UNIVERSITY OF SAN FRANCISCO

CHANGE THE WORLD FROM HERE

University of San Francisco Climate Action Plan

December 2014

University Sustainability Council

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EXECUTIVE SUMMARY

In keeping with the University of San Francisco mission to "to educate leaders who will fashion a more humane and just world," and in light of the university's pledge to carbon neutrality through the American College & University Presidents' Climate Commitment (ACUPCC), USF presents its first Climate Action Plan. With this Plan, USF joins hundreds of universities in taking action on climate change. The Plan identifies educational measures and outreach on climate change, as well as operational measures to save energy and carbon (greenhouse gas (GHG) emissions). Figure ES-1 highlights the current (FY2013) USF energy and carbon inventory, and sectors targeted for action under the Plan.

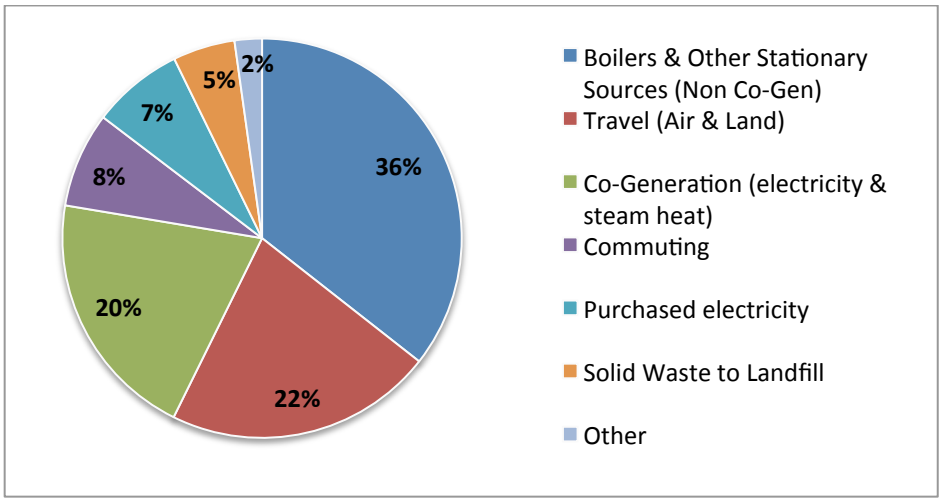

Figure ES-1. USF GHG Emissions Inventory FY2013 (by sector)

Table ES-1 summarizes USF targets and timeline for working toward carbon neutrality. Figure ES-2 illustrates the desired savings in Utilities, Transportation and other Emission sources over the next decade (fiscal year 2013 to 2023).

Table ES-1. USF Targets and Timeline for Carbon Neutrality

Target Years	% Savings Target	GHG Emissions Target
5-year target (2013 – 2018):	20% overall GHG savings	22,076 tCO2e
10-year target (2013 – 2023):	40% overall GHG savings	16,246 tCO2e
10-year target is based on:	*25% savings in Utilities emissions* *25% savings in Commuting emissions* *100% offset of Travel emissions* *20% savings in Waste and Other indirect emissions.*	
20-year target (2013 - 2043):	80% overall GHG savings	5,244 tCO2e
Carbon neutrality year: 2050	100% savings (Carbon Neutrality)	0 tCO2e (net)

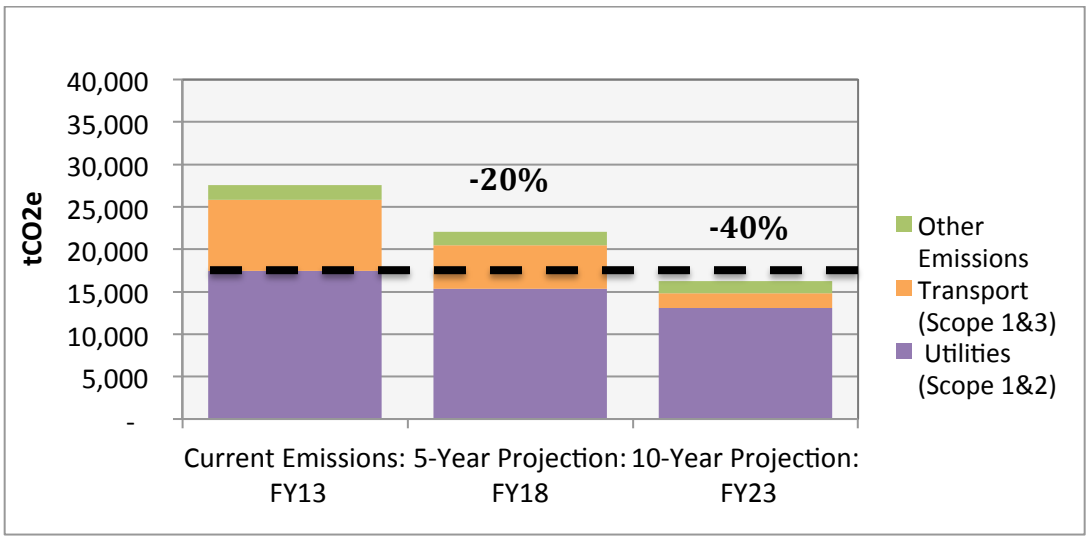

Figure ES-2. USF 10-Year GHG Emissions Saving Targets, FY2013 – FY2023.

To reach the targets, the university has identified priority strategies for energy and carbon savings (see Figure ES-2):

1. Conserve energy and carbon (reduce demand),
2. Enhance efficiency (reduce intensity),
3. De-carbonize supply (renewable energy),
4. Offset (reduce emissions elsewhere).

These strategies giving highest priority to actions that address the cause of the emissions problem on campus—namely, energy demand—by creating awareness and encouraging less consumptive behavior, as well as improved building design and technological upgrades. Attention is then given to improving efficiency, lessening the impact of energy supply, and as a last resort, offsetting emissions through off-site carbon saving.

Table ES-2 summarizes the main strategies for each sector of university activities, keeping in mind the priorities for energy and carbon saving noted above. The strategies include near-term actions, such as energy auditing and monitoring, and longer-term actions, such as implementing net-zero energy building design in new construction. Implementing these actions will involve engaging the campus community in Green and Gold campaigns, strengthening partnerships with San Francisco-based organizations, and actively participating in national networks such as the ACUPCC and the Association for the Advancement of Sustainability in Higher Education (AASHE).

Table ES-2. Summary of USF Energy and Carbon Saving Strategies

Educate and Engage
1. Establish an Office of Sustainability and University Sustainability Coordinator to coordinate climate action and sustainability efforts.
2. Enhance climate and sustainability education and research across the university, in keeping with USF mission as a socially responsible learning community.
3. Engage the campus community to be Green and Gold: Green Offices, Green Classrooms, Green Labs & Studios, Green Dorms, Green Events, Green Commuting.
4. Engage the surrounding community, alumni, and prospective students: develop climate and sustainability partnerships with City of San Francisco, Bay Area organizations, California agencies (CARB) and national organizations (AASHE); feature sustainability in external communications.
Conserve Energy in Buildings
1. Implement energy auditing and metering systems, to identify opportunities for energy demand reduction in water heating, space heating, electric appliance usage.
2. Implement energy management systems,
3. Require extensive use of passive energy systems in all new construction and upgrades (solar gain, shading, daylighting, ventilation).
4. Work with the City of San Francisco toward net-zero energy (and carbon) in all new construction and major retro-fits.
Enhance Efficiency
1. Analyze opportunities for boiler efficiency upgrades on Lone Mountain campus.
2. Analyze opportunities for additional efficiency upgrades in the USF co-generation plant.
3. Examine the potential for efficiency gains in refrigeration, lighting, cooling of computer clusters, and other commonly used appliances.
De-Carbonize Energy Supply
1. Conduct feasibility assessment for low carbon space heating and water heating: geothermal heating, additional solar water heating, bio-gas use in boilers, renewable electric heating.
2. Conduct feasibility assessment for use of bio-gas in the USF co-generation plant.
3. Conduct feasibility assessment for other on-site renewable electricity generation: wind, additional photovoltaics (PV), renewable fuel cells.
4. Explore additional Power Purchasing Agreements, Renewable Energy Credits, and other purchase options for renewably-generated electricity and heat.
Transport Sustainably
1. Enhance communication, website, comprehensive marketing about sustainable transportation for USF.
2. Secure more housing on-campus or near campus, to reduce the need for commuting.
3. Enhance infrastructure and support for bicycles and walking: increase bike racks and lockers, bike sharing (USF or San Francisco program), discounts at local bike shops, walking and biking route maps with local businesses & secure/covered bike storage.
4. Greater support for mass transit: display departure times in campus buildings, examine shuttle option, expand transit subsidy, collaborate with City to achieve mutual goals.
5. Encourage fewer vehicles overall, support low-carbon vehicles: expand car share and ride share programs; increase parking prices and street timer restrictions, consider charging stations and preferential parking for low-carbon vehicles.
6. Lighten up on air travel; offset remaining travel emissions.

Minimize Waste, Recycle, and Compost
1. Conduct waste characterization study and analyze emissions avoided from waste minimization, recycling and composting. Target future actions based on the studies.
2. Analyze and implement options: greater availability of recycling and compost bins in bathrooms and common spaces; hand dryers or compost bins to reduce paper towel waste; green purchasing program to reduce life-cycle waste of common products.
Conserve Water
1. Analyze and target reductions in hot water usage, to save heating energy and carbon, as well as water. Consider shower timers in dorms and gyms.
2. Develop overall water conservation plan and storm water plan, to manage ongoing impacts of climate change related to water.
Manage Food and Land
1. Analyze life-cycle emissions related to food and land management, to include in the carbon inventory and further guide sustainability efforts.
2. Enhance efforts to support: local food, community food production, low-carbon food choices, reduction of food waste, food recovery, composting.
3. Enhance efforts to incorporate drought-tolerant, ecologically beneficial land management on campus and in local partnerships.
Offset Remaining Carbon
1. Use carbon offsets as a last resort strategy to achieve carbon neutrality, for indirect emissions such as air travel emissions.
2. Develop offset purchasing guidelines to ensure the University is making quality investments in off-site carbon reduction.
3. Prioritize locally focused projects in offset purchasing decisions.
4. Connect responsibility for offset payments, such as air travel offsets, with the group sponsoring the activity.

1. USF Climate Action in Context

In 2009, University of San Francisco President Father Steven A. Privett, S.J., signed the American College & University Presidents' Climate Commitment (ACUPCC), committing the University to conduct a Greenhouse Gas Inventory and prepare a Climate Action Plan to set the University on a course to carbon neutrality. In May 2012, President Privett and Provost Jenny Turpin formed a University Sustainability Council to carry out the commitment. Consisting of administrators, faculty, staff and students, the Council worked for more than two years to produce the University of San Francisco's Climate Action Plan.

It is auspicious that at the time of completion of the Climate Action Plan, USF welcomes its 28th President, Paul J. Fitzgerald, S.J. As President Fitzgerald has written, human destruction of the environment is "stealing from future generations, taking from them countless possibilities for a decent life in exchange for our present consumeristic excesses and our sloppy mismanagement of the planet." This Climate Action Plan is USF "walking the talk" in fulfilling its educational mission and managing its operations.

1.1. Ethics and Equity in Climate Action

> "The most important social responsibility of a university is to be a promoter of justice at all levels: in individual relations, in organizations and also in societies where it operates, with a vision that is both local and global. A justice [that] must integrate… environmental justice, the dimension of gender, and human coexistence in a multicultural world."
>
> Fr. Adolfo Nicolas. S.J., Superior General of the Society of Jesus

The University of San Francisco embraces a global perspective and aims to educate leaders who will fashion a more humane and just world. Among its core values are social responsibility in creating, communicating and applying knowledge "to a world shared by all people and held in trust for future generations," "the moral dimension of every significant human choice," "the full, integral development of each person and all persons, with the belief that no individual or group may rightfully prosper at the expense of others," and "a culture of service that respects and promotes the dignity of every person."

These core values move the University to commit itself to reducing its impacts on the climate and also to educating ethical global citizens that can lead the transition to a

just and sustainable society. Historically, USF's social justice mission has involved serving those in need and addressing the consequences of inequality. For example, the University takes pride in placing sixth nationally for success in graduating low-income (Pell-Grant) students. Similarly, through its service learning and other programs the University annually sends hundreds of students as near as San Francisco's Tenderloin District and as far as Rajasthan, India, to serve those in need.

> This Climate Action Plan formalizes the University's extension of this tradition to matters of environmental stewardship. The March 2014 report of Working Group II of the Intergovernmental Panel on Climate Change, *Climate Change 2014: Impacts, Adaptation, and Vulnerability*, concludes that "[p]eople who are socially, economically, culturally, politically, institutionally, or otherwise marginalized are especially vulnerable to climate change." As the earth's climate changes due to human activity, the University's core values are invoked in two ways. Inequality must be addressed to minimize the vulnerability to climate extremes faced by the poorest among us. We must also engage ethically with the obligation and opportunity we have to reduce the suffering climate change will cause by striving for carbon neutrality.

1.2. Causes and Consequences of Climate Change

Based on multiple lines of scientific evidence, the overall consensus of the global scientific community (IPCC 2007, IPCC 2014) is that:

- global warming is unequivocal,
- natural fluctuations alone cannot explain current changes in climate,
- it is highly certain that human activity is the cause, and
- the impacts of climate change are already observable around the globe.

Human activity is occurring at such a large scale and rapid rate that it has disrupted the balance of the global carbon cycle, leading to an accumulation of heat-trapping gasses in the atmosphere, especially carbon dioxide (CO_2) and methane (CH_4). (See Figure 1.) The burning of fossil fuels (coal, oil, natural gas) is the dominant source of CO_2 emissions; fuel extraction and transport also emit CH_4. Fossil fuels are burned to produce heat and electricity; make industrial products including cement, steel, glass, and chemicals; and power vehicles. Agriculture, livestock production and disruptive land use (deforestation, building) emit CO_2 and CH_4, as well as the greenhouse gas nitrous oxide (N_2O). Whereas fossil fuels were formed by the sequestration of carbon from organic matter over geological time scales, humanity is burning them and reinserting the carbon into global cycles in mere decades. Nearly half of Earth's land has been altered

for crop and livestock production, with large impacts on water and ecosystems, as well as greenhouse gas emissions.

The consequences of the excess heat trapped in the atmosphere, on land, and in the oceans include: more erratic weather patterns, increased heat waves, more intense storms, disruptions in migratory cycles and food availability, drought, fire, spread of disease vectors, worsening of air quality, multiple impacts on human health and livelihood, melting of glaciers and sea ice, sea-level rise, and extinction of species.

