GUIDE: BEST PRACTICES FOR ACHIEVING ZERO OVER TIME FOR BUILDING PORTFOLIOS

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ABOUT US

ABOUT ROCKY MOUNTAIN INSTITUTE

Rocky Mountain Institute (RMI)—an independent nonprofit founded in 1982—transforms global energy use to create a clean, prosperous, and secure low-carbon future. It engages businesses, communities, institutions, and entrepreneurs to accelerate the adoption of market-based solutions that cost-effectively shift from fossil fuels to efficiency and renewables. RMI has offices in Basalt and Boulder, Colorado; New York City; Washington, D.C.; and Beijing.

ABOUT URBAN LAND INSTITUTE

The Urban Land Institute (ULI) is a global, member-driven organization comprising more than 40,000 real estate and urban development professionals dedicated to advancing the Institute's mission of providing leadership in the responsible use of land and in creating and sustaining thriving communities worldwide. ULI's interdisciplinary membership represents all aspects of the industry, including developers, property owners, investors, architects, urban planners, public officials, real estate brokers, appraisers, attorneys, engineers, financiers, and academics. Established in 1936, the Institute has a presence in the Americas, Europe, and Asia Pacific regions, with members in 76 countries.

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HIGHLIGHTS

1. Net-zero energy (NZE) buildings are gaining interest from building owners, tenants, and landlords alike.[i] NZE buildings provide increased rent rates, faster lease up, increased net operating income, less risk during market downturns, higher resale value, and a differentiated offering for landlords. NZE can provide tenants with healthier, more productive, and more enticing workspace environments, controllable energy costs, and alignment with corporate sustainability goals.

2. A zero-over-time (ZOT) approach sets commercial building portfolios on a financially viable path to achieve net zero energy. The ZOT approach helps portfolio owners and managers right-time deep energy efficiency, renewable energy, and energy storage projects with life-cycle event triggers for investment.[ii]

3. ZOT can be achieved by following six steps: setting goals, establishing a baseline, planning efficiency projects, analyzing renewable energy and energy storage opportunities, implementing projects, and tracking progress.

4. Putting buildings on the path to ZOT can carry value through multiple ownership transitions including short-term holding periods—each subsequent owner will benefit from the increased value of high-performing buildings, which retain value better than conventional buildings.

5. A case study portfolio in Denver illustrates that taking the ZOT approach can achieve net zero energy over a 20-year period with an incremental net present value (NPV) of added value of $1.3 million over 20 years and $10.3 million over 30 years, and 5% and 8% internal rate of return (IRR), respectively.

6. The geographic location of the portfolio is a significant factor in the economics of the ZOT approach. Areas with high utility rates and incentives, good solar resources, and lower labor rates will have more favorable economics. For instance, the same portfolio of buildings analyzed in Denver, Boston, and Milwaukee will see an 8%, 13%, and 10% IRR over 30 years, respectively.

7. The zero-over-time approach also reduces carbon emissions over the 20-year period by 46% compared with business as usual. This acceleration of emissions reduction is critical to avoid irreversible climate change.

[i] 80% of organizations plan to achieve nearly zero, net-zero, or positive energy status for at least one of their facilities, according to a 2016 Johnson Controls study.

[ii] Statistical analysis on NZE building performance is less available, but NZE indicators are informed by green building results. Green buildings have shown rent premiums between 2% and 17%, increased occupant satisfaction between 27% and 76%, decreased vacancy between 3% and 8%, 11%-26% increased building sale value, and a 1%-11% increase in employee productivity. These figures are taken from various reports listed in RMI's Deep Retrofit Value Guide and RMI's NZE Leasing Guide.

INTRODUCTION

THE ISSUE

Existing commercial buildings consume 36% of all electricity in the United States and are responsible for more than $190 billion in energy expenses every year. Today, existing buildings globally are only receiving energy retrofits at a rate of around 1% per year, while a rate of around 3.2% per year is required to avoid irreversible climate change and hit the two-degree increase target by 2040 (as laid out at COP21). The market needs an approach to renovate existing buildings that is both economical and strategically planned, blending short-term requirements with long-term goals. Although achieving net zero energy (NZE) in new buildings is very attainable, renovating an existing building or a portfolio of existing buildings to achieve NZE poses different challenges. The multiple barriers holding back energy retrofits are widespread and well known, and include split incentives, cost of capital, average investment horizon, internal payback hurdles, and the hassle factor.

A SOLUTION: ZERO OVER TIME

A zero over time (ZOT) approach will help portfolio owners navigate these barriers by providing a roadmap to achieve cost-effective deep energy retrofits over time. This approach focuses on long-term planning to deliver a series of cost-effective projects over 20 years that, together, amount to zero energy status for the entire portfolio while increasing revenues.[iii]

This approach applies not only to portfolios with a NZE goal, but can also be applied to existing buildings or portfolios with energy reduction targets. The solution is transferable from one building owner to another, so it supports the value of a long-term plan, regardless of the length of property hold time.

Stepping back, we recognize that capital and operations planning is complex and that methodologies vary widely from portfolio to portfolio. The ZOT process provides a useful framework and should be tailored to each application.

WHO IS THIS PAPER FOR?

Building and portfolio owners and managers are the primary audiences. This report also refers to the sustainability manager of a portfolio as the key point person to implement the zero-over-time approach. Because portfolios are organized differently, this job could also be taken on by the asset manager, energy manager, sustainability director, portfolio manager, property manager, or others who are responsible for the energy-consuming assets in each building.

WHAT IS NET ZERO ENERGY?

Net-zero energy (NZE) buildings are highly efficient and consume only as much energy as they produce or procure from clean, renewable resources on an annual basis. NZE ensures that over the course of a year, renewable generation and building energy use balance out, though NZE may not achieve net zero carbon.

[iii] The timeframe can vary but is primarily dependent on the trigger event calendar and project economics.

CHARACTERISTICS OF A SUCCESSFUL ZERO-OVER-TIME APPROACH

BUILDING BLOCKS OF A ZERO-OVER-TIME APPROACH

The ZOT approach focuses on cost-effective energy efficiency and renewable energy by prioritizing projects that pay back quickly in the short term, while aligning larger energy efficiency projects with major building life-cycle events, like equipment upgrades. Major life-cycle events can serve as trigger events for energy upgrades, as incremental costs for these upgrades will be lowest. A prime example would be installing a more efficient and smaller rooftop HVAC unit once the old unit has reached the end of its useful life. An investment to replace the HVAC unit at this time will already be planned, so the investment in the energy project can be considered an incremental cost (the additional cost of an efficient unit above the cost that was budgeted for standard equipment).

Projects can go one step further by considering the greater systems impact of energy upgrades. Taking a holistic approach can reduce capital and operating costs further. For example, the HVAC unit in the example above could be downsized if it were paired with building envelope upgrades, which reduce the heating and cooling needs of the building. This kind of whole-systems thinking and planning is not happening enough today.

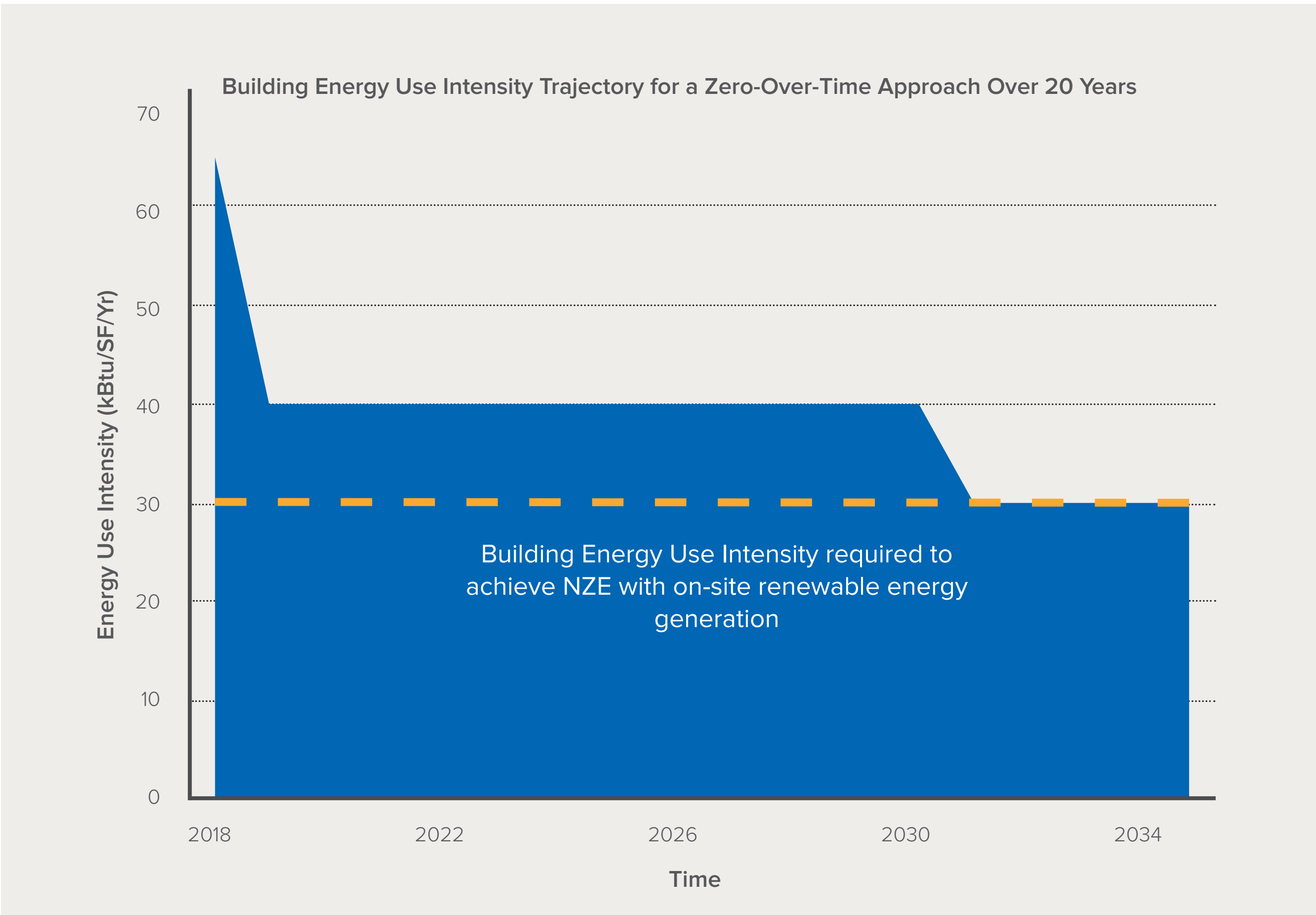
Overall, ZOT supports the long-term performance of a building and relies largely on information that building owners and asset managers are already collecting about the energy-consuming equipment in their buildings. This information is not always distributed to the relevant team members (e.g., the team's sustainability manager), so cost-effective energy upgrade opportunities can be missed. It is key for sustainability managers and others working closely on a portfolio's energy systems to work with other team members, gain access to the relevant tracked information, and understand key trigger events for each building. For large portfolios, this may be more challenging but also more profitable, so developing a thoughtful process is critical.

Achieving zero over time happens in two parts:

1. Decreasing building energy use and
2. Adding renewable energy (see Figure 1). Ideally, a portfolio will operate within the solar generation capacity that can be generated on-site, with all available surfaces covered in solar. Figure 1 demonstrates a building that approaches its "solar budget" over time.

FIGURE 1

ENERGY USE INTENSITY VS. SOLAR CAPACITY OVER TIME



WORKING AT THE PORTFOLIO SCALE

The zero-over-time approach is more impactful when applied to a portfolio, campus, district, or other collection of multiple buildings, compared to a single-building approach. Real estate portfolio owners and private investors stand to benefit the most from a ZOT approach. A collection of buildings has several benefits related to its overall scale, including:

- **Reduced costs through bulk purchasing.** In procuring energy-efficient equipment that is widely used across a series of buildings (e.g., LED lighting fixtures for an office portfolio), economies of scale can be achieved that result in discounted purchase prices and lower logistical costs related to managing a series of uncoordinated projects rather than one large, multi-site project.

KILROY REALTY CORPORATION BULK PURCHASING PROGRAM

While some REITs and large portfolio owners pursue a “bulk buy” of low-carbon technology to reduce materials and labor costs, others find that a portfolio-wide investment may reduce per-building administrative expenses even more. When pursuing its first energy storage project in 2016, Kilroy found that the new technology and new financing strategy required significant legal and financial scrutiny—and a significant number of billable hours from legal counsel. “In the end, because of all the legal and contract complexity, a one-building project would have administrative costs about the same as a 10-building project,” said Sara Neff, senior vice president, sustainability, at Kilroy Realty Corporation. “The scale of a multibuilding project helped us reduce the legal costs per building, and made the project profitable.” Kilroy also was one of the first REITs to execute a multibuilding energy storage program, a critical component necessary for achieving net zero over time.

Photo: Kilroy Realty Corporation

KIMCO REIT LIGHTING RETROFIT PROGRAM

For the Kimco Real Estate Investment Trust, lighting is the number one driver of energy consumption and electricity expenses. With approximately 500 shopping centers, the most meaningful way to change the trajectory of energy consumption is through large-scale retrofits. After analyzing the market, Kimco decided to pursue a large, bulk-buy contract to reduce equipment costs, and to rely on competitively sourced labor in each local market to help save on installation expenses. By working with a handful of prequalified national suppliers, Kimco was able to leverage its buying power in the market, and by standardizing its lighting specifications, Kimco was able to ensure that lighting quality and consistency was maintained across its building portfolio.

