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# Better Process Better Projects

October 8, 2013

Housing Washington Conference

Spokane, Wa



# About O'Brien & Company

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## Better Outcomes for High Performance Buildings

- Built projects: commercial, educational, residential
- Program and policy development: green building programs, city sustainability strategies
- Education and training: green jobs training, curriculum development



# Better Projects – Better Process

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- **Context**
  - The Building Performance Challenge
- **What's Possible**
  - Better Projects
- **Outcome Assurance**
  - Proven approach to getting better Outcomes



# PART ONE

## Context



# Downtown Seattle Portfolio

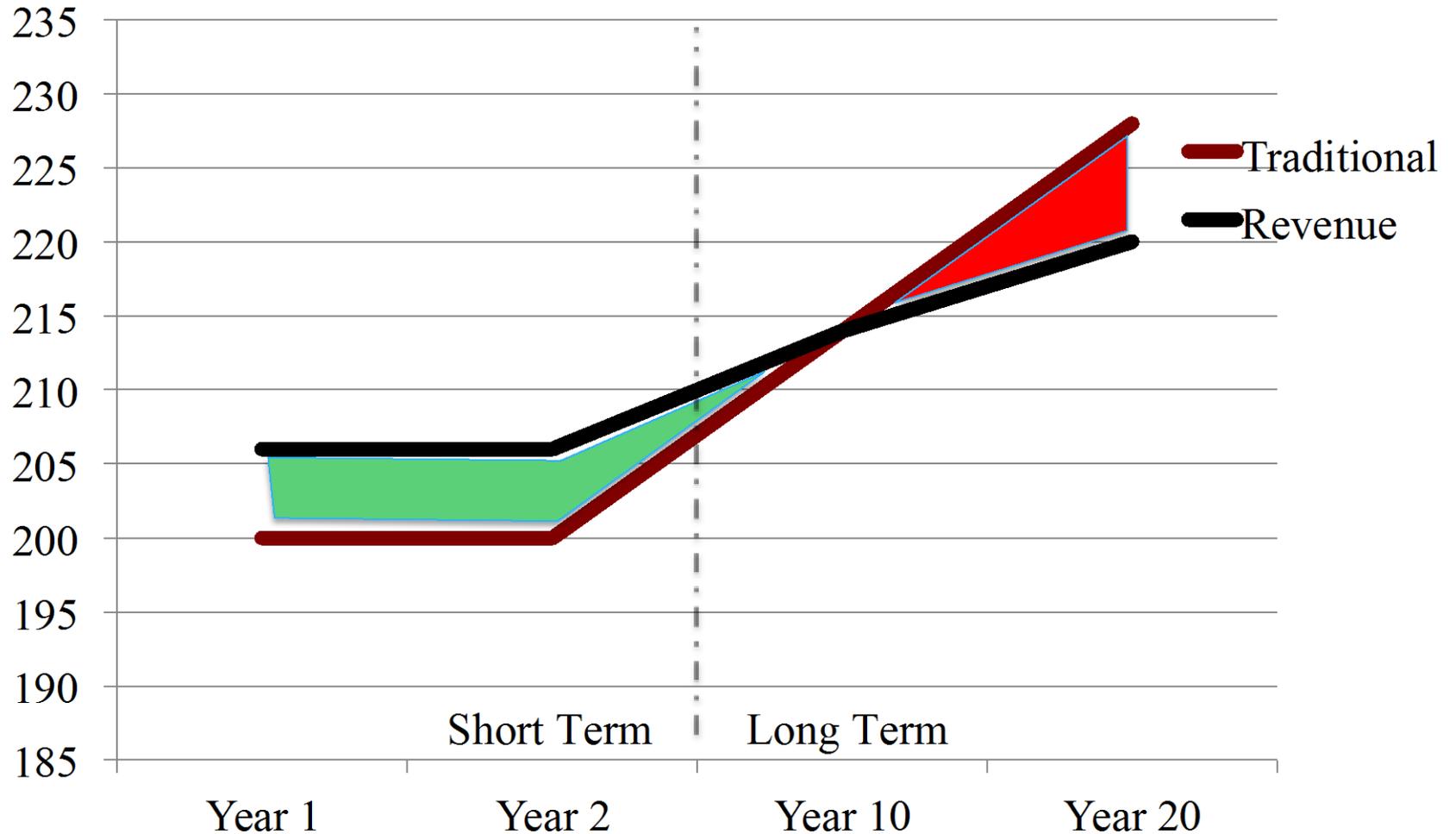
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- 621 Unit Portfolio, 10 Properties
- McArthur Foundation Grant Study
- Investment Paradigm:
  - High # of units for least cost

