Cashing in on Zero: Insights on Net-Zero Energy Developments

SA 205

Saturday, June 23, 2018

1.5 Learning Units

A'18 AIA Conference on Architecture 2018
June 21-23, New York City

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Questions related to specific products and services may be addressed at the conclusion of this presentation.

Speakers List

Susan McFaddin – President, Seven Generations: Panelist

Victor Olgyay, AIA – Principal, Rocky Mountain Institute: Panelist

Andrew Bush – Principal, Morgan Creek Ventures: Panelist

Ralph DiNola, LEED Fellow – CEO, New Buildings Institute: Moderator

Course / Learning Objectives

- Understand and communicate the clear business case for net-zero energy developments.
- Implement similar energy and financial models to support new and emerging net-zero energy projects
- Apply lessons learned from three real-world case studies of profitable net-zero energy building developments.
- Utilize a toolkit of contacts and resources that they can draw on when undertaking net-zero energy development projects.

Agenda

Introduction

- Revive
- Hazelwood Green
- Boulder Commons

Questions and Answers

2018 Getting to Zero National Status Update

Ralph DiNola

Chief Executive Officer

New Buildings Institute

nbi new buildings institute

What is a Zero Energy Project?

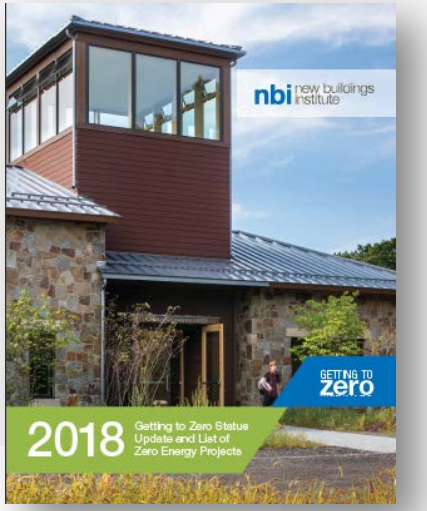
A Zero Energy (ZE) project* is highly energy efficient and meets 100% of its annual energy needs from renewable sources.

- ***Energy*** = *All energy (electricity, gas, steam, delivered fuels, etc.) consumed on site*
- ***Net*** = *One year or more of on-site renewable energy production minus energy use*
- ***Verified*** = *Minimum of one year of documented performance at net zero*
- ***Emerging*** = *ZE commitment, not yet a year of data (on a path to ZE)*
- ***EUI*** = *Energy Use Intensity in kBtu/sf/yr - metric of energy performance.*

**Also known as Net Zero Energy (NZE), or Zero Net Energy (ZNE). Zero Energy Building (ZEB)*

Proving Feasibility by Tracking Trends and Growth

700% growth since 2012 with nearly 500 projects



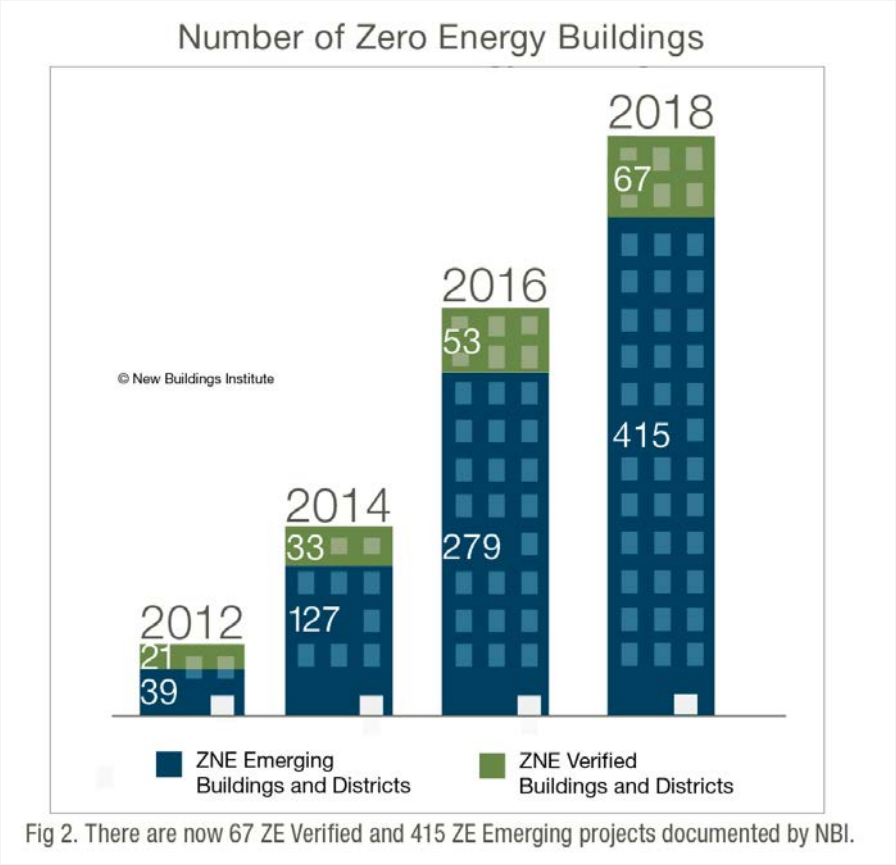


Fig 2. There are now 67 ZE Verified and 415 ZE Emerging projects documented by NBI.

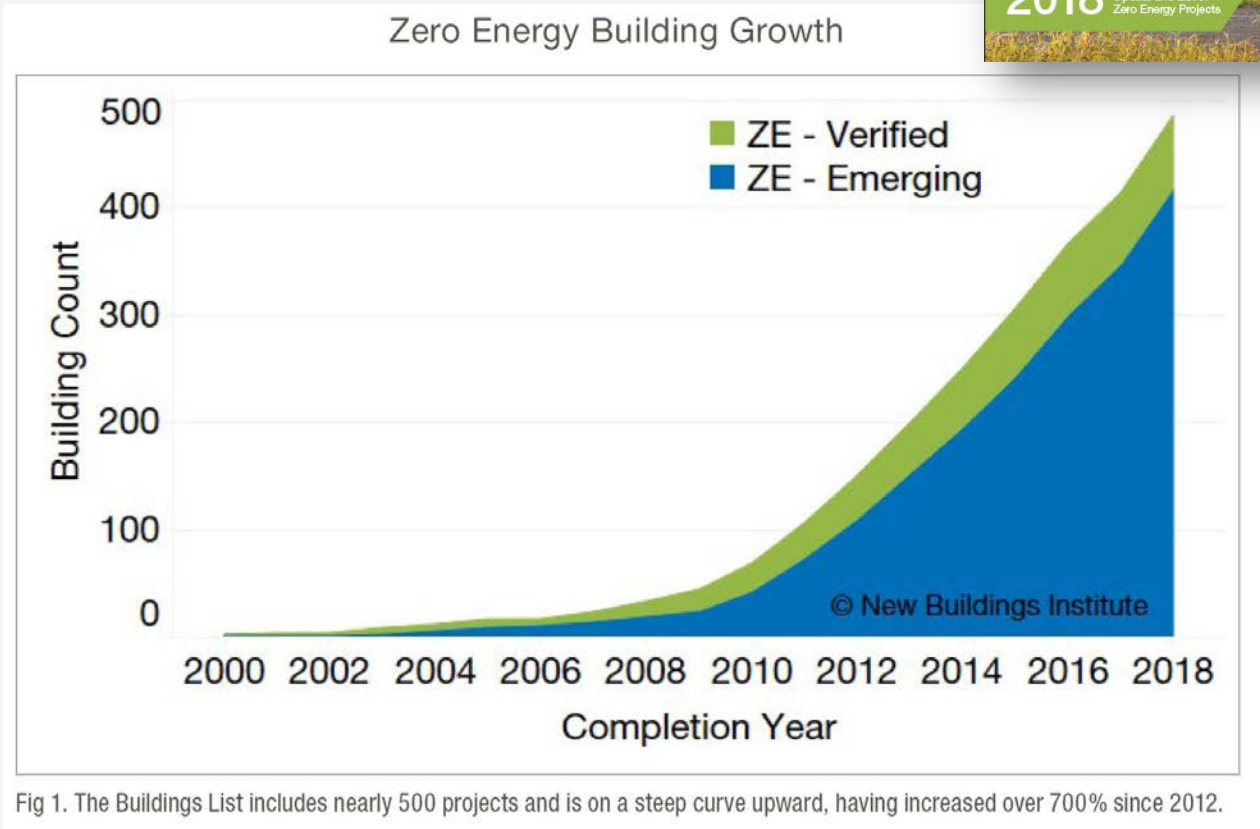


Fig 1. The Buildings List includes nearly 500 projects and is on a steep curve upward, having increased over 700% since 2012.

Trending Toward Larger Buildings

- More than 40% of all buildings and **88% of the total floor space of ZE Emerging buildings are 50,000 sf or larger.**
- **List of experienced practioners** is increasing:
  - 70 Mechanical/Electrical Firms
  - 101 Architecture Firms

Top ZE MEP Companies	Top ZE Architect Firms
Integral Group	EHDD
CMTA Engineers	Maclay Architects
PAE Engineering	HGA Architects
Stantec	HMC Architects
KPFF Consulting Engineers	ZGF Architects
Interface Engineering	BNIM
	Opsis Architecture

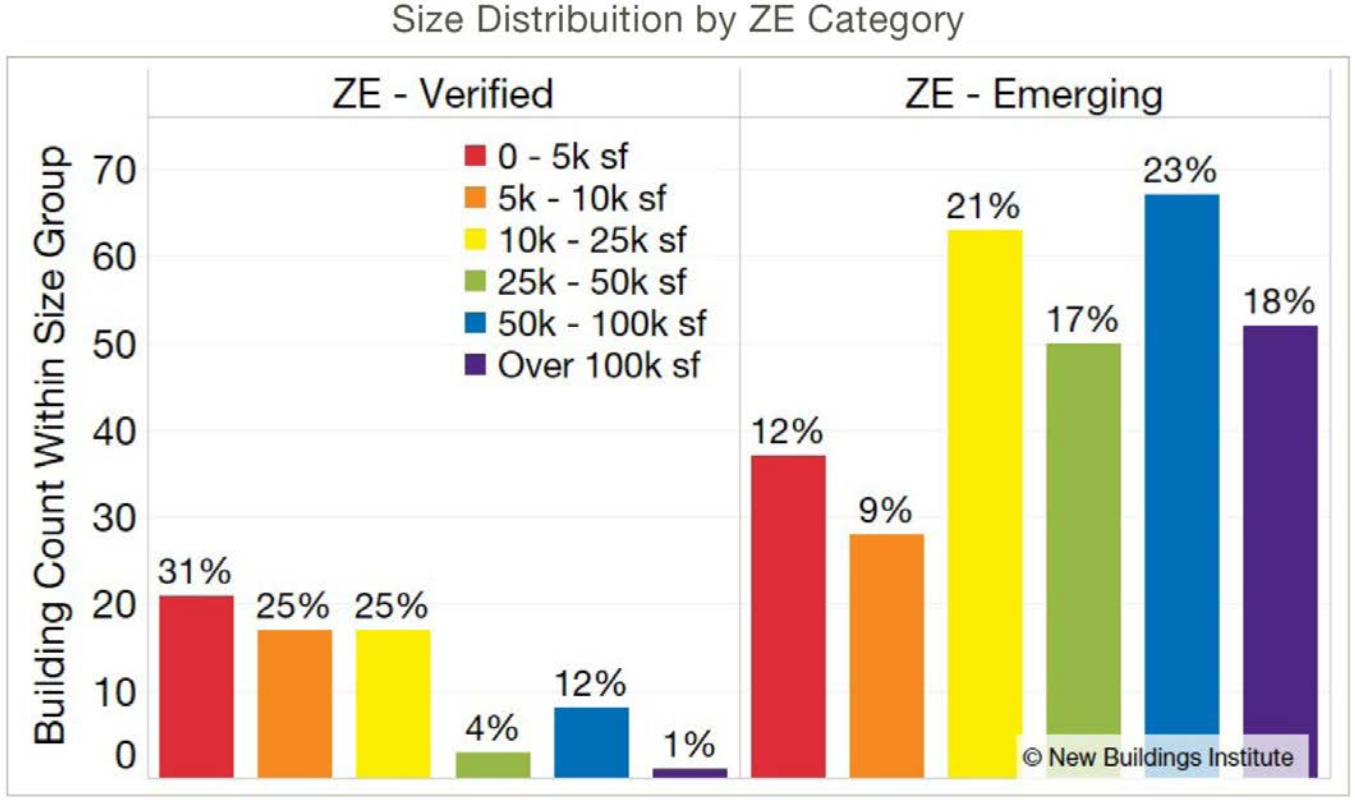


Fig 6. Nearly 30% of all buildings and 88% of the total floor space of ZE Emerging buildings are 50,000 sf or larger.

Schools Rule…

but many building types are getting to zero

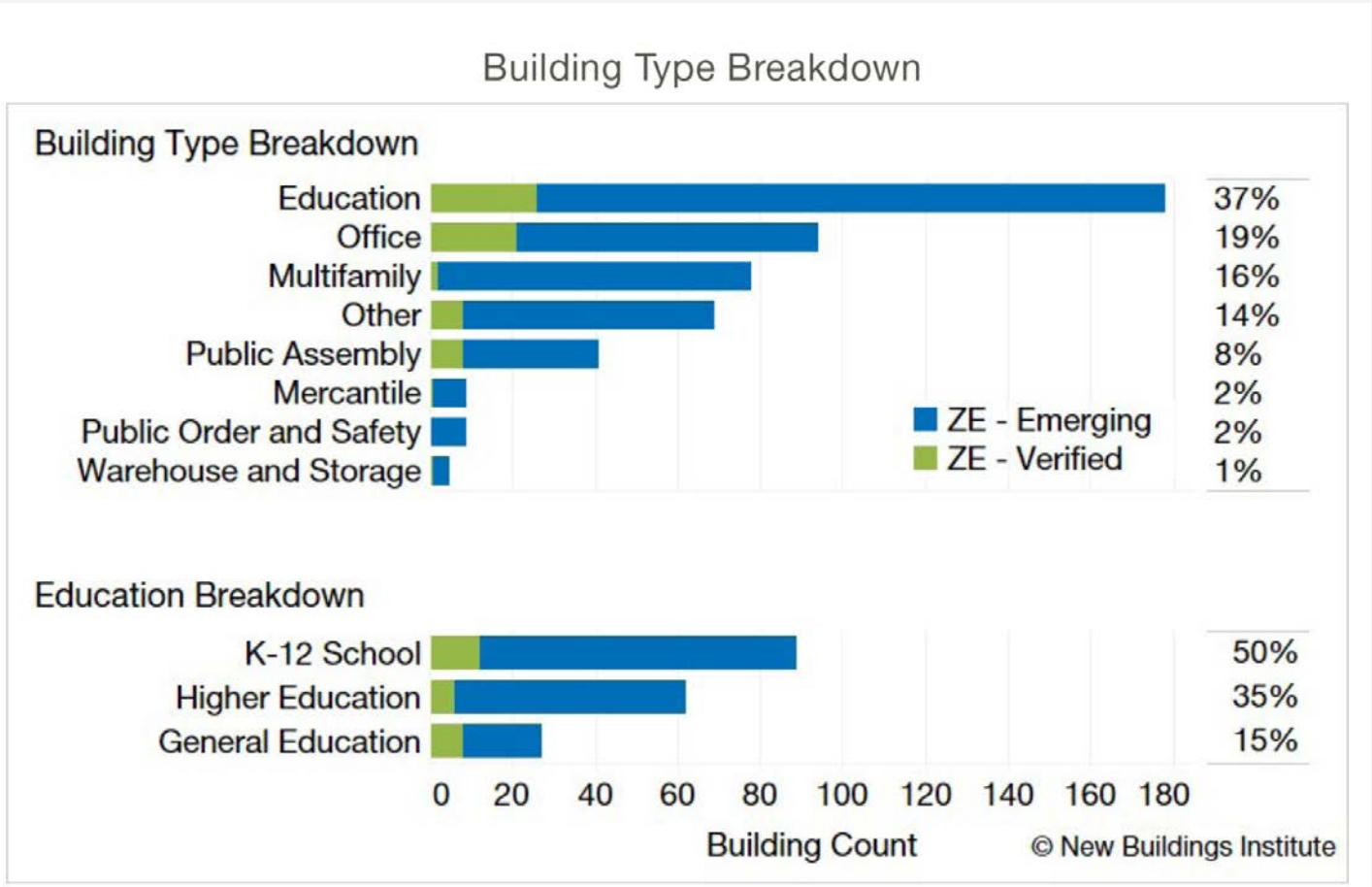


Fig 7. Zero energy buildings can be found across many different building types.