In evaluating projects, Kimco looked at the simple payback of lighting retrofits, but also evaluated the recovery rates for capital costs and expenses in their leases. Kimco also looked at projects as part of a national initiative and, as a result, evaluated a blended ROI across all projects (rather than evaluating each project one-by-one for approval).

Beyond cost recovery and payback, Kimco also recognized the qualitative value of standardizing lighting systems across its portfolio. New lighting offered an opportunity to improve lighting quality and coverage, helping shoppers feel safer in parking lots at night. The improved light levels and uniformity were also an aesthetic opportunity, making shopping centers more attractive to visit and more noticeable to vehicular traffic. Even though these values could not be captured in ROI calculations as easily as energy savings values, they helped provide a major motivation to ensure all lighting projects moved forward.

After four years of Kimco's national retrofit program, the company had completed retrofits at approximately 80% of its tier 1 properties, totaling tens of millions of square feet, with a goal to have the entire portfolio retrofit by 2020. Kimco saw a 30%–40% average improvement on efficiency from lighting, and an extra 10%–15% in efficiency from lighting controls. The company has been recognized multiple times by the US Department of Energy's Lighting Efficiency in Parking Campaign for the results of this initiative.

- Similar projects can reduce administrative burden related to project management and planning. Energy managers can test improvements at a pilot site, and then roll out the project to the rest of the portfolio once they have developed best practices.

- Bundling across an entire portfolio bolsters project economics. Bundling is the concept of grouping projects that are more cost-effective in the short term with projects that deliver deeper savings but may have a longer payback. In combination, these projects might meet a portfolio's investment criteria and result in much deeper savings than if the portfolio only pursued projects that stand on their own.

- Reducing risk. When many diverse projects are deployed as part of a single investment strategy, the failure of any individual project does not jeopardize the investment as a whole. Additionally, risk can be actively mitigated by diversifying energy investments by combining more conservative opportunities with higher-risk and return endeavors.

To read more about the benefits of working at a portfolio scale, refer to Rocky Mountain Institute's Portfolio Energy Optimization report.

ZOT IS PROFITABLE FOR BOTH SHORT AND LONG PROPERTY OWNERSHIP PERIODS

A well-developed ZOT plan can be transferred when buildings change hands, so although long-term planning is involved, building owners with short or long property holds (or something in between) can benefit from the ZOT approach. Portfolio owners that pursue efficiency projects with longer payback periods than their expected hold should still see a return on their investment through higher property resale values.

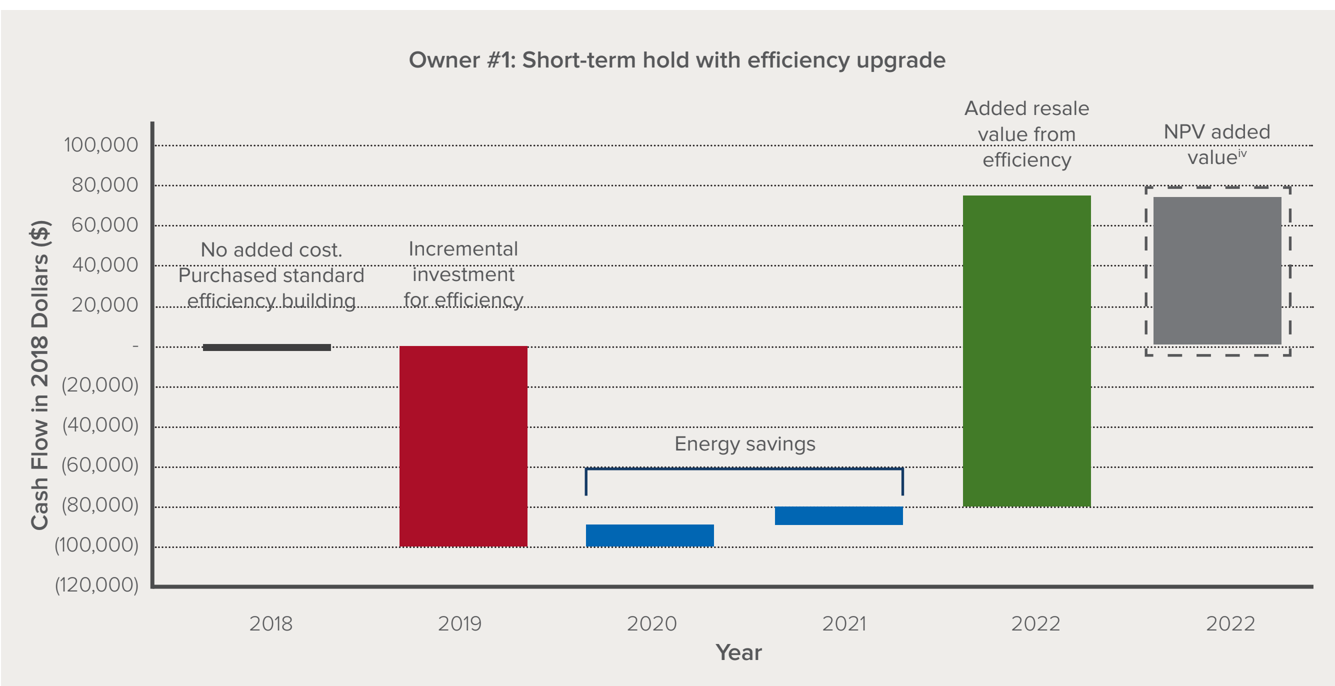
For example, a theoretical portfolio owner could invest in an energy project with a 10-year payback that reduces her energy costs by 20%, and resell the building in year two for an efficiency project IRR of 25%. The added resale value of the building equals the annual energy cost savings divided by an anticipated capitalization rate (typically around 6%), which makes this project immediately economical. This is earlier than the simple payback period of the energy project but would still deliver enough profit from the sale of the building to repay the owner. This is consistent with industry research showing a 13% increase in resale value for green buildings.

The following graphs show different ownership scenarios.

Figure 2 shows the economics of a short-term hold owner (owner #1) purchasing a standard-efficiency building, performing an upgrade project in line with her portfolio's ZOT process that has a 10-year payback period, and then selling it after three years. This results in a net profit for this developer.

FIGURE 2

SHORT-TERM HOLD WITH EFFICIENCY UPGRADE

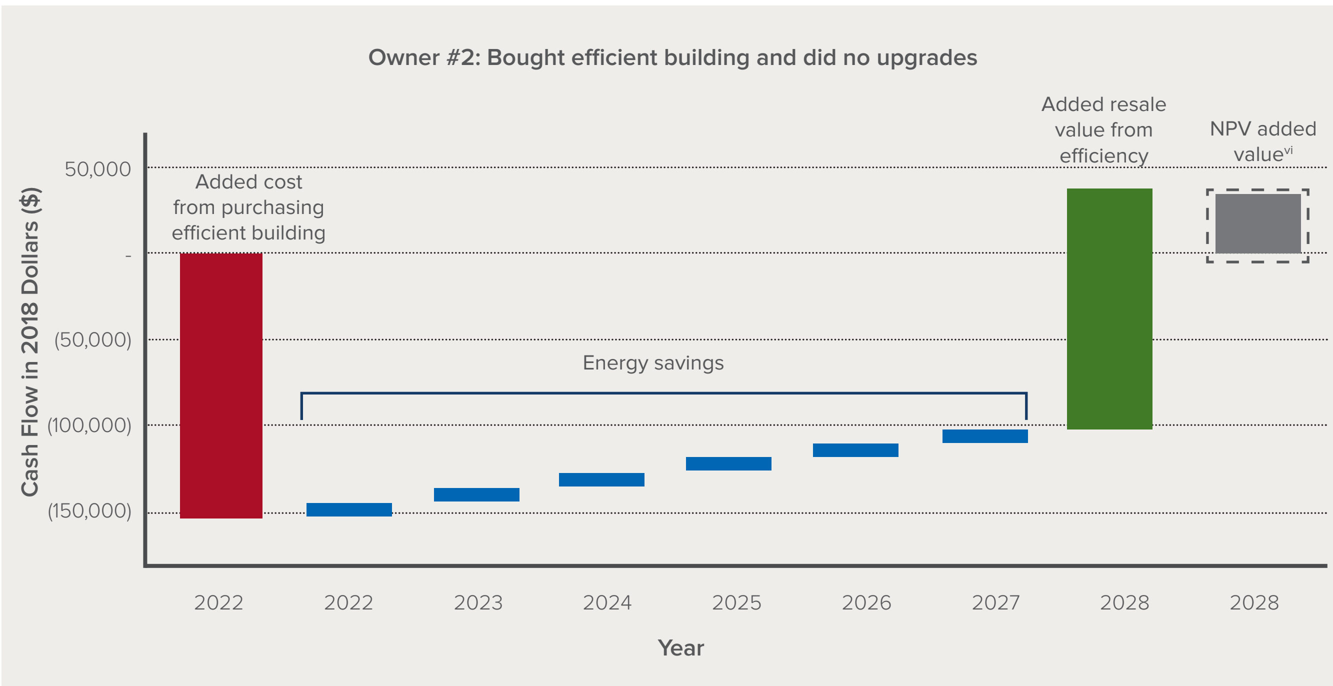


[iv] NPV assumes a 5% discount rate.

Figure 3 depicts the outcome when owner #2 purchases an efficient building from owner #1 and doesn't perform any efficiency upgrades—either because he doesn't intend to continue the ZOT approach, or because there are no viable projects. Even without additional efficiency upgrades, it was more beneficial for this property owner to purchase an efficient property than a standard-efficiency property, due to the annual energy savings realized beyond a standard building. The ZOT approach still benefits property owners who are not in the position to make upgrades while they hold the property.[v]

FIGURE 3

BOUGHT EFFICIENT BUILDING AND DID NO UPGRADES



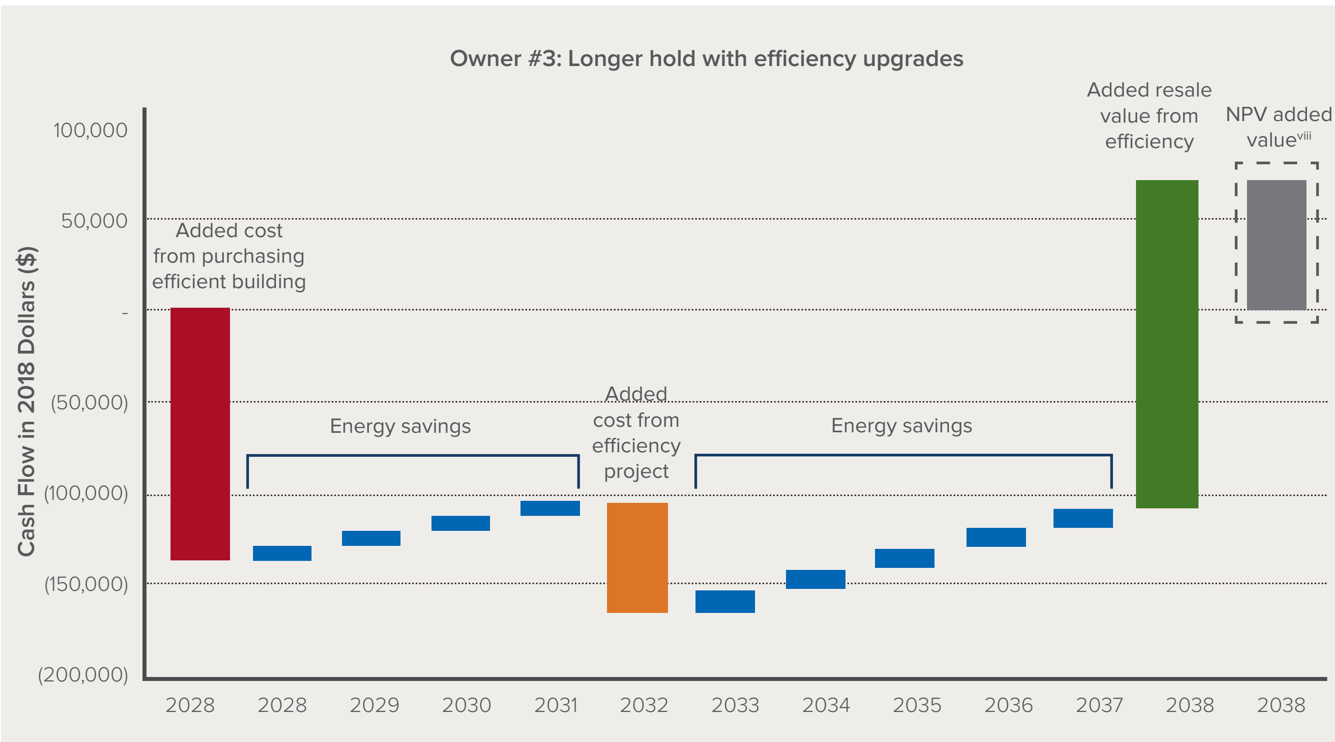
[v] Results could vary based on the useful life of the uprades performed.

[vi] NPV assumes a 5% discount rate.

