Life Cycle Assessment and the Building Envelope

Challenges and Opportunities

A presentation for the
Illinois Sustainable Technology Center

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TEGNOS
UNDERSTANDING THE BUILDING ENVELOPE™

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AGENDA

- LCA and Building Durability
- Product v. System LCA
- Applying LCA
- LCA in Building Codes and Standards

LCA and Building Durability

For buildings…

Service Life may be the most sensitive LCA variable…

…and **Durability** may be the most sensitive service life predictor

LCA and Building Durability

A Useful Definition of Durability:

"…the ability of a building or any of its components to perform its required functions in its service environment over a period of time without unforeseen cost for maintenance or repair."

Canadian Standards Association "Guideline on Durability in Buildings"(CSA S478-01)

LCA and Building Durability

Key Durability / Service Life Factors:

- Performance of required functions
- In the service environment
- Over a period of time
- Without unforeseen cost for maintenance or repair

LCA and Building Durability

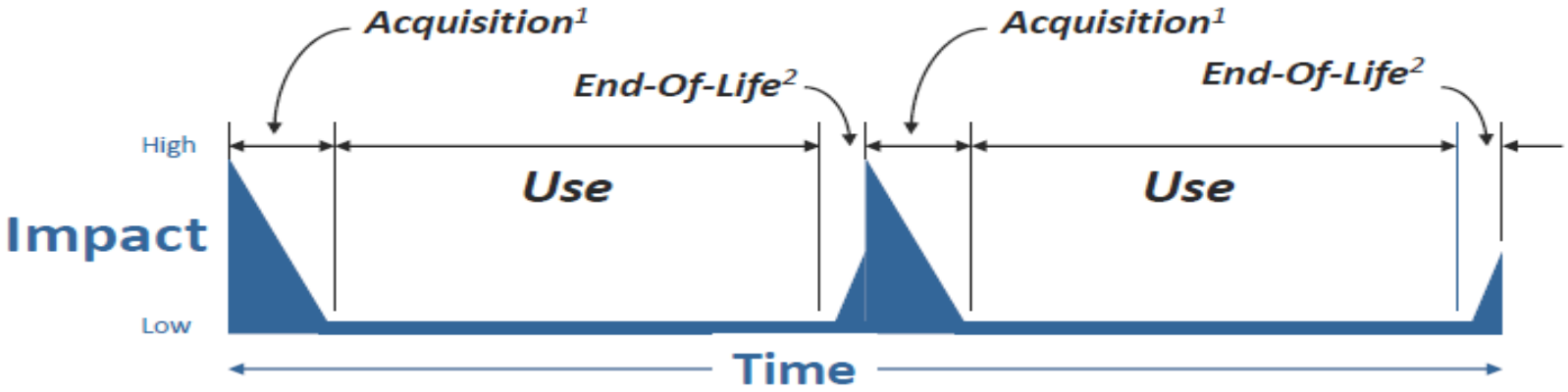
The Durability Problem:

"The majority of green building assessment systems focus on the design of the constructed building, with little focus on the effect of the building system's life during operation. This tendency has resulted in a failure of many rating systems to properly consider durability, lifecycle cost, and the effects of premature building envelope failures."

"Green Assessment Tools: The Integration of Building Envelope Durability." (McCay, 2007. *Proceedings of the 11th Canadian Conference on Building Science and Technology*.)

LCA and Building Durability

The All-Too-Common Building Life Cycle:

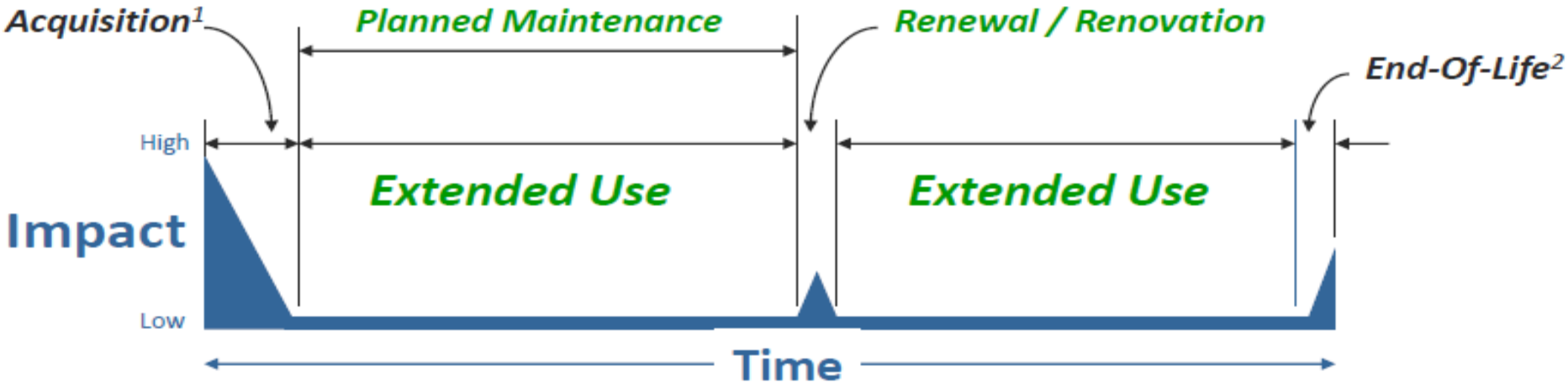


- Reduced Service Life
- Accelerated Replacement Cycle
- Increased Financial & Environmental Impact

1.Acquisition includes raw material extraction, manufacturing, transport & installation
2.End-of-Life includes removal & disposal

LCA and Building Durability

The Sustainable Building Life Cycle:



- Extended Service Life
- Planned & Orderly Replacement Cycle
- Reduced Financial & Environmental Impact

1.Acquisition includes raw material extraction, manufacturing, transport & installation
2.End-of-Life includes removal & disposal

LCA and Building Durability

Key Durability Issues for Effective LCA:

- Balancing initial durability and planned maintenance
- Validity of maintenance assumptions
- Modeling / prediction of aging effects
- Investigation of possible interaction effects

Applying LCA

Design Challenges

- Generic v. Proprietary LCA
- Product v. System LCA
- Scoring and Weighting

Application Challenges

- Resources
- Awareness / Knowledge

Applying LCA

Generic v. Proprietary LCA

- The generic challenge: Developing meaningful generic data from proprietary sources
  - Difficult to obtain
  - Highly variable
- The proprietary challenge: Developing a uniform "playing field" for proprietary data
  - Limited category rules available
  - Potential competitive influences on uniformity

Applying LCA

Product v. System LCA:

- Product LCA challenges
  - Potential over-emphasis on embodied impacts
  - Order of magnitude; When is a difference really significant?
  - Out-of-boundary features / benefits and systemic interactions
- System LCA challenges
  - Potential over-emphasis on operational impacts
  - The “chicken and egg” challenge: LCA professionals downplay the direct use of product LCA but still need product LCAs to build public databases
  - Limited end-user knowledge and lack of simple tools

Applying LCA

Scoring and Weighting:

- Categories
  - Broad or narrow?
- Scales
  - Numeric or technical?
- Weighting
  - Multiple-attribute or weighted index?

Applying LCA

Resources:

- Standards
  - Category rules
  - Reporting standards
- Databases
  - Generic v. proprietary
  - Maintenance and updating
- Funding
  - Corporate / NGO / government
  - Voluntary v. mandated

LCA in Codes & Standards

- **LEED 2012**
  - New credit for whole-building LCA versus a “reference building”
  - New credit for products with EPDs
- **International Green Construction Code (IGCC)**
  - Option for whole-building LCA versus “laundry list” of preferred products
- **ISO Standards**
  - Some U.S. companies have developed product EPDs
  - Some U.S. trade associations are developing PCRs
- **ASTM Standards**
  - New Committee E-60 formed to address LCA and other sustainability standards
- **ANSI Standards**
  - UL Environment and others developing “laundry list” product standards featuring LCA as one of many elements