Climate Action & Adaptation Plan

California State University, Long Beach | 2022

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A Message from President Conoley

The reality of global interconnectivity is, once again, front and center. The Coronavirus 19 pandemic has reinforced that collective action is vital to keep our communities safe. The same resolve and resilience evident in our community in our fight to keep our students, faculty and staff healthy, gives me confidence that we can meet another of our grand challenges, that is, mitigating the climate crisis, with rigor and collective action.

This Climate Action and Adaptation Plan (CAAP), is a culmination of extensive stakeholder engagement and a compilation of the solutions that will propel our university to achieve our 2030 and 2040 carbon neutrality goals. We must prepare our campus and community for a changing climate. The CAAP is designed to serve as a roadmap for managers and decision-makers across the university. It builds on the significant efforts our campus has already undertaken to maximize energy efficiency, increase renewable energy production, support clean air vehicle adoption, embrace the most ambitious green building standards, and integrate sustainability and environmental justice across the curriculum.

We will not succeed without our campus community's commitment to individual supportive actions. We have a unique and powerful platform in higher education. We can teach ourselves and our students about the absolute need to be committed to climate mitigation and climate resilience. Using our platform we have the opportunity to send graduates into the working world prepared to make decisions that are not solely good for business, but also for the health of our planet. This impact is monumental. Conversely, a failure to prioritize our responsibility to prepare students for the world they will inherit does them a disservice and could further exacerbate the climate crisis. By working to provide a learning environment that is a model of sustainability while also educating our students about their role as climate leaders, we lay the groundwork for a brighter future. How great is that!

In addition to our climate action efforts here on campus, it is also crucial that each of us endeavor to multiply our impact by sharing knowledge with others, using our voices at the ballot box, "voting" with our dollars when we shop, and supporting organizations doing the frontline work to advocate for a more just, healthy, and sustainable world. The time is now to work like our world depends on our personal and collective actions, because it does.

United as #onebeach, we will take action against climate change both on campus and off. We will work together, we will be resilient, and we will protect the future of the generations to come.

Go Beach! Go Green!

Jane

Executive Summary

Building from the 2014 Climate Action Plan (CAP), Beach 2030 Master Plan, and continued climate change mitigation efforts, this 2022 Climate Action and Adaptation Plan (CAAP) is a strategic planning tool created for California State University, Long Beach ("CSULB") by Brailsford and Dunlavey ("B&D" or "the consulting team"). The purpose of this plan is to outline a flexible roadmap for CSULB to eliminate greenhouse gas emissions (GHG) from campus operations in line with the institution's commitment to carbon neutrality and adapt to the inevitable negative impacts of climate change. The CAAP is a synthesis of years of collaborative engagement, a required step to meet the CSULB President's Climate Commitment, and a collective best attempt to address anticipated, and unanticipated, vulnerabilities that will impact CSULB as a result of climate change.

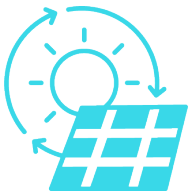
The consulting team, working with key CSULB staff (collectively "the planning team") from the President's Commission on Sustainability, the Office of Planning and Sustainability, Parking & Transportation Services, and Facilities Management, completed a series of stakeholder engagement meetings, a cross-campus interest assessment survey, data validation and modeling, and life-cycle cost analysis in the summer and fall of 2021. Findings from this collaborative work outline a technically, logistically, and economically feasible pathway for CSULB to **decarbonize campus operations by 2030 and commute related emissions by 2040.** This plan is focused specifically on addressing Scope 1, 2, and 3 emissions which are overwhelmingly created by transportation to and from campus (60%), the need to heat, cool, and power campus facilities via purchased electricity (17%) and combustion of natural gas (11%). It is important to note that this plan is not a specific commitment to any of the projects or initiatives described within, but rather intended as a guiding strategic roadmap – a tool to help the CSULB community navigate the complex path towards its climate goals.

This CAAP is organized around 5 major mitigation and 4 major adaptation Focus Areas. Each of these are detailed in the following pages.

Mitigation Focus Areas

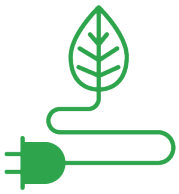
Strategic Energy Management (SEM)

A program to accelerate energy efficiency efforts and organize CSULB to strategically reinvest in buildings and prepare infrastructure for a future low- to no-carbon energy system.



Renewable Energy

A group of initiatives to optimize and advance renewable energy and electric infrastructure on and off campus.

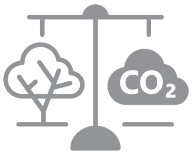


Campus Energy Transition

A portfolio of modern energy technologies that will allow CSULB to phase out natural gas and transition the campus fleet to zero-emission vehicles. This would dramatically increase cooling and ventilation on campus, address significant deferred maintenance, and align with state-wide mandates and goals.

Scope 3 Mitigation

A set of actionable items to eliminate, reduce, and offset emissions related to air travel, commuting, and waste generation. Scope 3 is the largest category of emissions for CSULB. State-wide mandates are expected to ultimately decrease these emissions over time, but CSULB will need to prepare campus infrastructure and policies to meet or exceed these mandates.



Offsets

While the goal is full decarbonization, it's likely CSULB will need to continue to buy some amount of carbon offsets and Renewable Energy Credits (RECs) to meet stated goals, especially in the short-term. As the first 3 focus areas of the plan are implemented the need for this residual mitigation will decrease.

The Mitigation Roadmap (MR)

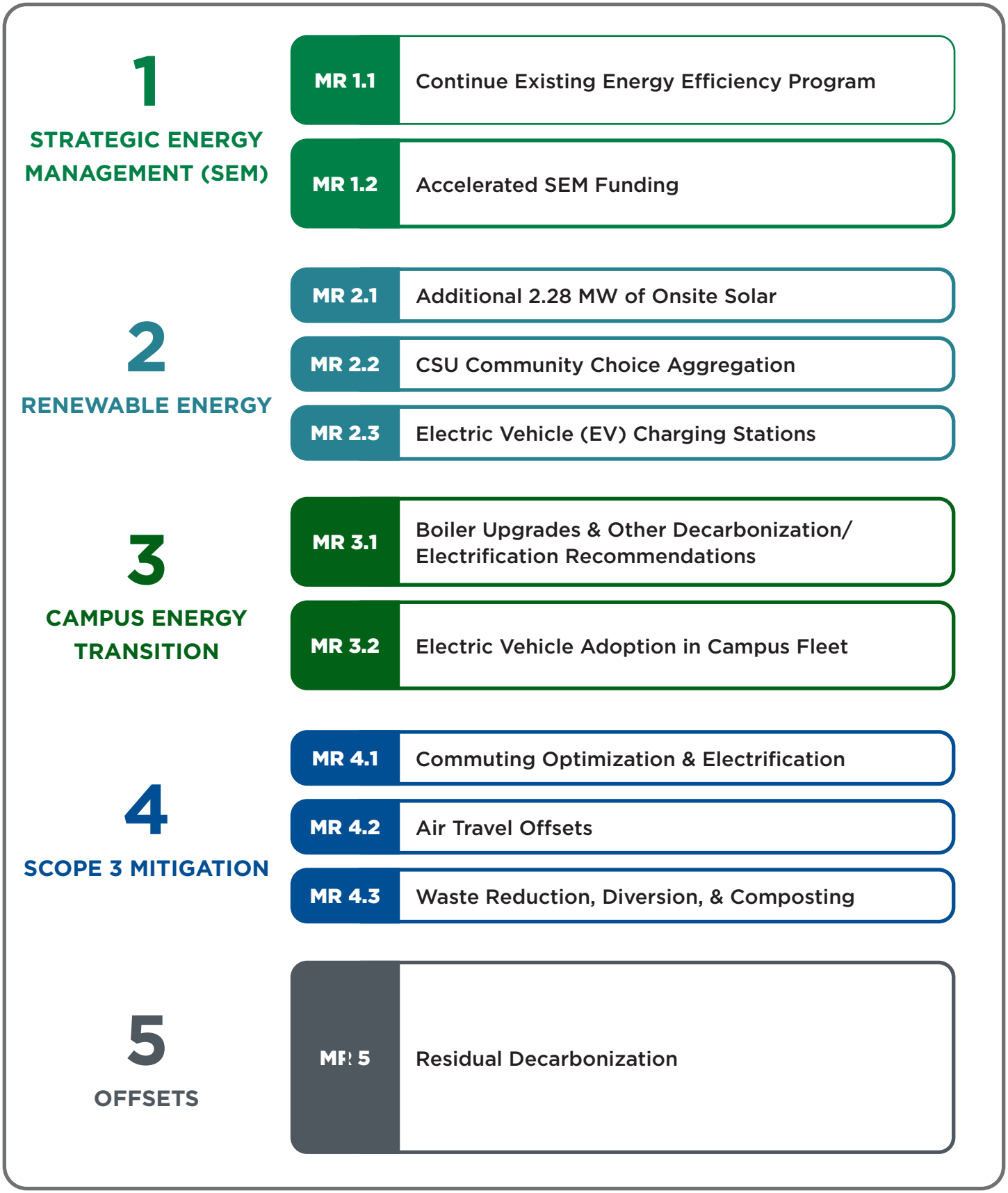


Figure 01. The Mitigation Roadmap

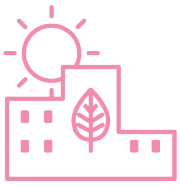
Adaptation Focus Areas

Capacity & Awareness

A strategy to fund, prepare, educate, and communicate sustainability, climate adaptation, and emergency preparedness.

Personal Resilience

Programs to address food and housing insecurity, in addition to overall wellness of the campus community.



Facilities & Operations

A program to enhance the campus urban forest, optimize landscape design and maintenance, and improve irrigation water efficiency to help combat extreme heat, drought, and unnecessary emissions pollution from aging equipment.

Curriculum

Dedicated actions to further curriculum, increase climate literacy, and expand academic programs related to sustainability and climate.

The Adaptation Roadmap (AR)

