Analyzing and Expanding the Green Janitor Education Program

A seedLA Project

seedLA

BSP BUILDING SKILLS PARTNERSHIP

U.S. GREEN BUILDING COUNCIL CHAPTER LOS ANGELES

BOMA Greater Los Angeles

United Service Workers West SEIU

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2 Executive Summary

SeedLA undertook a pro-bono consulting and research project for the Green Janitor Education Program (GJEP). The purpose of this ten week project was to quantify the impact of the GJEP to date and to strategize ways to market the program to new buildings.

First implemented in 2014 by a partnership including the U.S. Green Building Council- Los Angeles, the Building Owners and Managers Association of Greater Los Angeles, the Service Employees International Union- United Service Workers West, and the Building Skills Partnership, the GJEP has trained nearly 600 janitors in 37 buildings throughout Los Angeles, San Diego, and Orange counties. Over the course of a 30 hour curriculum, janitors learn why green cleaning is important and how to implement green cleaning practices both at work and at home. Given the number of janitors and buildings that have undergone the GJEP, it is now possible to assess the economic, environmental, social, and health impacts of the program. As the GJEP partnership looks to expand the program to new buildings, these impacts must be conveyed to prospective building owners and managers. Additionally, as California, and Los Angeles in particular, enforce increasingly strict recycling regulations, there is a need to assess the potential role of the GJEP in helping buildings meet these new standards. The goal of this project was to analyze the impacts of the GJEP and to strategize ways for the GJEP to help buildings meet their waste diversion goals.

Our findings are summarized as follows:

1. Between 2013 and 2016, 76% of GJEP buildings saw a decrease in energy and water usage. GJEP buildings used 5.6% less energy on average in 2016 than non-GJEP buildings. These reductions in energy and water use are likely due to a combination of green building practices, such as retrofits, in addition to the GJEP. Therefore, we recommend marketing the GJEP as the least expensive and easiest to implement of a number of practices that can reduce water and energy cost for buildings. To demonstrate potential savings, we have developed a predictive tool that projects the energy and water costs of a building into the future based on its current usage trends.
2. Based on the post-training surveys from trainees, it is clear that the GJEP has had a positive impact on the lives of the janitors who went through the program. This should be emphasized to prospective GJEP buildings using both quantitative measures and personal stories. In addition, we recommend designing a second feedback survey to be given to building owners and managers to assess their satisfaction with the program.
3. We have found abundant evidence of the health risks associated with the ingredients of standard cleaning products. Green cleaning products, on the other hand, use safer, more natural ingredients. While most janitorial companies already provide these products to their staff, the GJEP takes the important step of helping janitors understand the benefits

of these products. We recommend that the health and safety benefits of green cleaning products continue to be emphasized as part of the GJEP curriculum. These health benefits, and in particular the improved understanding of them by janitors, should be marketed to building owners and managers. We also suggest that long-term improvements in janitor health following a switch to green cleaning products be studied.

4. As part of the Zero Waste LA initiative, commercial office buildings will be charged $216.72 per three-cubic yard bin of trash removed by hauling companies each week. Bins dedicated to recycling and compost will be hauled for free. We estimate that a typical large office building will produce enough trash to fill approximately 10 of these bins every week. If buildings can divert even one bin per week to recycling and compost, then can save approximately $11,000 per year on trash hauling costs. Further recycling would produce even more savings. We recommend that the GJEP help buildings achieve this by providing buildings with signs and flyers to encourage recycling and to label different types of waste bins.
5. We recommend that the above benefits of the GJEP be emphasized to prospective building owners and managers. For this purpose, we have designed a marketing brochure advertising the GJEP and its potential benefits.

In this report, we present the detailed results of our research. We first outline an overview of our work (Section 3), followed by a summary of the GJEP within the broader landscape of green building practices (Section 4). We then discuss the economic and environmental (Section 5), social (Section 6), and health impacts (Section 7) of the GJEP. Next, we analyze the GJEP's potential role in helping buildings meet upcoming state and local waste diversion regulations (Section 8). Finally, we summarize our conclusions and recommendations (Section 9).

3 Project Overview

The goal of our project was to study the impact of the GJEP and find ways to attract new buildings as the program expands. Our team first familiarized ourselves with the overall landscape of sustainable building practices and the GJEP specifically. We identified the economic and environmental, social, and health impacts on buildings that participated in the program and strategized ways for the GJEP to aid buildings in meeting Los Angeles' waste diversion goals. Following a midterm review of our progress, we narrowed our focus to quantify the potential savings buildings can achieve through reduced energy and water usage and better waste diversion practices. Finally, we designed a marketing brochure to convey the benefits of the GJEP to new buildings.

Our team's workflow is outlined as follows:

1. Understand how the GJEP fits into the broader picture of sustainable building practices:
    a. Study the history and implementation of the GJEP.
    b. Research additional green building practices and similar green janitor programs.
    c. Investigate the current and future waste diversion standards for Los Angeles and California as a whole.
2. Quantify the environmental and economic impacts of the GJEP:
    a. Identify trends in the water and power usage of participant buildings.
    b. Compare usage of participant buildings to similar, non-GJEP buildings.
    c. Design a tool to estimate future water and power costs for a building.
3. Analyze the social impacts of the GJEP:
    a. Use post-training surveys to evaluate the positive effects of the program on trainees.
    b. Find additional ways to elicit feedback on the program:
4. Evaluate the health impacts of the GJEP:
    a. Research current janitorial practices.
    b. Identify the health risks associated with standard cleaning products.
    c. Compare the ingredients of standard and green cleaning products.
5. Strategize roles for the GJEP in helping buildings meet new waste diversion standards:
    a. Summarize current and future waste diversion regulations.
    b. Develop ways for the GJEP to directly engage building tenants in better recycling practices.
    c. Quantify the achievable savings available to buildings through improved waste diversion practices.
6. Market the impacts of the GJEP to potential new participants:
    a. Work with the GJEP team to design a marketing brochure highlighting the benefits of the GJEP.

