meeting its goals is to track the share of the market that CWI-qualifying products have over time. WWG is charged by its contract with the Alliance to track the number of CWI-qualifying products in the Northwest and to provide an estimate of what percentage of the total Northwest sales that represents. This is meant to allow the Alliance to assess the success of the program at increasing the market share of qualifying products over time.

This section outlines the steps that West Wall Group took to establish the market share tracking (MST) process, what they have done to track market share, the results they got, and briefly describes what the Alliance and HMG did to evaluate whether the results were reasonable.

WWG's MST Methodology

In 2002, the West Wall Group established a procedure for tracking market share of CWI-qualifying products. The basic steps were:

- Call and email known manufacturers within the NW market for their sales data on a monthly basis
- Track and report market share for qualifying products (in the 2nd and 3rd year)
- Coordinate/collaborate with the Alliance's evaluation contractor

WWG has frequent (generally, monthly) communication with the manufacturers it is working with to increase sales of CWI-qualifying products . During calls and email exchanges, WWG staff collects unit sales data from these manufacturers (as well as from other manufacturers that WWG is targeting for participation) and distributors. Although window manufacturers are the primary source for market share data, distributors are asked the same questions as a cross-check. As the Initiative proceeds, WWG also plans to augment the manufacturer data with data

from wholesalers and possibly building contractors. For 2003, data was collected from 12 manufacturers out of a possible 14 thought to represent virtually 100% of the Northwest market. Of the two missing, one declined to provide any data to WWG and the other was not initially known to sell into the Northwest commercial window market and was not added to the database until early 2004[11]. In 2004, data will thus be based on data from 13 or 14 manufacturers.

Specific data collected includes:

- total number of factory-built units sold in Oregon, Washington, Idaho and Montana (the Northwest)
- total number of units sold for commercial building projects in the Northwest
- total number of units sold for commercial buildings in the Northwest meeting the CWI specifications
- number of units sold with metal frames and with non-metal frames

Results

Both WWG and HMG have a low level of confidence that the results of WWG's 2003 market share tracking efforts, shown in Figure 2, are accurate, though the reasons for this are not yet understood. For example, nearly everyone who was asked – manufacturers as well as architects - claimed that the preponderance of product being installed in commercial building projects is aluminum framed. Many estimated that the ratio was about 70:30. This, of course, includes all window types, site built and factory built. Yet the data reported to WWG for factory built commercial windows indicates that over 95% of sales reported to them is non-metal framed. It also indicates, unbelievably, that in 2003, about 69% of all product sold was CWI-qualified. Similar problems with manufacturer data were found during HMG's attempt to estimate the baseline conditions of the market which is discussed in Section 3.2.2.

[11] The non-reporting manufacturer has given indications that he will start reporting in 2004.

	Percent of Total Sales
All Metal	4.2%
CWI Qualified Metal	2.2%
Metal *n* = 13,216	
All Non-metal	95.8%
CWI Qualified Non-metal	66.6%
Non-metal *n* = 302,364	
All CWI Qualified	68.9%
CWI Qualified *n* = 217,310	

Figure 2: 2003 Product Sales (window units as reported to WWG)

2.3.10 Summary of Activities

In brief, CWI's impressive accomplishments through the third quarter of 2004 as reported by WWG include:

- Project Steering Committee established -
  The Steering Committee was formed to help evaluate and refine the criteria for the CWI. The committee met mostly by conference call.
- Specifications developed -
  The original "draft" specifications included a 0.40 SHGC, 0.50 Visible Transmittance, a 0.35 U-factor for non-metal products and a 0.40 U-factor for metal products. The industry provided input that U-0.40 was too much of a stretch for metal frame windows, and after further analysis and industry input, WWG and the Alliance decided on U-0.42.
- Developed CWI Marketing Material including -
  "Commercially Speaking" newsletters that evolved into Project Profiles, a Designers' Guide for Energy Efficient Commercial Windows, promotional materials, and presentations for AIA groups and others.
- Created CWI web site -
  The CWI web site contains a copy of the specifications, interviews with manufacturers, architects and others involved with commercial windows, meeting notes, copies of presentations, summaries of the background analysis, and three issues of the CWI newsletter, Commercially Speaking."
- Conducted over 50 "lunch and learn" sessions with architectural and engineering firms, utilities and construction companies.
- Developed case studies -
  With the help of both manufacturers and architects, CWI produced a number of case studies that show the value that high-performance windows add to commercial building projects and highlight some of the

specific technologies that impart high performance to CWI-qualified products.

- Developed and implemented an extensive promotion that affected over a hundred window manufacturer representatives and design professionals (the *Step Up to the Plate* promotion is described elsewhere).

3. CURRENT EVALUATION

3.1 Evaluation Description

The broad goals of this evaluation are to help the Alliance to assess:

- Whether the Initiative's design is likely to meet the Alliance goal of transforming the market for commercial factory-built fenestration products,
- Whether the Initiative's implementation is effective in accomplishing that goal,
- Whether the tracking process established by the implementer provides accurate estimates of market share and market share trends, and
- What potential modifications or realignment the program needs in order to meet its original or newly recognized goals (adaptive management).

One step toward creating this assessment is to determine to what degree West Wall Group has met the progress indicators that were developed during the program planning process and included in the CWI Statement of Work. While progress indicators do not equate directly to market transformation, the Alliance hypothesizes that achieving them shows movement in that direction. It is important, however, to see how well these "means" function to achieve the larger "ends" over time. In this MPER, the original progress indicators, shown below, are taken as a given. In the second MPER, they will be analyzed to determine if they are still appropriate in light of program experience.

1. Creation of an industry-supported steering committee.
2. Creation of a broadly accepted product specification.
3. Increased awareness of the Initiative's specifications and associated products.
4. Increased total production and sales of qualifying products.
5. Increased numbers of (commercial building) projects with punched openings specifying qualified products.
6. Increased availability and number of qualifying products.
7. Matching funding and in-kind services of at least $1.5 million.

A key indicator implied in this list and pursued by both WWG and HMG is the change in market share of CWI-qualified products, from the assumed 12% at the outset, to over 50% by the end of 2005. This is somewhat different from numbers 4, 5, and 6 above, since it relies on being able to determine not just the numbers of products sold, but the percentage of the overall market that those sales represent. Collection and analysis of the data that would allow assessment of this indicator consumed a large portion of the evaluation team's time and

budget. The reasons for this are discussed at length in Section 3.2 (Market Share Baseline).

The evaluation included many different activities which, cumulatively, led to the conclusions and recommendations contained in this report. The following is a list of the evaluation activities:

- Review of WWG monthly reports
- Review of WWG presentation materials
- Attendance at CWI presentations
- Search of web sites and magazines for mentions
- Review of CWI web site
- Interviews of market actors with a range of industry perspectives
- Interviews and sales surveys with targeted manufacturers
- In-person interviews with Gary Curtis (president of WWG) and John Jennings (Alliance project manager)
- Phone interviews with other CWI staff
- Informal discussions with industry participants
- Analysis of WWG market share tracking procedures and data
- Attempts to create a market baseline

3.2 Market Share Baseline

The primary goal of CWI is to increase the percentage of energy efficient factory-built windows used in punched openings from an originally assumed 12% to over 50%. More generally, since the 12% figure was accepted as a planning assumption rather than a definitive, research-based conclusion, this was understood by the Alliance Board to mean that the Initiative would increase market share by 38% over whatever baseline was officially established once the program started. Determination of progress toward this goal obviously requires an estimate of market share as it changes over time as well as a reliable estimate of the baseline conditions.

3.2.1 Market Share Tracking Plan Evaluation

WWG tracked sales data from CWI participating manufacturers. As one of the evaluation tasks, HMG evaluated WWG's plan for market share tracking (MST). Although WWG was consistently tracking sales of qualifying products with the participating manufacturers, their plan to do so was not clearly articulated.

HMG reviewed the market share tracking methodology that WWG proposed, evaluated the overall strategy, and provided suggestions for clarity and improvements. The first suggestion was that West Wall Group create a Market

Share Tracking (MST) Plan that is a stand-alone, complete document. The evaluator suggested that the MST Plan fully and completely define for WWG staff, the Alliance, and the evaluation team exactly what would be done, by whom, and how. WWG completed the Plan (described in Section 2.3.9) and it now forms the basis from which WWG staff can assure uniformity and continuity in addressing their contractual obligation to track the market share of qualifying products in the Northwest over the span of the CWI program. It also formed the basis from which HMG evaluated the adequacy of the MST efforts.

HMG reviewed WWG's monthly status reports and quarterly sales numbers reported by the manufacturers who provided data to WWG. It was not possible to tell from these data what the pre-program market share percentage was, nor was it possible to gain a reliable estimate of what the contemporary market share was. The actual percentages of CWI-qualified products from the specific reporting manufacturers could be tracked over time, but no generalization to the market as a whole could be supported. The data caused the Alliance to question the original assumptions about market share.

3.2.2 Market Share Baseline Analysis

Given that the primary goal of CWI was to increase the market share by a specific percentage, estimating an accurate baseline became paramount to determining CWI's ultimate success. Initial HMG inquiries to Alliance staff made it clear that there was insufficient documentation to validate the initial estimate of 12%. Because of this situation, the evaluation contract was amended to include establishing the baseline as a task. Baseline was defined as the market share of CWI-qualifying product based on manufacturers' sales before the CWI began.

HMG's initial assumption was that data would be best collected from manufacturers that represented a large majority of the market. The strategy consisted of three steps, described in detail in the sections that follow:

1. Determine Key Market Share Representatives
2. Collect Data from Representatives
3. Analyze data and determine baseline.

The intent was to first establish 2002 market share of qualifying window products in the Northwest market to serve as the baseline. The same data collection would then be repeated each year to determine 2003 and 2004 qualifying product market share. The change from 2002 to 2005 would be the measure of CWI program success.

Determine Key Market Share Representatives

The first step was to compile a list of manufacturers that represented the majority of the factory-built, punched opening commercial windows market in the Northwest. This approach appeared both reasonable and manageable based on interviews with manufacturers conducted by HMG in May 2003, in which respondents estimated that just four manufacturers accounted for 60%-90% of

this market. Adding one or two other manufacturers was then assumed to assure capturing a minimum of 80% of the market. Based on this information seven manufacturers were originally selected: Best Built, EFCO, Empire Pacific Industries, LBL Windows, Mercer Industries, Milgard, and Starline. WWG and the Alliance reviewed this list and agreed that it would be representative of the CWI market and a sound basis for judging the program. Subsequently, an eighth manufacturer, Atrium Windows, was added; they had exited the commercial market the year before, but re-entered in time to be included[12].

Collect Data from Representatives

The specific goal was to obtain unit sales data for each quarter of 2002 from each of the seven manufacturers. By asking for historical rather than current data we hoped to minimize issues regarding propriety of information. Although manufacturers tend to be very wary of giving out current or even very recent sales data, they seem to have much less concern over that which they consider to be historical. To further reduce concerns over releasing sales data we assured confidentiality and promised to report only aggregated data. A second important aspect was to request data that would provide us with the information we needed to construct a defensible baseline without being excessively cumbersome for manufacturers to extract from their records With this in mind, a form was created that requested the following:

1. **Total glazing sales.** Sales were categorized into four different window types commonly recognized within the glazing industry: curtainwall, storefront, site-built punched openings, and shop built punched openings. Qualifying product is specific to the factory-built punched openings category.
2. **Percentage of total sales specific to the Northwest.** The Northwest was defined as Oregon, Washington, Montana, and Idaho.
3. **Within the Northwest, percentage of sales specific to the commercial market.** The commercial market was defined by the interview instrument as being windows for new commercial and large multifamily buildings.
4. **Within the Northwest, percentage of sales specific to punched opening windows.** This consists of the entire residential market[13], plus a portion of the commercial market. Interviewees were asked if they had an accurate record of punched opening windows going into commercials buildings. If not, they were asked to fill out a second spreadsheet based on window size and nature of the window order for specific projects. No respondents felt a need to use the second method.

