NCBPA

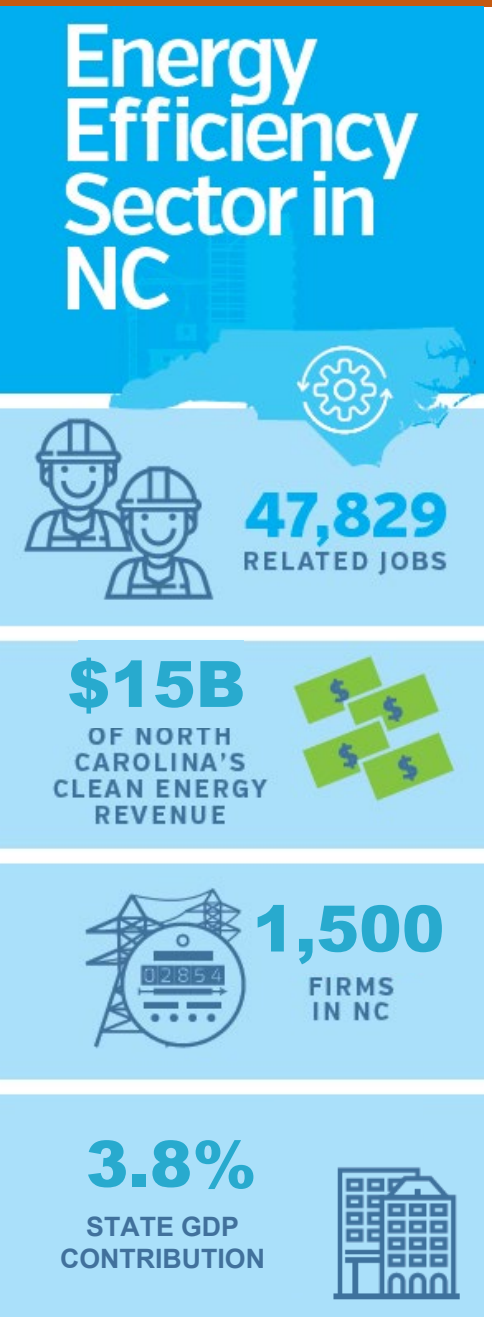
North Carolina Building Performance Association

Retrofitting in Today's Market

Retrofit Conference

October 9, 2018

About NCBPA



NCBPA
North Carolina Building Performance Association

North Carolina's
Energy Efficiency
Building Performance
Green Building
Trade Association

Membership information available at
www.BuildingNC.org

Presented By

NCBPA
North Carolina Building Performance Association

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I AM NOT A CONTRACTOR

What's Building Performance?

High-Performance Projects Provide Comfort, Sustainability, and ROI

Case studies emphasize high-performance building designs and retrofits

A report by the American Council for an Energy-Efficient Economy (ACEEE) has found that retrofitting smart technology to commercial buildings can cut energy bills by 18% in offices, 14% in shops and 8% in hospitals.

What's the Performance Target?

PHIUS
Passive House Institute US

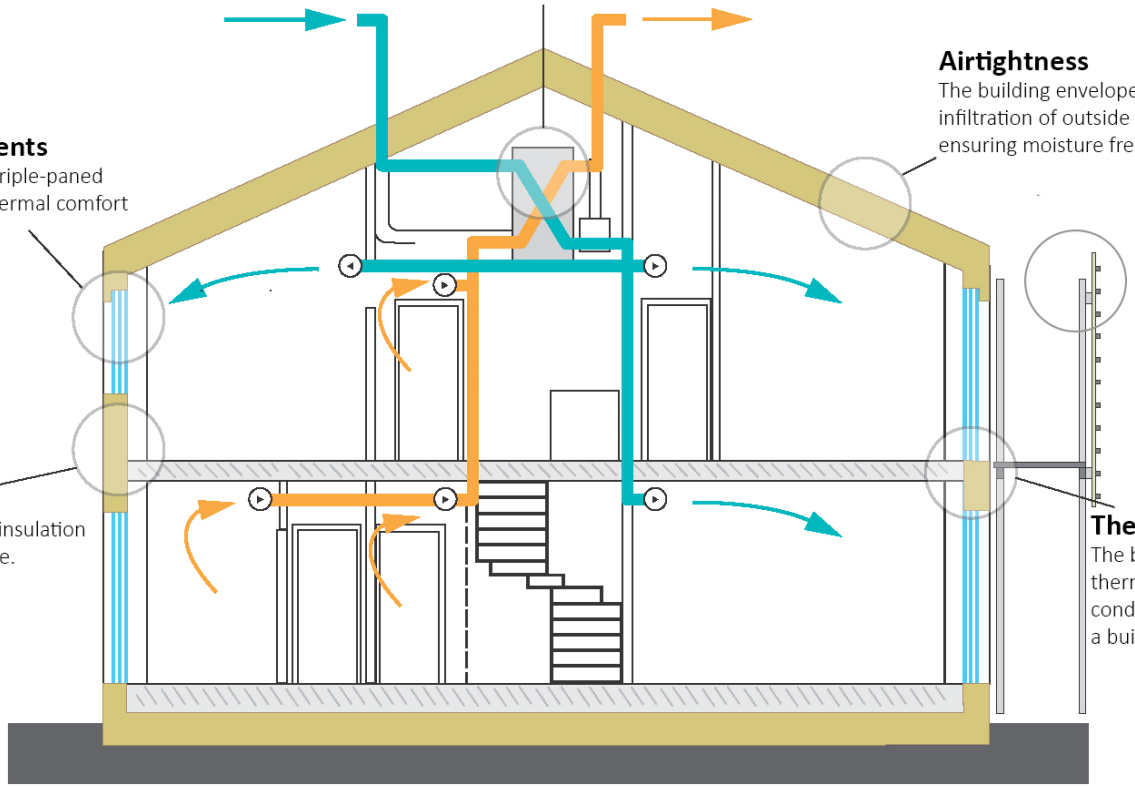
naphn 18
North American Passive House Network

Balanced ventilation with Energy Recovery Ventilation
Some form of balanced heat and moisture recovery is required in most climates.

Airtightness
The building envelope is extremely airtight, preventing infiltration of outside air and loss of conditioned air as well as ensuring moisture free assemblies.

High-Performance Components
High-performance windows typically triple-paned for cold climates and doors provide thermal comfort and building durability.

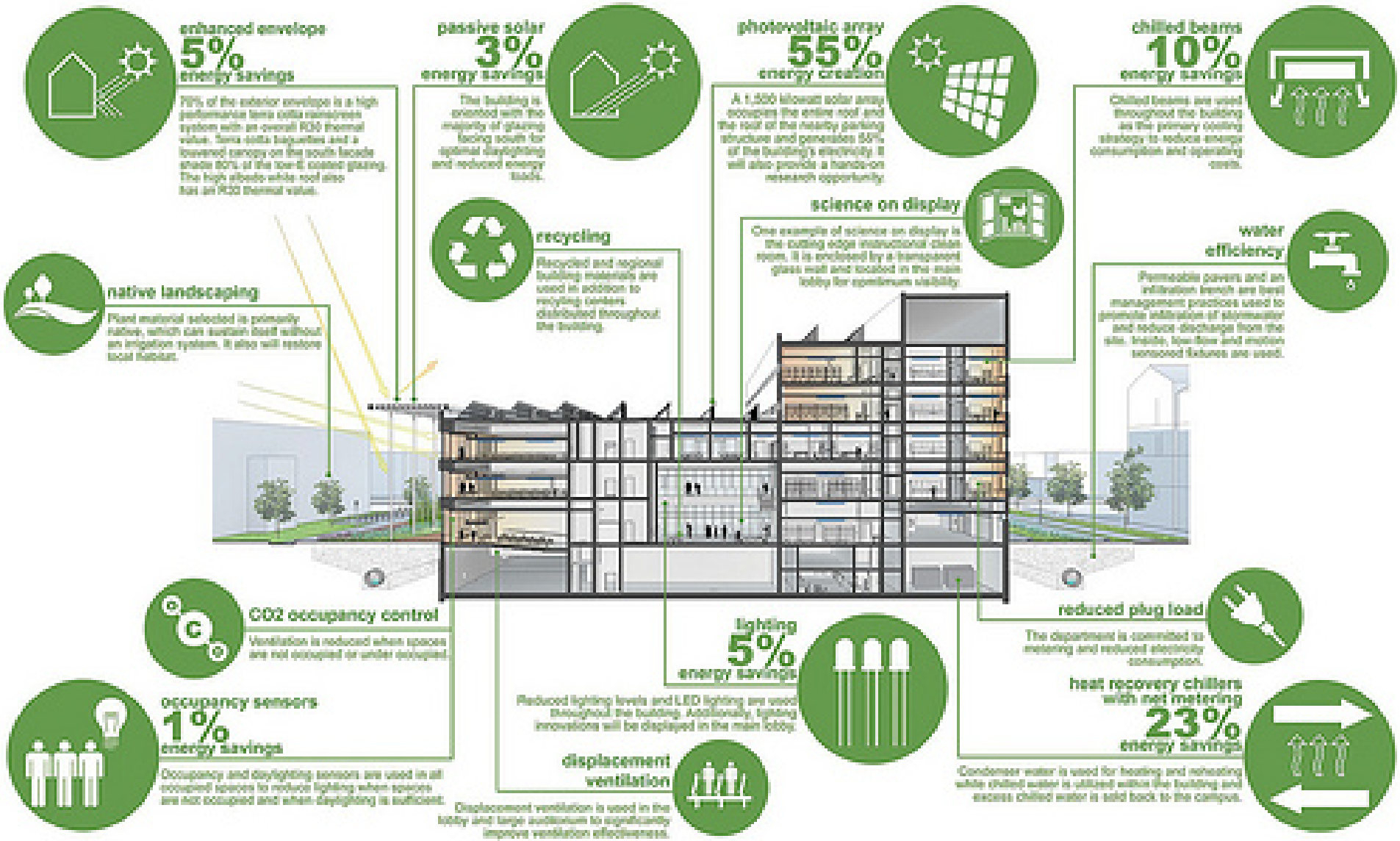
Shading and Solar Design
Solar gain is managed to exploit the sun's energy for heating while shading elements work to minimize overeating in cooling seasons.