4 The Green Janitor Education Program

Green building practices and technologies are rapidly growing in popularity among building owners. Implementing green building projects leads to substantial return on investment through increased worker productivity, higher rental rates, lower healthcare costs, and reduced operating costs, among other benefits. Thus, it is no surprise that in 2013, approximately 20% of investments in new real estate construction in the United States went towards green building projects. Owners and managers of existing commercial buildings are expected to invest nearly $1 trillion globally on green improvements to building infrastructure between 2015 and 2023.[1]

California is a leader in efforts to make commercial buildings more sustainable. In addition to the number of intrinsic benefits to green building projects, California is incentivizing these practices through statewide regulations. In 2012, Governor Edmund G. Brown Jr. signed executive order B-18-12, directing state-owned buildings to reduce energy use, water use, and greenhouse gas emissions by 2020.[2] More recently, the California state legislature passed AB 1826, enforcing strict recycling regulations on commercial buildings.[3] Meanwhile, Los Angeles has implemented the Zero Waste LA program to reduce waste disposal to landfills by 1 million tons per year by 2025.[4]

In this environment, the need for more sustainable building practices only increases. While there are a number of green improvements buildings can make to their infrastructure, the tenants themselves must be active participants in sustainability for the full range of benefits to be realized. At the forefront of this effort are janitors, who are most directly involved in the day-to-day operations of a building. Thus, the U.S. Green Building Council- Los Angeles, the Building Owners and Managers Association of Greater Los Angeles, the Service Employees International Union- United Service Workers West, and the Building Skills Partnership created the Green Janitor Education Program (GJEP).[5]

The GJEP teaches janitors the fundamentals of green building practices. With a 30 hour curriculum covering green cleaning, energy and water conservation, health and safety, and waste diversion, janitors learn why these practices are important in addition to how to implement these practices at work and at home. Since its inception in 2014, the GJEP has trained nearly 600 janitors in 37 buildings across Southern California, covering a total of over 20 million square feet. Given this initial success, the program is now looking to grow in Southern California and spread to other parts of the state, with the eventual goal of expanding nationwide. In light of this, our team has researched the impacts of the GJEP on participating buildings and strategized ways to market the program to new buildings.

5 Environmental and Economic Impacts

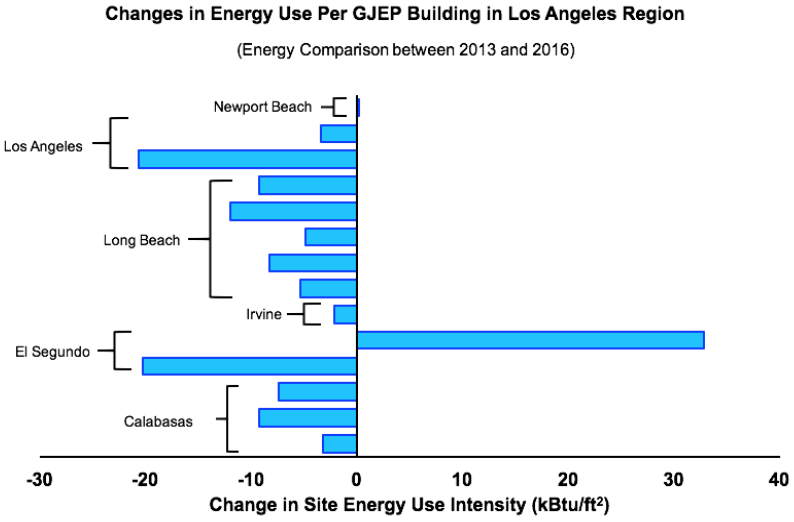
To determine the potential environmental and economic impacts of the GJEP and green building practices in general, we analyzed the energy and water usage in buildings associated with the GJEP. Data for energy and water usage for GJEP-associated buildings were obtained from Energy Star Portfolio Manager.[6] Data for energy usage for buildings not associated with the GJEP were obtained from Building Performance Database.[7] Next, we developed a predictive tool that can be used to estimate a four-year forecast of a particular building's energy and water costs.

5.1 Energy Usage Associated with Electricity

The cost of electricity is anticipated to increase annually as businesses expand and client demand increases.[8] Therefore, it is imperative that business and building owners evaluate how much electrical energy their buildings are using and if there are ways to efficiently manage their total electricity consumption. In the following analyses, we looked at trends within GJEP-associated and non-GJEP associated buildings as a measure of each building's energy use per square foot.

5.1.1 Buildings with GJEP see an overall reduction in electrical usage

We looked at electricity usage for GJEP-associated buildings in the greater Los Angeles and San Diego counties. Changes in site energy use intensity (EUI) were determined for all GJEP-associated buildings from 2013 to 2016, with data available from Energy Star Portfolio Manager. We chose to look at these two years because the GJEP was implemented in 2014. Of the buildings in the Los Angeles region, 86% of buildings saw an overall reduction of energy use per square foot (Figure 1).



Source: Energy Star Portfolio Manager

Figure 1. 86% of GJEP-associated buildings see a decrease in electricity use. Energy intensity use for each building is reported in kBtu per square foot. Individual buildings are sorted by cities within the greater Los Angeles county. The building with an increase of approximately 30 kBtu per square foot is the DIRECTV Plaza Cafe.

Performing the same analysis on the seven GJEP-associated buildings in the San Diego region, we see that 57% of these buildings have also seen a decrease in electricity usage between 2013 and 2016 (Figure 2).

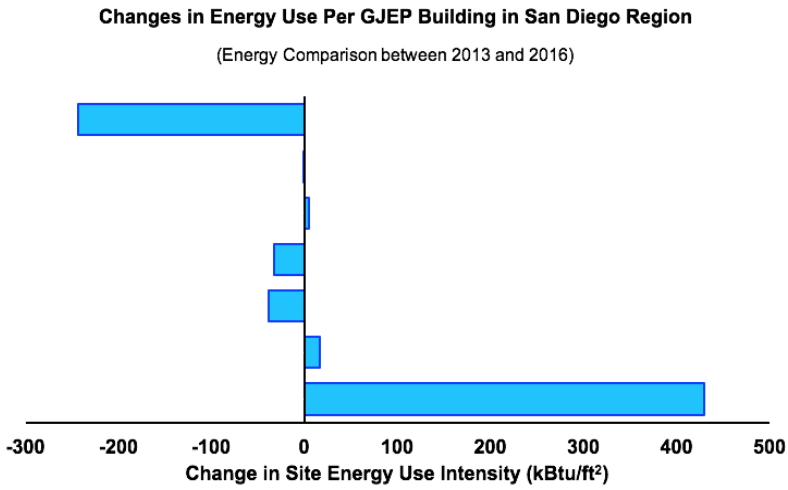


Figure 2. Of the GJEP-associated buildings in San Diego, 57% saw a decrease in electricity use. Decreases in site energy usage are shown for individual GJEP-associated buildings in San Diego. Energy intensity use for each building is reported in kBtu per square foot.

