

Green Rock Apartments Transform Multifamily Housing from Old to Sustainable.

Guide to reducing the carbon footprint of older multifamily housing buildings that is both profitable and satisfies the desires and trends of today's rental market.



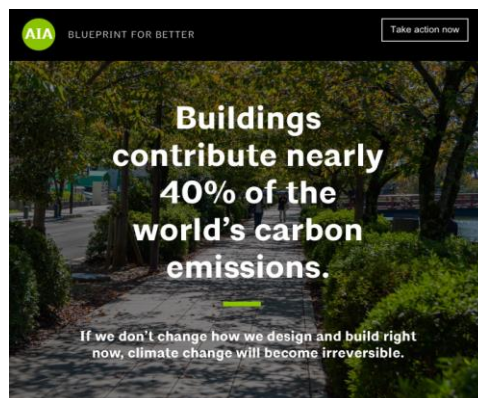
Presented by MRES in collaboration with Green Rock Apartments

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The following guide highlights four Green Rock Apartment buildings in Minneapolis, MN that have been retrofitted to near zero carbon by Owner Dale Howey. These retrofits have greatly lowered utility usage, increased owner profits and have improved livability for Residents. Most importantly, these retrofits significantly reduce the use of fossil fuels to further lower the world's extreme carbon emissions.

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Introduction

Dale Howey, a forward-thinking Minneapolis apartment owner/renovator, has achieved eight multi-unit reduced carbon apartment building retrofits over the past 6 years. These retrofit improvements coupled with enhanced livability amenities dramatically reduced each building's utility usage/cost of energy which has created significant cost savings resulting in financial gain for Green Rock Apartments.

By sharing Dale Howey's story, we intend to open source his unique approach and success with retrofitting multifamily buildings so that others may gain ideas, inspiration and guidance to encourage the current stock of multifamily housing to transition from carbon producing to carbon neutral housing. And to illustrate the other Green Rock Apartments initiatives which provide and support healthy living strategies for Residents and for our planet.

Dale Howey encourages and even *challenges* other multifamily property owners and managers to use their business leverage to invest in and create positive environmental change to help stabilize our climate. Dale Howey references that the world has 1.6 trillion square feet of building stock, of which 99 percent is not green” ([Drawdown](#)). And that buildings contribute over 40% the world's carbon emissions” ([Forum](#)).

“We must do what we can with what we have. Now. I learned by doing, please do the same.” - Dale Howey

The Residents of Green Rock Apartments value and appreciate this interest in providing their healthy living environment. His rental properties experience little to no turnover. During the multifamily property retrofit process, Dale Howey does NOT displace Residents. Green Rock Apartments online Resident reviews are extremely positive which is prized by property owners and help overall business. **Dale Howey also believes that as more Residents become aware of what is possible that they will seek out such healthy living accommodations as are provided at Green Rock Apartments.**

The following guide is intended to serve as a resource to share Dale Howey's successes and to inspire others to convert their existing apartment stock in a financially and environmentally

beneficial way to near net zero which will greatly aid in the transition of our society to one of renewable sustainable energy and living.

We appreciate any opportunities that you personally, or your organization may have to help distribute and share Dale Howey's Green Rock Apartments retrofit story. We encourage you to share widely.

DALE HOWEY'S STORY/PASSION FOR CHANGE

Dale Howey became aware of the climate crisis in the year 2000. When he learned more about the problems our planet is facing, he began to network with people in the renewables industry, as well as reading reports and viewing documentaries, researching everything he could to learn what people were doing to mitigate climate change.

Dale Howey personally adapted a low energy usage lifestyle for both his home and his work and used his own home as the experimental tool. From increasing his energy efficiency with new windows and insulation to installing a solar photovoltaic system on his own rooftop, Dale Howey began to live in a net zero environment.

During this time Dale Howey realized that we have a choice: we can either despoil our planet for money – or – by eliminating having an energy bill we can do our part to save the planet for future generations. Dale Howey concluded that we must modify our existing multifamily housing stock to build energy resilience, reduce costs and create healthy living environments because *there is not enough time to rebuild* all of our existing housing stock as net zero.

“We must retrofit our existing multifamily housing stock, and there is no time to waste.”

He realized that when we think about sustainable structures we often think of new shiny buildings. However, it is simple not possible or sustainable to replace 99% of our current 1.6 trillion square feet of building stock with new net zero structures ([DrawDown](#)).

At it's core, Dale Howey came to the realization that as long as there were energy bills there was harm to the planet through the burning of fossil fuels.

Through Dale Howey's model of retrofitting multifamily apartment buildings, he has learned and shared how this can be done and achieve a financial profit in doing so for the property owner and/or management company. Dale Howey's goal is to share what he has learned so that others will draw from and expand upon his successes.



WHO ARE GREEN ROCK APARTMENTS?

[Green Rock Apartments](#) are multifamily apartment buildings of various sizes and ages ranging from 24-unit city dwellings to 10-unit brick brownstones and are in Minneapolis, Minnesota. Under the guidance and support of owner Dale Howey, these Green Rock Apartments have over the past 6 years undergone the transition to as many energy efficient and enhanced healthy living features as financially possible. Near carbon zero retrofit projects ranged from solar energy systems over car parks and on rooftops to variable heat pumps replacing inefficient baseboard heat to much more that is reviewed within this guide.

Livability is Dale Howey's sole focus. Livability on our planet for future generations. And livability at home in your apartment and community today.

Livability amenities offered to residents at Green Rock Apartments include but are not limited to the following:

- Recycling/Organization of Waste Services
- Gardening food scaping, not landscaping, no grass only native plants
- Bike Program
- Gym access
- Free Wi-Fi
- Free locally made soap, hand, bath and toilet paper
- Electric Vehicle (EV) Charging Stations
- EV Car purchase rent credit

“This is what they want, what they like, a lifestyle. The traditional view of apartment living is changing...and you know what? This showing Residents that I and Green Rock Apartments value community and value them...has netted me no outstanding rents, and zero vacancy rates. Also not being greedy and not demanding the highest possible rent has helped as well. By offering free EV charging, a \$2000. break on rent if Residents buy an EV car, plant scaping versus landscaping with wild natural plants and gardening opportunities.

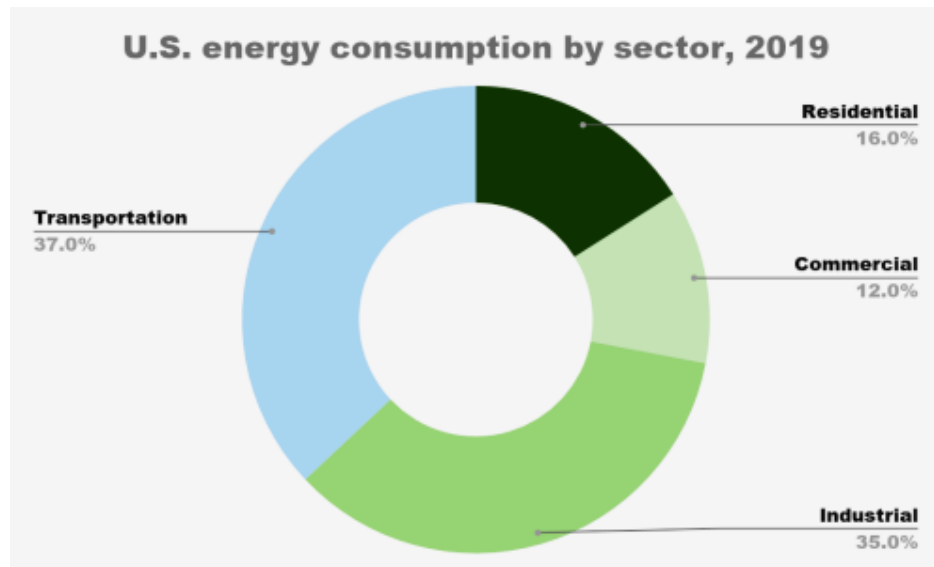
These offerings make ALL the difference.” – Dale Howey

WHY CARBON ZERO RETROFITS FOR MULTIFAMILY HOUSING ARE IMPORTANT

The United States has shifted its focus towards being more energy efficient. This process has gained traction in the last few years with the mainstream idea of humans having negative effects on the planet through too high carbon emissions which are creating climate change. The following chart shows the United States energy consumption by sector for the year 2019. As one can see, the Residential sector is a key contributor.

The U.S. Energy Information Administration said that “The residential sector accounts for 16% of U.S. energy ([U.S. Energy Facts](#)). This percentage may not seem very large, however the problem with the residential sector is the large amount of electricity consumption. Another fact from the U.S. Energy Information Administration says that “36.8% of ALL Electricity used in 2019 came from the residential sector” ([Monthly Energy Review – December 2022](#)). That is a shocking number considering residential energy consumption makes up only 16% of all energy consumption.

If one were to dig deeper into the residential consumption they would find that 85% of the energy in the residential sector comes from Natural Gas and Electricity ([U.S. Energy Facts](#)). These numbers are shown in the chart below.



