Development of Regenerative Design Principles for Building Retrofits

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The Need to Retrofit

- "In developed countries, the majority of buildings which will be standing in 2050 have already been built." (UNEP, 2009)
- Regenerative design concepts are starting to become well established in frameworks such as the 'Living Building Challenge' and 'One Planet Living', but the outcomes still seem to be new developments in unique and ideal conditions.
- We currently have the means and technology to achieve regenerative outcomes for building retrofits – a change of ***mind*** not techniques is required.

Bullitt Center, Seattle, WA – Living Building Certified

Research Aim & Objectives

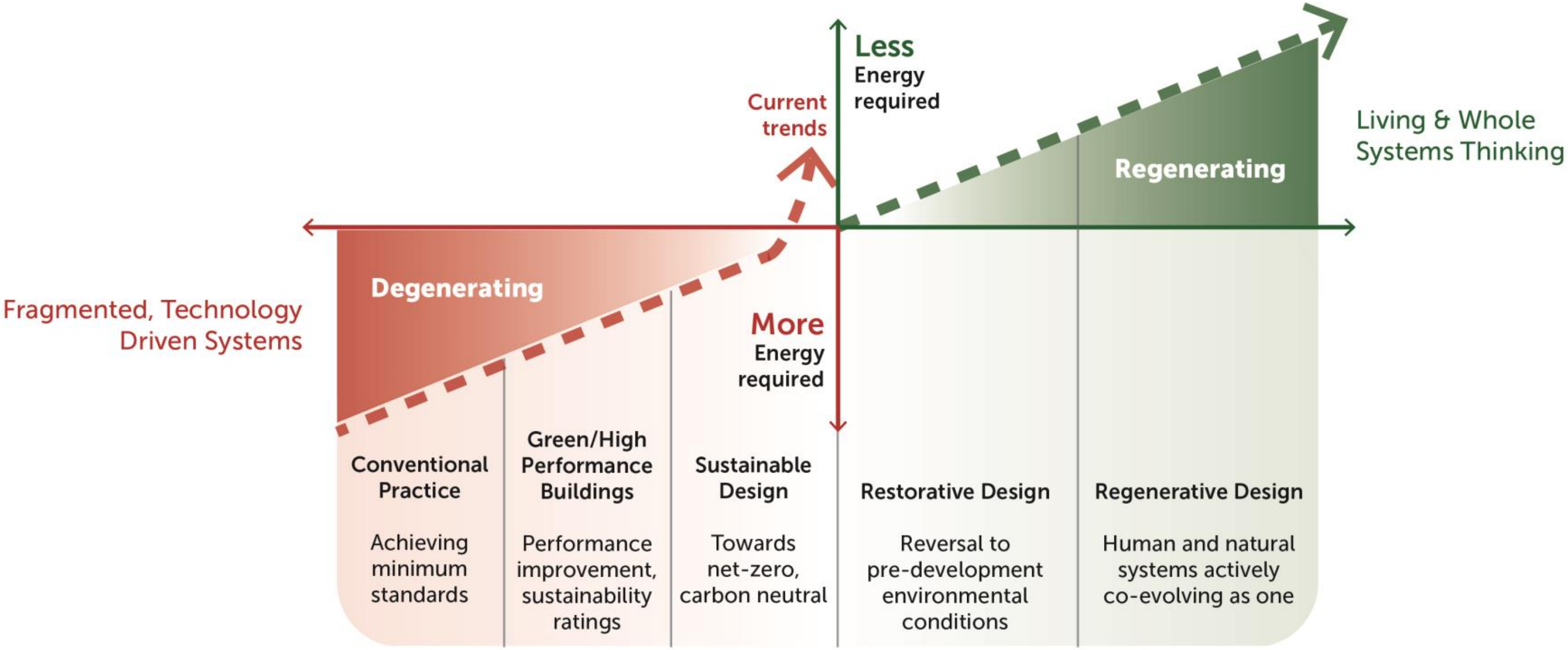
This research aims to propose a new approach to retrofitting embedded within a regenerative worldview. This approach will explore how the retrofit design process can not only improve the health and performance of a single building but add positive value to its surroundings.

To do so, this research will:

- Propose a ‘proactive’ approach to building retrofits.
- Develop a regenerative design model to explore the key interactions between physical, human and natural systems within the built environment.
- Develop a set of regenerative design principles to achieve ‘proactive’ retrofit outcomes.

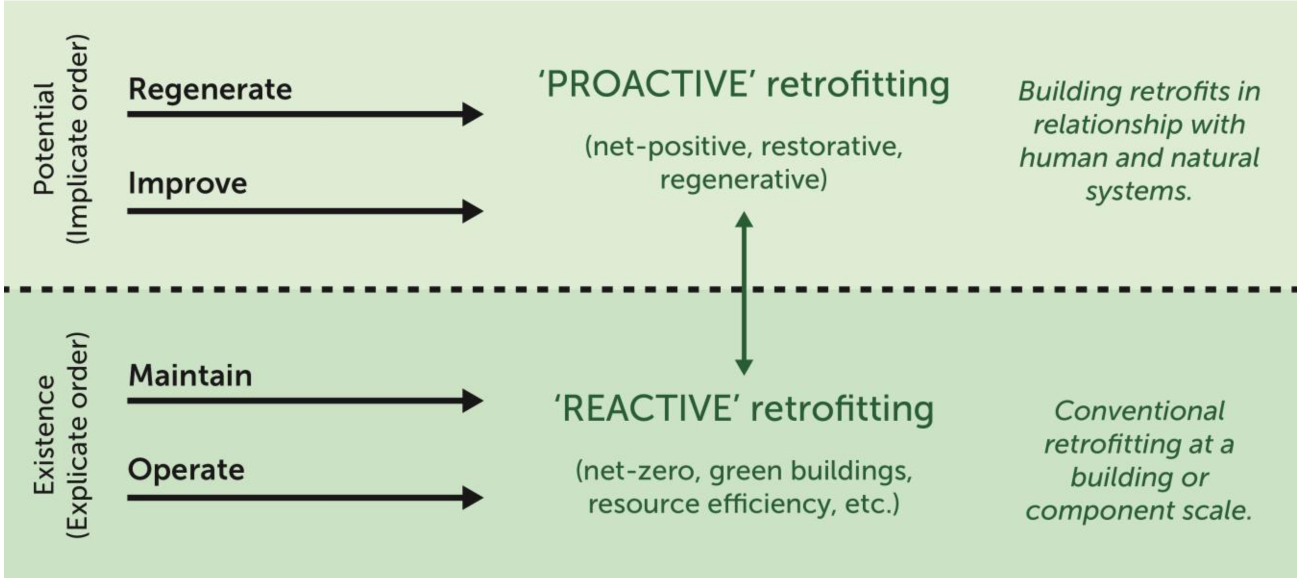
What is Regenerative Design?

