Assessing Building Performance

Lessons from the Field

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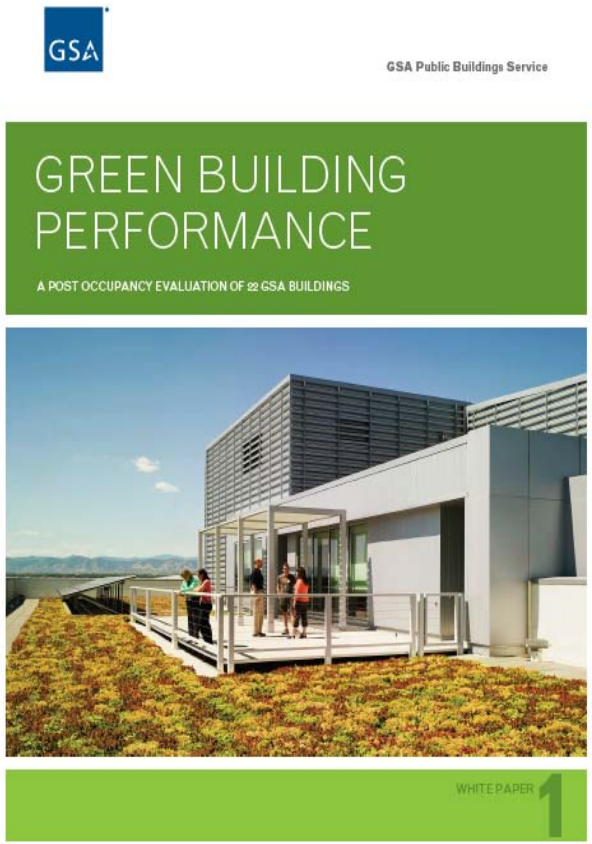
Agenda



- Drivers
- Key Findings
- Whole Building Performance Measurement
- Lessons Learned

9,624 Owned and Leased Assets

1 million

Tenants in 400 different federal agencies

$5.2 billion

Investment Underway to Green Inventory

Our Targets

37%

Energy Use Intensity, by 2020
Over 2003 levels

26%

Water Use Intensity, by 2020
Over 2007 levels

28%

Scope 1 and 2 GHGs, by 2020
Over 2009 levels

Executive Order 13514, 2009

Energy Independence and Security Act, 2007

MOU on High Performance and Sustainable Buildings, 2006

Energy Policy Act, 2005

www.wbdg.org/references/federal_mandates.php

GSA's Leadership in Sustainability




Do sustainably designed buildings deliver the performance they promise?



Key Findings
Green Buildings

- Use less energy & water
- Cost less to operate
- Support occupant satisfaction
- Emit less CO2 emissions
- Help meet federal mandates
- *Mileage May Vary*

KEY FINDINGS:

Compared to national averages, buildings in this study have:

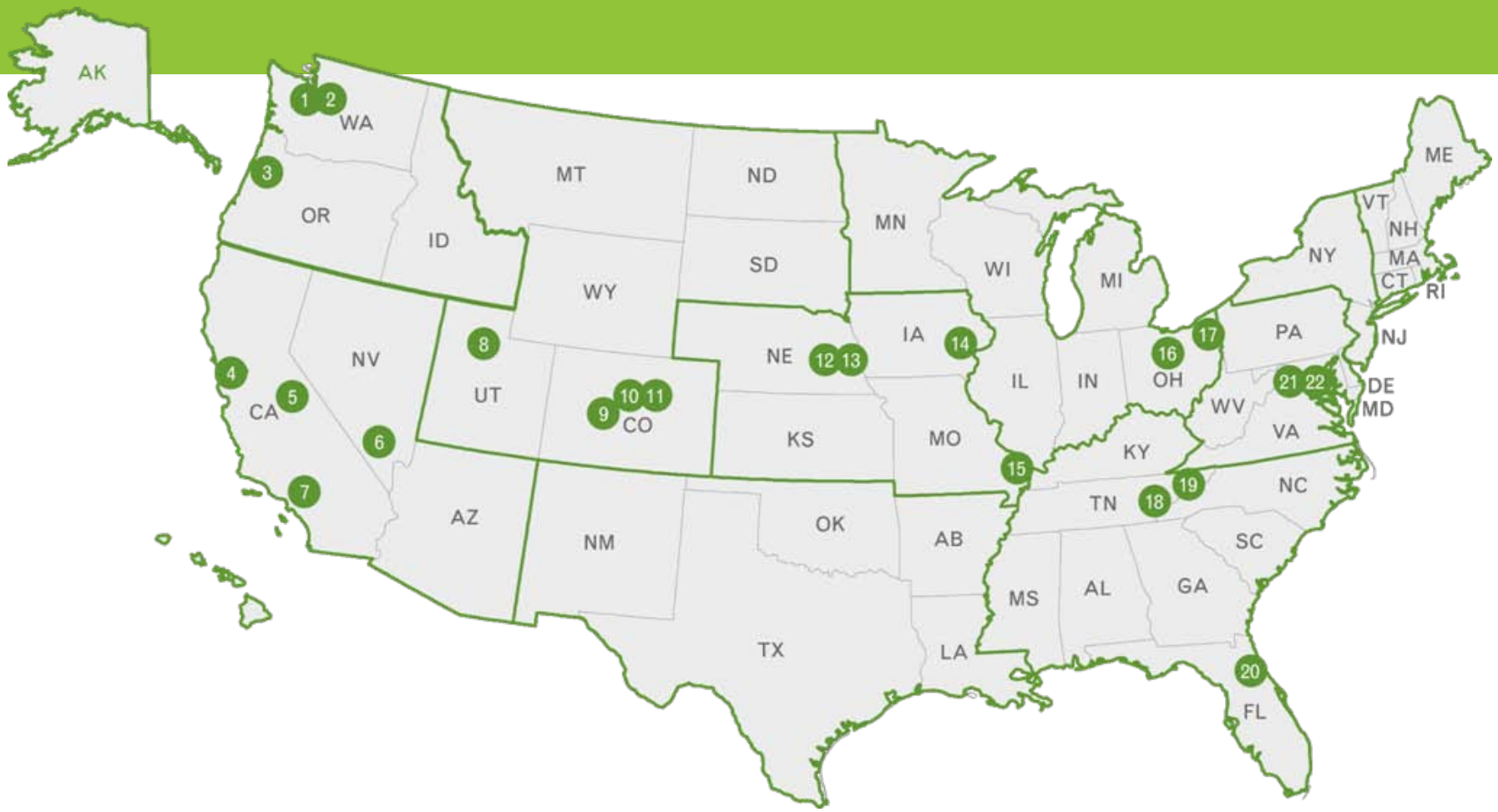
25%
Less energy use
(66 kBtu/sf/yr vs. 88 kBtu/sf/yr)

