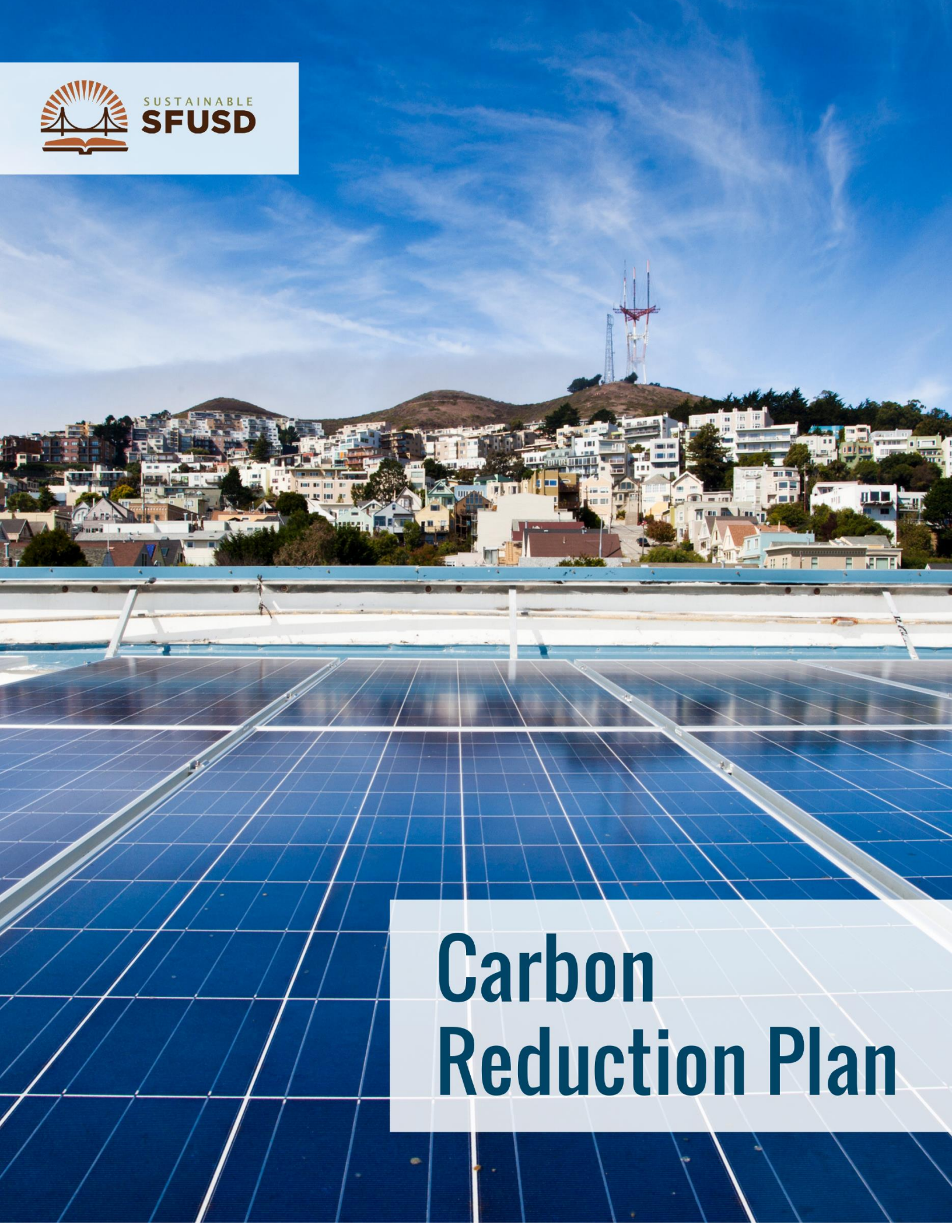
SUSTAINABLE SFUSD



Carbon Reduction Plan

EXECUTIVE SUMMARY

As we prepare students for the 21st century in our classrooms, we also want to prepare our facilities for the next 100 years. They should be **resilient** in the face of future changes to our climate and operated in a way that does not contribute to those changes.

That's why SFUSD is embarking on a multi-decade effort to achieve **carbon neutrality** by 2040. The technology exists to construct buildings that use no more energy than they generate, and all new SFUSD buildings will be built to this standard.

In existing buildings, we will gradually replace gas boilers with **electric heat pumps**. Instead of burning natural gas, our heat pumps will operate using clean, renewable electricity provided by the SF Public Utilities Commission (SFPUC) and by **solar panels** on our rooftops. Our goal is to achieve a 50% reduction in natural gas usage by 2030 and to stop burning it entirely by 2040. Thanks to past building modernizations, we are already well on our way to achieving these targets.

