Seattle Office of Sustainability & Environment

INTEGRATED DESIGN LAB
UNIVERSITY of WASHINGTON // W

Stewart Manor Affordable Housing

An energy efficiency and electrification path to carbon neutral

Credit: UW Integrated Design Lab

Located in West Seattle near the redeveloped High Point community, Stewart Manor offers affordable public housing apartments, and is managed by the Seattle Housing Authority (SHA). The building has 74 one-bedroom units with shared laundry facilities and is prioritized for people earning 30 percent or less of area median income or without housing. This makes the apartments highly sought after — current wait time for an apartment is three to four years. As a typology for electrification planning, this building is like many other Seattle area affordable apartments built in the mid to late 20th century. SHA owns and operates about a dozen buildings with similar characteristics and opportunities for improving efficiency and reducing climate pollution.

About

Address: 6339 34th Ave. SW, Seattle, WA 98126.

Size: 49,510 sf, six-story, 74 one-bedroom units for people with low incomes.

Original Construction: 1968.

Projected Energy Savings: 13% – 35%.

Projected Total Emissions Reductions: 27.5 MT CO2e annually.

Projected Utility Cost Savings: $18,500 annually.

Estimated Total Plan Costs: $8.15/sf.

Owner: Seattle Housing Authority.

Consultants: University of Washington Integrated Design Lab and Solarc Energy Group, with special thanks to Seattle Office of Housing for their technical feedback.

Affordable housing that cares for people and the planet.

Buildings are one of the largest and fastest growing sources of Seattle's climate pollution — contributing more than one-third of the city's core greenhouse gas emissions. For everyone's health and resilience, and especially for low-income and communities of color that are disproportionately burdened by climate pollution, we must power more of our lives, homes, and buildings with clean energy.

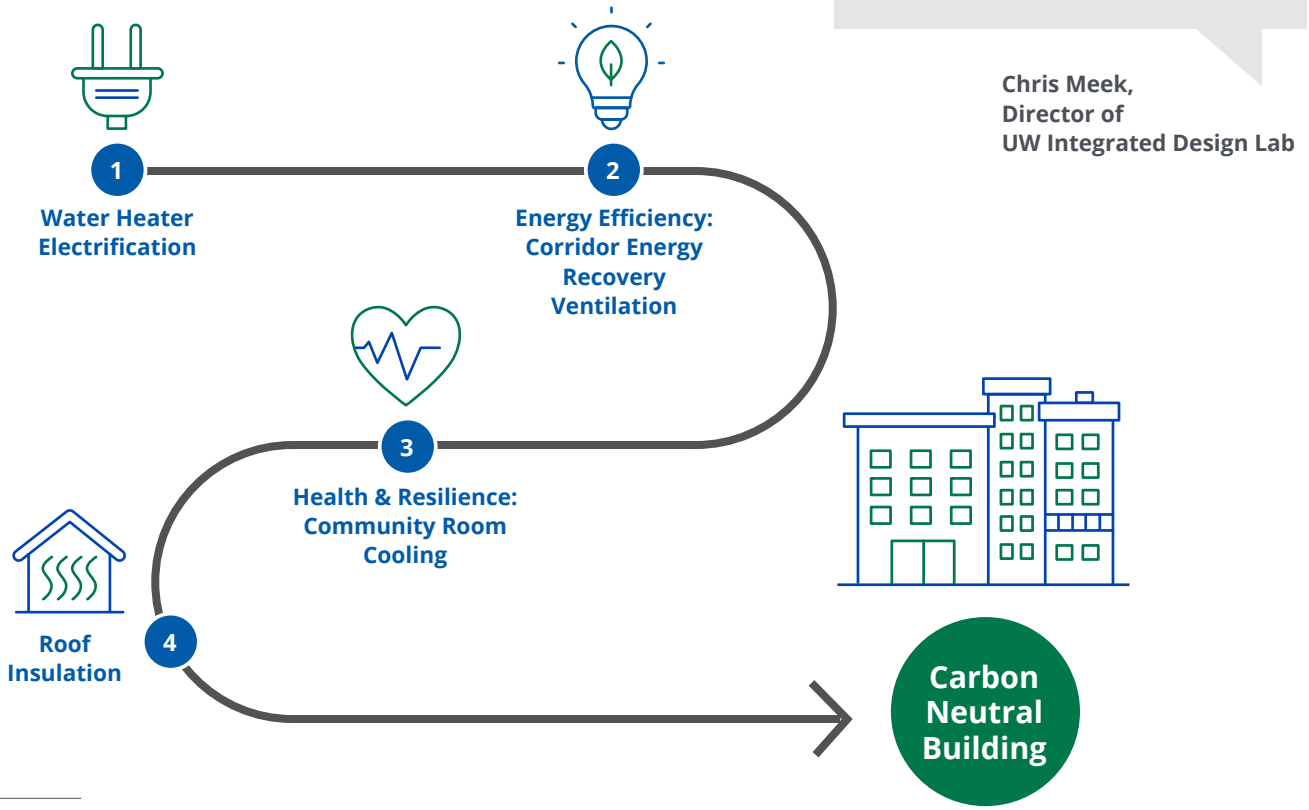
By taking steps to improve energy efficiency and electrify systems now, this conceptual retrofit plan for Stewart Manor shows what housing should look like — affordable, safe, healthy, and built for the future. We know that to mitigate the growing impacts of the climate crisis, removing fossil fuels from buildings is inevitable. Making these updates now can help SHA get out in front of rising construction costs and meet its 2020-2025 Sustainability Agenda as well as support the City of Seattle's climate goals for net-zero emissions buildings.[1] Furthermore, upgrading to heat pumps in the building's community room provides an easy-to-access, on-site cooling room to help residents cope with dangerous heat emergencies like Seattle had in June 2021.