[12] At the time that CWI launched, the window company in question was called “Best Built.” It was bought by Atrium and shortly thereafter, the company exited the commercial window market in the Northwest. They re-entered the market in late 2003.

[13] Although virtually all residential windows are factory built, only a relatively small subset of commercial glazing is comprised of factory built products. Further, commercial windows are a relatively smaller portion of the factory built window market than residential windows are.

5. **Volume data regarding commercial punched opening windows.** Interviewees were given a spreadsheet to provide specific sales volume information regarding this portion of the commercial market. The spreadsheet asked for quarterly sales data by frame type, four bins of U-factors and four bins of SHGC values. The bins were devised so that CWI-qualifying product could be separated from non-qualifying product, regardless of whether it used metal or non-metal frames (see the table in Figure 3 below). The volume data were summed for all reporting manufacturers, by performance bin. They were then compared to the Ducker study developed for AAMA and the Window and Door Manufacturers Association (WDMA), which contains volume data for commercial punched opening in the Northwest.

In addition, our survey instrument (attached as Appendix Section 6.4) also included questions on:

- what they estimated as their company's share of the market, and
- any definitional differences that they felt might affect the confidence we should put in their data.

Once the data we needed was determined, HMG solicited the participation of a highly placed representative within each company. We intended to meet in person with each representative but were not successful in all cases.

At the meetings (or over the phone), we explained the purpose of the survey, the level of detail and accuracy that we desired, and the time frame over which we wanted them to complete it. We carefully developed and explained definitions of "market," "qualifying product," and "factory-built punched opening commercial product" to avoid incompatibility of responses from various manufacturers. In some cases, this first meeting was fairly short and served primarily to provide the company management with assurances that we were not seeking any information that could be used inappropriately. In these cases it led to a second meeting with a mid-level staff member who had dealt more directly with the appropriate data.

Results

Data was obtained from six of the eight manufacturers[14] Including the four who we felt comprised the majority of the market. We estimated the share of the commercial punched opening window market in the Northwest that is CWI-qualifying product as a simple percentage based on the raw, reported numbers from the reporting manufacturers. Equation 1 represents this calculation. Figure 3 shows the aggregated data that we received and the results of the calculation.

[14] Although the other two manufacturers had expressed their willingness to participate, we were never able to arrange a meeting.

Equation 1:

$$\text{Baseline}(\%) = \left(\frac{\text{total volume of qualifying product sold}}{\text{total volume of NW commercial PO product sold}} \right)$$

2002 Northwest Sales	Q1	Q2	Q3	Q4	**Year**
Metal					
Qualifying Product	133	166	206	159	664
Non-Qualifying	1,583	3,115	2,486	2,739	9,923
Total	1,716	3,281	2,692	2,898	10,587
% Qualifying	8%	5%	8%	5%	**6%**
Non-Metal					
Qualifying Product	45,774	59,934	65,260	57,314	228,282
Non-Qualifying	1,118	1,397	1,732	1,341	5,588
Total	46,892	61,331	66,992	58,655	233,870
% Qualifying	98%	98%	97%	98%	**98%**
Total					
Qualifying Product	45,907	60,100	65,466	57,473	228,946
Non-Qualifying	2,701	4,512	4,218	4,080	15,511
Total	48,608	64,612	69,684	61,553	244,457
% Qualifying	94%	93%	94%	93%	**94%**

Figure 3: Estimate of Market Share 2002

Analysis

The results presented in Figure 3 were not dissimilar to the data gathered by WWG and, as with the WWG data, were highly inconsistent with previous market research. Not only would these data indicate that CWI-qualified products already have nearly 95% of the market, but they would also argue that non-metal products have well over 90% of the market.

These percentages are completely at odds with the Alliance's 2002 Market Research Report[15], Ducker's data on metal vs. non-metal market shares[16], and estimations made by those in the industry. Additionally, many observers of the industry in the Northwest indicated that one specific manufacturer ("Manufacturer A") was likely the largest player, holding an estimated 30% share of the entire

[15] NEEA. *Market Research Report:* ***A Characterization of the Nonresidential Fenestration Market***. November 2002. Prepared by Eley Associates.

[16] Ducker Research, under contract with the AAMA and the Window and Door Manufacturers' Association, gathers data on sales of residential and commercial windows by region of the United States, and provides a report tracking major trends in the market. Ducker's data unfortunately places Idaho and Montana in a separate region from Washington and Oregon. It also has a few other discontinuities with the data needs of this project, but it does provide the means for a good first order estimate of market size.

market. In fact, that is also the estimation that Manufacturer A made[17]. However, the data appeared to show that Manufacturer A had substantially less than 10% of the market. Another manufacturer who estimated that they had a much smaller share of the market than Manufacturer A, appeared to have over 40% of the market.

HMG called manufacturer A back and asked for verification of the data. The contact "verified" that the data were correct. HMG subsequently called the manufacturer again and explored potential misunderstandings of critical definitions, as well as other potential causes for bad data. The manufacturer approximately doubled the number of products sold once he understood that we also meant for him to include product sold for use in multifamily new construction. This was still less than 10% of what we estimated should be his company's 2002 sales of commercial windows. It is our opinion that the data cannot possibly be correct, yet we have no explanation for why it would be so far off[18].

The data in Figure 2 are further brought into question when compared against the expected size of the market based on either Ducker's sales data or construction permit data.[19] These sources indicate that total sales should be in the range of 350,000 to over a million units. Our survey results are 30% less than the lowest figure in this range.

Rather than simply reject the data, we initially attempted to revise it to account for some of the known problems. Starting with WWG's estimate of total market size, and self-reported estimates of the surveyed manufacturers' share of the overall market we then assumed:

- Manufacturer A has 30% of the total market (this agrees with the consensus from interviews, but not with the data Manufacturer A provided)
- Everything that Manufacturer A and the remainder of the market (those not in or responding to our survey) make is non-CWI-qualifying metal product (the most conservative assumption)
- All other data from reporting manufacturers is reasonable

Starting with an estimated market size of approximately 653,000 units in 2002 and using the above assumptions, approximately 36% would be CWI-qualified and approximately 35% would be non-metal framed. This is roughly three times the Alliance's estimate of CWI-qualifying product market share at the beginning of the program. Further, it places the estimate of non-metal product market

[17] In keeping with assurances that HMG made to each manufacturer, no manufacturers' names will be reported.

[18] In subsequent information received just before the publication of this report Manufacturer A indicated that they are only reporting their vinyl window sales to the commercial market. They produce and sell a significant volume of metal framed windows but have not reported sales due to their internal difficulties in separating the data.

[19] WWG estimated market size based on building permit numbers and glazing area to floor area ratios used in savings potential estimates by the NPPC.

share more than three times higher than virtually every estimate given by manufacturers steeped in this market.

There are several possible contributing reasons that the data we received from manufacturers might not be accurate.

In follow-up conversations, it became clear that a major one was that we were asking for data that required the manufacturers to think about their companies and their sales in a manner very different from how they normally do. They do not, for example, make clear distinctions about product being used in Oregon, Washington, Idaho and Montana, as opposed to any other area. Neither do they generally think of their products in terms of the buildings in which they will be installed. Most of them have residential products and commercial products but either category of product can, and is, used in both types of buildings – particularly when multifamily is grouped with the commercial building sector. It is entirely possible that the manufacturers made their best effort but that the categories of information we requested were too unusual for them to give reliable or comparable data.

As a final check, we tried to gain a better understanding of the relationship of the Ducker data to that obtained from the manufacturers. Though Ducker data itself is statistically derived and therefore subject to uncertainty, it is universally acknowledged to be the best source for industry data. WWG and HMG therefore initiated a conference call with Nick Lamb, Vice President of Ducker. Uncertainties about some of the data segregation (e.g., the process used to split national data into regional data for factory-built and site-built, or between single family residential, multifamily, and commercial) are somewhat different from the uncertainties we encountered with the data we collected from manufacturers. The end result was that there appeared to be more uncertainty for more variables than we had initially thought and we ended up with less (rather than greater) confidence in the data we obtained from manufacturers.

In conclusion, it is our hypothesis that it is not possible to collect reliable data on window sales from enough manufacturers to allow for a useful estimation of the share of the total Northwest commercial window market that CWI-qualified products represent. This hypothesis is re-enforced by the poor results obtained by WWG in using manufacturers' data to conduct market share tracking (discussed in Section 2.2.9).

The possibility remains that we could test this hypothesis with further, similar activities, but we recommend that the Alliance consider whether such efforts would be worth the expense. This does not mean that it is impossible to establish a baseline estimate. It does mean however, that a baseline estimate based on manufacturers' data, might not provide enough certainty to justify the expense. The Alliance may wish to explore other measures by which the Initiative could be judged such as new product introductions or manufacturers' and architects' awareness of features of high-performance windows.

3.3 Process Evaluation Activities

For the process evaluation, we interviewed supply-side market actors at all levels and a small subset of the demand-side market actors to assess:

- their awareness of the Initiative,
- their opinions about the efforts of the Initiative,
- their familiarity with the Initiative's marketing materials,
- their perceptions of changes in other activities and programs (e.g., BetterBricks, utility programs,) related to the work of the Initiative.

We also interviewed some of the CWI staff, and reviewed:

- CWI web site (including interviews and case studies),
- CWI newsletters (*Commercially Speaking*),
- *Designer's Guide for Energy Efficient Commercial Windows*,
- *Step Up to the Plate* promotional material,
- Communication between WWG and the Alliance, and
- CWI monthly reports.

Market Actor Interviews

In the spring of 2003 we conducted 17 interviews with members of the commercial window industry. Nine of the interviewees were also CWI Steering Committee Members. The interview guide is provided in the Appendix 6.2..

Nearly all of the people interviewed felt that the Commercial Window Initiative would be successful in making a significant change in the market. The most common reason given was some variant of, "Because Gary Curtis has demonstrated he can make things like this happen." In other words, their history with Curtis has instilled in most of the people we interviewed a confidence in West Wall Group – outside of any particulars of the program design.

In addition to their confidence in the CWI team, about half the respondents felt that the strategy itself was an effective one that was likely to succeed. This does not mean that they felt it was the best approach – just that it would cause a change in the market.

Despite their confidence in the CWI team and the effectiveness of the CWI strategy, most (all but three) felt that the CWI was not the appropriate approach. For the most part, the reservations fell into one of two categories: 1) the wrong performance specification levels, or 2) fear that a prescriptive (rather than performance) approach will lead to bad choices (both in specific building projects and in the market as a whole). Out of the seventeen interviews completed, only five thought that each individual specification (U-factor, SHGC and VLT) was appropriate. Out of those five, two still thought that the product defined by the three specifications taken together was too much of a push for the market. The three who thought the entire specification was appropriate, and not too much of a push, were a vinyl frame extruder, a predominantly residential window manufacturer, and a glass manufacturer who makes a qualifying soft coat product.