Source: Energy Star Portfolio Manager

Both buildings associated with the largest changes in energy usage are lab-based companies (La Jolla Biologics: greatest decrease in energy use and Vical Incorporated: greatest increase in energy use). Special focus of green building practices should be implemented here, as lab-based buildings can potentially be more energy-exhaustive than for example, a commercial office building.

Finally, we looked at a specific example of select Kilroy Realty properties and analyzed changes in site energy use between 2013 and 2016. On average, these properties saw an average decrease of 8% (Figure 3).

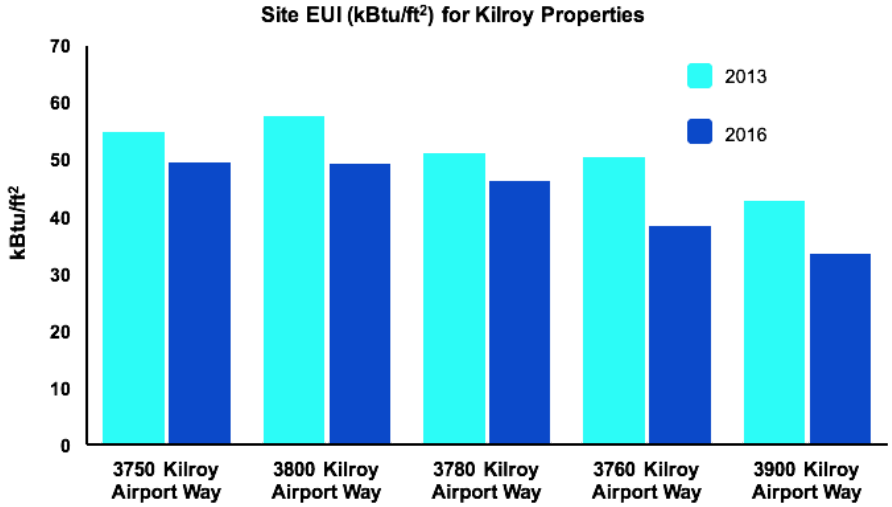
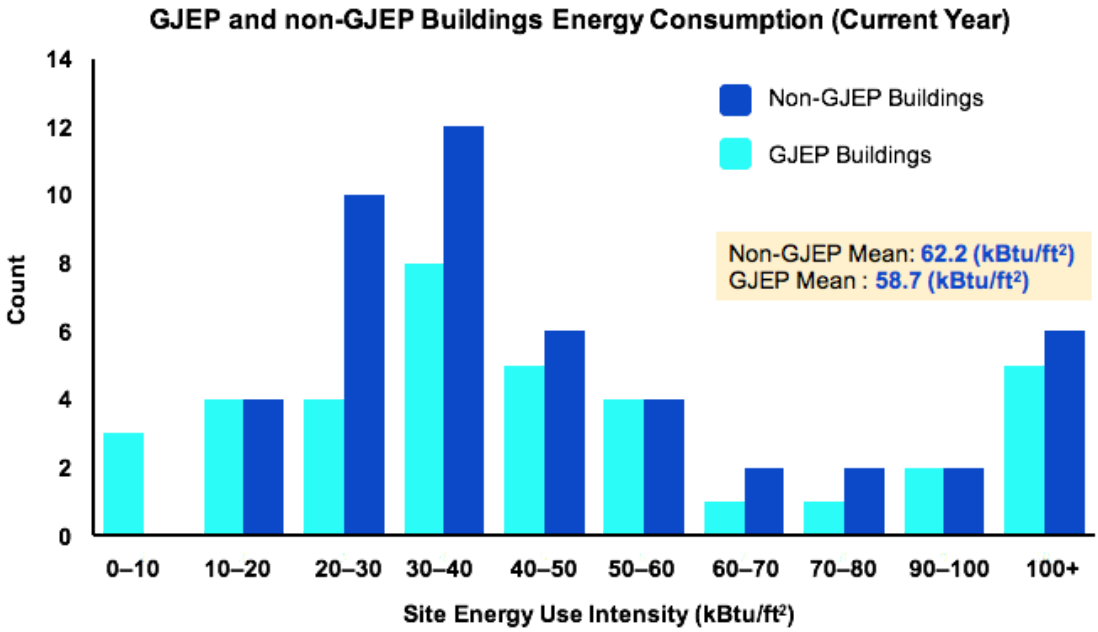


Figure 3. Energy use intensity for properties associated with Kilroy Realty between 2013 and 2016. Energy use decreases approximately 8% on average between these two time points.

In summary, these findings suggest that buildings associated with the GJEP saw decreases in electrical energy use. Although it is possible that the GJEP was not the sole contributor to the decreases in energy use, buildings with the program implemented saw decreases in electricity use in general. Therefore, in addition to continuing the GJEP, it is imperative that green-building practices, along with the GJEP, continue to be implemented so that building owners can see continued decreases in energy usage.

5.1.2 Comparing Energy Use of non-GJEP Buildings with GJEP Buildings

Within GJEP-associated buildings in the greater Los Angeles and San Diego counties, 76% have seen a decrease in electricity usage per square foot. We next compared these buildings to those that are not associated with the GJEP. In our analysis, we used data provided by Building Performance Database, a freely available database with data on energy use for all buildings in the city of Los Angeles. In our analysis, we compared GJEP and non-GJEP buildings of similar size (i.e., total square footage) for the current energy year. Figure 4 shows the distribution of energy use intensities for GJEP and non-GJEP buildings in the city of Los Angeles.



Sources: Energy Star, Building Performance Database

Figure 4. The distributions of site energy use intensity for GJEP-associated buildings and non-GJEP associated buildings are similar. However, the mean site energy use for GJEP-associated buildings is 5.6% lower than that of non-GJEP associated buildings.

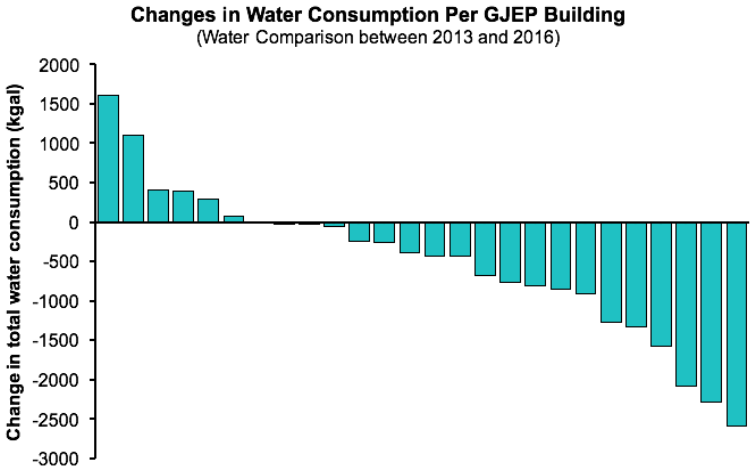
Notably, this analysis shows that GJEP-associated buildings use 5.6% less energy (in EUI) than non-GJEP associated buildings. This again suggests that implementation of the GJEP, along with other green building practices, helps to decrease building energy use. Thus, other buildings are strongly encouraged to implement the GJEP along with other green building practices.

