HYDRONIC SHELL
TECHNOLOGIES

Syracuse University
College of Engineering
& Computer Science

Simulation & Testing of a Novel Façade-Integrated Heating & Cooling Concept

Background:

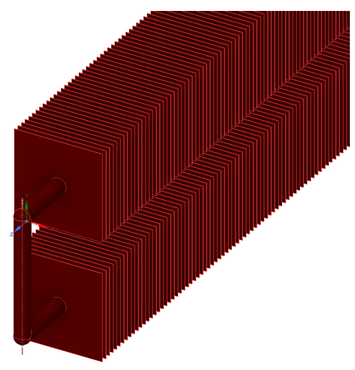
How do you decarbonize existing multi-family buildings without displacing the families?
This is the problem David Goldstein, the CEO of Hydronic Shell Technologies, aims to solve with his invention. With the backdrop of New York City's Climate Mobilization Act, which was enacted in 2019, there is a mandate calling for carbon emission reductions from large buildings. David's solution would not only help meet these goals but would also include the additional benefit of not needing to displace families from their homes in the process. The significant lack in current technologies emphasizes the imperative need to pivot towards the electrification of residential heating and cooling as an initial stride toward a more sustainable future.

Project Description:

The Hydronic Shell is a modular HVAC system integrated into panels that form an insulated shell over the existing building.
The system is installed externally, enabling decarbonization and modernization retrofits that are quick, affordable, and non-invasive. The Hydronic Shell provides heating and cooling as well as fresh air ventilation by running pipes along the exterior of the building and generating the needed energy via rooftop, high-efficiency HVAC pump units.

Current Progress:

- **Currently, CAD models have been generated (shown to the right and below) that will be in the FEA/CFD simulations; these will illustrate the interior surface and mean air temperatures.**
- **HVAC systems and standards are being researched using ASHRAE fundamentals handbook.**



Cavity convector unit

Next Steps - ANSYS Test Simulations:

- **Collect data for various water temperatures of the convective heating/cooling unit.**
- **Run simulations that show surface and air temperature distributions to test comfort parameters.**
- **Generate calculations based on 2D room temperatures to verify and validate with simulations.**
- **Gather information on other HVAC systems that will be used for CFD simulation comparisons.**
- **Next semester, a physical small-scale mock-up of a room will be created to test the Hydronic Shell system at the Syracuse Center of Excellence (COE).**

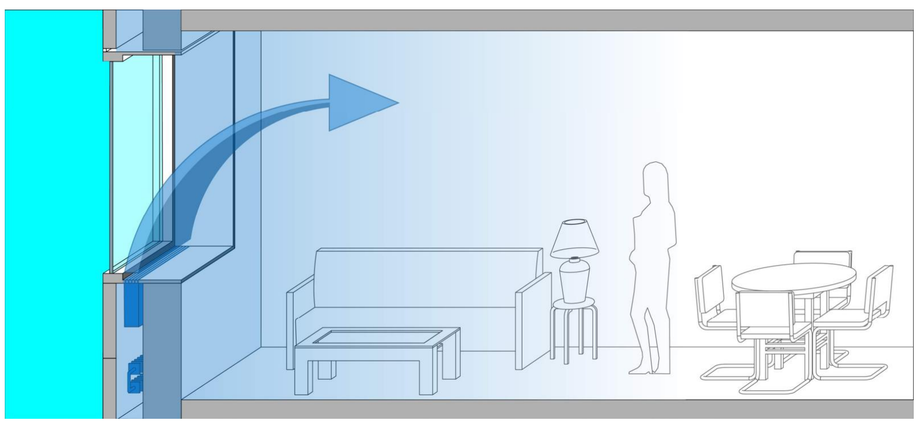
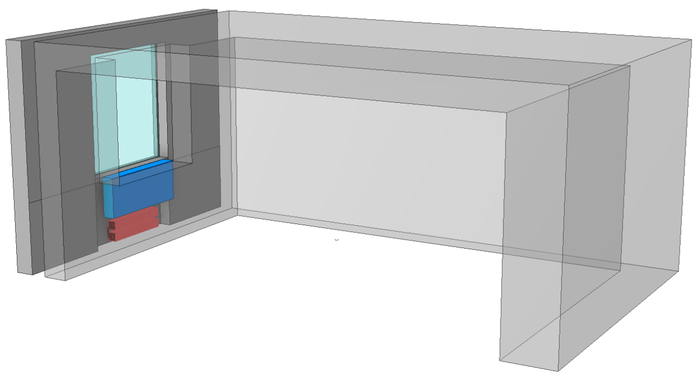
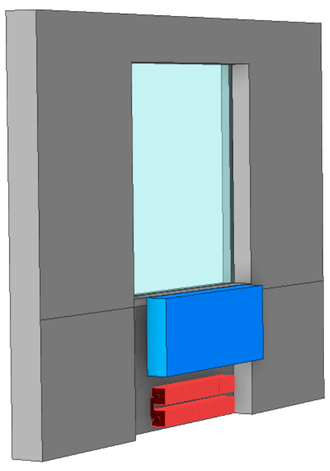