It is important to note that at the time of the interviews, the specification was in transition. Two questions, (1) whether a U-factor of 0.40 could be met by enough products that it did not constitute too much of a push, and (2) how the new NFRC simulation procedures would affect the rated U-factors for metal products, had caused WWG to go back and do further research.

Some interviewees expressed reservations about the strategy becoming a national approach without substantially more input from the industry. They were concerned that some very appropriate products could be effectively restricted (banned) from the program, similar to what they perceived to be a previous problem with the Residential ENERGYSTAR® Window program. One glass manufacturer said that he was ready to fight the CWI program until he was told that it was a Northwest only program with no specific plan for going national.[20] Others said that they had already talked with Rich Karney of DOE to try to get some assurance that he is not considering adopting the CWI as a national Commercial ENERGYSTAR® Window program. We did not discover during the interviews in spring 2003 whether parties felt they had received such assurances, but in subsequent discussions with HMG, DOE indicated that they **are** interested in evaluating CWI as a prototype for a national Commercial ENERGYSTAR® Window program.

A few respondents said that they thought the CWI specifications would essentially outlaw pyrolitic (hard-coated) glass. We hesitate to report a fear about "outlawing" a product (relying on a prescriptive approach only) since this is a voluntary program, but it points up another interesting and significant finding. The people in this industry with whom we spoke include company presidents, division directors, association spokespeople, etc. Still, there was a relatively low level of sophistication about building energy performance issues, the relationship of codes and standards to programs, and even window energy performance issues. This apparent lack of knowledge seemed to color a number of the responses about the program and its potential impact.

One of the people interviewed was Charlie Curcija (three others recommended that we talk with him). He is with the University of Massachusetts and is perhaps the lead outside technical consultant to the NFRC as it evaluates options for improving the analytical (rating system) tools. Charlie was the only one who refused to venture an opinion as to whether each of the three performance factors (four, counting the two U-factors) was appropriate, though he did say that he thought the overall product described might be too much of a push. His main concern was that a building level analysis was needed (rather than just product analysis) to determine the appropriateness of the specifications. He requested the CWI team perform this level of analysis, but WWG and the Alliance

[20] This party may have misinterpreted what he was told. Although there is "no specific plan for going national," one of the original stated goals of the CWI is to establish a regional program that can be morphed into a national one. The fact that the plan is not at this time "specific" may be of small consequence.

concurred that this did not appear to be workable as a market transformation strategy since it would require ongoing review on a project specific basis.

As mentioned above, several of the reservations about the CWI specifications were that they are specifications – rather than guidelines that allow for balancing of all three performance factors (or just the first two, for those who "do not believe that VLT is an energy issue") to find an optimal product. Although these same people understood the value of a simple, prescriptive approach, they either felt that the approach was inappropriate for the commercial window market, or they felt a simplified alternative calculation approach should be allowed.

When asked about what **they** would do if they wanted to change the market for high performance commercial windows, the most common answer was to put high performance specifications in the codes. The next suggestion was development of a simplified tool that could be used in the architect's office to demonstrate the cost-effectiveness of an energy efficient window in their specific project (7 respondents), followed by cash incentives (5 respondents).

The comments from the interviewees are summarized below:

1. Virtually all of the appropriate[21] industry members knew about the Commercial Window Initiative.
2. Most did not feel like they had been adequately informed of decisions before they were made. ("If there have been (or are to be) changes made to any of the specifications, the CWI needs to let the steering committee know. … and explain the changes.") [This seems to be an anomaly of the timing of the survey. CWI was busy examining an alternative to the first draft set of specifications and subsequently did vet them with the Steering Committee.]
3. Many wanted to see analysis that showed that the CWI specifications result in energy savings. ("The technical opinions and analyses that have been offered were largely ignored.") [Results of the analysis were made available on the CWI web site and Steering Committee members were made aware of how to review them. The analysis, by the NPPC, is still on the CWI web site.]
4. Most expected that the program will be successful at increasing market share for qualifying products. ("…for better or for worse.")
5. Many did not necessarily think it's a good thing because they do not like one or another of the specifications that have been adopted. (Even one of the five who did say they thought the U-factor was appropriate also said "but that's a tough one for metal to reach. It will have to be a ***very*** good T-break product to meet that requirement.")
6. Many "feared" that the CWI would become either a code requirement or a national program without sufficient analysis or industry involvement.

[21] By "appropriate" we mean the industry leaders in those portions of the commercial window industry that will be affected by the CWI.

7. A significant number wanted a simplified modeling tool to take along to architects' offices. ("Be ready to prove to the architect and/or developer that there is a positive benefit/cost ratio; either with a portable program or by pre-calculating a number of buildings and building types using a valid simulation program (e.g., DOE 2).")

Preliminary Summary of 2004 Market Actor Interviews

The interviews that were begun in October 2004 have not yet been completed. So far, HMG has interviewed ten of the original 17 who were interviewed in 2003, and another two who have been identified as important market actors in the interim. Two of the original 17 are no longer with their firms. However, there are some interesting findings to report from those interviews that are done.

There appears to be less concern than before that the CWI specifications are too hard for metal frame products to reach. In 2003, those who felt the metal frame U-factor was not appropriate outnumbered those who said they thought it was by nearly two to one. So far, only two people have expressed concern and they both stated mitigating factors that could change their minds. One cited the NFRC procedure (even the revised version) as creating a difficulty for gaining appropriate, rated U-factors, and the other proposed that a trade-off procedure that would allow CWI participation if the average of all products in building met the specification would solve his concerns. One active member of the Steering Committee who was fairly vocal in his concerns about the metal frame U-factor last year, now states that it is appropriate and he fully supports it.

Another interesting set of responses are those showing a change in opinion about CWI's chances for success. Five interviewees answered that they either think CWI will not change the market or they have significant reasons to be unsure that it will. That is not to say that the tide of opinion has swung that direction; these respondents are balanced fairly evenly with those who either feel they see a change happening already or that they soon will. Two respondents who last year thought CWI would be effective, now say they don't think it will; and two who last year said it wouldn't be, now say they feel it will be.

One of the reasons that was given this year for why CWI might not move the market was that "it takes incentives to make the change." Significantly, this window manufacturer feels they make a more efficient product, that there are too few competitors who do yet, "so [his] customers are concerned that they are being gouged on price." He wants utilities to cover the cost increment and is convinced that large portions of the commercial building sector are so price conscious that nothing else will make the difference. It is noteworthy that this same respondent indicated that he thinks the CWI is doing a good job and that he supports WWG's efforts completely.

When asked what they thought about the possibility of CWI expanding scope to address all segments of the commercial glazing market, nearly everyone thought it was a good idea. The sole dissenter, who does not make any products that fit the expansion categories, felt that it would water down CWI efforts too much, and

that they should be focusing on the commercial market sectors where customers care about energy efficiency: small office and multifamily buildings. Some others, although supportive of the idea, had cautions. For example, one northwest window manufacturer feels that the NFRC procedures (both rating and certification) have to be acceptably completed first, and CWI should spend some time researching the relationship of various SHGC specifications to the choice of products available. Several respondents thought that expansion to the site-glazed commercial window market would solve a number of problems associated with helping architects with their design problems, which they generally think of in terms of the whole building rather than specific window types.

CWI Interviews

As well as on-going discussions and meetings with WWG from the start of the evaluation process, the evaluation effort also included formal interviews with key personnel involved in implementing the CWI. These interviews were conducted in the summer of 2004.

One of the principal issues covered was differences between CWI staff's expectations before launching the Initiative and the reality they found. Because CWI staff had all worked on the Alliance's residential window Initiative previously they felt they knew the industry well and had strong beliefs about what they should be able to accomplish. The following summarized discussion items from the interviews show this was not always the case.

> *Manufacturers are aware of the benefits of high performance windows, but cannot motivate architects to use these products because of anticipated added costs without a clear understanding of the added benefits.*
> Once CWI staff began working with various manufacturers they found that many sales staff either did NOT know the energy performance benefits of their products or were reluctant to talk to a client about any product other than what they had historically sold to them (for fear of losing the sale). This understanding contributed to CWI talking with sales staff more about HOW to market the high performance products.
>
> *CWI staff thought that their offer for doing "Buddy Calls[22]" would be readily embraced as a means to selling higher profit products, and that they'd be doing more of them sooner.*
> Staff found that some manufacturers' reps were not making sales calls at all, others were using the calls just to keep the relationship alive, and others were not interested in having anyone accompany them. CWI is putting less emphasis on the Buddy Calls and more on equipping sales staff with knowledge and tools, as well as providing incentives for sales

[22] "Buddy Call" is the term that CWI coined for their joint sales calls with manufacturers reps. CWI staff accompanies the manufacturer's sales people on visits to architects and developers. The manufacturer sells their brand, and CWI up-sells to the more energy efficient products from that manufacturer.

staff to incorporate discussion of high performance products in their normal (solo) sales calls.

Conventional wisdom, which CWI staff accepted, was that vinyl window products hold a very small portion of the commercial window market.
For the kinds of products on which CWI has so far been focused, vinyl now appears to have the lion's share of the market. It turns out that for punched openings in relatively low-rise projects, vinyl is very competitive on price and has gained a larger market share than was expected. Another related revelation is that the "conventional wisdom" seems to have incorporated the full range of commercial fenestration (including curtain walls and store fronts), where vinyl's share may still be quite small. In other words, when window industry pundits say that vinyl has a very small share of the commercial market, they appear to be thinking of at least as much, if not more, about curtain wall and site glazed products as about factory built windows. However, the current focus of CWI is factory-built product for punched openings, and, it includes the semi-residential category of multifamily buildings. Vinyl products can have a larger share in these market segments, and still have a relatively small portion of the overall commercial glazing market.

CWI staff thought that the primary barrier with architects was their lack of knowledge of high-performance features available on certain manufacturers' products. If that barrier could be bridged then there would be a change in the market.
They found instead that there are a number of smaller, not entirely unrelated, barriers that have to be concurrently addressed. For example, there is a "diffusion barrier," such that information and training that CWI gives to the lead architects in a shop does not get to the dozens of other architects working on project drawings and specifications within their firms.

Additionally, architects are eager to hear about the new technologies and the impact the technologies have, but they are very averse to any presentation that feels to them like they are being "sold" a feature or product. Another example is that architects accept liability for their designs, CWI does not. The barrier is that unless architects see a local track record of products being used, they are wary of adopting what CWI tells them they should, regardless of the perceived (but unproven) benefits.

Another barrier was actually known to WWG before the CWI program began, but was thought to be relatively minor until it came up in several conversations with architects. Architects think of commercial fenestration in terms of an entire building; they do not naturally separate out factory-built products for punched openings. An inability to provide advice about CWI-qualified products across the spectrum of what architects need to

address in a building appears to have significantly diluted the power of the CWI message for some architects.

Similar to the Northwest residential window market, CWI expected the commercial market to be comprised almost entirely of product from regionally based manufacturers.
Staff found that a lot of product is manufactured elsewhere and shipped in. They even "discovered" some manufacturers, not local and not in the residential market, that WWG had not previously known were in this market. This surprise was principally because those manufacturers had had no contact with WWG (D&R, at the time) during the residential window program.