Private Sector is Paying Attention to ZE

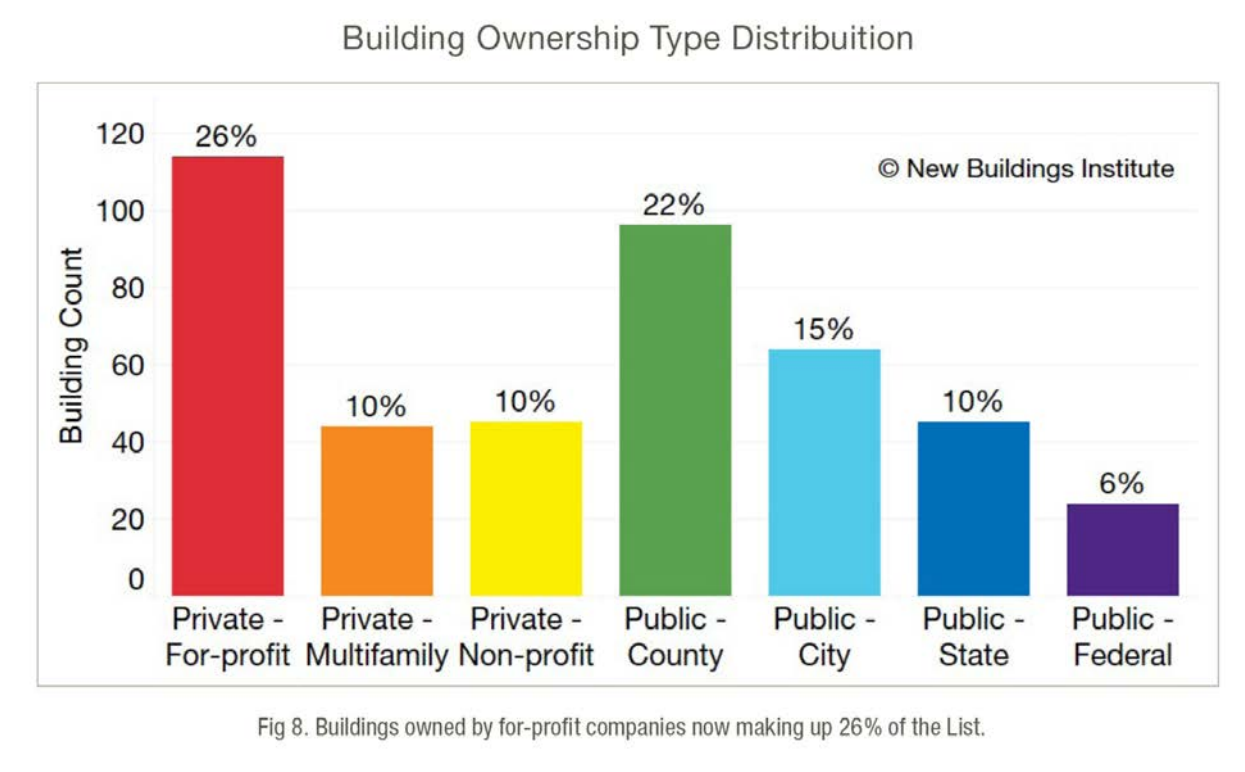


Fig 8. Buildings owned by for-profit companies now making up 26% of the List.

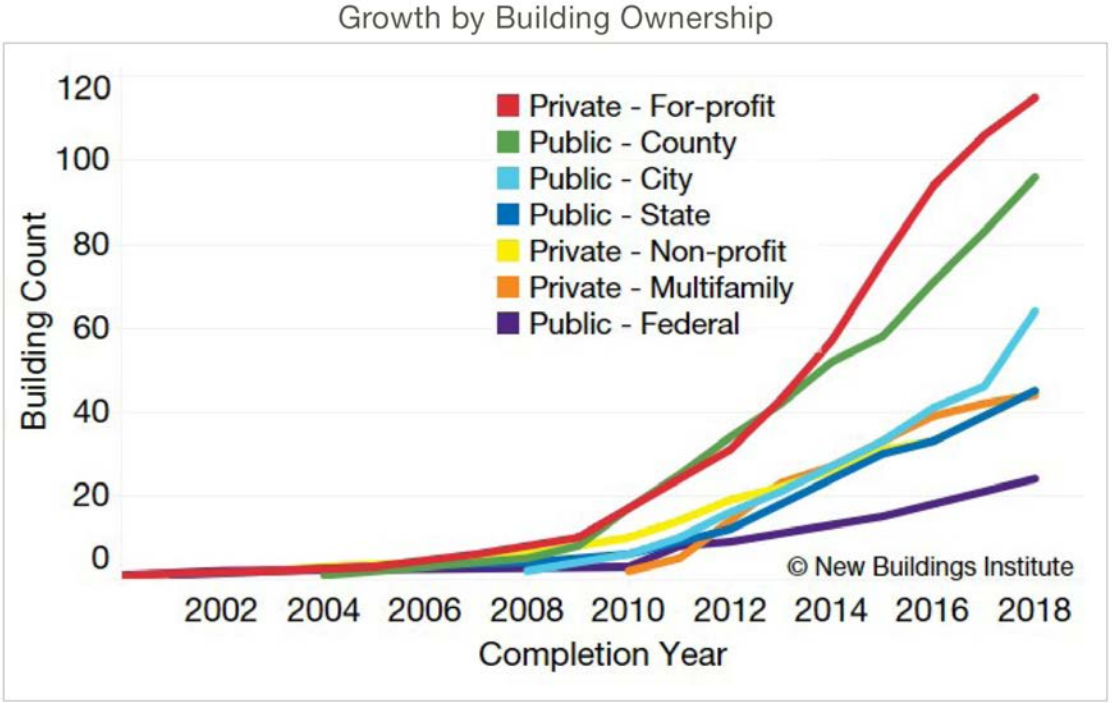


Fig 10. ZE Verified and ZE Emerging projects by ownership. Projects with missing ownership data are excluded.

- 26% of the full list is **for-profit private** sector buildings and overall private ownership is now at 46%.

Putting Performance into Perspective

ZE Verified buildings on average use **60% less energy** than comparable existing U.S. commercial buildings and 46% less than new buildings under one of the most stringent U.S. base code (CA Title 24).

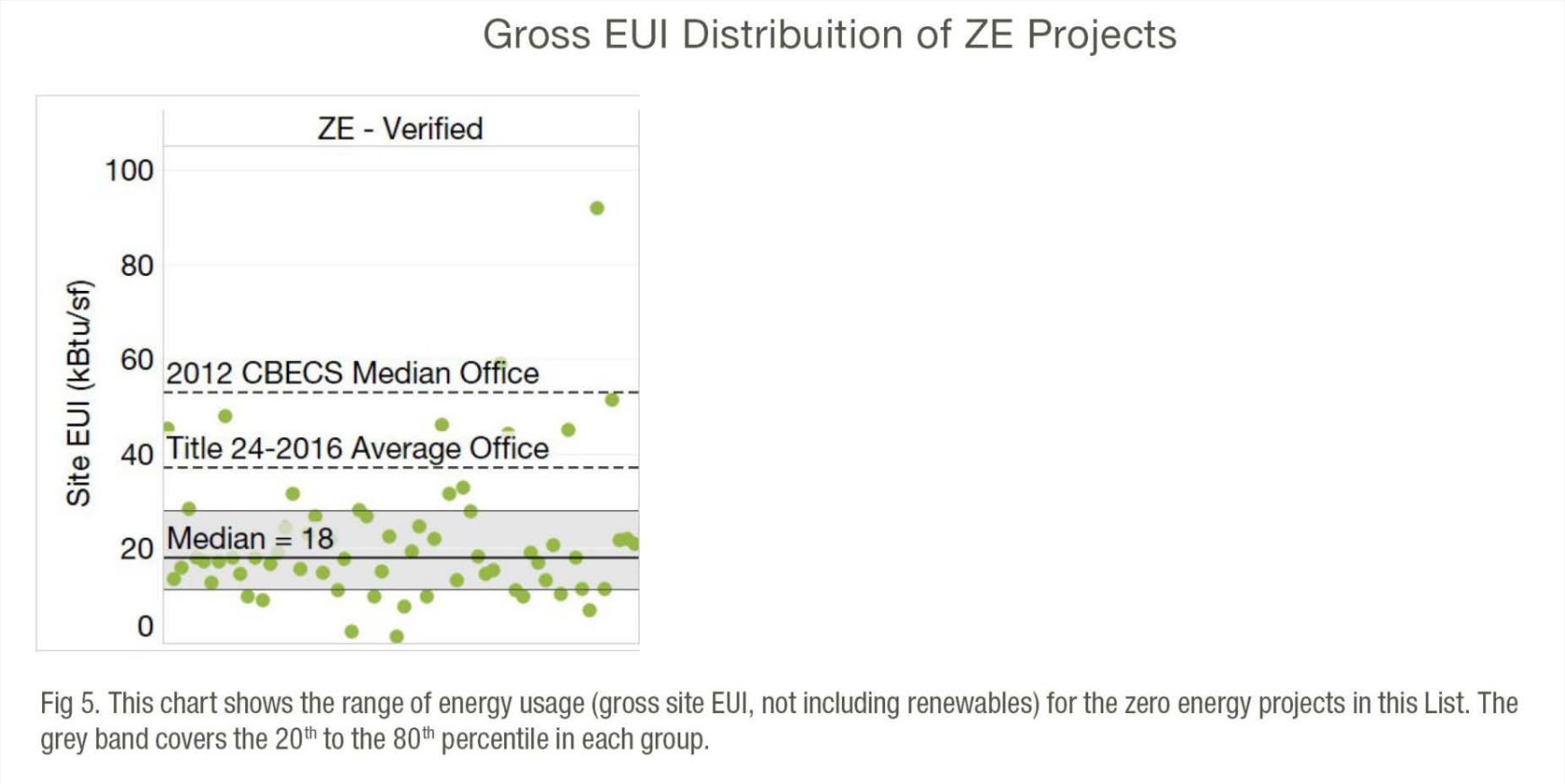
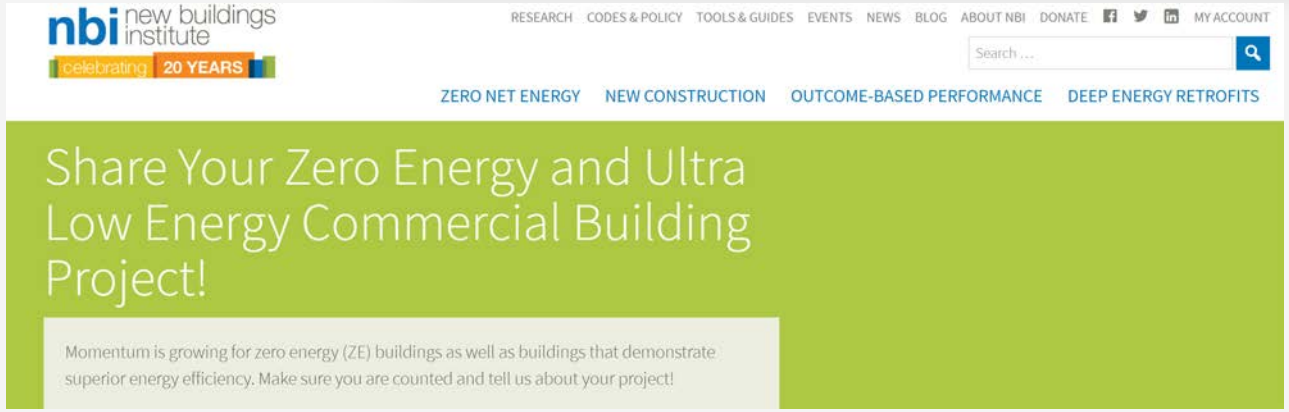


Fig 5. This chart shows the range of energy usage (gross site EUI, not including renewables) for the zero energy projects in this List. The grey band covers the 20th to the 80th percentile in each group.

Your Role in Getting to Zero

Use NBI's New ZE Resource Hub:

- ZE Action Bulletin
- ZE Project Guide
- Radiant Research and Case Studies
- Charrette Toolkit
- Santa Monica Residential Guide
- 3 new school retrofit case studies
- CA and NW Watchlists

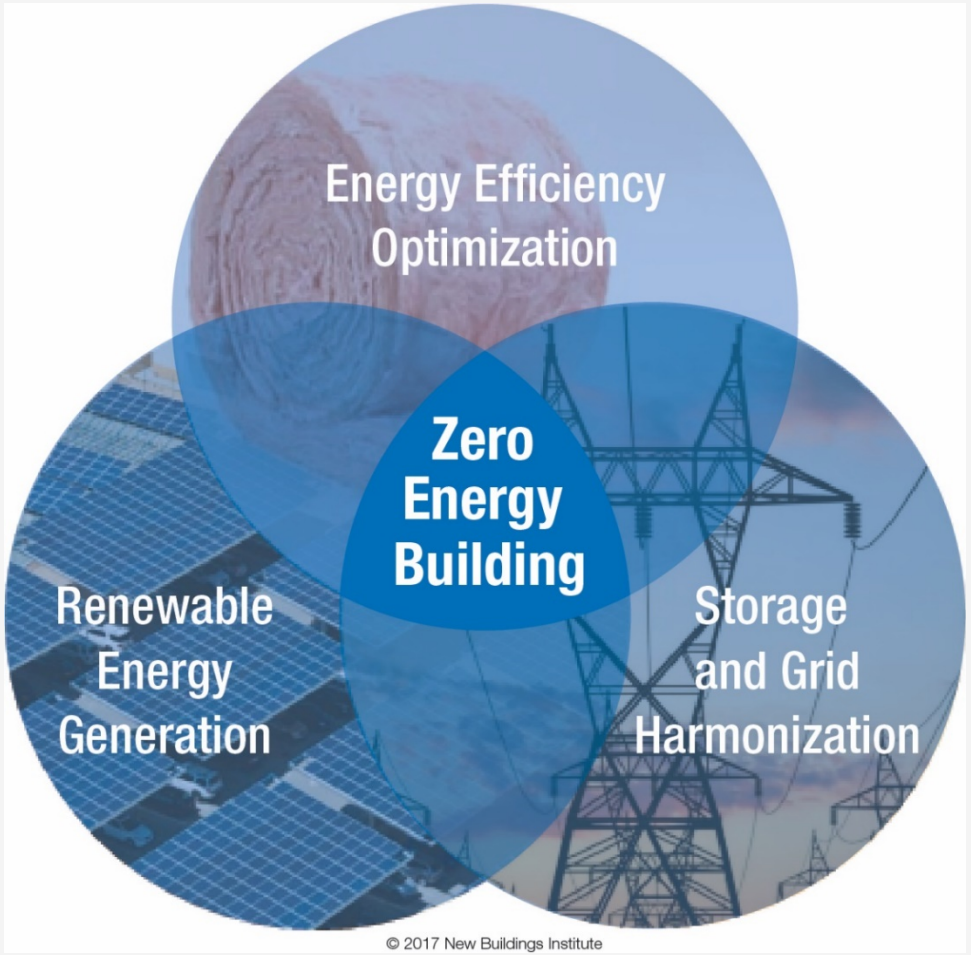


Hood River School District Library | Hood River, OR

Be Counted! ***Register your Project***

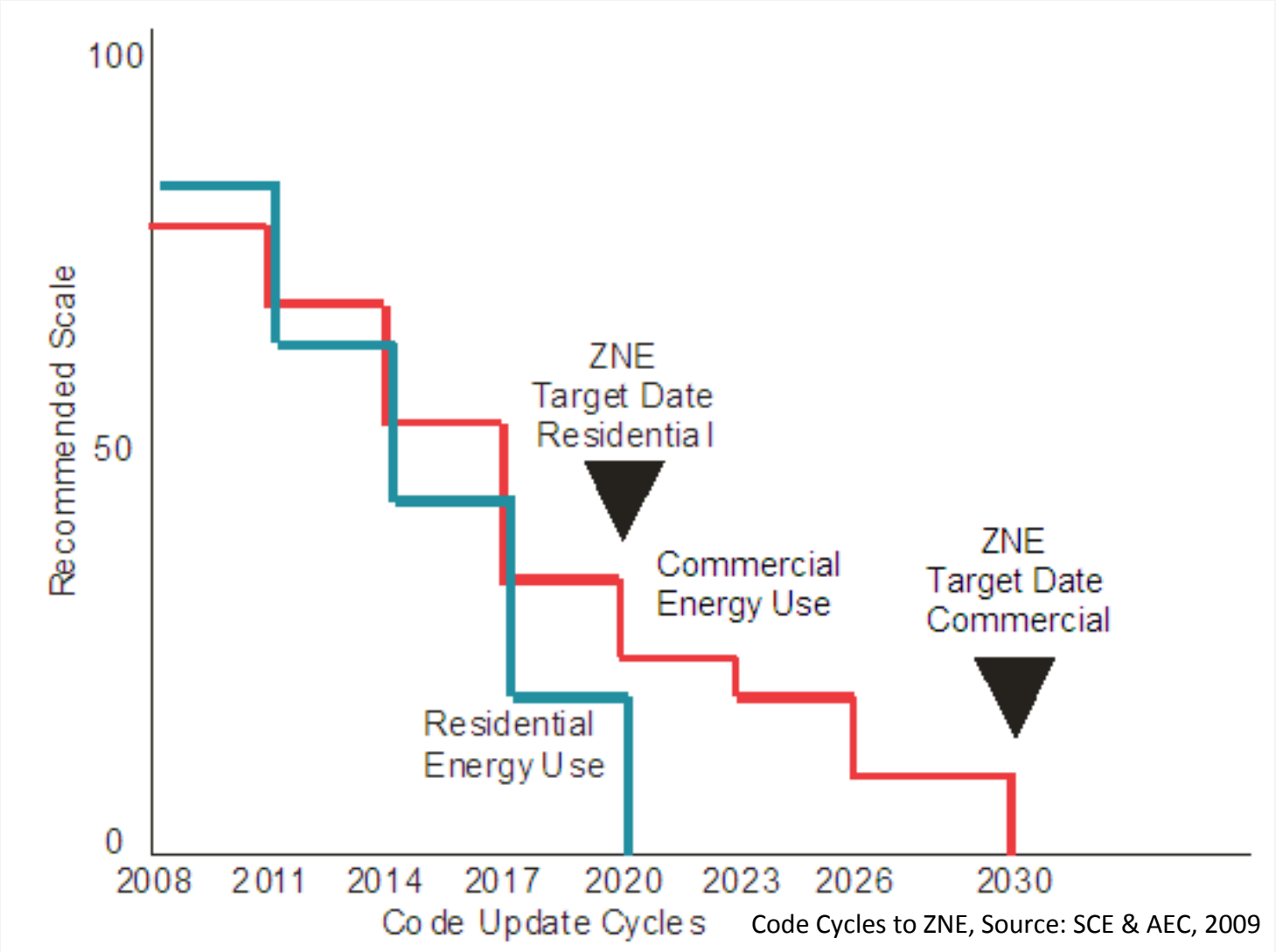
https://newbuildings.org/project-registry

