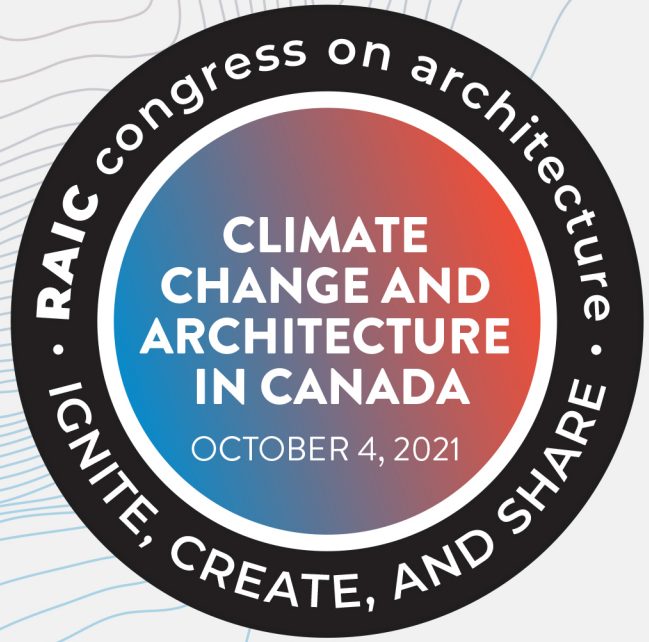
Taking Action: A Conversation on Climate Change and Architecture in Canada

October 5, 2020

TOWARDS FUTURE SOLUTIONS

Ajla Akšamija, PhD, LEED AP BD+C, CDT
University of Massachusetts Amherst/Perkins&Will

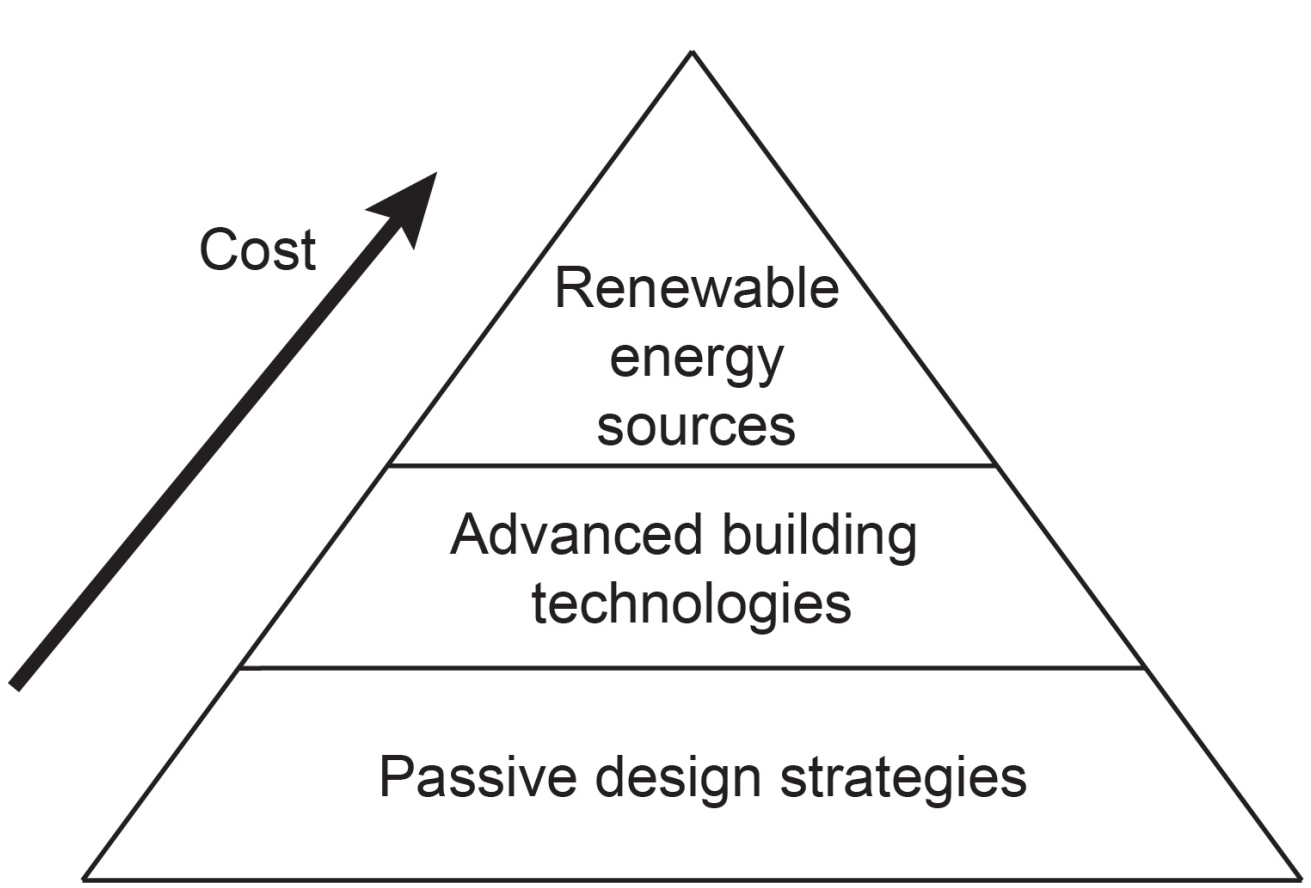


What Our Future Should Be: Nur Akšamija's artwork (16 years old)

COOLscience

Nur, a 10th grader from Hadley, is a Cool Science 2020 Runner-Up. Congratulations Nur!

How Do We Get There?



Integration of building performance analysis during design

Aksamija, A., (2016). "Regenerative Design and Adaptive Reuse of Existing Commercial Buildings for Net-Zero Energy Use", *Journal of Sustainable Cities and Society*, Vol. 27, pp. 185–195, DOI: 10.1016/j.scs.2016.06.026.