Staff expressed frustration that they were not able to move as quickly as they would have liked in the earliest stages of the Initiative, but they also felt like they were making a big difference in the industry. The primary reason that they were not able to launch many of the efforts as early as they wanted to was that they had to spend more time than they had anticipated in coordination with the industry establishing the qualifying specifications. Nonetheless, they stated that it was important to have all the players on board before they moved forward.

WWG/CWI was responsive to the concerns expressed in the market actor interviews. For example, they deemphasized the VLT as one of the qualifying criteria. Although VLT is still one of the stated specifications, WWG only tracks sales data by U-factor and SHGC. CWI staff also made additional efforts to help manufacturers understand that they were working strictly on marketing and education efforts, and not pursuing CWI qualification criteria as a code or standards issue.

3.4 Evaluation of CWI Outreach

One of the CWI goals is to have the Initiative's efficient products criteria be widely accepted and recognized by those interested in energy efficiency. To this end, the WWG not only created a web site and newsletter specifically for the program, but also provided press releases to trade publications and relevant organizations. One primary activity was to make numerous presentations to the supply side (e.g., window manufacturers) and the demand side (e.g., architects) of the commercial window market.

3.4.1 CWI Web Site

When we reviewed the CWI web site (www.commercialwindowsinitiative.org) several times during 2003 and 2004[23], we found it to be of professional quality

[23] Most recently in November of 2004.

but quite sparse. For example the *Technical Information* page, contains links to pages that provide:

- reports from steering committee meetings,
- results of analysis performed by C. Curcija proving that a metal frame window with a thermal break, low-E glazing, and Argon achieves the CWI-qualifying criteria (U= 0.42, SHGC= 0.40),
- results of whole building analysis performed by C. Gardner (including several types of buildings), and
- 2002 report by Eley Associates called, "*A Characterization of the Nonresidential Fenestration Market."*

However, there is no explanation of what any of these documents are nor how they fit into the specification development process. In fact, other than the links to these documents, there is nothing on the *Technical Information* web page.

Other pages on the site include: "*On The Boards: Real Stories About Real Projects that Aren't Done Yet,*" "Contact Us" (an email link), "*CWI Links*" (which is under construction, "*Upcoming Events*" (which lists and describes the *Step Up To the Plate* promotion and *Windows On Design* tours), "*CWI Specifications*," "*Marketing Information*," and the home page (which includes some interesting interviews with design professionals). The *Marketing Information* page has the most information actively linked to it. For example, it includes:

- Guidelines and restrictions for use of the CWI logo,
- Commercially Speaking (editions #1, #2, and #5; editions #3 and #4 are inexplicably absent),
- Personality and Project Profiles.
- A CWI Program brochure, and
- PowerPoint presentations made at an AAMA meeting and two lighting labs (Portland and Seattle).

Although WWG touted its *Designer's Guide for Energy Efficient Commercial Windows* during interviews[24], the guide does not appear on the web site. WWG indicated that the large number of graphics overwhelmed the site but this technical problem can certainly be overcome and HMG recommends that WWG pursue a solution. The *Designer's Guide* is well done and will certainly be well received by the design community. The CWI web site would be a good place to publicize it.

3.4.2 Print and Electronic Outreach

In its monthly reports, CWI listed recipients of press releases and other outreach efforts. Since this type of outreach is one of the program's specific goals, we evaluated how much effect there was from the outreach actions CWI took. We also attempted to gauge how much recognition CWI was getting in print and on web sites, whether or not they specifically sought it.

[24] The *Designer's Guide* is described more fully in Section 2.3.4.

Evaluation included a survey of relevant trade publications (late 2002 through June 2004) and web sites (including CWI's), and follow up contacts with selected trade organizations to asses their awareness of the Commercial Window Initiative and the West Wall Group. Publications and web sites searched included those focused on glass and fenestration related issues, whether from a national or regional perspective, and commercial construction related from a Northwest perspective (e.g., AIA chapters in the four-state area).

We searched for articles about the CWI, articles that mentioned CWI, letters mentioning CWI, and manufacturers' advertisements mentioning CWI. In our search, we included "Commercial Window Initiative," "CWI," "West Wall Group," "WWG," "Gary Curtis," "Northwest Energy Efficiency Alliance," "NEEA," and "BetterBricks." When we found mentions of the Northwest Energy Efficiency Alliance, NEEA, or BetterBricks, we searched further to see if it was related to the Commercial Window Initiative or some other issue. In general, before US Glass' July 2004 article, we found very little mention of CWI.

When we conducted the survey, U.S. Glass indicated that they would be running a short article on CWI in their July 2004 issue. We verified that this issue, which has a focus on energy efficiency, included a half-page article on the Initiative. The article highlighted the CWI *Step Up to the Plate* promotion and the *Designer's Guide for Energy Efficient Commercial Windows*." U.S. Glass also said that they planned to describe the CWI in their June 2004 "*Architects Guide to Glass*," which is a biennial publication.

In their June 2004 newsletter, the Efficient Window Collaborative published an article based on CWI press releases. A half-page article highlighting the efforts of CWI also appears in the August 2004 edition of the NFRC newsletter. The Seattle *Daily Journal of Commerce* published a half page article that WWG reported resulted in numerous calls to CWI inquiring about the program.

We were unable to find any other entity that published any of the press releases that WWG disseminated, although most of the people we spoke with at these organizations indicated that if a new press release was sent (to the right person), that they'd be happy to either publish it or write an article based on it. Several indicated that they recalled or had records showing that they had received something about CWI, but that it did not go to the right person. The *Daily Journals of Commerce* for both Portland and Seattle indicated a willingness to highlight the Initiative. AIA Seattle said that they were working a lot with the CWI but still had not put anything on their web site or newsletters. The National Fenestration Rating Council has mentioned Gary Curtis in their newsletters several times because he is a Board Member, but before the most recent edition (August 2004), they had not mentioned CWI. They indicated that they would like some information on the Initiative since they were going to redo their web site.

As a comparison, we also searched all the same published and electronic sources for ENERGY STAR® in relation to windows. As shown in Figure 4, we found 16 references to ENERGY STAR ® Windows, two each to Gary Curtis and CWI, and one for The Alliance. One of the two CWI mentions was on the

BetterBricks web site, but the other was in an article within the National Wood Window and Door Association's web site.

Web Site Search Results	
Keyword Search List	**Total Number of References**
Commercial Window Initiative or CWI	2
Northwest Energy Efficiency Alliance or NEEA	1
West Wall Group	0
Gary Curtis	2
Energy Star window	16

Figure 4: Web Site Review Results

Web sites that we reviewed with no mentions of the CWI included: AAMA's (both National and Western Region), six AIA locals in the four state area, USGBC, OIKOS, IRIS Communications and Seattle Department of Planning and Development. Oikos and Iris Communications are both organizations in the Northwest that specialize in obtaining and disseminating information about energy efficiency and sustainable development tools, programs and equipment.

In subsequent discussions with the CWI staff about these findings, they indicated that they had not made an effort to follow-up and ensure that press releases were published, or even reached the right people. Such outreach was envisioned by staff as being more important in the later stages of the program, while direct marketing (e.g., brochures, *Design Intent* lunch and learn sessions) was their focus until now. They also decided to develop relationships with the media contacts at the magazines and associations we surveyed so that future press releases would reach their targets and get published.

3.4.3 Direct Contacts

There have been three general types of direct contact that WWG has used to increase awareness of CWI and promote high-performance commercial windows: manufacturer focused, architect and engineer focused, and design team focused.

Manufacturer Contacts

Beyond the specific Steering Committee contacts, CWI cultivated manufacturers' support and input to the design of their efforts through hosted events at larger meetings (conferences) that the manufacturers were already attending, as well as by phone, email, and personal meetings. Their monthly reports list nearly sixty separate meetings with manufacturers. While the bulk of the earliest manufacturers meetings (through Spring 2003) were focused on honing the CWI specifications, the next round of meetings (through approximately Fall 2003) concentrated on developing leads for case studies of commercial buildings with CWI-qualifying windows. Most of the more recent meetings were designed to help the manufacturers market their high-performance products. Additionally, the

steering committee that was created to help develop the technical specifications, was utilized to get more targeted input on the program marketing efforts.

At the outset of the program, WWG had hoped that the manufacturers would be able to assist in developing the marketing messages for CWI, but that proved not to be the case.

Designer (A&E) Contacts

During 2002, while WWG was in the process of designing the outreach efforts of CWI and developing agreement on the specifications, they met with thirteen different Northwest architectural and engineering firms. An original plan was that the input from the demand side of the market would be coordinated through the Alliance's ***Better Bricks*** contractors, but it became apparent over time that this was not going to occur. WWG team members then arranged meetings directly with the architectural community for their input on program and marketing design.

CWI team members have now met with over 600 architects and engineers. Many of these meetings have been lunch time brown bag ("Design Intent") presentations on the performance advantages of high-efficiency fenestration. They tailored the messages to the language of the architectural community: solutions, not windows. It was not about the products, but about the technologies in the products and the performance advantages these technologies impart.

CWI has also made several presentations at design centers (e.g., the Seattle Lighting Lab) and AIA gatherings. By talking to architects about specific window technologies, and how these technologies affect the system and building performance, CWI appears able to get them excited about the kinds of products that are CWI-qualified. At one AIA presentation in Idaho, the CWI team got a standing ovation from an estimated 50 architects.

The CWI team learned from these presentations that the architects' knowledge about fenestration performance issues is not as good as CWI had assumed. Most, when asked, could not explain what solar heat gain coefficient (SHGC) measures, and in fact, did not know there is a difference between SHGC and shading coefficient (SC). Likewise, they did not know the difference between a low U-factor and a low-E coating. Most architects demonstrated that they did not understand that there are many different types of low-E coatings, nor what advantages different kinds impart; similarly they appeared to lack an appreciation for the variation in products' thermal break performance. The CWI team had to start with basics and describe the functional parts of a high performance glazing system, and how the features worked together to provide thermal comfort and energy savings.

Buddy Calls

What CWI is calling "buddy calls" are pitches to architects and developers coordinated with a manufacturer. CWI staff do not try to affect the decision of whether a project should use any specific manufacturer. The purpose of "riding along" with the manufacturer on *their* meeting with an architect, is to help show

the advantages of that manufacturer's high-performance products (versus their standard products).

CWI staff felt a little discouraged that they were not able to begin making the buddy calls as soon in the program as they would have liked. There were two reasons this didn't happen. First, many manufacturers were reluctant to have anything (such as discussions about performance features and advantages) potentially slow the decision to purchase. Manufacturers' representatives expressed some fear that such a discussion would give the architects and developers an opportunity to buy someone else' product.

Second, WWG realized early on that they would first have to teach manufacturers how to talk to architects. Even when manufacturers were advised that they would get farther with architects by selling features, solutions and technologies, they still sold their company and products. Additional buddy calls continue to be scheduled, with architect meetings often now initiated by CWI rather than the manufacturer. This appears to allow CWI the space to "teach" the manufacturer about how to approach the meeting, in a way that they probably couldn't if the buddy calls were initiated by the manufacturer.

3.4.4 Co-funding From Manufacturers

To date, WWG has documented manufacturers' co-funding of over $1.2 million toward its progress indicator goal of $1.5 million. This includes $500,000 for product development and plant changes by one manufacturer in the second quarter of 2004. Of the rest, most was in-kind donations in the form of manufacturers' staff time spent meeting with the CWI team (separate from the Buddy Calls), training on marketing of high performance products, and similar activities. Manufacturers did however spend a significant sum for promotions of CWI-qualified products. Three of them put up a total of nearly $45,000 for the *Step Up to the Plate* promotion, more than double what the CWI team had hoped for. Manufacturers spent another $16,000 on other promotions in coordination with CWI. The current pace of contributing would leave the CWI a little short of its goals by the end of 2006.