19%
Lower aggregate operational costs
($1.60/sf vs. $1.98/sf[8])

27%
Higher occupant satisfaction

36%
Fewer CO_2 emissions

Whole Building Performance Measurements
POE of 22 Sustainably Designed Buildings



Key Performance Indicators

Key Performance Indicators

EUI BTU/ GSF

CO_2
Employee Commuting
Building energy use

Maintenance Costs

General, grounds, janitorial

Water Use

Gallons / GSF

Occupant Satisfaction

office layout & furnishings, thermal comfort, air quality, lighting, acoustics, cleanliness

Normalizing Performance Metrics
Site & Building characteristics

Omaha NPS

Building Location	*601 Riverfront*	*Omaha*
	Nebraska	*68102-4226*
Building Function		*Federal Building*
Project Type		*New Construction*
Design Certification		*LEED-NC Gold*
Year Built		*2004*
# of Floors		*3*
Gross Square Foot		*68,000*
Rentable Square Foot		*62,772*
Usable Square Foot		*0*
Weekly Operating Hours		*70*
Regular Occupants		*125*
Average Daily Visitors (FTE)		*9*
Electronic Equipment		*140*
Site Cost		*N/A*
Design Cost		*N/A*
Construction Cost		*$8,500,000*
Management & Inspection		*N/A*
Total Cost		*$27,864,000*

Annual Performance Metrics

Gallons per occupant	*1,783*
Water Cost per occupant	*$4.87*
Gallons per GSF	*3.51*
Water Cost per RSF	*$0.01*
Energy Use (kBTU) per GSF	*67*
Energy Cost per RSF	*$1.17*
Building Emissions per Occupant ($MTCO_2e$)	*5.81*
General Maint Cost per RSF	*$0.66*
Janitorial Services Cost per RSF	*$0.90*
Grounds Maint Cost per RSF	*$0.14*
Ratio of Maint Requests to Total Maint Jobs	*0.62*
Solid Waste (lb) per occupant	*1937*
Solid Waste Cost per RSF	*$0.02*
Solid Waste Cost per occupant	*$11.21*
% Recycle of Total Waste Generation	*8%*
Survey Return Rate	*68%*
Commute Emmisions per occ ($MTCO_2e$)	*1.70*
% of Occupants who commute using mass transit, biking and/or walking	*0%*

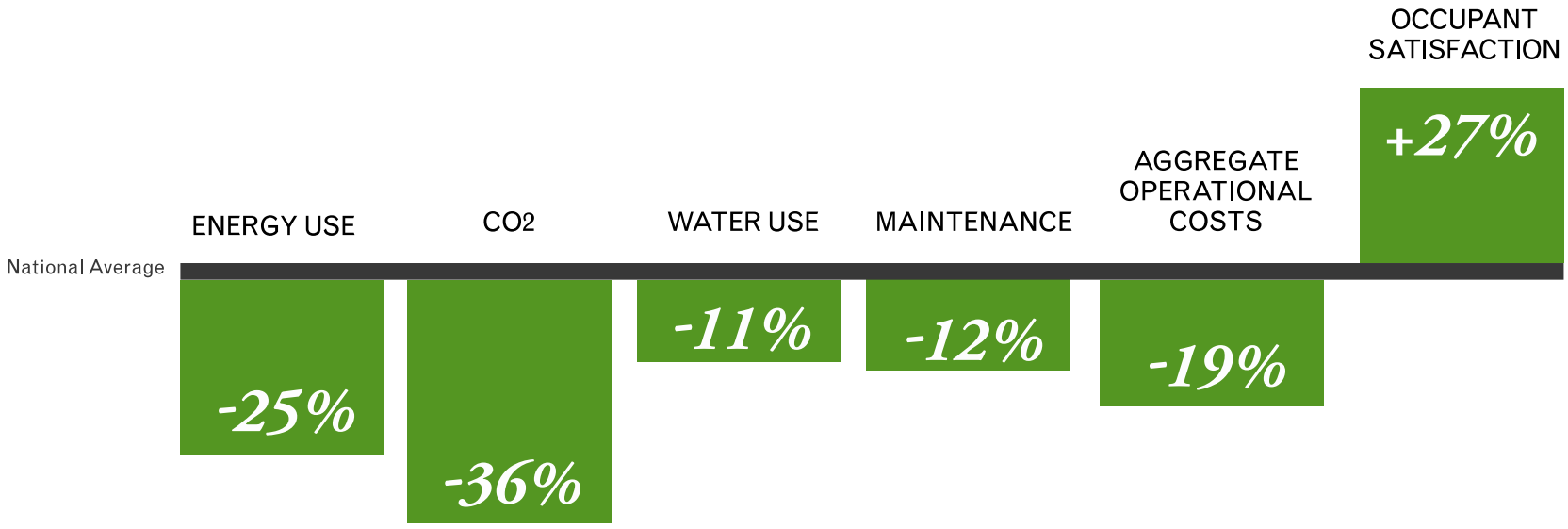
Benchmarking

Industry National Averages

EUI	CBECS National Survey of Commercial Buildings constructed between 1990 and 2003[3]
Energy Cost	BOMA[4] 2008 All Sector Total Building Rentable Area – Utility (less water)
CO_2	ENERGY STAR baseline[5], late 2009/early 2010
Maintenance Costs	IFMA[6] facilities less than 5 years old and BOMA[4] 2008 All Sector Total Buildings Rentable Area - Roads/Grounds
Water Use	IFMA[6] 50th Percentile, 2009
Occupant Satisfaction	Center for the Built Environment, UC Berkeley, 2009[7]