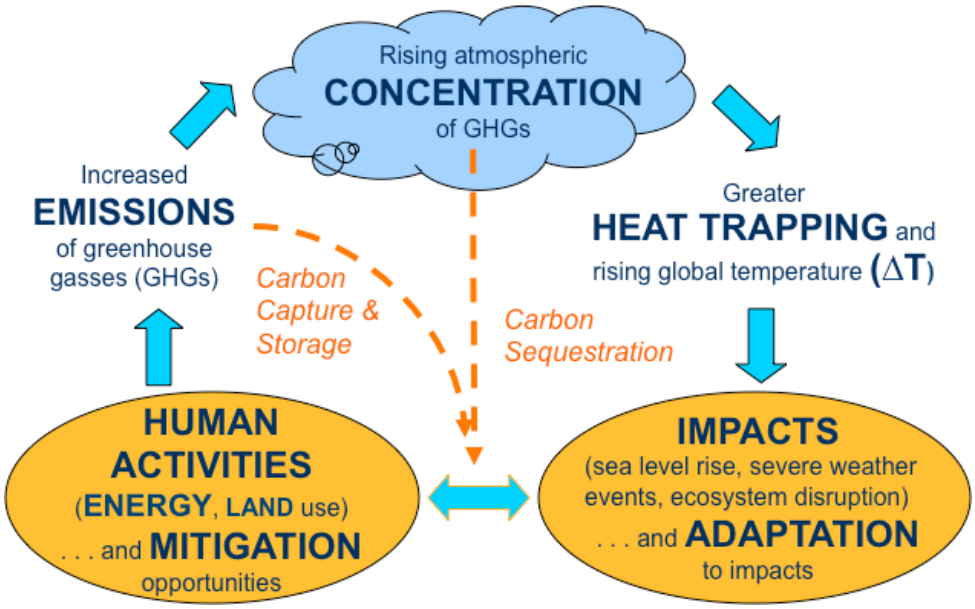

Figure 1. Human-Climate System; Causes and Consequences of Climate Change
Source: Ohshita 2007

Because of the long residence time of these greenhouse gases in the atmosphere, the impacts of climate change may last for centuries. To prevent the impacts from worsening, dramatic reductions in greenhouse gas emissions are needed globally; this is termed "mitigation." At the same time, because impacts are already occurring, we must also respond to those impacts; this is termed "adaptation."

The initial USF Climate Action Plan focuses on mitigation—on changing behavior and reducing greenhouse gas emissions—to encourage widespread action and prevent further impacts and suffering, in keeping with the university's mission of social responsibility and social justice. Updates to the Climate Action Plan can include adaptation actions, which also serve to reduce risk and foster resiliency in the face of climatic and social change.

1.3. Climate Commitments

American College and University President's Climate Commitment (ACUPCC)

As institutions of higher education with a long-term vision, more than 600 colleges and universities have chosen to take action on climate change, with knowledge of the climate disruptions already underway and the profound implications for humanity and all life on the planet. By signing the ACUP's Climate Commitment, USF President Father Steven Privett establishes USF 's commitment to climate education and social justice and places the university on a path to carbon neutrality. Carbon neutrality means that USF's net emissions of greenhouse gases are zero. Reaching this goal will provide an example of how a university can offer a first-class education in a just and sustainable manner.

City of San Francisco – Climate Action Plan

The City of San Francisco was one of the first U.S. cities to establish climate policy prepare a climate action plan. The San Francisco CAP was issued in 2004 and updated in 2013, with individual city departments developing more detailed actions in between. Since USF plays an important role in the city's emissions and education on climate change, here we highlight the San Francisco GHG emissions (Figure 2) and the city's climate targets (Figure 3).

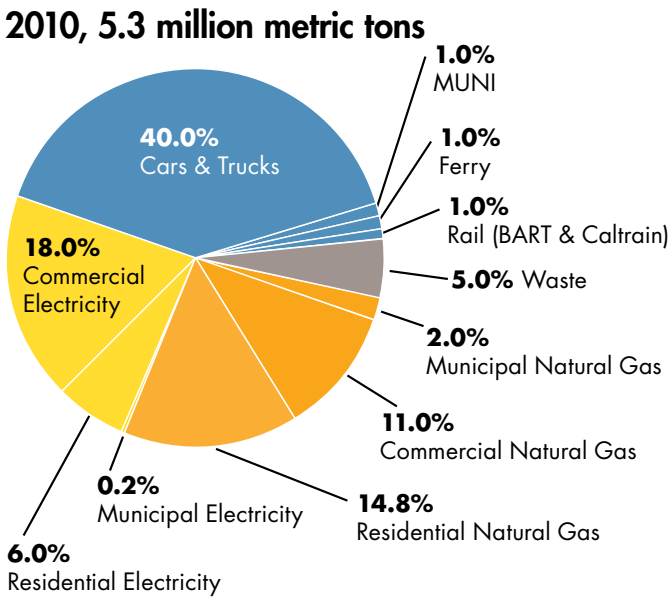

Figure 2. San Francisco 2010 GHG Inventory

Source: San Francisco Climate Action Update, 2013.

Transportation via cars and trucks causes the largest share of emissions (40%), followed by direct use of natural gas for space heating and water heating (28%), and use of electricity (24%).

The City of San Francisco set three overarching GHG emission targets, shown in Figure 3. The SF targets are aligned with scientific recommendations by the Intergovernmental Panel on Climate Change (IPCC), and call for greater action than the international Kyoto Protocol of the United Nations Framework Convention on Climate Change (UNFCCC) and the AB32 Global Warming Solutions Act of the State of California:

- initial GHG emissions reduction goal: 20% below 1990 levels by the end of 2012
- near-term GHG emissions reduction goal: 25% below 1990 levels by 2017
- mid-term GHG emissions reduction goal: 40% below 1990 levels by 2025

Figure 5. **San Francisco GHG Emissions On Track to Beat Upcoming International and State Targets**

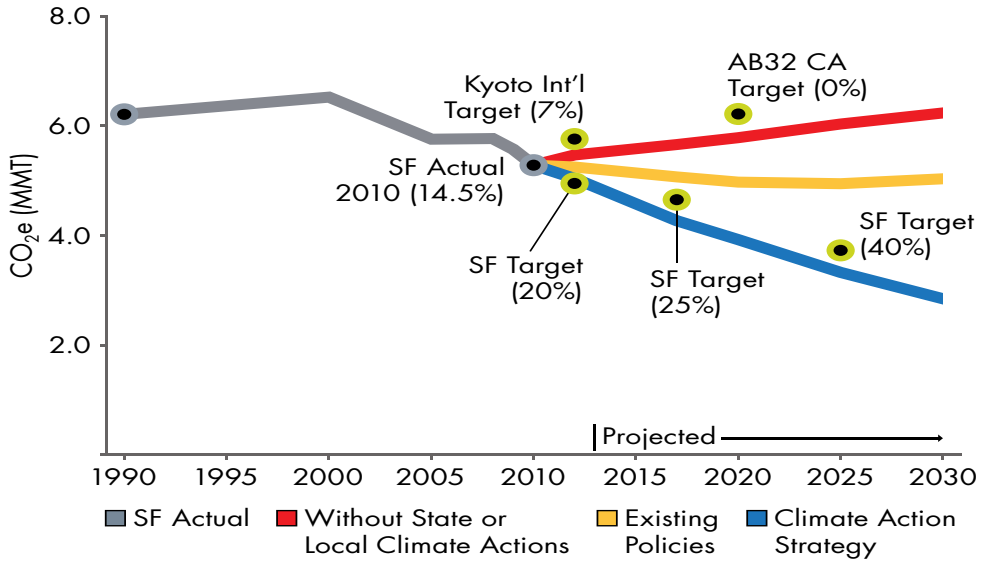

Figure 3. San Francisco and California GHG Emission Targets

Source: San Francisco Climate Action Update, 2013.

To achieve the GHG emission targets within San Francisco's Climate Action Plan, the city has set specific goals for each sector, including:

- 100% renewable electricity in Residential Buildings, 80% renewable electricity in Commercial Buildings
- Shift 50% of trips to non-automobile trips by 2017
- Zero Waste by 2020

State of California - Climate Policy

USF is also influenced by the State of California's groundbreaking policies to address climate change. Long a leader in energy efficiency, renewable energy, and environmental action, California has launched a suite of policies for climate change, including:

- AB 32 Global Warming Solutions Act
- Renewable Portfolio Standard
- SB 375 Sustainable Communities and Climate Protection Act
- Pavley Bill on Vehicle Greenhouse Gas Emissions Standards

The goal of AB 32 is to reduce California's carbon footprint back to 1990 levels by the year 2020, representing a 30% cut from the projected emissions trend. On a per person basis, this means a shift from 14 tons of carbon dioxide per year to 10 tons per year for each California resident. The Renewable Portfolio Standard requires electric utilities to generate less power from polluting fossil fuels and gain a greater share from renewable energy sources such as wind, geothermal, sustainable hydropower, biomass, and solar. SB 375 calls for better land use planning, for urban development that fosters more community with less driving and less energy consumption.

These are the climate action efforts that USF is part of, by virtue of its location in San Francisco and the State of California, and its role as an institution of higher education.

1.4. USF Master Plan Highlights for Climate Action

The Institutional Master Plan (IMP) for the University of San Francisco is a campus development plan to ensure the continuing excellence and evolution of the University. It presents options for campus development for the next ten years, including potential new construction, building renovations and upgrades, and site improvements. A number of the proposed projects offer opportunities to support USF's goals toward carbon neutrality.

USF's primary campus is the fifty-two acre Hilltop Campus, located just north of the Golden Gate Park Panhandle. The campus is integrated into the city and is made up of two large parcels and other adjacent properties. Upper Campus is located on Turk Boulevard between Parker Avenue and Masonic Avenue. Lower Campus is located one short block away between Golden Gate Avenue and Fulton Street. The total student enrollment on Hilltop Campus was 8,491 in Fall 2013. In addition to the Hilltop Campus, USF offers limited course work at two other locations in San Francisco, and throughout California. The San Francisco locations include a building at the Presidio and at 101 Howard Street, downtown. USF is the 15th largest employer in the City and its annual operating and capital expenditures, along with student and faculty/staff spending, total an estimated $111 million in San Francisco. These economic activities ripple through the local economy, generating over $323 million in economic impacts in the City.

The key elements of the Hilltop Campus physical master plan are:

- Accommodation of enrollment growth of less than 1% annually on average, over the next ten years. USF will also increase enrollment at its branch locations outside San Francisco, develop an online program for graduate students, and promote study-away programs.

- Enhancement of the image and identity of the University through the physical environment with strategic building, landscape, and way-finding improvements.
- Retention and accommodation of a mix of building uses on the Upper and Lower Campuses.
- Creation of a stronger visitor arrival experience and a safe, cohesive, and user-friendly pedestrian environment.

The University anticipates a need for 60,000 to 75,000 gross square feet of academic and support space at the Hilltop Campus. These spaces needs include new classrooms, instructional labs, faculty and staff offices, and study space, in new facilities.

USF houses the smallest percentage of undergraduates in its residence halls of any of its peers, and USF dormitories operate at full capacity. In response, USF plans to increase the percentage of undergraduates housed on the Hilltop Campus and build up to 635 new student-housing bedrooms on the Hilltop Campus.

Several smaller scale projects, if implemented, would help contribute toward meeting USF's sustainability goals including, but not limited to, technological upgrades to the Cogeneration Plant, upgrading the mechanical, electrical, and plumbing systems at Lone Mountain Main, as well as replacing the windows in Lone Mountain Main.

1.5. USF Goals for Sustainability and Climate

In light of the considerations, commitments, and circumstances noted above, USF has developed its current sustainability and climate goals.

Sustainability Goals

The USF "Sustainability Strategic Plan,"[1] advocates a mission-driven approach to sustainability with three goals:

- Building a culture of sustainability and diffusing sustainability across the curriculum.
- Institutionalizing the College's sustainability efforts with the aim of better communicating past and current sustainability-related collaborations and achievements, and cultivating new ones.
  Establishing partnerships with community organizations, city government, and other sustainability-related efforts, as well as supporting existing

[1] The sustainability goals stated here are from the College of Arts & Sciences Sustainability Strategic Plan. The university as a whole is still developing its sustainability goals.

partnerships, to nurture innovative, cross-sector, collaborative approaches to sustainability challenges.

Climate Goals

In addition to the broad sustainability goals above, the University aims to achieve the carbon neutrality goal to which it committed in the ACUPCC. Utilizing 2013 as a baseline year, USF has identified the interim targets in Table 1 to achieve its long-term carbon neutrality goal:

Table 1. USF Targets and Timeline for Carbon Neutrality

Target Years	% Savings Target	GHG Emissions Target
5-year target (2013 – 2018):	20% overall GHG savings	22,076 tCO_2e
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20-year target (2013 - 2043):	80% overall GHG savings	5,244 tCO_2e
Carbon neutrality target year: 2050	100% savings (Carbon Neutrality)	0 tCO_2e (net)

These goals and targets are explained in Section 3: Greenhouse Gas Emissions Inventory and Section 4: Future Energy and Carbon Saving.

In addition, the University seeks to reduce the risks of climate change impacts on its educational mission and financial stability. The University has already added a Resilience Manager to its Public Safety staff to coordinate responses to a variety of emergencies. Climate change resilience must address both sudden and long-term impacts, for example, how buildings will be retrofitted or designed to handle greater extremes in weather (heat waves, storm events, high winds, drought, fire, prolonged fog spells, etc.), and how energy supply will be managed to withstand disruption in gas or electricity due to extreme weather.

2. Sustainability Efforts to Date: A Foundation for Climate Action

USF places high value on sustainability. As such, the University has taken many steps across disciplines and facets of campus life toward building a sustainable campus

community. The University's efforts as both a sustainability leader and educator have been recognized by several independent organizations. Among these, USF was ranked 56th in the Sierra Club Magazine's 2011 "Coolest Schools" survey, which rates American colleges and universities according to their environmental practices, green initiatives and caliber of sustainability-oriented education. Here we summarize sustainability efforts to date that are pertinent for climate action, in campus operations and academics, scholarship, and service.

2.1. Campus Operations

Energy Sources

Several major infrastructure investments have supported the reduction of the campus carbon footprint thus far. A 1.5 megawatt cogeneration facility installed in the 1980s provides a significant percentage (60%) of electrical power to the Lower Campus. Waste heat from the generator motor is captured and used to create steam that provides heat to most lower campus buildings, including the heating of the Olympic-sized swimming pool.

Also in the 1980s, USF installed solar thermal water heaters on three of its residence halls: Phelan, Gillson and Hayes –Healy. With a relatively low-cost investment and simple technology, the university saves energy and carbon on water heating for student showers.

The University began its photovoltaic (PV) electricity production in 2003 on top of the Gleeson Library and the Geschke Learning Center and has since added four other campus rooftops arrays on Kalmanovitz, Cowell Hall, University Center and the Koret Health and Recreation Center, for a total capacity of roughly 590 kilowatts (kW) that have generated over 2.5 gigawatt-hours, avoiding over 7.5 million pounds of carbon . Power generation from PV was just over 753,000 kWh in fiscal year 2013. These panels contributed 4.5% of the University's electrical output and corresponding reduction in consumption from the PG&E grid.

Energy Efficiency

A campus wide interior re-lamping effort began in 2008 to higher efficiency fluorescent lighting and was completed in 2010. In 2008 alone nearly 8000 ballasts and over 16,000 lamps were exchanged. Exterior lighting is the current target with the Koret Center lower parking deck receiving over 50 LED fixtures. High-efficiency fluorescent lighting was installed in all campus buildings over the past decade. Further energy use reductions are being achieved through the installation of computer-controlled energy management systems in almost half the campus buildings.