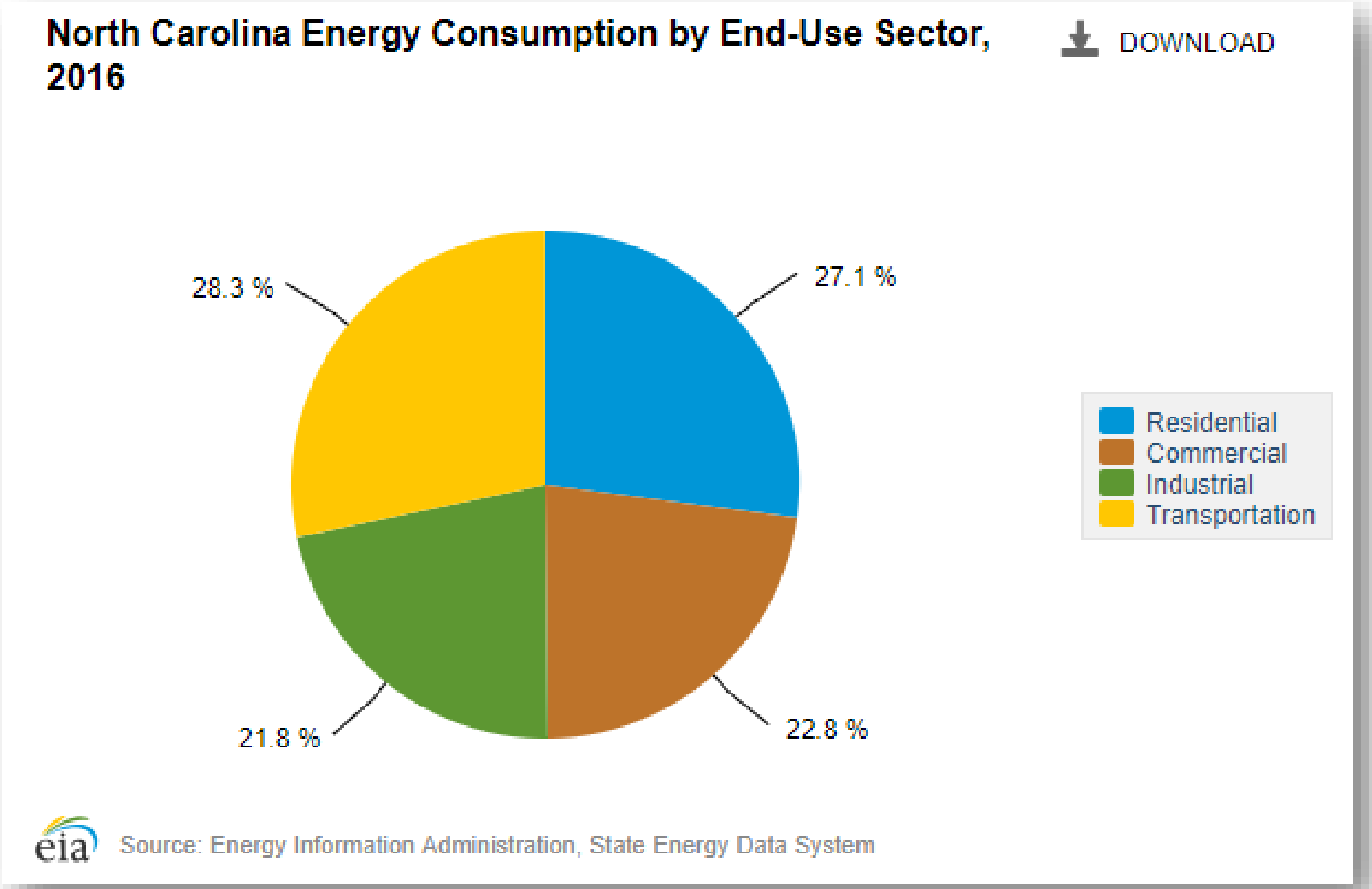
Continuous Insulation
higher than typical levels of continuous insulation are included through the entire envelope.

Thermal Bridge-Free Construction
The building envelope is designed to eliminate thermal bridges. A thermal bridge is a highly conductive material that extends from within a building's envelope to the outside air.

What's the Performance Target?



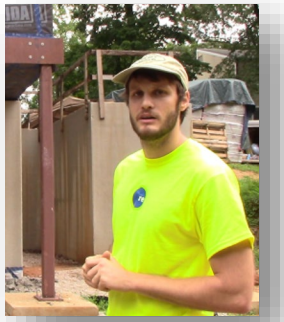
Why Building Energy Efficiency?



Why Building Performance?

Issues & Needs:		Solutions & Benefits:
• Evolving code changes	→	• Third-party verification
• New technology, increased automation and connectivity	→	• Hands-on design, installation and maintenance support
• Smart appliances and mechanical systems increasing	→	• Software-based performance and energy modeling and testing
• Needs for greater durability and resiliency	→	• EE/HP buildings work better and last longer
• Up-front costs increasing, high ROI needed for measures	→	• EE/HP buildings carry more market value - when proven
• Lots of construction, lots of inventory and competition	→	• EE/HP buildings stand out and carry more features and benefits

Energy Efficiency First



"We're never going to get to our carbon targets or energy targets just by ramping up our solar production. We need to be efficient and reduce first. A dollar towards efficiency goes a lot farther than a dollar towards production. *That's what we do*."

Dylan Buonfrisco, REdesign.build

ENERGY SOLUTIONS
NC STATE UNIVERSITY • ENGINEERING

REDUCE
RECOVER
RENEWABLES

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What's the Potential?

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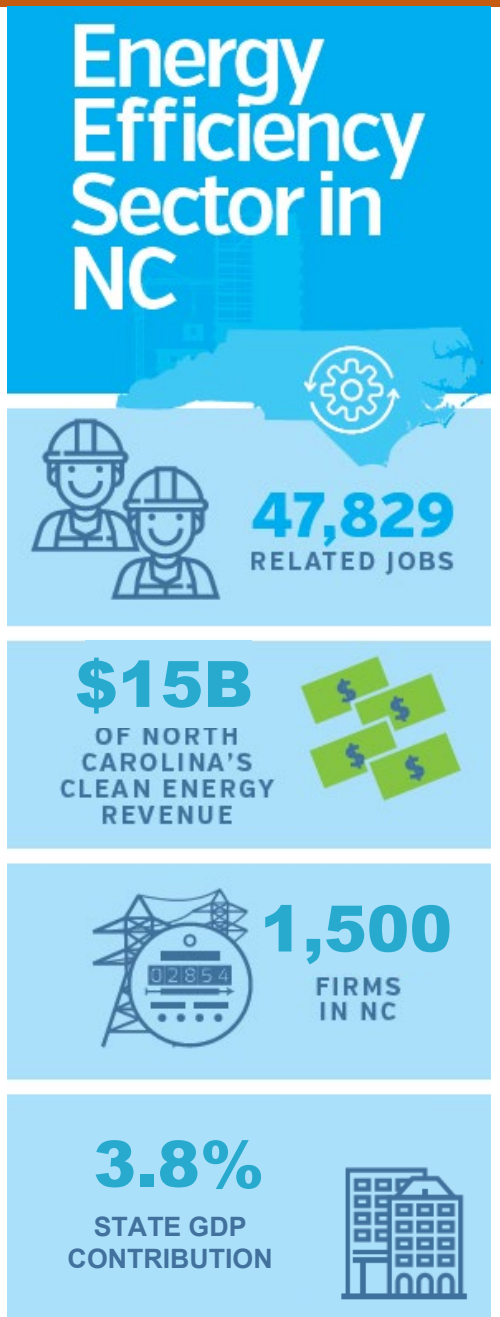
What's the Potential?



Energy Efficiency Sector in NC

RESIDENTIAL RETROFITS ANNUAL SAVINGS

$538 MILLION

COMMERCIAL & INDUSTRIAL RETROFITS ANNUAL SAVINGS

$508 MILLION

ENERGY EFFICIENCY

5%

REDUCTION

POTENTIAL

$129 MILLION

PUBLIC BUILDING RETROFITS ANNUAL SAVINGS

$3.0 BILLION

BUILDING CODE UPDATES ANNUAL SAVINGS

63,789

RELATED JOBS

$15.8B

OF NORTH CAROLINA'S CLEAN ENERGY REVENUE

1,580

FIRMS IN NC

$4.2 BILLION

STATEWIDE ENERGY SAVINGS

HOW MUCH is 21.9 MILLION METRIC TONS OF CO_2?