Complimentary Policy Elements



CA Title 24 Policy Path to ZNE Outcomes

Specific code improvements identified for upcoming code cycles



Code Cycles to ZNE, Source: SCE & AEC, 2009

Key Policies to Support ZEB

- Net Energy Metering
- Achieve ZE in energy codes by a date-certain (CA, WA…)
- Achieve interim goals to ZE (OR, NY,….)
- Enable utility programs to fully incent ZE
- Create Climate and/or Energy Roadmaps for State/City Agencies
- Regulate energy performance after Certificate of Occupancy (NYC, Boulder)
- Requirements for new and existing public buildings - lead by example and Tax Incentives

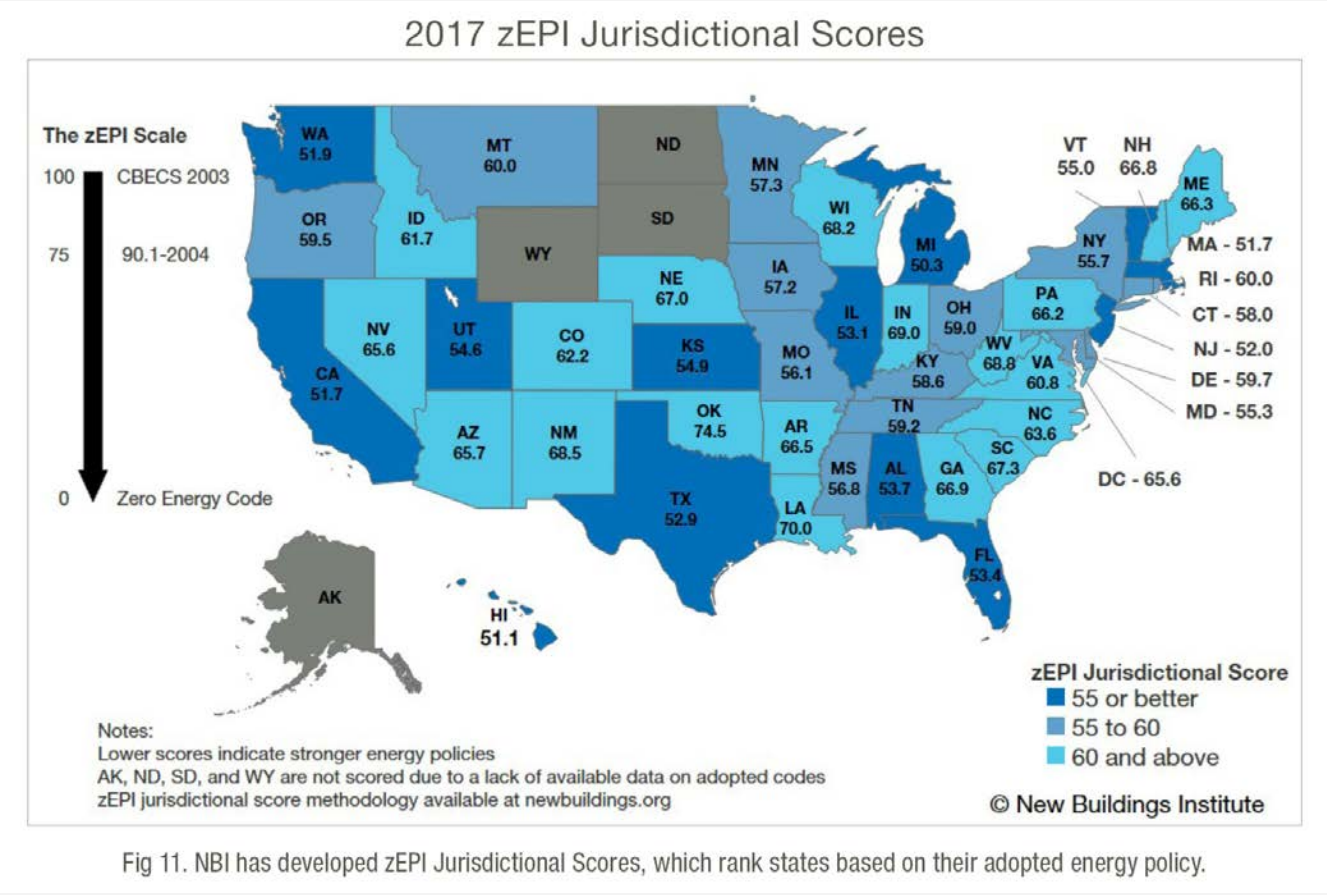


Fig 11. NBI has developed zEPI Jurisdictional Scores, which rank states based on their adopted energy policy.

States Getting to Zero

Washington ZE or ZE Capable in New Construction: **Executive Order 18-01**

Oregon Solar Ready and Carbon Neutrality: **Executive Order 17-20**

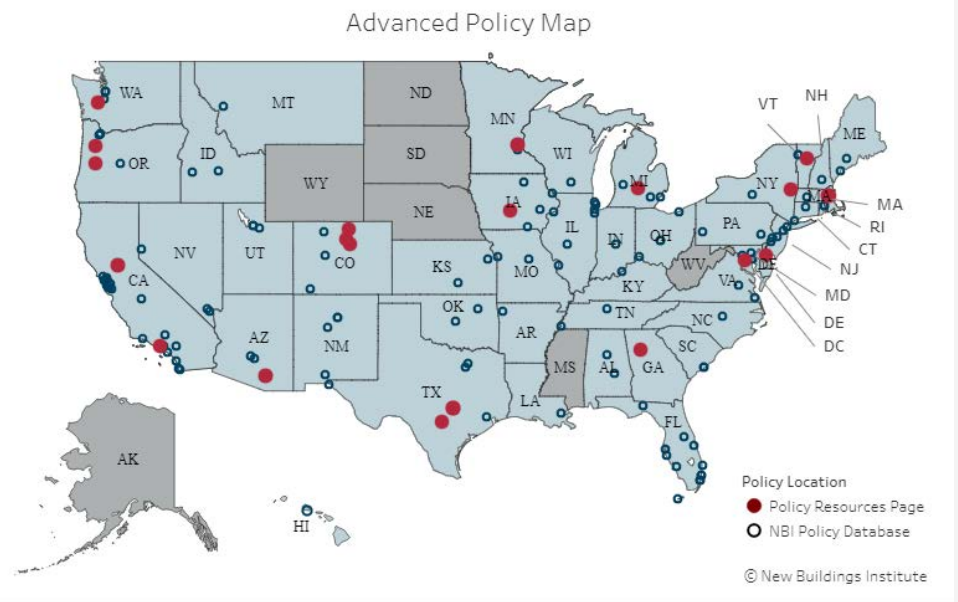
California ZE by 2025 and 2030: **Executive Order B-18-12**

Minnesota ZE by 2030: Sustainable Building 2030 & **Executive Order 17-12**

New York Voluntary Stretch Code: **NYStretch**

Delaware ZE capable homes by 2025, ZE capable commercial by ZE: **Senate Bill 59**

Vermont ZE for all new residential & commercial by 2030



Cities and Counties Getting to Zero

Carbon Neutral Polices – 37 cities targeting carbon neutral

Zero Energy Buildings – 11 cities with zero ordinances and propositions

New York City, NY
Pima County, AZ
Austin, TX
Lancaster, CA
Palo Alto, CA
Hayward, CA
Washington DC
Santa Monica, CA
Cambridge, MA
Boulder, CO
Park City, UT

State	zEPI Jurisdictional Score	ZE Emerging	ZE Verified
CA	51.7	192	22
OR	59.5	22	2
NY	55.7	13	4
AZ	65.7	15	1
MA	51.7	13	2

100% Renewables – 4 cities currently have goals for energy to be supplied by 100% renewable energy *Park City, UT, San Diego, CA, Santa Barbara, CA, Atlanta, GA*

Cashing in on Zero…

- What is the business case for net-zero energy developments?
- What energy and financial models can I use?
- What are the key lessons learned from three real-world case studies?
- What tools resources and contacts can draw on when undertaking net-zero energy development projects?

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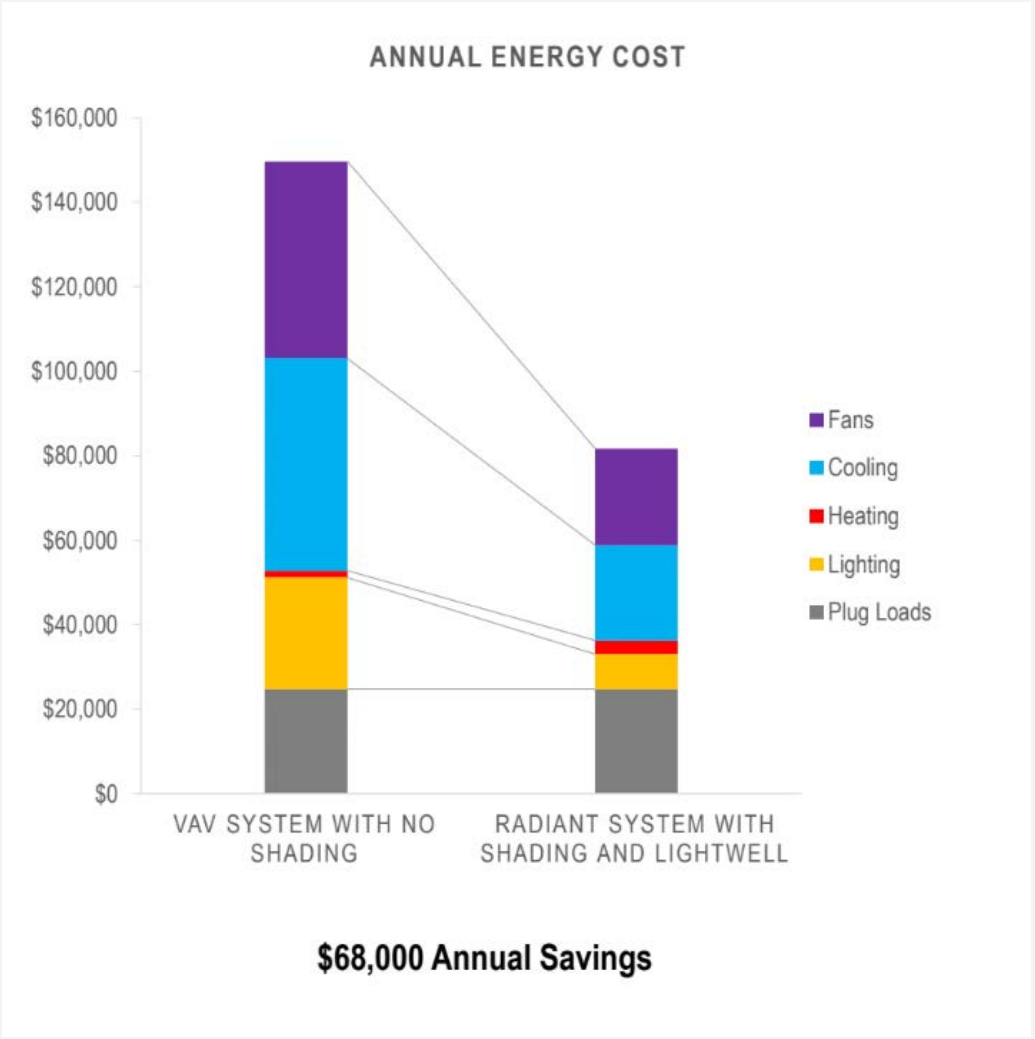
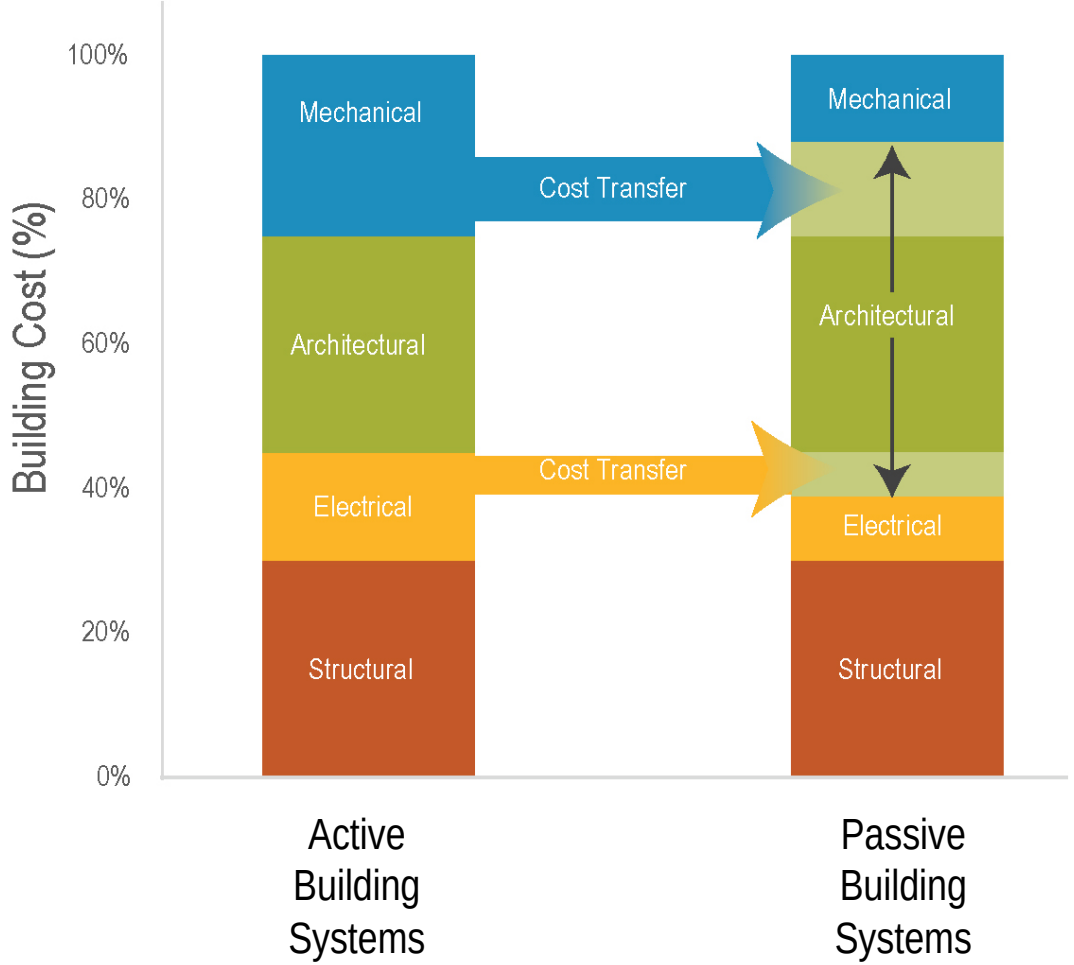
UC MERCED DOWNTOWN CENTER : HELLER MANUS ARCHITECTS

Energy Cost Savings : High Performance Building vs Normative Building Without Shade Structure

Lower annual energy use, higher likelihood of achieving ZNE

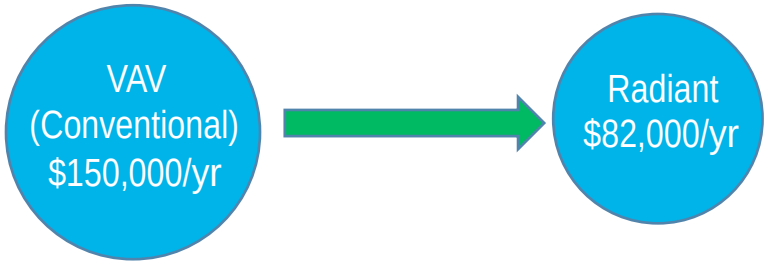


Cost Transfer
Doing More with Architecture



Life Cycle Cost Assessment
Minimizing Total Cost of Ownership

Using Life Cycle Cost Assessment, we can predict the incremental first cost that are supported by the annual energy savings.