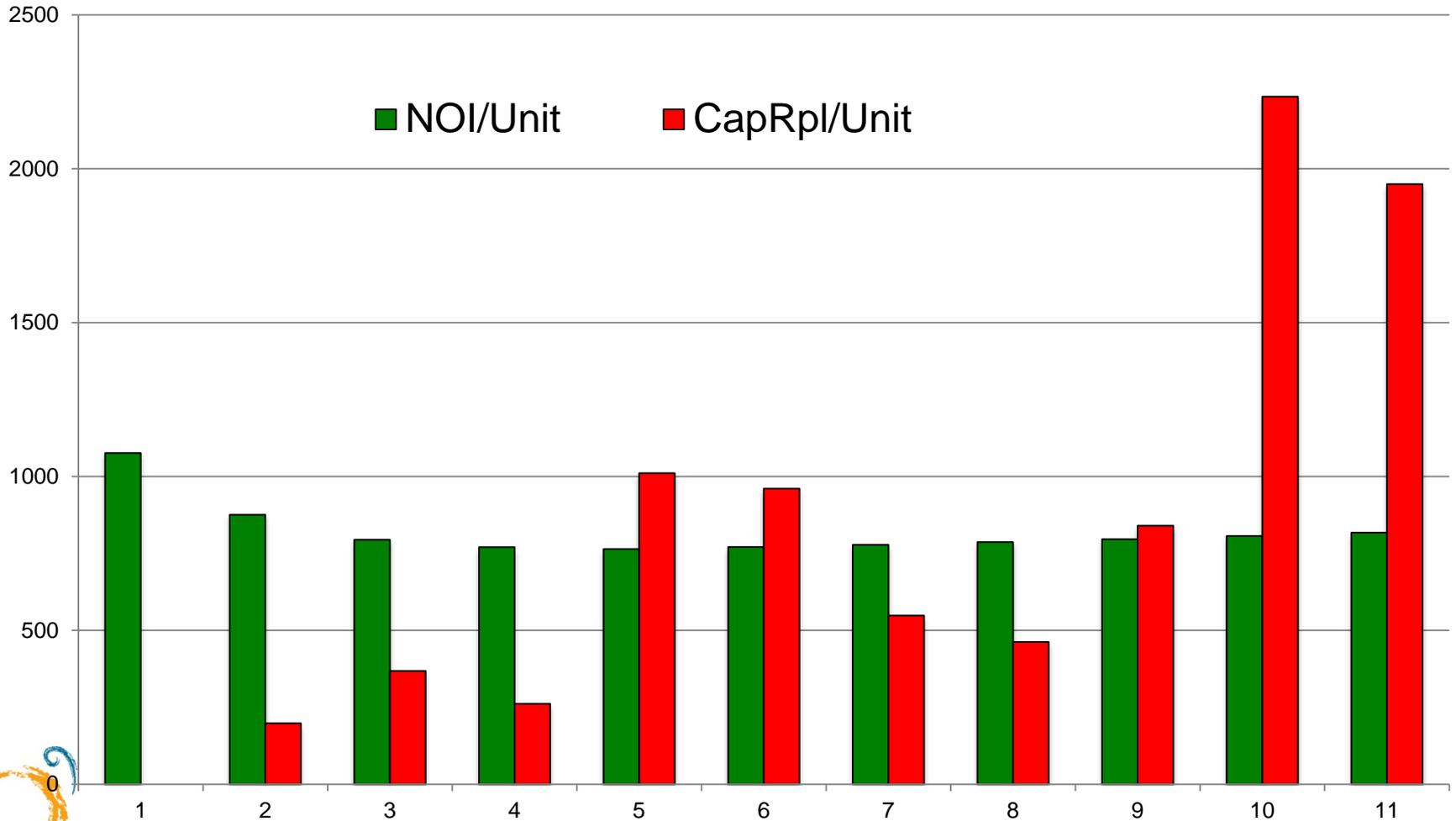


Courtesy of Pat Park, AdCor Consulting LLC

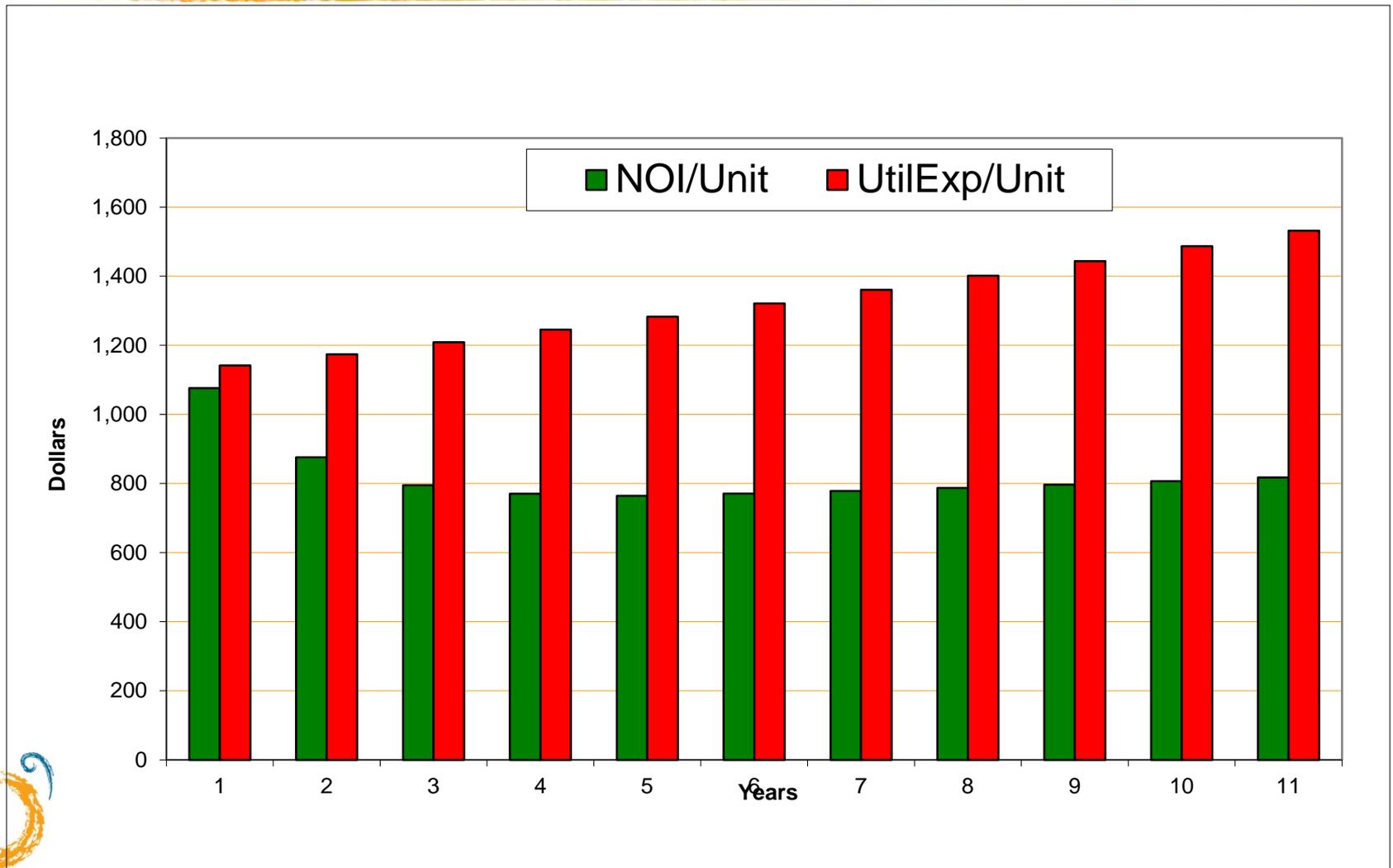
# Traditional lifecycle costs



# NOI vs Capital Replacement

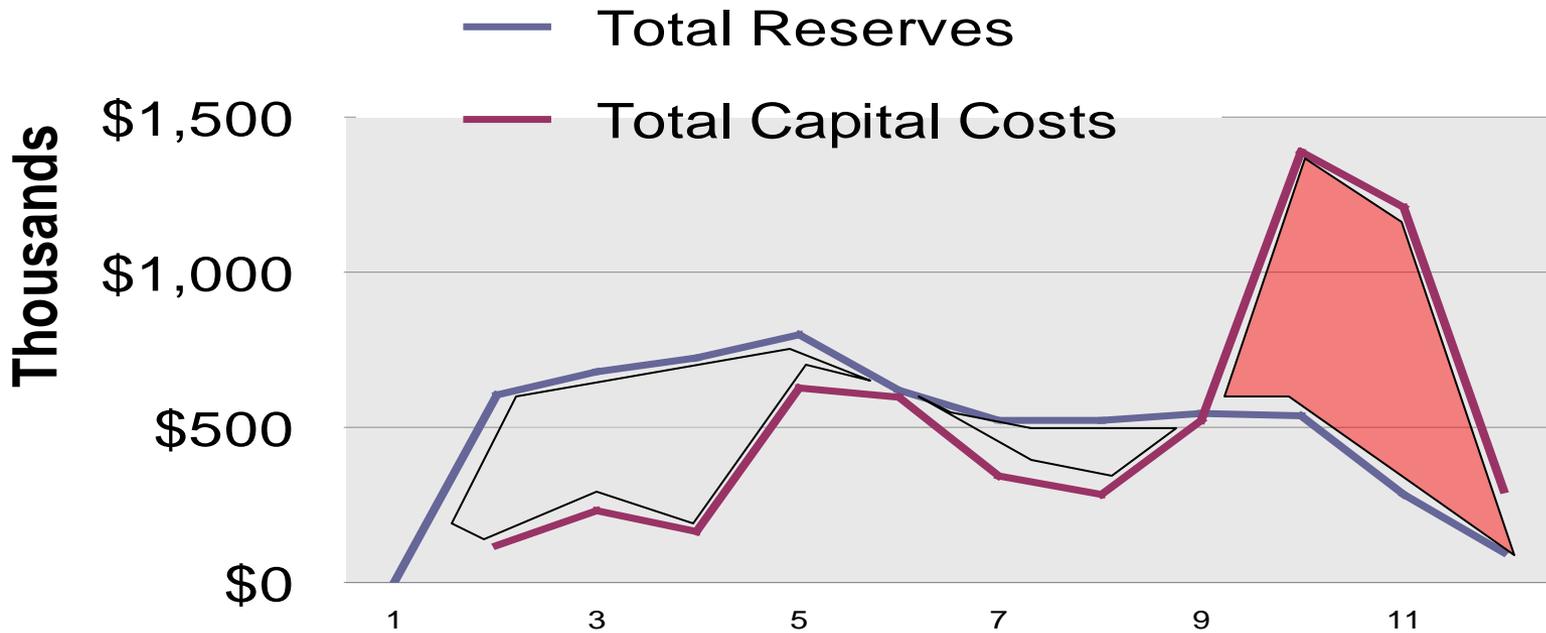


# NOI vs Utilities

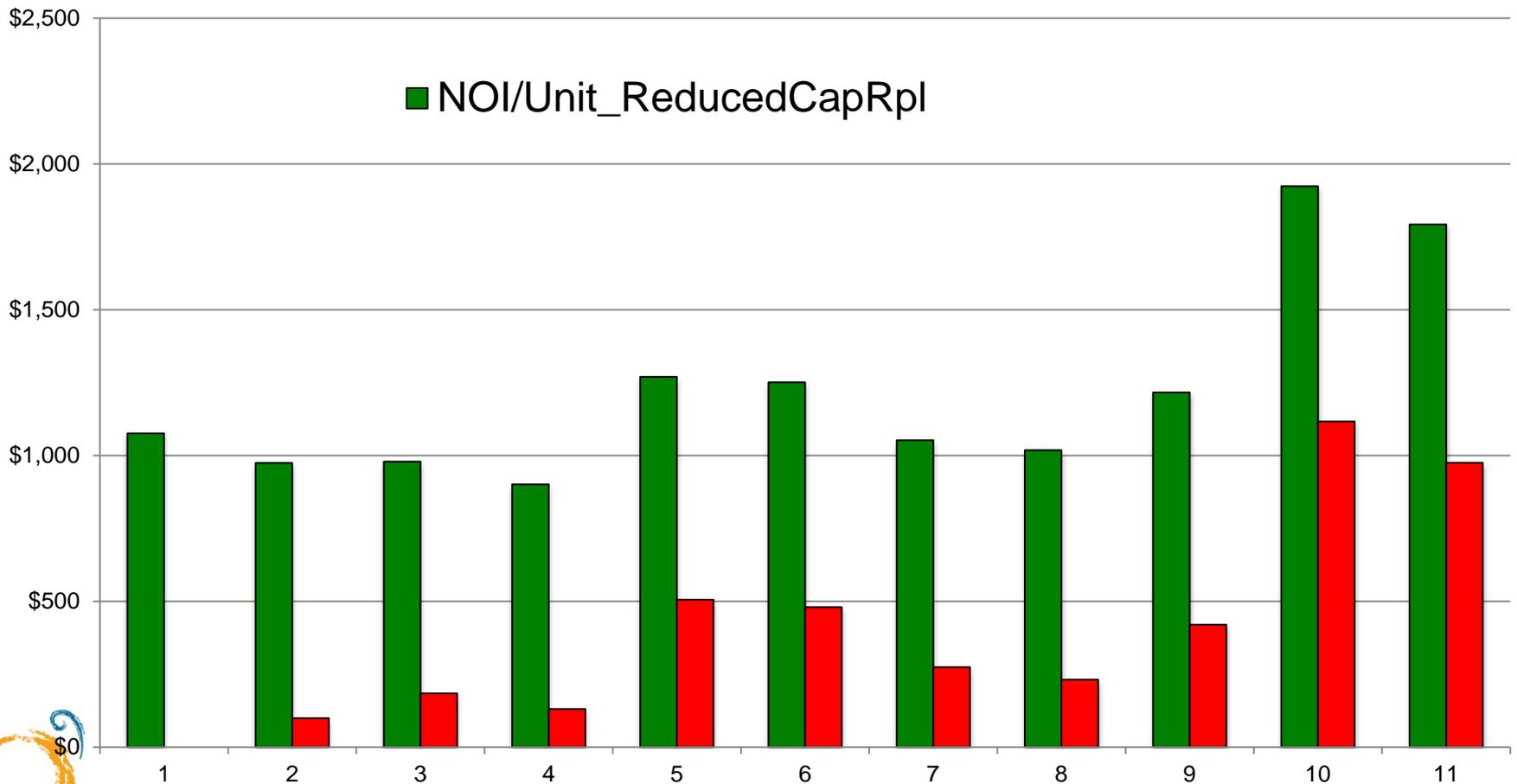


# McArthur Grant Findings

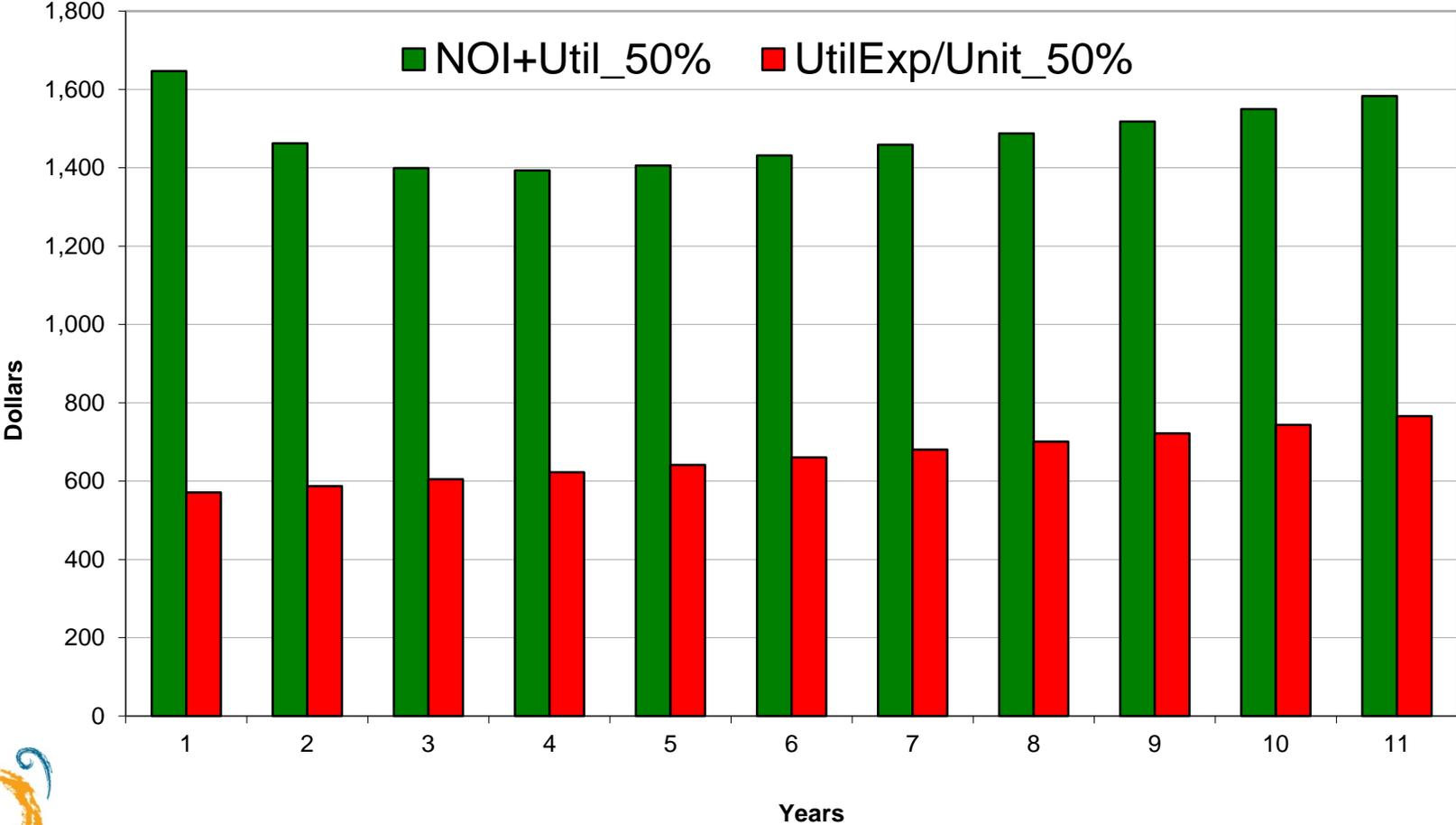
## Capital Needs vs Replacement Reserves



