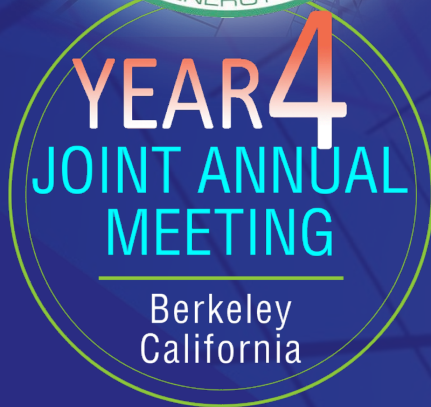


BUILDINGS ENERGY EFFICIENCY CONSORTIUM

U.S. - CHINA CLEAN ENERGY RESEARCH CENTER (CERC-BEE)



Materials that Improve the Cost-Effectiveness of Air Barrier Systems

Oak Ridge National Laboratory
China Academy of Building Research

Dow Chemical
3M Company
China Academy of Building Research
Kelong Insulation

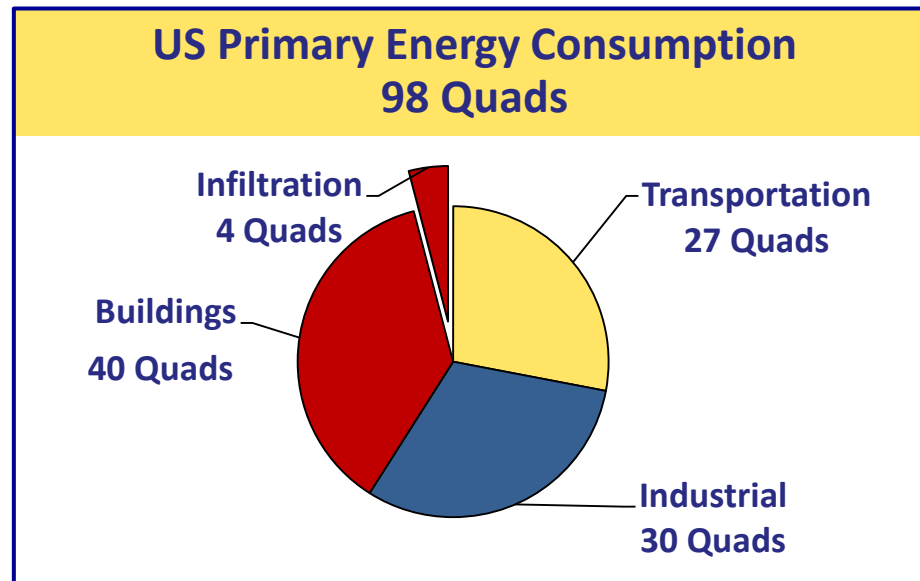
Presented By

Diana Hun (ORNL)

August 25, 2014

Purpose and Objectives

- Air leakage is responsible for 4% of the energy consumed in the US



*Office of Energy Efficiency and Renewable Energy
2011 Energy Data Book*

- Reduce energy penalty by simplifying installation of air barrier systems
 - Dow Chemical → sprayable liquid flashing (LF)
 - 3M → primer-less self-adhered membrane (PSAM)

Purpose and Objectives

Dow's Sprayable Liquid Flashing

Current Technologies



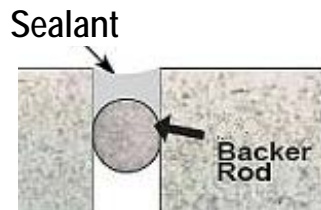
Liquid flashing

Needs bridging materials



Peel & stick

Time consuming and prone to error



Backer rod bridging gap

Sprayable Liquid Flashing



- Serves as air and liquid water sealant
- Applied with regular professional paint sprayer
- Bridges gaps up to ¼" wide without supporting materials
- Four times faster to install than tape
- Water-based → low VOC emissions, reduces cleaning time
- Adheres to:
 - Concrete masonry blocks
 - Exterior grade gypsum board
 - Rigid foam insulation
 - Concrete
 - Steel
 - Wood
 - Aluminum
- Anticipated installed cost is lower than current technologies

