

Existing Building Policy Proposal

# Cost Evaluation

# Apartment Roof Replacement

55,000 square feet, 5 floors, roof is 11,000 sq ft.

Green Roof Coverage requirement: 30% or 3,300 sq ft.

Cool Roof + small amount of green: 3% or 330 sq ft

Description	30% Green Roof*	Cool Roof & 3% Green**
Conventional Roof Replacement Cost (\$)	\$137,700	\$137,700
Additional Cost (\$)	\$52,581	\$6,058
Cost Increase (%)	38%	4.4%

\*Green roof on 30% of required area.

\*\*Green area of 3% of required area on the ground

# Industrial Roof Replacement

150,000 square feet, 1 floor, roof is 150,000 sq ft.

Green Roof Coverage requirement: 10% or 15,000 sq ft.

Cool Roof + small amount of green: 3% or 1500 sq ft.

Description	30% Green Roof*	Cool Roof & 3% Green**
Conventional Roof Replacement Cost (\$)	\$1,539,900	\$1,539,900
Additional Cost (\$)	\$160,589	\$29,785
Cost Increase (%)	10%	1.9%

\*Green roof on 30% of required area.

\*\*Green area of 3% of required area on the ground

# Retail Roof Replacement

150,000 square feet, 1 floor, roof is 150,000 sq ft.

Green Roof Coverage requirement: 50% for or 75,000 sq ft.

Cool Roof + small amount of green: 3% or 7500 sq ft.

Description	30% Green Roof*	Cool Roof & 3% Green**
Conventional Roof Replacement Cost (\$)	\$1,539,900	\$1,539,900
Additional Cost (\$)	\$683,615	\$129,925
Cost Increase (%)	44%	8.4%

\*Green roof on 30% of required area.

\*\*Green area of 3% of required area on the ground

# Office Roof Replacement

300,000 square feet, 15 floors, roof is 6,000 sq ft.

Green Roof Coverage requirement: 60% or 3,600 sq ft.

Cool Roof + small amount of green: 3% or 360 sq ft.

Cost Evaluation

Description	30% Green Roof*	Cool Roof & 3% Green**
Conventional Roof Replacement Cost (\$)	\$101,250	\$101,250
Additional Cost (\$)	\$50,321	\$7,508
Cost Increase (%)	50%	7.4%

\*Green roof on 30% of required area.

\*\*Green area of 3% of required area on the ground

# Energy Program for Existing Buildings

## Cost Benefit Analysis Challenges:

Building Age, Code Baseline

Building Type, Space Types (Lighting)

Building Class

Access, Phasing

Labor, Consulting, Demolition, Disposal

Unintended Issues during Retrofit

*No retrofit will look exactly the same, making forecasting costs and savings nearly impossible.*