5.2 Water Consumption

As the demand for the Earth's water supply increases, it is imperative that building owners are aware of how much water their respective buildings consume.[9] For our analysis, we looked at total changes in water consumption for buildings associated with the GJEP.

5.2.1 Water consumption for more than half of GJEP buildings decreases

Figure 5 shows the main comparisons of water consumption for GJEP-associated buildings between 2013 and 2016. Similar to electricity consumption, approximately 76% of these buildings show a decrease in water usage between these two years. However, it is important to note that a drought occurred in California in recent years, which may have also contributed to the decrease in overall water usage for these buildings.



Source: Energy Star Portfolio Manager

Figure 5. Changes in total water consumption (in kgal) for GJEP-associated buildings from 2013 to 2016.

5.3 Predictive Tool to Model Future Energy Costs

We developed a predictive tool to forecast future costs associated with total electricity and water usage for each building. This model uses previous data in the form of a building's total electricity and water usage to predict a growth or decrease for future years. Because building owners can input data from their own buildings, this model is amenable to each individual building, irrespective of whether a building is associated with the GJEP.

5.3.1 Breakdown of individual components of the model

This model contains four sections: Tab Index, Variable Inputs, Static Inputs, and Calculation (Figure 6):

1. **Tab Index**: This tab shows the individual components of the model and a brief description of each of the tabs. Instructions on how to use the model are documented here.
2. **Variable Inputs**: Users can input the total electricity used for the building in kWh and total water usage in kgal for two different time points (i.e., energy years). The User can select any two time points he or she wants to use, and the model will automatically calculate a growth rate from the data.
3. **Static Inputs**: In this tab, the User should only enter information regarding the electricity and water usage for the current energy year.
4. **Calculation**: Finally, the model will use the growth rate, along with the information in the static inputs, to calculate a predicted energy and water costs and total consumption over a four-year period. For the total costs, the model factors in an anticipated 4–5% annual increase in electricity and water costs.[10,11]

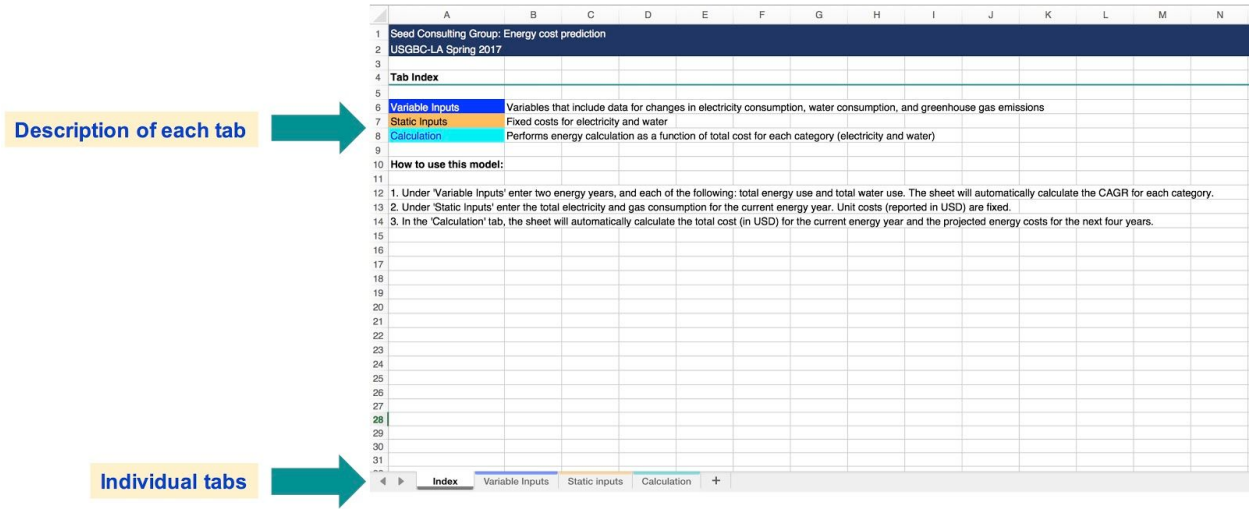


Figure 6. Breakdown of individual components of Predictive Tool. Brief descriptions of each tab and a general protocol are documented here.

5.3.2 Forecasting future energy and water consumption

We built a model that uses a compound annual growth rate (CAGR) to forecast a four-year projection of total electricity and water consumption for any building. The CAGR uses electricity and water consumption over two time points to determine a percent increase or decrease (Equation 1).

$$\text{CAGR} = \left[\left(\frac{\text{Final Value}}{\text{Initial Value}}\right)^{\left(\frac{1}{\text{Difference in years}}\right)} - 1\right] \text{x } 100\%$$

(Eq. 1)

Since the growth rate is compounded annually, the model is based on the assumption that implementation of the GJEP and other green-building practices will be continued to be practiced for each particular building.

Under Variable Inputs, the User can input the following information:

1. Energy Years for comparison (green boxes): In this example, we compared energy and water use for a building between 2013 and 2016. Note that is important that years entered in cells C7 and D7 are entered in chronological order.
2. In electricity output, the User can enter the total electricity use for each building under each year. If the total electricity is reported in kBtu (as Energy Star Portfolio Manager reports electricity in this form), the User can enter this information in cells C8 and D8, and the Excel model will automatically convert the energy into kWh. Water usage in kgal should be entered for each year in cells C10 and D10, respectively.
3. Finally, the growth rates between the two years will be automatically calculated in cells F9 and F10, so that the User only needs to input information in Cells C and D.

A brief summary of this example is shown in Figure 7.

