

Incremental Costs, Measurable Savings: *The Enterprise Green Communities Criteria*

April 21, 2010



The Next Generation. For Every Generation.

Enterprise



A leading provider of the development capital and expertise it takes to make sure that every American has the opportunity to live in a decent home.

- Enterprise works with investors, developers, government and grass roots organizations across the country
- Enterprise, in aggregate, is currently investing in communities at a rate of nearly \$1 billion a year.
- Enterprise's nearly \$9 billion investment in communities over the past 25 years has produced over 240,000 affordable homes and provided opportunity for those most in need.

Enterprise Green Communities



In 2004, Enterprise launched *Green Communities* with a bold aspiration to prove that:

- **Green affordable housing can deliver health, economic and environmental benefits to residents.**
- **Green and affordable can be one and the same.**

Keeping Families Healthy



“All we’ve ever wanted was to be able to provide for our children. To give them a nice place to grow up. We can do that here . . . Since we moved here, we’ve all been so much healthier. Every day, I’m like, ‘Thank you, thank you, thank you.’ Living here has been so positive for my family.”

**Nicki Alhagi, Oleson Woods
Resident
Portland, OR**

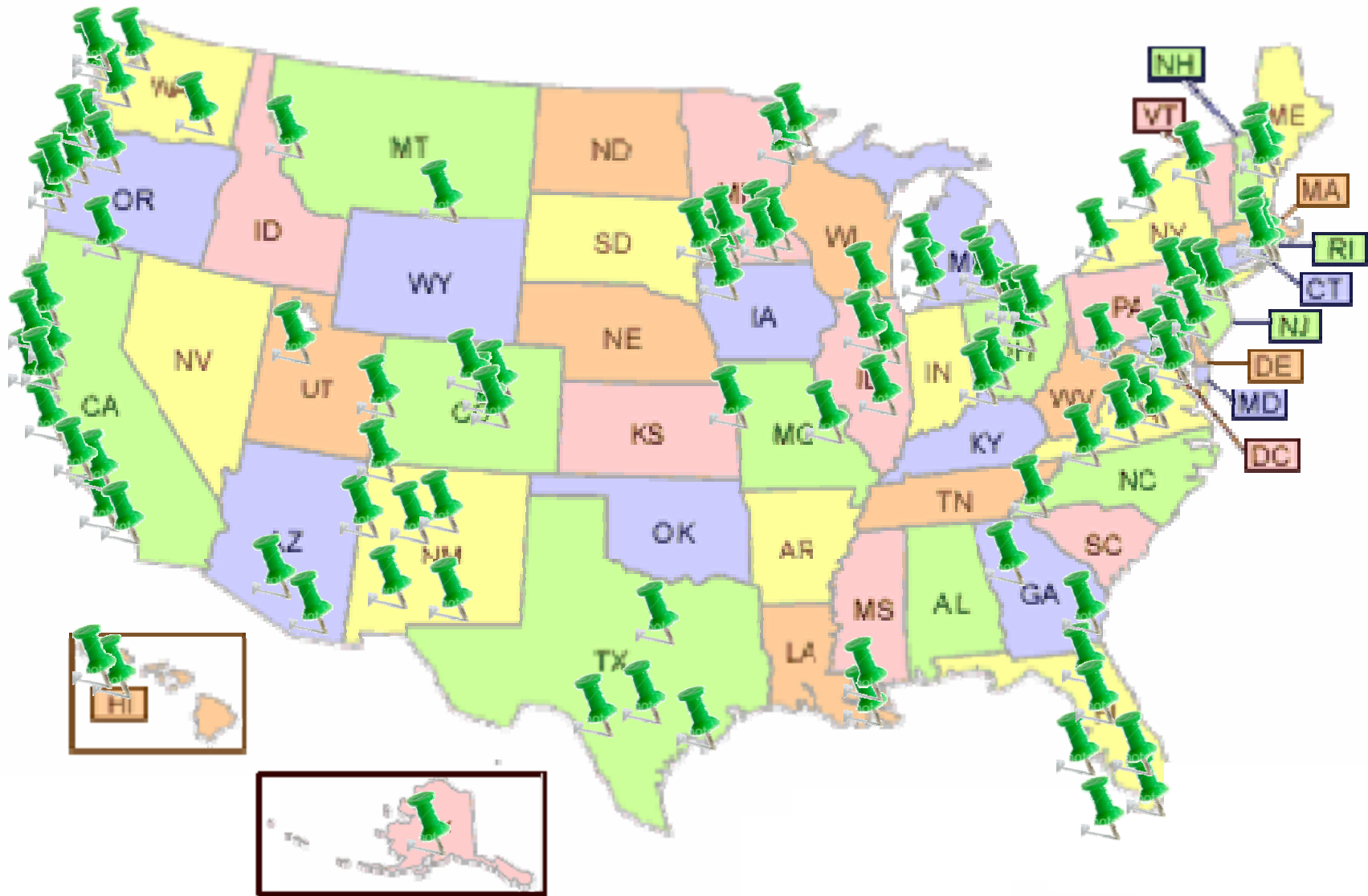
Giving Developers New Tools



“It is easy to be green. [We] will help revitalize our economy by making energy efficiency practices more affordable, accessible and achievable by consumers, businesses and government entities. By prioritizing energy efficiency practices, we can ease the woes of homeowners, lenders, financial markets, builders and our environment.”

- Representative Ed Perlmutter (D-Colo)

Results at Work

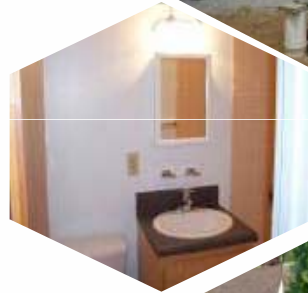


Green Communities Criteria

Integrated Design



Water Conservation



Materials Beneficial to the Environment



Energy Efficiency



Health



Location and Neighborhood Fabric



Operations and Maintenance



Intent of Evaluation Efforts



- **Assist developers understand costs of going green;**
- **Share methods to go greener; and**
- **Ensure the realization of health, economic and environmental benefits.**

Process

To measure the financial benefit from reduced utility costs over the life of the housing, Enterprise:

- Developed and administered survey of project managers of Green Communities developments to collect data points on costs and utility savings
- Shared results with project managers to quality assure results
- Worked with property owners and various utility companies to collect actual utility data of a subset of projects to verify energy and water savings

Methodology

To determine the projected and actual cost-effectiveness of green criteria, the following data were needed:

- Incremental construction costs to meet criteria
- Predicted operational savings
- Comparisons of actual utility usage to predicted usage

