

# NORTHSTAR HEALTHY HOME

HEALTH-CENTERED URBAN VILLAGE FOR THRIVING FAMILIES



University of Minnesota NorthStar Modular Team  
2023 Solar Decathlon Design Challenge, Multifamily Division, April 4, 2023



UNIVERSITY OF MINNESOTA

## PROJECT SUMMARY

NorthStar Healthy Home provides healthy, resilient, high performance, affordable homes for families in the Heritage Park neighborhood of North Minneapolis. This project transforms a city-owned brownfield into a pedestrian-oriented residential community promoting social connectedness and a walkable local economy while embracing a holistic health-centered approach to family wellness. NorthStar Healthy Home is a purposeful counterpoint to the site's history of disinvestment, systemic racism, and environmental injustice.

Our design is guided by the Enterprise Green Communities and the Minnesota Multifamily Rental Housing Design/Construction Standards, frameworks that would be required for funding a residence of this type. Throughout the design process, we have leveraged partnerships with professionals experienced in serving this community.

## GOALS

- Design for Human and Ecological Health and Wellbeing
- Address critical need for high quality, resilient, net-zero, affordable, multifamily housing
- Nurture Vibrant Community

## DESIGN STRATEGY

NorthStar Healthy Home utilizes volumetric modular construction to meet the combined challenges of health, affordability, net-zero design, and environmental stewardship. Factory built modules save money with shorter delivery timelines, material efficiencies, and improved quality of construction due to indoor building conditions. Our design implements a tight building envelope, vertical geothermal system, individualized ERV units, LED + daylighting scheme, and on site energy production via bifacial PV array contribute to achieve net zero. Human health and wellbeing is supported through use of nontoxic and low carbon materials, biophilic design, and trauma-informed design strategies



## PROJECT DATA

**LOCATION:** Minneapolis, Minnesota, USA

**CLIMATE ZONE:** 6A

**LOT SIZE:** 0.75 acres, 32,670 SF

**BUILDING SIZE:** 59,995 SF, 5 stories, 32 units

**OCCUPANCY (RESIDENTIAL):** 227 (200 SF/person)

**OCCUPANCY (COMMERCIAL):** 31 (150 SF/person)

**CONSTRUCTION COST:** \$90,050 / module

\$117/SF modules only

## ENERGY PERFORMANCE

**W/OUT RENEWABLE:** 42 kBtu/sq. ft./year

**WITH RENEWABLE:** Net Positive

8.35 kBtu/sq. ft./year

**AVERAGE UTILITY COST:** \$68,457

(whole building annual estimate)

## TECHNICAL SPECIFICATIONS

### R VALUES:

**Wall:** R35

**Roof:** R65

**Foundation Wall:** R36

**Windows:** U0.24 / SHGC: 0.23

**HVAC:** Ground source heat pump and unit ERV with high efficacy filtration and centralized DHW system.

**ON-SITE PV:** est. 217kW, roof mounted system

## PROJECT PARTNERS



## PROJECT HIGHLIGHTS

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### MARKET ANALYSIS

Healthy Home will provide Deeply Affordable Family Housing at 30% and 60% of local AMI and address a chronic shortage in the Minneapolis housing market. Designing with full market-ready volumetric modules made in Minnesota is cost-effective, reduces project timeline, and is safer for workers. Our project partners, RISE, MPHA, and Urban Works bring diverse experience in serving our target market.

### ARCHITECTURE

This modular multifamily building features four and five stories of residences with ground floor commercial space. Programming includes one, two, three, and four bedroom apartments with indoor and outdoor community areas. Site location and massing facilitate implementation of passive and net-zero design strategies. Intentional height variation and setbacks reflect the scale of the neighborhood.

### DURABILITY + RESILIENCE

Durability is dependent on effective moisture management with envelope and system design. A hybrid wall system features exterior insulation with cladding that can drain and dry. A precast concrete panel foundation surrounded by aggregate with a sump pump system helps keep assemblies dry. Primary resilience risks include extreme weather events in all seasons. Extreme heat events pose the greatest risk to residents, which is mitigated by central AC.

### ENERGY PERFORMANCE

Energy targets are met by minimizing loads, maximizing efficiency, and on site renewables. Loads are reduced via a high performance envelope, including low-e triple pane windows, EnergyStar appliances, and LED lighting. Centralized heating and DHW is supplied by a ground source heat pump. Roof mounted bifacial PV will provide an estimated 120% of building electricity.

### INTEGRATED PERFORMANCE

Integrating building performance is critical. Continuous building envelope and control layers applied onsite provide thermal and acoustical comfort while minimizing moisture risk and lowering energy use. An integrated hot water and heating system maximizes efficiency. LED lighting provides even, high quality, and energy efficient illumination while complimenting the daylighting scheme.

### ENGINEERING

The primary structure utilizes volumetric modular construction with 2x4 16" on center wood framing with 1-1/8" OSB pane with continuous insulation to reduce thermal bridging. An inverted flat roof allows for greater sealant integrity while minimizing puncture risk. Continuous control layers appropriate for Minneapolis' climate zone, 6A, ensures building integrity and durability. Heating, cooling and domestic hot water are provided by a ground source heat pump. In-unit ventilation is provided by ERVs to improve energy efficiency and IAQ.

### OCCUPANT EXPERIENCE

Occupant experience focuses on ensuring health and wellbeing of residents through biophilic and trauma-informed design strategies. Family life is supported with ample storage, in-unit laundry and flex spaces. Universal design strategies allow for ease of use across generations. Building systems and controls allow for thermal, humidity, and lighting control on an individual unit basis. Daylighting is balanced with energy consumption targets resulting in a 24% window to wall ratio.

### COMFORT + ENVIRONMENTAL QUALITY

Comfort and environmental quality is achieved through healthy material selection, which considers toxicity, global warming potential, embodied carbon, and circularity for human and ecological health. Our selection criteria uses transparency disclosure documentation including Declare Labels, HPDs, and EPDs. We also considered ease of reuse and certifications such as C2C, and FSC. Balanced ventilation provides fresh air via in-unit ERVs, while removing pollutants and humidity. Modular construction inherently allows for tight acoustic and odor separation. Appliances and lighting systems are intuitive and EnergyStar certified.

### EMBODIED ENVIRONMENTAL IMPACT

Primary structure and envelope material selection is based in part on LCA, embodied carbon, and GWP research and comparisons using Athena Impact Estimator for Buildings. Carbon sequestering materials specified include wood framed modules. Minnesota-made building components include windows, PV panels, cladding, and volumetric modules.