- Regenerative design can be roughly defined as the “reconnection of human aspirations and activities with the evolution of natural systems – essentially coevolution.”(Mang & Reed 2012)



Range of sustainability approaches (after Bill Reed, 2007)

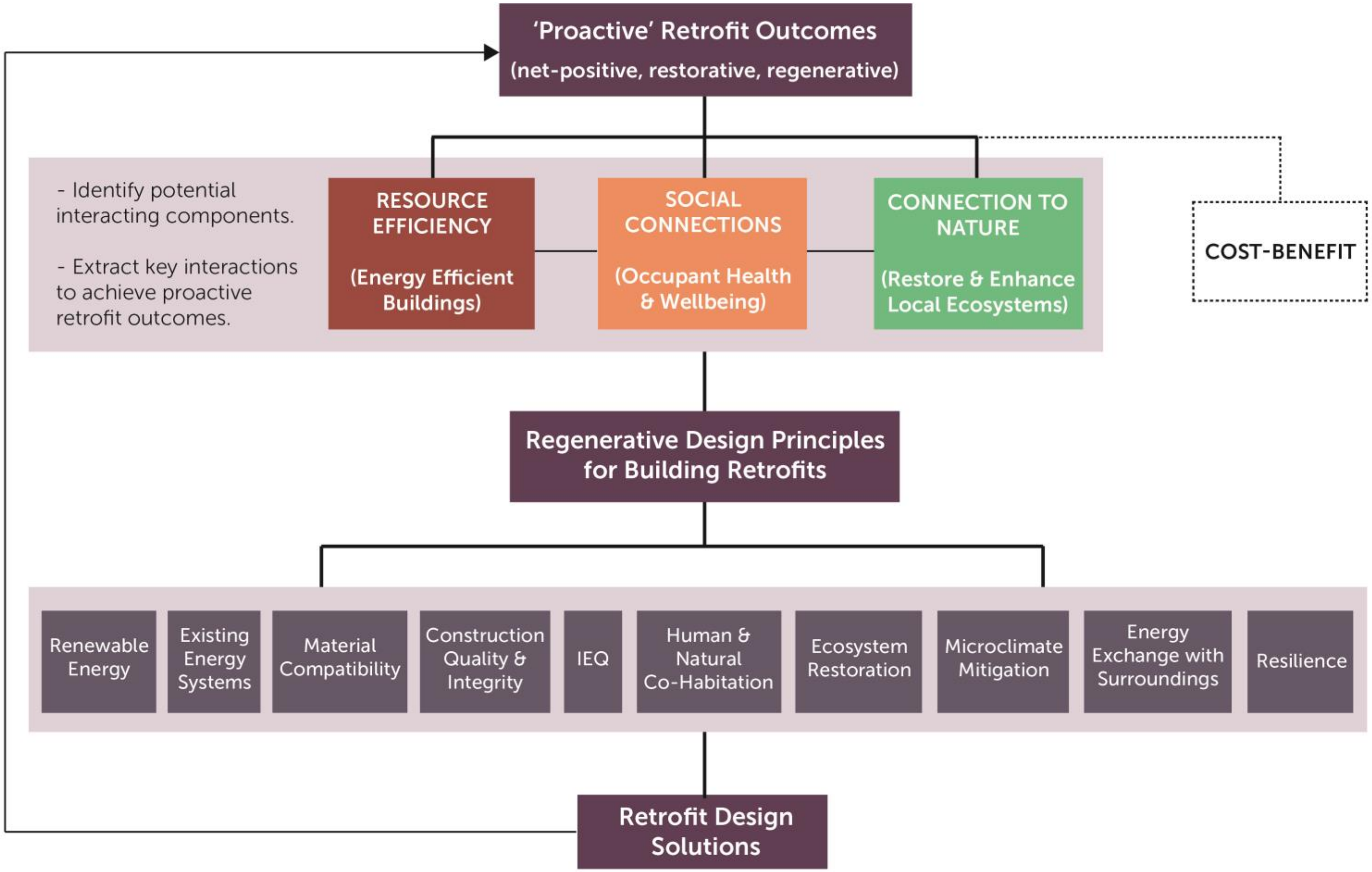
‘Reactive’ to ‘Proactive’ Retrofitting



Developed from original by Charles Krone, in Mang & Reed, 2012

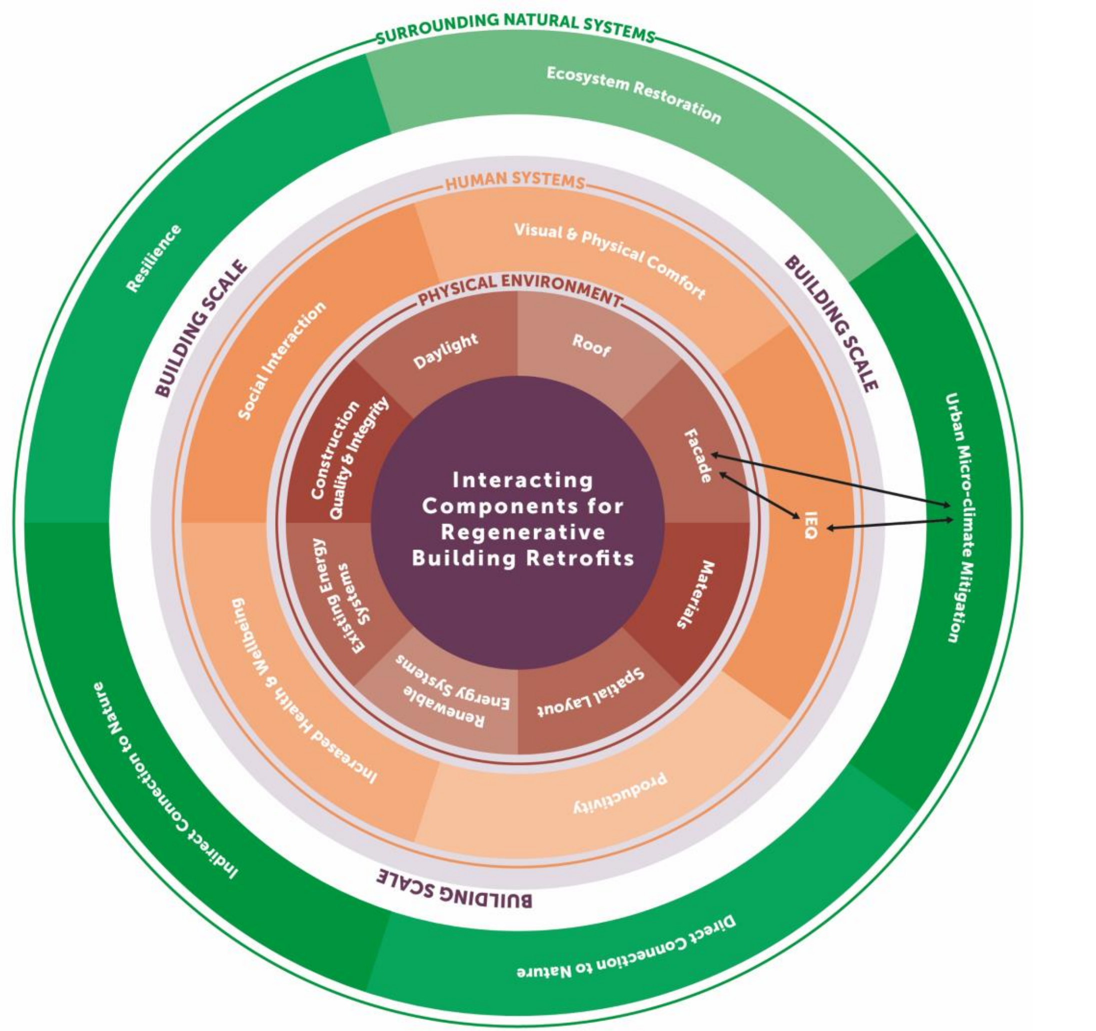
- Conventional approaches to building retrofits that are focused on energy and cost efficiency are simply ***‘reacting’*** to a negative event or circumstance.
- To be ***‘proactive’*** requires considering a building’s positive potential to interact with its surroundings by integrating net-positive, restorative and regenerative design concepts.