This large amount of Natural Gas and Electricity consumption is attributed to devices that consume a large amount of residential electricity such as appliances, heating and cooling, lighting, and hot water. If American households could simply use LED light bulbs or turn off the lights in rooms of their house when they are not in them, we could cut back on a large percentage of electricity usage. The residential sector is dependent on individual households (buildings) to change their habits or to realize the various ways in which they can use less or save energy. If we retrofit our households (buildings) to use energy saving devices as well as use clean energy sources we would reduce our impact on the climate.

The real reason to live an energy efficient lifestyle is that we want future generations to enjoy our planet and a planet that isn't destroyed by climate change or pollution. As technology advances, it become easier to live more efficiently but it is impossible to live efficiently if each person does not accept that they need to change their habits to live that way.

An article from National Geographic talks about the seriousness of climate change and how impactful our current actions are to the planet. The article states: "The authors of the latest landmark report by the UN Intergovernmental Panel on Climate Change (IPCC) says urgent and unprecedented changes are needed to avoid catastrophe and renewable energy sources such as hydropower, wind, solar, nuclear, geothermal energy must increase from about 20% of the electricity mix today to as much as 67 percent in the coming decade. According to some estimates, in thirty years, the world will be using 75% more energy than it does now. Our current energy mix won't meet that demand. Fossil fuels are naturally limited, but currently providing most of our power...by far. To reach a sustainable mix in time to avoid environmental and human disaster on an unprecedented scale, this process clearly must escalate." ([National](#)

[Geographic.](#)) This article gives examples of our damaging effects to the planet while also giving a solution to our problem. Solar energy is becoming cheaper and more efficient so individual households can produce their own energy. Along with the increasing ease of use for solar, the article says we will be using 75% more energy in 30 years from now which would be the year 2048. That means we need to find and use new solutions to provide clean energy to the planet, for example fusion energy. These new solutions are important to households which include apartment buildings so we can continue to provide energy that is not harmful to the planet while also having the security that it will not run out.

And finally, the American Institute of Architecture states: If you renovate or reuse the biggest parts of existing buildings – typically the structure and foundation – you can save 50% of your carbon on a project right off the bat. It's the first thing architects and owners should try to do. ([American Institute of Architecture](#)).

DALE HOWEY'S UNIQUE RETROFIT APPROACH

THE APPROACH:

Dale Howey has an instinctual “McGuyver” approach to updating newly acquired multi-family apartment building to carbon zero and making a healthy profit in doing so. And he is confident that this can be learned and even improved upon by others involved in the world's housing stock.

Retrofit means to improve upon and not destroy the original. Net zero energy retrofitting means to take steps to get rid of energy bills. To become energy independent. To lower energy usage through replacing existing apartments systems and features with those that promote energy efficiency. The resulting energy efficiency lowers costs for the apartment owner which translates into increased profits. These increased profits can be invested again into heightened livability for more buildings and for more residents, attracting today's renters and reducing turn over.

Basically, according to Dale Howey, when you begin to retrofit an apartment building you plug the biggest hole first. Each building is different and must be attended to in a different way, with different projects in a different order.

His first consideration when acquiring a building is how healthy is the building. Where is the building ailing? What is the toxicity of the building? What is the air quality? Inspect closely. Are the windows fogging in the winter...this means poor air flow. Is the roof leaking rivers into the floors below...does it need to be replaced, or just patched with tar for now. Is the electrical bill astronomical...there are probably baseboard heaters. Do Residents complain of no hot

water...let's consider variable heat pumps. Not uncommon still, Dale Howey acquired a Minneapolis apartment building that still had coal on the floor of the boiler room from the days of coal heating. With next generation oil containers before an octopus boiler was installed. Heat is now provided with infrared heaters in each unit and variable heat pumps. That boiler room is now a Workout Gym.

CREATING THE HIT LIST:

Dale Howey investigates each apartment building from these 4 perspectives:

- 1) **THE ENVELOPE/THE SHELL** – exterior/tuckpointing, double or triple pane windows, doors and window weather sealing, roof integrity, interior walls, asbestos abatement (or not), ecofriendly foam insulation, window reflective film and painting rooftops white to reflect heat.
- 2) **UTILITY SYSTEMS** – boiler, water, no hot water...possibly installing a modulating HVAC water heater. It is time for a Home Energy Squad audit (free with Xcel Energy, Minnegasco or most utilities).
- 3) **ENERGY SOURCE IMPROVEMENTS** – basically the goal is to walk away from fossil fuels. Ask what are the current energy sources? Change dryers from gas to heat pump units and **MUST** eradicate gas as a fuel source.
- 4) **LIVABILITY** - what environment focused amenities can be provided to enhance quality of life for residents and help the planet (which further helps the people that walk the Earth.) Quality of life enhancing transitions - say no to standard grass that has to be mowed, and yes to native plants and food scaping, not landscaping. Encourage residents to garden in the available outdoors space, enhancing community and healthy foods. Develop organization of waste/recycling, material waste reduction, install electric car charging, gather bicycles for loan, provide natural and local soaps and many more such ideas. What ideas do you have? What livability enhancements would your Residents like to have? This is a movement toward healthy living...and you can own it.

After this analysis of the apartment building, Dale Howey creates a HIT LIST. Projects to be done in the order he determines will have the most impact as to the health and energy efficiency of the building. He can begin checking off each item as it is completed. He knows to remain nimble if new opportunities or resources become available.

FIGURING THE BUDGET:

Dale Howey then does a cost benefit analysis for the building. What can he do with his available resources? Are there city programs that are donating products or expertise?

Dale Howey has no set budget for his apartment building retrofits. He begins retrofit projects based on what cash is available. He typically has multiple projects going on at the same time at his various buildings. He goes one unit at a time, incrementally. He feels that an occupied building is better than one that is emptied out for renovations. He will move a Resident within the building whenever possible during renovations. By not emptying out buildings, there is still income while Residents continue to pay rent.

WATCH THE CHANGE:

As the retrofits continue, Green Rock Apartments begin to see the changes. Lowered electric bills for common areas, happy reports of lowered electric bills from Residents, fewer water units being charged for the water bill and solar credits from the utility. Residents are enthusiastic about warmer units and hot water lasting long enough, motion sensor LED lighting in the garages and solar powered exterior lighting provide energy efficient and safe areas. And after one year and then two...the recorded lower electric bills, the complete deletion of a gas bill, lower water meter readings...all providing measurable data as to the effects of these retrofit projects leading to carbon zero living.

“If apartment building owners change their operating plans, even in simple ways, they will save themselves money and the climate.”

- Dale Howey

GREEN ROCK APARTMENTS OVERALL COST SAVINGS/PROFIT

- **Green Rock Apartments saved \$30k per year beginning in 2019 as a result of retrofits (\$29,386.50 Yearly Savings).**
- **The average electricity bill before purchase at 615 E 16th St was \$150 per month and now it is \$30 per month for each resident. Dale Howey states that when we are finished installing and have reached 205 thousand watts of solar we will be saving even more.**
- **Dale Howey saved \$40 a month in his personal dwelling after putting in LED bulbs**
- **1501 Portland Ave was paying \$2,000 for water and sewer when it was purchased and now it is \$700 per month**
- **Climate tax breaks allow us to write off thousands per year on our taxes**
- **Several buildings have cut in half the heating bill with retrofits**
- **The cost is approximately \$83. per square foot for retrofits...which is super low**
- **Tenant retention, saves 10%**



4 CASE STUDIES

GREEN ROCK APARTMENT BUILDINGS

CARBON REDUCING RETROFITS AND PROFIT

CASE STUDY #1 - 615 E 16TH ST, MPLS



PROPERTY NOTES:

- Built in 1918
- 22 units studios/1BR
- Purchased by Green Rock Apartments in August of 2018

IMMEDIATE ISSUES/THE HIT LIST:

- Original boiler from 1918, when purchased there were still piles of coal in boiler room, then switched to oil then gas
- Very high cost water and heat for each Resident
- Structural defects
- Asbestos present in many areas of the building
- Poor maintenance of existing apartments and mechanicals
- Underpowered electrical infrastructure for apartment use

- Replace original boiler from 1918 (had been converted from oil to gas) with a new high efficiency electric boiler
- Update inadequate apartment electrical infrastructure
- Replace gas heating system with high efficiency, electric heat pump units
- Install high efficiency toilets and low flow shower heads to reduce tenants' high water utility costs.

WHAT GREEN ROCK IMPROVEMENTS WERE MADE:

THE ENVELOPE/SHELL, exterior, windows, roof, doors, tear out walls, asbestos abatement, ecofriendly foam.

