PROJECT REPORT

Opportunities for Local Carbon Offset Credits in the San Diego Region

Summary of Findings from a Preliminary Review of Regulations and Protocols

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EPIC
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The Energy Policy Initiatives Center is a research center of the USD School of Law that studies energy policy issues affecting California and the San Diego region. Energy Policy Initiatives Center's mission is to increase awareness and understanding of energy- and climate-related policy issues by conducting research and analysis to inform decision makers and educating law students.

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1 INTRODUCTION

Carbon offset credits (offset credit) have existed for decades. Section 12 of the Kyoto Protocol, adopted in 1997, provides for offset credits as part of the Clean Development Mechanism (CDM).[1] The CDM allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol to implement a greenhouse gas (GHG) emission reduction project in other, typically developing countries. Since that time, offset credits have been developed both for compliance and voluntary purposes beyond the CDM.

In 2018, Governor Jerry Brown signed Executive Order B-55-18, establishing a statewide goal to achieve carbon neutrality by 2045 and to achieve net negative emissions thereafter. Because it is virtually impossible for local governments, businesses, and individuals to eliminate all future GHG emissions, achieving carbon neutrality likely requires canceling out remaining positive emissions either by removing emissions from the atmosphere or obtaining offset credits. California carbon neutrality policy direction, among other trends, has increased interest in offset credits, particularly whether there is potential to develop offset credits locally.

Building on previous research[2], the goal of this project is to identify opportunities to develop projects in the San Diego region to reduce or remove GHG emissions that could be used as offset credits from existing protocols. To support this overall goal, the Energy Policy Initiatives Center (EPIC):

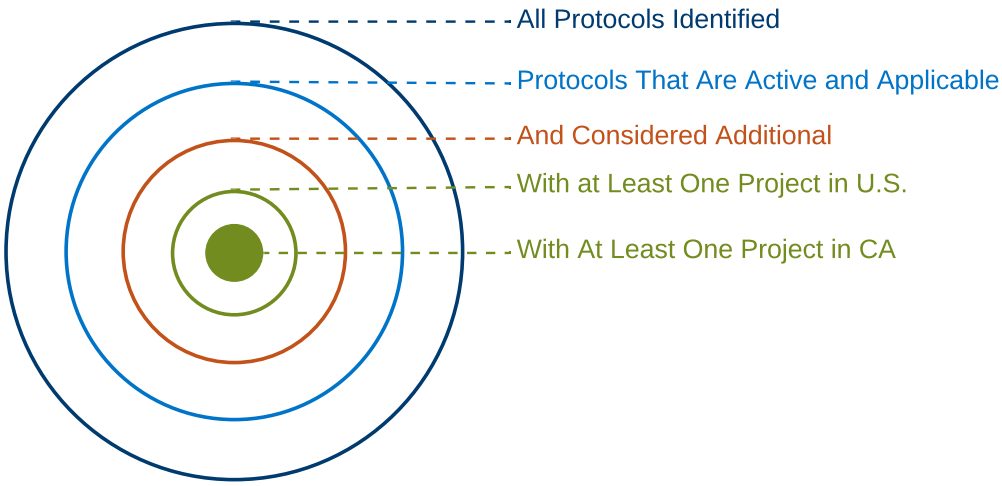
- Identified categories of GHG emissions in the San Diego region;
- Identified related offset credit protocols;
- Identified related regulations that require such activities;
- Identified protocols that covered activities applicable to conditions in the San Diego region and the number of projects developed in the United States (U.S.), California, and the San Diego region; and,
- Determined whether the offset credit protocols and related activities would result in GHG reductions or removals that are in addition to what would have happened otherwise, either because of regulation or common practices.

This screening process identified offset credit protocols that are active and cover activities that occur in the region, are considered to lead to additional GHG reductions or removals and had at least one project located in the U.S. and CA (Figure 1). This work constitutes a preliminary review of protocols and associated project types to determine whether local opportunities exist. While this review is done at the level of protocol category, we recognize that to determine whether a given

[1] See United Nations Framework Convention on Climate Change: Clean Development Mechanism: https://cdm.unfccc.int/about/index.html.
[2] Dudek, Evaluation of Greenhouse Gas Emissions Offset Availability within San Diego County, 2018, Appendix U3: https://www.ci.oceanside.ca.us/civicax/filebank/blobdload.aspx?BlobID=49641; Ramboll Environ US Corporation, Preliminary Assessment of The County of San Diego Local Direct Investment Program, 2017: https://www.sandiegocounty.gov/content/dam/sdc/pds/advance/cap/publicreviewdocuments/FinalPublicReviewDocs/CAPWebAttachments/h3direportweb.pdf.

project would be considered eligible under a specific protocol and its GHG impacts additional, a detailed review of each project is necessary.

Figure 1 Protocols Screening Process



1.1 About this Report

This report summarizes findings of our preliminary review, including a presentation of overall results for the protocols and brief summaries of each emissions category. Detailed reports for each emissions category are included as Appendices. Emissions categories include Natural and Working Lands, Industrial Processes and Product Use, Electricity and Natural Gas, Agriculture, Solid Waste, On-road Transportation, Wastewater Process Emissions, and Water.

Section 2 provides background information to provide context for the rest of the report, including a definition of offset credits and discussion of registries and protocols. Section 3 summarizes the approach used to screen protocols to determine their applicability to the San Diego region and whether associated GHG impacts would be considered additional. A summary of the overall results of the screening process is presented in Section 4. Section 5 presents a summary of results by GHG emissions category. A series of Appendix documents also focusing on GHG emissions categories provide a more detailed discussion of the summaries presented in Section 5.[3] Limitations of the project are presented in Section 6, and Section 7 provides a brief conclusion.

1.2 Key Findings

Based on the research conducted for this project, the following key findings emerged.

1.2.1 There are Limited Opportunities to Use Existing Carbon Offset Credit Protocols in the San Diego Region

Overall, there are limited opportunities for offset credit projects using existing protocols in the San Diego region. Limitations are due in part to California's comprehensive regulations related to GHG

[3] See Appendix I – Agriculture, Appendix II – Electricity and Natural Gas, Appendix III – Industrial, Appendix IV – Natural and Working Lands, Appendix V – On-Road Transportation, Appendix VI – Waste, and Appendix VII – Water.

emissions, the number of protocols that include activities applicable to the San Diego region, and the scale of activities related to eligible project types under relevant protocols. For example, California's laws and regulations relating to solid waste diversion and landfill gas capture effectively eliminate opportunities to reduce GHG emissions in the Waste category, though very limited possibilities may exist. Alternatively, the Agriculture and Natural Working Lands categories have little or no related regulation, but the nature and scale of agricultural operations, which is characterized by many small farms and limited activity covered by protocols (e.g., dairy farms and croplands), and limited area of land types (e.g., forest) in the region limit the possibility for offset credit projects using existing protocols. This finding does not mean that there are no opportunities for projects, but rather because a project would have to exceed regulation and go beyond common practices in a relatively limited number of activity types, potential projects likely would be few in number and small in scale.

1.2.2 The Agriculture, Industrial, and Natural and Working Lands Categories Have the Highest Number of Relevant Protocols

The Agriculture, Industrial Processes and Product Use, and Natural and Working Lands categories have the highest number of protocols that are active, applicable to activities in the San Diego region, and have resulting GHG reductions or removals that are considered additional based on the screening conducted for this project. When further screened for protocols that have at least one project in the U.S., a proxy for past feasibility, these three categories also have the highest number of protocols. Natural and Working Lands protocols include activities related to forestry, wetlands, and grassland management. Agriculture protocols include manure and fertilizer management, and those in Industrial Processes and Product Use mainly cover destruction and replacement of ozone depleting substances (ODS). While these categories have the most relevant protocols, further research would be required to determine the scale and scope of GHG reductions or removals. Table 1 presents the number of protocols at each stage in the screening process for GHG emissions categories considered.

Table 1 Offset Credit Protocols by GHG Emissions Category and Screening Results

GHG Emissions Category	All Protocols Identified	Active, Applicable	And Additional	And at Least 1 Project in U.S.	And at Least 1 Project in CA
Natural and Working Lands	51	28	28	11	5
Industrial Processes and Product Use	36	12	12	8	1
Agriculture	28	12	12	6	4
On-road Transportation	6	5	4	1	0
Civil Aviation	1	1	1	1	1
Electricity and Natural Gas	30	11	0	0	0
Solid Waste	11	9	0	0	0
Wastewater Process emissions	2	2	0	0	0
Off-road Transportation	1	1	0	0	0
Total	**166**	**81**	**57**	**27**	**11**

1.2.3 Eleven Carbon Offset Credit Protocols Considered Additional Have Been Used in California

Identifying protocols considered additional with at least one project in the U.S. was intended as a conservative approach to capture the highest number of protocols that could be used to develop projects in the San Diego region. A further screen to identify protocols considered additional with at least one project in California identified 11 protocols, including seven voluntary protocols and four CARB compliance protocols (Table 2). Because the ACR and CAR U.S. Forest Projects Compliance Offset Protocols are the same CARB protocol, there are only 10 unique protocols with at least one project in California. Similar to the findings in Table 1 above, the Agriculture, Industrial Processes and Product Use, and Natural and Working Lands categories represent a majority of these protocols. Three forestry protocols in the Natural and Working Lands category account for nearly three-quarters of all the offset credit projects associated with this group of protocols. Of all the projects located in California presented in Table 2, about 70% are associated with CARB compliance protocols, which have a higher price than voluntary offset credits.

Table 2 Projects Using Active, Applicable, and Additional Protocols with at least One Project in CA

	Number of Projects		
Protocol [Emissions Category]	**US**	**CA**	**SD Region**
CAR U.S. Forest Projects Compliance Offset Protocol (CARB) [Natural and Working Lands]	90	49	0
ACR U.S. Forest Projects Compliance Offset Protocol (CARB) [Natural and Working Lands]	89	16	0
CAR Ozone Depleting Substances Compliance Offset Protocol (CARB) [Industrial]	82	2	0
CAR Livestock Projects Compliance Offset Protocol (CARB) [Agriculture]	72	14	0
CAR U.S. Livestock [Agriculture]	64	6	0
CAR Forest [Natural and Working Lands]	41	19	1
VCS AMS-III.Y.: Methane Avoidance through Separation of Solids from Wastewater or Manure Treatment* [Agriculture and Waste]	8	2	0
CAR Organic Waste Digestion* [Agriculture and Waste]	2	1	0
ACR Afforestation and Reforestation of Degraded Lands [Forestry]	1	1	0
ACR Restoration of California Deltaic and Coastal Wetlands [Natural and Working Lands]	1	1	0
VCS VM0013 Calculating Emission Reductions from Jet Engine Washing, v1.0 [Civil Aviation]	1	1	0
Total	**451**	**112**	**1**

*Protocol included in more than one category.

1.2.4 There is Only One Project Using an Existing Carbon Offset Credit Protocol that is Located in the San Diego Region[4]

Of all the offset credit protocols and associated projects identified for this project, only one project is located in San Diego County: the Cuyamaca Rancho State Park (CRSP) Reforestation Project, which uses the Climate Action Reserve's Forest protocol. While not determinative of current potential for offset credit projects, lack of projects located in San Diego County suggests that in the past, projects may not have been feasible. This could have been due to the relatively few protocols

[4] Note that in this report the San Diego region is synonymous with San Diego County.

relevant to the San Diego region, limited opportunity for the project types eligible under protocols, high levels of regulation in California, or the price of voluntary offset credits.

1.2.5 Opportunities for Carbon Offset Credit Projects May Decrease Over Time as California Regulation Expands

Determining opportunities for additional GHG project opportunities should be considered a dynamic process. This report represents a snapshot in time of laws and regulation, the status of current protocols, and the current price of offset credits. As California continues to regulate GHG emitting activities over time, it is likely that opportunities for offset credits will decrease. For example, regulation of solid waste continues to divert more and more organic waste from landfills, further reducing whatever limited opportunity currently exists. In the Agriculture category, Senate Bill 1383 (Lara, Chapter 395, Statutes of 2016) allows CARB to regulate emissions from manure management. And, CARB is considering adding compliance protocols under its Cap-and-Trade program related to blue carbon and wetlands, forestry, livestock, agriculture, and rangeland, urban forestry, ODS, and mine methane capture.[5]

It is possible that the price of offset credits could increase over time, which could help projects that were not previously cost effective become feasible; however, this likely will take place in a context of decreasing opportunities for additional GHG reductions or removals as related regulation expands in California.