Figure 4 depicts what happens when owner #3 purchases the building from owner #2, and decides to perform efficiency upgrades to bring it closer to NZE a few years after purchase. This owner sees more benefit from this approach, similar to owner #1, due to the greater value of energy savings and a higher resale value, when compared with the total energy savings.[vii]

FIGURE 4

LONGER HOLD WITH EFFICIENCY UPGRADES



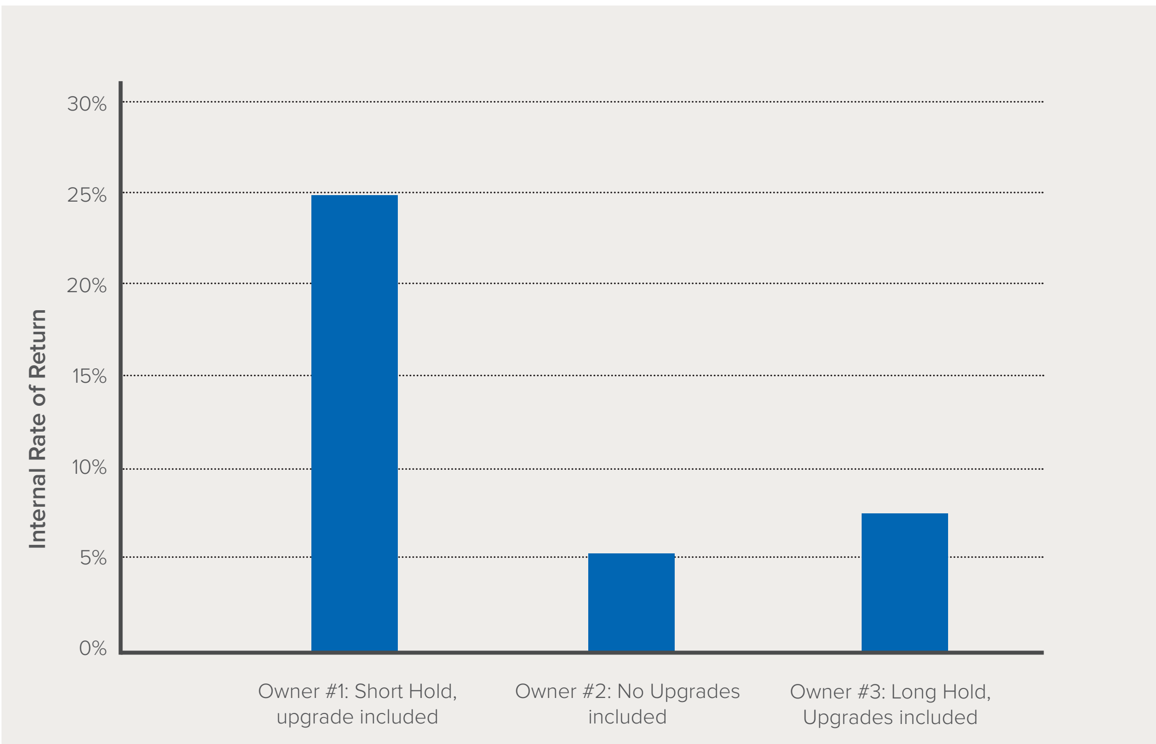
[vii] Results could vary based on the useful life of the uprades performed.

[viii] NPV assumes a 5% discount rate.

Figure 5 compares the IRR of the three building ownership examples. All result in a higher net present value than business as usual, but the owner that performed an energy upgrade then sold her building shortly thereafter saw the highest IRR.

FIGURE 5

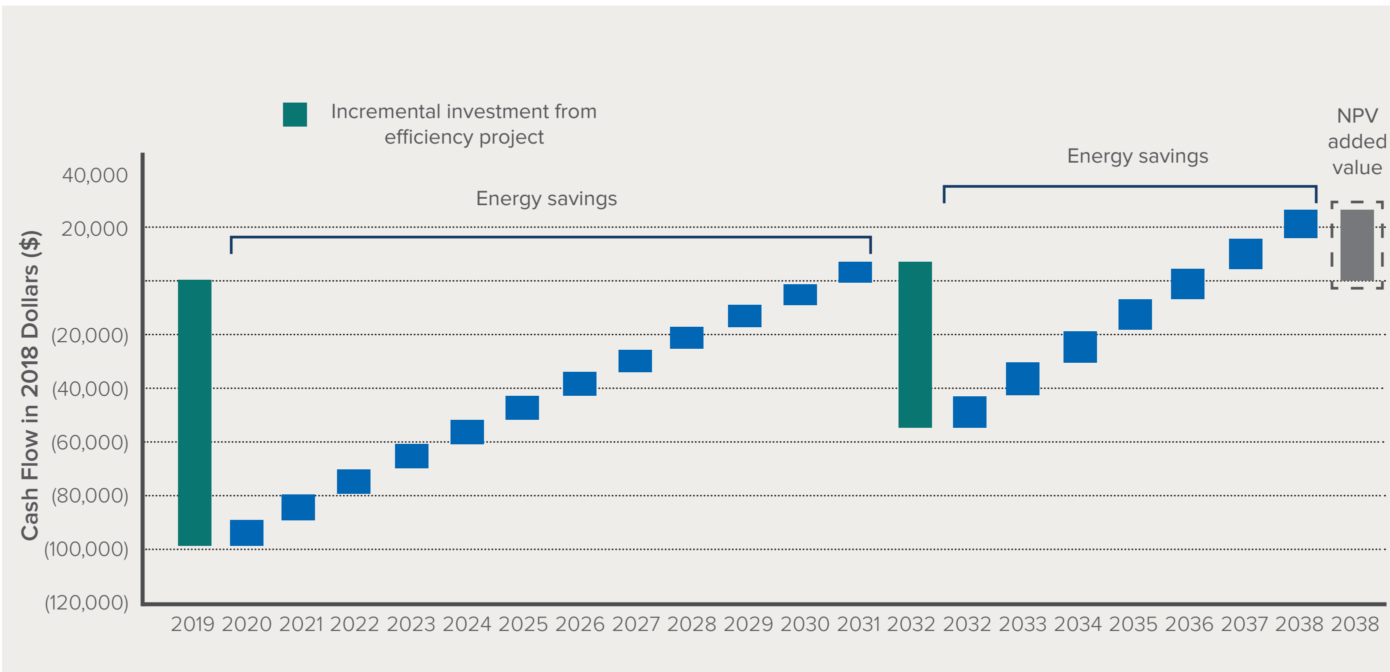
IRR OF THREE OWNERSHIP STYLES FOR AN EXAMPLE BUILDING



Alternatively, long-hold owners who are not looking to sell their building for 20 years would also see added value in doing the ZOT approach (Figure 6). Additionally, when they sell their property, they would benefit from a higher resale value. Because this example represents a long-term hold, the higher resale value was not included in Figure 6.

FIGURE 6

LONG-TERM HOLD OWNER



DEVELOPING A LEASE THAT SUITS THE ZOT APPROACH

This approach is also well suited for portfolio owners that have lease mechanisms in place to recover the cost of efficiency projects. This is relatively straightforward in a gross lease,[ix] because the building owner can pay for upgrades and pass along the amortized costs to tenants. For portfolios with triple net leases,[x] this could be an opportunity to modify the lease by extracting the energy costs from the operating expenses and having tenants pay a fixed base rent premium or "energy charge." The amount of this charge could be based on the building's past energy costs or could be similar to energy bills for surrounding properties. This allows the landlord to directly benefit from energy savings and could be an added value to tenants because they can have monthly fixed energy costs and reduced exposure to volatile utility costs. For more on lease structures, see RMI's Best Practices for Leasing Net-Zero Energy Buildings guide.

THE VALUE OF NZE

Although this paper focuses primarily on the hard values associated with NZE, there is significant additional value beyond energy savings. Green buildings have been proven to increase lease-up rates by up to 20%, decrease vacancy rates by 4%, garner 3.5% rent premiums, and increase resale value by 13%. For additional information on the value of NZE, see *RMI's Best Practices for Leasing Net-Zero Energy Buildings guide* and the *US Green Building Council's The Business Case for Green Building*.

[ix] Gross lease is a type of commercial lease where the tenant pays a flat amount, and the landlord pays for all property charges regularly incurred by the ownership, including taxes, utilities, and water. Expense reimbursements are usually trued up annually.

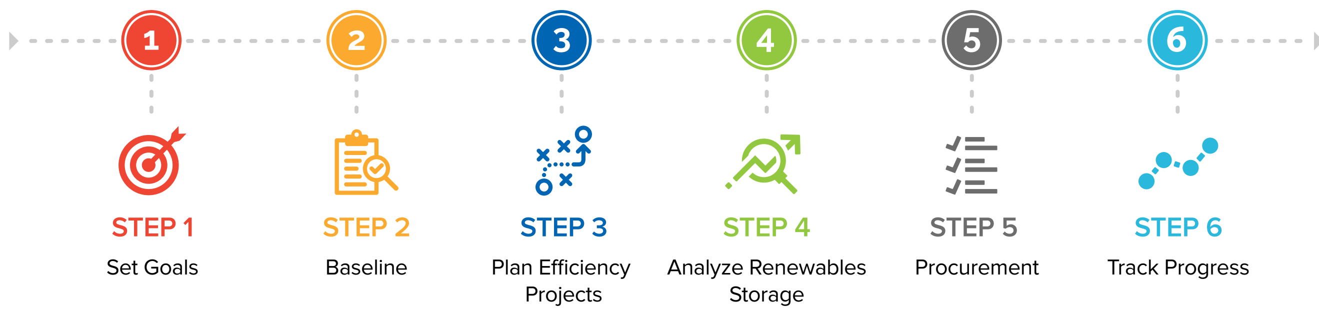
[x] A triple net lease (or "nnn" lease) is a lease agreement where the tenant is responsible for the ongoing expenses of the property, including real estate taxes, building insurance, and maintenance, in addition to paying the rent and utilities.

APPLYING THE ZOT APPROACH IN SIX STEPS

Achieving ZOT requires a thoughtful approach, but not an overly complicated one. Industry interviews and case study analysis informed the following six steps for achieving NZE cost-effectively over time:

FIGURE 7

STEPS FOR ACHIEVING NET-ZERO ENERGY OVER TIME



STEP 1: SET GOALS

SET CONCRETE SUSTAINABILITY GOALS

Making energy and sustainability goals clear, actionable, and well known across the organization is key to any successful project. While goal setting alone will not achieve results, it is a prerequisite to taking action. Goals demonstrate the direction that the team should be working toward. At a minimum, set an energy target and a goal around financing and investment. In most ZOT approaches, the energy goal is NZE. Financial and investment goals can include payback requirements for individual projects, internal rate-of-return requirements, or requirements to seek certain types of financing that won't affect an organization's balance sheet.

Goals should be informed by a cursory analysis of the portfolio to determine the amount of savings available from viable energy projects. This high-level analysis should be performed with a partner who can ideally be involved with the company over the long term. This could be an internal resource that develops energy projects or a third party like an owner's rep, a full-service design-build contractor, an energy service company (ESCO), or another entity that's well equipped to work with the team from the goal-setting stage through planning, design, and implementation.

It is very important for organization leaders as well as accounting, facilities, sustainability, and other functions to participate in decision-making around the ZOT process from the start. ZOT is a long-term commitment, and early buy-in from all stakeholders will make it easier to stay the course and follow a ZOT plan once it has started. Engagement of these groups influences the outcome of the ZOT approach, while allowing them to socialize the concept and build buy-in more broadly across the organization.

STEP 2: BASELINE

It is critical to establish a clear energy baseline, gather facility conditions information, and identify an approach to align with capital planning efforts for the portfolio before the actual work starts. There are often ways to improve existing building performance through recommissioning or active energy management processes while also using it as an opportunity to collect additional information about each building in the portfolio.

ESTABLISH A CLEAR ENERGY BASELINE

The first step in improving a building's performance is understanding how the building is actually performing so the team can track progress toward goals and identify opportunities.

Most of the energy-related information needed to develop a ZOT plan can be gathered relatively simply 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)

With that said, the site visit can drive much greater value if it is done in conjunction with recommissioning.

RECOMMISSIONING AND CONTINUOUS COMMISSIONING

Recommissioning (RCx) is a systematic process of tuning existing building controls and equipment to improve building performance, increase occupant comfort, and save energy. RCx is an effective, low-cost first step to reduce energy consumption and cost immediately in a building. Analyses of RCx projects for existing buildings show a median cost of $0.27 per SF, energy savings of 15%, and a simple payback period of 0.7 years.

Continuous commissioning (or active energy management) has similar goals (resolve operating problems, improve comfort, reduce energy use, and identify retrofits for existing commercial buildings) but is a lighter-touch and more continuous intervention. Continuous commissioning relies on building management systems and fault-detection diagnostics to continuously track a building's operation and identify issues. It can save more money than RCx efforts (because issues are caught sooner) and it can be less expensive to implement.

Leverage site visits for both RCx (or continuous commissioning) and collecting site data. This provides greater value to a sustainability manager, who otherwise may hire an energy auditor or collect the information in-house, both of which can be costly and deliver no direct energy reductions unless paired with a project.

In addition to performing minor upgrades, the RCx agent should be able to identify other energy projects that will be immediately cost-effective to implement, such as upgrades from an older, less-efficient lighting system to a new, efficient technology like LEDs. It would be valuable for the sustainability manager's team to begin pursuing any projects that can be implemented immediately.

STEP 3: PLAN EFFICIENCY PROJECTS

Planning efficiency projects is the most critical step in ensuring success once the projects identified in Step 2 have been implemented. It is important first to understand the types of energy conservation measures (ECMs) that make a good ZOT project, and then to develop a trigger event calendar that sets the project up for success.

The main objective in sequencing ECMs is to implement the independent and load-reduction ECMs first, before HVAC equipment is upgraded. This rarely happens because most retrofits are triggered by HVAC equipment failures, which doesn't allow for the analysis and forethought to reduce loads so that smaller, cheaper equipment can be used.