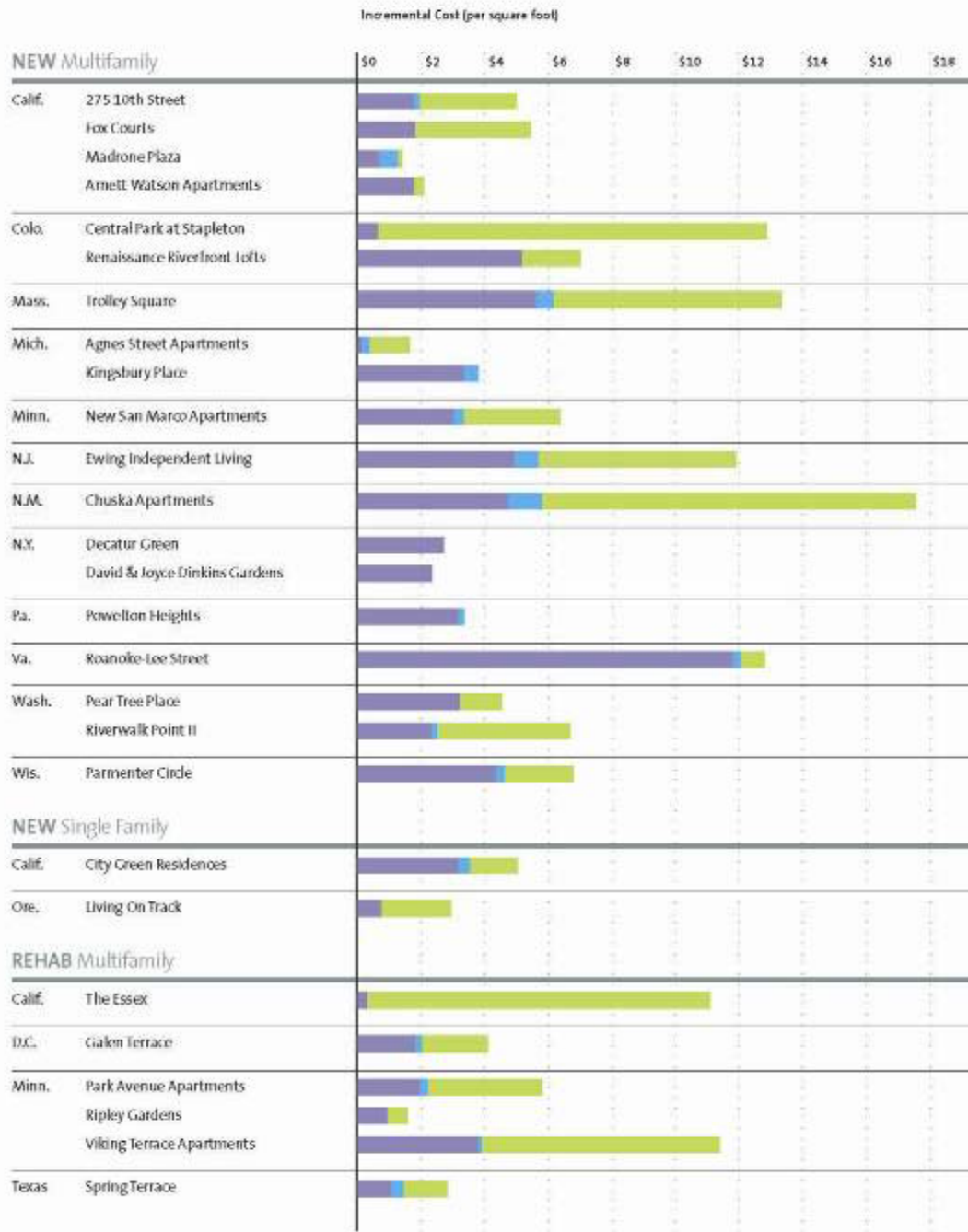
Incremental Costs

Incremental Cost: *Cost premium to meet the Green Communities Criterion as compared to developer's standard practice.*

- Incremental costs to meet each Green Communities Criteria were self-reported by developers
- Comparisons were normalized by square footage
- Outliers were investigated

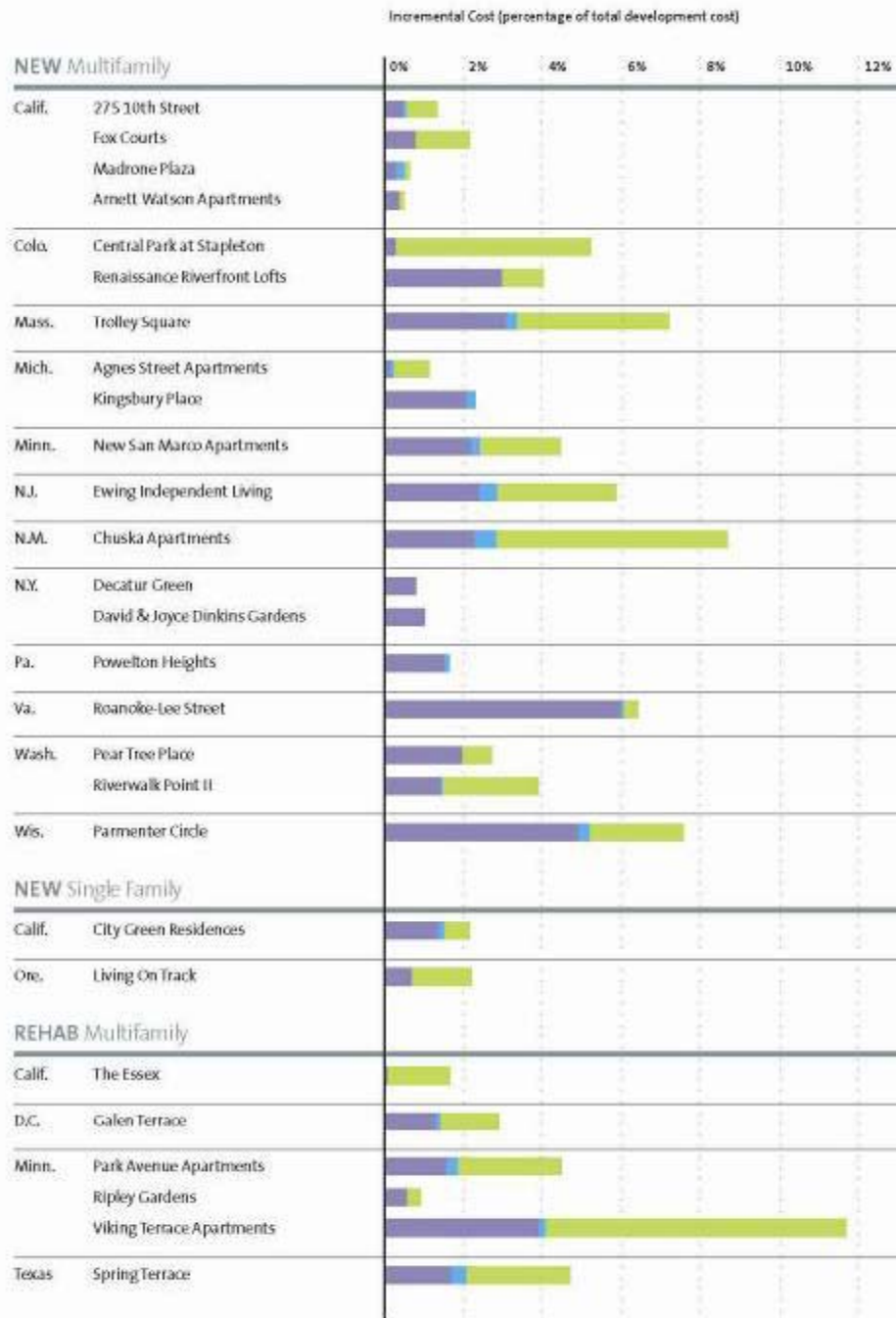
Incremental Cost to Meet Enterprise Green Communities Criteria (\$/Sq. Ft.)