*Project Drawdown, Paul Hawken*

# Net Present Value (NPV)

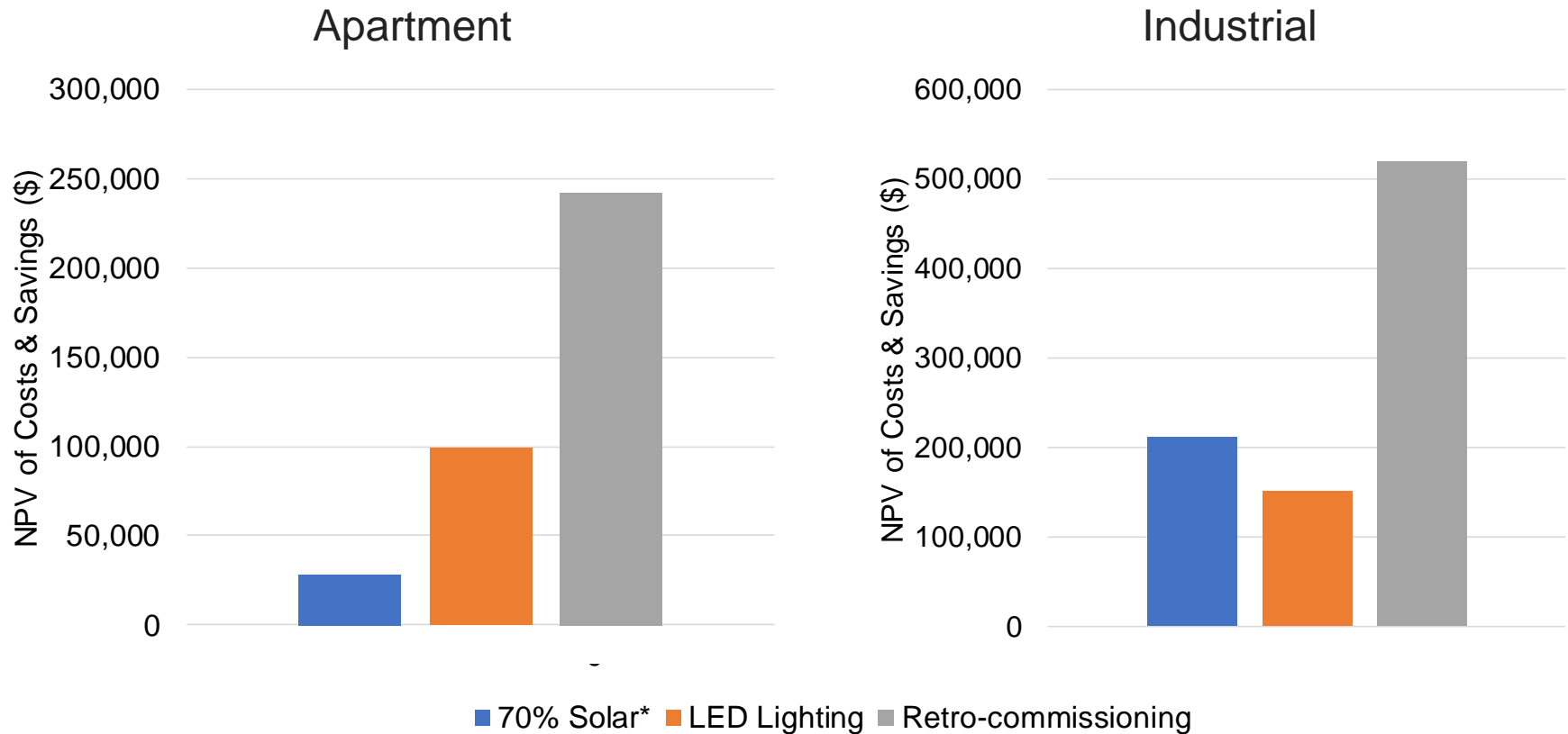
## Positive Value

Revenues are greater than the costs

## Negative Value

Costs are greater than the revenues

# Energy Program: Options with Positive NPV

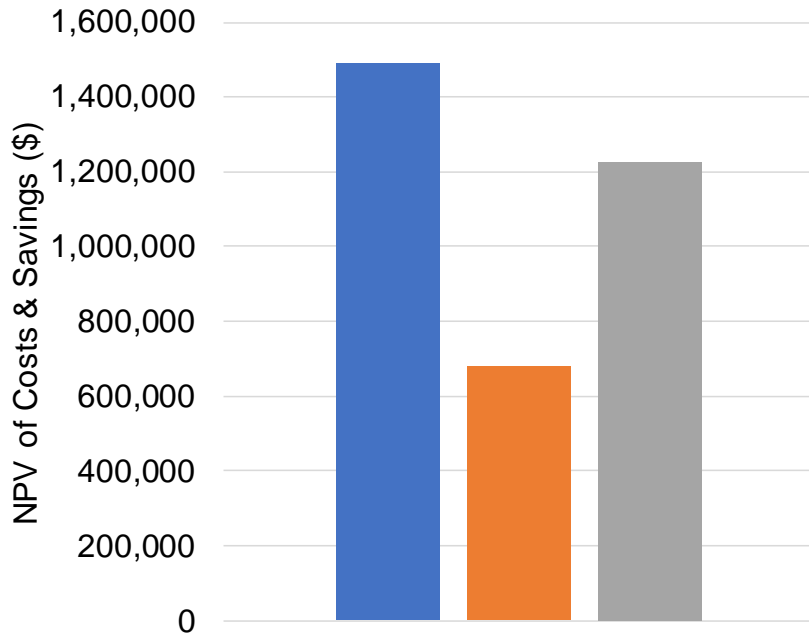


\*Solar panels on 70% of required area  
*Note differences in vertical scale*

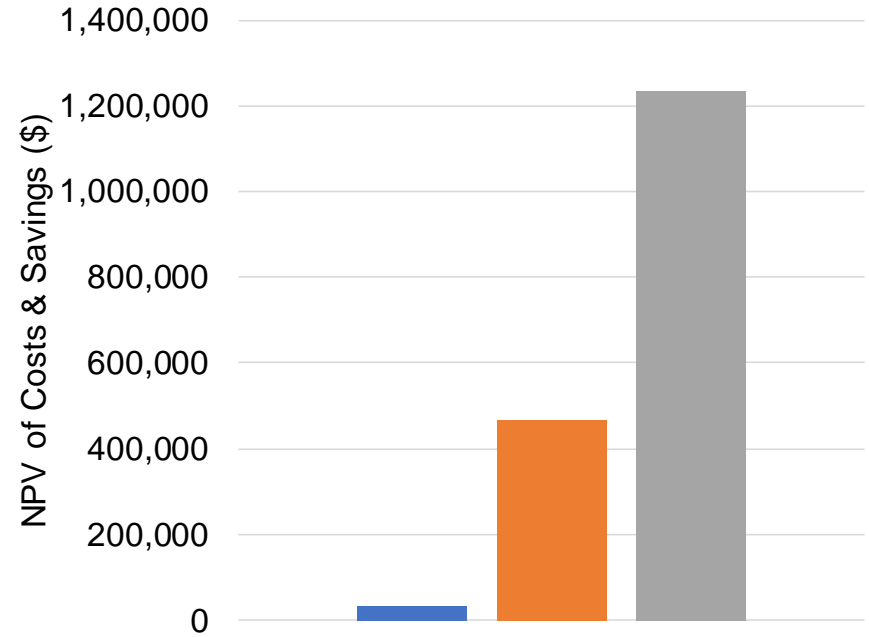


# Energy Program: Options with Positive NPV

## Retail



## Office



■ 70% Solar\* ■ LED Lighting ■ Retro-commissioning

\*Solar panels on 70% of required area  
*Note differences in vertical scale*

# Existing Buildings

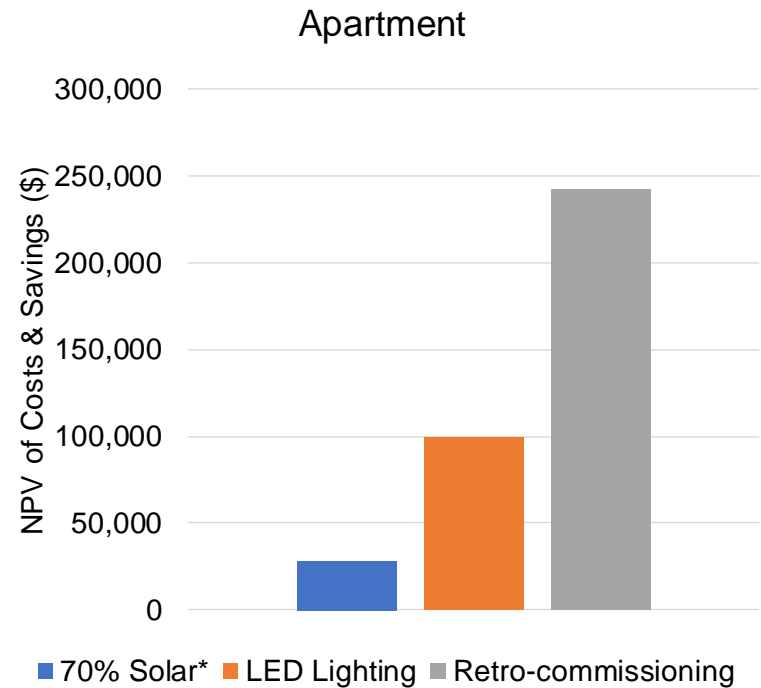