Regenerative Design Model for Building Retrofits

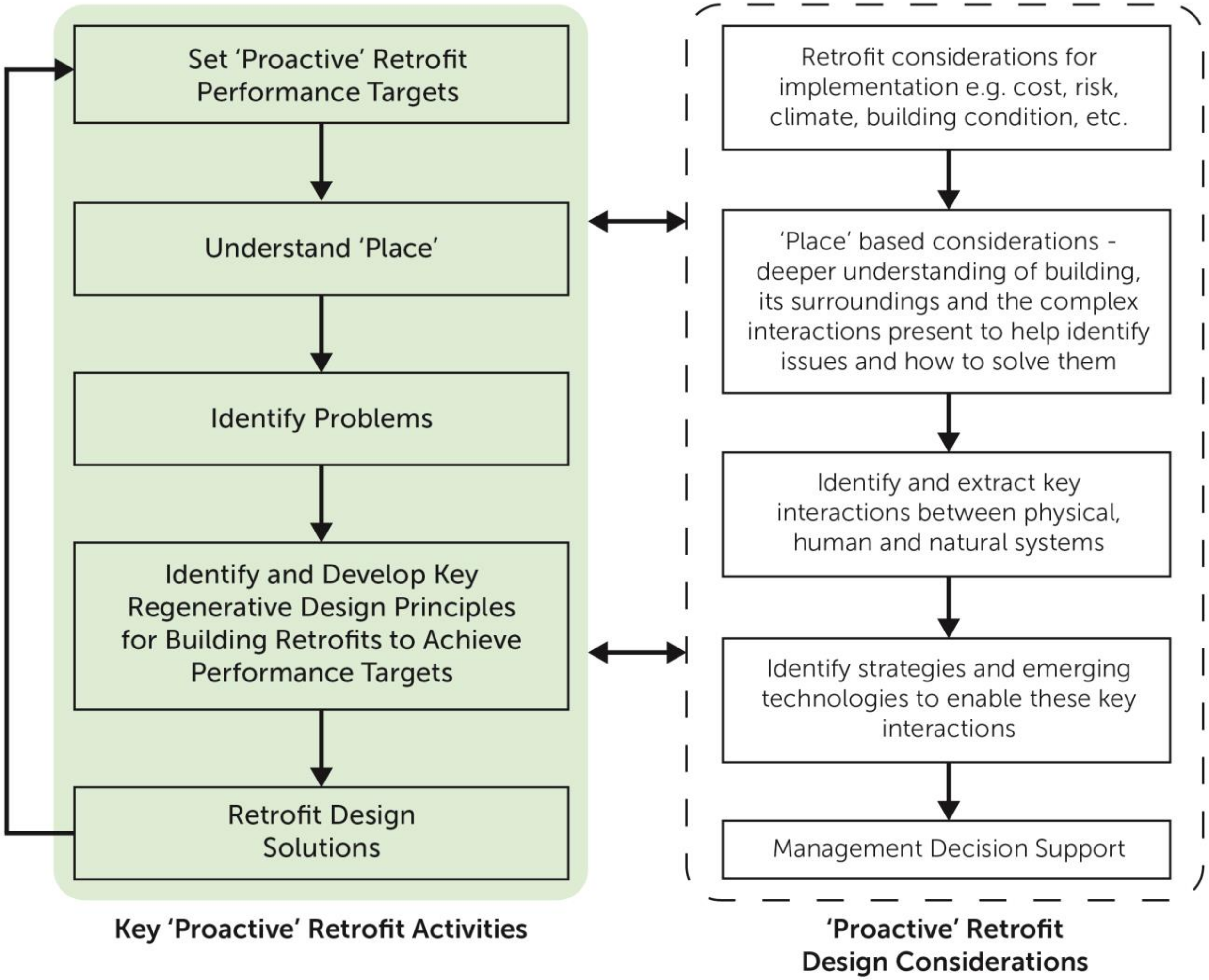


Identify and Extract Key Interactions

- Identify and extract key interactions between physical, human and natural systems to achieve ‘proactive’ outcomes.
- It is crucial that the interactions cross all three ‘dimensions’ in order to have a ‘proactive’ outcome.



Process Model for Proactive Retrofits



Performance Targets & Indicators

1. **Improve human and natural health and co-habitation:**

   - A building retrofit should encourage a harmonious relationship between building occupants and their surrounding built and natural environment.

   - A building retrofit should provide infrastructure to increase local biodiversity or new species habitation.

   - A building retrofit should provide shared spaces for natural and human habitats to create opportunities for social interactions and local food production.

Performance Targets & Indicators

2. Support a positive energy exchange with the surrounding built environment:

- A building retrofit should reduce energy consumption by integrating natural systems for improved heating, cooling and ventilation.
- A building retrofit should produce more energy than required through on-site and/or off-site renewable energy generation.
- A retrofitted building's excess energy should be stored for later use and/or invested in energy sharing strategies and initiatives with its surrounding built environment.