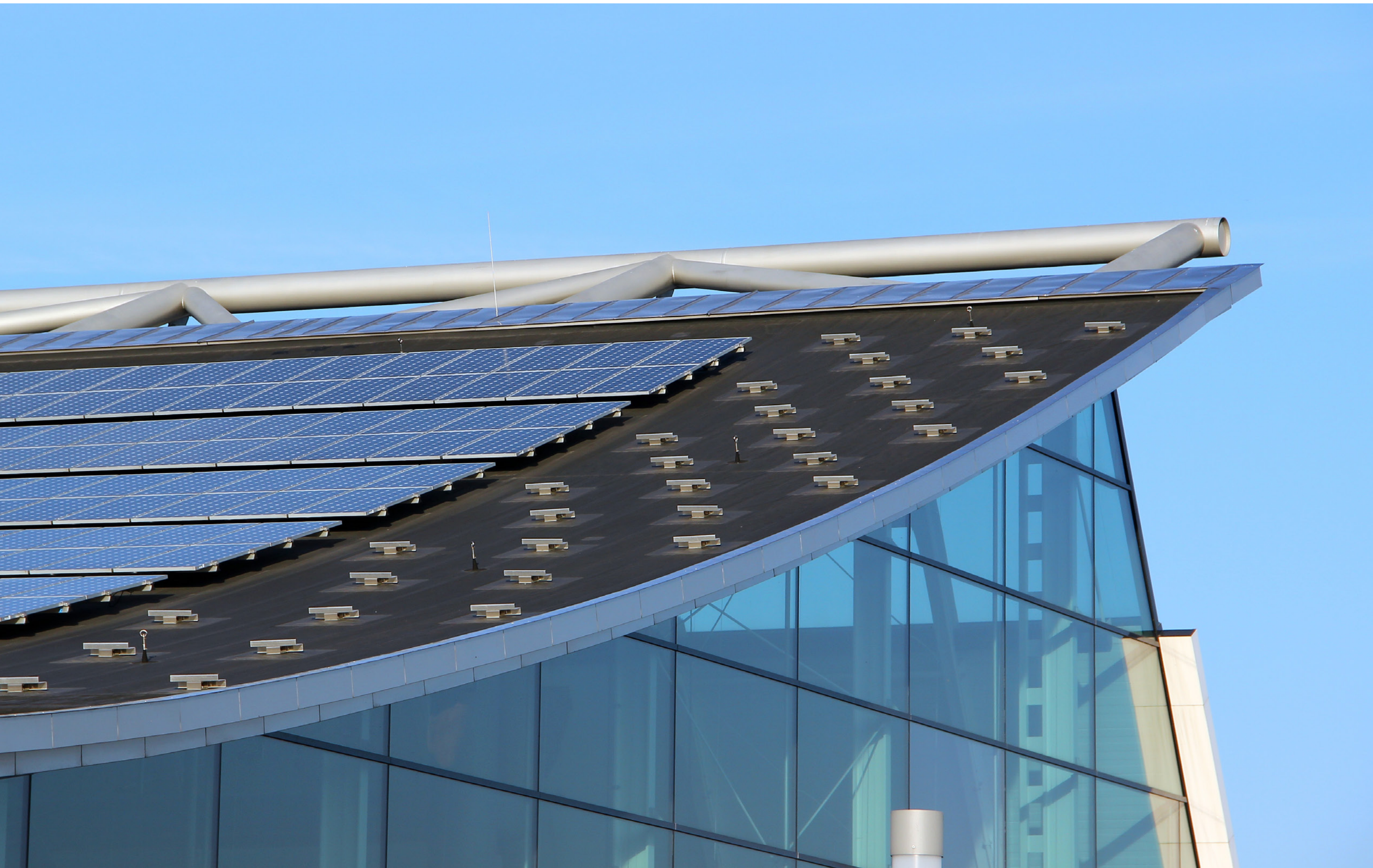
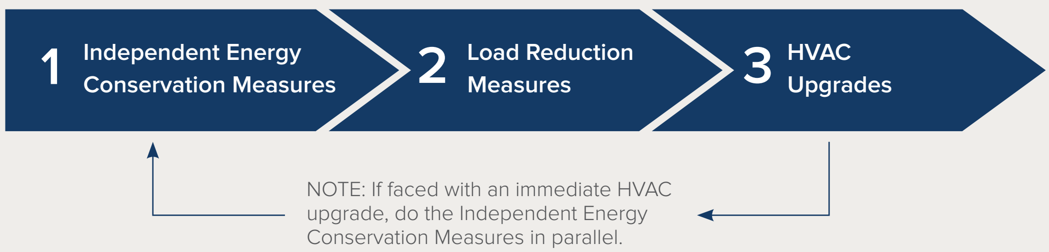


FIGURE 8

SEQUENCING ENERGY CONSERVATION MEASURES

Different ECMs will have different financial returns, interventions and reasons for implementing. The sequence of ECMs is critical and can greatly impact the payback and types of upgrades.

Recommended process:



1. Independent Energy Conservation Measures: Many independent ECMs are no-cost, which helps generate savings immediately and build momentum and buy-in. These ECMs will be identified during RCx. Examples of these updates include:

- Adjusting mechanical and lighting schedules to match current building occupancy.
- Adjusting heating, cooling, and lighting zones so consistently unoccupied zones aren't conditioned, ventilated, or lit.
- Engaging and educating tenants—consider a "turn it off" campaign or provide actual use data to inform all occupants, not just the individuals who pay the bills.
- Controlling your entry and exit (keep doors closed, encourage revolving door use).
- Using window blinds to reduce heat gain in summer and allow heat gain in winter.

These projects typically don't depend on trigger events, so they can be implemented independent of the calendar or other long-term plans. These are also very "financeable" projects—if up-front capital isn't available, most of the project can be accomplished through performance contracting, "as-a-service" business models (which can be provided by energy service companies or others), on-bill financing from a utility company, PACE, or other financing mechanisms.

2. Load-Reduction ECMs fundamentally reduce the building's heating and/or cooling loads and include measures 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.). Some are immediately cost-effective while others might need some investment and result in payback periods between 3 and 10 years (e.g., building envelope upgrades). These ECMs should be made before existing equipment replacement cycles per the ZOT calendar. The cumulative effect of these projects is the ability to downsize major HVAC equipment when it is ripe for replacement at the end of its useful life.

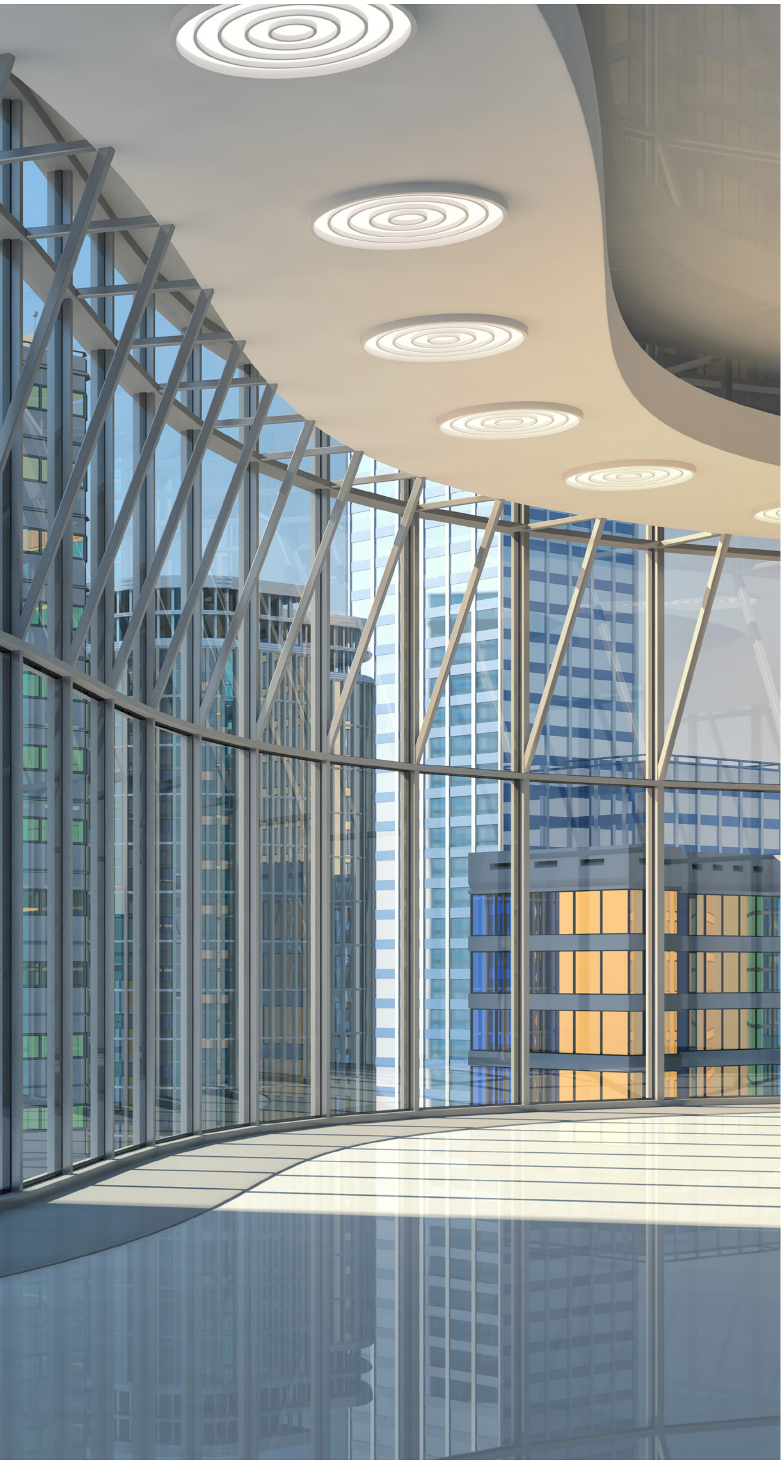
3. HVAC ECMs typically occur when major equipment nears the end of its useful life. Instead of replacing equipment "like for like," HVAC systems should be 'right sized' or even down sized. By doing this, systems can cost less than a like-for-like replacement (as a result of system downsizing and load-reduction measures). Lower loads and a new system will deliver powerful savings, particularly in buildings with outdated and inefficient existing systems.

HOST HOTELS CAPITAL PLANNING PROCESS

Host Hotels developed an innovative strategy to integrate energy efficiency into the capital planning process that aligns with the ZOT approach. When evaluating the purchase of HVAC equipment, boilers, and other large-scale energy-consuming equipment, Host requires a return on investment that factors the energy savings compared with the incremental cost of more efficient alternative equipment (not the total cost of the new equipment).

For example – if a high-efficiency HVAC system costs $100,000 and delivers $10,000/y in savings, the project would normally have a 10-year payback, and probably not be approved. However, if a $100,000 HVAC replacement is scheduled and the high-efficiency model costs an additional $10,000, the annual savings ($10,000) only needs to deliver an ROI that justifies the additional cost of the more efficient model – in this case, turning what was a 10-year payback into a 1-year payback.

Using this investment model in capital planning has allowed Host to purchase more efficient HVAC equipment, boilers, and other mechanical equipment that otherwise would have likely been replaced with the current market standard equipment.



CREATE A TRIGGER EVENT CALENDAR

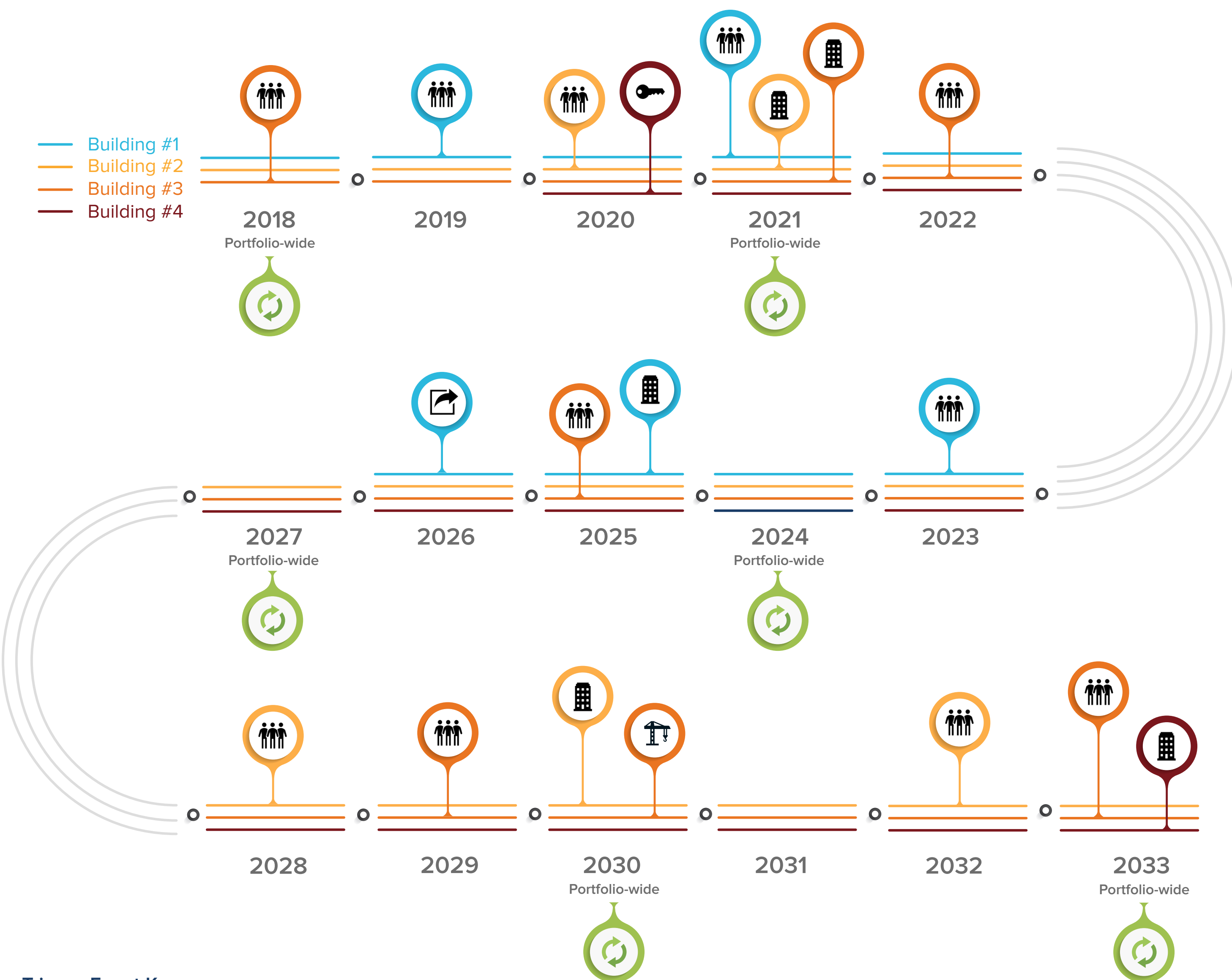
The trigger event calendar is the core tool that guides future energy projects that put portfolios on a pathway toward achieving their energy goals. It is essentially a calendar of energy upgrades, linked with key asset improvement cycles. Triggers are building life-cycle events that might enable a deep retrofit as a result of major building investments, changes in usage, or other events.