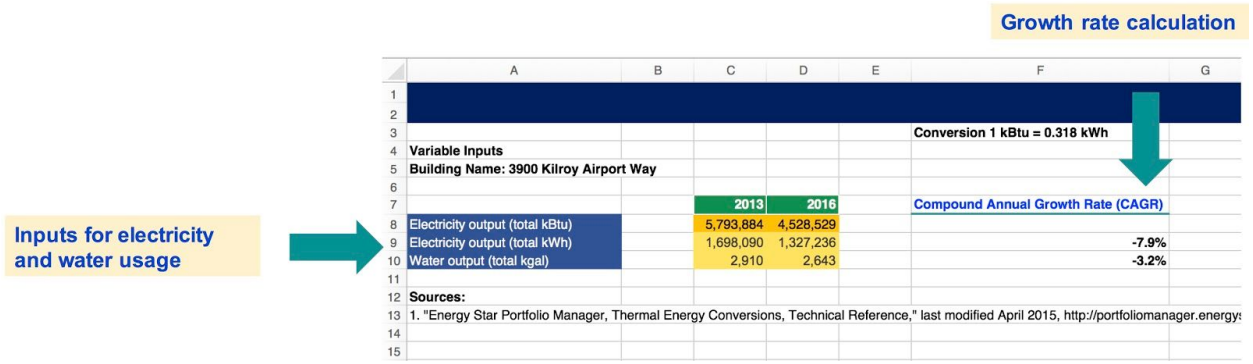


Figure 7. The 'Variable Inputs' tab allows the User to input information for any two energy years of choice, along with the total electricity and water usage for each associated year. The Excel sheet will automatically calculate the compound annual growth rate (CAGR) for both electricity and water usage.

Input current year, total electricity, and water usage for that year

	A	B	C	D
1				
2				
3				
4	**Static inputs**			
5		Cost (USD)	Predicted Increase in Rate Cost Per Year	
6	Energy rate per kWh	$0.18	4.0%	
7	Cost per kgal water*	$6.10	5.0%	
8				
9	Enter current year	2017		
10	Total electricity use (kWh) for energy year	2,000,000	< These are example numbers.	
11	Total water use (kgal) for energy year	3,000		
12				
13				
14	**Sources:**			
15	1. "Electric Power Monthly" last modified April 25, 2017, http://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t			
16	2. Lusvardi, W. "Are California Municipal Water Rates Too Low to Spur Conservation?" Last modified September 17, 20			
17	3. "Is residential electricity price going up or down," http://news.energysage.com/residential-electricity-prices-going-up-o			
18	4. McCoy, Kevin "USA TODAY analysis: Water costs gush higher " last modified September 29, 2012, https://www.usat			
19				
20				

Figure 8. In the 'Static Inputs' tab, the User enters only the total electricity usage and water consumption (in kWh and kgal, respectively). Predicted increases in electricity and water costs were listed in the sources documented in this tab.

	A	B	C	D	E	F	G	H
1								
2								
3								
4	**Calculation**							
5								
6	**Energy Costs**							
7	All costs are in $ USD							
8			2017		2018	2019	2020	2021
9			*Actual*		*Forecast*	*Forecast*	*Forecast*	*Forecast*
10								
11	Electricity Cost		$ 353,800		$ 338,938	$ 324,700	$ 311,061	$ 297,994
12	Water Cost		$ 18,300		$ 18,609	$ 18,924	$ 19,244	$ 19,570
13								
14	Total ($ USD)		$372,100		$357,547	$343,624	$330,305	$317,564
15								
16	**Total Electricity and Water Usage**							
17								
18			2017		2018	2019	2020	2021
19			*Actual*		*Forecast*	*Forecast*	*Forecast*	*Forecast*
20								
21	Total Electricity Output (kWh)		2,000,000		1,842,295	1,697,025	1,563,210	1,439,947
22	Total Water Output (kgal)		3,000		2,905	2,814	2,725	2,639
23								
24								

Figure 9. The 'Calculation' tab shows two final outputs: the predicted energy costs for electricity and water and the total usage for electricity and water. There is no need for the User to input any data in this part of the spreadsheet; all values are calculated from 'Variable Inputs' and 'Static Inputs.'

Under 'Static Inputs' the User enters information about the current year, total electricity use, and total water usage for the current energy year only. This tab contains information about the unit cost for electricity per kWh and water per kgal. The expected annual increases in electricity and water costs are documented on this tab as well. In this model, these numbers are considered fixed costs (Figure 8).

Finally, the 'Calculation' tab will automatically calculate the total electricity and water consumption for the actual year and will also calculate the predicted consumptions for the next four years. In this tab, energy costs are calculated, using the growth rate and the predicted increase in unit cost per year. The User does not input information in this tab; all the information from 'Variable Inputs' and 'Static Inputs' are automatically used for these predictions (Figure 9).

5.4 Findings and Recommendations: Economic and Environmental Impacts

In summary, implementation of the GJEP leads to an overall decrease in electricity and water usage. Our data shows that between 2013 and 2016, 76% of GJEP buildings saw a decrease in overall electricity and water usage, while 2016 energy usage was 5.6% lower in GJEP buildings than in non-GJEP buildings, on average. Furthermore, our predictive tool should be broadly useful for building owners to determine how implementation of the GJEP, along with green building programs, can lead to substantial cost savings. Of the green programs that lead to these savings, GJEP is the easiest and least expensive for buildings to implement.

6 Social Impacts

Corporate sustainability is often referred to as businesses embracing a triple bottom line – environmental, economic, and social impacts. In this section, we will focus on and evaluate the social impact of the GJEP and provide our recommendations. Social impacts are loosely defined as a company's impact on the surrounding community.[12] For the purpose of our analysis, we will define social impacts as any qualities of the GJEP that positively impact the social well-being of janitors, tenants, and local communities.

6.1 Post-training Surveys

We first analyzed the results of existing surveys given to janitors who have completed the training program. Based on our observations of the survey results from 325 janitors, we can objectively verify the program's effectiveness. One of the most striking statistics from the survey is a 100% recommendation rate of the program by the janitors. Over 99% are willing to support green cleaning more, while roughly 85% of the janitors would be willing to become a

green ambassador to share their knowledge externally. More importantly, more than 80% of participants actively implement green practices both at work and home by using microfiber cloths, recycling, and conserving water and electricity (Figure 10). The survey results clearly indicate positive changes in conservation behaviors and an increase in understanding of sustainability amongst the janitors, which clearly demonstrates the program's effectiveness in increasing janitors' green knowledge.

It is also important to recognize the janitors' influences on their community, family members, and coworkers in encouraging green practices once they are equipped with sustainability knowledge from the training. A great example of participants bringing an understanding of green practices home is a story about a worker who cut his electricity bill in half purely due to motivation from the program as opposed to a financial response.[13] The personal story of this janitor brings forth the underlying quality of the GJEP and is a strong narrative to demonstrate the social impact of the program. These types of personal stories provide evidence that this program empowers janitors to become active sustainability advocates.

Figure 10. Frequency of janitors who use green cleaning practices at work and at home after the GJEP.