Performance Targets & Indicators

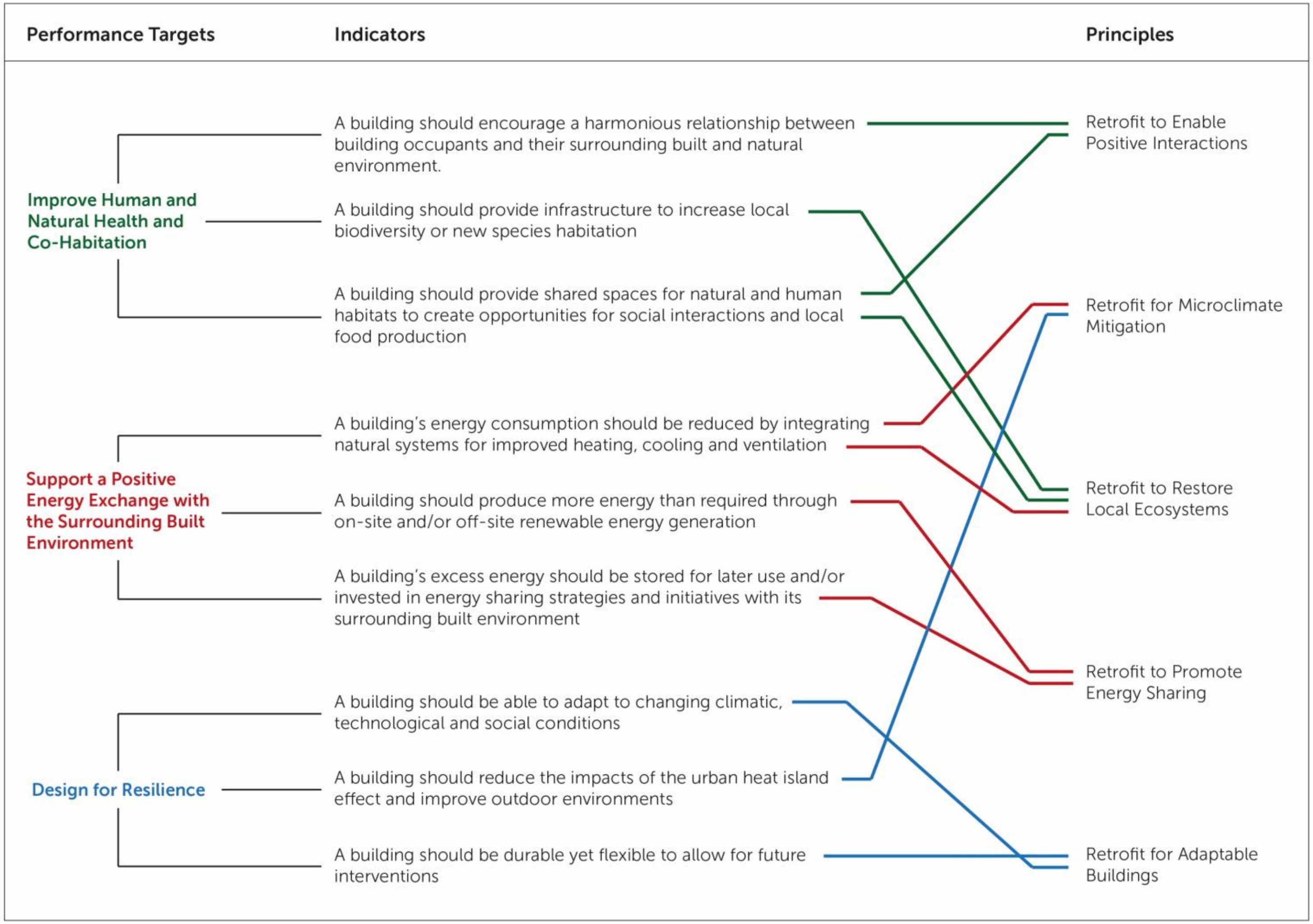
3. Design for resilience:

- A building retrofit should be able to adapt to changing climatic and technological conditions.

- A building retrofit should reduce the impacts of the urban heat island effect and improve outdoor environments.

- A building retrofit should be durable yet flexible to allow for future interventions.

Alignment of Principles with Performance Targets & Indicators



Key Regenerative Design Principles for Building Retrofits

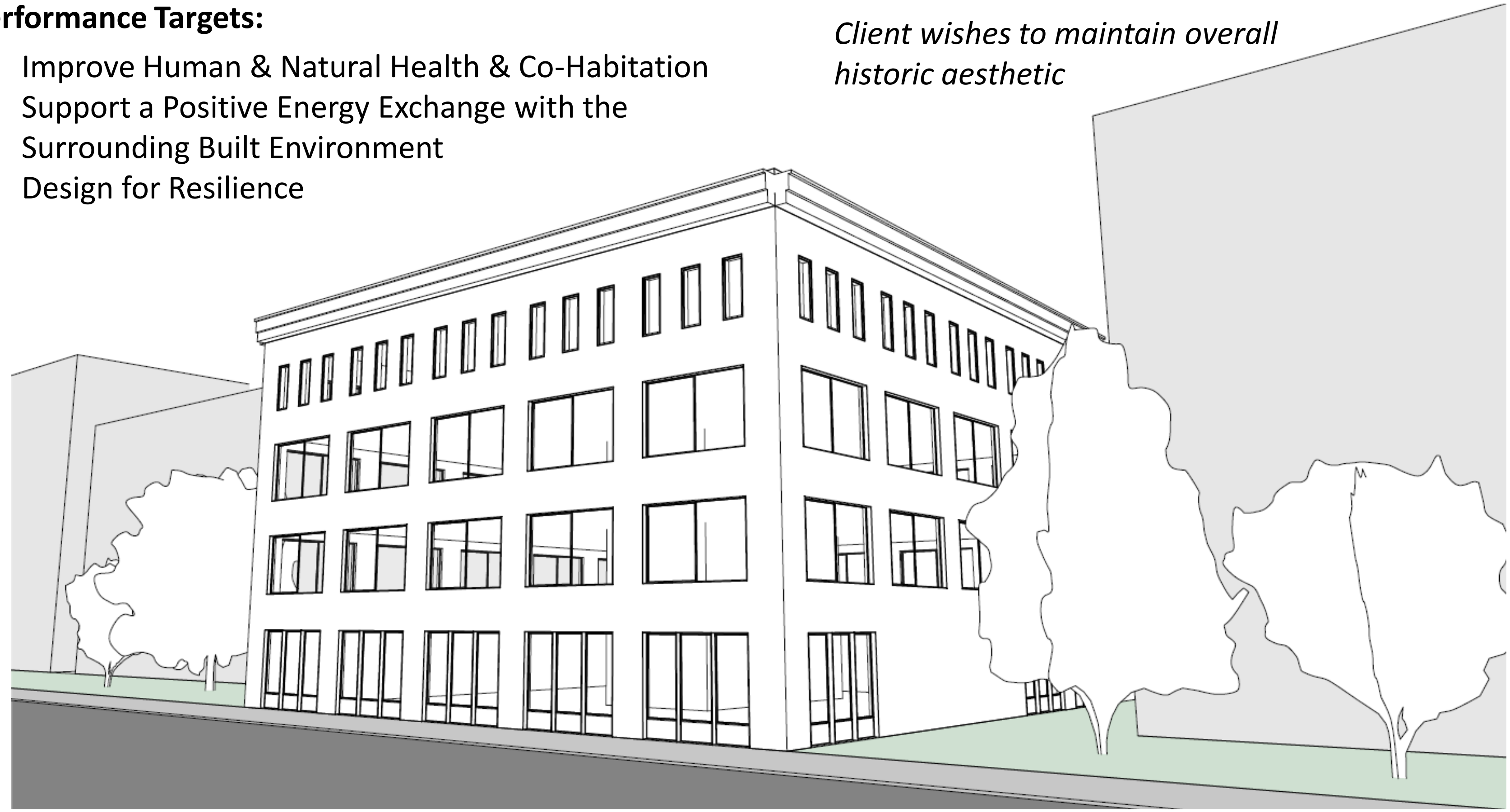
- **Retrofit to enable positive interactions:** a building should support interactions between people, technology and nature to encourage positive occupant behaviour.
- **Retrofit for microclimate mitigation:** new and existing materials should support comfortable internal environments and mitigate the effects of the surrounding microclimate.
- **Retrofit to restore local ecosystems:** the building envelope should integrate natural systems to improve the health of internal environments and restore local ecosystems.
- **Retrofit to promote energy sharing:** a building should actively seek to promote and be involved in energy sharing strategies and initiatives.
- **Retrofit for adaptable buildings:** an existing building should be redesigned to adapt to changing technologies and social conditions.

