

Fraunhofer Center for Sustainable Energy Systems

## Highlights of U.S. Building Envelope Research During the Last Decade

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# Agenda

- Technology/Engineering Challenges During Last Decade
  - Highlights
  - Disappointments
- Numerical Analysis
  - Successes
  - To-Do-List
  - Failures
- Code Work Highlights and Needs



# Technology/Engineering Challenges During Last Decade

# Technology/Engineering Challenges During Last Decade

## ■ Highlights

- Foam aging protocol
- High Performance Windows
- Vapor Retarder and Air Barrier research
- EIFS research
- Development of PCM technologies
- Cool roofs and over-the-deck ventilation design
- High performance insulations – VIPs , Aerogels
- Value framing, SIPs, ICFs, Core Wall
- Development of Tyvek and Smart Vapor Retarders

## ■ Disappointments

- Foundation research
- Radiant Barriers and Reflective Insulations
- Attic design - Knee Walls
- Stone and masonry wall retrofits
- Phenolic Foam applications
- Switchable Surface Technologies – Thermochromic, Electrochromic



# Numerical Analysis

# Numerical Analysis

## ■ Successes

- Development by Ken Wilkes of ASTM C1340 – AtticSim program
- Introduction of Energy Plus
- NIST, ORNL, and NRC hygrothermal models
- Window and shading simulation tools from LBNL
- Adoption of WUFI in North America
- ORNL cool roof calculator

## ■ To-Do-List

- Integration of Energy Plus and AtticSim
- Development of attic air ducts model for Energy Plus
- Development of PCM module utilizing two enthalpy curves for Energy Plus
- ORNL Roof Savings Calculator

## ■ Failures

- Lack of DOE support for DEO-2.2E
- Foundation module for Energy Plus
- Hygrothermal module for Energy Plus



# Code Work Highlights and Needs

# Building Code Work - Highlights and Needs

## ■ Successes

- ASHRAE 90.1 and 90.2
- ANSI/ASHRAE Standard 62.1, Ventilation for Indoor Air Quality,
- ASHRAE Standard 160P--Criteria for moisture control design analysis in buildings
- ASHRAE/IESNA/USGBC 189 - Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings
- IECC -2012
- CEC Title 24

## ■ Example of Needs

- Calculation of 3-D thermal bridges for whole building energy modeling
- Thermal mass credits for cellular concretes and log walls
- Thermal requirements for attic knee walls
- Thermal design requirements for window perimeters
- BIPV design recommendations
- Etc,,,,,,,,,,,,,,,,,,,,,





# Thank You!

## Any questions ?



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