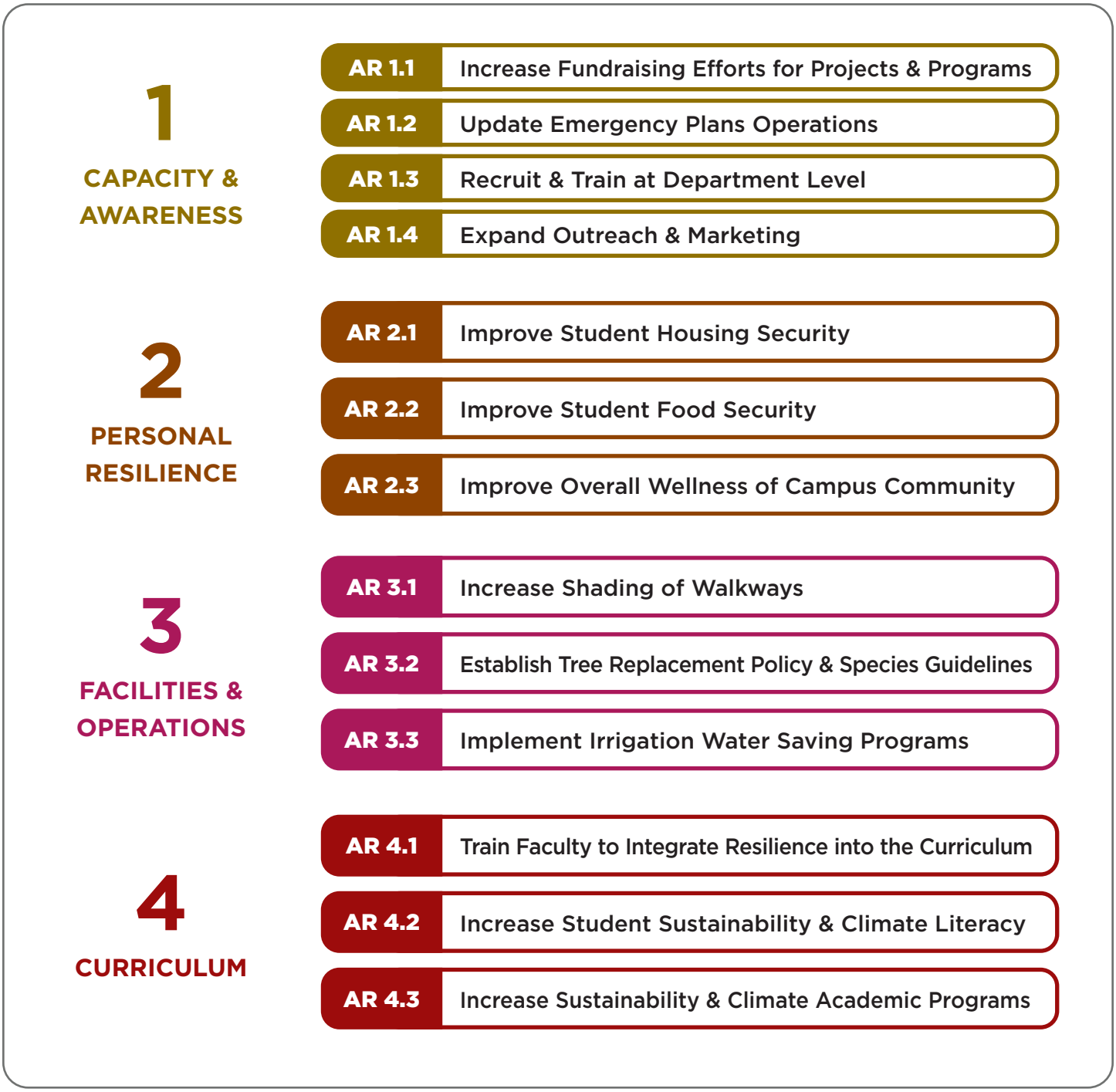


Figure 02. The Adaptation Roadmap

Climate Action

Background

CSULB signaled sustainability as a priority in 2011 when it signed the Second Nature Presidents' Carbon Commitment. Since then, deliberate action has been taken to incorporate environmental, economic, and equity issues throughout the campus fabric. The timeline below highlights major sustainability initiatives from the establishment of organized governance structures, inclusion of sustainability in campus plans, targeted data tracking and public reporting, intentional design of capital projects, and sustainability and diversity emphasis in the curriculum, to ongoing cross-campus engagement.

While CSULB has made incremental progress and challenged itself to reimagine a strategy for success, the urgency to address the climate crisis is as crucial as ever. Since CSULB adopted it's 2014 Climate Action Plan (CAP) the Intergovernmental Panel on Climate Change (IPCC)[1] has published additional research that outlines the extent of changes to the Earth's climate in every region, as a result of human activities that increase heat-trapping gases in the atmosphere. The rise in global temperatures directly impacts additional changes to the climate – such as extreme heat, drought, flooding, and poor air quality – that are felt on a regional scale.

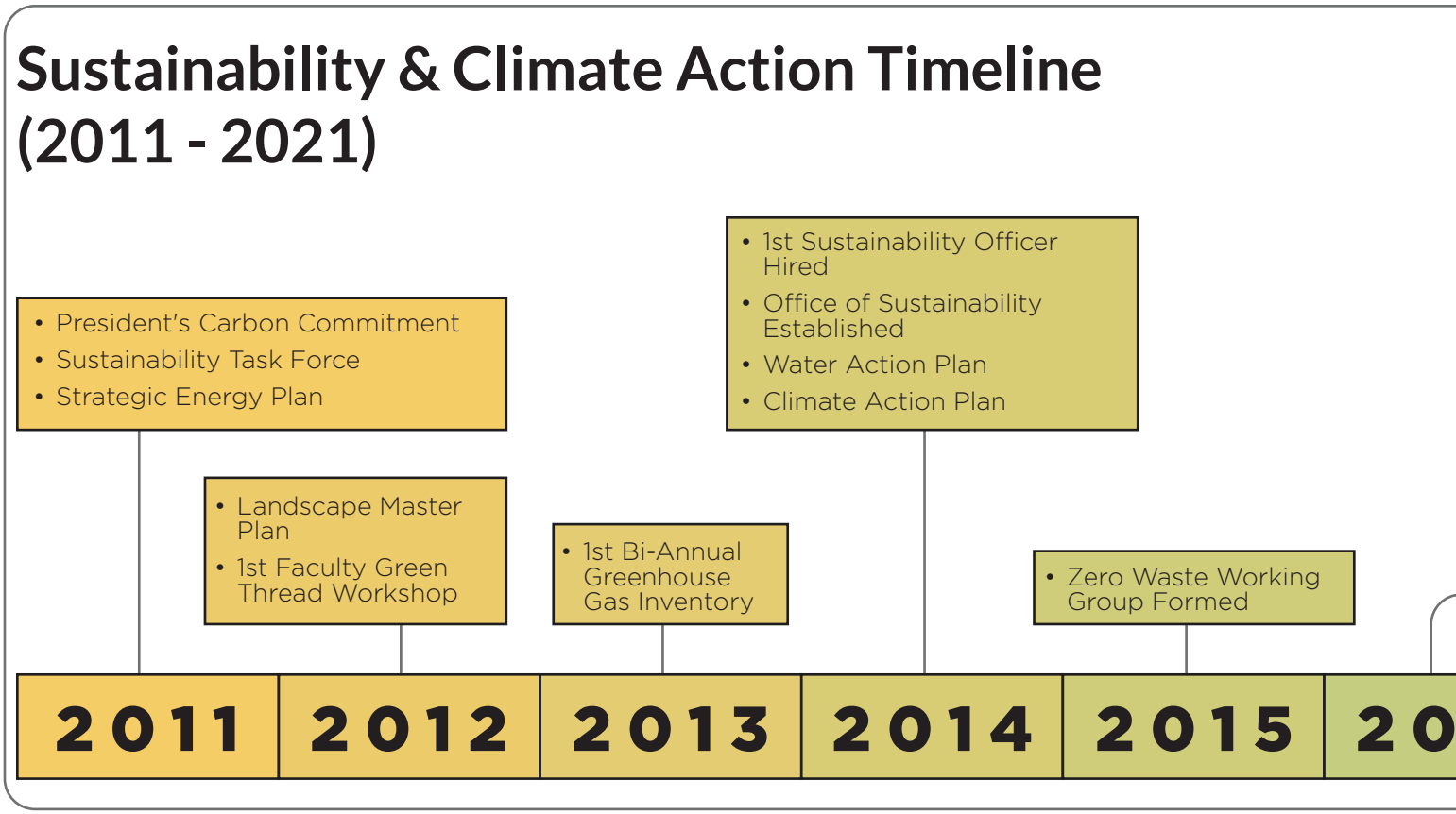


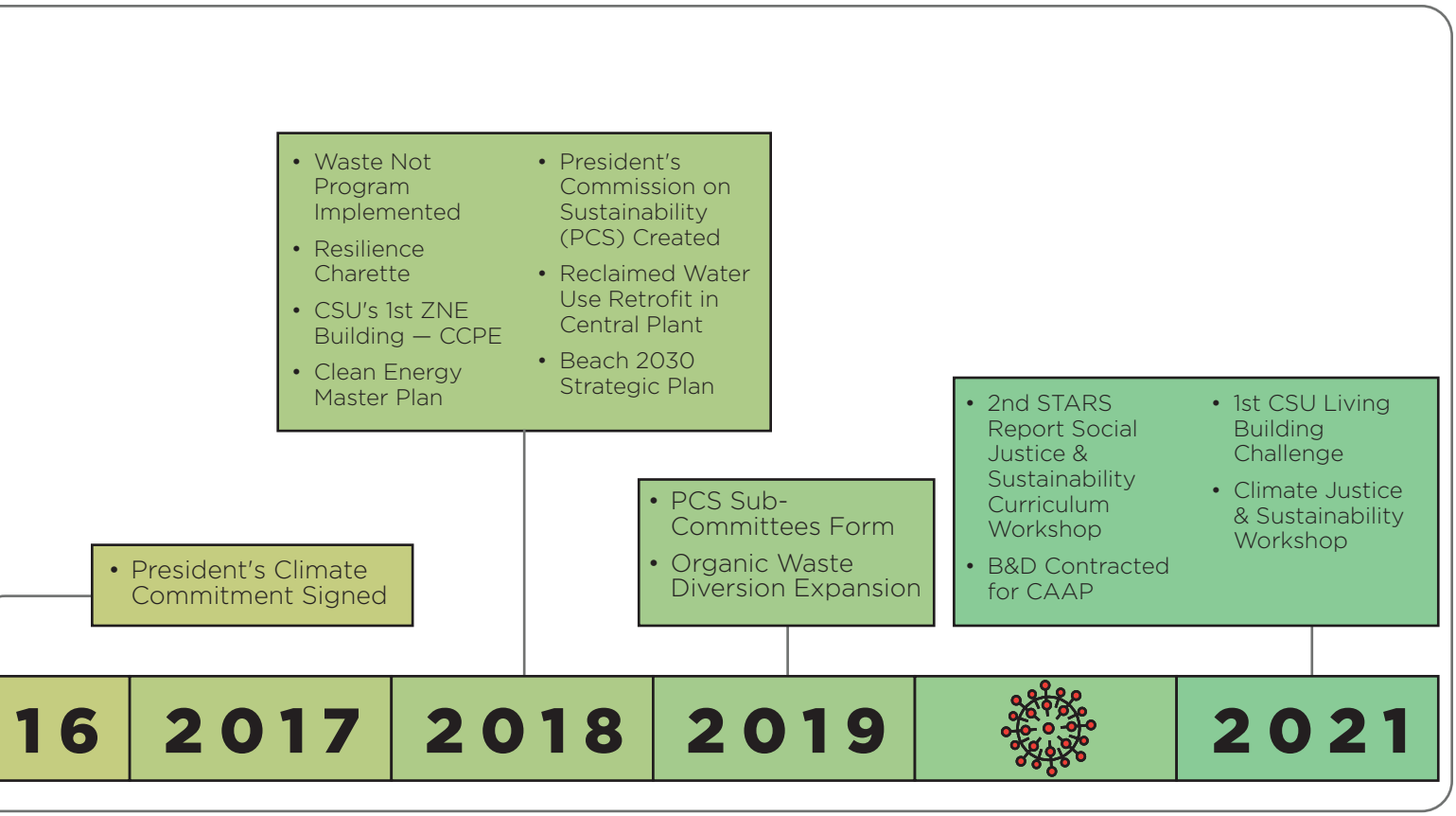
Figure 03. CSULB Sustainability Timeline

[1] The Sixth Assessment Report (AR6) https://www.ipcc.ch/ar6-syr/
[2] https://pressroom.usc.edu/labarometer-survey-finds-adverse-environmental-conditions-impact-a-growing-number-of-angelenos/

A recent University of Southern California survey found that 54% of Los Angeles County residents had gone to a cool location for the sole purpose of getting out of the heat and 51% avoided going outside at some point between summer 2020 and summer 2021 because of concerns about breathing wildfire smoke, among other results.[2] The survey also found people of color and low economic status were more likely to experience negative impacts of the climate crisis compared to other populations. The City of Long Beach is currently developing its own climate and adaptation plan,[3] which includes a climate vulnerability assessment of the City's most relevant climate stressors. This review indicates that by mid-century: average temperatures will increase 3 – 4 degrees Fahrenheit; heat waves will be more frequent, intense, and long lasting with less cooling at night; overall regional drought trends will increase (increasing water demand); precipitation will increase 6 – 11% annually, on average; sea-level rise is expected to be approximately 11 inches and when combined with higher storm tides will increase erosion and inland flooding; and air pollution may increase from other climate change events like wildfire.[4]

CSULB's continued efforts to mitigate and adapt to the climate crisis are more urgent than ever.

This CAAP emphasizes both mitigation and adaptation initiatives and moves the campus closer to achieving its modified goal of carbon neutrality for operational emissions (Scopes 1 & 2) by 2030 and for indirect, primarily commute-related emissions (Scope 3), by 2040.