CO_2

IT IS EQUIVALENT TO:

4.6 MILLION

CARS DRIVEN IN ONE YEAR

2.4 BILLION

GALLONS OF GASOLINE CONSUMED

5,486

WIND TURBINES RUNNING FOR ONE YEAR

26 MILLION

ACRES OF US FOREST

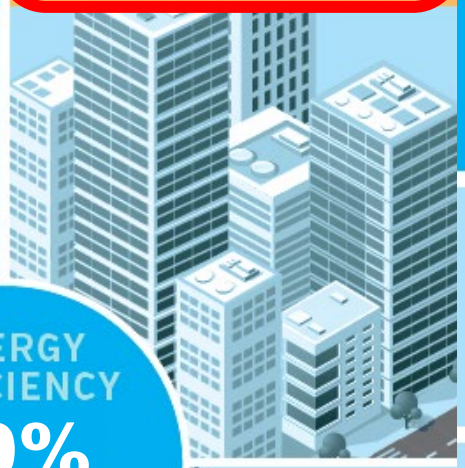
Energy Efficiency Sector in NC

RESIDENTIAL RETROFITS ANNUAL SAVINGS

$1.1 BILLION

COMMERCIAL & INDUSTRIAL RETROFITS ANNUAL SAVINGS

$1.0 BILLION



ENERGY EFFICIENCY

10%

REDUCTION POTENTIAL

$257 MILLION

PUBLIC BUILDING RETROFITS ANNUAL SAVINGS

$6.0 BILLION

BUILDING CODE UPDATES ANNUAL SAVINGS

79,749

RELATED JOBS

$16.5B

OF NORTH CAROLINA'S CLEAN ENERGY REVENUE

1,650

FIRMS IN NC

$8.3 BILLION

STATEWIDE ENERGY SAVINGS

HOW MUCH

is **43.7 MILLION** METRIC TONS OF CO_2?

CO_2

IT IS EQUIVALENT TO:

9.3 MILLION

CARS DRIVEN IN ONE YEAR

4.9 BILLION

GALLONS OF GASOLINE CONSUMED

10,972

WIND TURBINES RUNNING FOR ONE YEAR

51 MILLION

ACRES OF US FOREST

Energy Efficiency Sector in NC

RESIDENTIAL RETROFITS ANNUAL SAVINGS

$1.8 BILLION

COMMERCIAL & INDUSTRIAL RETROFITS ANNUAL SAVINGS

$1.7 BILLION

ENERGY EFFICIENCY

16.8%

REDUCTION POTENTIAL

$420 MILLION

PUBLIC BUILDING RETROFITS ANNUAL SAVINGS

$10.0 BILLION

BUILDING CODE UPDATES ANNUAL SAVINGS

101,029

RELATED JOBS

$17.5B

OF NORTH CAROLINA'S CLEAN ENERGY REVENUE

1,750

FIRMS IN NC

$13.9 BILLION

STATEWIDE ENERGY SAVINGS

HOW MUCH is 72.9 MILLION METRIC TONS OF CO_2?

IT IS EQUIVALENT TO:

15.5 MILLION

CARS DRIVEN IN ONE YEAR

8.1 BILLION

GALLONS OF GASOLINE CONSUMED

18,286

WIND TURBINES RUNNING FOR ONE YEAR

85 MILLION

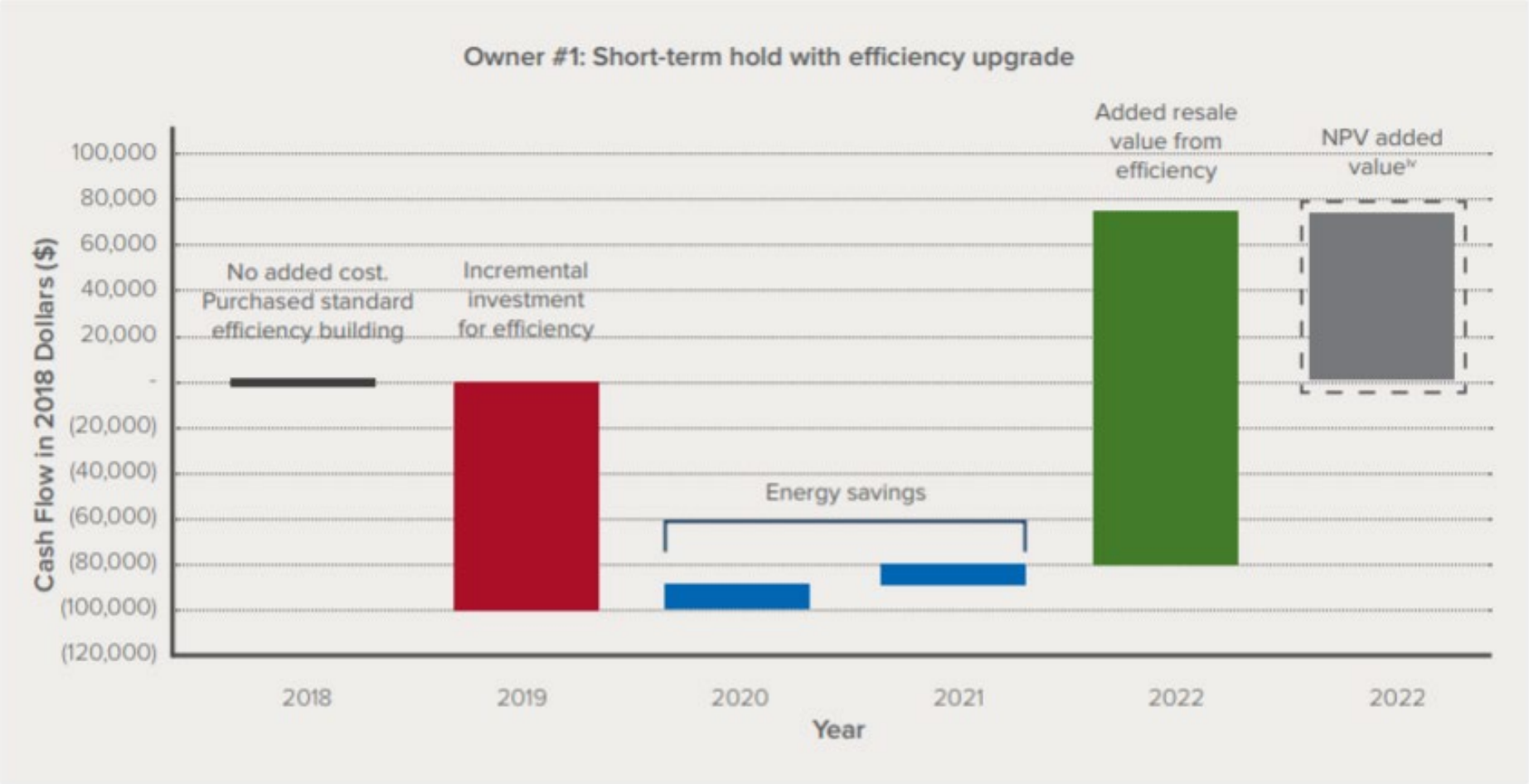
ACRES OF US FOREST

To Achieve 16.8% Energy Savings

	5% Savings	10% Savings	16.8% Savings
Energy Saved (BTU)	*99 Trillion*	*199 Trillion*	*331 Trillion*
Energy Code Savings $	$3.0 Billion	$6.0 Billion	$10.0 Billion
Public Buildings Savings $	$129 Million	$257 Million	$429 Million
Commercial Buildings Savings $	$508 Million	$1.0 Billion	$1.7 Billion
Residential Buildings Savings $	$538 Million	$1.1 Billion	$1.8 Billion
Total Savings $	**$4.2 Billion**	**$8.3 Billion**	**$13.9 Billion**
Total Investment $	**$798 Million**	**$1.6 Billion**	**$2.7 Billion**
Net Savings $ / %	**$3.4 Billion 526%**	**$6.7 Billion 519%**	**$11.2 Billion 515%**

Risk and Return on Investment

SHORT-TERM HOLD WITH EFFICIENCY UPGRADE



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What are the Barriers?

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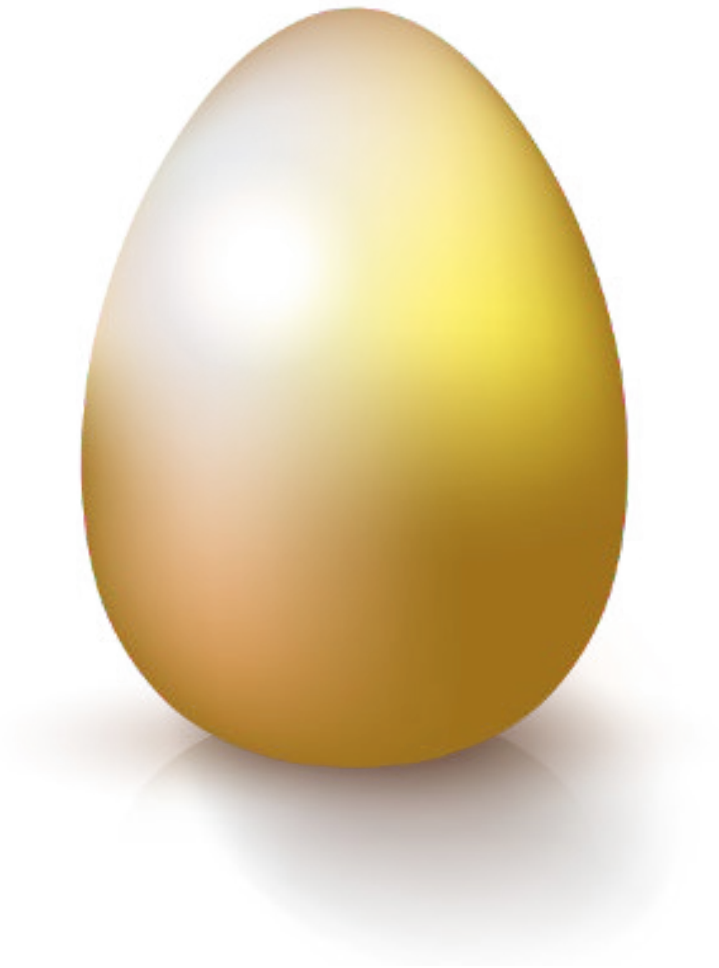
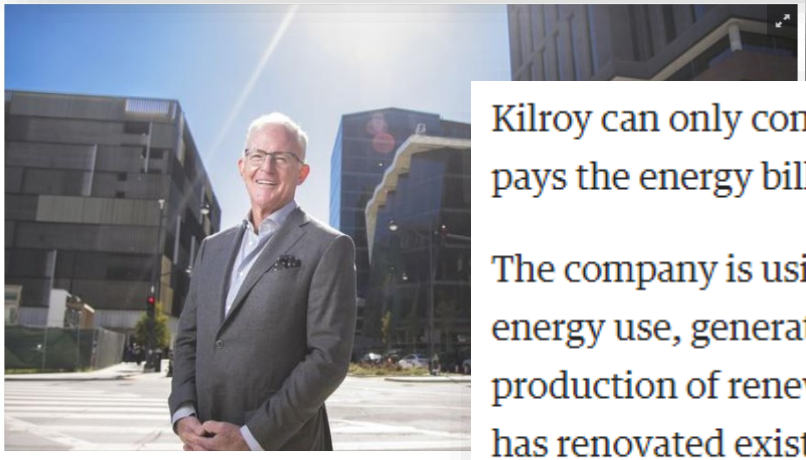
Building Owner & Operator Education



