Presidential Working Group on Sustainability in Education, Research & Operations

Operations Committee

Task Force on Carbon Removal and Offsets

Final Report

2022 - 2023

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EXECUTIVE SUMMARY

To guide the development of USC's carbon offset and removal program, the Task Force on Carbon Removal and Offsets (the "Task Force") was formed in 2022 and consists of diverse stakeholders of the USC community. The following report is the culmination of the Task Force's efforts to establish comprehensive evaluative criteria and key considerations to guide the decision-making process for USC's carbon offset and removal program.

The report begins by detailing USC's commitment to reach climate neutrality by 2025. To achieve this ambitious goal, the Task Force recommends that USC use a carbon management hierarchy that approaches carbon offsets as a means of last resort. The report continues with a discussion of the pros and cons of carbon offsets, followed by a review of peer institutions' current plans for purchasing and utilizing carbon offsets.

To evaluate prospective offset projects, the Task Force recommends using the following framework of considerations: 1) the assurance that all carbon offsets are Permanent, Additional, Verifiable, Enforceable and Real (PAVER), 2) the total amount of carbon dioxide equivalent reductions in metric tons, 3) the offset cost in dollars per metric ton, 4) the reduction of pollution, improvement of health, and improvement of environment near project sites, with an emphasis on achieving these benefits in the Los Angeles and Southern California regions, 5) the inclusion of social equity and environmental justice considerations, 6) the avoidance of co-negative impacts, 7) opportunities to involve the USC community, 8) partnerships and external funding potential, and 9) business and household savings.

The Task Force goes on to discuss six major offset project types: 1) Carbon Capture and Storage, 2) Forestry & Agriculture, 3) Fuel Switching, 4) Energy Efficiency, 5) Industrial Gas Abatement, and 6) Renewable Energy. The section on each project type includes a brief definition, project examples, key strengths and weaknesses, and various perspectives from members of the Task Force. The project types section concludes with a comparison among project types and their associated risks and benefits, a summary of each project type as they generally relate to the PAVER requirements and USC's evaluation criteria, and a discussion of novel projects if USC were to pursue developing its own carbon offset projects.

The report concludes with the Task Force's overall recommendations, including: 1) maintaining a commitment to reducing internal emissions first and reporting the decreasing use of offsets over time, 2) ensuring "PAVER" standards for offsets are highly likely to be fulfilled, 3) building a diverse portfolio of projects based on the Task Force's evaluative criteria, 4) prioritizing offset projects that benefit the South and East Los Angeles community, 5) partnering with external subject matter experts to conduct due diligence of offset projects, and 6) convening a working group organized by the Office of Sustainability once as needed to review to ensure recommendations remain current in an evolving voluntary offset market.

INTRODUCTION

The University of Southern California (USC) is committed to achieving climate neutrality by 2025, which is one of the goals listed in its sustainability framework, Assignment: Earth.[1] In order to achieve this ambitious goal, USC should follow a carbon management hierarchy that first prioritizes reducing its emissions through improved energy efficiency and conservation, second, eliminates emissions through the use of renewable energy sources, and, lastly, pursues a carbon offset program for the residual emissions that cannot be directly addressed by changes in campus operations and infrastructure. Furthermore, USC should commit to incrementally decreasing its reliance on the carbon offset program over time until offsets are no longer necessary. USC cannot achieve its ambitious goal of climate neutrality by 2025 without utilizing carbon offsets. This report was developed to guide USC as it implements this element of its carbon neutrality strategy.

Carbon offsets are reductions in greenhouse gas (GHG) emissions or increases in sequestration that are used to compensate for emissions that occur elsewhere.[2] Carbon offset credits are generated by projects that either reduce GHG emissions or remove carbon dioxide from the atmosphere and can be purchased through brokers, in marketplaces, or directly from project owners. In general, a carbon offset credit represents the reduction of one metric ton of carbon dioxide or other equivalent GHG emissions and is a transferable credit that is certified by an independent certification body or a government. Organizations striving to reduce their carbon footprints often purchase offsets to balance ongoing emissions that they cannot immediately reduce directly.

The 2022-2023 Task Force on Carbon Removal and Offsets[3] convened to provide recommendations to aid USC's Office of Sustainability and senior administrative leaders in utilizing carbon offsets as a part of its climate neutrality strategy. The goal of the Task Force is to adequately prepare decision-makers to purchase offsets to help meet USC's climate neutrality goals while advancing USC and USC's stakeholders' values and priorities.

USC's commitment to climate neutrality

In 2022, USC committed to reaching climate neutrality by 2025. Climate neutrality is defined as reaching net-zero GHG emissions, meaning USC will steadily reduce its carbon footprint and address any remaining emissions with the use of carbon offsets. For consistency in

[1] 4.1.a. USC will achieve climate neutrality for annual scopes 1 & 2 emissions for fiscal year 2025 and beyond while seeking to minimize the use of carbon offsets and 4.1.b. USC will achieve climate neutrality for annual scope 3 emissions (air travel, commuting, waste, T&D losses) for fiscal year 2035 and beyond (achieving a 50% reduction by 2028, using 2014 as the baseline). University of Southern California. (2022). See: *Assignment: Earth - Sustainability*. USC Sustainability. https://sustainability.usc.edu/assignment-earth/

[2] Carbon Offset Guide. (n.d.). *Understanding Carbon Offsets - What is a Carbon Offset?* Carbon Offset Guide. https://www.offsetguide.org/understanding-carbon-offsets/what-is-a-carbon-offset/

[3] The Charter for the 2022-2023 Task Force on Carbon Removal and Offsets is included in Appendix IX for reference.

measurement, other greenhouse gasses besides carbon dioxide are measured in metric tons of CO_2 equivalent ($MTCO_2e$). Climate neutrality can be achieved through the reduction of USC's emissions, and by investing in emissions removal or reduction outside of the USC campus, via carbon offsets.

USC's commitment to climate neutrality includes reducing and offsetting annual Scope 1 and Scope 2 emissions as defined by international greenhouse gas protocols. Scope 1 emissions are generated on campus by the burning of fossil fuels for building heating, the use of refrigerants and fertilizers, and from university-owned or leased vehicles. Scope 2 emissions are generated by the Los Angeles Department of Water and Power (LADWP), Southern California Edison (SCE) (for the Wrigley Institute on Catalina Island) and City of Pasadena (Pacific Asian Museum) in supplying electricity to USC. USC's Scope 1 and 2 greenhouse gas emissions for fiscal year 2022 were 94,799 $MTCO_2e$.[4]

USC has also committed to achieving climate neutrality for annual Scope 3 emissions by fiscal year 2035. Scope 3 emissions include the *indirect* emissions resulting from USC's operations, such as air travel, commuting, waste, transmission, and distribution losses. USC's Scope 3 emissions in fiscal year 2022 were 70,286 $MTCO_2e$. As these are Scope 1 and 2 emissions for other institutions, their emissions may decline over time due to those organizations' sustainability efforts, lowering USC's Scope 3 emissions. However, USC's programmatic and policy decisions, such as how to transport students for national activities, staff participation in conferences, and vendor purchasing deals, all impact the size of USC's scope three emissions. Therefore, it is essential USC both continually evaluate its own scope 3 activities to mitigate emissions through sustainable decision-making and evaluate its partners to ensure it is working with organizations committed to reducing their own emissions when possible.

These climate neutrality goals and emissions inventories are for the University Park Campus (UPC), UPC North Housing, the academic and research facilities of the Health Sciences Campus (HSC), the Wrigley Institute on Catalina Island, The Pacific Asian Museum in Pasadena, the USC Hotel, and off-campus owned and operated buildings. Keck Medicine of USC is currently developing its climate action strategy in alignment with the Assignment: Earth framework, but its emissions are currently tracked separately from the inventory listed previously.

USC's carbon management hierarchy

USC is encouraged to follow a carbon management hierarchy that places first priority on emissions reductions through energy efficiency and conservation, followed by the elimination

[4] USC Sustainability. (2022). *Greenhouse Gas Emissions Inventory Summary, FY14-FY222.* https://bpb-us-e1.wpmucdn.com/sites.usc.edu/dist/5/720/files/2023/02/Greenhouse-Gas-Emissions-Inventory-Summary-FY2014-%E2%80%93-FY2022.pdf

of emissions through the use of renewable energy sources. USC is currently implementing the following prioritized strategies to reach climate neutrality:

1. Improving energy efficiency in USC's existing buildings. Improved building energy performance resulted in a 15% energy intensity reduction between 2014 and 2022.
2. Renovating and building energy-efficient buildings following the new Sustainability Design and Construction Guidelines[5] developed by USC Facilities Planning and Management (FPM) and with input from a larger campus-wide committee.
3. Installing solar panels and energy storage where suitable on campus garages and rooftops. USC completed the installation of solar panels on Galen Center in 2020, adding to the solar previously installed at the Wrigley Institute on Catalina Island, and is currently working on additional solar projects.
4. Partnering with LADWP to purchase off-site solar power. In 2022, USC signed an agreement with LADWP which enables USC to obtain a quarter of its electricity from renewable energy sources.[6]
5. Electrifying the USC campus infrastructure as individual equipment nears end of life where suitable.
6. Transitioning the USC fleet towards electric vehicles, which will reduce emissions and noise pollution, and improve air quality.
7. Engaging the USC community to practice energy conservation behaviors.

Since on-campus energy efficiency projects are generally low-cost or cost-saving projects, often with high returns on investment, they should be USC's first-choice solutions. Deep energy retrofits can require higher upfront investment and generate lower financial return on investment but can produce additional resilience and other co-benefits. The pursuit of deep energy retrofit projects should be evaluated within the context of the financials and co-benefits of additional renewable energy and energy storage projects as those financials continue to improve over time. Conversely, the price of carbon offsets is estimated to increase six-fold by 2035 and beyond.[7]

The voluntary carbon offset market is also expected to grow rapidly over the following decades, with surging demand that may either increase carbon offset prices or potentially lead to lower quality offerings overall if developers, verification standards, and verifiers cannot keep pace. If the latter prevails, trust in the quality, transparency and monitoring of carbon offsets may decline. Indeed, substantial skepticism of the offsets market already exists. If underlying issues are not addressed, opposition to offsets may increase and open USC to reputational

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[5] USC's Sustainable Design and Construction Guidelines, published in 2022, are located here: https://fpm.usc.edu/wp-content/uploads/2022/08/USC-SDCG_FInal-PDF_20220722-1.pdf

[6] McQuiston, P. (2022, September 14). *USC-LADWP agreement taps solar power for university, neighbors*. USC News. Retrieved January 5, 2023, from https://news.usc.edu/202159/solar-power-usc-ladwp-agreement/

[7] Ernst & Young. Essential, expensive and evolving: The outlook for carbon credits and offsets. reporthttps://assets.ey.com/content/dam/ey-sites/ey-com/en_au/topics/sustainability/ey-net-zero-centre-carbon-offset-publication-20220530.pdf

risks if reliance on offsets is viewed as diminishing or diverting resources from USC's prioritization of gross emissions reductions.

It is for these reasons that the Task Force recommends carbon offsets to be a resource of last resort and used only for the remaining GHG emissions that USC is not able to eliminate directly. Furthermore, the Task Force recommends that carbon offsets are only purchased alongside active and continual efforts to lower USC's emissions directly, and that the level of offset purchases decreases incrementally over time until USC achieves zero emissions without any offsets. Carbon offsets should not be a substitute for ongoing efforts to eliminate emissions.

To ensure its commitment to this carbon management strategy, USC should produce an annual public report of its Scope 1, 2 and 3 GHG emissions, including historical trends to demonstrate the declining use of carbon offsets over time. In addition to this quantitative information, USC should provide an explanation of major achievements and obstacles toward the attainment of its climate neutrality goals.

Understanding the pros and cons of offsets

Offsets are important because they 1) have an immediate impact on reducing the GHG emissions driving climate change, 2) put a "carbon price" on emissions so there is an economic incentive to reduce emissions more quickly[8], and 3) provide a means for organizations, such as USC, to take responsibility for their contribution to climate change and address it on an appropriate timescale. In an ideal marketplace, offsets are a mechanism to finance global emissions reductions in the most cost-efficient order.

There are, however, drawbacks and criticisms of offsets. The voluntary carbon market is relatively new, with the first carbon offset projects established in 1989, and developing rapidly while increasing in prominence through international agreements, including the 2020 UN Carbon Offset Platform. Since the voluntary carbon offset market is new and unregulated, there is a high degree of variance in the quality of offsets. Several high-profile instances of misuse or mischaracterization of offsets have come precisely from this ambiguity, causing institutions to intentionally and unintentionally avail themselves of offsets that do not contribute to genuine capture or reduction of greenhouse gas emissions.

Furthermore, offsets are criticized by some climate activist communities, which perceive them as a mechanism enabling dirty industries to "pay-to-pollute."[9] Certain groups criticize offsets as

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[8] UNFCC. (2021, February 26). *A Beginner's Guide to Climate Neutrality*. UNFCCC. Retrieved January 4, 2023, from https://unfccc.int/blog/a-beginner-s-guide-to-climate-neutrality

[9] Middleton, R., & Williamson, P. (2023, January 24). Carbon offsets are a licence to pollute | Carbon offsetting. *The Guardian*. https://www.theguardian.com/environment/2023/jan/24/carbon-offsets-are-a-licence-to-pollute

financing superficially clean projects that enable dirty industries to continue operations, such as funding carbon capture for coal plants. Oil companies have purchased offsets to claim environmental gains when their core mission is at odds with sustainability goals.

In some instances, carbon offsets have been used in nefarious ways, such as exploiting communities around the project site by paying them under market value for land or resources, using offsets to skirt genuine environmental improvements, or to justify continued pollution while purchasing offsets somewhere far away with minimal need.[10] Such bad-faith utilizations of offsets violate the core premise of environmental justice (see Appendix II for more details). The Task Force developed evaluative criteria to mitigate the risk of using projects with these impacts. In particular, the Task Force recommends environmental justice be a key consideration in project evaluation. However, negative perceptions may linger among certain observers due to those individuals' inherent beliefs about the best approach to sustainability efforts, regardless of offset's quality. USC should be aware some may view such efforts with skepticism.

Carbon offsets alone are insufficient to create fundamental changes necessary to combat climate change and associated negative externalities of emissions. In addition to the global impact of its greenhouse gas emissions, USC's campus activities also produce environmental, health, and other externalities in Los Angeles, which often disproportionately impact disadvantaged communities. In addition to utilizing offsets, minimization and remediation of these externalities at their point of impact should remain a priority for USC.

Careful selection of carbon offset projects, along with embedding offset use within an overarching hierarchy which prioritizes continued reduction of direct emissions, helps to mitigate these limitations. Carbon offsets are not without flaws, nor a permanent solution, but they can be a beneficial bridging strategy as USC pursues its sustainability goals.