3.5 Key Findings and Recommendations

3.5.1 Unreliable Data for Market Share Tracking and Baseline

The principal finding is that the foremost performance criterion for the Commercial Window Initiative appears not to be easily measurable. West Wall Group and the HESCHONG MAHONE GROUP have both collected data from manufacturers on their sales, both of qualifying products and of all products. The data from manufacturers leads to untenable conclusions and it is now clear that manufacturers' data alone will not be sufficient to establish CWI progress.

As mentioned elsewhere, HMG has two alternative recommendations. One is to consider other metrics for evaluating the effectiveness of the CWI program efforts

such as new product introductions or manufacturers' and architects' awareness of features of high-performance windows. The other option is to spend significantly more on designing and implementing a data collection and analysis plan. The Alliance is exploring this possibility, which would include significant in-field data collection that could address many of the issues raised in this evaluation. If the Alliance decides that changes in market share of CWI qualified products (one necessary element for estimating the energy impact of the program) must still be tracked, then HMG recommends that the data be gathered by Ducker Research. Ducker, through its strong pre-existing reputation and connection to the fenestration industry, has the best prospect for success in obtaining reliable market share data.

3.5.2 Products Developed to Meet the CWI Specifications

At least three manufacturers have said that they are developing products specifically designed to meet the CWI specifications and capture a piece of the Northwest commercial window market. Even without knowing how successful they are or will be in acquiring market share with their new products, their significant commitment to meet CWI specs is a clear sign of market impact.

3.5.3 Market Structure

The original program approach was limited to factory-built products for punched openings and left site-glazed products for a later stage. This caused two dilemmas. First, the manufacturers do not necessarily track site-built versus factory-built products as the raw materials that go into them are the same. This may have contributed to some of the difficulty in obtaining reliable data on product sales.[25] Second, CWI staff found that architects do not make such a distinction either. They tend to see glazing as a feature of their projects, and seek any solution that helps them meet their design intent. Glazing is glazing, whether built in a factory or on site. The program's restriction to one segment of that continuum added some difficulty in the team's efforts to help architects understand the benefits of CWI-qualified products. Now that the new NFRC rating and testing procedures for site-built windows are available, HMG recommends that CWI address all commercial glazing.

3.5.4 Manufacturers' Attitudes

Manufacturers' opinions of the program improved over time. Our initial meetings and interviews (as part of the evaluation) revealed that a significant portion of the window manufacturers viewed the CWI with caution (at best) or apprehension (at worst). Many of those same manufacturers are now partners on CWI efforts.

[25] This is not to say that confusion between site and factory-built products was the sole factor. It is not clear that even if the program solves this issue by expanding its focus to include all commercial glazing, that it would be possible to obtain a reliable estimate of various manufacturers' market share, or of qualifying products' market share.

HMG is currently in the process of completing the second round of manufacturer interviews, but preliminarily it appears that the comments are more positive. Although some manufacturers said in 2004 that they do not think or are not sure that CWI will be successful, most of them still praise what CWI is doing. Several stated that they are working with CWI on their *Design Intent* sessions, devoted some of their staff's time to joint promotions with CWI, or are collaborating to have some of their projects highlighted in case studies.

3.5.5 CWI's Approach to Market Actors

WWG learned that the architectural community, and even most of the manufacturing community are much less aware of energy performance issues than had been thought at the program outset. Perhaps more important, they learned that the energy efficiency community and the architectural community do not speak the same language. WWG initially assumed that the window and glass sales reps that call on architects would have educated and informed the architects about high performance glazing systems. But as noted above (Section 3.4.3), most window and glass reps calling on architects are simply taking orders. The sales reps want to make sure that their brand is called out in the specifications the architect uses and then ordered. The sales reps do not want to do anything that might slow down *or lose* the sale (i.e., give their competitors an opportunity to "steal" the order).

Consequently, WWG had to revamp their messages to teach architects and manufacturer reps about U-factors, SHGC and visible transmittance. They had to explain what kinds of technologies affect each – even to the point of explaining that low emissivity and low U-factor are not the same thing. They now spend much of their time with architects and manufacturers' representatives providing information about performance in the language that the recipients use. The lunch time sessions have been modified to accommodate this need. HMG recommends a continued modification and revision of the training materials to be responsive to the diverse needs and learning styles of architects and to support program claims. The evaluation team suggests that the Alliance and the CWI team develop new metrics for evaluating program progress.

3.5.6 Metal versus Non-metal Market Share

Vinyl windows are ubiquitous in the northwest residential market, but were thought to have a fairly small portion of the commercial window market. Data from the manufacturers and architects (and commercial building projects) with whom CWI has worked provide a different story; vinyl has the majority of the market. This may be due largely to the particular portions of the market on which the program has so far focused: factory built fenestration for punched openings, and a "commercial" sector comprised largely of large multifamily projects. The residential building sector's shift to vinyl windows over the past decade and a half has carried over into the multifamily sector. And, since vinyl does not lend itself to "site built" processes, the balance of the market (which CWI has not yet approached) could be almost entirely metal frame. This may provide the basis

upon which the market pundits rely when declaring that vinyl windows hold a very small share of the (overall) commercial window market.

4. PROGRAM DIRECTION

The scope of the CWI as approved by the Alliance Board includes the task of exploring opportunities to expand the project to include all types of commercial glazing systems and all applications. The work plan anticipated exploring these opportunities in 2004-2005 with an expectation of presenting recommendations for expansion to the Alliance in the summer of 2005. However, several convergent influences encouraged WWG to consider reshaping the program earlier.

4.1 Modified Commercial Window Initiative Proposal

The following sections provide a synopsis of the key points of a WWG proposal to the Alliance along with HMG's comments based on the evaluation to date. The proposal is currently under consideration.

4.1.1 Expansion will not Fundamentally Alter the Program

It is important to note that the basic market transformation hypothesis is unchanged by expansion of CWI to include all commercial glazing systems[26]. The market barriers (lack of knowledge, cost/perceived cost, and split incentives) faced by the factory-built window market are the same barriers faced by all commercial glazing systems. The strategies and tactics to overcome the market barriers and achieve market persistence are also unchanged by expansion of the project. The CWI project team will continue to offer informational, educational, marketing and promotional activities targeting manufacturers and their distribution channels on the supply side and architects, specifiers and developers/owners on the demand side. The CWI team will also continue working to increase the use of factory-built commercial windows that meet CWI specifications.

While most of the strategies and tactics used by the project team will simply expand in content, some new activities will be required. In particular, the project team will work with the Steering Committee to develop performance criteria for those products not addressed by the current criteria.

HMG Comment: A number of the large manufacturers make products that span the gamut of commercial fenestration. Since manufactured, punched-opening

[26] The market transformation hypothesis (more high efficiency windows will be installed in commercial buildings if (a) an easily recognized identification mark (e.g., a label or a logo) is developed that helps users identify and select them, and (b) market actors are provided outreach and education on the value of high-performance windows) is unchanged. However, the p rogram theory that starting with a discrete portion of the commercial windows market would help to establish a foothold in the market that could then be expanded to all window types over time has proven incorrect.

products represent a relatively small portion of their overall business, they have been either on the periphery of the program so far or outside the discussions altogether. This recommended program change should bring them in and provide the Initiative with more force.

Based on interviews with the CWI team about their outreach to the architectural community, it appears that this expansion could make the task of training easier. Architects tend not to think of factory-built windows for punched openings, but rather "glazing solutions." If the Initiative encompasses all commercial glazing, then CWI staff would be able, with less effort, to provide a more useful set of messages to the design community.

4.1.2 NFRC has moved more rapidly than expected.

While NFRC ratings have been available for site-glazed commercial products for several years, the NFRC rating and certification procedures did not fit well with the business practices of commercial glazing manufacturers. NFRC recently revised its *rating procedures* to better fit the business practices of the industry. Revised *certification procedures* were expected to be approved in the fall of 2004, but were delayed and may not be available until the second quarter of 2005. While these changes in practices at NFRC were anticipated at the beginning of CWI, it has moved much more quickly than expected.

HMG Comment: While it may have appeared for a time that NFRC was moving rapidly because the revised nonresidential rating procedure was adopted more quickly than expected, the rating procedure is, at best, only one half of the needed revisions. The outline of the revised certification procedures continues to cause many industry members concern. Consequently, the appropriate committee has not yet been able to move beyond an outline. Gary Curtis was recently named as the Co-Chair of the NFRC Nonresidential Products Certification Sub-Committee in hopes that he could help speed the process.

4.1.3 Tracking market progress will be enhanced.

Tracking market progress through sales data and other progress indicators will be easier if CWI better fits the way market actors work. The current project scope asks manufacturers to track sales differently than they commonly do for their own purposes. As discussed above, manufacturers do not necessarily distinguish or track their product installations by building construction (e.g. punched opening). Expansion of the CWI scope to include all commercial glazing systems will allow CWI to better accommodate the way market actors think about, specify, produce, distribute and install commercial glazing systems.

HMG Comment: The proposed change would have the principal advantage to evaluation of removing one source of error in gaining reliable market share data – manufacturers' difficulty with conceptualizing (and reporting data for) the factory-built, punched opening window market as distinct from the rest of the commercial windows (or, in some cases, residential windows). It is not clear how large a contributing factor that was in the difficulty of obtaining reliable, consistent

market share data from manufacturers. Therefore, it is not clear how much the proposed program expansion will assist in getting more reliable data.

4.2 Savings Potential

West Wall Group also provided an estimate of the energy savings potential from expanding the program as they have outlined. This section describes their estimation and provides the evaluation critique of the methodology.

4.2.1 Market Size

Glazing used in commercial building projects includes four basic categories: site-built punched openings, factory-built punched openings, curtain wall, and storefront. Ducker estimates that the glazing market for commercial buildings in Oregon and Washington represents approximately 17 million square feet of glazing annually. Multifamily projects represent approximately 2 million additional square feet of glazing. Ducker estimates that *commercial windows* (factory-built or site built windows as opposed to curtain walls or store fronts) represent approximately 40% of the glazing used in *commercial buildings*. Ducker estimates that curtain wall and storefront glazing each represent approximately 30% of sales for a total of 10 million square feet of glazing in the two states. (30% curtain wall + 30% store front + 40% windows = 100% of commercial glazing in Oregon and Washington.) Alliance staff previously estimated Idaho and Montana sales (based on their share of the region's commercial electricity sales) as an additional 19%, or 1.9 million square feet. Thus, the estimated total market is 12 million square feet of curtain wall and storefront glazing.

HMG Comment: These data need to be used with caution. The assumption that Idaho and Montana represent 19% of the fenestration market in the Northwest is based on the fact that those states use 19% of the electricity and, lacking any better conversion, that they therefore receive 19% of the glazing. While it is *likely* that the percentage is not dramatically off, it is also quite *possible* that differing climatic conditions and demographics *could* cause the estimate to differ substantially from the market reality.

Further, many of Ducker's estimates of market splits (e.g., curtain wall vs. store front vs. punched openings) are based on national averages. In some cases, the unique set of circumstances in the Northwest (e.g., relatively advanced building codes, a history of aggressive utility programs, seismic design considerations) are likely to cause national averages to be quite far off for the Northwest.