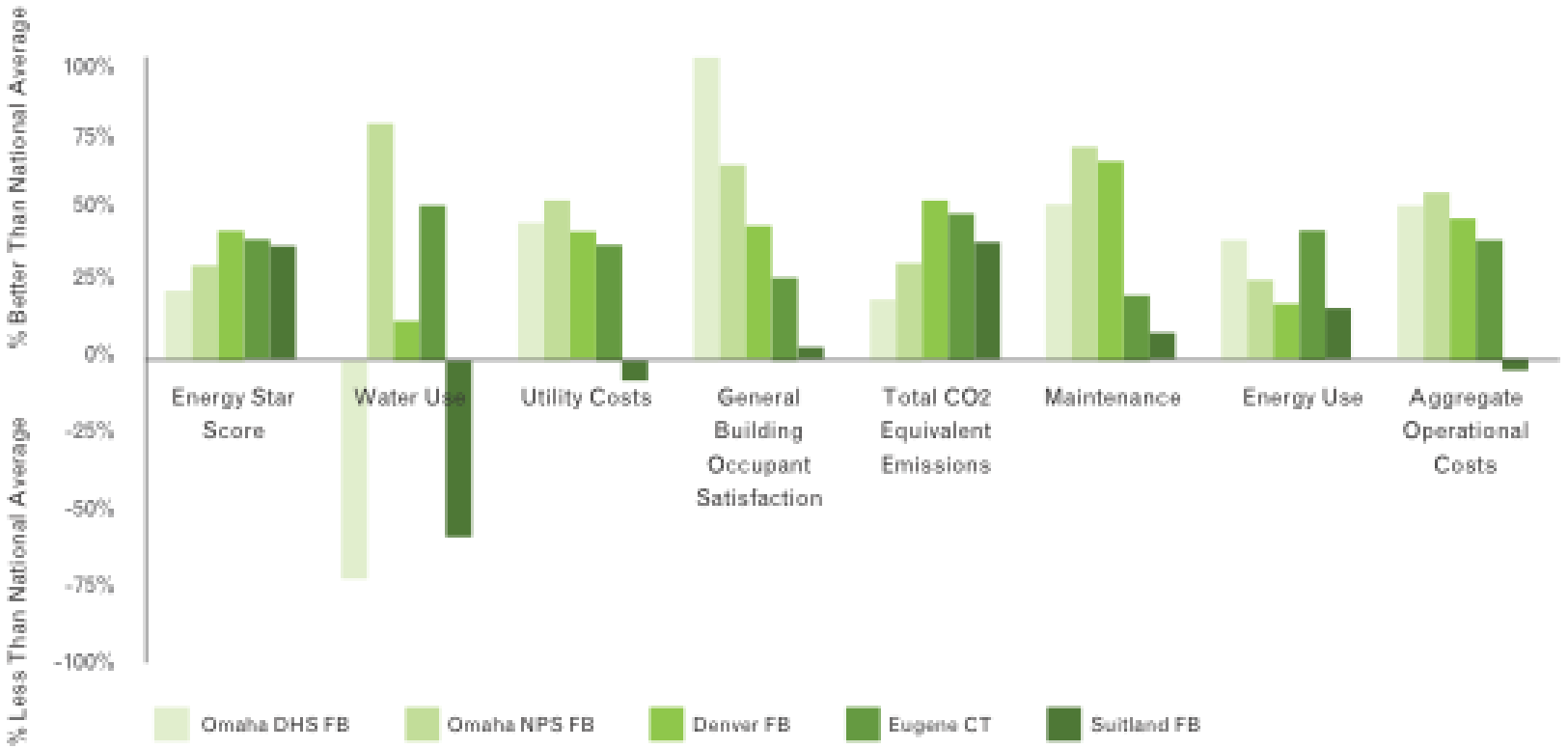
Green Building Study

POE of 22 Green Buildings



Design Intent is Important; not a Guarantee

Lessons Learned

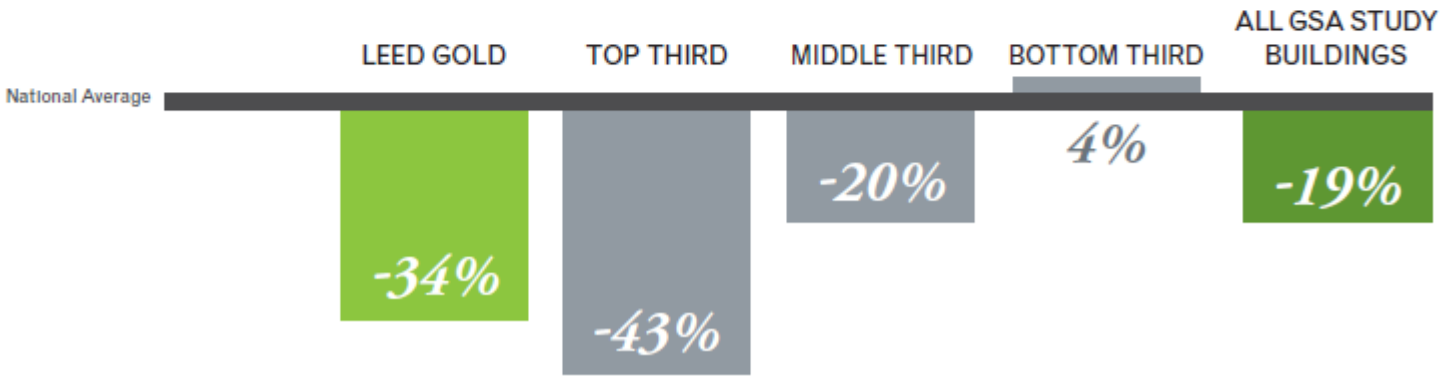


Operations & Maintenance Matters
Lessons Learned

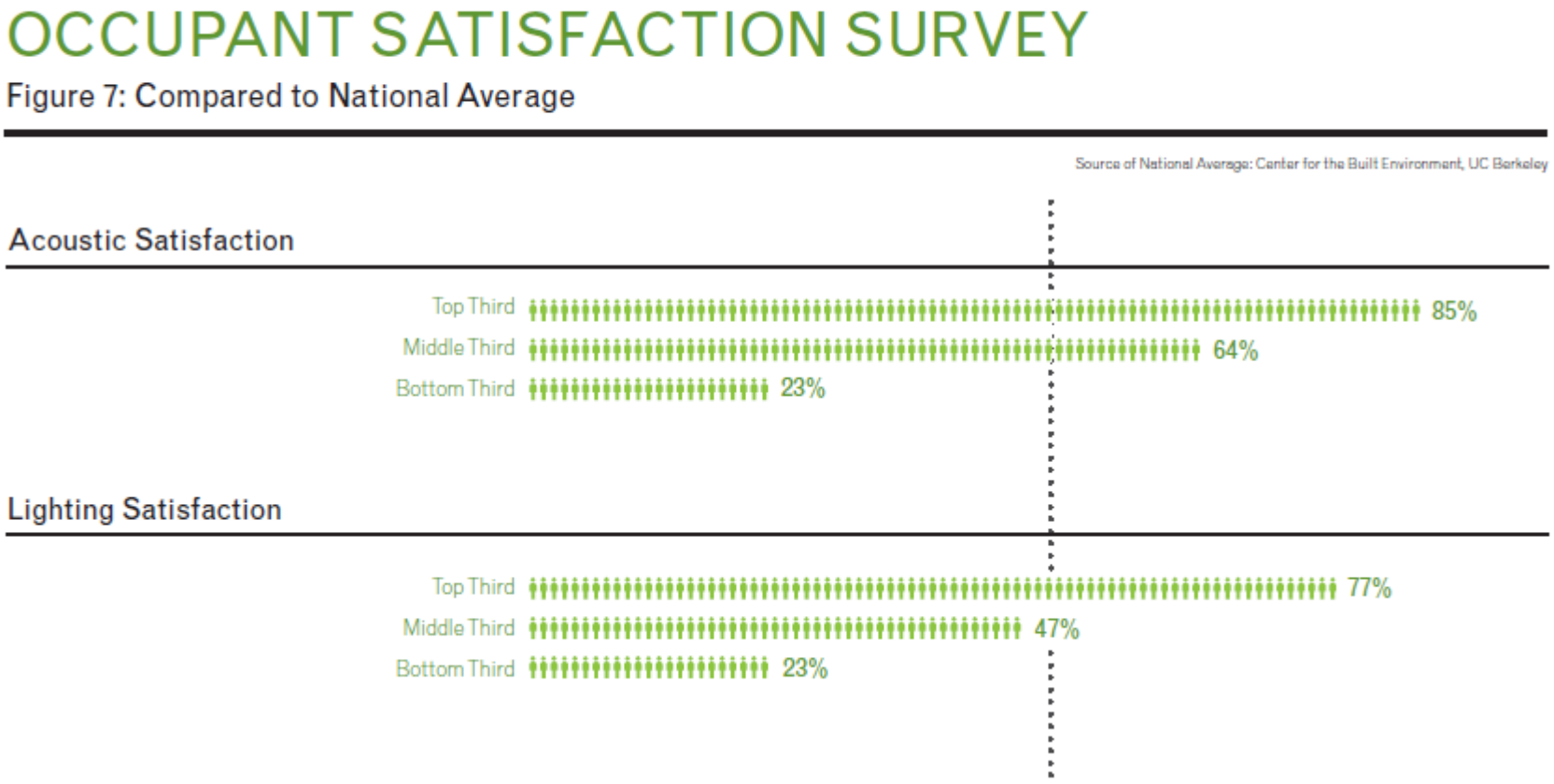
Figure 4: Aggregate Operational Costs: Performance of Study Buildings Compared to National Average

Source of National Average: BOMA

Aggregate Operating Costs:
water utilities, energy utilities, general maintenance, grounds maintenance, waste and recycling, and janitorial costs



