SUSTAINABLE BUILDING MADE EASY

COLORADO FORUM

The Nature Conservancy Colorado

CONTENTS

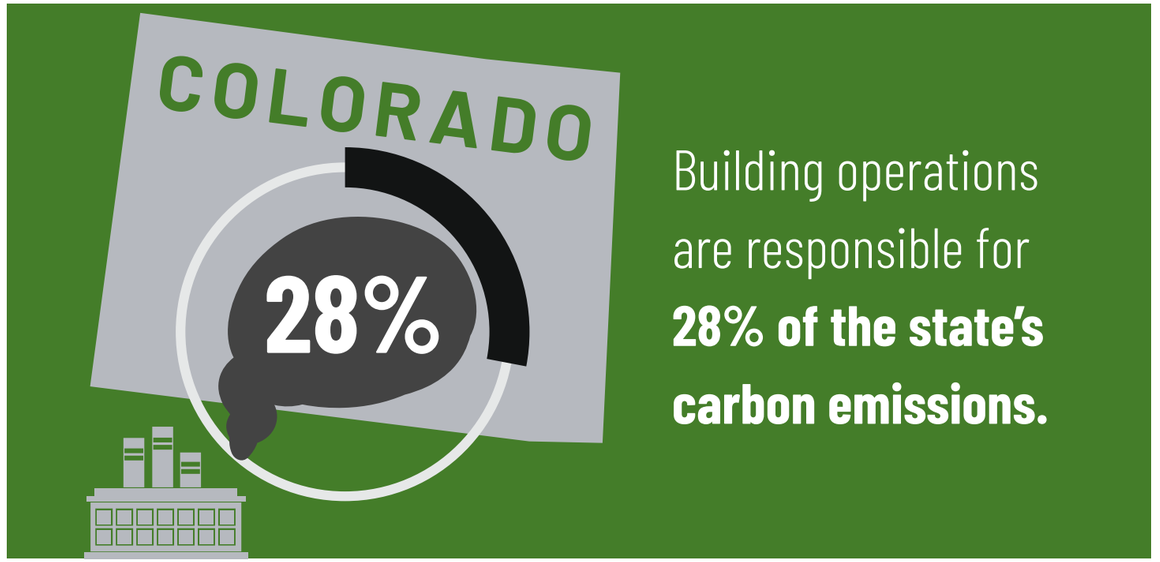
Why Sustainable Building Matters

Climate change may be the single greatest public threat of our time. Addressing this threat rapidly and effectively is our biggest challenge. This handbook focuses on Colorado's buildings and how you can help encourage a cleaner commercial, residential, and industrial building stock through carbon-wise construction and heating/cooling techniques.

Colorado's clean energy legislation builds on the State's progress in transitioning to the use of renewable energy to power buildings. Constructing efficient, well-ventilated buildings with increased reliance on sustainably sourced electricity (rather than natural gas) will reduce pollution generated by Colorado's building sector, support the health and comfort of Colorado residents, and help keep Colorado's skies clear and clean. Specifically, Colorado has set goals to reduce 50% of greenhouse gas (GHG) emissions by 2030 and 90% by 2050, relative to 2005 emissions levels.

By transitioning our building sector to embrace cost-effective and sustainable practices, we can restore clean air to the Front Range and provide healthier, more efficient buildings for Coloradans.

The Colorado Forum and The Nature Conservancy created a collaborative venture called the Healthy Colorado Initiative to help Colorado accelerate the State's necessary transition to a low carbon future. To reach ambitious State-legislated goals around low/zero emissions, **Colorado must immediately focus on optimizing building performance.** Whether you're planning a new building, remodeling, or simply looking for simple, everyday practices that improve building efficiency, this handbook provides a wide range of suggestions for building owners to substantially reduce building sector pollution, save money, and significantly lower Colorado's greenhouse gas emissions.



Each Decision Makes a Big Impact

The majority of the buildings built today will last through the year 2100.[1] Each decision we make about the structures in which we live and work creates an impact lasting for 50 years or more. It is crucial to make proactive choices with future generations in mind. Given the opportunity to upgrade, remodel, or construct a new home or building, we must consider which construction choices reduce emissions, increase efficiency, and move the building toward net-zero energy use. The best path toward a cleaner and more efficient building stock is to create a set of clean energy goals for each phase of a new build or retrofit process. This handbook will provide a framework to allow building owners to achieve their clean energy goals.

While clean energy legislation is a critical first step toward widespread change, laws and regulations have moved slowly to promote energy efficiency and net-zero emissions. Instead of waiting for significant legal and regulatory changes, private actors can move faster and more efficiently than the State government on this issue and should take the opportunity to lead the transition. **The private sector holds immense influence and can set an example by demonstrating how moving towards efficient and electrified buildings makes both environmental and economic sense.** For example, Amazon, among thousands of other companies such as Microsoft, Verizon, and JetBlue, has committed to net-zero emissions by 2040. Amazon's plan involves creating what they call a "carbon system of record," which measures the sources of carbon across all areas of the business in order to identify the most significant emitting sectors and create tailored mitigation solutions to lower emissions. Creating an effective, workable plan involves looking at the whole system and targeting seemingly small decision points that can amount to massive emissions reductions. A method like Amazon's creates an easy on-ramp to introduce climate-oriented thinking into all decision points without sacrificing the bottom line.[2]

Companies with net-zero emissions plans already in place demonstrate how businesses can lead by example in progressive climate action. We have offered a number of case studies in this handbook to allow you to learn from what has already been implemented and is working to achieve net-zero emissions plans. We hope these are valuable to you as you think about next steps for your building project(s).

1 The Future of Energy: Buildings, *The Institute for Science & Policy*
2 Cooperation is Crucial to Private-sector Decarbonization, says Amazon Sustainability Head, *Stanford University*

SUSTAINABLE BUILDING

Key Concepts and Best Practices

Building optimization includes four main components: electrification, improved efficiency, smart buildings, and design process.

ELECTRIFICATION

Our electricity is steadily becoming cleaner as our utilities shift to more renewable energy and retire fossil fuel sources. The global switch to renewables is actually reducing the cost of electricity[3] and improving reliability.[4] Switching building appliances and heating sources from natural gas and propane to electricity reduces fossil fuel use both in the building and at the power plant. Electrified buildings thereby increasingly benefit from electricity cost reductions over time as the grid transitions to cheaper, cleaner, more reliable sources of power.

In order to meet Colorado's clean energy goals, all new buildings need to utilize efficient electric equipment, and roughly a quarter of all existing buildings need to be converted to heating with electric heat pumps by 2030. In order to achieve this, we need to retrofit 3-5% of our existing building stock every year, a substantial increase from the current rate of approximately 1% per year.[5]

While the task seems monumental, shifts in Colorado's gas consumption can have a sizable impact. If 15% of direct natural gas use in residential and commercial sectors switched to electricity, and the increased electricity demand is met with zero emission energy sources (e.g. wind, solar), Colorado would cut GHG emissions by 1.6 million metric tons by 2030.[6]

3 https://ourworldindata.org/cheap-renewables-growth
4 https://www.utilitydive.com/news/pjm-grid-operator-reliability-capacity-market-coal-gas-wind-solar/649152/
5 Guide: Best Practices for Achieving Zero Over Time For Building Portfolios by Matt Jungclaus, Alisa Petersen, and Cara Carmichael.
6 Colorado's Climate Action Plan Emission Targets: Illustrative Strategies and GHG Abatement Potentials by M.J. Bradley & Associates. *February 2020*

IMPROVED BUILDING EFFICIENCY

Improving building efficiency offers numerous benefits, including reducing energy and maintenance costs as well as ensuring occupant health and well-being by improving indoor air quality. Building efficiency includes:

- Improving insulation;

- Changing from incandescent or CFL light bulbs to LED bulbs;

- Sealing air leaks;

- Improving the quality of windows; and

- Upgrading appliances to be electric rather than gas-powered.

