

DOE Building Envelopes Roadmap Workshop Meeting Notes

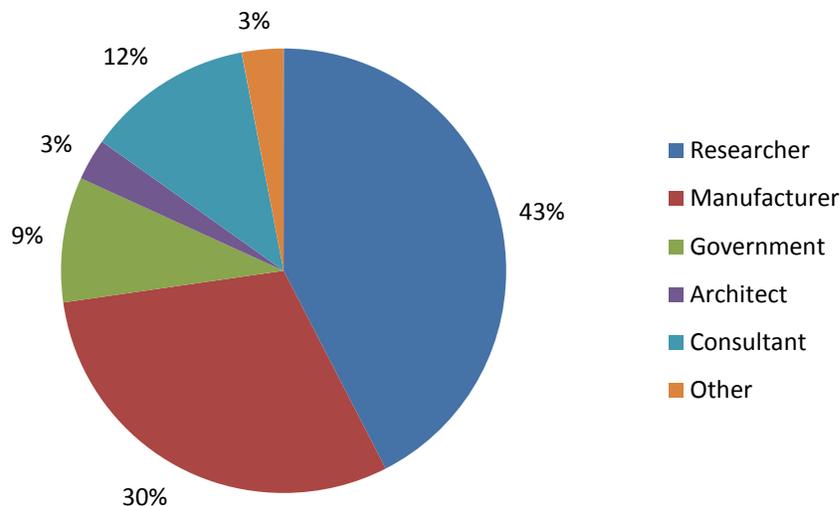
Clearwater Beach, Florida
December 9th, 2010, 1:00pm – 5:00pm

Visit our new **Building Envelope Program Blog** at:
www.eereblogs.energy.gov/buildingenvelope

Meeting Summary

On December 9th, approximately 80 stakeholders attended the DOE Building Envelopes Roadmap Workshop in Clearwater Beach, Florida. Examples of the various organizations represented at the workshop can be found on page 8. Of the 30 stakeholders that responded to the workshop evaluation, approximately 43 percent were researchers and 30 percent were manufacturers. The remaining 27 percent included government, architects, and consultants.

Figure 1 Stakeholder Disciplines Represented



At the workshop, DOE presented information on Envelope, Windows, and Cool Roofs research and development (R&D) activities. The stakeholders identified the highest priority items for DOE to work on. The items were consolidated and the stakeholders voted on the highest priority items. The top five highest priority items were discussed in more detail. In addition, evaluations were distributed to the stakeholders at the end of the workshop to solicit additional feedback on specific research areas.

Meeting Notes

Welcome and Introductions *by Doug Brookman and Marc LaFrance*

In this workshop, the group will discuss what DOE is doing now in the building envelopes area and what DOE should be doing. We will describe the research underway and also get your input as stakeholders.

DOE Overview of Envelope and Windows R&D Program Presentation *by Marc LaFrance*

The following questions were presented:

(1) Will dynamic windows meet the pending window code changes that require shading?

One of the challenges to code changes is to have dynamic windows seen as compliant (0.08 SHGC doesn't meet code). The primary objective is to motivate Soladigm and code people, as well as industry, to help. Costing analysis of dynamic windows versus shading would help the case. Analyses to justify code have to be based on established technologies and cost. We can't use electrochromics to justify code change. Shading has a lot of maintenance issues.

(2) Lots of money is being spent on windows, but perhaps we get the most heat loss through roofs – where is the biggest bang for the buck in government spending?

People thought we were done in opaque areas, but then we came up with the next generation of attics and roofs. We don't have carbon legislation to justify more research in opaque areas. The average stock of windows is less than R-2, whereas it is R-11 in walls – lots of loss in windows area.

Cool Roof Roadmap Presentation *by Meg Sullivan*

The following questions were presented:

(1) Does DOE's cool roof policy vary by climate zones?

The policy for putting cool roofs on DOE buildings does not vary by climate zone. However, DOE recommends cool roofs in climate zones 1-3. ASHRAE has required cool roofs in climate zones 1-3, except for a couple of exceptions based on cost effectiveness.

(2) How many square feet are being evaluated in the India project?

We are evaluating a campus, not 1 square kilometer, but we are only measuring radiation not the urban heat island effects. It is a \$5-10 million project by the Office of Science.

Envelope R&D Presentation *by ORNL*

The following comments and questions were presented:

(1) Foundations are missing.

In the Multi-Year Plan, we say that we had planned a major foundation effort in FY10. We were planning long-term foundations research, but the new administration wanted us to focus on existing buildings. We look at where all the energy goes - zero energy new buildings need to address foundations. However, we made the decision to delay the foundation work to address existing buildings.