# NOI vs Capital Replacement \$ Reduced\_50%

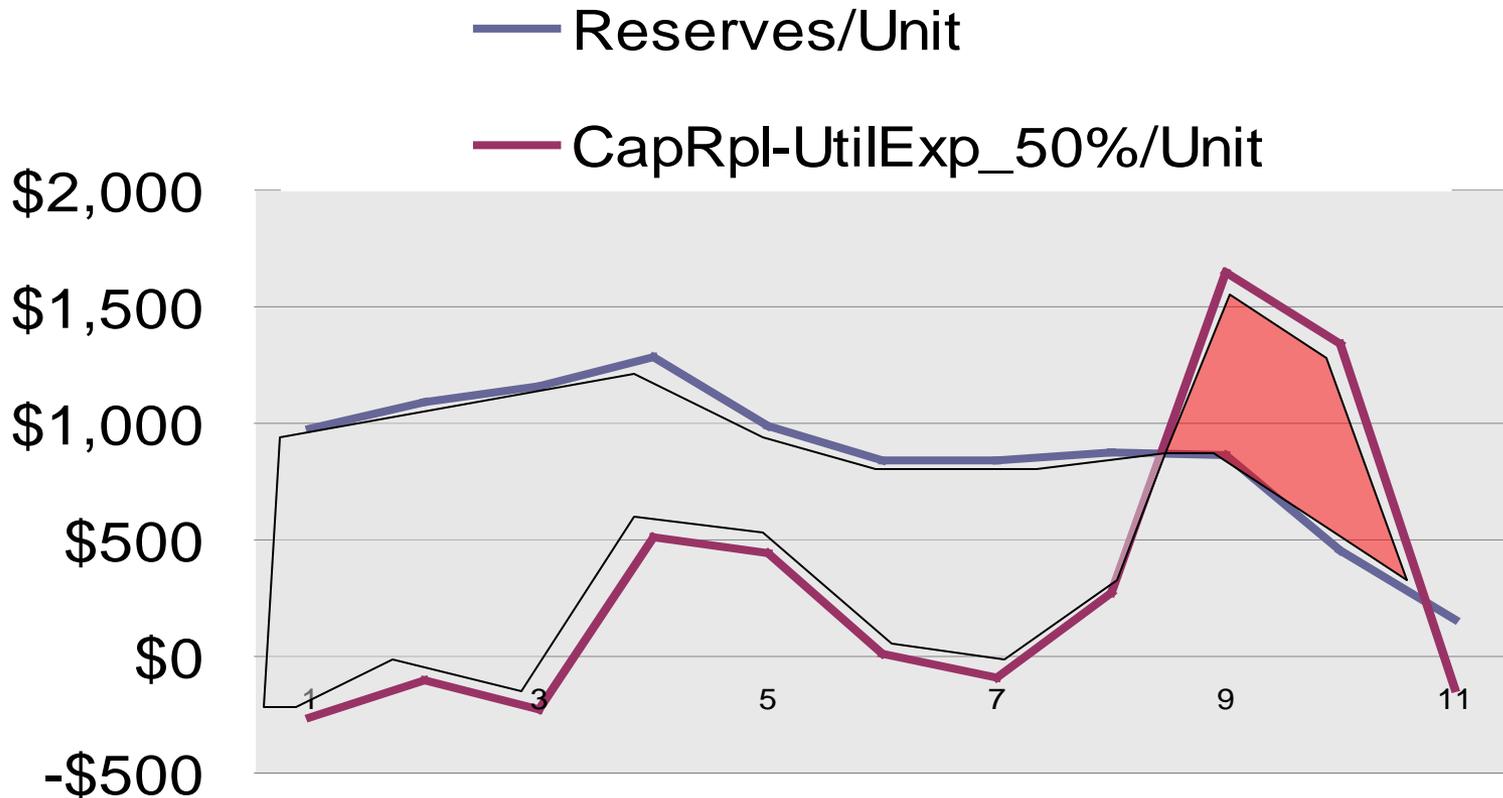


# NOI vs Utilities Reduced by 50%

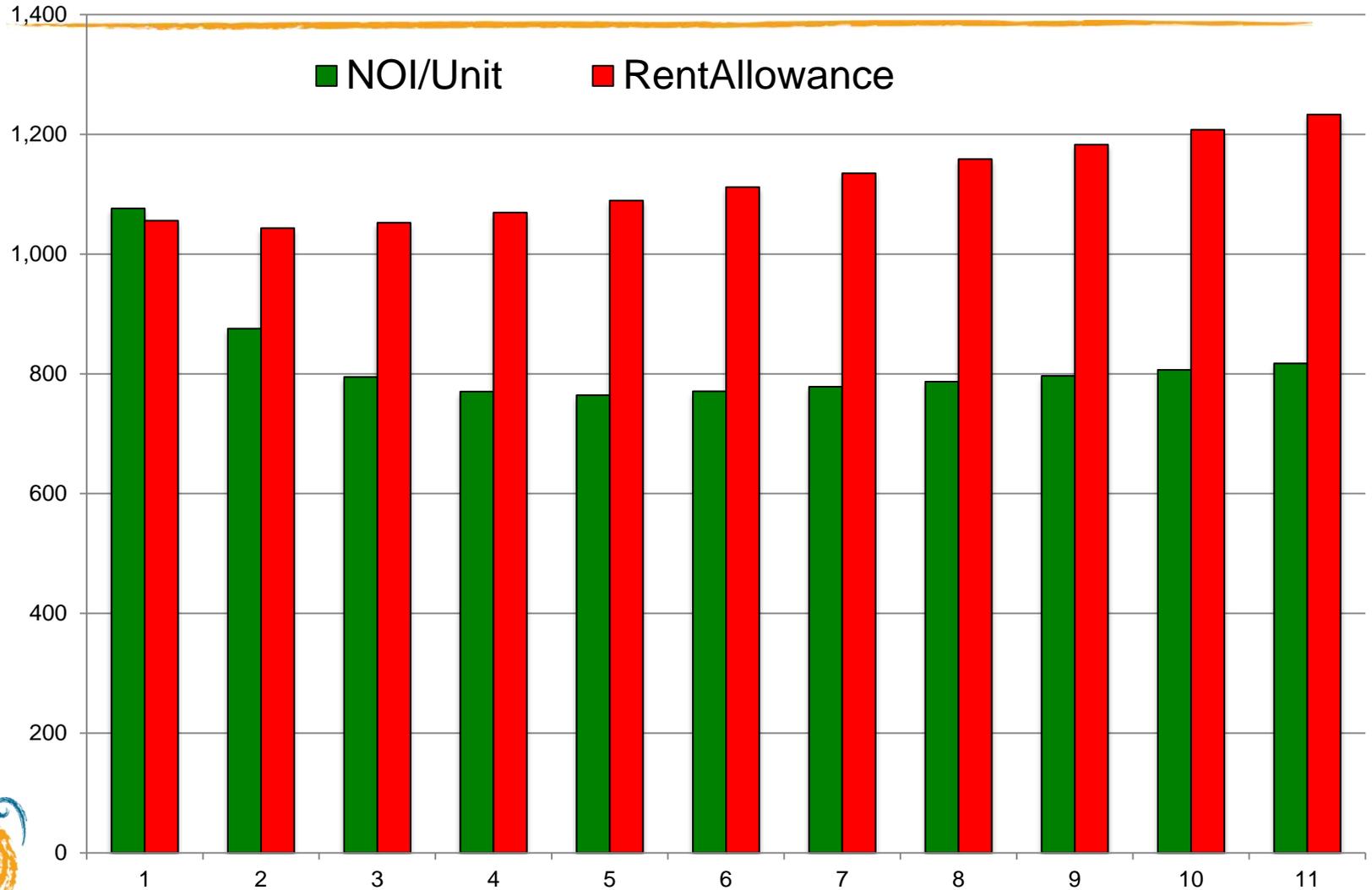


# Healthy Margin / Smaller Shortfall

## Capital Needs vs Replacement Reserves Per Unit



# NOI vs Rent Allowance



# If Reduce Rental Allowance (50%)

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## Traditional:

- SpcHeat \$24
- Cooking \$8
- Other (lights, plugs) \$36
- Water Heat \$20
- **Total: \$88**

## High Performance:

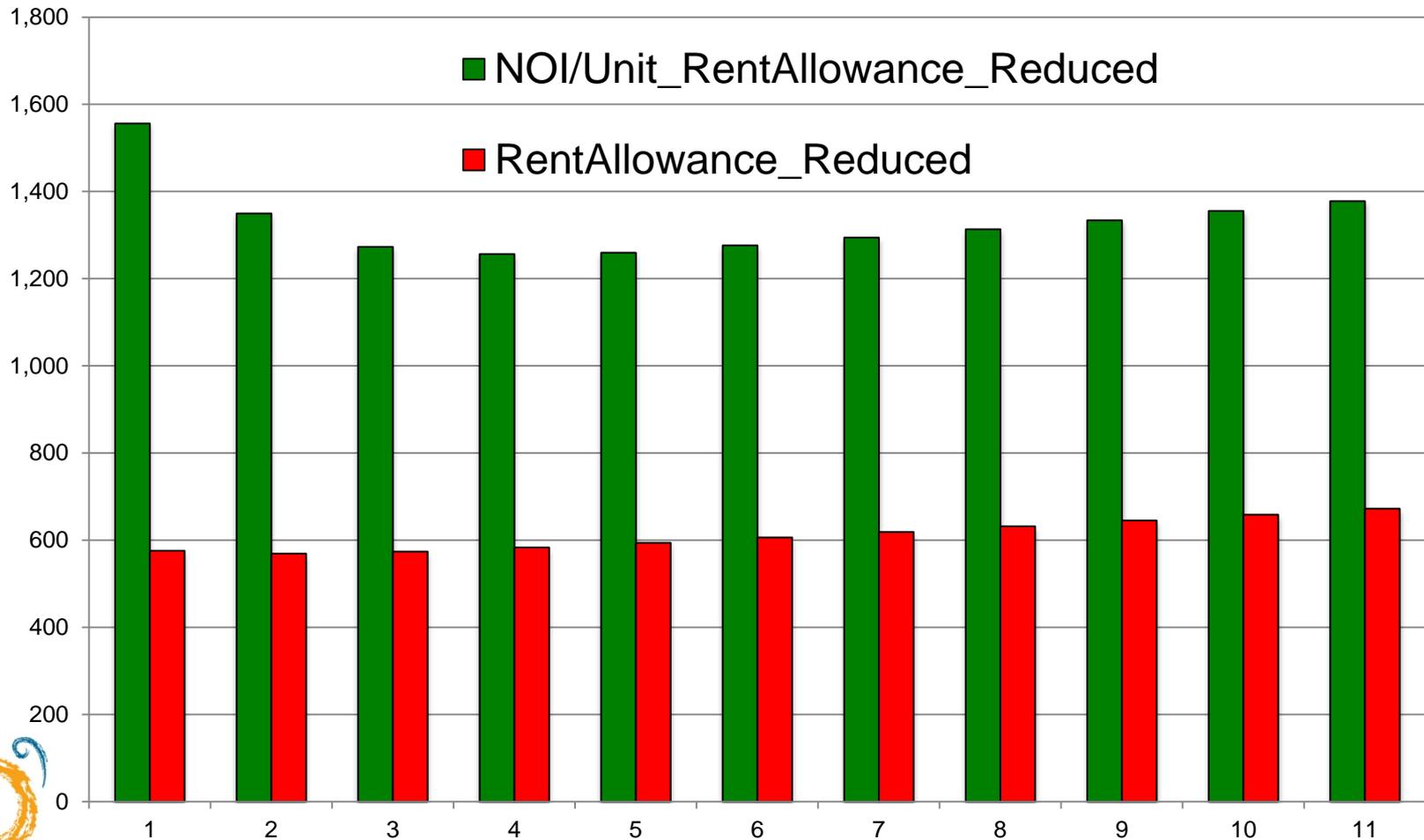
- SpcHeat **\$12**
- Cooking \$8
- Other (lights, plugs) **\$18**
- Water Heat **\$10**
- **Total: \$48**

**Difference: \$40**

(Add to reserves)

