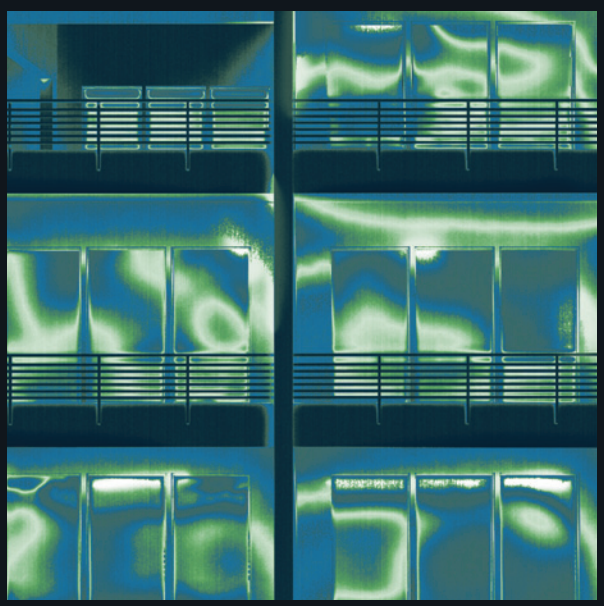
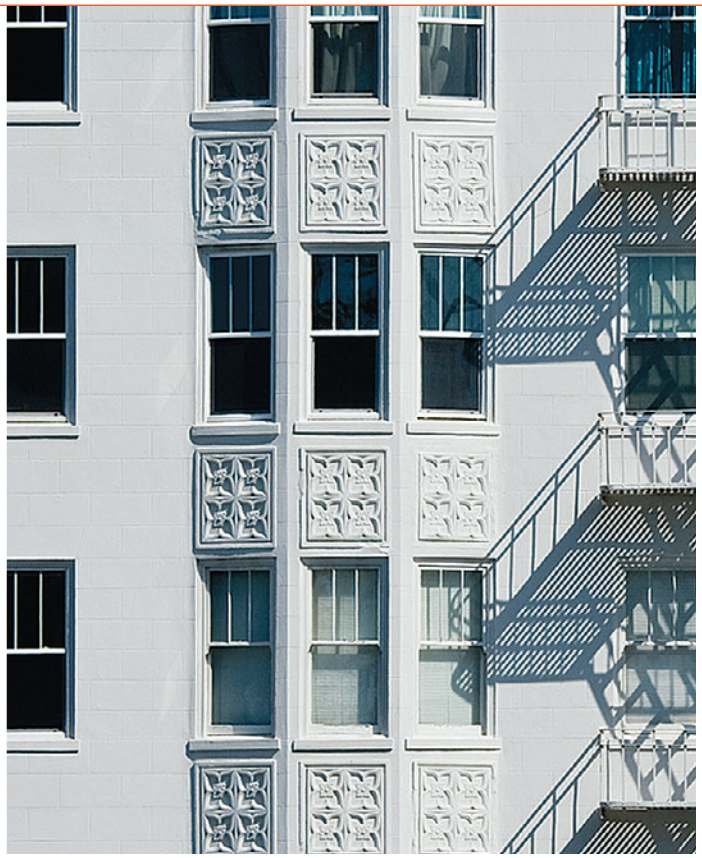
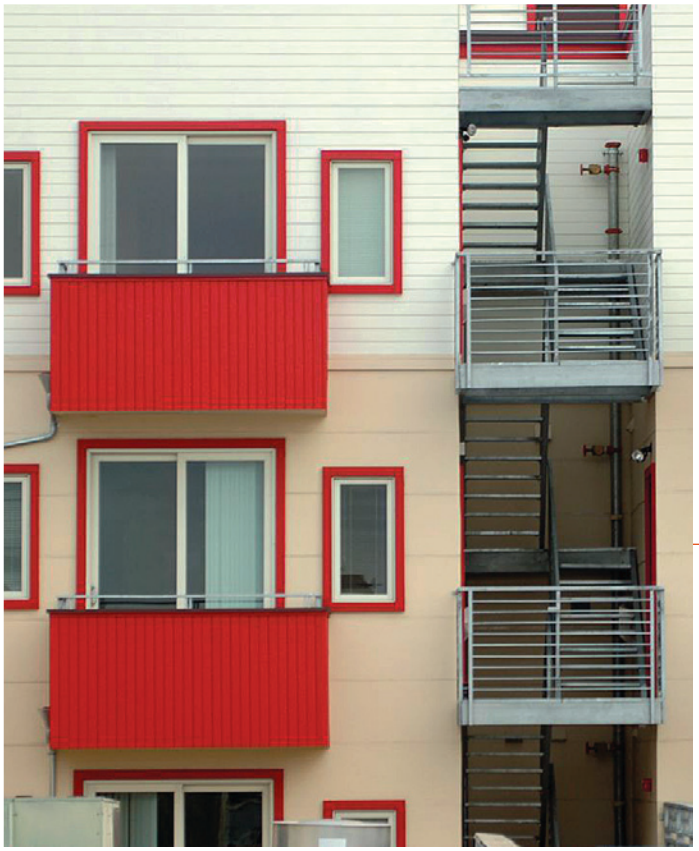
SPUR REPORT 02/2011

GREENING APARTMENT BUILDINGS

Two-thirds of San Francisco's housing stock is multi-family buildings. Retrofitting these apartments to use less water, energy and materials is a significant step to improve the sustainability of San Francisco. While new green building codes are important, changing the environmental impact of existing buildings has a more immediate effect. What will it take to green the buildings we already have?







photos clockwise from top left: Flickr members Troy Holden; Eric Fischer; Eric Fischer; Donnaphoto

San Francisco's multifamily housing stock comes in varied forms. These buildings have unique combinations of ownership, management, structure, occupancy and financing that affect their ability to take on significant green upgrades.

GREENING APARTMENT BUILDINGS

While new green building codes are important, in a built-out city like San Francisco retrofitting our existing built environment to conserve water, energy and materials is a key sustainability challenge. In 2010, SPUR convened a task force to identify opportunities to "green" multifamily apartment buildings — which contain more than two-thirds of the city's housing units. We found that there are challenges to widespread adoption of green upgrades, including low awareness, lack of capital, and a confusing, ever-changing slate of incentive and rebate programs.

SPUR Recommendation

SPUR recommends that the City, through the Department of the Environment, work together with the San Francisco Public Utilities Commission (SFPUC), Pacific Gas and Electric, and Recology (the City's waste-collection company) to create a "one-stop shop" or web-based tool for property owners to access and take advantage of the many free audit, rebate, direct install, and compliance assistance programs that currently exist among the various utilities serving San Francisco.

The tool should include a significant education component to provide information to tenants and property managers about recycling and composting, water conservation, and more. We further recommend that the City, working with the SF Apartment Association and tenant organizations, use this tool as the basis of a strategic outreach and marketing plan to reach buildings that could benefit from green upgrades.

