RetroFit Depot

Guide to Building the Case for Deep Energy Retrofits

RetroFit
AN RMI INITIATIVE

Rocky Mountain Institute®

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Introducing the Deep Energy Retrofit Guides

*Several commercial building energy retrofit guides already exist, but none address **deep** energy retrofits.*

Rocky Mountain Institute wants the owners, occupants, managers, and service providers[1] of our nation's commercial buildings to be aware of the opportunity in deep energy retrofits. We want them to know the value and to understand how to manage or mitigate the risk. We want them to have a solid understanding of the process of executing a deep energy retrofit. We want to arm them with design recommendations that will help make their deep energy retrofits most effective.

Such is the aim of the RetroFit Depot website. It is a source of information about deep energy retrofits for commercial buildings that is unbiased by commercial interests. On the website, people gain a high-level understanding of the value of deep retrofits, how they are different from simpler energy retrofits, and the required process to achieve them. For those who would like to learn more we have created a set of three guides.

Because you are now reading the Building the Case Guide, you are likely motivated to pursue deep energy investment, but perhaps still need to convince yourself and others of the value of deep energy retrofits. Whether you are an investment fund manager, a facility manager, a building owner, or a service provider preparing a pitch to your client, this guide will help you understand how value is created by investment in significant energy savings and provide the framework and facts to build the case for a deep energy retrofit.

1	**BUILDING THE CASE**	Provides comprehensive guidance on framing and quantifying the value of a deep energy retrofit, and preliminarily building the case.
2	**MANAGING DEEP ENERGY RETROFITS**	Lists the key components of the deep energy retrofit process to ensure that project is enacted in a way that limits or eliminates cost premiums, allows risk to be managed, and creates maximum value.
3	**IDENTIFYING DESIGN OPPORTUNITIES**	Provides the retrofit practitioner with instructions for identifying opportunities to reduce energy consumption by end-use.

[1] We use "owners" and "occupants" to refer to those individuals making the decision to invest in deep energy savings for their building space. They include owner-investors, owner-occupants, and tenants of buildings. We use "managers" to refer to those individuals who manage real estate. These professionals include portfolio, asset, property, and facility managers. We use "service providers" to refer to those individuals that provide real estate services to owners and occupants. They include brokers, appraisers, lawyers, lenders, and sustainability consultants, as well architects, engineers, contractors, and professionals at energy service companies (ESCOs).

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Acknowledgements

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Overview on Building the Case

You know you need to keep your buildings up-to-date or reposition them in the market. You keep reading about energy and sustainability in the headlines, but how does this news relate to you? Are you missing something? This Guide will detail how a deep energy retrofit can contribute to successful building upkeep or repositioning, helping you manage costs, mitigate risks, and build value for your organization.

Real estate investors, owners, managers, and retrofit practitioners can use this guide to create a competitive advantage for themselves and their company. And along the way they will transform buildings from energy hogs to more comfortable, livable, and workable spaces that can help usher in an efficient and renewable energy era.

A solid investment case for a deep energy retrofit will not only get a project started, but also help sustain momentum throughout its course. The case for the project will provide the retrofit team with a unified vision that they can continually reference as challenges emerge—effectively keeping molehills from turning into mountains. The case will also provide strong material for marketing the project after implementation.

How to use this Guide

The Building the Case Guide provides a framework for preliminarily considering the value of deep energy retrofits of commercial buildings, and it offers guidance on how to conduct further analysis. Facility managers, sustainability directors, property managers, and heads of real estate can use this guide to evaluate deep energy retrofits and to effectively present the opportunity to higher internal levels or external capital sources. Energy retrofit and design professionals should use this guide to inform their client interactions and in-house training.

The Guide should be used in conjunction with the Managing Deep Energy Retrofits and the Identifying Design Opportunities guides also provided on www.RetroFitDepot.org.

It is a "desk reference" that can be used for doing due diligence on a deep energy retrofit and can be continually referenced throughout its implementation. The approaches described in this document are techniques used by the most advanced real estate professionals.

A downloadable version of this guide is available on the RetroFit Depot website at www.RetroFitDepot.org. If you need more guidance on building the case for your commercial building deep energy retrofit project, you may contact Rocky Mountain Institute at bet@rmi.org.