- Spent 11k taking asbestos out of the boiler room and made it a gym
- Tuckpoint (seal/fill in between weathered masonry) entire building to limit air infiltration and heat loss
- Insulate between all units and ceilings for sound insulation and heat retention.
- Heat reflective coatings on all south, east, west windows reflecting 85 percent of UV radiation

SYSTEM/HEAT IMPROVEMENT, boiler, water heating, electric infrastructure. (Home energy squad audit is free with Xcel or most utilities)

- Orig boiler from 1918, piles of coal then changed to oil, then gas switched to 26 Daikin heat pump units for central air and heat for all apartments and building
- Heat pump laundry dryers to recoup moist hot air in the winter and vented in the warmer months as to not waste that heat
- Air exchangers added for fresh air intake
- Increase air quality and each unit gets central air and heat at a lower cost. Current average bills are \$35. per month as opposed to \$150. per month under the old system
- Removed gas water heater and utilized heat pump water heaters at roughly 20% reduction in cost, and 60 percent increase in efficiency

ENERGY SOURCE IMPROVEMENTS, walk away from fossil fuels:

- Added 25,000 watts solar on roof (2019 install)
- Gradually making it a gas free building by 2021
- Heat pump dryers add moisture and heat to the air in the winter (vented in summer)
- Removed gas heating, laundry and water heaters, gas stoves replaced with induction stoves with convection oven by end of 2021

LIVABILITY:

- Level 2 EV charging stations
- Food scaping not landscaping, planting food sources for animals and humans – we also plant native trees, native and pollinator friendly plants
- Made laundry free at all locations and added our waste reduction station that includes textile, light bulb, metal, electronics, plastic bag and Styrofoam recycling, compost bins and liners, LED light bulbs supplied, pet waste bags
- Outdoor seating spaces for community and grill area in tree-lined spaces
- Consistent and reliable heat and the addition of air conditioning

RESULTING SAVINGS/PROFITS AND REDUCED UTILITY USAGE:

- Original gas bill when purchasing the property was \$8,000 a year and is now bill is \$30
- In 2019, the property used approximately 1000kwh and in 2020 it used 3800kwh. Increased due to offsetting gas with electric use. Adding in the benefits of solar, and gradual increased in efficiency, netting 50 percent decrease in costs end of 2021
- \$400. per month electric bill is going to \$200. Per month with heat pumps
- Reduced cost of water and heat for each Resident from \$200 per month to \$35 per month
- Water bills are not very significant in savings due to some mitigation by previous owner. Currently water is \$225. per month or about \$6.25 per Resident

UTILITY SPECIFICS:

22 Units in Building	615 E 16th St		
		Varries by utility	2020 Average
2019 Average	Electricity (kwh)	1,075.08	3,821.00
2018 Average	Gas (therms)	144.33	92.16
2018 Average	Water (gallons)	24,220.24	26,928

- Average gas usage decreased by 52.17 therms between 2018 and 2020
- Gas has been eliminated by converting heat, water heat, and space heat to electricity using Daikin heat pumps, Rheem heat pump water heater, Frigidaire induction stoves.
- The increase in electricity usage is positive and reflects the transition away from gas to renewable solar. Building uses its own installed rooftop solar system.

FUTURE HIT LIST PROJECTS FOR THIS BUILDING:

Eradication of all gas by the end of 2021

Net zero goal, no fossil fuels, all renewable energy by 2030 via solar thermal, increased efficiencies, more solar tech improvements, solar thermal energy for hot water and space heating

CASE STUDY # 2 - 1018 19th AVE N, MPLS



PROPERTY NOTES:

- Built in 1911
- 15 units, 4 studios, 7 1 BR, 4 2 BR
- Purchased by Green Rock Apartments in 2000

IMMEDIATE ISSUES/THE HIT LIST:

- Damaged, aged roof
- Unused basement area and dirt floor
- \$9000. per year electric bills using baseboard heaters throughout
- When took over building 10 people lived in each apartment
- ¼" plywood covered basement windows
- Excessive wall structures in small apartments
- Unsafe wiring
- No fire safety equipment
- Poor envelope including windows and doors

WHAT GREEN ROCK IMPROVEMENTS WERE MADE:

THE ENVELOPE/SHELL, exterior, windows, roof, doors, walls, asbestos abatement, ecofriendly foam, poured concrete floors in basement, adding usable space and facilities

- Double pane thermal windows throughout in all and glass block in basement windows with vents
- Spray foamed the underside of roof, added vapor barrier foam in basement walls to improve air quality. Super insulated roof with 6 inches of additional ISO foam insulation Rebates from city to add this insulation in the amount of \$6000. to bring total roof envelope to R-54
- Added 80-millimeter white reflective roof membrane and new hatch for better seal
- Reflective coating on ALL exterior windows deflects 85% of radiation, less heat in summer. This is a carbon negative film
- Utilized basement for 2 additional units for max use of structure
- Added Level II EV charging station for Residents to share

SYSTEM/HEAT IMPROVEMENT:

- Discouraged use of electric baseboard heaters, removed where possible. Supplied Residents with safe infrared heaters as back up that are 3 times more efficient than baseboards and have installed 9 of 11 units with heat pump units for heat and A/C throughout
- Electric heat, 1,500 watt electric infrared space heaters, electric hot water tanks in each unit upgraded to heat pump units by Rheem
- City of Minneapolis gave 4-6 heat pumps to study the cold climate, installed March 2021
- Replacing window A/C units with Heat pump cooling, 40% more efficient
- Experimenting with on demand units. Seems to reduce bills dependent on Resident use
- Spending \$500. per unit on electric hot water controls, Resident can control on phone

ENERGY SOURCE IMPROVEMENTS, walk away from fossil fuels:

- 28.5k watts of solar on roof
- They have installed some switches for the water heater that Residents can turn off whenever they are not using the water heater. Savings can be extreme with this ability.
- Only need to heat the water heater once or twice a day and the water is hot enough for the rest of the day
- Removed gas dryers and replaced with heat pump dryers and provided alternate clothes racks to dry clothes naturally

LIVABILITY:

- Added an EV charger for Residents to share
- 2' thick stone walls, thermal mass, keeps building heat in
- Replacing all baseboard heat with infrared space heaters and heat pump units
- Some heat pump units donated for city study on consumption change
- Food scaping, not landscaping, at all properties

- Native plants, water sequestration, and bee friendly
- Increased organization of waste/recycling, waste reduction
- Added gym, storage lockers, bike garage inside and bike work space
- Made laundry free at all locations and added our waste reduction station that includes textile, light bulb, metal, electronics, plastic bag and Styrofoam recycling, compost bins and liners, LED light bulbs supplied, pet waste bags

RESULTING SAVINGS/PROFITS AND REDUCED UTILITY USAGE:

- \$90. per month average in 2020 for house meter instead of \$400, and that is without solar. Should be net positive for 2021
- Residents were paying \$150 a month in electric and now average \$60 per month
 - Currently the lowest energy user is paying around \$30 per month, with an electric hot water heater, electric induction range, and infrared heat
- Water bill was \$700 - \$800 per month, now it is 1/10th of cost
- Received \$11,000 from City Matching Funds program for roof insulation

Utility Specifics:

15 Units in Building	1018 19th Ave N		
		Varries by utility	2020 Average
2014 Average	Electricity (kwh)	1,380.66	814.5
	Gas (therms)		No Gas (0)
2007 Average	Water (gallons)	20,046.40	21,864.04

- A large electricity reduction occurred between 2014 to 2020
 - The reduction for the averages was 566.16kwh
- The average electric bill 2020 was \$114. from \$193.
- They have also removed all gas usage from the building

FUTURE HIT LIST PROJECTS FOR BUILDING:

All heat pump and solar thermal heat and space heat
 Tuck point and seal exterior
 Permeable parking surface for water sequestration
 Replace all stoves with induction/convention units
 Offer solar ovens and teach use
 Expand garden offerings and grow more food
 Plant as many trees as possible

CASE STUDY #3 - 1600 PARK AVE, MPLS



PROPERTY NOTES:

- Built in 1961
- 11 units - 1 BR
- Purchased by Green Rock Apartments in December of 2018

IMMEDIATE ISSUES/THE HIT LIST:

- When acquired property, water was condensing and pouring off windows due to high heat and no ventilation
- Rat infestation
- Cosmetic deterioration
- Non-working appliances
- No organized parking
- No common spaces
- Low function of premises

WHAT GREEN ROCK IMPROVEMENTS WERE MADE:

THE ENVELOPE/SHELL:

- First step was to put in new windows (thermal, double pane commercial grade)
- Cleaned up insulation and put foam in any walls they had to rip up
- Heavily insulated roof, R50 roof insulation with help from the city \$6000.
- Added rooftop white reflective TPO 80 mil membrane so it doesn't heat up
- Upgraded appliances and put in wall sleeve heat pump units for efficient A/C and heating down to 35F
- Increased vapor barriers with foam and damaged insulation. Plaster has thermal mass radiant quality which seems to create an efficient thermal. Gas heat is very effective in this building with an annual bill of just \$2,000.