The ZOT plan should be developed in partnership with a consultant and/or implementing partner. The sustainability manager should work collaboratively with a firm that ideally can deliver the trigger event calendar, support implementation, and periodically update the plan. This firm could also be the contractor that implements the energy upgrades and should be incentivized to help save the greatest amount of energy, cost-effectively, over time.

Figure 9 is a graphical example of a trigger event calendar. This report will discuss each trigger event in detail in the “trigger events to consider” section of the report.

FIGURE 9

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

The ECM recommendations in the trigger event calendar summary balance the highest priority efficiency measures based on ease of implementation, simplicity and sequence. If ZOT plans are too complicated, developers may be unwilling to make time to implement them. The trigger event calendar and the ZOT plan should be developed to span beyond individual projects and inform future portfolio investments. Buildings could experience unforeseen renovations, sustainability managers and other personnel could turn over, and many other changes could occur. The trigger event calendar should be revisited annually and when buildings are sold, functions change, and/or buildings experience unanticipated repairs.

The core steps for delivering a good trigger event calendar involve identifying the applicable trigger events for the building or portfolio, understanding their timing in the life cycle of the building or portfolio, and planning to act on each trigger event over time. The trigger event calendar lays out major building life-cycle events that can be paired with key actions, such as energy upgrade projects, to reduce the administrative burden and cost of taking action. For example, aligning the trigger event of a planned roof replacement with the action of increasing the insulation in the roof means the energy project's cost includes only the incremental cost of the more heavily insulated roof, significantly reducing the investment needed to perform the energy upgrade.

Typically, portfolio managers and asset managers are already collecting much of the information necessary to develop a trigger event calendar. These stakeholders have an understanding of the age of major equipment, the calendar for refreshing the building's interior and exterior, the schedule of lease terms, and other key information about the most critical trigger events for energy efficiency projects.

This information is often used to inform routine maintenance projects and aesthetic improvements. In this case, portfolio managers and asset managers can leverage this information to turn these routine events into opportunities to reduce operational costs and get on a pathway to NZE through a series of planned and cost-effective energy upgrades.

The following section outlines key trigger events and suggested actions to consider.

KEY TRIGGER EVENTS TO CONSIDER

TABLE 1

TRIGGER EVENT #1: LEASE TURNOVER OR RENEWAL

TIMING	WHERE APPLICABLE	ACTIONS TO CONSIDER
When negotiating lease (up to two years before lease is up)	Lease renewal or new tenant	Add green lease language to standard lease template, and include in all lease renewals.
		If tenant has a triple net lease, use this opportunity to pull the energy costs out of the operating expenses and add an energy charge to the base rent. If the tenant has a gross lease, use this opportunity to clarify energy operating expenses and initiate transparency into actual energy use and costs, as separate from other operating expenses. For more information, visit the Green Lease Leaders website.
		Implement a plug load budget for tenants to help control plug load consumption. See the Boulder Common's case study for best practices with this approach, including submetering, disclosure, and compliance.
		Provide tenants with a simple, one-page summary of the energy cost savings and increased occupant productivity value they receive from being in the building. Make these benefits tangible to the ultimate occupants and decision makers.
	Typically new tenant, but possibly lease renewal	Tenant Improvement (TI) requirements should include LED lights, automated lighting controls, CO_2 sensors, and/or submeters. Language written into TI requirements can be tested and refined across the portfolio. Additional tenant fit out best practices can be found in the US Department of Energy report Energy Efficiency in Separate Tenant Spaces—A Feasibility Study.
During vacancy	New tenant	HVAC reconfiguration or envelope upgrades such as window replacement, window films, and air sealing.

COLLABORATION REQUIREMENTS: The point of lease turnover or renewal is typically tracked by property managers, but the energy or sustainability manager may not have this information. It is important that sustainability and energy personnel are in sync with property managers. These events uncover when a tenant space may be vacant, a prime opportunity to make energy upgrades (see ULI's Tenant Energy Optimization Program for a guide to maximizing energy efficiency and financial returns during tenant build-out) and to add green leasing language to the lease template. This trigger event is important to stay on top of because most lease terms are at least five years and have a renewal rate of 64%, so a missed opportunity could significantly delay efficiency improvement projects in the space. New and renewing tenants usually want a tenant improvement budget, and this is the opportunity to require a certain standard for efficiency in the tenant fit out.

TABLE 2

TRIGGER EVENT #2: MAJOR EQUIPMENT REPLACEMENT

TIMING	ACTIONS TO CONSIDER
HVAC replacement	Replace HVAC equipment with higher-efficiency equipment or new HVAC technology at end of life. Always right-size mechanical equipment to the actual loads (not just like-for-like sizing), and wherever possible downsize equipment if load-reducing ECMs were performed. Consider fuel switching equipment from gas to electric.
Roof replacement	Consider adding insulation if recommended by the energy analysis, and ensure that the roof meets load requirements for future solar installation. Consider adding toplighting, which improves daylighting, though design carefully to avoid introducing too much heat. If viable, add solar. Consider painting the roof white in hot climates.
Window replacement	Consider high-performance windows. Note that high-performance windows may reduce loads enough to downsize HVAC, so ensure HVAC sizing is analyzed before the next HVAC replacement.
Siding replacement	Install continuous insulation on exterior walls.
Backup power generator replacement	Consider swapping out diesel generator for batteries and/or a microgrid as technology improves and becomes more affordable.
Water heating systems replacement	Consider opportunity for fuel switching to electric. For more information, review RMI's report on *The Economics of Electrifying Buildings*.

COLLABORATION REQUIREMENTS: It is critical to consult with energy or sustainability managers to plan for system replacement before it becomes an emergency and results in a like-for-like replacement. If the sustainability manager knows when something was installed, she can use BOMA's preventive maintenance guidebook or manufacturer guidance to estimate when it may need replacement. Oftentimes, equipment is replaced much later than recommended, resulting in additional maintenance costs and poor thermal comfort for tenants. Retrocommissioning agents can also help track the state of equipment during site visits to better document and plan equipment replacements. By tracking equipment end of life, the sustainability manager can then pass this information to the building engineer with instructions for purchasing more efficient equipment.

TABLE 3

TRIGGER EVENT #3: NEW BUILDING ENTERING PORTFOLIO

TIMING	ACTIONS TO CONSIDER
Beginning of acquisition negotiations	Work with acquisition team to standardize a sophisticated property condition report (PCR) that includes an energy audit and equipment functional performance tests.
Immediately after acquisition	Evaluate all actions related to trigger events #1—Lease Turnover or Renewal and #2—Major Equipment Replacement, particularly if the building is being repositioned or otherwise undergoing a major renovation as part of the acquisition.

COLLABORATION REQUIREMENT: Sustainability managers should be involved when a new building enters the portfolio. Often, they are not included due to the perception that their involvement could slow down the acquisition process, yet they can actually add significant value. Planning for energy during the purchase of a building allows building owners to understand their asset better, to budget for efficiency projects, and to set the intention to improve the efficiency of a building over time. The sustainability manager should also request a property condition report (PCR) to identify long-term capital expenses and budgets. This helps avoid gaps in funding for more efficient equipment when equipment reaches end of life as most budgets typically assume like-for-like replacement.

TABLE 4

TRIGGER EVENT #4: BUILDING LEAVING PORTFOLIO

TIMING	ACTIONS TO CONSIDER
Preparation for selling the building	Prepare an owner's statement of value (sample and instructions provided in the Appraisal Institute and Institute for Market Transformation's report Green Building and Property Value). The statement of value should include the project vision, the current financial pro forma, building plans and specifications, cost information on improvements, utility bills and/or energy modeling results, certification reports, and operations and maintenance costs and data. Provide this information to listing agents and assessors to help increase valuations.[xi]
	Work with the acquisition team to standardize more sophisticated property condition reports (PCR) that include an energy audit and performance assessment.
	Provide listing agents and prospective buyers a simple, one-page summary of the energy cost savings and increased occupant productivity value tenants receive from being in the building. Make these benefits tangible to the ultimate occupants.

COLLABORATION REQUIREMENT: As buildings are sold, fully capture the value gained from efficiency and upgrades for the sales team as well as the assessors. This requires assembling a value narrative that includes the efficiency upgrades, lower operating costs, and increased net operating income. (A great sample value report can be found in Green Building and Property Value.) Consider taking it a step further and helping prospective buyers communicate that value to future tenants. This is self-evident, yet often overlooked. To benefit from the added value of efficiency projects, buildings need to prove a better net operating income (NOI) for a certain period of time—typically at least one year. Additionally, certifications like ENERGY STAR that require a year of actual performance can be used to market a building to potential buyers. Keep in mind that banks and appraisers cannot fully maximize valuation for green and high-performance buildings without active engagement and advocacy from the owner. Sustainability managers should interface with the sales team to fully communicate the value.

[xi] Other helpful resources about valuing green building attributes: https://www.corporatesustainabilitystrategies.com/wp-content/uploads/2016/01/Assessing-the-Value-of-Green-Buildings.pdf, https://www.appraisalinstitute.org/assets/1/7/Green-Building-and-Property-Value.pdf

TABLE 5

TRIGGER EVENT #5: NEW CONSTRUCTION OR MAJOR RENOVATION PROJECT

TIMING	ACTIONS TO CONSIDER
Build NZE requirements into the request for proposal, even before conceptual design	Design all new construction projects to be NZE or NZE ready. Energy use intensities for NZE ready buildings can be calculated using Architecture 2030's tool. Ideally all new construction should be designed to be all electric, so all of its energy use can be offset by renewable energy. Roofs should also be designed to structurally hold a solar photovoltaic (PV) array, even if it is not installed until a future date.
Resurfacing or revamping parking lot; updating landscaping	Consider installing a ground source heat pump mechanical system and, in particular, a vertical or horizontal geothermal well infrastructure in conjunction with the improvement project. Consider the ground source heat pump only if it is proven to be an appropriate system type and cost-effective.

COLLABORATION REQUIREMENT: The sustainability manager should work with the design team to set a goal of NZE early in the design process. It is much more cost-effective to design a new-construction building to be NZE than to retrofit it later. Typically this can be done at an up-front cost premium of 0% to 12% above costs for a code-compliant building, with substantial long-term energy cost savings.

TABLE 6

TRIGGER EVENT #6: ENERGY CHECKUPS

TIMING	ACTIONS TO CONSIDER
After utility demand charges ($/kW) increase or every three years	Review the economics of various ECMs that may not have been cost-effective when last analyzed. This will especially affect energy storage, load shifting, and load-reduction technologies, which in turn may also make renewable energy technologies like solar PV more viable. Consider applying for available demand-response programs.
After utility energy charges ($/kWh) increase or every three years	Review the economics of various ECMs that may not have been cost-effective when last analyzed. This will especially impact the economics of solar PV and battery storage, but could also apply to higher SEER-rated HVAC systems and more efficient cooling towers and boilers. ECMs can become more cost-effective because of lower utility rates or lower equipment costs.
When a new rate structure is available or every three years	Review the latest rate structures and rate pilot programs offered by the utility to see if they're applicable to the portfolio, and determine whether switching could make efficiency or renewable energy projects more economical. Consider applying for available demand-response programs, incentives, and rebates.
Every three to five years	Engage a commissioning agent to perform retrocommissioning. Retrocommissioning includes adjusting control set points for lighting and HVAC, tuning HVAC equipment, replacing faulty sensors, and otherwise improving a building's performance (short of replacing equipment).
Every year	Revisit the building's tenant engagement strategy to encourage tenants to reduce energy loads within the buildings. Beyond green leasing language, this can include developing energy newsletters, launching energy challenges within the building, and other forms of engagement. Tenants can be responsible for up to 70% of an average office building's energy consumption, so engagement is critical.

