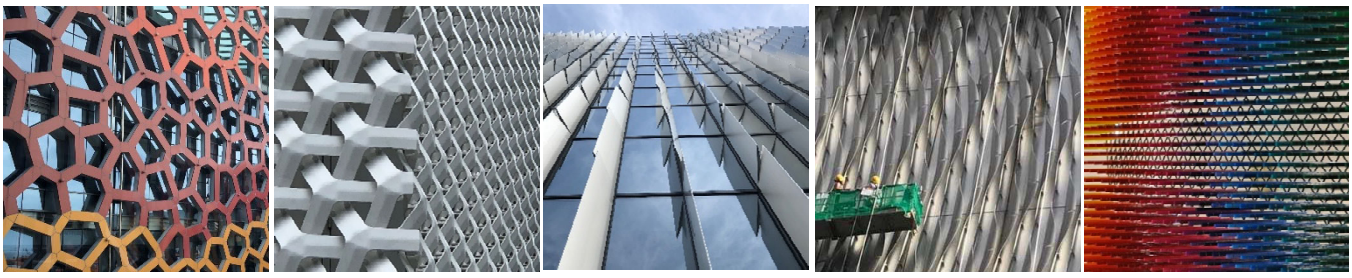
Net Zero Energy Retrofitting: Adaptable Kinetic Facades

ARCH 7104 Diploma Studio Spring 2023 Prof. Kyoung Hee Kim, PhD AIA NCARB [kkim33@uncc.edu, Rm 227]



[Promise] We live in an era that faces global challenges of climate change and resource depletion. With rapid urbanization and growing energy consumption, building facades become ever more important in architectural practice and environmental stewardship. As existing buildings are responsible for more than half of the total energy consumption and CO2 emission, energy-efficient retrofitting promises a significant opportunity for energy saving and emission reduction. There has been an increase in the integration of kinetic facades in contemporary buildings due to their environmental potential and aesthetic construction. The kinetic façade can be one of the sustainable solutions for net zero energy retrofits.

[Problem] Building envelopes in contemporary buildings play an important role as micro-climate controllers and aesthetic performers. One of the primary problems of contemporary building enclosures is their "static" nature in relation to their "dynamic" environment. The studio focuses on kinetic building enclosures that correspond to dynamic environments in space, program, time, and occupants to balance multi-faceted design requirements as a mediator between indoor and outdoor.

[Objectives] This Diploma studio focuses on the design of a multimodal kinetic façade system. The studio activities consist of desk surveys, parametric modeling & simulations, performativity measurements, prototyping, discussions, lectures, pin-ups, and reviews to maximize two primary learning objectives:

- The studio serves as a summative experience for the professional MArch degree.
- Design a project that exhibits conceptual, formal, aesthetic, technological and experiential clarity, criticality, and sophistication.

[Project] The project is a ***net zero energy refitting with kinetic facades*** that contributes to innovations and vibrancy of cities. Kinetic façades can consider six degrees of freedom and address multimodal design goals including but not limited to thermal and illuminous environments, airflow, water, soil, ecosystem, energy, carbon, user experience as well as aesthetic quality. The project should create a compelling narrative for promoting the triple bottom line of sustainability for the user, nature, and the built environment, focusing on one of the followings.

- ***Active kinetic façades****:* active systems deploying to predictive measures and/or real-time measures.
- ***Kinetic material façades****:* material systems responding to heat, air, and moisture (HAM) such as hygroscopic, thermo-bimetals, shape alloy memory.
- ***Bio kinetic facades****:* bio-based facades or biomimetic systems following functional strategies found in nature.

[Evaluation] This project is evaluated on architectural design quality, relevancy, and caliber of execution. The distribution of cumulative course assignments are as follows:

Assignment Description	**Weight for Course (%)**
Design project activities (total)	85%
Formal project presentations and documentation	15%
	100%

[Bibliography]

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- Kolarevic, B., Parlac, V. Building Dynamics: Exploring Architecture of Change. New York: Routledge, 2015
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