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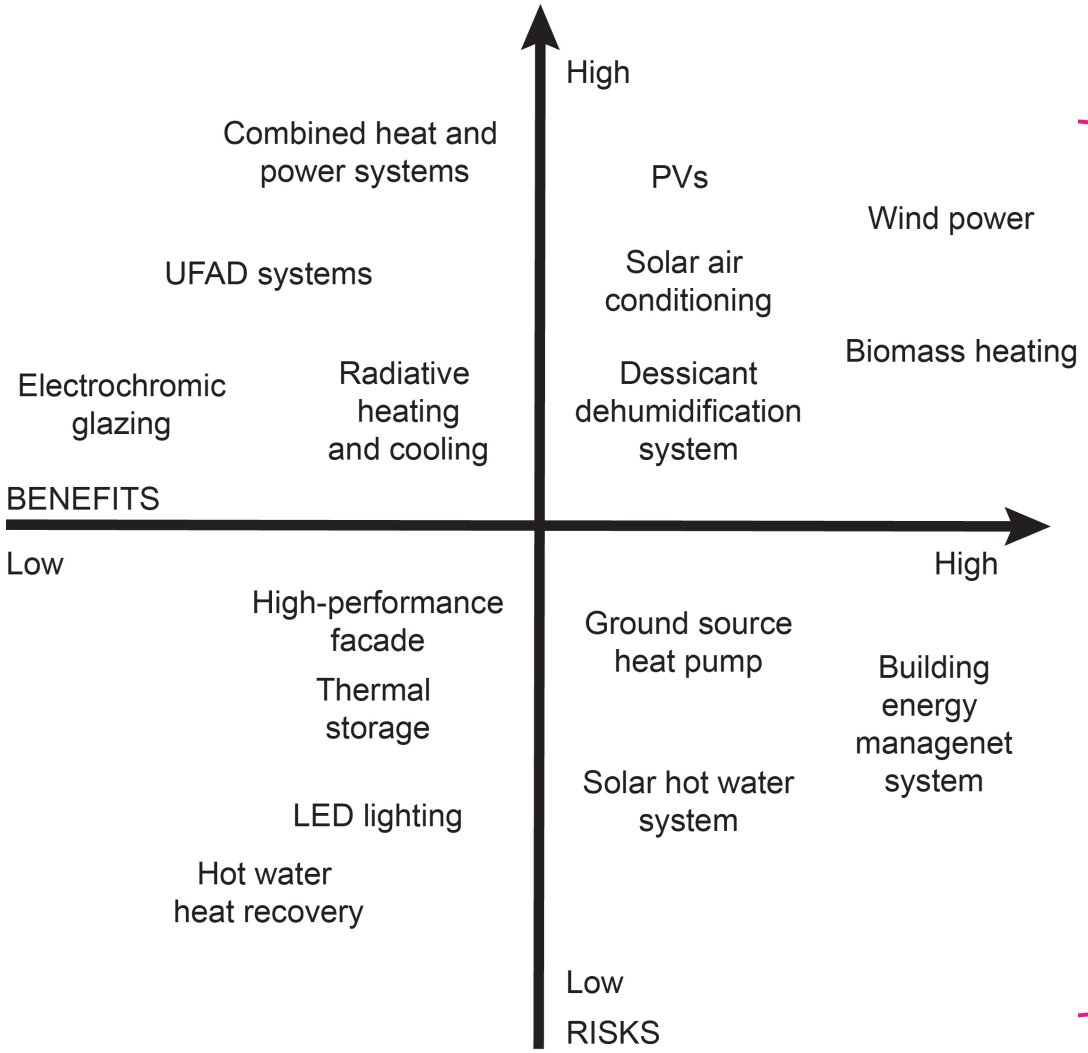

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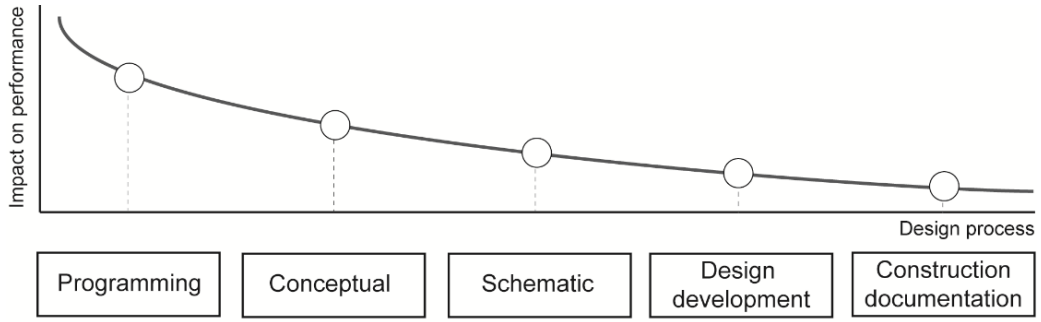
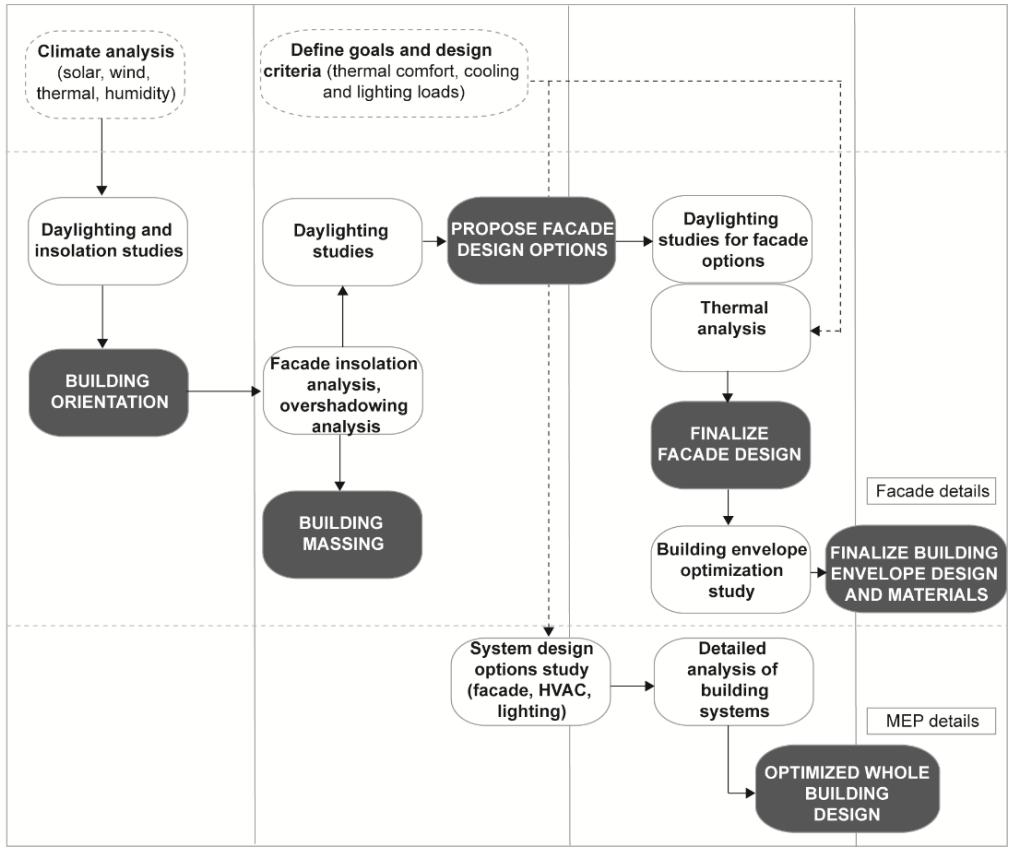
How Do We Get There?