Criteria: ● Energy ● Water ● All Other



Incremental Cost to Meet Enterprise Green Communities Criteria (% of TDC)

Criteria: Energy Water All Other



Predicted Operational Savings

Annual Operational Savings:

Reductions in energy and water usage between the development as designed to meet the Green Communities criteria and the same development as designed to meet the local construction code.

Cost-effectiveness determined only for Green Communities Energy and Water criteria

Energy & Water Criteria Evaluated	
4.1	Water Conserving Appliances & Fixtures
5.1	Efficient Energy Use
5.2	Energy Star Appliances
5.3	Efficient Lighting
5.4	Electricity Meter
5.5	Additional Reductions in Energy Use
5.6	Photovoltaic (PV) Panels

Predicted Operational Savings

Built energy simulation models

- Consistent energy savings data
- Savings by fuel-type and by end-use
- Tracking and comparison to actual post-construction utility bills

Predicted Operational Savings

Procedure for energy simulation models:

- Hourly simulation software
- Envelope, HVAC, DHW, and lighting all taken from submitted drawings
- Usage schedules and plugloads consistent with affordable housing retrofit audit data and multifamily audit program guidelines

Predicted Operational Savings

Procedure for water savings calculations:

- Water fixture and appliance performance submitted by developer in Survey
- Usage schedules consistent with affordable housing retrofit audit data

Predicted Operational Savings

What baseline should be used for comparison?



Predicted Operational Savings

Baseline for determining energy savings:

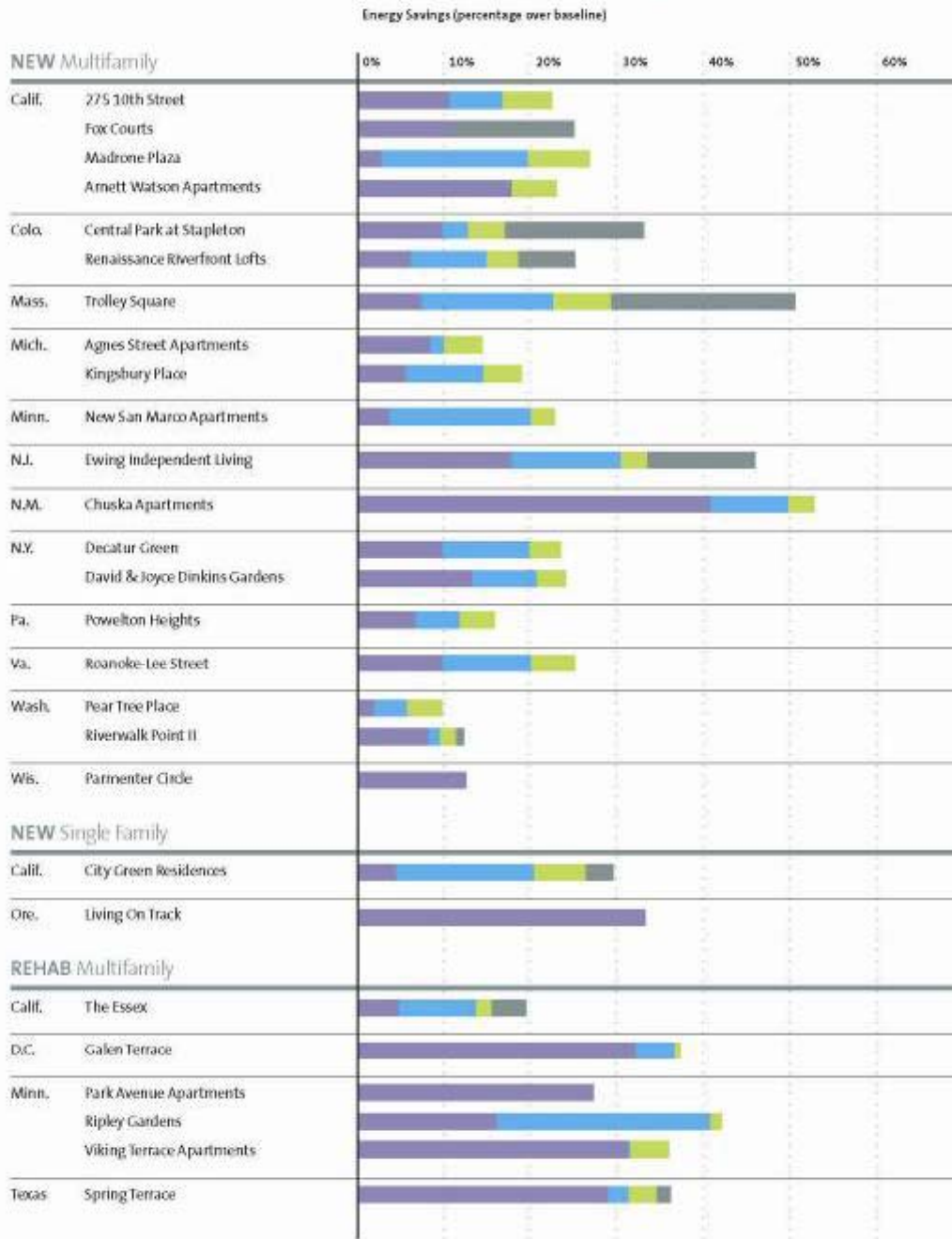
- Local construction code, as reported by the developer in Survey
- HVAC and DHW efficiencies taken from ASHRAE 90.1–1999
- Usage schedules and plugloads equal to the as-designed development