Up-Front Costs vs. Benefits

Kilroy Realty Corp. wants to be the first major landlord to achieve carbon neutral operations



John Kilroy, chairman of the board, president and CEO of Kilroy Realty Corp.
TODD JOHNSON | SAN FRANCISCO BUSINESS TIMES

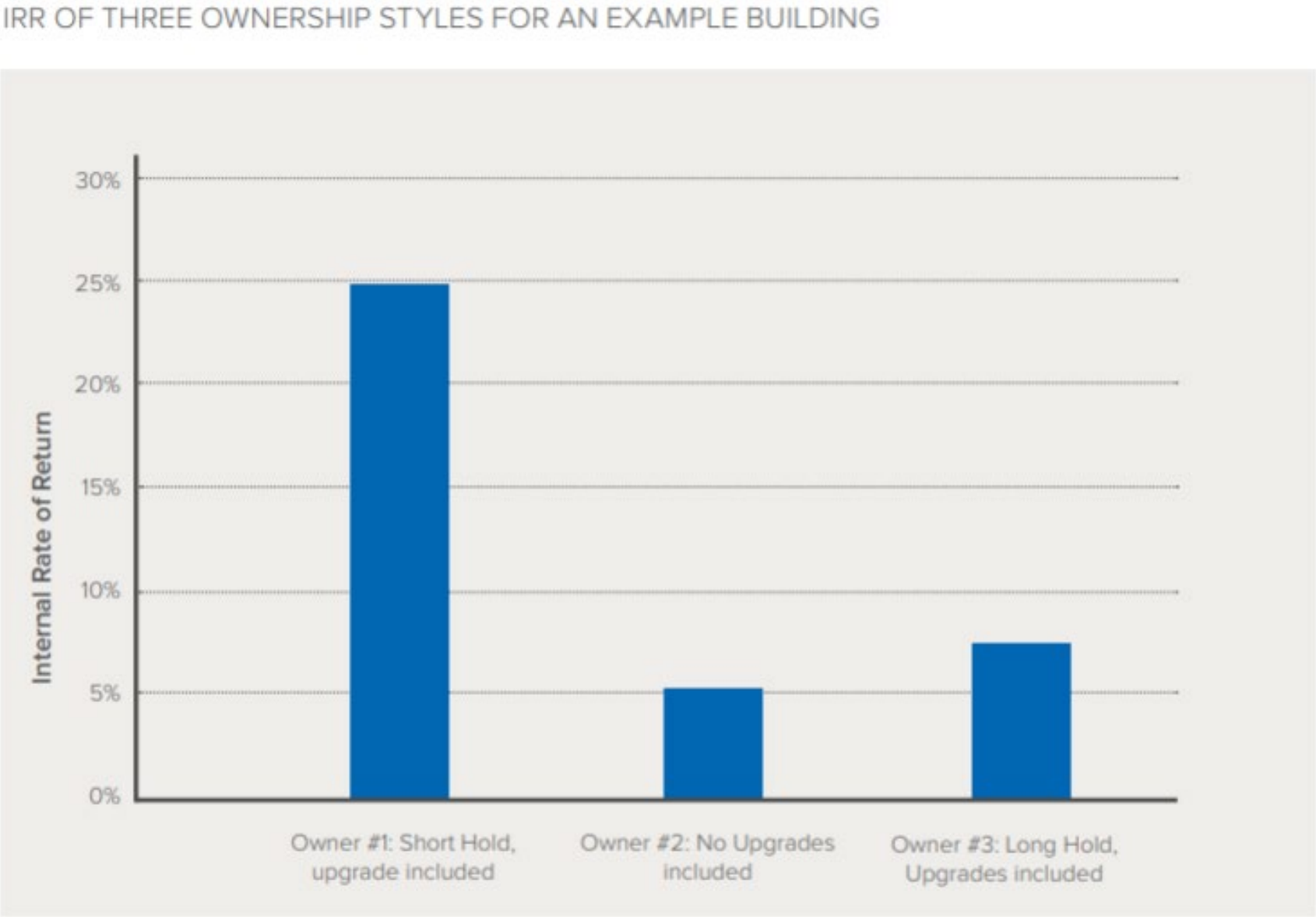
Kilroy can only control the emissions offsets for properties where the landlord pays the energy bills as opposed to properties where tenants do.

The company is using a three-pronged approach to reach the goal: reduce energy use, generate energy onsite using solar panels and pay for offsite production of renewable energy. Within the last several years, the company has renovated existing buildings and developed new buildings to achieve LEED, the popular green building certification.

"Once you get your low-hanging fruit out of the way, we believe in innovation – coming up with better and better technology," said Sara Neff, senior vice president of sustainability at Kilroy.

"We are a long-term owner. We do what we think is best for our company and community," Kilroy said. "I personally don't believe the real estate industry has pushed into sustainability nearly enough. We hope we can get more people to come along in this direction."

Short-Term ROI Needed



Workforce Concerns

BUILDER

COMMERCIAL CONTRACTORS FRET OVER SHORTAGE OF LABOR

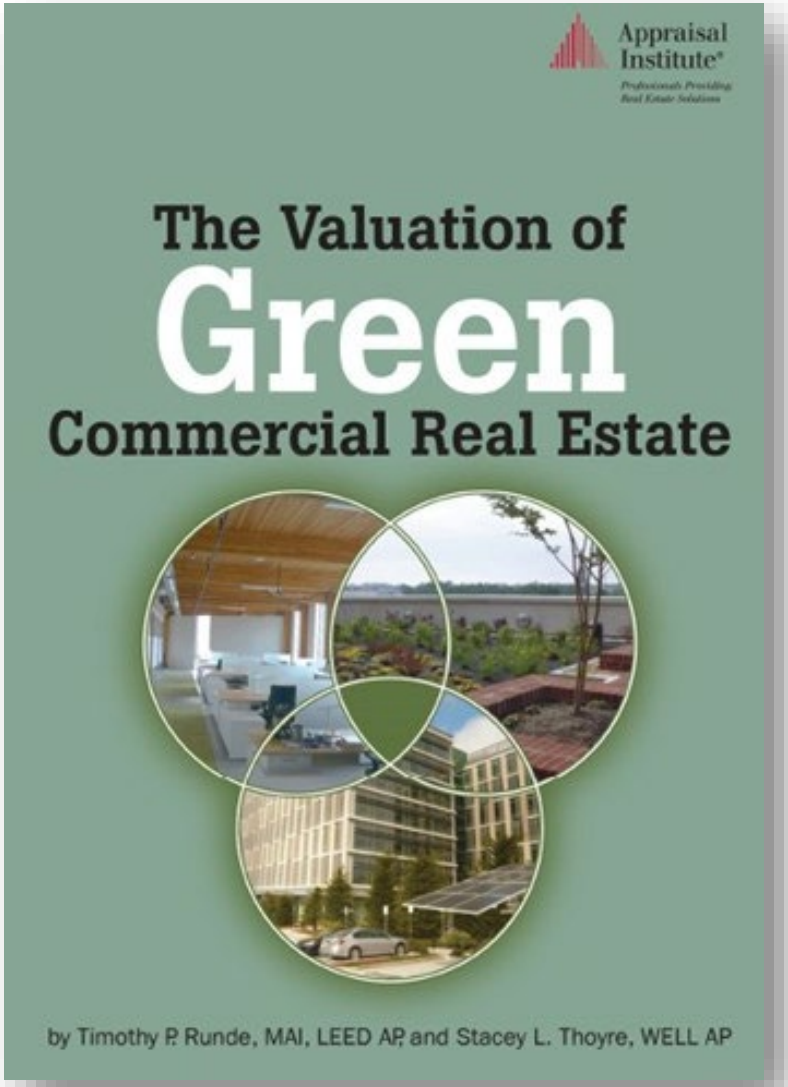
USG, US COC index says more than 90% expressing concern.

Photo Courtesy of Adobe Stock

Findings from the Q2 2018 USG Corporation + U.S. Chamber of Commerce Commercial Construction Index (Index) show four straight quarters with more than 90% of contractors concerned over labor shortages.

Concerns increased quarter-over-quarter, with 47% of respondents expecting problems finding skilled workers to worsen in the next six months.

Market Valuation



Real Estate Portfolios

The Split Incentive

Lease = an agreement between two parties (the owner and the tenant)

It sounds legalistic (and okay, it is). But at heart, green or energy-aligned leasing encourages behavior that will reduce energy use in buildings, while saving money for owners and tenants.

Split incentives

Wants to make his building more energy-efficient. But if he pays for upgrades, why should his tenants get all the benefits at no cost?

The Owner

Wants to be green, but pays a flat rate for utilities by the square foot. So she has no incentive to use less energy.

The Tenant

Enter the green lease

Industrial Opt-Out Info

Iowa governor signs bill critics say will 'eviscerate' efficiency programs

WRITTEN BY

Karen Uhlenhuth
May 7, 2018

PHOTO BY

Steve / Creative Commons

Iowa Gov. Kim Reynolds signed a bill Friday that critics say could largely evaporate utility-sponsored energy efficiency programs in the state.