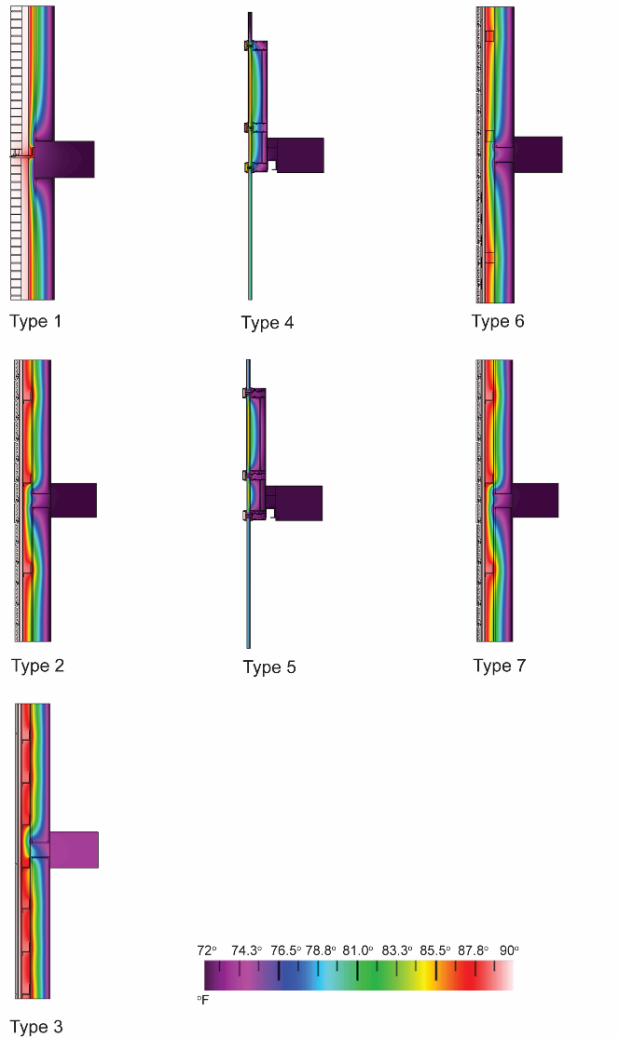
Impact of design decisions on building performance



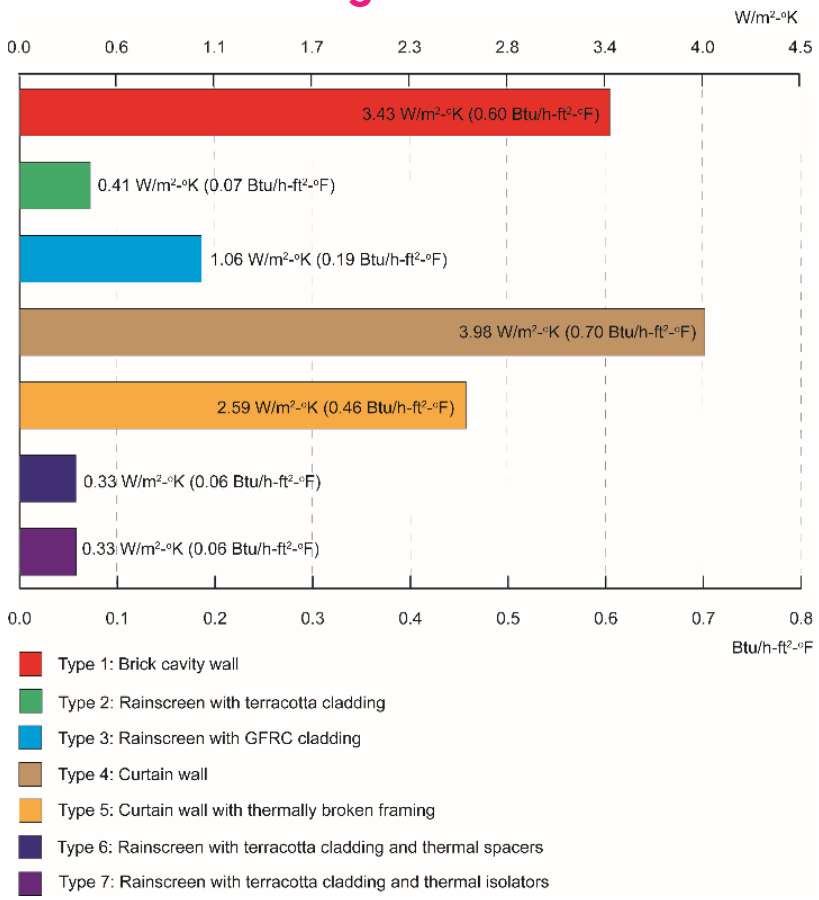
Performance-based design

Aksamija, A., (2015). "Design Methods for Sustainable, High-Performance Building Facades", *Advances in Building Energy Research*, Vol. 10, No 2, pp. 240-262, DOI: 10.1080/17512549.2015.1083885.

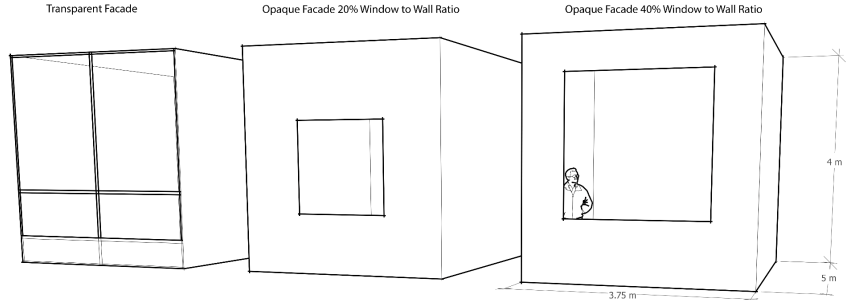
Impact of Climate Change on Building Envelope Performance: Current Climate, 2050 and 2080