Window replacements began on the western elevation of Fromm Hall about 2004, followed by the School of Education in 2006 and 2007, and continued with Phelan Hall's windows being replaced during the 2011 renovation of the building. Currently a study is underway for the replacement of windows at the historic Lone Mountain site.

New Construction

The newest addition to campus, the 58,000 square foot Lo Schiavo Center for Science & Innovation, is on track for gold LEED certification. It employs a sophisticated building management system that tracks interior and exterior conditions. Automated windows open and close to allow natural flow of outside air to provide interior optimum temperatures and comfort levels. The building makes extensive use of natural day-lighting with corridors on the exterior of the building and an abundance of glass partitioning and skylights for classrooms and labs. A living roof over the plaza level portion of the building is populated with Bay Area indigenous plant life and acts as insulation so the space below requires less heating or cooling. Interspersed among the plants are several bio-ponds that create habitat for local insects and birds.

The building was designed for cross-disciplinary use, particularly for the sciences but for other disciplines as well. This cross-utilization of classroom and laboratory space, enabled the design of a building with lower mass and less materials. A 25,000-gallon cistern collects storm run-off, diverting it from the San Francisco sewer system and allowing for the water to be used for make-up water for cooling towers in adjacent buildings. The materials used in the furnishing of the building were low VOC and were manufactured with a high recycled material content. This signature building exemplifies USF's commitment to the protection and enhancement of the environment.

Waste Management & Recycling

The University hosted San Francisco's first central recycling center in 1970, giving Richmond Environmental Action free land as a home for its drop-off and processing depot. The partnership lasted for 26 years until the University needed the land to build much needed housing.

USF students spearheaded the first concerted campus recycling effort in 1979 collecting paper, bottles and cans. The university placed the student recyclers under Facilities as the scope on campus increased. 2003 marked the year USF began collecting and recycling e-waste, three years before any law or mandate to do so. A compost collection program began in the back-of-house operations of the food services in 2006 and in 2007 expanded to the front-of-house and began in residence halls. The Eco-Educator program began in 2011 in the main dining services area, placing recycling ambassadors at recycling/composting/waste locations to facilitate fellow students

correctly sorting their disposable items, providing both on-the-spot education and reducing cross-contamination. The university also provides student staffing for a year-round Neighborhood Clean-up Program where all the neighborhoods surrounding the university are canvassed for litter, which is recycle, compost and waste sorted. The main campus diverts 63-67% of all waste from landfill.

USF participates in Recyclemania, a national competition between over 600 universities. In 2012 USF placed 25th out of 605 schools in the composting competition, and 63rd overall for the Grand Championship. Additionally, recycling has been implemented in the residence halls and dozens of existing water fountains have been upgraded to encourage the use of reusable bottles.

Each month, USF collects 131 tons of recycling and composting combined. With eWaste and scrap metal, the University diverts 64% of its waste from landfill. Nevertheless, USF still generates 93 tons of trash every month and almost 75% of it still recyclable. USF is working to improve that ratio.

Campus Environment

The University's contracted janitorial service has been LEED certified for its green practices and use of environmentally friendly cleaning products.

The University in May 2008 established its 54 acres of campus smoke-free and has implemented a concerted effort of educating student and faculty-staff during orientations about the policy. Students are employed by the campus student health department to act as Fresh Air Marshals, interacting with smokers who do light up on campus to make them aware of the policy.

Sustainable Transportation

The University of San Francisco first implemented transportation demand management strategies in the early 1980s. USF's current Transportation Demand Management (TDM) program offers a variety of strategies to encourage the USF community to use alternative transportation and reduce drive-alone rates. The purpose and goals of the TDM plan is to reduce USF community generated vehicle trips from traveling to and from campus. By extension the plan improves pedestrian safety, reduces vehicle emissions, and improves neighborhood quality of life.

The existing TDM program offers the following services:

- Night Shuttle Service

- Muni FastPass for Students
- Preferential Parking Spaces and discounted parking rates for Carpools
- Zipcar and City Car Share
- ZimRide Ridesharing Program
- Commuter Check program, partial commuting subsidy for faculty and staff
- Commute Buddy Program
- Guaranteed Ride Home
- Bicycle Racks
- Marketing Efforts & Enhanced Transportation Website

2.2 Academics, Scholarship and Service

Degree Programs and Course Offerings

USF has multiple degree programs that focus on the environment and sustainability, and include coursework or research on climate change. The College of Arts & Sciences administers a Masters of Science in Environmental Management (MSEM), a Bachelors of Arts in Environmental Studies (ENVA), a Bachelors of Science in Environmental Science (ENVS), as well as undergradute minor degree programs in ENVA, ENVS and Urban Agriculture. The Architecture and Community Design major emphasizes "Building Communities for Human & Environmental Sustainability." Many of its required courses integrate sustainability themes and at least five of its electives are explicitly focused on sustainability topics. The International Studies major includes an environmental track that students may follow, and the Sociology major offers an optional emphasis in "Urbanization and Environment." Two relatively new Masters of Arts programs in the college–Public Affairs and Urban Affairs–have expressed interest in adding specialization in sustainability. The MA in Urban Affairs currently offers an elective on "Critical Sustainabilities." The Masters of Arts in International Studies requires a course titled "Globalization, Development and Environment." A total of 128 courses are offered in the College of Arts & Sciences that engage in some way with environmental and/or sustainability issues.

The School of Management and the College of Arts & Sciences currently offer joint MBA/MSEM degrees. The joint degrees enable students to gain technical expertise in the environmental field as well as management training. Graduates of the student-initiated joint program have gone on to careers in environmental finance, clean tech, corporate social responsibility, and national environmental administration.

The School of Management also offers an online advanced professional certificate in Sustainable Supply Chain Management that includes courses on Sustainable Supply Chain Management and Corporate and Environmental Sustainability. The certificate program is a USF-branded certificate offered through a for-profit online education service called University Alliance. A total of nine courses are offered in the School of Management which engage in some way with environmental or sustainability issues.

The School of Law has an active environmental law society and advisory board. Students earning a JD can choose the "Property & Environmental Law" cluster for their electives. Courses include "Energy Law," "Environmental Law," "International Environmental Law," "Land Use Law," and "Water (& Natural Resources) Law."

The School of Nursing and Health Professions offers a Masters in Public Health that includes a course titled "Environmental and Occupational Health Issues in Public Health."

The School of Education has individual students and faculty working on environmental education, yet does not currently have a degree program or courses with environmental or sustainability emphases.

Faculty Research

Faculty in the environmental degree programs (ENVA/ENVS/MSEM) are engaged in research ranging from wetland restoration and international environmental treaties to urban sustainability and climate change adaptation. Additional faculty in Computer Science, Economics, and several other departments or programs also conduct research in environmental fields. Several of these faculty have received National Science Foundation funding, Fulbright Awards, and other honors for their research, even while they are dispersed throughout the University. There is opportunity to align these award-winning efforts into a cohesive inter-departmental partnership to pursue new collaborative research and build new partnerships to benefit the environment.

Community Engagement

Community engagement is at the heart of each of the environmental degree programs. Faculty engaging in research in environmental fields often work closely with community partners and through their teaching connect students to the community partners. An excellent example of this is the free monthly community dinner at a nearby church. Students in the Urban Agriculture program prepare the meal with food grown in the USF garden and gleaned from local farmers markets. Students in Architecture and Community Design regularly work with community partners to provide design solutions to building, resource management, and other sustainability challenges. As

with faculty research, no mechanism exists to gather instances of community engagement around sustainability, so the extent of these efforts is not fully known.

3. Greenhouse Gas Emissions Inventory

3.1. Methodology

The USF greenhouse gas inventory is a best estimate of annual emissions resulting from operations within university boundaries (mainly energy consumption) and associated activities (transportation and waste).[2] Also referred to as a "carbon inventory," the inventory follows commonly utilized methodology, based on internationally accepted IPCC guidelines and the Greenhouse Gas Protocol (World Resources Institute and World Business Council on Sustainable Development), adapted for universities into a Campus Carbon Calculator by Clean Air Cool Planet. (CA-CP). A partnership between Clean Air Cool Planet and Sightlines LLC has led to a new web-based tool, CarbonMap.[3]

University greenhouse gas emissions are organized into three "scopes," based on the location and level of control over the emissions, as illustrated in Figure 4. The three scopes include:

Scope 1 - direct GHG emissions from sources that are owned or controlled by the institution, including: production of electricity, heat, or steam (e.g., natural gas-fired boilers and co-generation facility); university-owned vehicle fleet; fugitive emissions (from unintentional leaks of refrigerant).

Scope 2 - GHG emissions from imports of electricity, heat or steam (e.g., purchased electricity from Pacific Gas & Electric Company (PG&E)).

Scope 3 - indirect sources of GHG emissions that may result from the activities of the institution but occur off-campus from sources owned or controlled by another company, such as: business air travel, commuting to and from the university, outsourced activities and contracts, and methane emissions from solid waste and sewage.

An initial carbon inventory was conducted by students and faculty in collaboration with USF Facilities staff in 2008-2009. The initial inventory Included analysis of carbon savings due to co-generation, solar electricity (photovoltaic), solar water heating, recycling and composting. The initial inventory also estimated future savings from boiler efficiency improvements, but had only limited data on commuting and air travel. The university subsequently hired Sightlines LLC to conduct annual inventories, based

[2] Current university carbon inventory methodology focuses on operational emissions. Emissions from production of the food eaten on campus or products consumed on campus are not included in this inventory. Nevertheless, we include some strategies to reduce food-related life-cycle emissions in our climate action plan.

[3] See the campus CarbonMap tool for more details: http://campuscarbon.com

on the university fiscal year .[4] Improved data gathering led to better estimates of emissions from commuting and air travel. Analysis of carbon savings from current efforts is still needed, in addition to the inventory presented here.

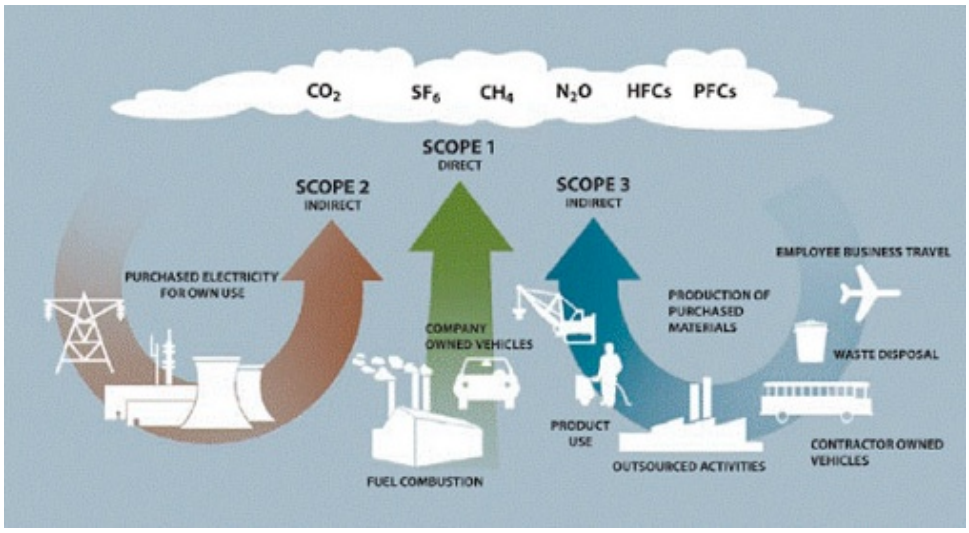


Figure 4. Greenhouse Gas Emission Scopes
Source:

Throughout this report, the term "carbon" is used interchangeably with the terms "greenhouse gas" or "GHG," since the two main greenhouse gasses, CO_2 and CH_4, are carbon-based. Emissions are presented in metric tons of carbon dioxide equivalent (tCO_2e). Each greenhouse gas absorbs different levels of heat in the atmosphere, i.e., each greenhouse gas has a different global warming potential (GWP). For example, one unit of CO_2 has a global warming potential of 1, while the same amount of methane (CH_4) causes 21 times as much warming.[5] To sum up the influence of the different gasses into a single emissions number, we convert the emissions to carbon dioxide equivalents.

3.2. USF Operations and Major GHG Emissions Sources

The campus operations that are major emission sources include: on-site co-generation of electricity and steam heat; on-site boilers for space heating and water heating; electricity purchased from Pacific Gas & Electric (PG&E); commuting to and from campus; university air travel; and waste disposed in landfill.

[4] For example, FY2013 runs from 1 June 2012 to 31 May 2013.
[5] For more information on global warming potential and residence times of greenhouse gases in the atmosphere, see IPCC 2007 or IPCC 2013.

A snapshot of the FY2013 inventory in Figure 5 shows that the three big carbon sources at USF are:

1. On-site stationary sources: (natural gas for water heating and space heating),
2. Co-generation of electricity and steam heat (fired with natural gas)
3. University travel (air and ground).

On-site stationary sources. Considering the mild Mediterranean climate of San Francisco, the large share of boiler emissions (for space heating and water heating) is somewhat surprising. Peer-to-peer benchmarking of heating per gross square foot (GSF) of building space also shows USF boiler emissions to be relatively high. This may be due to the high intensity of building usage on campus (i.e., high population density). Energy auditing and enhanced data gathering may reveal other reasons for the large emissions from heating.

Electricity. Although USF purchased nearly as much electricity as it produced on-site in FY2013, emissions from on-site generation were greater. PG&E electricity has a lower carbon intensity (0.2997 tCO2e/MWh) than USF fossil gas-fired co-generation unit (0.6000 tCO2e/MWh). The PG&E generation mix includes hydropower and other renewables (geothermal, biomass, wind, solar), and the share of renewables is obliged to increase under California law, resulting in lower-carbon electricity. However, to properly compare the two sources of electricity, analysis of carbon savings from utilization of waste heat by the USF co-generation plan should be conducted. Electricity generated by the nearly 500-kW collection of solar PV installations on campus generate no greenhouse gas emissions and therefore don't appear in Figure 5.

Air travel and Commuting. USF emissions from air travel are on par with those from similar universities. Commuting emissions appear somewhat low relative to the large number of commuters to this urban campus. With further management travel data and analysis of transportation surveys, greater insight can be gained on commuting patterns and emissions.