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[10] Carbon Offset Guide. (n.d.). *Concerns About Carbon Offset Quality*. Carbon Offset Guide. Retrieved January 10, 2023, from https://www.offsetguide.org/concerns-about-carbon-offset-quality/

BENCHMARKING PEER INSTITUTIONS' CARBON OFFSET PORTFOLIOS

Given the ambiguity of best practices in the voluntary carbon offset market, the Task Force conducted benchmarking of peer institutions to establish a baseline for best practices by secondary education institutions when purchasing carbon offsets. This benchmarking process ensures the independently created recommendations meet or exceed common practices across the board.

The Task Force examined 39 peer institutions' current plans regarding purchase and utilization of carbon offsets. Of the 39 institutions in this benchmarking process (described in Appendix III), 44% have published clear, public plans to purchase carbon offsets. Consistently, this research finds that institutions planning to purchase carbon offsets have aggressive climate neutrality goals (an average of the year 2027[7]) and improvements in energy efficiency similar to USC.[11]

Methodology

Selected institutions are either current members of the IVY+ Listening Post (IVY+LP) for Sustainability Consortium[12] (of which USC is a member), directly mentioned in the sustainability plan of an IVY+LP member school or deemed leaders in the collegiate sustainability space. IVY+LP is a collection of higher education institutions "committed to sharing solutions that include the implementation of innovative technologies as well as research and operational methodologies that advance our commitment to greenhouse gas reduction on our campuses."[13] The Task Force evaluated each institution's commitment to achieving climate neutrality, the presence of an actionable carbon offset purchasing plan, the type of offset project investments, the amount of emissions offset through offset projects, and offset project co-benefits. These evaluations were made through the examination of publicly available sustainability reports and other literature published only by the institutions themselves.

Results and Analysis

Actionable Offset Purchasing Plans: Of the 39 institutions evaluated, 17 have published actionable carbon offset purchasing plans or strategies. 22 did not express interest in purchasing carbon offsets in the immediate future. Seven of these 22 institutions are utilizing renewable energy certificates (RECs), which entail the purchase of property rights to the non-power (environmental) attributes generated by renewable energy production from a public

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[11] Note that the data and observations presented in this section are based on publicly available information posted on or prior to 1/1/2023 and are subject to change as institutions modify their carbon offset purchasing plans.
[12] Brown University. (n.d.). *Ivy Plus Sustainability Consortium | Sustainability | Brown University*. Sustainability at Brown. Retrieved January 6, 2023, from https://sustainability.brown.edu/ivy-plus-sustainability-consortium
[13] Princeton University Office of Sustainability. (2023). *Partnerships | Office of Sustainability*. Sustainability at Princeton. Retrieved January 5, 2023, from https://sustain.princeton.edu/about/partnerships

market or project developer.[14] RECs are measured in units of energy, not in carbon impact, and have different legal and technical specifications.[15] USC is currently utilizing RECs to reduce its Scope 2 emissions, which will enable the institution to achieve its 2025 climate neutrality goal when coupled with the purchase of carbon offsets.

Operational Energy Use Reduction: All 17 institutions with carbon offset purchasing plans have also achieved a reduction in operational energy use, consistent with USC's continued reduction in energy use and Scope 2 emissions.

Climate Neutrality Commitments: A climate neutrality date is a specific, publicly committed to, goal date for an institution to emit no net Scope 1 and 2 emissions. Of these 17 institutions with carbon offset purchasing plans, 15 have publicly committed to a climate neutrality date and 5 have already achieved their climate neutrality goals. These 17 institutions hold an average climate neutrality goal of year 2027, meaning that USC's goal of 2025 is slightly more aggressive than the average.

Eight of the nine benchmarked peer institutions that have committed to a climate neutrality date at or before USC's Scope 1 and 2 climate neutrality goal (2025) have actionable offset purchasing plans. Just 2 of 18 benchmarked institutions with a minimally aggressive or non-published neutrality date (2040 or later) currently have an actionable offset purchasing plan. These results indicate that schools with aggressive climate neutrality dates and sustainability plans overwhelmingly utilize investments into carbon offset projects, while schools with less aggressive neutrality commitments are unlikely to have developed public purchasing plans.

Portfolio Size: The amount of $MTCO_2e$ offset through each institution's offset project portfolio varies greatly. Fifteen of the 17 institutions with clear carbon offset purchasing plans have published data on their annual yield of carbon credits. Of these 15 peer institutions, the average aggregate offset portfolio totals 44,282 $MTCO_2e$ per year of an overall average of 165,831 $MTCO_2e$ Scope 1 and 2 emissions. The largest institution's offset portfolio totals 121,252 $MTCO_2e$ (100% of the institution's total Scope 1 and 2 emissions), and the smallest portfolio totals 80 $MTCO_2e$ (0.08% of the institution's total Scope 1 and 2 emissions). Individual project sizes also vary from one another.

Number of Projects Utilized: Carbon offset portfolios leverage multiple offset projects to yield a larger number of total carbon credits. Many of these portfolios utilize offset projects of various project types and sizes. Fourteen of the 17 institutions with clear carbon offset purchasing

[14] Environmental Protection Agency. See: EPA. (2022). *Renewable Energy Certificates (RECs)*. EPA.gov. Retrieved January 10, 2023, from https://www.epa.gov/green-power-markets/renewable-energy-certificates-recs
[15] Environmental Protection Agency. See: EPA. (2022). *Renewable Energy Certificates (RECs)*. EPA.gov. Retrieved January 10, 2023, from https://www.epa.gov/green-power-markets/renewable-energy-certificates-recs

plans have published data on the number of offset projects within their portfolio, with the average portfolio utilizing 2.1 projects.

Portfolios containing a larger number of carbon credits frequently leverage a larger number of offset projects. Multiple portfolios contained 5 projects, however, 7 institutions used just 1 project in their portfolio. The average amount of $MTCO_2e$ offset by institutions utilizing just 1 offset project in their portfolio is 10,278, which is significantly lower than the average of all peer institutions' portfolios. Some other universities utilize a single project to offset a large majority of their Scope 1 and 2 emissions, and supplement the portfolio with significantly smaller projects, however these portfolios remain largely undiversified and vulnerable to systematic risk. One benchmarked institution utilized a single project to offset over 100,000 $MTCO_2e$ of emissions, its entire Scope 1 and 2 emissions portfolio.

Working Groups and Dedicated Staff: The investment in and maintenance of a carbon offset portfolio is a time-consuming and technical process which necessitates careful consideration. As the carbon offset marketplace continues to develop and evolve, careful supervision of a carbon offset portfolio is crucial. Two peer institutions found in this benchmarking survey, Duke University[16] and Yale University[17], have formed committees of expert faculty and dedicated staff members to maintain and guide their offset portfolio. These two peer institutions consistently publish the most comprehensive and innovative literature surrounding carbon offset use in higher education. USC's Office of Sustainability should periodically form a similarly focused and staffed working group to ensure its carbon offset portfolio remains secure and transparent, positioning itself as a leader among academic institutions.

Informational Interviews

USC's benchmarking process included informational interviews with five peer institutions actively purchasing carbon offset credits to better understand their process for vetting and purchasing carbon offsets. A common best practice among this sample group was the issuance of a Request for Proposals (RFP) for consultants or brokers to assist in the project selection process. These contracted subject matter experts performed due diligence to ensure only quality offsets were being considered and created frameworks to prioritize projects. Multiple universities recommended conducting due diligence through external support. Other advice received from some of these universities include an encouragement to join the Science Based Targets initiative (SBTi), to procure biogas to address scope 1 emissions and RECs to address scope 2 emissions, and to establish multi-year purchasing contracts with locked-in pricing for carbon offsets.

[16] Duke Office of Sustainability. (n.d.). *Duke's Campus Sustainability Committee | Sustainability | Duke*. Sustainability | Duke. Retrieved January 5, 2023, from https://sustainability.duke.edu/about/csc
[17] Yale University Office of the Provost. (2023). *Committees | Office of the Provost*. Office of the Provost. Retrieved January 5, 2023, from https://provost.yale.edu/committees/carbon-offsets-oversight-committee

EVALUATIVE CRITERIA

As USC continues to reduce its campus emissions, the university will also need to make a large financial investment in carbon offsets to achieve its 2025 climate neutrality goal. Such an investment brings great potential for impact, as well as a high level of interest and scrutiny by the USC community and stakeholders including peer institutions, the city of Los Angeles, and those impacted by USC emissions, among others. It is important that USC develops an offset portfolio that is effective at offsetting its carbon emissions, reflective of its core values, and sets a standard other institutions can adopt in their approach to carbon offset and removal.

There is no universally agreed-upon set of criteria for evaluating carbon offset projects, partly due to the complexity of offset projects, variance in quality control by the developers or exchanges from which offsets are purchased, and the subjective weighting of co-benefits that result from offset programs.

In response to this complexity, the Task Force developed criteria to facilitate the selection of high quality offset projects: 1) fulfillment of "PAVER"[18] requirements that certify an offset's technical quality and legitimacy, 2) the amount of CO_2e reductions in metric tons, 3) offset cost in dollars per metric ton, 4) the strength of the project's co-benefits according to the Task Force's weighting scheme, 5) social equity and environmental justice considerations, and 6) the avoidance of co-negatives.

[18] PAVER is a commonly used, although not formally established, evaluative standard to ensure carbon offsets are of a high quality. PAVER is an acronym for the following criteria: Permanent, Additional, Verified, Enforceable, and Real.

PAVER: Background and Utilization

Since the primary goal of a carbon offset program is to avoid, reduce or sequester GHG emissions, it is essential to ensure the authenticity, quality, and effectiveness of offset credits. However, there is no broad consensus on the standards to evaluate the quality of offset projects on the voluntary market. To address this issue, USC conducted a review of primary and secondary resources, including guidance materials from advisory bodies and active offset programs at peer institutions.

From the review of resources, it is clear that these varying standards generally include five predominant criteria that require carbon offset projects to be Permanent, Additional, Verified, Enforceable, and Real. These five requirements are commonly referred to with the acronym "PAVER."[19] The remaining criteria besides PAVER that the Task Force encountered in its review are broadly incorporated into the Task Force's definition of PAVER requirements and USC's evaluative criteria.[20] A list of the sources reviewed, as well as a table illustrating the criteria that each of these individual sources use, can be found in Appendix V.

Based on this emerging consensus, the Task Force strongly recommends that the fulfillment of PAVER criteria be the first priority for any offset purchase. USC decision-makers should verify the extent to which PAVER standards are met per the definitions provided below when evaluating any offset project.

Permanent

Emission reductions and removals should be irreversible for a goal of 100 years, with safeguards in place to mitigate the risks of reversal.

Permanence refers to the risk that emissions sequestered as a result of a carbon offset credit could be released back into the atmosphere at some point in the future. The issue of permanence is primarily a concern of sequestration projects, and biological sequestration projects in particular, rather than GHG reduction projects. Forestry and Agriculture projects (e.g., improved forest management and reforestation) are at especially high risk of reversal due to land mismanagement and natural disasters, such as forest fires. For this reason, sequestration projects, whether biological, geological, or oceanic in nature, should have adequate safeguards in place to ensure the potential for reversal is minimized or that there are mechanisms in place to guarantee restoration of the offset project to ensure durable

[19] Duke Carbon Offsets Initiative. (n.d.). *Duke Carbon Offsets Initiative Carbon Sink Guide*. Sustainability | Duke. Retrieved January 4, 2023, from https://sustainability.duke.edu/sites/default/files/carbonsink.pdf
[20] "Verified" includes "Not Double Counted", "Enforceable" includes "Transparent", "Registered/Traceable" and "Retired", and "Real" includes "Measurable/Quantifiable", "Account for Leakage", and "Synchronous". The remaining reviewed criteria, such as "Co-benefits" and "No Net Harm", are discussed as separate evaluation criteria or elsewhere in the report.

functionality or compensation for offsets rendered invalid. High quality offsets should include mechanisms to mitigate these concerns, such as using reserve pools, buffers, temporary credits, and insurance to recoup investments in the event a project is disrupted.

A common standard for determining the permanence of high-quality offset projects is a commitment to a minimum of 100 years of sequestration. For example, California's Compliance Offset Program requires offset projects "to monitor, report, and verify carbon stocks for at least 100 years following credit issuance."[21] While arguments have been made that using 100 years as the default time horizon is hard to justify, it is consistent with conventional carbon credit accounting, the 100-year time horizon used by a consensus of climate scientists when determining global warming potentials (GWPs), and broader societal impacts of climate impact.[22] For these reasons, the Task Force has adopted the commonly used target of a 100 year term to achieve permanence.[23]

Additional

Emission reductions and removals would not have occurred under a baseline, business-as-usual scenario.

Distinguishing a project's performance relative to a baseline is often referred to as determining additionality, since emission reductions should be additional to what would have happened under a business-as-usual scenario. In other words, emissions reductions should only be recognized if they would not have happened without the incentive provided by carbon offset purchases. If a reduction "would have happened anyway," then issuing offset credits allows for a net increase in GHG emissions. It is for this reason that additionality is critical to the success and integrity of carbon trading programs that recognize project-based GHG reductions.

While there is general agreement that additionality considerations are important, its application remains open to interpretation. The stringency of additionality rules involves a balancing act and addressing one type of error may unintentionally expose projects to other additionality vulnerabilities or undermine project availability to an unmanageable degree. Criteria that are too lenient will undermine the GHG program's effectiveness, while criteria that are too stringent could limit the recognition of legitimate GHG reductions. Methods of

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[21] California Air Resources Board. (2013, May). *California Air Resources Board's Process for the Review and Approval of Compliance offset Protocols in support of the Cap an*. California Air Resources Board. Retrieved January 4, 2023, from https://ww2.arb.ca.gov/sites/default/files/cap-and-trade/compliance-offset-protocol-process.pdf

[22] Galik, C. S., Baker, J. S., Daigneault, A., & Gregory Latta. (2022, July 25). *Crediting temporary forest carbon: Retrospective and empirical perspectives on accounting options*. Frontiers. Retrieved January 4, 2023, from https://www.frontiersin.org/articles/10.3389/ffgc.2022.933020/full

[23] Ton-year accounting uses methodologies for quantifying the climate impact of projects in single-year increments. If USC choses to purchase a project that employs ton-year accounting, a minimum purchase of 100 ton-years is to be considered equivalent to 1 ton for 100 years.

demonstrating additionality include regulatory, technological, financial, and other evaluations that registries employ to prove a project would not occur absent investment via offsets.[24]

Verified

Emission reductions and removals must be monitored, project activities confirmed, and data evaluated by independent third-party auditors.

Project verification plays an essential role in upholding the integrity of carbon offset programs by ensuring the data reported by project developers is relevant, complete, consistent, accurate, transparent, and conservative. In the context of offsets, "conservative" means using emissions factors, baseline assumptions, and methodologies that would likely underestimate carbon reductions when facing calculation or measurement uncertainties.[25] All offsets should be validated and verified by independent third parties to minimize the risk of double counting and other false claims. Validation determines that the methodologies and baseline used for a project are legitimate. Verification provides quantifiable evidence that claimed emissions reductions have taken place.