Hypothetical example

Performance Targets:

- Improve Human & Natural Health & Co-Habitation
- Support a Positive Energy Exchange with the Surrounding Built Environment
- Design for Resilience

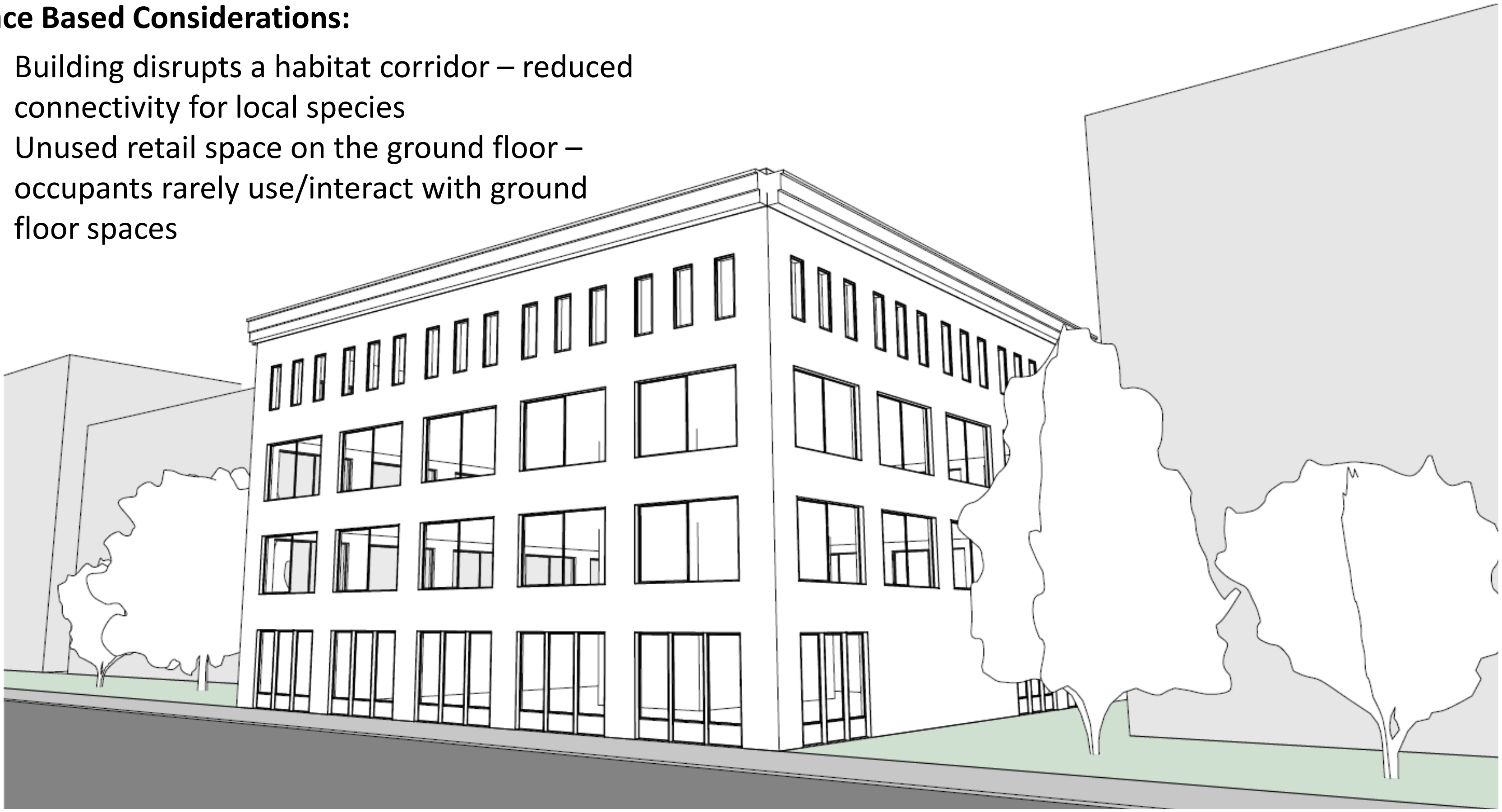
Client wishes to maintain overall historic aesthetic



Hypothetical example

Place Based Considerations:

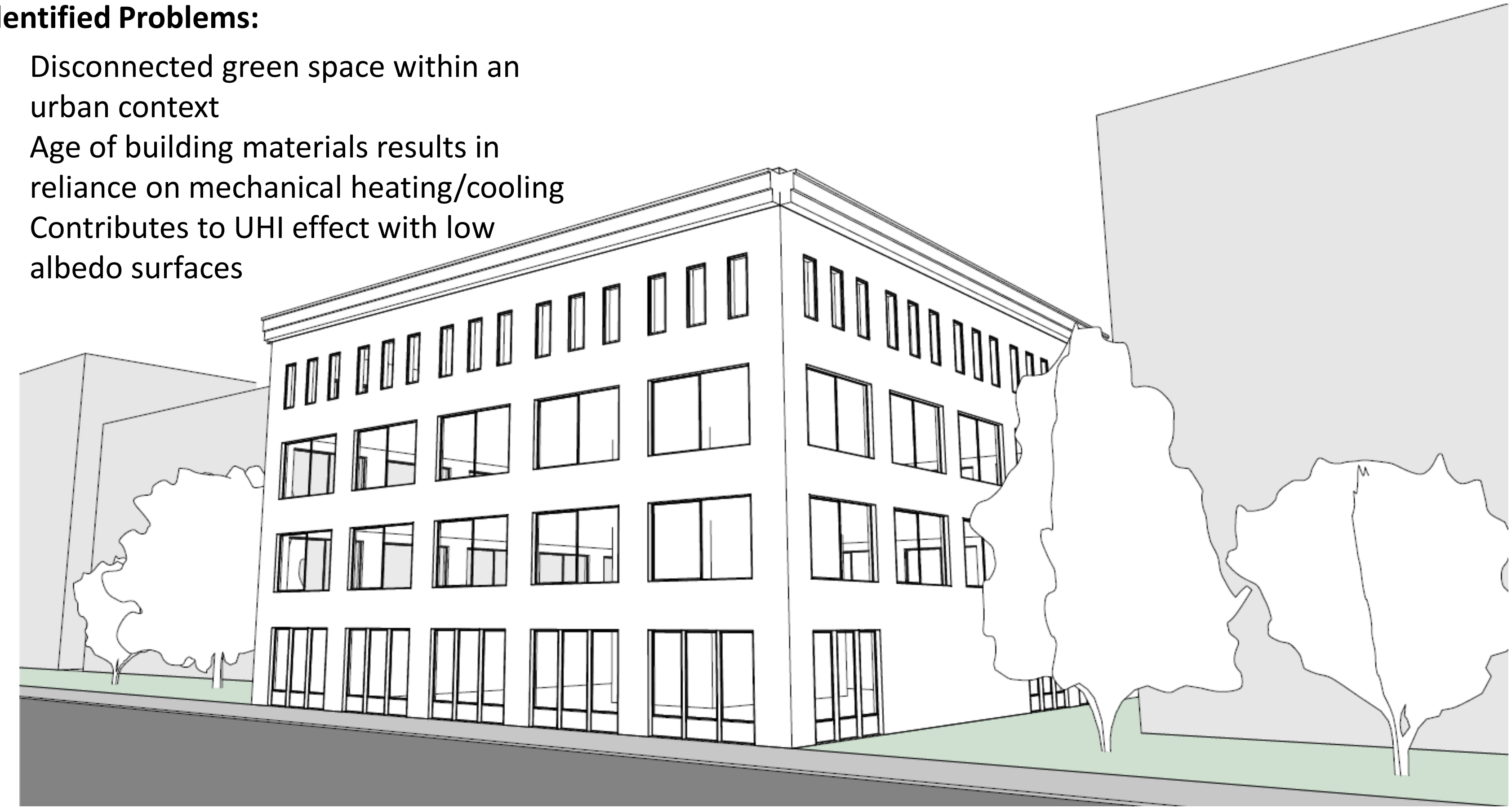
- Building disrupts a habitat corridor – reduced connectivity for local species
- Unused retail space on the ground floor – occupants rarely use/interact with ground floor spaces



