U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

# Ultra-high R/inch VIP with new developmental core material

Oak Ridge National Laboratory, NanoPore Inc. and Firestone Building Products Co.
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## Team:

- **Kaushik Biswas, PhD and Andre Desjarlais (ORNL): Scientists at ORNL's Building Envelope Center of Excellence with 8+ and 40+ years of experience, respectively, in building envelope technologies RD&D, including vacuum insulation.**
  - Dr. Biswas and Mr. Desjarlais have successfully led several mid- to large-scale, multi-organizational research projects funded by DOE and DOD
- **Douglas Smith, PhD (NanoPore): Developer of micro/nano-porous insulations since 1993, with 100+ patents; Inventor of modified atmosphere insulation (MAI), a low-cost variant of vacuum insulation panels (VIPs).**
- **John Letts, PhD (Firestone): 20+ years of experience in polyiso foam technology and manufacturing. Firestone is an industry leader in building materials with $1.4 billion dollar in sales and a major manufacturer of roofing products and polyiso.**

OAK RIDGE NATIONAL LABORATORY
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NanoPore

Firestone
BUILDING PRODUCTS

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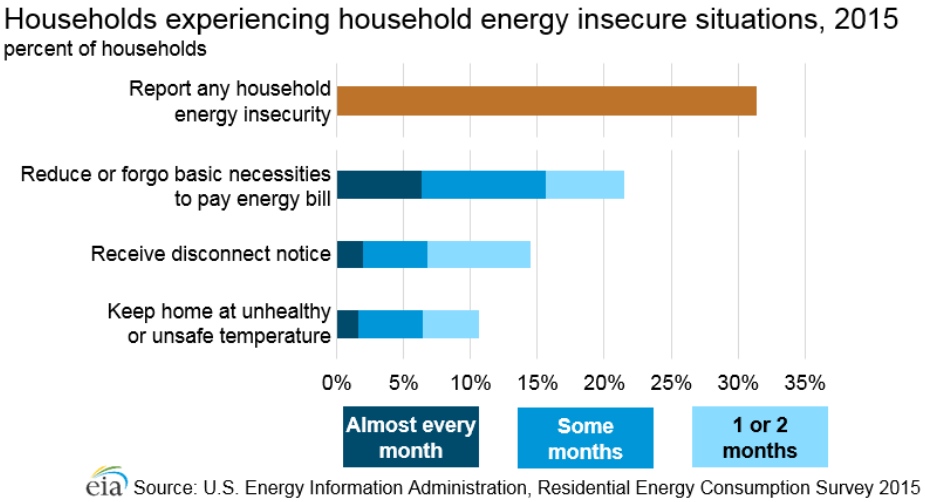
## The Problem (The Need/Challenge)

- In 2010, the primary energy consumption attributed to building envelope (roofs and walls) was 5.8 quadrillion BTUs (~6% of entire US consumption)
- Economic implications: About 1/3rd of US households facing hardships related to energy costs
- Envelope upgrades/retrofits have proven ineffectual with existing insulations that can achieve R6/inch or less
- Goal: Develop high-performance, cost-effective insulation systems
- Low-cost VIPs, for e.g. MAI, is a potential solution
- The team has developed prototypes of R12/inch MAI-foam composites