1.2.6 Further Research Would be Needed to Determine Details about Carbon Offset Credit Project Opportunities

This project represents a preliminary screening to identify potential opportunities to reduce or remove GHG emissions in the San Diego region. More research would be needed to determine whether any specific project could be considered eligible under offset credit protocols and whether the associated emissions are additional. It is possible that a project associated with a protocol considered not additional here could, in fact, result in additional offset credits. The opposite may also be possible. Further, research to evaluate cost effectiveness, assess other feasibility considerations, and better characterize the scale of the opportunities identified here would be needed to better understand actual possibilities for offset credit projects in the San Diego region.

1.3 Potential Next Steps

This project focused on identifying opportunities for offset credit projects using existing protocols. This was a necessary but not sufficient step to understanding the broader potential for GHG reduction or removal activities in the San Diego region and alternatives to offset credits. In the process of conducting research and analysis for this project, we identified potential next steps.

1.3.1 More Detailed Analysis of Carbon Offset Credit Protocols Considered Additional

This project focused on identifying protocols and associated project types that would be considered additional. It did not further evaluate those protocols to determine whether resulting

[5] California Air Resources Board, Compliance Offsets Protocol Task Force Final Recommendations, 2021: https://ww2.arb.ca.gov/sites/default/files/2021-03/offsets_task_force_final_report_030221.pdf.

GHG reductions and removals would be real, permanent, enforceable, etc.; whether the resulting protocols would lead to high quality offset credits; whether the eligible activities would be cost effective; or whether there is scalable opportunity to implement eligible activities. A more detailed analysis of this type would be needed to estimate the potential opportunity for offset credits in the San Diego region.

1.3.2 Expanded Analysis of GHG Reduction and Removal Opportunities

This project established a useful framework to identify GHG emissions; the methods to reduce or remove emissions; the related regulation at federal, state, and local levels; and related offset credit protocols. However, this project focused on GHG reduction and removal methods and regulations most relevant to the activities covered by existing offset credit protocols. A more detailed analysis beyond the scope of existing protocols would help to identify other GHG reduction or removal opportunities that could be the basis of policies, programs, or new protocols.

1.3.3 Assess Options for a Regional Carbon Offsetting Program

Results summarized in this project report suggest that opportunities for projects related to offset credit protocols may be limited in the San Diego region. This raises the question of whether there are mechanisms or instruments (other than existing protocols and registries) to achieve GHG reductions and removals that could be traded among parties in the San Diego region or possibly a broader region, or used to satisfy GHG obligations (e.g., California Environmental Quality Act (CEQA)). Understanding options for this sort of alternative process, including criteria to determine validity, methods of calculation, programmatic requirements and structure, tracking process, and legal and regulatory implications, would help determine feasibility and possible next steps.

2 BACKGROUND ON CARBON OFFSET CREDITS

This section provides basic information about carbon offset credits to provide context for the rest of the report. It summarizes the definition of "carbon offset credit"; the key characteristics that make a GHG reduction or removal an offset credit; the role of offset credit programs, including related standards, accounting methodologies, and registries; the concept of additionality, a key screening criterion for this project; and, alternatives to offset credits.

2.1 What are Carbon Offsets Credits?

The term carbon offset generally refers to a GHG emissions reduction or removal that is used to compensate for emissions that occur in another location. A carbon offset credit (offset credit), the focus of this report, is a transferable instrument that meets specified criteria and is certified by a government or independent organization to represent an emission reduction or removal of one metric ton of CO_2 or an equivalent amount of other GHGs (MT CO_2e).[6,7] As a simple example, consider a company that reduces emissions to the extent possible but still emits 1,000 MT CO_2e annually. If the company would like to cancel out these remaining emissions, it can acquire offset credits from a project that reduces or removes 1,000 MT CO_2 e annually. In this illustrative example, the company has not reduced its own emissions to zero, but has used an equivalent reduction or removal from elsewhere to cancel out emissions that it could not directly reduce, remove, or avoid.

KEY CONCEPT: Carbon Offset Credit

A "carbon offset credit" (offset credit) is a transferable instrument certified by a government or independent organization to represent an emission reduction or removal of one metric ton of CO_2, or an equivalent amount of other GHGs (MT CO_2e).

2.1.1 Compliance vs. Voluntary Carbon Offset Credits

In general, there are two types of offset credits: compliance and voluntary. Compliance offset credits are typically used as a way to comply with requirements imposed as part of a carbon market or regulation, such as California's Cap-and-Trade program. California regulation defines an offset credit that can be used to comply with its carbon regulations as "a tradable compliance instrument issued by CARB that represents a GHG reduction or GHG removal enhancement of one metric ton of CO_2e. The GHG reduction or GHG removal enhancement must be real, additional, quantifiable, permanent, verifiable, and enforceable."[8]

[6] Broekhoff, D., Gillenwater, M., Colbert-Sangree, T., and Cage, P. 2019. "Securing Climate Benefit: A Guide to Using Carbon Offsets." Stockholm Environment Institute & Greenhouse Gas Management Institute. http://www.offsetguide.org/pdf-download/.

[7] Carbon dioxide (CO_2) is considered the reference gas and has a global warming potential (GWP) of 1. All other GHGs are measured against CO_2. For example, the ozone-depleting substance HFC-125 has a GWP of 3,500. Every ton removed is like removing 3,500 tons of CO_2. Similarly, methane (CH_4) has a GWP of 25 times higher than CO_2.

[8] 17 California Code of Regulations (CCR) § 95802(a).

Under California's Cap-and-Trade program and the Low Carbon Fuel Standard (LCFS), regulated entities are required to lower emissions to a specific level via a compliance allowance allocation for Cap-and-Trade or decrease the carbon intensity (CI) of fuel for the LCFS. Under Cap-and-Trade, If the regulated entity cannot reduce emissions to the specified compliance allowance allocation by implementing its own project to reduce or remove emissions, it can either use banked allowances from previous vintage years (or a future vintage allowance if assigned for true-up quantity by CARB) or purchase offset credits[9] generated by a regulated entity or opt-in entity to meet the emissions allowance for that covered entity. In the case of offsets, CARB has developed offset protocols, which set forth eligible project types, eligibility criteria, and methods to estimate GHG impacts, that regulated entities can use to help achieve their emissions targets. Only CARB-approved offset credits can be used to satisfy the requirements under the Cap-and-Trade program. They are part of an offset credit market specifically for CARB compliance. Similarly, the LCFS allows low- or zero emission fuels to generate credits that can be sold to other regulated entities under the LCFS. For our purposes here, we will consider compliance offset credits and LCFS credits to be CARB offset credits. All other offset credits are considered voluntary.

Voluntary offset credits, as the name implies, are used outside of compliance markets. These credits, which are often used to satisfy voluntary corporate commitments to achieve specific emissions targets, can be purchased, traded, and retired as part of a voluntary carbon market.

KEY CONCEPT: Compliance vs. Voluntary Offsets

There are two types of carbon offset credits:

- Compliance Offset Credits – Offset credits in this category are used to comply with regulatory requirements. For our purposes here, a compliance offset credit is one used in CARB's Cap-and-Trade Program. These compliance offset credits are defined in statute, have protocols developed by CARB, and are available through the three main offset credit programs in the U.S.: American Carbon Registry, Climate Action Reserve, and Verified Carbon Standard Registry (Section 2.2).
- Voluntary Offset Credits – Offset credits that are not used for CARB compliance purposes and that satisfy the criteria of the protocols and methodologies developed by the offset credit programs. Voluntary offsets are generally used by corporations for GHG emissions commitments.

2.1.2 Defining Characteristics of Carbon Offset Credits

To ensure that offsets represent a discernable environmental benefit, offset credit programs and CARB have developed specific criteria. As noted above, California regulation states that to be considered an "ARB offset credit" for compliance purposes, a "GHG reduction or GHG removal enhancement must be real, additional, quantifiable, permanent, verifiable, and enforceable."[10] These same criteria are also used in the voluntary market and define what an offset credit from any program is. If these criteria are not met, the GHG reduction or removal may be considered to be

[9] Note: offset credits are limited to 4% of covered entity's compliance obligation from 2021–2025 and 6% from 2026–2030.
[10] 17 CCR § 95802(a).

another type of GHG emissions claim, but it would not be considered an offset credit (i.e., a tradeable asset). For example, ACR seeks to ensure that offsets are "real, measurable, permanent, in excess of regulatory requirements and common practice, additional to business-as-usual, net of leakage, verified by a competent, independent third party, and used only once."[11]

California regulation defines the six related criteria included in the definition for CARB offset credits.[12] While these apply only to offsets used for compliance purposes under the Cap-and-Trade regulation and offset credit programs may define these terms somewhat differently, these are the generally accepted definitions for these terms in carbon markets, and they comprise the defining characteristics of an offset credit.

- "Additional" means…GHG emission reductions or removals that exceed any GHG reduction or removals otherwise required by law, regulation or legally binding mandate, and that exceed any GHG reductions or removals that would otherwise occur in a conservative business-as-usual scenario.
- "Enforceable" means…the authority for CARB to hold a particular party liable and to take appropriate action if any of the provisions of this article are violated.
- "Real" means…GHG reductions or GHG enhancements result from a demonstrable action or set of actions, and are quantified using appropriate, accurate, and conservative methodologies that account for all GHG emissions sources, GHG sinks, and GHG reservoirs within the offset project boundary and account for uncertainty and the potential for activity-shifting leakage and market-shifting leakage.
- "Permanent" means…either that GHG reductions and GHG removal enhancements are not reversible, or when GHG reductions and GHG removal enhancements may be reversible, that mechanisms are in place to replace any reversed GHG emission reductions and GHG removal enhancements to ensure that all credited reductions endure for at least 100 years.
- "Quantifiable" means, in the context of offset projects, the ability to accurately measure and calculate GHG reductions or GHG removal enhancements relative to a project baseline in a reliable and replicable manner for all GHG emission sources, GHG sinks, or GHG reservoirs included within the offset project boundary, while accounting for uncertainty and activity-shifting leakage and market-shifting leakage.
- "Verifiable" means that an Offset Project Data Report assertion is well documented and transparent such that it lends itself to an objective review by an accredited verification body.

Note that while CARB requires offset credits to be enforceable, voluntary registries generally do not. Also, the concept of leakage, which is not listed above, is a key concept in offset credits. Leakage refers to the "unintended increases in GHG emissions caused by a project outside of its boundaries… The classic example is a forest preservation project that avoids the emissions caused

[11] The American Carbon Registry, THE AMERICAN CARBON REGISTRY STANDARD: REQUIREMENTS AND SPECIFICATIONS FOR THE QUANTIFICATION, MONITORING, REPORTING, VERIFICATION, AND REGISTRATION OF PROJECT-BASED GHG EMISSIONS REDUCTIONS AND REMOVALS, V 7.0 2020, p. 10: https://americancarbonregistry.org/carbon-accounting/standards-methodologies/american-carbon-registry-standard/acr-standard-v7-0_final_dec2020.pdf.
[12] 17 CCR § 95802(a).

by clearing one parcel of forest, but ends up shifting the production of timber through deforestation to other areas."[13]

2.2 Carbon Offset Credit Programs

Given the many different approaches to reduce or remove emissions, offset credit programs have been established to develop and approve standards that establish criteria for the quality of offset credits; determine whether offset projects satisfy these standards; and operate public registries that issue, transfer, and retire offset credits.[14] This report focuses on the three major programs that have projects located in the U.S. (Figure 2).

Figure 2 Voluntary Carbon Offset Credit Programs

Organization	Standard	Accounting Methods	Registry	GHG Unit
Winrock International	The American Carbon Registry (ACR) Standard	Methodologies	American Carbon Registry	Emission Reduction Tons (ERT)
Climate Action Reserve (CAR)	Reserve Offset Program Manual	Protocols	Reserve Registry	Climate Reserve Tonnes (CRT)
Verra	Verified Carbon Standard (VCS)	Methodologies	Verified Carbon Standard Registry	Verra Carbon Units (VCU)

The California Air Pollution Control Officers Association (CAPCOA) GHG Rx[15] also developed an offset credit program that is intended to be similar to those listed in Figure 2. At this time, there are no projects listed in its registry, but its protocols were included in the analysis for this report. The three main offset credit registries list and track projects, and resulting offset credits, for voluntary offset credits and CARB compliance offset credits.[16] The CAPCOA GHG Rx is not approved to operate in the CARB Cap-and-Trade system.