This report was reviewed, debated and adopted as official SPUR policy by the Board of Directors on January 19, 2011.
spur.org/greenbuildings

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The Opportunity of Existing Buildings

Improving the resource efficiency of buildings is an important way to reduce our city's ecological footprint. Buildings account for about half of San Francisco's greenhouse gas emissions (and indirectly account for more), consume water and generate waste. Reflecting the city's progressive values, San Francisco has been a national leader in green building policy, creating a green building program in 1999 and adopting municipal green building standards in 2004. In 2008 the city adopted a landmark ordinance requiring all new residential and new larger commercial buildings to meet high performance standards under the LEED or GreenPoint Rated systems. This ordinance was updated in 2010 to affect every new building in the city.

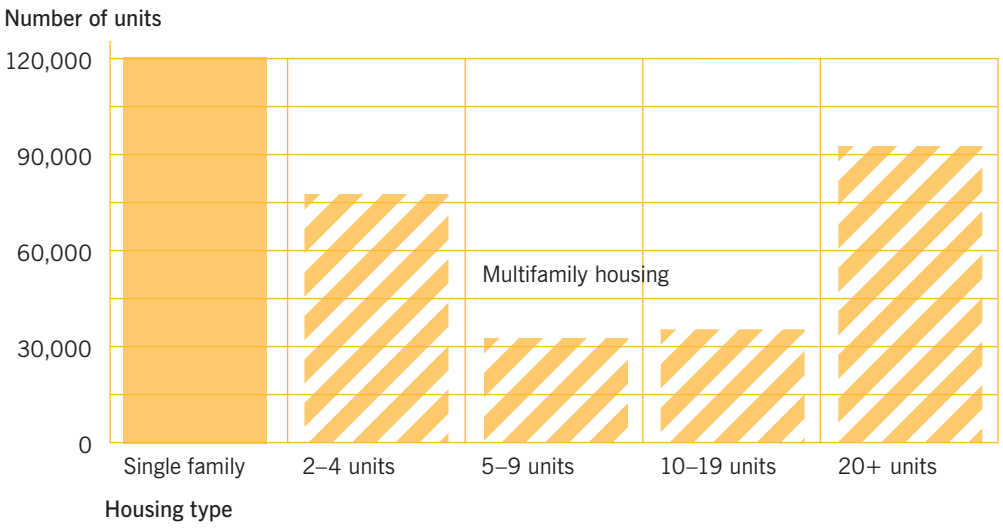
Raising the bar for new buildings — especially given the explosion of new green building technologies, and the growing popularity and accessibility of sustainable design — stimulates innovation and creates future environmental benefits. But in a built-out city like ours, existing buildings are going to be responsible for the vast majority of resource use over any meaningful planning period. New buildings and major renovations account for 1-2 percent of total square footage in San Francisco buildings per year, so it would take more than 60 years to green half of the building stock in San Francisco through construction and major renovation.[1] Thus, one of the greatest challenges in urban sustainability today is retrofitting or greening the buildings that we already have.

SPUR convened a task force in February 2010 to explore issues in greening existing residential buildings in San Francisco. We specifically focused on multifamily buildings, which have more than two-thirds of the city's residential units, and are 81 percent renter-occupied (Figure 1). In theory, green improvements to apartment buildings could save utility costs for both owners and residents while reducing environmental impacts. Our task force sought to determine if there were any significant barriers to achieving these savings, including policy barriers, and if so, what San Francisco could do to overcome them. We considered opportunities to improve water efficiency and conservation, waste diversion, and energy efficiency, including electricity and gas. We also explored how San Francisco's 1979 rent stabilization law affects the decision-making process for building owners to perform upgrades.

For decades, the primary San Francisco policy tool to upgrade the energy and water efficiency of residential buildings has been the Residential Energy Conservation Ordinance (RECO), which requires properties to either have or install certain energy and water-saving fixtures when they are sold.[2] Various financial incentives and favorable financing resources from state and federal governments, as well as utilities, have provided policy support for retrofits as well. In 2009, a City task force made recommendations to require the measurement and improvement of energy efficiency in existing commercial buildings; those recommendations may be adopted this year. While these initiatives are a good starting place, we have not thoroughly examined what we can do to take advantage of new green building techniques to improve the environmental performance in

Figure 1: Number of Units in Multifamily Buildings in San Francisco

More than two-thirds of San Francisco's residential units are in multifamily buildings, which are 81 percent renter-occupied.



Source: U.S. Census Bureau, 2009 American Community Survey 1-Year Estimates, Table B25024.

multifamily residential or mixed-use buildings, which constitute the majority of the housing stock in San Francisco. These buildings often have unique combinations of ownership, management, structure, occupancy and financing that affect their ability to take on significant green upgrades. While there is a wealth of resources available for residential building owners who wish to retrofit their properties, these resources can be confusing and difficult to locate. If the unique needs of multifamily and mixed-use buildings are not addressed directly in a comprehensive, integrated fashion, they could miss out on significant new lines of funding from federal and utility sources, as well as the opportunity to contribute to citywide environmental goals and gain direct energy and water cost savings.

Challenges for Multifamily Buildings

Multifamily and mixed-use buildings are already some of the most resource-efficient housing that we have. They tend to be energy efficient, on a per capita basis, because their shared-wall geometry means that less heating and cooling is lost to the exterior.[3] They tend to be water efficient because they often have shared clothes washers and use less outdoor water per capita — especially with the limited lot sizes typical in San Francisco. Their efficient form utilizes limited urban space to add density that supports public transportation, walkability and a vibrant public realm.

However, multifamily buildings — especially rented apartment buildings — have a complex set of conditions that make prescribing a "one size fits all" standard for green improvements more challenging than for other types of buildings. Within the sector, the variety of physical configurations — from low-rise to high-rise, from all-residential to mixed-use — have different reference standards for efficiency and energy analysis. Owners of affordable versus market-rate buildings are faced with different financial and regulatory realities that have implications for their decision-making process. Within buildings, there are private areas and common areas, and a range of individual systems and central systems, which have different rules for participation in various utility and rebate programs.

Renovating an existing multifamily building that already has residents living in place is usually more complicated than building efficient features into new construction. Many owners prefer to perform improvements at unit turnover, when the unit is vacant and existing tenants will not be disturbed. However, by renovating on a unit-by-unit basis, owners lose the economies of scale gained from retrofitting the entire building at once. The timing of the renovation becomes particularly important if the owner wishes to take advantage of rebates, which are not realized until after the improvements are installed.

Split incentives are commonly thought to be a key reason for underinvestment in efficiency in renter-occupied buildings. Split incentives exist when different parties, with different economic motivations, are responsible for equipment selection, usage and utility payments. For example, in a rented building, often the building owner will pay the entire water bill, leaving tenants — who control actual water use and total water consumption — with little incentive to conserve. On the other hand, those same tenants commonly control and pay for the electricity used by kitchen appliances or lighting fixtures, but they cannot select or replace those appliances and fixtures, because they may not have the authority, financial resources and/or the expectation of cost recovery during their tenancy. SPUR's task force found that the presence of split incentives appeared to be less of a barrier in the decision-making process for greening buildings than we expected. From the case studies we explored and from our discussions, we learned that investments in efficiency and conservation that did not directly benefit the building owner were often undertaken anyway for non-financial benefits, such as occupant comfort, general building improvement and maintenance, unit marketability, or just because they are the "right thing to do."