Purpose and Objectives

3M's Primer-Less Self-Adhered Membrane

Current Technologies



Typical asphalt-based self-adhered membrane
Primer required over substrate



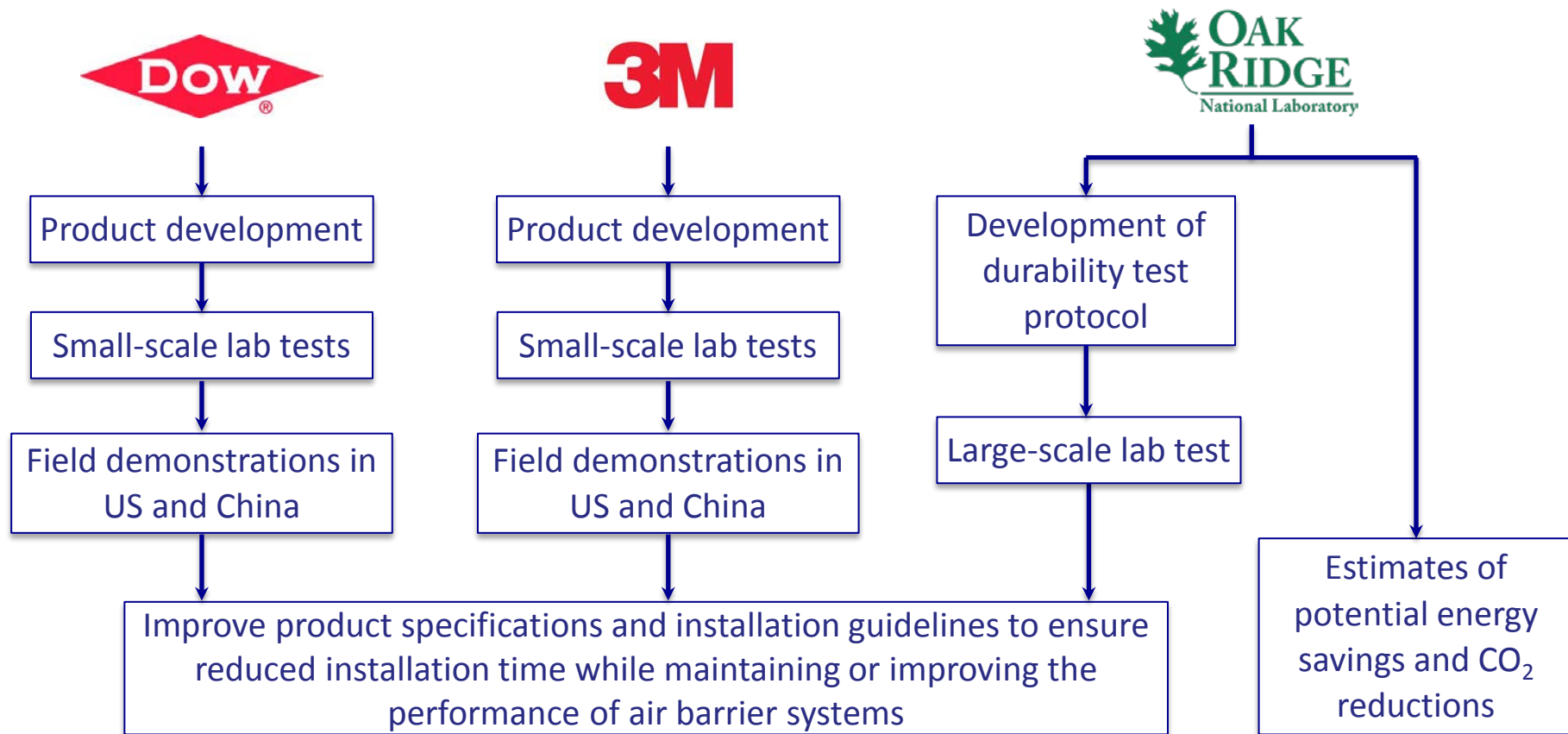
Failure can occur if primer is not adequately dried