The verification process typically includes a case-by-case review of potential conflicts of interest, project site visits, assessment of misstatements, review of methodologies, verification of emission reduction calculations, and submission of a final report. However, carbon accounting protocols do not offer guidance on how to solicit or conduct the verification process, which is instead left to the discretion of project developers. For this reason, it is essential that all offset projects are independently audited by accredited validation and verification bodies (see Appendix VII for examples of such registries). To minimize conflicts of interest, USC should ensure validating auditors are different from verification counterparts.

Enforceable

Emission reductions and removals are only counted once and then retired from the market.

Enforceable carbon offsets are both unique and traceable, in that they are counted or claimed by only one party and that all project impacts are tracked transparently in a public registry. Qualified registries maintain serialized records of all certified offset projects, document chains of custody, provide transparency requirements for public reporting, and key source documents.

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[24] World Resources Institute & World Business Council for Sustainable Development. (2005, November 29). *The Greenhouse Gas Protocol for Project Accounting*. GHG Protocol. https://www.wbcsd.org/Programs/Climate-and-Energy/Climate/Resources/The-GHG-Protocol-for-project-accounting
[25] California Air Resources Board. (2013, May). *California Air Resources Board's Process for the Review and Approval of Compliance offset Protocols in support of the Cap an*. California Air Resources Board. Retrieved January 4, 2023, from https://ww2.arb.ca.gov/sites/default/files/cap-and-trade/compliance-offset-protocol-process.pdf

Registries also simplify the transferal process, provide quality assurance, and secure contractual ownership of carbon offsets.

The preferred way for offset credits to be retired is through a registry or similar third party to clarify ownership of offsets and minimize the risk of double counting. Double counting occurs when emissions reduction credits get used by more than one entity or for more than one purpose. This is of particular concern with renewable energy projects that may have associated renewable energy certificates (RECs), leading to overlapping environmental claims. While it is essential that carbon offsets are retired once purchased and applied against an inventory, institutions are not precluded from reselling offsets if they are not otherwise applied against their own emissions.

Real

Emission reductions and removals are measurable and account for uncertainty and leakage.

An offset project is considered real if it uses conservative and transparent measurement calculations, has a defensible performance baseline, and results in an absolute net reduction of GHG emissions. Real emission reductions use conservative assumptions, values and procedures, and are based on an accurate baseline to ensure calculations are not over-estimated. Transparent calculations are achieved when all relevant details of a project are made clear and available to the offset purchaser and other stakeholders. Third-party verification systems help ensure the "realness" of credits by binding project developers to proper project implementation and auditing developers on execution.

Beyond using recognized measurements and credible baseline scenarios, reduction and removal calculations should also make appropriate adjustments for leakage and uncertainty. Leakage refers to the unintended impacts of a project, such as an increase of emissions outside a project boundary. For example, leakage may occur where preservation in one area results in clear-cutting of a forest elsewhere. To address uncertainty, a project's carbon credit accounting should use conservative assumptions and well-established methodologies.[26]

The generation of the carbon credits should also occur during a reasonably close period as the GHG emissions they are offsetting, which is referred to as synchronicity.[27] Since transactions can involve prompt delivery, forward delivery, or forward crediting, it is important that offsets are purchased for an appropriate, or "synchronous," time period. Offset credits based on future commitments to reduce emissions, such as advanced market commitments, should be avoided

[26] California Air Resources Board. (2013, May). *California Air Resources Board's Process for the Review and Approval of Compliance offset Protocols in support of the Cap an*. California Air Resources Board. Retrieved January 4, 2023, from https://ww2.arb.ca.gov/sites/default/files/cap-and-trade/compliance-offset-protocol-process.pdf
[27] Second Nature. (2016). *Carbon Markets & Offsets Guidance*. Second Nature. https://secondnature.org/wp-content/uploads/Carbon-Markets-and-Offsets-Guidance-1.pdf

absent binding requirements that real emissions reductions occur. The Task Force recommends USC follow the advice of Second Nature to purchase and retire offsets with a vintage year[28] within 5 years to the emissions being offset.[29]

[28] "Vintage year" refers to the year in which offset emission reduction occurred.
[29] For further guidance, please see: Second Nature. (n.d.). *Carbon Offsets Archives | What Does Vintage Year Mean?*. Second Nature. https://secondnature.org/topics/carbon-offsets/

Determining and Utilizing Evaluative Criteria

Once PAVER due diligence has been conducted, project evaluation proceeds to a second step. The Task Force has established a series of other considerations, referred to as "evaluative criteria." These criteria were developed after comprehensive discussion among the Task Force members on the considerations and values they felt should influence the offset purchase process.

Evaluative criteria include a review of PAVER standards as a prerequisite. The framework also includes two descriptive metrics that should be tracked during project evaluation: the amount of carbon dioxide equivalent emissions in metric tons reduced by a project, and the cost of a project. Finally, the criteria include several important considerations outlined by the Task Force, including co-benefits, equity and environmental justice, and the potential for negative impacts.

Some offset projects produce co-benefits beyond carbon dioxide emissions reductions. Consideration for environmental and health benefits near the project site should be evaluated, and projects that produce these co-benefits in Los Angeles should be prioritized over projects that produce co-benefits elsewhere, given USC operations have a specific impact on the Los Angeles community. Additional co-benefits include opportunities to involve the USC community, external funding opportunities, and business and household savings. Further, environmental justice and avoidance of co-negatives created by a project should be considered. Each of the evaluative criteria are explained in the table below.

Table 1. Evaluative Criteria

Criteria		Definition
PAVER		All carbon offsets should be Permanent, Additional, Verifiable, Enforceable and Real.
Amount of CO_2e Reduction in Metric Tons		The quantity of CO_2e metric tons offset by a specific project. Projects can range widely in size and are often sold by the ton. Total investment in certain offset projects may represent several thousand tons of CO_2e. Buyers often purchase only a percentage of the overall offset credits generated by the project.[30]
Cost	**Cost per metric ton of CO_2 equivalent**	As of 2022, offset credits range from less than $15 per ton to more than $100 per ton. • Cost determined by a range of factors, such as technical difficulty of project implementation • There may be advantages to long-term investment in more expensive offsets, such as supporting technological innovations necessary for fighting climate change • Projects with extremely low costs, such as several dollars per ton, may have underlying legitimacy problems, like PAVER issues or unfair compensation; such projects should be viewed skeptically
	Total annual cost	Sum cost of all purchased offsets by year.
Co-benefits	**Reduction of pollution, improvement of health, and improvement of the environment near project sites, with an emphasis on achieving these benefits in Los Angeles**	Projects will be weighted more heavily based on proximity to USC communities, particularly those communities impacted by USC activities. However, for projects beyond the Los Angeles region, projects with co-benefits proximate to site implementation should be prioritized over projects without such localized co-benefits, all else being equal. Examples of co-benefits include: • Reductions in air pollution near the project site as a result of project activity • Improvements to the health and well-being of communities proximate to the project site, often through the reduction of health-impacting pollution • Improvements to ecosystems, such as protecting biodiversity, improving water quality, or reducing soil erosion
	Opportunities to involve the USC community	Potential for involvement of students, faculty, staff, and nearby USC community and stakeholders • Research and scholarship opportunities • Includes activities such as information sharing and gathering, as well as direct engagement including, but not limited to, information sessions, community feedback meetings, surveys, or community-hosted events.

[30] Carbon dioxide equivalent (CO_2e) converts non-CO2 greenhouse gasses' environmental impact to a unit basis of CO_2, enabling quantitative comparisons. See: EPA. (n.d.). *Definition: CO_2e*. EPA.gov. Retrieved January 4, 2023, from https://www3.epa.gov/ghgreporting/help/tool2014/userarchiveversion/definitions/co2e.html

Criteria		Definition
Co-benefits	**Partnerships and external funding potential**	Opportunities include: • Outside funding to support the projects, e.g., from government subsidies, grants, or donors • Collaboration opportunities with Los Angeles organizations that leverage the partner's expertise, capabilities, or scale • Educational, engagement, and/or research partnerships
	Business and household savings	Projects that provide a financial benefit to businesses and households, such as: • Reduced energy consumption or other cost benefits • Job creation or increased business revenue • Relevant indirect effects on workforce and business opportunities
Equity and Environ-mental Justice[31]	**Distribution of costs and benefits**	Negative impacts of projects should be minimized while benefits of projects should be maximized for various demographics as follows: • The Task Force expressed a strong preference for prioritizing projects in Los Angeles. Subsequent Task Force prioritization was as follows: regions near Los Angeles, particularly California, the United States, and then international projects. This is due to USC operations impacting the Los Angeles community and a desire to keep projects as close to Los Angeles as possible. • Socio-demographic prioritization of historically disadvantaged communities • Address historical inequities through targeted benefits to disadvantaged communities (e.g., indigenous communities, low-income communities, people of color, and vulnerable populations) • Prioritize mitigating environmental hazards in communities near projects
	Environmental Justice[32]	Prioritize maximizing environmental justice considerations, including: • Redressing historic and ongoing environmental injustice • Equitable distribution of project benefits • Prioritizing collaborative engagement with relevant communities, including involvement in project rollout and ongoing implementation, monitoring, and evaluation of project effectiveness
Avoidance of Co-negatives		Negative impacts of offset projects may include: • Environmental impacts, such as mining activities associated with renewable technologies or the emission of pollutants other than greenhouse gasses Opportunity costs and tradeoff considerations of projects should be considered

[31] See Appendix II: Environmental Justice and Carbon Offsets for more details.
[32] "Delegates to the First National People of Color Environmental Leadership Summit held on October 24-27, 1991, in Washington DC, drafted and adopted these 17 principles of Environmental Justice. Since then, the Principles have served as a defining document for the growing grassroots movement for environmental justice." For more information, please see: People of Color Environmental Leadership Summit. (1991, October 27). *Principles of Environmental Justice*. EJnet.org. https://www.ejnet.org/ej/principles.pdf

CRITERIA WEIGHTING

To differentiate between offset projects, the relative importance of each criterion needs to be weighted based on the shared values of the Task Force. The Task Force asked members to provide a ranking of the evaluative criteria using a rigorous ranking procedure. Subsequently, the individual ranks were converted to ratings and averaged across Task Force members. For more information on the methodology utilized to derive weighted preferences of Task Force members, see Appendix VI.

Table 2 contains the results of this weighting process.

Table 2. Evaluative Criteria for Project Selection

Evaluative Criteria	Rank	Weights or Quantification
PAVER	Preliminary	0-1[33]
Amount of CO_2e reduction in MT	% of USC Need	# of tons
Offset Cost in $/MT	Size in USC Offset Portfolio	$/MT
Co-Benefit: Reduction of pollution, improvement of health, and improvement of the environment near project sites, with an emphasis on achieving these benefits in the Los Angeles and Southern California regions	1	34%
Equity and Environmental Justice	2	19%
Avoidance of Co-Negatives of Carbon Reduction Projects	3	17%
Co-Benefit: Opportunities to involve the USC community	4	13%
Co-Benefit: Partnerships and external funding potential	5	11%
Co-Benefit: Business and household savings	6	7%

[33] Sliding scale of the degree to which a project meets PAVER standards

Using the Evaluative Criteria

Each project should be evaluated in three steps: 1) Assessment of the degree to which the PAVER standards are met, 2) Project parameter evaluation (including the amount of CO_2e reduction in metric tons and the offset cost in dollars per metric ton), and 3) Assessment of the degree to which the evaluative criteria are met.

Due to the significant time and expertise needed to accomplish the steps outlined above, and avoid the reputational risk associated with the purchase of low-quality carbon offsets, the Task Force recommends that USC leverage third-party consultants for offset project review and evaluation. The peer institutions reviewed with similar programs either have full-time staff or leverage third-party experts dedicated to this analysis. Furthermore, it is recommended that USC carefully vet select projects to be purchased through a multi-year agreement, rather than performing the due diligence process on an annual basis.[34]

Step 1: PAVER Prerequisite & Due Diligence

The first phase of project analysis should assess the degree to which the PAVER standards are met. Some promising projects may be in a nascent stage, and though they may not meet PAVER immediately, they may provide long-term value that justifies initial investment to help them achieve PAVER in the longer term. Due diligence is critical to ensure that projects are rigorously vetted for quality and integrity. If an offset project is highly likely to sufficiently satisfy PAVER criteria, project evaluation should proceed to the second phase.

In the rare cases where promising projects are in a nascent stage and do not yet meet PAVER standards, but provide long-term value that justifies initial investment, USC may invest in such projects and not claim offset credits until these projects achieve operational viability and PAVER standards.

Step 2: Carbon Reduction and Cost Parameters

Once PAVER evaluation is complete, key project parameters should be evaluated. These parameters are primarily: 1) the amount of CO_2e reduction in metric tons and 2) the offset cost in dollars per metric ton. This information is necessary to gauge the scope of a particular project as well as maintain an overall picture of USC's evolving offset portfolio. These factors do not have an explicit weighting component akin to the evaluative criteria in step three. Instead, they provide descriptive project information to understand how projects compare to

[34] If USC wants to purchase excess credits to be banked for future retirement, it is recommended that the bulk purchases be retired within 5 years of their vintage year, as outlined by the synchronicity preference described in the PAVER section of this report.

one another in cost and effectiveness. Evaluators may consider additional contextual factors such as USC's overall offset budget and existing offset profile.

Step 3: Analysis of Evaluative Criteria

The third phase of project evaluation entails the application of evaluative criteria and Rank Order Centroid (ROC) weights.[35] As with the first two steps, thorough due diligence is essential. In this instance, due diligence serves to develop informed opinions about the project's effect on each of the evaluative criteria. Those criteria are listed in Tables 1, 2, and 3, and include co-benefits, avoidance of co-negatives, and environmental justice. Quantitative assessment of each criterion is desirable when possible, but qualitative judgements are likely necessary given probable information limitations.

After evaluative criteria information is collected and recorded, weights should be applied to gauge the overall performance of the project in these priority areas. Those weights are recorded in Tables 2 and 3 and provide decision-makers with the Task Force's assessment of the relative importance of each criterion.

Two illustrative examples help demonstrate how such weights might be used

First, if quantitative information is available and can be converted to a common scale, weights can be applied to arrive at a numerical ranking of project preference. For instance, if comparing two projects that quantifiably benefit the health of the community in which the project is based, and the first project is based in South or East Los Angeles, while the second is based in a developing country, the South or East Los Angeles project would rank higher.

Second, even in the absence of quantitative information, decision-makers can use these percentages as guidelines to assess how the Task Force would prioritize competing offset project choices with benefits in distinct communities. For instance, if a qualitative determination found that a hypothetical "Project A" had one co-benefit of improving South or East Los Angeles health, and a hypothetical "Project B" had one co-benefit of encouraging external funding opportunities, "Project A" would have a weight of approximately three times that of "Project B," assuming all other elements of each project were equivalent.