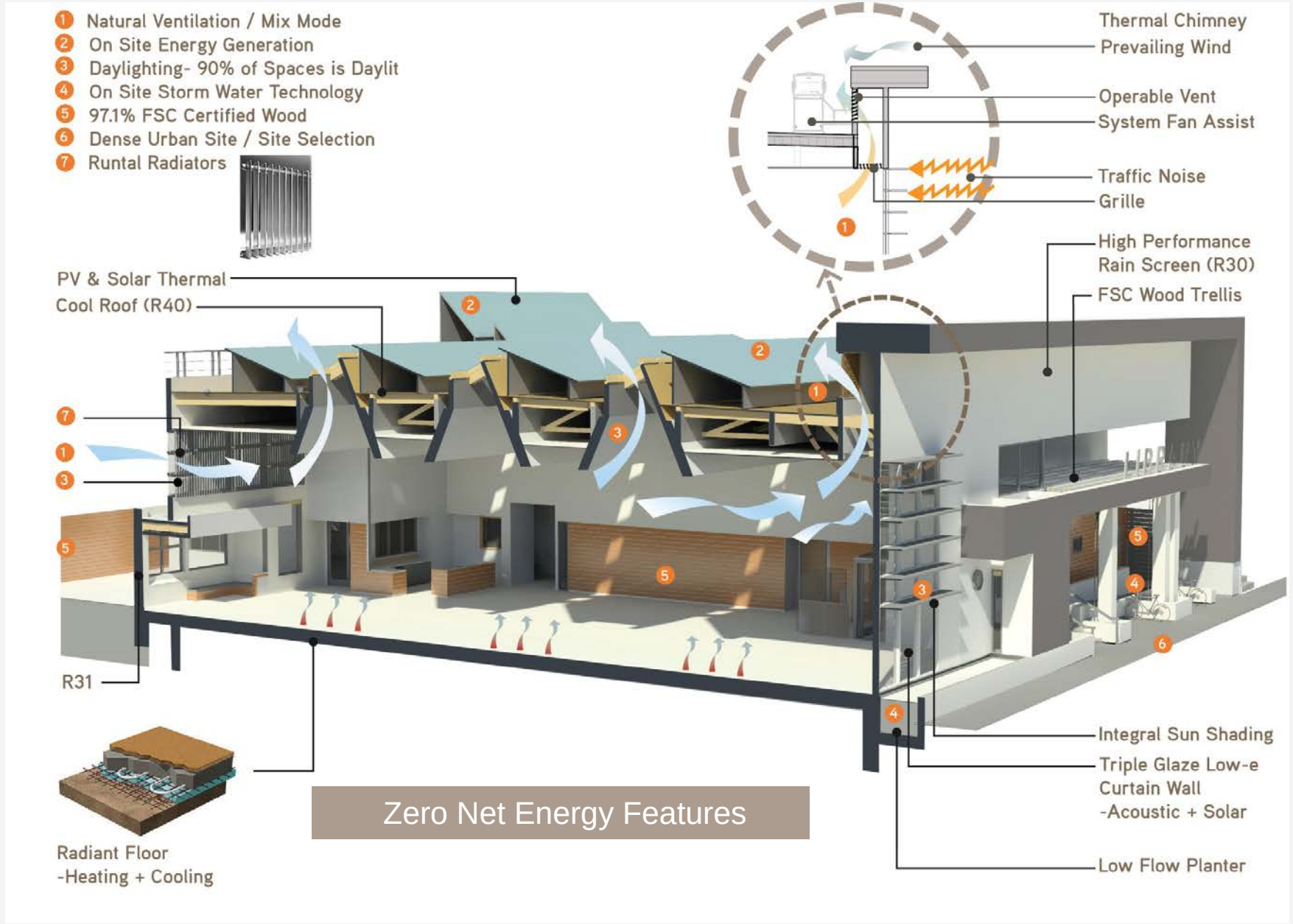


30-Year Savings

Generates $679,000 in Net Present Value

Equates to saving $9/sf First Cost

LCCA Assumptions	
Discount Rate	6%
Analysis Period	15 years
Electric Cost	$0.15/kWh
Energy Escalation	4%/yr



Zero Net Energy Features

- 1st Public Library in California to be Certified NZEB by ILFI
- AIA East Bay Merit Design Award
- Gold Nugget ZNE Grand Award
- 2015 IES Excellence in Illumination Award
- 1st ZNE public library in CA
- 2nd ZNE public library in USA
- 2nd ZNE Municipal building in CA
- 3rd ZNE Municipal building in USA
- Largest (by sq ft) ZNE library building in USA as of February 2015

Costs Comparisons - Recently Completed Libraries in California

Date: 5/27/2015 (Rev.) Data - City of Berkeley CCR Hardcosts. Online City of Santa Monica meeting minutes

Library	Gilroy Library (Large) *1	West Berkeley Library	Berkeley South Branch *5	Claremont Branch Remodel *3	Berkeley North Remodel *4	Santa Monica Pico Branch Library*2
ZNE (zero net energy)	No	Yes	No	No	No	No
LEED	Gold	Platinum*	Gold	Silver	Silver	Platinum*
New/ Remodel	New	New	New	Remodel/ addition	Remodel/ addition	New
Completion Date	April, 2012	Dec-13	May,2013	2012	2012	Apr-14
Area (sf)	52,600	9,399	8,700	7,800	9,900	8,690
Estimate	$18,200,000	$7,500,000	$4,300,000	$3,300,000	$4,560,000	$6,900,000
Bid	$18,177,226	$5,495,000	$4,963,000	$2,970,000	$4,360,000	$6,915,020
CCR Hard Costs (2014)	$19,200,000 ($19,797,256)	$5,797,653 ($5,891,701)	4813503 ($4,891,587)	$3,074,823 ($3,119,861)	$4,644,322 ($4,788,793)	$7,200,000
costs/sf	$376.37	$626.84	$562.25	$400.00	$483.71	$828.54

$64.59/sf premium vs. South Branch
Includes Renewables

*1 - includes $700,000 owner related increases. There are efficiencies in larger buildings and typically cost per square feet will appear lower.
*2 - Architectural Record Article 3/2015
*3 - Existing building with 380sf addition-interiors only
*4 - Existing building with 4,000sf two storey addition
*5 - Includes Renewables to meet LEED criteria 2.5-12.5%

Costs Comparisons


CEDAR
REVIVE
PROPERTIES
ZERO
ENERGY READY HOME


314
GREEN LEAF
232
GREEN LEAF
220
GREEN LEAF
GREEN LEAF STREET
GREEN LEAF STREET
GREEN LEAF STREET
321
GREEN
LEAF
315
GREEN
LEAF
309
GREEN
LEAF
303
GREEN
LEAF
BLUE SUN STREET
225
GREEN LEAF
203
URBAN
PRAIRIE
209
URBAN
PRAIRIE
215
URBAN
PRAIRIE
221
URBAN
PRAIRIE
240
URBAN PRAIRIE
320
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314
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308
URBAN
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302
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PRAIRIE
URBAN PRAIRIE STREET
URBAN PRAIRIE STREET
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URBAN
PRAIRIE
251
URBAN
PRAIRIE
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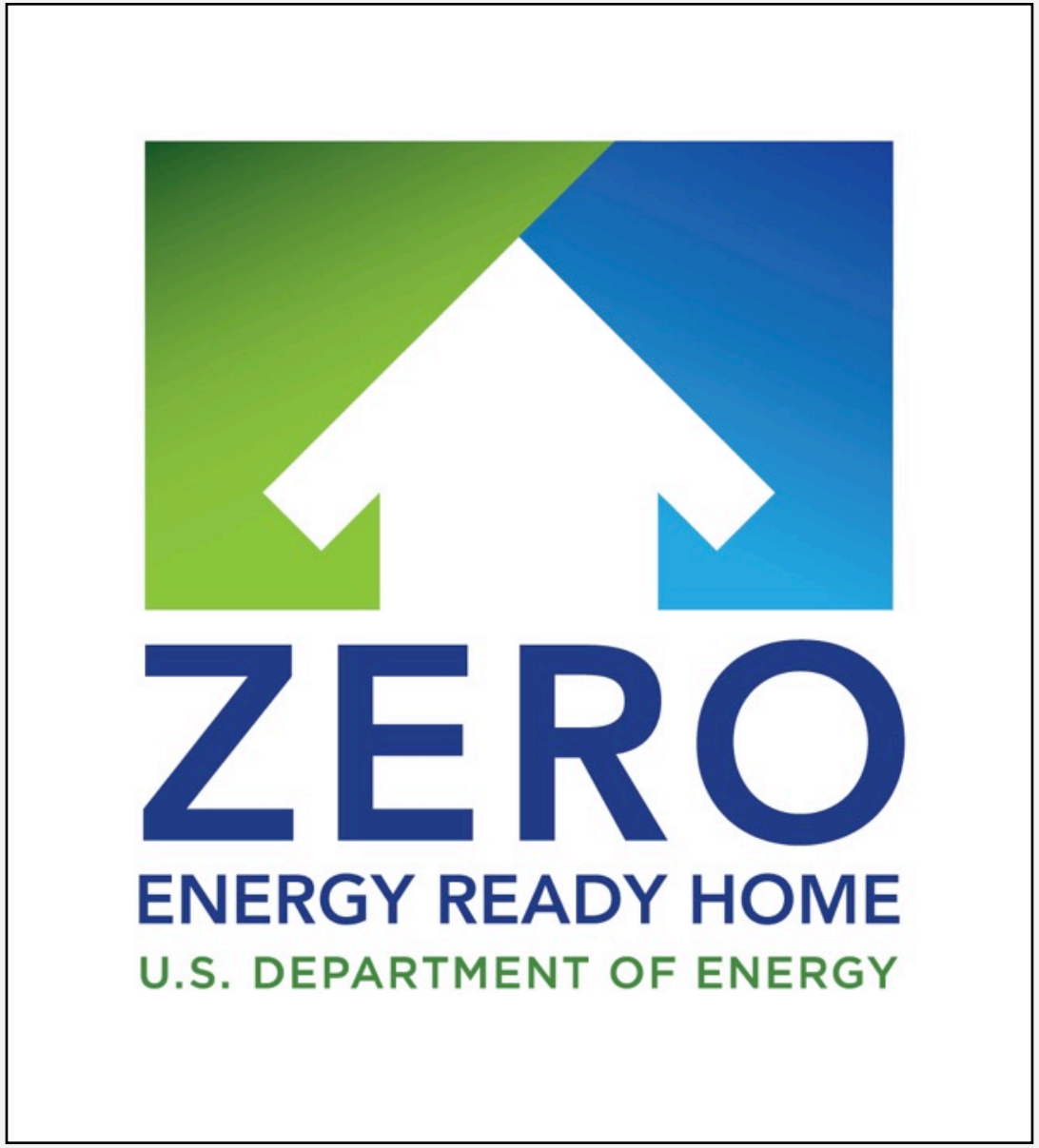
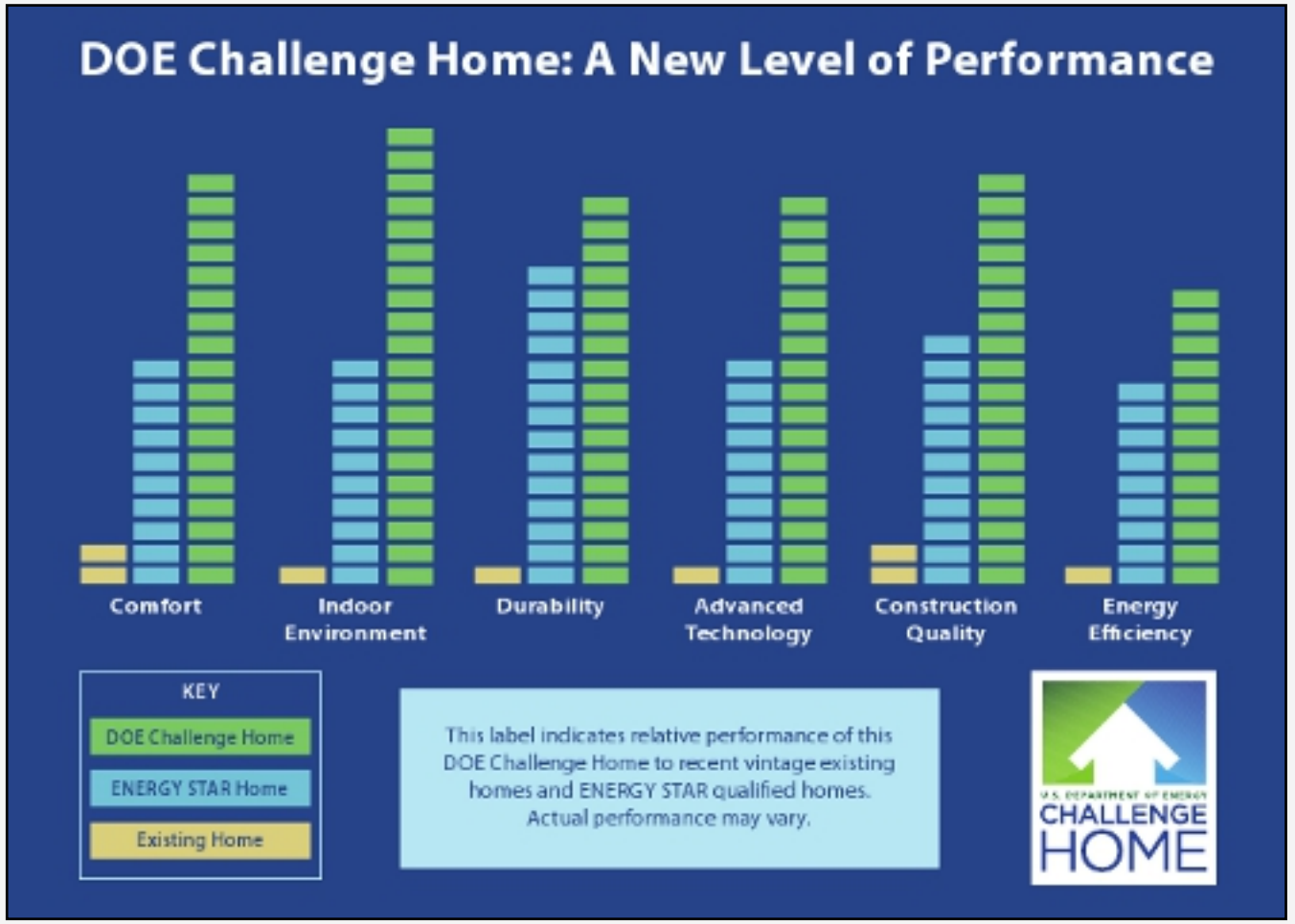
URBAN PRAIRIE
309
URBAN PRAIRIE
BLUE SUN STREET
PRIVATE DRIVE
PRIVATE DRIVE


ZERO
ENERGY READY HOME
U.S. DEPARTMENT OF ENERGY

Quantifiable Metrics



NOCO HBA
Best Green Home
Revive/Philgreen
2015

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Yearly savings compared to:

	Versus Typical Existing Home	Versus Typical New Home
130 Typical resale home	$0	($540)
100 Typical new home	$540	$0
75 ENERGY STAR® Home	$988	$448
40 Revive Home without PV	$1437	$897
0 Zero Energy Home	$2335	$1795

	HERS	Energy Costs	Annual Savings
Existing House	130	$3,061	($1,175)
IECC 2012	100	$1,924	$0
Energy Star	75	$1,175	$749
Revive	9	($146)	$1,886

City of Fort Collins Utilities

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10 a.m. to 5 p.m. Wed.

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V/TDD: Dial 711 for Relay Colorado
E-mail: *utilities@fcgov.com*
Web: *fcgov.com/utilities*
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Account Number	Customer Name	Service Address	Bill Date	Date Due	Amount Due

Service	Rate Code	Service Date From	Service Date To	Days	Meter Readings Previous	Meter Readings Present	Multiplier	Usage	Charge
Electric Energy		07-01-16	08-01-16	31	4293	4436	1	143 KWH	
Base Charge	E130								$5.37
Tier 1	E130							143 KWH	$13.19
Electric Net Returned	E130	07-01-16	08-01-16	31	1838	2531	1	693 KWH	-$60.29
Stormwater	H118	07-01-16	08-01-16	31					$12.94
Wastewater	Q221	07-02-16	08-01-16	30				4800 WQA	$35.06
Water		07-02-16	08-01-16	30	453	768	10	3150	
Base Charge	WB20								$16.33
Tier 1	W220							3150 GAL	$7.97
				Sub-total					$30.57
				City Sales Tax					$0.67
				Total charges this billing period					$31.24

Revive Economics

Total Marginal Cost for Zero Ready (4.8%)	$17,325
Increase mortgage payment	$84
Monthly savings	$138
Pre-purchase Leased Solar 6.5kW	$11,115
City of Fort Collins Solar Rebate	$1,500
Total Marginal Cost w/ Solar (7.8%)	$26,940
Increase mortgage payment	$130
Monthly savings	$200

Keys to Success

1. DOE Zero Energy Ready Zero Home (ZERH)
2. DOE Building America Solutions Center
3. Energy and Environmental Building Alliance (EEBA)
4. Champion
5. Economic include Operating Costs and Capital Costs
6. Right thing to do

Hazelwood Green

A Brownfield Site with a Forward-Leaning Vision

- Location: Pittsburgh, PA
- 180 acre former steel mill site
- 6MM gross ft^2 of building floor area
- 60% residential, 30% office, 10% other
- Deregulated electricity market

Problem Statement

- Site owners have a net-zero energy ambition
- Must be financially sound for developers, building owners, and tenants
- First cost premium may threaten project viability
- Market advised that net zero energy was unachievable