Lighting & Acoustics Matter
Lessons Learned



Baselines Matter

Lessons Learned

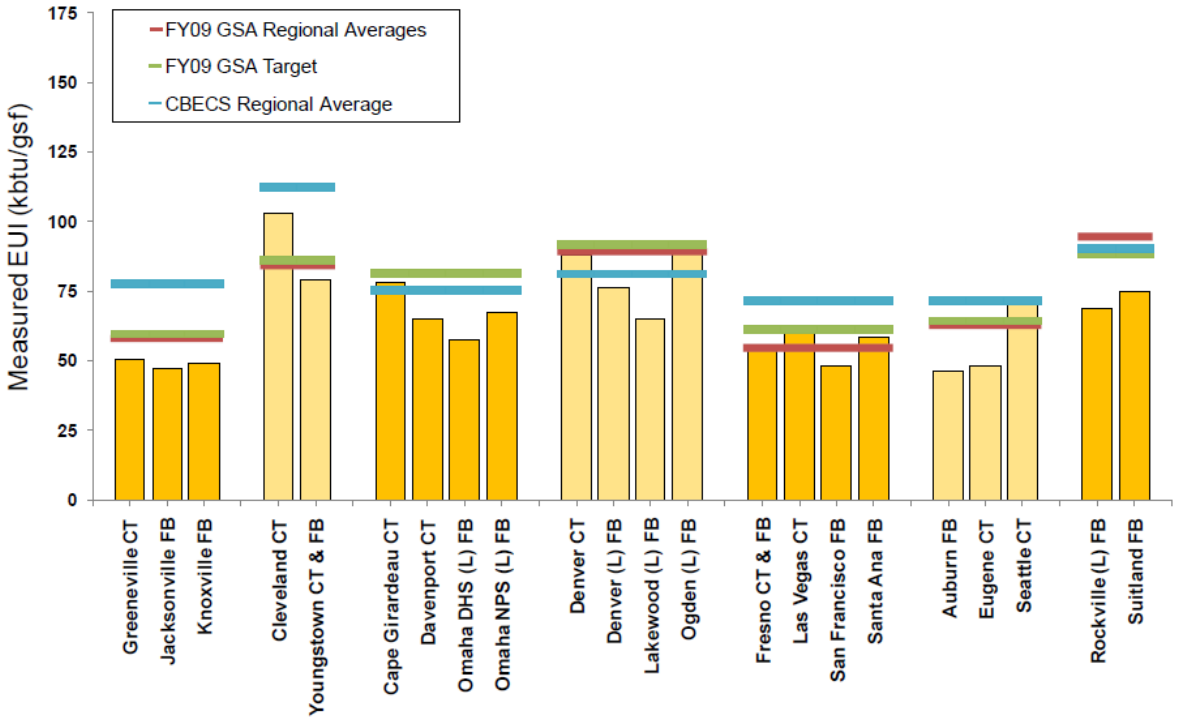


Figure S4. Energy performance of GSA buildings is strong when compared to industry averages.

Leadership in Sustainability, Commitment to Performance.

Download a copy of
Green Building Performance:
gsa.gov/sustainability

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Table 4. Baseline Values and References

Metric	Value	Units	Source
Water	15	gal/gsf	IFMA # 32 50th Percentile (2009 pg 59)
	13	gal/gsf	GSA FY2015 Target
	0.19	$/rsf	BOMA 2008 All Sector Total Building Rentable Area - Utility Water/Sewer
Energy	2.53	$/rsf	BOMA 2008 All Sector Total Building Rentable Area - Utility (less water)
	88	kBTU/gsf	EIA CBECS Table C12 Office 1990-2003
Maintenance - Grounds	0.45	$/rsf	BOMA 2008 All Sector Total Building Rentable Area - Roads/Grounds
Maintenance - Preventative	0.75	Ratio	IFMA #32 Facilities less than 5 years old (2009 pg. 47)
Maintenance - Service	0.25	Ratio	IFMA #32 Facilities less than 5 years old (2009 pg. 47)
Waste	0.05	$/rsf	IFMA #25 (2004 pg. 27)
Recycling	0.01	$/rsf	IFMA #25 (2004 pg. 27)
Occupant Satisfaction	1.13		CBE 2009 Survey Average Score - General Building Satisfaction
	1.23		CBE 2009 Survey Average Score - LEED General Building Satisfaction
Transportation	2.3	MTCO2e/ occ/year	EPA Climate Leaders Guidance (2008) and DOT Travel Survey (2001)

Building Name	Annual Costs (US$)				
	Aggregate Maintenance	Waste & Recycle	Total Water	Total Energy	Aggregate Operating Cost per RSF
Greeneville CT	$394,936	$829	$6,352	$176,042	$4.25
Jacksonville FB	$1,026,012	-	$24,555	$427,075	$4.93
Knoxville FB	$464,084	$4,380	$16,061	$198,759	$5.69