The evaluation so far has shown, more than anything else, that estimates of the character of the market based on rough data from several sources and tempered by a current and personal familiarity with the market, might not be verifiable with data. The best option is therefore to develop better primary data such as the previously mentioned in-field market research the Alliance is considering, or

Ducker Research data specifically focused on the unique character of the northwest fenestration market.

4.2.2 Product Performance Baseline

Previous market studies have identified typical base case glazing system performance values as U-0.55 and SHGC 0.45. For the purpose of estimating savings and cost-effectiveness, WWG suggests a criteria similar to the current CWI criteria for factory-built glazing (U-0.42 for metal framed systems; U-0.35 for non-metal framed systems; SHGC 0.40 for all systems).

HMG Comment: It is likely that manufacturers will make the same arguments previously discussed about U-0.40 being too much of a push for factory-built commercial windows. Unless there is clear and compelling evidence that U-factors for site-built windows, curtain wall systems, and store fronts are generally lower than for factory-built windows, the Initiative should use U-0.42 for all metal frame products.

4.2.3 Market share

The project team anticipates achieving a 25% market share for qualifying products in the storefront and curtain wall glazing market by the end of 2007.

HMG Comment: WWG has not established the current market share for CWI-qualifying products. It is certainly not zero and may, if the information we have on factory-built windows is any indication, actually be at or near the target level already, at least for non-metal products. The estimation methodology seems (without being explicit) to assume that either (a) the current market share is zero and they will achieve a 25% market share, or (b) that CWI will raise the market share by 25%, regardless of what it is now. Either assumption requires a solid, verifiable estimate of the baseline condition.

If the proposes to use “achieving a 25% market share for qualifying products in the storefront and curtain wall glazing market by the end of 2007” as a measure of their success in the changed program, then the Alliance should require them to “prove” that the market share in this new (to them) market segment is not already above the target percentage. Indeed, the Alliance should require that (a) a methodology for gaining a reliable estimate of the baseline and future market share for CWI-qualified product be developed and externally critiqued, and (b) require the gathering and analysis of the data that would establish or verify their estimate.

4.2.4 Savings Calculation (Estimate)

WWG estimated the potential energy savings for the new expanded scope of work by taking the total storefront and curtain wall market multiplied by the estimated market share for qualifying products (see Section 2.2) to derive an estimate of the square footage of glazing expected to meet CWI specifications annually. The estimated square footage of CWI-qualified glazing is then

multiplied by an estimated savings per square foot. This gives an estimate of the annual savings for the expanded scope of work.

Savings per square foot of glazing have been estimated by the Northwest Power Planning Council at 1 – 12 kWh/sq ft for new construction. Based on hundreds of tax credit applications, the Oregon Department of Energy (ODOE) estimated energy savings of 6-16 kWh per square foot for new, and 12–20 kWh/sq ft for replacement/remodeling projects. For the purposes of their estimates, CWI assumed new construction savings to be 6 kWh/sq ft. and replacement/remodels to be 15 kWh/sq ft.

Ducker estimates that, nationally, new construction accounts for 70% of glazing sales in commercial buildings. The remaining 30% is used for remodeling and replacement glazing projects.

Total NW curtain wall and storefront glazing	12 million sq ft
Projected CWI market share (new and existing)	25%
Projected square footage @ CWI spec.	3 million sq ft
New construction (70%)	2.1 million sq ft
Replacement/remodel (30%)	0.9 million sq ft
New construction savings:	2.1 million x 6 kWh/sq ft = 12.6 million kWh/yr
Replacement savings:	0.9 million x 15 kWh/sq ft = 13.5 million kWh/yr
Combined savings:	26.1 million kWh/yr (or 2.98 aMW)

HMG Comment: This analysis appears to start from the assumption that the current market share for CWI-qualified product among curtain wall systems and store fronts is zero. As mentioned above, this does not seem like a reasonable assumption. Further, during evaluation of the CWI market tracking efforts in 2003-04, HMG found reasons to question the applicability of national characteristics (e.g., the 70/30 split between new and retrofit curtain wall and storefront areas), which the above calculations are based on, to the Northwest market, with its history of advanced codes and innovative programs.

Although there is significant reason to believe that expansion to cover all commercial glazing systems will significantly improve the effectiveness of the CWI, HMG believes that most of the data quality issues that exist with the current program configuration will be helped only marginally by the expansion to the whole market. Measurement of program success based on the previously described market data acquisition plan will not be able to provide robust support for market transformation claims. The evaluation team suggests that the Alliance develop new metrics for evaluating program progress.

As an alternative, HMG suggests that the Alliance could contract directly with Ducker to gather Northwest-specific data and provide an estimate of the size of the northwest commercial fenestration market, and specific important break-outs. In particular, northwest apportionment between:

- Commercial and residential sales
- Metal versus nonmetal sales (in commercial fenestration)
- Qualifying versus non-qualifying sales (in commercial fenestration)

Although we are convinced that any statistical method will not be able to definitively establish market share trends, Ducker has a better chance than any entity to obtain reasonably reliable sales and performance data from manufacturers. Ducker has for many years provided market rends reports to manufacturers based on data gathered from the manufacturers themselves. This has built a strong foundation of trust and process that no other entity has with manufacturers. Therefore, HMG recommends that if the Alliance remains of the judgment that quantitative market share data is needed to determine (a) program progress toward market transformation, and (b) program energy savings, then the Alliance should contract with Ducker for gathering and analyzing Northwest specific data.

5. ASSESSMENT OF ACE ANALYSIS

Our assessment of the ACE Analysis of cost effectiveness of the CWI program was primarily an assessment of the assumptions used in the analysis. The ACE model creates an estimate of the savings due to a program and the value of those savings. Each assumption is an input to the ACE model. The accuracy of savings estimates created by the model are highly subject to the potential accuracy of the inputs, or assumptions. This evaluation does not include an evaluation of the model itself.

Each line in the "Assumption" column in the table below lists a specific assumption made in the analysis. Some of the "assumptions" are closer to "data" and some are less certain. For example, the first row indicates an assumption of "Five new and two retrofit building types (representing 58% of commercial square footage)." The analysis starts with the assumption that the impact of high-performance windows in the nonresidential sector can be fairly accurately estimated by using just five building types. (As an aside, the text within the ACE model for CWI actually lists seven building types that were modeled.)

The next column lists the source of the assumption, if it is known. NPPC is the Northwest Power Planning Council. WWG is the West Wall Group. NEEA is the Northwest Energy Efficiency Alliance, and Ducker is the Ducker Worldwide (an industry research firm that provides regular reports on window sales characteristics).

For most assumptions, we estimated the error range of the assumption (reported in the next column), and where possible, we estimated the impact that assumption errors might have on the final estimate. This assessment is listed in the "Sensitivity" column. The final column, "Comments," contains both comments and recommendations.

	Data or Assumption	Source	Est. Error Range	Sensitivity	Comments	Recommendation
1	Five new and two retrofit building types (representing 58% of commercial square footage)	NPPC	Plus or minus 50%.	This is a large input with a lot of impact on the final estimates.	The types listed are (1) new hospital, (2) new school, (3) new lg. office, (4) new hotel, (5) new sm. Office, (6) existing sm. Office, (7) existing sm. Retail. This is more than the five claimed in the notes. Also, this does not include large multifamily, which is turning out to be a very large proportion of the "commercial" window market CWI is targeting. New proportions (with multifamily added) could have a large impact on the overall estimates and require the estimates to be redone.	Make the number and type of buildings mentioned in the text consistent with the number analyzed. Add multifamily to the analysis.
2	Measure life is 45 years	not stated	+10% to -50%	If the life is cut in half then the expected savings are also.	For hospitals and schools, 45 years may be a good average (±10 years or 25%). However, 45 years is optimistic as a measure life for offices, hotels, retail, and multifamily buildings. 15-30 years would be more appropriate.	Change measure life to 30 years.
3	savings from U-0.60 to U-0.45 assumed to be about the same as from Uo=0.55 to Uo=0.35	WWG	± 5-10%	will not sig. affect the results	Lacking a full set of analyses with the "appropriate" U-factors, this is close enough. Note that the assumption is conservative when applied to the non=metal products and optimistic when applied to metal products. Therefore, if the the %age of nonmetal products is higher than assumed, then the final estimate will be conservative.	None.
4	current practice is Uo=0.55	WWG	± 10-25%	could lower the baseline U-factor, reducing the program delta.	If the manufacturers' data is to be believed, then the "current practice" is a much lower (better) average U-factor. Vinyl seems to have a much larger share of the market than preveiously assumed. This is partially due to the fact that earlier estimates did not include windows going into multifamily buildings, and most of these will be the residential vinyl window.	Alliance should conduct research to determine with greater confidence the types and characteristics of windows currently installed.
5	retail cost/SF of window will be $0.00 to $0.50 for wood/vinyl, and $0.50 to $2.00 for aluminum	Mnfctr. Per WWG	?	this range of incremental costs ***seems*** reasonable, so differences are unlikely to be large enough to matter much.	This is one of the most difficult pieces of information to get right. The range of values is as tight as I think can be expected when asking manufacturers about pricing. Nonetheless, since the cost increment for vinyl windows is so much lower than for metal frame windows, the weighted average incremental cost may be significantly less if the non-metal products have a larger market share than assumed.	As part of research mentioned above, Alliance should attempt to collect better information on incremental costs.
6	Wood is 15% of the market and aluminum is 85%	???	±> 80%	final estimate of baseline is highly sensitive to this estimate	We assume that the statement is meant to be "Wood and vinyl" rather than just "wood." Even so, preliminary data indicates that non-metal products might be outselling metal frame products for this market (at least until the site built products are included). If this is true, then the baseline U-factor is much lower than originally thought.	See research recommendation above. Also, clarify if wood actually means "non-metal".
6a	so the area weighted average cost is $1.10/SF of window area	NEEA	??	highly sensitive	If vinyl has more market than estimated, AND the proportions stay relatively constant, then the net cost of market improvements could be 1/2 of what was estimated. If future improvement is instead made by a switch from metal to non-metal, then the cost to the industry could be even LESS than that.	Conduct research.

7	Oregon and Washington window sales at 23 million SF/year	Ducker	WWG new proposal says 17M sf/yr (+ 2M for MF); data appears to be ± 5M-10M s.f.	errors in this estimate will be reflected in baseline AND market share, so final result is not that sensitive to it.	Our opinion is that IF we are going to make estimates of the market size that (a) we need to make sure estimation methods are consistent across input sources, or (b) choose ONE source and stick with it so change is measured over time (rather than any absolute estimates of volume).	Conduct research to improve confidence in these values.
8	Idaho and Montana are 19% of the region's commercial electricity sales	NPPC	??	final estimate is probably not highly sensitive to this data point	Accept the estimate.	None.
8a	therefore, add an estimated 5.5 million SF of window	??		erros in this estimate would not greatly affect the final estimate	Accept the estimate. It is a bit of a stretch to say that because ID + MT have ~19% of the energy sales in the NEEA region, that 19% of commercial windows sold in the region are in ID + MT, but (a) there appears no better source of an estimate, and (b) inaccuracies won't matter much.	None (pending future research results)
9	Assuming that 44% of all windows are Punched Opening	Ducker	± 10-20%	not highly sensitive	This estimate is based on a national average which may be significantly different from the NW regional average. However, WWG is assuming 40% in their new proposal and the "data" that WWG and HMG gathered in 2003-04 indicated that this could be a gross underestimation. Further, most of the "mom and pop shops" are likely (a) to be more heavily involved in retrofit glazing and (b) store front glazing and (c) less involved in curtain wall systems. Accurate, consistent data on mom-and-pop operations is nearly impossible to obtain, but the estimates (from construction data) can likely get close enough.	None
9a	(20% factory assembled and 80% site fabricated)	??	??	unknown	We cannot comment on this other than to say that if the CWI now changes to include site built commercial windows, that this becomes a moot point for the future.	None.
10	the regional market size in 2001 is 12.5 million SF of window	WWG, based on above data and estimates	± 50% (8M to 16+M)	estimate of baseline or market share could be off by up to 1/2, but if a consistent method is used from year to year, the delta should be fairly accurate.	Accept subject to comparison with totals from manufacturers' surveys. NEEA needs to determine what methodology to use consistently across years.	Update if future research provides more defensible values in the future. Try to use a consistent source of data over time.
11	The commercial window market is assumed to grow at 3% every year	??	??	of small consequence to estimate of program impact	accept the estimate.	None.