In order to eliminate the use of gasoline and diesel in our vehicle fleet, SFUSD is mandating that all new cars be **emissions free** and that school buses switch to **renewable diesel** by 2020. By 2030, we plan to remove our final gas-powered vehicle from the fleet.

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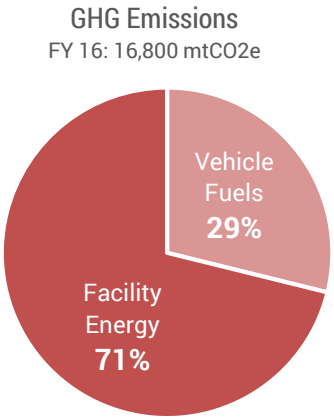
CONTEXT

In 2008, with support from the San Francisco Public Utility Commission (SFPUC) and San Francisco Department of the Environment (SFE), San Francisco Unified School District (SFUSD) hired its first Director of Sustainability. By allowing the District to focus on the three core goals of managing utility costs, reducing waste, and promoting healthy and environmentally-friendly modes of transportation for the school commute, the creation of the Sustainability Office was a major step forward in aligning SFUSD with the environmental ambitions of the City of San Francisco.

Since the Office's creation, managing utility usage and cost has become a top priority as the SFPUC has raised electricity and water rates in recent years and California's drought demanded reductions in water consumption. In addition, the District recognizes its obligation to fight anthropogenic climate change as a member of the environmentally-progressive San Francisco city family.



Because it benefits from carbon-free hydroelectric power, the District's (Scope 1 & 2) climate footprint is dominated by the natural gas it uses to heat its buildings and fuels it uses to power its vehicles. That's why the SFUSD Sustainability Office has developed this Zero Net Energy strategy for SFUSD buildings in consultation with the Bond, Buildings & Grounds, and Facilities Departments. Vehicle fuels make up about 30% of SFUSD's greenhouse gas emissions. These include diesel fuel used in large school buses, gasoline used in smaller school buses, and gasoline used by District fleet vehicles. Efforts to reduce the use of fossil fuels in SFUSD-affiliated vehicles are described at the end of this document.

The City and County of San Francisco has a goal of reducing its greenhouse gas emissions 40% by 2025 and 80% by 2050. In addition, the State of California has a legislated greenhouse gas reductions goal of 40% by 2030 (SB32) and an executive directive to reduce emissions 80% by 2050. As part of that goal, the State of California is mandating that all new commercial buildings, and half of existing buildings, be Zero Net Energy (ZNE) by 2030. This means that they should use no more energy over the course of a year as they generate through on-site renewable energy systems. Since the systems installed as part of the 2016 SFUSD facilities improvement bond will still be around in 2030, it is essential that the District prepare for future building requirements today.

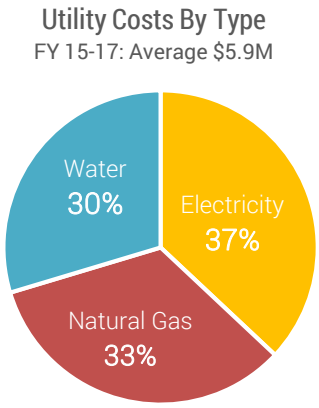
The Division of the State Architect (DSA) is eager to promote the achievement of these State targets and hosted an architecture competition to identify ways in which schools in a variety of CA climate zones could be upgraded to ZNE status. It has also launched a pair of ZNE school retrofit pilots to determine the feasibility of implementing deep energy reductions in California's existing school building portfolio. In order to gain an insight into the products and processes needed to allow an existing building to meet ZNE status, SFUSD is taking part in the DSA pilot by retrofitting Garfield Elementary School on Telegraph hill to meet this ambitious target. SFUSD is also an implementing

partner, along with twelve (12) other school districts, in the Department of Energy's Zero Energy Schools Accelerator. The goal is to help districts nationwide to incorporate ZNE construction practices into their building projects.

The market for zero energy buildings is taking off rapidly, in California as well as the rest of the country, and educational buildings make up the bulk of such projects. This is due to the fact that schools tend to have just a few stories and are therefore more easily powered by solar PV installed on their rooftops. In addition, since educational institutions generally own school buildings and utility bills make up the second biggest expense after salaries, school districts have a strong incentive to reduce utility bills even when projects have longer paybacks. Increasingly, however, ZNE schools are being constructed at no additional cost with respect to traditional construction. In addition, upgrades to the lighting and heating systems in modernized schools pay big dividends in terms of user comfort, educational performance of the students, and resilience in the face of a warming climate. Finally, schools take seriously their role as role models for the next generation of society and see opportunities to integrate zero energy buildings into the school curriculum.