The ENERGY STAR program, run by the Environmental Protection Agency, which promotes energy efficiency for commercial buildings, helped businesses and organizations save nearly $10 billion in energy costs in 2016.[7]

In addition to benefiting the environment and people's health (natural gas use in the home has been attributed to over 12% of childhood asthma cases[8]), energy-efficient buildings typically have lower operating costs, better financing terms, command higher rents and occupancy rates for commercial buildings and yield higher purchase prices for residential buildings.[9] Each of these benefits increase a property's value, generating an internal rate of return of up to 25% on energy improvements.[10] Improving energy efficiency often involves higher up-front costs than typical maintenance work, but these investments may have a shorter payback period. The U.S. Department of Energy estimates that the typical household can save 25% on utility bills with energy efficiency measures and up to 30% savings through improvements in regulating interior temperature.

7 ENERGY STAR Facts and Stats.
8 https://news.cuanschutz.edu/news-stories/should-you-extinguish-your-gas-stove
9 The business case for energy efficiency investments in buildings and plants: Energy Efficiency & Financial Performance: A review of Studies in the Market by Better Buildings, U.S. Department of Energy.
10 How much does energy efficiency cost? Last updated 7/13/2020

SMART BUILDINGS

Smart buildings optimize energy consumption by allowing an owner or tenant to remotely monitor and/or manage energy use in the building. In many cases, these systems can also communicate with the energy provider to assist in managing energy use during peak times in exchange for monetary compensation or avoiding higher rates. You may already have the beginning of a smart, grid-interactive building.

In commercial buildings, building energy management systems represent a growing trend, especially in commercial buildings, connecting various devices and sensors such as mechanical systems, lighting, occupancy control, security, and metering data among others. The resulting complete picture of the building has demonstrated operational energy cost reductions, improved building uptime through targeted and predictive maintenance, improved safety and security through complete fire alarms and access system monitoring, and improved occupant comfort. Simple payback periods for a building management system are commonly under one year.

Furthermore, building energy management systems drastically simplify energy reporting for current and future legislative requirements. They also act as a platform for integrating further technologies efficiently, such as on-site energy generation, on-site energy storage (for load shifting), or electric vehicle chargers. Building energy management systems can serve as the gateway to the energy provider. Various systems can be scheduled to optimize energy costs or unlock incentives from the energy provider by supporting the efficient operation of the grid.

In residential buildings, smart thermostats, like Nest or Ecobee, have the ability to manage an HVAC system remotely and to interact with the grid if the user chooses to opt in. Such thermostats use motion detection to determine when and where to provide heating or cooling. By communicating with the grid, smart thermostats anticipate periods of increased demand on the grid and will cool or heat the building in advance of peak energy use. This saves money and energy for both the occupant and the utility. Some utility providers even offer financial incentives to use a grid-interconnected product.

Smart thermostats are just one example of how smart buildings benefit the energy grid and consumers. Some other ways a grid-interactive building can reduce energy and costs include:

- Battery storage, which can offset higher utility rates when demand is high
- Smart electric vehicle charging, optimizing when the vehicle is charged so that the owner receives the lowest rate
- Grid-interactive electric water heaters

Smart buildings create a two-way communication line between the user or occupant of a building and the grid. To learn more, click here.

DESIGN PROCESS

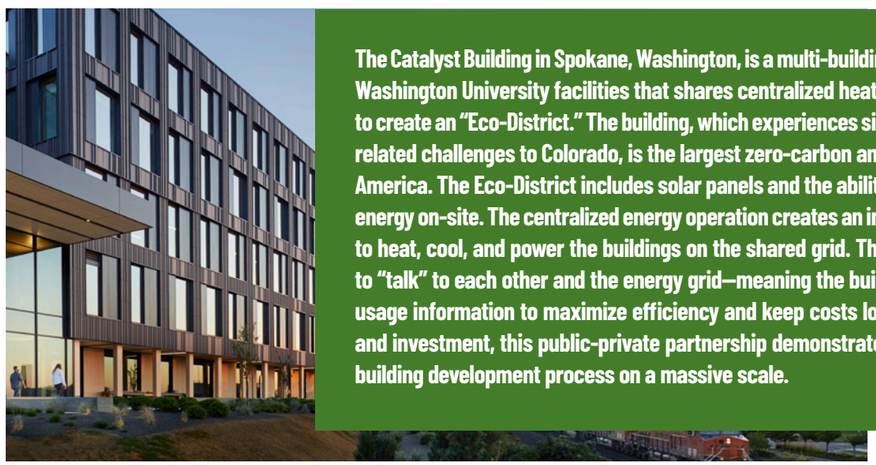
Reaching net-zero emissions for a building requires research and early planning. Incorporating low-emissions goals in the nascent design stages, for either retrofits or new construction. It allows the property owner and contractor to achieve efficient clean energy strategies during construction and throughout the life of the building. This is known as a whole systems approach and is critical to achieving net-zero emissions in buildings. Thoughtful and early planning also maximizes the rate of return and minimizes costs along the way.

There are some well-established efficiency planning certification guidelines that buildings can follow in order to increase energy efficiency, and in turn, they receive recognition that can boost market value of a building. For example, LEED certification is the "most widely used green building rating system in the world".[11] LEED certification provides a framework for healthy, highly efficient, and cost-saving green buildings by rating buildings on how effectively it addresses carbon, energy, water, waste, transportation, materials, health and indoor environmental quality. As a result, studies show that buildings that are LEED certified had a 21.4% higher average market sale in 2018[12] and commanded 11% righer rents than non-LEED buildings in 2021.[13] Other frameworks exist that are similar to LEED that offer guidance on how to construct clean, efficient buildings such as the ICC Green Construction Building Codes and ASHRAE.

All of the case studies outlined in this handbook used this approach to develop their projects. In order to see how this whole systems approach was implemented on a large scale, learn about McKinstry's Catalyst project in Spokane, Washington. While your project may not be as large as the McKinstry project, the same principles can be used.

A whole systems approach provides the structure needed to optimize when upgrades are made, to decide which upgrades or planning choices to pursue, and to achieve a net-zero or low-emissions project in a cost-efficient manner.

If you are constructing a new building or doing a substantial retrofit, you may want to consider off-site construction to potentially lower costs and further your impact. Off-site construction uses precast concrete which lowers building GHG emissions that come from embedded carbon in most building materials. The potential for cost savings is to reduce the on-site construction schedule and can help speed to market, which benefits the owner.



The Catalyst Building in Spokane, Washington, is a multi-building complex made up of Eastern Washington University facilities that shares centralized heating, cooling and electrical grid to create an "Eco-District." The building, which experiences similar geographic and weather-related challenges to Colorado, is the largest zero-carbon and zero-energy project in North America. The Eco-District includes solar panels and the ability to store battery and thermal energy on-site. The centralized energy operation creates an innovative shared energy model to heat, cool, and power the buildings on the shared grid. This system allows the buildings to "talk" to each other and the energy grid—meaning the buildings share utility and energy usage information to maximize efficiency and keep costs low. Funded primarily by grants and investment, this public-private partnership demonstrates how technology can aid the building development process on a massive scale.

11 LEED Rating System
12 CBRE, Green is Good: The Enduring Rent Premium of LEED-Certified U.S. Office Buildings
13 Cushman & Wakefield. (2021). Green Is Good: Sustainable Office Outperforms in Class A Urban Markets.

If you are constructing a new building or doing a substantial retrofit, you may want to consider off-site construction to potentially lower costs and further your impact. There is a broad range of prefabrications and modular solutions that exist and should be considered. For example, off-site construction uses precast concrete which lowers building GHG emissions that come from embedded carbon in most building materials. Reducing the on-site construction schedule is not only a potential for cost savings, but it can also help speed to market, which benefits the owner.

