

Zero Energy Commercial Buildings Consortium (CBC) Building Envelope Working Group

Second Input Questionnaire: Barriers to Achieving NZECB Vision

New and Existing Buildings

Design

- Complexity and cost of using whole-building energy models to make effective tradeoffs between envelope, lighting and mechanical systems Prescriptive performance requirements for specific building envelope performance instead of whole building energy consumption limits
- Accuracy of energy modeling tools for absolute energy consumption predictions
- All-glass / high glazing fraction buildings
- Risk associated with newer technologies.
 - Design/engineering teams need to have confidence in the simulated energy and comfort performance so they can realize the full energy savings and can avoid redundant systems
 - Liability concerns
- The current design and construction process is a barrier – it is clear that a more holistic approach is needed
- Limited knowledge by building professionals and clients (building owners) of product and system solutions that exist today to increase energy efficiency; particularly for renewable energy and daylighting
 - Particularly for integration building systems
- Lack of access to high-quality performance data (historic) for measures to make existing buildings more efficient
- Insufficient consideration in ZEB planning of occupant comfort/productivity and environmental impacts
- Business incentives for designers and engineers: payments for design based on meeting deliverables, not performance goals
- In some cases, design goals conflict between achieving LEED and ZEB
 - Requires further education of clients to understand difference

Delivery

- Lack of envelope commissioning / testing
 - Building tightness a major issue
- The US construction market is very conservative and slow to adopt new technologies. Need to figure out ways of increasing adoption rates which will result in price reductions through economies of scale and spur yet further market adoption
 - Good book on this topic: “Broken Buildings, Busted Budgets”
 - Liability concerns
- Value engineering / Substitutions during delivery stage
- The current design and construction process is a barrier – it is clear that a more holistic approach is needed
 - Lack of knowledge/expertise in integrated design process (IDP)

- Disparate trades do not communicate effectively, particularly for products spanning more than one MasterFormat specification category (e.g. 08 for fenestration and 16 for controls and automation for dynamic shading/glazing systems)

Envelope Component and System Needs

- Technology Risk: All the energy efficiency and renewable energy technologies needed to achieve the vision may not be there in 30-40 years
- Lack of widespread availability of design features to achieve ZEB
- Envelope quality needed for ZEB not often met by current construction delivery process
 - EIFS and fenestration integration very challenging for effective implementation in practice
- Window and glazing manufacturer resistance to R&D to push the convergence of much higher quality, much higher performance, and, yes, lower cost
- Improved thermal performance of wall systems, particularly framing
- Spray foams can have challenges to achieve fire ratings for applications in exterior insulation systems
- BIPV integration into existing building structures, and very costly
- BIPV not produced in ready-to-use/apply format
- Negligible window-integrated PV available
- Phase-change materials not proven and application/specification not understood
 - Liability and flammability challenges
- Many high-efficiency PV products have very limited or non-availability in the U.S.
 - People willing to pay more abroad – market goes there

Operations

- Behavioral (Operations): This problem is common to new and existing buildings. Even if the building is built for net zero, ensuring envelopes are operated and maintained to achieve ZEB involves navigating through a myriad of political, organizational and behavioral roadblocks.
- Ongoing commissioning of building envelopes, particularly for dynamic envelopes
- Measurement and verification
- Lack of as-built information detail about the building for effective operations
 - Needs to be integrated into building development process from beginning of this process

Owners' Concerns

- Real and/or perceived cost of ZEB too high
 - Lack of life cycle cost analysis in assessing measures
- The current philosophy on buildings design: In the US we build to lowest cost rather than performance. This inhibits new technology adoption.
 - Linked to contractor reward structure (rewarded by lowest initial cost)
- Risk associated with newer technologies.
 - Owners need to be able to have confidence in the cost and benefit of the configurations to support their decisions to pay the additional up-front costs.
 - Owners need to have confidence that the maintenance and operation of dynamic systems will be reasonable
 - System failure and subsequent litigation
- Lack of financing mechanisms available to all parties (builder, landlord, tenants) so that the costs can be financed in a way that mitigates split incentive issues

- Real dollar value of better daylight, better thermal performance, natural ventilation (improved IAQ/IEQ, productivity / increased sales, avoiding moisture/water problems) not well quantified for consideration in design process

Regulatory

- Lack of code adoption and enforcement
- Codes calling for a reduction in window-wall ratio, yet when lighting controls are used the optimum window to wall ratio is higher than the level at which the codes are heading.
- Low energy cost or low carbon cost to make ROI time to be uneconomical
- Not enough legislative pressure and incentives to push for codes that approach ZEB
- Spray foams can have challenges to achieve fire ratings for applications in exterior insulation systems
- Uncommon practices, notably for integrated systems, may face significant hurdles to approval by code officials – create cost and schedule issues
 - Codes not pro-active in anticipating new, high-performance technologies and practices
- Codes do not reflect future cost-effectiveness of newer technologies at higher production volumes / greater market penetration

Specific to Existing Buildings

Delivery

- Cost and time will be the largest hurdles for major envelope renovation projects.
- Unknown conditions will be a significant barrier, with significant cost and schedule implications

Design

- Physical constraints on renovation scope – can limit energy savings potential
 - The overall building geometry and orientation are typically set
 - The building envelope is likely to be established and in many cases will be largely retained
 - The primary building structure is a given
- The main barrier is thinking about existing buildings like if they were new buildings.

Envelope Component and System Needs

- Windows: Even if the frames are ok, in order to increase thermal performance in the glazing, triple pane may be required and the frame will likely not be able to accommodate the increased glass thickness and would therefore need to be replaced too (increases cost)
- Aesthetic concerns by historical commissions for exterior insulation retrofits
- Cost-effective exterior insulation

Owners' Concerns

- Cost and time will be the largest hurdles for major envelope renovation projects.
- Unknown conditions will be a significant barrier, with significant cost and schedule implications
- Lack of reasons for owners to upgrade existing buildings