Predicted Operational Savings

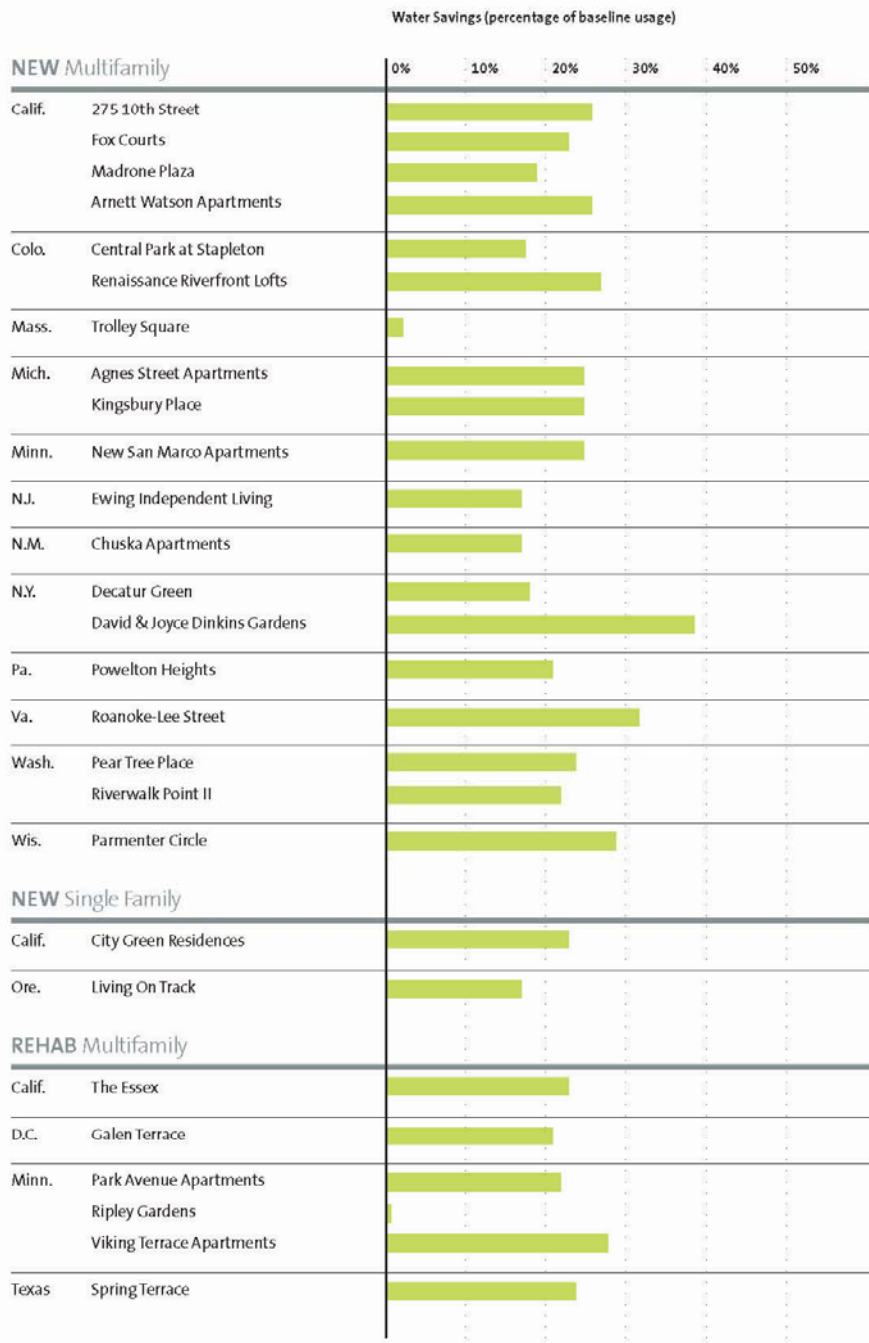
Baseline for determining water savings:

- EPAAct 1992
- Usage schedules equal to the as-designed development

Annual Energy Savings for Meeting All Green Communities Energy Criteria (% over Baseline)



Predicted Annual Water Usage Savings Over Baseline for Meeting Enterprise Green Communities Criteria 4-1 (% of Usage)



Chuska Apartments - Gallup, NM



Predicted vs Actual Performance

Tracking post-construction performance

- Measure 'actual savings'
- High-level feedback if building is performing as designed

Predicted vs Actual Performance

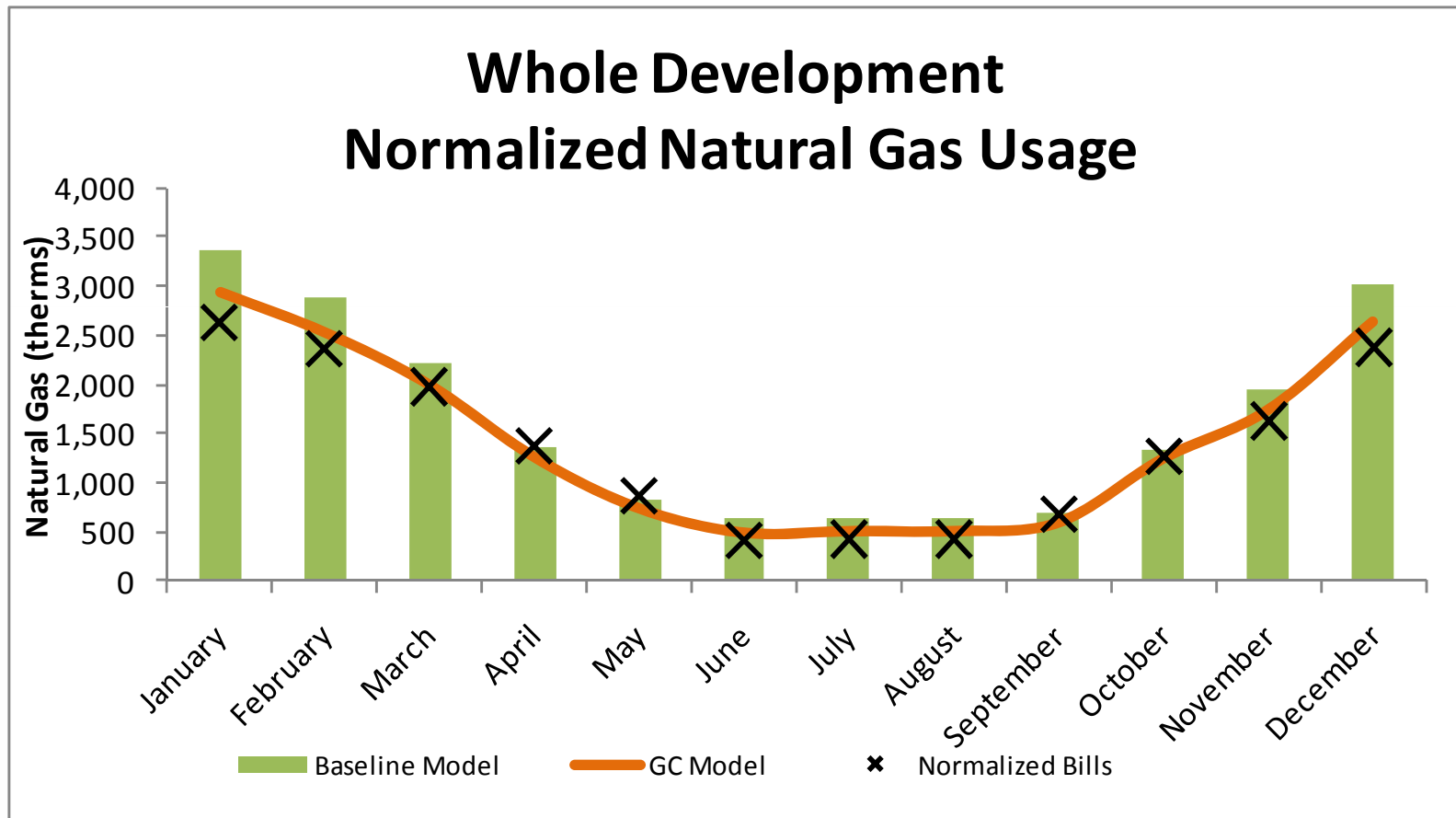
For Energy:

- Weather normalized consumption compared
- Utility bills regressed and normalized with TMY2 weather
- Monthly resolution for energy model predictions and utility bills

For Water:

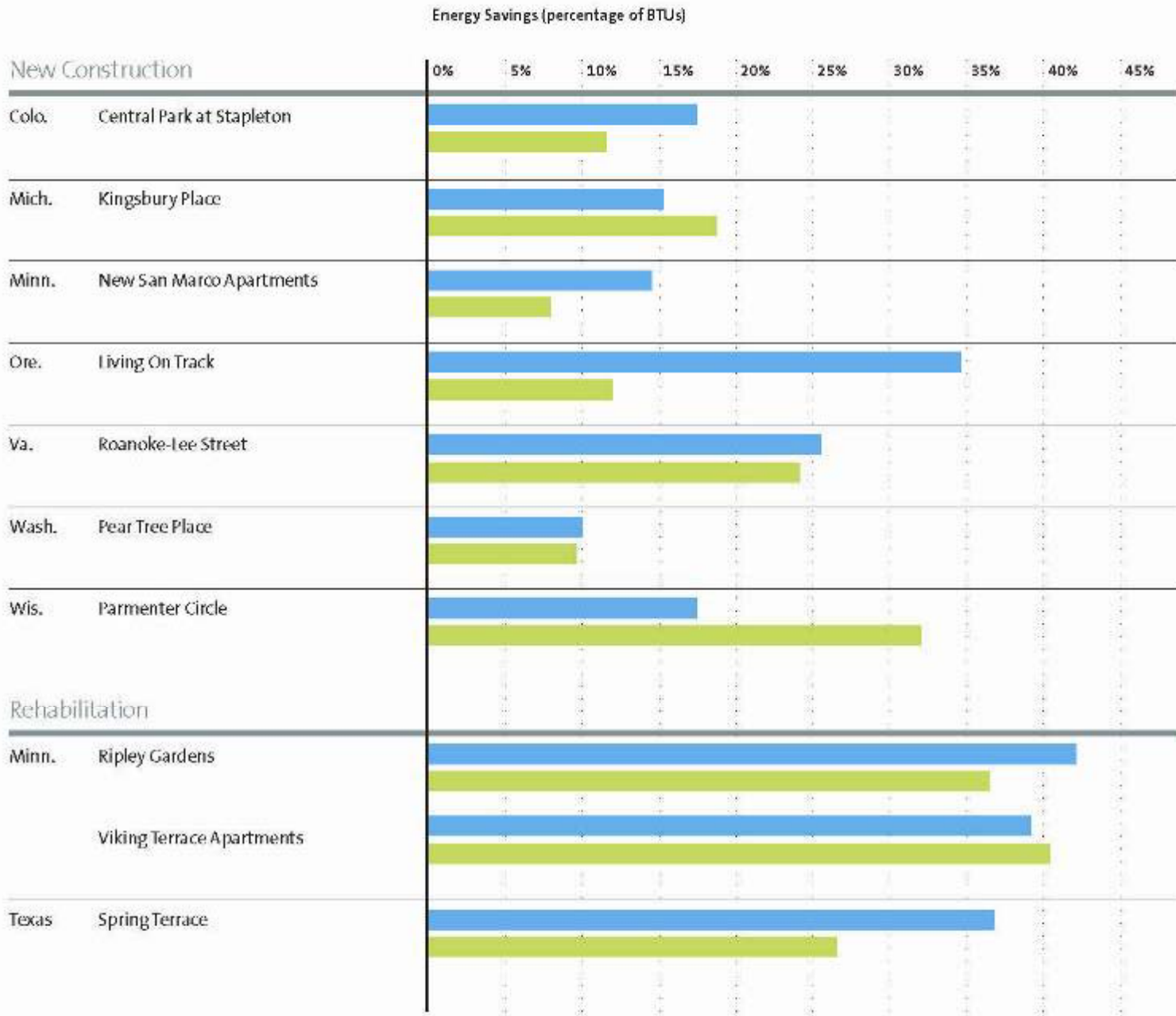
- Average annual consumption compared

Predicted vs Actual Performance



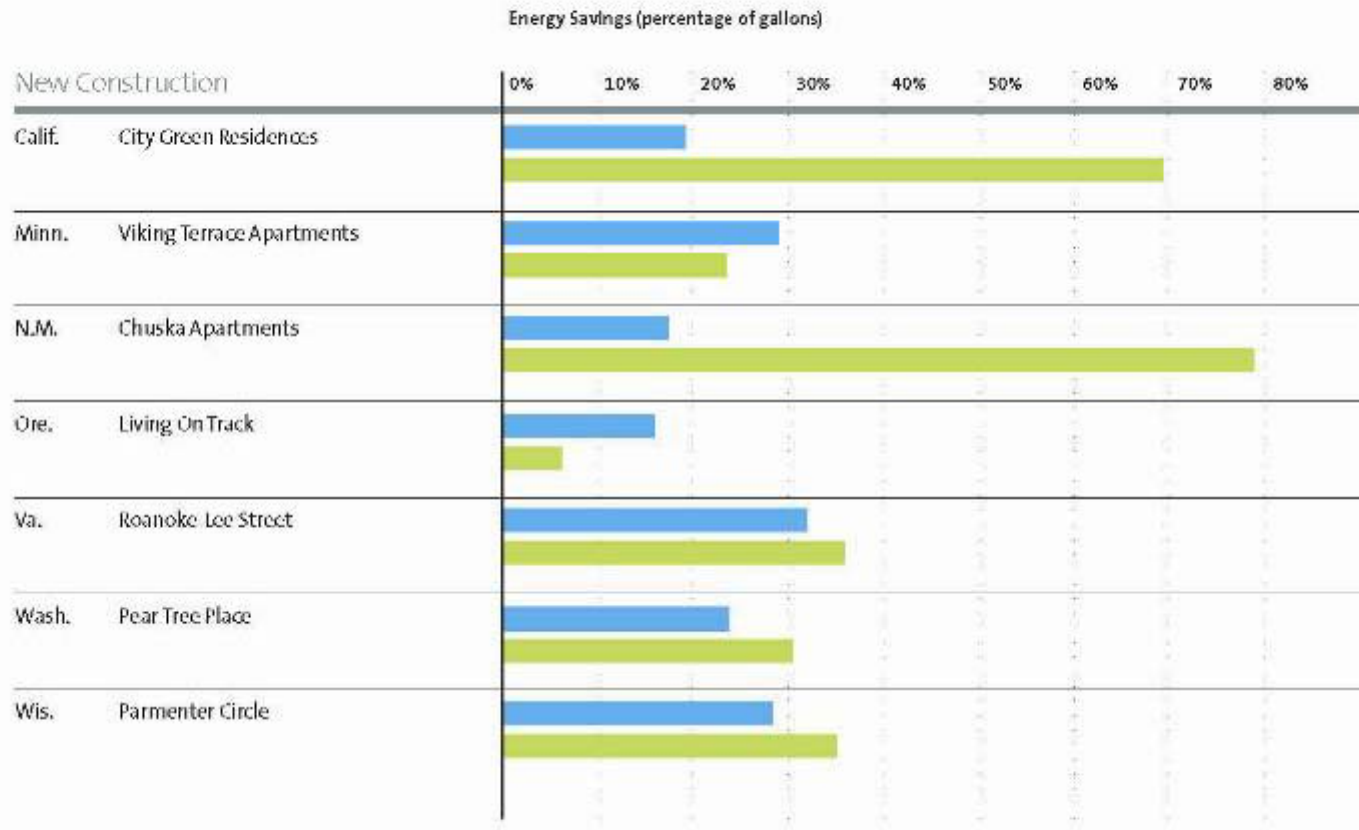
Predicted and Actual Energy Usage Savings Over Baseline (% of BTUs)

