



Thin-glass triple-pane commercial windows

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DOE Field Validation

- Addresses the lack of objective performance and cost data that inhibit some technologies from finding their customer base.
- DOE helps to identify, install and monitor technology performance in real world installations and then communicates the results to the public via a case study

Demonstration Objectives

Validate the potential of Selected technology

Technical Examples

- Verify energy reduction, associated utility cost savings, peak demand reductions
- Verify ability to eliminate perimeter heating
- Verify occupant satisfaction impacts, i.e. comfort

Market Adoption

- Investigate applicability to different building types, sizes and end use systems
- Evaluate maintenance, operability benefits to operations/management staff
- Verify the cost-effectiveness

Host Site Role vs Lab Role

- **Site Role:** Work with Lab team and window manufacturer to provide information needed for site evaluation, conduct demonstration, provide information for M&V scope development and during M&V process
- **Lab Role:** Evaluate candidate sites, recruit and select site, develop M&V Scope, conduct rigorous M&V

Field Validation Schedule

- Site selection (1-3 months)
 - Interested sites fill out site recruitment and scoping forms
 - LBL follows up for any additional information
- Technology installation (1-2 months)
- Testing and evaluation (12-18 months)

Benefits of Participation

- Engage in low-risk pilot with installation and deployment managed by others
- Receive independent M&V and an evaluation of benefits, conducted by Lawrence Berkley National Laboratory.
- Inclusion in a well-supported, high-visibility DOE-funded demonstration program
- Gain insights regarding this technology's fit for your portfolio

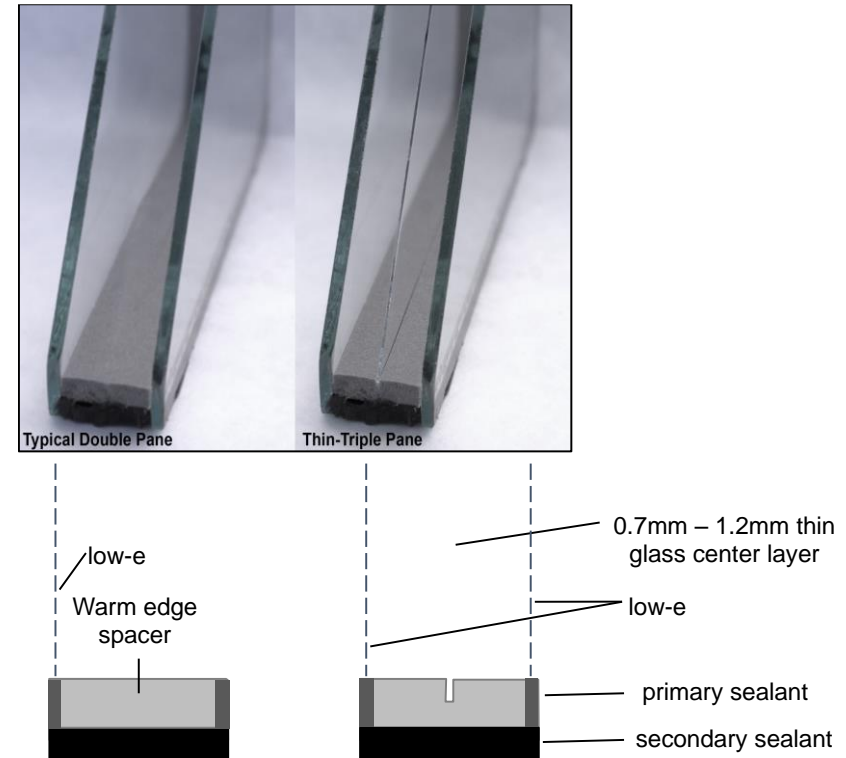
Thin-triple Overview - Technology

The thin-glass triple-pane concept is based on the novel use of components that have been available for years. This technology is a high-performance solution for the mass-market ready for industry adoption.

The design uses a combination of:

- thin-glass (0.7 - 1.6 mm) center layer
- 2 low-e coatings.

The thin glass keeps IGU **weight and width to a minimum**, enabling the use of **existing frame profiles** and should make triple pane installation easier.