Steps to a carbon neutral building:

Through an energy audit and modeling, the UW Integrated Design Lab and Solarc Energy Group identified a four-step path for the Stewart Manor apartments to **reduce energy use by 35 percent and emissions by 79 percent** to achieve an all-electric carbon neutral building, while adding on-site cooling in the community room.[2] For this building, total cost for the plan is estimated at $8.15 per square foot. Estimated utility cost savings are $18,500 annually using 2021 rates.[3]

Learning from the Seattle Housing Authority and Seattle Office of Housing experiences was a highlight of this project. Collaborations like these are critical to meeting the intersecting crises of affordability, human health, and climate change.

Chris Meek,
Director of
UW Integrated Design Lab



1 https://www.seattlehousing.org/sites/default/files/Sustainability%20Agenda%20Updated%205-24-2021.pdf

2 In 2019, Seattle City Light emissions factors were 41.57 lbs. Co2/MWh and City Light offsets these emissions to achieve carbon-neutral status as an electric utility. Building owners should, however, participate in the utility's Green Up Program to call their building net-zero at the site. Visit https://www.seattle.gov/city-light/business-solutions/renewable-energy-services

3 Utility prices based on 2021 rates of $0.91/therm and $0.11/kWh. Due to the regulatory uncertainty around carbon emissions (Washington State and/or Federal Carbon Taxation), gas costs may be subject to future increases at significantly higher rates than equivalent electricity from low-carbon sources.

1 Water Heater Electrification

Replacing the two existing gas domestic hot water (DHW) heaters with a split, air-to-water CO2, electric heat pump system with two 250-gallon water tanks reduces energy use by 13 percent. This also immediately transitions the building to carbon neutral by eliminating all gas use. Since DHW equipment has few dependencies on other energy uses, it can be upgraded first, addressing possible asset failure risks and reducing climate-polluting emissions early in the process. And, since the building was originally outfitted with electric resistance water heaters, no additional electric service upgrade is needed.

Estimated cost: $4.15/sf

2 Energy Efficiency: Corridor Energy Recovery Ventilation (ERV)

An ERV is a type of air-to-air heat exchanger that uses the exhausted heat from the residential unit bathrooms to pre-heat the incoming fresh air supplied to the hallways. This step reduces total energy use 26 percent by removing the existing rooftop make-up air units and replacing them with two ERVs with an assumed heat recovery effectiveness of 60 percent.