Learn more about hybrid construction here:

> Examples of useful hybrid building technology
> What is hybrid construction?
> Hybrid timber construction
> Hybrid concrete construction

If you are planning to retrofit a building to achieve zero carbon, RMI (formerly known as Rocky Mountain Institute) and Urban Land Institute recommend the approach below to accomplish that goal:[14]

SET TANGIBLE SUSTAINABILITY GOALS. Projects are successful when energy and sustainability goals are clear, actionable, within the desired budget, and well-known across the organization. At a minimum, set an energy target and a goal around financing and investment such as payback requirements for individual projects, desired impact on asset value, or internal rate-of-return requirements. Goals should be informed by a cursory analysis of the building portfolio to determine the amount of savings available from viable energy projects. It is very important for an entire organization, including its leaders, accounting, facilities, sustainability, and other functions, to participate in the goal-setting process from the start, as early buy-in from all stakeholders will make it easier to maintain the course.

ESTABLISH AN ENERGY BASELINE. Building owners can use a building energy management system to assess a building's baseline and track energy usage and improvement over time. Once goals are set, the next step in improving a building's performance is to understand how the building is actually performing so the team can track progress toward goals and identify opportunities. Most of the information to develop a plan can be gathered during a site visit, including:

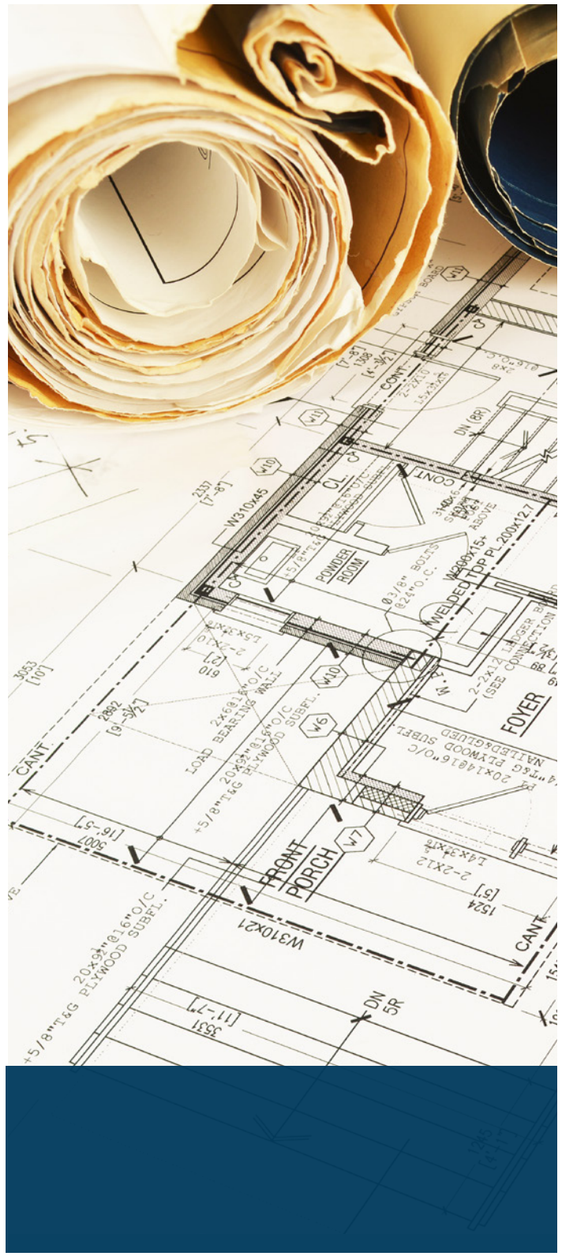
- Type, age, and condition of equipment in the building, including hvac equipment, lighting, controls, roof, windows, etc.
- Approximate window-to-wall ratio
- Insulation levels in the roof and walls and insulation weak points (from thermal imaging)
- Infiltration levels (from blower door testing); current utility rate structure (from utility bills)

14 https://rmi.org/insight/zero-over-time-for-building-portfolios/

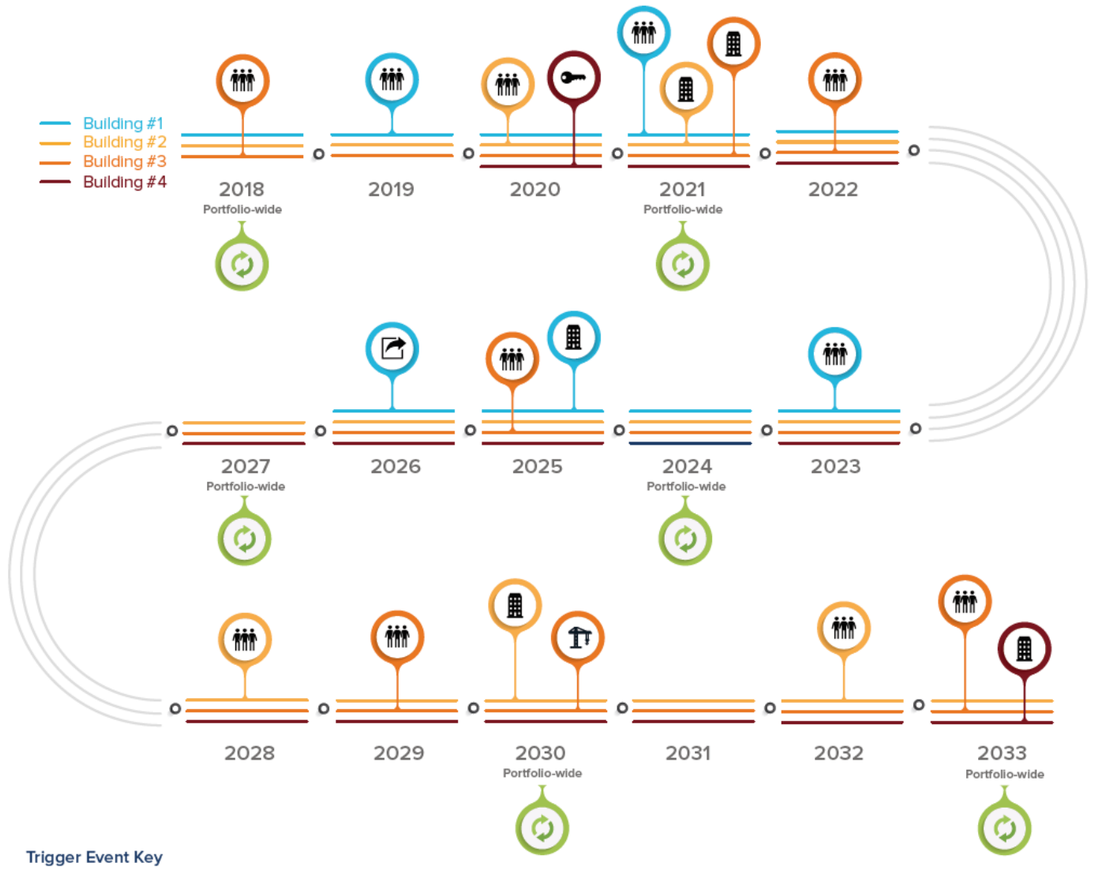
PLAN EFFICIENCY PROJECTS. Independent energy conservation measures can be no-cost, which means they generate savings immediately. Analyze the budget by assessing upfront costs versus savings over time. Some examples of energy conservation measures are 1) adjusting mechanical and lighting schedules to match current building occupancy; 2) adjusting heating, cooling, and lighting zones so consistently unoccupied zones aren't conditioned, ventilated, or lit; 3) engaging and educating tenants by providing actual use data to inform occupant behavior; 4) controlling entry and exit (keep doors closed, encourage revolving door use); and 5) using window blinds to reduce heat gain in summer and allow heat gain in winter.

Load reduction energy conservation measures reduce the building's heating and/or cooling loads. These include strategies like building envelope improvements (adding wall or roof insulation, sealing for air tightness, adding window films and exterior shading devices, etc.), lighting upgrades (replacement with LED fixtures or bulbs, dimming capabilities, vacancy and daylight controls, etc.), and plug load reduction (implementing equipment sleep mode, metering workstations, upgrading equipment, swapping desktops for laptops, etc.).

