

Quantifying the value of building reuse

A life cycle assessment (LCA) of rehabilitation and new construction

Objective

- The question of whether to rehabilitate a building or to replace it with a new one is an age-old question within the building industry. Historically, this has been a question of economics. It is now recognized that it is also a question with environmental implications.
- The National Trust for Historic Preservation wished to answer the latter question and commissioned an LCA to better understand the conditions under which rehabilitating and energy retrofitting a building is environmentally preferable to demolition and new construction. A team of building industry and LCA experts pooled together to tackle this project: Cascadia Green Building Council, Green Building Services, Skanska and Quantis.



Quantis Solution

- To evaluate the life cycle environmental profiles of rehabilitated and newly constructed buildings.
- Five building types in four U.S. climate zones were considered; two of these types included a warehouse repurposing analysis where a warehouse was converted to a different use:

Atlanta (hot, humid)	Chicago (cold)	Phoenix (hot, arid)	Portland (temperate)
Commercial office (+ warehouse repurpose)	Single-family residence	Multi-family residence (+ warehouse repurpose)	Elementary school Urban village

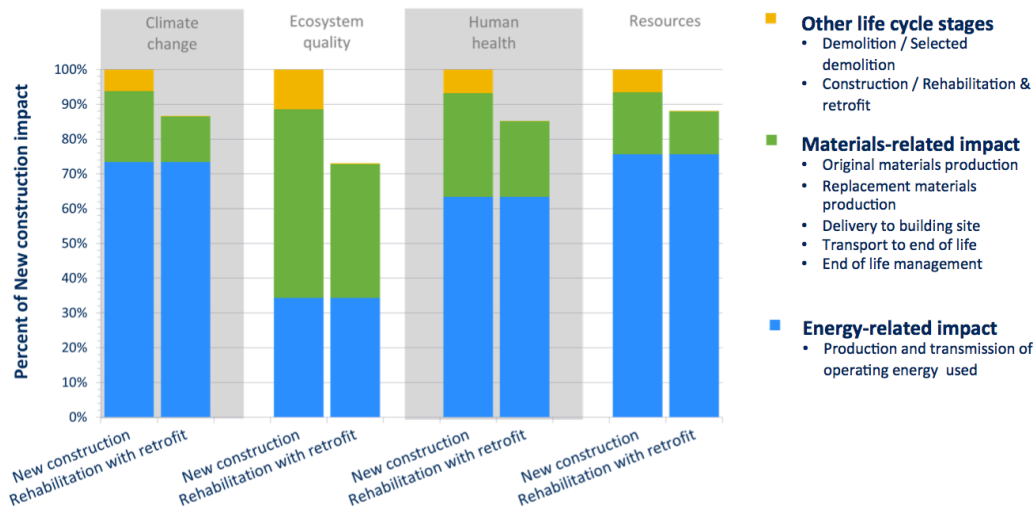
“Quantis’ whole-building calculator allowed us to look at a wide range of building types and climate zones in a very streamlined way. We would not have been able to do such a comprehensive study without this tool.”

Patrice Frey

Director of Sustainability
National Trust for
Historic Preservation



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Key findings

- While the figure shows only results of one building, four indicators and one climate zone, conclusions are based on the results of all five building types, 17 indicators and four climate zones.
- Scenario tests were also performed to understand the sensitivity of results to energy performance, electricity grid mix and building lifetime.

- New construction generally requires more material than rehabilitation with retrofitting, so in cases where energy performance is equivalent, rehabilitation with retrofitting offers environmental benefits relative to new construction.
- This need for fewer materials implies that rehabilitation with retrofitting offers near-term environmental savings, a particularly important benefit in the context of climate change pressures.
- Enhancing energy efficiency can require additional materials. Efficiency upgrades provide an environmental advantage only if the building lasts long enough for environmental savings from reduced energy use to exceed the environmental costs of the additional materials.
- Repurposing projects may not offer as many environmental savings due to the amount of materials needed, which can be similar to those needed by new construction.