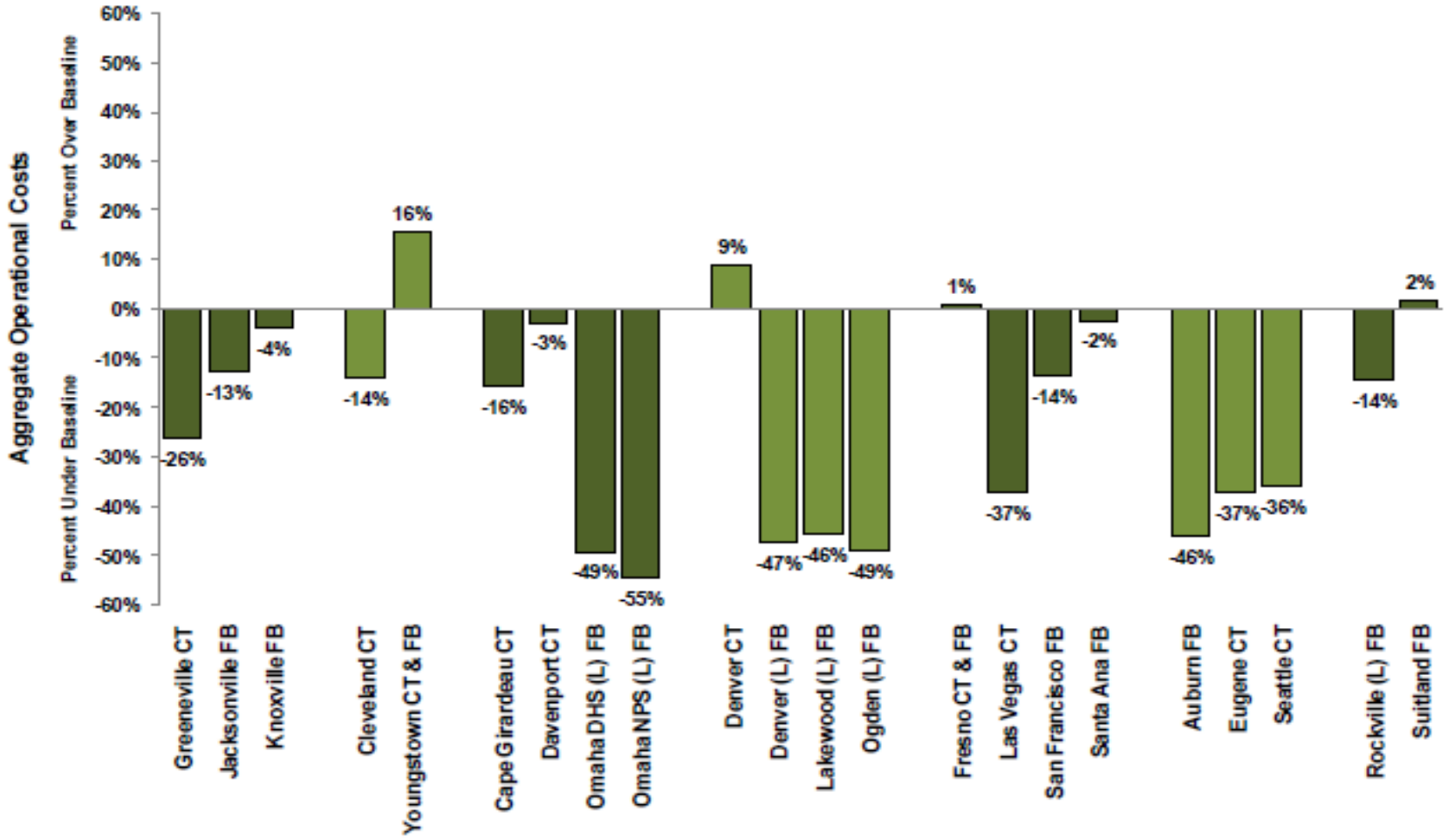

Figure 45. Aggregate operational costs compared to the baseline

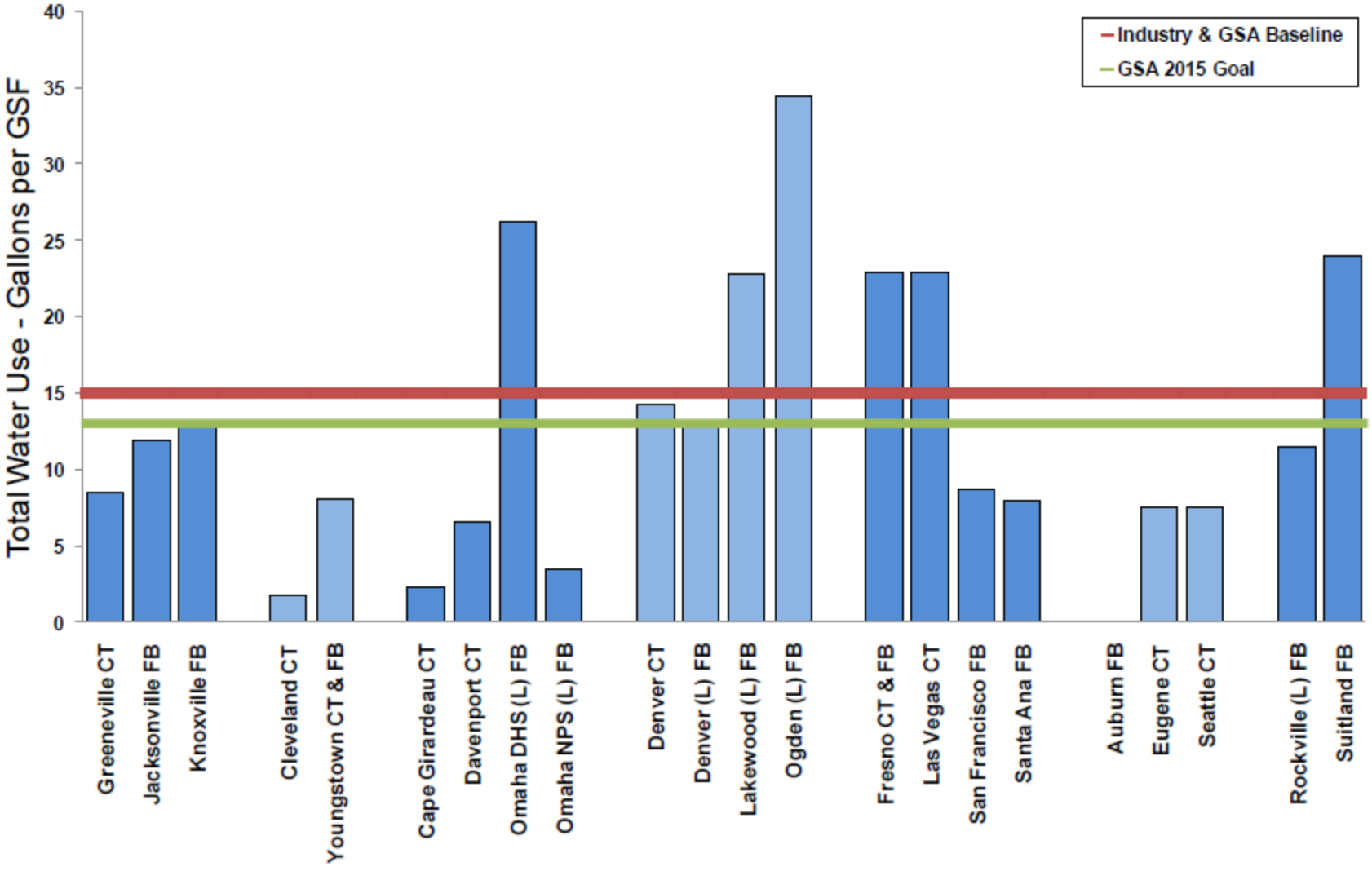

Figure S5. Two-thirds of the GSA buildings use less water than the GSA baseline.