Thin-triple Overview - Performance

Triple-pane thermal performance

in a double-pane framing package:

- R-4 (U-0.25) or better fixed windows (Argon fill)
- R-5 (U-0.20) or better fixed windows (Krypton fill)

SHGC and VT tuned as required by building location, orientation, and site conditions

Uncompromised structural performance

- Non-structural center-layer
- Tested up to 50 sf
- CW-30 or higher (low- mid-rise commercial)
- Vertical applications

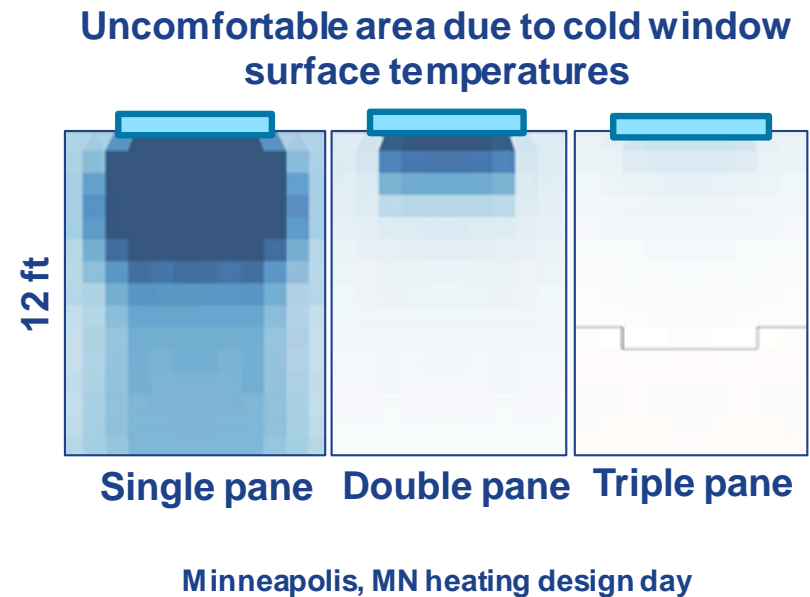


Pressure testing 50sf thin-glass triple pane

Thin-triple Overview - Comfort

Triple pane windows **eliminate discomfort** near windows in even the coldest US climates

- 5-30% of perimeter zone can be uncomfortable due to radiation heat loss and downdrafts from cold code minimum double-pane windows
- **Increase window size** without compromising comfort



Thin-triple Overview - Energy

Thin-triple pane utilized in new construction or in combination with deep retrofit can **eliminate perimeter heating**.

Highly insulated building envelopes are:

- more resilient
- reduce peak heating and cooling loads
- More stable utility load



Thin-triple Expected Benefits

- Whole building energy savings delivered through reduced window heat transfer
- Improved occupant satisfaction and comfort – regain perimeter zone area
- Reduced morning “warm-up” time and load
- Easier installation expected compared to conventional triple-pane due to reduced weight
- Can allow for HVAC capacity downsizing and perimeter zone elimination

Site Requirements

- Required characteristics
 - Building type: low-rise office
 - Building size: small to medium (<100,000 sf)
 - Punched opening window frame type
 - Fiberglass framing permitted by local fire code (for R-5 or better performance)
 - Ability to continuously transmit metered performance data through access to stable Wi-Fi network or LBNL's own cellular service
 - Nice to have, or ability to install, smart meters to collect data at 1-hour intervals for additional analytics and sub-metering.
 - Whole building gas use, electric use, and peak demand. Interval whole building electricity usage and gas data (hourly or sub-hourly)
 - Historical baseline electrical (interval) and gas (monthly) data for 12 months
- Other Considerations
 - LBNL is available to work with agencies to review portfolio building characteristics and equipment to find the right sites.
 - Window retrofit will show biggest impact as part of a larger retrofit effort, allowing HVAC system downsizing and elimination of perimeter heating
 - Stable occupancy, operations, and internal loads
 - Building staff engagement, Meter ability for rigorous M&V
 - Full documentation of as-built drawings

Next Steps

- If you are interested in hosting the technology validation in your facilities, please contact the LBNL team

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Thank You!