The cumulative effect of these projects is the ability to downsize to smaller, less expensive HVAC equipment when it is time for replacement at the end of its useful life. Implementing these efficiency projects should be planned out through a trigger event calendar. A trigger event calendar is a calendar of energy upgrades, linked with key asset improvement cycles. Triggers are the building life-cycle events that may enable a deep retrofit as a result of major building investments, changes in usage, or other events.



EXAMPLE TRIGGER EVENT CALENDAR*



Trigger Event Key

Lease Turnover or Renewal

Actions to Consider
- Green lease language
- Adjust energy charge based on lease structure
- Plug load budget
- Tenant energy feedback
- Low-/no-cost cost ECMs
- HVAC reconfiguration or envelope upgrades

Major Equipment Replacement

Actions to Consider
- Replace major HVAC or water heating equipment
- Add roof and insulation
- High-performance windows
- Replace fossil fuel gensets with electric and thermal storage
- Fuel switching from gas to electric

New Building Entering Portfolio

Actions to Consider
- Standardize property condition report to include energy audit and functional performance tests
- Evaluate all "actions to consider" for lease turnover and major equipment replacement trigger events

Building Leaving Portfolio

Actions to Consider
- Include energy information in statement of value
- Standardize property conditions report to include energy audit and functional performance tests
- Provide energy one-page summary to agents and prospective buyers

New Construction or Major Renovation Project

Actions to Consider
- Design all new construction to NZE (or NZE-ready)
- Consider systems like ground source heat pumps
- Design roofs to handle on-site solar PV

Regular Energy Checkups

Actions to Consider
- Continuously:
  - Tenant engagement
  - Commissioning
- Every three years:
  - Assess new utility rates
  - Reconsider solar PV and energy storage

* FROM: Guide: Best Practices For Acheiving Zero Over Time For Building Portfolios

ANALYZE RENEWABLE ENERGY AND ENERGY STORAGE TO DETERMINE HOW MUCH ENERGY YOU NEED AND WHETHER IT IS CURRENTLY COST-EFFECTIVE. Renewable energy generation and storage prices are dropping quickly. According to a recent International Renewable Energy Agency report, between 2010 and 2019, unit costs of solar energy decreased by 85%, wind energy by 55% and lithium-ion batteries by 85%.[15] Also, government incentives, such as rebates, discounts, or tax credits and deductions, change regularly, so an analysis from two years ago may no longer be helpful. Once a site has maximized building efficiency, building owners should offset energy consumption with renewable energy in this general order of priority: 1) pursue on-site renewable energy to the fullest extent; 2) pursue local community solar; 3) pursue other local off-site renewable energy options.

START IMPLEMENTING YOUR PROJECTS AND TRACK YOUR PROGRESS. Tracking the building's actual energy consumption against its goal of net-zero emissions will help the owner to understand the progress that is being made. Installing submeters (energy meters that sit below a master meter) will enable performance tracking. This will allow the building owner to analyze where the energy upgrades may be falling short or exceeding the expected improvements.

INSTALLING SUBMETERS (ENERGY METERS THAT SIT BELOW A MASTER METER) WILL ENABLE PERFORMANCE TRACKING SPECIFIC TO BUILDING END USES. There are benefits to installing meters that can individually track the energy being used from different systems, including the HVAC system, lighting, and plug loads, to enable owners and operators to easily identify savings opportunities. Sub-metered information and a robust building controls system can continually improve the property's performance and fine-tune building energy systems to ensure they're always performing at their potential. You may also want to consider interval meters, which can show the load profile of the building every 15 minutes, to immediately spot spikes and take corrective action.

15 The Economist: Data point: clean energy costs are falling

Commercial Buildings

Creating a net-zero energy commercial building can be accomplished with new buildings or by retrofitting existing buildings. In either case, a key to success is in the whole-systems planning and design process, and RMI predicts that by 2035, 75% of U.S. floor space will be new or renovated. This offers significant potential for business owners to implement a variety of practices that can vastly diminish GHG emissions. Whether your business is remodeling, purchasing a new building, or just identifying simple practices to save energy, we have listed some recommendations below.

- **Simultaneously reduce cooling energy costs and avoid gas space heating with Variable Refrigerant Flow (VRF) systems and heat pump technologies.** When considering a new commercial building or building retrofit, VRF systems are rapidly becoming the baseline. VRF uses an inverter-driven compressor to adapt power consumption to actual demand, **reducing cooling costs 2-3 times**. An increasingly widespread technology to comply with both energy efficiency improvements and indoor air quality codes is the use of decentralized VRF units combined with Dedicated Outdoor Air Systems (DOAS). The same systems can be used for heating and cooling when specified with a heat pump. A heat pump uses the same refrigerant loop like on an air conditioner or refrigerator, but moves energy in the opposite direction by reversing the flow. By specifying VRF systems and DOAS with a heat pump, **efficiencies three to four times higher than conventional heating technologies can be realized**. Leading commercial building design firms are familiar with these technologies and currently implementing them.

- **Ensure buildings have proper insulation and that each room is sealed against air leaks.** Aging buildings tend to have older insulation and windows. When rooms are properly sealed and ventilated and windows are updated, the risk of air/heat in the cooling/heating process escaping and being wasted is reduced. An energy audit,[16] often available for low- or no cost via public or utility funding, can help pinpoint these issues.

- **Install sensors and/or timers for appliances and lights.** Technologies like light timers or sensors lower unnecessary electricity use. This allows buildings to be more efficient, lowers pollution levels, and saves money for property owners.

- **Install Building Energy Management System:** Building Energy Management Systems connect a building's systems (for example, lighting, HVAC, and plant room equipment) to create a single, central platform to manage a building's energy consumption, sometimes across multiple sites. Building Energy Management Systems can significantly reduce energy costs and also enable building owners to better track energy use over time.

- **Contact an "Energy Efficiency as a Service Provider":** Efficiency-as-a-service is a pay-for-performance, off-balance sheet financing solution that allows customers to implement energy and water efficiency projects with no upfront capital expenditure. The provider pays for project development, construction, and maintenance costs. Once a project is operational, the customer makes service payments that are based on actual energy savings or other equipment performance metrics, resulting in immediate reduced operating expenses. The energy services agreement (ESA) is the most common type of arrangement, but other models such as lumens-as-a-service and energy subscription agreements are also in use. To Learn More about Energy Efficiency as a Service Provider, please check out this case study.

Commercial Building Economics: Smart buildings help to manage demand charges, which are fees applied to electric bills based upon the highest amount of power drawn during a billing cycle. **Those charges can total up to 60% of annual energy costs.** Demand charges apply almost exclusively to commercial buildings and are rarely used for residential customers.

16 https://energysmartcolorado.org/for-your-business

Incentives and Resources:

Federal Tax Credits

- Commercial Tax Deduction (179D): Building owners who place in service energy efficient commercial building property (EECBP) or energy efficient commercial building retrofit property (EEBRP) may be able to claim a tax deduction. An increased deduction may be available for increased energy savings or meeting prevailing wage and apprenticeship requirements.
- C-PACE: Property-assessed clean energy (PACE) financing is a solution that allows building owners to finance clean energy improvements through a special property tax assessment. This approach ensures that repayment of the loan transfers with building ownership. PACE must be authorized by state legislation, and once passed, states can convene a decision-making body to design and run a PACE program. PACE programs should be expansive enough to offer financing for a wide range of projects, including those focused on resilience, energy efficiency, and renewable energy, for both new construction and existing buildings. Thirty-seven states already have PACE-enabling legislation, twenty-two of which have active programs
- Business Energy Investment Tax Credit: up to 30% investment tax credit depending on renewable energy technology.
- Modified Accelerated Cost Recover System: businesses may recover investments in certain property through depreciation deductions; up to 50%.
- Renewable Electricity Production Tax Credit (PTC), Federal: inflation-adjusted-per-kilowatt-hour (kWh) tax credit for electricity generated by qualified energy resources and sold to an unrelated person during the taxable year.