Energy Savings: ● Predicted | ● Actual

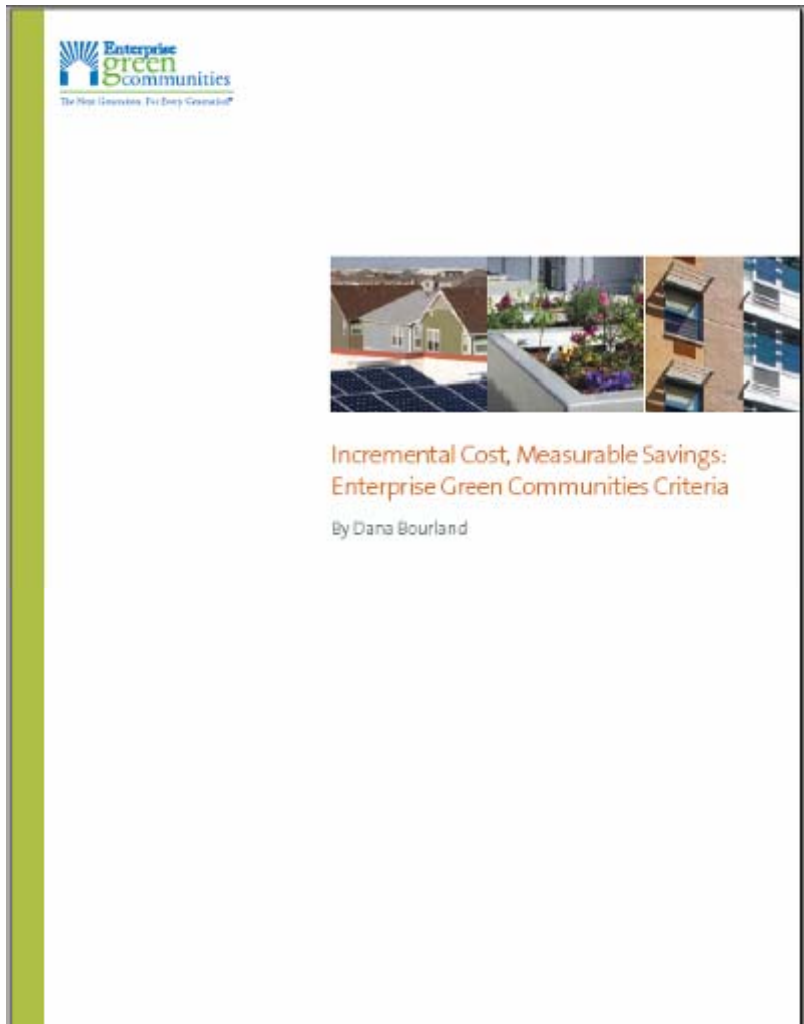


Predicted and Actual Annual Water Savings Analysis (% of Gallons)

Energy Savings: ● Predicted ● Actual



Report Findings



In 2009, Enterprise released report evaluating cost effectiveness of the Green Communities Criteria, *Incremental Cost, Measurable Savings*

- Estimated lifetime savings exceed the initial investment of incorporating Green Communities Criteria into affordable housing
- Direct savings come from energy and water conservation measures

Key Findings

Cost to incorporate the Green Criteria	Projected “Lifetime” Utility Cost Savings
\$4,524 per dwelling unit	\$4,851 per dwelling unit

- Average cost per unit to meet Energy and Water Criteria = **\$1,917**
- Energy and water efficiency measures paid for themselves as well as produced **\$2,900 in projected per-unit lifetime savings.**

Key Findings

<u>Construction Type</u>	<u>Costs</u>	<u>Savings</u>
Moderate Rehab (does not include major systems replacement)	Moderate Rehab projects had the <u>lowest</u> cost premium for compliance	For Moderate Rehab projects, the predicted lifetime savings are <u>two times</u> the cost premium, providing them the <u>highest</u> return on investment of any subset of the 27 projects surveyed
Substantial Rehab (includes major systems replacement such as HVAC, plumbing and electrical systems)	Substantial Rehab projects had the <u>highest</u> cost premium for compliance	Substantial Rehab properties are projected to have remarkably <u>high</u> lifetime utility cost savings

Key Findings

- Projects located in Oregon and Washington state reported no cost premiums for meeting the Green Communities Criteria
- Larger cost premiums were associated with providing adequate ventilation and improving energy efficiency
- The 15 supportive housing projects in our survey had the highest predicted lifetime savings, while the three projects with for-sale homes had the lowest.
- On average, low-tech roof-water harvesting systems yielded modest costs, while potentially offering significant future savings

Conservation Measures = Utility Savings

Implementing the following conservation measures produced dramatic utility cost savings:

- Building to Energy Star standards or better
- Installing all energy improvements with a 10-year or better payback for moderate rehabilitation projects
- Installing Energy Star lighting and appliances
- Individually metering electricity for rental dwelling units (except supportive housing) to encourage conservation
- Installing water-conserving appliances and fixtures

Quickest Payback = Water Conservation



- Installing water-conserving fixtures and appliances result in a very high returns on investment in terms of utility cost savings.
 - Average savings of **\$352 to \$935** per home, versus average cost premium of **\$80** per home.
 - In simple payback terms, the investment is recouped in **2 to 3 years**.