These examples are simplified; the Task Force recognizes that project comparison and decisions are complex and will require use of best judgment by decision-makers. However, weights provide a useful tool to help decision-makers compare and distinguish among projects when making decisions about USC's portfolio.

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[35] Rank Order Centroid (ROC) weights based on the assumption that the distributions of weights are uniform within the ranking constraint and sum to 100%. This enables a calculation of the expected value, or "centroid" of the distribution for each weight, summing to 100%. For further reading, see Barron and Barrett, "Decision Quality Using Ranked Attribute Weights, 1996.

In addition to project-to-project comparison, these weights can also be used to evaluate projects on an individual basis. After assessing how a project scores based on each evaluative criterion, decision-makers should revisit the project's overall impact considering criteria weighting to form a picture of the desirability of a project. For instance, once due diligence is complete, a decision-maker may find that a project has a rather minimal effect on all criteria besides household savings, which has the smallest ROC weight at 7%. This information would provide one additional piece of information that helps build the overall picture of the priority of the project in addition to factors such as the overall cost of a project and USC needs.

PROJECT TYPES AND KEY CONSIDERATIONS

The Task Force conducted categorization and evaluations of six major offset project types. The categorization of these six offset types was based on synthesizing research and Task Force discussion.[36]

Each project type section of this report includes summarized information of key strengths and weaknesses of the project type, as well as a summary of prominent Task Force perspectives on those project types. These six project types include: Carbon Capture and Storage, Energy Efficiency, Forestry & Agriculture, Fuel Switching, Industrial Gas Abatement, and Renewable Energy.

Carbon Capture and Storage

Carbon capture and storage is the *removal* of carbon dioxide already present in the atmosphere for its permanent sequestration or storage. These projects focus on the scrubbing of previously emitted carbon dioxide from ambient air often using Direct Air Capture (DAC) technologies. DAC projects and technologies are still developing and vary greatly between providers. The carbon dioxide captured by these technologies is sequestered in a permanent, secure location or material where the carbon dioxide cannot be released back into the atmosphere, such as underground geologic formations, concrete storage, or potentially in the ocean. Projects examples include:

- Direct Air Capture and Sequestration (DACS) technologies that capture and store carbon dioxide from ambient air
- Mineralization (storing CO_2 in fluid form in reactive geologic formations where it mineralizes to produce water-insoluble calcium or magnesium carbonate)
- Enhanced weathering (using finely ground carbonate or silicate rock, such as basalt, to speed up natural geochemical reactions that remove CO_2 from the atmosphere)

Peer institution projects in this category include the Porthos / Port of Rotterdam and Shopify Carbon Engineering, and DAC work by companies such as Climeworks or Carbon Capture. To date, no other peer institutions report use of DAC projects for carbon offset credits.

Key Considerations

Carbon capture and storage projects have several distinguishing and beneficial features. Some of these projects are technologically advanced and scientifically sound, enabling a high degree of confidence in their permanence compared to other projects, particularly organic

[36] Information supporting technical summaries, categorization of project types, and key benefits and risks come from Second Nature's Carbon Offset Project Types 101 and the Carbon Offset Guide's project types risk manual.

sequestration techniques such as many forestry and agriculture projects. In contrast, some projects utilizing enhanced weathering are low-tech, and have lower degrees of confidence.

Many experts argue these technologies are essential to any successful global sustainability effort, so investing early and often via offsets helps support a critical industry. In support of this project type, Task Force members noted that the technological promise of this field justifies continued investment. Furthermore, the rigor and quality of some of these projects align with the desire to support long-term technological solutions, though this varies by carbon capture offerings, which should be evaluated on a case-by-case basis.

There are also risks and drawbacks associated with these projects. While their technological potential makes them appealing, the existing scope and offerings are limited and often in developmental phases, constraining investment opportunities. In addition to limited investment opportunities, this developmental phase adds risks that projects may not succeed.[37] This also makes investment opportunities costly on a per ton basis. Additionally, some reports indicate certain storage techniques have the potential to contaminate underground aquifers used for drinking water.[38, 39]

Industrial Gas Abatement

Industrial gas abatement is the capture and storage or destruction of gas emissions to *avoid* their release into the atmosphere. These abatement projects avoid the release of various industrial gasses into the atmosphere by capturing emissions at their source. Industrial gasses targeted by these offset projects include refrigerants or carbon dioxide from industrial or commercial operations, or methane from landfill, coal mining, wastewater treatment, gas and petroleum production and livestock farming operations. Many industrial gasses contribute to increased global temperatures at a higher rate than carbon dioxide, making their capture critical to limiting increased global warming. Abated industrial gasses can be sequestered for future uses as a fuel source, such as burning captured methane to heat industrially used water. Additionally, captured industrial gasses can be combusted into individual components that contribute to global warming to a lesser degree, such as the combustion of captured methane into water and the less potent carbon dioxide. Projects examples include:

- Electric power plants equipped with pre-combustion, post-combustion, or oxy-fired technologies

[37] de Coninck, & Benson, S. M. (2014). Carbon Dioxide Capture and Storage: Issues and Prospects. *Annual Review of Environment and Resources*, *39*(1), 243–270. https://doi.org/10.1146/annurev-environ-032112-095222
[38] Newmark, R. L., Friedmann, S. J., & Carroll, S. A. (2010). Water challenges for geologic carbon capture and sequestration. *Environmental management*, *45*(4), 651–661. https://doi.org/10.1007/s00267-010-9434-1
[39] Fogarty, & McCally, M. (2010). Health and Safety Risks of Carbon Capture and Storage. JAMA : the Journal of the American Medical Association, 303(1), 67–68. https://doi.org/10.1001/jama.2009.1951

- Methane avoidance, destruction, capture, and reutilization at coal mines, landfills, cattle ranches, dairy farms, etc.
- Leak prevention in natural gas transmission and distribution systems
- Fugitive emissions of industrial gasses capture, destruction, or avoidance (refrigerants, insulating foams, ozone depleting substances, HFCs, PFCs, SF_6, etc.)
- Avoidance, destruction, reuse, or recycling of N_2O byproduct from adipic or nitric acid production

A peer institution utilizing this project type is Duke University, whose Swine Waste-to-Energy project[40] captures the methane emissions from swine farm operations in North Carolina. These captured emissions are then combusted to power a 65-kilowatt microturbine that provides electricity to the farm.

Peer institution Yale University partnered with the Greater Lebanon Refuse Authority to create the Landfill Gas Collection and Combustion Project.[41] This project captures landfill gas emissions for combustion in power generators. The facility generates an average of 3,200 kilowatts of electricity per hour, which is enough to supply approximately 2,400 homes with electricity each day.

Key Considerations

Industrial gas abatement projects target emissions at the source, helping mitigate the worst environmental impacts of major industrial polluters. These projects have the additional benefit of offset availability, as there are typically many industrial gas abatement projects available on offset registries. Several projects repurpose the captured gas for other means, providing added utilization benefits. There may also be the potential for co-benefits within Los Angeles, given the number of polluters in the city who may seek partnerships for offsets. The Task Force acknowledged that industrial gas abatement projects are important in the fight against climate change. In particular, there was general Task Force consensus that emissions are not likely to abate immediately, and thus their capture is necessary.

Though these projects offer benefits, evaluators should be aware of potential drawbacks. First, these projects can be seen as disproportionately beneficial to polluting industries, either by avoiding emission fees or by indirectly rewarding their emissions. Additionally, this may undermine cleaner solutions, including discouraging broad government action that would provide a long-term, sustainable solution. With these drawbacks come the possibility that investment may result in reputational risk for investors, as institutions investing in industrial gas abatement offsets may be seen as supporting these industries. Several Task Force

[40] Duke Office of Sustainability. (n.d.). *Swine Waste-to-Energy (Loyd Ray Farms) | Sustainability | Duke*. Sustainability | Duke. Retrieved January 4, 2023, from https://sustainability.duke.edu/offsets/projects/lrf

[41] Yale Office of Sustainability (n.d.). *Verified Offset Projects | Sustainability | Yale Sustainability* | Yale. Retrieved January 6, 2023, from https://sustainability.yale.edu/priorities-progress/climate-action/carbon-offsets/verified-offset-projects

members expressed their concern that industrial gas abatement projects may benefit polluting industries, (although other members pointed out some projects are available in this area that avoid this concern, such as working with wastewater treatment plants). Some Task Force members were concerned that these projects perpetuate harm, health disparities and environmental racism if they maintain polluting industries in marginalized communities. Additionally, Task Force members highlighted that some areas of California are ahead of the curve at utilizing these techniques, and thus additional implementation would likely need to happen in other states or localities beyond California, (meaning less potential for projects in the Los Angeles region). These concerns and the status of capture programs vary widely, however, by the specific gas considered, such as methane compared to refrigerants.

Energy Efficiency

Energy efficiency is the use of less energy to perform the same task or produce the same result in operational activities, most commonly in buildings.[42] One example of this type of project is building weatherization, which is the act of protecting buildings from weather elements to improve the building's comfort, energy consumption and efficiency. Internal USC energy efficiency improvements do *not* generate offsets but, rather, direct emissions reductions. Energy efficiency offsets, instead, entail USC investing in energy efficiency improvements for other organizations. Projects examples include:

- Installation of efficient lighting, appliances, HVAC systems, insulation, etc. in households or businesses that are not a part of USC's facilities portfolio
- Distribution of improved cookstoves to impoverished families
- Waste heat/gas recovery, combined heat and power projects, trigeneration, etc.

An example of this type of project in a peer institution includes the University of Rochester's Energy Efficiency and Weatherization Project, which has invested over $6 million in increasing the energy efficiency of hundreds of homes in the local community.

Key Considerations

There are several advantages to energy efficiency projects that align with Task Force objectives and priorities. These projects have well-tested case studies with clear carbon accounting methods. Task Force members that supported energy efficiency projects emphasized the direct positive co-benefits of these projects, particularly the potential for resultant household savings, even if the savings are marginal.

[42] U.S. Department of Energy. (n.d.). *Energy Efficiency*. Department of Energy. https://www.energy.gov/eere/energy-efficiency

However, there are also potential drawbacks to energy efficiency projects. Given wide penetration of government regulation and market incentives, as well as difficulty in establishing energy efficiency baselines, determining additionality for these projects can present a challenge - particularly in Los Angeles. Furthermore, these projects are typically modest in total offset volume, potentially requiring multiple investments in this project type to offset a meaningful amount of USC's emissions. Task Force members who were skeptical of this project type suggested that energy efficiency improvements should only be an internal investment to reduce USC's own emissions, rather than a type of offset purchased. Members were also concerned about potential double-counting issues introduced by these projects, such as USC buying or generating emissions reductions as offsets while the associated utility may also be counting the energy reductions to achieve compliance with legal regulations.

Forestry and Agriculture

Forestry and agriculture projects leverage photosynthesis to capture and sequester carbon emissions through the planting and conservation of forests and green spaces. Forestry projects include reforestation and afforestation, urban forestry, and land conservation projects. Agricultural projects include improved soil management techniques. Forestry projects are one of the most widely known of all offset project types. Projects available to USC might include:

- Afforestation, reforestation or avoided deforestation
- Urban forestry and agroforestry projects
- Soil carbon (low-till/no-till practices, crop rotation, use of biochar, improved fertilizer management, and other soil and crop management practices to increase sequestration)
- Wetlands restoration and blue carbon projects (conservation, restoration and management of coastal and marine ecosystems)

An example of an urban forestry project used by a peer institution is Duke University's urban forestry pilot projects,[43] which have resulted in the planting of over 6,400 trees across 3 states. This project offered important co-benefits, including community education and increased pedestrian safety.

An example of a land conservation project by a peer institution includes Columbia University's Medland Spring grassland conservation project, which aims to prevent the additional destruction of grasslands in Colorado's shortgrass prairie.

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[43] Duke Office of Sustainability. (n.d.). *Urban Forestry | Sustainability | Duke*. Sustainability | Duke. Retrieved January 4, 2023, from https://sustainability.duke.edu/offsets/projects/forestry

Key Considerations

Forestry and agriculture projects have several advantages. These are extremely common offset projects, providing ample opportunities for investment and experiences of peer institutions and other actors within the marketplace that USC can draw upon. These projects, particularly urban forestry projects, also provide potential opportunities for USC community members to study and engage with urban forestry projects. Furthermore, there may be opportunity for urban greening projects in South or East Los Angeles if USC is able to find partners.

Additionally, there are often ecosystem, biodiversity, and urban heat island reduction co-benefits to these projects. Some Task Force members voiced support for the adoption of forestry and agriculture projects due to their positive impacts on biodiversity near the project site while leveraging natural carbon removal processes, and their aesthetic nature. Task Force members expressed enthusiasm for the potential of these projects to reduce microclimate disparities in low-income neighborhoods, particularly in communities around USC's campuses.

Though these projects are common and cost-efficient, there are downsides and increasing skepticism regarding these projects.[44] There are PAVER concerns regarding the permanence standard which worried the taskforce. These projects are uniquely susceptible to natural disasters, with earthquakes, forest fires, and other events undermining significant investments by large corporations in forestry offset projects. Reforestation and afforestation projects have significant land requirements, raising environmental concerns as well as indigenous rights concerns with any land acquisition or utilization. Furthermore, forestry projects have resulted in 'leakages' whereby logging that would have been conducted in a newly protected area transfers to another area rather than being prevented altogether. Some Task Force members argued against the use of forestry and agriculture projects, focusing on uncertainty regarding the fulfillment of PAVER standards.

Fuel Switching

Fuel switching offset projects substitute one energy source with another less environmentally damaging fuel for the same activity. Fuel switching replaces fossil fuel energy sources with other, less damaging fossil fuel energy sources or cleaner energy sources. For instance, this could involve replacing a carbon-dioxide generating fuel with hydrogen fuel. Project examples include:

- Utilizing renewable natural gas (biogas from livestock, landfills, and wastewater treatment facilities)
- Blending hydrogen with natural gas

[44] See an Opinion article in the Los Angeles Times from 11/29/22: https://www.latimes.com/opinion/story/2022-11-29/california-carbon-offset-forest-satellite-climate-change

- Electrification (electric water heating, space heating, stoves, and electric vehicle charging)
- Substituting coal, kerosene, or gasoline with natural gas

Another example of this project type comes from peer institution American University, which partnered with the Paradigm Project to deliver Energy Efficient Cookstoves in Kenya[45]. These cookstoves utilize biogas instead of open fires or kerosene, greatly reducing the emissions resulting from cookstove operations while simultaneously improving indoor air quality.

