Implementation Strategies for Sustainable Building Technologies: Risk Management and Real Options Valuation

Lara Greden and Leon Glicksman
Massachusetts Institute of Technology, Building Technology

Executive Summary

Use flexible design concepts to address risks of implementation of innovative, sustainable building technologies.

- Risk aversion hinders adoption of sustainable building technologies despite recognized potential benefit.
- Design that addresses risk can hedge losses while informing a more rational investment.
- Case study: option to install air-conditioning in a nat. vent. building to address climate and market risks.
- This research adds to the understanding of strategies to address risk in new building technologies.

Real Options Background

An option gives the owner the right, but not the obligation, to take an action in the future for a prespecified price.

Examples of options in building design

- Hybrid ventilation "switches" depending on climate.
- Flexibility to switch between lab types depending on business needs.

Real Options research has addressed real estate development, oil exploration, electric power plant investments and more.

Valuation of options in building design holds potential to
- Inform investment and design decisions.
- Hedge uncertainty in risky designs.

Case Application: Address risk of a naturally ventilated (NV) building with options-based design

Uncertainties & Option Design

- Market: the building might lease/sell for below market value without AC if building use changes, AC might be necessary
- Technical: the NV building might not be comfortable if climate changes

Real Options Valuation Model

Define: option value as the (average) energy costs saved while in NV mode

Conclusions and Forward Work

- Options provide building owners with a fall-back position, thereby reducing the risk of investment.
- Resulting option valuation informs investment to be made in the design & construction of NV with option for AC.

Forward Work

- Characterize uncertainty in market value using expert opinion
- Identify case study buildings
- Assess energy and carbon emissions avoided

Obtain feedback regarding practical implementation considerations.

Assess potential of strategy to encourage adoption of new, sustainable building technologies.

Contact Address: Lara Greden, lkgreden@mit.edu
Massachusetts Institute of Technology, 77 Massachusetts Avenue, Building Technology 5-418, Cambridge, Massachusetts 02139

This work is supported by the Cambridge-MIT Institute and an NSF graduate research fellowship.