SYSTEM, HEAT IMPROVEMENT, boiler, water, modulating HVAC water heater:

- Updated to more efficient appliances, and heat pump units
- Installed better controls and air well for less heat loss in Winter

ENERGY SOURCE IMPROVEMENTS, walk away from fossil fuels:

- Heat pump in AC sleeve increases AC efficiency and heat down to 35F. AMANAA HEAT PUMP 1600
- Keep boiler at lowest setting
- Updated appliances to star rated
- 40,000 watt solar array installed June 2021. First covered parking with solar in Minneapolis, solar on carport, first carport type structure for multifamily housing in Minneapolis

LIVABILITY:

- Native plants
- Food scaping, not landscaping
- Increased organization of waste/recycling
- Took out storage lockers and made bike garage attached to the laundry room
- Made laundry free at all locations and added our waste reduction station that includes textile, light bulb, metal, electronics, plastic bag and Styrofoam recycling, compost bins and liners, LED light bulbs supplied, pet waste bags

RESULTING SAVINGS/PROFITS AND REDUCED UTILITY USAGE:

- Biggest impact was insulating the roof and replacing windows reducing heating and cooling energy bills for common spaces and for Residents

Utility Specifics:

11 Units in Building	1600 Park Ave	2019 Average	2020 Average
	Electricity (kwh)	327.58	255.5
	Gas (therms)	329.25	303.58
	Water (gallons)	20,128.68	12,947.88

- All utilities decreased from 2019 to 2023
- Solar PV now generates 100% of electricity for property, so net zero building for Owner Including car charging, electric heat pump dryers, and offset gas use
- The most significant decrease is electricity with a kwh decrease of 72.08kwh

FUTURE HIT LIST PROJECTS FOR THIS BUILDING:

All heat pump and solar thermal water heater and space heat

Permeable parking surface

Replace all stoves with induction/convection units

Offer solar ovens and teach use

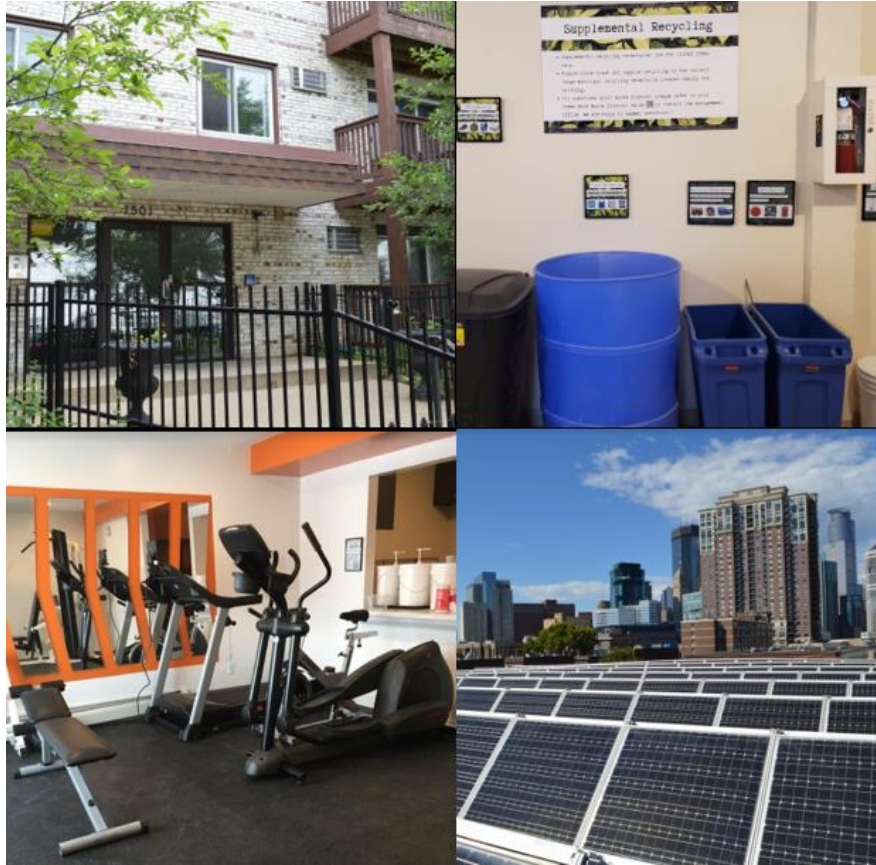
Expand garden offerings and grow more food

Plant as many trees as possible

Upgrade electrical infrastructure to accommodate more electric centered appliances to stop burning fossil fuels



CASE STUDY #4 - 1501 PORTLAND AVE, MPLS



PROPERTY NOTES:

- Built in 1970
- 47 1 BR units and 1 studio
- Purchased by Green Rock Apartments in January of 2007

IMMEDIATE ISSUES/THE HIT LIST:

- Major water puddles 6” deep on the roof
- Extreme heat loss and gain in building due to poor windows and doors and almost inoperative boiler system full of sediment and leaking

WHAT GREEN ROCK IMPROVEMENTS WERE MADE:

THE ENVELOPE/SHELL:

- UV Reflective coatings on the windows
- New double pane thermal doors and windows improvement – replaced single pane aluminum wind
- Updated to double pane commercial glass in exterior entryways x 3

- Added roof insulation to max heat retention - r32 using iso high density foam
- Made “roof slushies”, with a snow blower to keep water and ice buildup in the winter for 5 years until could afford a new roof, 60 millimeter TPO membrane, white reflective roof

SYSTEM, HEAT IMPROVEMENT, boiler, water, modulating HVAC water heater:

- 30k Solar, installed by 10k Solar in 2012, a Minnesota made panel
- Pulled out an old boiler, put in a Knight by Lochinvar condensing boiler, went from \$3500. mo gas to \$400 - \$600 per month
- Water heater/boiler 40-50% more efficient, 3-4 year payback
- Took 30 gallons of heavy sediment out of the system. Installed filter sock in system to continue cleaning it for efficient operation
- Replaced all controllers and added high-capacity flush valves to expedite cleaning
- Replaced damaged radiator fins
- Added passive water heating using boiler
- Upgraded heating system in parking garage with new components
- Partnering with Xcel and eviecarshare.com to install 4 shared EV spots and 2 long range EV vehicles

ENERGY SOURCE IMPROVEMENTS:

Why should I do this? Do you have a utility bill?

- Monitor and adjust boiler monthly and filter boiler system from debris for efficiency
- In 2007, switched standard boiler to condensing boiler for 50,000 sq ft building, 40-50% in energy savings with a 4-year payback on the new boiler system
- Maintain heating controls for Residents – running correctly – have control of heat so they are not opening their windows to cool their apartment
- Motion sensors in parking garage for all lighting. 75 lights are on only 5% of the time instead of 100 %. \$150 per month savings on switching to LED bulbs and new controls

LIVABILITY:

- Free car charging, 4 Level 2 EV chargers, 4+ Residents own EV's
- Residents who buy an EV get \$2k rent credit over 12 months or \$166 per month over the remainder of year lease
- Updated elevator mechanicals for efficiency
- LED lightbulbs throughout
- Make sure all controls are up to code (garage heat)
- Native plants
- Food scaping, not landscaping

- Made laundry free at all locations and added our waste reduction station that includes textile, light bulb, metal, electronics, plastic bag and Styrofoam recycling, compost bins and liners, LED light bulbs supplied, pet waste bags

RESULTING SAVINGS/PROFITS AND REDUCED UTILITY USAGE:

- \$2000. per month in water, now \$700.-\$800. per month, new efficient toilets, toilets were number one waste of water
- Gas use went from \$3000 in energy use in 2006, 2007 to \$500 in average gas use in 2020, for hot water and all heating, including parking garage, parking pad
- Water heater goes with boiler, the combo of the 2 is about 40-50% better than standard

Utility Specifics:

47 Units in Building	1501 Portland Ave		
		Varries by utility	2020 Average
2014 Average	Electricity (kwh)	3,446.21	3,634.99
2016 Average	Gas (therms)	904.92	969.66
2007 Average	Water (gallons)	110,270.16	70,371.84

- This building has different years for the previous data due to data availability
- The most significant decrease is water from 2007 to 2020 of 53/34 units
- The total yearly utility savings for this building is over \$4000.

FUTURE HIT LIST PROJECTS FOR THIS BUILDING:

- All heat pump and solar thermal water and space heat
- Tuck point and seal exterior
- Permeable parking surface
- Replace all stoves with induction/convection units
- Offer solar ovens and teach use
- Expand garden offerings and grow more food
- Plant as many trees as possible



PRODUCTS USED FOR RETROFITS

Disclaimer: The products listed below are intended to give a general idea of what your options may be, how much they cost, etc. Not all options may be available to you and may depend on which contractor you choose. Be sure to research experienced contractors in your area to find a good fit for your property. Some products, such as insulation, lighting, and window coverings, may be easily installed without a contractor, but be sure to choose the best options for your specific needs.

For **ENERGY STAR rebates**, see the [ENERGY STAR Rebate Finder](#).

Heat Pumps

What should I know about environmentally friendly heat pumps?