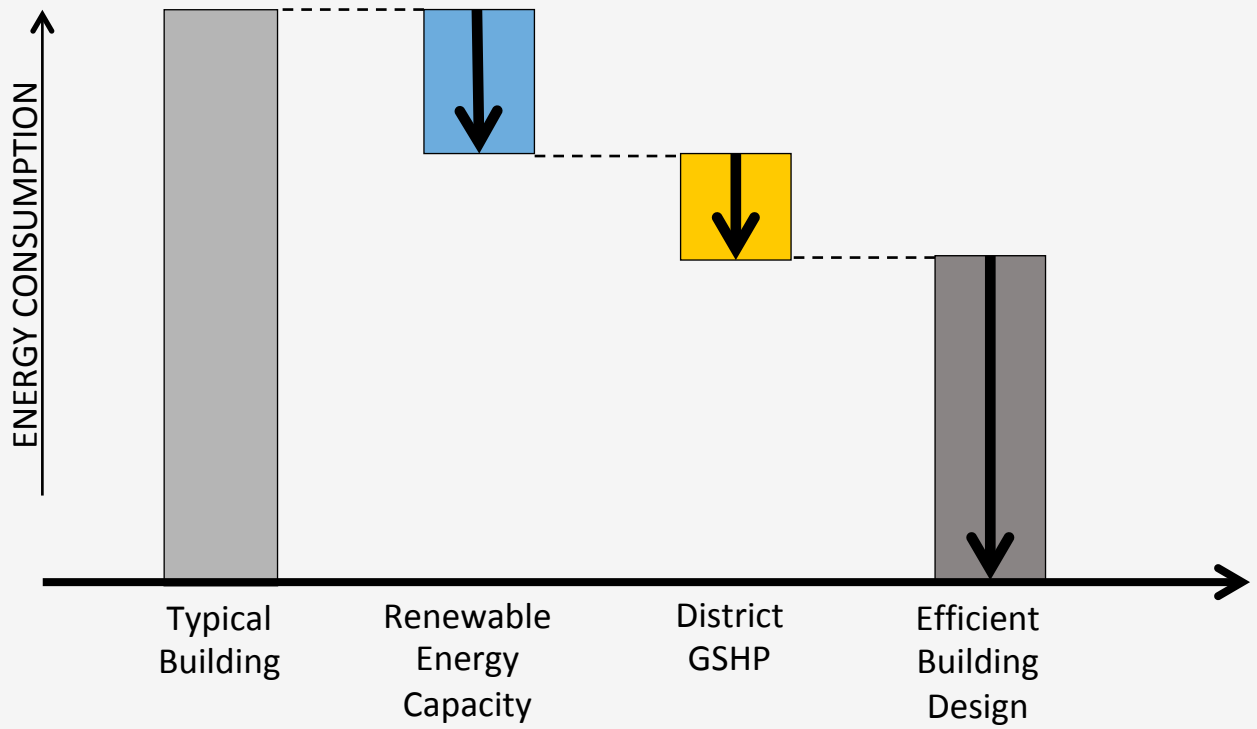
Developing Site Net-Zero Energy Ambitions

Zero Energy Vision

- Best-in-class efficiency standards
- Central geothermal heating/cooling
- Rooftop solar PV
- Integrated financing solution

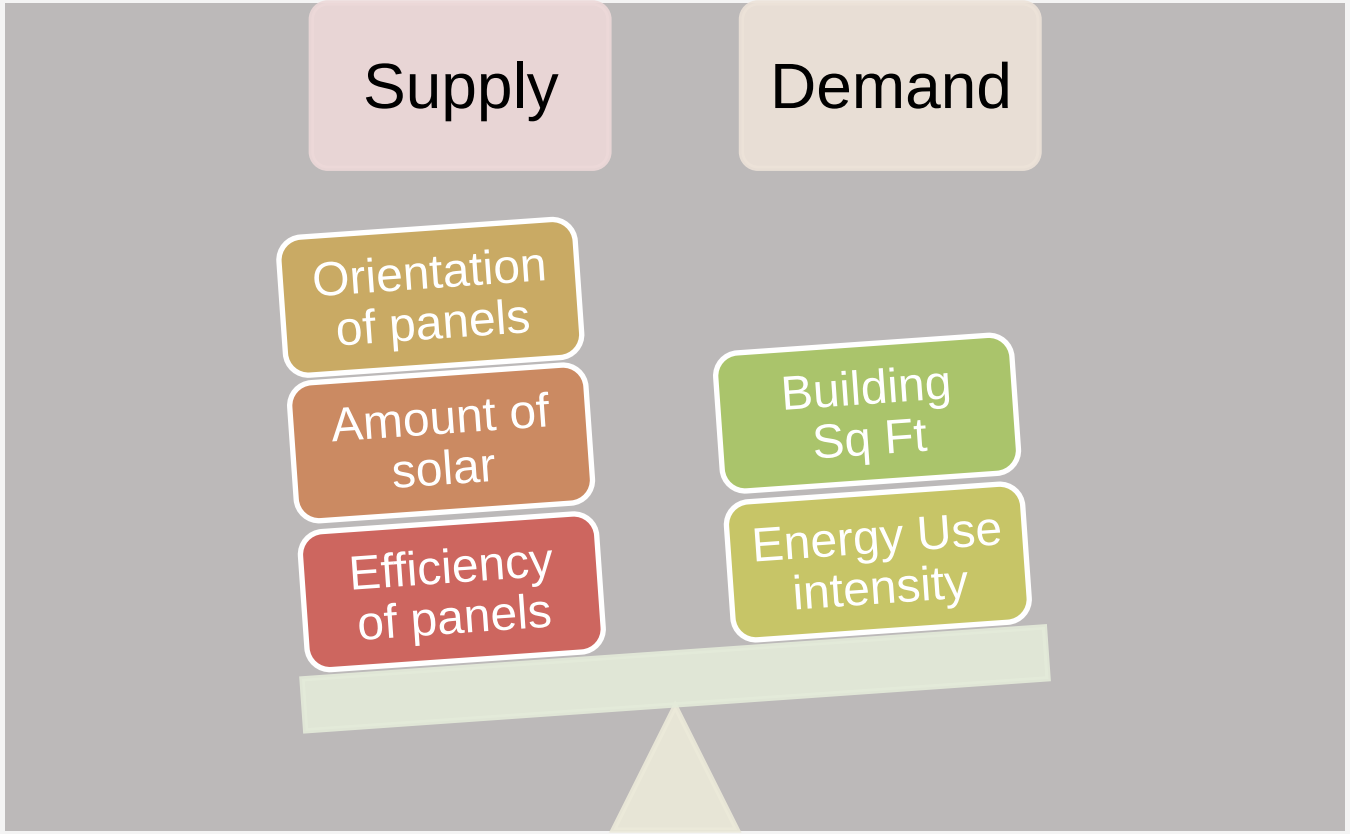
A whole-systems technical and business approach can result in a **financially attractive** proposition for developers, tenants, and an Integrated Energy Services Provider

The pathway to zero for Almono includes on-site renewables, district scale GSHP, and efficient building design

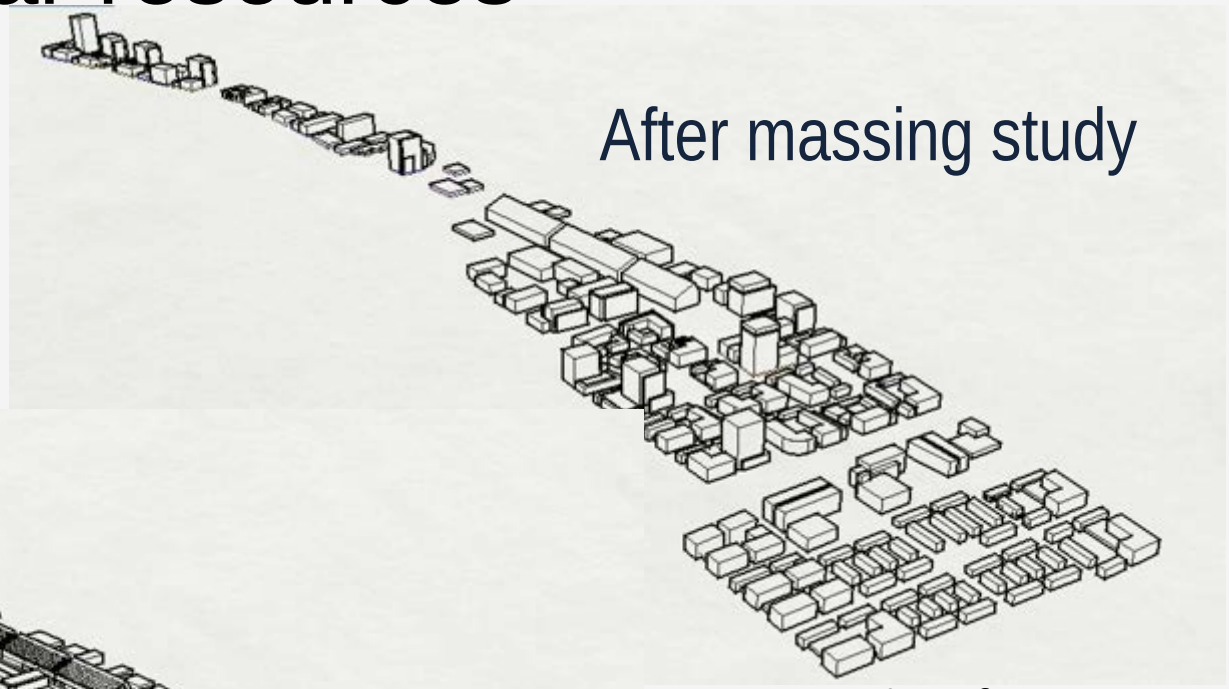


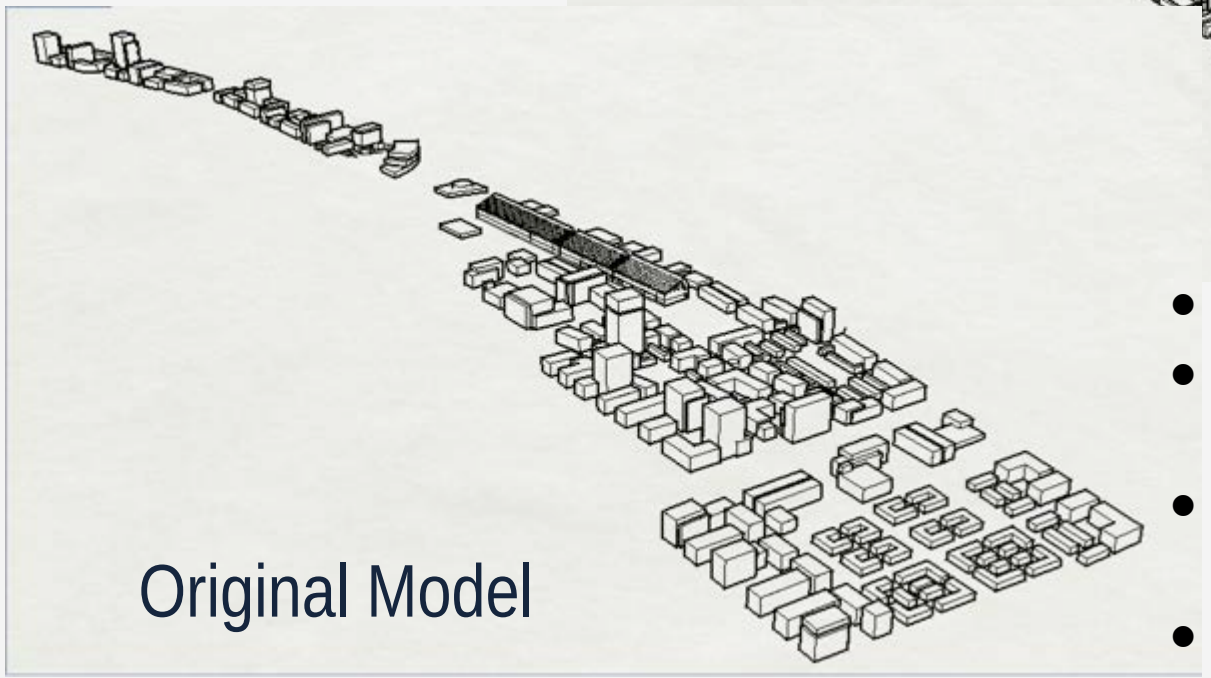
Achieving net-zero energy requires a holistic approach to balance energy supply & demand

Key Concept:
Several factors affect the net-zero energy budget, making on-site net-zero energy easier or more difficult to achieve



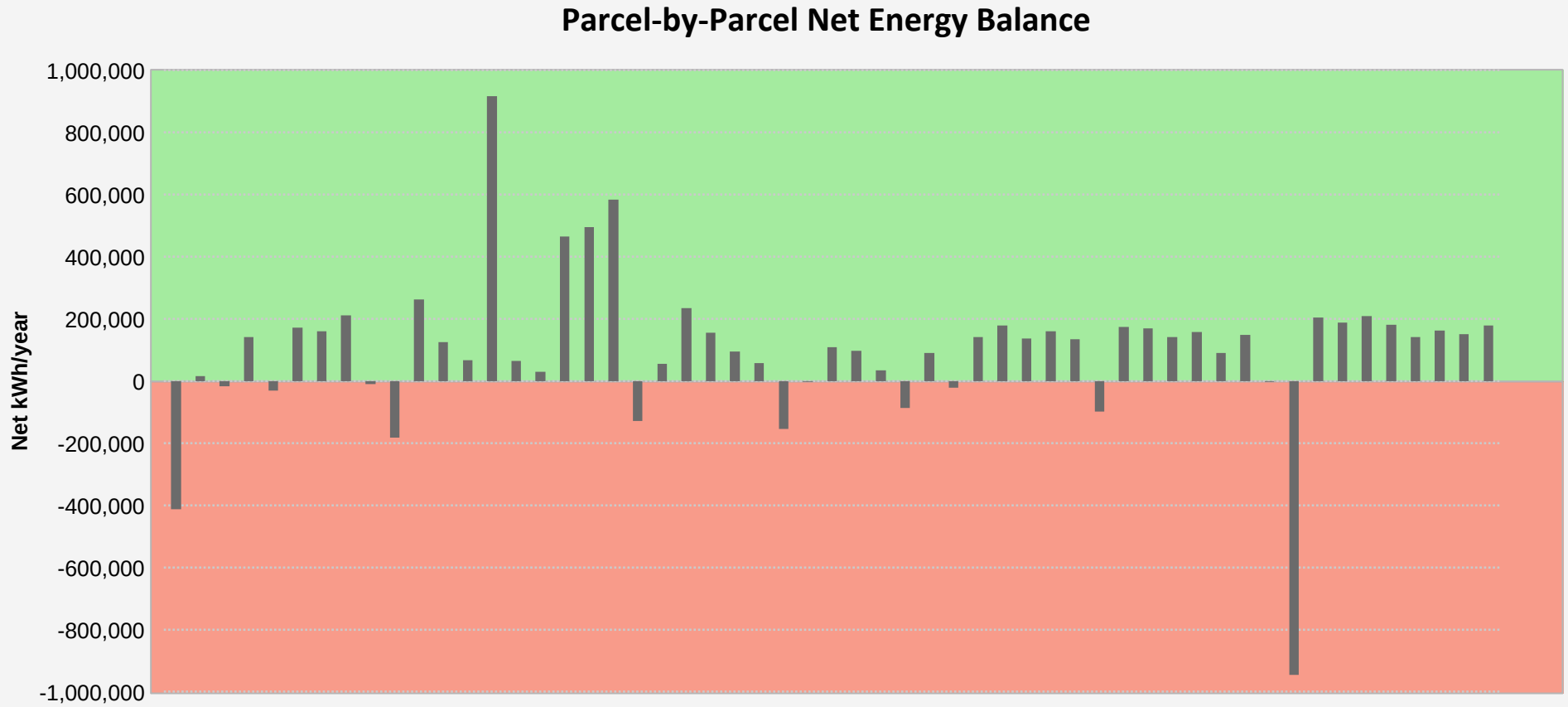
Site-wide studies allowed us to quantify and maximize available on-site solar resources



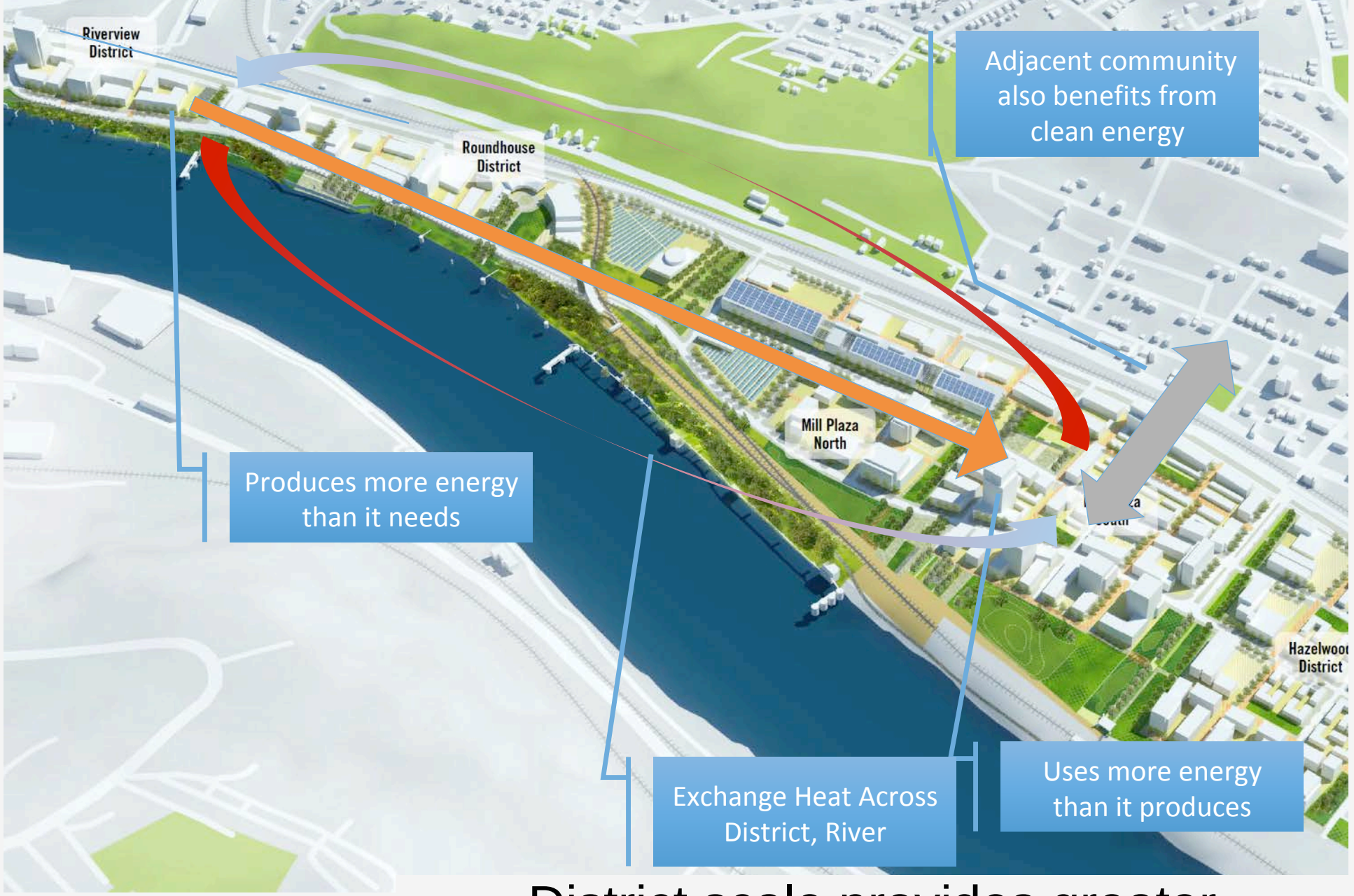


- Maximized roof PV area
- More solar access for south-facing windows
- Passive solar-advantaged building orientation
- 25% increase in site solar insolation, even with a 5% increase in site program (sq ft)