## Appendices

# NPV Parameters

Parameter	Assumption	Source
Analysis Period (years)	32 (i.e. till year 2050)	
Discount Rate (%)	7	Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs ( <a href="https://www.wbdg.org/FFC/FED/OMB/OMB-Circular-A94.pdf">https://www.wbdg.org/FFC/FED/OMB/OMB-Circular-A94.pdf</a> )
Energy Escalation Rate (%)	2	Energy Escalation Rate Calculator ( <a href="https://energy.gov/eere/femp/energy-escalation-rate-calculator-download">https://energy.gov/eere/femp/energy-escalation-rate-calculator-download</a> ): Colorado, 1.5% Inflation, Commercial
Electricity Blended Rate (\$/kWh)	0.098	U.S. Energy Information Administration ( <a href="https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a">https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a</a> ): Colorado, Commercial
Energy Savings	12% for LED 16% for retro-commissioning	Calculated based on site energy use intensity (EUI) of DOE Commercial Reference Buildings in Denver, Post-1980 Construction. Building types used were Mid-rise Apartment, Warehouse, Stand-alone Retail, and Medium Office.

# Existing Buildings: Apartment

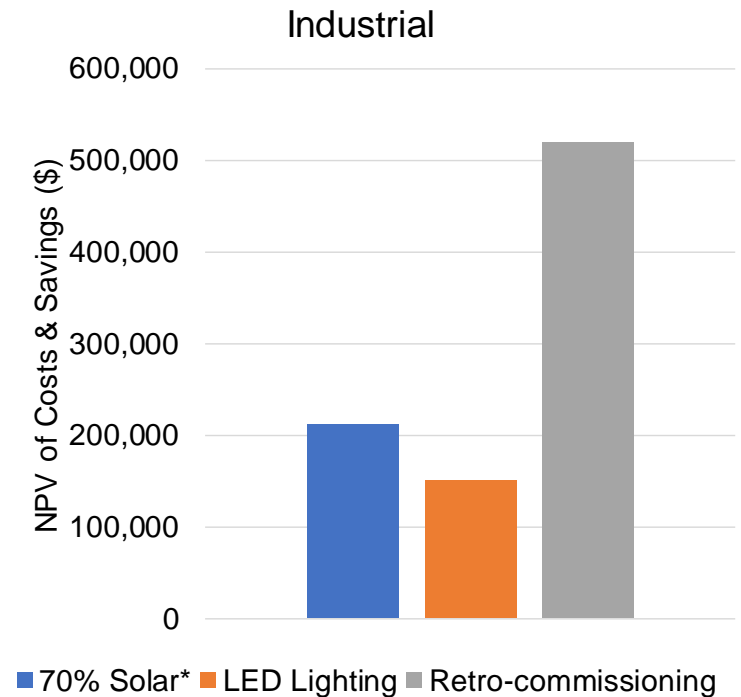
Description	70% Solar*	LED Lighting	Retro-commissioning
Conventional Roof Replacement Cost (\$)	\$137,700	N/A	N/A
Additional Cost (\$)	\$55,294	\$85,000	\$3,750
Cost Increase (%)	40%	N/A	N/A
NPV (\$)	\$28,002	\$99,607	\$242,398