Thermal modeling



Energy modeling

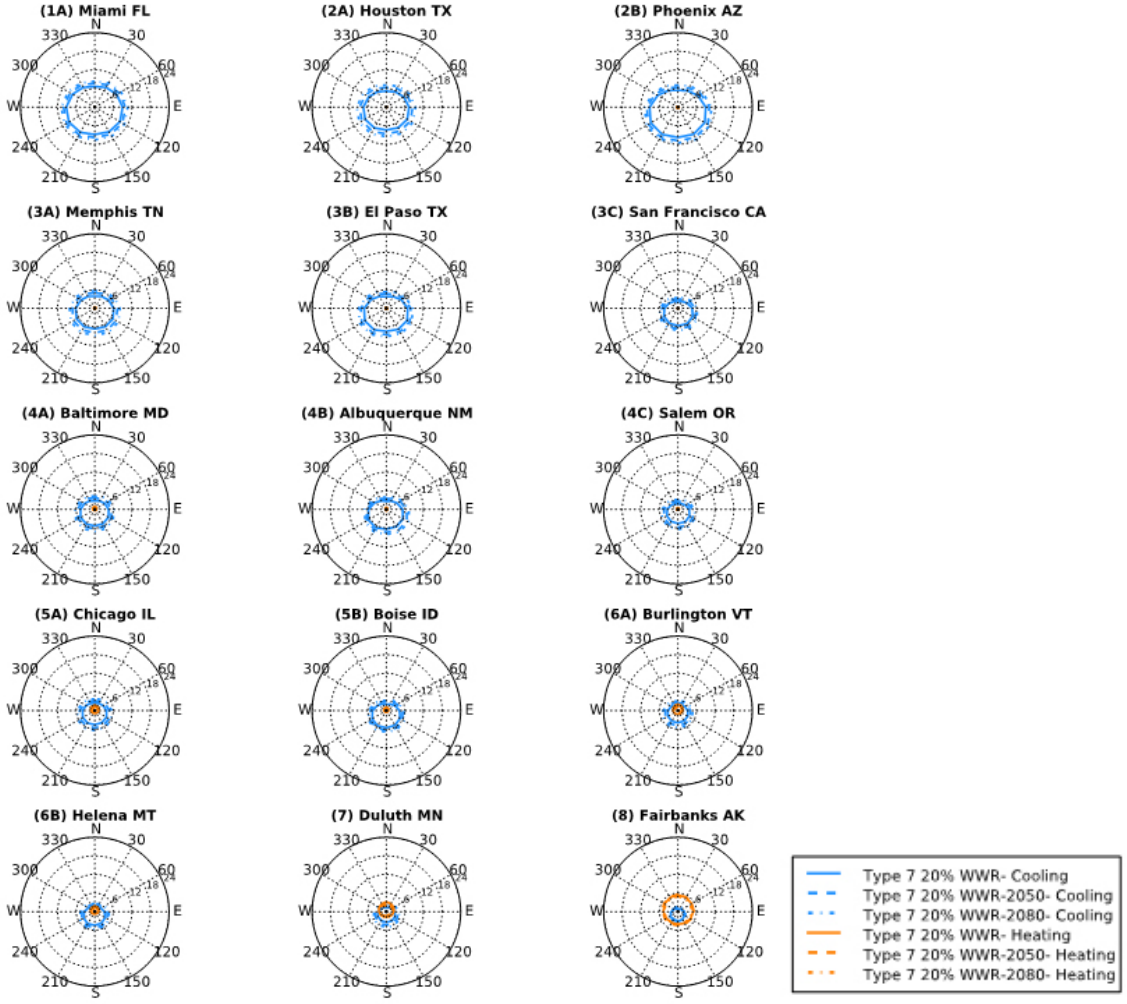


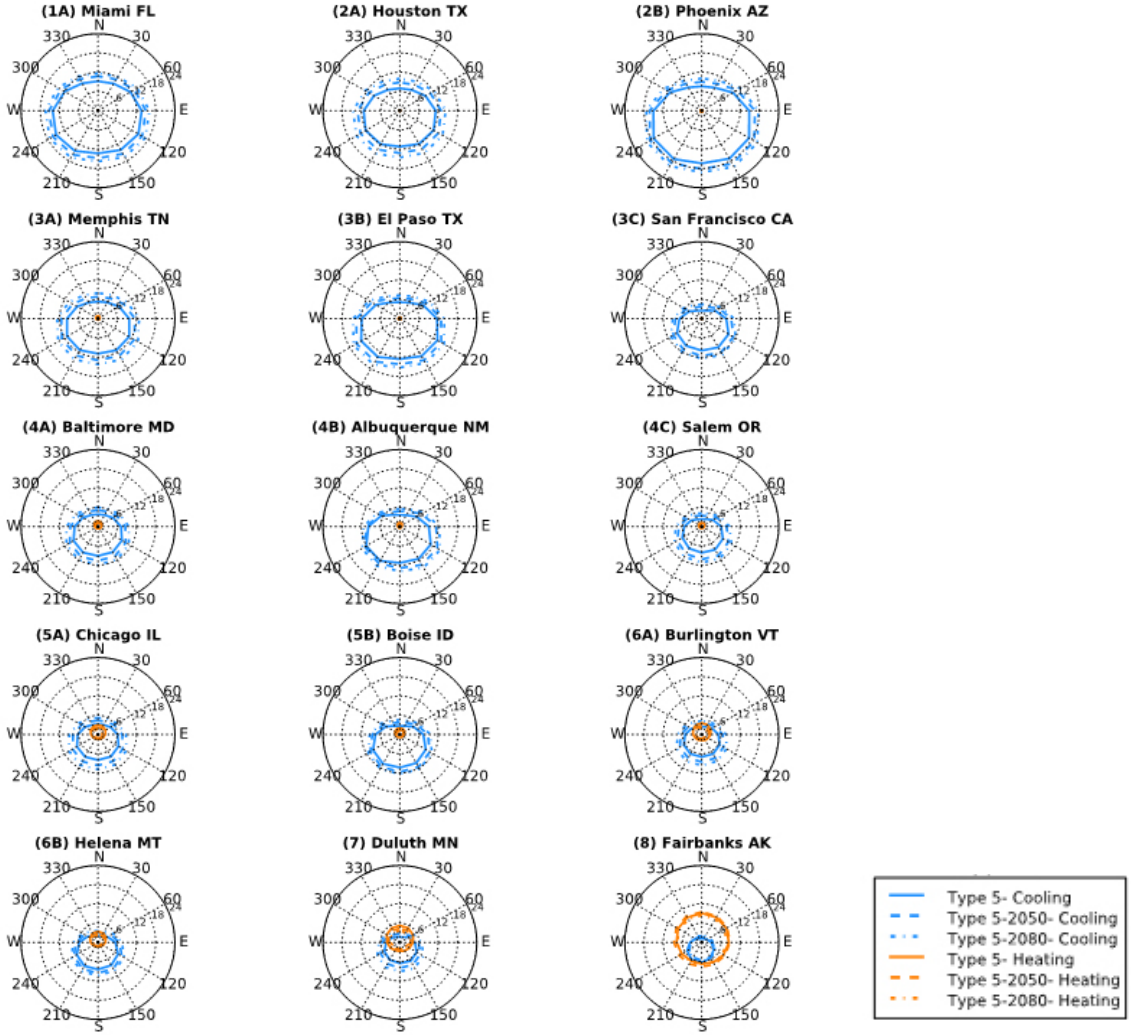
	Climate zone	City	State	Zone	Region
1	1A	Miami	Florida	Very hot	Moist
2	2A	Houston	Texas	Hot	Moist
3	2B	Phoenix	Arizona	Hot	Dry
4	3A	Memphis	Tennessee	Warm	Moist
5	3B	El Paso	Texas	Warm	Dry
6	3C	San Francisco	California	Warm	Marine
7	4A	Baltimore	Maryland	Mixed	Moist
8	4B	Albuquerque	New Mexico	Mixed	Dry
9	4C	Salem	Oregon	Mixed	Marine
10	5A	Chicago	Illinois	Cool	Moist
11	5B	Boise	Idaho	Cool	Dry
12	6A	Burlington	Vermont	Cold	Moist
13	6B	Helena	Montana	Cold	Dry
14	7	Duluth	Minnesota	Very cold	-
15	8	Fairbanks	Alaska	Subarctic	-

Aksamija, A., and Peters, T., (2016). "Climate Change and Performance of Facade Systems: Analysis of Thermal Behavior and Energy Consumption in Different Climate Types", *Perkins and Will Research Journal*, Vol. 8, No. 2, pp. 52-79.