District scale provides greater opportunity to share energy across the site

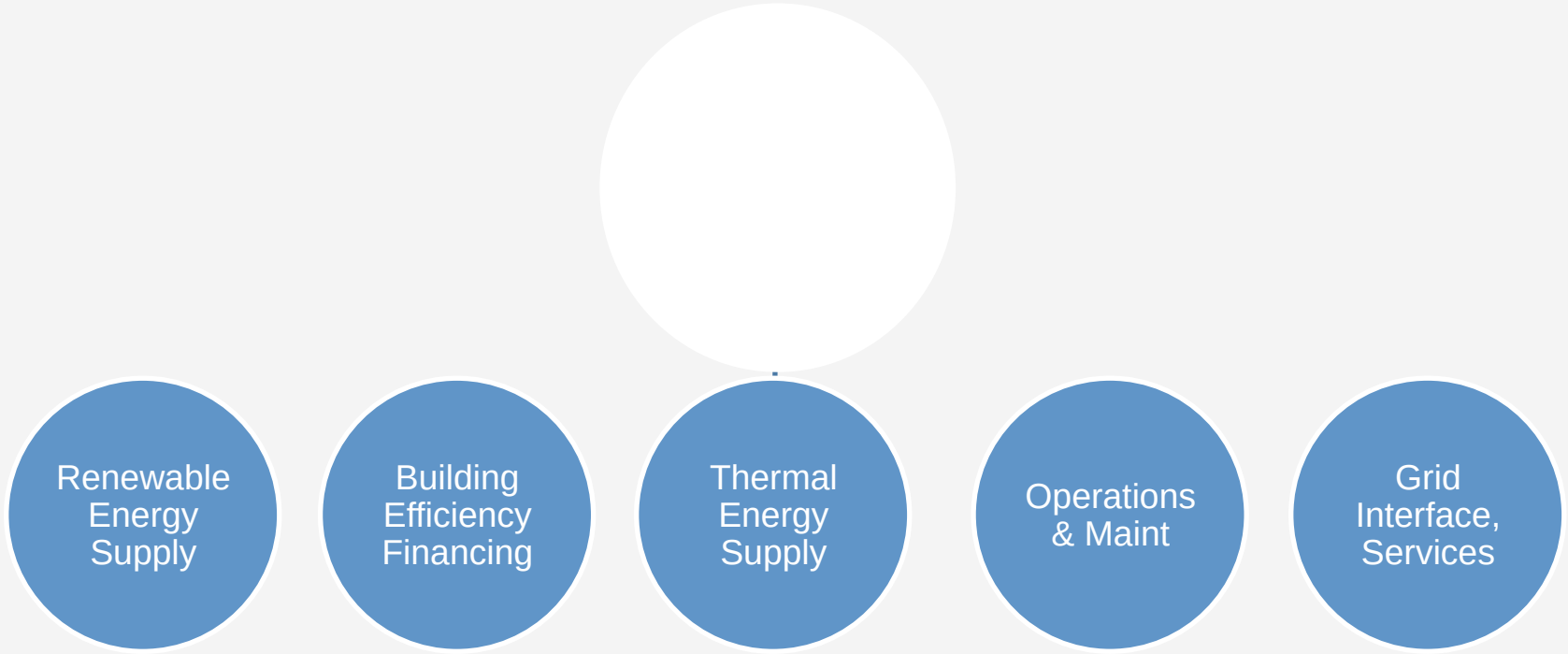


Each bar indicates the net energy balance of each development parcel on site with recommended EUIs and maximum PV

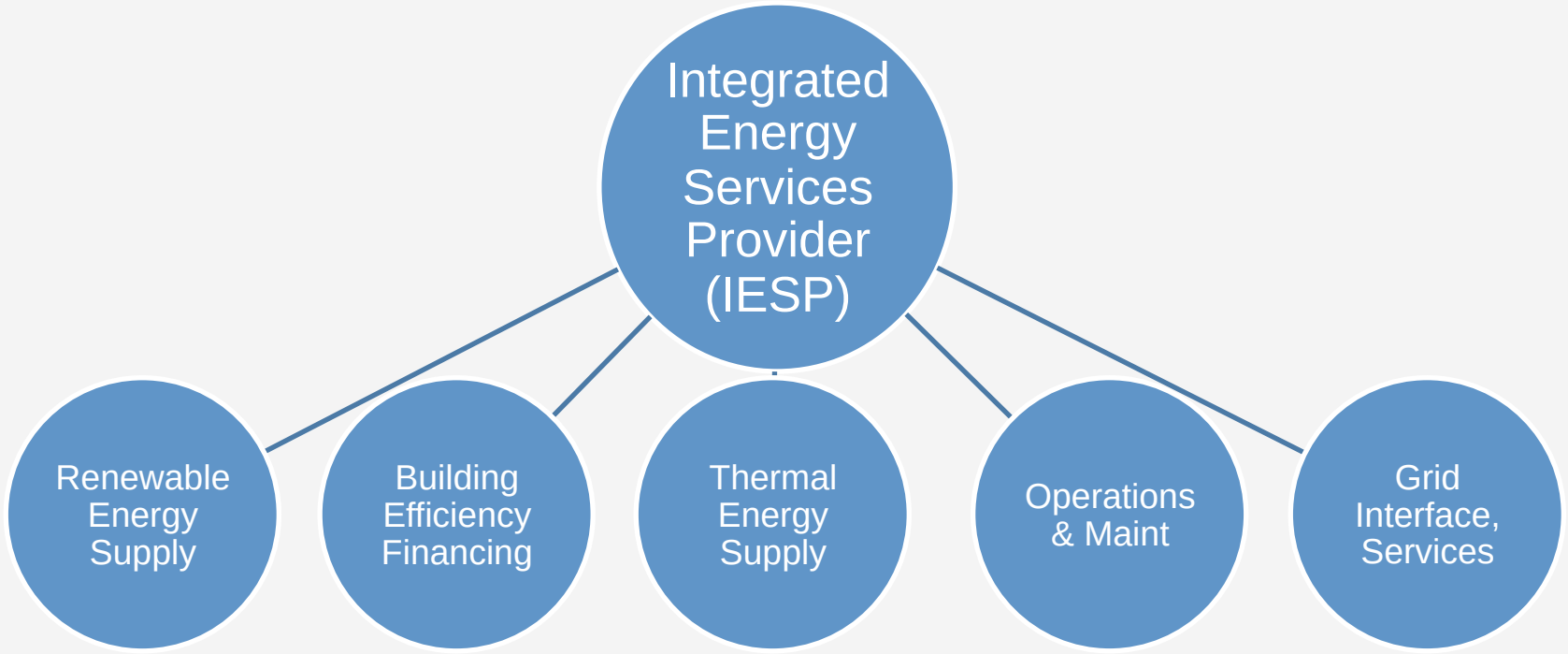


District scale provides greater opportunity to share energy

This integrated technical and business approach could enable a number of new energy savings and revenue opportunities across the site

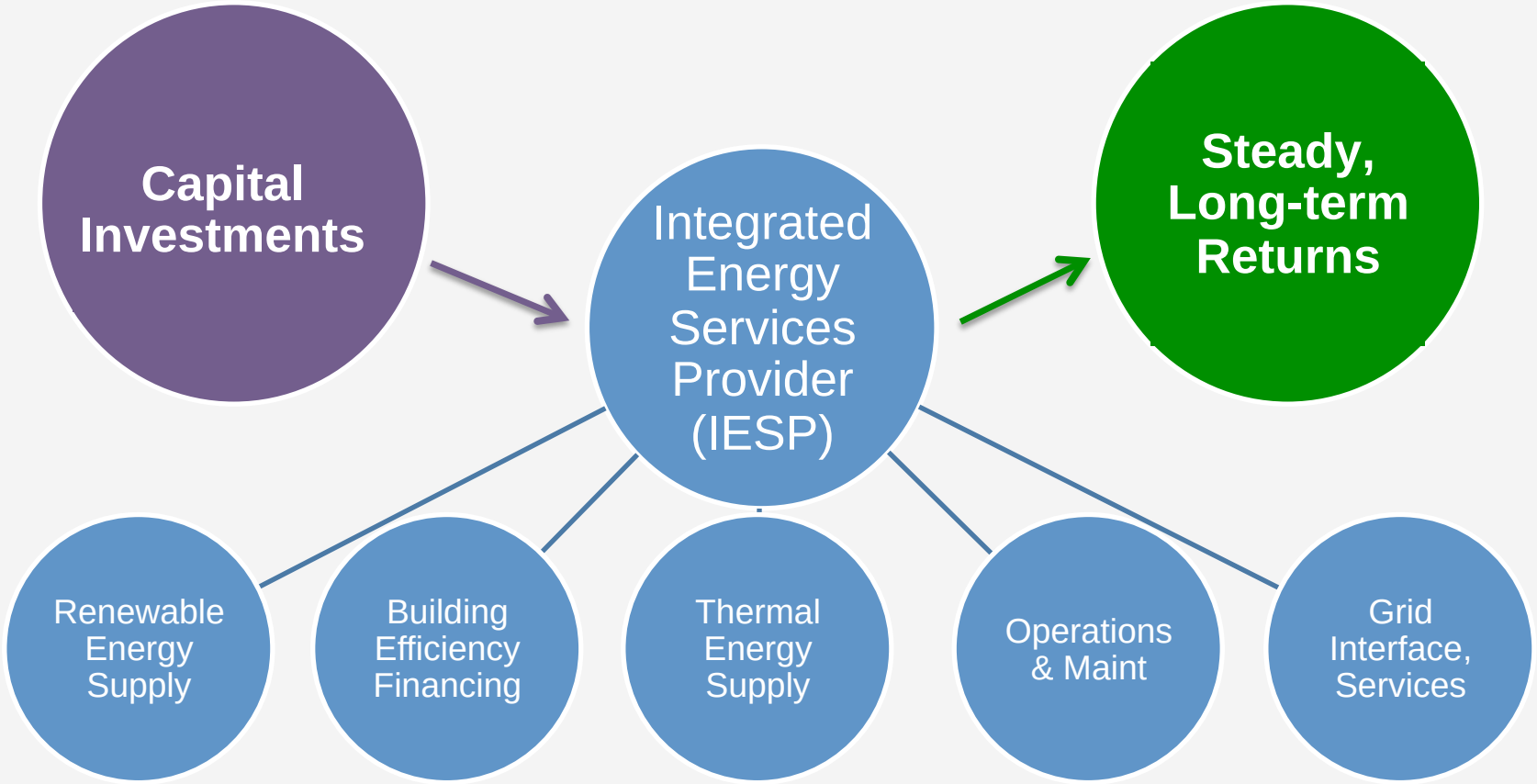


These functions could all be performed by a single entity



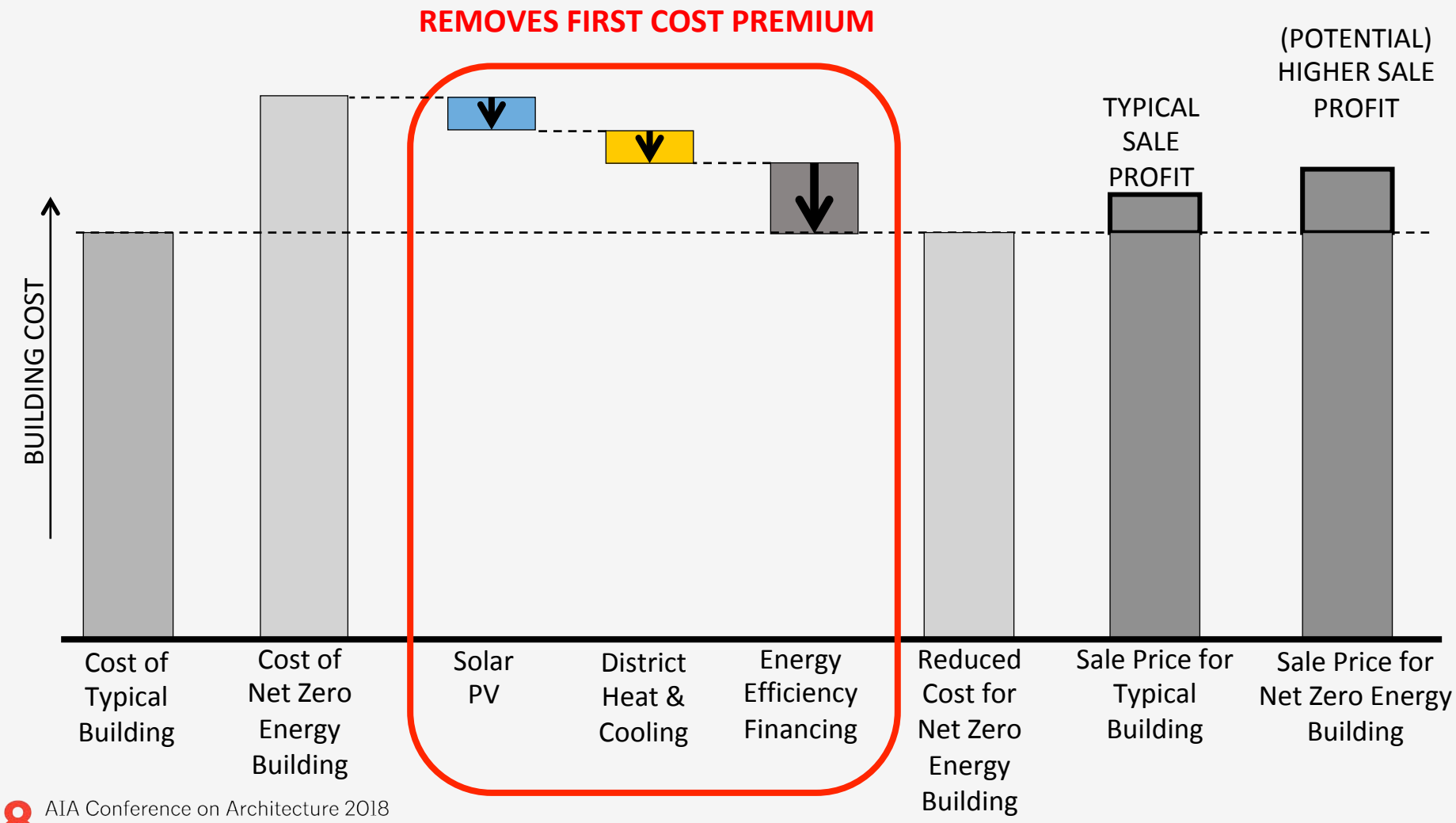
The **integrated energy services provider (IESP)** aggregates site energy services while ensuring that **net-zero energy is financially attractive** to **vertical developers and tenants**

The IESP would have aligned incentives while driving a greater investment opportunity

