# abs_RTECH

active building skins: Retrofit Technologies for Energy-Efficient Cooling and Heating

## PROJECT TEAM _

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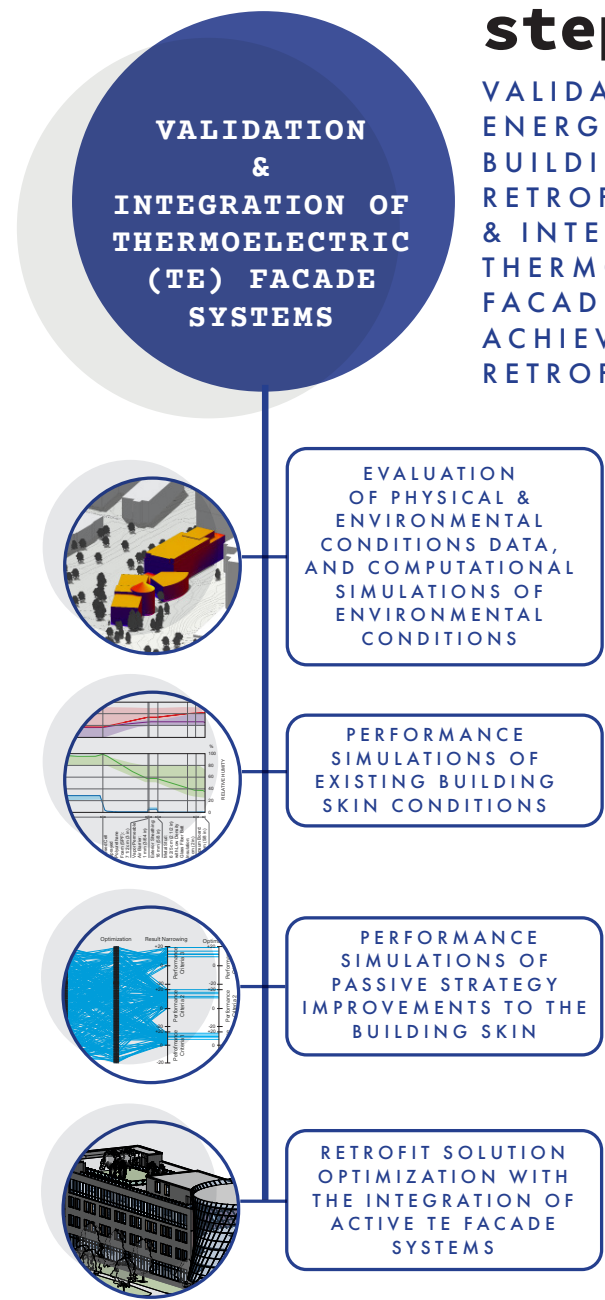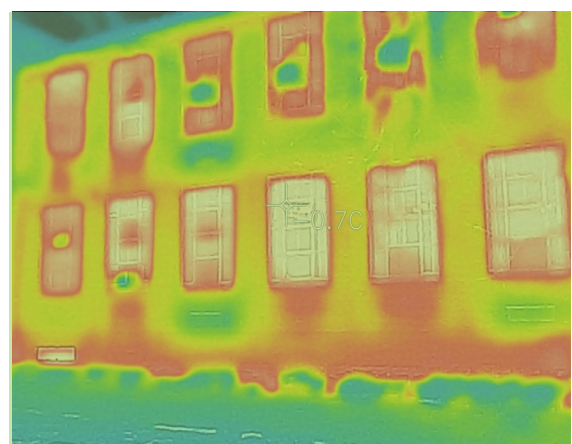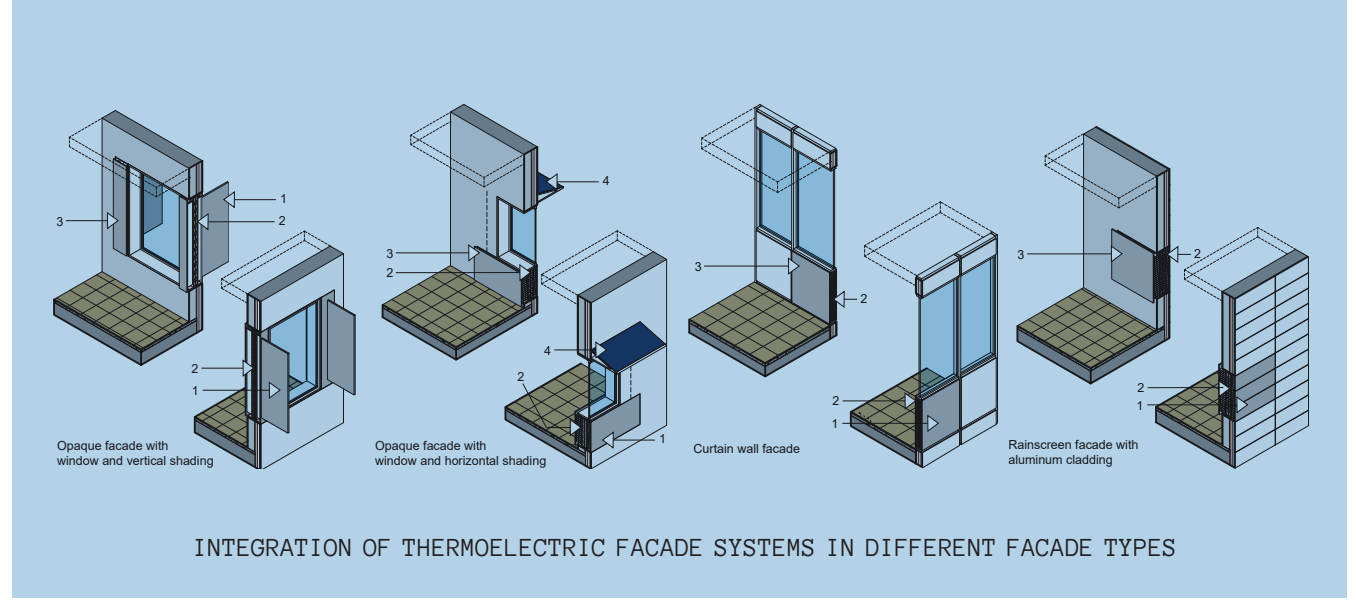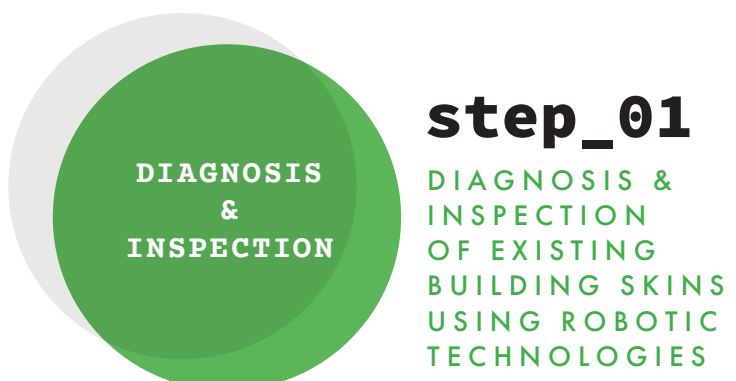https://www.facadetectonics.org/people/