Air source heat pumps use the air outside to heat and cool your home (although some heat pumps only heat). These heat pumps use electricity instead of natural gas and are typically the most efficient way to heat and cool your home, making them a low carbon technology.

The following options are **air-to-air heat pumps**, which use fans to circulate warm or cool air to condition the indoor space. These systems come in both ducted and ductless options, which will vary based on how the home is set up. Ducted systems utilize existing ductwork in the home to distribute the conditioned air throughout the home, while ductless (often called **mini splits**) use indoor heads placed in individual rooms to heat/cool the home. Ductless systems are most common in multifamily applications, therefore the options below are all ductless. Outdoor units can usually connect to 3-4 indoor units through a refrigerant line and electrical wiring. Each indoor unit can be individually set, providing maximum comfort in every zone.

Heat pump efficiency is greatly increased when a **mini split inverter** is used instead of a single stage compressor. The inverter continuously regulates temperature and has a variable capacity, which means it can run at a range of speeds to maintain a set temperature without using unnecessary energy. This differs from a single stage compressor, which can only operate at full/fixed capacity and continually turns on and off. The following options have mini split inverters.

Definitions:

- SEER = Seasonal Energy Efficiency Rating, used for air conditioning equipment. *Higher* indicates a higher efficiency.
- HSPF = Heating Seasonal Performance, used for heat pumps. *Higher* indicates a higher efficiency.
- EER = Related to SEER. *Higher* indicates a higher efficiency.

Models

***For cold climates like Minnesota, make sure to get a heat pump that can heat below 0°F.*

Daikin units

Multi-Zone Daikin AURORA (2 and 3 zones)

- Up to 17.9 SEER / 12.5 HSPF
- **Dale has used** this type of heat pump
- Up to 100% heating capacity at 5°F, up to 100% cooling capacity at 104 °F
- Operates efficiently as low as -15°F
- Energy Star certified
- Compatible with wall mount units, slim duct units, ceiling cassette units

Multi-zone systems (2, 3, 4, or 8 zones)





- Up to 18.9 SEER / 12.5 HSPF / 12.7 EER
- Energy Star certified
- Compatible with wall mount units, slim duct units, ceiling cassette units

Quaternity, Daikin

- Most efficient Daikin ductless system
- Only *one* indoor unit per outdoor unit
- Up to 26.1 SEER / EER 15.8 / 11.0 HSPF
- Ability to monitor and control humidity
- Integrated air cleaner
- Compatible with wall mounted indoor unit

Prices not available without consultation. For those in the Minneapolis-St. Paul area, however, [MSP Plumbing & Heating](#) carries Daikin ductless heat pumps and is certified Daikin Ductless Pro. They estimate that the cost of installation for a heat pump in Minneapolis-St. Paul is between \$4,669 - \$5,689 with an average cost of \$5,009.

Fujitsu units

BTU	18,000	24,000	36,000	45,000
 <p>2 Zones Multi</p>	<p>AOU18RLXFZ AOU18RLXFZH</p>			
 <p>3 Zones Multi</p>		<p>AOU24RLXFZ AOU24RLXFZH</p>		
 <p>4 Zones Multi</p>			<p>AOU36RLXFZ1 AOU36RLXFZH</p>	
 <p>5 Zones Multi</p>				<p>AOU45RLXFZ</p>

Fujitsu multi-room mini-split systems. [Source](#)

Models with an ‘H’ at the end can operate down to -15°F and have base freeze prevention. Wall mounted, floor mounted, compact cassette, and slim duct indoor models available, depending on the BTUs desired for each zone.

Prices are not available without booking a consultation.

Mitsubishi units

Note: This is not a comprehensive list of all Mitsubishi heat pump products.

[3-zone mini-split systems](#)

- ❖ 36,000 BTU Ductless Mitsubishi Mini-Split Multi Zone MXZ-C Series - Heat Pump Condenser, \$2886.00
 - Functions down to 5°F
- ❖ 28,600 BTU Mitsubishi Multi-Zone Ductless **H2i Hyper Heat Pump** Condenser w/ Base Pan Heater, \$3365.25
 - Functioning down to -13°F
- ❖ 42,000 BTU Ductless Mitsubishi Mini-Split Multi Zone MXZ-C Series - Heat Pump Condenser, \$3505.50
 - Functions down to -4°F

4-zone mini-split systems

- ❖ 36,000 BTU Ductless Mitsubishi Mini-Split Multi Zone MXZ-C Series - Heat Pump Condenser, \$2886.00
 - Functions down to 5°F
- ❖ 42,000 BTU Ductless Mitsubishi Mini-Split Multi Zone MXZ-C Series - Heat Pump Condenser, \$3505.50
 - Functions down to -4°F
- ❖ 36,000 BTU Mitsubishi Multi-Zone Ductless **H2i Hyper Heat Pump** Condenser w/ Base Pan Heater, \$3759.00
- ❖ 42,000 BTU Mitsubishi Multi-Zone Ductless **H2i Hyper Heat Pump** Condenser w/ Base Pan Heater, \$4540.50

5-zone mini-split systems

- ❖ 42,000 BTU Ductless Mitsubishi Mini-Split Multi Zone MXZ-C Series - Heat Pump Condenser, \$3505.50
 - Functions down to -4 °F
- ❖ 42,000 BTU Mitsubishi Multi-Zone Ductless **H2i Hyper Heat Pump** Condenser w/ Base Pan Heater, \$4540.50
- ❖ 48,000 BTU Mitsubishi Multi-Zone Ductless **H2i Hyper Heat Pump** Condenser w/ Base Pan Heater, \$5313.00

Mitsubishi [indoor units](#) range from 6,000 BTU to 24,000 BTU, with floor-mounted, wall-mounted, and ceiling recessed cassette options.

Water Heaters

What makes a water heater environmentally friendly?

The most efficient water heaters are electric **heat pump water heaters (HPWHs)**. Similar to how air-to-air heat pumps work, a heat pump water heater uses the heat in the air to heat water in a tank. These types of water heaters can be [two to three times more energy efficient than a traditional water heater](#), and have a [typical payback period of 2-5 years](#). The average lifespan of a HPWH is 10-15 years. They can be found on their own, can be retrofitted to an existing storage water heater, or can be a part of an integrated system with space heating and cooling. Be sure to perform maintenance throughout the lifespan of your water heater to keep it running efficiently.

It is important to keep in mind that these water heaters “require installation in locations that remain in the 40°–90°F (4.4°–32.2°C) range year-round and provide at least 1,000 cubic feet (28.3 cubic meters) of air space around the water heater” [[source](#)]. A good place to put them is in a furnace room or other room with excess heat.

When considering options for a new heat pump water heater, start by looking at **ENERGY STAR's list of heat pump water heaters** [here](#), or adjust the filters on the left side for other ENERGY STAR certified water heaters. A common efficiency rating for water heaters is the *Uniform Energy Factor (UEF)*. A higher UEF indicates [higher efficiency](#).

If your property is connected to natural gas and you wish to continue using a gas boiler, consider buying a **condensing gas boiler**. These types of boilers are designed to be operated at lower temperatures (which causes condensation to form, but it does not negatively impact their performance), and can have an [energy efficiency of 90% or more](#). You can **find ENERGY STAR certified boilers** [here](#).

Finally, **for larger buildings** that constantly circulate heated water, **recirculation controls** have been shown to save significant energy and have a **payback period around 1-4 years**, depending on building size [[source](#)][[source](#)]. The controls can be time-based or demand-based, so that energy is not wasted when hot water is not needed, and are usually installed without complaints. Ask your contractor about installing one in your building for an accurate estimate of the money and energy you can save.

Windows and window coatings

How can I make my windows more energy efficient?

Windows can be responsible for leaking [25-30% of the energy used](#) in residential heating, so it is important to address this to improve the shell of a building. **There are many ways you can update windows** to make them more efficient. [Energy.gov](#) has a great list of ways to do this, including [weather stripping](#), using window coverings, and applying window coatings. The following section contains a few examples of window coatings, but many different kinds are available depending on your specific needs. Look for coatings that **reduce solar heat gain**, and note that window coatings are most effective on *east- and west-facing* windows.

Window Coatings

[Gila Titanium Heat Control Window Film](#) \$34.97

- ❖ Light tint
- ❖ Blocks 88% UV rays
- ❖ Daytime privacy
- ❖ Reflective material
- ❖ Rejects up to 72% of total solar energy

[Hidbea One Way Window Film Heat Control Anti-UV Window Tint](#) \$53.91

- ❖ Blocks 90% infrared rays and 95% UV rays

- ❖ Allows natural light
- ❖ Daytime privacy
- ❖ Available in 4 colors

[Rabbitgoo 3D Rainbow Window Film](#) \$22.99

- ❖ This is a *decorative window film*
- ❖ Blocks 84% UVA rays and 99% UVB rays
- ❖ Blocks sunlight, allows soft natural light

What to look for when buying new windows.