12	year 2001 baseline efficient units are assumed to about 12% of the market		NEEA	Actual could have been 10%-50%	Overwhelming impact on estimate of program impact	The 12% market share baseline is too low of an estimate for the full market. It may, or may not be right for the metal -frame portion of the market. 12% cannot be verified and is not supportable by any data available so far.	Conduct research as mentioned above.
13	By 2005 the target is 50% of the market as efficient (U=0.35 or lower) units		WWG	N.A.	see comment in #11	see comment in #12	None until baseline and market share tracking are established.
13a	80% of the windows sold in 2010 will be efficient		WWG	n.a.	ditto	ditto	None for now.
14	Project, evaluation and market costs		NEEA	no comment	no comment	no comment	None.

Figure 5: Analysis of Assumptions in CWI ACE Cost/Benefit Assessment

6. APPENDICES

6.1 Original CWI Steering Committee

AFG Industries
Fred Walin
PO Box 929
Kingsport, TN 37662
800.251.0441
fred_wallin@afg,com

Alliance to Save Energy
Alison Tribble
1200 18th St. NW, Ste:900
Washington, DC 20036
202.530.2231
atribble@ase.org

Atofina
Thomas Culp
900 First Avenue
King of Prussia, PA 19406
610.878.6366
thomas.culp@atofina.com

Cardinal Corporation
Jim Larsen
775 Prairie Center Drive
Eden Prairie, MN 55344
952.229.2609
jlarsen@cardinalcorp.com

EFCO Corporation
Chris Fuldner
1000 County Road
Monett, MO 65708
800.221.4169
ctf@efcocorp.com

Graham Architectural Products
Raj Goyal
30730 Links Court
Temecula, CA 92591-3946
909.587.9700
rcgoyal@aol.com

Guardian Industries
Tim Singel
14600 Romine Road
Carleton, MI 48117
734.654.4243
tsingel@guardian.com

Kawneer Company, Inc.
Greg McKenna
Technology Park/Atlanta 555 Guthridge Court
Norcross, GA 30092
770.860.6433
greg_mckenna@kawneer.com

Keystone Industries
Michael DeRosa Jr.
105 Mahoning Ave
New Castle, PA 16102
770.860.6433
michael1@keystone-industries.com

Lignell Consulting Services
William Lingnell
1270 Shores Ct
Rockwall, TX 75087
972.771.1600
lingnell@swbell.net

Marvin Windows & Doors
Jim Krahn
PO Box 100, Highway 11 WestWarroad, MN 56763
218.386.1430
jimkrahn@marvin.com

Mikron Industries
Marvin Stover
1034 6th Ave.
North Kent, WA 98032
263.854.8020
marvin_stover@mikronvinyl.com

Mikron Industries
Paul Warner
1034 6th Avenue
North Kent, WA 98032
253.854.8020
paul_warner@mikron.com

NFRC
Jim Benny
5221 SE 77st.
Berryton, KS 66409
jbenny@nfrc.org

NFRC
Susan Douglas
8484 Georgia Avenue
Silver Spring, MD 20910
301.589.1776
sdouglas@nfrc.org

Pilkington
Paul Gore
811 Madison Avenue
Toledo, OH 43697-0799
419.247.4833
pgore@expostl.lof.com

PPG
Al Lutz
Guys Run Rd., PO Box 38361
Pittsburgh, PA 15238-8361
412.820.8642
alutz@ppg.com

Tecton
Lee Assenheimer
2502 North Clark St, Ste 227
Chicago, IL 60614
773.477.1639
lassenheimer@tectonproducts.com

TRACO
Mike Manteghi
71 Progress Avenue
Cranberry Township, PA 16066
724.776.7050
mike.manteghi@traco.com

University Of Minnesota
John Carmody
1425 University Ave. SE
Minneapolis, MN 55455
612.624.1351
carmo001@maroon.tc.umn.edu

Velux
John Lawton
1418 Evans Road
Greenwood, SC 29649-8725
864.941.4751
john.lawton@VELUX.com

Wausau
Ken Brenden
1415 West Street, PO Box1746
Wausau, WI 54402-1746
715.846.3339
kbrenden@wausauwindow.com

Werner Systems
Alan Brown
2365 Railroad Street
Corona, CA 92880
909.371.8678 x213
alan@wernerengineering.com

DOE
Rich Karney
202.586.9449
richard.karney@ee.doe.gov

DOE
Marc LaFrance

Oregon Office of Energy
Mark Kendall
625 Marion St. NE
Salem, OR 9730
503.378.6043
mark.w.kendall@state.or.us

AAMA
Wagus Carl
1827 Walden Office Sq. Ste:550
Schaumburg, IL 60173
847.303.5664
crwagus@aamanet.org

6.2 Phone Interview Survey Instruments

The interview guide below was used for interviewing window manufacturers. It was modified slightly for use in interviews with glass manufacturers or coaters, frame extruders, and design professionals and association staff.

Interview Guide for Window Manufacturers

Interviewer: _____

Interviewee Contact Information

Contact Attempt Dates:_____

Interview Date: _____

Name:_____

Title: _____

Organization:_____

Industry Type: _____

Phone Number: _____

E-mail: _____

Member of the CWI Steering Committee Yes No

Member of the Better Bricks Advisory Council Yes No

Background Information

Introduction of interviewer (Nehemiah Stone) and the purpose for my call. Ask if this is a convenient time to talk. If not, when would be a better time?

Additional Notes:

Window Manufactures

1. How would you describe your company's market? [*Open-ended question to get their assessment of their company*] What percent of your market is nonresidential? How big is your company in the market?
2. What major window types does your company produce? Has this product mix been changing?
3. Does your firm's market extend into site-built windows?
4. Are there any specific building sectors your company focuses on (e.g., public buildings, hotel/motel, schools, office buildings, etc.)?

5. Is the trend toward energy efficient fenestration pretty strong or pretty weak? [We will make sure that we understand their meaning of energy efficient fenestration, e.g., does it just have a low U-factor or does it also have a low SHGC and/or high VLT?] Is the pace picking up or is the growth of that sector pretty steady?
6. What influences do you think are having the greatest effect on trends toward energy-efficient windows sales/production*? [We're looking for market changes, economic influences, code impacts, etc*]
7. How about trends specifically in the shop built punched opening window market?
8. Have you heard of the Northwest Energy Efficiency Alliance's *Commercial Window Initiative*? If no go to **Q9**. If yes, continue:
    a. Has anyone from the West Wall Group, the Alliance's contractor for the Initiative, contacted you about the program? Have you seen a presentation on the Initiative, for example, at an industry meeting?
    b. Are you familiar with the Initiative's (draft) efficient commercial window performance specification? [To verify that they really know what it is, we will get them to describe it; including specs.] --..
    c. If so, what's your opinion of the (draft) specification?
        i. Appropriateness of the U-factor?
        ii. Appropriateness of the SHGC?
        iii. Too much of a push for today's market?
        iv. Not enough of a stretch?
    d. Other than the West Wall Group or the Alliance, has anyone asked you about or mentioned the (draft) specification? (e.g., customers, other manufacturers, industry association staff, reporters)
    e. In your opinion, is the Initiative likely to make a lot of difference in the market? Why, or why not?
9. [Provide a very brief description, in a generic fashion, of the elements of the CWI.] In your opinion is this a strategy that would move the market to more efficient products? If you wanted to encourage a market shift toward more efficient products, what would you suggest doing?
10. Any other comments?

6.3 Evaluator's Market Share Tracking Plan Recommendations

In addition to the general recommendation to make the MST Plan more complete, clearer and as specific as is feasible, the evaluation also had the following specific recommendations for the MST Plan:

A. In its first draft of the MST plan, WWG listed six barriers to obtaining quality information from the factory-built commercial window market. HMG recommended that WWG indicate how they planned to overcome each of the six barriers. These challenges include:

   1) the manufacturing firms are generally privately held and often do not release data to outside parties;
   2) the firms do not track the data in the same manner that we request (by U-factor or SHGC);
   3) sales territories do not identically match the Alliance service territory;
   4) fears that the data may give competitors an advantage;
   5) fears that the data will be used to impose mandatory requirements; and, in some cases,
   6) poor record keeping limits the ability of the firms to respond to our information requests.

B. List each type of industry player (window manufacturer, glass manufacturer, extruder, etc.) and exactly what information is being asked of them. This helps the evaluators to understand the comparability of data WWG obtained from different sectors of the market, what data is going to be obtained and what might be missing, and how extensively WWG will rely on each portion of the industry to create their market share estimates.

C. Clarify that when asking about the number of units sold in the region, that WWG is explicitly asking about CWI-qualifying products, including all three parameters: U-factor, SHGC and VLT. [Note: subsequent to HMG making its recommendations, VLT was dropped as a data point in the sales data collected from manufacturers, although it is still officially one of the specifications for a CWI-qualified window.]

D. Provide a full description of how WWG creates an estimate of the size of the full market (both nonresidential windows and nonresidential new construction, including major rehabs), the exogenous factors affecting the market, and how WWG relates those back to the estimated changes in the market share of CWI-qualified products. For example, the utility and government organizations listed as sources for construction data are excellent sources for estimating the size of the market, but (a) aren't likely to be in agreement, and (b) will provide data that still needs to be

explained in terms of economic trends, changes in government spending, etc. The MST Plan should explain how the "data" is used.

E. Most importantly, the Plan should explain how the information from the manufacturers and other industry players, the data on new construction (and rehab) market size and trends, and other collected data will be analyzed (a) to generate an estimate of CWI-qualifying product market share, (b) to estimate the change in that market share over time, and (c) to estimate the impact of the CWI program on the market share of those products.

6.4 Baseline Market Share Data Collection Instrument

The first two pages comprised a list of definitions to ensure comparability of answers, and a set of questions designed to gauge the respondent's place in and understanding of the Northwest commercial window industry. (See Figure 6.)

The remaining page was pair of tables. The manufacturer was instructed to use the first table if s/he could; in other words if s/he knew the split of their sales data between residential and nonresidential products. Data entered into the second table would be deemed less accurate, but could still provide an estimate of the split between residential and nonresidential products based on certain product and/or sales criteria. (See Figure 7.)