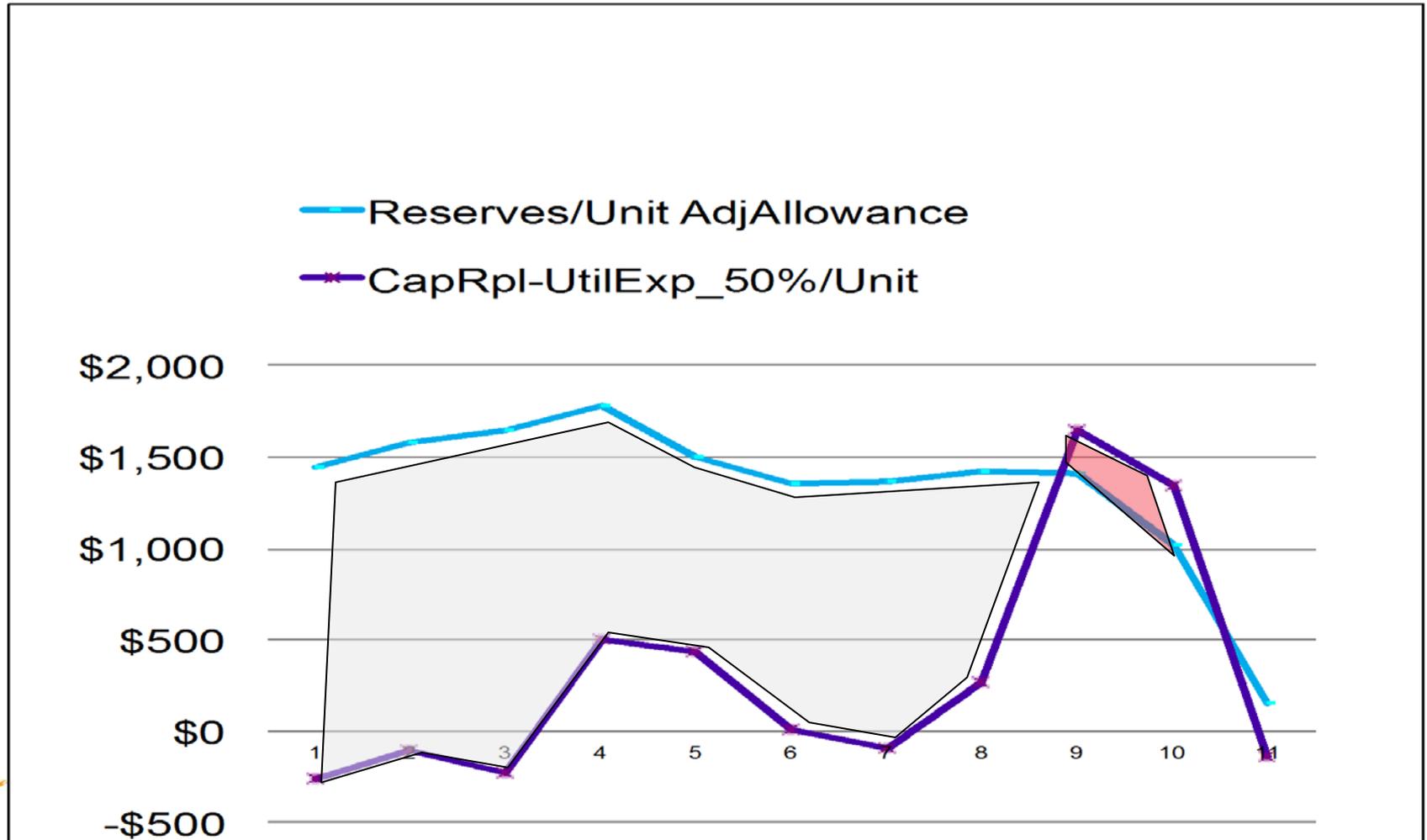


# NOI vs Reduced Rent Allowance



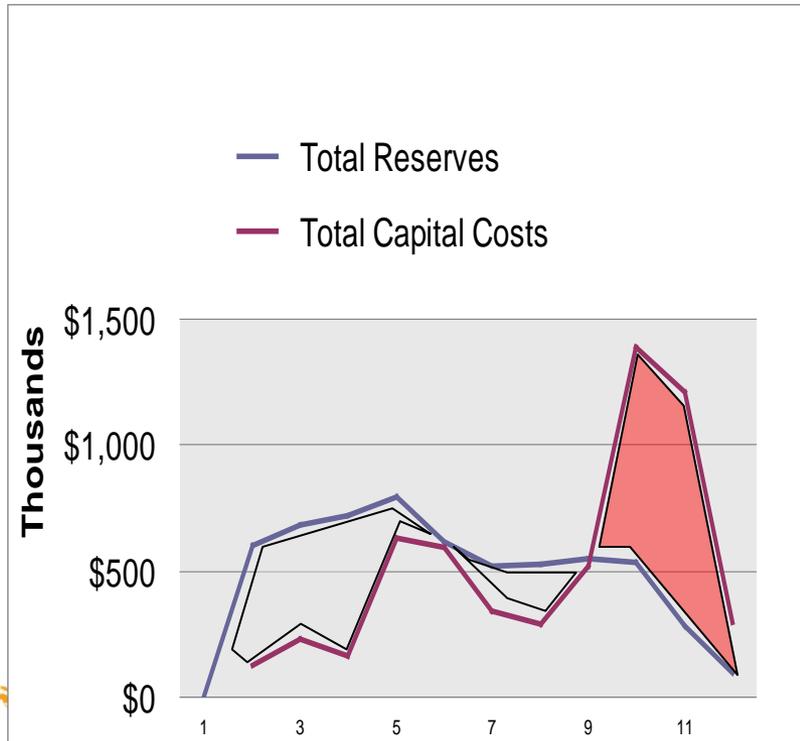
# Large Reserves / Small Shortfall

Lower capital Replacement, Utility Savings & Rent Allowance



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Lower capital Replacement, Utility Savings & Rent Allowance



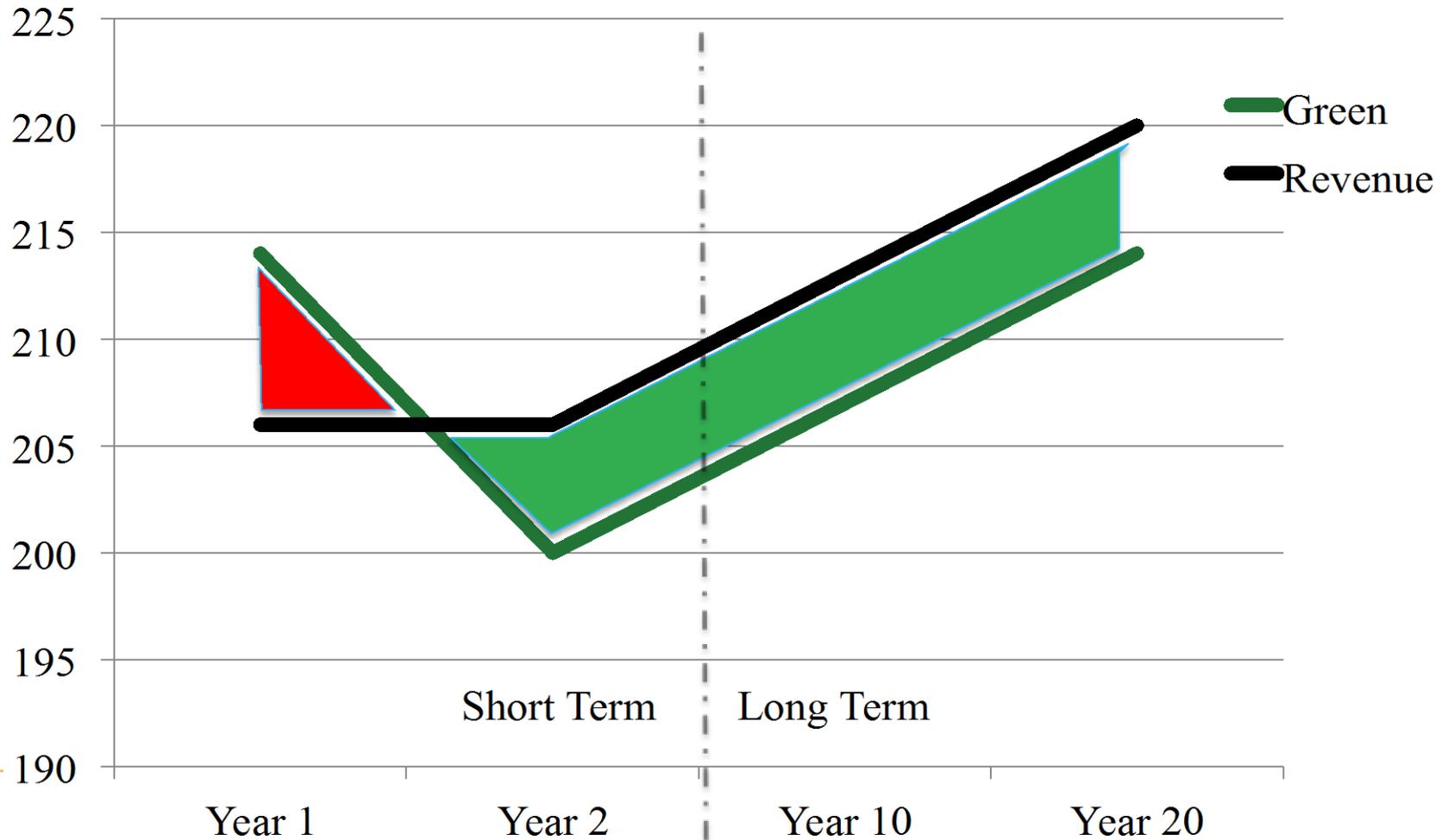
# Total Cost of Ownership (TCO)

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- Paradigm Shift: Focus on TCO
  - Design on 100 yr life cycle cost (vs only capital cost e.g. 200/SF or \$200K/Unit)
- Focus on Operational Sustainability First (NOI)



# Desirable Total Cost of Ownership



# Cha – Ching!

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# PART TWO

## What's Possible?



# “Performance Premium” vs Savings Analysis

# of Units	50	Cost/Unit	AddedCost%	AddedCost/Unit	Difference
Land	\$ 1,100,000	22,000	0%	0	
Construction	\$ 6,600,000	132,000	5%	6600	
Indirects	\$ 2,500,000	50000	1%	500	
Consultants	\$ 400,000	8000	40%	3200	
<b>Total</b>	<b>10,200,000</b>	<b>204,000</b>	<b>5%</b>	<b>10,300</b>	

	TCO		Present Value of Savings	
UtilExp_50%/Unit			(\$3,958)	
CapRp/Unit_50%			(\$2,877)	
RentAllowanceDecrease			(\$3,564)	
<b>TotalYear 10</b>	<b>\$9,680,029</b>	<b>\$193,601</b>	<b>(\$10,399)</b>	<b>(\$99)</b>
<b>TotalYear 15</b>	<b>\$9,537,002</b>	<b>\$190,740</b>	<b>(\$13,260)</b>	<b>(\$2,960)</b>
<b>TotalYear 20</b>	<b>\$9,393,976</b>	<b>\$187,880</b>	<b>(\$16,120)</b>	<b>(\$5,820)</b>