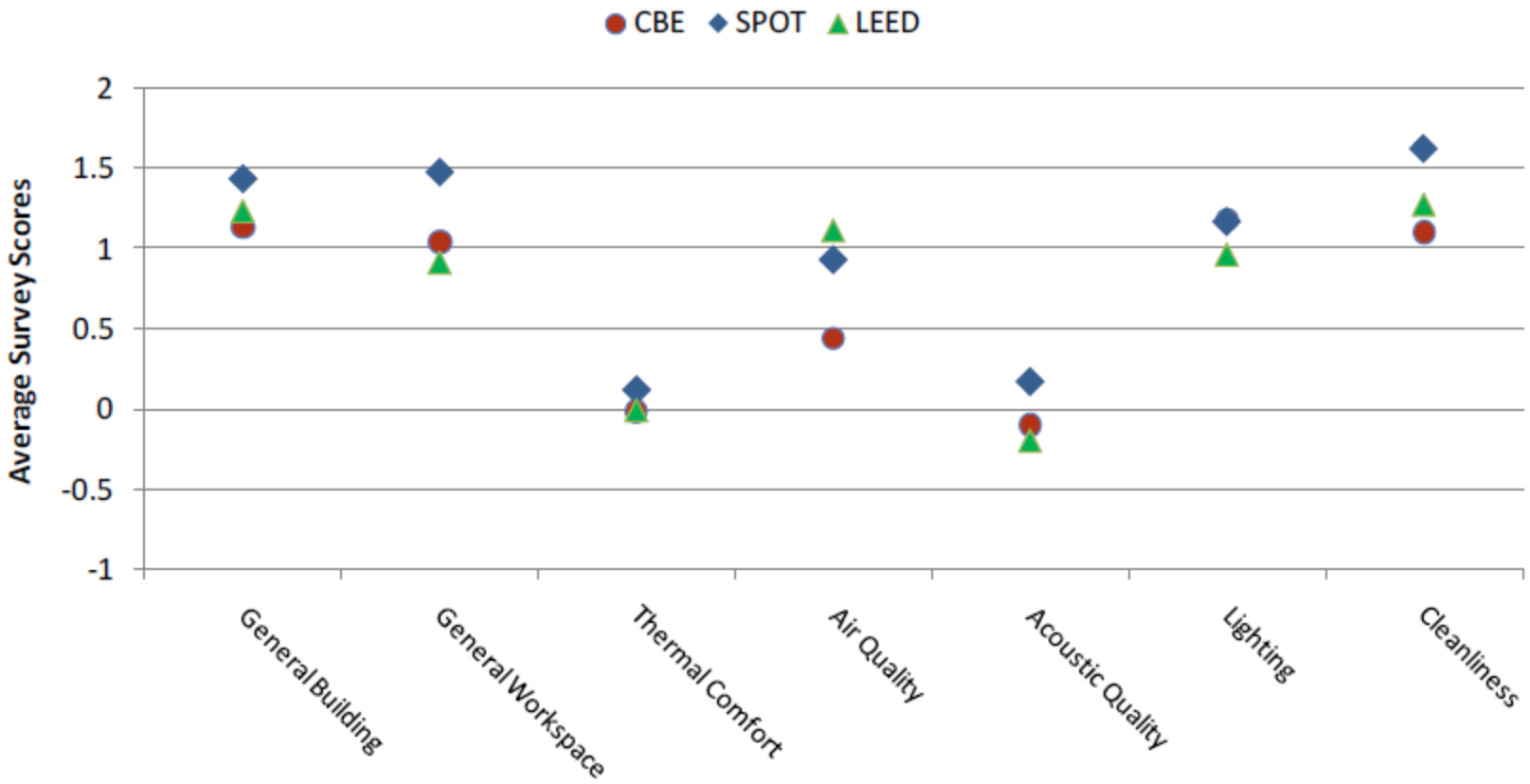

Figure S6. On average, the study building occupants are more satisfied with the buildings than those in the CBE database.