Primer-Less Self-Adhered Membrane



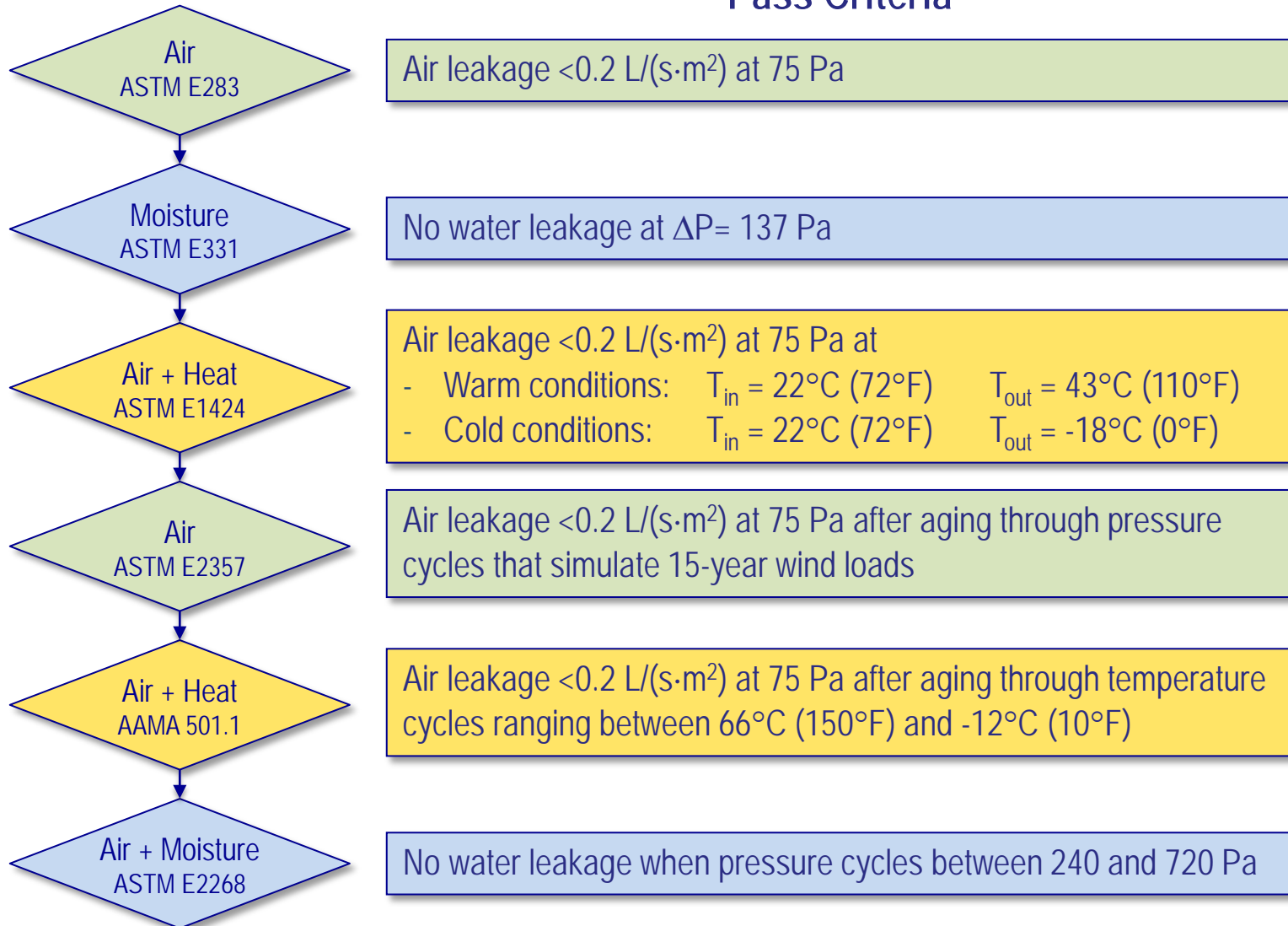
- Serves as air, liquid water and water vapor barrier
- Does not need a primer → decreases installation time by ½
- Can be applied at -18°C
- Adheres to:
 - Concrete masonry blocks
 - Concrete
 - Exterior grade gypsum board
 - Steel
 - Rigid foam insulation
 - Wood
 - Aluminum
- Anticipated installed cost is lower than current technologies