# High Performance Case Studies

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- **Modular Multi-family**

- The Belfield Townhomes

- Design-Build Delivery

- **Retrofit Multi-family**

- The Hatfield Building

- Integrated Design Process



# High performance case study

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**BELFIELD HOMES**  
PHILADELPHIA, PENNSYLVANIA 19141

Design-Build Delivery



**Architect: Tim McDonald**

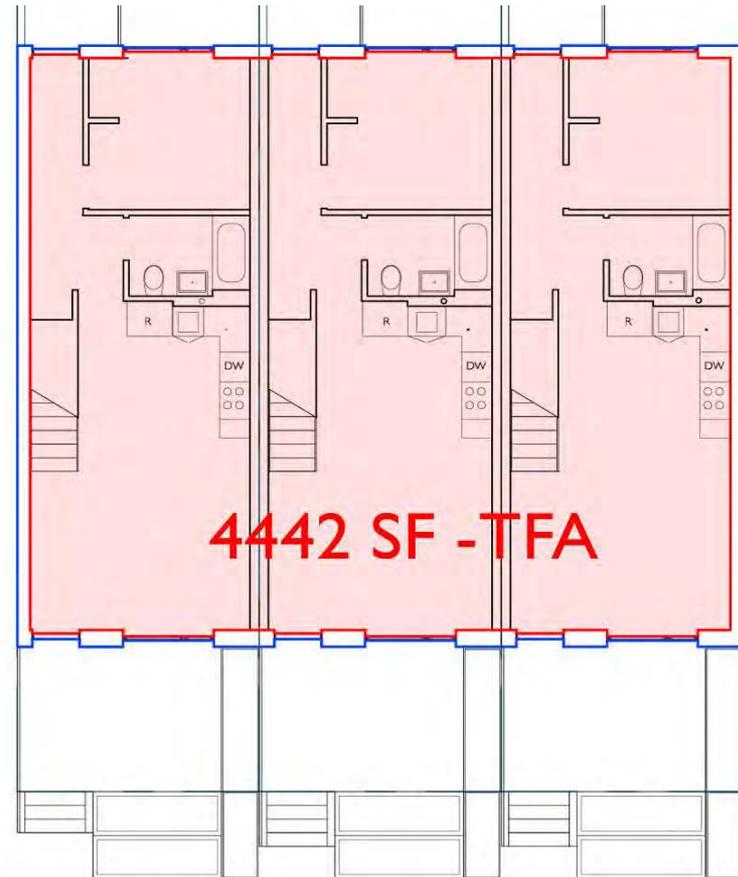
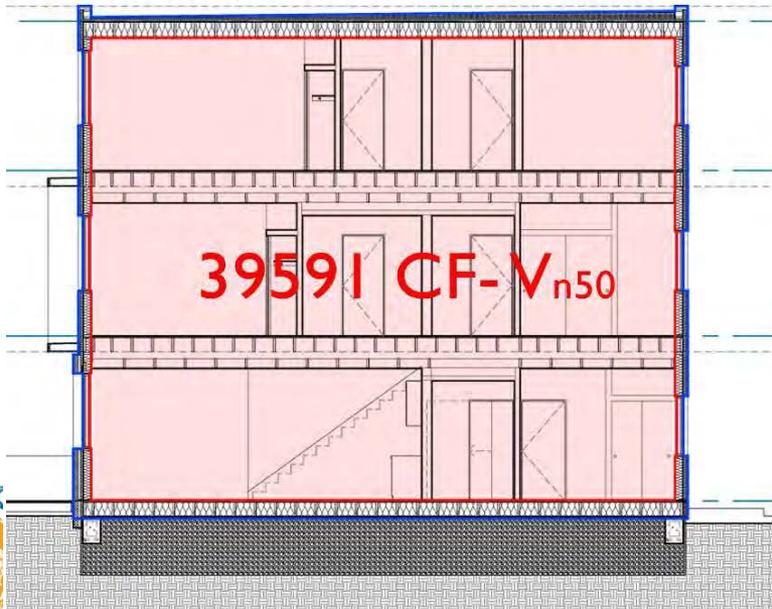


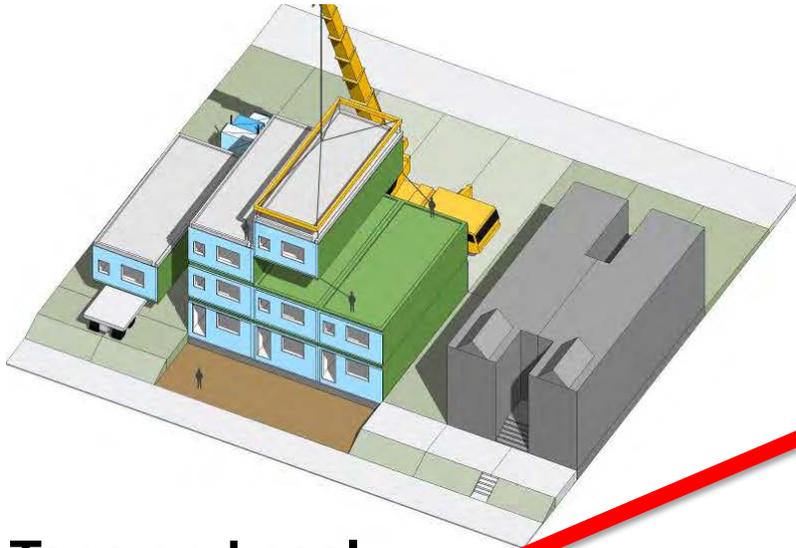
Courtesy of:  
Julie Kreigh,  
Kreigh Architecture Studio



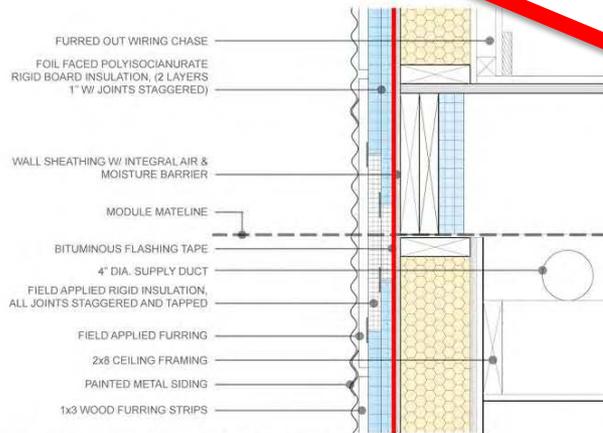
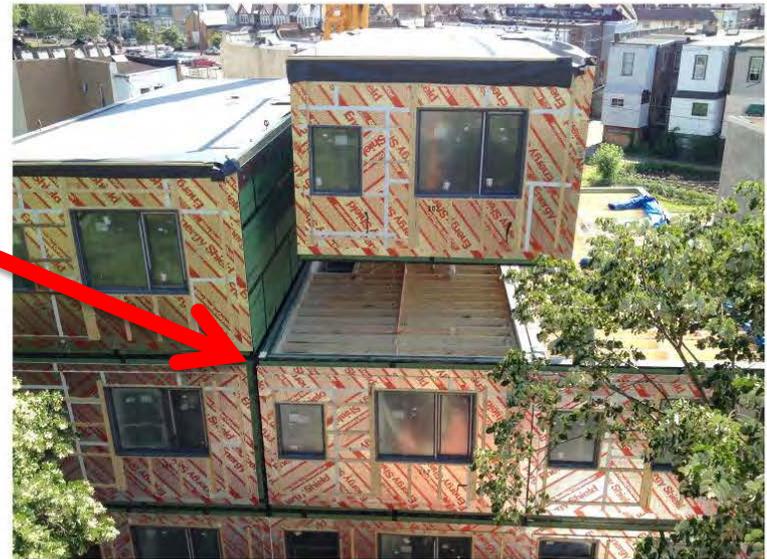
# Air, Water, Vapor Tight

## THERMAL ENVELOPE





# Tape and seal all joints for airtightness



**DETAIL: MODULE CONNECTION**



**BELFIELD HOMES**  
PHILADELPHIA, PENNSYLVANIA 19141





# MEASURE

\$20 | \$200  
Utility Bills  
Per Month

# WHY?

**eMonitor Dashboard**  
1739 Belfield Ave. Philadelphia Pa 19144

Current use: 0.36 kW | \$0/hr    Outside Temp: 66°F    Switch location

**Utility Meter**    **Power Production**

1896 Watts    2248 Watts

**361w**  
Power Usage Now

**Top Appliances/Circuits On**

- Ht Pump-HeatCool (141w)
- Lvl 3 - Energy Recovery V... (101w)
- Kitchen Refrigerator (79w)
- Unmonitored Power (32w)

**30-Day Carbon Footprint**

PA Avg: 981 lbs.    My CO<sub>2</sub>: 338 lbs.

**Where I've used electricity in the past 30 days. Top 12 Circuits**

HT Pump HEAT COOL: \$29

LVL 3 Energy rec: \$7

LVL1 Clg LTG sta: \$0  
EXT LTG outlet: \$0  
eMonitor smoke de: \$0  
LVL 2 Hall LTG B: \$0  
Ht Pump HOT WATER: \$1  
Kitchen refrigera: \$5

**Electricity Cost by Month**

This Month	\$30
Last Month	\$43
Actual	\$24

**Top 4 Users by Cost - Last 30 days**

Ht Pump-HEAT/COOL/energy recover	\$29
LVL 3 - Pump-HOT WATER	\$7
Kitchen refrigerator	\$5
Ht Pump-HOT WATER	\$1

**Past Year**    **Past Month**

Usage (kWh)    Production (kWh)

Aug: 350 kWh Usage, 100 kWh Production  
Sep: 150 kWh Usage, 50 kWh Production

**Past Day**    **Past Week**    **Past Month**

Use    Production    Both

Watts used today

12:00AM    4:00AM    8:00AM    12:00PM    4:00PM    8:00PM

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## CONSTRUCTION COSTS

	PER UNIT	PROJECT TOTAL
GENERAL CONDITIONS	\$1,500	\$4,500
EXCAVATION & GRADING	\$3,000	\$9,000
FOUNDATIONS	\$7,000	\$21,000
HELICAL PIERS	\$6,500	\$19,500
SITE UTILITIES (WATER / SEWER / ELECTRIC)	\$10,000	\$30,000
SOLAR PV (5 KW PER HOUSE - 15KW TOTAL)	\$15,000	\$45,000
<b>TOTAL SITE WORK</b>	<b>\$43,000</b>	<b>\$129,000</b>
FRAMING / INSULATION / SHEETROCK / PAINT	\$50,250	\$150,750
EXT.WINDOWS & DOORS	\$9,850	\$29,550
MECHANICAL SYSTEM	\$8,500	\$25,500
PLUMBING & SPRINKLERS	\$9,500	\$28,500
ELECTRICAL	\$5,500	\$16,500
CABINETS / COUNTERTOPS	\$5,500	\$16,500
APPLIANCES	\$6,200	\$18,600
HARDWARE & FINISHES	\$9,300	\$27,900
EXTERIOR CLADDING	\$4,500	\$13,500
E-MONITORING	\$1,900	\$5,700
LABOR / INSPECTIONS / OH-P / DELIVERY / INSTALL	\$95,000	\$285,000
<b>TOTAL MODULAR</b>	<b>\$206,000</b>	<b>\$618,000.00</b>
<b>MODULAR COST PER SQFT</b>		<b>\$107.00 SF</b>
<b>TOTAL HARD COSTS</b>	<b>\$249,000</b>	<b>\$747,000.00</b>
<b>COST PER SQFT (1920 SQFT x 3 HOMES = 5760 SQFT)</b>		<b>\$129.69</b>



# High performance case study

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## Multi-Family PASSIVE HOUSE