Sam Taylor, DOE, is representing the Residential team. Foundations are critical – they impact moisture, durability and health & safety. Building America is asking for more low grade moisture analysis. There is a foundations handbook draft that Jeff Christian, ORNL, is putting together. ORNL has 10 case studies, of which 6 discuss handling foundation and moisture. Building Science is doing an air sealing below grade guide.

(2) Who is covering toxins and global warming potential?

To paraphrase, we will call it “indoor air quality” – EPA is addressing/leading. DOE is helping a little bit. We do accelerated testing for blowing agents.

Windows R&D Presentation *by Christian Kohler and Arturo Romero*

The following comments and questions were presented:

(1) Commercial windows are included in Phase II of the solicitation.

(2) How does the window volume purchase work?

We are mainly pushing through the website. There is a 20 window minimum required for purchase. They can request a lower amount. The main focus was originally institutional buyers, contractors, etc. – not homeowners. Triple panes will become the next round for ENERGY STAR. DOE is trying to drive this.

(3) Do you track sales?

The numbers are a little disappointing, so we are getting ready to disclose them. These market conditions were not anticipated. We will keep building momentum.

Prioritization Process and Pareto Voting: Stakeholders Identify Highest Priority Item per Category for DOE to Work on

The prioritization process is another form of input to the DOE Building Envelopes program, along with the participant surveys. The process identified the following high priority areas for DOE to work on, along with the number of pareto votes in parentheses.

The top five overall vote getters are listed below, along with notes of the detailed discussions that took place in the workshop surrounding these items.

(1) Retrofit Thermal Shorts (15)

Energy loss assessment of thermal shorts and air leaks in existing buildings is needed. Calculate heat transfer and assign dollar values on a unit basis.

Take the therm program and turn it into a complete user interface – happens to be a real high priority that has been discussed. We can get it going right now.

Any discussion on turning it into a 3D program? Geometry, meeting window frames in 3D is much harder. 2D to approximate 3D is short-term. Get a lot of challenging designs with 3D – don't know temperatures of these components, outside structural members.

If you want to help people to use, create a catalog and then add on. We need a 3D model; we should focus on 3D. Students are doing 3D in college.

With 200-300 items in your catalog, you can do a quick analysis for your climate zone. It has to have the base case as well, i.e., NFRC for curtain walls. Europe has 3D thermal catalogue- there are collaborations with Germany, Sweden – seek to internationally collaborate to reduce burden for DOE.

What role could international play? User group could be formed to provide input. A lot of people are willing to participate. TC 3.4, under NIMS = DOE led user group (define details, specify what to model).

I can also see difficulty that 1- and 2D are already too complicated. More intuitive interface, middle ground is needed. Work on specifying some of the dominant uses first.

Thermal and moisture are still on table; moisture might add complexity – could be a structured approach; add simulation of air leaks and WUFI doesn't do that.

Top 5 tasks - 3D models, Catalog of Details, User Working Group, Moisture Impacts, and Air Leaks

(2) Foundations – Validation and Modeling (15)

Improved foundation hygrothermal modeling with field validation across all climate zones (especially in cold climate retrofits) is needed.

Basically, this is consistent with what was coming out of Building America, where we talked about a lot of moisture modeling in WUFI. But, below grade, what is the moisture loading and how do you model that? For below grade retrofits, people are lacking moisture and thermal modeling through low grade walls. Air flow, internal pressures, soil pressures – it would be nice to have some guides.

The top 4 tasks are: Air pressure, Thermal, Air flow, Moisture

How do you characterize the existing building conditions and local soil conditions to feed into the model? Different types of soil play a role.

We don't have the tools. We should put the activities from labs together and convene a large group to get started (3-5 years), then validate at end. How about making DOE solicitation? 1 strong champion is needed.

Effects of rain, water leakage – Add-ons in the model

The modeling capabilities are there, but the assumptions need work – the next level should be a staged-approach.

(3) Cool Roofs – Validation of Savings (11)

Validation of savings and changes to maintain performance of cool roofs is needed, including answering:

- Will it deliver savings?
- Will it last through the lifecycle planned?

The whole idea is to get new things that we are doing. Accelerated aged ratings are a big part of what DOE is already doing. From what we discussed, what are we missing?

Monitoring/measuring green roofs have the big advantage of thermal mass, but are not cost effective. DOE will put them in the calculator, but will probably not move into this area significantly (move on to bigger bang for buck items).

Cool roofs can save energy, but they also make a difference in the temperature of the world. Hence, cool roofs are also relevant for cool areas. Communication of the three benefits (energy efficiency, UHI, and global cooling) are needed. See the Cool Roof roadmap posted on the blog.

Validation is very important; clients say “show me the money.”

The EPA is managing ENERGY STAR cool roofs and is allowing self-certification and no three year aged ratings; please provide your input to change.