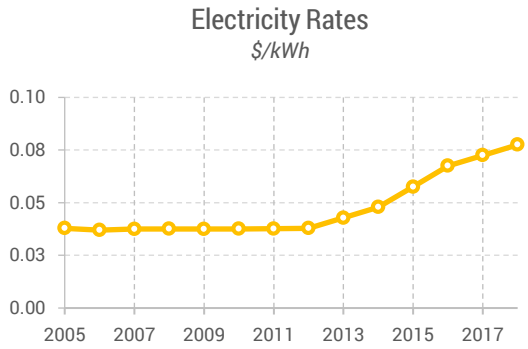
UTILITIES

The District spends just under $6 million per year on utility costs, a number that has not changed in several years. This low value is made possible by a special municipal utility rate and a bulk purchasing arrangement for natural gas. Changes in the rates of individual utilities have varied, however, such that natural gas no longer makes up the bulk of SFUSD utility costs.



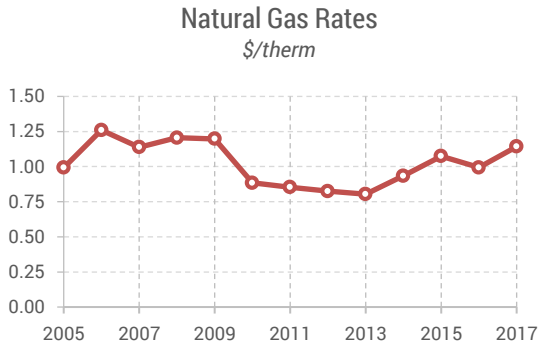
Electricity

The SPFUC provides the District with near carbon-free electricity generated by its Hetch Hetchy water system on a special municipal rate schedule without demand charges. Historically, this rate schedule has provided the District with below market rate electricity. For comparison, in 2008 the district was paying 3.75¢ per kWh compared to PG&E's standard commercial rate of approximately 16¢ per kWh. This 75% cost difference has reduced the incentive to reduce electricity usage. Over the past 8 years, however, rates have increased as the SFPUC seeks to approach the cost of service for all of its municipal rate customers. In FY2017 and FY2018, electricity rates are set to increase by 7.5% and 6.9%, respectively. Rate increases being planned for subsequent years will ensure that electricity is the District's largest utility cost in the next few years.



Natural Gas

PG&E, through an agreement with a bulk purchaser (SPURR), provides the district with natural gas services on a small commercial (G-NR1) rate schedule. Natural gas rates have fluctuated significantly in recent years due to market effects and the impact of the boom in shale gas production.

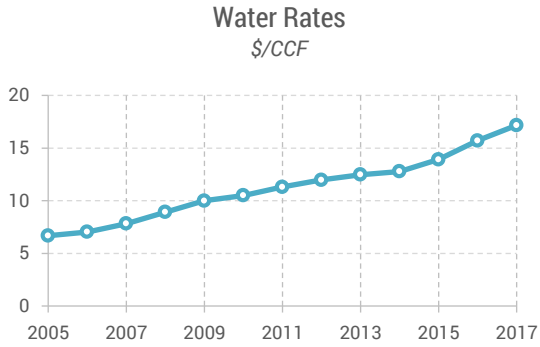


PG&E recently received approval from the California Public Utility Commission (CPUC) to increase transmission charges for all its customers. For the district this is estimated to increase fixed transmission costs by 23%, or an additional $150,000 annually. In addition, natural gas as a fuel commodity has remained well below its 5 and 10 year averages. As supply dwindles, the District can anticipate that both transmission and supply costs will increase in the future.

Water

The SFPUC provides water and sewer services on a standard W-1C commercial rate schedule. This schedule includes a fixed transportation charge for access to the water and sewer piping, based on the number and size of water meters, a volumetric charge for the amount of water consumed, and a mixture of sewer treatment charges that are established at a system-wide level.

Since 2008, both fixed and volumetric charges for water and sewer costs have increased approximately 12% annually to cover upgrades to the City's sewer and water delivery systems and will continue to do so through FY 2018. Based on historical trends, the district can expect rates beyond FY 2018 to continue to increase and for a new stormwater charge to be implemented.