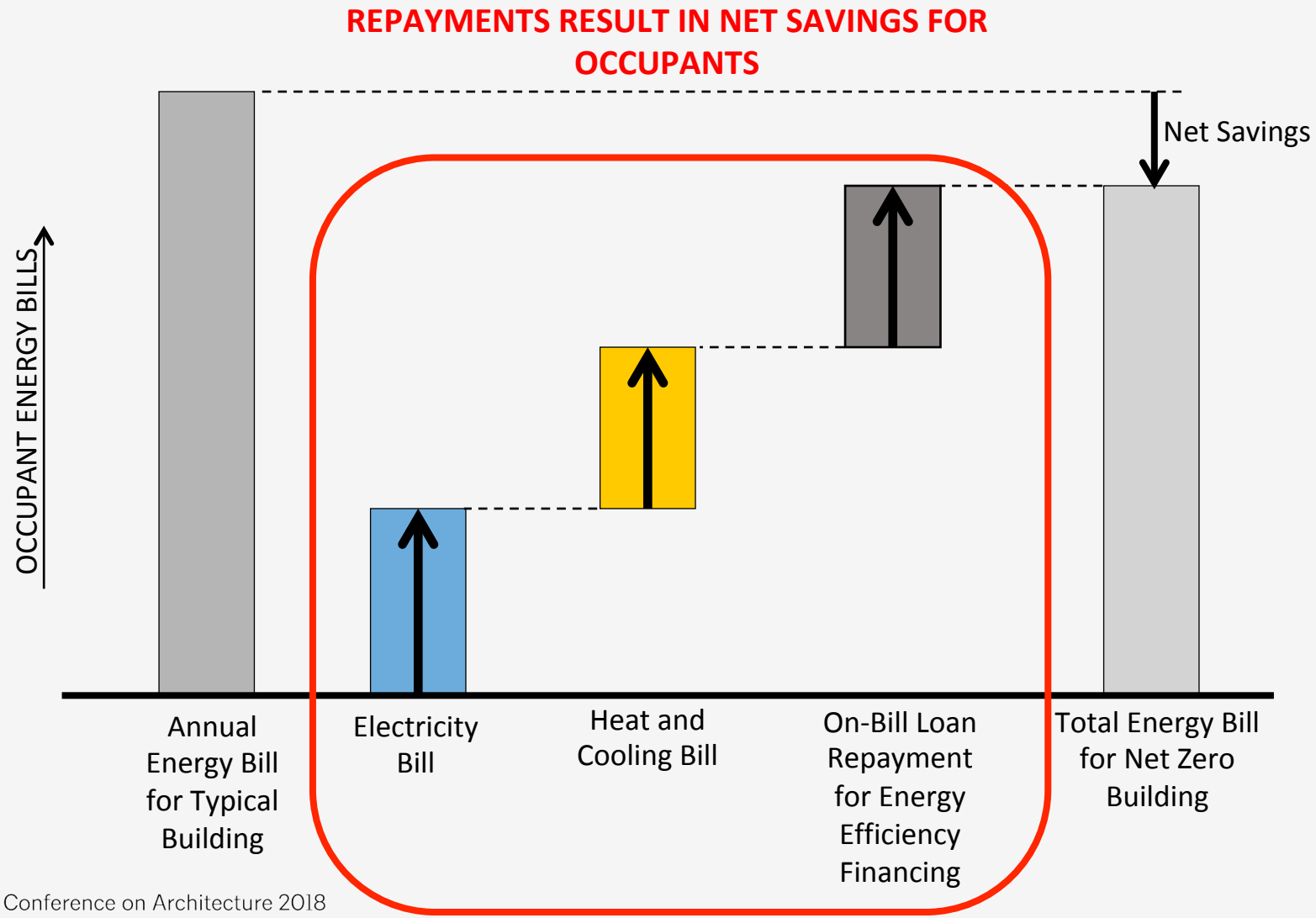


The **integrated energy services provider (IESP)** aggregates site energy services while ensuring that **net-zero energy is financially attractive** to **vertical developers and tenants** while collecting a **steady, long-term return** (comparable to infrastructure investment).

IESP shifts up front costs from individual building to central entity



IESP revenues are delivered through the occupant energy bills



Key Conclusions

An integrated energy service provider model paves a pathway to achieving net-zero energy without compromising real estate market economics

1. **Enables a technical path to net zero energy:** District heating and cooling technologies are coupled with efficiency and renewable energy for overall greater carbon reductions impact than business-as-usual

2. **Enables capital markets to invest:** The investment has sufficient scale and repayment security because the IESP has a captive market for decades to come.

3. **Reduces or eliminates first cost premium:** Shifts the first cost for heating/cooling equipment, efficiency, and on-site renewable generation to a central entity

4. **Results in net savings for occupants** by reducing the total cost of energy for tenants

5. **Central IESP balances load diversity** and aggregation of complementary load profiles.


THE COMMONS
NET ZERO OFFICE

A'18 AIA Conference on Architecture 2018
June 21-23, New York City

How do you design/develop to NZE?


EXIT

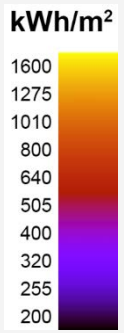
What does a Developer Want?
What's in it for them……?

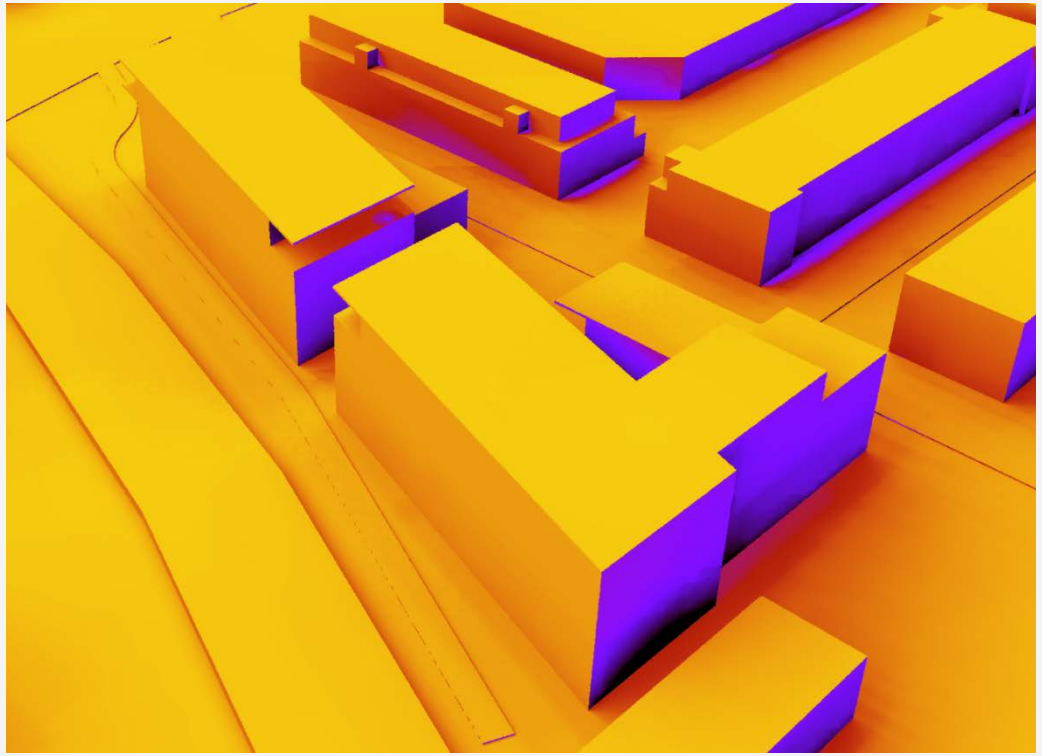
- Lease Rates/Sales Price that create a return on invested capital (8-10%)
- Predictability with regard to operating costs and tenants
- Long-term operating costs lower than competitors
- Long-term Value (high occupancy, appreciation, etc.)

OUR STRATEGY

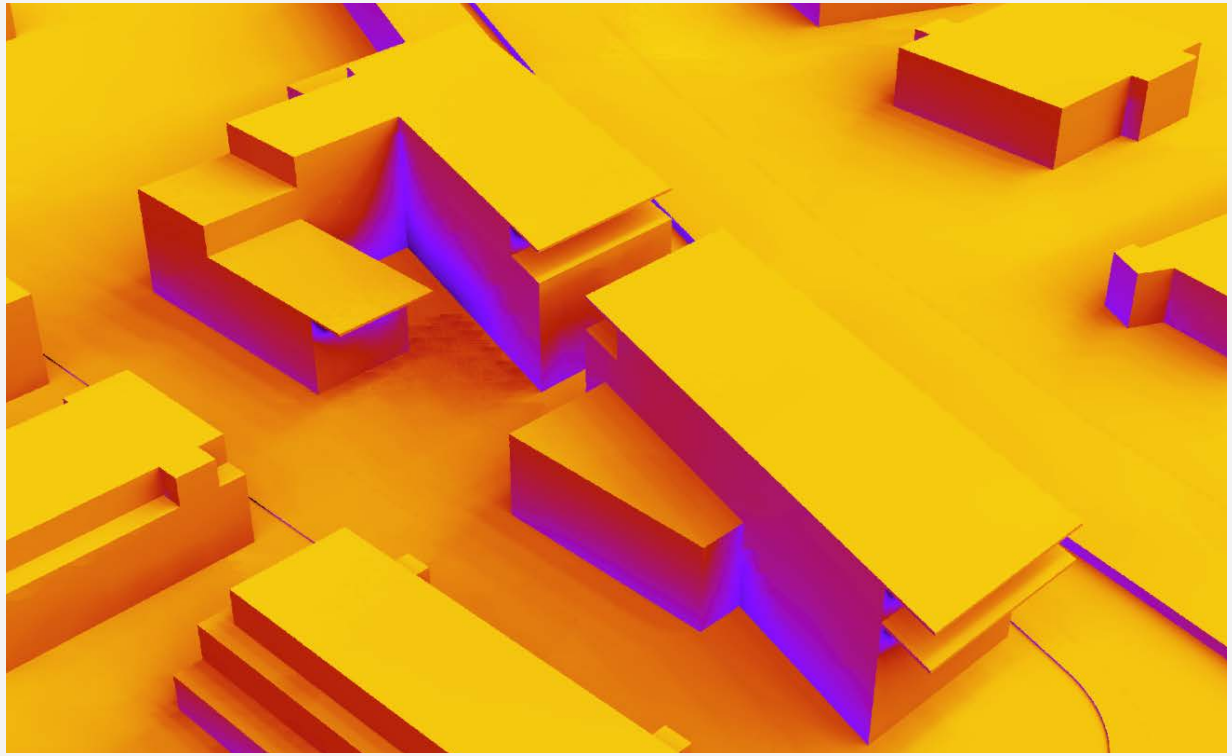
- High quality design
- Long Life/Loose Fit
- Low Resource Consumption
- Great Environment for People
- Dialogue with the Environment

PHOTOVOLTAIC LOCATIONS / SOLAR ANALYSIS



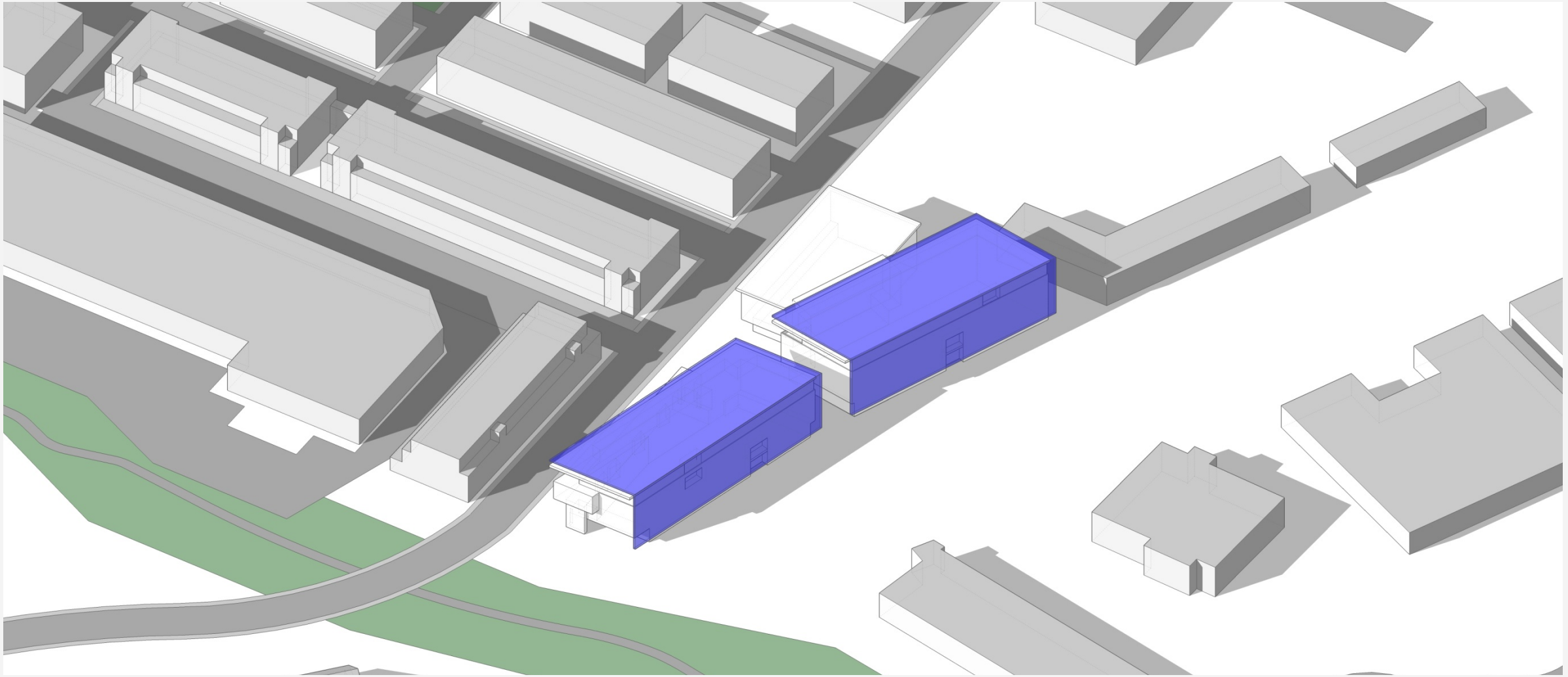


Northeast Perspective - Aerial



Southwest Perspective - Aerial

SOLAR / BUILDING FORM EVOLUTION



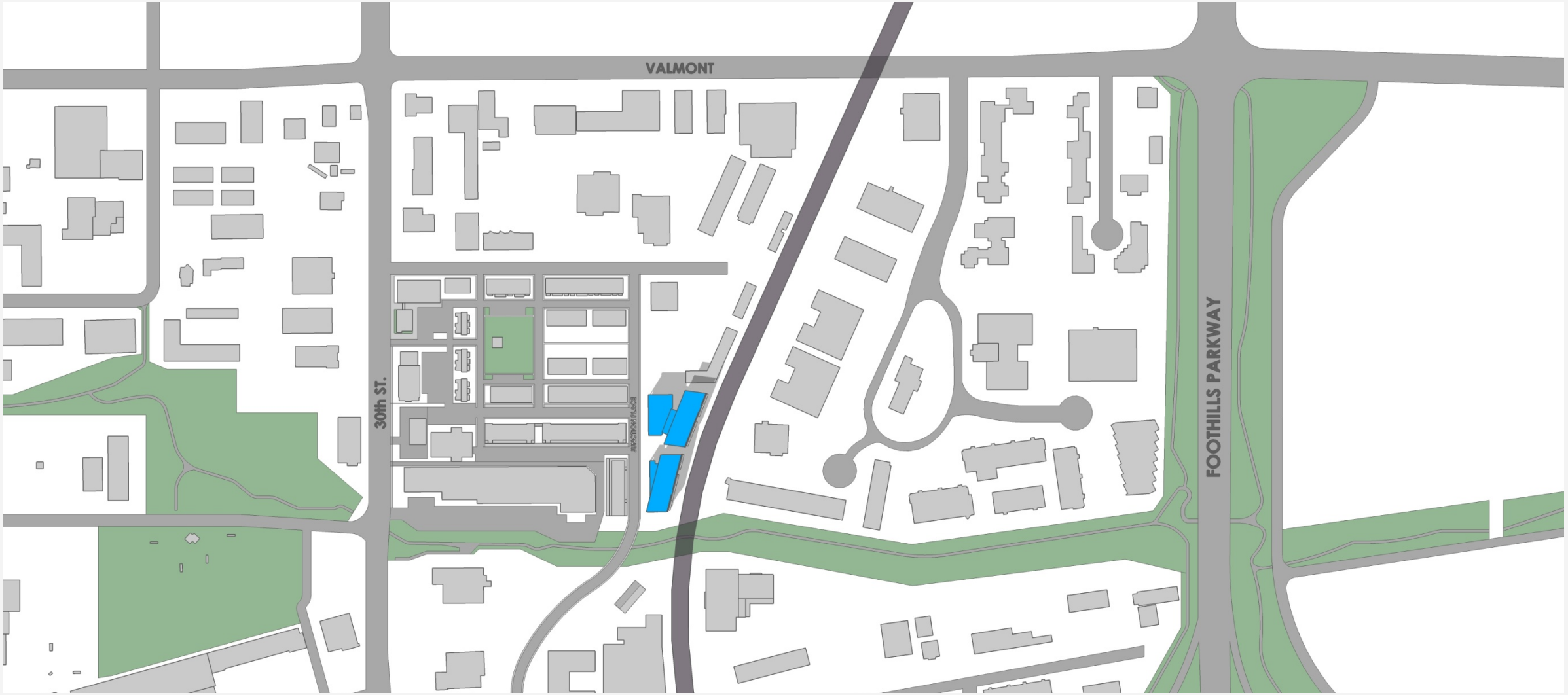
How can solar create a good return?.....before tax credits, etc.