The following sections discuss each of the major functions of these programs.

[13] Broekhoff, D., Gillenwater, M., Colbert-Sangree, T., and Cage, P. 2019. "Securing Climate Benefit: A Guide to Using Carbon Offsets." Stockholm Environment Institute & Greenhouse Gas Management Institute.
[14] Ibid.
[15] See California Air Pollution Control Officers Association GHG Rx: http://www.ghgrx.org/.
[16] See California Air Resources Board, Compliance Offset Program: https:/ww2.arb.ca.gov/our-work/programs/compliance-offset-program.

2.2.1 Standards

In the voluntary market, each offset credit program has a standard that sets forth principles and requirements for all aspects of the offset credit lifecycle—from project eligibility to retirement of offset credits. As an example, "the ACR Standard details requirements and specifications for the quantification, monitoring, and reporting of project based GHG emissions reductions and removals, verification, project registration, and issuance of carbon credits. The Standard establishes the level of scientific integrity that every project must meet in order for ACR to register its GHG emissions reductions and removals as tradable environmental assets."[17] Similarly, the CAR Reserve Offset Program Manual provides "overarching principles, its general project accounting guidelines, and its rules and procedures for registering projects and creating offset credits for the voluntary market. It also describes the process used by the Reserve to develop protocols for determining the eligibility of, and quantifying reductions from, carbon offset projects."[18]

While much of the information in these programs is relevant to project eligibility and development, key sections are relevant to our analysis here. For example, in some cases, these standards explicitly exclude categories of projects. For example, Verra's Verified Carbon Standard (VCS) excludes certain project categories based on project size and location in non-least developed countries, a United Nations designation. According to the VCS Standard, these projects are considered viable without the financial benefits of offset credits. For example, all project activities that reduce hydrofluorocarbon-23 (HFC-23) emissions and grid-connected electricity generation using wind, geothermal, or solar power plants/units are not eligible for offset credits under the VCS Standard.[19]

Also, the VCS Standard explicitly addresses the challenge of developing a projects within an emissions trading program, like California's Cap-and-Trade regulation. It states that "[w]here projects reduce GHG emissions from activities that are included in an emissions trading program or any other mechanism that includes GHG allowance trading, evidence shall be provided that the GHG emission reductions or removals generated by the project have not and will not be otherwise counted or used under the program or mechanism."[20] Acceptable evidence includes a letter from the program administrator confirming that emissions reductions or removals have been canceled from the program or overall emissions cap.[21] These requirements would make it difficult for projects in sectors covered by California's Cap-and-Trade regulation, including electricity, cement, cogeneration, glass production, petroleum and natural gas systems, petroleum refining, stationary combustion, and suppliers of natural gas.

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[17] The American Carbon Registry, THE AMERICAN CARBON REGISTRY STANDARD: REQUIREMENTS AND SPECIFICATIONS FOR THE QUANTIFICATION, MONITORING, REPORTING, VERIFICATION, AND REGISTRATION OF PROJECT-BASED GHG EMISSIONS REDUCTIONS AND REMOVALS, V 7.0 2020, p. 9–10: https://americancarbonregistry.org/carbon-accounting/standards-methodologies/american-carbon-registry-standard/acr-standard-v7-0_final_dec2020.pdf.

[18] Climate Action Reserve, Reserve Offset Program Manual, 2021, p. 1: https://www.climateactionreserve.org/wp-content/uploads/2021/03/Reserve_Offset_Program_Manual_March_2021.pdf.

[19] Verified Carbon Standard: A VERRA STANDARD, VCS Standard, v4.0, 2019, p. 2–3: https://verra.org/wp-content/uploads/2020/03/VCS-Standard-v4.0_Updated.pdf.

[20] Id. at 47.

[21] Ibid.

In the compliance market, the CARB Cap-and Trade regulation serves the same role as standards do in the voluntary market.

2.2.2 Protocols and Methodologies

One of the main functions of an offset credit program, as part of the overall program standard, is to develop and maintain GHG accounting methodologies, or protocols, which standardize and establish among other things project eligibility requirements, excluded activities, and methods to quantify GHG reductions or removals. While the term "protocol" is used by CARB and CAR, and "methodology" is used by ACR and VCS, we refer to these accounting methodologies as protocols throughout this report. Figure 3 provides examples of offset credit protocols in the Agriculture emissions category organized by the protocol categories used in this report.

Figure 3 Examples of Carbon Offset Credit Protocols in the Agriculture Emissions Category[22]

Crop Management
ACR Rice Management Systems
CAPCOA Voluntary Emission Reductions in Rice Management Systems (ACR)
CAR Rice Cultivation
VCS Rice Cultivation Compliance Offset Protocol (CARB)
Feed Supplements
VCS VM0041 Methodology for the Reduction of Enteric Methane Emissions from Ruminants through the Use of 100% Natural Feed Supplement, v1.0
Fertilizer Management
ACR Reduced Use of Nitrogen Fertilizer on Agricultural Crops
CAR Nitrogen Management
VCS VM0022 Quantifying N2O Emissions Reductions in Agricultural Crops through Nitrogen Fertilizer Rate Reduction, v1.1
Manure Methane Reduction
ACR Livestock Projects Compliance Offset Protocol (CARB)
CAR U.S. Livestock
VCS AMS-III.D.: Methane Recovery in Animal Manure Management Systems, Version 21.0

Verifying that offset credits projects meet the criteria set forth in standards and protocols is conducted by third party auditors. In the CARB compliance market, verifiers must be approved by CARB. In the voluntary market, verifiers must be approved by the American National Standards Institute (ANSI).[23]

[22] American Carbon Registry, ACR Standards, Approved Methodologies, Last Visited March 30, 2021: https://americancarbonregistry.org/carbon-accounting/standards-methodologies.
[23] https://ansi.org.

2.2.3 Registries

Once a project has been determined to satisfy all relevant criteria, the resulting credit can be issued and listed on an offset credit registry. Registries track issuance, transfer, and retirement of offset credits typically through a publicly available online platform. These digital platforms help prevent double counting of offset credits and providing transparency. The public can access project information and offset credit volumes issued.

There are three main offset credit registries that are approved to operate in the CARB Cap-and-Trade market: American Carbon Registry (ACR) [24], Climate Action Reserve (CAR) Registry[25], and Verified Carbon Standard (VCS) Registry[26] (Figure 2 above).

2.3 Additionality

In the context of offset credits, it is important to determine whether a project and associated GHG reductions or removals would have happened in the absence of any benefit derived from creating an offset credit. Additionality is a defining characteristic of offset credits, and there are several different ways to determine, or test, whether a project is additional.

As noted above, California regulation defines "additional" to mean "greenhouse gas emission reductions or removals that exceed any greenhouse gas reduction or removals otherwise required by law, regulation or legally binding mandate, and that exceed any greenhouse gas reductions or removals that would otherwise occur in a conservative business-as-usual scenario."[27] This definition creates a two-part test of additionality: a Legal Requirement Test and a Common Practice Test (sometimes called performance test). A project would have to satisfy both tests to be considered additional. Even though this two-part test is developed in the context of CARB's compliance offsets, it is similar to that used by offset credit registries and thus can serve as a reasonable framework to determine whether offset credit protocols and resulting GHG emission reductions or removals would be considered additional.

Ultimately, additionality must be determined on a project-by-project basis. We consider the analysis presented here a preliminary screen of protocols and project types (e.g., anaerobic digestion of dairy cow manure) to determine whether, as a group, they could be considered additional. The additionality determination provided here is intended as a preliminary determination, and specific additionality screening would have to be applied to a specific project to determine whether the associated GHG reductions or removals are additional.

Also, this report focuses on GHG reduction and removal project opportunities in the San Diego region, which places a geographical constraint on the additionality determination included. It is possible that protocols considered not additional within the San Diego and California context could be considered additional in other states.

[24] See American Carbon Registry: https://americancarbonregistry.org/.
[25] See Climate Action Reserve: https://www.climateactionreserve.org/.
[26] See Verra: https://verra.org/.
[27] 17 CCR § 95802(a).

KEY CONCEPT: Additionality Tests

There are several different tests to determine additionality. This report uses two common tests.

- Legal Requirement Test – This test determines whether there are any laws, regulations, policies, or legally-binding mandate that would have required the activity. If the activity does not exceed requirements, related emissions reductions would fail the legal requirement test and be considered not additional.
- Common Practice Test – This test determines whether in the absence of a requirement the activity would have happened anyway due to technological, financial, or other considerations. For example, if the activity is cost effective without the proceeds from carbon offset credits or represents a common practice, it could be considered not additional.

2.3.1 Legal Requirement Test

The Legal Requirement Test, sometimes called the Regulatory Surplus Test, determines whether the activity exceeds regulations in place at the time a project begins. Offset credit programs and CARB require all projects to pass the legal requirement test. As an example, the CAR Reserve Offset Manual states that a "project passes the legal requirement test when there are no laws, statutes, regulations, court orders, environmental mitigation agreements, permitting conditions or other legally binding mandates requiring its implementation, or requiring the implementation of similar measures that would achieve equivalent levels of GHG emission reductions."[28] While similar to CARB's basic legal requirement test language, this expands on examples of legally-binding mandates other than laws and regulations that might cause a project to be considered not additional. For example, based on this language, a habitat restoration project implemented as part of otherwise required environmental mitigation (e.g., under CEQA), could not be considered for GHG reductions or removals unless the project went beyond the required mitigation.

Potential for future regulation is also an important factor when considering an offset credit project. For example, if a project were implemented at a time when the activity would pass the legal requirement test but subsequent regulation would render the activity not additional, no offset credits would be viable after the new regulation is in place. According to the Climate Action Reserve Offset Program Manual, "if a project becomes subject to a regulation, ordinance or permitting condition that effectively requires its implementation, the project can no longer be considered additional and its crediting period will be terminated. The crediting period will likewise be terminated if the emission sources affected by a project are included under an emissions cap (e.g., under a state or federal cap-and-trade program) or GHG emissions from the project/project site are directly regulated by a local, state or federal agency."[29]

Also, the existence of a requirement alone may not be sufficient to determine additionality. There could be instances where a project exceeds regulation and could be considered additional. For

[28] Climate Action Reserve, Reserve Offset Program Manual, 2020, p. 7–8: https://www.climateactionreserve.org/wp-content/uploads/2021/02/Reserve_Offset_Program_Manual_October_2020.pdf.
[29] Id. at 12.

example, if a developer were required to plant a given number of trees but planted double the amount. Those above and beyond the regulation could be considered additional. The strictness of the regulation and cost of exceeding such regulation are two factors to determine the amount of feasible activity and resultant GHG reductions or removals that could be achieved.

2.3.2 Common Practice Test

A project that passes the Legal Requirement Test can be considered not additional for other reasons. The Common Practice Test, also sometimes called the Performance Test, is an industry or sector-specific analysis that requires the individual project to either achieve emission reductions in excess of what would have occurred otherwise based on whether there is widespread deployment of the particular project, technology, or practice or whether there is performance achievement that is greater than average within a relevant geographical area.[30] This determines what is considered a common practice in a specific geographical region. A project-by-project analysis to determine whether the applicable project passed a common practice test was beyond the scope of this project. Nonetheless, we provide some preliminary findings on whether the GHG emissions reduction or removal activity could be considered common practice.

2.3.3 Other Considerations

While we use additionality as a screening criterion for this project, other offset credit characteristics (Section 2.1.2) are relevant to our analysis here. For example, there are circumstances where it can be difficult to ascertain clear ownership of a GHG reduction or removal when a project is part of a covered sector in California's Cap-and-Trade regulation. For example, if a project in the voluntary market seeks to reduce electricity use, it can be nearly impossible to trace ownership of resulting GHG impacts of power producers that are also reporting emissions; that is, if the electricity reduction at the end-use affects reported emissions at the regulated power plant, ownership of reductions is obscured. In these cases, resulting GHG emissions reductions or removals could be considered additional, but the lack of clarity around ownership makes these project ineligible for offset credits. For categorization purposes and simplicity, in cases where determining ownership would be a challenge, we consider the project to be not additional.