[3] https://www.longbeach.gov/lbds/planning/caap/
[4] https://www.longbeach.gov/globalassets/lbds/media-library/documents/planning/caap/lb-caap-proposed-plan-app-d-_dec-14

Mitigation vs Adaptation

The inclusion of both mitigation and adaptation in this CAAP emphasizes the need for CSULB to reduce greenhouse gas emissions while adjusting to the effects of climate change. Mitigation focus areas will emphasize specific initiatives and actionable steps to achieve a reduction in greenhouse gas emissions. Adaptation focus areas consider approaches for ensuring the physical campus and community members are resilient to the impacts of climate change, prepared to absorb inevitable stressors, and able to thrive on a changing planet. While this plan is organized around two distinct sets of focus areas, it is important to recognize that mitigation and adaptation are spheres of action which intersect and interact in various ways, as illustrated by the figure below.

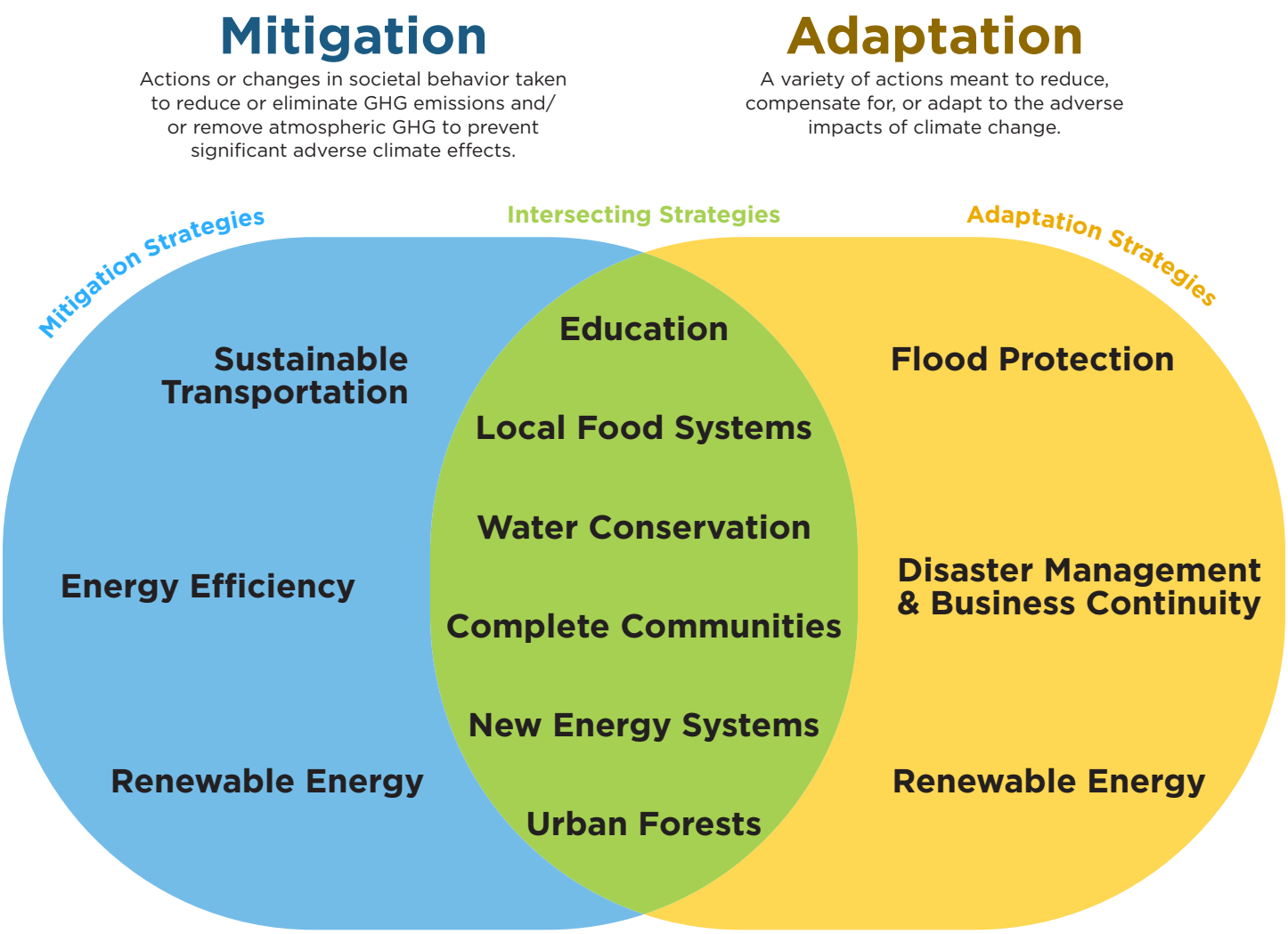


Figure 04. Mitigation vs. Adaptation

Interest Assessment

Going from idea to initiative, the planning team collaborated with stakeholders through a series of meetings with the Climate Action Plan subcommittee and key campus leaders[5] and reviewed various campus reports to determine the CAAP vision and criteria. A survey to assess climate action solutions was jointly assembled and distributed with the goal of gauging interest and support for various potential mitigation strategies (see figure 5 and appendix for details). These steps were taken to engage the campus community in the process of further refining goals and objectives, to accelerate solutions with broad agreement, focus education or further investigation where the picture was not clear, and rule out ideas that simply didn't make sense for CSULB.

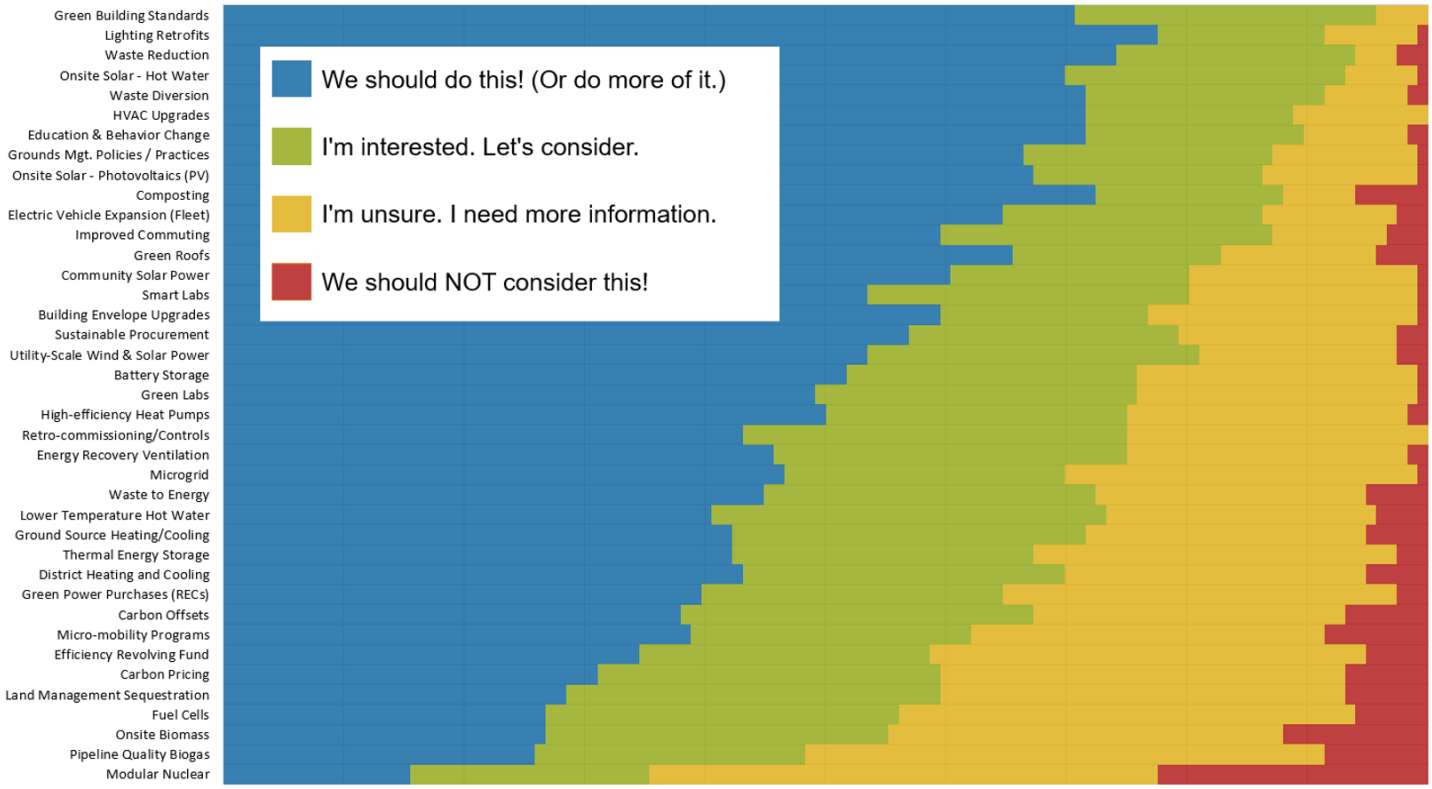


Figure 05. Results from Interest Assessment for Climate Action Solutions

Goals & Considerations

During the process to engage the campus community in the CAAP design, specific goals and considerations where identified:

- Synthesize existing energy project studies into a climate neutrality roadmap
- Determine the most feasible and actionable climate resilience strategies
- Identify appropriate metrics for measuring progress towards resilience goals
- Leverage other university priorities to ensure optimal CAAP implementation
- Generate buy-in for CAAP implementation
- Integrate scope 3 carbon neutrality goal
- Provide sufficient details to compel and guide campus decision makers
- Communicate a concise and engaging plan to our diverse community

Additional CAAP considerations:

- Clarify approach to carbon offsets - targets cannot be met through projects and efficiencies alone
- Outline an adaptable roadmap - the feasibility of certain projects and strategies is still unknown or subject to other variables
- Integrate resilience strategies alongside mitigation strategies

[5] See "Acknowledgements" section for a complete list of stakeholders.

Business as Usual

The Business-as-usual Forecast (BAU) is a key modeling tool used by the planning team to develop the climate mitigation initiatives in this plan. The BAU represents a base-case scenario that forecasts what would happen if the current campus buildings, district energy system, fleet, and related business practices were to continue their current (pre-pandemic) trajectories. The BAU assumes that current systems and equipment would be replaced or rebuilt at the end of their useful lives and that additional capacity would be added to support new building loads to continue to provide reliable energy services. The BAU Energy and GHG forecast projects how the district energy supply system will meet the energy demands of the future campus and its implied Scope 1, 2, and 3 GHG emissions. The BAU financials include the major capital expenditures (CAPEX) and annual operating expenses (OPEX). The BAU also establishes a commodity price forecast for purchased electricity, natural gas, and other energy related commodities. **The BAU should not be considered a prediction**, but rather a modeling tool used to help CSULB understand the likely implications of each proposed initiative both individually and as a portfolio.