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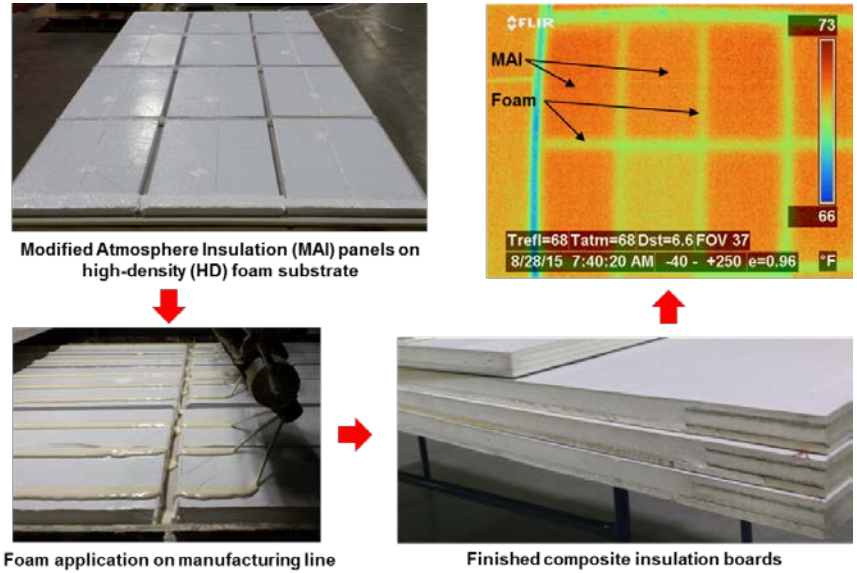
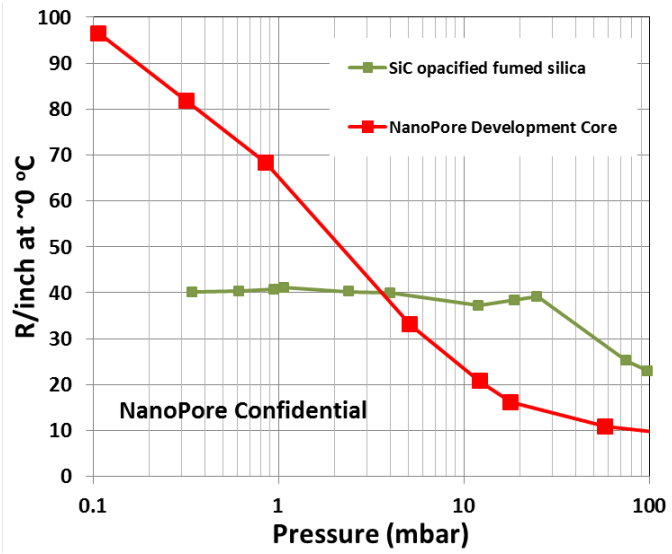
## The Solution

- Composite foam boards with VIP/MAI that can achieve ≥ R12/inch (vs. ≤R6/inch of current insulations)
- Cost-effective technology
  - New developmental core can yield R80/inch at lower cost than silica-based MAI
  - Current silica-based MAI/VIPs can achieve R40/inch



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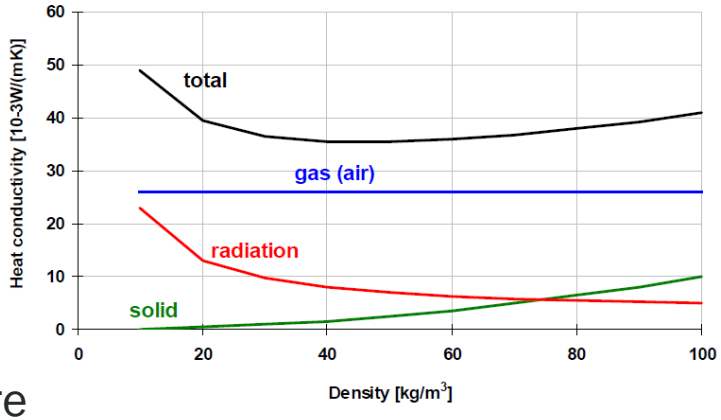
## Advantage, Differentiation, and Impact

- New core technology can yield R80+/inch
- Thinner panels for same R-value as traditional VIPs
  - Lower material and shipping costs
- We will investigate:
  - Barrier films to maintain the low internal pressure
  - Optimization of the core to minimize solid conduction and infrared radiation
  - Projected costs of the VIP/MAI-foam composite with the new core material
- **Perform an installation demonstration of the R12/inch composites on a low-slope roof of an occupied commercial building**
  - Contractor feedback will enable further technology development/optimization
- **2030 primary energy savings potential (using DOE Market Calculator)**
  - 452 TBTUs (0.45 quads) for low-slope commercial roof applications
  - 1.1 quads for residential wall applications (from 2014 DOE Envelopes Roadmap)



# Thank You

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