If you are in a position to buy new windows, there are some key environmental characteristics to look for. **A detailed guide for replacing windows** can be found [here](#), but there are some general things to look out for. Make sure the windows are ENERGY STAR certified, and check the [NFRC](#) label to compare different windows. The label will contain the following four ratings:

- *U-Factor*: measures how well a window can hold heat in. Lower numbers are better.
- *Solar Heat Gain Coefficient (SHGC)*: measures how well a window can keep unwanted heat out. Lower numbers are better.
- *Visible Transmittance*: measures how well a window can transmit natural light. Higher numbers let in more light.
- *Air Leakage*: measures how air tight a window is. Lower numbers are better.

Another rating you may want to look for is [Performance Grade](#) (PG) which is based on tests done to determine the structural integrity, air, and water resistance.

A good place to start looking for new windows is [ENERGY STAR's list of most efficient windows of 2020](#). Many of these windows have low-emissivity coatings, which lower the U-Factor and SHGC of the window, and some are gas-filled to improve insulation.

Infrared Space Heaters

What is an infrared heater?

An [infrared heater](#) warms your body and the objects in a room in a similar way that the sun does. The sun emits infrared light, which is invisible to the human eye, and your skin and clothing absorb it and warm you up. An infrared heater works the same way, which differs from traditional space heaters that heat up the air. By using infrared light, these heaters can provide **instant, highly efficient heat**. Another benefit of infrared heaters is that they do not dry out the air.

These heaters are ideal for spaces where you can be in the direct path of the heat so that your skin can absorb the light. By heating objects, energy is not wasted through hot air rising near the ceiling or by heating rooms that are not occupied. All of the following options only use up to 1500 watts, which is comparable to a common hair dryer.

Models:

[1500W Elite Series Dr. Infrared Heater with Ultrasonic Humidifier/Oscillating Fan](#)

Room Size / BTUs	Heat Settings	Remote Control	Cool touch	Anti-tip over	Overheat Safety	Timer	Filter	Price
Medium room	4	✓	✓	✓	✓	✓	✓	\$134.99

[1500W Lifesmart Smart Boost 6 Element Portable Infrared Quartz Mica Indoor Room Space Heater,](#)

Room Size / BTUs	Heat Settings	Remote Control	Cool touch	Anti-tip over	Overheat Safety	Timer	Filter	Price
Up to 1,000 cubic feet	3	✓	✓	✓	✓	✓	✓	\$129.99

[1500W Lifesmart Corp Lifelux Series Ultimate 8-Element Infrared Heater](#)

Room Size / BTUs	Heat Settings	Remote Control	Cool touch	Anti-tip over	Overheat Safety	Timer	Filter	Price
Up to 1,100 cubic feet	3	✓	✓	✓	✓	✓	✓	\$118.89

[1500W Original Dr. Infrared portable space heater](#)

Room Size / BTUs	Heat Settings	Remote Control	Cool touch	Anti-tip over	Overheat Safety	Timer	Filter	Price
Medium room	3	✓	✓	✓	✓	✓	✓	\$108.75

[1500W Kenmore 96380 Infrared Heater](#)

Room Size / BTUs	Heat Settings	Remote Control	Cool touch	Anti-tip over	Overheat Safety	Timer	Filter	Price
5,120 BTUs, medium to large room	3	✓		✓	✓	✓	✗	\$99.99

[1500W Heat Storm Infrared Cabinet Electric Space Heater](#)

Room Size / BTUs	Heat Settings	Remote Control	Cool touch	Anti-tip over	Overheat Safety	Timer	Filter	Price
More than 300 square feet	2	✓	✓	✓	✓	✗	✗	\$87.99

Solar PV Electric Systems

You do not *need* to install solar panels to make your building more sustainable. But, it is important to know just how much solar energy could do for your property, the incentives that Minnesota energy companies and the federal government provide and how to go about installing solar. The products listed so far, and the options listed below, will still help increase your building's energy efficiency, save you money and help the environment.

Dale Howey and Green Rock Apartments has been using [Apadana Solar Technologies](#) exclusively on his most recent solar installations, including his 40kW carport project. According to Dale Howey, Account Representative Andy Goke has an incredible knack for finding local grants and funding. Apadana Solar Technologies, and Andy Goke, can be reached via their website, or directly at andy.goke@apadanatech.com or 612-470-1393.

Did you know that **Minnesota has a similar solar potential to places [in Texas and Florida](#)**? It is also one of the [top 10 states for solar](#) in the US. Investing in solar panels in Minnesota can provide **\$25,015 - \$33,844 in savings** over a 20-year period [for a 5kW system](#), and that is *not*

including any tax credits or incentives. The average solar payback period is 9.41 years when paying cash. However today there are a variety of green energy low interest loans and many solar installations are completed with no money down. As fossil fuel prices and demand for stable, clean and cost-effective energy sources increase, solar is emerging as the **'king of electricity'**.

After you make your property more energy efficient, one of the first things you should do before installing solar is to educate yourself. Visit the [Minnesota Department of Commerce's page on solar energy](#), which has some great **resources and information on installing solar**. You can also learn more about how to install solar in Minnesota at the [Clean Energy Resource Teams \(CERTs\)](#) website. They have information on "[Simple Steps to Solar](#)", a list of [solar installers](#), a comprehensive [Minnesota Solar Guide](#) and more. To get an estimate for the solar potential of your property, check out [The Minnesota Solar Suitability App](#). To get an **independent site assessment**, you can visit the MRES website to [schedule a meeting with a certified assessor](#) to get an honest, candid and detailed report on your property's potential for solar. Our assessors do not sell solar installations.

There are many **financial incentives and financing options** available in Minnesota for those looking to install solar. Visit [The Database of State Incentives for Renewables & Efficiency](#) (DSIREUSA) for an extensive list of incentives available in Minnesota. Some things to consider include the [30% Federal Tax Credit](#) for solar installations, which is available through 2033, and [rebates and rewards](#) from Minnesota utility companies, which help offset the cost of solar installation. Additionally, by law, solar systems do not increase the tax assessed value of your property. There is also no sales tax on solar installations in Minnesota, which saves you 7%. To cover the rest of the installation cost, check out [solar loans](#) and talk to your local installer. Apartment building owners have the option to have all residents on one utility electric bill with solar, or just their common area's meter.

Minnesota winters can be harsh, but there are **solar panels that can produce well in cold climates**. Although there may be a dip in solar electricity production in the winter due to fewer daylight hours (solar electricity is produced by the sun's light and not the sun's heat), solar panels can [still produce electricity](#). The shorter days are somewhat offset by the fact that the solar panels will not overheat in the cold, and some light is reflected off the snow on the ground. Check out [Solaria's 400W All Black Solar Panel](#), or the [Q.PEAK DUO ML-G9](#) for some examples of solar panels fit for Minnesota winters. But remember, a local solar installer will help you find the best panels and system for your property.

Eco-friendly Insulation

Improving the insulation in a building is one of the first things Dale Howey does to make a building eco-friendly. It is an easy, relatively inexpensive, and impactful way to make any property more energy efficient. Be sure to focus on wall, roof, window, door, and floor insulation. **For more information**, see [Insulation -Why Is It Important?](#) **For a DIY guide** from Energy.gov, see [Adding Insulation to an Existing Home](#). For more information on **how to insulate windows and doors**, watch [Video: How to insulate windows and doors](#). Finally, before choosing what type of insulation you will use, think about the environmental impact of different insulation types. **For eco-friendly insulation**, visit [Top 5 Green Insulation Options](#).

Interior and Exterior Lighting

Lighting is a relatively easy change you can make that can make a big difference. Consider switching out traditional incandescent light bulbs, [which lose 90% of their energy to heat](#), with **LED, halogen incandescent, or CFL** (compact fluorescent lamp) light bulbs. All of these options will save you money over the lifespan of the bulb, but LED light bulbs are the most efficient. To save additional money and energy, consider implementing dimming light bulbs for indoor spaces, and look for outdoor bulbs that have automatic daylight shut-off and motion sensors. Check out **ENERGY STAR's light bulb page** [here](#), which includes [an easy three step guide to choosing a new lightbulb](#), [a guide to dimmable ENERGY STAR LED lighting](#), and a [certified light bulbs product finder](#).

Start buying light bulbs based on *lumens*, or the amount of light a bulb produces, rather than *watts*, the amount of energy the bulb uses. For example, if you are looking to replace a 100 watt incandescent bulb, you will want to look for a bulb giving about 1600 lumens. You can buy a bulb with less lumens for a dimmer light, and more lumens for a brighter light. Learn more about buying light bulbs based on lumens [here](#).

Solar exterior lighting options are now widely available through most electricians, further reducing the cost of building/common area electricity.

Electric Vehicle Chargers

Increasingly, Residents are requesting EV car charging options for their electric cars from multifamily apartment buildings. Numerous local electricians are installing Level 2 EV car chargers for multifamily buildings including [Apadana Solar Technologies](#) who can install both chargers for current use as well as charging hubs, to easily allow for chargers to be added in the future, as their need grows. Another Minnesota EV charger installer is [LHU Construction](#)

[\(Lightinghouse USA\)](#). It is important to note that the cost of the electricity used to charge electric vehicles can easily be calculated and billed to Residents as needed.