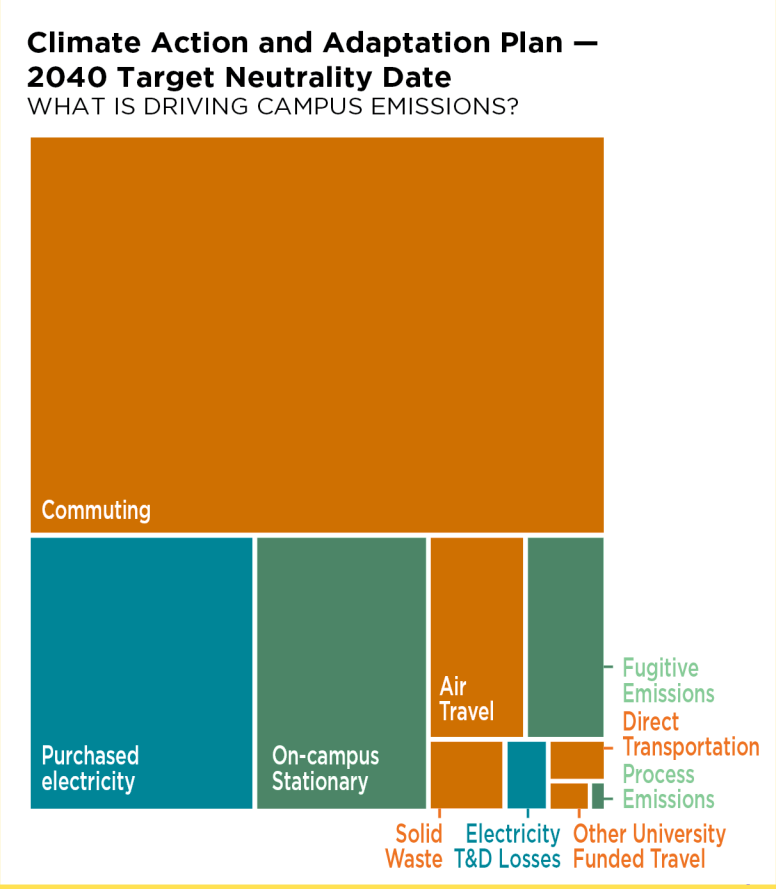


Figure 06A. Campus Emissions by Source and Scope

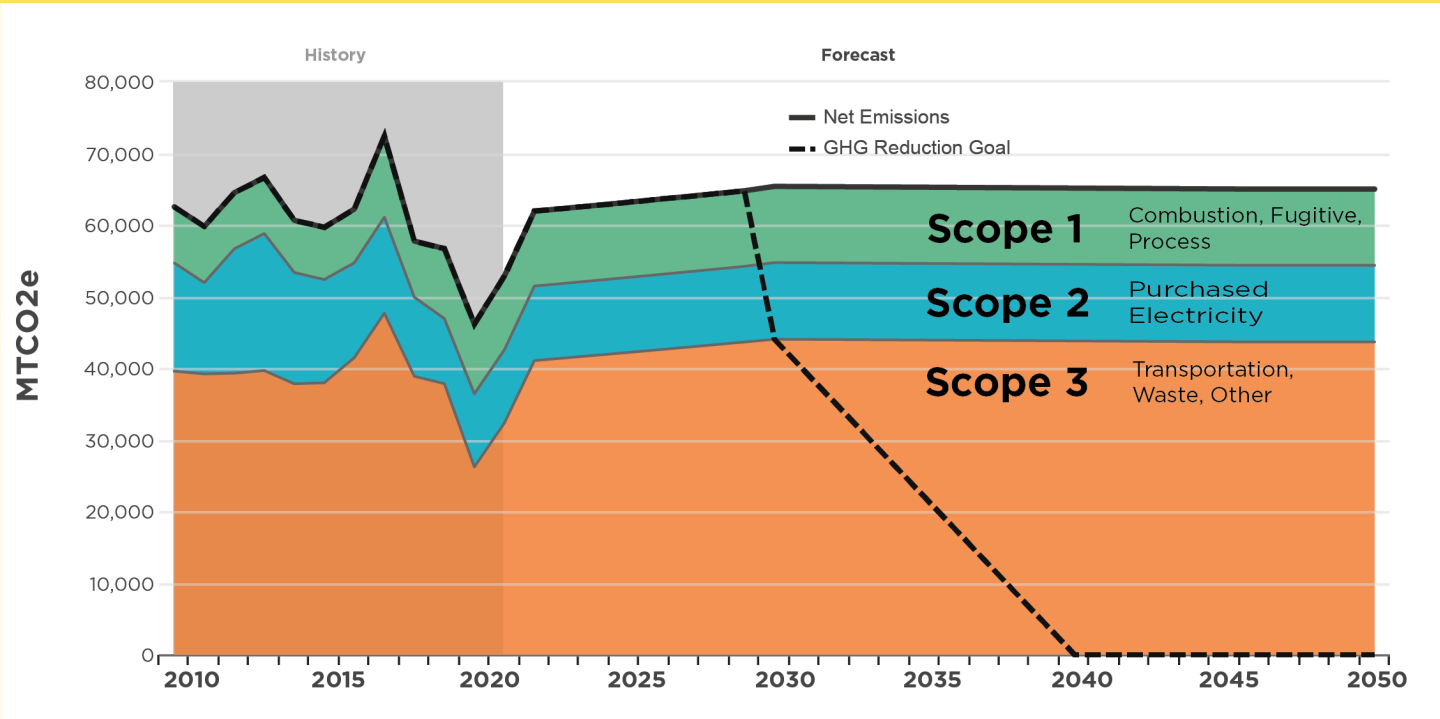


Figure 06B. Campus Emissions by Source and Scope

Key Assumptions & Insights

CSULB's GHG emissions are overwhelmingly from vehicle commutes to campus, energy purchased from the grid, and stationary combustion of fossil fuels on campus. For planning purposes, the team assumed future campus emissions would be aligned with historical averages and that no new sustainability initiatives would be adopted. The BAU does not include probable changes in the external environment such as the "greening of the grid" [6] and increased presence of zero emission vehicles on the road although these topics are addressed later in the roadmap initiatives. The BAU model is intentionally simplified. It provides an understandable baseline forecast to allow for the evaluations of alternatives paths forward. The GHG reduction goal is intended to show the trajectory needed to reach full decarbonization.

Initiative Selection

In addition to responses gathered from the interest assessment survey, insights were collected from an engineering study, stakeholder discussions, a climate adaptation charette, other staff generated initiatives (e.g. Carbon Neutral Commuting Program), current campus planning efforts, and details used to generate GHG inventories. The team used this information to generate a list of initiatives that would move the university closer to its climate neutrality goals. Each potential strategy was assessed for feasibility based on cost, labor requirements, operational impact, external policies, and timing. The strategies found to be the most implementable and with potential to yield signification GHG emissions reductions were refined into campus-specific targets organized into Focus Areas, Initiatives, and Action Steps. Strategies that were excluded and the constraints that led to their omission are included in the appendix.

Important terms used in this plan:

- **Focus Areas** – General, high-level areas of emphasis used to group Initiatives.
- **Initiatives** – Groups of similar projects and programs within a Focus Area
- **Action Steps** – Specific, applicable tactics to achieve desired objectives within an Initiative.

[6] In this case, "greening of the grid" refers to decarbonizing energy sources through mandates from State and Federal legislation that would ultimately support CSULB carbon emissions reduction goals.

Climate Action & Adaptation Plan

Mitigation Roadmap

1 STRATEGIC ENERGY MANAGEMENT (SEM)

2 RENEWABLE ENERGY

3 CAMPUS ENERGY TRANSITION

4 SCOPE 3 MITIGATION

5 OFFSETS

Adaptation Roadmap

1 CAPACITY & AWARENESS

2 PERSONAL RESILIENCE

3 FACILITIES & OPERATIONS

4 CURRICULUM

At-A-Glance

MR 1.1	Continue Existing Energy Efficiency Program
MR 1.2	Accelerated SEM Funding
MR 2.1	Additional 2.28 MW of Onsite Solar
MR 2.2	CSU Community Choice Aggregation
MR 2.3	Electric Vehicle (EV) Charging Stations
MR 3.1	Boiler Upgrades and Other Decarbonization/Electrification Recommendations
MR 3.2	Electric Vehicle Adoption in Campus Fleet
MR 4.1	Commuting Optimization and Electrification
MR 4.2	Air Travel Offsets
MR 4.3	Waste Reduction, Diversion, & Composting
MR 5	Residual Decarbonization
AR 1.1	Increase Fundraising Efforts for Projects & Programs
AR 1.2	Update Emergency Plans Operations
AR 1.3	Recruit & Train at Department Level
AR 1.4	Expand Outreach & Marketing
AR 2.1	Improve Student Housing Security
AR 2.2	Improve Student Food Security
AR 2.3	Improve Overall Wellness of Campus Community
AR 3.1	Increase Shading of Walkways
AR 3.2	Establish Tree Replacement Policy & Species Guidelines
AR 3.3	Implement Irrigation Water Saving Programs
AR 4.1	Train Faculty to Integrate Resilience into the Curriculum
AR 4.2	Increase Student Sustainability & Climate Literacy
AR 4.3	Increase Sustainability & Climate Academic Programs

Recommendations Roadmaps

Mitigation Roadmap (MR)

1

STRATEGIC ENERGY MANAGEMENT (SEM)

Strategic energy management (SEM) is a long-term approach to energy efficiency that includes setting goals, tracking progress, and reporting results. A successful SEM plan builds long-term relationships with energy users and targets persistent energy savings. For buildings, strategic energy management reduces costs across many end-uses and institutionalizes practices to sustain long-term savings. The SEM program focuses on a portfolio of efficiency measures and enabling technologies including:

- Energy Metering and Management Systems
- Lighting Refurbishments
- Retro- and Ongoing Commissioning
- Behavior Change Programs
- Green Labs / Smart Labs

MR 1.1 — Continue Existing Energy Efficiency Program

CSULB currently budgets $1.6M annually for energy efficiency projects and has full-time staff dedicated to deploying these funds to deliver cost-saving projects.

Energy Savings Targets:

- 15% by 2031
- 27% by 2041
- 35% by 2050

MR 1.2 — Accelerate SEM Funding

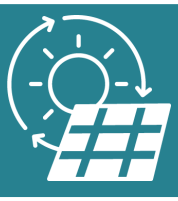
This initiative envisions an acceleration of energy efficiency efforts through a SEM program that includes a dedicated revolving funding mechanism. The program would capture the funds unlocked by energy efficiency projects to be reinvested into additional projects that can drive further savings. MR 1.2 uses the same assumption for scale of savings as MR 1.1, except MR 1.2 deploys projects faster to deliver the 35% energy reduction target 12 years sooner.

Targeted Results:

- 18% Return on Investment (ROI)
- 35% Energy Reduction
- 15% GHG Mitigation

2

RENEWABLE ENERGY



Electricity is CSULB's second largest GHG emissions source and the largest source of emissions under the university's operational control. While energy efficiency can help eliminate energy waste, other decarbonization strategies will require CSULB to purchase more electricity in the future. To reach CSULB's stated goals, this electricity must come from a renewable source. The Mitigation Roadmap includes 3 major initiatives related to renewable electricity.

MR 2.1 — Additional 2.28 MW of Onsite Solar

CSULB has identified additional viable locations for installation of onsite photovoltaics (PV). This initiative would focus investments into the most economical PV projects, which would include some roofs but would primarily consist of solar parking canopies. The team modeled this as a capital investment. CSULB would most likely utilize a Public-Private Partnership (P3) structure to take advantage of tax incentives.

Modeling Assumptions:

- 2.28 MW installed at $3.50 / Watt
- 18% capacity factor
- 0.5% annual degradation factor

Targeted Results:

- $1M Avoided Energy Costs
- 3% Reduction of Direct GHG
- 0.5% Reduction of Total GHG

MR 2.2 — CSU Community Choice Aggregation

California's electricity grid is rapidly decarbonizing and providing electricity customers with a broader array of choices for purchasing carbon-free and renewable electricity at or below the cost of default grid power. This initiative envisions CSULB switching electricity providers to procure 100% clean electricity through a Community Choice Aggregator (CCA) or through a series of offsite power purchase agreements (PPAs) where CSULB would retain and retire the associated renewable energy certificates (RECs) generated by the project(s).

Modeling Assumptions:

- Cost-neutral with current and forecasted rates
- Would begin in 2023.

Targeted Results:

- 100% Clean Electricity
- 12% Reduction of Direct GHG
- 4% Reduction of Total GHG
- $0 University Capital

MR 2.3 — Electric Vehicle (EV) Charging Stations

Based on data provide by the California Air Resources Board (CARB), 30% of vehicles on the road will be full-electric or plug-in hybrid electric by 2031[7]. This initiative envisions a significant expansion of vehicle charging infrastructure over the next 10-15 years. The plan recommends such upgrades be paired with solar deployment (**MR 2.1**) and potentially paired with additional battery storage. CSULB will most likely utilize a P3 structure to take advantage of tax incentives as well as to capture revenue potential from vehicle charging.

Targeted Results:

- Added Resilience
- Potential New Revenue Sources
- Potential for Electricity Demand Management

3

CAMPUS ENERGY TRANSITION

The combustion of natural gas is the third largest source of emissions on the CSULB campus. Most of this natural gas is used as part of the campus district energy system. The mitigation roadmap envisions a transition away from combustion-based technologies and towards technologies based on highly efficient heat-pumps which can run with much lower amounts of electricity. This transition does require significant capital investment, but once implemented it should dramatically lower annual operating costs.