Diagram depicting expected heat transfer (cooling)



Model living room with unit installed



Hydronic Shell unit

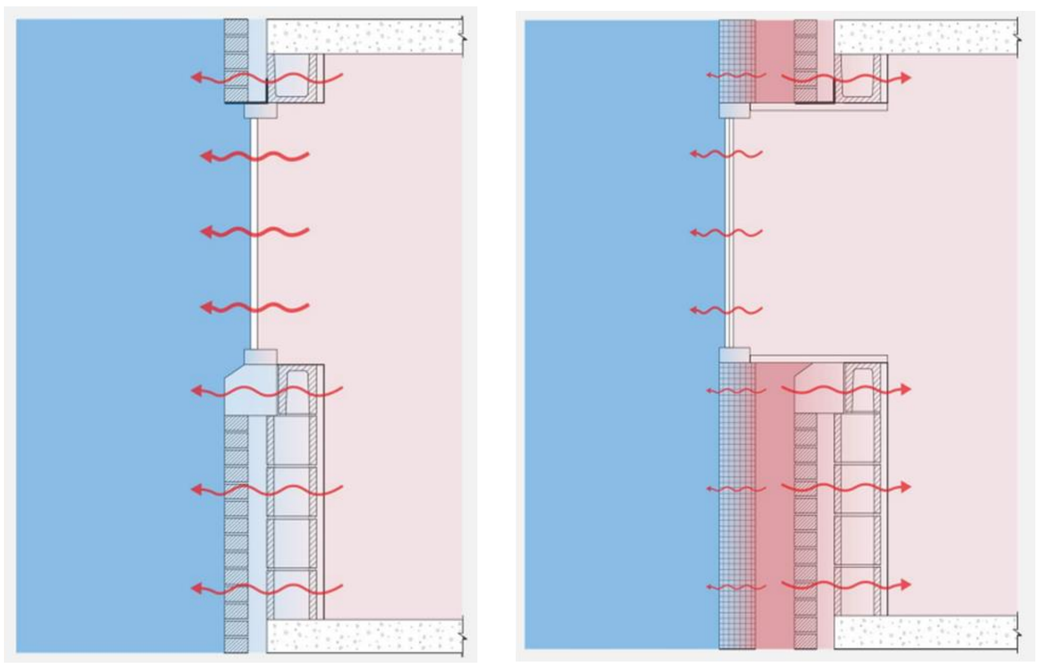
Deliverables:

PHASE 1 (Fall semester):

- **Thermal output tables of convective elements of various types and sizes with varying water temperatures.**
- **Color thermal images showing interior surface temperatures that can be achieved with different wall types.**
- **Color thermal images showing distribution of comfort parameters (air temperature & mean radiant temperature) of the Hydronic Shell system, as well as conventional alternatives including PTACs, mini-splits, and ducted fan coils.**

PHASE 2 (Spring semester):

- **A summary of results from testing a physical prototype of the Hydronic Shell system that includes a comparison to the simulation results as a means of validation.**
- **Submit one or more papers for publication that summarize the work done for this project.**



Conventional (left) vs. Hydronic Shell (right) heat flows

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