Impact of Climate Change on Building Envelope Performance: Current Climate, 2050 and 2080

Results of energy modeling





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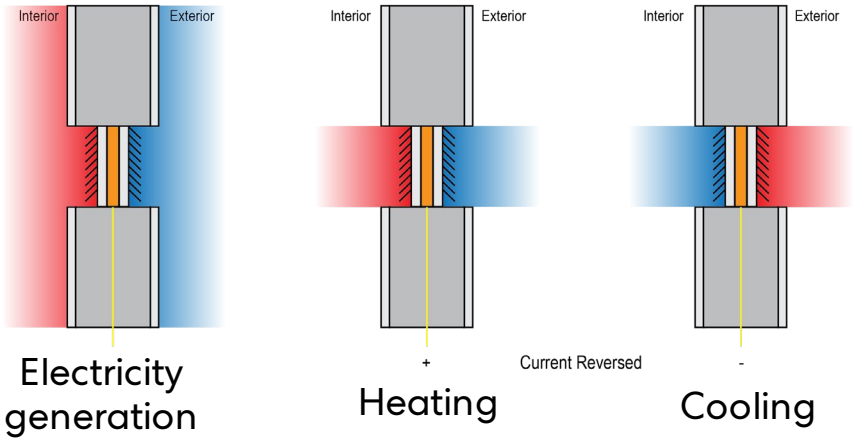
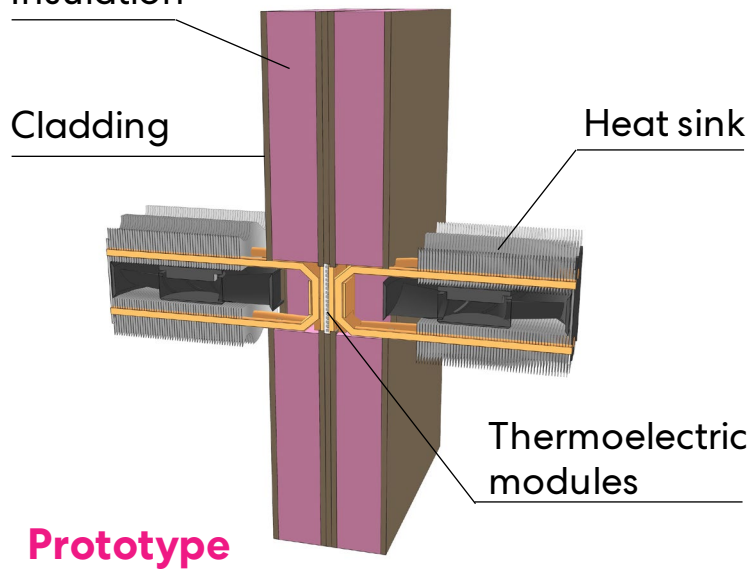
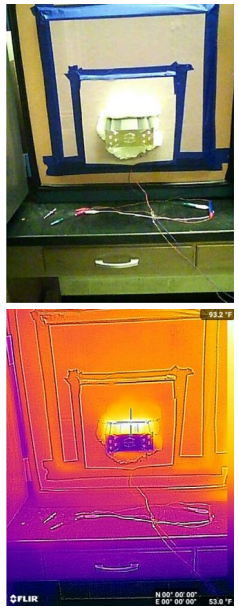
Smart Facade Systems for Heating, Cooling and Electricity Generation

Concept

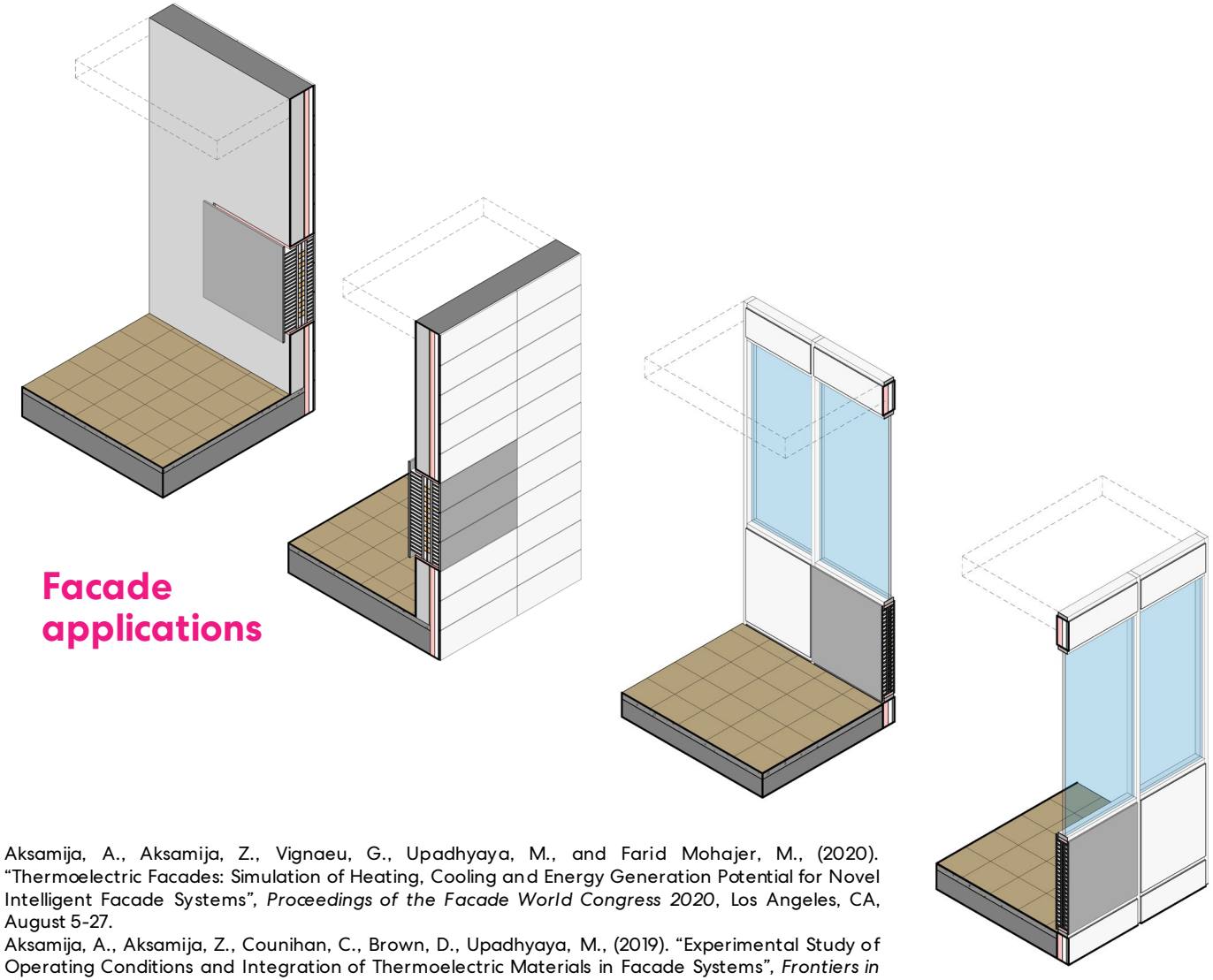




Prototype



Testing



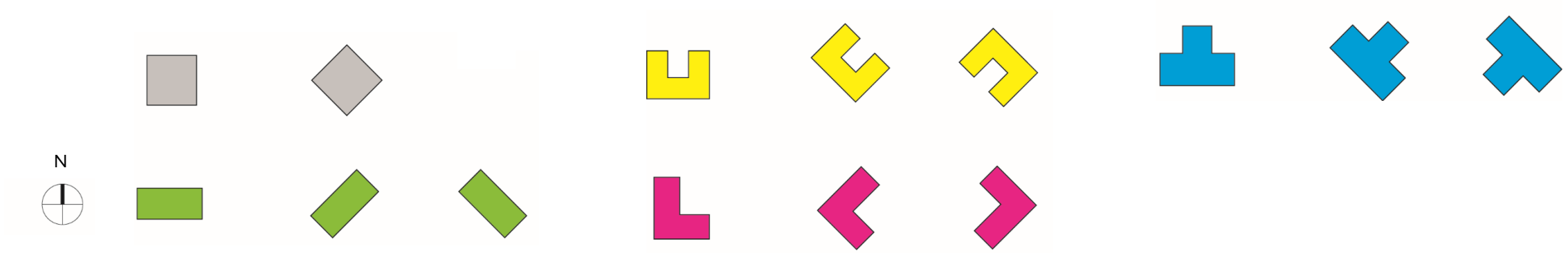
Facade applications

Aksamija, A., Aksamija, Z., Vignaeu, G., Upadhyaya, M., and Farid Mohajer, M., (2020). "Thermoelectric Facades: Simulation of Heating, Cooling and Energy Generation Potential for Novel Intelligent Facade Systems", *Proceedings of the Facade World Congress 2020*, Los Angeles, CA, August 5-27.