6.2 Findings and Recommendations: Social Impacts

We recommend that survey results are incorporated into advertising materials and communications to potential tenants. As the survey results clearly indicate success of the program, it would be most effective to weave numbers and graphs into program descriptions on the GJEP website. Secondly, we recommend a use of storytelling to show the social impact through personal narratives. To maximize this strategy, it is important to have a real individual

with a name, picture, and personal quotes to make the story more personal and interesting, which can sometimes have a more lasting impact in the reader's mind than series of numbers and statistics about the program. The objective of such impactful stories is to show how this program affects the lives of real people and their communities after the program. Lastly, we recommend measuring social impacts using quantifiable metrics.[14] It is most convincing to prospective clients if the social impacts are measured and communicated as quantifiable benefits. From building owners' and tenants' perspectives, we believe asking them to fill out surveys or scorecards several months after completion of the GJEP would be an effective tool to measure the social impact of the program in the eyes of the building occupants. Ultimately, the idea is to use the client feedback as a way to validate the program's effectiveness to potential clients, who would be keen to know how existing customers review the GJEP.

7 Health Impacts

In addition to the economic, environmental, and social impacts of green cleaning, there are a number of health benefits to consider. While standard cleaning products contain dangerous chemicals, green cleaning products are much safer. The health impacts of these products reach beyond the janitors themselves, as tenants face reduced exposure to harmful chemicals in the enclosed space of a building if green products are used. In addition, the use of microfiber clothes instead of standard cotton clothes can save janitors time and energy, especially when using green cleaning products, which can be less effective than standard products despite their safety benefits.

7.1 Green Cleaning Products

We investigated the health effects of various chemicals in commercial cleaners and discovered that a number of existing chemicals used can be harmful to humans. Through our research, we found that the American Association of Poison Control Centers listed cleaning substances as the third most common source of poison exposure in adults in 2006.[15] Hazardous substances that are commonly used in cleaning products include phthalates, perchloroethylene, quaternary ammonium compounds, triclosan, and 2-butoxyethanol.[16] Some of these chemicals are neurotoxins, while others have been known to contribute to a wide spectrum of health effects, ranging from skin irritation and respiratory disorders to liver and kidney damage. These chemicals contribute to poor indoor air quality, exposing not only the janitors themselves, but also any tenants who occupy the building, to health risks.

Indeed, there have been increasingly high levels of toxins stored in fat cells of our bodies as more toxic chemicals are introduced to our everyday environment, especially from the past 20–30 years. A report by the American Lung Association reveals that the chemical compound 1,4-Dichlorobenzene, which is usually found in household deodorizers and room fresheners, was

found to be in 100% of the fat cells of people who were tested. Related bioaccumulation studies have shown that some toxins are stored in our bodies for life.[17] These studies suggest that the chemicals in regularly used cleaning products can remain in our bodies long after exposure and may be detrimental to our overall health over time.

In order to mitigate the absorption of potentially harmful chemicals in cleaners, we recommend the GJEP to encourage janitorial companies to use safer cleaners that are derived from natural substances. Such products meet the standards developed by the following certification organizations: Green Seal, ECOLOGO, and GreenGuard. Green Seal and ECOLOGO set their standards based on a lifecycle-based approach of each product, whereas GreenGuard focuses on products that have low chemical emissions and low volatile organic compounds (VOCs). Through establishing rigorous standards, these green product certification programs emphasize safety for human health and the environment as well as sustainability of resources used in each product.[18]

While green cleaning products may require more effort to use due to their mild ingredients, we found that this can be mitigated by replacing cotton clothes with microfiber clothes. Microfiber cloths carry numerous benefits: they tend to last longer and require less water to wash than cotton cloths to wash. Moreover, they are hypoallergenic and can dry faster than cotton cloths.[19] We feel that these benefits mitigate the drawbacks of green cleaning products.

7.2 Findings and Recommendations: Health Impacts

We recommend further education of janitors regarding the detrimental health effects of common commercial cleaners with an emphasis on more widespread use of green cleaning products. To quantify the long-term health benefits of these products, we advise a study of the health records of janitors, if possible. Such a study would track the frequency of problems such as allergies, asthma, and skin irritation among janitors before and after switching to green cleaning products.

8 Waste Diversion

Recent and upcoming regulations and programs addressing waste have a direct impact on janitors. California state and local regulations require waste to be diverted from landfills. As the regulatory landscape evolves, janitors and building owners need to prepare for upcoming changes and explore opportunities for cost savings.

8.1 California State Regulations

The California legislature and Governor Brown passed AB-341 setting a statewide goal for a 75% recycling, composting, or source reduction of solid waste by 2020.[20] AB-1826 requires businesses to arrange for organic waste recycling services with an incremental increases in the scope of businesses affected based on volume of waste produced.[21] The schedule is as follows:

- April 1, 2016: 8 cubic yards of organic waste per week
- January 1, 2017: 4 cubic yards of organic waste per week
- January 1, 2019: 4 cubic yards or more of commercial solid waste per week
- Annual report submitted to CalRecycle
- If organic waste in 2020 is not reduced by 50% of baseline 2014, businesses that generate 2 cubic yards or more of commercial solid waste per week

In September of 2016, SB-1383 was passed to establish methane emissions reduction targets below 2013 levels by 2030. This in turn established targets to achieve a 50% reduction in the level of the statewide disposal of organic waste from the 2014 level by 2020 and a 75% reduction by 2025. CalRecycle, the regulatory authority responsible for overseeing the achievement of organic waste disposal reduction targets, established an additional target that not less than 20% of currently disposed edible food is recovered for human consumption by 2025. CalRecycle will conduct informal workshops in 2017, initiate the formal rulemaking in late 2017 or early 2018, and adopt the regulations in late 2018 or early 2019.

California's aggressive organic waste regulations will require building owners to begin to separate organic waste. To accomplish this, building management, building tenants, and janitors will need to be educated on the new requirement. This need is addressed in Section 8.3.

8.2 City of Los Angeles Local Regulations

The City of Los Angeles created the Solid Waste Integrated Resources Plan (SWIRP), also referred to as LA City's Zero Waste Plan.[22] This is a master plan for solid waste management to achieve 90 percent diversion from landfills by 2025 and zero waste by 2030. SWIRP led to the creation of Zero Waste LA, a public, private partnership that expands the City of Los Angeles' current residential and recycling services to all business, commercial, industrial, and large multifamily customers. The partnership is a 10 year, $3.5 billion waste hauling contract assigning seven waste haulers eleven franchise zones shown in Figure 11 below. Zero Waste LA calls for a weekly hauling rate of $216.72 per week for a three-cubic yard solid waste bin, with free hauling of recycling and compost, subject to annual increases per annual Cost of Living Adjustments. Recycling bins are to be provided at no extra cost and compost bins are coming soon. Franchisees are required to collectively reduce solid waste disposal by 1 million tons a year by 2025.