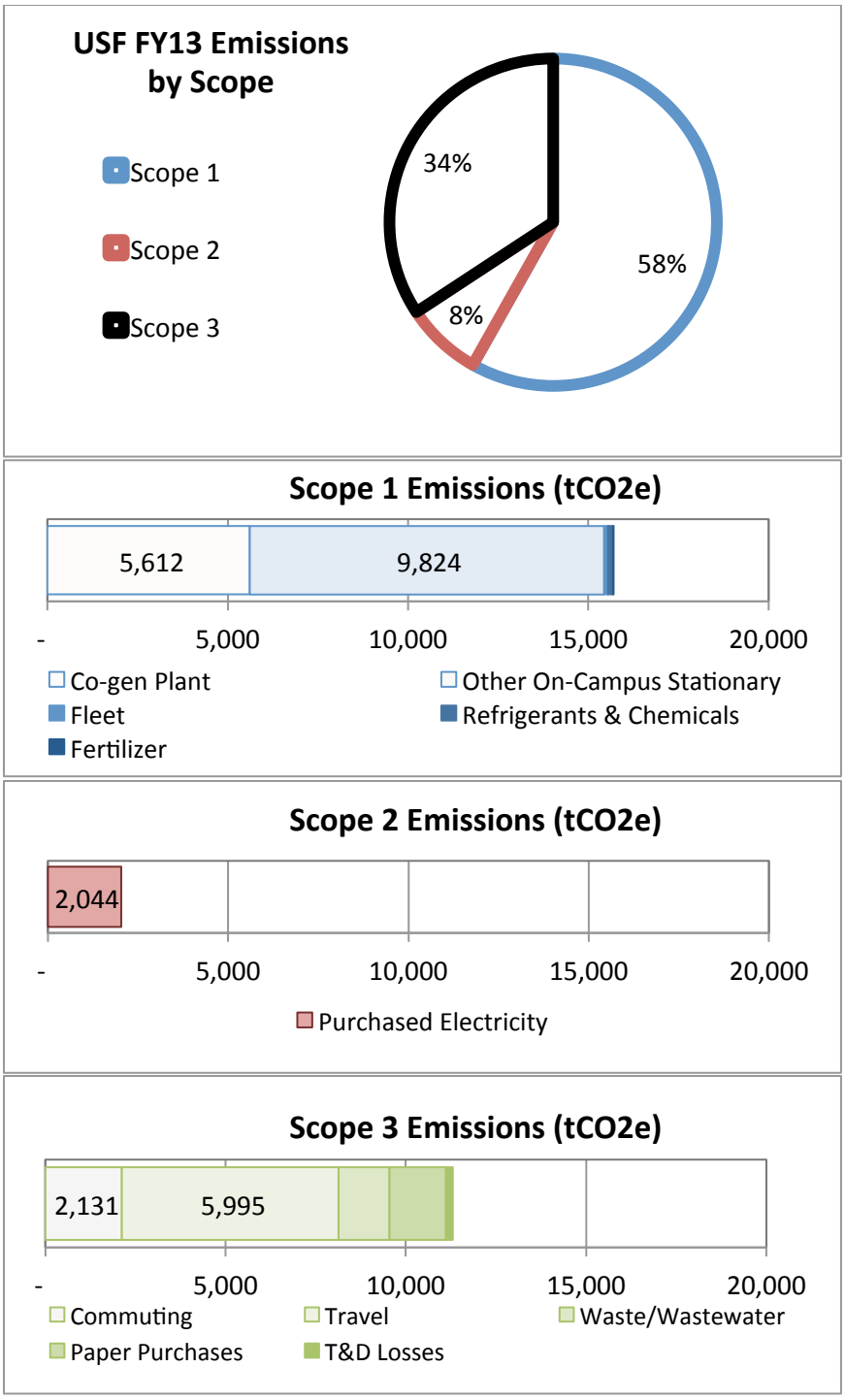


Figure 5. USF Greenhouse Gas Emissions, by Scope, FY13
Source: Sightlines LLC

3.3. USF GHG Emissions Trends FY 2005 - 2013

USF greenhouse gas emissions have fluctuated over the past eight years (FY 2005 – 2013), with a net decrease of -2%, as shown in Figure 5. In absolute terms, emissions declined overall from 28,410 tCO2e in FY2005, to 27,204 tCO2e in FY2013 (see Table 2). The emission savings were achieved despite an18% increase in student population and a 4% increase in gross square feet (GSF) of campus buildings.

The inventory from FY2005 to 2013 also shows that emissions can fluctuate significantly, due to changes in the amount of electricity purchased versus generated on-site, as well as weather conditions, construction, and changes in campus population. For example, the USF co-generation unit underwent major maintenance and boiler upgrades in FY2007 and FY2010. During those time periods, less power was produced by the co-gen and a greater share of electricity was purchased from PG&E, who provides relatively low-carbon electricity. From FY2010 to FY2012, emissions increased along with the student population increase. In FY2012 and 2013, emissions leveled off along with student population. In those years, less electricity was used overall, but emissions from boilers and transportation were higher.

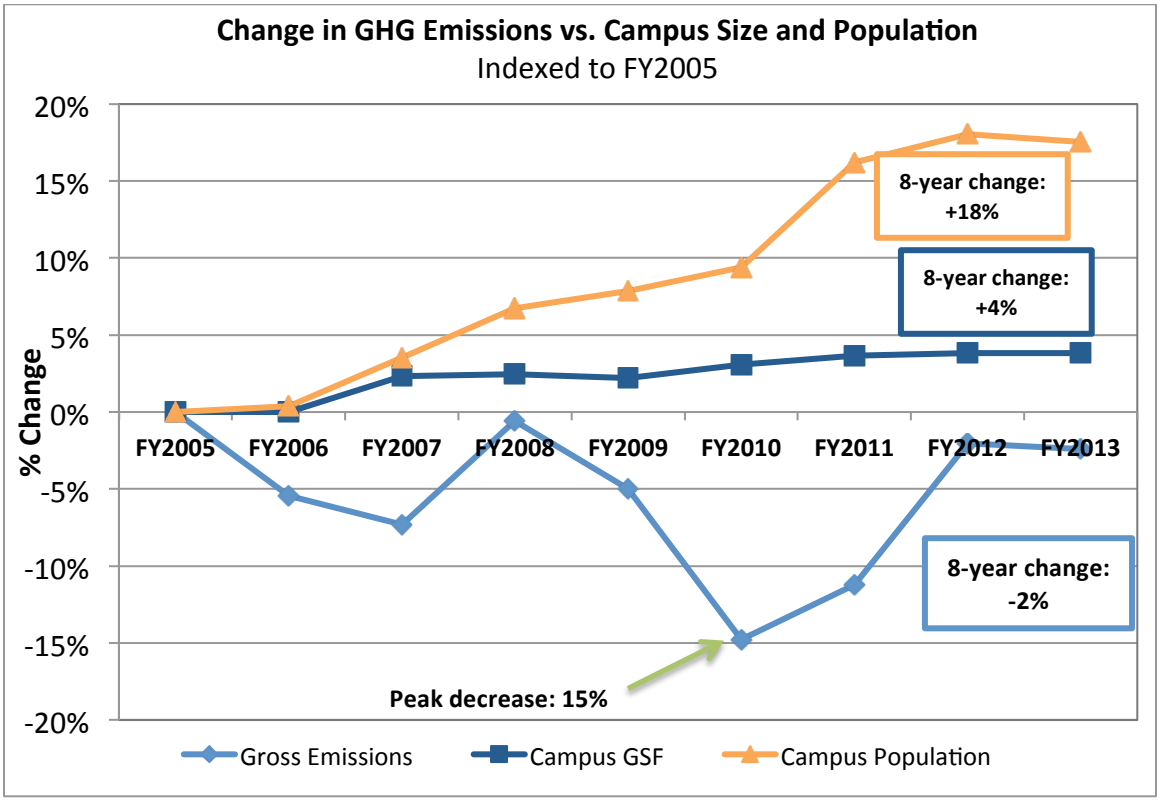


Figure 5. Change in GHG Emissions vs. Campus Size and Population

Source: Sightlines LLC

Table 2. USF Greenhouse Gas Emissions Summary (tCO2e), FY05 – FY13

	FY2005	FY2006	FY2007	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013
Scope 1	13,527	12,529	11,470	16,046	15,785	12,300	13,774	15,136	15,783
Scope 2	2,578	2,958	3,603	1,787	1,671	2,959	1,931	2,275	1,819
Scope 3	12,305	11,304	11,168	10,414	9,412	8,562	9,056	9,873	9,602
TOTAL	**28,410**	**26,791**	**26,241**	**28,247**	**26,868**	**23,821**	**24,761**	**27,284**	**27,204**

Source: Sightlines LLC

3.4. Future Energy and Carbon: Projections and Goals

To reach the goal of carbon neutrality, USF is setting several interim targets across its operations. To set these targets, the university, and its consultant Sightlines LLC, examined past trends, benchmarked its performance with peer institutions, considered its Institutional Master Plan and financing, considered upcoming state and local requirements, analyzed efforts of universities making the greatest progress in climate action, and estimated future energy and carbon scenarios. Based on available information, we are utilizing FY2013 as the baseline year, and 2050 as the target year for climate neutrality.

Business As Usual (BAU) Scenario

Based on the USF Master Plan, student population is expected to increase by1% per year over the next 10 years. Campus building floor space is planned to increase 22% over the next years (FY2013 – FY2023). Without energy conservation or efficiency improvements, and without de-carbonization of energy supply or carbon offsets, USF's Business As Usual (BAU) carbon emissions are estimated to increase by 18% over the 10-year time period. The BAU scenario is shown in Figure 6.

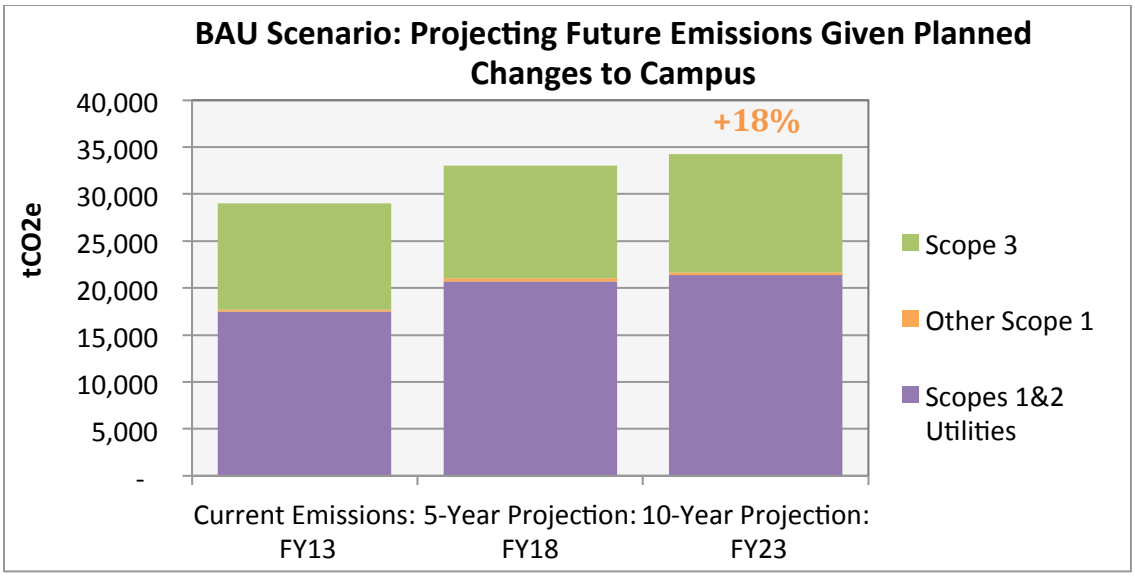


Figure 6. USF BAU Emissions Scenario, FY2013 – FY2023.

Source: Sightlines LLC

Future change to GSF: From FY13 Master Plan, pages 67-71 **(indexed to FY13)**	**FY18: 19%**	**FY23: 22%**
Future change in Population: From FY13 Master Plan, page 62. **(indexed to FY13)**	**FY18: 5%**	**FY23: 10%**

To counteract the Business As Usual scenario, and shift toward carbon neutrality in an active and realistic way, USF asked Sightlines to conduct initial analysis of its facilities and benchmarking with peer institutions. From this initial analysis, USF identified emission reduction targets and strategies for further investigation and implementation.

Because USF installed a gas-fired co-generation plant (to capture waste heat) and solar water heating (to reduce fuel use) in the 1980s, and installed nearly 500 kW of solar photovoltaic arrays in the 2000s, the university has already made great strides in avoiding greenhouse gas emissions. As a result, USF does not have the quick and big fixes that some universities are now undertaking. Rather, future energy and carbon savings will have to come from multiple initiatives, including well-understood energy monitoring and conservation efforts, as well as new initiatives in building design and renewable power supply.

Utilizing 2013 as a baseline year, USF has identified the following interim targets to achieve the long-term carbon neutrality goal:

5-year target (2013 – 2018):	20% overall GHG savings
10-year target (2013 – 2023):	40% overall GHG savings
20-year target (2013 - 2043):	80% overall GHG savings.
Carbon neutrality target year:	2050

The 10-year target, shown in Figure 7, is based on:
- 25% savings in Utilities emissions
- 25% savings in Commuting emissions
- 100% offset of Travel emissions
- 20% savings in Waste and Other indirect emissions.

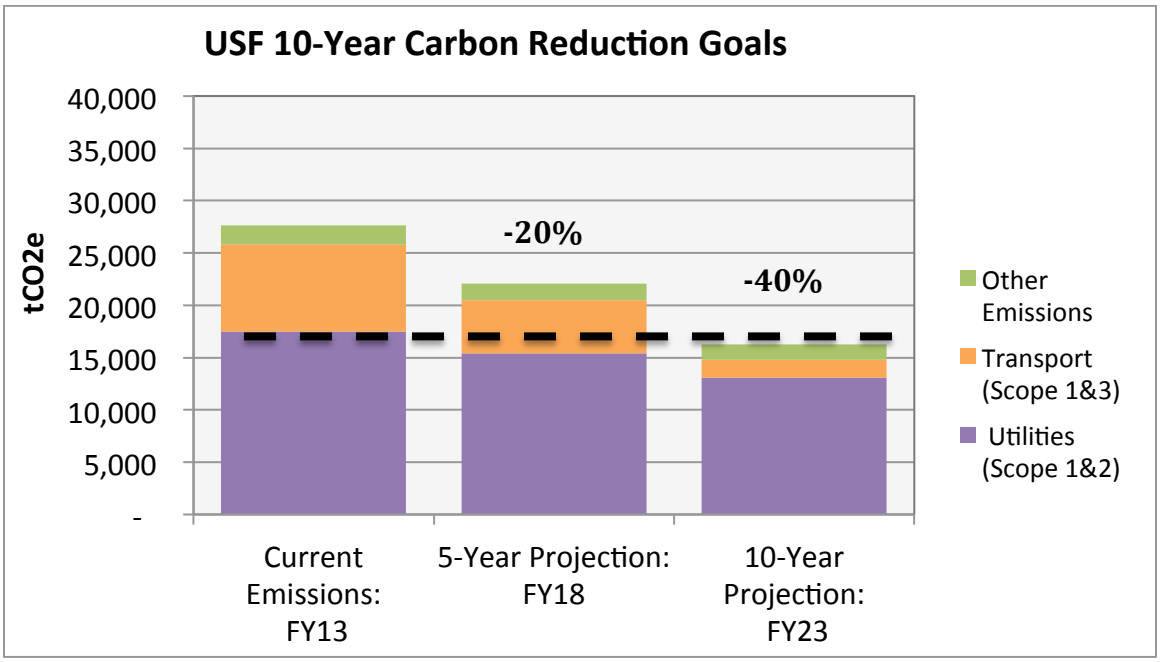


Figure 7. USF 10-Year GHG Emissions Saving Goals, FY2013 – FY2023.