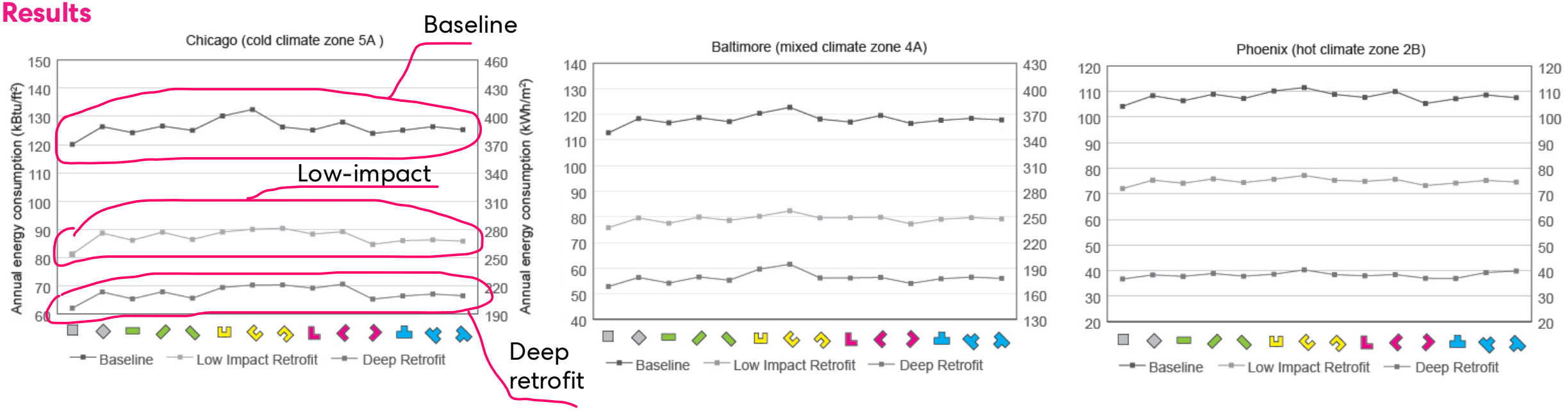
Aksamija, A., Aksamija, Z., Counihan, C., Brown, D., Upadhyaya, M., (2019). "Experimental Study of Operating Conditions and Integration of Thermoelectric Materials in Facade Systems", *Frontiers in Energy Research, Special Issue on New Materials and Design of the Building Enclosure*, Volume 7, Article 6, DOI: 10.3389/fenrg.2019.00006

Existing Buildings: Impacts of Energy-Efficient Retrofit Strategies in Office Buildings (Low-Impact and Deep Retrofits)

Modeling prototypes



Results

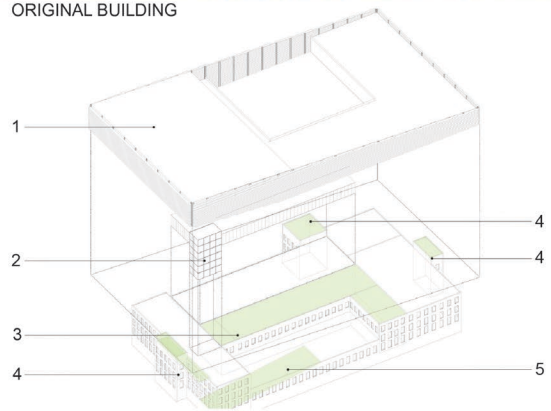


Aksamija, A., (2017). "Impact of Retrofitting Energy-Efficient Design Strategies on Energy Use of Existing Commercial Buildings: Comparative Study of Low-Impact and Deep Retrofit Strategies", *Journal of Green Building*, Vol. 12, No. 4, pp. 70-88.

Existing Buildings: Methods for Reaching Net-Zero Energy through Regenerative Design

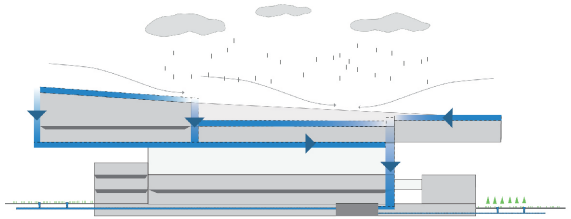
Case study/ regenerative design strategies

ORIGINAL BUILDING



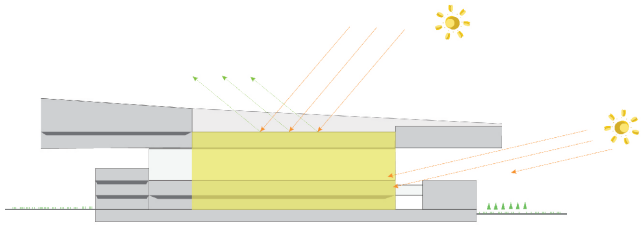
1 Added office levels
2 Added vertical circulation
3 Removed building elements to open up the original courtyard
4 Removed entrances
5 Removed ramp

ADAPTIVE REUSE DESIGN

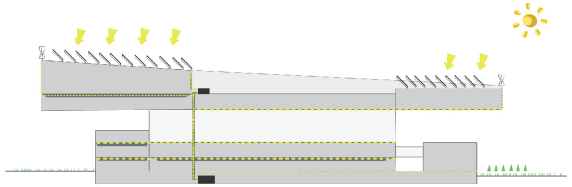


Rain water collection

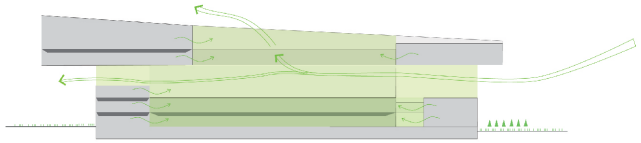
Hydro-energy



Daylighting



Photovoltaics and wind turbines



Natural ventilation

Biomass heating

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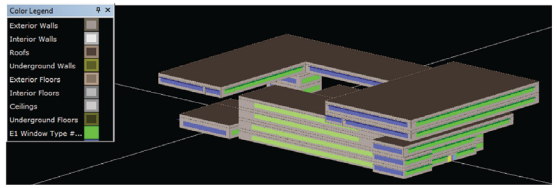
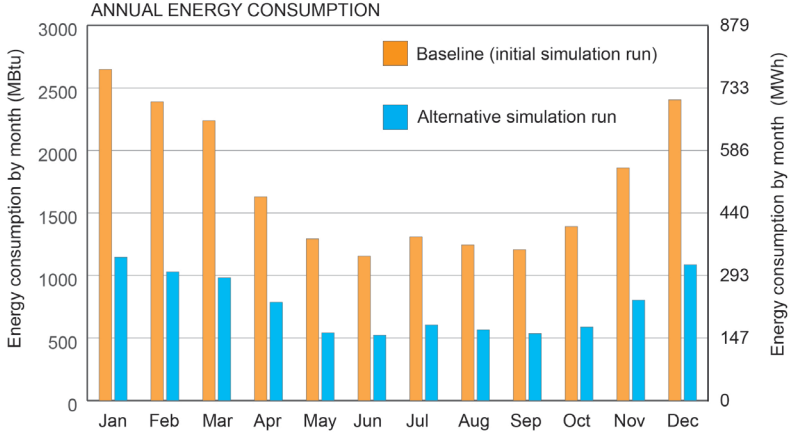
Existing Buildings: Methods for Reaching Net-Zero Energy Design (Low-Impact and Deep Energy Retrofits)