Additional Resources for Deep Energy Savings

This guide is written more for achieving deep energy savings at an individual building level, and is relevant for but not focused on achieving deep energy savings across an entire buildings portfolio. For a higher-level portfolio view that compliments the advice provided in this guide, see:

- **BetterBricks, "High Performance Portfolio Framework," 2010** Provides a strategic and comprehensive overview on investing in energy efficiency across an office building portfolio. Available for free download.
- **U.S. Department of Energy, "Advanced Energy Retrofit Guides," 2011** These guides help building owners, facility managers and energy managers plan, design, and implement energy efficiency measures in their existing buildings to realize savings from commissioning and retrofit, including deep retrofit; individual guides are tailored to separate property types. Available for free download online.

Framework for Building the Case

The purpose of building the case for a deep energy retrofit is to prove the value of investing in deep energy savings. To do this, you must tap into what really motivates decision-makers—for example, greater tenant and buyer demand for the real estate—and document how efficiency investment contributes to these goals.

The “value” story—as opposed to the simpler “energy cost savings” story—is different for different types of properties and retrofit investments, but by applying the framework below to the specifics of your property, you can help create the documentation and underwriting support for deeper investment.

BUILDING THE CASE	
1	**Identify the Value Creating Triggers.** Deep energy retrofits are more valuable if they are timed in accordance with certain events in a property’s life cycle. We list several triggers that can significantly improve both the economics and convenience of energy improvements.
2	**Estimate and Prove Potential Value.** List and try to quantify all the types of value that deep energy retrofits can create for the business or the organization. What can the retrofit create besides energy cost savings? Increased tenant retention, for example, would grow net operating income as a result of the retrofit.
3	**Manage and Mitigate Risk.** Gain familiarity with some of the common perceived risks, such as actual energy use exceeding what was predicted. The careful analysis and implementation of a deep energy retrofit can manage and mitigate these risks effectively.
4	**Tell a Good Story.** Bring together all that you’ve learned from the steps above, identify the strongest arguments for the deep energy retrofit, and build a case.

1. Address the Value Creating Triggers

“The Aventine is truly a case study worth sharing. Having an Energy Star score of 100 for the last three years with just recently achieving LEED Platinum certification, this building, operation, and the transformation that occurred is a great story to demonstrate to others how they can turn an average building into an ultra-high efficient building. It just takes commitment, focused effort, and of course, making the right decision with capital dollars.”

—Carlos Santamaria, Glenborough, LLC
(Courtesy of the Northwest Energy Efficiency Alliance)

As the Aventine project demonstrated, getting a great retrofit result stems from not so much increasing your capital expenditure but from reconsidering how and when to spend your dollars. The incremental cost of pursuing deep energy savings is significantly reduced if you were already planning to spend money on capital improvements, which buildings always require anyway.

We identify below the key situations that will improve the value of investment. In proving the value of investment, you should specify why the timing of your investment maximizes value. To that end, the table below describes the opportunities from timing deep energy savings with different situations.

Additional Resources

Building Owners and Managers Association (BOMA) International & Rocky Mountain Institute, 2012, “Working Together for Sustainability: The RMI-BOMA Guide for Landlords and Tenants.” This guide jointly produced by Rocky Mountain Institute and BOMA outlines five actionable steps that building owners and tenants can take to partner in the shared goal of energy efficiency, including how to use a tenant fit-out to trigger deeper energy savings.

SITUATION	OPPORTUNITY
ADAPTIVE REUSE, MARKET REPOSITIONING, OR MODERNIZATION	Repositioning an existing building will require significant capital expense to which the cost of a deep retrofit would be incremental and likely small in comparison.
ROOF, WINDOW OR OTHER MAJOR ENVELOPE REPLACEMENT	Planned roof, window and other major envelope replacements provide opportunities for significant improvements in daylighting and efficiency at minor incremental cost, providing the leverage for a deep retrofit that reduces loads and potentially the cost of replacing major equipment such as HVAC and lighting.
HVAC, LIGHTING OR OTHER MAJOR EQUIPMENT REPLACEMENT	Major equipment replacements provide opportunities to address envelope and other building systems as part of a deep energy retrofit. After reducing thermal and electrical loads, the marginal cost of replacing the major equipment with much smaller equipment (or no equipment at all) can be negative.
UPGRADES TO MEET CODE	Life safety upgrades may require substantial disruption and cost, enough that the incremental investment and effort to radically improve the building efficiency becomes not only feasible but also profitable.
NEW ACQUISITION OR REFINANCING	New acquisition or refinancing at historically low interest rates can put in place attractively financed building upgrades as part of the transaction, upgrades that may not have been possible at other times.
FIXING AN “ENERGY HOG”	There are buildings, often unnoticed, with such high energy-use or high energy-prices (perhaps after a major rate increase) that deep retrofits have compelling economics without leveraging any of the factors above.
MAJOR OCCUPANCY CHANGE	A company or tenant moving a significant number of people or product into a building or major turnover in square footage presents a prime opportunity for a deep retrofit, for three reasons. First, a deep retrofit can generate interior layouts that improve energy and space efficiency, and can create more leasable space through downsizing mechanical equipment. Second, ownership can leverage tenant investment in the fit-out. Thirdly, tenant disruption can be minimized.
ENERGY MANAGEMENT PLANNING	As part of an ongoing energy management plan for a group of buildings, the owner may desire a set of replicable efficiency measures. These measures can be developed from the deep retrofit of an archetypical building and applied to a larger set of similar buildings.