In terms of metric tons of CO2e, the baseline and targets are:

2005 GHG emissions (start of GHG emissions estimates):	28,410 tCO2e
2013 GHG emissions (baseline year for CAP targets):	27,606 tCO2e
2018 GHG emissions target:	22,076 tCO2e
2023 GHG emissions target:	16,246 tCO2e
2043 GHG emissions target:	5,244 tCO2e
2050 GHG emissions target:	0 tCO2e

These targets are based on analysis of savings and offset opportunities in each sector of USF operations. Details are provided in Section 4. Future Energy and Carbon Saving Strategies.

4. Future Energy and Carbon Saving Strategies

To reach its Climate Action Plan targets, the university has identified priority strategies for energy and carbon savings (see Figure 8):

1. Conserve energy and carbon (reduce demand),
2. Enhance efficiency (reduce intensity),
3. De-carbonize supply (renewable energy),
4. Offset (reduce emissions elsewhere).

These strategies giving highest priority to actions that address the cause of the emissions problem on campus—namely, energy demand—by creating awareness and encouraging less consumptive behavior, as well as improved building design and technological upgrades. Attention is then given to improving efficiency, lessening the impact of energy supply, and as a last resort, offsetting emissions through off-site carbon saving.

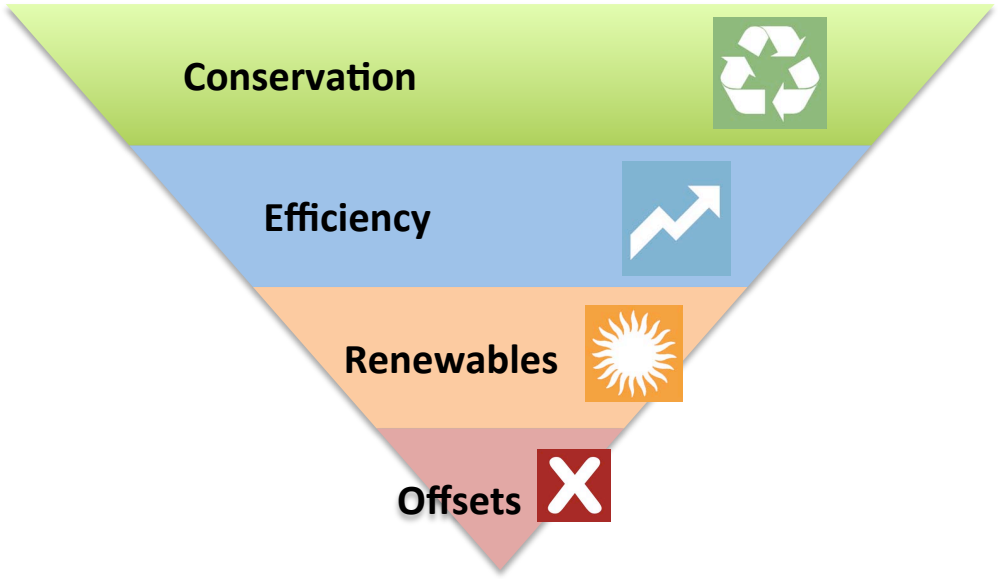


Figure 8. Priorities for Energy and Carbon Saving

For example, for on-site stationary sources, these priorities include:
1. Shift to passive systems (e.g., better thermal mass/insulation, day-lighting) and change behavior;
2. Make technical efficiency improvements (e.g., boiler upgrades);
3. use renewable power (solar water heating, PV electric, wind or geothermal, bio-gas, renewable energy credits);
4. Buy off-sets or conduct local off-set projects.

In addition, several criteria are considered in selecting energy and carbon saving strategies:

- University mission
- Educational value
- CO2e reduction potential
- Social and Ecological benefits and costs
- Economic benefits and costs
- Risk reduction

Table 3 summarizes the main strategies for each sector of university operations, keeping in mind the priorities and criteria for energy and carbon saving noted above. The strategies include near-term actions, such as energy auditing and monitoring, and longer-term actions, such as implementing net-zero energy building design in new construction. Implementing these actions will involve engaging the campus community in Green and Gold campaigns, strengthening partnerships with San Francisco-based organizations, and actively participating in national networks such as the ACUPCC and the Association for the Advancement of Sustainability in Higher Education (AASHE).

Table **3**. Summary of **USF** Energy and Carbon Saving Strategies

Educate and Engage
1. Establish an Office of Sustainability and University Sustainability Coordinator to coordinate climate action and sustainability efforts.
2. Engage the campus community to be Green and Gold: Green Offices, Green Classrooms, Green Labs & Studios, Green Dorms, Green Events, Green Commuting.
3. Engage the surrounding community, alumni, and prospective students: develop climate and sustainability partnerships with City of San Francisco, Bay Area organizations, California agencies (CARB) and national organizations (AASHE); feature sustainability in external communications.
4. Enhance climate and sustainability education and research across the university, in keeping with USF mission as a socially responsible learning community.
Conserve Energy in Buildings
1. Implement energy auditing and monitoring systems, to identify opportunities for energy demand reduction in water heating, space heating, electric appliance usage.
5. Implement energy management systems,
2. Require extensive use of passive energy systems in all new construction and upgrades (solar gain, shading, daylighting, ventilation).
3. Work with the City of San Francisco toward net-zero energy (and carbon) in all new construction and major retro-fits.
Enhance Efficiency
1. Analyze opportunities for boiler efficiency upgrades on Lone Mountain campus.
2. Analyze opportunities for additional efficiency upgrades in the USF co-generation plant.
3. Examine the potential for efficiency gains in refrigeration, lighting, cooling of

computer clusters, and other commonly used appliances.
De-Carbonize Energy Supply
1. Conduct feasibility assessment for low carbon space heating and water heating: geothermal heating, additional solar water heating, bio-gas use in boilers, renewable electric heating.
2. Conduct feasibility assessment for use of bio-gas in the USF co-generation plant.
3. Conduct feasibility assessment for other on-site renewable electricity generation: wind, additional photovoltaics (PV), renewable fuel cells.
4. Explore additional Power Purchasing Agreements, Renewable Energy Credits, and other purchase options for renewably-generated electricity and heat.
Transport Sustainably
1. Enhance communication, website, comprehensive marketing about sustainable transportation for USF.
2. Secure more housing on-campus or near campus, to reduce the need for commuting.
3. Enhance infrastructure and support for bicycles and walking: increase bike racks and lockers, install ing secure & covered bike storage, bike sharing (USF or San Francisco program), discounts at local bike shops, walking and biking route maps with local businesses.
4. Greater support for mass transit: display departure times in campus buildings, examine shuttle option, expand transit subsidy, collaborate with City to achieve mutual goals.
5. Encourage fewer vehicles overall, support low-carbon vehicles: expand car share and ride share programs; increase parking prices and street timer restrictions, consider charging stations and preferential parking for low-carbon vehicles.
6. Lighten up on air travel; offset remaining travel emissions.
Minimize Waste, Recycle, and Compost
1. Conduct waste characterization study and analyze emissions avoided from waste minimization, recycling and composting. Target future actions based on the studies.
2. Analyze and implement options: greater availability of recycling and compost bins in bathrooms and common spaces; hand dryers or compost bins to reduce paper towel waste; green purchasing program to reduce life-cycle waste of common products.
Conserve Water
1. Analyze and target reductions in hot water usage, to save heating energy and carbon, as well as water. Consider shower timers in dorms and gyms.
2. Develop overall water conservation plan and stormwater plan, to manage ongoing impacts of climate change related to water.
Manage Food and Land
1. Analyze life-cycle emissions related to food and land management, to include in the carbon inventory and further guide sustainability efforts.
2. Enhance efforts to support: local food, community food production, low-carbon food choices, reduction of food waste, food recovery, composting.
3. Enhance efforts to incorporate drought-tolerant, ecologically beneficial land management on campus and in local partnerships.
Offset Remaining Carbon
1. Use carbon offsets as a last resort strategy to achieve carbon neutrality, for indirect emissions such as air travel emissions.
2. Develop offset purchasing guidelines to ensure the University is making quality investments in off-site carbon reduction.
3. Prioritize locally focused projects in offset purchasing decisions.

4. Connect responsibility for offset payments, such as air travel offsets, with the group sponsoring the activity.

4.1. USF Buildings: Conserve Energy, Improve Efficiency

Energy conservation and efficiency are the priority strategies for smart use of energy in USF buildings and facilities. Providing an energy service—such as lighting, heating, ventilation, or computing—with less energy, lessens environmental impacts and saves money for the university.

Buildings and Utilities Goal: Decrease energy utility-related emissions by 25% over the next ten years (from FY13 to FY23).

Figure 9 shows the level of energy conservation and efficiency improvements in energy use in USF buildings leading to a 25% savings in energy utilities and carbon. Review of USF facilities and benchmarking of USF with peer universities identified opportunities for reducing energy intensity per gross square foot (GSF) of building space.

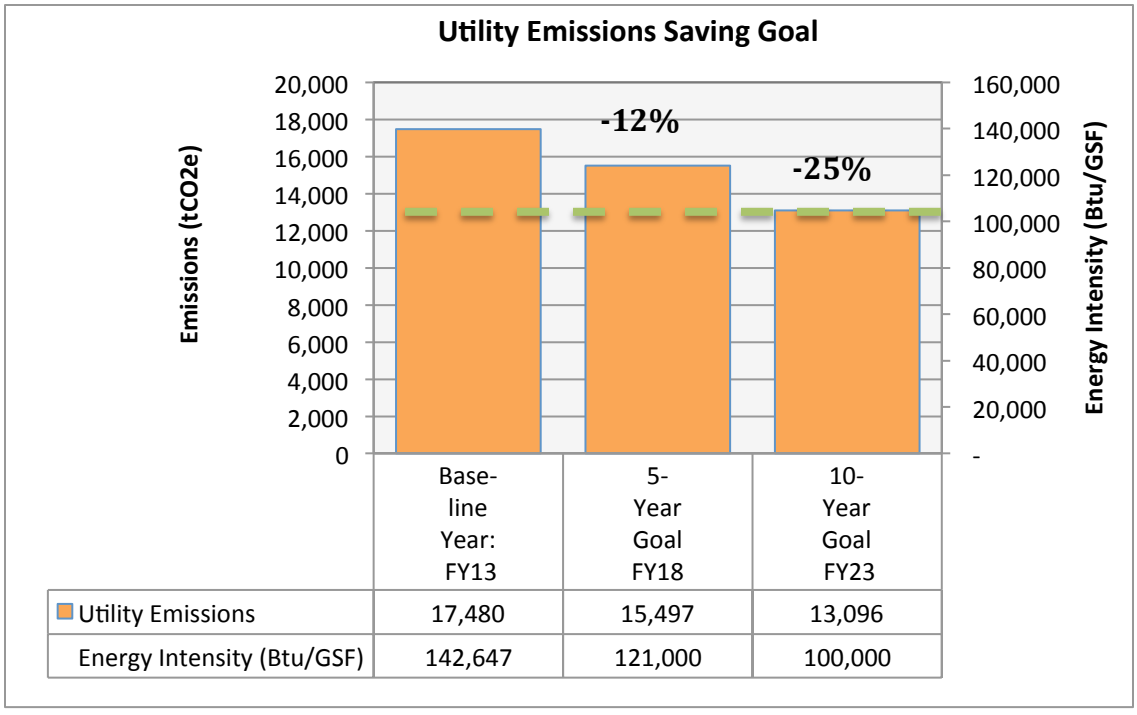


Figure 9. Utility GHG Emissions Saving Goal

Source: Sightlines LLC

Building Strategies: Conservation, Efficiency

1. Implement energy auditing and monitoring systems, to identify opportunities for energy demand reduction in water heating, space heating, electric appliance usage.
2. Examine the potential for efficiency gains in refrigeration, lighting, cooling of computer clusters, and other commonly used appliances.
3. Engage the campus community to be Green and Gold, including: Green Offices, Green Classrooms, Green Labs & Studios, Green Dorms, Green Events, Gold LEED certification.
4. Require extensive use of passive energy systems in all new construction and upgrades (solar gain, shading, daylighting, ventilation).
5. Work with the City of San Francisco toward net-zero energy (and carbon) in all new construction and major retro-fits.

USF is already examining LEED certification of the planned new Lone Mountain residence hall, which would include use of passive energy systems, efficient building systems, as well as photovoltaics on the roof for renewable generation of electricity. USF is also planning to conduct a campus refrigeration inventory, which would inform investment in newer more efficient models; thin multiple department kitchen units; and supply residence halls with Energy Star models as part of the room. Other projects under consideration are to connect steam-loop back to the Co-Generation plant to re-capture remaining waste heat, and a LED lighting expansion with daylight & dimming controls.

4.2. Energy Supply: De-Carbonize, Improve Generation Efficiency

Efforts to lessen energy demand and improve the efficiency of energy use are priority strategies to reduce the University's energy consumption and carbon emissions. A lower level of energy demand can then more feasibly be supplied by efficient and renewable energy sources. USF's current energy supply comes in the form of electricity and heat. Electricity is generated from the fossil gas-fired co-generation plant, on-site solar photovoltaics, and the PG&E mix, while heat is provided from fossil gas boilers, recovered steam heat from co-generation, and solar water heating. Because USF already uses the lowest carbon fossil fuel—natural gas—fossil fuel switching is not an option for carbon savings. Further energy supply efforts must involve improvements in

supply efficiency as well as de-carbonization through renewable energy sources, on-site and purchased.

De-Carbonization Goals: Contribute to the decrease of utility-related emissions by 25% over the next 10 years (from FY13 to FY23).
Develop a plan to reach 100% renewable energy from on-site and purchased supply by the year 2050.

De-Carbonization Strategies:

1. Conduct feasibility assessment for low carbon space heating and water heating: geothermal heating, additional solar water heating, bio-gas use in boilers, renewable electric heating.
2. Conduct feasibility assessment for use of bio-gas in the USF co-generation plant.
3. Conduct feasibility assessment for other on-site renewable electricity generation: wind, additional photovoltaics (PV), renewable fuel cells.
4. Explore additional Power Purchasing Agreements, Renewable Energy Credits, and other purchase options for renewably-generated electricity and heat.

USF can work in partnership with the City of San Francisco, to evaluate and implement campus projects that also contribute to the city-wide goal for 100% renewable electricity in homes, 80% in commercial facilities. USF can also work in partnership with Pacific Gas & Electric and other power providers to reach 100% renewable energy supply.

To improve efficiency in energy supply, the university is analyzing opportunities for additional efficiency upgrades in the USF co-generation plant. Analysis of heat savings from the co-genreation plant is also needed.

4.3. Transport Sustainably

Commuting

As an urban campus in a city lauded for sustainable transportation,[6] USF has the opportunity to strengthen partnerships with the City of San Francisco, local coalitions, and regional agencies to achieve energy and carbon savings. The City already has a

[6] In 2012, the Institute for Transportation and Development Policy awarded San Francisco the annual Sustainable Transport Award. See: http://www.smartplanet.com/blog/solving-cities/which-us-city-has-the-most-sustainable-transportation/

well-developed public transit system, demand-based variable pricing on parking, and an expanding bicycle network along with pedestrian-friendly street enhancements. At the same time, a high-priced housing market is pushing many USF community members farther away from campus. These are the benefits and challenges USF considers in its strategies for sustainable, low-carbon commuting.