The new law caps spending on the programs at levels substantially less than what utilities now spend. It also allows certain customers to stop paying fees that support the programs, and it omits rural electric cooperatives and municipal utilities, which serve about one-third of Iowa customers, from having to offer any programs.

The bill also takes a swipe at solar installations by allowing municipal utilities to discriminate against customers with their own generation. Iowa's 136 municipal utilities serve about 216,000 customers, or 13.5 percent of all electricity customers in the state.

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What Trends and Solutions Drive Growth?

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Net Zero Energy Buildings

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

Innovative Project Financing: C-PACE

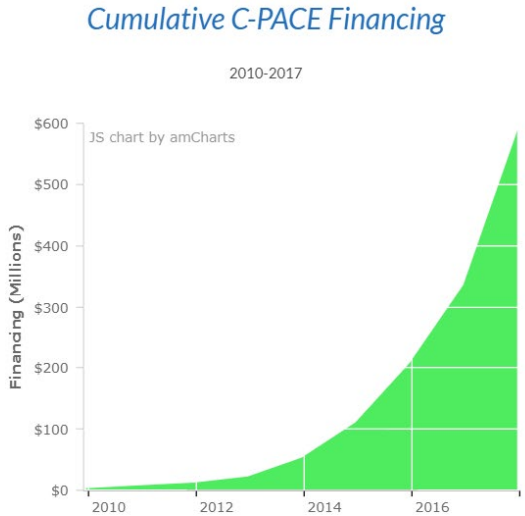
C-PACE OVERVIEW

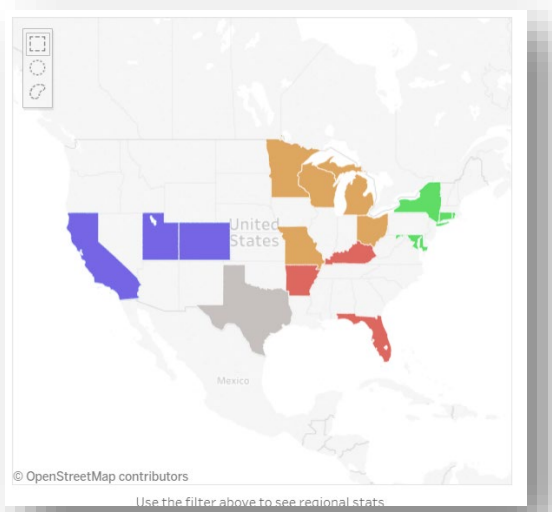
$712
Millions

1690
Commercial projects

10,700
Jobs created

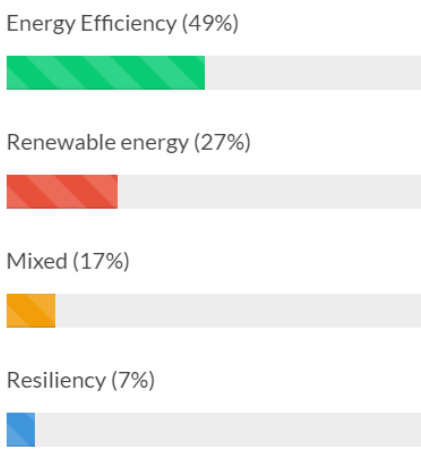
(Source: 15 jobs per million, EcoNorthwest)





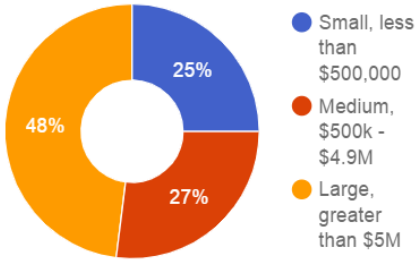
C-PACE improvement type breakdown

(By $ funded)



C-PACE projects by amount financed

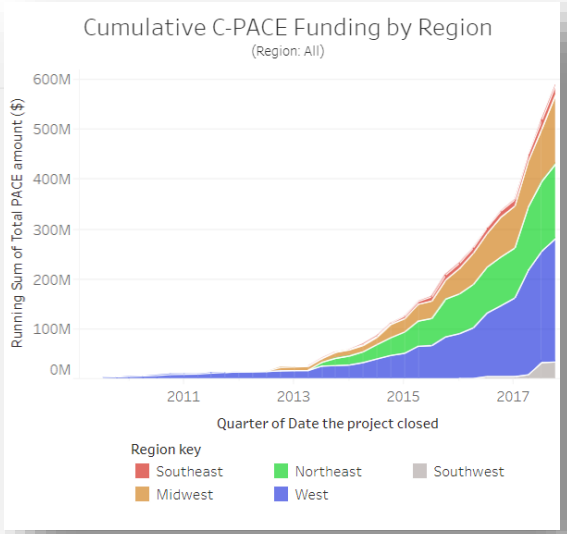
(By $ funded)



C-PACE dollars funded in each state (states > $10MM)

(By $ funded)

State	Total PACE amount ($, Millions)
CA	260
CT	127
MO	56
MN	51
OH	37
TX	36
DC	34
CO	25
MI	22
WI	18
FL	15
MD	11



Disaster Recovery & Code Reform

Act now to support updated building codes and disaster recovery reform

SEPTEMBER 20TH, 2018

by Dominic Sims

QUICK HITS

Hurricanes. Wildfires. Earthquakes. Tornados. Floods. The number and severity of natural disasters affecting our communities continues to increase each year. In 2017, between Hurricanes Harvey, Irma and Maria and the California wildfires, the loss of life was significant and damages exceeded $300 billion. And today, the images and stories coming out of North and South Carolina after Florence show the power of nature and the scale of the devastation.

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SUBMISSIONS

Check out upcoming BSJ topics and send us articles for consideration:

FAST COMPANY

09.14.18 | WORLD CHANGING IDEAS

How capitalism and climate change make a perfect storm for hurricane damage

Instead of preparing for inevitable hurricanes, coastal developers keep putting up houses they know will get destroyed–after they've made their money.

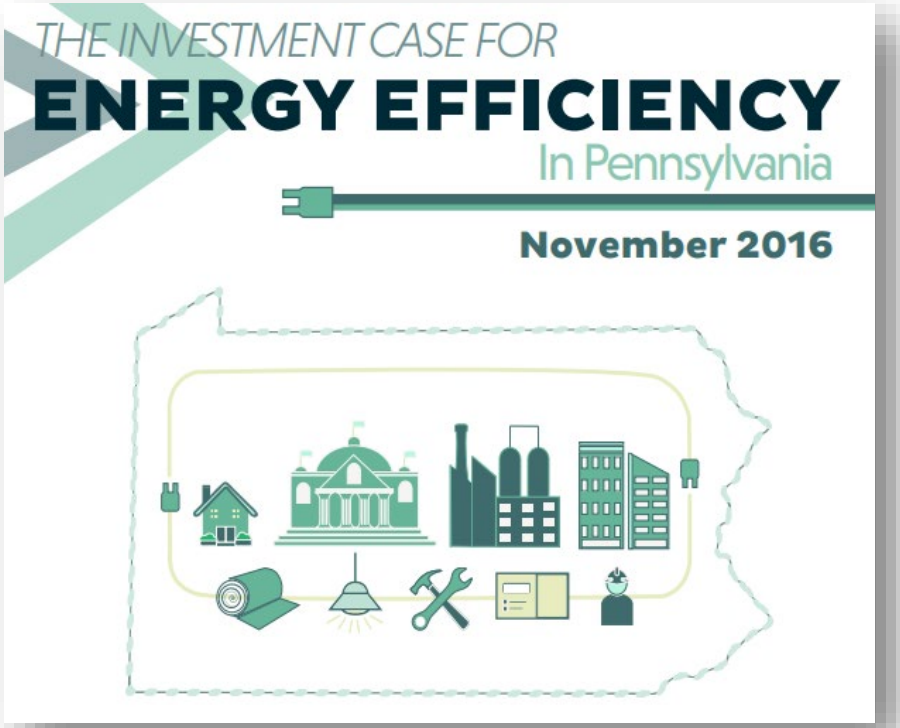
Envelope Commissioning

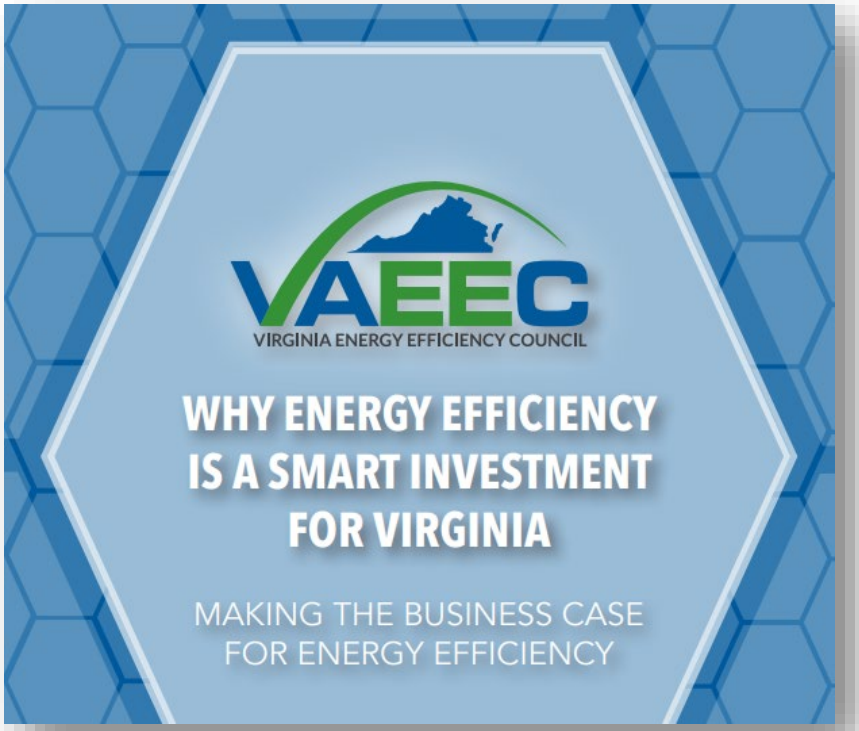
Cost of BECx

Building / Project Name	Total Project Cost	MEP Cx Costs	BECx Costs	Envelope Issues?	Forensic Testing
School of Dental Medicine	$ 60 M	$ 370 k	$ 32 k	No	$0
Heart Institute	$ 60 M	$ 243 k	Not Done	Yes	$58k
Health Sciences Building	$ 61 M		Not Done	Yes	$300k +
Gateway Residence Hall	$ 58 M	$ 323 k	$ 64 k	No	$0
White Residence Hall	$ 20 M		$ 44 k	No	
Clement Residence Hall	$ 20 M	$ 30 k	$ 60 k	No	
Student Union	$ 122 M	$ 537 k	$ 181 k		