2.4 Alternatives to Carbon Offset Credits

Successful completion of projects that satisfy all the elements a specific protocol can lead to issuance of offset credits. One offset credit program, CAR, has developed a program to provide an alternative approach. The Climate Forward Program[31] certifies projects to earn "forward mitigation units" (FMU), which represent all the expected GHG reductions or removals expected over the lifetime of the project and are granted on an *ex ante* basis; that is, before future GHG reductions or removals occur. FMUs are designed to be used to compensate for future projected emissions. This differs from offset credits, which are granted on an *ex post* basis, only after the reductions are verified to have occurred. Also, offset credits are used to cancel emissions that have occurred in the

[30] See America Carbon Registry, THE AMERICAN CARBON REGISTRY STANDARD: REQUIREMENTS AND SPCIFICATIONS FOR THE QUANTIFICATION, MONITORING, REPORTING, VERIFICATION, AND REGISTRATION OF PROJECT-BASED GHG EMISSIONS REDUCTIONS AND REMOVALS, Version 7.0, 2020, p. 27–28: https://americancarbonregistry.org/carbon-accounting/standards-methodologies/american-carbon-registry-standard/acr-standard-v7-0_final_dec2020.pdf.

[31] See Climate Forward: https://climateforward.org/.

past. Climate Forward currently has six approved methodologies: Dairy Digesters V1.0, Pools Covers, Improved Cook Stoves V1.0, Mature Forest Management V1.0, Reforestation V1.1, and Solar Photovoltaics V1.0.

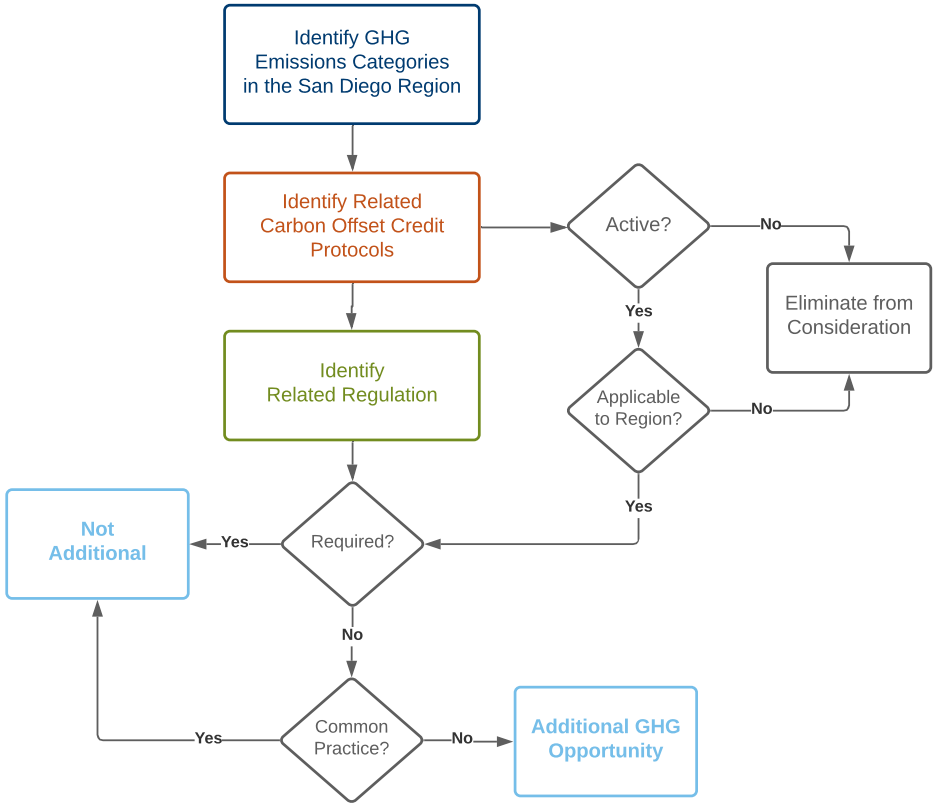
Because FMUs are granted on an *ex ante* basis, they could be used as reductions against a business-as-usual projection. FMUs were used by Newhall Ranch project to cancel out future emissions.[32]

[32] Climate Forward projects can be viewed at https://climateforward.apx.com/myModule/rpt/myrpt.asp?r=111.

3 PROJECT APPROACH

The goal of this project is to identify project opportunities to reduce or remove GHG emissions in the San Diego region that could be used to generate offset credits. To support this overall goal, EPIC identified categories of GHG emissions in the San Diego region; identified related offset credit protocols; identified related regulations that require such activities; identified protocols with activities applicable to conditions in the San Diego region and the number of projects developed in the U.S., California, and the San Diego region; and, determined whether the offset credit protocols and related activities would be considered additional to what would have happened otherwise. Figure 4 and the sections below summarize this process.

Figure 4 Process to Identify Additional GHG Opportunities



3.1 Identify GHG Emissions Categories

The basic organizing framework for this project is based on the categories of GHG emissions used in the San Diego regional GHG inventory, which are based on those used by CARB in its statewide inventory of GHG emissions. EPIC used emissions categories and subcategories to organize activities to reduce emissions, regulations, and protocols. CARB's main categories are: Energy; Industrial Processes and Product Use; Agriculture, Forestry and Other Land Use; and Waste. These categories can be further broken down into subcategories.

This report focuses on the following GHG subcategories: Industrial Processes and Product Use, Electricity and Natural Gas, Agriculture, Solid Waste, On-road Transportation, Wastewater Process Emissions, and Water.[33] These subcategories represent about 90% of regional emissions and nearly all of the protocols identified. Reasons for including or excluding categories from this report vary (Table 3). For example, even though the Wastewater GHG emissions subcategory represents minimal emissions, it is combined with solid waste as part of the overall Waste category because it has similar emissions characteristics and reduction activities and several protocols include project activities that affect wastewater. Because the Civil Aviation and Off-road Transportation categories had one applicable protocol and relatively limited emissions, we did not separately summarize findings for these categories. Also, the Marine Vessels, Other Fuels, and Rail subcategories had no specifically-related protocols. Even though the Water category has minimal emissions and only one related protocol, it is Included as a subset of electricity and natural gas because of the interest in water conservation and efficiency in the San Diego region and because emissions in the category result from electricity and natural gas use.

In addition to the GHG emissions categories, we also include the categories of CARB's Natural and Working Lands inventory of carbon stocks in California. With these, we can also review protocols associated with emissions removals, including those related to forestry, urban forestry, and wetlands.

Table 3 GHG Emissions Categories Included in Report[34]

GHG Category - Subcategory	Included in Report?	Reasoning
Agriculture - All Subcategories	Yes	Many protocols and many projects in U.S.
Energy - Civil Aviation	No	One protocol, minimal emissions
Energy - Electricity and Natural Gas	Yes	High emissions and medium number of protocols
Energy - Off-road Transportation	No	One protocol and no projects in U.S.
Energy - On-road Transportation	Yes	High emissions
Energy - Other Fuels	No	No protocols
Energy - Rail	No	No protocols
Energy - Water*	Yes	Interest in water conservation and efficiency
Industrial Processes and Product Use - All	Yes	Many protocols and highest number of projects in U.S.
Waste - Solid Waste	Yes	High number of projects in U.S
Waste - Wastewater Process Emissions	Yes	Similar emissions characteristics as solid waste
Natural and Working Lands - All	Yes	Highest number of protocols and many projects in U.S.

*Water is not an emissions subcategory of Energy but is categorized here because GHG reductions from water conservation result from reductions in energy use.

[33] Note that subcategories used in this project may not match all CARB categories. For example, we include categories for water and other fuels for purposes of organizing protocols.
[34] Note that categories and subcategories presented are based on CARB's Documentation of California's 2000–2018 GHG Inventory – Index. See https://ww2.arb.ca.gov/applications/california-ghg-inventory-documentation.

3.2 Identify Related Carbon Offset Credit Protocols

We reviewed all the protocols of the major three offset credit programs that operate in the CARB compliance market (ACR, CAR, and VCS), including both voluntary and CARB compliance protocols; CAPCOA GHG Rx, which mostly uses protocols from the other programs[35]; and we also included protocols from the CDM that were recognized by one of the programs (VCS), though we did not include all CDM protocols. We recognize that other programs exist but chose this group as representative for an initial screen of relevant protocols, particularly for considering projects in the San Diego region. We grouped protocols into categories that may not match those used by programs, and some protocols are listed more than once to account for eligible activities that fit more than one GHG emissions category.

Note that CARB compliance protocols are listed multiple times because each of the three major programs administer the protocols, and we identified projects related to each protocol (see Section 3.4.1). We also included CAR's Climate Forward Program methodologies.[36]

3.2.1 Categorization of Protocols

Figure 5 provides an example of the overall categorization of protocols used in this project. Each protocol is organized into a protocol category, which is in turn organized into an emissions subcategory. Depending on the type of emissions, each overall GHG emissions category can contain several subcategories. In this way, protocols and related project activities can be mapped to GHG emissions categories.

Figure 5 Example of Protocol Categorization

GHG Emissions Category →	**WASTE**
GHG Emissions Subcategory →	**Solid Waste**
Protocol Category →	**Landfill Gas**
Protocol →	ACR Landfill Gas Destruction and Beneficial Use Projects
	CAR Mexico Landfill
	CAR U.S. Landfill
	VCS ACM0001: Flaring or Use of Landfill Gas, Version 19.0
	VCS AMS-III.G.: Landfill Methane Recovery, Version 10.0

3.3 Identify Related Regulations

For each of the emissions categories and subcategories, we identified related federal, state, and local laws, regulations, or other requirements related to the GHG reduction activity. For example, in the electricity and natural gas category, we identified requirements related to energy efficiency, building electrification, and clean energy. We also considered related policies and measures included in Climate Action Plans (CAP) that could result in a requirement.

[35] CAPCOA GHG Rx Case-By-Case Protocol not included in the analysis.
[36] See Climate Forward: https://climateforward.org/.

3.4 Screen Carbon Offset Credit Protocols

Once we identified a pool of protocols, we then removed for consideration those that are geographically specific (e.g., Forestry in Mexico), covered activities that do not occur in the region (e.g., rice cultivation), or are expressly not applicable according to an offset credit program's standard (Section 2.2.1). Also, protocols that are no longer active or temporarily inactive for review were eliminated from consideration. While protocols do not provide an exhaustive view of the range of possible GHG reduction and removal activities, given the strict process to screen projects, they are a reasonable proxy for the types of projects that could be additional.

3.4.1 Identify Projects using Protocols

We identified the number of projects in the U.S., particularly those in California or the San Diego region, to help determine how often a protocol is used. The number of projects associated with a protocol, while not definitive, can be indicative of past feasibility. The projects identified here reflect available project data from Fall 2020. Also, projects listed in ACR were not associated with specific protocols but broader categories. Based on project information available, we assigned projects to protocols. We could not identify the ACR protocol associated with two associated projects. As a result these projects were eliminated.

Because some protocols have a wide range of eligible project activity, associated projects may fit into more than one protocol category. As a consequence, some protocols are listed under different categories, thus related projects are also listed more than once. This will affect to the total number of projects and the number of projects in the respective GHG emissions or protocol category, since we did not determine which specific category the projects fit into. Overall the impact to the results presented here of listing certain protocols more than once is minimal.

3.4.1.1 Projects Included

Each registry has a different way of categorizing projects. The following summarizes which projects were include or excluded for each registry.

- CAR - Projects connected to the CARB Cap-and-Trade Program with a status of "inactive" or "terminated" were excluded from this analysis. Voluntary projects with a status of "completed," "listed," "registered," or "transitioned" were included.
- ACR - Projects with a CARB status of "inactive" or "terminated" were excluded from this analysis. All voluntary project statuses were included.
- VCS – Only projects with a status of "withdrawn" were excluded.

To capture all projects, some CARB protocols are listed for each registry. CAPCOA GHG Rx had no associated projects.

3.5 Determine Additionality

For the remaining protocols, we used a two-prong test to determine additionality (Section 2.3): the Legal Requirement Test to determine whether the activity is required in some way and the Common Practice Test to determine if the activity would have occurred otherwise because it is considered commonplace.