GOALS

The SFUSD School Board, via its *Carbon Neutral Schools* Resolution, is calling on the District to achieve the following targets as it seeks to phase out fossil fuel use by 2040:

Buildings

- New buildings will be designed wherever possible with the goal of using no more energy than they could generate on site.
- New and modernized buildings will be plumbed for rainwater collection where feasible.
- SFUSD will strive to reduce gas usage 30% by 2020, 50% by 2030, and 100% by 2040.
- SFUSD will strive to reduce its water usage 30% by 2020 and 50% by 2030.

Fleet

- All *new* SFUSD-owned vehicles shall be emissions-free.
- SFUSD will strive to fuel all diesel-powered buses with renewable diesel by 2020.
- All SFUSD-owned vehicles will be electric or powered by low-carbon fuels by 2030.

Renewables

- SFUSD will strive to generate all of its own power on site by 2050.
- SFUSD will strive to meet 50% of water demand via rainwater by 2050.

What about electricity?

SFUSD receives its power and water from the SFPUC's Hetch Hetchy Power System, which generates 1.6 billion kilowatt hours of clean, hydroelectric energy each year. As a result, the District's electricity is already 100% greenhouse gas-free. To achieve carbon neutrality in its buildings, SFUSD is therefore focusing its efforts of switching its heating systems from natural gas to electricity.

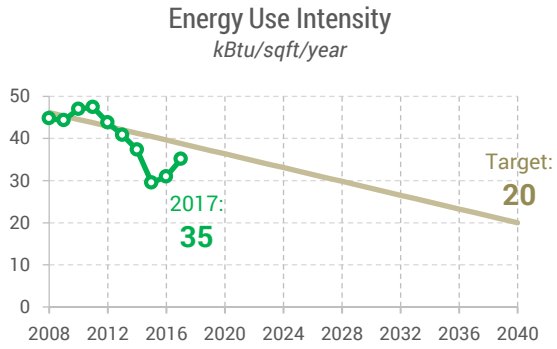
PROGRESS

Thanks to existing energy efficiency efforts and sustainable design choices during past modernization projects, SFUSD has made significant progress toward these goals since the Sustainability Office was founded.

Energy Use Intensity (EUI)

EUI measures the energy use of a building on a per-square-foot basis. This metric quickly captures the energy efficiency of a building stock and incorporates the impact of energy retrofits as well as the addition of renewable energy. The District's long-term goal is to reduce the average EUI to 20 kBTU/sf/yr by 2040 since this value makes it possible to cover a 2-3 story building's yearly energy usage entirely by roof-mounted solar panels.

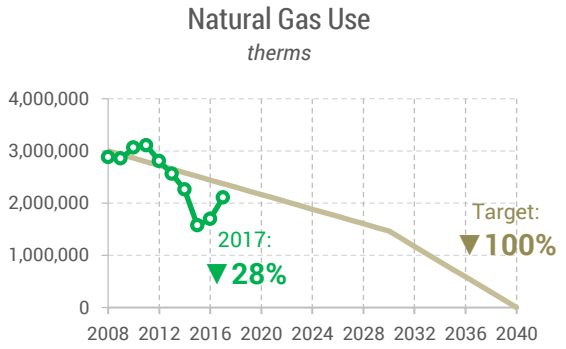
The District's EUI hovered around 45 kBTU/sf/yr for many years before the efforts of the sustainability office and the impact of a couple warm winters caused it to start dropping in 2012 and eventually reach 30 kBTU/sf/yr in 2015. This represents a **reduction of 33%** over our 2008 baseline across the entire SFUSD building stock.



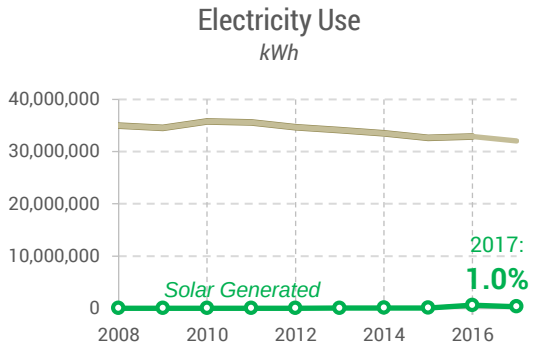
The winter of 2016-2017 has been the coldest in recent memory, so an increase in the District's energy usage is expected. Early indications suggest, however, that EUI will not rise nearly as much as heating degree days, a validation of the District's energy efficiency strategy.