COLLABORATION REQUIREMENT: The sustainability team should coordinate with the team responsible for paying the utility bills to be aware of any changes to the utility rate structure. For each efficiency project, the sustainability manager should review the latest utility rate structure and ensure the analysis accurately accounts for it. Using blended utility rates will likely result in inaccurate energy savings estimates, and will not account for savings from reduced demand.

INFORMING THE TRIGGER EVENT CALENDAR THROUGH TECHNO-ECONOMIC ANALYSIS

The trigger event calendar should inform and be informed by energy and cost analysis. Analysis can be performed at a cursory level for straightforward load-reduction ECMs, but larger, more complex measures would benefit from deeper energy modeling. It is important that the energy model include location-specific factors, such as material and labor rates, detailed utility rates, climate zone, and available incentives. This level of detail will help identify the best locations to perform upgrades. This analysis should also consider the investor's economic thresholds (as defined during the goal-setting exercise). Energy modeling can truly pay dividends when there are opportunities to improve the design of building systems that were either not designed properly from the beginning or that could be resized based on other load-reduction measures. For example, an energy model could tell a team whether air sealing the building could reduce the size of its heating and cooling system and by how much.

Additionally, the energy analysis can be used to ensure that the trigger event calendar, would result in NZE or NZE ready buildings. If the planned efficiency projects don't achieve the desired level of savings, it is better to know at the onset of the plan, so different efficiency measures can be considered or even different economic threshold requirements can be discussed.

STEP 4: ANALYZE RENEWABLE ENERGY AND ENERGY STORAGE

DETERMINE WHAT TYPE AND QUANTITY OF RENEWABLE ENERGY IS COST-EFFECTIVE

In order to achieve NZE, the portfolio will need to incorporate renewable energy— likely a combination of on-site and off-site renewables. It is important that building managers consider efficiency in their portfolios before calculating how much renewable energy they will need to achieve NZE. Energy efficiency measures will reduce the amount of renewable energy needed to achieve NZE, which minimizes up-front costs and operational expenses in the long term.

Assuming that the site has maximized building efficiency, portfolio owners should then offset the energy consumption by pursuing renewable energy in this general order of priority:

1. **Pursue on-site renewable energy to the fullest extent.** Properties where it is conventionally achievable to reach NZE through building efficiency and rooftop solar PV should not look past this first step. Properties with a higher population or load density (e.g., high-rise buildings or data centers) may not have a feasible path to achieving NZE using on-site resources.
2. **Pursue local community solar.** This is not an option in every location, but the local utility would have information on current or future community solar plans.
3. **Pursue other local off-site renewable energy options.** A great option for renewable energy procurement is to procure other local renewable energy cost-effectively. Ideally, this renewable energy should come from within the same metropolitan area. If this is not possible, it should at least come from within the same utility interconnection region as the property.

4. **Pursue other options.** It is possible to use other renewable procurement options like renewable energy certificates (RECs) or utility green tariffs, but it is more difficult to trace and validate impact. Evaluating RECs can be complicated, and RECs may be less beneficial to the grid, so all of the relevant characteristics of RECs should be considered before choosing this option.

The cost of renewable energy is declining rapidly, so even if it has been examined in the last five years, it's likely worth having another look. In 2016, the installed cost of utility-scale solar fell by 30%, and commercial solar fell by 15%. These types of substantial shifts make it worth reevaluating both on-site solar and utility-purchased solar options whenever utility rates are being considered and renegotiated.

BACK-OF-THE-ENVELOPE PV FEASIBILITY

To quickly gut check whether on-site solar PV is cost-effective for a portfolio, spread the current cost of solar PV out over the electricity that will be produced over the lifetime of the solar PV equipment.[xii] If that cost per kWh is lower than the local utility energy rate, then it is cost-effective today. For example, the current cost of commercial solar PV is roughly $1.85/W. As a rule of thumb, solar PV generates about 1,300 kWh annually per kW installed and has a lifetime of 25 years. This means that in any location with a utility charging greater than $0.057/kWh, it is likely cost-effective to install solar. Note: The cost of solar and solar PV production varies by location, so refine these numbers to be location specific. A solar photovoltaic (PV) system can reduce demand charges if the solar generation occurs at the same time as the building's peak demand. In general, buildings whose electricity demand is highest during the day—often schools and office buildings—have the greatest likelihood of seeing demand charge savings from PV. However, it is impossible to predict with absolute certainty how much a PV system will influence a building's demand charges. The savings can be estimated according to this guidance from NREL."

BATTERY STORAGE

Electric battery storage can help to reduce or shift a building's peak demand and perform other services to shape the building's load profile. This provides a number of services to the grid that can be monetized throughout utility regions in the United States. A 2015 report by Rocky Mountain Institute explores the cost-effectiveness of these grid services, and declining battery costs indicate that electric battery storage is becoming increasingly cost-effective. Recent industry data showed that battery storage may be cost-effective if utility demand charges are greater than $9/kW. Thermal energy storage (which includes technologies like ice storage or heating masonry bricks) can offer similar benefits (including load flexibility), but was not explored as part of this report.

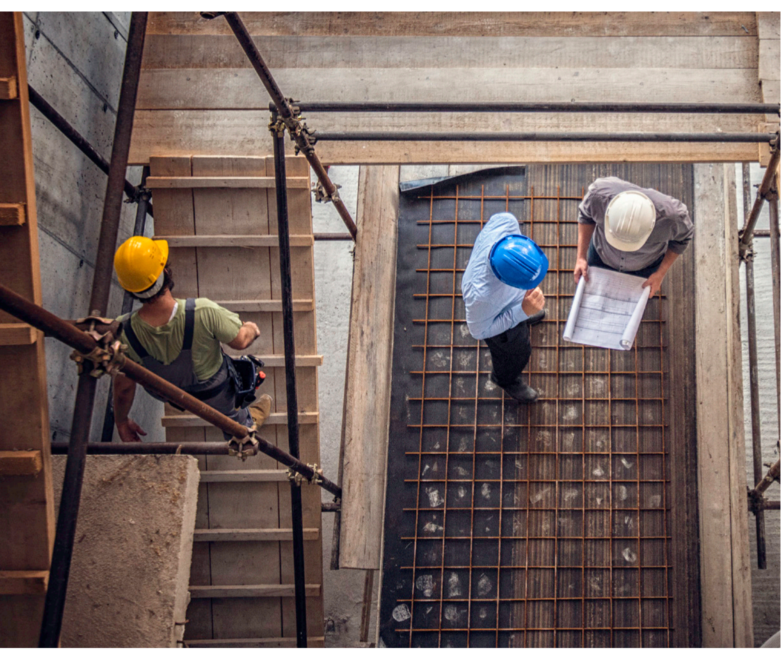
[xii] Equation: [Solar PV Cost ($/W) X Installed Capacity (W)] / [Annual Energy Produced (kWh/y) X Anticipated Life of Equipment (y)] < Utility Energy Charge ($/kWh)

STEP 5: PROCUREMENT

START PURSUING PROJECTS

The next step is to begin implementing projects. These projects can be financed in-house or with full support from an implementing partner. The partnership structure could be a fully outsourced model, like utilizing an energy service company (ESCO), an energy-focused design-build contractor, or a small project management company; a partnership with national vendors; or use of an owner's rep to supplement in-house capabilities. Most owners, regardless of in-house capabilities, should be able to manage and execute on these types of projects with a variety of partnership structures.

If the owner seeks to use a third party, she should find one that is willing to engage in a long-term partnership and fully embrace in the ZOT approach. Doing so will reduce the number of separately bid projects that the owner must procure, reduce overall costs, and ensure a long-term stream of business for the implementing partner. This reduces headaches and aligns the goals of the implementing partner and the owner.



STEP 6: TRACK PROGRESS

TRACK ENERGY CONSUMPTION AGAINST THE GOAL AND IMPROVE PERFORMANCE

Tracking progress is the final step and the key to long-term success. Tracking the building's actual energy consumption against its goal of NZE will help the portfolio's owners to understand the progress that is being made, and allow the facility management team to recognize where energy upgrades may be falling short or exceeding the expected improvements from taking a ZOT approach.

Installing submeters (energy meters that sit below a master meter) will enable performance tracking. A common best practice to start with is to have separate meters for each tenant space within a building. Beyond that, 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. This allows the sustainability manager to accurately pinpoint issues or areas of high performance, and provide feedback to tenants. In many cases, this feedback can incentivize tenant behavior and inform better equipment use. In some cases, this information can also be used to hold tenants accountable for their own energy consumption. In green leasing structures, this information can also be used to track tenant energy consumption against specified targets, which could increase or decrease their energy charges for the month.

Submetered information and a robust building controls system can also be used to continually improve building performance. This information can help to diagnose problems that typically increase energy consumption and could lead to costly maintenance bills. Further, it can be used to fine-tune building energy systems and ensure that they're always performing at their potential. Submetering is especially valuable with interval meters, which can show the load profile of the building every 15 minutes, in order to immediately spot spikes and take corrective action. Interval meters can also be used to compare different building management strategies to shave peaks and adjust building start-up and shut-down to optimize energy performance.

KEEP AN EYE TO THE FUTURE

Future shifts in a portfolio's makeup, technology, utility rate design, and a number of other factors could shift the direction of the ZOT approach substantially. It is important to:

- Consider changing uses within the portfolio. If a new tenant takes over a typical office lease to turn the office into a data center, the approach should be shifted to account for high-intensity energy loads, and may need to consider more off-site solar options. There is a similar effect when the portfolio changes as buildings are bought and sold.
- Track new utility rate structures. As technology and utilities evolve, new rate structures will treat on-site energy generation, grid-interactive building technologies, and battery storage differently. There may be new opportunities for sustainability managers to generate revenue for their buildings by leveraging these technologies and engaging with utilities.
- Be prepared for evolving technology. On-site solar PV is economical in many parts of the United States, but in others, it may not be competitive with low commercial utility rates. Battery energy storage and other technologies are coming down the cost curve, and could improve the economics of new energy projects in the coming years. As utility rate structures and technology evolve, many trending toward time-varying rate structures, there will be new opportunities to generate revenue.

HOW DIFFERENT LOCATIONS CAN IMPACT ZOT PLAN ECONOMICS

Even though real estate investment is often a fluid process that varies across geographic locations, the ZOT approach still provides value.

HOW DOES ZOT WORK IN DIFFERENT LOCATIONS?

Location-specific factors can significantly change the cost-effectiveness of energy efficiency and renewable energy projects. To demonstrate this, RMI applied a sample portfolio data set (based on the John Madden Company portfolio included in Case Study at end of the report) in three different US locations: Denver, Boston, and Milwaukee. All three scenarios were modeled using the same building characteristics and the same energy efficiency measures; the key differences, which drove different project economics, are summarized in the table below.

TABLE 7

LOCATIONAL IMPACTS OF ZOT ECONOMICS

LOCATION	MATERIAL AND LABOR FACTOR[xiii]	UTILITY ENERGY CHARGE[xiv]	UTILITY DEMAND CHARGE	IECC CLIMATE ZONE	SOLAR RESOURCE (KWH/KW[xv])	20 YEAR IRR FOR ZOT
DENVER	0.898	$0.035/kWh	$21.09/kW	5	1,407	5.0%
BOSTON	1.114	$0.154/kWh	$22.40/kW	5	1,130	10.9%
MILWAUKEE	1.027	$0.103/kWh	$6.86/kW	6	1,171	7.6%

The ZOT approach is economical in Denver (the location of the case study) over a 20-year timeframe, but it is more cost-effective in other locations. The local Denver utility's low energy consumption rates made on-site solar PV less attractive in Colorado and caused energy efficiency projects to have long payback periods. In Boston and Milwaukee, the economics are more appealing due to higher energy charges, which make on-site solar very cost-effective. Additionally, differences in material and labor factors, solar resources, and available incentives also impact results.

Due to higher energy consumption charges, the same portfolio undergoing the same efficiency projects paid back five years faster in Boston and three years faster in Milwaukee than in Denver, despite having higher material and labor costs, and less of a solar resource.

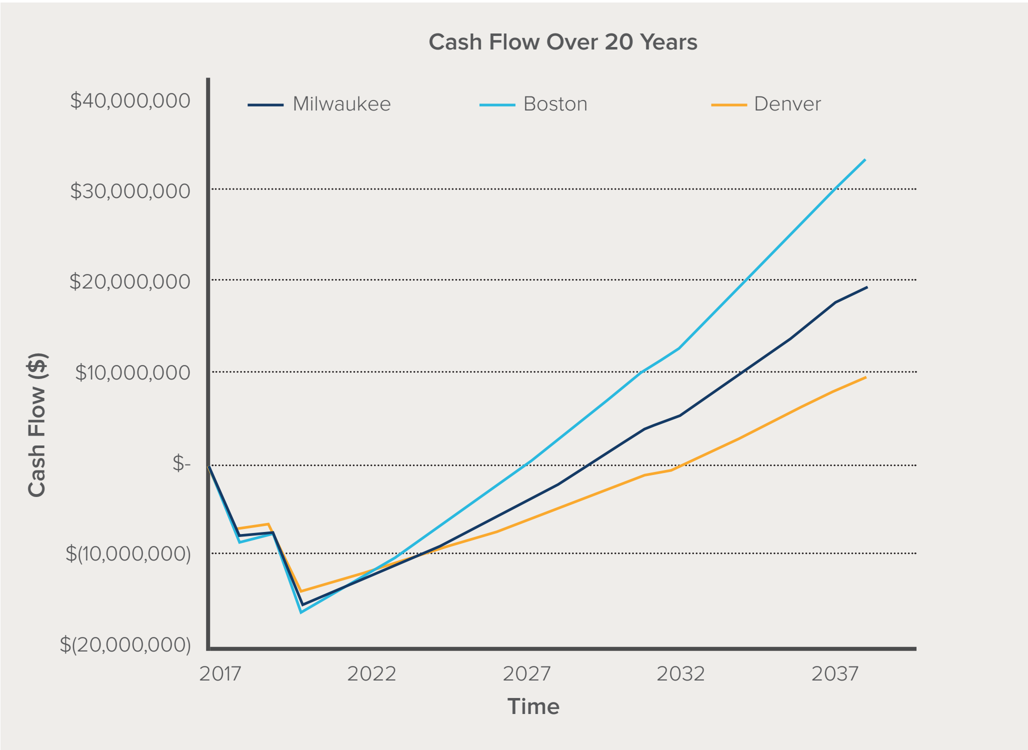
[xiii] RS Means https://login.gordian.com/logout?id=6c2707c9633844f9a37a215b341b7cbd

[xiv] Genability https://www.genability.com/

[xv] System Advisor Model analysis https://sam.nrel.gov/

FIGURE 10

COST-EFFECTIVENESS OF ZOT APPROACH IN THREE LOCATIONS



In all three locations, pursuing deep levels of efficiency and a combination of off-site renewables and on-site solar PV was more cost-effective than business as usual. In Boston and Milwaukee, on-site solar PV could be installed to the fullest extent, as the utility energy charge was far higher, making solar much more cost-effective than in the Denver utility rate structure. These analyses conservatively estimate savings, since demand charge reductions from PV were not included.