We recognize that determining additionality can be challenging and subjective. Indeed, "determining whether an activity is additional requires comparing it to a scenario without revenue from the sale of carbon offsets. Such a scenario is inherently unknowable and must be determined using educated predictions (such as about future fuel, timber, or electricity prices). The determination can also fall prey to "information asymmetry": only a project developer can say whether the prospect of selling offset credits was truly decisive, but regardless of the truth, every project developer has an incentive to argue that it was. In light of these uncertainties, it best to think of additionality in terms of risk: how likely is a project to be additional?"[37]

Based on this, we categorized protocols as follows:

- Additional – Protocols or related activities that could be considered clearly additional because they are not regulated or common practice. For example, most of the protocols and activities included in the Natural and Working Lands category have little or no related regulation, are not commonplace, and could therefore be considered additional.
- Not Additional - Protocols or related activities that could be considered clearly not additional because they are regulated and are considered common practice. For example, given CARB's Landfill Methane Control Measure and the fact that most landfills already capture methane, activities to capture and destroy landfill gas can be considered not additional.
- Likely Additional – Protocols or related activities that had some ambiguity about additionality but leaned toward being additional. For example, electric charging would be likely additional because it is possible that a charging station could be used to acquire credit under the Low Carbon Fuel Standard. In the context of offset credits, a project participating in the Low-Carbon Fuel Standard crediting system would be considered not additional.
- Likely Not Additional - Protocols or related activities that had some ambiguity about additionality but leaned toward being not additional. For example, waste diversion is regulated, and there is an intent to divert all of California's organic waste. However, there are some specific instances, including Tribal lands, where projects could occur and be additional. While it appears that this likelihood is relatively small, we wanted to allow for this possibility.

3.5.1 Other Factors for Consideration

While determining whether an activity would result in additional GHG reductions or removals is an important criterion, there are other important factors to consider when assessing the viability of offset credits. For example, for CARB compliance offset credits, the project proponent must demonstrate additionality but also that the GHG reduction or removal is real, verifiable, permanent, quantifiable, and enforceable. A subset of verification and enforceability includes demonstrating clear proof of ownership of the offset credit. This project assessed additionality but mentions the implications of the other criteria where needed. Determining whether a project activity and its associated GHG impacts meet the broader criteria requires analysis on a project level basis.

Also, this project did not evaluate the eligible activities to reduce or remove GHG within each protocol by cost, potential to reduce or remove GHG emissions, or overall feasibility; however, where applicable, we do highlight other important factors to consider. For example, agriculture-

[37] Broekhoff, D., Gillenwater, M., Colbert-Sangree, T., and Cage, P. 2019. "Securing Climate Benefit: A Guide to Using Carbon Offsets." Stockholm Environment Institute & Greenhouse Gas Management Institute.

related protocols may be considered additional, but there appears to be limited potential in our region due to the nature and scale of the agriculture sector, which is characterized by many small farms and limited activity in the project types covered by existing offset protocols (e.g., manure methane management).

Section 6 summarizes the limitations of this analysis.

4 OVERALL RESULTS OF CARBON OFFSET PROTOCOL SCREENING

The project team identified 166 offset credit protocols.[38] While not exhaustive, these protocols constitute a representative sample. Of all protocols identified, 81 protocols were active and covered activities relevant to the San Diego region. Protocols were eliminated at this stage if they were not active, had specific geographical requirements, or covered activities not applicable to the San Diego region. Fifty-seven protocols were considered additional, including those determined to be "additional" and "likely additional." Of these, 27 had at least one project in the U.S., and 11 had at least one project in California. Figure 6 summarizes results of this process.

Figure 6 Number of Protocols at Each Stage in the Screening Process

This section provides more detail about the protocols at each stage of the screening process. Analysis of protocols by GHG emissions sector, including relevant regulation, is summarized in Section 5 below and discussed in more detail in the Appendix documents.

4.1 Protocols by Carbon Offset Credit Registry

We reviewed 1) the voluntary and CARB compliance offset credit protocols of the three major programs authorized to list CARB's compliance protocols: ACR, CAR, and VCS; 2) CAPCOA GHG Rx, which mostly uses protocols from the other registries; 3) protocols from the CDM that were recognized by one of the programs (VCS) and had at least one project; and 4) methodologies from the CAR Climate Reserve's Climate Forward Program. CARB compliance protocols are listed multiple times because each of the three major programs administers the protocols (see Section 3.4.1 above).

To track protocols and projects for each program, each program was reviewed separately. Table 4 shows the list of program designations used to organize protocols and projects. All but one CAPCOA GHG Rx protocols is an existing protocol from another program. Also, CARB protocols are listed with each administering program.

[38] This total includes the CARB compliance protocols associated with all three main registries and several protocols are included more than once to account for activities that fit more than one category.

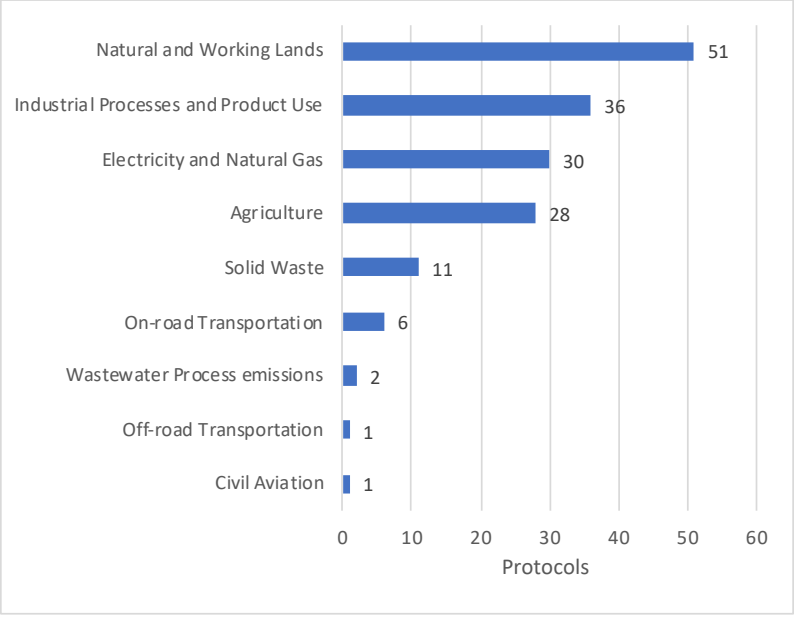
Table 4 Protocols by Registry at Each Screening Stage

Registry	All Protocols Evaluated	Active, Applicable	And Additional	And at Least 1 Project in U.S.	And at Least 1 Project in CA
American Carbon Registry	34	11	10	7	2
American Carbon Registry - CARB	6	4	4	3	1
CAPCOA GHG Rx	14	9	5	0	0
Climate Action Reserve	22	11	8	5	3
Climate Action Reserve - CARB	6	4	4	3	3
Climate Action Reserve - Climate Forward	6	4	3	1	0
Verified Carbon Standard	48	22	16	4	1
Verified Carbon Standard - Recognized	24	12	3	3	1
Verified Carbon Standard - CARB	6	4	4	1	0
Total	**166**	**81**	**57**	**27**	**11**

4.2 Protocols by GHG Emissions Category

As noted in Section 3.2.1 protocols are organized by GHG emissions and protocol categories. Figure 7 shows the total number of protocols in each GHG emissions category.[39] Of the 166 protocols identified, four GHG emissions categories represent nearly 90% of all protocols. There are 51 protocols in Natural and Working Lands, about 31% of all those identified; 36 protocols in Industrial Processes and Product Use (22%); 30 protocols in Electricity and Natural Gas (18%); and 28 protocols in Agriculture (17%).

Figure 7 Number of Protocols by GHG Emissions Category



[39] Note that seven protocols were included in more than one protocol category because eligible project activities fit more than one GHG emissions category.

The number of protocols in each GHG emissions category is not correlated to the contribution of each category to overall regional emissions. Figure 8, which is sorted by the number of protocols, compares the contribution to regional emissions and the number of protocols for each GHG emissions category.[40] Natural and Working Lands, which is not an emissions category included in the San Diego regional GHG inventory, has the most protocols of any other category. By contrast, On-road Transportation, which represents the largest percentage of regional emissions, includes only six protocols. We did not assess GHG emissions reductions and removals associated with each protocol category.

Table 5 Contribution to Regional Emissions and Number of Protocols by Emissions Categories

GHG Emissions Category	Contribution to Regional GHG Emissions	Number of Protocols Evaluated
Natural and Working Lands	N/A	51
Industrial Processes and Product Use	4.0%	36
Electricity and Natural Gas	33.0%	30
Agriculture	0.2%	28
Solid Waste	5.0%	11
On-road Transportation	43.3%	6
Wastewater Process Emissions	0.5%	2
Civil Aviation	4.0%	1
Off-road Transportation	3.0%	1
Marine Vessels	0.1%	0
Other Fuels	5.0%	0
Rail	0.3%	0
Water*	1.5%	0
Total	**100%**	**166**

*There is one water protocol, which is included in the Electricity and Natural Gas category here.

Table 6 shows the number of protocols in each GHG emissions category at each stage in the screening process. The Natural and Working Lands and Agriculture emissions category has the highest number of protocols. Note that two protocols within the Natural and Working Lands category are the same CARB compliance forestry protocols administered by two different registries. Eleven protocols remain once all screening criteria are applied. Because two are the same CARB compliance protocol, there are 10 unique protocols remaining.

[40] San Diego Association of Governments, San Diego Forward: The Regional Plan, Appendix D 2012 Regional Greenhouse Gas Emission Inventory for the San Diego Region and Projections, 2015, p. 26: https://www.sdforward.com/pdfs/RP_final/AppendixD-2012GreenhouseGasEmissionsInventoryfortheSanDiegoRegionandProjections.pdf. (Note this is the last publicly available estimate of regional emissions.).

Table 6 Protocols at Each Stage of the Screening Process by GHG Emissions Category

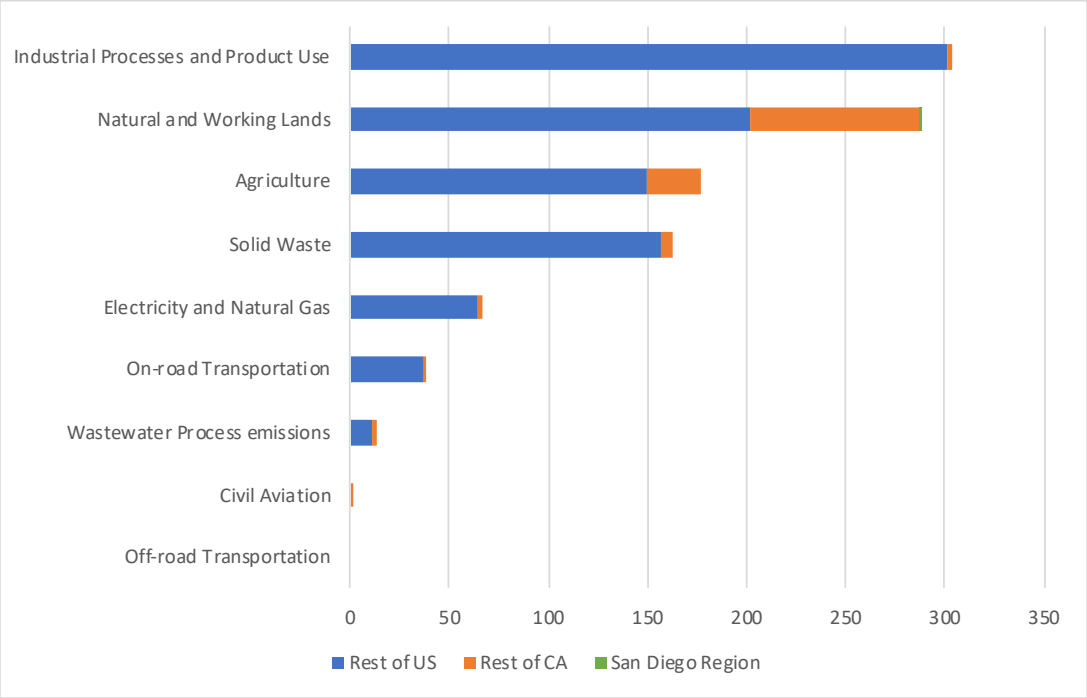
GHG Emissions Category	All Protocols Identified	Active, Applicable	And Additional	And at Least 1 Project in U.S.	And at Least 1 Project in CA
Natural and Working Lands	51	28	28	11	5
Industrial Processes and Product Use	36	12	12	8	1
Agriculture	28	12	12	6	4
On-road Transportation	6	5	4	1	0
Civil Aviation	1	1	1	1	1
Electricity and Natural Gas	30	11	0	0	0
Solid Waste	11	9	0	0	0
Wastewater Process emissions	2	2	0	0	0
Off-road Transportation	1	1	0	0	0
Total	**166**	**81**	**57**	**27**	**11**

4.2.1 Projects by GHG Emissions Category

We also identified the number of projects associated with each protocol and projects located in the U.S., California, and the San Diego region. This provides perspective on how often protocols were used and, while not definitive, can help understand feasibility of project types. Figure 8 shows the number of projects associated with the protocols in each GHG emissions category.[41] When viewing projects for all protocols identified, the Industrial Processes and Product Use category has the most projects (304); nearly all are located outside California. There are 288 projects using protocols in the Natural and Working Lands category. Most of these are located outside of California, and there is only one in the San Diego region, which is also the only offset credit project in the region. The project is the Cuyamaca Rancho State Park (CRSP) Reforestation Project, which is registered with the CAR.