2. Estimate and Prove the Potential Value

"Greening alone did not take the [Vance Building] from 68% to 96% leased, but marrying a green vision with an assiduous attention to real estate investment, development and operating fundamentals has attracted a dynamic tenant mix, increasing top-line revenues, net operating income and value."

—Nathan Taft, Jonathan Rose Companies

(Courtesy of the Northwest Energy Efficiency Alliance)

Study after study provides evidence that it is profitable to achieve a large amount of building energy efficiency. In a 2009 report, McKinsey & Company estimates the U.S. can reduce 28% of the commercial and residential building energy consumption by 2020, saving $1.2 trillion at only $500 billion cost. The National Academy of Sciences states in a 2009 report that the U.S. can save 32% of commercial building energy use by 2030. Rocky Mountain Institute estimates the U.S. can reduce at least 38% (up to 69%) of energy consumption in buildings by 2050 for a $1.4 trillion profit. These macro-economic numbers indicate the potential for cost-effective energy savings in individual buildings across the country.

Further substantiating investment in building efficiency is all the value beyond energy cost savings, such as what Jonathan Rose Companies was able to capture in its deep energy retrofit of the Vance Building. The values beyond energy cost savings provided by a deep energy retrofit often make the difference between an owner deciding to go ahead with a project and not.

This section will recommend how to articulate the value and cost of a deep energy retrofit. A key challenge in building an effective case is in providing substantiating evidence. To this end, this section also provides recommendations on how to make your case more compelling with "Prove It" highlighted boxes.

Critical to any discussion of value is how to manage and mitigate risk, which is covered in the following section.

FINANCIAL ANALYSIS APPROACH

Because the purpose of this guide is focused on the preliminary case for deep energy retrofits, we recommend using order-of-magnitude estimates for the financial analysis. These estimates provide enough detail for getting an up-front sense of the opportunity in deep energy retrofits.

The predominant financial analysis method for energy retrofits is simple payback analysis based on energy cost savings alone. We recommend against this approach because it leaves out all the other non-energy-cost values that benefit building owners and occupants. Instead, use traditional discounted cash flow analysis over the time period that you intend to hold the building. Enable the following value-variables of the deep energy retrofit (discussed in each section below) to be adjusted for sensitivity analyses:

- Operation Expenditure Savings ($/square foot/year)
- Value Beyond Energy Costs Savings (can be quantified in $/square foot/year)
- Gross Capital Cost ($/square foot)
- Avoided Capital Cost ($/square foot)

OPERATION EXPENDITURE SAVINGS

Reducing energy cost is typically the biggest driver of operational cost savings and it is perhaps the most commonly cited value of a deep energy retrofit. For organizations that occupy a large amount of square feet of space, reducing energy cost can have a significant impact on the bottom line.

For most office buildings energy cost is $2–3 per square foot per year. Healthcare properties are one of the most expensive types, usually at $11. Building maintenance costs are another form of operation expenditure, and tend to be highly variable. Ask the facility manager of your building for an estimate of the energy and maintenance costs.

As an order-of-magnitude estimate, a deep energy retrofit will likely save 25–50% of the current annual energy cost. This is roughly true for all space types. If the building is already Energy Star certified (>75 rating) or if it is a healthcare or laboratory facility, then use the lower end of this range. If the Energy Star rating is less than 50, then assume 50% savings is possible.

ENERGY STAR RATING	RECOMMENDED ENERGY COST SAVINGS ESTIMATE
GREATER THAN 75	25%
50–75	35%
LESS THAN 50	50%

In some cases maintenance cost savings can be significant but they can also be quite low, depending on the quality of the equipment currently installed in the building. As noted in the Cleveland Clinic true retrofit story, where efficiency measures are saving $5 million in energy costs per year, poorly functioning systems and equipment require the largest share of maintenance costs due to the need for repair and addressing comfort complaints. Replacing this equipment not only saves energy but also significant maintenance cost. In addition, some equipment is inherently less costly to maintain, such as LED lights, because of a longer useful life. The facility manager should be able to tell you the maintenance cost for your building and may be able indicate how much of this cost would be reduced through purchasing new equipment (or a major rehabilitation of the existing equipment).