Creating a Market Rate Return on Solar

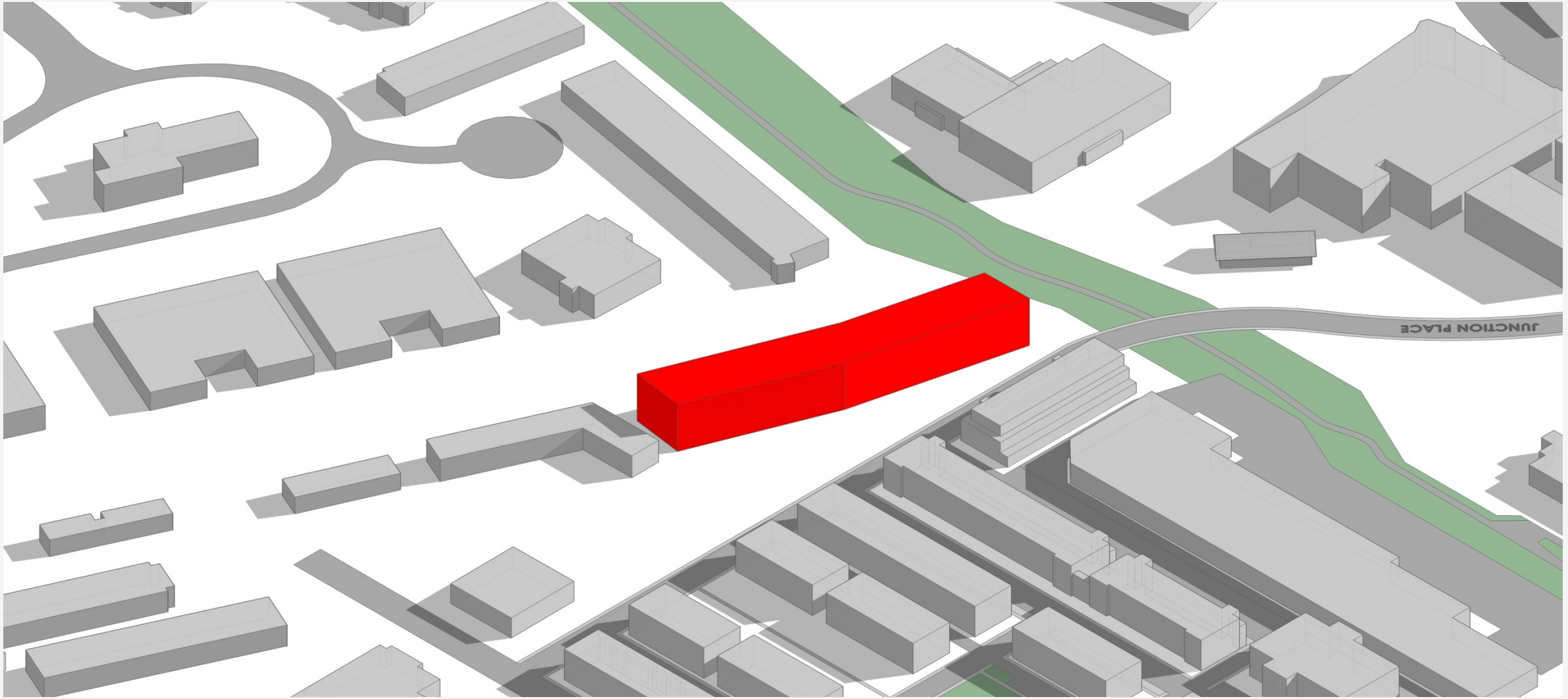
- Total Solar Cost-including attachment $~~1.9~~ 2.3M
- Market Rate for Energy (low end) $1.90/foot/year
  --$190,000 per year before depreciation/credits
- ~~10~~ 8.3% Cash on Cash Return-before financing

100,000 Square Foot Building

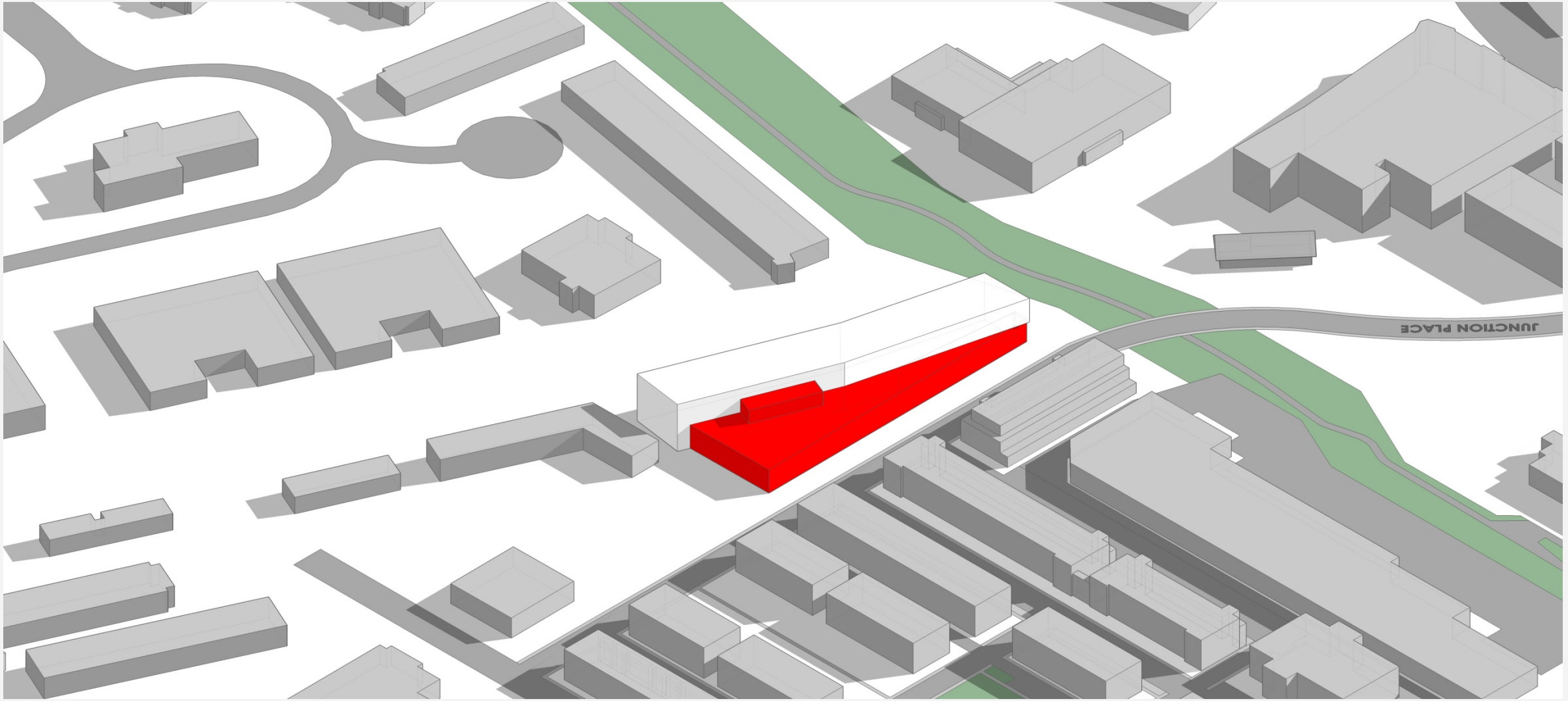
SITE AND BUILDING ORIENTATION



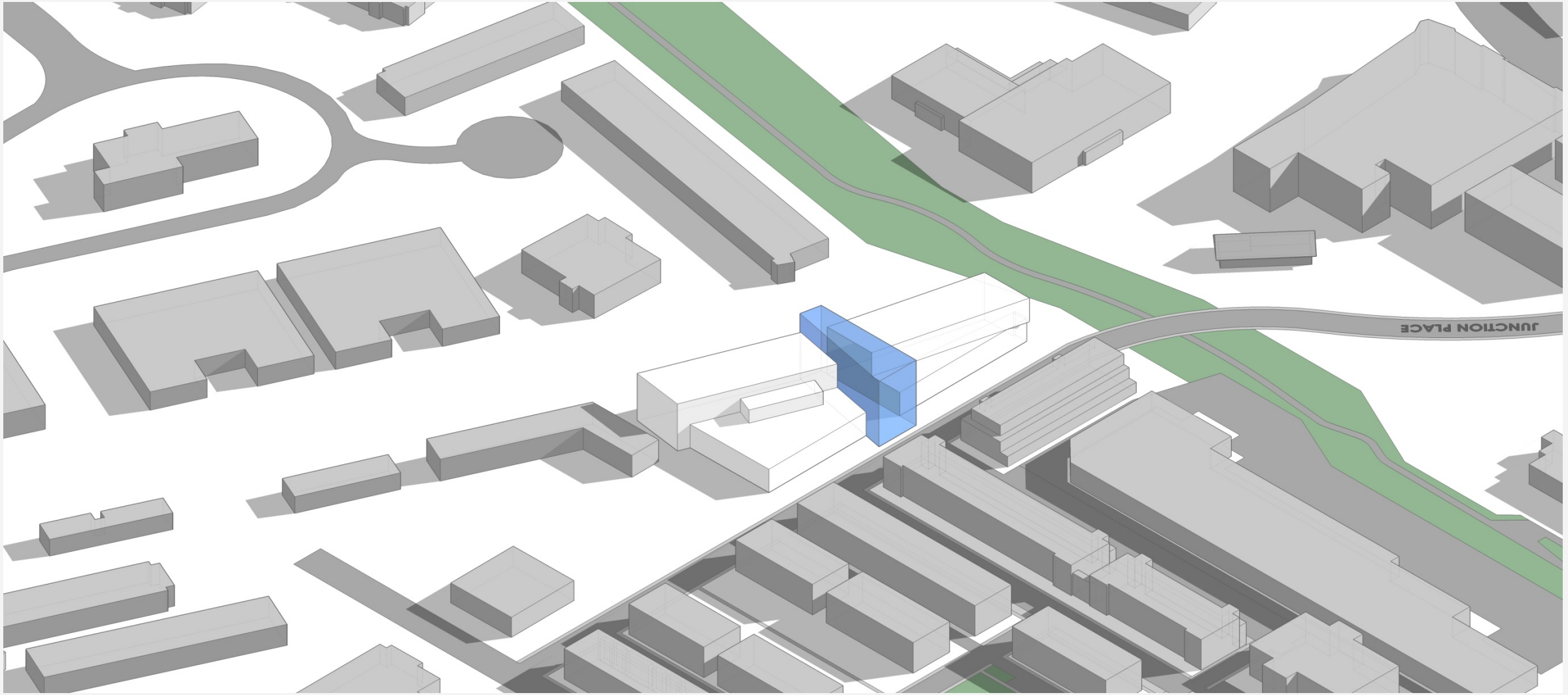
REAR BAR / BUILDING FORM EVOLUTION



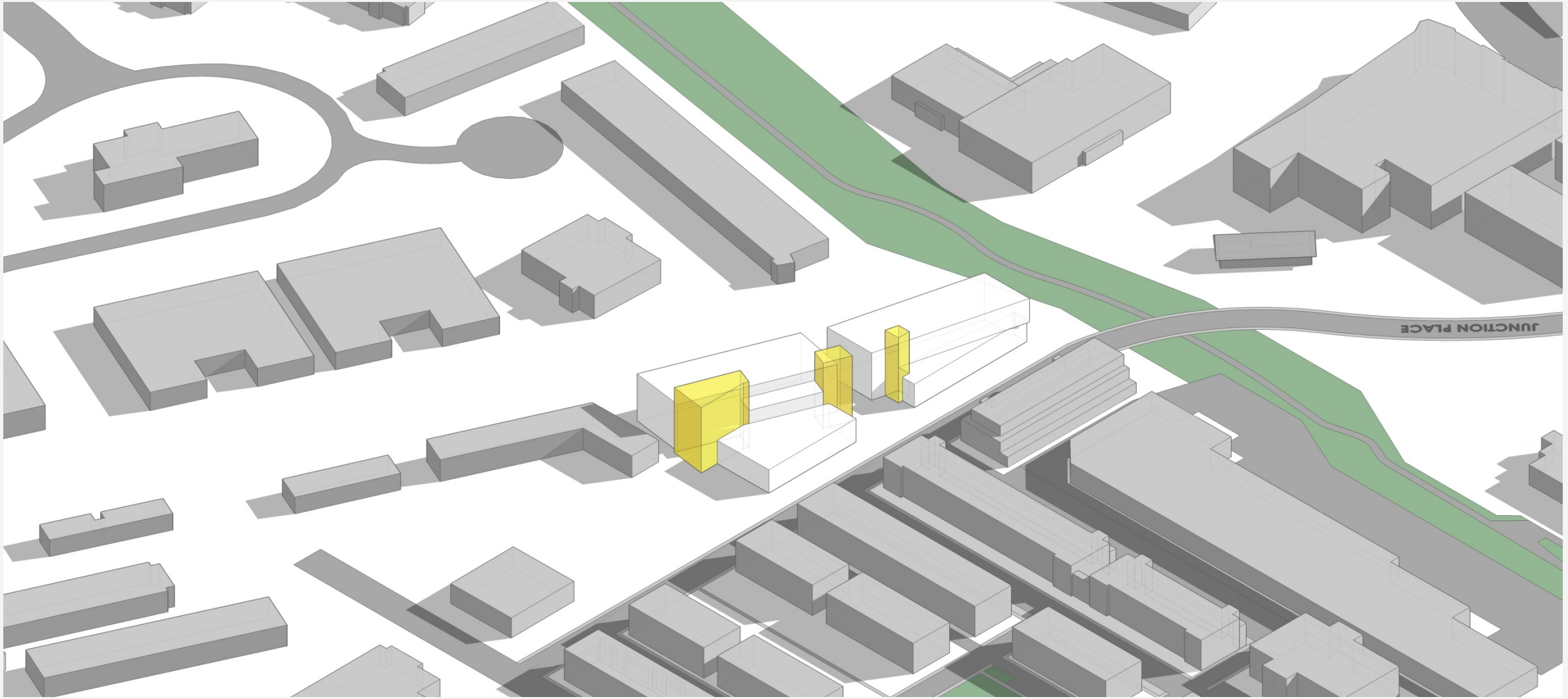
FRONT BAR / BUILDING FORM EVOLUTION



SPLIT / BUILDING FORM EVOLUTION



DAYLIGHTING / BUILDING FORM EVOLUTION



DAYLIGHTING

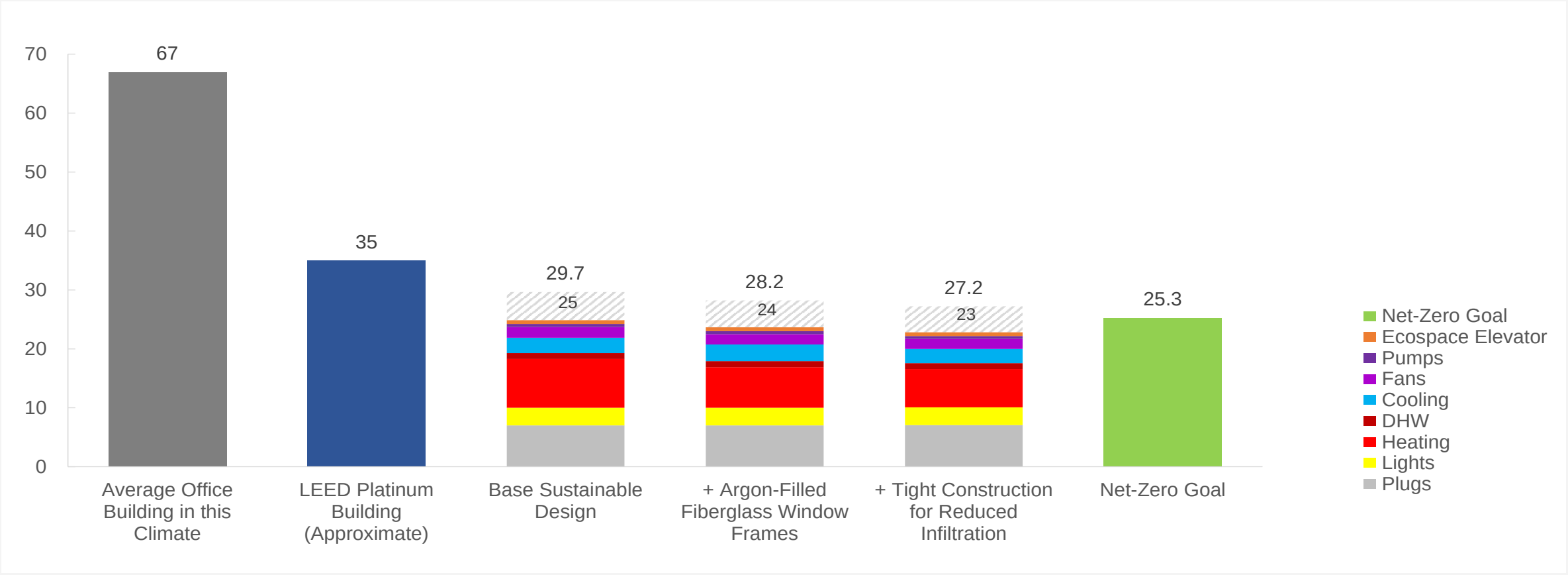
A Building is the sum of its systems

Daylight, views, efficient floor plans, flexible configurations

"Off the shelf" Components

- Narrow Floor Plates
- Variable Volume Refrigerant System
- Composite Steel Structure
- Triple Glazed Windows-gas filled
- Good Thermal envelope-mineral wool on exterior
- All LED Lighting

NET ZERO GOAL / ENERGY COMPARISON



A new space for RMI-Bright, Collaborative and Energy Efficient

Where do we go from here?

Repeat, Refine and Expand

- When it works-Repeat
- Refine details and installation methods
- Develop new integration techniques
- Integrate transportation into the dialogue
- Develop more district level projects
- Continue to ”Experiment”

BOULDER COMMONS

REPLICABLE NZE FOR MULTITENANT BUILDINGS

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Thank you!