[41] Note that the seven protocols listed more than once represent 28 projects, about 3% of total.

Figure 8 Number of Carbon Offset Credit Projects by GHG Emissions Category



4.3 Active and Applicable Protocols

Once inactive protocols, those with specific geographic requirements, and those covering activities not relevant to the San Diego region were removed from consideration, 81 active and applicable protocols remain. This number also reflects protocols excluded because of existing program standards that eliminate generation of offset credits for various reasons. For example, the Verra VCS Standard excludes projects in non-Least Developed Countries, including the U.S., because these activities are considered financially competitive, no longer need carbon finance, and/or are regulated by Cap-and-Trade.[42]

Four protocol categories represent about 90% of all projects identified in the U.S. (Table 7). Ozone depleting substance (ODS) management has highest number of projects (244, 28% of total projects). The forestry protocol category within Natural and Working Lands has the second-highest number of projects (228, or 26% of total). Manure methane management accounts for 167 projects, about 20% of the total. And, 137 projects (15%) were associated with the capture and destruction of landfill gas. About 80% of forestry projects and 70% of ODS management projects are associated with CARB's compliance protocols.

[42] Verified Carbon Standard: A VERRA STANDARD, VCS Standard, Version 4.0, 2019, at p. 2–3 & 47: https://verra.org/wp-content/uploads/2020/03/VCS-Standard-v4.0_Updated.pdf.

Table 7 Number of Projects Using Protocols Considered Active and Applicable

	Number of Projects			
GHG Emissions Category / Protocol Category	**US**	**CA**	**SD Region**	**Number of Protocols**
Agriculture	**167**	**23**	**0**	**12**
Feed Supplements	0	0	0	1
Fertilizer Management	0	0	0	1
Manure Methane Reduction	167	23	0	10
Civil Aviation	**1**	**1**	**0**	**1**
Engine Washing	1	1	0	1
Electricity and Natural Gas	**20**	**2**	**0**	**11**
Energy Efficiency	19	2	0	9
Renewable Electricity	1	0	0	2
Industrial Processes and Product Use	**248**	**2**	**0**	**12**
Lubricant Management	4	0	0	2
ODS Management	244	2	0	10
Natural and Working Lands	**244**	**86**	**1**	**28**
Forestry	228	85	1	8
Grasslands	14	0	0	6
Soil Management	1	0	0	4
Urban Forest	0	0	0	5
Wetlands	1	1	0	5
Off-road Transportation	**0**	**0**	**0**	**1**
Vehicle Efficiency	0	0	0	1
On-road Transportation	**35**	**1**	**0**	**5**
Alternative Fuels	35	1	0	3
Carpooling	0	0	0	1
Transportation Efficiency	0	0	0	1
Solid Waste	**149**	**5**	**0**	**9**
Landfill Gas	137	3	0	3
Waste Management	12	2	0	6
Wastewater Process emissions	**13**	**2**	**0**	**2**
Wastewater Treatment	13	2	0	2
Total	**877**	**122**	**1**	**81**

Three of the four protocol categories with the highest number of projects—ODS management, manure methane reduction, and land fill gas projects—all involve high global-warming potential (GWP) gases. In terms of GWP, carbon dioxide (CO_2) is considered the reference gas and has a global warming potential (GWP) of 1.[43] All other GHGs are measured against CO_2. A small amount

[43] Intergovernmental Panel on Climate Change, Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts

of these gases, particularly ozone-depleting substances, is equivalent to a significant amount of CO_2. For example, the refrigerant HFC-125 has a GPW of 3,500.[44] Every ton removed is like removing 3,500 tons of CO_2. Methane (CH_4) has a GWP of 25 times higher than CO_2.[45]

4.3.1 Inactive or Non-Applicable Protocols

Nineteen protocols identified for this project are considered inactive; nearly all are from the ACR registry (Table 8). This is likely because ACR lists its currently inactive protocols rather than simply removing them from their website. Also, there is one CAR Climate Forward methodology related to solar photovoltaics, which is being revised and is therefore considered inactive.

Table 8 Number of Project Using Inactive Protocols

Protocol Category	US	CA	SD Region
ACR AMS-I.C.: Thermal energy production with or without electricity	0	0	0
ACR Biochar Projects	0	0	0
ACR Changes in Fertilizer Management	0	0	0
ACR Conversion of High-Bleed Pneumatic Controllers in Oil & Natural Gas Systems	2	0	0
ACR Destruction of Ozone Depleting Substances (ODS) and High-Global Warming Potential (GWP) Foam from International Sources	0	0	0
ACR Energy Efficiency Measures in Thermal Applications of Non-Renewable Biomass	1	0	0
ACR Grazing Land and Livestock Management	0	0	0
ACR Grid-connected Electricity Generation from Renewable Sources	1	0	0
ACR Improved Efficiency of Vehicle Fleets	3	0	0
ACR Landfill Gas Destruction and Beneficial Use Projects	13	0	0
ACR Methane Recovery in Animal Manure Management Systems	3	2	0
ACR N2O Abatement from Nitric Acid Production	1	0	0
ACR Reduced Use of Nitrogen Fertilizer on Agricultural Crops	3	1	0
ACR Replacement of SF6 with Alternate Cover Gas in the Magnesium Industry	1	0	0
ACR Restoration of Degraded Wetlands of the Mississippi Delta	2	0	0
ACR Rice Management Systems	2	1	0
ACR Southwestern Forest Restoration: Decreased Wildfire Severity and Forest Conversion	0	0	0
ACR Switch from Non-renewable Biomass for Thermal Applications	0	0	0
CAR Solar Photovoltaic (Climate Forward)	1	1	0
Total	**33**	**5**	**0**

Table 9 summarizes the number of projects associated with the protocols in each category that were considered not applicable. We removed for consideration protocols that are not

to eradicate poverty, Annex I: Glossary, 2019, p. AI-5 (Carbon Dioxide (CO_2) Definition): https://report.ipcc.ch/srocc/pdf/SROCC_FinalDraft_Glossary.pdf.

[44] Intergovernmental Panel on Climate Change, AR4 Climate Change 2007: The Physical Science Basis, 2007, p. 212 (100-year GWPs): https://www.ipcc.ch/site/assets/uploads/2018/05/ar4_wg1_full_report-1.pdf.

[45] California Air Resources Board (CARB), What is Global Warming Potential?: https://ww2.arb.ca.gov/resources/documents/high-gwp-refrigerants.

geographically specific to the region (e.g., Forestry in Mexico), covered activities that do not occur in our region (e.g., rice cultivation), or are expressly not applicable according to a registry's standard (Section 2.2.1). The forestry protocol category had the highest number of protocols (15) considered not applicable. This was due to geographic requirements and absence of commercial logging operations in the San Diego region.[46] The next highest categories, mining methane management and crop management, which includes protocols related to rice cultivation, cover activities that do not occur in the region.

Table 9 Number of Projects and Protocols Considered Not Applicable by Protocol Category

	Number of Projects			
Protocol Category	**US**	**CA**	**SD Region**	**Number of Protocols**
Carbon Capture & Storage	10	0	0	2
Cogeneration/Thermal Energy Production	4	0	0	2
Crop Management	2	1	0	8
Energy Efficiency	0	0	0	1
Fertilizer Management	2	0	0	1
Forestry	41	0	0	15
Fuel Switching	8	0	0	5
Grasslands	0	0	0	1
Landfill Gas	0	0	0	1
Manufacturing Improvements	8	1	0	7
Manure Methane Reduction	0	0	0	1
Mining Methane Management	37	0	0	9
ODS Management	3	0	0	4
Other	2	0	0	2
Renewable Electricity	25	0	0	3
Wetlands	3	0	0	5
Total	**145**	**2**	**0**	**67**

[46] Based on employment data for 2019 and 2020 through Q3 from the California Employment Development Department Quarterly Census of Employment and Wages, there are no employees or wages for the logging industry in San Diego County.

4.4 Active and Applicable Protocols Considered Additional

Of the offset credit protocols considered active and applicable, 57 can be considered additional (Table 10). This means that the protocol would pass the Legal Requirement and the Common Practice tests and includes protocols considered "Additional" and "Likely Additional." Industrial Processes and Product Use, Natural and Working Lands, and Agriculture have the highest number of projects. The protocols associated with Waste were eliminated by the additionality screening.

Table 10 Number of Projects Using Active, Applicable, and Additional Protocols by Protocol Category

	Number of Projects			
GHG Emissions Category / Protocol Category	**US**	**CA**	**SD Region**	**Number of Protocols**
Agriculture	**167**	**23**	**0**	**12**
Feed Supplements	0	0	0	1
Fertilizer Management	0	0	0	1
Manure Methane Reduction	167	23	0	10
Civil Aviation	**1**	**1**	**0**	**1**
Engine Washing	1	1	0	1
Industrial Processes and Product Use	**248**	**2**	**0**	**12**
Lubricant Management	4	0	0	2
ODS Management	244	2	0	10
Natural and Working Lands	**244**	**86**	**1**	**28**
Forestry	228	85	1	8
Grasslands	14	0	0	6
Soil Management	1	0	0	4
Urban Forest	0	0	0	5
Wetlands	1	1	0	5
On-road Transportation	**2**	**0**	**0**	**4**
Alternative Fuels	2	0	0	2
Carpooling	**0**	**0**	**0**	**1**
Transportation Efficiency	0	0	0	1
Total	**662**	**112**	**1**	**57**

After protocols with no projects in the U.S. are removed, 27 protocols considered additional remain (Table 11). There are no projects in California for protocols in the lubricant management, grasslands, and soil management protocol categories. And there is only one project in alternative fuels, engine washing (aviation), and wetlands protocols.

Table 11 Number of Projects Using Additional Protocols with at least One Project in the U.S

	Number of Projects			
GHG Emissions Category/ Protocol Category	**US**	**CA**	**SD Region**	**Number of Protocols**
Agriculture	**167**	**23**	**0**	**6**
Manure Methane Reduction	167	23	0	6
Civil Aviation	**1**	**1**	**0**	**1**
Engine Washing	1	1	0	1
Industrial Processes and Produ	**248**	**2**	**0**	**8**
Lubricant Management	4	0	0	2
ODS Management	244	2	0	6
Natural and Working Lands	**244**	**86**	**1**	**11**
Forestry	228	85	1	7
Grasslands	14	0	0	2
Soil Management	1	0	0	1
Wetlands	1	1	0	1
On-road Transportation	**2**	**0**	**0**	**1**
Alternative Fuels	2	0	0	1
Total	**662**	**112**	**1**	**27**

Table 12 below provides a full list of the active and applicable protocols considered additional for the San Diego region. This list represents protocols with at least one project in the U.S.

Table 12 Protocols Considered Additional with at least One Project Located in the U.S.