Madrone Plaza - Morgan Hill, CA



Central Park at Stapleton – Denver, CO



Galen Terrace - Washington, DC



Trolley Square - Cambridge, MA



Spring Terrace - Austin, TX



Roanoke Lee Street Project - Blacksburg, VA

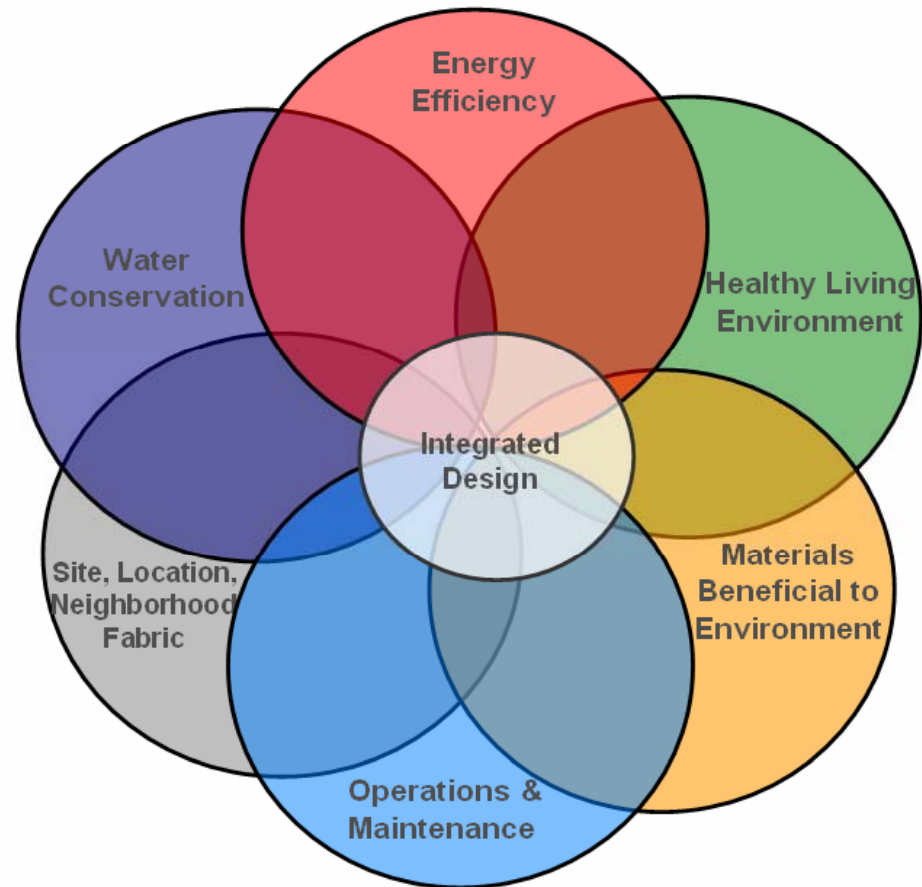


What We Learned Along the Way...

- **Start early, Be comprehensive**
- **Engage members of the development & operations team**

Average Cost:

- **Range: \$5K - \$10K**



What We Learned Along the Way...

- Criteria found in the plans and specs were found in the buildings **95%** of the time.
- Criteria **NOT** found in the plans or specs were found in the buildings **37%** of the time.



What We Learned Along the Way...Specify

2.02 PAINTS AND COATINGS - GENERAL

- A. Paints and Coatings: Ready mixed, except field-catalyzed coatings. Prepare pigments:
1. To a soft paste consistency, capable of being readily and uniformly dispersed to a

12. The following sign is to be made and prominently posted on the job site. It is the responsibility of the general contractor to ensure that his labor force, all subcontractors and their labor forces, all suppliers, and other visitors be made aware of these rules and follow them at all times. Sign to be posted:
- a. This building house is being constructed as a healthy building. Only specified products and procedures may be used.
 - b. Alternatives to specified materials must be approved in writing by the owner and /or architect prior to use. If in doubt, contact the general contractor.

- C. Chemical Content: The following compounds are prohibited:
1. Aromatic Compounds: In excess of 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
 2. Acrolein, acrylonitrile, antimony, benzene, butyl benzyl phthalate, cadmium, di (2-ethylhexyl) phthalate, di-n-butyl phthalate, di-n-octyl phthalate, 1,2-dichlorobenzene, diethyl phthalate, dimethyl phthalate, ethylbenzene, formaldehyde, hexavalent chromium, isophorone, lead, mercury, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, naphthalene, toluene (methylbenzene), 1,1,1-trichloroethane, vinyl chloride.

What We Learned Along the Way...



Duct Blaster

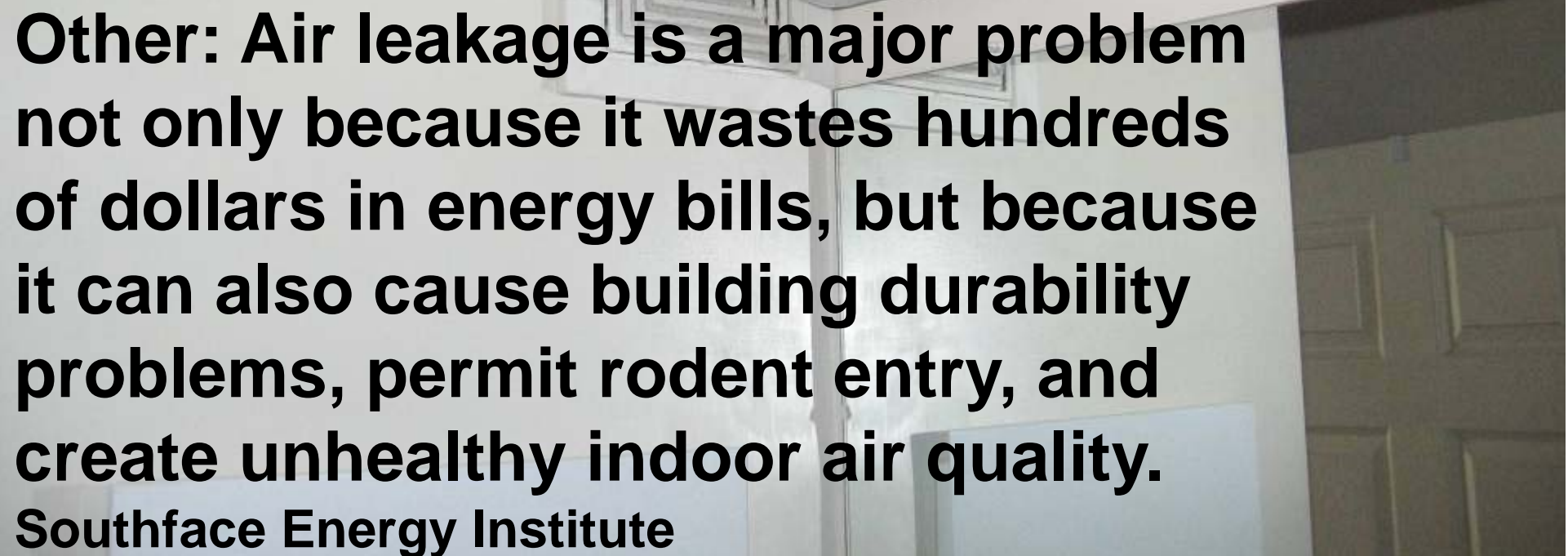


Bathroom Exhaust Fan

Through performance testing, we found higher than expected duct leakage in ten projects.

- Air leakage can be more difficult and more costly to correct after construction is complete.
- In 2 projects, residents were the first to notify property staff about the leakage because they experienced drafts and discomfort in their apartments and were turning up the thermostats to compensate.
- We recommend that a local building performance specialist be hired on a routine basis to perform air sealing.