Approach



Durability Test

Pass Criteria

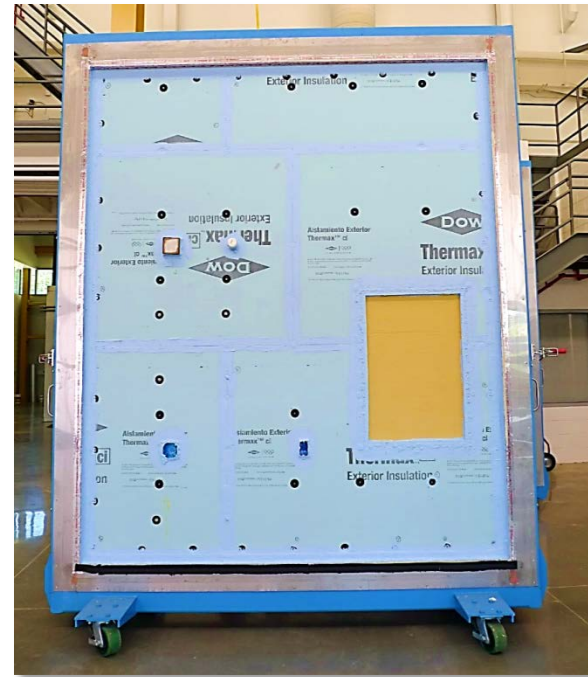
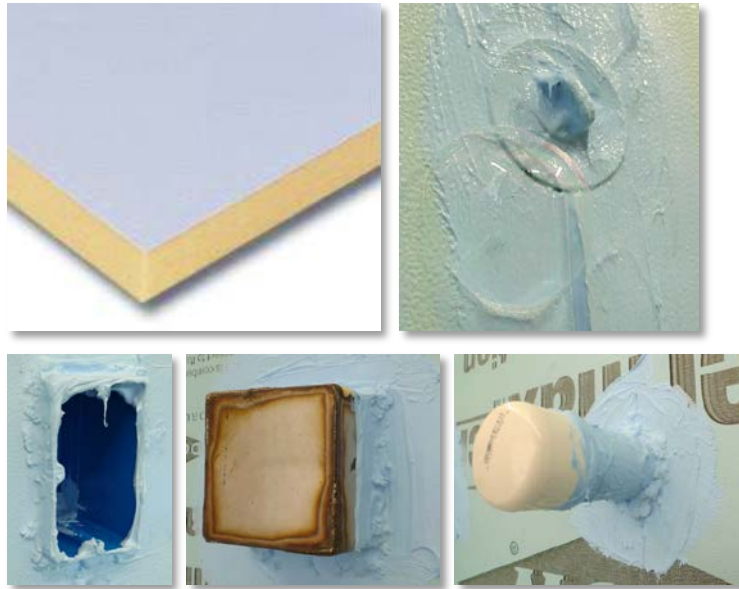




Sprayable Liquid Flashing (LF)

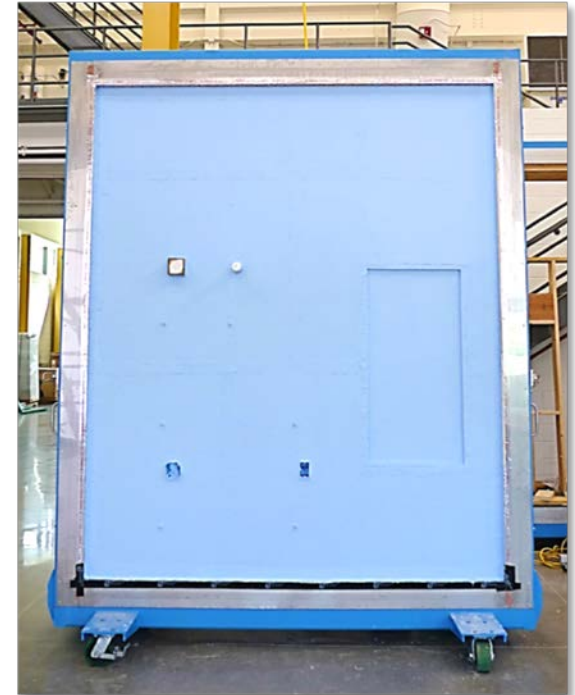
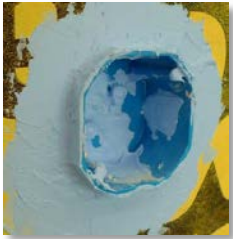
Dow