Electric Vehicles (EVs)

If you are interested in purchasing an electric vehicle but do not want to spend money on a new car, check out [GS Motors](#) in Hopkins, MN. They sell used EV cars, and many are still under warranty. You can find their [current inventory](#) on their website. They also have an ‘appointment-only’ policy to give each customer individual attention to answer questions and provide EV information. Additionally, most car manufacturers today offer electric options, with many new electric cars now on the market! Be sure to ask about the Federal Tax Credits that are available when purchasing an electric car.

Heat Pump Dryers

Heat pump dryers use **50% less energy than traditional dryers**. [Learn more](#) about heat pump dryers on the ENERGY STAR website, watch this [1-minute video](#) to see how they work, and find ENERGY STAR certified heat pump dryers [here](#), with a clothes dryer buying guide included.

Energy Efficient Cooktops

The most energy efficient cooktops are **induction cooktops**. [They work](#) by using electromagnetic energy, which is conducted through cast iron, steel and magnetic stainless-steel cookware. Note that aluminum, copper, and non-magnetic stainless-steel cookware will not work on these cooktops. Along with being energy efficient, they are easy to clean, provide precise cooking, and do not get nearly as hot as gas or electric stove tops.

For some **options for induction cooktops**, see this [Treehugger article](#). Many cooktops come with a complimentary set of induction cookware. Although they may be pricey, they will save you energy. They also use electricity, so if your electricity source is renewable then this type of cooking is low-carbon.

Electric Snow Blowers

For more information on electric snow blowers, see [The 6 Best Electric Snow Blowers of 2021 \(any why it's important\)](#). For more electric snow blower options, go to [10 Best Electric Snow Blowers in 2020](#).

Organics Recycling and Gardening

To implement **organics recycling** at your property, visit [Hennepin county's page on apartment, townhouse, and condo recycling](#). Additional recycling resources can be found on the page, such as [recycling educational materials](#) for your residents, including organics recycling guide, information on the **move-out and bulky household waste reuse program**, and **grant funding** for multifamily properties to improve waste reduction.

Consider supporting a nearby **community garden** and promote it to your residents. You can find information on community gardens in Minneapolis [here](#). Find an MPRB managed garden [here](#), or visit COMGAR to search for plots in your area and ask questions about nearby community-managed gardens. You can even [lease your own lot](#) to start a community garden for your residents. Start a communal garden shed with tools to help your residents grow their own food, like Dale Howey does. Encourage your residents to also garden in the available outdoor spaces on your properties. Community gardens contribute to a zero carbon lifestyle by avoiding carbon emissions associated with commercial farming and food transportation.

Find locally made [hand soap](#), [bath soap](#), and organic [toilet paper](#).

If an induction cooktop does not seem feasible, there are [other ways to save energy](#) in the kitchen. Always look for **ENERGY STAR certified appliances**, use flat-bottomed cookware for more efficient cooking, and match the size of the pan with the burner you are using.

Bicycle Borrow Program



There is a [growing interest](#) in bicycle share programs and bicycle storage for multifamily properties. Many public bicycle borrow programs exist in Minneapolis, but if you would like to **start your own** for the convenience of your Residents, or live in a place with limited access to bicycles to rent, consider keeping a collection of bicycles in a variety of sizes for Residents to borrow as needed. This is a program that [Dale Howey offers](#), and his Residents enjoy the access to a bicycle whenever they would like. Consider using a bike share service, such as [On Bike Share](#), or renting your own bicycles.

If you choose to not participate in bike sharing, make sure to **have sufficient and secure bike storage** and advertise it to future and current Residents.

FINANCING AVAILABLE FOR BUILDING RETROFITS

This section provides a list of financing resources available for property owners looking to make sustainable upgrades.

Ask your tax professional, local contractor or any of the following organizations about their financing resources and about the current Federal, State or Local Tax Credit Incentives that are available to assist you with the cost of your near carbon zero retrofitting projects. There may be additional incentives, including rebates and discounts, available to you depending on your utility company and what products you buy.

[EV Level II Car Charging Grants – State of Minnesota](#)

The State of Minnesota Pollution Control Agency has dollars available to install Level 2 electric vehicle (EV) charging stations in public places, workplaces, and multiunit dwellings. Level 2 charging stations provide 6.6kW to 19.2 kW of power for drivers to charge their electric vehicles. The purpose of the program is to increase the use of electric vehicles in place of gas-powered cars to reduce tailpipe emissions including greenhouse gas emissions in the state.

[Green Cost Share Initiative - City of Minneapolis Health Department](#)

The City of Minneapolis provides funding for multi-family properties for projects involving energy efficiency and solar installation. Some programs give priority to buildings in designated Green Zones of Minneapolis and/or properties that participate in the 4d Affordable Housing Program, although all are welcome to apply.

[4D Affordable Housing Incentive Program - City of Minneapolis](#)

Program where rental property owners can receive property tax reductions if 20% or more of their rental units are affordable for 10 years. Additional benefits include cost sharing for energy efficiency improvements and solar installations. This is one way Dale

Howey finances his retrofits. You can find guidelines and FAQs on [the website](#). Applications go live online in October and are due in early January.

[Green Zones Initiative - City of Minneapolis](#)

The City of Minneapolis has designated Green Zones as a part of their efforts to support low-income communities, Indigenous communities, and communities of color, who “experience unequal health, wealth, employment, and education outcomes, and also are overburdened by environmental conditions such as traffic and stationary pollution sources, brownfield sites, blight and substandard housing.” See the Green Zone Boundaries on their website [here](#), and visit the [Green Zones Frequently Asked Questions \(FAQ\)](#) to see what questions people have. For additional questions or more information, contact Kelly Muellman at kelly.muellman@minneapolismn.gov or 612-673-3014.

[MN PACE Financing - Property Assessed Clean Energy](#)

PACE loans are available to commercial building owners to help pay for energy efficiency upgrades and renewable energy investments. These loans are fit for most multi-tenant buildings. Projects that can be financed include solar panels, HVAC systems, lighting and more. This loan program is incredibly beneficial because it allows an owner to pay no upfront costs, and utility savings often exceed payment obligations, so the investment results in a cash positive outcome. [Contact MinnPACE](#) to learn more.

[MN Center for Energy and Environment - CEE](#)

The Minnesota Center for Energy and Environment offers loans for energy efficiency projects and energy related improvements for multi-family housing. See their loans page [here](#), where you can learn more and apply.

ORGANIZATIONS THAT ASSIST MULTI-FAMILY PROPERTY OWNERS TO ACHIEVE CARBON REDUCING RETROFITS

[APADANA SOLAR Technologies](#) - Solar/ EV Chargers/ LED lighting Retrofits

Apadana and Apadana Solar Technologies provides engineering, procurement, and construction services across the spectrum of solar energy, EV Charging, and LED lighting upgrades, small to large and simple to complex. They are a company founded and staff by engineers, supply chain professionals, and solar energy experts, with a mission to help their customers achieve their social, environmental, and financial goals via cleaner energy. Visit their website or contact Andy Goke at andy.goke@apadanatech.com or 612-470-1393.

[LHU Construction \(LightingHouse USA\)](#)

LHU Construction provides a wide range of products and services specifically designed for multi-housing communities. We can help you in your transition to green your building with our comprehensive list of products. Our parent company was established in 2009 as a clean technology company and has won many awards including CleanTech Open, MN Cup, and Tekne Awards. In addition to a full range of Construction services, we specialize in Energy Efficiency, Solar, EV infrastructure, Grant Management, and Security Technology. For free assessments, contact Alex Gedstad at 651.472.6789 or email AlexG@LHUconstruction.com.

[CERTs \(Clean Energy Resource Teams\)](#)

CERTs is a Minnesotan organization with staff and resources for sustainable, clean-energy projects. See their [tools and guides](#) page for businesses and organizations, which contains resources ranging from electric vehicles to energy efficiency. They have also recently released a collection of '[Home and Energy Guides and Tips](#)', with a guide specifically made for landlords.

[MN RETAP](#)

The Minnesota Retiree Environmental Technical Assistance Program (RETAP) offers free energy efficiency and waste reduction assessments and aids cities and counties working to become more sustainable. The organization's consultants are retired professionals interested in promoting sustainability in Minnesota. To request a free assessment, contact Rin Porter, RETAP Coordinator: 952-236-7585.

[Minnesota Multi-Housing Association \(MHA\)](#)

This organization provides assistance, support, and community to its members, who all commit to the values of integrity, leadership, relationships, and innovation in the multi-family housing sector. Learn more about what MHA membership can do for owners and managers of rental properties [here](#). Contact them at mha@mmha.com.