Prove it

Find a case study or story about a deep energy retrofit of a building that is comparable to yours. Appendix profiles several recent deep energy retrofits of office buildings to achieve an 85+ Energy Star rating. They have saved between 24 and 63% energy use, and between $0.23 and $1.63 per square foot per year. Which of the buildings in that list is closest to yours?

For more case studies, see the RetroFit Depot, the Getting to 50 Database, and the New Buildings Institute and Northwest Energy Efficiency Alliance Report "A Search for Deep Energy Savings".

VALUE BEYOND ENERGY COST SAVINGS FOR THE OCCUPANT, ENTERPRISE, AND INVESTOR

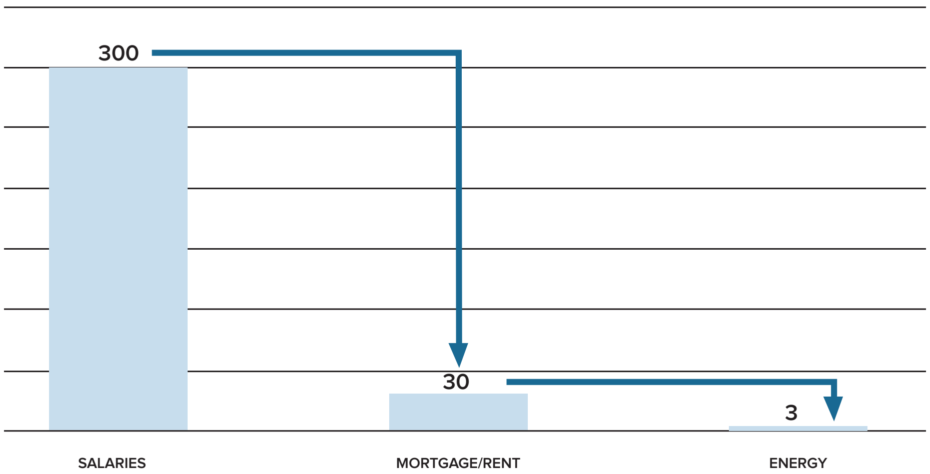
The value beyond energy cost savings is the least common source of value to be quantified, but often is a key driver during decision-making. As shown in the table below, a deep energy retrofit includes envelope, passive design, and other measures that not only increase energy efficiency but also improve other performance factors such as thermal comfort and visual acuity. Increasing building performance with regard to these factors, in turn, can produce value such as improved occupant health, organizational reputation, and property value. In summary, deep energy retrofits (1) install measures that (2) improve building performance to (3) create value for the occupant, enterprise, and investor.

1) DEEP ENERGY RETROFIT MEASURES		2) BUILDING PERFORMANCE	3) VALUE	
ENVELOPE	Insulation Windows Air tightness Green/white roof Etc.	THERMAL COMFORT ACTIVE OCCUPANT ENVIRONMENTAL CONTROL	REDUCTION IN COST	Lower maintenance cost Lower health cost (absenteeism, health care) Lower employee recruiting and churn costs
PASSIVE DESIGN	Natural ventilation Daylighting Landscaping Etc.	INDOOR AIR QUALITY	REVENUE GROWTH	Higher occupancy rates Higher rents Increased employee productivity Improved marketing & sales
ELECTRIC LIGHTING	Fixtures upgrade Controls Redesign Etc.	VISUAL ACUITY AND COMFORT	IMPROVED REPUTATION AND LEADERSHIP	Recruiting best employees or tenants Employee or tenant satisfaction and retention Public relations/brand management Retain “social license” to operate
PLUG LOADS & MISC.	Efficient equipment Controls Etc.	GREEN BUILDING RATING OR SCORE	COMPLIANCE WITH INTERNAL AND EXTERNAL POLICIES/ INITIATIVES	Meet needs of Global Reporting Initiative, Corporate Social Responsibility, Carbon Disclosure Project Meet responsible investment fund requirements Meet growing Securities and Exchange Commission regulations
HEATING, COOLING, & VENTILATING	Demand control ventilation Digital controls Balance air & water flows Chiller upgrade Etc.	VIEWS TO THE OUTDOORS SPACE EFFICIENCY SPACE FLEXIBILITY	REDUCED RISK TO FUTURE EARNINGS	Reduced risk from energy disclosure mandates Limit exposure to energy/water price volatility Overall reduced potential loss of value due to functional obsolescence Reduced legal risks—sick building syndrome and mold claims, etc.