Commuting Goal: Decrease emissions from student & employee commuting by 25% over the next 10 years (from FY13 to FY23).

Commuting Strategies: Conservation, Efficiency, De-Carbonization and Offsets

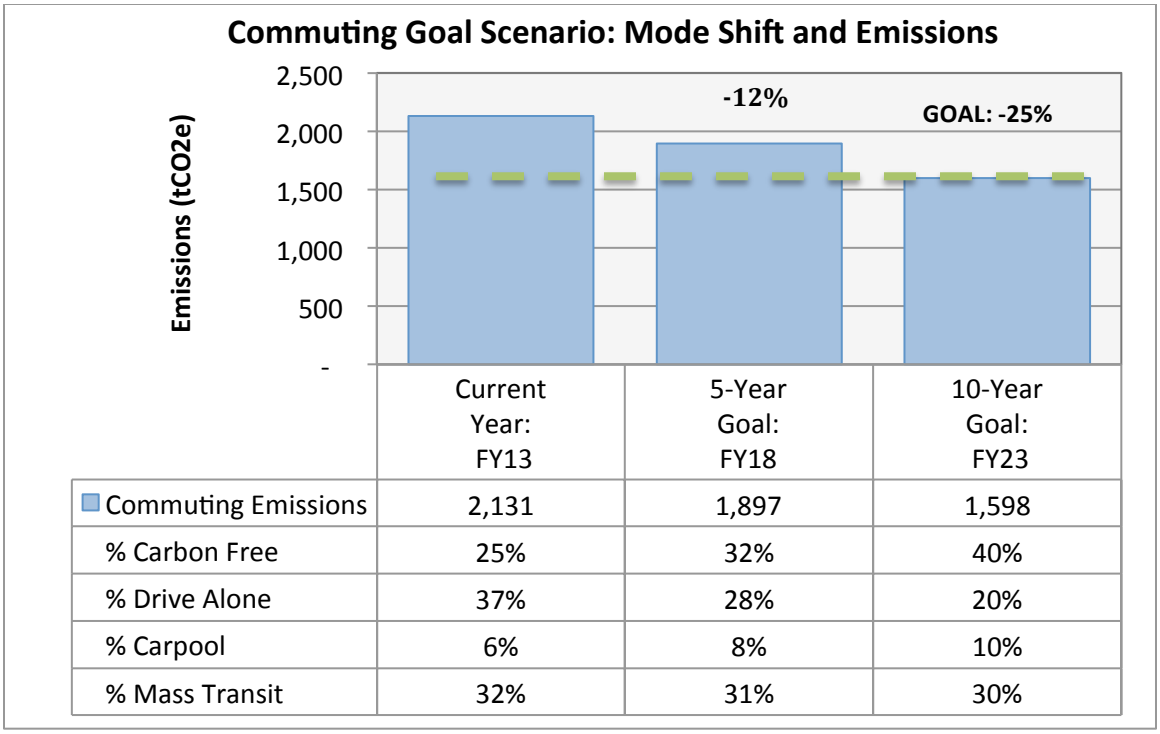
1. Enhance communication, website, comprehensive marketing about sustainable transportation for USF.
2. Secure more housing on-campus or near campus, to reduce the need for commuting.
3. Enhance infrastructure and support for bicycles and walking: increase bike racks and lockers, install secure & covered bike storage, bike sharing (USF or San Francisco program), discounts at local bike shops, walking and biking route maps with local businesses.
4. Greater support for mass transit: display departure times in campus buildings, examine shuttle option, expand transit subsidy, collaborate with City to achieve mutual goals.
5. Encourage fewer vehicles overall, support low-carbon vehicles: expand car share and ride share programs; increase parking prices and street timer restrictions, consider charging stations and preferential parking for low-carbon vehicles.

Increased housing on-campus or other housing-related efforts near campus will conserve transport energy and carbon, by reducing the need for commuting and shifting to non-motorized commuting modes (walking and bicycling). One of the biggest influences on student driving is the proximity of student housing to campus. Currently, USF can only accommodate 38 percent of the undergraduate student population in residential campus housing facilities.[7] The proposed new dormitory on the Lone Mountain campus could make an important contribution to reducing commuting emissions.

Increased use of public transit improves efficiency per passenger mile and utilizes lower-carbon energy sources (e.g., electric trains and busses, fuel cell and bio-diesel busses). Encouragement for car pools improves efficiency and support for low-carbon

[7] Lund and Chang, 2013.

vehicles (e.g., electric vehicles, plug-in hybrids) reduces the carbon per passenger mile. Figure 10, based on analysis by Sightlines LLC, illustrates how these strategies can encourage a shift to lower carbon transportation modes to meet USF goals for sustainable transportation. Achievement of the USF goals is intertwined with City and regional initiatives for sustainable transportation and affordable housing.



	Current Year: FY13	5-Year Goal: FY18	10-Year Goal: FY23
Commuting Emissions	2,131	1,897	1,598
% Carbon Free	25%	32%	40%
% Drive Alone	37%	28%	20%
% Carpool	6%	8%	10%
% Mass Transit	32%	31%	30%

Figure 10. Commuting GHG Emissions Goals: Save 25% in 10 Years
Source: Sightlines LLC Consultants

The University has already employed a traffic consulting firm and conducted a comprehensive Transportation Demand Management (TDM) study. The primary goal of the expanded TDM plan is to reduce the drive-alone rate and reduce future parking demand by 13% by 2022. The expanded TDM Plan (section 1.3) has fourteen strategies, which can be analyzed for carbon-saving benefits:

- Comprehensive Marketing Efforts
- Enhance transportation website
- Shuttle System. Examine optimal options to offer first/last mile connections from BART, Caltrain, and potentially other locations within SF.
- Expand transit subsidy (beyond Muni FastPass) for students
- Increase prices of on-campus parking permits (implementation started 2014)

- On street timer restrictions, in collaboration with USF neighbors
- Expand preferential parking for carpools
- Bicycle sharing
- Additional bicycle racks
- Secure and covered bicycle cages or lockers
- Discounts with local bicycle shops
- Commute buddy program
- Expand car share program (expansion begun in 2013)
- Expand Ridesharing Program (expansion begun in 2013)

To support these measures, USF can educate commuters on alternatives to driving alone and investigate their reasons for not choosing other options. USF can also improve infrastructure for and safety of pedestrian and biking options, take advantage of the opportunity for telecommuting when reasonable, incentivize carpooling and use of mass transit, and limit convenient low-price parking options.

Air & Ground Travel

The largest share of USF transportation emissions are due to air travel for university business. Ground travel also adds emissions. Travel is an integral part of maintaining University visibility, recruiting top-tier students, and supporting faculty research.

Travel Goal: Offset 50% of travel emissions in the next five years, 100% in the next ten years (FY13 to FY23).

Travel Strategies: Conservation, Offset

Investigate options for attending conferences remotely and cut back on non-essential travel. Encourage low-carbon travel modes as much as possible—direct flights use less energy; rail travel has lower emissions than air travel. Develop a program for offsetting remaining travel emissions.[8]

4.4. Minimize Waste, Recycle, and Compost

USF, along with the City of San Francisco, has already taken important steps to reduce the amount of waste generated. Minimizing waste saves life-cycle resources, as well as saving carbon. Recycling of valuable materials (metals, plastics, paper) from products that can no longer be used is the next best strategy. For organic materials (food scraps,

[8] Several universities have already implemented travel offset programs, including Santa Clara University, Cornell, Duke, and Utah State.

waste paper products), composting utilizes the organic resources as fertilizer. Organic materials that end up as waste in a landfill will decompose, emitting methane (CH_4), which is 21 times more potent a greenhouse gas than CO_2. Thus composting is an essential strategy for reducing greenhouse gas emissions and meeting USF's climate action targets.

Waste Minimization Goal: Contribute to 20% savings in Waste, Water, and Other indirect emissions over the next 10 years (FY2013 – FY2023). Compost and Recycling are key components of these savings.

The USF climate action plan has two main strategies to encourage further waste minimization, recycling, and composting:

1. Conduct waste characterization study and analyze emissions avoided from waste minimization, recycling and composting. Target future actions based on the studies.

2. Analyze and implement options: greater availability of recycling and compost bins in bathrooms and common spaces; hand dryers or compost bins to reduce paper towel waste; green purchasing program to reduce life-cycle waste of common products.

4.5. Conserve Water

On the USF campus, the city of San Francisco, and the State of California, energy for water heating causes a significant share of greenhouse gas emissions. Saving hot water saves energy and carbon. In addition, California is already feeling the impacts of climate change in shifting rainfall and snowfall patterns. To manage the drought being faced by the state, USF needs to promote overall water conservation. (See Appendix C for more information on the water-energy nexus and opportunities for GHG saving from water conservation.)

Water Conservation Goal: Contribute to 20% savings in Waste, Water, and Other indirect emissions over the next 10 years.

The USF climate action plan has two main strategies for water conservation:

1. Analyze and target reductions in hot water usage, to save heating energy and carbon, as well as water. Consider shower timers in dorms and gyms.
2. Develop overall water conservation plan and stormwater plan, to manage ongoing impacts of climate change related to water.

Currently, the university has 46 different water accounts that are managed by different individuals. Some of these accounts include several buildings, making it hard to identify how much water is been utilized by a specific building or for a specific use. These issues make water management difficult since the accountability of water consumption is limited. USF Facilities recently started to consolidate all water accounts to track consumption. Based on FY2013 data, about 18% of the water purchased was used for irrigation and 82% of the water was used for domestic purposes. Domestic water is heated for showers, cooking, the swimming pool, and other campus activities. As seen in the USF carbon inventory, boilers for water heating and space heating are a large source of emissions. Therefore, in order to reduce CO_2 emissions, hot water consumption needs to decrease.

4.6. Manage Food and Land

Sustainable farming practices and low-carbon, healthy food choices are necessary to save resources, but those efforts are short-changed if food is wasted. Even with food sustainability efforts already implemented at USF, the university can do more to counter the U.S. trend of wasting 40% of our food.[9] Moreover, almost all of that uneaten food ends up rotting in landfills where organic matter accounts for 16 percent of U.S. methane emissions.[10] (See Appendix C for more details on life-cycle carbon of food, avoiding food waste and greenhouse gas emissions, and promoting sustainable food.)

Food and Land Goal: Contribute to 20% savings in Waste, Water, and Other indirect emissions over the next 10 years. This includes reducing food waste and fertilizer-related greenhouse gas emissions.

Strategies to increase awareness of the connections between food, land management, and climate change include:

1. Analyze life-cycle emissions related to USF food and land management, to include in the carbon inventory and further guide sustainability efforts.
2. Enhance efforts to support: local food, community food production, low-carbon food choices, reduction of food waste, food recovery, composting.
3. Enhance efforts to incorporate drought-tolerant, ecologically beneficial land management on campus and in local partnerships.

[9] Americans waste, throw away nearly half their food: study. http://www.reuters.com/article/2012/08/21/us-food-waste-idUSBRE87K0WR20120821

[10] Wasted: How America Is Losing Up to 40 Percent of Its Food from Farm to Fork to Landfill. NRDC issue paper, 2012.

4.7 Offset Remaining Carbon

Carbon offsetting is the reduction of Greenhouse gas (GHG) emissions off-site in order to compensate for emissions made on-site. Individuals, communities, institutions and governments can purchase carbon offsets to mitigate their own greenhouse gas emissions from transportation, electricity use, buildings, agriculture, etc. Offsets are usually earned by financial support of projects that reduce the emission of GHGs such as wind farms and reforestation projects. Unlike internal emission reduction methods, for example improving energy efficiency in buildings and power sectors, some colleges and universities purchase carbon offsets in order to achieve their carbon neutrality goals.

Offset Goal: ***Offset 50% of travel emissions in the next five years, 100% in the next ten years (FY13 to FY23).***

While USF can somewhat diminish travel, it is an important component of university activity that will continue and is therefore a good candidate for emissions offsets.

The USF approach to offsets is to:

1. Use carbon offsets as a last resort strategy to achieve carbon neutrality, for indirect emissions such as air travel emissions.
2. Develop offset purchasing guidelines to ensure the University is making quality investments in off-site carbon reduction.
3. Prioritize locally focused projects in offset purchasing decisions.
4. Connect responsibility for offset payments, such as air travel offsets, with the group sponsoring the activity.

Table 4 presents an offset analysis, considering all of USF GHG emissions and current carbon prices. California, which has launched its cap-and-trade program as part of the state's climate policy, has carbon prices in the past two years that were $10 to $14 per metric ton CO_2 equivalent (tCO_2e).[11] Though USF will first undertake energy and carbon savings on its own campus, and use offsets as a low-priority strategy, the analysis gives an overview of the current cost implications of carbon. As climate impacts become more and more apparent, and more stringent climate policies are implemented, carbon offset prices are likely to rise.

[11] Environmental Defense Fund. 2014. "California Carbon Market Watch: A COMPREHENSIVE ANALYSIS OF THE GOLDEN STATE'S CAP-AND-TRADE PROGRAM YEAR ONE 2012-2013." Available at https://www.edf.org/sites/default/files/CA_Carbon_Market_Watch-Year_One_WebVersion.pdf

Table 4. USF Carbon Offset Analysis

Scope	Category	FY13 Emissions (tCO2e)	Offset Cost (max per year) low price	Offset Cost (per year) high price*
			$10	$14
Utilities (Scope 1 & 2)	Boilers & Other Stationary Sources (Non Co-Gen)	9,824	$98,240	$137,536
	Co-Gen (electricity & steam heat)	5,612	$56,120	$78,568
	Purchased electricity	2,044	$20,440	$28,616
	Utilities Sub-total	*17,480*	*$174,800*	*$244,720*
Transportation	USF Fleet (Scope 1)	209	$2,090	$2,926
	Faculty & Staff Commuting	588	$5,880	$8,232
	Student Commuting	1,386	$13,860	$19,404
	Travel (Air & Other)	*5,995*	*$59,950*	*$83,930*
	Transport Sub-total	*8,178*	*$81,780*	*$114,492*
Other Emissions (Chemicals & Indirect Scope 3)	Refrigerants, Chemicals & Fertilizers	138	$1,380	$1,932
	Solid Waste to Landfill	1,389	$13,890	$19,446
	Wastewater	34	$340	$476
	Elec.T&D Losses	180	$1,800	$2,520
	Paper Life-cycle	50	$500	$700
	Other Sub-total	*1,791*	*$17,910*	*$25,074*
	TOTAL	**27,449**	**$274,490**	**$384,286**

*Notes: Thanks to USF MSEM student Weijia Li for preparing the offset analysis, May 2014. $14/tCO2e was the high carbon price in California in 2013. As climate policy develops, carbon prices may well rise.

Categories boxed in red are the main targets for offsets.

5. Education, Research, and Outreach for Climate Action

The recommendations that follow are oriented toward building the institutional framework required to integrate climate action and sustainability into the academic experience. USF has already succeeded in similar efforts with respect to institutionalizing social justice and diversity across the University and is well-positioned to integrate sustainability.

The USF College of Arts & Sciences Sustainability Strategic Plan, from which many of the recommendations below are adapted, calls for a reorientation "so that current and future students graduate with an understanding of the sustainability challenge and an ability to think critically about their role in addressing the challenge." Further, USF believes its moral and spiritual obligation to its community and beyond calls for every graduating student to leave the University with literacy in sustainability, including the causes of environmental impacts and strategies to sustain the natural and human environment.