MR 3.1 — Boiler Upgrades and Other Decarbonization/Electrification Recommendations (Fulcrum Study)

CSULB has been studying a variety of engineering approaches to upgrade and electrify aging campus supply and distribution assets. This initiative envisions the campus funding the core recommendations from an analysis completed in 2021, which outlines a portfolio of projects including:

- Distribution system upgrades
- Lowering building operating temperatures
- Replacing aging boilers to improve efficiency and flexibility
- Use of heat-recovery chillers capture energy wasted during periods of simultaneous heating and cooling
- Electrical system upgrades

Targeted Results:

- 68% Reduction in Fossil Fuels
- 31% Reduction of Direct GHG
- 10% Reduction of Total GHG

MR 3.2 — Electric Vehicle Adoption in Campus Fleet

Many electric vehicles (EVs) models are already cost competitive with equivalent internal combustion engine ("ICE") vehicles on a total-cost-of-ownership basis. CSULB should consider replacing ICE vehicles with EVs or plug-in hybrid models as vehicles reach their functional end-of-life or lease term.

Modeling Assumptions:

- Fleet Electrification will reach 75%+ by 2050.
- Cost-neutral capital and operating costs

Targeted Results:

- $43k Return on Investment (ROI)
- 35% Energy Reduction
- 15% GHG Mitigation

[7] https://www.greencarreports.com/news/1132190_california-plan-80-fully-electric-by-2035-50-mile-plug-in-hybrids-tighter-tailpipe-emissions

4

SCOPE 3 MITIGATION

More than half of CSULB's GHG emissions fall into Scope 3, which represents indirect emissions sources including those generated from commuting, university funded business and athletics travel, and landfilled waste. Given that the majority of CSULB's emissions come from these sources which the university has very little direct control over, the decision was made to adopt a different carbon neutrality target year for Scope 3. While the year 2030 remains the goal for achieving neutrality for the university's direct emissions from Scopes 1 and 2, CSULB adopted a 2040 goal for Scope 3. Extending the target date for Scope 3 allows additional time to promote and support emerging transportation technologies and the anticipated evolution of commuting, telecommuting, and remote learning

MR 4.1 — Commuting Optimization & Electrification

This initiative includes the impacts of likely policies that will increase both work-from-home for employees and online courses for students, which will reduce vehicle miles traveled in all modes of transportation. It also envisions the implementation of a Carbon Neutral Commuter Program that will offer commuters the option of paying a small extra fee with their parking permit to purchase verified offsets for the emissions generated by their trips to and from campus.

Modeling Assumption:

- Initial participation rate of 10% growing to 40% by 2030

Targeted Results:

- 31% Reduction of Total GHG
- 40% Participation in 10 years
- $0 Net Cost to the University

MR 4.2 — Air Travel Offsets

This initiative envisions new University business policies and practices to require university-funded travel to include a modest fee to fund the purchasing of verified carbon offsets. This policy can be modeled on similar programs already enacted at UCLA and Cal State East Bay. The program would likely begin as a smaller pilot for willing departments and later roll out more broadly once initial logistical challenges are addressed.

Targeted Results:

- 4% Total GHG Mitigation
- 75% Participation Rate

MR 4.3 — Waste Reduction, Diversion & Composting

There are a variety of existing waste reduction, recycling and composting programs and efforts already underway on the CSULB campus including the Waste Not program launched in 2018. These programs are not primarily focused on GHG emissions reduction, but instead on other important environmental and financial outcomes such as reducing plastic pollution and avoiding disposal fees. This plan assumes these programs will cut the volume of CSULB's waste hauled to landfills by 50% over the next decade.

Targeted Results:

- ~1% Mitigation
- 5-% Waste Diversion

5
OFFSETS

The CAAP assumes that CSULB will likely choose to address any residual emissions through high-quality, verified offsets to achieve carbon neutrality.

MR 5 — Residual Decarbonization

This plan recognizes that despite dramatic technology improvements, aggressive policy support and public awareness, there are some categories of emissions that will be extremely hard to mitigate in an affordable way for a public institution, especially over the next 10-20 years.

Action Guidance:

- Use Renewable Energy Certificates (RECs) for any electricity not addressed by MR 2.1 and 2.2.
- Offset Residual Scope 1 emissions starting in 2030
- Offset Residual Scope 3 emissions starting in 2040
- Align purchases with CSULB's Research / Education Mission
- Prioritize Local Offsets
  - (E.g. Offsets from providing energy efficiency for low-income housing)
- Use a Portfolio Approach and team up with other buyers
  - Higher prices for offsets may be justified for offsets with other co-benefits like research opportunities or specific local impacts,
  - The CSU and UC systems have immense buying power as a group,

Adaptation Roadmap (AR)

As CSULB continues to work toward the goal of reducing campus greenhouse gas emissions, and thus the university's ongoing contribution to the climate crisis, it is critical to recognize that mitigating emissions is only half of the solution. CSULB must also take steps to prepare the physical campus and students, faculty and staff for current climate change impacts and the increase of these experiences in the future.

CSULB recognizes that creating a truly climate resilient community is an undertaking that carries beyond the boundaries of the campus. Addressing resiliency involves everything from improving access to public transit and affordable housing, adapting infrastructure to sea level rise, and addressing inequitable distribution of economic opportunities and green spaces across our cities. While CSULB will continue to foster partnerships with the City of Long Beach and community organizations to advance these broader adaptation goals, the university has chosen to focus on strategies for building resilience that are within the campus' purview for the purposes of this plan. Vulnerabilities and impact areas specific to CSULB that are (Figure 07.) directly related to each adaptation initiative are highlighted in this section.

Vulnerabilities & Impact Areas Considered in CSULB's Resilience Planning Process

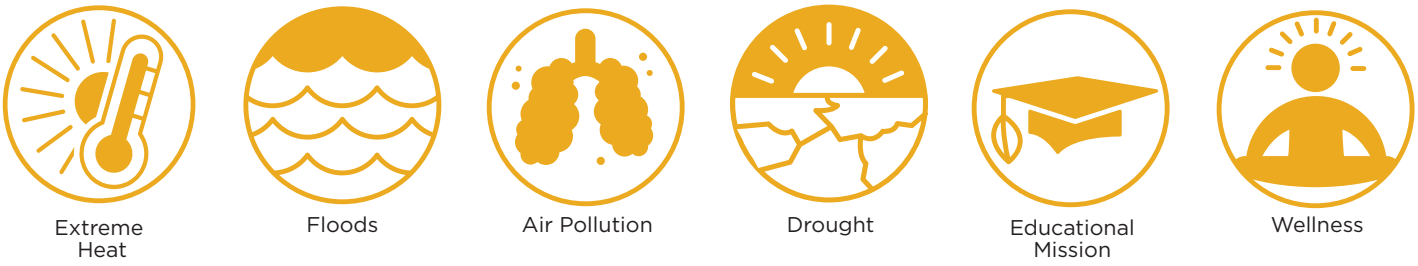


Figure 07. CSULB Vulnerability & Impact Areas

1 CAPACITY & AWARENESS

The initiatives in this focus area aim to increase the financial resources available to support climate action efforts as well as improve the campus community's understanding of the climate crisis and empower them to be part of the solution.

AR 1.1 — Fundraise for Climate Action

This initiative aims to enhance adaptive capacity by increasing fundraising efforts to support sustainability, climate action and adaptation projects and programs. Priority will be placed on raising funds through donors, grants, and sponsorships.

Target:

- Annual university fundraising campaign dedicated to sustainability

1 CAPACITY & AWARENESS *(cont)*

AR 1.2 — Update Emergency Operations Plan & Improve Messaging

To build consensus and momentum to act, the campus community must understand how the negative outcomes associated with the climate crisis are related to other emergency situations and natural disasters. This initiative calls for revising the Emergency Operations Plan (EOP) and developing templates and resources to easily enable messaging into various university communications.

Targets:

- Complete EOP update by 2023
- Complete 2 communication templates by 2023

AR 1.3 — Recruit & Train Department Level Sustainability Champions

In collaboration with the existing Building Marshal program, CSULB should recruit and train peer-to-peer educators through a department-level Sustainability Champions/Climate Action Liaisons program. In conjunction with the Emergency Manager, Office of Sustainability staff will recruit and train diverse campus employees on the issue of climate change. These individuals will serve as a resource to students and colleagues and further climate action and adaptation education in their department operations.

Targets:

- 50 Sustainability Champions recruited and trained by 2023
- Engage at least one department by 2030

AR 1.4 — Expand Outreach & Marketing

Building consensus around climate change solutions will not be possible if the campus community is not informed nor empowered. This initiative will expand outreach and marketing efforts to raise awareness about the climate crisis as a way to generate support and buy-in for climate action.

Targets:

- Track and annually increase
- Social media followers
- Number of students engaged in sustainability events and programs
- Awareness of available programs

2
PERSONAL RESILIENCE

The most vulnerable and economically disadvantaged members of any community are typically those most negatively affected by the impacts of climate change. The initiatives in this focus area are designed to help ensure that the basic needs of CSULB's most vulnerable students are addressed.

AR 2.1 — Improve Student Housing Security

Anticipated increase in temperature and precipitation, as a result of climate change, impact individuals that are unhoused or housing insecure due to lack of a safe or reliable location to shelter during extreme heat, intense storms, or unanticipated flooding. This initiative seeks to address students at CSULB that experience housing insecurity.

Target:

- Increase number of safe nights students are housed annually (from 2017-18 baseline of 509 nights) through the CSULB Basic Needs Program

AR 2.2 — Improve Student Food Security

According to a 2018 study, 41.6% of students across the CSU system reported that they experienced some level of food insecurity[8]. With food security being a pressing issue for many CSULB students, a critical part of supporting personal resilience will be to continue to bolster existing programs and develop new programs to meet currently unmet needs.

Targets:

- Exceed the number of applications to the CalFresh program above and beyond the target established by the Department of Public Social Services
- Create a similar program for DACA/Dreamer students

AR 2.3 — Improve Overall Wellness of Campus Community

Environmental, financial, and social stressors affect students' ability to learn and succeed. Increase of these stressors is anticipated as negative climate impacts intensify and exacerbate new challenges. Supporting the physical, psychological, and emotional wellness of CSULB students is critical to help them adapt to our changing planet.

Target:

- Increase case management capacity to support student wrap around services

[8] www.calstate.edu/impact-of-the-csu/student-success/basic-needs-initiative/Documents/BasicNeedsStudy_phaseII_withAccessibilityComments.pdf

3
FACILITIES & OPERATIONS

Many of the strategies for increasing the resilience of campus facilities and operations are also key mitigation strategies, including the energy conservation and decarbonization measures described in other areas of this plan. Initiatives listed in this section are aimed at adaptation strategies that do not overlap with those outlined in the Mitigation Roadmap.

AR 3.1 — Increase Shading of Walkways

According to the vulnerability assessment of the City of Long Beach's Climate Action & Adaptation Plan, the number of extreme heat days (over 95 F) in Long Beach per year is projected to increase from an average of four in the baseline period (1980-2000) to 11-16 days by mid-century and 11-37 by end-of century, depending on the emissions scenario.[9] This initiative aims to ensure that our campus population can adapt to more frequent heat waves.

Target:

- Increase the percentage of shaded walkways on campus grounds through strategic tree planting and architectural interventions.

AR 3.2 — Establish Tree Replacement Policy & Species Guidelines

CSULB's extensive urban forest is one of the most prized features of the campus and one of its most significant opportunities to support a more resilient campus. CSULB has a unique opportunity to leverage this resource to maintain consistent levels of carbon sequestration capacity.

Targets:

- Establish and build consensus for a tree replacement policy for trees that are removed due to construction and renovation projects
- Develop guidelines and recommendations that consider current and anticipated climate change impacts for tree species planted on campus
- Transition current landscaping equipment to zero-emissions option upon replacement. All new purchases of landscaping equipment will be zero-emissions starting in 2024.[10]

AR 3.3 — Implement Irrigation Water Savings Program

The severity and length of future droughts throughout the state of California are predicted to increase due to decreased precipitation and higher temperatures. With these predictions on the horizon, CSULB must take all necessary steps to conserve potable water as much as possible. This initiative outlines a water conservation approach to reduce leaks and improve water conservation.