[CONTINUED]
VALUE BEYOND ENERGY COST SAVINGS FOR THE OCCUPANT, ENTERPRISE, AND INVESTOR

The ability of an organization to increase revenue through employee productivity or reduce employee health cost, in particular, has the potential to be an enormous value driver for a deep energy retrofit. See the chart below that juxtaposes the cost of salaries with the cost of energy in a typical office space[2]. Salaries are about 10 times the cost of the mortgage or rent and about 100 times that of energy. A mere 1% increase in employee productivity would overshadow energy cost savings.

ANNUAL ORGANIZATION ENERGY AND OTHER COSTS
(USD per square foot)



After examining the potential benefits of a deep energy retrofit you can select some that you feel would be worthwhile to quantify and include in a discounted cash flow analysis—or at least include in a sensitivity analysis. Let us look at one example of how to do this. Studies have demonstrated a 15% reduction (the low end of the range) in office absenteeism[3]. Assuming that a reduction in sick days provides value to your organization, how much value could be produced if your building had a similar effect on your employees?

Let's assume an average annual salary, with fringes, of $75,000 and 250 gross square feet per employee, which takes into account common areas, corridors, etc. Dividing the salary cost by the worker density gives us an annual salary expense of $300 per square foot. If employees typically take eight sick days out of the total 250 working days, then about 3.2% of salary cost—or $9.60 per square foot per year—goes to sick days. If this cost is reduced by 15%, then you are saving $1.44 per square foot per year. Compare this value to a $3 per square foot annual energy bill and you begin to understand the profound effect of even a 15% change in employee absenteeism resulting from a more sustainable building.

Prove it

Seek out the studies that demonstrate the value of energy efficient or sustainable properties. The Green Building Finance Consortium research database lists several of the studies that substantiate the value purported in this guide. Review the relevant studies so when questioned about your sources, you will have a specific answer ready.

[2] This chart was inspired by Romm, Joseph and William D. Browning. 1994. "Greening the Building and the Bottom Line." Rocky Mountain Institute: Snowmass, CO.
[3] Gurtekin PhD, B., Hartkopf PhD, V., & Loftness FAIA, V. Building Investment Decision Support (BIDS). Carnegie Mellon University Center for Building Performance and Diagnostics.

GROSS CAPITAL COST

The gross capital cost of a deep energy retrofit can vary dramatically because it is often coupled with a major renovation for non-efficiency purposes, and project teams rarely disaggregate the cost for efficiency from the rest of the project. However, a recent study shows that a deep energy retrofit of a standard 500,000 gross square foot, 12-story office building would cost $25 per square foot at minimum and potentially over $150 per square foot (see Table below).

ENERGY USE	ENERGY REDUCTION (KBTU/SF/YR)	CAPITAL COST ($/SF)
PLUG LOAD	6–15	0
LIGHTING	6–8	3–5
VENTILATION	4–5	2–5
COOLING	10–25	10–75
HEATING	3–10	10–75
TOTAL	30–50	25–150+

Source: Kok, Nils, Norm Miller, and Peter Morris, 2011: "The Economics of Renovation." Available at www.nilskok.com.

The ranges of capital cost are substantial, and the high end is very large. When considering capital cost, it is important to keep in mind that the work can be phased over several years. See the Managing Deep Energy Retrofits Guide for more on this approach. Also, utility and state incentives can offset a significant amount of capital cost. A number of financing options can also eliminate up front costs completely. Finally, avoided capital costs can make the overall capital cost picture far more attractive and are discussed in the next section.

Prove it

Similar to what you have done for energy cost savings, find a case study or story about a deep energy retrofit of a building that is comparable to yours. Appendix profiles several recent deep energy retrofits of office buildings to that achieved an 85+ Energy Star rating. Their cost was between $3.20 and $204 per square foot, phased over as long a period as nine years. Which of the buildings in that list is closest to yours? For more case studies, see the RetroFit Depot and the New Buildings Institute and Northwest Energy Efficiency Alliance Report "A Search for Deep Energy Savings".