Hypothetical example

Identified Problems:

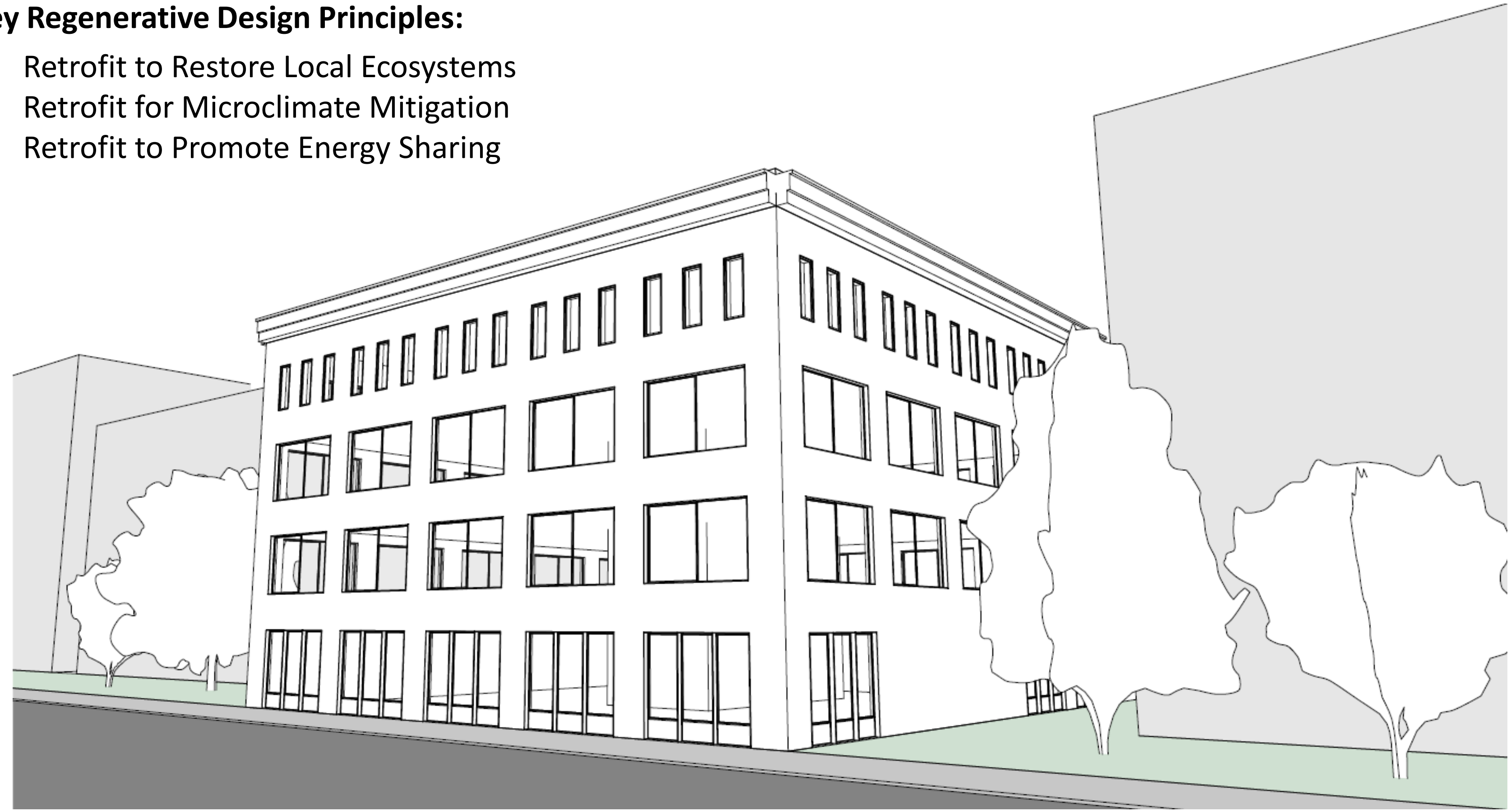
- Disconnected green space within an urban context
- Age of building materials results in reliance on mechanical heating/cooling
- Contributes to UHI effect with low albedo surfaces