## DESCRIPTION _

Our project proposes a 3-step process which will integrate the currently available robotic technologies with our extensive research and development of a promising energy saving facade applicatoin technology using thermoelectrics to achieve economically feasible, energy-efficient and safe methods of building skin retrofits.
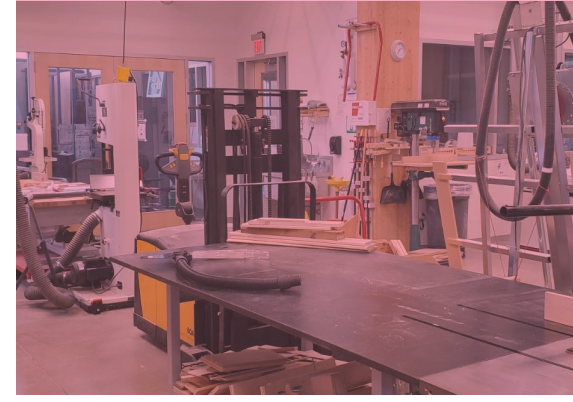
Step 01 utilizes robotic technologies for initial data collection and inspection of the current physical state and performance of building facades.

Step 02 integrates our current research and design solution optimization on facade retrofits using computational software and the UMass developed thermoelectric (TE) facade system that generates energy using thermoelectric modules (TEMs) based on environmental factors and data from Step 01.

Step 03 applies robotic technologies to fabricate and assemble components and prototypes of full scale TE facade systems based on the optimally performing and most economic design solution determined in Step 02.

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INTEGRATION OF THERMOELECTRIC FACADE SYSTEMS IN DIFFERENT FACADE TYPES

## step_01

### DIAGNOSIS & INSPECTION

DIAGNOSIS & INSPECTION OF EXISTING BUILDING SKINS USING ROBOTIC TECHNOLOGIES

- ASSESMENT OF PHYSICAL QUALITIES
- SURVEYING, RASTER SCANNING & THERMAL IMAGING
- ANALYZING DAMAGE & INSPECTION OF CURRENT CONDITIONS
- DETECTION & LOCATION OF STRUCTURE FOR INEGRATION OF THERMOELECTRIC (TE) FACADE SYSTEMS

## step_02

### VALIDATION & INTEGRATION OF THERMOELECTRIC (TE) FACADE SYSTEMS

VALIDATION OF ENERGY-EFFICIENT BUILDING SKIN RETROFIT STRATEGIES & INTEGRATION OF THERMOELECTRIC FACADE SYSTEMS TO ACHIEVE OPTIMAL RETROFIT SOLUTIONS

- EVALUATION OF PHYSICAL & ENVIRONMENTAL CONDITIONS DATA, AND COMPUTATIONAL SIMULATIONS OF ENVIRONMENTAL CONDITIONS
- PERFORMANCE SIMULATIONS OF EXISTING BUILDING SKIN CONDITIONS
- PERFORMANCE SIMULATIONS OF PASSIVE STRATEGY IMPROVEMENTS TO THE BUILDING SKIN
- RETROFIT SOLUTION OPTIMIZATION WITH THE INTEGRATION OF ACTIVE TE FACADE SYSTEMS

## step_03

### CONSTRUCTION & IMPLEMENTATION

CONSTRUCTION & IMPLEMENTATION OF OPTIMAL RETROFIT SOLUTIONS USING ROBOTIC TECHNOLOGIES

- DIGITAL FABRICATION OF BUILDING SKIN PROTOTYPES WITH INTEGRATED TE FACADE SYSTEM COMPONENTS
- ROBOTIC CONSTRUCTION & ASSEMBLY OF BUILDING SKIN PROTOTYPES WITH INTEGRATED TE FACADE SYSTEMS
- ROBOTIC OFF-SITE CONSTRUCTION & ASSEMBLY OF FULL SCALE TE FACADE SYSTEM MODULES, AND THEIR INSERTION ON CONSTRUCTION SITE

## 3-STEP RETROFIT PROCESS _