	Number of Projects			
GHG Emissions Category/ Protocol Category	**US**	**CA**	**SD Region**	**Number of Protocols**
AGRICULTURE	**167**	**23**	**0**	**6**
Manure Methane Reduction	**167**	**23**	**0**	**6**
ACR Livestock Projects Compliance Offset Protocol (CARB)	20	0	0	1
CAR Livestock Projects Compliance Offset Protocol (CARB)	72	14	0	1
CAR Organic Waste Digestion*	2	1	0	1
CAR U.S. Livestock	64	6	0	1
VCS AMS-III.D.: Methane Recovery in Animal Manure Management Systems , Version 21.0	1	0	0	1
VCS AMS-III.Y.: Methane Avoidance through Separation of Solids from Wastewater or Manure Treatment Systems, Version 4.0 (VMR0003)*	8	2	0	1
CIVIL AVIATION	**1**	**1**	**0**	**1**
Engine Washing	**1**	**1**	**0**	**1**
VCS VM0013 Calculating Emission Reductions from Jet Engine Washing, v1.0	1	1	0	1
INDUSTRIAL PROCESSES AND PRODUCT USE	**248**	**2**	**0**	**8**
Lubricant Management	**4**	**0**	**0**	**2**
ACR Re-refining Used Lubricating Oils	3	0	0	1
ACR Recycling of Transformer Oil	1	0	0	1
ODS Management	**244**	**2**	**0**	**6**
ACR Advanced Refrigeration Systems	3	0	0	1
ACR Ozone Depleting Substances Compliance Offset Protocol (CARB)	95	0	0	1
ACR Transition to Advanced Formulation Blowing Agents in Foam Manufacturing and Use	28	0	0	1
CAR Ozone Depleting Substances	35	0	0	1
CAR Ozone Depleting Substances Compliance Offset Protocol (CARB)	82	2	0	1
VCS VM0001 Infrared Automatic Refrigerant Leak Detection Efficiency Project Methodology (not HFC-23)	1	0	0	1
NATURAL AND WORKING LANDS	**244**	**86**	**1**	**11**
Forestry	**228**	**85**	**1**	**7**
ACR Afforestation and Reforestation of Degraded Lands	1	1	0	1
ACR U.S. Forest Projects Compliance Offset Protocol (CARB)	89	16	0	1
CAR Forest	41	19	1	1
CAR Mature Forest Management (Climate Forward)	2	0	0	1
CAR U.S. Forest Projects Compliance Offset Protocol (CARB)	90	49	0	1
VCS AR-ACM0001: Afforestation and Reforestation of Degraded Land, Version 5.2.0	4	0	0	1
VCS U.S. Forest Projects Compliance Offset Protocol (CARB)	1	0	0	1
Grasslands	**14**	**0**	**0**	**2**
ACR Avoided Conversion of Grasslands and Shrublands to Crop Production	1	0	0	1
CAR Grassland	13	0	0	1
Soil Management	**1**	**0**	**0**	**1**
VCS VM0021 Soil Carbon Quantification Methodology, v1.0	1	0	0	1
Wetlands	**1**	**1**	**0**	**1**
ACR Restoration of California Deltaic and Coastal Wetlands	1	1	0	1
ON-ROAD TRANSPORTATION	**2**	**0**	**0**	**1**
Alternative Fuels	**2**	**0**	**0**	**1**
VCS VM0038 Methodology for Electric Vehicle Charging Systems	2	0	0	1
Total	**662**	**112**	**1**	**27**

*Protocol included in more than one category.

Table 13 presents 11 protocols considered additional that have at least one project in California. Because two of these protocols are the same CARB compliance protocol administered by two different programs, there are 10 unique protocols remaining after the final screening criteria. While past implementation of protocols is not necessarily an indicator of future potential, it could suggest past feasibility. The protocol with the most projects in California is the CAR U.S. Forest Projects Compliance Offset Protocol (CARB). The CAR voluntary forest protocol is the only protocol to have a project in the San Diego region.

Table 13 Projects Using Protocols Considered Additional with at least One Project in California

	Number of Projects		
Protocol [Emissions Category]	**US**	**CA**	**SD Region**
CAR U.S. Forest Projects Compliance Offset Protocol (CARB) [Natural and Working Lands]	90	49	0
ACR U.S. Forest Projects Compliance Offset Protocol (CARB) [Natural and Working Lands]	89	16	0
CAR Ozone Depleting Substances Compliance Offset Protocol (CARB) [Industrial]	82	2	0
CAR Livestock Projects Compliance Offset Protocol (CARB) [Agriculture]	72	14	0
CAR U.S. Livestock [Agriculture]	64	6	0
CAR Forest [Natural and Working Lands]	41	19	1
VCS AMS-III.Y.: Methane Avoidance through Separation of Solids from Wastewater or Manure Treatment* [Agriculture and Waste]	8	2	0
CAR Organic Waste Digestion* [Agriculture and Waste]	2	1	0
ACR Afforestation and Reforestation of Degraded Lands [Forestry]	1	1	0
ACR Restoration of California Deltaic and Coastal Wetlands [Natural and Working Lands]	1	1	0
VCS VM0013 Calculating Emission Reductions from Jet Engine Washing, v1.0 [Civil Aviation]	1	1	0
Total	**451**	**112**	**1**

*Protocol included in more than one category.

4.5 Protocols Considered Not Additional

Of active and applicable protocols, 24 are considered not additional. This includes those considered "Not Additional" and "Likely Not Additional" (Table 14). Nine protocols in the Solid Waste emissions subcategory represent a total of 149 projects in the U.S., including those related to landfill gas and solid waste diversion. These are considered not additional in part because California has regulations requiring most landfills to capture and destroy methane emissions and requiring diversion of organic waste. Section 5.6 below and Appendix VI discuss protocols in the Waste emissions category.

While some electricity-related and natural gas-related protocols could be considered additional, California's Cap-and-Trade regulation creates ambiguity over ownership of the reduction. The three major registries consider electricity-related projects problematic for this reason, and there are only two energy efficiency-related and no renewable electricity projects located in California.[47]

[47] Note that there are projects associated with CAR Climate Forward Program's Solar PV Methodology, but the methodology is being updated and not currently available. As a result, it is considered inactive.

One protocol related to vehicle efficiency in the Off-road Transportation GHG emissions category is considered "Likely Not Additional," but is dependent on the actual vehicle in use. Given current regulations, it could be difficult to determine whether an activity in the protocol would be additional. For example, if the vehicle purchased or used is already following existing regulations by utilizing aerodynamic drag reduction or anti-idling regulations, then the activity would not be additional because the vehicle is already in compliance with the proposed activities listed in Phase 1 of the GHG emission reductions in state and federal regulations. Complicating this is the fact that certain model years of tractors are preempted by federal law from complying with California low-rolling resistance tire regulations but trailers from those model years are not. Further, several options to reduce emission under the protocol are not regulated but may be a common practice because of cost savings. Evaluation of each activity would be required to determine additionality.

Table 14 Projects Using Protocols Considered Not Additional

	Number of Projects			
GHG Emissions Category / Protocol Category	**US**	**CA**	**SD Region**	**Number of Protocols**
Electricity and Natural Gas	**20**	**2**	**0**	**11**
Energy Efficiency	19	2	0	9
Renewable Electricity	1	0	0	2
Off-road Transportation	**0**	**0**	**0**	**1**
Vehicle Efficiency	0	0	0	1
On-road Transportation	**33**	**1**	**0**	**1**
Alternative Fuels	33	1	0	1
Solid Waste	**149**	**5**	**0**	**9**
Landfill Gas	137	3	0	3
Waste Management	12	2	0	6
Wastewater Process Emissions	**13**	**2**	**0**	**2**
Wastewater Treatment	13	2	0	2
Total	**215**	**10**	**0**	**24**

Table 15 lists the active and applicable protocols considered not additional. As a group, the protocols considered not additional have few projects in California. While not definitive, this suggests that it may be difficult to find eligible projects that would meet the protocol criteria, which includes additionality, and be cost effective at previous voluntary offset credit prices. Two projects are associated with the CAR Climate Forward Program (CAR Pool Covers), which grants FMUs and not offset credits. Section 2.4 discusses these alternatives to offset credits. The other seven California-based projects are associated with Solid Waste and Wastewater Emissions, categories with significant regulation.

Table 15 Projects Using Active, Applicable Protocols Considered Not Additional

	Number of Projects		
GHG Emissions Category / Protocol Category / Protocol	**US**	**CA**	**SD Region**
ELECTRICITY AND NATURAL GAS	**20**	**2**	**0**
Energy Efficiency	**19**	**2**	**0**
CAPCOA Boiler Efficiency Protocol	0	0	0
CAPCOA Weatherization of Single and Multi-Family Homes (Verra)	0	0	0
CAR Pool Covers (Climate Forward)	2	2	0
VCS AMS-II.E.: Energy Efficiency and Fuel Switching Measures for Buildings, Version 12.0 (Efficiency only)*	1	0	0
VCS AMS-II.J.: Demand-side Activities for Efficient Lighting Technologies, Version 7.0 (Small-scale only)	1	0	0
VCS VM0008 Weatherization of Single Family and Multi-Family Buildings	4	0	0
VCS VM0018 Energy Efficiency and Solid Waste Diversion Activities within a Sustainable Community*	0	0	0
VCS VM0025 Campus Clean Energy and Energy Efficiency (Efficiency only)*	11	0	0
VCS VMR0005 Methodology for Installation of Low-Flow Water Devices	0	0	0
Renewable Electricity	**1**	**0**	**0**
CAPCOA Biomass to Energy	0	0	0
VCS ACM0022: Alternative Waste Treatment Processes, Version 2.0*	1	0	0
OFF-ROAD TRANSPORTATION	**0**	**0**	**0**
Vehicle Efficiency	**0**	**0**	**0**
VCS VMR0004 Revisions to AMS-III.BC to Include Mobile Machinery, v1.0	0	0	0
ON-ROAD TRANSPORTATION	**33**	**1**	**0**
Alternative Fuels	**33**	**1**	**0**
ACR Truck Stop Electrification	33	1	0
SOLID WASTE	**149**	**5**	**0**
Landfill Gas	**137**	**3**	**0**
CAR U.S. Landfill	116	3	0
VCS ACM0001: Flaring or Use of Landfill Gas, Version 19.0	19	0	0
VCS AMS-III.G.: Landfill Methane Recovery, Version 10.0	2	0	0
Waste Management	**12**	**2**	**0**
CAPCOA Updated Organic Waste Digestion Version 2.1 (CAR)	0	0	0
CAR Organic Waste Composting	7	1	0
CAR Organic Waste Digestion*	2	1	0
VCS ACM0022: Alternative Waste Treatment Processes, Version 2.0*	1	0	0
VCS AM0025: Avoided Emissions from Organic Waste through Alternative Waste Treatment Processes	2	0	0
VCS VM0018 Energy Efficiency and Solid Waste Diversion Activities within a Sustainable Community*	0	0	0
WASTEWATER PROCESS EMISSIONS	**13**	**2**	**0**
Wastewater Treatment	**13**	**2**	**0**
VCS ACM0014: Treatment of Wastewater, Version 8.0	5	0	0
VCS AMS-III.Y.: Methane Avoidance through Separation of Solids from Wastewater or Manure Treatment Systems, Version 4.0 (VMR0003)*	8	2	0
Total	**215**	**10**	**0**

*Protocol included in more than one category.

5 RESULTS BY GHG EMISSIONS CATEGORY

To summarize analysis for each GHG emissions sector, the project developed seven Appendices that review regulations, protocols, and discuss whether protocols are considered additional. The following sections present key findings from the related Appendices for Agriculture, Electricity and Natural Gas, Industrial Processes and Product Use, Natural and Working Lands, On-Road Transportation, and Waste (including Solid Waste and Wastewater), and Water.[48]

5.1 Agriculture

Emissions in the agriculture category, which accounts for less than 1% of regional emissions,[49] can be divided into three subcategories: enteric fermentation, manure management, and fertilizer management. Enteric fermentation results from the natural digestive process of ruminant animals. Microbes in the digestive tract, or rumen, decompose and ferment food, producing methane as a by-product.[50] New feed supplements and dietary changes that inhibit methanogens in the rumen can reduce methane emissions.[51] Manure management includes activities designed to help reduce methane emissions from cattle farms by collecting and destroying methane from decomposing manure and also by separating solids from manure before treatment. Lastly, nitrous oxide emissions from synthetic fertilizer and agriculture soils can be reduced through nitrogen inhibitors, conversion to slow-release fertilizers, and by using organic fertilizer.

Generally speaking, the opportunities for offset credit projects in the San Diego region are limited due to the lack of ruminant farming operations and crop land. This summary discusses the limited opportunity for projects as well as potential regulation that could further reduce the applicability of agriculture protocols and additionality projects. A more detailed discussion of the Agriculture category is provided in Appendix I.