Natural Gas

Since Hetch Hetchy power is 100% renewable, the District's building carbon footprint is entirely the result of its natural gas usage. Thus, the goal of eliminating SFUSD's carbon footprint by 2040 centers around efforts to reduce heating loads and electrifying building heating systems. That's why it is particularly encouraging to note that gas usage has **dropped by 42%** over the past eight years, again due to energy efficiency efforts and milder weather.



Solar



Because of its hydroelectric electricity supply, SFUSD has not been in a hurry to generate renewable energy on site. In addition, the District's low electric rate has made solar power financially unattractive (see sidebar). As electric rates rise, however, the financial feasibility of procuring renewable energy will be investigated. Of particular interest is the possibility that the SFPUC will offer a feed-in tariff that pays clients for generating power and feeding it into the grid. This might dramatically change the cost-benefit calculation and drive large scale solar generation across the District.

Despite the financial obstacles, SFUSD does host a number of solar PV systems thanks to mandates for the SFPUC to install renewable energy on public buildings. The first such system went up on Alvarado Elementary School in 2013 and was installed by staff at the City's Department of Public Works. Later additions have been outsourced to private contractors. In total, SFUSD has generated 780,000 kWh of electricity and now covers **1.8% of its electricity use** via rooftop PV systems.

Why so little solar?

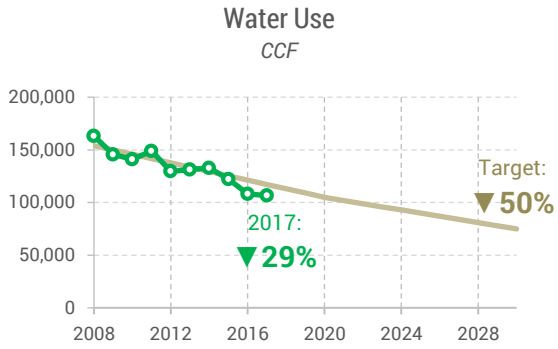
Because it receives subsidized municipal power from the SFPUC, the District has not been able to take advantage of Power Purchase Agreements (PPAs) that districts, which are clients of Investor-Owned Utilities (IOU), have used to fund solar PV installations. In short, PPAs have been more expensive than receiving Hetch Hetchy power through the grid. As a result, the slow roll-out of rooftop solar on SFUSD buildings has been the result of mandates for the installation of solar on public buildings and has been funded almost entirely by the SFPUC.

Water

Water usage has a minimal carbon footprint in San Francisco, where the water arrives from the Sierra Nevada mountain range via gravity. Preparation and treatment do require energy, however, and the ongoing water concerns of the State of California motivate the Sustainability Office to monitor water consumption along with energy-related metrics.

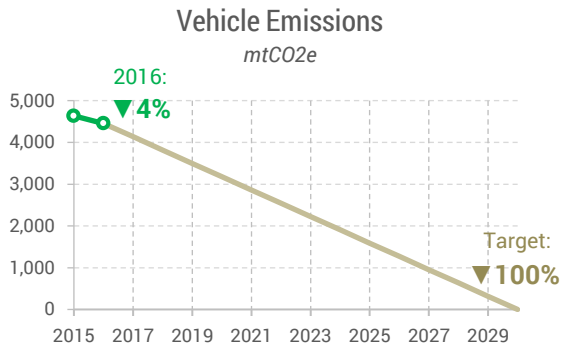
Thanks to diligent efforts to identify and fix leaks through interval data analysis, installation of high

efficiency fixtures as part of bond modernization and deferred maintenance work, the widespread installation of low-flow aerators, and a preference for turf fields over natural grass, the District has been able to **reduce** its **water usage by 28%** since 2008. The Sustainability Office expects that the continuation of existing efforts will eventually reduce water usage 30% by 2020.



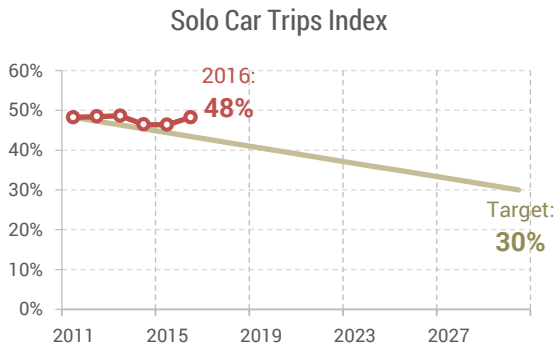
Transportation

Over 85% of SFUSD fuel use is attributable to school buses and less than 15% to District vehicles. The largest share of the latter is attributable to cars, vans, and truck operated by Maintenance & Operations. Fuel data prior to 2015 is not readily available; the District has been able to **reduce** its **vehicle emissions by 4%** since then.