David Peters

Rent control is another overarching issue for multifamily buildings in San Francisco. The Rent Board estimates that 75 percent of tenants live in rent-controlled apartments, which are generally units built before 1979. San Francisco's rent control law creates several disincentives for owners to undertake building retrofits, including green improvements. The largest disincentive for big capital improvements is that most tenants must be paid $5,101 or more to be relocated temporarily. Not all green retrofits require relocation of tenants, but many projects with the largest potential for energy and water savings do, such as insulating exterior walls, replacing windows or reconfiguring plumbing. The law specifies over what period an improvement may be paid for by cost-sharing or passing through costs to tenants — usually between 10-20 years. It also specifies what percentage of those costs may be passed through: 100 percent of certain capital costs may be passed through in smaller buildings, but buildings with more than five units may only pass through 50 percent of costs. A 2003 ordinance allowed for 100 percent pass-through of just one

[1] Mayor's Task Force on Existing Commercial Buildings Final Report, December 2009, page ii; www.sfenvironment.org/downloads/library/sf _ existing _ commercial _ buildings _ task _ force _ report _ 1.0.pdf

[2] In 2009, the city through an ordinance spearheaded by the SFPUC updated the water efficiency standards and expanded compliance requirements to commercial properties.

[3] From "Improving California's Multifamily Buildings: Opportunities and Recommendations for Green Retrofit & Rehab Programs," Findings from the Multifamily Subcommittee of the California Home Energy Retrofit Coordinating Committee (MF HERCC), Draft Report. October 7, 2010.

type of energy conservation improvement: high-efficiency refrigerators in units where the tenant pays the electric bill. Because appliances are not cost-effective to amortize over 10 or more years, this provision has never been utilized.

Besides exploring the prevalence of split incentives and the challenges of rent control, SPUR's task force sought to explore the ease of undertaking voluntary efficiency improvements, and the availability of greening tools and financing for both building owners and tenants. We found that challenges and opportunities for the different resources — water, waste, energy — were distinct, though some greening tools apply across categories (See sidebar: Toolbox for greening buildings). Many of these tools are used in combination by different utilities and by the City to incentivize greater green performance; however, some of the tools are not maximized or utilized to their possible extent.

SPUR's task force concluded that the three biggest barriers to greening multifamily buildings in San Francisco are:

1. **Lack of awareness of available greening tools and opportunities,** and how to use them;
2. **Inability to systematically share improvement costs and benefits** in ways that mutually benefit building owners and tenants; and
3. **Lack of access to external financing.**

Of these, we believe number one is the most important area for the City to make improvements now.

Because greening challenges for multifamily buildings vary so much by resources and utilities, we explored and will present each one, and its opportunities, in turn.

There are numerous rebate programs available to multifamily buildings, but the number and variety of programs is confusing, and awareness of these opportunities is not as high as it could be.

Flickr member: gail m tang

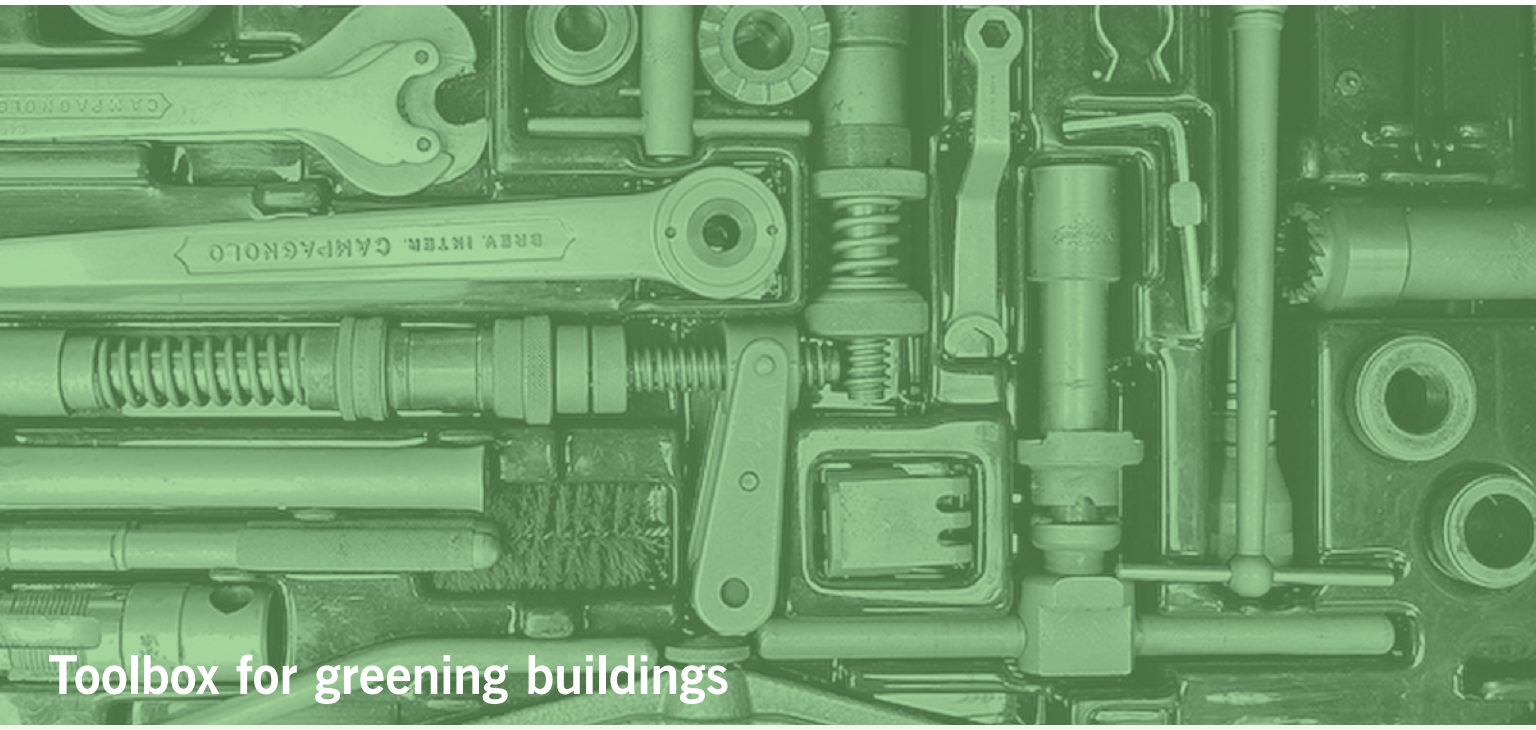
Water

Multifamily buildings are responsible for 40 percent of total water use in San Francisco and 60 percent of residential use. Although per-capita water use is actually declining in San Francisco, there is still wasted water, and with a growing regional population we still need to conserve: San Francisco has committed to conserving million gallons a day through conservation by 2018.[4] Multifamily buildings have access to several greening tools provided by the SFPUC, including free building audits, free water-saving devices such as efficient faucet aerators and showerheads, and rebates for high-efficiency clothes washers. Low-income customers and affordable housing owners can take advantage of an SFPUC direct-install program for high-efficiency toilets. The SFPUC has found that the largest water-saving opportunities in multifamily buildings are often replacing toilets and fixing leaks.