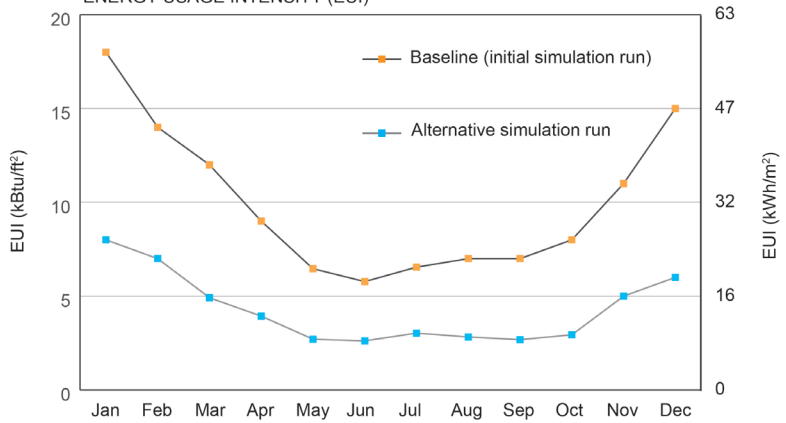
ENERGY MODEL



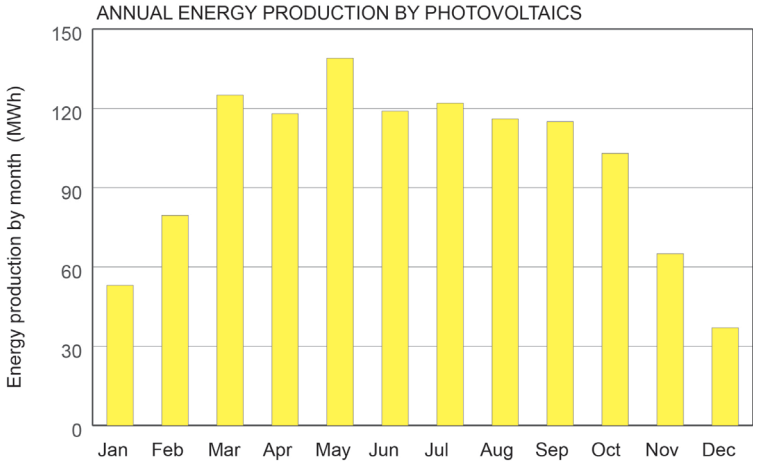
ANNUAL ENERGY CONSUMPTION

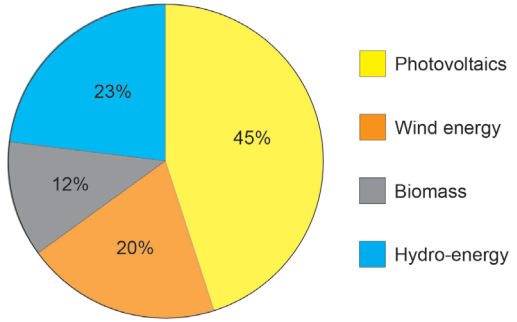


ENERGY USAGE INTENSITY (EUI)