Reducing fuel usage, or switching to renewable fuels or electricity for District-owned vehicles, is only part of the puzzle. A significant amount of Scope 3 (indirect) greenhouse gas emissions results from the transportation of students to and from school. While these emissions are not under SFUSD's control, it is in a position to reduce these emissions through education and behavior change. Through its participation in the SF *Safe Routes to School* program, the District hopes to encourage families to walk, bike, take transit, or carpool to school. Unfortunately, despite individual success stories, the number of students driving to school has remained constant for many years. Even the inclusion of neighborhood preference in the District's assignment process did not lead to a reduction in the **almost 50% of students** that are **driven to school**.

While not covered in this document, plans to reduce the solo commute rate to below 30% as called for in the *Equitable & Sustainable School Transportation* resolution of December 2015 are in the works and include districtwide traffic safety and bicycle education, the roll-out of walking school buses at all school sites, online carpool apps, and a longer range effort to minimize the need for car trips via changes to the assignment process and after school offerings.



Fighting Climate Change and Truancy

Every Monday morning, Bessie Carmichael Elementary organizes a walking school, a group of students and families who walk to school together. Not only does this create time for kids to get to know each other better, but they get an opportunity to be physically active. As a result, the kids arrive energized and ready to learn and the neighborhood benefits from less traffic and fewer car emissions. Cleverly, the assistant principal has started leading the walking school bus past the homes of chronically truant students, picking them up as the group walks by. This helps to ensure that these students don't slip behind in school and arrive in time for the District-provided breakfast.

STRATEGY

SFUSD has already made significant progress on its path to eliminating natural gas use in its buildings. Since all of this work is being done within existing budgets, a brief look at available funding sources is warranted.

Funding

Bond

The 2016 Proposition A Bond will provide a total of $744 million worth of facility upgrades, including $100 million for IT infrastructure, $20 million for Student Nutrition Services, $5 million for green schoolyards, and **$5 million for sustainability projects**.

While the amount set aside for sustainability is small, many of the building improvements discussed below will actually be incorporated into each project's general construction budget. Instead, sustainability funding will cover:

- Creation of controls and commissioning specifications that align with the *Carbon Neutral Schools* policy
- Development of ZNE assessments to guide design decision in modernization projects
- Scope that is generally not included during bond modernizations but called out for in the ZNE assessments

Facilities

In general, SFUSD spends about $3 million per year on **deferred maintenance** projects and up to $10 million in **developer** fees. Where these funds support projects that have an impact on utility usage, they can be leveraged to improve the District's energy performance. For example, insulation can be added to roofing projects or high performance glazing specified during a window replacement. By coordinating its efforts with the Sustainability Office, the Facilities Department is therefore able to support the District's ZNE goals.

Proposition 39

SFUSD is slated to receive a total of $12 million from the State of California to implement **energy efficiency improvements** in its K-12 schools. The funding is intended for projects with a relatively short payback but can be used for deeper energy retrofits if other sources of funding (such as bond funds) are leveraged to offset total project costs. Prop 39 was passed in 2013 and funds from this 5-year program must be spent by the summer of 2020. In 2017, Senate Bill #518 extended the program indefinitely and future funds will be allocated during the yearly State budget process.

SF Public Utilities Commission (SFPUC)

Because it serves as the District's power and water utility, and because of its aggressive sustainability goals, the SFPUC has a keen interest in supporting the **electrification of SFUSD buildings** and supporting the **deployment of solar PV** across the portfolio. Thus, all but one of the District's five rooftop solar power plants have been constructed by the SFPUC, and the agency is also exploring the installation of heat pumps to replace outdated gas or steam boiler systems.

Other Sources

The transition from gas-based heating to electric heat pumps is a major undertaking that will take substantial funds over the next two decades. It is therefore in the best interest of the District to diversify its funding stream for energy efficiency and fuel switch projects. Promising opportunities include:

- Energy Conservation Assistance Act (ECAA) Loans: These loans are available to school districts and other agencies to improve facilities and reduce energy usage. To date, San Francisco county has not availed itself of these funds.
- Power Purchase Agreements (PPAs): These allow schools to install solar PV at no upfront cost because the project developer sells the power generated to the school district at a fixed rate that is typically lower than the local utility's retail rate.