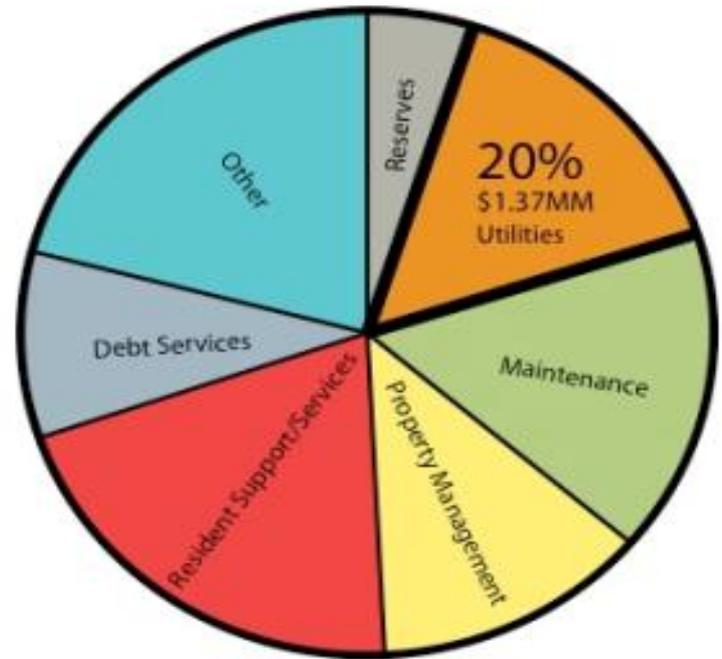
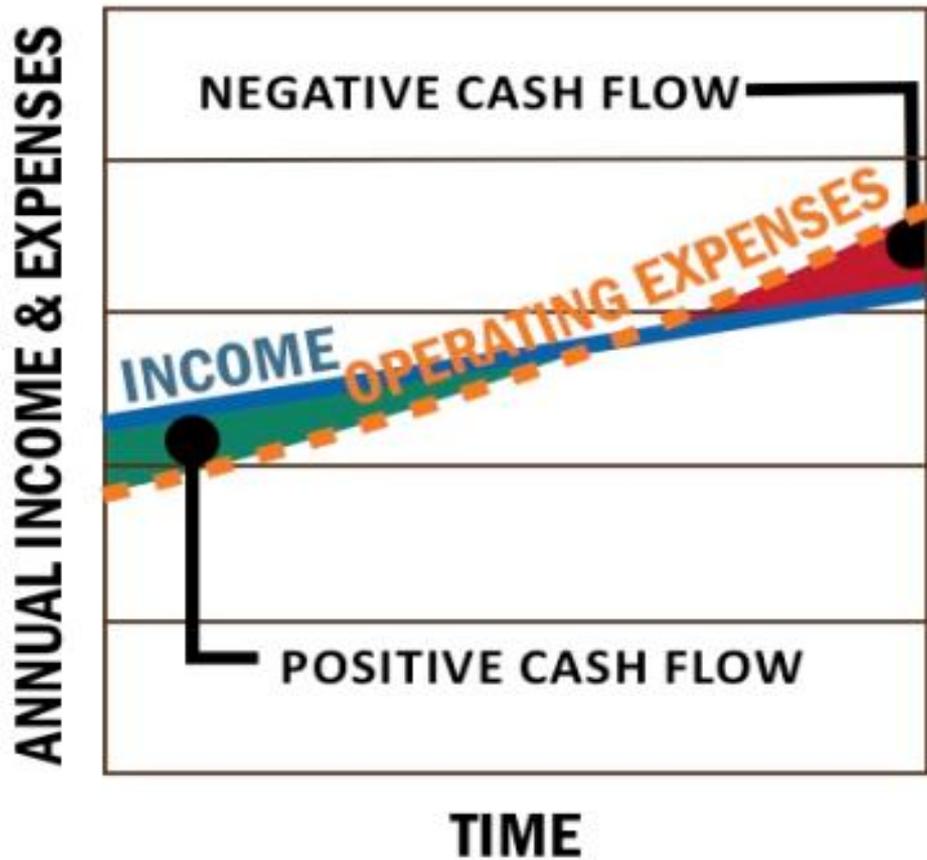
Mark O. Hatfield Building | Portland, Oregon

Highly Integrated  
Process and Model  
Up-Front

Courtesy of:  
Julie Kreigh,  
Kreigh Architecture Studio

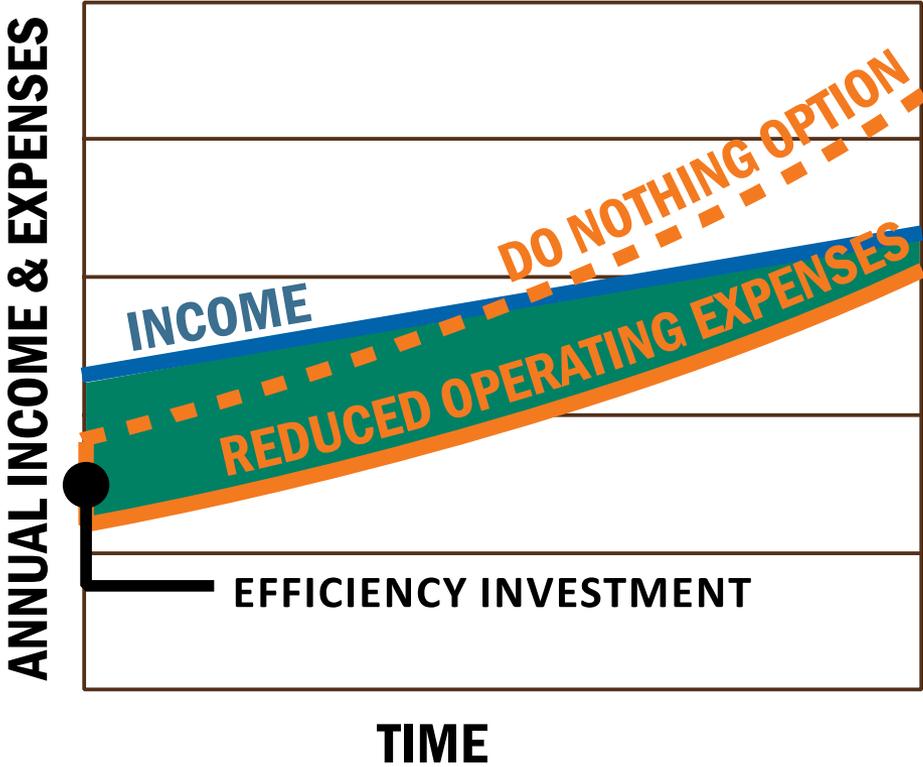


# WHY THE CONCERN?



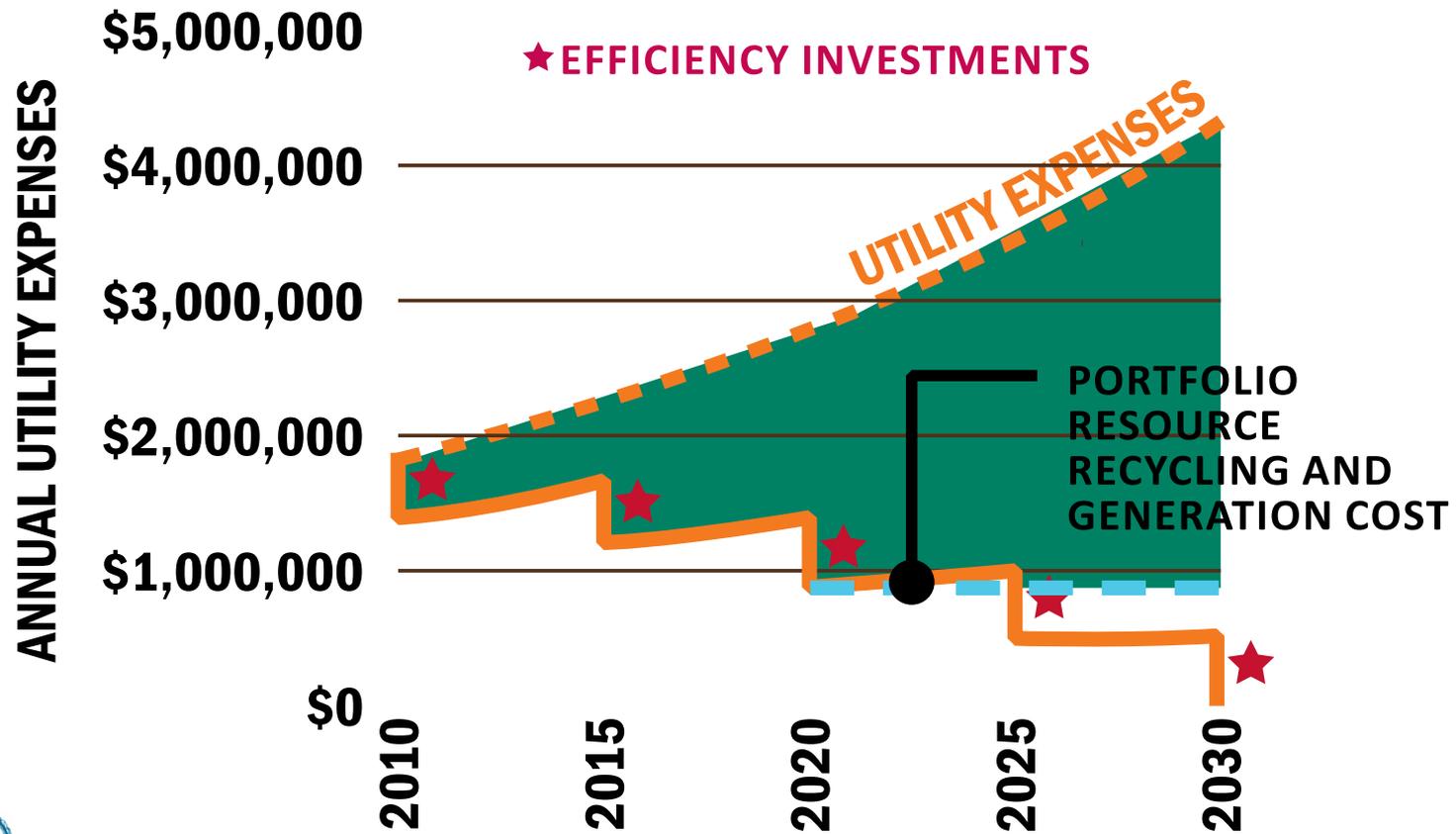
OPERATING EXPENSES

# WHAT ARE OUR OPTIONS?



# TIME FOR GIANT LEAPS... ...NOT BABY STEPS

## 20% reductions every 5 years



# ASSEMBLY COMPONENT OPTIONS

Invest in a process that functions as a GPS- it will allow the team to stay the course or change course as needed without losing sight of the end goals

	Existing Building	Good Rehab	Better Rehab	Best Rehab Passive House
Basement Slab Insulation	none	none	none	none
First Floor Insulation	none	none	none	none
Wall Insulation	none	none	2" EPS Exterior Insulation	6" EPS Exterior Insulation
Roof Insulation	Existing 4" Polyiso Board	Existing 4" Polyiso Board w/limited repair	Existing 4" Polyiso Board w/limited repair	Existing 4" Polyiso Board w/limited repair
Window Frame	Aluminum (not thermally broken)	Fiberglass (Cascadia 300 tilt/turn)	Fiberglass (Cascadia 300 tilt/turn)	Fiberglass/Vinyl (Rehau Geneo Euroline 4700)
Frame U-Value	unknown	0.289	0.289	0.14
Window Glazing	Single Pane	2-pane/Cardinal LoE 366 Argon	3-pane/Cardinal LoE 366/180 Argon	3-pane Rehau Geneo PHZ
U Value IGU	1.02	0.20	0.12	0.11
Airtightness (ACH at 50 pa)	10	5.00	0.60	0.60
Airtightness (cfm/sf, 75a)			0.16	0.16