LF on Polyisocyanurate Boards



- LF used to seal gaps around penetrations and board joints
- Successfully completed durability test
- Lessons learned
 - Special attention to be paid when LF is applied to the underside of penetrations

LF on Exterior Grade Drywall



- LF used to seal gaps around penetrations and board joints, and served as the water-resistive barrier over exterior grade drywall
- Successfully completed durability test

LF: Field Tests



Substrates: foil-faced polyisocyanurate board insulation and steel



**China Academy of Building Research (CABR)
Beijing, China**



Concrete window sill



Installed liquid flashing

Dow's Target Outcomes

Target Outcomes

Status

Generate technical product planning roadmap in 2014

On schedule

Launch the LF in the US in 2014

On schedule

Initiate lab and field tests

On schedule

Generate economic value proposition in 2014

On schedule

Present benefits from the LF at major trade conferences

On schedule

Key accomplishment

Patent awarded to Dow's liquid flashing: US20130042961A1



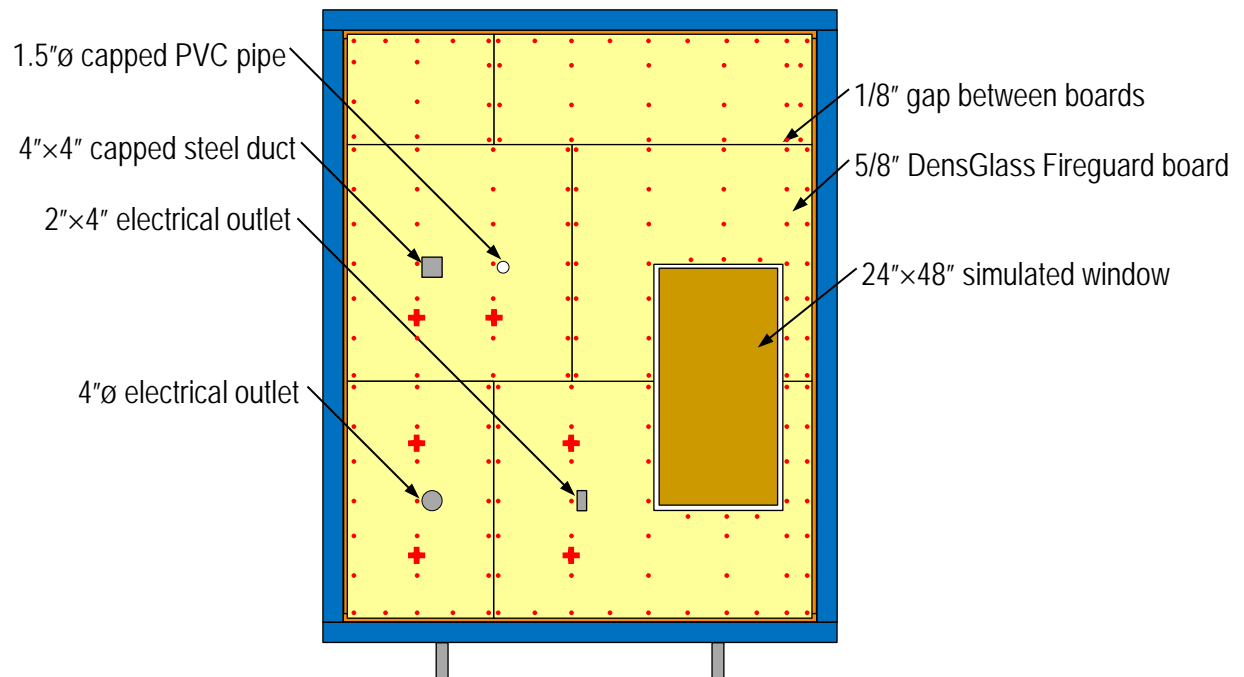


Primer-Less Self-Adhered Membrane (PSAM)