\*Solar panels on 70% of required area

# Existing Buildings: Industrial

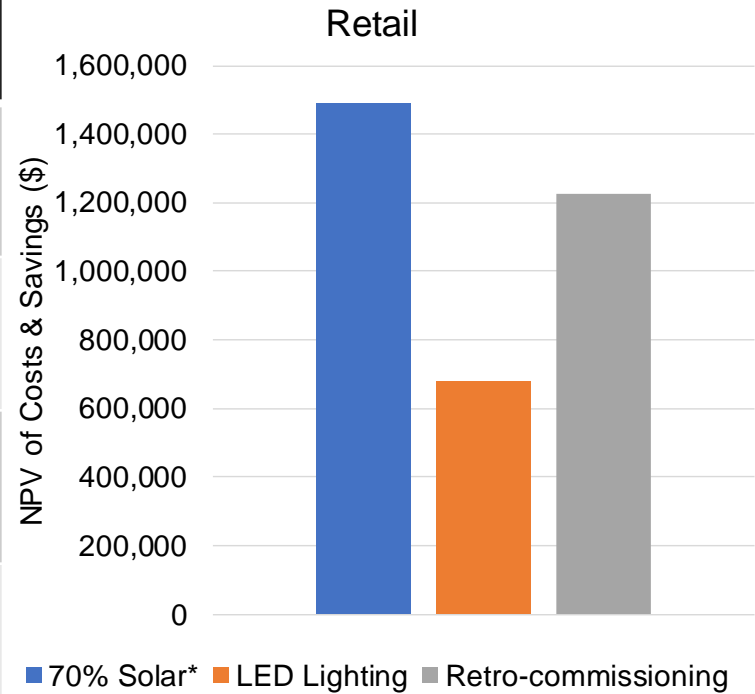
Description	70% Solar*	LED Lighting	Retro-commissioning
Conventional Roof Replacement Cost (\$)	\$1,539,900	N/A	N/A
Additional Cost (\$)	\$166,467	\$255,000	\$20,000
Cost Increase (%)	11%	N/A	N/A
NPV (\$)	\$212,210	\$150,045	\$520,054



\*Solar panels on 70% of required area

# Existing Buildings: Retail

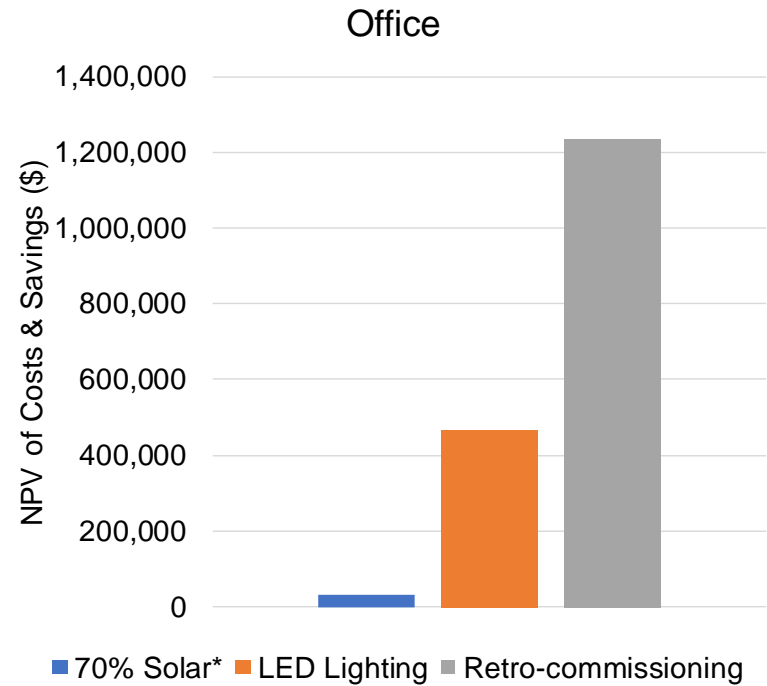
Description	70% Solar*	LED Lighting	Retro-commissioning
Conventional Roof Replacement Cost (\$)	\$1,539,900	N/A	N/A
Additional Cost (\$)	\$685,039	\$255,000	\$20,000
Cost Increase (%)	44%	N/A	N/A
NPV (\$)	\$1,487,335	\$679,083	\$1,225,433



\*Solar panels on 70% of required area

# Existing Buildings: Office

Description	70% Solar*	LED Lighting	Retro-commissioning
Conventional Roof Replacement Cost (\$)	\$101,250	N/A	N/A
Additional Cost (\$)	\$59,315	\$510,000	\$65,000
Cost Increase (%)	59%	N/A	N/A
NPV (\$)	\$31,555	\$465,414	\$1,235,547



\*Solar panels on 70% of required area