In apartment buildings in San Francisco, water service is typically not sub-metered to bill individual tenants for their incremental water use. The building owner usually has a one-to-one relationship with the SFPUC, which has a master meter for the whole building located on the sidewalk. This is especially true for large buildings. Tenants typically pay for water service through their rent, but the cost is not related to individual utilization. Because of this payment structure, any reduction in water use will result in direct savings for the building owner, which is a powerful incentive to install water-efficient features.

SPUR's task force agreed that in theory, sub-metering or individually metering water service is a best practice, to align incentives for conservation. But we learned that in reality, it is expensive and physically challenging to retrofit a building with sub-meters. Not only is it difficult to carve out the space to route pipes within the building — and nearly impossible to complete such retrofits outside of a gut rehab — but there typically isn't space on the sidewalk to accommodate separate utility meters, especially for larger buildings. Each installation of an SFPUC meter costs around $8,000. Another option is to install sub-meters monitored by a qualified third party within the building that create a new billing relationship between an owner and tenants. (The owner retains a billing relationship with the SFPUC for the whole building.) These meters must be certified by the Weights & Measures division of the Department of Public Health, and are generally cheaper

[4] For more information on San Francisco's plan to save 10 million gallons a day of Tuolumne River water by 2018 (about 12 percent of our current supply), view SPUR's March 2010 article, "Water, water everywhere: A look at San Francisco's urban water plan," www.spur.org/publications/library/article/water _ water _ everywhere.



Toolbox for greening buildings

Individual Metering or Sub-metering. In individually metered or sub-metered buildings, residents' utility bills are based on how much electricity, gas or water they actually use, rather than a set portion of the overall building usage. When bills reflect utility usage, residents are more likely to conserve.

Rebate. Rebates are incentives in which a portion of the cost of a specified green building improvement is returned to the purchaser after installation. Rebates are offered by a wide variety of organizations, from utility companies to local governments, covering everything from insulation to clothes washers.

Direct-install program. Most commonly offered by utilities for nonprofits or small businesses, these programs typically involve an on-site water or energy audit followed by the installation of appropriate water- or energy-saving equipment. Equipment and installation can be completely free, or a portion of the costs can be repaid as part of subsequent utility bills.

Audit. An evaluation of an existing building to assess current energy or water use, or accessibility of waste/recycling bins, etc., and prioritize potential improvements. There are many tools available online to assist owners and tenants in conducting their own audit, or the audit can be done by a professional who can give specific improvement recommendations.

Cost-sharing. Capital improvement pass-throughs are one mechanism by which landlords of rent-controlled buildings can pass on all or part of the cost of green improvements, amortized over a set period of time, to the tenants, who will benefit from the improvements through reduced utility bills or improved comfort.

Education. In the form of either general awareness building or technical assistance, education is critical all around: for owners of small buildings with limited resources, and for property managers to ensure continued efficiency of building systems. Outreach programs aimed at transforming tenant behavior can reduce overall energy demand and encourage better recycling.

Device/appliance giveaways. Where a portable and relatively inexpensive device can transform a users' demand on water or energy — such as efficient showerheads, or compact fluorescent light bulbs — utilities may give them away or subsidize them to promote usage.

Green labels or certification. A sustainable building, particularly one that has earned branded labels or awards, can be a powerful marketing tool for attracting tenants. Two common ones in the Bay Area are Leadership in Energy and Environmental Design (LEED), administered by the U.S. Green Building Council, and GreenPoint Rated, administered by Build It Green.

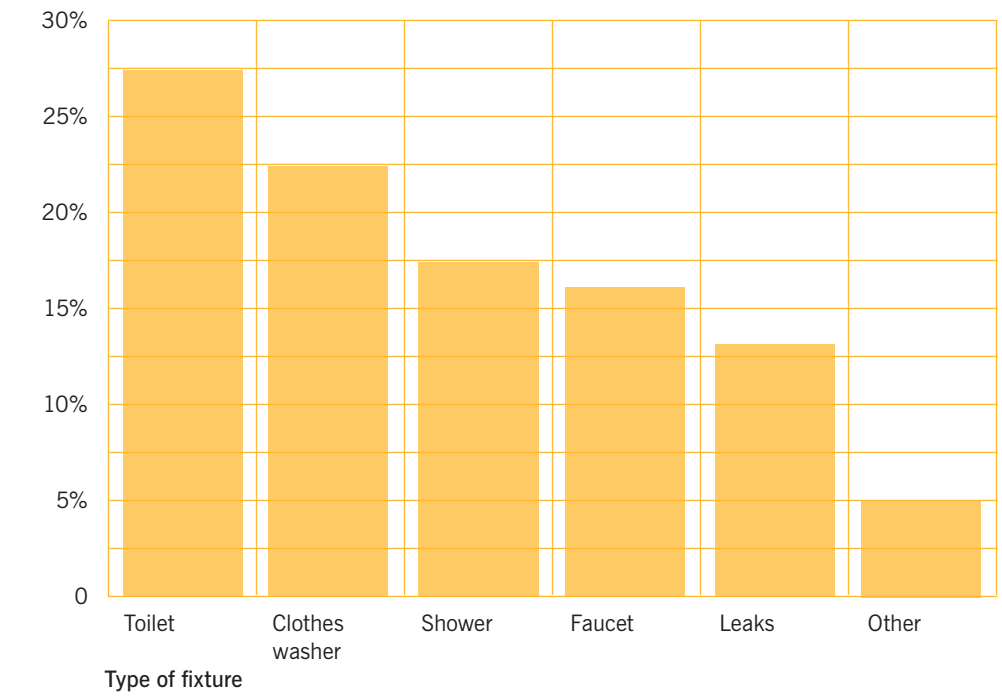
Building standards are guidelines that encourage green building techniques in a range of areas, from site planning to energy efficiency. These standards can come in the form of voluntary certification programs or mandatory building codes, such as San Francisco's RECO. Standards can be performance-based, which require a building to achieve target efficiency levels without specifying how these targets should be reached, or prescriptive, which specify certain types of technologies that must be used.

and more practical to install as a retrofit than new SFPUC meters. However, billing practices surrounding such meters are loosely regulated; rates and fees must be negotiated between the owner and the sub-metering company. Finally, within the scope of existing leases for buildings covered by rent control, water service responsibility cannot be shifted to tenants without the landlord providing a tenant with a commensurate rent reduction, so sub-metering benefits are clearer with new tenancies.

Switching out plumbing appliances and fixtures, however — supported by the free devices, audits and rebates provided by the SFPUC — is much simpler, unlikely to be a problem under rent control, and cost-effective (See Table 1: Water conservation case studies). Both owners and tenants can take advantage of these opportunities. The payback period for installing water-efficient toilets, showerheads and faucet aerators is very short, usually within two years. Water audits are an especially effective tool for building owners because multifamily buildings typically have higher leak rates due to unreported leaks, many in the valves of toilets and showers, and many have not undergone major plumbing retrofits in the last 20 years. Existing SFPUC technical assistance programs have been very successful, reaching hundreds of multifamily properties and distributing thousands of rebates and free devices. Logistically, replacing fixtures is a relatively straightforward improvement. Owners do not need to wait for unit turnover, nor do they need to relocate tenants; the fixtures can be installed in a matter of hours with the tenants in place.