State Tax Credits

- Colorado Green Business program rebates and financial resources
- State EZ Investment Tax Credit: save up to 3% tax credit for eligible energy resources.

City and County Tax Credits

- Property Tax Exemption for Renewable Energy Systems (City/County): tax rebates or credits to commercial property owners who install renewable energy systems.
- Sales Tax Exemption for Renewable Energy Systems (City/County): tax rebates or credits to commercial properties who install renewable energy systems.
- Renewable Energy Property Tax Assessment (City/County): required to assign tax liability.

Other Loans and Financing Options

- COLORADO C-PACE - Property Assessed Clean Energy Financing, e.g. 10+ year financing with low rates paid back via property tax assessment.
- Colorado Clean Energy Fund, nonprofit financial institution focused on funding additional investments in clean energy projects.
- Capital Lease, e.g. customer is equipment owner; must declare equipment as an asset and lease payments as a liability.
- Operating Lease, e.g. lessor owns equipment; customer rents equipment at a fixed monthly payment.
- Commercial Loan, e.g. borrow money directly from banks or lenders to pay for projects.
- OBF/OBR On-Bill Financing or Repayment, e.g. utility or private lender supplies capital; repaid via existing utility bill.
- EPC - Energy Performance Contract, e.g. $1M+ projects preferred; no upfront cost; ESCO installs equipment and energy savings pay back financers.
- ESA or MESA - Energy Services Agreement, e.g., $1M+ projects preferred; no upfront cost; ESA provider coordinates capital and equipment; service payments based on savings.

COMMERCIAL BUILDING CASE STUDIES

The case studies below offer examples of how newly built commercial space can be net zero buildings. As you are thinking about your next new building, here are some ideas to consider:

>> Small Office:

Photo Credit: Tim Griffith

The RMI Innovation Center, located in Basalt, Colorado, is a 15,610 square-foot office building and state-of-the-art convening center that demonstrates how carbon-free buildings should be designed, contracted, constructed, and operated. The building, located in a cold climate zone at ~6600 Ft. elevation, is exceeding performance expectations. It produces more energy than it uses by leveraging the following key strategies: all electric systems, low embodied carbon construction, battery storage to provide demand flexibility, highly passive design to minimize active heating systems, no mechanical cooling system, and an Integrated Project Delivery contracting methodology. The excess energy is used to power six on-site electric vehicles.

The RMI building is 74% more efficient than the average office in the same climate while costing less to operate, emitting less carbon, and increasing reliability. The building is fully insulated, and the windows are all airtight. RMI encourages individual heating and cooling by supplying employees with fans/heaters and chairs that can be heated or cooled to individual preference which requires less energy than the associated energy consumption of heating and cooling entire rooms. Finally, the building utilizes natural light and relies on efficient LED light bulbs as the primary lighting tools. These design choices equip the building to last 100 years and demonstrate how offices can vastly diminish carbon emissions.

Our goal was an RMI building that supports our mission, including a fiscally responsible solution. The Innovation Center was built at a cost similar to other local examples, and it costs much less to operate each year than a typical building. Plus, RMI's staff are proud, comfortable, and productive working in the daylit, well-ventilated space, which provides much bigger returns than utility bill savings for any company. Much of the success of the project was due to a clear alignment around goals from the beginning, a strong design/construction team and an integrative design process. It's easy for owners to set these expectations up front, and costs much less than 'greening' a building as an afterthought.

– Marty Pickett, *Managing Director RMI*

Learn more about this project HERE.

>> Medium Office:

Photo Credit: Morgan Creek Ventures

The Boulder Commons, located in the heart of downtown Boulder, Colorado, consists of two commercial properties totaling over 100,000 square feet of professional office and commercial space. The Boulder Commons met the challenge of creating a net-zero building that is leased to tenants, who may have varying degrees of motivation to reduce energy consumption or greenhouse gas emissions. This model integrated net-zero practices into the construction and design of the building. The interior of the building is not affected by the heat of summer nor the cold of winter. Triple-element windows were installed to create a shield of protection from the weather, thereby allowing for a downsizing of mechanical system elements and decreasing the operating costs of heating and cooling the building. To maximize Boulder's sun conditions, Boulder Commons installed solar panels on the roof and also on the southeast wall of the exterior. As a result, the side panels ultimately cost less per unit of energy produced than the roof panels. The Boulder Commons office demonstrates how setting clear, clean energy goals that are maintained throughout the design process can create longstanding change and reduce carbon emissions.

We have seen the future... and it is today. All electric buildings. They are the best long term investment in real estate. The most resilient and the lowest long term risk as it relates to climate change. As an institutional investor, what would you prefer to own ten or twenty years from now? An all electric building or a fossil fuel powered building? You should be building your portfolio today based on that observation. Our returns today are equal to our fossil fuel based competitors. Imagine how much better our returns will be a decade from now.

– Andrew W. Bush, *Founder, Morgan Creek Ventures LLC*

Learn more about this project HERE.

>> Large Office:

When 1144 Fifteenth (also known as the Optiv building) opened in 2018, the 40-story Class A tower was not only the tallest office building to be constructed in Denver in nearly three decades, it also set new standards as one of the most efficient buildings in the market. As a fully-electric building, it consumes less energy and produces less pollution, all while reducing operating costs, from which savings can be passed on to 1144's tenants.

What makes 1144 different from most buildings in its market is its newer equipment features and system technologies such as lighting controls and scheduled HVAC systems with temperature controls. For example, 1144's HVAC systems temper all outside air coming into building with the exhaust air leaving the building. This is done through a heat recovery wheel which allows 1144 to precool hot summer outside air and preheat cold winter air—all by utilizing exhaust air that would otherwise just leave the building. Another way in which 1144 is unique are its solar sensors installed in strategic areas of the structure. They change temperature set points around the building in real time depending on the solar intensity. These automated systems are not only more environmentally friendly, but they also improve the user experience for 1144's tenants and their employees.

Learn more about this project HERE.

Photo Credit: David Sundberg: © David Sundberg/Esto

Residential Buildings

Residential buildings are where we sleep, eat, grow up, and raise families. And as an increasing number of individuals and companies adopt a hybrid work practice, we find ourselves spending an increasingly large share of time in our homes.

An energy audit is one of the first steps one can take to discover the best way to make a home more efficient. A home energy audit creates a customized path to become more energy-efficient based on your individual home and the way you use it. Many local jurisdictions and utilities offer rebates to help offset the cost of an energy audit.

Interested in scheduling a home energy audit?

> Learn more here: Department of Energy.

If you live in, manage, own, or are thinking of developing smaller scale multi-family housing, you can benefit your bottom line, improve the health of those who live in the building, and reduce emissions by working toward net-zero housing. These homes are less expensive to build because they don't need a gas hook up, and they have lower electric bills due to their efficient design. In some cases, homes produce more energy than they consume through on-site energy generation that exceeds the needs of the efficient home.

BEST PRACTICES TO MAKE YOUR HOME MORE ENERGY-EFFICIENT INCLUDE:

GET AN ENERGY AUDIT: In many places, this will be free or subsidized through your local government or utility. It is a quick process that identifies the top areas for energy savings and cost savings, and generally outlines the general costs and payback of measures. In some cases, it may be a baseline required to qualify for additional incentives. An energy audit is a great first step in identifying air leakage and areas where insulation is deficient. This is a lower cost fix and generally recommended prerequisite for further upgrades.

SWITCH FROM A GAS STOVE TO AN INDUCTION STOVE. Induction stoves, which look a lot like traditional electric stoves, quickly heat surfaces using magnetic energy. These stoves heat faster than traditional electric or gas stoves, thereby allowing individuals to cook faster. Induction stoves also reduce risk of burns or fires. Not only does this allow for more precise and safer cooking, but it also conserves energy and avoids harmful emissions from burning gas.