FIGURE 11

IRR FOR EACH LOCATION SHOWS FAVORABLE ECONOMICS

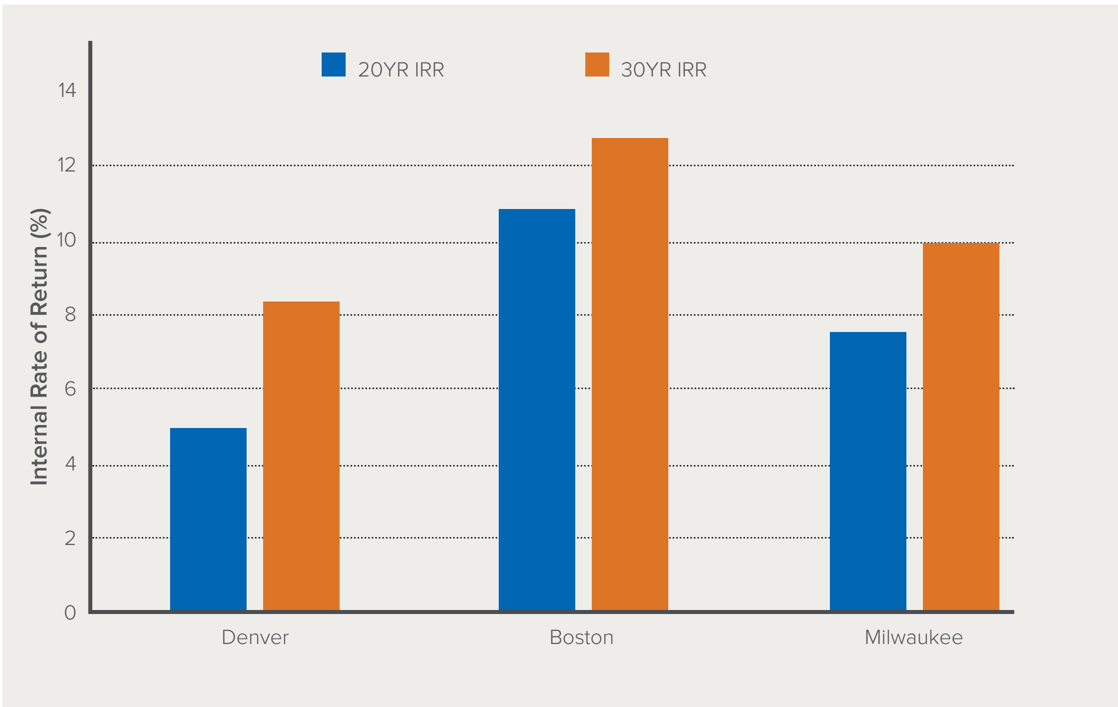
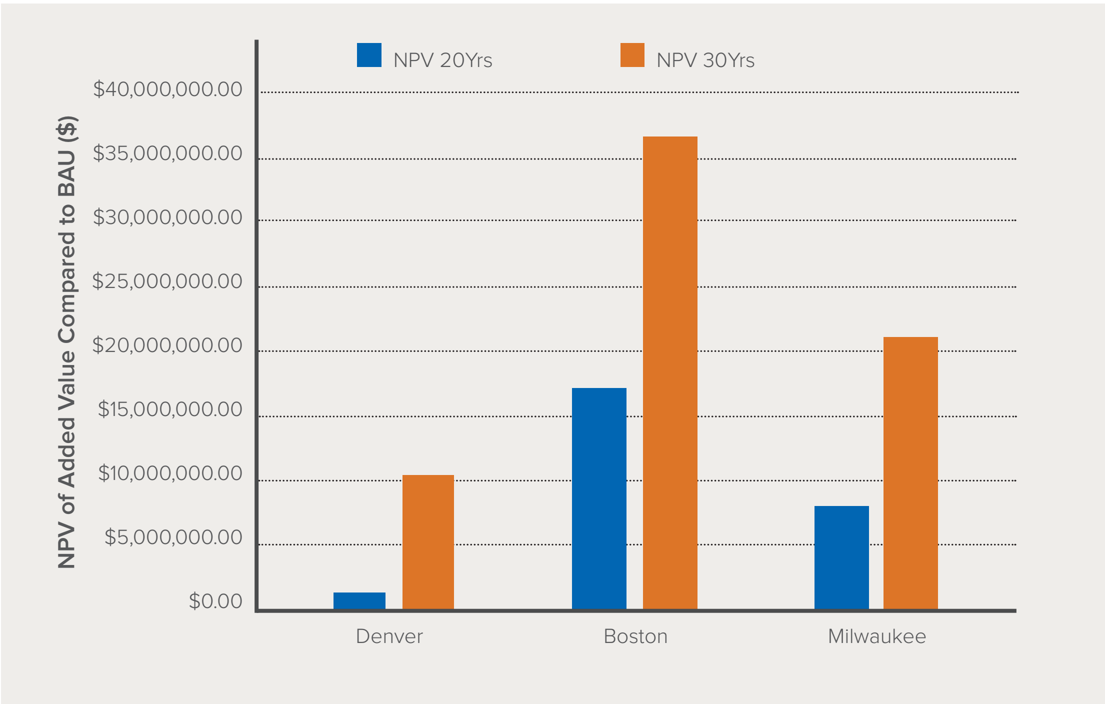


FIGURE 12

NPV OF ADDED VALUE SHOWS EACH LOCATION RESULTS IN HIGHER VALUE THAN BUSINESS AS USUAL, BUT BOSTON HAS THE STRONGEST ECONOMICS



The economics are drastically different based on the analysis period as well. The economic analysis was performed over both 20-year and 30-year timeframes. The 20-year timeframe was established to look at project economics over the course of the ZOT plan. However, looking at economics over this timeframe alone underestimates the added value because it accounts for the costs of efficiency projects completed in year 20, but misses the savings that accrue in the following years. Looking at a 30-year period shows the added value (largely through utility cost savings) that these measures are producing after the portfolio has achieved NZE.

CONCLUSION

ZOT is a straightforward and actionable plan that can drive a commercial building portfolio toward zero cost, energy, and potentially carbon over a 20-year period while also delivering:

- Revenue-positive projects for short- and long-hold property owners
- NPV-positive operation over the 20-year period it takes to get to NZE[xvi]
- Between an 8% and 13% IRR on energy project investments over 30 years

Please use this action guide and six-step process to transform your commercial portfolio while driving toward zero.

[xvi] The timeframe can vary but primarily depends on the trigger event calendar and project economics.

CASE STUDY: THE JOHN MADDEN COMPANY PORTFOLIO IN COLORADO

Photo: John Madden Campus in South Denver, CO

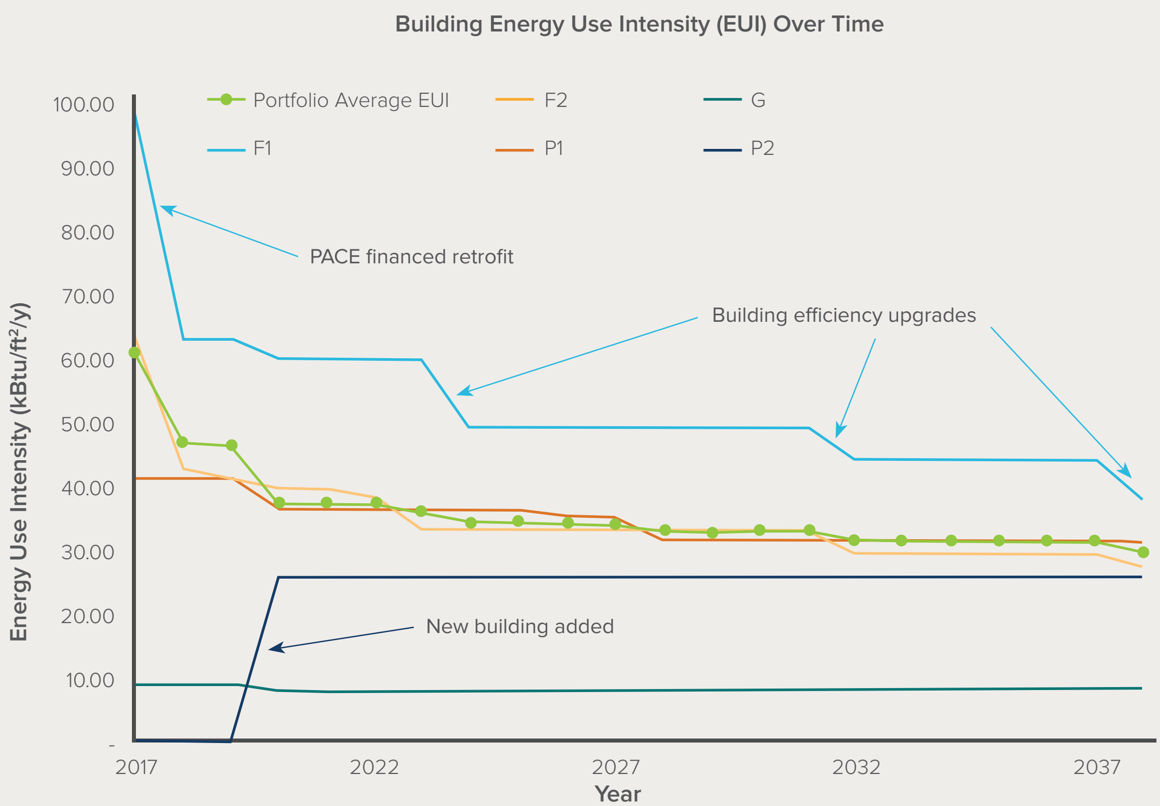
This case study provides an example of how portfolios can use trigger event calendars to map a cost-effective path to NZE use. The John Madden Company (JMC) is a mid-sized private investment portfolio located in Denver, with over 700,000 SF across four buildings. The portfolio is composed primarily of office space but also includes museum, cafe, and restaurant spaces. JMC plans to add a 400,000 SF building to the portfolio in the next five years.

The CEO of the John Madden Company, Blair Madden Bui, has plans for bringing her portfolio to NZE by 2038 and is currently undertaking a significant efficiency project that will reduce energy consumption in two buildings by 30%. The current effort utilizes PACE financing, and is the largest PACE deal in Colorado (at $7.1 million). This project includes replacing rooftop units, upgrading lighting and controls, replacing water fixtures, installing advanced energy metering for all tenant spaces, pursuing LEED certification, and implementing a three-year active energy management (AEM) program.

First, the JMC team will reduce energy use across their buildings. In 2017, the JMC portfolio had an average energy use intensity (EUI) of 62 kBtu/SF/y. The portfolio is well maintained, and it operates below the US average of 78 kBtu/SF/y for office buildings. The current PACE-financed retrofit will reduce the average EUI to 47 kBtu/SF/y. Over time, additional upgrades for envelope improvements, reduced plug and lighting loads, more efficient HVAC equipment, and a new NZE-ready building will bring the portfolio down to an average EUI of 29 kBtu/SF/y by the end of the 20-year ZOT plan (laid out below in JMC's trigger event calendar). The target energy use intensity was determined with the Architecture 2030 Zero Code Energy Calculator.