5.1 Encourage and evaluate sustainability in the curriculum

As with any curriculum goals, the goal of sustainability in the University curriculum must be approached systematically. This can be accomplished by appointing a Sustainability Curriculum Committee tasked with assessing the current sustainability-related curricula and the extent to which it reaches a wide range of students. The committee will need to begin by identifying desired outcomes. What types of knowledge, attitudes, and behaviors are desired? This exercise can lead to a definition of "sustainability" as understood and practiced by the University, as well as help shape a set of criteria for what falls under the umbrella of "sustainability curriculum." The sustainability learning outcomes should be connected to the University's Institutional Learning Outcomes, particular outcome number seven:

> "Students describe, analyze, and evaluate global interconnectedness in social, economic, environmental and political systems that shape diverse groups within the San Francisco Bay Area and the world."

The Association for the Advancement of Sustainability in Higher Education's (AASHE) Sustainability Tracking and Rating System (STARS) provides universities with a framework for comprehensive measurement of sustainability efforts. The Sustainability Curriculum Committee will be guided by the "Academics" category of STARS. Criteria in this category include:

- Academic Courses
- Learning Outcomes
- Undergraduate Program
- Graduate Program
- Immersive Experience
- Sustainability Literacy Assessment
- Incentives for Developing Courses
- Campus as a Living Laboratory

Inventory of Sustainability Courses

Beginning with academic courses, the Sustainability Curriculum Committee will conduct a thorough inventory of existing courses with sustainability or environmental themes. Existing USF courses that engage with sustainability or environmental topics to a degree greater than passing mention, provide a starting point. The Committee can inquire with all departments and programs to update and request syllabi for all courses in the list.

Assessment of Student Sustainability Literacy

Another priority for the Committee is to assess the sustainability literacy of USF students. Existing survey instruments can be utilized. The Assessment of Sustainability Knowledge (ASK) tool, developed by Ohio State University's Environmental and Social Sustainability Lab has been tested thoroughly and could easily be adapted to the sustainability definition and outcomes generated by the Committee. Ideally, the questionnaire would be administered to a sample of entering and exiting students annually.

5.2 Develop Academic Strategic Plan for Sustainability

Based on the assessment conducted as part of 5.1, an Academic Strategic Plan for Sustainability can be developed. The College of Arts & Sciences Sustainability Strategic Plan can be used as a starting point. A timeline for implementation of the plan will be included. The Plan may include, but not be limited to, the following elements.

Sustainability Across the Curriculum

Sustainability course offerings at USF are found mainly in the College of Arts & Sciences. Another task of the committee will be development of incentives for sustainability

courses across the University. These might take the form of summer course development stipends or faculty workshops on integrating sustainability into courses (with course development resources made available to participants). Another approach to exposing more students to sustainability-related courses is to add a "Sustainability Literacy" or "Environmental Literacy" requirement to the Core Curriculum. This would elevate sustainability in the University's mission similar to the way that the current Service Learning and Cultural Diversity requirements institutionalize student engagement with essential elements of USF's mission. The task force can survey the many existing examples of sustainability general education requirements implemented at other universities and develop a set of recommendations for possible sustainability core requirement approaches for USF.

Offer Incentives for Sustainability-related Scholarship

Even modest resources could be used to great effect to incentivize sustainability scholarship while enhancing faculty-student collaboration. For example, students could compete to become Sustainability Fellows who would become part of a sustainability learning community of faculty and students. Fellows could also be assigned to specific faculty as research assistants. Faculty could be incentivized to participate in such a program with the promise of a research assistant and a small research grant. The Sustainability Fellows Program could be part of a larger Sustainability Honors Program, entry into which might require high academic standing and evidence of academic work in a sustainability-related area.

Link Learning Opportunities with University Sustainability Projects

There is untapped opportunity for faculty and Facilities Managers and other staff to work collaboratively to use the campus as a "living lab" for sustainability experimentation and learning. AASHE describes a sustainability living lab as follows:

> A living lab is a given place where problem-based teaching, research and applied work combine to develop actionable solutions that make that place more sustainable. These living labs accelerate transitions to a more sustainable place through joint commitments from students, faculty, staff and local residents to design, implement, adapt and teach new approaches that address issues of equity, economy and ecology.

Building a living lab model for USF's sustainability efforts could result in a win-win situation. Facilities and other units would have access, in the form of students, to new resources for data collection and data analysis and new energy and ideas for awareness

campaigns and planning. Faculty would benefit from immersing their students in the campus sustainability lab, a space for providing the hands-on experience and skill development necessary for understanding and tackling complex sustainability challenges.

Many other universities' efforts provide models that might guide USF's efforts (see Portland State University's "Our Campus: A Living Laboratory for Solutions") and AASHE offers extensive resources on the topic.

5.3 Sustainability Beyond the Curriculum

Expanding the institutional commitment to sustainability across the entire campus requires involvement of various Divisions and Departments outside of formal academic units. These include Student Life (e.g., Student Housing and Residential Education, Office of Student Leadership and Engagement, ASUSF), Information Technology Services (which has already undertaken a range of "Green IT" initiatives), the Office of Diversity Engagement and Community Outreach, Gleeson Library (which already supports sustainability awareness and outreach), Athletics, University Ministry, and the Koret Health and Recreation Center.

Representatives of these and other relevant units can be invited to form a Co-Curricular Programming Subcommittee of the University Sustainability Council. The charge of the Council—initially established to develop the USF Climate Action Plan—could be updated to take on a wider array of activities. The subcommittee would meet regularly to provide support in the integration of the sustainability learning outcomes identified in section 5.1. Responsibilities may include:

- Coordinate co-curricular sustainability education and programming and communicate efforts to the University Sustainability Council.
- Develop a comprehensive peer education program (Seattle University's "Sustainable Education and Engagement Delegates" program is a useful model).
- Develop formal guidelines for organizing and implementing sustainable events on campus, building on the Environmental Safety Office's "Green Your Event" tips.

6. Implementation Strategies

The preceding sections identified numerous actions to achieve USF's 10-year target and long-term goal for carbon neutrality. Here we highlight overarching strategies for implementing the climate action plan: institutional actions, monitoring, financing, purchasing, and partnerships.

6.1. Institutional Strategies

Extensive efforts have been made to move the University of San Francisco toward a more sustainable campus, as documented in section 2, "Sustainability Efforts To Date." Creating an Office of Sustainability—to coordinate these efforts and to communicate about them with the USF community, prospective students, our neighbors and the rest of the world—is the next step. An ideal solution is to appoint a University Sustainability Coordinator who would coordinate efforts across academic and operational units to harness the full potential of the University's sustainability efforts, coordinate co-curricular student learning opportunities, and connect faculty with Facilities and other staff to better utilize the campus as a sustainability lab. Experience at other universities, such as the University of San Diego, shows that cost savings achieved with the help of a Sustainability Coordinator can more than cover the salary of the position.

The charge of the University Sustainability Council—initially established to develop the USF Climate Action Plan—could be updated to take on a wider array of activities. Representatives of relevant units can be invited to form subcommittees of the University Sustainability Council.

While the scope of such an office and position is determined, USF may develop a one-stop web portal for all activities, events, courses, and other information related to sustainability at USF. The site will strive to be flexible and easily editable so that events and accomplishments can be easily updated. The site can also serve to document faculty research and projects and to profile community partners. A social media strategy, including a Twitter account, Facebook page, and YouTube channel could also be part of the communication plan.

6.2. Metrics and Monitoring

The University's sustainability efforts will require more data collection to succeed. The University is pursuing a campus-wide program of installing steam meters and electrical meters and sub-meters to better document energy usage and provide for effective analysis, planning, and resource saving strategies.

The Energy Audit and Metering: Gathering the Data[12]

Energy audits are a critical step in understanding campus energy use. Energy auditing is the process of taking a comprehensive accounting of energy use (and loss) within an established built environment. As of 2011, the City of San Francisco requires that all commercial buildings greater than 10,000 square feet complete an energy audit once every five years. They must also benchmark performance annually.[13] With its strong Climate Action Plan, San Francisco may be poised to include other large institutions such as universities in the mix of those requiring energy audits. USF is examining options for energy auditing, to get out in front of upcoming regulation, and to join the many universities across the country that have already conducted comprehensive energy audits.

A campus energy audit is likely to be prepared by a private firm, with estimated costs ranging anywhere between $.10/square foot (sf) to $.70/sf.[14] To help finance this upfront cost, up to $20,000 in grant money is available via the Energy Partnership Program from the California Energy Commission (CEC).[15] Other energy efficiency programs available through the CEC, the City of San Francisco, and utility partnerships may be available to further reduce the upfront costs to USF. While the complete up-front cost of the audit may not be absorbed, its value in developing energy and cost-saving strategies will be long-lasting.

Case Study: Oregon State University

- An energy audit for the main administration building alone identified efficiency measures that would produce a 29.5% energy cost savings.
- The improvements would come at a cost of $1,250,106 with a return on investment time of 16.1 years.
- Measures to fix buildings steam pipes would cost $96,391 but would have a payback time of only 2.9 years.

(Gilles, D. and He, J. 2012)

In addition to the energy audit, campus metering is essential for the university to

[12] Much of this section contributed by USF MSEM students Alex Hunt and Sarah Morton in May 2014.
[13] Guevara 2011
[14] New Jersey Clean Energy Program 2013
[15] California Energy Commission 2012

accurately track energy expenditures and formulate reduction strategies moving forward. Typically, utility metering systems are installed in a piece-meal manner and do not allow for accurate tracking of energy use for campus facility managers. Specifically, sub-metering allows facilities managers to measure both water and energy use and gather data on electricity, natural gas, steam and chilled water use for each building and piece of equipment. Using robust data gathered from the meters, the campus will be able to better account for how old buildings are performing, and target which projects would achieve the greatest energy savings. Installation of advanced meters average $3,000 per unit[16], which could lead to a total cost between $60,000 and $300,000 to USF (depending on the number of units and level of accuracy desired). Installation of metering devices is particularly important in energy use visibility, optimizing energy use (especially when class is *not* in session), and to prioritize energy efficiency projects.

Given the substantial amount of data generated in metering and sub-metering, the University will examine creating a full-time or part-time position to manage these data. This position might enable USF to achieve cost savings from energy efficiency improvements in the long term, which would eventually benefit the University financially.

Case Study: Emory University

- As part of Emory's commitment to reducing their energy consumption per square foot by 25% by 2015, they have prioritized energy efficiency in a retrofit project.
- The first phase is a $5 million investment and targets five of the biggest, most iconic buildings on campus. The second phase will retrofit eight buildings, focusing on many of the biggest energy hogs on campus.
- The project to improve more than 1 million square feet of space is expected to pay for itself through utility savings within just a few years. Early calculations (still in progress) indicate that energy saved will result in dollar savings approaching $10,000 a month, or in excess of $100,000 per year.

(Emory University 2014)

6.3. Financing Climate Action[17]

Financing is an essential component of the climate action strategies identified in this plan. Some strategies are revenue positive, while others are budget neutral or will need significant investment. Some strategies the university will undertake to meet city or state requirements; others because they are "the right thing to do." Financing mechanisms may be revenue-generating (grants, fund raising, student fees), leverage expense reallocation (campus utility budget, capital project budget, departmental contributions), or involve partnerships or a combination of mechanisms (utility and city

[16] United States Environmental Protection Agency 2007
[17] Much of this section contributed by USF MSEM students Alex Hunt and Sarah Morton in May 2014.

partnerships for efficiency or renewables, revolving loan funds).[18] Here we highlight some of the financing mechanisms USF may utilize for climate action.

Dedicated Revolving Loan Fund for Energy Efficiency or other Environmental Projects

Revolving loan funds provide a dedicated funding source for universities to invest in energy efficiency (or other climate action initiatives) while capturing the cost savings from those efficiency projects. The savings are then used to replenish the fund, thereby allowing for similar future efficiency investments. Typically, the loans are administered with little to no interest, reducing the financial burden on sustainability projects, which is a common barrier to their implementation. Loans are generally small, such that a project would only target one part of an efficiency effort (i.e. HVAC or lighting), rather than a complete building retrofit. As a result, the projects are cost-neutral and allow for long-term operational cost savings. Revolving loan funds are an increasingly popular way for universities to finance efficiency projects while bringing in student participation. AASHE publishes a database of university revolving loan funds and as of May 2014 there were 84 funds at 80 universities totaling $118,737,518.[19] Many of the universities with green revolving funds participate in the Billion Dollar Green Challenge with the purpose of developing funds to finance energy efficiency upgrades on their respective campuses.[20]

Initial revolving loan funding at USF is likely to come from internal sources, the university budget in particular (research, administration, student fees, or savings and investment accounts). Rather than starting the fund directly from the budget, the fund could be sourced via university donations (directly or indirectly). A revolving loan fund for climate initiatives could be especially appealing to environmentally-minded donors and serve as a marketing point to potential students. Savings from other efficiency projects, student fees, and investments from the endowment are additional potential funding sources. Despite the initial funding requirements, university green revolving funds show a high return on investment. The highest return was 63% at the University of Denver for their Energy Reserve Fund and the lowest return was 29% for Iowa State University's Live Green Revolving Loan Fund. Furthermore, university revolving funds have reported an average payback period between 1 and 10 years, with a median payback of 4 years.[21] Table 5 includes examples of green revolving loan funds.

[18] See the Middlebury CAP for more details on financing mechanisms; see also Appendix B.
[19] AASHE 2014b
[20] Billion Dollar Green Challenge 2014
[21] Sustainable Endowments Institute 2012

Table 5 Examples of Revolving Loan Fund for Energy Efficiency

University	Fund Amount	Comments
Western Michigan University[22]	$365,000	Created in 1980. The "Quasi-Revolving Fund" recaptures money from cost-savings but also sources capital from the broader utilities, maintenance, and other budgets as necessary.
Harvard University[23]	$12,000,000	The largest revolving fund of its kind. Created in 2001. A life cycle costing calculator for GHG emissions or utility cost reduction must be used as justification. Loans must be paid back within 11 years.
Oberlin College[24]	$344,000	Created in 2007. In addition to loans, grants are also available for projects such as student awareness or bike racks.
Oregon State University[25]	$300,000	Created in 2011. Used to fund energy efficiency and renewable energy projects on campus.

University Sustainability Fees

Across the country university students are demonstrating the value they place on their university's commitment to sustainability and tackling climate change. Many universities have introduced fees or surcharges to student tuition that are reserved for purchasing renewable energy credits, financing on campus energy efficiency efforts, or encouraging student research/projects in these areas. In these examples, the fees have typically arisen from student pressures on the university administration. However, in an era of increasing costs of higher education, the potential revenue generated may remain low relative to the required climate commitment. The USF Student Senate introduced a small sustainability fee, which supports their internal sustainability efforts and has the potential to support an energy audit. Nevertheless, this fee is small relative

[22] Sustainable Endowments Institute 2011
[23] Harvard University Sustainability 2014
[24] Oberlin College 2014
[25] Oregon State University 2014

to what other universities are doing and the financial contribution the university must commit in order to meaningfully address campus GHG emissions reduction.