Key Considerations

Fuel switching projects offer important co-benefits. For example, switching to less harmful fuels in cooking stoves can improve respiratory health outcomes in affected households. Often, the new fuel type is less polluting and more energy efficient, which can reduce household spending costs. These projects also have reasonable implementation feasibility; many fuel switching projects can utilize existing fossil fuel infrastructure, and thus can accelerate the ability to rapidly transition to cleaner energy sources. Fuel switching also supports market signals to fossil fuel-based industries about the changing demand for fuel types. One Task Force member observed, "Supporting residential fuel switching in Los Angeles is complicated but would advance the city of Los Angeles' strategy and policy direction for decarbonization through electrification with renewable energy while also reducing indoor air pollution and safety risks." However, complication is likely due to existing regulations nullifying offset projects as well as the complex and costly nature of modifying Los Angeles infrastructure. Task Force members were excited by the opportunities for existing or novel projects that focus on fuel switching in transportation, particularly for switching diesel buses to electric.

A key consideration for fuel switching project types is that there is generally lower availability of these projects. Existing projects are often small in scale, infrequent, and experimental, which may undermine their utility. Gold Standard's offset registry provides several examples of fuel-switching projects, but most of them exist as projects in developing countries - which was less preferred by the Task Force compared to supporting Los Angeles based projects, if all else is equal. Project availability is limited in Los Angeles due to existing regulations, including those adopted by the California Air Resource Board (CARB), which undermine additionality. Members of the Task Force voiced greater support for other project types that limit greenhouse gas emissions over fuel switching projects. One member stated that fuel switching can sometimes include fuels that still emit greenhouse gasses, and USC's resources would better serve going to sustainable solutions that avoid this pitfall.

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[45] Verra. (2020). *Paradigm Kenya Clean Cookstoves Project*. Verra. Retrieved January 6, 2023, from https://registry.verra.org/myModule/rpt/myrpt.asp?r=206&h=117071

Renewable Energy

Renewable energy offset projects expand renewable energy capacity, or establish new renewable projects, including hydroelectric, wind, and solar energy projects. This is distinct from purchasing energy for USC from existing renewable projects, which may take the form of renewable energy certificates but are not carbon offsets. Offset-generating projects are frequently found in developing countries. Projects examples include:

- Biomass power plants (bagasse power, palm oil solid waste, sawmill waste, etc.)
- Rural solar electrification projects
- Small- and large-scale hydropower projects
- Electricity generation from wind, geothermal or other renewable power sources

Key Considerations

Investment in renewable energy can increase overall energy capacity. There is high demand for renewables in California and globally. In addition to offsetting USC's emissions, these projects may increase long-term capacity to generate renewable energy for the energy grid. Due to high demand for renewable energy in California, there might be avenues for projects in areas near USC; however, city and state regulations may complicate additionality defenses of these projects. Members of the Task Force viewed renewable energy offset projects favorably. Because the sector is growing quickly and replacing gas- and coal-powered industries, it has the potential to have an immediate and significant impact in the fight against climate change.

The potential for "double-counting" risk and thus the additionality PAVER standard are the biggest concerns related to renewable energy offsets. This is a result of ample market and government incentives for renewables - particularly in Los Angeles, undermining opportunities for projects near USC. Leveraging certified offsets that carefully evaluate the emissions reductions of renewable energy projects can be useful in mitigating these risks. Several Task Force members were concerned that these projects might cause job losses in fossil fuel markets; however, there is also optimism about adding demand for clean energy jobs. There was also concern that this project type already has broad momentum and market incentive. Because of this, one member noted that USC's support of this project type may not be required for renewable energy's widespread adoption.

Comparisons of Project Types

While each project type has its unique considerations, there are some associated risks and benefits that occur across nearly all project types. Many project types face difficulty with establishing normal operating conditions prior to investment, creating problems for establishing additionality. Baselines can be hard to define either due to measurement issues, such as with determining the carbon storage of forestry projects, or due to existing market incentives and regulations that influence a project team's decision-making, such as with energy efficiency and renewable energy projects. Table 3 (below) provides a synthesis of key benefits and risks for each project type.

Table 3. Benefits and Risks by Project Type

Project	Benefits	Risks
Carbon Capture and Storage	• Tends to be additional and permanent • Provides support for emerging technology and job creation • USC researchers and Los Angeles-based start-ups currently developing technologies	• Limited availability of existing approved projects • Emerging technology comes with a high cost to implement • May be seen as legitimizing emissions by removing CO_2 from the air instead of encouraging fewer emissions • Potential to contaminate underground aquifers used for drinking water
Industrial Gas Abatement	• Targets point-source emissions • Widespread offset availability • Repurpose fuel to avoid waste • Possible project opportunities in Los Angeles • May reduce odor issues and improve air quality near the project site	• May perpetuate, or be seen as perpetuating, polluting industries, with a disproportionately negative impact on disadvantaged communities • Potentially undermines cleaner, long-term solutions • Limited opportunities to involve the USC community
Energy Efficiency	• Clear carbon accounting guidelines • Can lead to significant air quality improvements and human health benefits • Can reduce energy expenditures	• Limited scale per project • State and regional regulations and common practices significantly restrict Los Angeles opportunities
Forestry & Agriculture	• Ecosystem improvements and biodiversity preservation • Opportunity for community engagement • Ample best practices to guide project implementation • Potential to enhance soil productivity and reduce erosion	• Reversible due to susceptibility to natural disasters • Large land requirements • Potential conflict with indigenous land rights and communities near the project site • Difficulty establishing baselines, making additionality challenging • Poorly designed projects can have negative consequences, such as community displacement
Fuel Switching	• Ease of implementation • Operates as a market signal • Permanence and enforcement are generally not an issue • Alternative fuels have less harmful waste by-products than fossil fuels • Air quality improvements	• Lower availability of projects • The use of natural gas may slow the transition to low-carbon energy • Alternative fuels may result in pollution and higher food prices • State and regional regulations significantly restrict opportunities in Los Angeles
Renewable Energy	• Increases clean energy generation in target areas • Possible California partners • Reduces air pollution where fossil generation is displaced • Rural electrification	• “Double-counting” risk (i.e., renewable energy certificates making overlapping environmental claims) • Comprehensive regulations significantly restrict opportunities in Los Angeles

These project types can also be considered in relation to the specific evaluation criteria established by the Task Force. Table 4 provides a summary of some general attributes for each project type as they relate to the PAVER requirements and USC’s evaluation criteria. The comments provided in this table are only to be used as a reference guide of general considerations between each project type and USC’s evaluation criteria, and not as a means of project evaluation.

Table 4. General Considerations by Project Type

Criteria	Carbon Capture & Storage	Energy Efficiency	Industrial Gas Abatement	Forestry & Agriculture	Renewable Energy	Fuel Switching
Permanent	Limited or no risk of reversal	Limited or no risk of reversal	Limited or no risk of reversal	Highly susceptible to natural disasters and land management changes	Limited or no risk of reversal	Limited or no risk of reversal
Additional	Likely. Offset revenue primary return on investment	Unlikely. Energy cost savings often exceed offset credit revenues	Likely. Offsets only source of revenue, but regulatory drivers should be examined	Frequent challenges in determining baseline activity	Offset revenue unlikely to influence investment decisions	Offset revenue unlikely to influence investment decisions
Verifiable	Emerging technologies with developing accounting methodologies	Clear carbon accounting, but a variety of uncertainties depending on the project	Uncertainties addressed with quantification rules	Biological quantification is inherently more uncertain	Uncertainty about avoided baseline emissions	Risk over-crediting if upstream emissions are unaccounted
Enforceable	Enforcement and double counting are generally not issues	Double counting of indirect emissions reductions	Ownership issues may occur with indirect emission reductions	Enforcement and double counting are generally not issues	Potential double counting reduction if RECs are also sold from the project	Enforcement and double counting are generally not an issue
Real	Unrealized potential and limited availability of projects	Leakage is generally not an issue	Leakage is generally not an issue	Leakage risk can be a significant issue	Leakage is generally not an issue	Leakage is generally not an issue, but may slow the transition away from fossil fuels
Amount of CO2e reduction in metric tons	Amounts to be purchased will be determined on a per-project basis					
Project Cost	Highest cost to implement as technology develops; likely to require subsidies	Generally lowest-cost projects	Near-average carbon offset costs	Typically lower cost projects	Near-average carbon offset costs	Near-average carbon offset costs
Reduction of pollution, improvement of health, improvement of the environment	No additional project-site benefits beyond CO_2	Limited additional environmental benefits; regulations significantly restrict Los Angeles's opportunities	Additional environmental benefits due to black carbon emissions reductions; limited Los Angeles opportunities	Direct ecosystem benefits; potential recreation opportunities	Limited additional environmental benefits; regulations significantly restrict Los Angeles opportunities	Potential indoor air quality benefits for participating households; regulations significantly restrict Los Angeles's opportunities
Opportunities to involve the USC community	USC researchers are currently developing technologies	Limited opportunities to involve the USC community	Limited opportunities to involve the USC community	Limited opportunities to involve the USC community	Limited opportunities to involve the USC community	Limited opportunities to involve the USC community

Criteria	Carbon Capture & Storage	Energy Efficiency	Industrial Gas Abatement	Forestry & Agriculture	Renewable Energy	Fuel Switching
Partnerships and external funding potential	Future opportunities for partnerships and external funding are unknown					
Business and household savings	No opportunities for business or household savings	Opportunities for businesses or household savings	Opportunities for business savings	No opportunities for business or household savings	Business or household savings via lower energy bills	Projects may allow participating families to save time and money
Equity and Environmental Justice	Potential to perpetuate the fossil fuel industry and existing negative impacts in neighboring communities	Can make energy efficiency measures more accessible	Potential to perpetuate the fossil fuel industry and existing negative impacts in neighboring communities	Some projects may violate human rights as indigenous lands are targeted by project developers	Limits mercury, particulates, and NOx which disproportionately impact disadvantaged communities	Potential to perpetuate the fossil fuel industry and existing negative impacts in neighboring communities
Avoidance of Co-Negatives	Environmental impacts vary based on technology, and may become clearer as the industry develops	Negative environmental impacts are unlikely	A potential concern of perpetuating polluting industries	Preservation in one area could result in clear-cutting elsewhere	Large-scale hydropower projects have negative social and environmental impacts	Alternative fuels may result in water/air pollution, biodiversity loss, and higher food prices

The main takeaway from Tables 3 and 4 is that each project type has numerous positive and negative attributes related to each evaluation criterion. Some project types tend to perform better in relation to PAVER requirements than to USC values, such as the carbon capture and storage category. Other project types tend to perform better in relation to USC values than to PAVER requirements, such as the forestry & agriculture category. Certain project types are also at a higher risk of equity, environmental justice, and co-negative issues, such as carbon capture and storage, industrial gas abatement, and fuel switching. Lastly, regional and state regulations subvert additionality claims and significantly restrict opportunities in Los Angeles for renewable energy, fuel switching and energy efficiency projects, and thus limit opportunities to involve the USC community.

Given the various risks and benefits for each project type, it is recommended that USC develops a diverse portfolio of offset projects that meet PAVER requirements and have a combined contribution toward achieving USC's values regarding co-benefits, equity and environmental justice, and the avoidance of co-negatives.

Novel Projects

There are opportunities for institutions to develop their own carbon offset projects, also referred to as "novel" projects. The Task Force discussed this idea but outlining or selecting specific novel project options exceeded the scope of the Task Force mandate.

The general attitude of the Task Force is that novel projects are promising and exciting opportunities for USC to creatively address emissions issues, operate as a leader, partner with organizations, companies, and communities, and financially support a sustainability project with tangible co-benefits, particularly in and around the USC community.

There are, however, many logistical and resource constraints to any novel project. USC does not have the internal development expertise and capacity to create a novel project on its own, so a novel project might work under one of the following scenarios:

- USC partners with a project developer who is willing to take on most of the associated risk while USC provides financial support
- USC partners with a developer on a near-complete project whereby USC involvement helps bring this project to fruition
- USC partners with other large "off-takers" (i.e., entities planning to develop novel offset projects) on a project that those groups and their developers have the capacity to drive. Risks and rewards would then be shared across all participating groups.

The Task Force feels that opportunities for novel project development in Los Angeles with project partners should continually be evaluated and become a part of USC's offset profile if such an opportunity arises to meet the above novel development requirements while maximizing co-benefits outlined in the evaluative criteria. The USC University Relations team should be engaged at the beginning stages of any future project to ensure that the input of our external USC community is included throughout the project.

FINAL RECOMMENDATIONS

USC's commitment to climate neutrality by 2025 requires immediate and comprehensive action, including the purchase of carbon offsets. To best navigate the unregulated and evolving nature of the voluntary carbon offset marketplace, and to ensure the purchase of offsets consistent with USC's values and climate neutrality goals, USC should:

1. Maintain its commitment to prioritize the reduction of internal emissions, using carbon offsets as a last resort for emissions that cannot be directly eliminated. The number of offset credits should continue to decrease, with progress shown through annual public reporting of total offset investments.
2. Ensure PAVER standards for offset projects are highly likely to be fulfilled, meaning projects are Permanent, Additional, Verifiable, Enforceable, and Real.
3. Build a diverse portfolio of offsets, rather than focusing on a single project or project type. Prospective projects should be prioritized based on the evaluative criteria of equity and environmental justice, co-benefits, and avoidance of co-negatives. Co-benefits include reduction of pollution, improvement of health, improvement of the environment near project sites, opportunities to involve the USC community, partnerships and external funding potential, and business and household savings.
4. Give special consideration to offsets projects that benefit the South and East Los Angeles community, either through the purchase of pre-existing projects or the co-development of novel projects with community input.
5. Partner with external subject matter experts to perform due diligence of prospective carbon offset projects and ensure recommendations are satisfied.
6. Convene a working group organized by the Office of Sustainability once climate neutrality is first achieved, and as needed thereafter, to review previous offset investments and to ensure recommendations remain current in an evolving voluntary offset market.

The Task Force believes that by leveraging these recommendations USC will be well-positioned to make informed and impactful choices in the development of its carbon offset program and avoid the reputational risks associated with carbon offset projects that do not meet the Task Force's evaluative criteria.

APPENDICES

Appendix I: Definitions of Terms Commonly Used in this Report

Additionality: An essential consideration for GHG offsets, additionality refers to offsets that would *not* have occurred in the absence of a market for carbon offsets. If the offset would have occurred regardless (for instance, to comply with new energy-efficient building codes), then it is not additional.

Carbon Neutrality: A "net-zero carbon footprint," or reducing institutional carbon emissions and addressing the remaining balance through carbon offsets.

Carbon Offset: A reduction or removal of CO_2e GHG emissions that is used to "cancel out" or compensate for the emissions created by other activities.

Climate Neutrality: A step beyond "carbon neutral," climate neutrality involves balancing all greenhouse gas emissions with carbon offsets. This includes not only carbon emissions but non-carbon greenhouse gas emissions, such as nitrous oxide and methane.

CO_2 : Carbon dioxide, a colorless, odorless greenhouse gas that accounts for approximately two-thirds of human activity-driven global warming.

CO_2 Equivalent: Often abbreviated CO_2e, it is a measurement used to compare the emissions from different greenhouse gasses on their global-warming potential (GWP), to the equivalent amount of carbon dioxide.