Construction Flaws

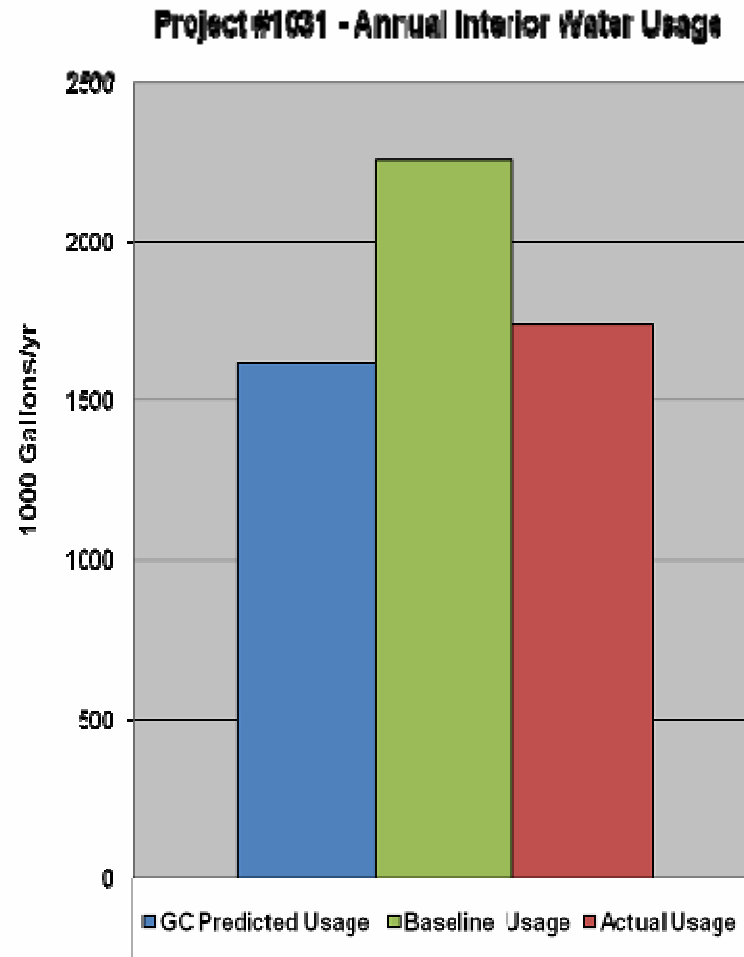


Other: Air leakage is a major problem not only because it wastes hundreds of dollars in energy bills, but because it can also cause building durability problems, permit rodent entry, and create unhealthy indoor air quality.

Southface Energy Institute

What We Learned Along the Way...

- Developers do not routinely track the costs associated with going green
- Property owners do not typically track electricity, gas and water usage.
- Residents seem most interested in having a healthier place to live.



Ongoing Resident Education



THE CENTRAL PARK ENERGY FLYOVER

North East Denver
Housing Center

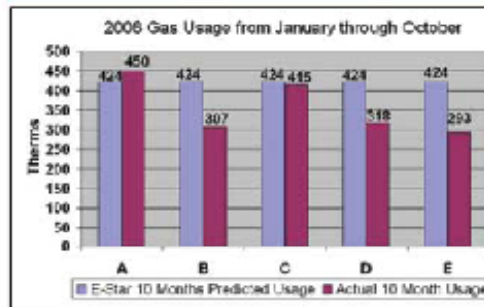
December
Unit 101

How Much Energy Have You Used?

Our Central Park @ Stapleton community focuses on sustainability! What does this mean? A part of being sustainable means SAVING ENERGY!! Northeast Denver gave you a head start by installing many energy efficient measures. We also had energy raters estimate the amount your Gas (Therms) and Electricity (Kwh or Kilowatt Hours) usage before you moved in. We used this to determine how much energy you should be using over the past 10 months. The good news! Many of you have "beat" the estimates and are using less energy than predicted!! The graphs below allow you to see how YOUR unit compares to the estimate.

Blue = Estimated Usage and Purple = How much you have used and other identical units.

Natural Gas Usage from January 2008 to October 2008

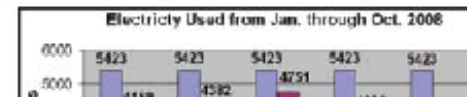


Your Unit A

Getting Better!! You have used 450 Therms, 26 more than predicted, but you have reduced the gap by 2 Therms since June.

Use the tips on the back of the newsletter to keep on saving energy!

Electricity Usage from January 2008 to October 2008



Your Unit A

Great Job!! You have used 4169 Kilowatt Hours, 1,254 less than predicted.

Important Phone Numbers:

Maintenance Hotline:
303-377-6363

Continental Divide:
303-393-7368

Xcel Energy
800-895-4999

Stapleton Master
Community Association:
303-366-0724

Denver Police:
(Non Emergency):
720-913-2000

Park Hill Library
303-331-4063

Poison Control:
303-739-1123

Upcoming Event!!!

Gingerbread House Workshop

Tools: Resident Manual Template

TROLLEY SQUARE MANUAL PARA VIVIR “VERDE”



Preparado por:
Jane Jones
Mathias Rosenfeld

Traducción por:
Madeline Fraser Cook
New Ecology, Inc.

Homeowner's Rehab, Inc./Trolley Square LLC
2401 Massachusetts Avenue
Cambridge, MA 02140
Telephone – (617) 491-5466 / Fax – (617) 497-9410



HRI
HOMEOWNER'S
REHAB, INC.

Template version

[Please read the attached memo on "Adapting and Customizing the Green O&M Manuals for Other Development Projects"]

HEALTHY HOME GUIDE
for Residents of [INSERT Project Name]

[INSERT developer's name]

Tools: Operations and Maintenance Manual Template



Green Operations & Maintenance Manual for The New San Marco Apartments

Best Practices for a Healthy and High-Performance Building

Template manual

Green Operations & Maintenance Manual for [Project Name]

Best Practices for a Healthy and High-Performance **Building**

[INSERT PHOTOS/IMAGES OF PROJECT AND RELEVANT LOGOS
FROM THE DEVELOPER, ETC.]

Green Operations & Maintenance Manual for **[Project Name]**

Green Communities Website Resources

Publications:

- Incremental Cost, Measurable Savings
Source: <http://www.enterprisenextgen.org/pdf/form/form.php>
- Sharing the Benefits of Building Green – High Point Community Study
Source: <http://www.practitionerresources.org/>
- Viking Terrace Case Study
Source: <http://www.nchh.org/LinkClick.aspx?fileticket=fMvyBzNTHhc%3d&tabid=363>
- Breathe-Easy Homes Case Study
Source: <http://www.practitionerresources.org/>

Templates and Resources:

- Green Development Plan
- Resident Manual
- Operations and Maintenance Manual
- Green Single Family Rehabilitation Specifications
Source: <http://www.greencommunitiesonline.org/tools/resources/index.asp>

Thank you!



For more information:

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Mailbox: greencommunities@enterprisecommunity.org



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