AVOIDED CAPITAL COST

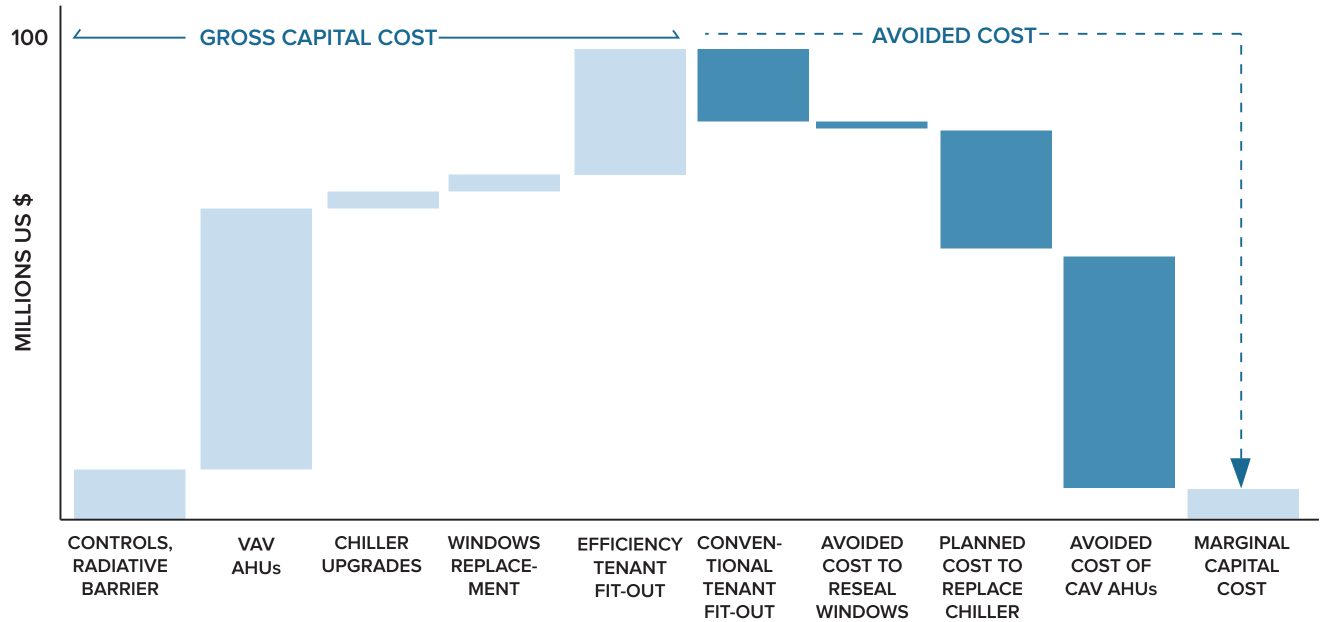
Capital cost savings result from avoiding business-as-usual expenditures. A deep energy retrofit often replaces items that would need to be replaced anyway as part of business-as-usual building operation and management. To accurately account for the incremental cost of the efficiency investment, the business-as-usual replacement costs should be subtracted from the deep energy retrofit cost[4].

Consult with the facility manager to understand what improvements are already planned, or should be planned over the next five or ten years. The facility manager should be able to give you an order-of-magnitude capital cost estimate for the needed improvements. Account for these future improvements as avoided (or negative) costs in your discounted cash flow model.

Do not always expect to have the same size, quantity, or cost of equipment after a deep energy retrofit. Deep energy retrofits can reduce loads enough to downsize or eliminate mechanical equipment—making it less costly to replace. In addition, good lighting design can sometimes eliminate lighting fixtures, such as in areas that have too many fixtures to begin with and areas that have adequate daylight during occupied hours.

Facility managers may also be able to calculate for you an order-of-magnitude capital cost savings resulting from a dramatic reduction in heating and/or cooling load. The Empire State Building saved over 30% of its cooling load through a window replacement to avoid a costly ($17 million) chiller replacement; perhaps your office building could do the same. Facility managers may also be able to estimate cost savings from reduced lighting equipment (fewer lamps to replace each year).

EMPIRE STATE BUILDING GROSS AND AVOIDED COSTS



[4] For more on this approach, see the Empire State Building True Retrofit Story

Prove it

Avoiding capital costs happens on nearly all energy retrofit projects because all buildings have equipment and components that need to be replaced eventually. A deep energy retrofit installs new equipment and components that enable the owner to avoid business-as-usual replacement costs. For example, the Empire State Building was slated for new air handling units at a cost of $45 million. Instead, the owner decided to implement fewer and more efficient units (in combination with other deep energy retrofit measures) at a gross cost of $47 million. After accounting for the $45 million in avoided cost, the owner had to pay only $2 million in incremental cost.