Co-Benefit: Additional benefits from engaging in a specific project or type of project, e.g. social- or cost-related benefits.

Co-Negative: Additional negative externalities caused by an offset project, even if temporary. For example, disruption to a community's operations as a result of project implementation.

Environmental Justice: As defined by the EPA, "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. This goal will be achieved when everyone enjoys: The same degree of protection from environmental and health hazards, and Equal access to the decision-making process to have a healthy environment in which to live, learn, and work." See Appendix 2: Environmental Justice and Carbon Offsets for additional information.

Greenhouse Gas (GHG): Gasses that trap heat in the atmosphere, including carbon dioxide, methane, nitrous oxide, and fluorinated gasses.

PAVER: A common standard for carbon offsets to ensure that offsets purchased are high quality. PAVER stands for Permanent, Additional, Verifiable, Enforceable, and Real. Note: PAVER standards are not universal.

Scope 1 Emissions: Emissions from sources owned or controlled by an organization (e.g., on-site combustion for building heating, cooling, and electricity; university-owned or leased vehicles).

Scope 2 Emissions: Emissions from energy utilities purchased by an organization (e.g., emissions from the energy LADWP supplies USC counts towards USC's Scope 2 emissions).

Scope 3 Emissions: Emissions from sources not owned or directly controlled by an organization but directly resulting from the organization's activities or value chain (e.g., supply chain, waste processing, business travel, employee, and student commuting).

Appendix II: Environmental Justice and Carbon Offsets

Understanding the Issue

USC operates in an environmental justice community and is one of the largest emitters of air pollutants in the South Los Angeles region. The neighborhoods around USC are among the most environmentally disadvantaged in the state of California[46]. Based on data reported to the California Air Resources Board (CARB), USC was responsible for approximately 26% of total greenhouse gas emissions for the South Los Angeles community (based on the AB 617 boundary designations) in 2019.[47] In addition, USC operations emit health damaging air pollutants, including nitrogen oxides (share in South Los Angeles: 25%), PM 2.5 (share in South Los Angeles: 11%) and Diesel PM (share in South Los Angeles: 94%). These pollutants are known to harm the respiratory, cardiovascular, and neurological health of communities.

The EPA defines Environmental Justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. This goal will be achieved when everyone enjoys: The same degree of protection from environmental and health hazards, and equal access to the decision-making process to have a healthy environment in which to live, learn, and work." In Los Angeles, environmental justice has been a particularly fraught issue. Redlining – the 1930s practice of color-coding maps to rank the loan worthiness of neighborhoods – resulted in communities of color being segregated to locations with significant environmental hazards in Los Angeles.[48] In the U.S., Black and Hispanic communities are exposed to matter from environmental hazards "at a rate more than 50% higher than whites." [49] Greenhouse gas-emitting industries are disproportionately sited in disadvantaged communities and communities of color, causing them to bear the brunt of pollution.[50]

In many cases, carbon offset programs have been shown to perpetuate environmental injustice and continue to disproportionately harm disadvantaged, Indigenous and communities of color; in other words, the communities that have already suffered the most environmental and health

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[46] California Office of Environmental Health Hazard Assessment (Cartographer). (2022). CalEnviroScreen 4.0 Indicator Maps [Map]. OEHHA. Retrieved January 01, 2023, from https://oehha.ca.gov/calenviroscreen/maps-data

[47] California Air Resources Board (Cartographer). (2022). Carb Pollution Mapping Tool v2.6 [Map]. California Air Resources Board. Retrieved 01 10, 2023, from https://www.arb.ca.gov/ei/tools/pollution_map/?_ga=2.236976193.1118139338.1671419580-1940139639.1658108458

[48] Cumming, D. (2018). Black Gold, White Power: Mapping Oil, Real Estate, and Racial Segregation in the Los Angeles Basin, 1900-1939. Engaging Science, Technology, and Society, 4, 85-110. https://doi.org/10.17351/ests2018.212

49 Meadows-Fernandez, A. (2020, October 14). The Double Jeopardy of Environmental Racism. Hopkins Bloomberg Public Health Magazine. https://magazine.jhsph.edu/2020/double-jeopardy-environmental-racism

[50] Cushing, L., Blaustein-Rejto, D., Wander, M., Pastor, M., Sadd, J., Zhu, A., & Morello-Frosch, R. (2018). Carbon trading, co-pollutants, and environmental equity: Evidence from California's cap-and-trade program (2011–2015). PLOS Medicine, 15(7)(e1002604–e1002604). https://doi.org/10.1371/journal.pmed.1002604

impacts from society's fossil fuel dependence. To understand how carbon offsets have harmed disadvantaged communities, please review the following case studies.

Coal in San Antonio, TX: Trading Carbon Credits for Community Health[51]

In 2006, residents of southeast San Antonio, Texas were offered 'free' trees from the public utility. The utility and state leadership in Austin declared this as a model program to exchange pollution for carbon offsets. However, the trees to be planted in the neighborhood came at the cost of a new coal fired power plant permitted to be built adjacent to the two existing coal-fired power plants. The result was doubling of coal byproducts (e.g., particulate matter, mercury, etc.), pumped daily into a community already plagued with asthma, poor air quality and poverty. The approval for the new coal fired power plant in San Antonio and the promise of carbon offsets set a precedent to fast-track 15 new coal-fired power across the state of Texas. Investing in carbon offsets increased air toxins in the surrounding neighborhood, perpetuating funding of dirty energy products and disproportionately burdening disadvantaged people of color.

Swine in North Carolina: Benefiting Corporations over Community Health

Swine production in North Carolina changed dramatically during the last decades of the 20th century. Between 1982 and 2006, the number of hog operations in the state declined precipitously while the hog population increased from approximately 2 to 10 million[52]. Production became concentrated in rural eastern North Carolina[53]. Industrial producers raised large numbers of hogs in confinement houses designed to vent toxic gasses and particles into the surrounding environment.[54] These facilities stored animal feces and urine in open pits or cesspools and applied the waste to surrounding fields, with each facility generating waste near that of a town of 50,000 people.[55] Air pollutants from the routine operation of confinement houses, cesspools, and waste sprayers affected nearby neighborhoods, causing disruption of activities of daily living, stress, anxiety, mucous membrane irritation, respiratory conditions, reduced lung function, and acute blood pressure elevation.[56] The proportion of Black, Hispanic,

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[51] Case from the personal experience of Dr. Jill Johnston, personal communication, February 8, 2023.

[52] Edwards B, & Driscoll A. (2009). From Farms to Factories: The Environmental Consequences of Swine Industrialization in North Carolina. In Gould K. & Lewis T. (Eds.), *Twenty Lessons in Environmental Sociology* (153-175). New York:Oxford University Press.

[53] Furuseth,O. (1997). Restructuring of Hog Farming in North Carolina: Explosion and Implosion. *The Professional Geographer*, *49*(4), 391–403. https://doi.org/10.1111/0033-0124.00086

[54] Cole, Todd, L., & Wing, S. (2000). Concentrated Swine Feeding Operations and Public Health: A Review of Occupational and Community Health Effects. *Environmental Health Perspectives*, *108*(8), 685–699. https://doi.org/10.1289/ehp.00108685

[55] Schiffman, Bennett, J. L., & Raymer, J. H. (2001). Quantification of odors and odorants from swine operations in North Carolina. *Agricultural and Forest Meteorology*, *108*(3), 213–240. https://doi.org/10.1016/S0168-1923(01)00239-8

[56] Casey, Kim, B. F., Larsen, J., Price, L. B., & Nachman, K. E. (2015). Industrial Food Animal Production and Community Health. *Current Environmental Health Reports*, *2*(3), 259–271. https://doi.org/10.1007/s40572-015-0061-0

Donham, Reynolds, S. J., Whitten, P., Merchant, J. A., Burmeister, L., & Popendorf, W. J. (1995). Respiratory dysfunction in swine production facility workers: Dose-response relationships of environmental exposures and pulmonary function. *American Journal of Industrial Medicine*, *27*(3), 405–418. https://doi.org/10.1002/ajim.4700270309 and American Indians living within 3 miles of an industrial hog operation were 1.50, 1.41, and 2.22 times higher, respectively, than the proportion of non-Hispanic Whites ($p<0.0001$) in the state of North Carolina.[57] In addition to well-documented effects on physical, mental, and social well-being, residents of areas with a high density of industrial hog operations (IHOs), and especially residents of color, were subjected to intimidation including threats of legal action, violence, and job loss.[58] The industry's close ties with local and state government officials helped it to avoid regulation that could have protected neighborhoods and created barriers to democracy in rural communities of color. This pattern is recognized as environmental racism.

In 2020, the U.S. Court of Appeals for the Fourth Circuit Ruling[59] regarding the nuisance of IHOs to the nearby residents determined:

"At the end of all this wreckage lies an uncomfortable truth: these nuisance conditions were unlikely to have persisted for long—or even to have arisen at all—had the neighbors of Kinlaw Farms been wealthier or more politically powerful…. Murphy-Brown's interference with their quiet enjoyment of their properties was unreasonable. It was willful, and it was wanton."

The permitting and operation of IHOs in North Carolina continues to be subject to Title VI Complaints of the 1964 Civil Rights Act and is under investigation by the US Environmental Protection Agency.

The funding of anaerobic digestion systems (e.g. methane capture or waste-to-energy systems) at IHOs in North Carolina that are then traded in the carbon offsets market perpetuates the existence of cesspits and sprayfields known to cause adverse health impacts and fails to

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Donham, Cumro, D., Reynolds, S. J., & Merchant, J. A. (2000). Dose-Response Relationships Between Occupational Aerosol Exposures and Cross-Shift Declines of Lung Function in Poultry Workers: Recommendations for Exposure Limits. *Journal of Occupational and Environmental Medicine*, *42*(3), 260–269. https://doi.org/10.1097/00043764-200003000-00006
Wing, Horton, R. A., Marshall, S. W., Thu, K., Tajik, M., Schinasi, L., & Schiffman, S. S. (2008). Air Pollution and Odor in Communities near Industrial Swine Operations. *Environmental Health Perspectives*, *116*(10), 1362–1368. https://doi.org/10.1289/ehp.11250
Horton, Wing, S., Marshall, S. W., & Brownley, K. A. (2009). Malodor as a Trigger of Stress and Negative Mood in Neighbors of Industrial Hog Operations. *American Journal of Public Health (1971)*, *99*(S3), S610–615. https://doi.org/10.2105/AJPH.2008.148924
Schinasi, Horton, R. A., Guidry, V. T., Wing, S., Marshall, S. W., & Morland, K. B. (2011). Air Pollution, Lung Function, and Physical Symptoms in Communities Near Concentrated Swine Feeding Operations. *Epidemiology (Cambridge, Mass.)*, *22*(2), 208–215. https://doi.org/10.1097/EDE.0b013e3182093c8b
Wing, Horton, R. A., & Rose, K. M. (2013). Air pollution from industrial swine operations and blood pressure of neighboring residents. *Environmental Health Perspectives*, *121*(1), 92–96. https://doi.org/10.1289/ehp.1205109
Mirabelli, Wing, S., Marshall, S. W., & Wilcosky, T. C. (2006). Asthma symptoms among adolescents who attend public schools that are located near confined swine feeding operations.(Author abstract). *Pediatrics (Evanston)*, *118*(1), 370–.
Tajik, Muhammad, N., Lowman, A., Thu, K., Wing, S., & Grant, G. (2008). Impact of Odor from Industrial Hog Operations on Daily Living Activities. *New Solutions*, *18*(2), 193–205. https://doi.org/10.2190/NS.18.2.i

[57] Wing, S. & Johnston, JE. (2014). Industrial Hog Operations in North Carolina Disproportionately Impact African-Americans, Hispanics and American Indians. *The University of North Carolina at Chapel Hill.*

[58] Wing S, Cole D, & Grant G. (2000). Environmental Injustice in North Carolina's Hog Industry. *Environmental Health Perspectives*. 108(3): 225-231. https://doi.org/10.2307/3454438
Wing S. (2002). Social Responsibility and Research Ethics in Community-Driven Studies of Industrialized Hog Production. *Environmental Health Perspectives.* 110(5): 437-444. https://doi.org/10.1289/ehp.02110437
Thu, K. (2003). Industrial Agriculture, Democracy, and the Future. In Ervin, A., Holtslander, C., Qualman, D., Sawa, R. (*Eds.*) *Beyond Factory Farming: Corporate Hog Barns and the Threat to Public Health, the Environment, and Rural Communities*. Saskatoon, Saskatchewan:Canadian Centre for Policy Alternatives.

[59] McKiver v. Murphy-Brown, LLC, 980 F.3d 937. Page 78 (4th Cir. 2020). https://www.ca4.uscourts.gov/opinions/191019.P.pdf

address the need for protections from air and water pollution.[60] Such projects have failed to identify or require cleaner technology to manage hog waste, instead incentivizing harmful industries by providing them with a new revenue stream.

USC Recognizes its Commitment to the South Los Angeles Community

Reducing climate pollution greatly benefits everyone, yet the way USC achieves these reductions could either improve or worsen current patterns of inequity for marginalized and minoritized peoples. Environmental justice supports centering populations that are least responsible for, and most vulnerable to, the climate crisis as decision makers in local plans to address the crisis. It means acknowledging that climate change threatens basic human rights principles, which hold that all people are born with equal dignity and rights, including to food, water, and other resources needed to support healthy communities.

Recognizing this issue, the Task Force chose to include environmental justice as one of the evaluative criteria for project consideration. The Task Force expressed that it wants to ensure that the purchase of carbon offsets creates distributional equity; that is, they do not consistently benefit non-marginalized communities over marginalized communities. One example of this might be tree planting or afforestation efforts that only occur in higher socioeconomic neighborhoods rather than lower socioeconomic neighborhoods. Additionally, environmental justice also considers the issue of *fairness* versus *equity*. For instance, projects that benefit all Los Angeles neighborhoods equally may be *fair*, but they are not *equitable.* Treating all neighborhoods equally ignores the disparate realities faced by different Los Angeles communities, including different degrees of exposure to harmful pollution or lack of tree canopy coverage. To further understand the impact that environmental inequity has had on California, please refer to the CalEnviroScreen map.[61]

Projects USC invests in could integrate these components of climate justice by seeking:

1. **Health co-benefits:** Providing co-benefits that improve the health of communities where the project is taking place.
2. **Justice and equity:** Directly addressing social and environmental justice and/or health equity issues through planning, community engagement, implementation, and outcomes.
3. **Prioritization of projects in the Los Angeles community:** Investing in projects that do the most to improve the health and resilience of the disproportionately impacted communities they serve.