A study from RMI, Mothers Out Front, Physicians for Social Responsibility, and the Sierra Club found, "gas stoves may be exposing tens of millions of people to levels of air pollution in their homes that would be illegal outdoors under national air quality standards." The EPA also found that homes with gas stoves have roughly 50% (but up to 400%) higher levels of Nitrogen Dioxide (NO_2) than homes with electric stoves.[17] This indoor air pollution has harmful effects on people, such as increasing risk for asthma. In fact, natural gas use in the home has been attributed to over 12% of childhood asthma cases.[18]

In recognizing the risk that gas stoves pose to residents, in 2023 Denver considered phasing out natural gas appliances for large commercial buildings – both new and old – as well as gas appliances in new homes. Following this debate, new Denver

17 https://www.epa.gov/indoor-air-quality-iaq/inside-story-guide-indoor-air-quality
18 https://news.cuanschutz.edu/news-stories/should-you-extinguish-your-gas-stove

building codes will ban natural gas furnaces and water heaters in new commercial and multifamily construction starting in 2024. Furthermore, by 2027, natural gas will not be permitted for any heating or cooling equipment in new commercial buildings.[19]

INSTALL AIR SOURCE ELECTRIC HEAT PUMPS: Air source electric heat pumps are significantly (200-300%+) more efficient than gas equipment resulting in operational cost savings. In order for Colorado to meet its sustainability goals, electric heat pumps will need to comprise over 60% of residential heating equipment sales by 2030 and over 95% by 2040, up from about 2% today. In Colorado, Group 14 Engineering and Community Energy Inc. conducted a study that evaluated system options, economics, and strategies to achieve electrification of buildings. The study found that **for single family homes, the upfront cost of all electric space and water heaters is about 25% less expensive than homes with comparable natural gas-powered equipment.** There are significant Federal, State and local rebates to further reduce the capital cost for the heating system and any necessary home upgrades, which is detailed below. Especially when combined with solar, operating costs will be lower than using natural gas.

INSTALL SOLAR PANELS: Solar is a clean and abundant renewable energy source. Solar panel installation today is very streamlined through certified providers that can quickly quote a price and payback period,as well as coordinate with the utility providers (such as Xcel Energy). Solar panels can be an efficient way to generate electricity for your home and can be installed at any point. Depending on local electricity rate structures, ask a qualified solar contractor to provide energy storage options. These also act as a backup power source in the event of an outage.

Want to learn more about how you can install solar in your house? Click here.

REFRIGERATOR/AC AND HEATERS. Ask the manufacturer of your refrigerator and your AC units if they use harmful hydrofluorocarbon (HFC) chemicals. HFC chemicals have thousands of times the warming impact of CO2 and are therefore being phased out of most cooling products. HFC chemicals require proper disposal. If you are looking for new appliances, opt for an energy-efficient, climate-friendly cooling product. Explore products here.

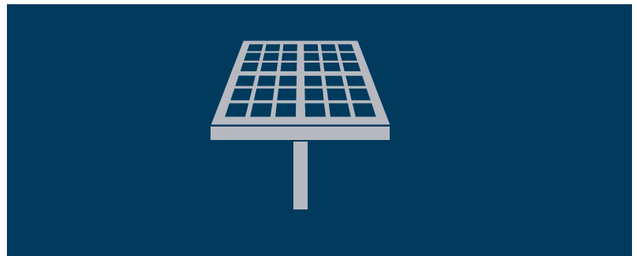
INSTALL DOUBLE-PANED WINDOWS. Double-paned windows help insulate your home by keeping the heat or AC locked into the room, so that it will not escape through windows or insulation.

To learn more about energy efficient windows, click here.

PRACTICE ECO-FRIENDLY HABITS. Small behavioral changes can make a big difference in the grand scheme. Regulate your electricity use by unplugging unused cords and appliances and turn off lights in rooms that aren't being used. Additionally, you can install timers for lights and thermostats to only use energy when it's needed. To better regulate internal temperature, rely on shades and upgraded windows. These easy practices decrease emissions and save money on monthly energy bills.

Incentives and Resources: can generally be stacked!

- Click here for an overview of Federal residential tax incentives (owner and renter)
- Here is an overview of State programs available
- City of Denver Home Energy Rebates
- Click here for an example of Utility offered programs
- Tax Credits for Home Builders



19 The Denver Gazette: Denver imposes natural gas ban on heating, cooling equipment in commercial buildings, multi-family housing

RESIDENTIAL BUILDING CASE STUDIES

>> Single Family:

The Cohen family in Lakewood, CO built their family home with two unique systems that vastly reduce the home's emissions: geothermal heating/cooling and solar generated electricity. Well established with most electric companies and easy to install at any time, solar panels greatly reduce electricity costs and can generate rolling credits for excess electricity created. While the largest cost is the upfront installation, the return on investment for this system is typically 10-12 years, depending on the number of solar panels, the amount of sun received, and the energy needs of the home. The geothermal heating and cooling system requires upfront planning and coordination between the general contractor and utility company. While the upfront cost of these installations are quite high, the savings and impacts over time more than make up for the cost. The geothermal system, which requires significant drilling and engineering, is not economically viable for a retrofit or remodel, but coincides well with a new build. The Cohen family stresses that while they could have sacrificed these systems for more conventional choices, they could not pass up the environmental benefit and the economic pay off over time. They chose these systems not just to be green, but to increase the livability of the home, decrease ongoing energy expenses, and increase the resale value of the home.

Learn more about geothermal heating here.

To learn more about net-zero residential housing projects, click here.

> ***My recommendation is do your research in advance or you'll miss the opportunity. It's easy to miss. Our planning process took many years. This needs to be an early component of the plan.***
>
> **– Dana Cohen**

Photo Credit: the Cohen Family

>> Multi-Family Small:

Aspen Skiing Company's Willits Block 9 is a 134-bed, $22M worker housing project in Basalt, Colorado that is directly adjacent to the bus line, a 25-minute ride to Aspen, and a few minutes from company offices. The building is entirely electric and highly energy-efficient, with EV chargers and a bike share onsite.

Learn more about this project HERE.

Willits Block 9 employee housing busted two myths about electric buildings. It's an example of cold-climate use of heat pumps which is something many engineers say is not possible. That's important because the technology has arrived, but the industry is not aware of it. Second, the building's operational costs will be approximately equal to an equivalent natural gas-heated structure, even in a region with cheap natural gas.

– Auden Schendler, ***Vice President of Sustainability, Aspen Ski Company***

>> Multi-Family Large:

Hirschfeld Tower in Denver, CO is a low to moderate income residential property consisting of 209 units. Originally built in 1967, the property was renovated in 2008 with the intention of increasing efficiency and comfortability while lowering costs, reducing maintenance, and minimizing the carbon footprint. After much research, the retrofitting project team utilized a closed loop ground source heat pump. The heat pump system consists of plastic pipes built underground and functions by removing heat from inside the complex to cool individual apartments or extracting heat from underground to heat the space. However, the system is designed to take advantage of natural heating and cooling whenever possible, which saves money and heavily reduces GHG emissions.

The team assessed installing this geothermal heat pump system against a conventional mechanical heating and cooling system and a hybrid system combining geothermal heat pumps and conventional heating and cooling. The results indicated that it would cost the same to install a traditional mechanical system as it would be to install the heat pump system. When comparing the heat pump system to a hybrid, installation costs would be the same, but maintenance and infrastructure costs would be higher for the hybrid system. As a result, with the geothermal heat pump system, the Hirschfeld tower costs less than $0.50 per square foot to operate compared to the $1.00 per square foot cost that the previous mechanical system cost. Implementing this system reduced operating costs and vastly reduced the building's carbon footprint.

To learn more about sustainable multi-family developments, click here.

The dream of my grandfather, A.B. Hirschfeld, was fulfilled in 1947 when he completed The A.B. Hirschfeld Press Building – a glowing example of timeless Art Deco architecture that was home to his 80,000 square foot state-of-the-art printing plant, the largest between Chicago and the West Coast.