FIGURE 13

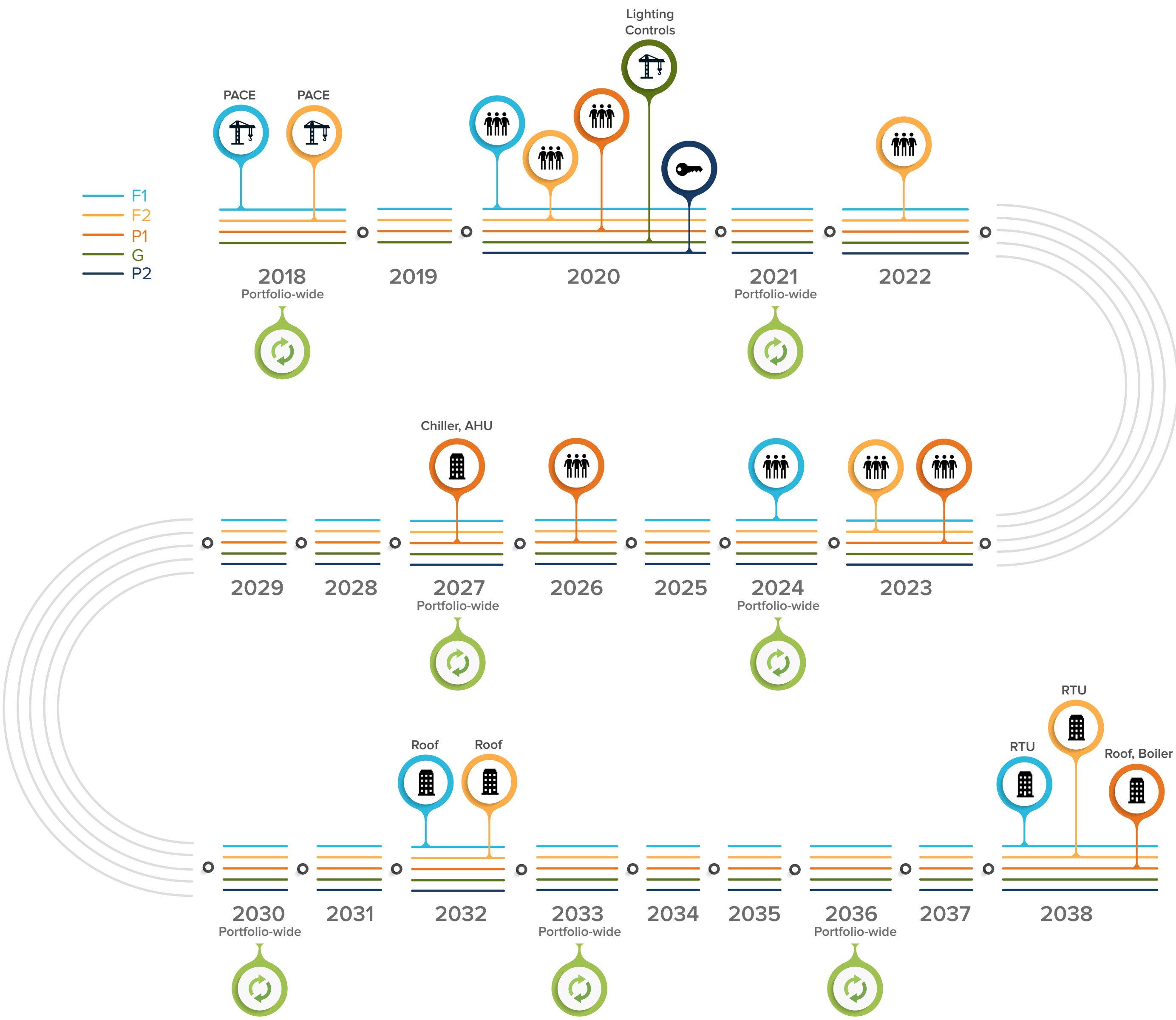
ENERGY USE INTENSITY REDUCTIONS FOR EACH BUILDING AND THE PORTFOLIO—AVERAGED OVER 20 YEARS—BRING THE PORTFOLIO TO NZE READY LEVELS. EVEN WITH A NEW BUILDING COMING ONLINE IN 2020, THE PORTFOLIO'S TOTAL ENERGY CONSUMPTION DECREASES, DUE TO AGGRESSIVE ENERGY EFFICIENCY.



Note: Buildings on the Madden Campus and abbreviations: Fiddler's Green 1 (F1), Fiddler's Green 2 (F2), Palazzo Verdi (P1), a large garage (G), and Palazzo Verdi 2 New Construction (P2)

FIGURE 14

JMC'S TRIGGER EVENT CALENDAR



Note: Buildings on the Madden Campus and abbreviations: Fiddler's Green 1 (F1), Fiddler's Green 2 (F2), Palazzo Verdi (P1), a large garage (G), and Palazzo Verdi 2 New Construction (P2)

TABLE 8

TRIGGER EVENT CALENDAR SUMMARY

	TRIGGER EVENT	HIGHEST PRIORITY ENERGY CONSERVATION MEASURES, BALANCING SIMPLICITY AND IMPACT	COST ASSUMPTIONS
	End of tenant lease	When a tenant lease comes up for renewal, add a requirement for LED lights, controls, and a plug load budget of 7 kBtu/SF/y to the tenant improvement requirements and the lease. This will save between 13% and 21% of energy use, depending on building and baseline conditions.[xvii]	No additional cost to building owner; cost is included in tenant fit out. Some additional time to educate tenants on new requirements. Submetering is already in place.
	Major equipment replacement	Envelope: When the current roof reaches the end of its life, add additional roof insulation and air sealing to reduce heat gain/loss. With contractors on-site, also add window films and wall air sealing to reduce the solar heat gain and air infiltration/exfiltration. This will reduce energy consumption by roughly 10%, because the existing roofs have minimal insulation (between R-6 and R-15).	Assumed added insulation resulted in an incremental cost of $6.50/SF roof area. Window films cost $6.30/SF window area. Infiltration reduction costs $0.60/SF floor area.
		HVAC: When HVAC equipment reaches the end of its life, upgrade to a more efficient, smaller HVAC system, which is possible because previous efficiency measures reduced heating and cooling loads. Additionally, include demand-controlled ventilation and energy recovery ventilation. This will reduce energy consumption by between 7% and 14% and result in an average equipment capacity reduction of 10%.	The incremental cost for more efficient, smaller rooftop units with energy recovery ventilation (ERV) and demand-controlled ventilation (DCV) is roughly 40% higher than a like-for-like replacement.[xviii]
	New building coming online	Analysis assumed the new P2 building is built to NZE-ready levels of efficiency, with an EUI of 26 kBtu/SF/y. This will save ~50% more energy than if the building were code compliant.	Conservatively assumed 10% incremental cost to build to NZE over a code-compliant baseline building. Anticipated that incremental costs will continue dropping over time.
	Major renovation	This includes the current planned PACE retrofit project for F1 and F2. This approach also recommends a controls package for the parking garage, anticipated to be implemented in 2020.	Total retrofit cost of $7.1 million, financed through PACE. Amortized costs passed through to tenants over time.

[xvii] Analysis assumed a proposed lighting power density (LPD) of 0.4 W/SF and a plug load of 7/SF. Baseline LPD and plug load varied by building, and were based on McKinstry's previous analysis of utility bills and metered data.

[xviii] This was determined from looking through cut sheets from manufacturers, RS Means, and in-house industry research.

Having an extremely efficient building is an important step in bringing a building to NZE. Equally important is how the portfolio offsets the remaining energy use with renewable energy. On-site solar should be considered first. Due to the height of the buildings in the JMC portfolio, even the most aggressive on-site solar PV installation (which includes several constructability challenges) would not be able to offset more than 34% of the energy use of the portfolio.

Additionally, with the local utility's low energy charge (around $0.035/kWh), it is difficult to achieve a viable return on investment without factoring in demand charge reductions. Assuming a solar PV cost of $2.75/W installed and a 25-year life of solar PV equipment, utility energy charges greater than $0.047/kWh are needed to reach cost parity,[xix] even factoring in the solar investment tax credit (ITC) and the Modified Accelerated Cost Recovery System (MACRS) tax credits. They coudn't pursue a typical power purchase agreement (PPA), but would need to find one that could account for demand charge reduction.

The portfolio managers do have plans to pursue some on-site solar PV and, to make up the difference, the team will need to consider off-site options to achieve NZE. Currently, the cost-optimal solution for this portfolio is to offset most or all of the energy through Renewable Connect, a community solar program recently launched by Xcel Energy, the local utility. This program allows customers to subscribe to a community solar array and maintain the Renewable Energy Credits (RECs) at no incremental cost for 10-year contracts (there are shorter-term contract options with small incremental costs).

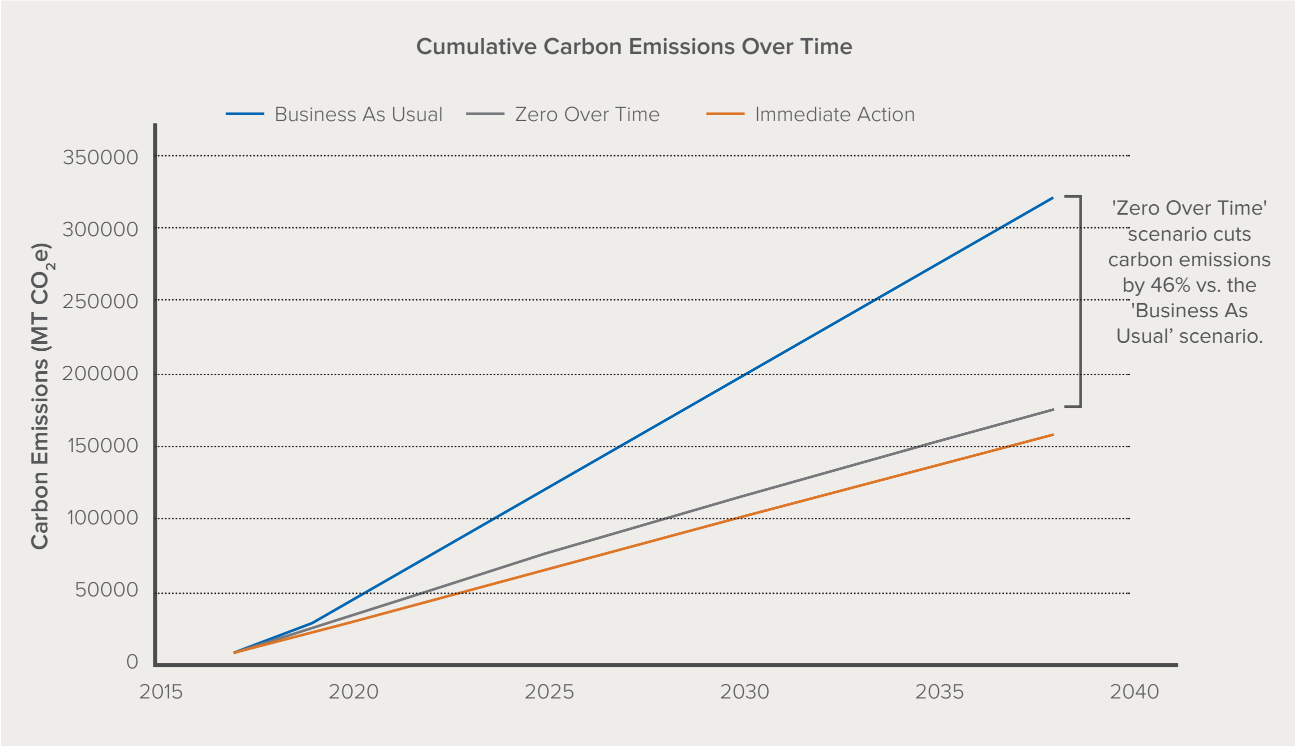
Currently, the cost-optimal solution for this portfolio is to offset most or all the energy through this community solar program. However, the declining and variable cost of on-site solar, as well as potential utility rate changes, could change the economics of on-site solar. Approximately 850 kW could be installed within today's physical roof space and site-constructability constraints. RMI recommends that JMC pursue some on-site solar PV as it becomes economical, and offset the remaining energy with community solar through the Renewable Connect plan. On-site solar adds value, particularly in marketing and outreach efforts, where it provides a direct and visible connection to the overall NZE vision. Of course, it can also provide cost savings (potentially paired with battery storage, as explored in the call-out box below).

The high-demand utility charges that JMC experiences (around $20/kW) makes energy storage a viable economic option for this portfolio. At an estimated cost of $500/kWh, analysis showed that batteries sized to shave 5% off the portfolio's peak energy demand has an 8.1 year simple payback period. Batteries sized to shave 10% off the portfolio peak was almost cost-effective over the life of the battery equipment with a 13.1 year simple payback. With storage costs dropping, this will likely become even more cost-effective in coming years.

[xix] This analysis assumes no reduction to demand charges from solar PV. In reality, there would likely be a contribution, because solar generation is generally coincident with building peak loads in the late summer afternoons. However, it is hard to predict whether building load and solar peaks would occur simultaneously with any certainty, so these cost savings were not used.

FIGURE 15

THE DIFFERENCE BETWEEN THREE CUMULATIVE CARBON EMISSION SCENARIOS: BUSINESS AS USUAL (ORANGE), ZERO OVER TIME (GREY), AND AN IMMEDIATE ACTION SCENARIO, WHERE NZE IS ACHIEVED IN YEAR 1 (2018).



Another key focus for the JMC portfolio is reducing CO_2 emissions. The ZOT approach shows a substantial reduction in cumulative carbon emissions (46% compared with business as usual) by 2038. The immediate action scenario shows the lowest cumulative carbon emissions, but it is only a slight improvement over the ZOT scenario (51% compared to business as usual). However, the immediate action scenario is not as cost-effective as the ZOT approach. This acceleration of emissions reduction is critical to avoid irreversible climate change.

The bottom line is there is a cost-effective path for JMC to achieve NZE over 20 years through a series of well-timed energy projects. JMC can leverage this plan to achieve NZE with an IRR of 5% over its 20-year journey toward NZE and continue to save with minimal capital expenses, resulting in an IRR of 9% after 30 years. Though the portfolio can't achieve NZE through on-site renewable energy alone, a combination of on- and off-site local solar installations will allow JMC to achieve its vision without increasing its energy costs, and while supporting leading community solar programs. This plan will only look more favorable as energy costs escalate, as the costs of solar and storage decline, and as NZE becomes more of a market differentiator for the commercial real estate industry.

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