Figure 2: How Homes Use Water

Typical indoor, residential water-use patterns, based on national studies, suggest that high efficiency toilets may be the single largest water-saving opportunity in multifamily buildings.



Source: American Water Works Association, 1999.

Table 1: Water Conservation Case Studies

Water conservation audits, rebate utilization and leak repairs resulted in four San Francisco properties finding significant water and cost savings.

Property	Improvement	Water Savings	Cost Savings
1455 Filbert St.	Replaced 36 old toilets with high-efficiency models (received $4500 in rebates); installed free showerheads, fixed leaks	57% reduction, 600,000 gallons/year	55% reduction, $5,000/year
1755 Geary	Replaced 166 old toilets (received $20,750 in rebates), fixed leaks	42% reduction, 2.2 million gallons/year	47% reduction, $26,000/year
Fillmore Center	Replaced almost 6,000 fixtures including toilets, showerheads, kitchen and bathroom faucets	38% reduction, 6.3 million gallons/year	62% reduction, $159,000/year
309 Hyde Street	Replaced 19 toilets and repaired leaks in two older ones; installed free devices in 8 units, including showerheads and faucet aerators	55% reduction, 1.15 million gallons/year	55% reduction (estimated), $15,000/year

Source: San Francisco Public Utilities Commission and the Fillmore Center

David Peters

Waste

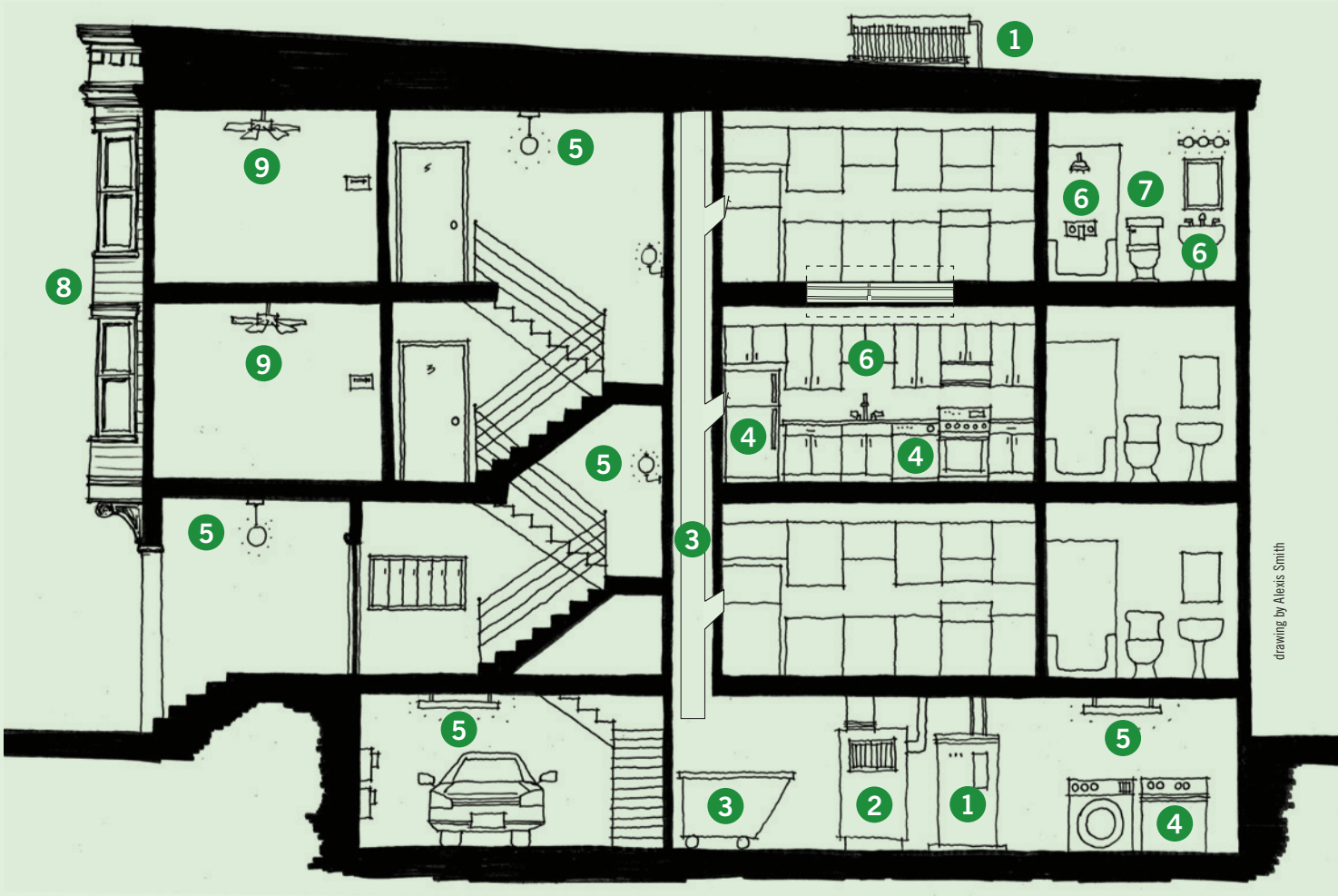
San Francisco already has the highest waste diversion rate in the country, measured in late 2010 at 77 percent, which exceeded our citywide goal of 75 percent.[5] The biggest challenges for continued success in this area for multifamily buildings are twofold: dealing with the different physical layouts of buildings to configure three bins for sorting waste, and improving residents' awareness of how to sort trash, recycling and compost properly.

The Department of Environment (SFE) and the City's waste-collection company, Recology, continue to conduct extensive outreach and education to implement the City's 2009 Universal Recycling Ordinance, which requires all properties to separate trash, recyclable materials and compostable waste in accordance with San Francisco's three-cart collection program. In the first half of 2010, SFE and Recology had conducted outreach to more than 400 multifamily buildings. The ordinance has proven very successful, increasing our citywide waste diversion 5 percent within its first year. SPUR's task force agreed that we have not tapped out the full potential of this ordinance, and we expect continued improvement in the future. Continued outreach, building by building, will be the most important strategy to directly educate building owners and tenants, and to work out the most efficient arrangement for three carts on site.

Cart configuration — to provide equally convenient opportunities for building residents to dispose of trash, recycling and compost — is an especially big challenge in existing buildings that have waste chutes. Chutes have typically been used for trash alone. Some buildings have more than one chute and can designate them for different materials, but these are rare. For larger buildings, a successful strategy is retrofitting chute systems with mechanized diverters or baffles that sort waste within a single chute, but space must be available at the bottom of the chute. These systems, while expensive, can have a payoff of less than one year because they significantly reduce the volume of trash, allowing a building to pay for fewer trash carts or fewer collection days each week. SPUR's task force agreed that it would be helpful for SFE and Recology to show building owners examples of this technology in action.

Improving tenants' awareness of and commitment to recycling is the

[5] For more information on San Francisco's plan to save 10 million gallons a day of Tuolumne River water by 2018 (about 12 percent of our current supply), view SPUR's March 2010 article, "Water, water everywhere: A look at San Francisco's urban water plan," www.spur.org/publications/library/article/water _ water _ everywhere.