Estimated cost: $2.85/sf

3 Health & Resilience: Community Room Cooling

With dangerous extreme heat events likely increasing as the climate warms, installing heat pumps that provide air-conditioning in "cooling rooms" helps vulnerable residents stay in their apartment community and avoid heat exposure traveling to off-site cooling centers. This step, which could be completed at any time, replaces the existing baseboard electric resistance heaters in the community room with a 2.5-ton mini-split heat pump. While it is much more efficient, saving 78 percent in heating energy for the room, the increased cooling and fan use minimizes some of the savings.

Estimated cost: $0.20/sf

4 Roof Insulation

Since this building will need a new roof by 2026, increasing the insulation value from R-20 to R-40 when the roof is replaced is a low-cost way to improve energy efficiency and comfort. This saves 1 percent energy use overall, and increases comfort during cold and hot weather spells for the tenants in top floor apartments.

Estimated cost: $1.15/sf (insulation only)

Credit: UW Integrated Design Lab

When I think about climate change and resilience in Seattle, I think about heat waves and wildfire smoke. I think about the thousands of people we serve who need to be kept comfortable during extreme heat events or when smoke fills the air. I am excited that we had the opportunity to think about cooling.

Bobby Coleman, Sustainability Administrator at Seattle Housing Authority

Note: Cost for steps 1, 2 and 4 were estimated using comparable affordable housing projects for equipment, labor, and markup, completed between 2018 and 2020 and adding an 8 percent per year escalation to 2021. Step 3 was based on comparable 2021 projects. Costs do not include potential incentives.

These four steps reduce the building's annual energy use intensity (EUI) from 57 kBtu/sf to 37 kBtu/sf with the largest savings coming after completion of the first two steps. While this path does not quite meet the voluntary State of Washington energy performance target for multifamily buildings (currently 32 kBtu/sf/yr), the measures are a good start with minimal tenant disruptions.[4] Additional steps in the units at tenant turnover or during a major renovation could achieve an EUI of less than 30 kBtu/sf/yr. The in-unit options explored included: adding a variable refrigerant flow (VRF) heating and cooling system to serve each apartment (replacing electric resistance); adding small heat-recovery ventilators; and insulating and air-sealing the interior walls. On-site solar panels on the roof or on parking canopies could help the building achieve net-zero energy.

Projected Energy and Emissions Savings by Step

Plan Steps	EUI (kBtu/sf/yr) Baseline=57.0	Projected Energy and Emissions Savings by Step (%)[5]			
		Electric	Gas	Total Energy	Total Emissions[6]
1 Water Heater Electrification	50.1	-6%	100%	13%	71.4%
2 Energy Efficiency: Corridor Energy Recovery Ventilation	37.8	26%	0%	21%	6.9%
3 Health & Resiliency: Community Room Cooling	37.4	0%	0%	0%	0%
4 Roof Insulation	37.4	1%	0%	1%	0.3%
OVERALL PLAN SAVINGS		**21%**	**100%**	**35%**	**78.6%**

Climate. Health. Equity.

This conceptual plan demonstrates that retrofitting affordable housing to reduce emissions and electrify supports multiple goals across climate, health, and equity. It can also serve as a model for the hundreds of Seattle apartment buildings needing electrification retrofits to address the dual crises of climate change and affordable housing. Meeting these goals will require new funding resources and creative partnerships.

> ***I'm excited to think about heat pump water heaters. In our newest developments, hot water continues to be the next biggest piece of the emissions pie, and this technology addresses that head on.***
>
> **Bobby Coleman, Sustainability Administrator at Seattle Housing Authority**

4 https://www.commerce.wa.gov/growing-the-economy/energy/buildings/

5 Negative numbers indicate an increase in energy use, which is an expected result as the building's energy efficiency is improved along with changes in equipment fuel source.

6 Emissions factors: Gas - 5311 gCO2e per therm. https://portfoliomanager.energystar.gov/pdf/reference/Emissions.pdf
Electric (2018) - 4.26 gCO2e per kWh. https://www.theclimateregistry.org/our-members/cris-public-reports.

Get in touch with us.

Electrifying buildings is one of the most powerful levers for reducing climate polluting emissions. Have ideas, a building you want to retrofit, or ways your organization might want to collaborate? Contact us at **cleanbuildings@seattle.gov**.