Targets:

- Convert all landscape irrigation spray nozzles to more efficient MP rotators
- Complete the expansion of the purple pipe network of reclaimed water across the entire campus.

[9] https://www.longbeach.gov/globalassets/lbds/media-library/documents/planning/caap/lb-caap-proposed-plan-app-c-_dec-14
[10] https://ww2.arb.ca.gov/news/carb-approves-updated-regulations-requiring-most-new-small-road-engines-be-zero-emission-2024

4
CURRICULUM

As an educational institution tasked with preparing students for their future careers and leadership roles in their communities, CSULB has a responsibility to ensure these individuals gain a solid understanding of the challenges, solutions, and responsibilities that exist in relation to the climate crisis. The initiatives in this focus area aim to empower students with that knowledge.

AR 4.1 — Train Faculty to Integrate Resilience into the Curriculum

This initiative focuses on supporting faculty in their efforts to integrate climate and sustainability-related topics and themes into their courses, with particular emphasis on the Green Thread Curriculum Workshop program. Faculty that participate in this program are trained on strategies that link sustainability and climate change in their particular discipline.

Targets:

- Encourage and incentivize faculty to participate in the successful Green Thread Curriculum Workshop program

AR 4.2 — Increase Sustainability & Climate Academic Programs

In addition to training individual faculty to incorporate sustainability and climate change into their courses (**AR 4.1**), this initiative takes a more systemic approach. By integrating sustainability and climate-related learning outcomes at the department and course level, CSULB is making a deliberate emphasis on the importance of educating its students for a rapidly changing world.

Targets:

- Increase the number of academic programs with a sustainability or climate-related learning outcome that applies to all students
- Recruit faculty and student champions as advocates

AR 4.3 — Increase Student Sustainability & Climate Literacy

In a 2021 survey,[11] more than half of the students who responded (n = 305) indicated that were concerned about sustainability, climate change, and/or environmental pollution, with 42% stating that they were "very concerned." These issues are clearly front of mind for many CSULB students, however, the campus doesn't currently have a clear picture of the level of knowledge students possess about these issues. This initiative aims to remedy this data gap.

Targets:

- Assess the sustainability and climate literacy of the student body to establish a baseline by 2023
- Aim to increase literacy rate 5% annually from baseline

[11] CSULB Student Sustainability Impressions Survey (2021)

Impacts

This section outlines the greenhouse gas, financial and energy impacts of the portfolio of initiatives in the Mitigation Roadmap.

Greenhouse Gas Emissions Reductions

The following "wedge diagrams" show the projected carbon mitigation contribution of each Mitigation Roadmap initiative. Projected impacts are modeled in relation to only Scopes 1 and 2 in the first diagram in order to isolate the university's direct, operational emissions sources for which the 2030 neutrality date has been adopted. The second diagram layers in the impact of initiatives designed to address Scope 3 emissions sources, showing a path for achieving our 2040 neutrality target.

Scope 1 and 2 Wedge Diagram

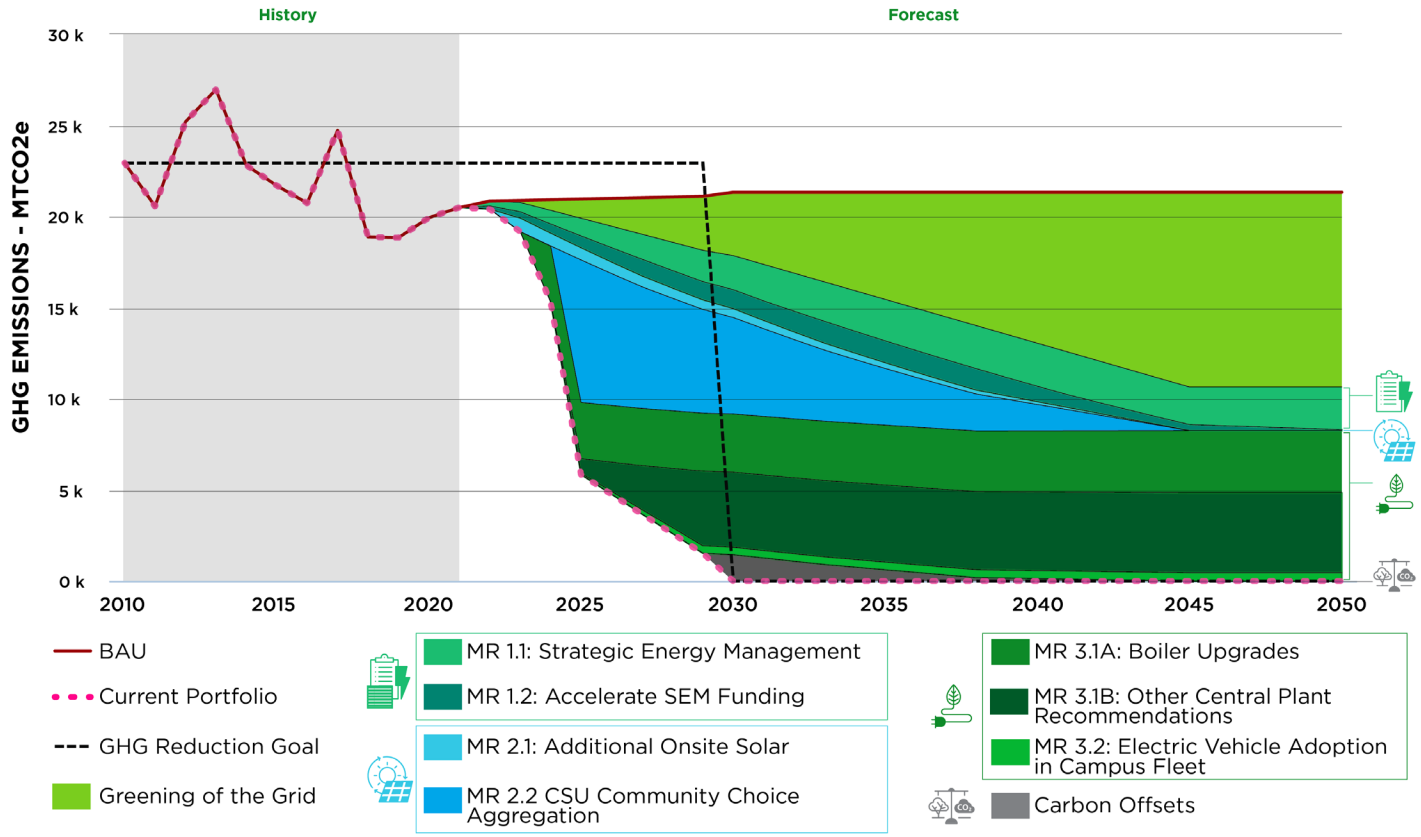


Figure 08. Carbon Reduction Impacts by Initiative Scopes 1 and 2

Insights

- The **Greening of the Grid** wedge shows the expected impacts as California implements Senate Bill 100, the policy requiring that renewable and zero-carbon energy resources supply 100 percent of electric retail sales to customers by 2045. Note that the bulk of the impacts will occur after CSULB's 2030 neutrality target for Scopes 1 and 2. The planning team considered the Greening of the Grid an important macro-economic trend rather than a proactive CSULB initiative.
- **MR 1.1** and **1.2** are relatively modest carbon mitigation measures since they will largely focus on saving electricity which will become less-carbon intensive over time due to the Greening of the Grid. These measures will be very effective at saving money and will reduce the need for other more expensive measures.
- **MR 2.1** and **2.2** focus on accelerating CSULB's move to 100% clean electricity. MR 2.1 Additional Onsite Solar has a modest carbon impact. MR 2.2 CSU Community Choice Aggregation has the potential for larger scale impact since the solar installations are not limited to the physical campus. The wedges also decline in scale over time due to the Greening of the Grid.
- **MR 3.1 A & B** are focused on replacing aging natural gas equipment and improving the efficiency of CSULB's thermal systems as the campus moves towards electrification.
- **MR 3.2** shows the impact of electrifying fleet vehicles as electric versions become cost-competitive with gasoline versions over the next decade.
- The **Carbon Offsets** wedge shows the residual emissions that won't be addressed by the 2030 neutrality date by other measures. This wedge is expected to decline towards zero as other measures are fully implemented.

Scope 1, 2 and 3 Wedge Diagram

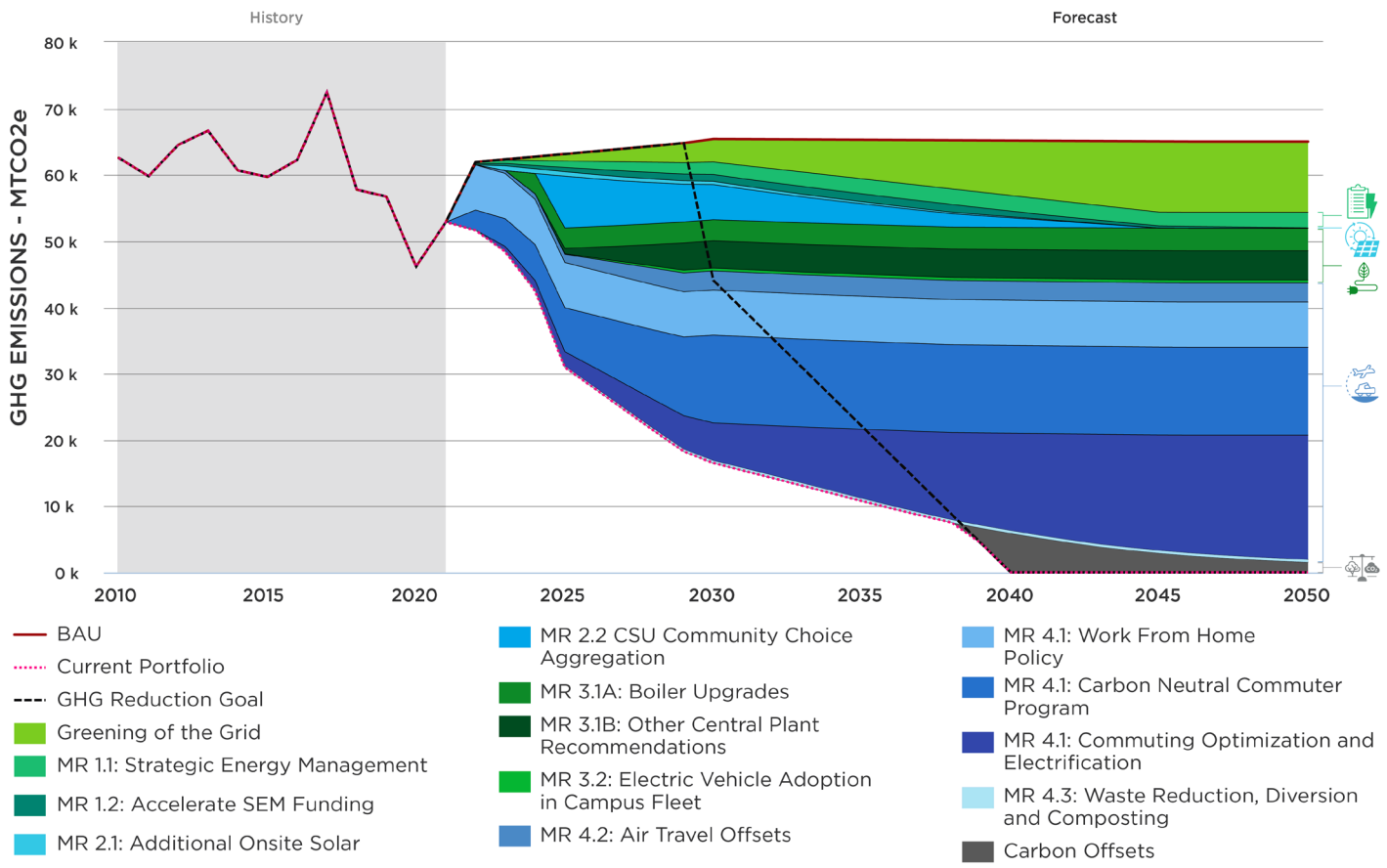


Figure 09. Carbon Reduction Impacts by Initiative Scopes 1, 2 and 3

Insights

- See *Scope 1 and 2 Wedge Diagram* for details on **MR 1.1** through **MR 3.2**
- **MR 4.1 Work from Home Policy** shows the impact of 20% of staff and 10% of student and faculty trips avoided due to work-from-home policies and remote learning options.
- **MR 4.1 Carbon Neutral Commuter Program** shows the impact of a voluntary program that allows commuters to offset their own emissions through an extra fee on their parking permit. The model assumes a 40% participation rate by 2030.
- **MR 4.1 Commuting Optimization and Electrification** shows the macro-economic impact of California's vehicles transitioning to electric and other low- or no-carbon alternatives. By 2050, the model assumes California will reduce emissions per vehicle mile traveled by 95% based on guidance from California Air Resources Board (CARB) and the US EPA. This is a significant mitigation measure in the long term, but it is not expected to reach full impact until 10 years after CSULB's 2040 neutrality target for Scopes 1, 2, and 3.
- **MR 4.2 Air Travel Offsets** anticipates a program that could purchase offsets for 100% of air-travel emissions through a per-ticket fee on 75% of flights. This voluntary program will phase in between now and 2030.
- **MR 4.3 Waste Reduction, Diversion & Composting** assumes a 50% diversion rate is achieved by 2030. Note, while waste diversion programs will continue to be an important focus for general sustainability efforts, this yields only a small mitigation impact since solid waste only accounts for a fraction of overall GHG emissions.
- **Carbon Offsets** shows the residual emissions remaining to reach the 2040 target and beyond. Required annual offset purchases by the university should decline as other mitigation measures reach full implementation in the last decade.