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[60] The False Promises of Biogas: Why Biogas Is an Environmental Justice Issue. (2021). *Environmental Justice*. https://doi.org/10.1089/env.2021.0025
[61] California Office of Environmental Health Hazard Assessment (Cartographer). (2022). *CalEnviroScreen 4.0 Indicator Maps [Map]*. OEHHA. Retrieved January 01, 2023, from https://oehha.ca.gov/calenviroscreen/maps-data

Appendix III: Peer Institutions Included in Benchmarking Research

Table 5 (below, ordered by public carbon neutrality date) shows the public climate neutrality dates of benchmarked peer institutions, if the peer institution has committed to an actionable carbon offset purchasing plan (denoted with a black dot), and if the peer institution is an IVY+ Listening Post member school (denoted with a black dot). All but one institution that is committed to a climate neutrality date at or before USC's Scope 1 and 2 climate neutrality goal (2025) have actionable offset purchasing plans. Just three benchmarked institutions with a less aggressive neutrality date, 2040 or later, currently have an actionable offset purchasing plan. It is possible institutions with substantially later neutrality dates than USC, such as targets in the 2040s, took alternative routes to achieving that goal, such as avoiding the use of offsets. Nonetheless, it is useful to compare schools strategies and timelines for achieving key sustainability benchmarks such as climate neutrality. This table highlights the disparity in the investment into carbon offset projects by schools with more and less aggressive climate neutrality dates, with schools aligned with USC's aggressive neutrality goal most frequently utilizing carbon offsets.

Table 5. Peer Institution Commitments

School Title	Climate Neutrality Date	Has Offset Purchasing Plan	IVY + LP School
Middlebury College	2016	•	
American University	2018	•	
Arizona State University	2019	•	
Vanderbilt University	2021	•	•
Columbia University	2021	•	•
Duke University	2024	•	•
UCLA	2025	•	
Oregon State University	2025	•	
University of Michigan	2025		•
Harvard University	2026	•	•
MIT	2026	•	•
University of Rochester	2030	•	•
Georgetown University	2030		•
George Washington University	2030		•
University of Virginia	2030		•

School Title	Climate Neutrality Date	Has Offset Purchasing Plan	IVY + LP School
Yale University	2035	•	•
Cornell University	2035	•	•
New York University	2040	•	•
University of North Carolina	2040	•	
Brown University	2040		•
University of Pennsylvania	2042	•	•
Princeton University	2046		•
Dartmouth University	2050		•
Emory University	2050		•
University of Notre Dame	2050		•
Tulane University	2050		•
Washington & Lee	2050		
Davidson College	2050		
Tufts University	2050		
University of Richmond	2050		
Stanford University	2050		•
University of Chicago	Not Published	•	•
Wake Forest University	Not Published		•
University of Wisconsin	Not Published		•
Caltech	Not Published		•
University of Miami	Not Published		•
John Hopkins University	Not Published		•

Appendix IV: Peer Institutions' Project Type Use

Table 6 (below) denotes the utilization of specific project types by benchmarked peer institutions according to publicly available information (for more information on the benchmarking process, see the above "Benchmarking Peer Institutions' Carbon Offset Portfolio" section). Each black dot indicates an institutions' self-reported investment into the project type. It does *not* reflect the number or aggregate size of offset projects contained within a single project type (e.g. an institution could be investing in multiple, large projects under a single project type).

The most frequently used project type is Forestry and Agriculture projects with 10 relevant examples, while no peer institutions publicly report the use of Carbon Capture and Storage projects.

Please note that this information is pulled from self-reported, publicly available information on the peer institution's websites. The below chart does not include non-reported investments, and thus may not be comprehensive of each peer institution's complete carbon offset portfolio. This information is also not intended to imply the inherent superiority of one project type over another, but rather to illustrate investment trends.

Table 6. Project Use by Peer Institutions

Peer Institution	Carbon Capture & Storage	Energy Efficiency	Forestry & Ag	Fuel Switching	Industrial Gas Abatement	Renewable Energy
Duke University			•		•	
Arizona State University			•			
Harvard University						
MIT						•
University of Pennsylvania						•
University of Rochester						•
Vanderbilt University						•
Yale University			•		•	
New York University			•			

Peer Institution	Carbon Capture & Storage	Energy Efficiency	Forestry & Ag	Fuel Switching	Industrial Gas Abatement	Renewable Energy
UCLA			•		•	
Cornell University			•			
American University		•	•	•	•	•
Oregon State University			•			
Middlebury College			•		•	•
University of Chicago						
University of North Carolina					•	
Columbia University			•	•	•	
Totals	0	1	10	2	7	6

Appendix V: Advisory Bodies and Peer Institutions Criteria Comparison

To develop carbon offset criteria for USC, the Task Force reviewed the carbon offset characteristics either recommended or required by expert advisory bodies and peer institutions. This information helped the Task Force develop the PAVER standards and is captured in the table below.

Table 7. Survey of Offset Criteria Reference by Advisory Bodies and Peer Institutions

The following groups were included in the review of criteria requirements:

- Business for Social Responsibility (BSR) is a sustainable business network and consultancy
- California Air Resources Board (CARB) is charged with protecting the public from the harmful effects of air pollution and developing programs and actions to fight climate change
- Carbon Offset Guide is an initiative of the Greenhouse Gas Management Institute and the Stockholm Environment Institute
- Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) is the first global market-based initiative for any sector
- International Carbon Reduction and Offset Alliance (ICROA) promotes emissions reductions and offsetting to the highest standards of environmental integrity and in support of the Paris Agreement
- The Integrity Council for the Voluntary Carbon Market (Integrity Council) is an independent governance body for the voluntary carbon market
- Second Nature works with hundreds of colleges and universities to help make the principles of sustainability fundamental to every aspect of higher education
- World Resources Institute (WRI) is a global research organization that works with governments, businesses, multilateral institutions, and civil society groups
- Peer institutions: Berkeley, Duke, MIT, and Yale (highlighted in gold)

Criteria	BSR	CARB	Carbon Offset Guide	CORSIA	ICROA	Integrity Council	Second Nature	WRI	Berkeley	Duke	MIT	Yale	Total
Permanent/Durable	•	•	•	•	•	•	•	•	•	•	•	•	**12**
Additional/Baselines	•	•	•	•	•	•	•	•	•	•	•	•	**12**
Verified/Validated/ Audited	•	•		•	•	•	•	•		•	•	•	**10**
Enforceable/Unique/ Owned	•	•		•	•		•	•		•	•	•	**9**
Real	•	•		•	•		•	•		•	•	•	**9**
Measurable/Quantifiable	•	•	•		•	•	•		•				**7**
No Net Harm			•	•		•			•				4
Transparent						•	•				•	•	**4**
Account for Leakage				•			•		•				**3**
Not Double Counted				•		•	•						**3**
Co-benefits			•				•				•		**3**
Registered/Traceable						•	•						**2**
Synchronous	•						•						**2**
Retired							•				•		**2**
Emissions Factors									•				**1**
Program Governance						•							**1**
Transition to Net-Zero Emissions						•							**1**
Scaleable									•				**1**
Total	**7**	**6**	**5**	**8**	**6**	**10**	**13**	**5**	**7**	**5**	**8**	**6**	**86**

Sources[62]

[62] Business for Social Responsibility (BSR) - Guiding Principle: https://www.bsr.org/reports/BSR_Getting-Carbon-Offsets-Right.pdf
California Air Resources Board (CARB) - Process for the Review and Approval of Compliance Offset Protocols: https://ww2.arb.ca.gov/sites/default/files/cap-and-trade/compliance-offset-protocol-process.pdf
GHG Management Institute/Stockholm Environment Institute – Carbon Offset Guide: https://www.offsetguide.org/wp-content/uploads/2020/03/Carbon-Offset-Guide_3122020.pdf
Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) - Carbon Offset Credit Integrity Assessment Criteria: https://www.icao.int/environmental-protection/CORSIA/Documents/ICAO_Document_09.pdf
International Carbon Reduction & Offset Alliance (ICROA)/ International Emissions Trading Association (IETA) - New Voluntary Carbon Market (VCM) Standards: https://www.icroa.org/_files/ugd/653476_2e5379c215b64a609503b063e4de2e9f.pdf
The Integrity Council for the Voluntary Carbon Market - Core Carbon Principles: https://icvcm.org/wp-content/uploads/2022/07/ICVCM-Public-Consultation-FINAL-Part-2.pdf
Second Nature - Carbon Markets & Offsets Guidance: Principles of High-quality Offsets: https://secondnature.org/wp-content/uploads/Carbon-Markets-and-Offsets-Guidance-1.pdf
World Resources Institute (WRI) - Criteria for carbon offsets: https://files.wri.org/d8/s3fs-public/outside_the_cap.pdf
Berkeley Public Policy, The Goldman School – Repository of Articles on Carbon Offset Quality : https://gspp.berkeley.edu/faculty-and-impact/centers/cepp/projects/berkeley-carbon-trading-project/repository-of-articles
Duke Carbon Offsets Initiative - Meeting PAVER Requirements: https://sustainability.duke.edu/sites/default/files/carbonsink.pdf
Research conducted as part of MIT's Sustainability Lab Class - Criteria for a good Offset or REC: https://mitsloan.mit.edu/sites/default/files/2018-10/BU-Report-2018.pdf
Yale Sustainability - Verified Carbon Offsets: https://sustainability.yale.edu/priorities-progress/climate-action/verified-carbon-offsets

Appendix VI: Weighting Methodology

To determine the collective preference of each criterion, the thirteen members of the Carbon Task Force were provided a survey to assess their individual preferences for each criterion. In this survey, members were provided a table with the six criteria defined by their worst and best performance level (see Table 8 below). Participants were asked which criterion they would most like to change from worst to best and rank these from first, second, third and so on. The criterion ranked number one is deemed the highest priority in ensuring its outcome is achieved while the sixth ranked criterion is deemed the lowest priority in ensuring its criteria is achieved. These individual ranks thus reflect preference for prioritizing each criterion.

Individual ranks were then transformed into Rank Order Centroid (ROC) weights. This approach assumes that the distributions of weights are uniform within the ranking constraint and sum to 100%. This enables a calculation of the expected value, or "centroid" of the distribution for each weight, summing to 100%.[63] This provides each weight with a percentage out of 100% representing its relative importance.

Three aspects of evaluative criteria (the PAVER requirement, the offset cost per metric ton, and the amount of emissions offsets) are not evaluated as ROC weights. Instead, PAVER criteria is a prerequisite to project selection and operate on a 0-1 sliding scale of the extent to which a project meets PAVER requirements. Project cost and quantity track key individual project metrics while also helping measure key metrics of the overall offset portfolio. ROC weighting is the final step where qualitative values are applied.

[63] Barron, F. & Barrett, B. E. (1996). Decision Quality Using Ranked Attribute Weights. *Management Science*, *42*(11), 1515–1523. https://doi.org/10.1287/mnsc.42.11.1515

Table 8. Six Value Criteria with Definitions of Worst and Best Levels

Criteria	Worst Case Scenario	Best Case Scenario
Co-Benefits: Reduction of pollution, improvement of health, improvement of environment near project sites, prioritizing achieving these benefits in the Los Angeles and Southern California regions	The offset project has no pollution, environmental, or health benefits proximate to the project site	The offset project has substantial pollution, environmental, or health benefits in Los Angeles, where the project is based
Co-Benefits: Business and household cost savings	No business or household cost savings	Significant business and household cost savings in the Los Angeles region
Co-Benefits: Partnerships and external funding potential (external funding opportunities, collaboration opportunities with Los Angeles partners, research, and scholarship opportunities)	No partnership or funding opportunities	Opportunities to obtain research funding, collaborate with Los Angeles organizations, and support research and scholarship
Co-Benefits: Opportunities to involve the USC community (students, faculty, staff, and nearby USC community involvement)	No opportunity to involve students, faculty, or staff, and no community involvement	Many opportunities to involve students, faculty, staff, and the USC community
Avoidance of Co-Negative Impacts: Environmental impacts (such as project development, construction, and operations) or other negative impacts (such as displacing established infrastructure)	Some disruptions or negative impacts due to project development and operations	Avoidance of disruptions or negative impacts due to project development and operation
Equity and Environmental Justice: Equitable distribution of project costs and benefits, reduction of burden on disadvantaged communities	Project does not address equity and does not reduce any environmental burden on disadvantaged populations, or develops carbon offset projects at the expense of new polluting projects developed in marginalized communities	Project provides an equitable distribution of costs and benefits and reduces environmental burdens on disadvantaged populations

Ranks and ROC weights were then averaged with the results shown in Table 9. This survey technique enabled the Task Force to isolate and order their weighted preferences and to provide weights for administrators to use when evaluating projects.

The highest weighted criteria was a 34% weight for the importance of co-benefits related to a reduction of pollution, improvements of health, and improvements of environment - with the greater Los Angeles as a priority. 19% and 17% weights were given to equity and environmental justice and the avoidance of co-negatives, respectively. The lowest weighted criteria (7%) was given to business and household cost savings.

Table 9. Average Ranks and Rank Order Centroid weights across 13 Survey Participants

Evaluative Criteria	Average Rank	Average ROC Weights
Reduction of pollution, improvement of health, and improvement of environment near project sites, with an emphasis on achieving these benefits in the Los Angeles and Southern California regions	1	34%
Equity and environmental justice	2	19%
Avoidance of co-negative impacts	3	17%
Opportunities to involve the USC community	4	13%
Partnerships and external funding potential	5	11%
Business and household cost savings	6	7%

Appendix VII: Registries

The Task Force researched five major carbon offset project registries to identify which registries adopt best practices for PAVER standards compliance. These registries are organizations responsible for facilitating carbon credit sale and acquisition, as well as independently auditing and confirming the legitimacy of offset projects listed on their registries. Due to the non-universal nature of standards in the newly emerging carbon offset market, it is essential to diligently select the most reliable registries to verify offset investment.

Evaluation Methodology

Five of the largest carbon registries selected for research by the Task Force include: Gold Standard, the Climate Action Reserve, the Verified Carbon Standard, Plan Vivo, and the American Carbon Registry. Protocols from each registry have been researched to provide context for how well these groups satisfy the Task Force's PAVER requirements. Registries were ranked in the categories of Permanence, Additionality, Verifiability, Enforceability, and Realness.

Findings

The registries that explicitly defined the highest number of PAVER standards in their published guidelines were the Climate Action Reserve and the American Carbon Registry, which both met all PAVER standards. Plan Vivo was comparatively lower ranked due to having three categories with insufficient or little language on specific PAVER standards.

All registries have a variety of documentation specifying precise mechanisms for defining PAVER requirements and evaluating each project based on those guidelines. As a result, decision-makers should further evaluate the particulars of any project listed on the registries which may be considered viable for USC.