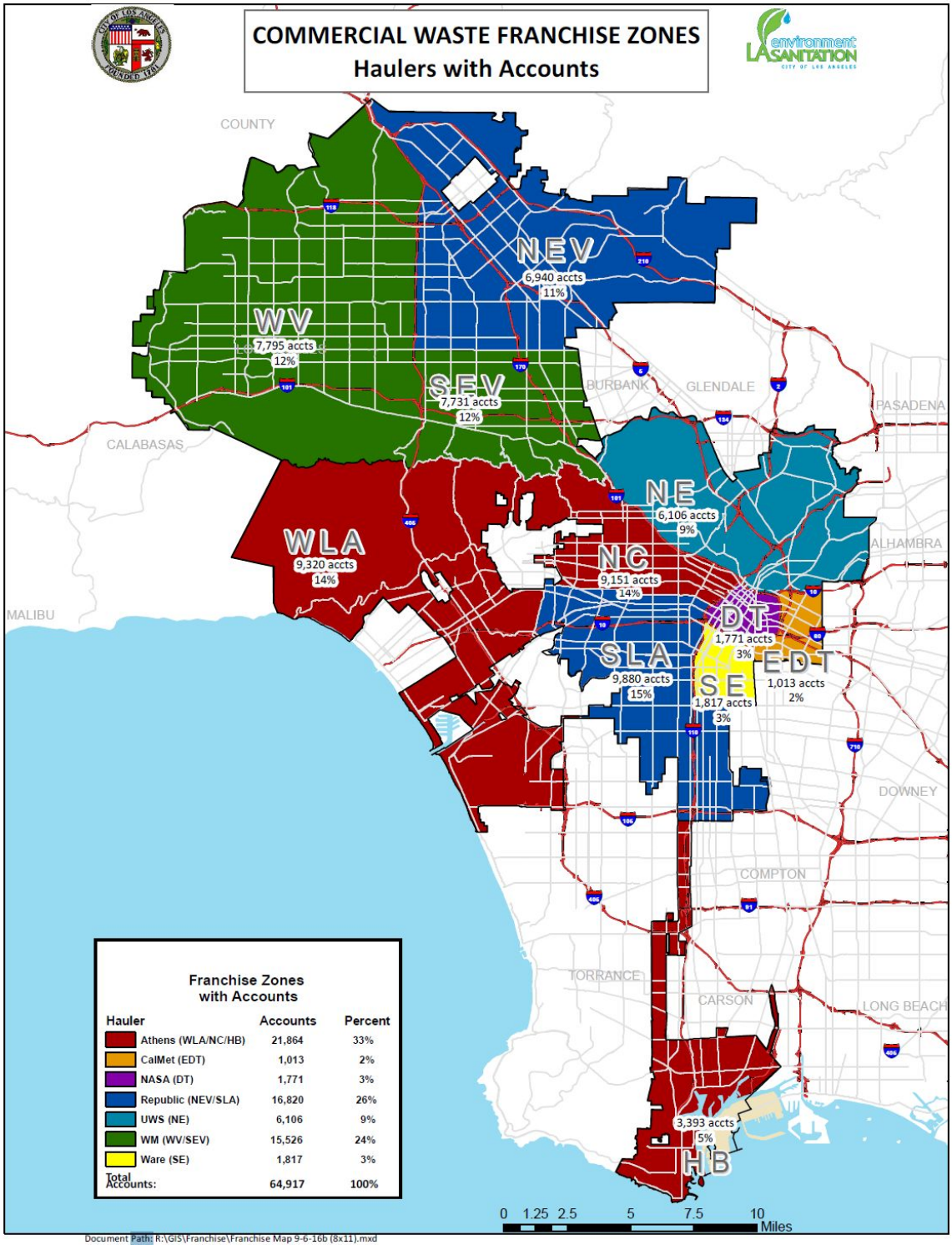


Figure 11. Commercial Waste Franchise Zones of Los Angeles City

8.3 Organics Recycling Education

Upcoming organic waste diversion regulations affect building management, building tenants, and janitors. Building management should coordinate with the waste hauler to receive the necessary bins. Janitors will have an extra waste stream to manage. We believe that for building management and janitors, the transition will be relatively painless. However, changing the behavior of the tenants will be more difficult. Tenants need to be educated on how to recycle and separate organics from regular trash to maximize waste diversion. Waste haulers, such as Waste Management, have resources available to educate tenants (see Figure 12). Flyers such as these should be displayed next to organics recycling bins to guide tenants in separating their waste. Figure 13 would be ideal for educating janitors since it shows that organics should be separated into the waste bins with yellow lids. Another example of effective signage is shown in Figure 14. This is provided by the waste hauler Recology, which services the City of San Francisco. San Francisco has had mandatory recycling and composting since 2009, and is an example of the best practices available.[23]

Figure 12. Organics Recycling Flyer for Tenant Engagement

Figure 13. Organics Recycling Flyer for Janitor Education

Figure 14a. Recology Recycle Signage

Figure 14b. Recology Compost Signage

Figure 14c. Recology Landfill Signage

8.4 Opportunities for Cost Savings

Encouraging tenants to maximize their waste diversion through clear signage can result in significant savings on a building's waste removal bill. With weekly hauling costs of $216.72 per three-cubic yard bin, if a building can reduce their waste by one bin per week, this would net over $11,000 in savings per year. To calculate achievable cost savings, we used Kilroy Realty's 2016 Sustainability Report to estimate the amount of waste a typical building produces.[24]

8.4.1 Kilroy's Case: Estimating Benefits

In order to compute cost savings from waste diversion, our team looked at the waste diversion status for Kilroy Realty Corporation as a case study. According to Kilroy's sustainability report, their directly managed properties generated 3,948 tons of waste in 2016. To convert this into a volume, we used an estimated waste composition for large office buildings and volume-to-weight conversion factors for different types of waste, given in Figure 15.[25,26] The resulting waste density of 291.41 lbs per cubic yard implies Kilroy's total 2016 waste equates to approximately 191 three-cubic yard bins per week generated. Kilroy's directly managed properties cover 8,595,542 square feet, meaning every 45,000 square feet of a building equates to approximately one three-cubic yard bin of waste produced per week.