Nine ways to green multifamily apartment buidings

1. **Water Heating** offers the largest single opportunity to save energy in multifamily housing. Strategies include increasing the thermal efficiency of the water heater, installing solar hot water systems and improving distribution systems.

2. **Heating, Ventilation and Air Conditioning (HVAC).** Three-quarters of SF's housing stock predates the first energy efficiency codes of the 1970s. Substantial energy savings can be achieved by replacing outdated boiler and furnace systems.

3. **Waste Diversion.** Mechanized diverters installed in existing waste chutes — to sort trash, recyclables and compost — can have a payback period of less than one year by reducing a building's trash volume, thus requiring fewer collection days.

4. **Appliances.** Cooking and refrigeration make up a larger portion of energy use in multifamily housing than in single family housing. Efficient dishwashers and clothes washers save both water and energy.

5. **Common Area Lighting** creates a significant energy load that is unique to multifamily housing. This load can be reduced through photocells or timers (for exterior lights) and occupancy sensors (for garage and laundry areas).

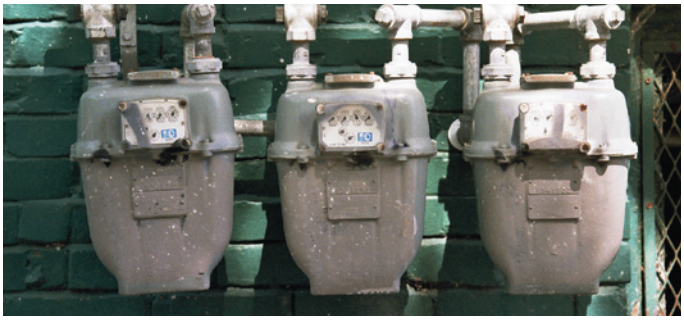
6. **Water Fixtures.** With a typical payback period of less than two years, aerators and high-efficiency faucets and showerheads are some of the easiest ways to conserve water. Free audits can help to prioritize improvements.

7. **Toilets.** In a typical household, toilets use more water than any other fixture. Those installed before 1994 use over twice as much water as the standard toilet available today.

8. **Weatherization.** A multifamily building's shared walls mean that less heating and cooling is lost to the exterior. However, older buildings can still benefit from new windows, cool roofing and better insulation.

9. **Small Fixtures** within individual units — such as programmable thermostats, compact fluorescent lighting, and efficient ceiling fans — can save both electricity and gas.

other significant challenge to further improving waste diversion in multifamily buildings. In San Francisco, tenants (except perhaps in the smallest buildings) typically do not pay for waste management services. While many tenants do a superior job of recycling and kitchen composting, it only takes a few mistakes — unintentional or not — to "contaminate" an entire building's bins with the wrong kind of material (e.g. plastic bottles in the compost bin). At first, a building owner or manager will receive a written warning about this, and the opportunity to meet with SFE and Recology to improve the building's recycling set-up, but if violations continue, the bins may not get picked up, creating a health hazard and frustration for everyone in the building. Although building owners are now required to conduct outreach and tenant education annually, these communications can sometimes feel like a reprimand to tenants. SPUR concluded that it would be helpful for tenant organizations, possibly with technical and/or financial assistance from the City, to conduct more education and outreach to tenants on proper waste diversion.



Flickr member: KayVee.INC

Energy

Energy use in multifamily buildings is a broad area, and includes lighting, appliances, water heating, outdoor lighting, mechanical ventilation, heating and cooling. Over two-thirds of all households in San Francisco use gas for heating, and 88 percent of households use gas to heat hot water.[6] In multifamily buildings, electricity use is commonly individually metered, with the building owner paying for electricity in common areas, but gas use for cooking, heating and water heating is typically centrally metered. Energy use in multifamily housing is different from single-family housing in a number of ways:[7]

- **Common area (hallways and elevators) and garage lighting** in multifamily properties can use significant amounts of energy;
- **Taller buildings have a smaller roof relative to the building envelope,** so efficiency measures like attic insulation and "cool roofs" have less impact on overall energy use, and there is limited room for installation of solar photovoltaics to generate renewable energy;
- **Multifamily buildings often have central mechanical systems,** such as hot water and HVAC systems that serve multiple dwelling units. The

6 U.S. Census Bureau, Current Housing Reports, Series H170/98-39, American Housing Survey for the San Francisco Metropolitan Area: 1998, Table 2-5.

7 From "Improving California's Multifamily Buildings: Opportunities and Recommendations for Green Retrofit & Rehab Programs," Findings from the Multifamily Subcommittee of the California Home Energy Retrofit Coordinating Committee (MF HERCC), Draft Report. October 7, 2010, page 17.

Case Study: Cathedral Hill Plaza Apartments

Colleen MChugh

Cathedral Hill Plaza, a mid-1960s building with 169 units on 13 floors, has taken a piece-by-piece, unit-by-unit approach to greening that has yielded significant energy and water savings within just a few years. In 2002, the building received a new domestic hot water system, reducing gas use by approximately 5 percent. General Manager Linda Corso and Property Manager Maherah Silmi have utilized free audits from the Department of Environment and SFPUC to identify and prioritize green improvements, which so far have included installing Energy Star lighting, dishwashers and refrigerators, new cook tops and ovens, ultra low-flush toilets, compact fluorescent lighting and dimmer switches. New appliances and fixtures are installed in each unit upon unit turnover, resulting in a smooth transition for tenants.

The building management was able to identify significant rebates for most of the improvements, and install the toilets, faucet aerators and low-flow showerheads for free, courtesy of the SFPUC. Cathedral Hill has provided compost bins and kitchen compost pails to residents since 2008, but to make waste diversion even easier for tenants, recycling and composting containers were set up in each floor's trash room in December 2009 instead of only in the garage. They also regularly invite the Department of the Environment to staff a table in the lobby to educate residents on waste sorting.

The next big improvement planned for the building is to replace the boilers for the heating system, which will reduce gas use by 10 percent each year, and pay for themselves in approximately seven years. Cathedral Hill's greening strategy shows that a gradual, tune-up approach can be affordable and effective when the building is highly occupied and does not otherwise need major renovations.

Table 2: Appliance usage and heating types in San Francisco, Marin and San Mateo Counties

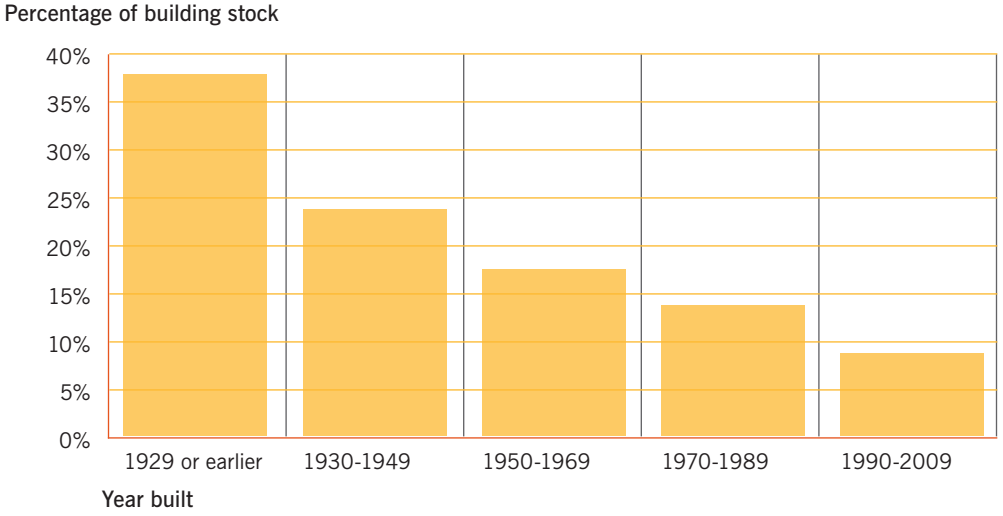
Fewer than 10 percent of multifamily buildings in San Francisco have air conditioning. Larger buildings have fewer in-unit clothes washers, but more diverse types of heating systems.