University sustainability fees across the country have largely risen due to pressures students have put on university administrations (Table 6). Where these fees have been implemented, they are frequently passed by large margins. In the 22 sustainability fees passed by student votes or referendums examined by the Association for the Advancement of Sustainability in Higher Education (AASHE), the average pass percentage was over 79%.[26] Furthermore, the students at the University of North Carolina Chapel Hill reapproved their original 2003 fee again in 2005 and 2007 by 85% and 83% votes, respectively.[27] In an environmentally conscious city such as San Francisco, we would expect the students at USF to do the same (depending on the details of the proposal). While sustainability fees are typically driven by student support, some universities use the Board of Trustees to introduce mandatory fees to support renewable energy and energy efficiency (i.e., The University of Vermont).

Table 6 University Sustainability Fees - Examples[28]

University	Fee	Background
Evergreen State College	$1.00/credit	Used for the purchase of renewable energy and funds the installation of renewable energy and energy conservation technologies on campus. Generates approximately $240,000 annually.
College of William & Mary	$15/semester	Supports facilities upgrades, student research grants for sustainability projects, and creation of green endowment fund. Passed by an 85% margin in student referendum.
Connecticut College	$25/year	Funds purchase of renewable energy. Passed by a 75% margin in student petition.
Bowling Green University	$5/semester	Supports a variety of green or environmental projects on campus. Passed by Board of Trustees following a series of petitions and support from many student organizations.
Western Washington University	$21/year	Funds purchase renewable energy credits and finance student projects for energy efficiency. Passed by an 85% margin. Generates $355,000 annually.

The fee amount levied varies greatly across universities. Universities are primarily known to take two approaches: surcharges on each credit hour or fees by term.

[26] AASHE 2014a
[27] UNC Sustainability 2009
[28] AASHE 2014a

Surcharges based on credits are typically scaled to the cost of tuition, such that small community colleges may charge less than $0.25 per credit[29] while larger universities may charge $1.00 per credit[30] or more. USF will investigate the use of a sustainability fee to conduct energy and carbon monitoring and management, or to utilize for the initial investment in energy and carbon saving facilities.

Financial Mechanisms for Renewable Energy Projects

De-carbonizing energy supply typically requires significant up-front investment in renewable energy technology. Several financing mechanisms have been developed to overcome this capital barrier. USF has already utilized such mechanisms for the installation of solar thermal water heating systems in the 1980s, and installation of solar photovoltaic systems over the past 10 years. Table 7 summarizes these mechanisms; Appendix C provides further detail. Because USF has already covered a large share of useable roof space with PV, the university must consider other sources of renewable energy on campus, or purchase of off-site renewables.

Table 7. Financial Mechanisms for Renewable Energy Projects[31]

Source	Typical Project Size	Responsibility for Utility Bills
Energy Service Performance Contract (ESPC)	Unlimited	ESCO or Customer
Energy Services Agreements (ESAs)	$250,000 - $10 million	Customer
Managed Energy Service Agreements (MESA)	$250,000 - $10 million	MESA provider
Power Purchase Agreement (PPA)	Unlimited	Customer
Utility Energy Service Contract	Unlimited, though funding is capped	Customer

[29] Central Oregon Community College 2014
[30] Evergreen State College 2013
[31] WSGR 2013

6.3 Low-Carbon Procurement[32]

Green, or sustainable, procurement is the process of purchasing products and services based on life-cycle value, not only initial cost. While life-cycle greenhouse gas emissions associated with all of these products are still rough estimates (based on the Clean Air-Cool Planet baseline study), there are greenhouse gas emissions associated with consuming all of these goods. Some sustainable goods and foods may have lower initial costs, while others have higher initial costs. Despite the perception that the costs are higher overall for "green" products, less toxic products are typically less costly to transport, store, handle and dispose.

Products consumed by USF include office supplies, computer equipment, cleaning products, appliances, food, and furniture. Numerous universities have established sustainable procurement policies, many of which encourage purchase of local consumer goods and food. Table 8 gives examples of universities that have made commitments to sustainable purchasing.

In San Francisco, the Environmentally Preferable Purchasing program requires the City to consider the environmental and health impacts associated with products it buys. The City's Commission on the Environment reviews the City's purchases and identifies which projects should be substituted with more environmentally sustainable products.[33] The City maintains a list of approved products on its website.[34] Products consumed by the University are similar to those of the City of San Francisco and given the similarity, the University will investigate adopting a purchasing policy for environmentally preferable products approved by the City.

[32] Much of this section contributed by USF MSEM students Alex Hunt and Sarah Morton in May 2014.
[33] California Sustainability Alliance 2014
[34] San Francisco Department of the Environment 2014

Table 8. University Examples of Environmental Purchasing Policies

College/University	University Goals for Environmental Purchasing
Evergreen State University[35]	Increase local and organic food purchases by 10% of total food purchases. Establish an Environmentally Preferable (Green) Purchasing Program. Chlorine-free 100% post-consumer recycled paper required for general campus correspondence including laser printing and copy machine use.
Princeton University[36]	Encourage sustainability in the supply chain and procurement of purchased goods and services Increase sustainable food purchases to 75 percent by 2015 and raise awareness about green dining.
Pomona College[37]	90% white copy paper purchased 100% PCW, PCF, FSC-certified 90% colored paper, cardstock, and alternative sizes (excluding posters) purchased at least 30% PCW Dining Services: 30% of total food purchases qualify as sustainable by 2020
University of Wisconsin Oshkosh [38]	Develop and follow sustainability-focused purchasing policies in more than 50% of spending for campus materials and equipment by 2012. Minimize the environmental and social impacts of operations (including indirect impacts of suppliers) while continuously providing a variety of nutritious and sustainably-grown foods.

6.4. Off-Campus Partnerships

Climate action presents USF with challenges and opportunities, especially in the formation or strengthening of partnerships. As "the University of the best city ever," USF can enhance ties with City of San Francisco agencies and organizations, including SF Department of Environment, the Mayor's Office, SF Metropolitan Transportation Agency (SF MTA), Pacific Gas & Electric, and others. Region IX of the U.S. Environmental Protection Agency is based in San Francisco, as are offices of the California Energy Commission. USF's Sacramento campus offers opportunity for further connection with state agencies, such as the California Air Resources Board. Major consulting firms and non-profit organizations working on climate action have Bay Area offices, such as the Bay Conservation and Development Commission (BCDC), Environmental Defense, The Nature Conservancy, AECOM, ARUP, and ICF, to name but a few. USF could also engage nearby universities in collaboration on climate action: UCSF, SFSU, SJSU, UC Berkeley,

[35] Evergreen State College 2009
[36] Princeton University 2014
[37] Pomona College 2011.
[38] University of Wisconsin 2008

Stanford University, Santa Clara University, Gonzaga and others. All of these potential partners include USF alumni, adjunct faculty, or USF affiliates on their staff.

7. Conclusions and Next Steps

This first USF Climate Action Plan highlights the university's goals and next steps toward carbon neutrality. The university's mission to educate leaders who will fashion a more humane and just world motivates our participation in the ACUPCC. A brief history of sustainability efforts to date—from the founding of one of the first graduate environmental degrees in the country in the 1970s, to installation of a co-generation facility in the 1980s, to nearly 500 kW of solar photovoltaics and the new LEED-Gold certified Center for Science and Innovation in the new century—shows a strong foundation for climate action. USF's location in San Francisco, in California, which are hubs of climate change policy, provides the university with many partnership opportunities.

Measures for climate action over the next ten years require concentrated effort, yet are within the university's reach. Research, innovation, and even more partnership will be needed to achieve goals beyond that. The USF Climate Action Plan is expected to evolve over time, as actions are implemented and further analysis informs future steps. Next steps and analysis include:

- Establishing an Office of Sustainability and a Sustainability Coordinator that can tap USF expertise, engage the USF community, and lead implementation of the USF Climate Action Plan;
- Furthering education and outreach on sustainability and climate change;
- Strengthening partnerships with agencies and organizations for climate action, especially the City of San Francisco, "the best city ever";
- Conducting energy auditing and establishing an energy monitoring and management system;
- Conducting engineering and financial analysis for efficiency and de-carbonization options for the USF co-generation facility and other campus infrastructure.
- Preparing a Climate Resilience and Risk Management Plan.

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- MSEM 672 Climate Change Mitigation – Spring 2014: analysis of USF carbon inventory, energy and carbon saving strategies.
- ENVA/ENVS 366 Environmental Policy – Fall 2013: climate action policy briefings.
- ENVA 450 Capstone Practicum in Environmental Studies – Spring 2011, 2012: preparation of USF bike plan.
- ENVS 360 Climate Change – Fall 2012: conducted initial analysis of climate actions by universities in the ACUPCC; created "Climate Action Style" video on USFtv.
- ENVS 350 Energy and Environment – Spring 2009, Fall 2011: analysis of energy and carbon savings from USF co-gen, solar thermal water heating, solar PV electricity, wind potential.
- ENVS 360 Climate Change – Spring 2008: conducted the first carbon inventory of USF, in collaboration with USF Facilities staff.
- ENVS 350/MSEM 680 Energy and Environment - Spring 2005: initial energy saving analysis for the proposed new science center, recommended **USF Green and Gold** strategy of Green building, Gold LEED rating.

Student Thesis and Independent Study Work:

Brian Reyes, MSEM 2009, Sergio Marquez, MSEM 2009: preparation of initial USF carbon inventory report. Detailed transportation survey and analysis for carbon savings.

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References

AB 1613, Blakeslee, Chapter 713, California Statues of 2007.

AASHE. 2014a. Dedicated Student Fees for Sustainability. Retrieved April 27, 2014. Accessed from http://www.aashe.org/resources/mandatory-student-fees-renewable-energy-and-energy-efficiency

AASHE. 2014b. Campus Sustainability Revolving Loan Funds Database. Retrieved May 1, 2014. Accessed from http://www.aashe.org/resources/campus-sustainability-revolving-loan-funds/

ACUPCC. Undated. *American College & University Presidents' Climate Commitment*. Retrieved May 11, 2014. Accessed from http://www2.presidentsclimatecommitment.org/html/commitment.pdf

Billion Dollar Green Challenge. 2014. Retrieved May 1, 2014. Accessed from http://greenbillion.org/

California Sustainability Alliance. 2014. "Case Studies, San Francisco". Retrieved May 11, 2014. Accessed from http://sustainca.org/tools/green_procurement_toolkit/san_francisco

California Energy Commission. 2012. Energy Partnership Program. Retrieved April 24, 2014. Accessed from http://www.energy.ca.gov/efficiency/partnership/index.html.

Central Oregon Community College. 2014. Tuition and Fees. Retrieved April 27, 2014. Accessed from http://www.cocc.edu/admissions/tuition-fees-payment/

Department of Energy. 2014. "Renewable Energy Project Funding". <http://energy.gov/eere/femp/renewable-energy-project-funding> Accessed May 4, 2014.

Emory University Division of Campus Services. 2014. *Energy Conservation*. Access online at http://www.campserv.emory.edu/pdc/engineering/Energy_Conservation.html.

Evergreen State College. 2009. *The Evergreen State College Carbon Neutrality by 2020 Climate Action Plan.* September. Accessed from http://www.evergreen.edu/sustainability/docs/CAP%20Final%20082809.pdf

Evergreen State College. 2013. Tuition Rates. Retrieved April 28, 2014. Accessed from http://www.evergreen.edu/business/studentfinancialservices/tuitionrates

Green Mountain College. 2014. "Sustainable Purchasing Initiative at Green Mountain College." Retrieved May 4, 2014. Accessed from http://www.greenmtn.edu/farm_food/research/sustainable-purchasing-initiative.aspx

Guevara, L. "SF Requires Energy Audits, Benchmarking for Commercial Buildings." GreenBiz.com. February 10, 2011. Available online at: http://www.greenbiz.com/news/2011/02/10/sf-requires-energy-audits-benchmarking-commercial-buildings.

Harvard University Sustainability. 2014. Green Revolving Fund. Retrieved May 1, 2014. Accessed from http://green.harvard.edu/programs/green-revolving-fund

National Renewable Energy Laboratory. 2012. Energy Efficient Building Management. Retrieved April 28, 2014. Accessed from http://www.nrel.gov/tech_deployment/climate_neutral/energy_efficient_building_management.html

National Science and Technology Council Committee on Technology. 2011. Submetering of Building Energy and Water Usage Analysis and Recommendations of the Subcommittee on Buildings Technology Research and Development. October. Accessed from http://www.energystar.gov/buildings/sites/default/uploads/tools/Submetering_of_building_energy_and_water_usage.pdf?bfc5-0791

New Jersey Clean Energy Program. 2013. Frequently Asked Questions. Retrieved April 27, 2014. Accessed from http://www.njcleanenergy.com/commercial-industrial/programs/local-government-energy-audit/frequently-asked-questions.

Oberlin College. 2009. Oberlin College*: A Plan to be Carbon Neutral.* Adopted October 30, 2009. Accessed from <http://rs.acupcc.org/site_media/uploads/cap/408-cap.pdf>

Oberlin College. 2014. Green Edge Fund. Retrieved May 1, 2014. Accessed from http://ocsites.oberlin.edu/edgefund/

The Oberlin Project. 2014. "Oberlin and Renewable Energy". Retrieved May 11, 2014. Accessed from http://www.oberlinproject.org/energy/oberlin-renewable-energy

Oregon State University. 2014. Sustainable Energy Revolving Loan Fund. Retrieved May 1, 2014. Accessed from http://oregonstate.edu/ssi/funding/serlf

Pacific Gas and Electric Company (PG&E). 2014. Self Generation Incentive Program (SGIP). Retrieved May 11, 2014. Accessed from http://www.pge.com/en/mybusiness/save/solar/sgip.page

Pomona College President's Advisory Committee on Sustainability (Pomona College). 2011. *Pomona College Sustainability Action Plan*. April. Accessed from http://pomona.edu/administration/sustainability/resources/publications/SAP.pdf

Princeton University. 2014. "Sustainability at Princeton: Purchasing". Retrieved May 3, 2014. Accessed from <https://sustain.princeton.edu/progress/purchasing>

San Francisco Department of the Environment. 2013. San Francisco Climate Action Strategy Update. October.

San Francisco Department of the Environment. 2014. "SF Approved: Use less, buy the right thing." Accessed from http://www.sfapproved.org/

Shapiro, I. 2009. *Energy Audits in Large Commercial Office Buildings*. ASHRAE Journal. January 2009.

University of Wisconsin. 2008. University of Wisconsin Oshkosh Campus Sustainability Plan 2008-2012. February. Accessed from http://www.uwosh.edu/assets/announcement/sustainability/docs/Campus_Sustainability_Plan_Final_Whole.pdf

U.S. Environmental Protection Agency. 2008. *Renewable Energy Certificates.* July. Accessed from http://www.epa.gov/greenpower/documents/gpp_basics-recs.pdf

Wilson Sonsini Goodrich & Rosati (WSGR). 2013. Innovations and Opportunities in Energy Efficiency Finance. May. Accessed from http://www.wsgr.com/publications/PDFSearch/WSGR-EE-Finance-White-Paper