Definitions

1 Nonresidential buildings	This construction type includes office buildings, schools, retail buildings, warehouses, and high-rise residential buildings. It does not include low-rise residential buildngs.
2 Commercial buildings	See "nonresidential buildings."
3 Commercial windows/glazing	Windows/glazing sold to the nonresidential building sector. This includes three categories of glazing types: Curtain wall glazing, storefront glazing, and punched opening windows.
4 Curtain wall glazing	A built-up wall/glazing system that is not load bearing. It is comprised of vertical and horizontal mulliuns, glazing and opaque panels, and gaskets. It is erected on site.
5 Storefront glazing	A street level glazing facade often used for display purposes. Storefront glazing in usually built on-site.
6 Punched opening windows	A type of window that is installed in a rough opening framed to the approximate (slightly larger) size of the window. Punched opening windows can be either built on-site or arrive to the site as a previously manufacturered product. Some punched opening windows might otherwise be considered residential windows except that they are sold for use in a nonresidential building.
7 Manufactured product	Factory built as opposed to site-built, even if the site-built product comprises components cut at the factory for site assembly.
8 U-factor, SHGC	Performance ratings obtained in accordance with and certified in accordance with the NFRC procedures. Note: in order to determine **total** sales volume, products that are not rated and certified in accordance with the NFRC procedures should still be included.
9 Sales volume	We are looking for numbers of units sold in each category. If this proves impossible for any particular manufacturer, we would accept dollar volume sold in each category with an educated estimate of the average cost/unit for each category. Likewise, if square feet of product is the only accurate way that a particular manufacturer can report data, then we would accept that with an educated estimate of average sf per unit by category.

Questions

1 Please describe the type of entity(ies) to which your company sells manufactured fenestration products. Some possibilities include: project developers, distributors, glazing contractors, retail stores or retail chains.

2 Other than manufactured commercial windows for punched openings, what other types of fenestration products does your company sell?

3 Of the above fenestration product types, approximately what percentage of your product was manufactured commercial windows for punched openings, versus all others combined?

TYPE	**%**
Manufactured commercial windows for punched openings	
Other	

4 Approximately what percentage of your company's total sales of fenestration products is in the Northwest (OR, WA, ID, and MT)?

5 Approximately what percentage of your company's total sales (for the indicated quarters of last year) of manufactured commercial windows for punched openings were in the Northwest (OR, WA, ID, and MT)?

6 In 2002, what percentage of the Northwest market for just manufactured commercial windows for punched openings do you believe that your company had?

7 On the spreadsheet titled "NRMfctPunchedOpening," please enter the number of units that you sold in the four quarters of 2002 that (a) were manufactured commercial windows for punched openings, AND (b) fit the performance criteria described in column "A" on the spreadsheet. The first row is a total of all manufactured punched opening commercial windows of all performance levels, including all those in the rows below it, plus all those of that don't qualify in any of listed categories.

8 Please tell us of any issues that might reflect on the relative accuracy of your answers. For example, if you classify your company's fenestration products differently than in those categories about which we are asking, let us know how you

Figure 6: Pages One and Two of the Baseline Market Share Survey Instrument

U-factor		SHGC			Number of Units Sold (OR, WA, ID, MT) 2002					Number of Units Sold (to ALL locations) 2002				
Min.	Max.	Min.	Max.	**Sold To Nonresidential Projects**	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total
all	all	all	all	All U-factors & SHGC (inc. categories below)					0					0
0.421	any	0.45	any	U-factor >= .42, SHGC >= .45					0					0
0.401	0.42	0.421	0.45	U-factor < .42, SHGC < .45					0					0
0.401	0.42	0.401	0.42	U-factor < .42, SHGC < .42					0					0
0.401	0.42	0.351	0.40	U-factor < .42, SHGC < .40					0					0
0.401	0.42	0.001	0.35	U-factor < .42, SHGC < .35					0					0
0.351	0.40	0.421	0.45	U-factor < .40, SHGC < .45					0					0
0.351	0.40	0.401	0.42	U-factor < .40, SHGC < .42					0					0
0.351	0.40	0.351	0.40	U-factor < .40, SHGC < .40					0					0
0.351	0.40	0.001	0.35	U-factor < .40, SHGC < .35					0					0
0.001	0.35	0.421	0.45	U-factor < .35, SHGC < .45					0					0
0.001	0.35	0.401	0.42	U-factor < .35, SHGC < .42					0					0
0.001	0.35	0.351	0.40	U-factor < .35, SHGC < .40					0					0
0.001	0.35	0.001	0.35	U-factor < .35, SHGC < .35					0					0

NOTE: The first table is just for those that are **known** or **thought** by the company to be nonresidential. The table below should be filled out only if there is a significant difficulty with differentiating nonresidential product from residential, and should include those sales where the at least half of the product was either over 5'0X5'0 or fixed glazing. We are assuming that these sales are more likely to be nonresidential and this approach will help us capture some product that might not initially be thought to be nonresidential.

The numbers from the two table are not additive, and very well may be overlapping.

U-factor		SHGC			Number of Units Sold (OR, WA, ID, MT) 2002					Number of Units Sold (to ALL locations) 2002				
Min.	Max.	Min.	Max.	**Sold To Nonresidential Projects**	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total
all	all	all	all	All U-factors & SHGC (inc. categories below)					0					0
0.421	any	0.45	any	U-factor >= .42, SHGC >= .45					0					0
0.401	0.42	0.421	0.45	U-factor < .42, SHGC < .45					0					0
0.401	0.42	0.401	0.42	U-factor < .42, SHGC < .42					0					0
0.401	0.42	0.351	0.40	U-factor < .42, SHGC < .40					0					0
0.401	0.42	0.001	0.35	U-factor < .42, SHGC < .35					0					0
0.351	0.40	0.421	0.45	U-factor < .40, SHGC < .45					0					0
0.351	0.40	0.401	0.42	U-factor < .40, SHGC < .42					0					0
0.351	0.40	0.351	0.40	U-factor < .40, SHGC < .40					0					0
0.351	0.40	0.001	0.35	U-factor < .40, SHGC < .35					0					0
0.001	0.35	0.421	0.45	U-factor < .35, SHGC < .45					0					0
0.001	0.35	0.401	0.42	U-factor < .35, SHGC < .42					0					0
0.001	0.35	0.351	0.40	U-factor < .35, SHGC < .40					0					0
0.001	0.35	0.001	0.35	U-factor < .35, SHGC < .35					0					0

Figure 7: Sales Data Collection Sheet of Baseline Market Share Survey

6.5 Alternate Baseline Market Share Equation

- **Percentage of the manufacturer's total sales specific to the Northwest.** We expect all interviewees to have fairly accurate data regarding sales specific to the Northwest, but manufacturers with a greater percentage of their sales in the Northwest may have a better sense of which of their products are entering the Northwest market. Manufacturers with only a small percentage of their sales in the Northwest are more likely to provide product information that represents the national market.
- **Percentage of the manufacturer's punched opening sales specific to the commercial market.** Manufacturers with only a small percentage of their punched opening windows sales in the commercial market are more likely to provide product information that represents the residential market.

The considerations above will be used as weighting factors in calculating a baseline percentage. An example of this is shown in equation 2.

Equation 2:

$$Baseline(\%) = \sum_{i=1}^{6} \left(\frac{\%\ \text{of overall that is NW market}}{\text{sum of }\%\ \text{of overall that is NW market}} \right)_i \times \left(\frac{\%\ \text{of NW commercial PO market}}{\text{sum of }\%\ \text{of NW commercial PO market}} \right)_i \times \left(\frac{\text{qualifying product sold}}{\text{NW commercial PO product sold}} \right)_i$$

6.6 List of magazines and web sites examined

Periodicals

Reference	Source	Issue	Page	Type	Notes
Energy Star	DWM	Mar-04	26	article	Updated Canadian Energy-Star levels
Energy Star	DWM	Apr-04	99	article	Review of the IGMA annual mtg: presentation on Canadian and U.S. Energy Star programs
Energy Star	DWM	Apr-04	100	article	Review of the AAMA annual mtg: DOE considering performance-based alternatives to expand Energy Star program
Energy Star	DWM	Nov/Dec-03	28	article	Aluminum window mfgs concerned over new Energy Star criteria: U=0.40 in certain areas will limit Al window sales
Energy Star	DWM	Sep/Oct-03	20	article	Energy Star skylights require U=0.60 for certain areas due to testing change to alpha = 20 degrees (was 90)
Energy Star	DWM	Sep/Oct-03	20	article	Industry reaction to new Energy Star window requirements
Energy Star	US Glass	May-04	8.5	other	Advertisement insert promoting Hi-Tech Energy Windows as an Energy Star Partner
Energy Star	US Glass	May-04	12	article	"…75% and 35% of residential windows feature NFRC labels and Energy Star performance ratings, respectively..."
Energy Star	NFRC Update	Nov/Dec-02	3	article	Helping builders select windows: look for the Energy Star label
Energy Star	NFRC Update	Summer 02	2	article	USDOE withdraws proposal to change Energy Star criteria
Gary Curtis	NFRC Update	Jan/Feb-03	2	article	Gary Curtis tells Nehemiah about NFRC and Nehemiah goes to ASHRAE Atlanta

Websites

Reference	Source	Date	URL	Type	Notes
CWI	BetterBricks	Mar-04	http://www.betterb	article	introduce *Designer's Guide for Energy Efficient Commercial Windows*
NEEA	BetterBricks		http://www.betterb	article	introduction to the organization with a link to their website
Energy Star	AAMA		http://www.aamar	other	Energy Star is listed in the pull-down menu on the search page
Energy Star	AAMA	Jun-03	http://www.aamar	article	Energy Star Program Revisions Finalized in Adoption of the Four-Zone Alternative
CWI	NWWDA	Nov-02	http://www.nwwda	article	monthly newsletter: NEEA awards contract to West Wall Group for new commercial windows program
Gary Curtis	NWWDA	Sep-01	http://www.nwwda	article	monthly newsletter: review Energy Star windows criteria
Energy Star	NWWDA	Apr-02	http://www.nwwda	article	Window&Door Magazine: Energy Star program drives a lot of the demand for energy efficient windows
Energy Star	NWWDA	Sep-01	http://www.nwwda	article	Fenestration Magazine: Manufacturers already offer many windows that meet or exceed Energy Star levels
Energy Star	Seattle DPD (De	Jan-04	http://www.seattle	article	Energy Star Home: meet WA state code then upgrade to Energy Star windows (among other items)
Energy Star	Seattle DPD (De	Feb-02	http://www.seattle	other	Brief on Energy Code update. "More than 60% of the residential windows sold in the Northwest are Energy Star"

Websites with no mention

Western Region AAMA	http://www.aamanet.org/Western_Region/new_WR_page.htm
U.S. Green Building Council	http://www.usgbc.org/
AIA Washington Council	http://www.aiawa.org/index.html
AIA Seattle	http://www.aiaseattle.org/
AIA Oregon	http://www.aia-oregon.org/
AIA Portland	http://www.aiaportland.com/
AIA Idaho	http://www.aiaidaho.com/
AIA Montana	http://www.aia-mt.org/
IRIS Communications	http://irisinc.com/
Oikos	http://oikos.com/index.lasso

Web Site Search Results

Web Site Search Results	
Keyword Search List	**Total Number of References**
Commercial Window Initiative or CWI	2
Northwest Energy Efficiency Alliance or NEEA	1
West Wall Group	0
Gary Curtis	2
Energy Star window	16