Additional Resources

Scott R. Muldavin, Value Beyond Cost Savings: How to Underwrite Sustainable Properties, 2010. Rapid market change has significantly increased the demand for sustainable properties by tenants, investors and regulators, but decision-making on sustainable property investment has not evolved past simple-payback or return measures based on operating cost savings. Value Beyond Cost Savings meets this challenge, providing a roadmap for integrating the value and risks of sustainable investment into decision-making, enabling larger and more profitable levels of sustainable property investment. Available for free download.

McGraw-Hill Construction, "Business Case for Energy Efficient Building Retrofit and Renovation," 2011. Through in depth market research and case studies, this report shows that industry-wide adoption of energy efficiency investments is ultimately profitable and makes good business sense. Available for free download.

Terrapin Bright-Green, "The Economics of Biophilia: Why Designing with Nature in Mind Makes Financial Sense," 2012. Incorporating daylighting and other biophilic design measures into the built environment is not just a luxury, but a sound economic investment in health and productivity, based on well-researched neurological and physiological evidence. Today productivity costs are 112 times greater than energy costs in the workplace. Integrating quality daylighting schemes with a view to nature into an office space can save over $2,000 per employee per year in office costs. Whether it is hospitals that allow patients to heal more quickly, offices that boost productivity, schools that improve test scores, or retail outlets with higher sales, this paper makes the business case for incorporating biophilia into the places where we live and work.

3. Manage and Mitigate Risk

As part of a preliminary case for a deep energy retrofit, an in-depth study of risk is not needed. However, it is helpful to have an understanding of where the common risks are and how they can be managed and mitigated. Risk stems everywhere from the efficiency technologies themselves to the process of selecting and implementing efficiency measures. The table below lists the most common risks and the plans that can mitigate them. More details about these mitigation plans can be found in the Managing Deep Energy Retrofits Guide, which details the unique methods and processes of a deep energy retrofit.

RISK DESCRIPTION	LEVEL	POTENTIAL MITIGATION PLANS
ACTUAL ENERGY USE MAY EXCEED PREDICTED	High	• Use best-in-class predictive modeling (including peer reviews during the project) • Create measurement & verification plan to account for weather variations • Consider procurement vehicles such as Integrated Project Delivery and performance contracting • Implement post-construction commissioning • Engage occupants (see below)
OCCUPANTS MAY NOT COOPERATE OR BEHAVE AS YOU EXPECTED, LEADING TO HIGHER ENERGY USE AND COST	High	• Engage occupants during analysis process via design charrettes and meetings • Thoroughly research installed technology and get user testimonials • Test improvements among certain groups before full rollout
OCCUPANT IMPACTS, SUCH AS REDUCED ABSENTEEISM AND BETTER TEST SCORES, ARE NOT REALIZED	High	• Ensure that the building occupants, their activities, and the implemented retrofit measures are similar to the ones in the studies you referenced • Include occupant input for the selection of retrofit measures
DESIGN IS NOT CONSTRUCTED ACCURATELY; PROJECT IS NOT ON TIME NOR ON BUDGET	High	• Consider procurement vehicles such as Integrated Project Delivery and performance contracting • Implement post-construction commissioning
ENERGY PRICES MAY BE FAR GREATER OR LESS THAN EXPECTED	Med	• Conduct sensitivity analysis to understand how energy prices impact the financial return • Obtain long-term energy supply contract (e.g. a power purchase agreement) or technology (e.g. solar panels)
NEWER, MORE COST-EFFECTIVE TECHNOLOGY BECOMES AVAILABLE DURING OR SHORTLY AFTER CONSTRUCTION	Med	• Research all alternatives prior to the go-ahead • Provide flexibility to upgrade during operation
PROPERTY/FACILITY MANAGEMENT STAFF DO NOT OPERATE THE BUILDING APPROPRIATELY	Low	• Create measurement & verification plan • Train the operators • Include operators in the design process

4. Tell a Good Story

"When you do enough research, the story almost writes itself. Lines of development spring loose and you'll have choices galore."

—Robert McKee

At this point you have identified the potential value generated for your organization by deep energy retrofits and have identified the various sources of risk. Now you can ask yourself, what is the most compelling storyline?

A storyline begins with an opportunity to solve a problem or to otherwise improve the organization. Perhaps you are concerned that your portfolio is falling behind in sustainability and tenants may opt for the competitor buildings that are more sustainable. Or maybe your business operates with a slight profit margin and you could dramatically increase it with much more energy-efficient buildings.