	2–4 Units	5–9 Units	10–19 Units	20–49 Units	50+ Units	All multi-family
Appliances						
Clothes washer in unit	39%	15%	13%	10%	11%	22%
Dishwasher	35%	28%	32%	42%	38%	35%
Air Conditioning						
Central air conditioning	2%	1%	2%	3%	8%	3%
Room unit air conditioning	4%	9%	5%	5%	6%	6%
Heating						
Warm-air furnace	61%	55%	48%	43%	40%	52%
Steam or hot water system	6%	10%	19%	23%	29%	15%
Built-in electric units	6%	9%	16%	22%	21%	13%
Floor, wall or other built-in hot air units without ducts	13%	15%	13%	10%	7%	12%
Other	13%	8%	3%	2%	3%	8%
None	2%	2%	1%	1%	1%	1%

Source: U.S. Census Bureau, Current Housing Reports, Series H170/98-39, American Housing Survey for the San Francisco Metropolitan Area: 1998 Table 2-23.

Figure 3: Age of Buildings in San Francisco

Three-quarters of the city's housing stock predates the first energy efficiency codes of the 1970s. Building envelope improvements to those structures could yield savings and improve occupant comfort.



Sources: U.S. Census Bureau, 2009 American Community Survey 1-Year Estimates, Table B25034; U.S. Census Bureau, Current Housing Reports, Series H170/98-39, American Housing Survey for the San Francisco Metropolitan Area: 1998, Table 2-23.

ventilation and exhaust for kitchens, bathrooms and laundry rooms can use a lot of energy;

- **Because exposure to exterior walls is lower** and air infiltration is less of an issue, cooking and refrigeration comprise a larger portion of the energy budget of multifamily homes.

San Francisco's coastal climate is one of the mildest in the country, with a low demand for heating and, especially, cooling. (See Table 2). In coastal climate zones, appliances and lighting comprise 40 percent of energy demand by multifamily buildings, whereas these systems are responsible for only 13 percent of energy demand in inland climates.[8] Still, three-quarters of San Francisco's housing units predate the first energy efficiency codes of the 1970s, so building envelope improvements could yield savings and improve occupant comfort (See Figure 3).

The Multifamily Subcommittee of the California Home Energy Retrofit Coordinating Committee (HERCC), a collaboration of utilities, government agencies and building experts convened in 2009 to coordinate residential retrofit programs across California, recently reported that the single largest opportunity to save energy in multifamily housing is in water heating. This opportunity is even more significant and cost-effective when water heating is centralized in the building. Key strategies include increasing the thermal efficiency of the water heater, combining the water heater with solar hot water systems,[9] and improving distribution systems through pipe insulation, recirculation controls, and high-efficiency pumps.[10]

Rebates are a key tool for promoting energy efficiency. SPUR's task force found that there are already numerous rebate programs available to multifamily buildings, but the number and variety of the programs is confusing, and awareness of these opportunities is not as high as it could be. PG&E and SFE's Energy Watch offer local rebate programs to multifamily properties. A large number of federal and state energy upgrade programs, with a recent significant boost from federal stimulus financing, are available only to permanently affordable housing. Of those available to market-rate buildings, some are available to both owners and tenants, some are available only to owners for common areas, some are based on a performance improvement, and some are based on a device improvement. A full listing of utility-supported rebates available to buildings in San Francisco is on SPUR's website at spur.org/greenbuildings. All of these programs have different rules for eligibility, requirements for participation and levels of rebate.

The statewide multifamily HERCC recently recommended that utilities and agencies offering incentives begin to reward a performance-based approach for multifamily buildings, in addition to the current approach of awarding incentives and rebates for changing out specific pieces of equipment. This approach would help asset managers identify and implement

[8] According to a presentation by Heather Larson, Green Building Program Manager for Stopwaste.org, presented to SPUR's task force on October 27, 2010.

[9] Solar hot water systems, which heat water to a base temperature, are a completely different technology from solar photovoltaics, which generate energy. The latter has proven complicated to install in multifamily buildings because of limited per capita roof space and because these buildings are generally individually metered for electricity. Solar hot water, on the other hand, is ideal for multifamily buildings because they typically rely on a single hot water system that is shared by all tenants.

[10] MF HERCC Draft Report, October 2010, p. 17.

Case Study: The Fillmore Center

The Fillmore Center, built in 1991, is a multifamily mixed-use property covering three city blocks, ten buildings and more than one million square feet, including 1,114 residential units. In October 2010, it received LEED for Existing Buildings (LEED-EB) Silver certification, making it the largest multifamily housing project to receive LEED-EB in the United States. Elie Rothschild, CEO of Sustainable Energy Partners, provided an overview of the Fillmore Center project to SPUR's task force. For this property, the motivation to pursue LEED certification was to improve property values and create a showpiece in the portfolio of Prudential, the owner, and the Laramar Group, the property manager. Before the LEED-guided renovation, the building had some deferred maintenance problems, including significant problems with its ventilation system. The first step in the process was to improve air handlers and install new efficient boilers — one in each tower — which boosted boiler energy efficiency by almost 25 percent. The building implemented composting and set aside areas for electronic and other hazardous waste. All water fixtures were swapped for high-efficiency models, including faucet aerators and dual-flush toilets; at the same time each unit received these upgrades they received new energy-saving refrigerators and efficient lighting fixtures. Common area and outdoor lighting was equipped with newer fixtures and compact fluorescent bulbs. One of the most innovative aspects of the greening included designating one week each year as "tenant education week" and one week as "staff education week." Staff were educated on pest management, proper waste sorting and green purchasing. Tenants were provided with free compact fluorescent bulbs for their fixtures and free bio-bags for composting; through better education, the buildings improved waste diversion by 40 percent. Although the project managers considered installing solar panels, they found less than 10 percent of electricity and natural gas costs could be offset by solar photovoltaics or solar thermal installations, so they declined this option. Most of the upgrades were supported by numerous and substantial rebates, making the cost recovery term very short.