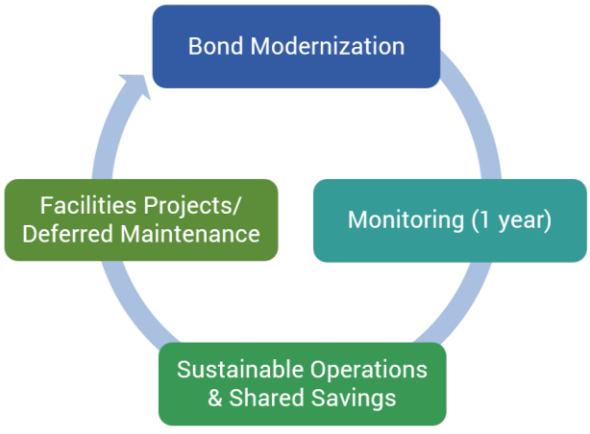
Facilities

The District has many opportunities to improve the carbon footprint of its buildings:

BOND PROJECTS: voter-approved funding for new construction & major renovations provides the best opportunity for deep energy retrofits

MONITORING: post-occupancy commissioning and energy monitoring can identify opportunities to adjust operation to meet design intent

OPERATIONS & SHARED SAVINGS: preventative maintenance, energy and water monitoring, and engagement of users prevent rising energy and water usage as buildings age



FACILITIES PROJECTS: major repairs and deferred maintenance projects provide an opportunity to improve energy and water efficiency

In order to take advantage of each of these opportunities to affect the energy usage of the District's buildings, the *SFUSD Project Requirements* have been created to assist design teams in supporting the District's ambitious zero carbon goals. In summary:

NEW BUILDINGS: New campuses and new buildings on an existing campus will be designed to achieve an Energy Use Intensity (EUI) < 20 kBTU/sf/yr. SFUSD's preferred strategies for achieving such exemplary energy efficiency are outlined in the *ZNE Guidelines* at the end of this document. While the addition of renewable energy is generally outside the scope of new projects, solar readiness should be built into the building.

BOND MODERNIZATIONS: Projects that are part of the 2016 Prop A Bond will incorporate improvements to the lighting systems and building envelope as outlined in *ZNE Assessments* commissioned by the District for every project prior to the design phase. These assessments will also look for opportunities to improve heating and ventilation systems, but these items will generally be tackled in future bonds unless failing equipment necessitates earlier action.

FACILITIES PROJECTS: Projects managed by the Facilities Department generally have limited scope and will support ZNE goals by upgrading building elements as they wear out. In each case, the *ZNE Guidelines* below and *District Design Standards + Guidelines* (DDSG) will inform the design and selection of materials and/or equipment for these projects.

RENEWABLES & STORAGE: Solar PV will be incorporated into projects as budgets allow. In a few years, as solar prices sink further, it will be financially prudent for SFUSD to become its own utility by generating electricity at costs below market rates. Furthermore, if the SFPUC's electric rate shifts to a Time-of-Use structure, the District will begin to explore the possibility of installing batteries to absorb midday PV generation for later consumption.

Beyond capital projects, SFUSD has numerous day-to-day opportunities to improve the energy efficiency of its building stock.

MAINTENANCE & OPERATIONS: The District has many opportunities to reduce energy and water usage during the routine operations of its buildings. One issue in implementing these practices, however, is the fact that there are no staff specifically assigned to performing these tasks. Thus, the Sustainability Office has teamed up with Buildings & Grounds staff to make the necessary site visits, systems adjustments, or operational improvements. In this way, leaks are being fixed, thermostats are being reprogrammed to conserve energy, and potential capital projects are being identified and funded via Prop 39 or Facilities.

EDUCATION & TRAINING: As capital and maintenance projects are implemented at SFUSD sites, it is important that site occupants are educated on how to operate their buildings in a way that supports the District's sustainability goals. In fact, studies have shown that energy reductions greater than 20% can be generated through occupant engagement alone. For this reason, the Sustainability Office makes occupant engagement throughout the facility cycle a key priority. User surveys help to identify comfort issues and improperly working heating systems, the *Shared Savings* Program (below) educates staff about energy efficient building operation, and soon-to-

be-developed ZNE trainings will help occupants of SFUSD's most efficient buildings to enable their ambitious energy targets.

SHARED SAVINGS: The *Shared Savings* behavioral energy reduction program focuses on decreasing natural gas, electricity, and water use in the district. Schools that sign up for the program identify a staff champion, who works with the District's Conservation Manager to roll out behavior change campaigns as well as infrastructure fixes that reduce utility use. If a school reduces its utility bill by greater than 5% over baseline, the school receives 50% of the savings to spend as it sees fit. Regular feedback provides schools with positive reinforcement for good conservation behaviors and dissuades sites from wasting money and resources that could be allocated elsewhere.