Hypothetical example

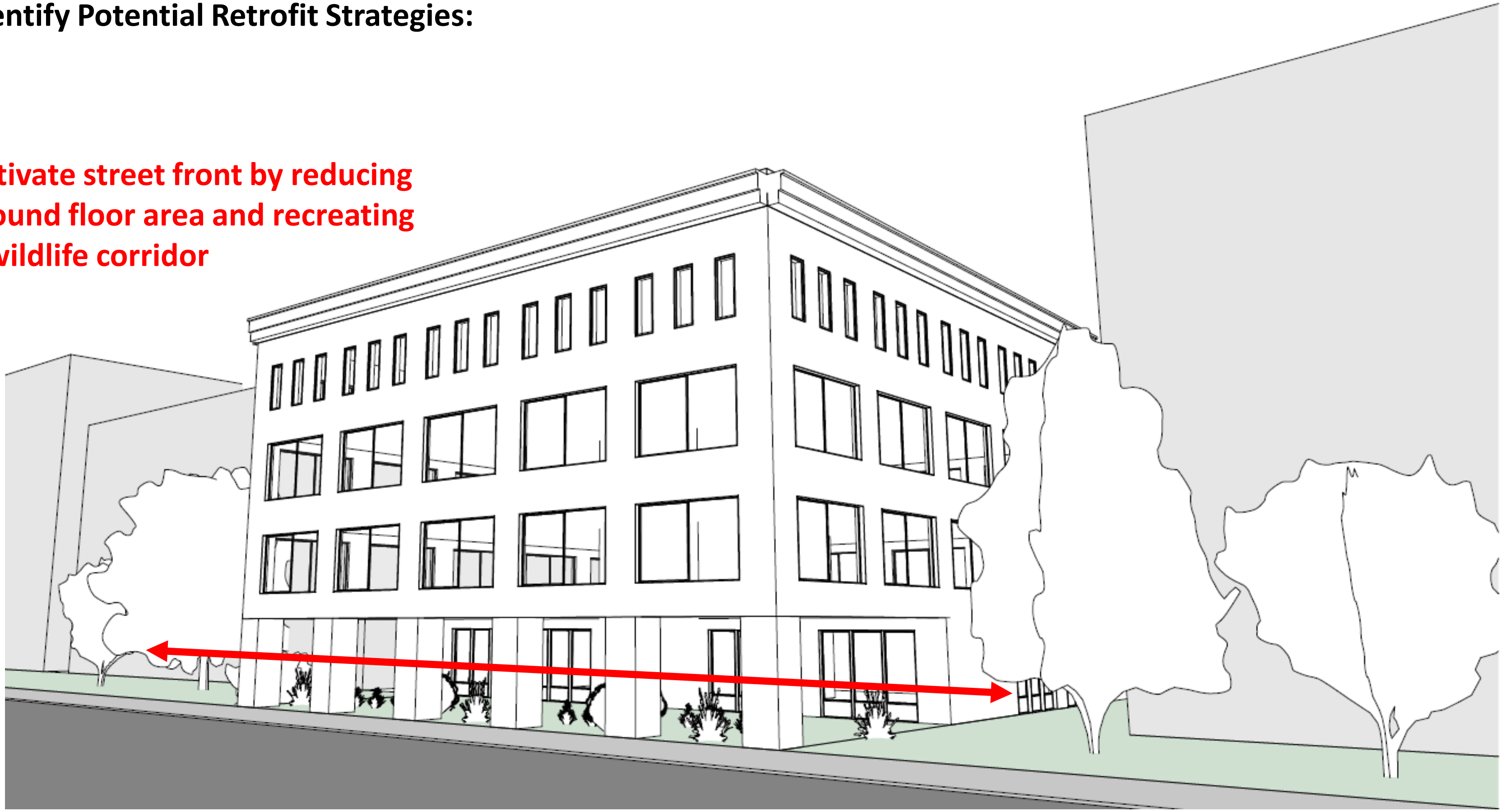
Key Regenerative Design Principles:

- Retrofit to Restore Local Ecosystems
- Retrofit for Microclimate Mitigation
- Retrofit to Promote Energy Sharing



Hypothetical example

Identify Potential Retrofit Strategies:



Hypothetical example

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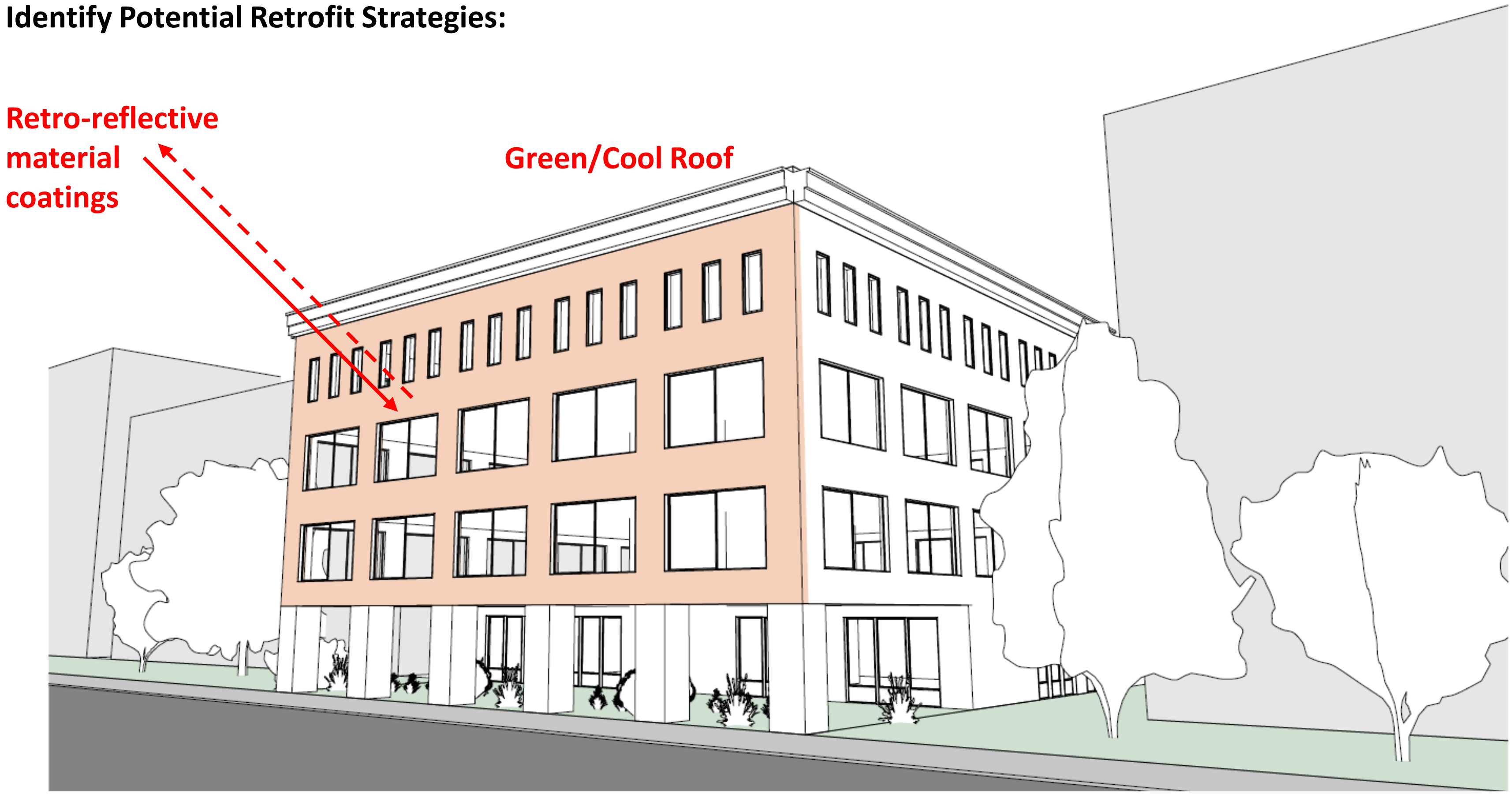