3M

PSAM: Lab Tests

- Selected material layout
 - Steel framing
 - Wall 1 exterior substrate: exterior grade drywall
 - Wall 2 exterior substrate: concrete boards
- Tests will begin in September 2014



PSAM: Field Tests



Substrates: exterior grade drywall and steel



**China Academy of Building Research (CABR)
Beijing, China**



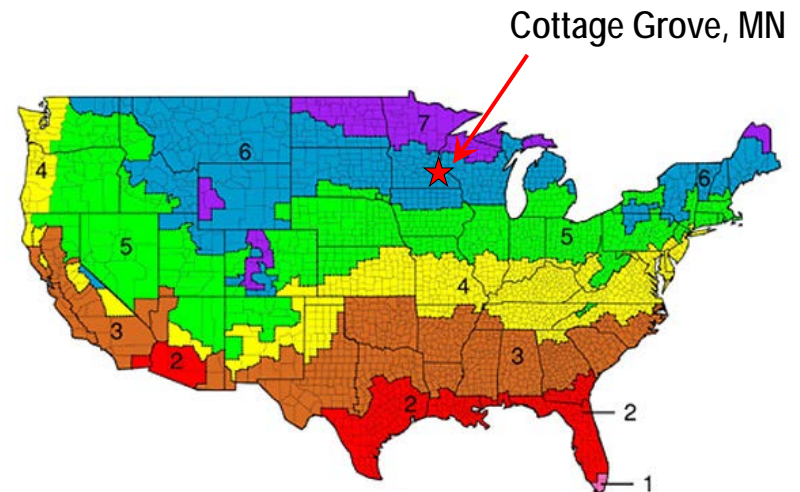
Concrete window sill



Membrane as flashing

PSAM: Whole-Building Tests

- DOE's Emerging Technologies / Commercial Building Integration Lab Call
- ORNL and 3M were awarded funds for multi-year project
 - Conduct whole-building tests: air leakage will serve as the main variable
 - Build, instrument and monitor ten test facilities
 - Quantify energy savings due to improvements in airtightness
- Test site: Cottage Grove, MN
- Project to begin in October, 2014



3M's Target Outcomes

Target Outcomes

Status

Generate product planning roadmap in 2015 based on results from 2014 lab and field tests	On schedule
Initiate lab and field tests	On schedule
Launch PSAM in China in 2014	On schedule
Present benefits from the PSAM at major trade conferences	On schedule

Key accomplishment

Secured funds from ET/CBI lab call to quantify energy savings from improvements in airtightness



CHICAGO!

AIA Convention 2014
June 26-28, Chicago

Remaining 2014 Tasks

ORNL

- Test two walls with PSAM
- Coordinate air barrier system with the Kelong design team
- 2014 funds requested: \$240K
- 2014 funds received: \$115K
- 2014 funds remaining: \$10K

Dow and 3M

- Continue working on target outcomes

CABR

- Conduct air and water penetration tests on windows with LF and PSAM
- Report results

Kelong Insulation

- Share drawings with ORNL, Dow and 3M
-

Appendix

- 2015 requested budget: \$220K
- Quarterly plan

Quarter	Main Tasks
1	<ul style="list-style-type: none">• Test 1 wall
2	<ul style="list-style-type: none">• Test 2 walls• Coordinate installation of LF and PSAM in Kelong building
3	<ul style="list-style-type: none">• Test 1 wall• Estimate energy savings and reductions in CO₂ emissions
4	<ul style="list-style-type: none">• Issue final report• Dow and 3M meet target outcomes