Financial Impacts

The following charts provide a high-level summary of the life-cycle costs of the business as usual (BAU) approach versus the approach outlined in the CAAP. A few important caveats:

- While this plan was grounded in actual financial history and informed by various engineering studies and best-available cost forecasts, the costs shown are high-level estimates only. These are the sum of many compounding modeling assumptions. Energy and construction cost volatility and additional regulatory impacts or other external forces will change these assumptions.
- The BAU Reference Case assumes CSULB does properly invest in maintaining energy and building systems through 2050.

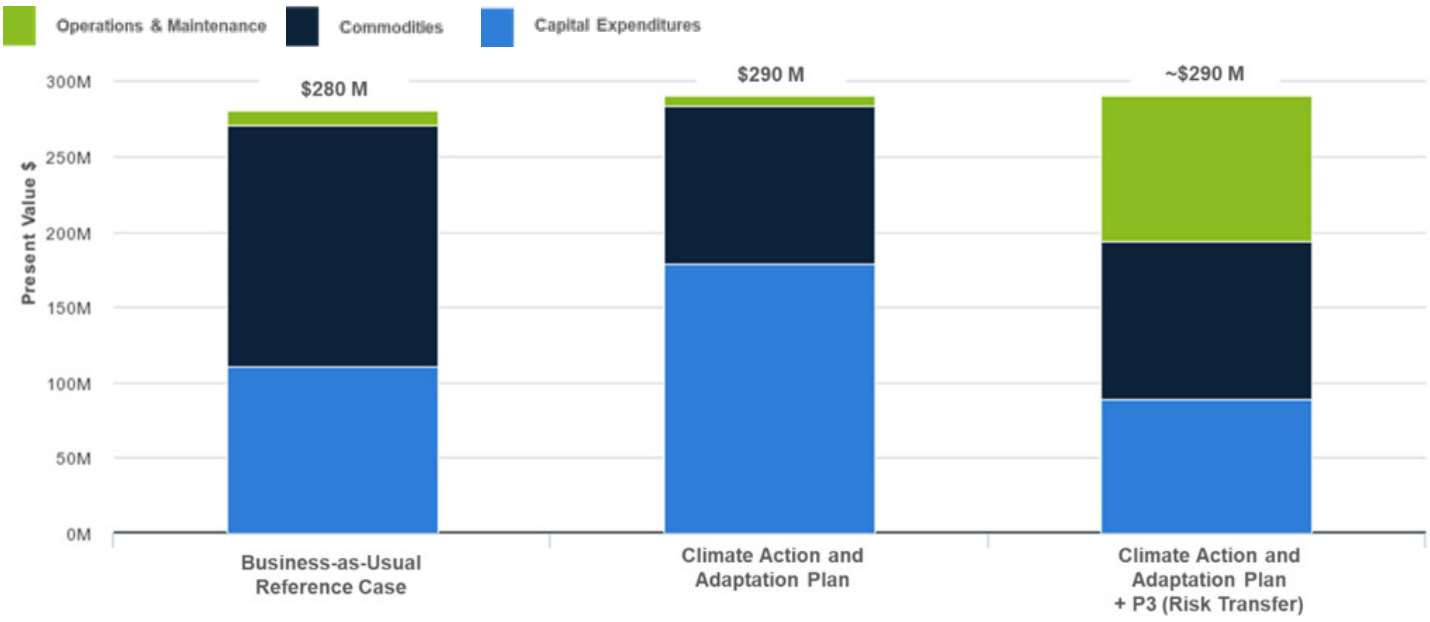


Figure 10. Life-Cycle Cost Comparison

Insights

- The CAAP as modeled would be slightly more expensive than the BAU Reference Case. The CAAP would require more capital investments in exchange for lower Operating and Maintenance and Commodity Costs.
- CSULB could also consider alternative delivery methods such as a public-private partnerships (P3). This approach could limit the amount of capital CSULB must provide but it would also add a service agreement or payment structure and therefore increase the Operations and Maintenance budgets required.
- Given the uncertainty noted above, the question for CSULB is less about which is the least expensive, and more a question of which price-risk profile is the most attractive. All three cases, as modeled, are roughly the same on a life-cycle costs basis.

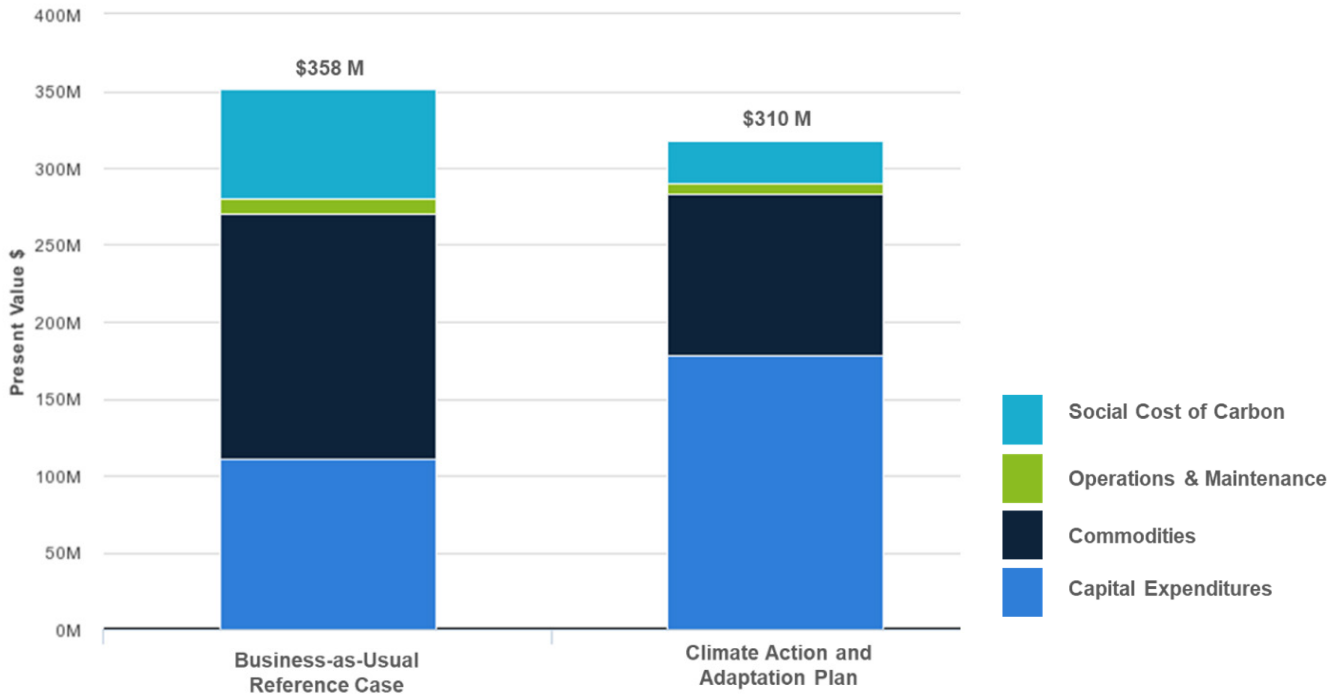


Figure 11. Life-Cycle Cost Comparison with a Social Cost of Carbon

Insights

- If we layer in a Social Cost of Carbon (an estimate of the cost per metric ton of damages caused to society from by emitting a MTCO2e of GHG Emissions) the CAAP becomes more attractive financially. The graph above uses the Biden Administration's Social Cost of Carbon price of $51 / MTCO2e with a 5% annual price escalation.
- Note that the Social Cost of Carbon is not going to directly affect the University's annual operating or capital budget, but it is an important tool to help quantify the external costs in-action would inflictput on society and is therefore a useful tool for long-term investment decisions.

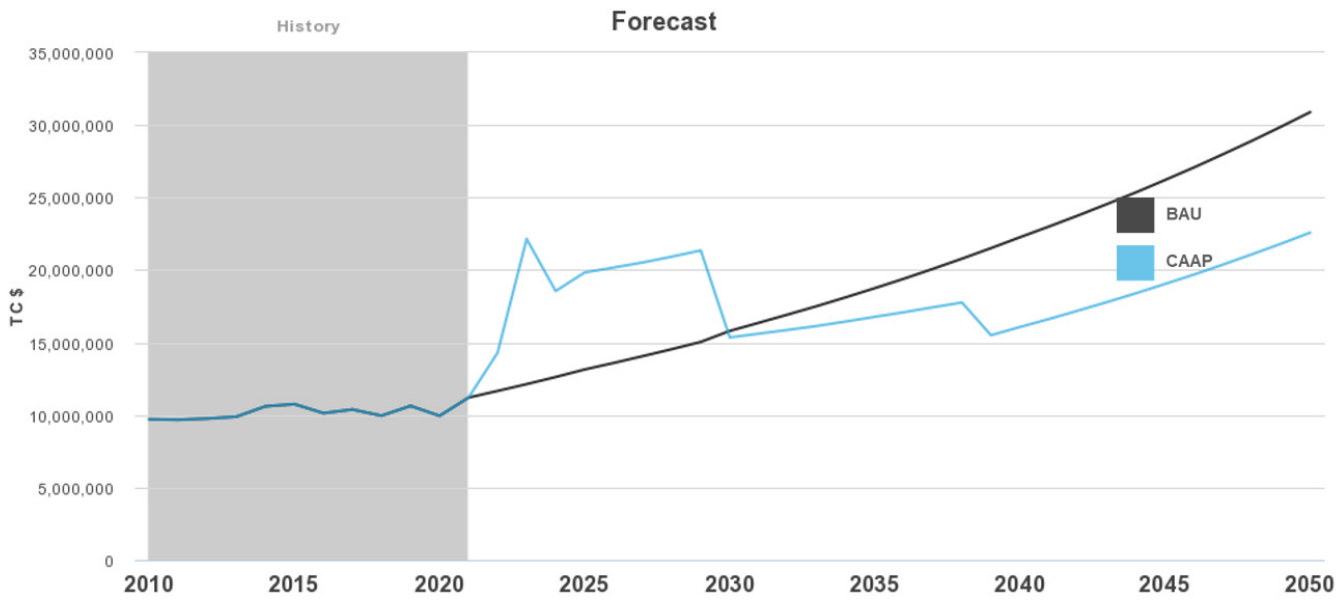


Figure 12. Total Cashflow Comparison (without a Social Cost of Carbon)

Insights

- Total cashflow is an important metric for campus financial planners. Even if the CAAP is a better long-term financial decision, the institution needs the capacity to afford the short-term investments. The CAAP does require significant near-term investments, roughly double the current rate of capital and operating spending associated with campus energy infrastructure.
- Once the majority of the CAAP has been implemented, the financial picture improves dramatically since the overall system will be more financially and energy efficient. Investments in the next decade can help ensure financial health for decades to come.