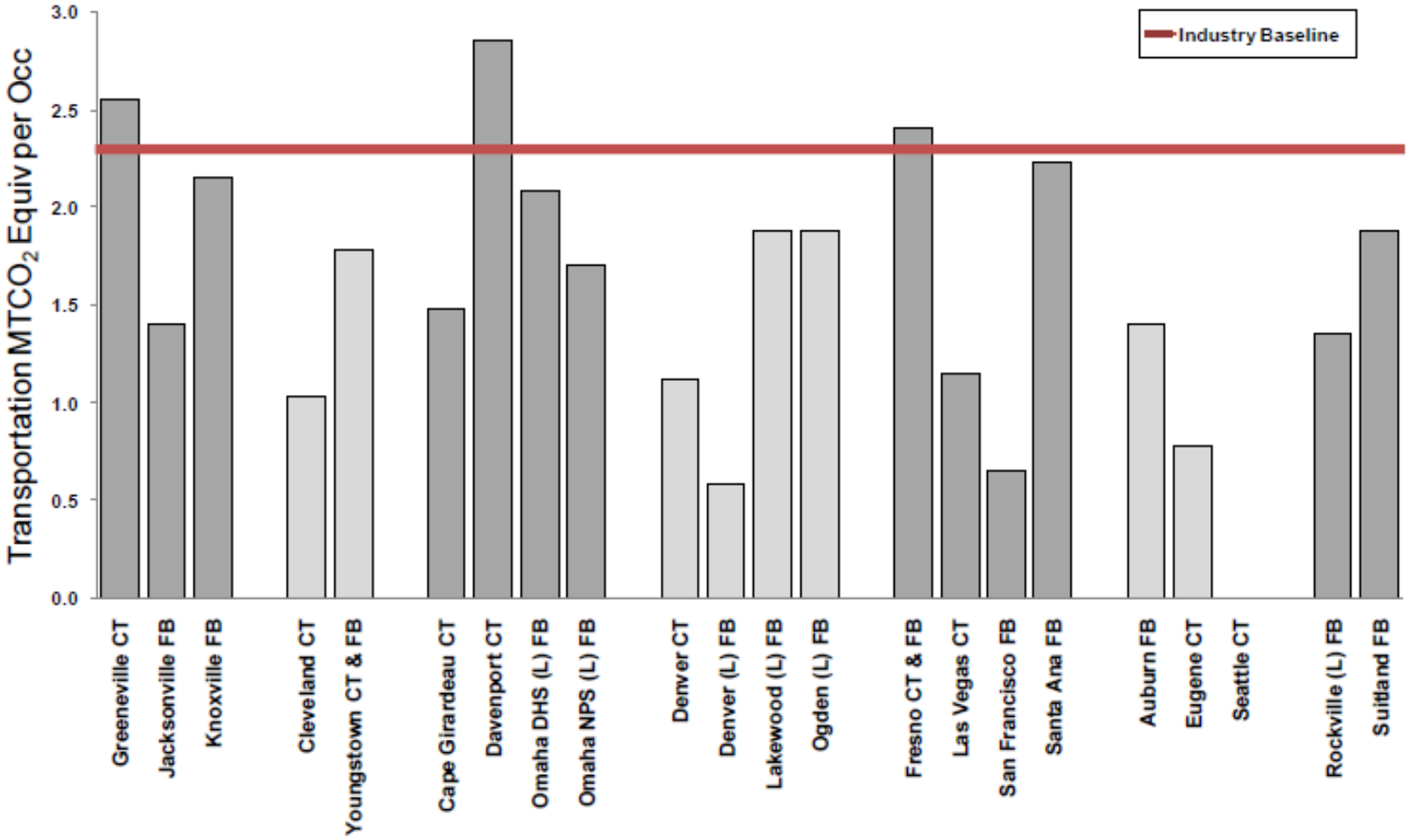

Figure S8. Lower emissions as a result of building occupant commute for most buildings.

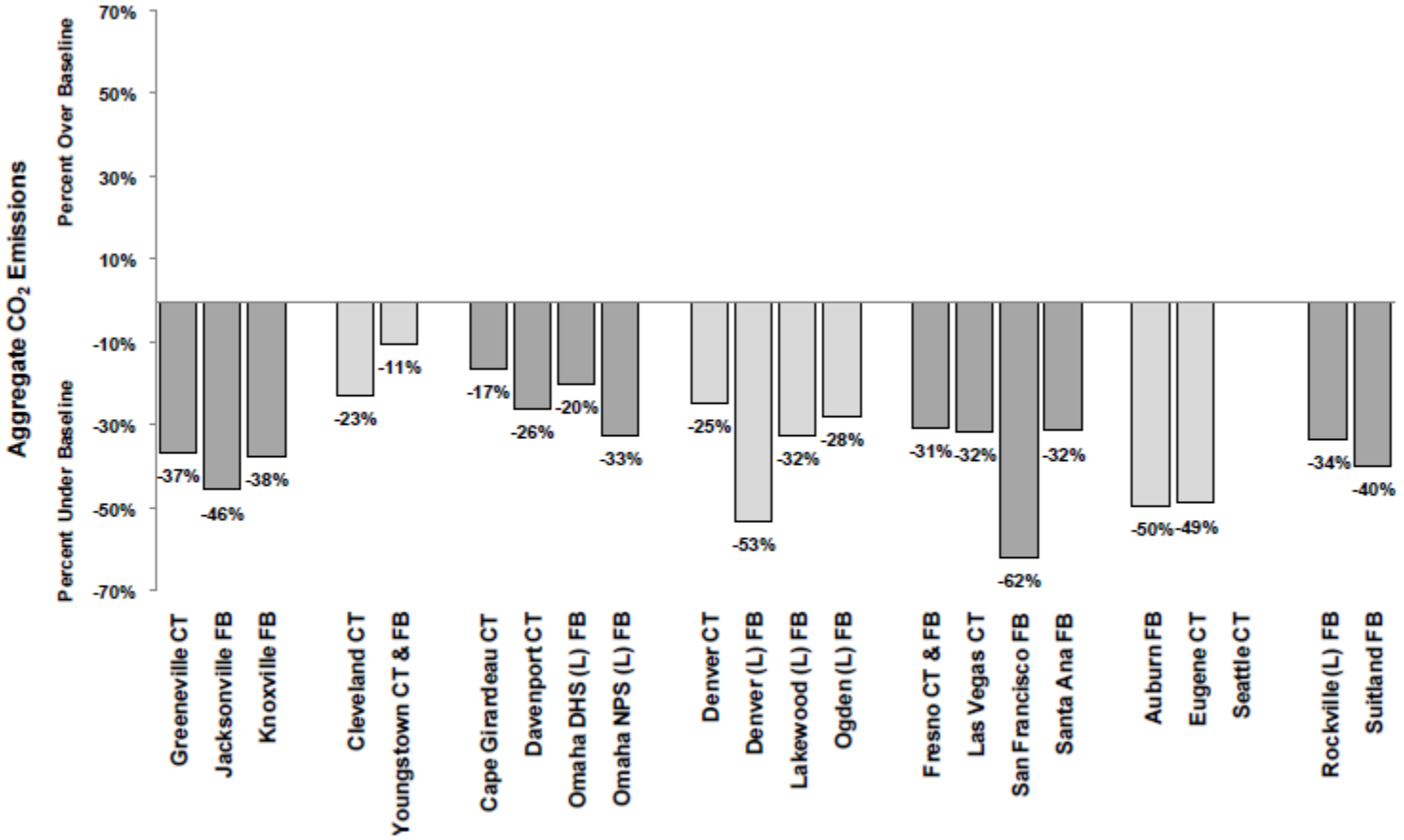

Figure S9. Emissions as a result of building energy performance and occupant commute.

Federal Laws, Policies, and Executive Orders on Sustainability