Hypothetical example

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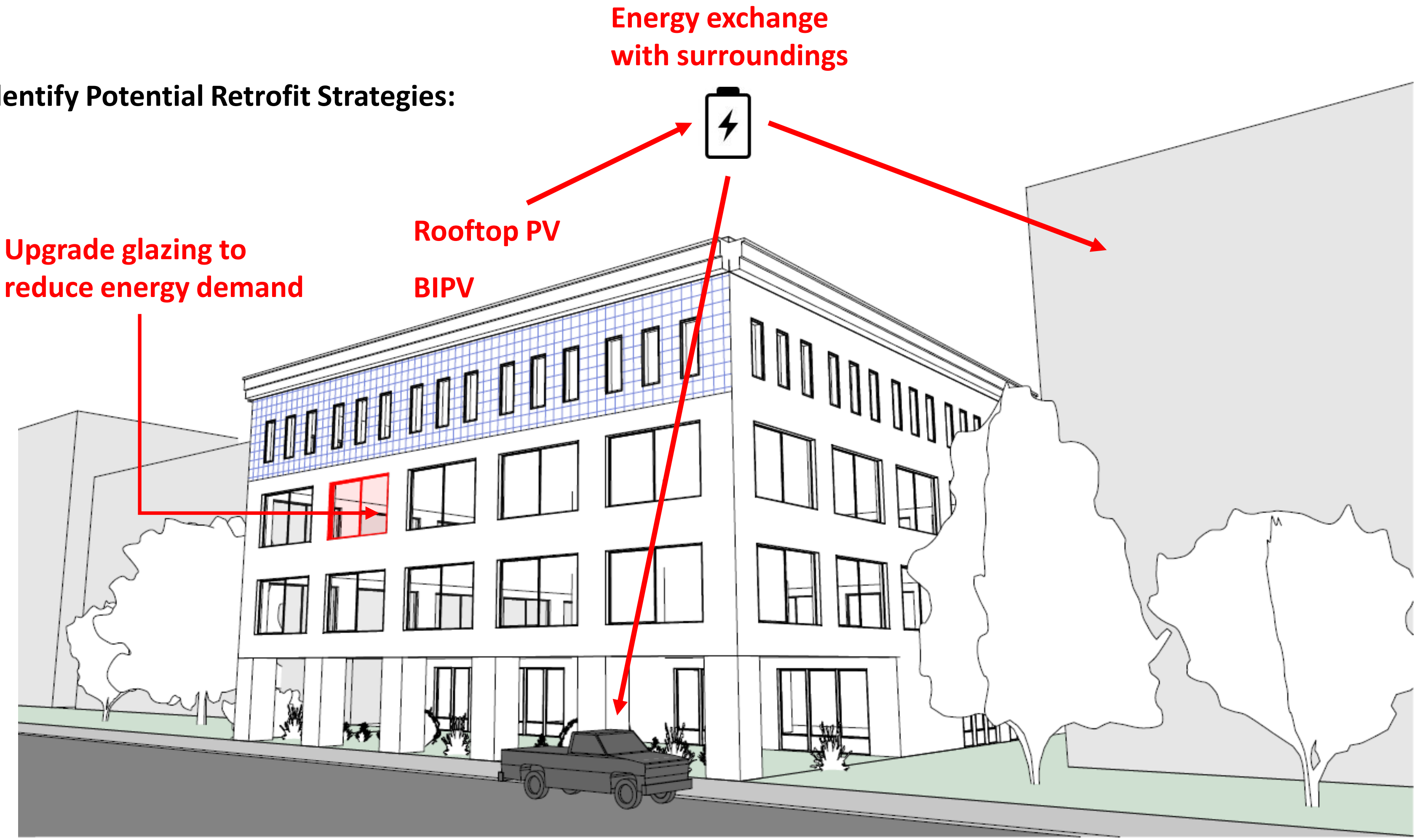
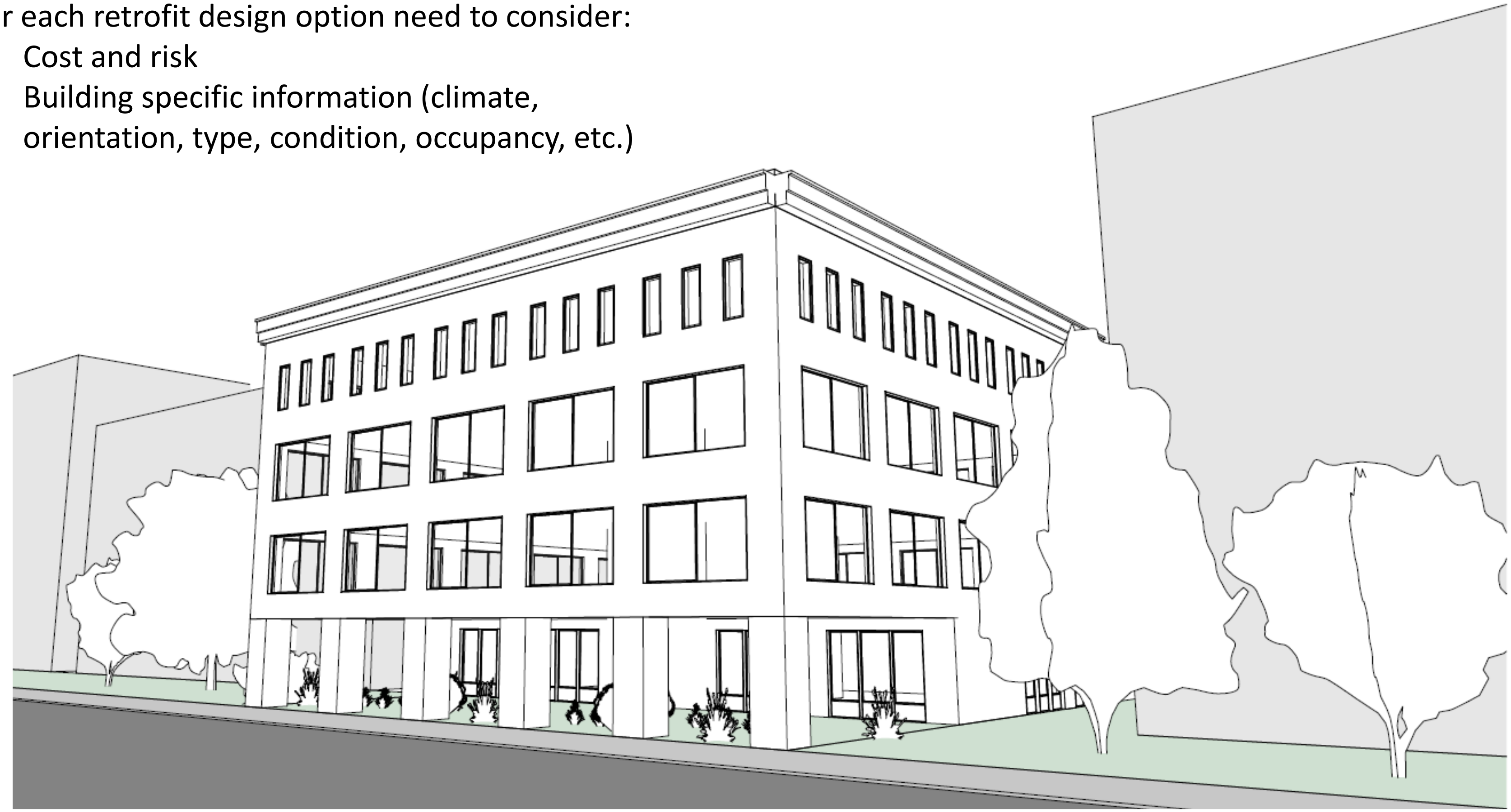


Hypothetical example

For each retrofit design option need to consider:

- Cost and risk
- Building specific information (climate, orientation, type, condition, occupancy, etc.)



Significance

- These principles aim to provide high-level guidance to designers in order to ***expand*** (rather than prescribe) potential retrofit solutions to achieve ‘proactive’ outcomes.

- So rather than any specific techniques, strategies or technologies, the true benefit of ‘proactive’ retrofitting is the underlying shift in mindset that a single building retrofit can add positive value to and interact with its surroundings.

Thank you