Energy Impacts

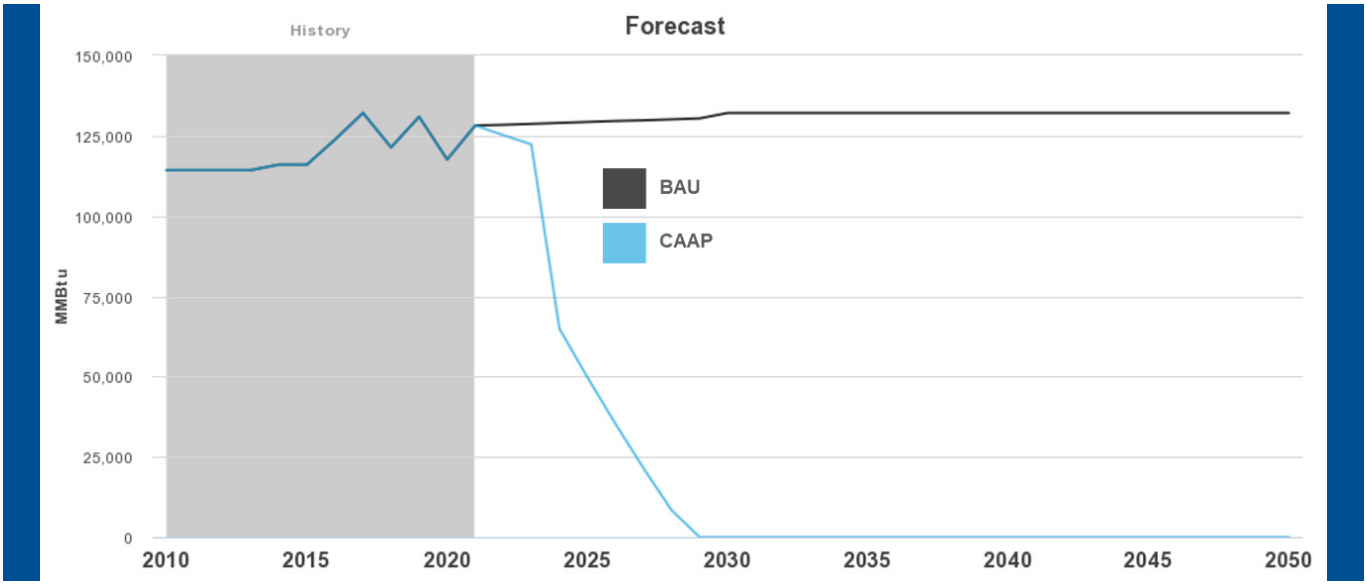


Figure 13. Natural Gas Consumption Comparison

Insights

- Many of the initiatives in the CAAP are designed to quickly phase out the use of fossil fuels on the CSULB campus. CSULB may require some minimal amount of natural gas combustion after 2030, but as modeled, the combination of energy efficiency, building , distribution and central system upgrades could fully electrify the campus by 2030.

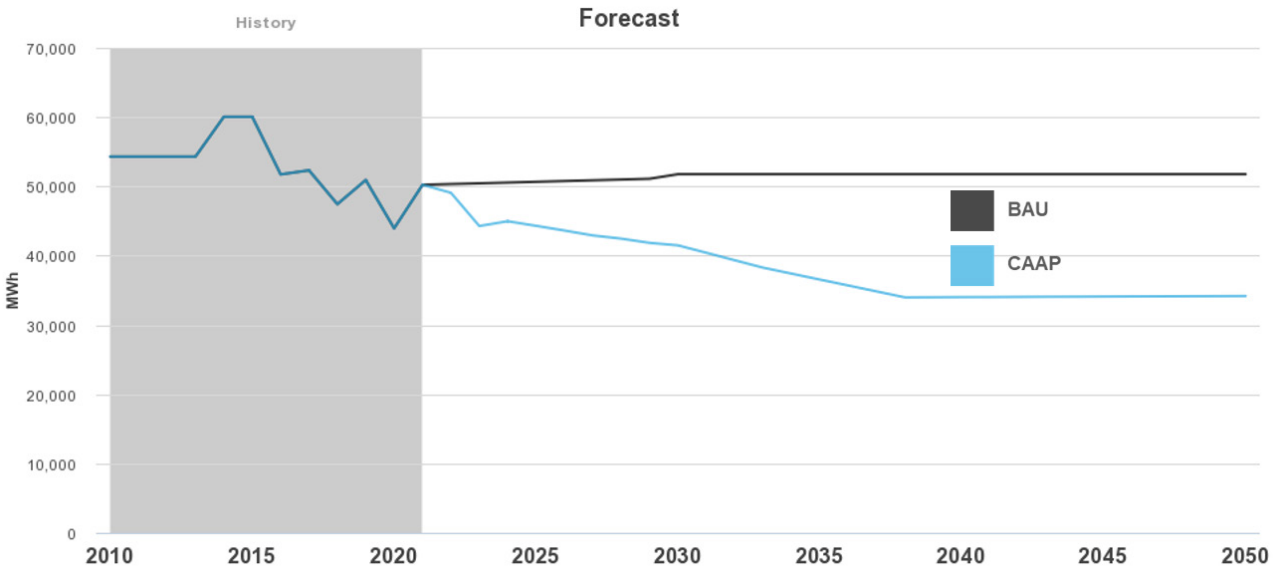


Figure 14. Purchased Electricity Consumption Comparison

Insights

- One might expect a large spike in purchased electricity demand associated with electrification. However, the modeling suggests that if CSULB can continue aggressive energy efficiency efforts, which largely target current electricity uses, the aggregate affect can continue the downward trend seen since 2015.
- Reasons include: the systems envisioned in the CAAP can utilize more waste heat currently evaporated in the cooling tower and achieve much higher thermal efficiencies.

Key Next Steps

As with any long-range planning exercise this plan suggests a mix of short and long-term actions for CSULB to achieve the goal of full decarbonization, while achieving adaptation goals. This section outlines the key next steps the planning team recommends for CSULB to begin implementing in 2022.

Strategic Energy Management (SEM)

- **Actions**
  - [ ] Green Revolving Fund
  - [ ] Energy Metering and Management Systems
  - [ ] Lighting Refurbishments
  - [ ] Retro- and Ongoing Commissioning
  - [ ] Behavior Change Programs
  - [ ] Green Labs / Smart Labs

Boiler Upgrades and Other Decarbonization / Electrification Recommendations

- **Actions**
  - [ ] Distribution system upgrades
  - [ ] Lowering building operating temperatures
  - [ ] Replacing aging boilers to improve efficiency and flexibility
  - [ ] Use of heat-recovery chillers capture energy wasted during periods of simultaneous heating and cooling
  - [ ] Electrical system upgrades

CSU Community Choice Aggregation

- **Actions**
  - [ ] Procure 100% clean electricity through a Community Choice Aggregator (CCA) or through a series of offsite power purchase agreements (PPAs) by 2025.
  - [ ] Retain and retire the associated renewable energy certificates (RECs) generated by the project(s)

Scope 3 Mitigation

- **Commute Optimization and Electrification Actions**
  - [ ] Adopt work-from-home policy
  - [ ] Increase online and hybrid courses compared to pre-pandemic levels
  - [ ] Adopt Carbon Neutral Commuter program
  - [ ] Increase electric vehicle charging infrastructure
- **Air Travel Offset Policy Actions**
  - [ ] Develop air travel offset policy for university-funded air travel

Increase Sustainability and Climate Academic Programs

- **Actions**
  - [ ] Design inclusion parameters
  - [ ] Audit current academic programs
  - [ ] Recruit faculty champions as advocates
  - [ ] Identify opportunities for learning outcome alterations (e.g. self-studies)
  - [ ] Engage students in advocacy efforts

Implementation & Reporting

CSULB's institutional sustainability initiatives are overseen by the President's Commission on Sustainability (PCS) and associated subcommittees and working groups. The Division of Administration & Finance oversees funding and support for this CAAP. The CSULB Office of Sustainability is responsible for overall engagement, communication, and education about this plan. Beach Building Services will lead efforts associated with capital planning, design, and construction, as well as general campus maintenance and operations. The Curriculum Subcommittee of the PCS will work with the Office of Sustainability, Academic Affairs, and campus faculty on efforts to incorporate climate and sustainability into the curricula and design the necessary support for faculty to create new, or update existing, courses. Additionally, Academic Affairs will continue support for virtual teaching and learning post-pandemic. Human Resources will work with union representatives and managers throughout the campus to adopt a post-pandemic work-from-home policy. Parking and Transportation Services will lead efforts in reducing Scope 3 emissions by developing a Carbon Neutral Commuter Program and by expanding electric vehicle charging infrastructure.

An annual progress report will be organized by the Office of Sustainability and presented to the PCS. A comprehensive update to this CAAP is anticipated every 5 years.

Acknowledgments

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Key Stakeholder Groups

2014 Climate Action Plan Working Group
Beach Building Services Leadership Team
Office of Planning & Sustainability
Presidential Commission on Sustainability (PCS)
PCS CAAP Update Committee
PCS Communications and Engagement Committee
PCS Curriculum Committee
PCS Transportation Solutions Committee
Resilience Working Group
Transportation Working Group
Water Working Group
Zero Waste Working Group
Division of Finance (DAF) Executive Team
Parking & Transportation Services

Photo credit: Sean DuFrene & Joseph Philipson
Graphic Design: Krista Dajay

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Appendix

Potential Solutions Evaluated

The following table lists the specific solutions that were considered by the planning team. Some solutions were ruled out based on early technical or economic analysis while others were not specifically analyzed as part of the scope of this plan. In many cases the team bundled like solutions together so they could be analyzed as part of a larger strategic initiative.

Solution	Initiative(s)	Note
Demand: People, Practices, and Policies		
Green Building Standards	MR 1	
Education & Behavior Change	MR 1	
Green Labs	MR 1	
Efficiency Revolving Fund	MR 1	
Sustainable Procurement	n/a	Future Opportunity
Grounds Management Policies / Practices	AR 3	
Demand: Systems & Technologies		
Lighting Retrofits	MR 1	
HVAC Upgrades	MR 1, MR 3.1	
Building Envelope Upgrades	MR 1, MR 3.1	
Green Roofs	n/a	Didn't evaluate
Energy Recovery Ventilation	MR 1, MR 3.1	
(Retro-)Commissioning / Controls	MR 1, MR 3.1	
Smart Labs	MR 1, MR 3.1	
Supply: Supply Efficiency & Reliability		
District Heating and Cooling	MR 3.1	
Microgrid	MR 3.1	
Battery Storage	MR 3.1	
High-efficiency Heat Pumps	MR 3.1	
Lower Temperature Hot Water	MR 3.1	
Thermal Energy Storage	MR 3.1	
Supply: Alternative Supply		
Pipeline Quality Biogas	n/a	

Solution	Initiative(s)	Note
Onsite Biomass	n/a	
Fuel Cells	n/a	
Modular Nuclear	n/a	
Electric Vehicle Expansion (Fleet)	MR 3.2	
Supply: Renewables		
Onsite Solar - Hot Water		Didn't evaluate
Onsite Solar - Photovoltaics (PV)	MR 2.1 & 2.2	
Ground Source Heating/Cooling (GeoExchange)	MR 3.1	Potential part of system
Waste to Energy	n/a	Logistically impractical
Green Power Purchases (RECs)	MR 2.1 & 2.2	Avoid cost-additive unbundled RECs
Utility-Scale Wind & Solar Power	MR 2	Implied with "greening of the grid"
Community Solar Power	MR 2.2	
Other: Transportation		
Micro-mobility Programs	MR 4.1	
Improved Commuting	MR 4.1	
Air-Travel Mitigation and Offset Programs	MR 4.2	
Other: Waste Management		
Waste Reduction	MR 4.3	
Waste Diversion	MR 4.3	
Composting	MR 4.3	
Other: Offsets/Other		
Land Management Sequestration	n/a	
Carbon Offsets	MR 5	
Carbon Pricing	Overall	


CSULB SUSTAINABILITY