Transportation

Three types of vehicles comprise the District's transportation footprint:

1. large, diesel-fueled school buses
2. small, gasoline-powered school buses
3. the District-owned fleet

The first two are operated under contract with First Student, Inc. The last includes the cars, vans, and trucks stationed at the District's maintenance yard (834 Toland St). Eliminating the greenhouse gas emissions associated with all District-affiliated vehicles will therefore take a multi-pronged approach:

An Uphill Battle

The San Francisco topography provides a number of challenges for vehicles of all kinds. Many an alternative fuel technology has not passed the test of the City's hills, explaining why the District still relies on gasoline and diesel vehicles to power its small and large school buses. It came as no surprise, therefore, that the test drive of an electric van ended abruptly when the vehicle stopped in the middle of the block on a particularly steep street on Potrero Hill. Undaunted, the salesman called his tech department and they were able to unlock additional motor power via an over-the-air update. Just like a Tesla.


Zenith Motors

DIESEL: Efforts are currently underway to switch the diesel vehicles over to renewable diesel, a fuel that is identical to its petroleum-based counterpart but cuts greenhouse gas emission by over 60%. Furthermore, because it contains fewer impurities, fleets that have made the switch report reduced filter maintenance. The City of San Francisco and San Jose Unified School District have both made the switch with good results and even some cost savings because of incentives under California's *Low Carbon Fuels Standard* (LCFS). While renewable diesel won't be required until the District rebids its bus contract in 2020, the Sustainability Office is working with First Student to utilize the fuel much sooner.

GASOLINE: A drop-in replacement fuel for gasoline is not currently available, so the District will await the development of a more robust market for small electric vans and buses before

mandating that First Student replace its current fleet as they go out of service in a decade or so. Of particular importance is the ability of these vehicles to handle the steep terrain that is common in San Francisco.

FLEET: The vast majority of District-owned vehicles belong to the Buildings & Grounds and Custodial departments. Pick-up trucks, delivery and utility vans, and supervisor vehicles make up this fleet. Despite generous incentives from the State of California, electric vans still cost about twice the purchase price of a standard utility van. For this reason, SFUSD has decided to hold off on purchasing this type of vehicle at this time. However, thanks to a $10K rebate available only to public agencies, the purchase of an electric car is cost competitive with gasoline equivalents. That's why the District's *Carbon Neutral Schools* resolution requires that all new District cars be zero emissions vehicles.

Ultimately, the District would like to convert all vehicles to electric operation since electric vehicles are more cost-effective to run than their gasoline or diesel counterparts. As the price of electric vehicles drops quickly in the next few years, the up-front cost disparity to regular vehicles will no longer be a barrier to their widespread adoption.

Scoot

The SFUSD Sustainability Office often visits school sites to meet with Shared Savings champions or to identify building upgrades that will save energy or water. In the past, many of these trips were made by car since it was a lot more time-efficient than taking public transit. Thanks to a partnership with Scoot, provider of one-way electric scooter rentals, these trips are now powered by electrons instead of gasoline.

CONCLUSION

The San Francisco Unified School District is committed to leading the fight against climate change, both to inspire its students to take personal action as well as to reduce its utility and fuel costs so that more funding is available for the classroom. As it seeks to reduce its environmental footprint, the District knows that students will benefit through heathier learning environments, lower pollution levels around schools, and opportunities for curriculum and career integration. SFUSD efforts to reduce energy usage and greenhouse gas emissions complement and support existing efforts to minimize waste, connect students to nature, and promote active school commutes. They help to prepare students for the realities of a warming and resource-constrained 21st century world.

But SFUSD is only a tiny player in the fight against climate change. To really have an impact, the District must think beyond its own borders. That's why the SFUSD Sustainability Office is engaging with the California State Architect, US Green Building Council, New Buildings Institute, and Department of Energy to widely sharing the details of its strategy with other districts at conferences and workshops. District staff are consulting with colleagues in other cities to ensure they benefit from the tools and resources developed for San Francisco Unified (and learns from them in return). And SFUSD is increasingly being recognized with awards and accolades for its pioneering efforts to implement its *Carbon Reduction Plan*.

Climate change may one day be remembered as the biggest challenge to face humans in the history of the species. But it will hopefully also be remembered as a challenge that was successfully overcome…one student and one district at a time.