A bigger dream was realized posthumously in the year 2000 when A.B.'s prized architectural possession was saved from the wrecking ball by Denver's Sage Hospitality, conserved and repurposed in the form of a 122-room extended stay hotel – Towne Place Suites by Marriott. How proud A.B. must be to have his creation preserved and utilized for generations to come.

– A. Barry Hirschfeld

A **larger-scale project** or full area redevelopment has an even greater opportunity to have an impact. You might want to consider creating a multi-building interactive system, where several buildings communicate with one another through grid interactivity to optimize performance and lower energy needs and costs. **Larger scale projects can offer a higher return** on solar and storage energy systems and can leverage thermal energy to create a more passive heating and cooling system.

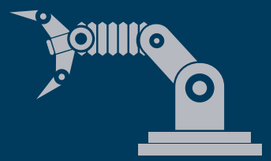
Industrial Buildings

Industrial buildings include warehouses, distribution centers, and greenhouses, the latter of which has seen a boom in Colorado to accommodate cannabis grow operations. Like large-scale commercial and residential properties, industrial buildings tend to have a larger building footprint and a high electricity load. Through increased efficiency, grid interactive buildings, and electrification, industrial complexes can drastically reduce their impact.

BEST PRACTICES INCLUDE:

- **UNDERSTAND YOUR USAGE**: monitor utility expenses over time with an energy management system to make tracking easy. Building owners can use a building energy management system to assess a building's baseline and track energy usage and improvement over time. Once goals are set, the next step in improving a building's performance is understanding how the building is actually performing so the team can track progress towards goals and identify opportunities for increased efficiency.
- **CONTACT AN** "ENERGY EFFICIENCY AS A SERVICE PROVIDER": Efficiency-as-a-service is a pay-for-performance, off-balance sheet financing solution that allows customers to implement energy and water efficiency projects with no upfront capital expenditure. The provider pays for project development, construction, and maintenance costs. Once a project is operational, the customer makes service payments that are based on actual energy savings or other equipment performance metrics, resulting in immediate reduced operating expenses. The energy services agreement (ESA) is the most common type of arrangement, but other models such as lumens-as-a-service and energy subscription agreements are also in use. To Learn More about Energy Efficiency as a Service Provider, please check out this case study.
- **UNDERSTAND YOUR KEY REQUIREMENTS:** there is likely a low/no carbon alternative available for any industrial process. Depending on temperature and energy requirements, the exact technology may differ vastly. Some frequently overlooked technologies include geothermal energy, concentrated solar,and hydrogen. When process heat temperatures from other sources are not possible or economical, these technologies may play a role. Carbon capture is a potential remediation option if other solutions do not exist. For an example of how some industries have shifted to low-carbon alternatives, click here.
- **REDUCING EMISSIONS**: Adding solar panels to the roof or planting urban gardens can prevent or offset emissions.
- **USING ELECTRIC SPACE HEATERS AND COOLERS**: For a large industrial space, consider relying on electric heating and cooling mechanisms for smaller spaces, as opposed to heating and cooling the whole area. This can help mitigate building emissions.
- **CREATE A MORE EFFICIENT BUILDING ENVELOPE**. In addition to ensuring the building envelope is properly sized, the structure itself can also incorporate strategies such as using reflective roof coatings to help minimize energy requirements.

Photo Credit: REI



INDUSTRIAL BUILDING CASE STUDIES

>> REI Distribution Warehouse:

In 2016, REI opened a new distribution center in Goodyear, Arizona that supports over a third of the company's sales. Distribution centers typically consume a massive amount of energy due to their large size and intense operating schedules. Accordingly, REI prioritized efficiency outcomes from the onset of design to minimize the impact of the new building. The result is one of the most sustainable distribution centers in the U.S. It is a LEED Platinum certified structure and produces all the energy it consumes via a 280,000 square foot, 2.2 MW rooftop solar installation. The facility also minimizes water waste with a non-evaporative cooling system which maintains the internal building temperature while saving millions of gallons of water. With their Goodyear Distribution Center, REI demonstrates how companies can balance business outcomes with efficient operations and clean energy goals.

> ***The building's design was a collaborative project that's meant to provide an example for other companies and manufacturers to learn from and leverage.***
>
> **– Bill Best,** ***Vice President of Supply Chain Operations, REI***

Learn more about this project HERE.

Photo Credit: REI

Legislation

Building Code Legislation and Tax Credits

In light of the passage of the Inflation Reduction Act (2022), as well as legislation passed by the Colorado General Assembly aimed at improving green building standards across our State, Colorado residential households and businesses can now take advantage of new tax credits by making their buildings more environmentally friendly.

Colorado's new green building standards for residential or commercial buildings, in particular, means that those looking to build or renovate need to be aware of the revised environmental standards that now apply in Colorado. This section will give a brief overview of these new developments regarding commercial and residential code and tax changes – as well as new energy efficiency standards for State government introduced by Governor Polis's through executive order in 2022 – and offer additional resources for those looking to see how these new building codes apply to their individual circumstance.

Governor Polis's Executive Order Concerning the Greening of State Government

In addition to new legislation aimed at making Colorado's business and residential sectors more energy efficient, Governor Jared Polis has extended this effort to include government as well. In 2022, he signed an executive order concerning the "Greening of State Government," which established new goals to reflect the State's commitment to efficient and sustainable government operations. These new green standards, which reflect the State Government's commitment to reaching its ambitious energy efficiency goals, represent a new front in Colorado's effort to reduce its greenhouse gas emissions.

Governor Polis's executive order, which can be found here, requires state government agencies and departments to, among other things:

1. Reduce greenhouse gas emissions resulting from State operations by at least 26% by the end of FY 2024-25 over the FY 2014-15 baseline.

2. Reduce energy use per square foot in State facilities by at least 15% by the end of FY 2024-25 (normalized for weather) over the FY 2014-15 baseline.

3. Ensure that at least 7% of total electricity consumed by State facilities is renewable by the end of FY 2024-25.

4. Reduce greenhouse gas emissions from State vehicles by at least 15% by the end of FY 2024-25 over the FY 2014-15 baseline.

5. Reduce greenhouse gas emissions from State vehicles categorized as special use by at least 7.5% by the end of FY 2024-25 over the FY 2014-15 baseline.

6. Reduce potable water consumption by at least 2% by the end of FY 2024-25 over the FY 2014-15 baseline.

To achieve these goals, Governor Polis in his 2022 executive order requires state government agencies to take a number of specific energy saving steps, such as:

a. Reviewing daily operations to decrease the environmental impact of State government

b. Identifying and pursuing energy efficiency improvements for State buildings that are cost effective when compared to carbon and methane alternatives.

c. Identifying energy efficient HVAC systems, including the use of geothermal, when installing systems for any major capital investment.

d. Completing comprehensive LED lighting or equivalent retrofit projects for State facilities

e. Tracking water (potable and non-potable) and energy used in covered State facilities;

f. Ensuring that EVs (BEVs and PHEVs) are the default vehicle type for all light-duty vehicles for future vehicle purchases; and

g. Identifying and pursue water efficiency improvements for State buildings that are cost effective.

Taken together, the steps outlined in Governor Polis's executive order amount to an expansive new vision for how State government can work alongside Colorado's businesses and residents to chart an ambitious course towards improving our state's environmental future. For more granular detail on the steps outlined in the Governor's 2022 executive order, click here.

New Federal Tax Credits for Households and Businesses Looking to Improve The Energy Efficiency of their Buildings[20]

The following tax credits are available through the Inflation Reduction Act for households and businesses looking to increase their energy efficiency. Additional information about these IRA tax credits, beyond the details outlined below, can be found here.

1. **HOME CLEAN ELECTRICITY PRODUCTS**: Federal tax credits equivalent to 30% of the cost of 'home clean electricity products' – e.g., solar electricity products; fuel cells; wind turbines; and battery storage – can be claimed through the 2032 tax year.