To calculate the waste produced by a typical office building that would be targeted by GJEP, we used this estimate and the median size of GJEP buildings, 462,375 square feet. We found that such a building would produce approximately ten three-cubic yard bins of waste per week. As the cost of waste hauling per bin per week is $216.72, the total waste cost for these ten bins is $2,167.20 per week, or $112,694.40 per year (Figure 16). As mentioned above, diverting one bin to recycling and compost per week would lead to savings of over $11,000 per year. However, if a building can achieve 50% waste diversion, as Kilroy accomplished according to their report, the potential savings are over $56,000 per year. If such a building can become a zero waste facility, they can save the full $112,694.40 per year. These potential savings are summarized in Figure 17. While we consider these savings to be a best-case scenario, this example shows the potential monetary incentives associated with better waste diversion practices. The GJEP can be marketed as a way to directly engage janitors and tenants in recycling, helping buildings reduce their waste hauling costs.

Waste Subcategory	Pounds in a cubic yard *1	Avg waste content for a large office *2
Food	396	0.38
Low-grade paper	245	0.22
High-grade paper	323	0.12
Compostable	245	0.09
Trash/Other	138	0.19

*1 EPA Volume-to-Weight Conversion Factors

*2 City and County of San Francisco Department of the Environment

Waste Densities for Large Office Buildings with No Ground Floor Retail (lb per cu. yd.)	291.41

Figure 15. Estimated Waste Density (lb per cubic yard)

Kilroy's Waste Performance	Total weight of managed assets waste in 2016 (lb) *1	8,703,850
	Avg waste density for large office (lb per cu. yd.)	291.41
	Kilroy's annual waste volume (cu. yd.)	29,868.06
	Kilroy's weekly waste volume (cu. yd.)	574.39
	Number of waste bins needed for all waste per week	191.46

Standardization	Total managed assets (sqft) *1	8,595,542
	Number of waste bins needed per sqft	0.000022275

Cost Analysis	Avg sq ft of a building (based on GJEP client data)	462,375
	Avg number of waste bins per building	10.30
	Cost of waste hauling per bin per week (dollars)	216.72
	Total waste cost per week (dollars)	2,167.20
	Total waste cost per year (dollars)	112,694.40

*1 Kilroy 2016 Sustainability Report

Figure 16. Estimating Waste Volume and Cost

Estimated Savings: Kilroy Case Study

Waste Diversion

- **$11,000** annual savings for every recycling bin reduced
- Weekly hauling costs $216.72 per 3 cubic yard bin
- Average building produces about 10 bins of waste*

Waste Diverted	Cost Savings
10%	$11,269.44 per year
50%	$56,347.20 per year
100%	$112,694.40 per year

*Based on our estimated calculations using Kilroy's figures

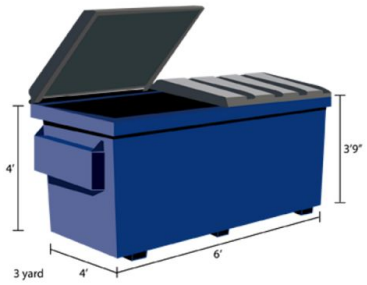


Figure 17. Potential savings through waste diversion. Based on our calculation of waste produced per square foot using Kilroy Realty Corporation's Sustainability Report, we estimate that a typical GJEP building produces 10 3-cubic yard bins of waste per week. This figure summarizes the potential savings a building can achieve as a function percentage of waste diverted, given the hauling cost of $216.72 per bin for non-diverted waste.

8.5 Findings and Recommendations: Waste Diversion

Zero Waste LA's waste hauler franchising agreement and the new organic waste diversion regulations will have significant impacts on buildings in the City of Los Angeles. Educating tenants and janitors on organic waste recycling is critical to maximizing waste diversion. Waste hauling companies already have resources such as informational flyers available to aid in education. We recommend that these be provided to buildings as part of the GJEP. If recyclables and organic waste are properly separated and the waste bins per week is reduced by one whole bin, buildings will save over $11,000 over the course of a year. For a building that produces 10 bins of waste per week, achieving 50% waste diversion would save over $56,000 per year, while 100% waste diversion would save $112,694.40 per year.

9 Conclusions and Recommendations

Our research has shown that the Green Janitor Education Program has been extremely successful in helping janitors to understand the importance of green cleaning and for buildings to experience the associated benefits. As the program expands to new buildings, these benefits should be emphasized. As such, we have designed a marketing brochure that can be used to advertise the GJEP and its impacts to prospective buildings. In addition, we recommend the following detailed marketing strategies:

Market the GJEP as the least expensive and easiest to implement of a number of practices that can reduce water and energy cost for buildings. We have found that GJEP buildings have seen decreases in their energy and water costs and use less energy than non-GJEP buildings due to a combination of the GJEP itself and other green building practices. We have developed a tool that can be used to predict the potential savings associated with these practices.

When marketing the social impacts of the GJEP, emphasize both quantitative metrics and personal stories from janitors. Design a feedback survey for building owners and managers to assess their satisfaction with the GJEP. The current post-training surveys show the positive impact of the GJEP on the janitors who go through the program. A feedback survey for building owners and managers can identify benefits of the GJEP that are most apparent to the building occupants. In addition to the quantitative measures current and additional surveys can provide, personal stories about how janitors have been impacted by the GJEP will resonate strongly with building owners and managers.

Emphasize the health benefits of green cleaning products and the understanding of these benefits gained by GJEP trainees to prospective building owners and managers. To better quantify these health benefits, use the medical records of janitors to track their overall health before and after switching to green cleaning products. Green cleaning products are much safer to use than standard products. The ingredients of these products are associated with health concerns such as asthma, allergies, skin irritation, and more serious problems. By tracking how frequently janitors are affected by these health issues, the benefits of green clean products can be directly quantified.

Offer flyers and signs labeling waste bins and emphasizing the importance of recycling to buildings that take part in the GJEP. With the upcoming Zero Waste LA waste hauling regulations, buildings that can divert one three-cubic yard solid waste bin per week into compost and recycling can save $11,000 per year. Buildings that can divert even more waste can achieve further savings, potentially tens of thousands of dollars per year. The GJEP can help buildings achieve this by engaging tenants in better recycling practices through the use of signs and flyers.

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About Seed

Seed Consulting Group is a 501(c)3 nonprofit organization that provides pro-bono consulting to organizations pioneering a healthier and more environmentally sustainable California. Our mission is empowering leaders to shape a sustainable future. We have chapters across the state in Los Angeles, Orange County, and San Francisco.

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