Take a look at all the different benefits you identified. Where is the biggest potential? Does it align with a major concern of the decision-makers in your organization? What type of value would be most compelling?

Here is an example of a storyline for a deep energy retrofit:

1. Our real estate company manages a fund with a core-plus investment strategy and has a large office property with failing mechanical equipment.
2. Making the building more sustainable while completing the renovation could attract more, higher paying tenants, which would in turn cause greater appreciation by the time we plan to sell.
3. According to trends in our region, properties with Energy Star certification have sold for 2–5% more than buildings without such certification.
4. An increase in total appreciation by only 2% beyond what we would otherwise expect would equate to $X amount of increased profit.
5. A deep energy retrofit can dramatically improve the building efficiency and easily attain Energy Star certification.
6. Achieving an Energy Star rating in the high 90s would provide the added benefit of improved community stature and marketing for our company.
7. Therefore, we should begin the process of a deep energy retrofit to know the cost and value of achieving a high Energy Star rating.

In Conclusion

With enough commitment and vision, retrofit practitioners and building owners can use this and other RetroFit Depot guides to take advantage of this unique opportunity and reap the many benefits afforded by deep energy retrofits. Businesses can become more competitive, profitable, and resilient by leading the transformation of our building stock that is largely inefficient. This transition will build a stronger economy, a more secure nation, and a healthier environment.

We welcome your feedback. Your experiences and observations are valuable to the continued development of the RetroFit Depot website. The journey is just beginning, and we look forward to hearing from you.

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Appendix:
Deep Energy Retrofit Case Studies

Leading real estate owners, managers, and practitioners have enacted several deep energy retrofits to date. New Buildings Institute, the Northwest Energy Efficiency Alliance, and Rocky Mountain Institute have thus far led the documentation of these deep-energy-saving projects. The following table lists several deep energy retrofits of office buildings to achieve an 85 and above Energy Star rating. (See following page.)

BUILDING NAME	OWNER TYPE	DEEP ENERGY RETROFIT TYPE[5]	LOCATION	SIZE (1000) SF	MEASURED ENERGY USE (KBTU/SF/YR)	% REDUCTION FROM BEFORE	% BETTER THAN AVG.COMPARABLE	ENERGY STAR RATING BEFORE)	GROSS CAPITAL COST (W/ REBATES) ($/SF)	LENGTH OF PROJECT (YR)	OPERATING EXPENSES REDUCTION ($/SF/YR)
THE AVENTINE	INVESTOR	EFFICIENCY UPGRADE	CA	253	23	63	45	100 (85)	$3.20 (2.51)	1	$0.46
HOME ON THE RANGE	OWNER OCCUPIER	RENOVATION	MT	8.5	46	N/A	72	99	($169)	1	N/A
200 MARKET	INVESTOR	RENOVATION	OR	389	65	N/A	30	98	$67.30	9	N/A
VANCE	INVESTOR	RENOVATION	WA	134	39	24	64	98 (93)	$26.00	1	N/A
INDY CITY-COUNTY	OWNER OCCUPIER	EFFICIENCY UPGRADE	IN	731	57*	35	N/A	80+ (50)	$11.40	1	$1.03
JOHNSON BRAUND	OWNER OCCUPIER	EFFICIENCY UPGRADE	WA	8	29	59	47	94	$31.	1	$0.48
1545 WILSON	INVESTOR	EFFICIENCY UPGRADE	VA	313	64	35	43	92 (63)	$3.50	1	$0.80
LOVEJOY	OWNER OCCUPIER	RENOVATION	OR	12.9	40	N/A	38	92	$115	1	$0.39
EMPIRE STATE BUILDING	INVESTOR	HISTORIC RENOVATION	NY	2,700	60*	38	N/A	90 (52)	$204[6]	9	$1.63
BEARD-MORE	INVESTOR (MULTI-USE)	HISTORIC RENOVATION	ID	29	32	N/A	47	90	$105.5 (105.0)	1	$0.81*
ALLIANCE	INVESTOR, OCCUPIER	RENOVATION	CO	38	42	N/A	39	85	$4.42 (3.07)	1	$0.23

[5] A renovation is a major construction project that includes energy efficiency upgrades as well as improvements with an aesthetic/functional focus, such as interior redesign. A historic renovation is a renovation with the added constraints of a historic building. An efficiency upgrade replaces most or all of one or more systems for efficiency and occupant satisfaction improvement, such as the upgrade of HVAC, lighting, and envelope.

[6] The cost of the efficiency improvements as only $4.90/SF (less than 3 percent of the gross cost).