Gold Standard[64]

- **Permanence:** "Contribution to the buffer is not required for projects that issue Gold Standard Voluntary Emissions Reductions for permanent GHG reductions and/or avoidance i.e., involves no risk of GHG reversal." (Section 11.1.1)
- **Additional**: "All Projects shall be demonstrated to be additional, meaning that they shall reduce anthropogenic emissions of greenhouse gases below those that would have occurred in the absence of the proposed Project." (Section 7.1.1)

[64] The Gold Standard Foundation. (2022, February 24). *GHG Emissions Reductions & Sequestration Product Requirements – Gold Standard for the Global Goals*. Gold Standard for the Global Goals. Retrieved January 12, 2023, from https://globalgoals.goldstandard.org/501-pr-ghg-emissions-reductions-sequestration

- **Verifiable**: The "Project Developer shall appoint an eligible Gold Standard approved Validation and Verification Body (VVB) to conduct a Validation or Verification of the project." (Section 1.1.1)
- **Enforceable**: "In order to avoid double counting the Project shall not be included in any other voluntary or compliance standards programme unless approved by Gold Standard." (Section 3.1.1 C)
- **Real**: "By successfully following the Procedures and applicable Requirements included the Project Cycle Section, the Project demonstrates real and verified outcomes and are able to issue the relevant Certified Impact Statements and/or Products." (Section 4.1.38)

Climate Action Reserve[65]

- **Permanence**: "The Reserve defines "permanence" as being equivalent to the radiative forcing benefits of removing CO2 from the atmosphere for 100 years." (Section 2.8)
- **Additional**: "GHG reductions must be additional to any that would have occurred in the absence of the Climate Action Reserve, or of a market for GHG reductions generally. "Business as usual" reductions – i.e., those that would occur in the absence of a GHG reduction market – should not be eligible for registration" (Section 1.2)
- **Verifiable**: "GHG reductions must result from activities that have been verified on an ex post basis. Verification requires third-party review of monitoring data for a project to ensure the data are complete and accurate." (Section 1.2)
- **Enforceable**: "Transfers from another GHG registry shall be reviewed by the verification team, and the verification body must ensure that no double-counting has occurred by cross-checking the previous registry's records with the Reserve software." (Section 4.6.1.3)
- **Real**: "Estimated GHG reductions should not be an artifact of incomplete or inaccurate emissions accounting. Methods for quantifying emission reductions should be conservative to avoid overstating a project's effects. The effects of a project on GHG emissions must be comprehensively accounted for, including unintended effects (often referred to as "leakage"). (Section 1.2)

Verified Carbon Standard[66]

- **Permanence**: "Where GHG emission reductions or removals are generated by projects or programs that carry a risk of reversibility, adequate safeguards must be in place to ensure that the risk of reversal is minimized and that, should any reversal occur, a mechanism is in place that guarantees the reductions or removals will be replaced or compensated." (Section 3)

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[65] Climate Action Reserve. (2019, November 12). *Reserve Offset Program Manual*. Climate Action Reserve. https://www.climateactionreserve.org/wp-content/uploads/2019/11/Reserve_Offset_Program_Manual_November_2019.pdf; Climate Action Reserve. (2021, February 3). *Verification Program Manual*. Climate Action Reserve. https://www.climateactionreserve.org/wp-content/uploads/2021/02/Verification_Program_Manual_February_2021.pdf
[66] Verra. (2022, January 20). *Program Guide*. Verra. https://verra.org/wp-content/uploads/2022/01/VCS-Program-Guide_v4.1.pdf

- **Additional**: "GHG emission reductions and removals must be additional to what would have happened under a business-as-usual scenario if the project had not been carried out." (Section 3)
- **Verifiable**: "All GHG emission reductions and removals must be quantifiable using recognized measurement tools (including adjustments for uncertainty and leakage) against a credible emissions baseline." "There must be sufficient and appropriate public disclosure of GHG-related information to allow intended users to make decisions with reasonable confidence." (Section 3)
- **Enforceable**: "Each VCU must be unique and must only be associated with a single GHG emission reduction or removal activity. There must be no double counting, or double claiming of the environmental benefit, in respect of the GHG emission reductions or removals." (Section 3)
- **Real:** "All GHG emission reductions and removals and the projects or programs that generate them must be proven to have genuinely taken place." (Section 3)

Plan Vivo[67]

- **Permanence**: "Risks to the maintenance of the Carbon Benefits for a period of at least 50-years must be identified and significant risks must be mitigated." (Section 3.11.1)
- **Additional**: "Project Interventions must not be feasible for Project Participants to implement in the absence of the Project." (Section 3.7.1)
- **Verifiable**: "All Progress Indicators must be monitored throughout the Crediting Period, and corrective actions must be implemented if targets are not met." (Section 4.6.1)
- **Enforceable**: "To avoid the risk of Double Counting Carbon Benefits for which Plan Vivo Certificates are issued, there must be no overlap of Project Areas with other greenhouse gas emission reduction projects or initiatives generating transferable emission reduction or removal credits from the same carbon pools or emission sources." (Section 3.13.1)
- **Real**: Not specified

American Carbon Registry[68]

- **Permanence**: "For projects with a risk of reversal of GHG removal enhancements or avoided conversion projects, Project Proponents shall assess and mitigate risk, and monitor, report, and compensate for reversals." (Page 23)
- **Additional**: "Every project shall use either an ACR-approved performance standard and pass a regulatory surplus test, or pass a three- pronged test of additionality in which

[67] Plan Vivo. (202). *Plan Vivo Standard Project Requirements*. Plan Vivo. https://www.planvivo.org/Handlers/Download.ashx?IDMF=9fd4491d-6851-4819-a970-e2e94338445e
[68] American Carbon Registry. (2020, December). *American Carbon Registry Standard v7.0*. American Carbon Registry. https://americancarbonregistry.org/carbon-accounting/standards-methodologies/american-carbon-registry-standard

the project must: 1. Exceed regulatory/legal requirements; 2. Go beyond common practice; and 3. Overcome at least one of three implementation barriers: institutional, financial, or technical." (Page 26)

- **Verifiable**: "Projects must maintain material regulatory compliance. To do this, a regulatory body/bodies must deem that a project is not out of compliance at any point during a reporting period. Projects deemed to be out of compliance with regulatory requirements are not eligible to earn Emission Reduction Tons during the period of non-compliance." (Page 23)
- **Enforceable**: "ACR allows for offset project registration simultaneously on ACR and other voluntary or compliance GHG programs or registries in only two circumstances: 1) the simultaneous registration is disclosed and approved by both programs/registries, including explicitly through regulation, and 2) offsets issued for the same unique emissions reductions (project boundary and vintage) do not reside concurrently on more than one registry. To prevent double issuance and double use of offsets for projects registered simultaneously on ACR and another GHG program, 1) offsets representing the same emissions reduction must be publicly canceled from one registry before they can be converted and reissued on another registry or 2) offsets can be issued to a project by both programs as long as the registration of the project under more than one program is disclosed in writing to the GHG program and the verifier, and the offset represents unique emissions reductions in terms of location (project boundary) and vintage." (Page 58)
- **Real**: "GHG reductions and/or removals shall result from an emission mitigation activity that has been conducted in accordance with an approved ACR Methodology and is verifiable. ACR will not credit a projected stream of offsets on an ex-ante basis." (Page 22)

Conclusion

The results of the Task Force's research have concluded that, based on each registry's definitions of its standards, the Climate Action Reserve and the American Carbon Registry are the most likely to verify reliable offset projects that produce high-quality credits.

Appendix VIII: Supplemental Reading on Carbon Offsets

Carbon Offset Briefers

- Second Nature. (2016). *Carbon Markets & Offsets Guidance*. Second Nature. https://secondnature.org/wp-content/uploads/Carbon-Markets-and-Offsets-Guidance-1.pdf
- Carbon Offset Guide. (n.d.). *Understanding Carbon Offsets - What is a Carbon Offset?* Carbon Offset Guide. https://www.offsetguide.org/understanding-carbon-offsets/what-is-a-carbon-offset/
- Broekhoff, D., Gillenwater, M., Colbert-Sangree, T., & Cage, P. (2019, November 13). *Securing Climate Benefit: A Guide to Using Carbon Offsets*. Carbon Offset Guide. https://www.offsetguide.org/wp-content/uploads/2020/03/Carbon-Offset-Guide_3122020.pdf
- Duke Carbon Offsets Initiative | Duke University. (n.d.). *Guide to Carbon Offsets and Co-benefits*. Sustainability | Duke. https://sustainability.duke.edu/sites/default/files/cobenefitsguide.pdf

Offset Standards and Verification Examples

- American Carbon Registry. (n.d.). *American Carbon Registry Standard*. American Carbon Registry. Retrieved January 4, 2023, from https://americancarbonregistry.org/carbon-accounting/standards-methodologies/american-carbon-registry-standard
- Climate Action Reserve. (n.d.). *Verification - Climate Action Reserve*. Climate Action Reserve. Retrieved January 4, 2023, from https://www.climateactionreserve.org/how/verification/
- Second Nature. (2016). *Carbon Markets & Offsets Guidance*. Second Nature. https://secondnature.org/wp-content/uploads/Carbon-Markets-and-Offsets-Guidance-1.pdf

Appendix IX: Charter for the Task Force on Carbon Removal and Offsets

Presidential Working Group on Sustainability in Education, Research & Operations

Operations Committee

Task Force on Carbon Removal and Offsets

Charter and Scope of Work

June 30, 2022

The Task Force on Carbon Removal and Offsets is hereby established with a one-year term for the express purposes described below.

MEMBERSHIP

Membership shall consist of volunteers, including:

- Three faculty members, inclusive of
    - **Detlof von Winterfeldt**, *J.A. Tiberti Chair of Ethics and Decision Making and Professor of System Engineering, USC Viterbi School of Engineering; Professor of Public Policy, USC Price School of Public Policy; Executive Director, USC Center for Sustainability Solutions*, appointed by the PWG Operations Committee
    - **Jill Johnston**, *Assistant Professor of Population and Public Health Sciences, Keck School of Medicine of USC*, appointed by the PWG DEI Committee
    - **Iraj Ershaghi**, *Omar B. Milligan Chair in Petroleum Engineering and Professor of Chemical Engineering and Materials Science, Director of the Ershaghi Center for Energy Transition (E-CET)*, appointed by the PWG Research Committee
- Five staff members, inclusive of
    - **Julie Hopper**, *Sustainability Program Specialist – Data Analyst*, appointed by the Office of Sustainability
    - **Brian Gross**, *USC Senior Business Officer*, appointed by the SVP of Administrative Operations
    - **Paul Pulido**, *Senior Program Manager, Economic and Workforce Development*, appointed by University Relations
    - **Zelinda Welch**, *Associate Director Sustainability,* appointed by Facilities Planning and Management
    - **Miguel Gonzalez**, *Associate Administrator, Support Services at Keck Medical Center of USC*, appointed by the SVP of Health Affairs
- Three students appointed by the PWG Student Committee
    - **Darby Warburton,** *Graduate Student*, Viterbi School of Engineering

- ○ **Shreya Puranik,** *Graduate Student,* Marshall School of Business
  - ○ **Alexis Markan,** *Undergraduate Student,* Dornsife College of Letters, Arts and Sciences
- One alumni member appointed by the PWG co-chairs
  - **Abby Lunstrum**, Ph.D., USC Dornsife College of Letters, Arts and Sciences
- One community member appointed by University Relations
  - **Angelic Perez,** *Community Engagement Coordinator, Koreatown Youth + Community Center*
- USC's Chief Sustainability Officer, ex-officio
  - **Mick Dalrymple**

The committee will be managed by **Hannah Findling** from the President's Office and supported by President's Sustainability Internship Program intern **Harry Aaronson** and the PWG student assistant **Sean McCalla**, who all serve as non-voting members of the task force.

<u>SCOPE OF WORK</u>

The Task Force shall:

1) Educate itself on the basics of carbon offsets in greenhouse gas (GHG) accounting protocols, international protocols and certifications for carbon offsets, carbon markets and major trends, regulatory/policy trends, and USC's projected offset/removal needs. The Task Force's scope does not include Renewable Energy Credits (RECs), though knowledge of the differences between RECs and Offsets/Removal is foundational.
2) Benchmark similar guidelines from other universities considered to be leaders on climate action and/or offsets.
3) Create and recommend guidelines to help USC achieve its carbon neutrality goals delineated in *Assignment: Earth*, specifically regarding criteria and prioritization among those criteria for:
   - the development of carbon removal or offset projects that are third-party certified, and/or
   - the purchase of certified carbon removal certificates and carbon offsets

<u>RESOURCES</u>

1) The Task Force will have the assistance of a part-time President's Student Internship Program intern for research and report writing, and a member of the Office of Sustainability staff for part-time coordination purposes.
4) The Task Force is encouraged to explore the following attributes or co-benefits:
   - Financial costs
   - Mitigation versus removal

- Verifiable quantification, additionality, double-counting avoidance, and persistence (including technology trends that improve quantification and verification).
- Mission-related co-benefits
  - Leveraging and involving USC research
  - Providing educational opportunities for students
  - Addressing environmental justice issues and opportunities
  - Impacting local, regional, state, national, international communities
  - Utilizing campus as a living lab (within the contexts permitted by GHG accounting protocols)
- Implementation complexity and timelines
- Potential to attract philanthropic financial assistance
- Potential to partner with other organizations for reduced costs and/or increased impact
- Ethical considerations in the cost-benefit analyses of reducing emissions on campus versus investing in offset projects that reduce emission-related pollution and climate impacts for vulnerable populations (locally and internationally)
- Internal and external communications optics
- Other criteria that the Task Force develops or discover, and any subtractions or modifications/re-structuring to the above

5) Leverage the following resources (non-exclusive)
   a. *Developing a Novel Carbon Offset Program in the University of Southern California's Surrounding Communities of South and East Los Angeles,* Research Report Developed for USC's Presidential Working Group on Sustainability by Xingyu Xiong, Samuel Wands, Noah Silver, Karla Fernandez, May 9, 2021
   b. Second Nature's carbon offset resources: https://secondnature.org/library/?_search=offsets
   c. AASHE's Campus Sustainability Hub (https://hub.aashe.org/)
   d. USC faculty and staff expertise
   e. Industry expertise
   f. USC Local Government and Community Relations team
6) The Task Force may determine its own frequency and method of meeting to accomplish the charter on time.

DELIVERABLES AND TIMELINE

The recommended guidelines deliverables shall cover:

1) Minimum required and optional attributes for removal certificates, carbon offsets, and/or development of projects, with some form of prioritization (weighting, ranking, other)[69]

[69] Note that USC is unlikely to develop carbon offset/removal projects itself but, rather, to work with experienced project developers to do so, if project development is recommended by the Task Force.

2) Preferences for types of certificates/offsets/projects[70] with some form of prioritization
3) Any types of certificates/offsets/projects to be avoided
4) Other related recommendations as the Task Force sees fit

The Task Force shall present preliminary recommended guidelines to the PWG Operations Committee by January 15, 2023, in document and/or presentation format, and deliver final recommended guidelines in document format to the PWG Operations Committee by March 1, 2023.

Upon acceptance and recommendation by the PWG Operations Committee, the Task Force and PWG Operations Committee shall deliver the final guidelines recommendations in presentation and document format to the full PWG for endorsement by April 1, 2023.

[70] Examples of "types of certificates/offsets/projects" include afforestation, landfill gas capture or destruction, soil management, agricultural biogas, direct air capture, etc.