[Minnesota Multifamily Affordable Housing Energy Network](#)

The Minnesota Multifamily Affordable Housing Energy Network is a division of Fresh Energy that focuses on energy efficiency and conservation in multifamily housing. They work to provide reliable data access, expand energy efficiency programs, find and promote financing options and more. Contact Ben Passer, passer@fresh-energy.org, Senior Policy Associate, Energy Access and Equity, to learn more about this initiative.

[Fresh Energy](#)

Fresh Energy is a political activism group in Minnesota pushing for bold change to reach a carbon-neutral economy. Their efforts span from renewable energy and transportation to equality and energy efficiency. They have been integral towards moving Minnesota towards 100% clean energy. They are currently taking action to change building energy codes, encouraging net-zero carbon commercial and residential buildings, and fighting for energy efficiency in the housing sector

RESOURCES TO LEARN MORE

MOVIES, VIDEOS, PODCASTS, MORE

Websites/Organizations

[Project Drawdown](#) - *Climate Solutions*

Project Drawdown provides a comprehensive and ever-changing plan to reach the point where greenhouse gasses begin to *decline* in the atmosphere. The book was released in 2017, but the website is continually updated with new information and emerging technologies. Solutions are broken down into sector, impact, and payback.

[American Institute of Architects](#) - *reaching carbon zero through retrofitting buildings*

The American Institute of Architects is an organization advocating and providing resources for architects, with over 200 chapters around the world. Their campaign Blueprint for Better aims to motivate everyone involved in the housing industry to implement the changes necessary to reach zero-carbon, sustainable housing. Some interesting AIA articles to check out are [Architecture's Carbon Problem - Blueprint For Better](#), and [Renovating Buildings to Protect the Climate and Rejuvenate Communities - Blueprint For Better](#). You can sign up for AIA's *Blueprint for Better* newsletter [here](#).

[Bioneers Revolution](#) - *Highlighting solutions, connecting people*

Bioneers is a nonprofit organization that connects people working to fight environmental and social issues with solutions and with each other. Their [website](#) highlights programs, media coverage, and talks focused on all aspects of the climate crisis and social justice. Check out their podcast, [The Bioneers: Revolution From the Heart of Nature](#), on Apple Podcasts, Spotify, Soundcloud, and more. Their 2020 virtual conference talks are now on their website, check out all the amazing talks, performances, and more that happened [here](#). They also have a multitude of free and inexpensive books and eBooks highlighted on their website, check them out [here](#). You can also find them on [Facebook](#).

[RMI](#)

Rocky Mountain Institute works globally to move our energy systems to net-zero carbon. They encourage rapid, market-based change to keep global warming under 1.5 °C. One area of focus for them is carbon-free buildings, including new buildings and retrofitting existing ones. Be sure to check out their many [articles, programs, and insights into retrofitting](#).

[American Council for an Energy Efficient Economy \(ACEEE\)](#)

The American Council for an Energy-Efficient Economy (ACEEE) is a nonprofit organization that works to advance energy efficiency in a multi-faceted way. One focus for them is sustainable building upgrades and affordable multifamily housing. You can see their [multifamily project](#) page, with reports on energy efficiency programs and technical assistance resources.

MRES

The Minnesota Renewable Energy Society is a grassroots renewable energy organization that works locally to advance a sustainable society and renewable energy economy for all through education and leadership. MRES hosts a free monthly webinar for anyone interested in learning more about green energy, solar electricity and sustainable living, and the meeting link can be found on the website. MRES reaches the community through advocacy, education and awareness

MN 350

MN 350 is a state-wide organization fighting climate change in a variety of ways. They are involved in pipeline protests, political engagement, clean energy, and transportation advocacy, indigenous rights, and much more. Visit their website, email them at info@MN350.org, or call 612-440-5350 to learn more.

Movies

Kiss the Ground, 1 hour 24 minutes, available on Netflix and Vimeo

This inspiring movie focuses on the harm caused by traditional farming practices, and the benefits of regenerative farming. It focuses on the carbon, chemicals, and pollutants currently in our air and soil, and how regenerative farming can make a drastic change. After watching, visit KissTheGround.com to learn more and take action.

Before the Flood, 1 hour 36 minutes, rent or buy on iTunes, Amazon, or Google Play

This film features Leonardo DiCaprio as he travels the world to see the effects of climate change first-hand. He talks to scientists and political leaders about what the future may look like, and what individuals and elected officials can do to prevent disaster.

A Plastic Ocean, 1 hour 42 minutes, available for purchase on the website or through Amazon

An award-winning documentary that shows the harsh reality of plastic pollution, how difficult it is to separate ourselves from single-use plastics, and what we can do about it.

Our Planet, 8 episodes, ~50 min/episode, available on Netflix

A beautiful Netflix documentary series focused on showing the beauty of our world and those that inhabit it.

Videos

Benefits of Zero Energy Homes - YouTube

This YouTube playlist features videos from a variety of sources describing the benefits of net-zero energy homes. From Zero Energy Project to Tedx, these videos showcase everything a 'green home' can do for you and the planet.

Books

[*The Sustainable\(ish\) Living Guide: Everything you need to know to make small changes that make a big difference*](#) by Jen Gale

This book provides ways to live more sustainably without dramatically changing your life, as well as provide ways to ease into sustainable living. Topics range from plastic use, zero waste, food, family, home, travel, celebrations and more. There are resources at the end of each chapter for more information and to help facilitate change in your life.

[*Turning the Tide on Plastic: How Humanity \(And You\) Can Make Our Globe Clean Again*](#)

by Lucy Siegle

“Without big action, at the current rate, pieces of plastic will outnumber fish in the ocean by 2050. That is the legacy we are leaving our children and grandchildren. Turning the tide on plastic is here just in time. Journalist, broadcaster and eco lifestyle expert Lucy Siegle provides a powerful call to arms to end the plastic pandemic along with the tools we need to make decisive change. It is a clear-eyed, authoritative and accessible guide to help us to take decisive and effective personal action. So now is the time to speak up, take action and demand the change you want to see in the ocean, in the supermarket aisles and on the streets. It's time to **turn the tide on plastic, and this book will show you how.**”

Podcasts

[*Sustainability Defined*](#), available on Apple Podcasts, Spotify, Android devices and more

This podcast tackles one topic of sustainability during each episode. They have a great way of bringing a well-rounded and clear approach to everything they talk about. Be sure to check out the episode [*Sustainable Building Design with Divya Nataraja*](#). This episode focuses on what makes a building sustainable, an overview of different retrofit approaches, and the growing interest in sustainable buildings. I also recommend checking out the episode [*Reversing Global Warming with Paul Hawken \(Project Drawdown\)*](#). This episode was recorded in 2018, but they updated it in January 2021 to talk about what Project Drawdown has achieved since they first talked.

[*The Climate Champions*](#), available on Podbean and their website

“A podcast about the people mitigating climate change” is exactly what this podcast is about. Every episode highlights a new person doing amazing things for climate change. I highly recommend the episode with [*J. Drake Hamilton, Senior Science Policy Director at Fresh Energy*](#). She talks about all that Fresh Energy is doing in Minnesota, the big changes they have facilitated, and her personal journey (spoiler alert: she was invited to speak to Obama about climate change!)

[*Sustainable World Radio*](#), available on Apple Podcasts, Spotify, YouTube and more

This amazing podcast produced by Jill Cloutier showcases the natural world and how we can live in harmony with our planet. Check out the episode [*Grow Good Food Without a Yard*](#), with guest Acadia Tucker, who is a regenerative farmer, climate activist, and

author. Jill and Acadia talk about general gardening tips, as well as tips for balcony and indoor gardening.

[Bioneers Revolution](#), available on [Apple Podcasts](#), [Spotify](#), [Soundcloud](#), and more

Bioneers is a nonprofit organization that connects people working to fight environmental and social issues with solutions and with each other. Their [website](#) highlights programs, media coverage, and talks focused on all aspects of the climate crisis and social justice. Check out their podcast, [The Bioneers: Revolution From the Heart of Nature](#), on Apple Podcasts, Spotify, Soundcloud, and more. Their 2020 virtual conference talks are now on their website, check out all the amazing talks, performances, and more that happened [here](#). They also have a multitude of free and inexpensive books and eBooks highlighted on their website, check them out [here](#). You can also find them on [Facebook](#).

WHAT CAN I DO RIGHT NOW?

Look at your property in a new way, knowing you can profit from carbon zero retrofitting

Have an Energy Efficiency Audit through [Home Energy Squad](#) or your utility company.

Understand the impact that retrofitting your building to carbon zero will have for you and your Residents and for the planet

Make one change this month that reduces your building's energy use

Email your residents asking what healthy livability amenities they would like most

Create your hitlist for green energy ideas for your property

Spread the word to other property owners and managers so the combined impact is greater

Email your members of Congress to encourage green legislation. You can email congress members through AIA's [Take action now - Blueprint For Better](#)

Join a green building advocate organization such as [Rocky Mountain Institute \(RMI\)](#) to stay on top of green energy building news.

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***“DO YOU STILL HAVE AN ENERGY BILL?
WHY. NO REALLY.
WHY?”
- Dale Howey***