Building and Energy Code

State Policy Investments & Mandates





Arkansas PSC increases energy efficiency goals for electric utilities

Posted By Max Brantley on Fri, Jul 13, 2018 at 4:24 PM

The **Arkansas Public Service Commission** today ordered higher energy efficiency goals for electric utilities. The Sierra Club and Audubon Arkansas lauded the PSC decision.

What's the Starting Point?

In North Carolina, low-hanging fruit of energy efficiency is going to waste

WRITTEN BY

Elizabeth Ouzts
September 4, 2018

PHOTO BY

Aine / Creative Commons

Correction: North Carolina lagged behind 31 states in progress toward its 2017 energy efficiency potential. An earlier version of this story misstated its ranking.

A decade ago, energy conservation was widely viewed as the 'low-hanging fruit' of clean energy policy in North Carolina, the cheapest and easiest way to reduce fossil fuel consumption and cut pollution.

Now, experts say too much of that fruit is rotting on the ground.

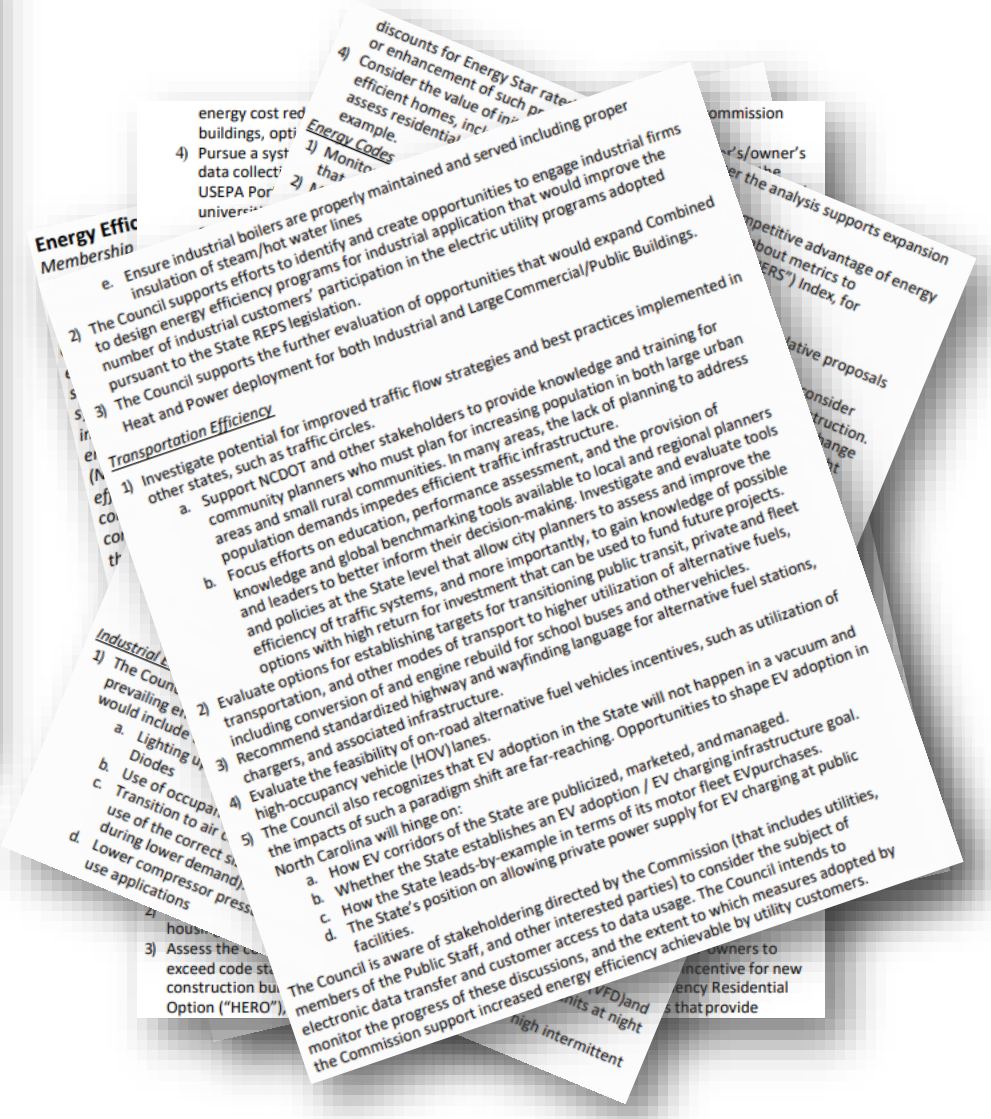
Building EE Policy Support in NC

NORTH CAROLINA
Department of Environmental Quality

Energy Policy Council

Biennial Report

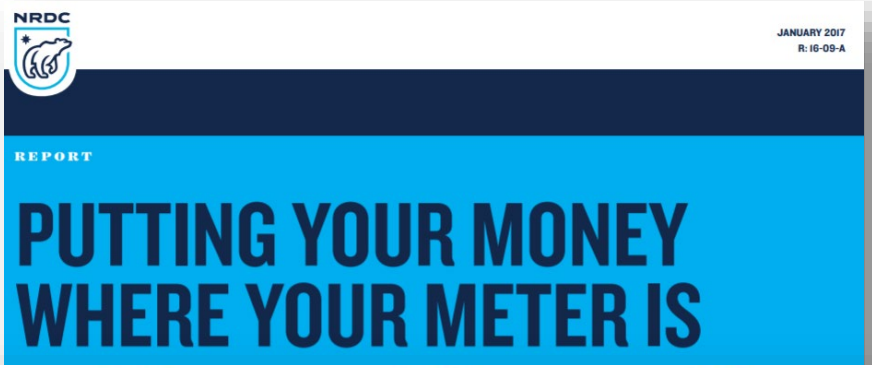
May 2018

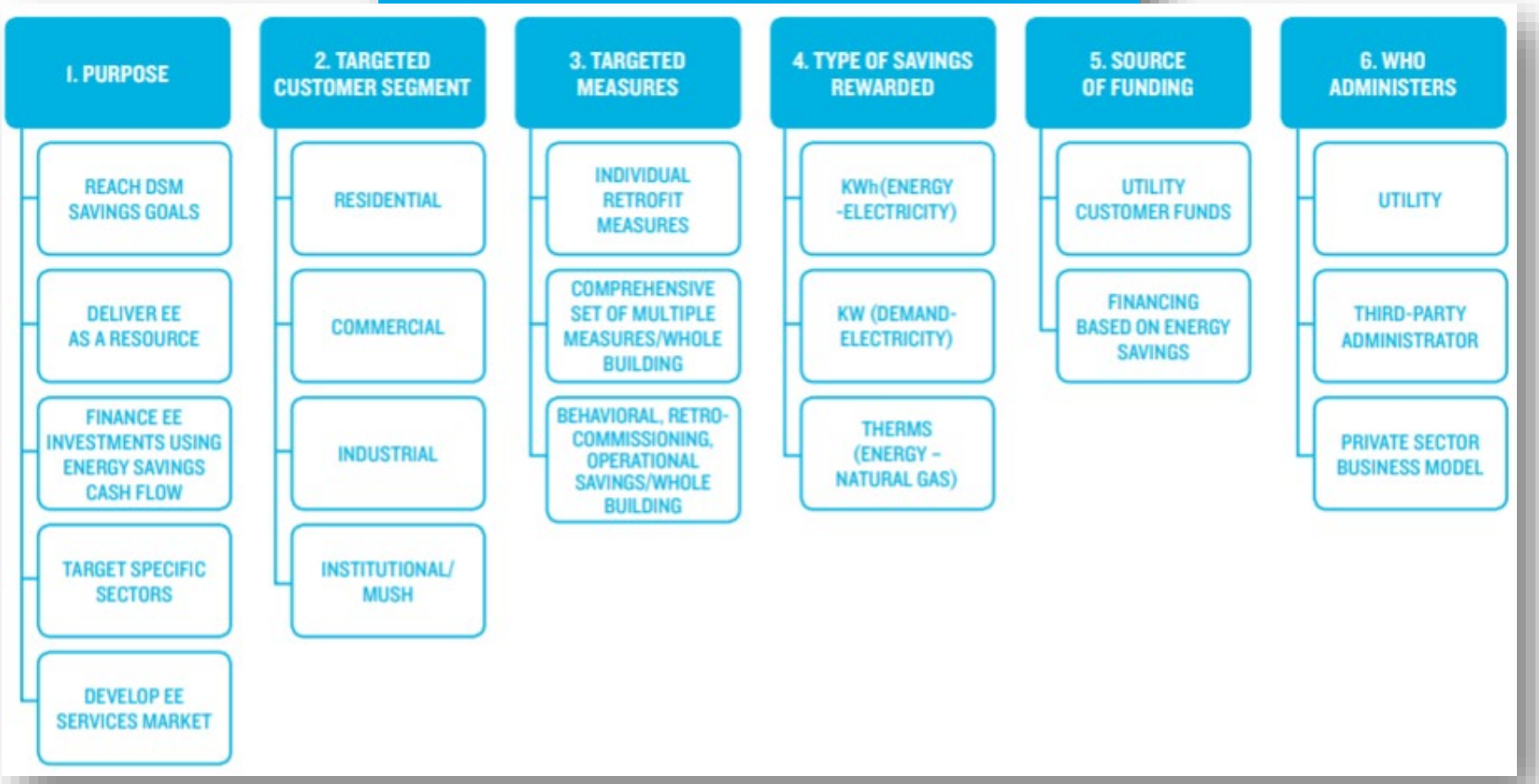


Utility Cost Effectiveness Testing

Laws, Regs, Orders:	Policy Goals Reflected in Laws, Regulations, Orders, etc.					
	Low-Cost	Fuel Diversity	Risk	Reliability	Environ-mental	Economic Development
PSC statutory authority	X			X		
Low-income protection						X
EE or DER law or rules	X	X	X	X	X	X
State energy plan	X	X	X	X	X	X
Integrated resource planning		X	X		X	X
Renewable portfolio standard		X	X		X	X
Environmental requirements					X	