Code people have not done an independent analysis in climate zones 1-3 (Add to roadmap to do analyses for the whole country). Envelope people from ORNL will be coming up with cost data and we need your help and validation with cost data.

(4) Phase Change Materials (12)

Yan did an excellent job at ORNL; he is now at Fraunhofer, working with Germans and the Bavarian Energy Center. Whole house simulations are going on.

There are partners that want to work on new mixture products. It might be slightly underfunded – FY12 increase. We don't have appropriations yet for FY11.

There was a presentation by the Finnish man advocating nanotechnology for the next generation of insulation materials. Elongate the nano cells so you have heat transfer (DOE is funding).

PCMs can help cool roofs and increase application of cool roofs.

(5) Dynamic Windows and Highly Insulating Windows – Low Cost Processing (8)

DOE is already doing this.

Summary and Wrap-Up by *Marc LaFrance*

The event today had three key points – education, gaps analysis, and true assessment. We want to get your feedback. Stakeholder interaction is important; the program is very industry-oriented. Who delivers energy efficiency? Industry does. Also, we identified some things today that industry will have to do.

The next steps include a summary of this meeting, which will be posted on the blog. The blog address is:

[www.eereblogs.energy.gov/building envelope](http://www.eereblogs.energy.gov/building-envelope)

All the presentations from this meeting are on the internet. We are trying to be as transparent as possible. Also, please sign up on the blog to receive communications.

We really appreciate your time and energy, and are very grateful.

Appendices

Appendix A: Example Attendee List

Appendix B: Pareto Voting Results

Appendix C: Feedback from the Workshop Evaluations

Appendix D: DOE Responses to General Stakeholder Comments

APPENDIX A

Example Attendee List

Air Barrier Association of America	Morrison Hershfield Ltd.
Bayer Bay Systems	Moultrie Technical College
British Columbia Institute of Technology	National Institute of Standards and Technology
Building Enclosure Council	National Renewable Energy Laboratory
Cardinal Glass Industries	Natural Resources Canada
CEMEX	NAVFAC MIDLANT
CertainTeed Corporation	Navigant Consulting, Inc.
Chalmers University of Technology	North American Insulation Manufacturers Association
Cosella-Dorcen Products, Inc.	Nu Wool Company
Danish Building Research Institute	Oak Ridge National Laboratory
Dedicated Roof and Hydro-Solutions, LLC	Pacific Gas and Electric Company
DLR Consultants	PCM Innovations, LLC
Dryvit Systems, Inc.	Saint-Gobain CertainTeed Insulation
DuPont	SES Consulting
Eclipse Energy Systems, Inc.	Spectra Tech Inc.
EIFS Industry Members Association	Sto Corp.
Faculdade De Arquitetura E Urbanismo	Technical University of Denmark
Fraunhofer-Institut für Bauphysik	The Dow Chemical Company
Fuqua and Partners Architects	U.S. Army Corps of Engineers
Georgia Pacific	U.S. General Services Administration
HADP Architecture	VaproShield, LLC
Honeywell	VTT Expert Services Ltd.
Ivy Group Consultants	Washington State University Extension Energy Program
Judd Allen Group	Wiss, Janney, Elstner Associates, Inc.
Kingspan Insulated Panels, Inc.	Washington State University Extension Energy Program
Lawrence Berkeley National Laboratory	
Lund University	
Mercury Marine Facilities	
Meyer, Scherer & Rockcastle Architects	

APPENDIX B

Pareto Voting Results

Research Area	Priority Items (Number of Votes)
Overall Top 5	<ul style="list-style-type: none"> • Retrofit thermal shorts (15) • Foundations – validation and modeling (15) • Cool Roofs – validation of savings (11) • Phase change materials (12) • Dynamic windows and highly insulating windows – low cost processing (8)
Advanced Materials	<ul style="list-style-type: none"> • Self-drying smart materials for the envelope walls (6) • Aluminum curtain wall framing replacement material (4)
Windows	<ul style="list-style-type: none"> • Blast-resistant energy efficient windows (5) • Building Integrated Photovoltaics (3) • Thermal transmittance of spandrel areas (2) • More research on window performance – Comparing traditional shade design with photochromics (dynamic windows) (1)
Walls	<ul style="list-style-type: none"> • Research/study of Exterior Insulation Finishing Systems (EIFS) – Continuous exterior insulation retrofit project demonstrating its effectiveness (7) • Life-cycle performance in terms of energy efficiency and durability (5) • Develop cost-effective variable R-value wall assemblies for commercial applications (4) • Continuous Insulation (CI) calculator demonstrating improvement to envelope energy performance as thickness is increased beyond ASHRAE 189.1 (4) • Validated decision tree for envelope retrofit projects in residential and commercial buildings (3) • Durability of wall flashings (2) • Moisture safety, moisture control, and drying potentials (2) • Wall layer performance: Foam/fiber layering – real performance for thermal and air leakage; Foam/vacuum panel/foam layering – real performance and durability (1)