ANNUAL ENERGY PRODUCTION BY PHOTOVOLTAICS



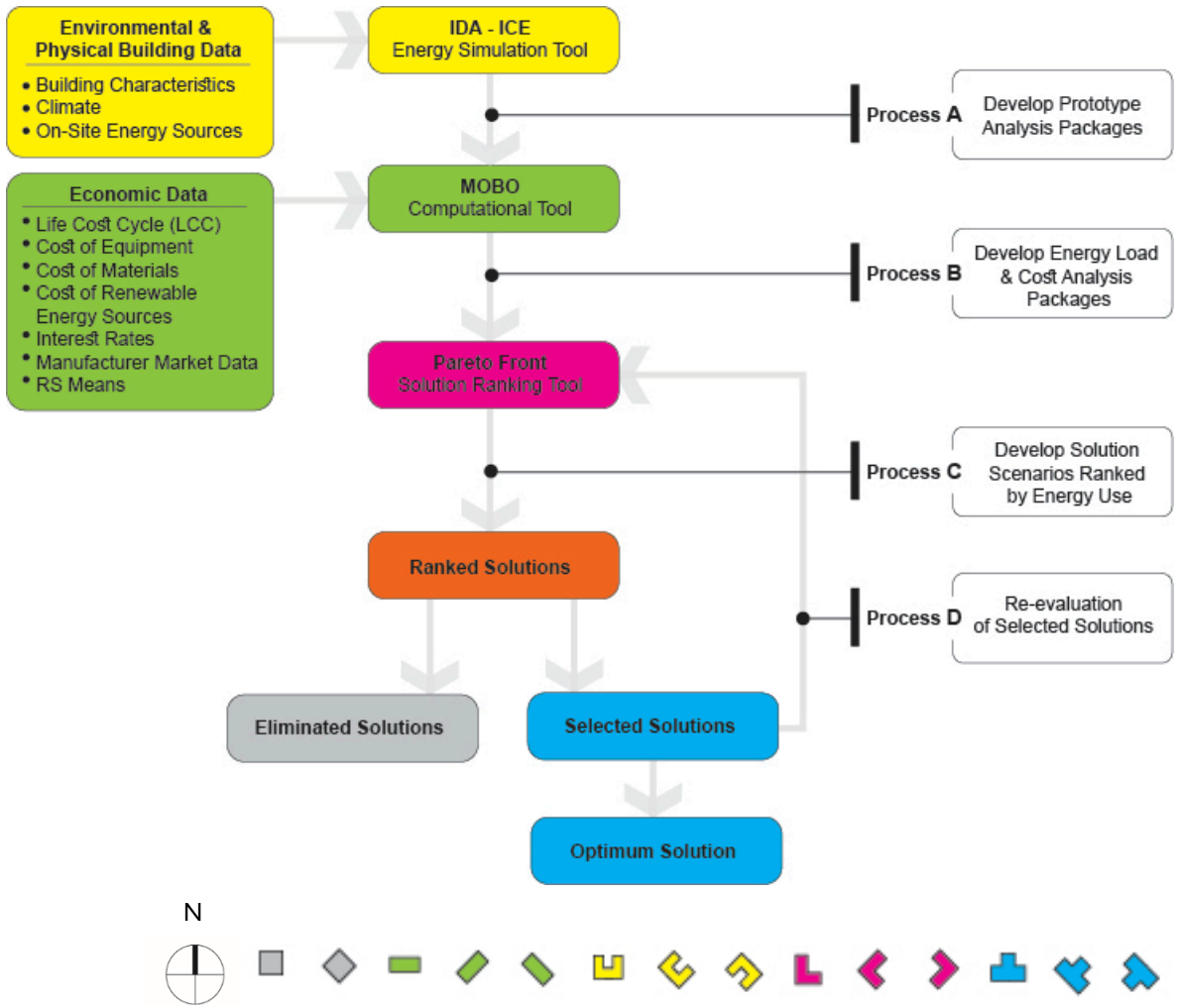


RENEWABLE ENERGY SYSTEMS PRODUCTION
FOR MEETING NET-ZERO ENERGY

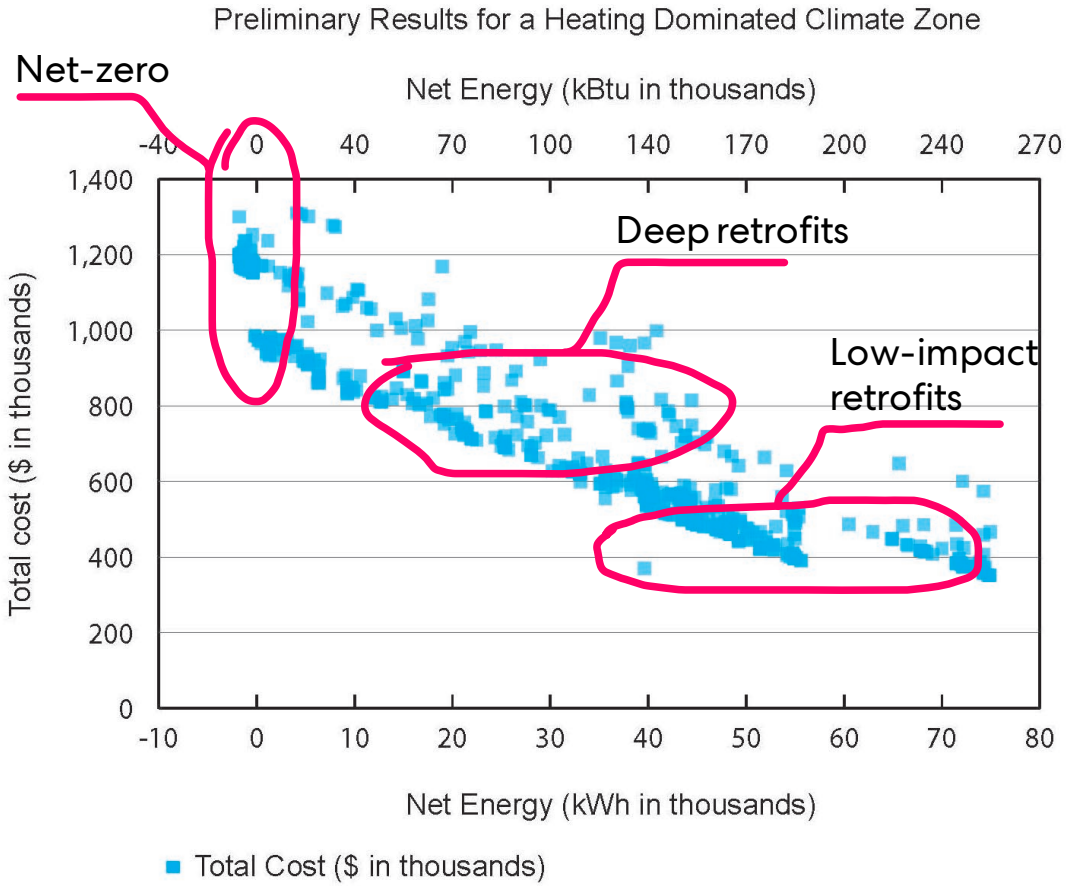
Aksamija, A., (2016). "Regenerative Design and Adaptive Reuse of Existing Commercial Buildings for Net-Zero Energy Use", *Journal of Sustainable Cities and Society*, Vol. 27, pp. 185–195, DOI: 10.1016/j.scs.2016.06.026.

Existing Buildings: Methods for Reaching Net-Zero Energy Design/Cost Optimization

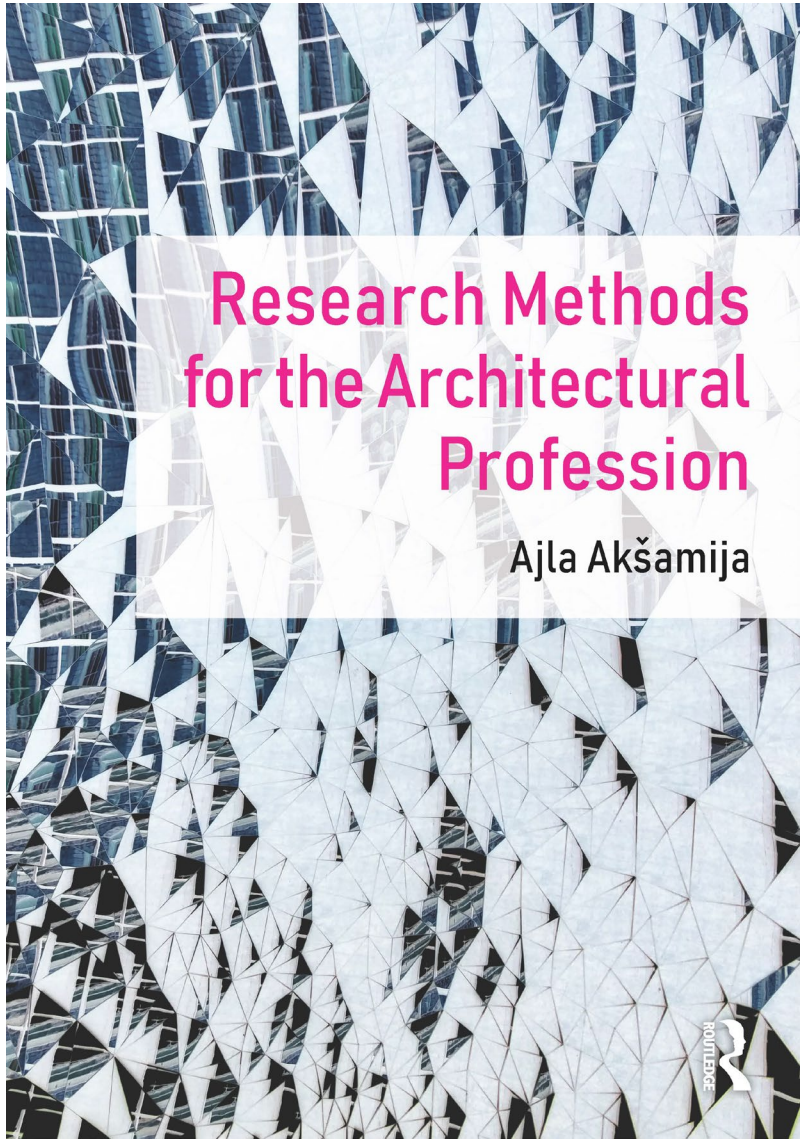
Process



Results



Integration of Research and Practice



New book, early 2021 (Routledge)

UMass Architectural Research Collaborative

New research entity at UMass

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