Colleen MChugh

Case Study: 1515 Greenwich Street

Colleen MChugh

At 1515 Greenwich Street, a major rehab project created an opportunity to retrofit a typical San Francisco Edwardian with some of the greenest technologies available. Owner Bob Mayer's goal was to save resources by sub-metering water and hot water to create user incentives to conserve — since tenants would be paying for their unit's use of water — but also to remodel the building so that tenants would not have higher utility costs than other buildings where they might choose to rent. In 2008, the 35-unit building, which was largely unoccupied at the time, added parking and a new roof deck, and received seismic upgrades, a new elevator, windows, insulation, wiring and gas pipes. But perhaps its most innovative and efficient new component was its sub-metered water system. Each unit was equipped with wireless water meters, visibly accessible to tenants in the garage, that could enable units to be billed for their individual use of water. Mayer, who continued to pay the building's master meter charges, then contracted with a third party company to monitor these meters and bill new tenants for their individual use. Kitchens and bathrooms were equipped with motion sensors to trigger hot water circulation when someone would enter one of these rooms. By keeping water hot through efficient pipe insulation and recirculation, the user would have instant hot water, and not waste water running the tap while waiting for it to warm up. Bob Mayer told SPUR's task force that tenants are now paying generally less for all utilities than they used to pay for just electricity and gas. He did not try to pass-through any costs of this improvement and did not have to relocate tenants for this project, due to existing vacancies. However, he said that the specific circumstances surrounding the building's operation and financing were what enabled him, with so few existing tenants, to take on such a major remodel; generally, such a project might be cost-prohibitive due to the challenges of financing capital improvements under San Francisco's rent stabilization law.

the most cost-effective set of improvements first, through energy analysis software and with technical assistance from certified energy raters. The performance-based approach — as opposed to a package of prescriptive measures — was recommended on a state-wide level because prescriptive packages would vary dramatically between climate zones and building types.

The downside to a performance-based approach is that it can be less accessible, particularly for non-professional owners of smaller properties who may not understand what will be required to meet performance targets. The applicability of a prescriptive program versus a performance program to a particular project is dependent upon the "trigger event" or motivator for a level of investment in building improvements (see Table 3).

SPUR concluded that better outreach and information for property owners and tenants would go a long way towards increasing the use of available rebate programs in San Francisco. Property owners often need assistance to determine which programs, resources and approach are appropriate for their property or portfolio. To move forward with this outreach, navigation tools are currently being developed by Stopwaste.org and Energy Upgrade California, a partnership of the California Public Utilities Commission and California Energy Commission, to clarify and facilitate property manager participation in these programs.[11] The tools will also be designed to help property managers engage in ongoing improvements as their buildings reach certain trigger points (see Table 3).

Besides the various rebates, incentives and audit tools available to multifamily stakeholders, voluntary certifications or green labels can provide a whole-building approach with some added marketing potential. In the Bay Area, the principal voluntary green certification programs are LEED for Existing Buildings (LEED-EB) and GreenPoint Rated, which launched the GreenPoint Rated system for existing multifamily homes in 2010.[12] While LEED is a better-known label, it is based upon a commercial standard, and widely considered to be a time-consuming and substantial investment, even for buildings with professional management. GreenPoint Rated, a rating system for residential green building, based upon California's building codes and implemented by the Bay Area nonprofit Build It Green, is the standard required for all new homes built in San Francisco as of 2009. However, it is less well known nationally, so its ease of use and marketability potential are less documented.

Finally, the City of San Francisco has developed a financing tool, GreenFinanceSF, that would provide city bond money to property owners to upgrade the energy performance of their buildings, to be repaid through property tax payments over 10–20 years via a lien on their property. This program, and others of its kind recently launched in California and collectively referred to as PACE (Property-Assessed Clean Energy), are all on hold due to an intervention by the Federal Housing Finance Authority on concerns related to federal mortgage lenders' financial requirements. SPUR's task force agreed that if this program is ever able to launch, it could be an important

[11] For more information, visit www.energyupgradeca.org, a project of the California Energy Commission and California Public Utilities Commission.

[12] More information on LEED can be found at the U.S. Green Building Council's website, www.usgbc.org; more information on GreenPoint Rated is available at www.builditgreen.org.

Table 3: Events That Trigger Energy and Green Upgrades

These trigger points are opportunities for different types of green upgrades. The scope of upgrades will depend on factors such as the age and condition of the building, type of occupancy, and whether the building is an affordable or market-rate property.

Trigger event	Scope of upgrade
Tune-up/ Spruce-up	Ongoing maintenance of mechanical equipment or lower cost, easier-to-implement measures that spruce up a property at time of sale or purchase such as servicing mechanical equipment, repainting common areas, or making landscape and irrigation improvements.
Replacement	Replacement of specific central or individual equipment that is broken or aging, including water heaters, boilers, furnaces, air conditioners, appliances, lighting and irrigation systems.
Unit turnover	Unit-specific improvements made when occupants vacate. Upon vacancy, it is common practice to paint units, replace carpets, address moisture intrusion and other minor repairs, replace appliances, and make accessibility improvements.
Retrofit	Usually more limited in scope than a whole-building rehab, retrofits typically consist of a package of coordinated improvements designed to achieve a specific goal, such as seismic safety or energy efficiency.
Rehab	Building-wide overhaul may include remodeling common areas, upgrading structural elements, installing new electrical, plumbing and mechanical equipment, and more.

Source: Multifamily Subcommittee of the Home Energy Retrofit Coordinating Committee (MF HERCC), Draft Report. October 7, 2010.

source of financing for green improvements, especially for those buildings subject to rent control and its restrictive pass-through rules.

Conclusion

SPUR's task force considered many tools and barriers to improve the resource efficiency of existing multifamily housing in San Francisco. We found that there are specific challenges to widespread adoption of green upgrades, including low awareness, lack of capital and a confusing, difficult-to-navigate slate of incentive programs. However, we also found that these barriers would not likely be solved by local policy changes we can recommend at this time. In fact, many of them are being addressed through new statewide initiatives and utility programs, which seek to ensure that the multifamily sector is not excluded from tools and financing newly available for performance testing and weatherization of single family homes.

Instead, SPUR recommends that the City, through the Department of the Environment, work together with the SFPUC, PG&E and Recology to create a "one-stop shop" or web-based tool for property owners to track down how to take advantage of the many free audit, rebate, direct install and compliance assistance programs that currently exist among the various utilities serving San Francisco. The City should incorporate the navigation tool being developed by Stopwaste.org that will guide property owners or managers through a step-by-step process to identify and prioritize needs, and match them to available programs, as well as a similar tool from Energy Upgrade California to be launched statewide. The City's tool should include a significant education component to provide information to tenants and property managers about recycling and composting, water conservation and more. It could also link the building community to case studies of some of the newer or not-yet-common green building technologies that could be especially beneficial and cost-effective in multifamily buildings, such as solar hot water and mechanized waste chute diverters. We further recommend that the City, working with the San Francisco Apartment Association and tenant organizations, use these tools as the basis of a strategic outreach and marketing plan that would identify and provide assistance to buildings that could benefit from green upgrades.

Existing multifamily buildings are a significant part of San Francisco's built environment, and will continue to be for decades to come. SPUR's task force was encouraged by the many recent efforts of utilities, building experts and government agencies to close the "green gap" between these buildings and ones to be built in the future, which are required to be more efficient in almost every respect. We believe the most important next step for the City is to continue to build awareness and help buildings implement these opportunities, so they may serve as models to others, and move San Francisco ever closer to the sustainable future it seeks. ✹

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