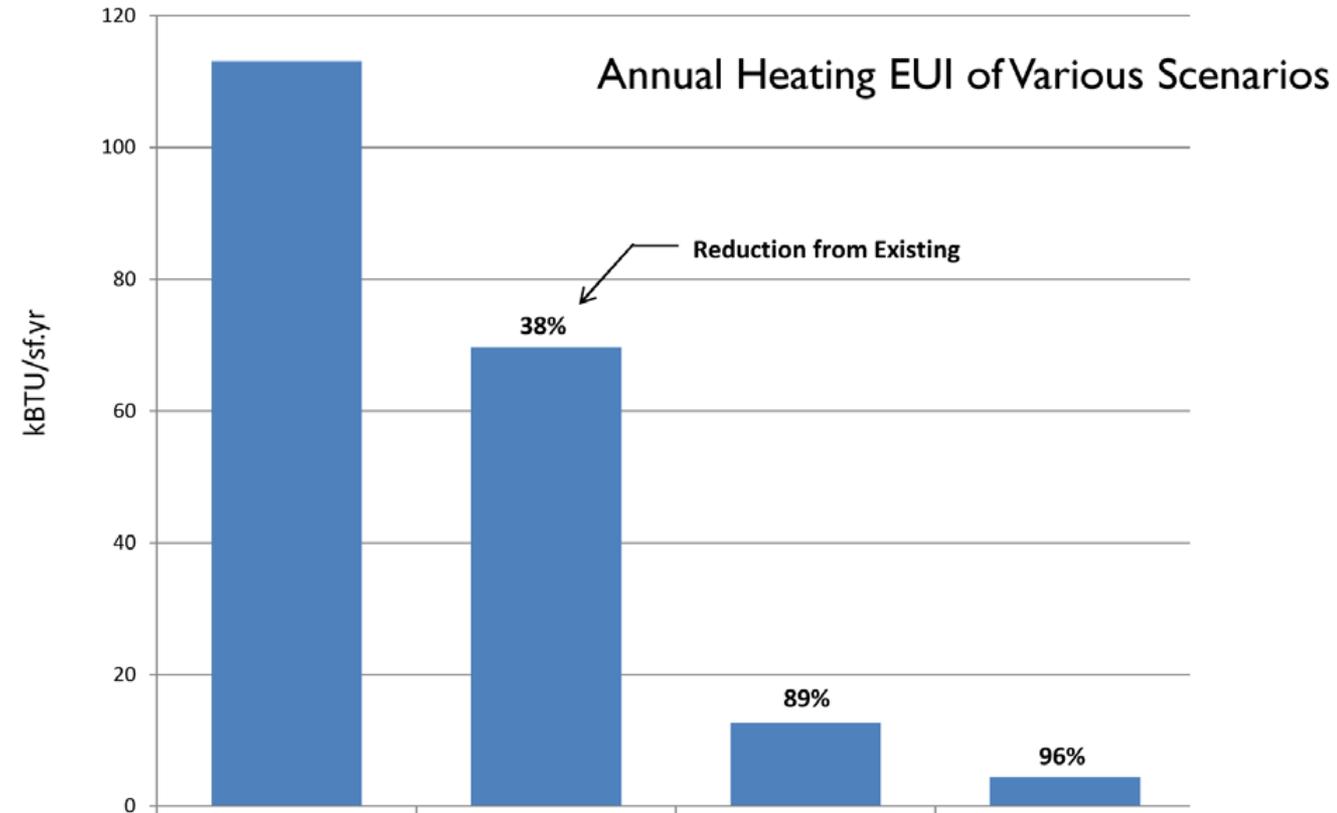


# CAPITAL COST

Source: Walsh Construction

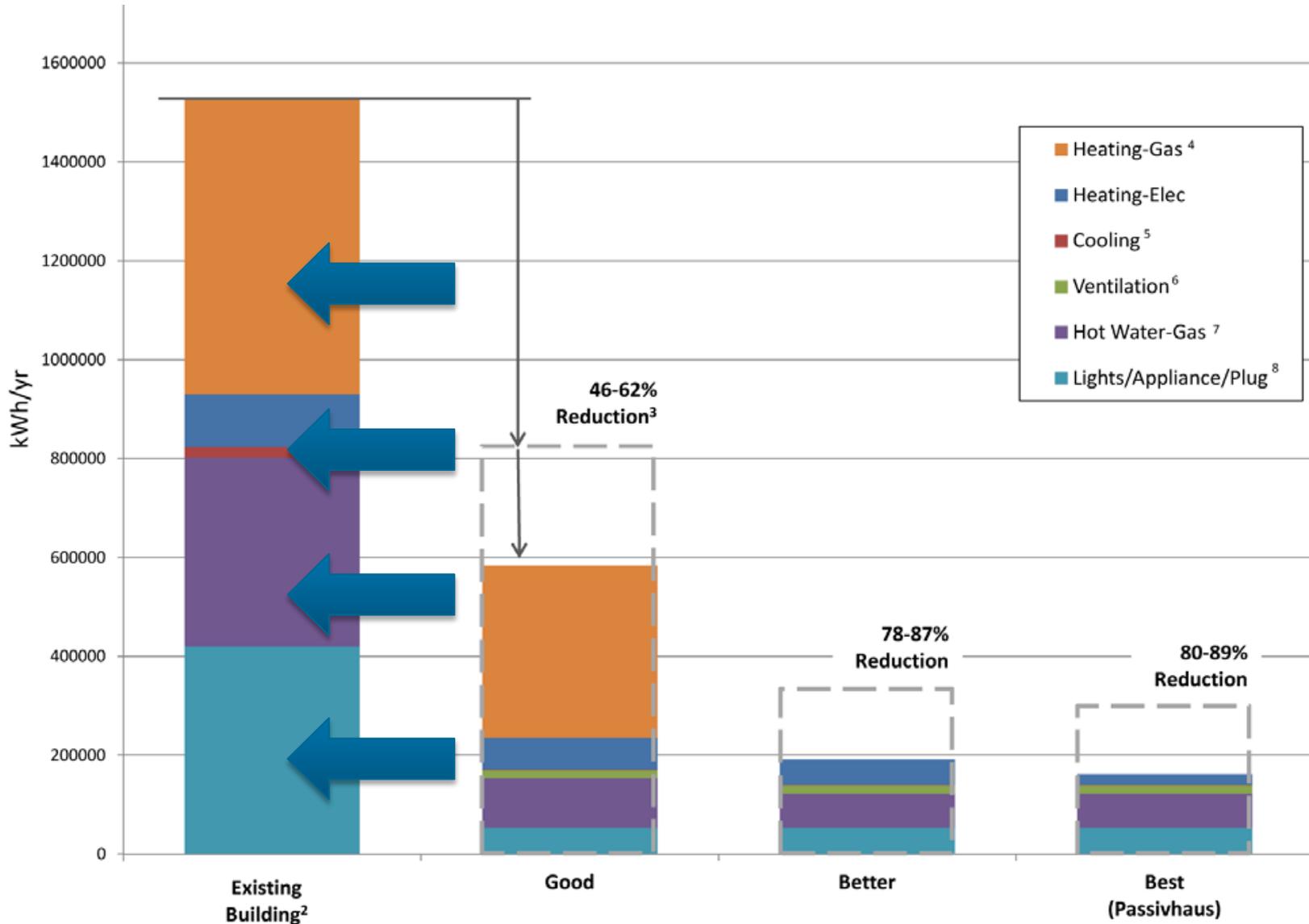



## ENERGY USE INDEX



# TOTAL SITE ENERGY USE

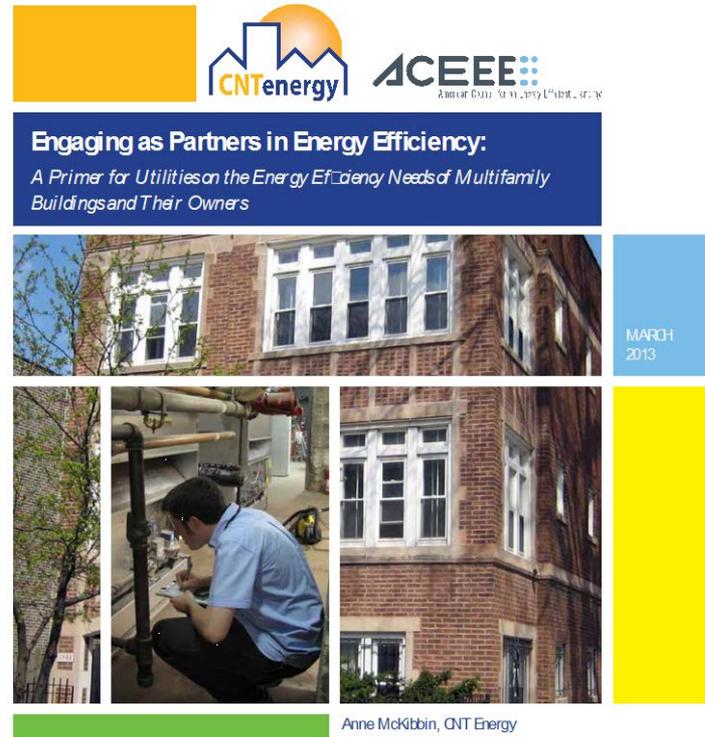
Source: Green Hammer



# High performance benefits

- Utility bill reduction reduces long-term operations costs for Multi-family housing

It depends on the Investment.....



McArthur Grant Findings 2013



# Better Investment | Better Product

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- Aggressive energy performance targets
  - Aggressive construction quality and durability
  - Passive strategies and low technologies
  - Passive operations and low maintenance
  - Lower monthly and total cost of operations
- 
- **Better investment for a better product is achievable with a better process**



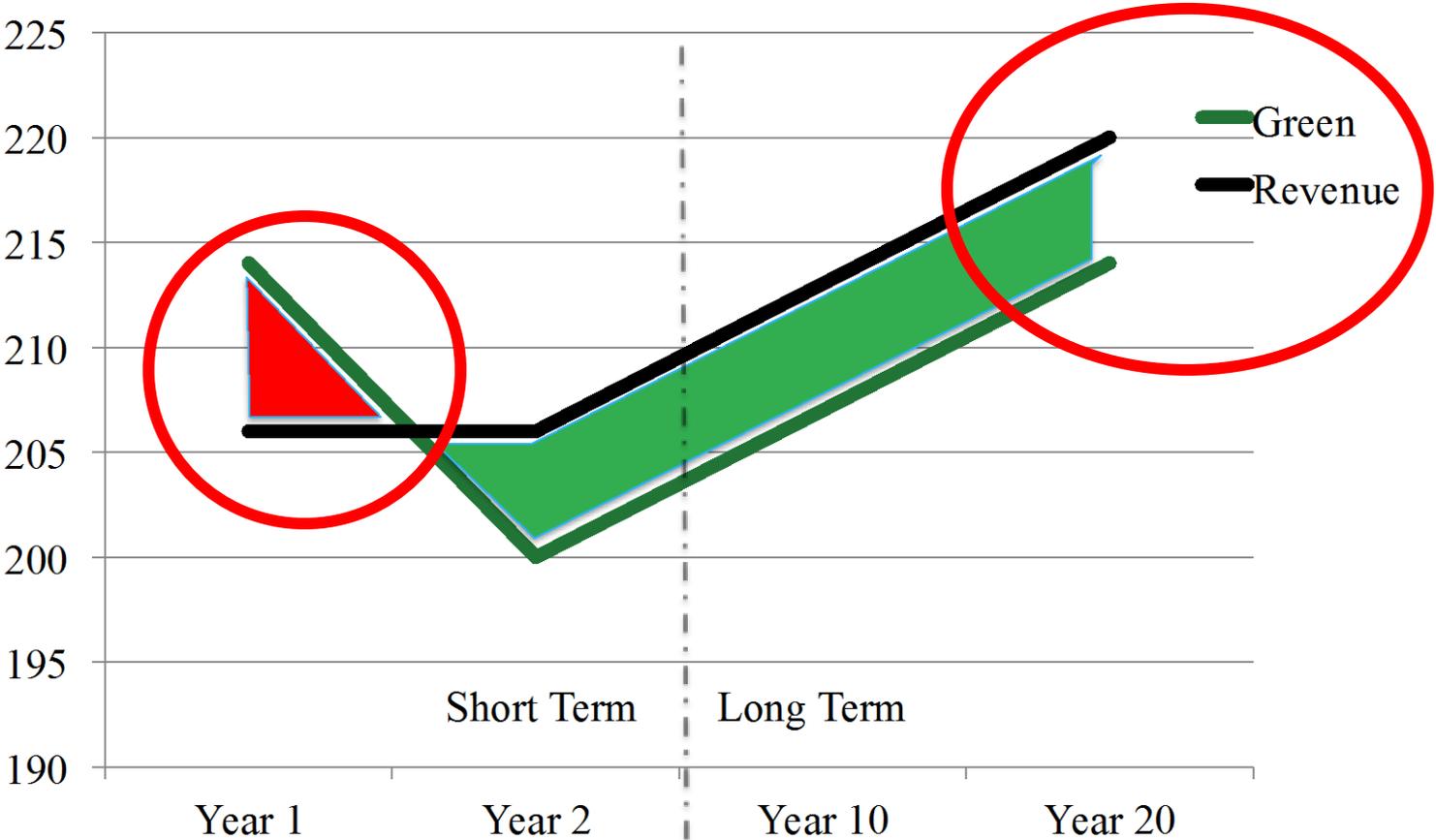
# PART THREE

## Outcome Assurance



# High Performance Lifecycle Costs

- o The total cost of ownership



“If you do not  
**change**  
the direction, you may  
**end up**  
where you are  
**going.**”