Pay-For-Performance Programs





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Case Studies

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Host Hotels' Capital Planning Process

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.

Cushman & Wakefield

BUILDING INFORMATION
Cushman & Wakefield Inc. TENANT NAME
The Durst Organization / Port Authority of New York & New Jersey (PANYNJ) BUILDING OWNER
One World Trade Center, New York, NY LOCATION
10 years LEASE TERM
5,932 square feet PROJECT SIZE

FLOOR 45 BUILDOUT	
Energy reduction	
Annual electricity reduction	kWh/SF
Total electricity savings over le	Wh/SF
Adjusted incremental impleme	l / SF
Total electricity cost savings ov	l / SF
NPV of project investment	$49,541 total Total / SF
ROI over lease term	359%
IRR	78.6%
Payback period (with incentives)	1.7 years

https://tenantenergy.uli.org/case-study/cushman-wakefield-inc/

American Geophysical Union in DC

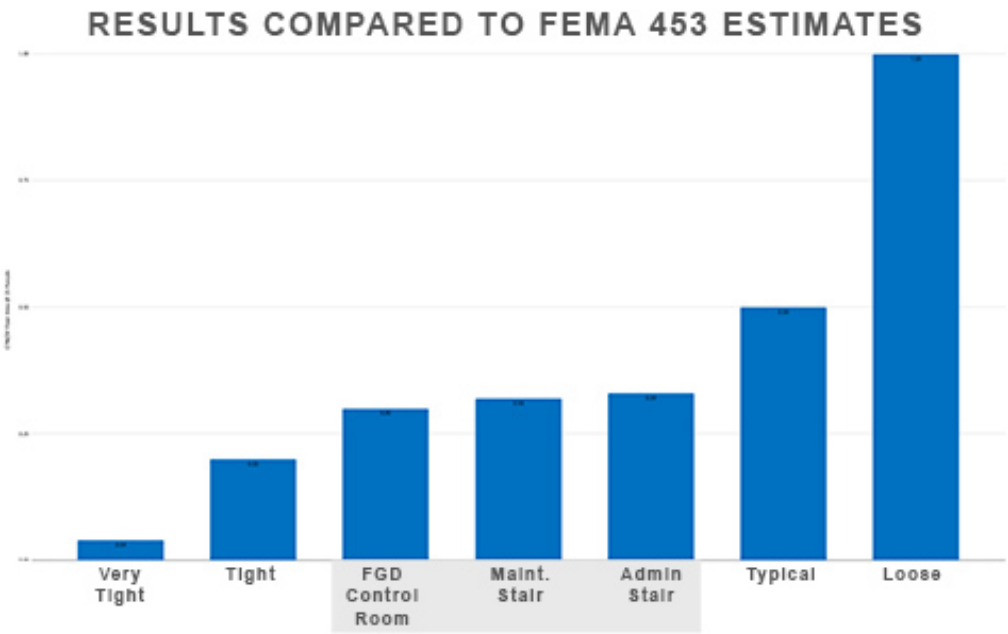
American Geophysical Union building under construction in Washington, D.C. (Kevin Koski)

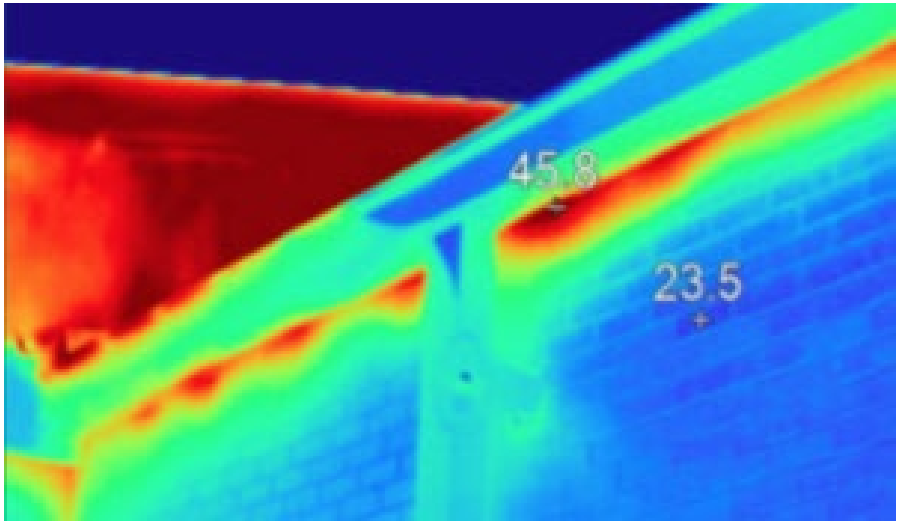
Major Renovations Targeting Zero Net Energy

Washington, D.C., will soon get its first multitenant, gut-rehab, net-zero office building. The American Geophysical Union (AGU) project, led by MGAC, Hickok Cole Architects, Interface Engineering, Skanska, and Stratacomm, is striving to relaunch the nonprofit organization's 84,000-square-foot (7,800 sq m) headquarters to be net zero, using an array of technologies to make the building both super-efficient and innovatively renewable.

HPBS Case Studies

HIGH PERFORMANCE BUILDING SOLUTIONS





Optima Engineering Retrofit

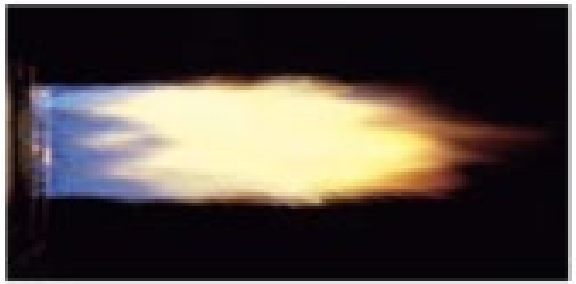
FEATURED PROJECT – LOCAL GOVERNMENT CREDIT UNION OFFICE

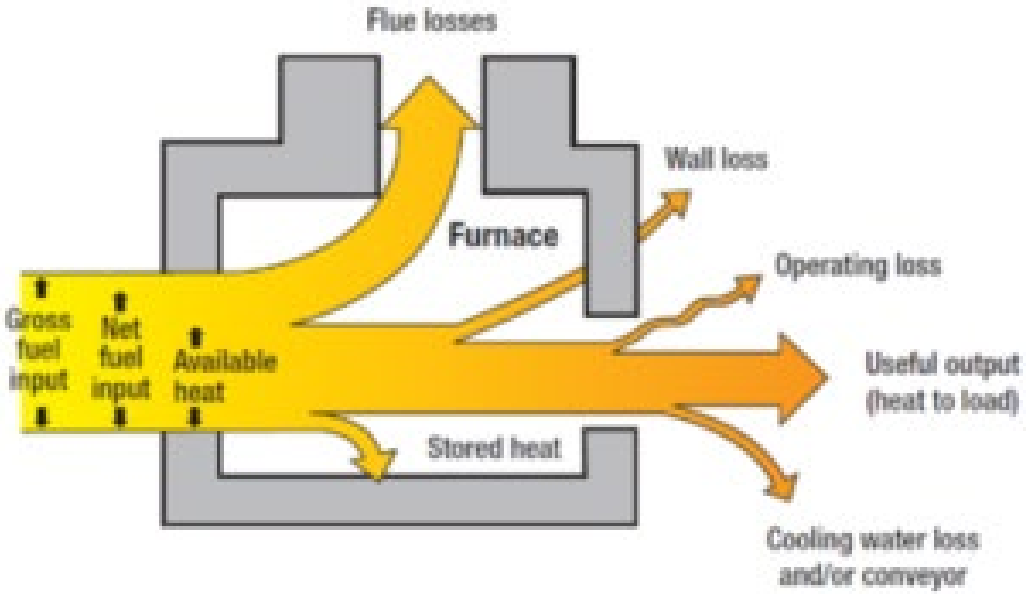
Optima Engineering teamed up with Gensler Raleigh to help transform this outdated, traditional financial institution into a State-Of-The-Art, modern facility. The existing building is an approximately 100,000 square foot facility, with many systems already in place, however all equipment had to be replaced due to age and current code compliance requirements. The building was fitted with a new Building Automation System using DDC technology to control all of this new equipment. Existing lighting was removed as it was old and inefficient, and was replaced with LED fixtures. The plumbing system needed to be replaced to conform with new code regulations, therefore new water-efficient fixtures were installed.