Research Area	Priority Items (Number of Votes)
Foundations	<ul style="list-style-type: none"> Moisture intrusion from footing-wall transition; Exterior insulation for the above-grade section (4)
Enabling Research (Testing & Support Activities)	<ul style="list-style-type: none"> Develop and evaluate low-energy, cost-effective insulated wall and roof systems that are durable and have stable moisture cycles (3) “Whole house” energy and cost optimization to achieve 30% reductions – walls, windows, foundation, and air tightness specifications (3) Air barrier sealants that improve effectiveness, longevity, and durability (1) Currently, the DOE program lacks an element which might relate to individual elements of research, and the summary effect of the research, to Whole Building Performance, and such an element is needed (0)
Policy Formulation/ Revision	<ul style="list-style-type: none"> Making retrofitting attractive to all strata of society, e.g. rental apartment management (1)
Attic & Roofing Systems	<ul style="list-style-type: none"> Attic temperature and moisture measurement in northern climates for various attic-roof constructions such as sealed attics, standard soffit-ridge, above sheathing ventilation, and cool color (4) Attic “low cost fiberglass energy retrofit” with and without air flow (2) Means to cost effectively reduce attic temperatures when there are ducts in the attic (1)
Other Issues	<ul style="list-style-type: none"> Energy rating of existing inventory of buildings – coordination with other organizations in the arena, and formulation of uniform code/policy (7) Whole building moisture management tools for practitioners, not only for experts with at least 5 years of experience with Energy Plus (7) Air infiltration, since it impacts energy, indoor air quality, moisture, comfort, and durability of the envelope (5) Indoor Air Quality – With 2012 energy codes moving to ACH 3 in most climate zones, and retrofitting tightening buildings, research should focus on both reduction and absorption technologies (1)

Appendix C

Feedback from the Workshop Evaluations

See associated PowerPoint titled “Building Envelope Roadmap Workshop Evaluations.”

Appendix D

DOE Responses to General Stakeholder Comments

Stakeholders at the Buildings XI meeting raised many important questions in their evaluations of DOE's roadmap. The most relevant of these have been answered below.

Roof and Attic design:

Q. What are the best designs for builders and the best products for manufacturers to make? And how should these designs be integrated with the use of cool roofs?

A. The roof and attic design guide for hot climates will be finalized soon ([the draft](#) is available on our R&D blog) and will address the best roof and attic designs. Design guides for other climate zones are planned. The use of cool roof materials is addressed in the design guide.

Cool Roofs:

Q. Even very knowledgeable people do not understand the three relatively widespread inputs: 1) Radiative forcing (global cooling) 2) Heat islands and 3) Building energy savings. We really need much better communication methods.

A. We agree that more information is necessary to ensure that these three areas are well understood. Our cool roof roadmap addresses these areas and the importance of education, but we will try to do more to reach out to our stakeholders with good information. The [Global Cool Cities Alliance](#) is also working to educate people about the advantages of cool roofs.

Advanced Materials:

Q. Metal building retrofit: Practitioners in industry need a better understanding of thermal details (effective wall/roof R-values) before any improvements in thermal performance can be designed and achieved.

A. The Department's insulation [fact sheet](#) was updated in 2008. This provides information on different insulation materials, R values, and design options. We will work to ensure that our stakeholders are aware of this information.

Windows:

Q. Research seems like "space age" technology compared to everyday building practice. To be successful, technology transfer/industry application to all stakeholders is key.

A. Through workshops/educational seminars we hope to better bridge the two. Our volume purchase program includes low-e storm windows, which are used for low income housing. The [efficient](#)

[windows collaborative](#) works to promote energy efficient windows and educate people on their benefits.

Q. Need more attention on commercial fenestration, Building Integrated Photovoltaic (BIPV) needs attention. Neither DOE's Solar or Envelope is working on developing BIPV or supporting BIPV. DOE needs to decide a place for it in their program.

A. DOE agrees this is an important area and attempted work in this area in the past but it was not funded. We are considering it for future activity and it will likely be addressed more thoroughly in future multi-year plans. The FY12 budget request released on February 14, 2011 includes funding for this work.

Q. Need to drive window research to step-up in areas of energy efficiency and stop the prevention of energy codes (e.g. ASHRAE 90.1) from moving forward.

A. More stringent energy codes are to be established in the next several years; they will address several areas of inefficiencies in our commercial and residential buildings. A key effort is to gain momentum for voluntary programs , so that more stringent codes are more likely in the future.