Lao Tzu



# Five Steps to Preserving NOI

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- Begin with the End in Mind
- Align the incentives
- Check and Correct your Course
- Confirm Arrival
- Learn and Share



# Begin with the End in Mind

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# Begin with the End in Mind

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- Benchmark
  - Know where you are
- Define Desired Outcomes
  - Know where you are going
  - Occupaphillia
- Plan your Route
  - Know your limits
  - Recruit the Right Team
  - Align the Incentives



# Align the Incentives

## NREL Research Support Facility

- Performance-based Design Build; firm fixed price
- Energy Goal: 35.1 kBtu/sqft/yr (Typical Large Office: 100 kBtu/sqft/yr)
- Energy Performance 50% Better than ASHRAE 90.1

# Align the Incentives

---

## Clear Goals - Prioritized

- Owner, Designer, Contractor, Operator

## Performance Incentives

- Measurable Success Criteria
- Award Fee incentives
- Beyond On-time, On-budget



FIGURE 5 Commercial Construction Building Costs - By Cost Per Square Foot

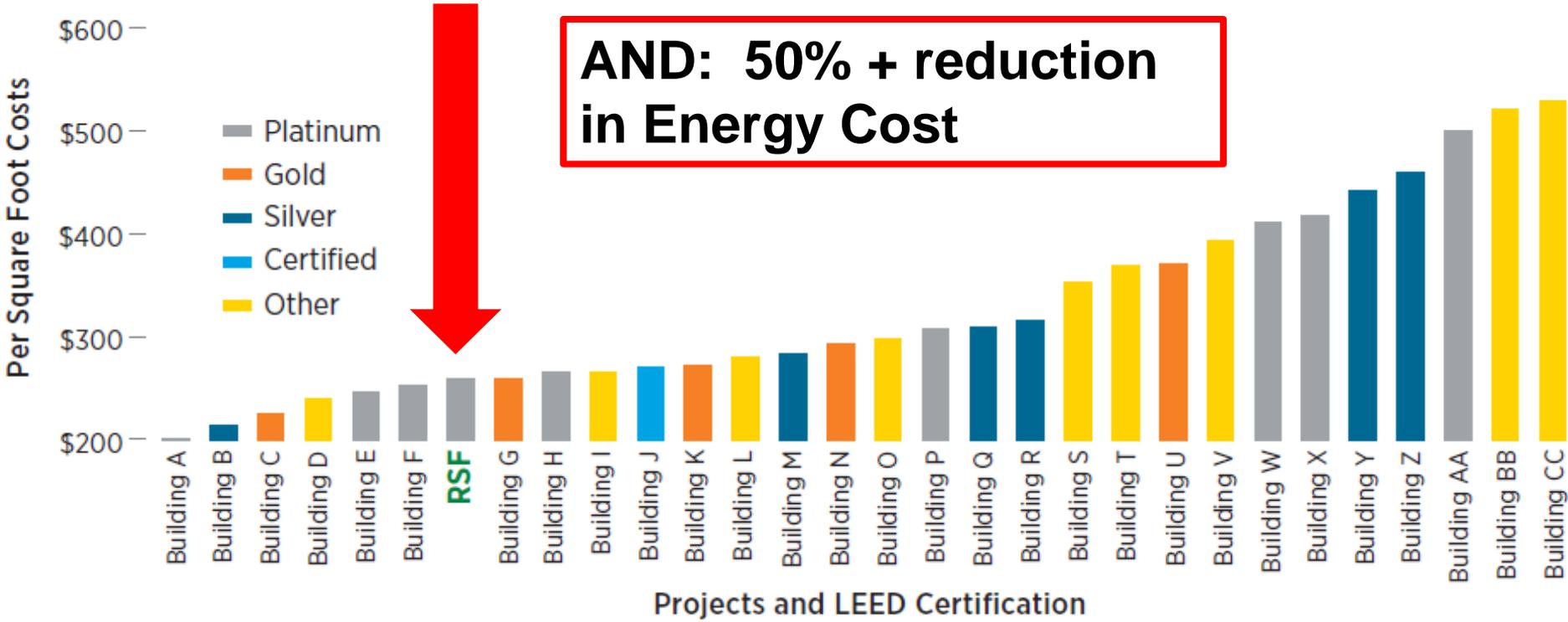


Figure by Stacy Buchanan, NREL



# Check and Correct Course

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# Check and Correct Course

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- Performance Specifications
  - Clear Communication of Desired Outcome
- Construction Quality Assurance
  - Build Capacity in the Field
  - Check Progress - Make Corrections
  - “As REALLY Built”
- Verification & Performance Testing
  - On the Right Track?



# Confirm Arrival

OH, SHUT UP, TOTO! KANSAS SUCKED! BESIDES, LOOK AT THE SHOES THEY HAVE HERE!

TORNADO

KANSAS

EMERALD CITY  
Home of the Great and Powerful Oz

WOOF!  
WITCH!  
WOOF!

MUNCHKIN  
LAND  
MUST BE THIS TAIL TO ENTER



Where Dorothy's House Fell

# Confirm Arrival

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- Commissioning
  - Systems Function as Designed
- Turn Over to Facilities/Property Management
  - Training – Staff and Tenants - Ongoing
  - O & M Plan – Investment not Expense
- Measure and Verify
  - Easy Access to Useful Data
  - Compare to Goals and Benchmarks
  - Close the Learning Loop



# Learn & Share



Firefox | eMonitor Dashboard | https://www.emonitor.us/eMonitor/index.php

Welcome, Belfield **Not Belfield?** Settings | Support | Log Out

HOME | Circuits | Controls | Alerts | Ways to Save | Report Card | Local Weather

Monitor Status: Current use: 0.36 kW | \$0/hr | Outside Temp: 66°F | Switch location

1739 Belfield Ave. Philadelphia Pa 19144 | Share My eMonitorWindow

Utility Meter: -1896 Watts

Power Production: 2248 Watts

Top Appliances/Circuits On:

- HT Pump-Heat/Cool (141w)
- Lvl 3 - Energy Recovery V... (101w)
- Kitchen Refrigerator (79w)
- Unmonitored Power (32w)

30-Day Carbon Footprint:

PA Avg: 981 lbs. | My CO2: 338 lbs.

30-Day Phantom Power: \$0

**CENTRAL CITY concern** | **WALSH Construction Co.**

in the past 30 days, Top 12 Circuits

Click a slice or label for detail / View All Circuits

HT Pump HEAT COOL : \$29

LVL1 Clg LTG sta : \$0

EXT LTG outlet : \$0

eMonitor smoke de : \$0

LVL 2 Hall LTG B : \$0

HT Pump HOT WATER : \$1

Kitchen refrigera : \$5

LVL 3 Energy rec : \$7

Electricity Cost by Month:

This Month	\$30
Last Month	\$43
Actual	\$24

Top 4 Users by Cost - Last 30 days:

HT Pump-HEAT/Cool Energy recover	\$29
LVL 3 - HT	\$7
Kitchen refrigerator	\$5
HT Pump-HOT WATER	\$1

Past Year | Past Month | Past Day | Past Week | Past Month

Usage (kWh) | Production (kWh)

Watts used today

View History Details | View Circuit Details

Export Data | Share your eMonitor experiences on Facebook

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# Better Process . . .

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- Begin with the End in Mind
- Align the Incentives
- Check and Correct your Course
- Confirm Arrival
- Learn and Share



. . . **Better Projects**

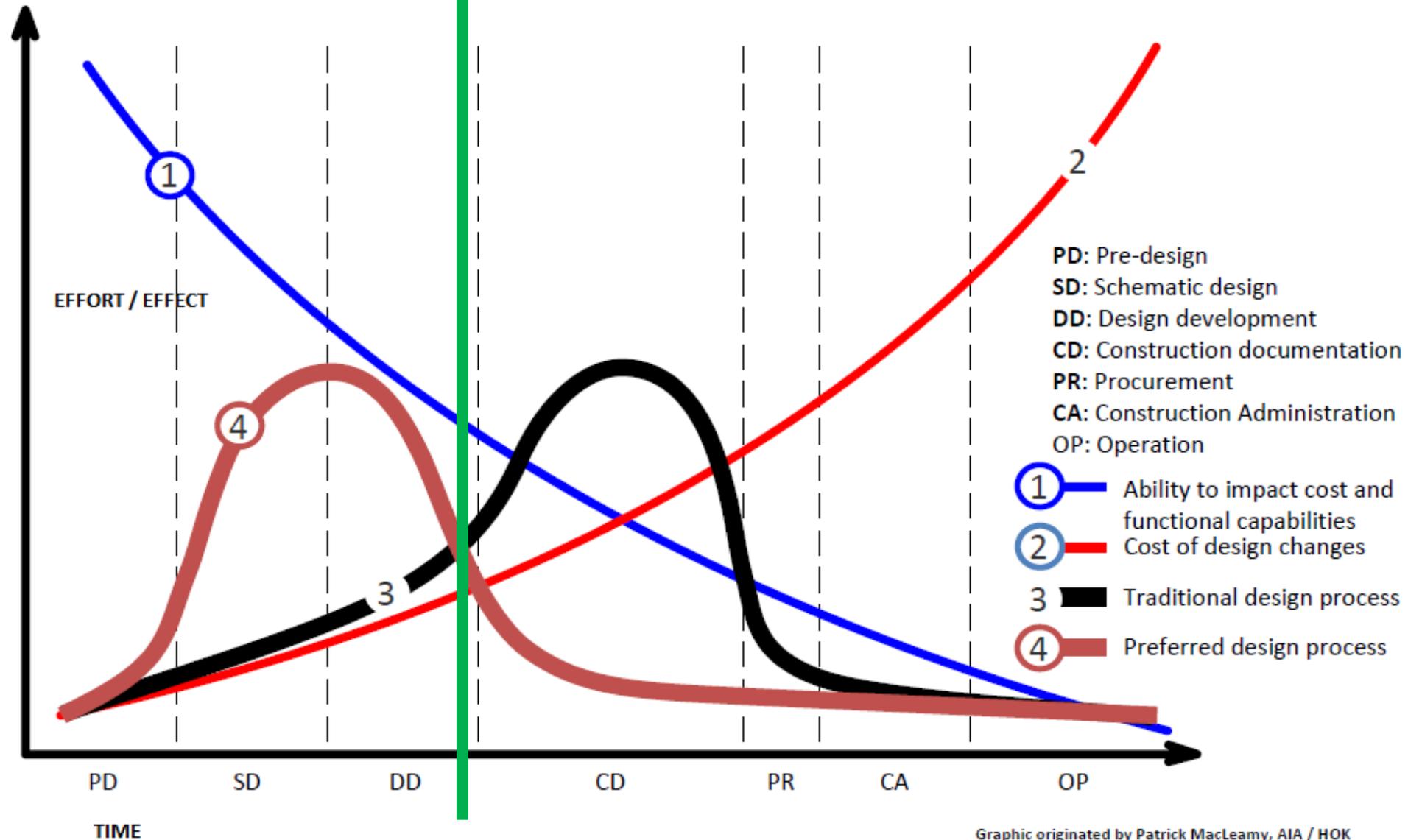
# The CHALLENGE

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RESTRUCTURE the affordable housing Construction & Rehab delivery model to facilitate this better process.



# Design Effort



# Barriers?

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- Team Capacity
- Available Resources
- Up Front Risk
- Funding Structure
- Contracts
- Investor Expectations
- Design-Bid-Build model





**SUCCESS**

- **Early Money to fund a front-loaded process**
- **Teams Set Up for Success**
- **Quantifiable Outcomes & Aligned Incentives**



# Thank you!

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Alistair Jackson

Principal

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