2. **HEATING, COOLING, AND WATER HEATING**: Federal tax credits equivalent to 30% of the cost (up to $2,000 per year) of air source heat pumps (as a replacement for A.C. and central heating), heat pump water heaters (as a replacement for traditional water heaters), and biomass stoves can be claimed through the 2032 tax year. Additionally, 30% of the cost of geothermal heat pumps and solar water heaters (with no yearly cap) can also be claimed. Finally, 30% (up to $600 per year) of the cost of efficient air conditioners, heating equipment, and water heating equipment can be claimed as well. These tax credits, like those applied to other clean energy products, are available through the 2032 tax year.

3. **OTHER ENERGY EFFICIENCY UPGRADES**: Additional tax credits equivalent to 30% (with varying yearly caps, depending on the equipment) can be claimed on other key energy efficiency equipment. The approved equipment includes: electric panel or circuit upgrades for new electric equipment; insulation materials; windows, including skylights; exterior doors; and home energy audits.

Taken together, the IRA's green tax credits for energy efficiency upgrades for new and existing buildings represents a substantial opportunity for Colorado residents and businesses looking to save money on improving their energy efficiency – while also improving sustainability and lowering emissions.

Additional information on other Federal tax incentives, as well as Colorado State tax incentives, available to Colorado households and businesses can be found here.

20 Inflation Reduction Act Tax Credits & Incentives

II. Colorado Building Codes[21]

In 2021, the General Assembly passed the "Energy Performance for Buildings" statute (HB21-1286), which requires owners of commercial, multifamily, and public buildings 50,000 square feet or larger to annually benchmark their whole-building energy use and meet set building performance targets. Together, these buildings must reduce sector-wide emissions from buildings 7% by 2026 and 20% by 2030 from 2021 levels. Building Performance Colorado (BPC) is Colorado's statewide program aimed at increasing energy efficiency and decreasing greenhouse gas (GHG) emissions from the building sector to meet these targets. To learn more about Colorado's Building Performance Program, click here.

Additionally, Gov. Jared Polis signed the legislation "Electric Utility Promote Beneficial Electrification" (SB21-246), into law on June 21, setting in motion a process that will see the Colorado Public Utilities Commission implement a beneficial electrification program. Under that program, investor-owned electric utility operators Xcel Energy Inc. and Black Hills Corp. will have to develop plans to displace fossil fuel-powered appliances and heating systems in favor of high-efficiency electric alternatives, like heat pumps and induction stoves. Utilities will qualify for incentives by exceeding any electrification or emissions reduction targets that regulators establish. The law also authorizes the companies to offer incentives to their customers for electricity services and encourage companies to begin phasing out gas and fossil-fuel related rebates.

In 2022, the Colorado General Assembly passed, and Governor Polis signed, House Bill 22-1362, which implemented a range of new green building standards for Colorado residents and businesses, as well as municipal and county governments, with an eye toward achieving our goal of reducing Colorado's emissions by 90% by 2050. The following building codes – along with some additional State tax benefits – represent the new standards that apply to the construction of new buildings in Colorado.

One key piece to note: the development of these standards is ongoing, and the full interpretation and practical effect House Bill 22-1362 will continue to unfold over the coming years. Although the various building standards of this bill will be further clarified and specified to the local context over the next several years, the following updates represent the most recent updates to Colorado's Model Solar and Electric energy standards, as presented in the Code Board's June 1, 2023 report, which can be found here.[22]

ELECTRIC READY – Any new residential homes and commercial and multifamily buildings under 10,000 sq. ft. that are designed and built with gas-powered equipment must be built 'electric ready.'

"Electric Ready" means adequate panel capacity, dedicated electric panel space, electrical wire, electrical receptacles, and adequate physical space to accommodate future installation of high-efficiency electric appliances including heating, water heating, cooking, drying, and an electric vehicle[23].

Commercial and multifamily buildings at or above 10,000 sq. ft. are required to provide dedicated electric panel space, electrical wire, electrical receptacles, and adequate panel capacity for electric-readiness.

However, large commercial buildings often face ***significant physical space constraints*** in efforts to electrify. For instance, it is often difficult to find additional space for the new transformers needed to accommodate greater electrical loads brought on a shift to greener electricity. To remove this barrier, large commercial buildings must retain physical space for ***future*** electric service equipment.

21 Colorado Model Solar and Electric Ready Code Report
22 Colorado Model Solar and Electric Ready Code Report
23 House Bill 22-1362

SOLAR READY – New residential homes and commercial and multifamily buildings of ***all*** sizes to be built solar ready.

"Solar Ready" means adequate panel capacity, dedicated electrical panel space, electrical conduit, physical roof space, and structural load to accommodate future installation of solar panels, with exemptions for small roofs and consistently shaded roofs.

For commercial buildings, in particular, an exception is given for solar arrays not directly installed on the building's roof but somewhere on the building premises or parking lot, so long as it meets the size and output requirements. Additional exceptions to new code requirements for commercial buildings can be found here.

ELECTRIC VEHICLE (EV) READY – The House Bill required all residential homes be built EV ready or EV capable, leaving the Energy Code Board with the responsibility to determine which would be appropriate for Coloradans. Abbreviated definitions of "EV ready" and "EV capable" are set out below. More detailed definitions can be found here.

"EV Ready" means having a parking space that has the electrical panel capacity, raceway wiring, receptacle, and circuit overprotection devices installed to support future implementation of electrical vehicle charging.

"EV Capable" means having a parking space that has the electrical panel capacity and conduit installed to support future implementation of electrical vehicle charging.

For commercial and multifamily buildings of ***all*** sizes, the House Bill required parking facilities to supply EV ready, EV capable, & EV supply equipment installed spaces with provisions for electrical service capacity in 20% or more of the vehicle parking spaces.

WAIVERS UNDER THE NEW COLORADO BUILDING CODES

All residential and commercial buildings are eligible for a waiver from these code requirements if granted by the state or local government or in the case of a declared natural disaster. Waivers to exempt new homes from Colorado's new building codes are, for example, being considered for the rebuilding of homes in Louisville which were damaged by the 2022 Marshall Fire in Boulder County. Arguments in favor of a waiver in this circumstance hold that the homes are being rebuilt as a result of a 'declared natural disaster.'

In broad terms, however, the use of waivers for Colorado's new Building Codes was included as a means to minimize costs to builders, building owners, and developers, but jurisdictions, such as Louisville, may opt to omit the waiver section from their codes and apply all requirements of this model code to all projects.

Commercial buildings at or above 10,000 sq. ft. are also eligible for a waiver if the project developer can demonstrate that the costs of complying with the code impose a 'substantial cost differential' on a project. A substantial cost differential is defined by the House Bill as "one percent or greater of the total mechanical, electrical, and plumbing construction costs on the project".

Additional information waivers and their availability in certain jurisdictions can be found here.

Acknowledgments

This handbook would not be possible without the work of the engineering and development firm McKinstry and the law firm Moye White LLP.

McKinstry's talented team was instrumental in the analysis and content development process and with designing the final product. McKinstry is a national leader in the design and delivery of high-performing buildings. The company is committed to innovating waste and climate harm from the built environment through a five-year strategic Action for Impact initiative. This includes working with clients on zero-carbon solutions and partnering with industry in bringing our collective zero-carbon future to life.

Thank you to Moye White for spearheading the development of a handbook geared towards sustainability in the building sector. The law firm of Moye White worked diligently on all facets of the project.

Moye White is a full-service law firm offering strategic representation in complex commercial transactions and disputes including, with respect to the building industry, representation in all aspects of design, construction, and finance in new and existing public and private sector commercial, industrial, and residential construction projects.

Also, we want to acknowledge all of the Colorado companies who shared their stories and best practices for reducing the impact of gas-powered buildings on the environment. Thank you to all who contributed!

We are enormously grateful for the assistance of McKinstry, Moye White, and all of the organizations involved in helping to produce this Sustainable Building Handbook.