- 100,000 SF, 4-story office building renovation
- All equipment replaced to comply with current building code requirements
- New Building Automation System using DDC Technology
- High-efficiency air-cooled chiller
- 4-pipe chiller water & boiler system
- New LED light fixtures
- Fire alarm replaced with new addressable system
- Stand-by 1250Kw diesel powered generator

Combustion Waste Heat

- 107,388,000 MMBTUs
- 40% of 20%
- 210,000





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Steps to High Performance Retrofits

Retrofit Conference

October 9, 2018

Steps to High Performance Retrofits

- Research.
- Understand options.
- Set goals.

- Identify rebates, incentives and financing options.

- Formulate baseline metrics.
- Align with goals.

- Plan for efficiency and performance first.
- Incorporate valuation best practices.

- Add-on renewables, storage and other energy options as needed.

- Design and build.
- Commission.
- Work with experts.

- Monitor performance.
- Analyze data.
- Make improvements.
- Keep monitoring.

Hire an Expert

Hire a Building Scientist:

- HVAC
- Envelope/enclosure
- MEEP commissioning

Use an Energy Services/Performance Contractor:

- ESCOs are paid through actual energy and water savings after retrofit projects take place, lowering the up-front cost to little or nothing to the owner.

High Efficiency HVAC, controls and automation are key.

Specific Retrofit Projects

Replace natural gas appliances and systems with electric.

- Doing so provides greater flexibility for benefiting from improvements to electricity-based energy efficiency and renewable energy sourcing

Incorporate solar-capable roofing for future applications.

Replace major HVAC and water heating systems with high efficiency.

Add high performance roofing, siding and insulation.

Replace windows – when the time is right.

Considerations for Rentals

Use green leases and create a feedback loop for tenants on energy and utility usage.

Adjust energy/utility charges based on conservation/usage.

Install low-/no-cost Energy Conservation Measures (ECMs).

Lighting retrofits are high ROI.

Promote increased comfort and customer satisfaction.

Install sub-meters so that tenants can be charged for the electricity they actually use and benefit from savings.

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Additional Resources

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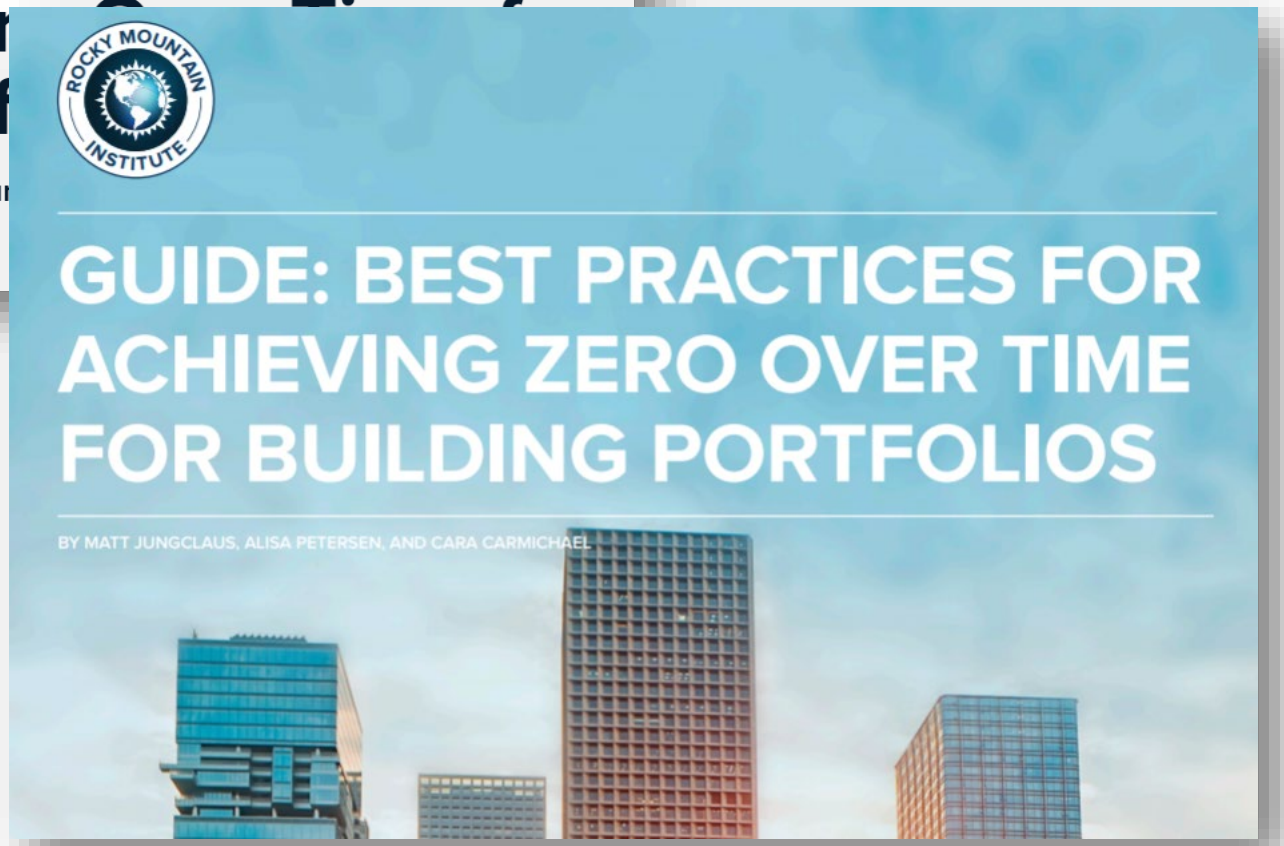
Net Zero Energy Buildings



Tenant Energy Optimization Program

Urban Land Institute

ULI Tenant Energy Optimization Program

PROVEN, REPLICABLE PROCESS THAT DELIVERS RETURNS

The Tenant Energy Optimization Program integrates energy efficiency into tenant space design and construction and delivers excellent financial returns through energy conservation.

BENEFITS

Tenants using the step-by-step design and construction process typically demonstrate energy savings of 30 to 50 percent, have payback periods of three to five years, and average a 25 percent internal rate of return (IRR).

View Benefits

PROCESS

The foundation of the program is a ten-step process that details pre-lease, design and construction, and post-occupancy phases. The process emphasizes the importance of collaboration among tenants, building owners, and service providers.

View Process

Pay-For-Performance Programs

NRDC

JANUARY 2017
R: 16-09-A

REPORT

PUTTING YOUR MONEY WHERE YOUR METER IS

A STUDY OF PAY-FOR-PERFORMANCE ENERGY EFFICIENCY PROGRAMS IN THE UNITED STATES

Prepared for the Natural Resources Defense Council and Vermont Energy Investment Corporation

BuildingPerformanceNC.org

BUILDING PERFORMANCE NORTH CAROLINA

ABOUT | FAQ | RETROFITS | EXISTING BUILDINGS | NEW BUILDINGS | HIRE PROFESSIONALS

- Improve Building Performance
- Leisure and Hospitality
- Warehouses and Data Centers
- Agricultural
- Governmental and School
- Commercial and Office
- Multifamily
- Retail Stores
- Healthcare Facilities

Features of High Performance Buildings

Properly Designed, Sized, Installed, Sealed Controlled and Maintained Heating, Air and Ventilation (HVAC) System(s).

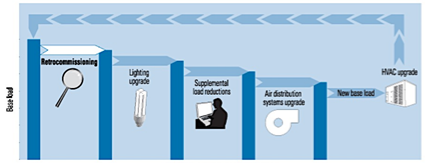
The U.S. Department of Energy estimates that the average U.S. building loses 20 to 30 percent of treated air through leaks.

What You Can Do: Inspect the supply and return ducts, collars and fittings, and areas where ducts connect to the supply registers. Use sealants or sealant tape to patch holes and leaky areas in the HVAC system. Avoid duct tape; this misnomer fails quickly in the presence of rapid temperature fluctuations. Insulate the duct work wherever possible with duct insulation sleeves, foil backed self-adhesive foam, or fiberglass batting.

- ENERGY STAR Ductless Heating and Cooling
- A Guide to High-Performance HVAC
- Information on insulation and duct sealing.
- Information on duct sealing.
- HGTV's guide to duct sealing
- Is the thermostat panel blank? Is the gas furnace not working? Before calling a specialist, check out this list of HVAC tips to find answers to common HVAC problems.
- Checking the HVAC system for leaks is simple. Learn how to find and fix leaks.
- No HVAC problems? Keep it that way; Check out ENERGY STAR's Heating and Cooling Maintenance Checklist.

Hire a Professional: Seal holes in ducts with aeroseal's duct sealing technology. Duct Sealing (aeroseal)

Upgrades: Where to Begin?



Stages of an integrated upgrade approach

Leisure and Hospitality Buildings Include:

- Hotels and motels
- Gyms, natatoria, and recreational buildings
- Sports stadiums
- Music and theater arenas

Hotels/Motels

- Energy expenses constitute the largest segment of the operating budget for hotels and motels after labor costs.
- The EPA estimates that each 10 percent reduction in energy use is equivalent to improving average room rate by $1.35 in full-service hotels ($0.62 for limited-service hotels).
- Studies have shown that commissioning can save a typical 100,000-ft2 hotel 10 to 15 percent of its energy costs, or roughly $20,000 per year

Common reasons for initiating energy-related upgrades in hotels and motels include:

- Customer complaints
- Corporate sustainability policies
- Frequent equipment malfunctions and shortened equipment lifetime due to years of deferred maintenance
- Piecemeal additions to buildings and internal changes to existing spaces that have not been accompanied by corresponding changes to heating and cooling systems
- Previous attempts to reduce energy use by inappropriate measures, such as covering vents
- Major pieces of capital equipment or building elements, such as a boiler or a roof, that are nearing the end of their useful life

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Retrofitting in Today's Market

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