[48] Water is a subset of the Electricity and Natural Gas emissions category.
[49] San Diego Association of Governments, San Diego Forward: The Regional Plan, Appendix D 2012 Regional Greenhouse Gas Emission Inventory for the San Diego Region and Projections, 2015, p. 26: https://www.sdforward.com/pdfs/RP_final/AppendixD-2012GreenhouseGasEmissionsInventoryfortheSanDiegoRegionandProjections.pdf. (Note this is the last publicly available estimate of regional emissions.)
[50] Climate and Clean Air Coalition, Enteric Fermentation, 2014: https://www.ccacoalition.org/en/activity/enteric-fermentation.
[51] Verra, Methodology for the Reduction of Enteric Methane Emissions from Ruminants through the Use of 100% Natural Feed Supplement, Approved VCS Methodology VM0041, Version 1.0, 2019, p. 6: https://verra.org/methodology/reduction-of-enteric-methane-emissions/.

Key Findings for Agriculture

- There are limited opportunities in the San Diego region due to minimal related activity
- All protocols related to the agriculture category are considered additional
- CARB is considering related regulations and compliance protocols
- There are relatively few GHG carbon offset credit projects in California
- Nearly all carbon offset credit projects address manure management

5.1.1 Current and Future Methane Regulation

Currently, there are no federal or state laws requiring methane emission reductions through enteric fermentation practices, manure management, or nitrous oxide emission reduction from fertilizer management practices. However, SB 1383 (2016) directs CARB to reduce methane emissions 40% below 2013 levels by 2030 and allows for regulation to be adopted on or after January 1, 2024. As a result, CARB has the option to regulate methane emissions from both manure management and enteric fermentation when it becomes possible to do so. It will be necessary to reassess the additionality status of agriculture protocol projects in 2024 to determine whether regulation is adopted. If enacted, these regulations could further reduce the already limited potential for GHG emission reductions through methane management.

A recent Final Recommendation Report from CARB Compliance Offsets Protocol Task Force outlines recommendations on increasing offset projects with direct environmental benefits in the State, including using voluntary protocols related to enteric fermentation and manure management that could serve as the basis for new compliance protocols under the Cap-and-Trade regulation.[52]

5.1.2 California Does Not Regulate Fertilizer Management

The applications of manure and synthetic fertilizer to agricultural soils are major sources of nitrous oxide emissions. Emission reduction in this category can be achieved through fertilizer management, including practices using nitrogen inhibitors in fertilizers, conversion to slow-release fertilizers, and using organic fertilizer or soil amendments. There are no federal, state, or local laws or regulations that require the implementation of practices to reduce nitrous oxide in fertilizer application.

5.1.3 Protocol Screening Results

Of the 26 protocols identified, 13 are active and covered activities applicable to the San Diego region, and all 13 protocols are considered additional (Table 16). Most protocols in this category, including those considered additional, are related to manure methane reduction. There is only one protocol in both fertilizer management and feed supplements that are considered additional. The manure management category is the only one with a project in the U.S. and CA.

[52] See California Air Resources Board, Compliance Offsets Protocol Task Force Final Recommendations, 2021: https://ww2.arb.ca.gov/sites/default/files/2021-03/offsets_task_force_final_report_030221.pdf.

Table 16 Protocols at Each Screening Stage in the Agriculture Category

Protocol Category	All Protocols Evaluated	Active, Applicable	And Additional	And at Least One Project in US	And at Least One Project in CA
Manure Methane Reduction	12	11	11	7	5
Crop Management	8	0	0	0	0
Fertilizer Management	4	1	1	0	0
Feed Supplements	1	1	1	0	0
Multiple Categories	1	0	0	0	0
Total	**26**	**13**	**13**	**7**	**5**

Of the 167 total projects in the U.S. using active and applicable protocols related to the Agriculture category, 23 are located in California, mostly in the Central Valley, and none are in the San Diego region. Also, some of the protocols identified have no projects in the U.S. (Table 17). If these are removed, only six protocols remain, and they are all related to manure management. Of those, most are associated with CAR's Livestock protocols and about half are associated with CARB compliance protocols. All of the eligible project types included in the protocols researched can be considered additional (Table 17).

Table 17 Projects Using Active and Applicable Protocols in the Agriculture Category

GHG Emissions Category/Protocol	US	CA	San Diego Region	Additionality Determination
Enteric Fermentation Management	**0**	**0**	**0**	
VCS VM0041 Methodology for the Reduction of Enteric Methane Emissions from Ruminants through the Use of 100% Natural Feed Supplement, v1.0	0	0	0	Additional**
Fertilizer Management	**0**	**0**	**0**	
VCS VM0022 Quantifying N2O Emissions Reductions in Agricultural Crops through Nitrogen Fertilizer Rate Reduction, v1.1	0	0	0	Additional
Manure Management	**167**	**23**	**0**	
CAR Livestock Projects Compliance Offset Protocol (CARB)	72	14	0	Additional**
CAR U.S. Livestock	64	6	0	Additional**
ACR Livestock Projects Compliance Offset Protocol (CARB)	20	0	0	Additional**
VCS AMS-III.Y.: Methane Avoidance through Separation of Solids from Wastewater or Manure Treatment Systems, Version 4.0 (VMR0003)*	8	2	0	Additional**
CAR Organic Waste Digestion*	2	1	0	Additional**
VCS AMS-III.D.: Methane Recovery in Animal Manure Management Systems, Version 21.0	1	0	0	Additional**
CAPCOA U.S. Livestock (CAR)	0	0	0	Additional**
CAR Dairy Digesters (Climate Forward)	0	0	0	Additional**
VCS Livestock Projects Compliance Offset Protocol (CARB)	0	0	0	Additional**
VCS VMR0003 Revisions to AMS-III.Y to Include Use of Organic Bedding Material, v1.0	0	0	0	Additional**

*Protocol included in more than one category.
**These protocols can be considered additional at least until 2024, when CARB can regulate manure methane emissions per SB 1383.

5.1.4 Summary of Opportunity

There are limited opportunities for additional offset credits in the Agriculture emissions category in the San Diego region. This is due in part to nature and scale of agriculture sector in the San Diego region, which is characterized by many small farms and has limited activity in the areas covered by offset credit protocols. Related to enteric fermentation and manure management, the San Diego region has only three commercial dairies in operation. Further, all of the projects related to protocols considered additional and that have at least one project in the US are related to manure methane management. While these activities are not currently regulated, there appear to be minimal opportunities to implement these activities in the region.

There were similar findings for fertilizer management. The relatively small amount of cropland in the region limits the opportunity of GHG reduction projects using existing offset credit protocols. There is one protocol related to fertilizer management that is applicable to the region involving reductions in the rate of nitrogen fertilizer applied to cropland. While this type of activity can be considered additional, the opportunity to implement such projects appears limited.

5.2 Electricity and Natural Gas

The electric and natural gas category, which is a subset of the main energy category, includes emissions from supply, transmission, and end-use. This category accounts for about one-third of regional emissions, with electricity contributing about 23% and natural gas about 8%.[53] While electricity and natural gas can be seen as two distinct GHG emissions categories, we combine them here because some activities to reduce emissions, including energy efficiency and renewable supply, can be applied to both and is reflected in certain protocols as well.

In general, the electric and natural gas category has limited opportunities for offset credit projects in the San Diego region. High levels of regulation at the federal, state, and local level preclude many of the project types included in related protocols. The following sections summarize the key findings of our analysis for the electric and natural gas emissions category. A more detailed discussion is provided in Appendix II.

Key Findings for Electric and Natural Gas

- Electric and natural gas emission categories are highly regulated
- No electric and natural gas-related carbon offset credit protocols are considered additional
- There are few electric and natural gas-related carbon offset credit projects in California and none in the San Diego region
- There are limited opportunities for related projects in the San Diego region

5.2.1 Nearly All Aspects of Electricity and Natural Gas are Regulated

Electricity generation is highly regulated by the California under Cap-and-Trade, which regulates all natural gas suppliers, cogeneration, self-generation of electricity, stationary combustion, and first deliverers of electricity that emit more than 25,000 metric tons of CO_2e.[54] California also sets renewable portfolio standards for electricity supply with all load serving entities required to procure 60% renewable energy by 2030 and 100% carbon-free energy by 2045 under Senate Bill 100 (De León, Chapter 312, Statutes of 2018). The U.S. EPA further regulates criteria pollutants and source categories, including CO_2, from new, modified, and reconstructed power plants under Clean Air Act (CAA) Section 111(b).[55] The D.C. Circuit struck down[56] the Trump Administration's Affordable Clean Energy (ACE) rule under CAA Section 111(d) for existing power plants. It is likely that the existing

[53] San Diego Association of Governments, San Diego Forward: The Regional Plan, Appendix D 2012 Regional Greenhouse Gas Emission Inventory for the San Diego Region and Projections, 2015, p. 2: https://www.sdforward.com/pdfs/RP_final/AppendixD-2012GreenhouseGasEmissionsInventoryfortheSanDiegoRegionandProjections.pdf. (Note this is the last publicly available estimate of regional emissions.).

[54] 17 CCR §§ 95810 & 95812(c).

[55] 42 U.S.C.A. § 7411(f); Federal Register, 86 FR 2542, 2542-2558: https://www.federalregister.gov/documents/2021/01/13/2021-00389/pollutant-specific-significant-contribution-finding-for-greenhouse-gas-emissions-from-new-modified.

[56] *American Lung Association v. Environmental Protection Agency*, 985 F.3d 914 (2021).

and the recently struck down regulation will be revised or new regulations introduced under the Biden Administration.

The U.S. EPA regulates natural gas in a number of ways that were recently amended to ease regulation of the natural gas industry with the Biden Administration and Congress in the process of reversing some or all of these actions. These include:

- The recent amendment to the National Environmental Policy Act (NEPA);[57]
- Methane Standards for Oil and Gas Facilities including amended volatile organic compound (VOC) emission standards[58, 59] (Note: On April 28, 2021, the U.S. Senate voted to repeal these rules in Joint Resolution 14 under the Congressional Review Act. If approved by the U.S. House of Representatives and signed by the President, these regulations will be withdrawn);
- Bureau of Land Management (BLM) Amendment to Methane Waste Prevention Rule;[60] and
- Pipeline and Hazardous Materials Safety Administration (PHMSA) Relaxing Pipeline Regulations during Pandemic.[61]

California responded over the last several years by both increasing the procurement of renewable natural gas[62] and by increasing regulation of intrastate natural gas regulation that strengthen monitoring, leak abatement requirements, short-lived climate pollutant methane reductions,[63] and requiring reduction of GHG emission from California Public Utilities Commission (CPUC) regulated intrastate transmission and distribution lines.[64] This is in addition to existing regulation that includes:

[57] See Council on Environmental Quality (CEQ) National Environmental Policy Act (NEPA) Regulations, 40 CFR Parts 1500, 1501, 1502, 1503, 1504, 1505, 1506, 1507, 1508, 1515, 1516, 1517, and 1518 (2020): https://www.govinfo.gov/content/pkg/FR-2020-07-16/pdf/2020-15179.pdf; See also CEQ: NEPA.gov: https:/ceq.doe.gov/laws-regulations/regulations.html, Last Visited February 18, 2021.
[58] See United States Environmental Protection Agency Final Rule amending 40 CFR Part 60 (2020), EPA-HQ-OAR-2017-0757: https://www.epa.gov/sites/production/files/2020-08/documents/frn_oil_and_gas_review_2060-at90_final_20200812_admin_web.pdf.
[59] See United States Environmental Protection Agency, Final Rule amending 40 CFR Part 60 (2020), EPA-HQ-OAR-2017-0483: https://www.epa.gov/sites/production/files/2020-08/documents/frn_og_reconsideration_2060-at54_final_rule_20200812_admin_web.pdf.
[60] See Bureau of Land Management (BLM) Final Rule Amendment and Rescission of 43 CFR Parts 3160 and 3170, RIN 1004-AE53: https://www.blm.gov/sites/blm.gov/files/Final%20Rule%20-1004-AE53%20-%20%20Ready%20for%20OFR%209.18.18_508%20%281%29.pdf.
[61] See U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration, PHMSA Stay of Enforcement – COVID 19, March 20, 2020: https://www.phmsa.dot.gov/news/phmsa-stay-enforcement-covid-19.
[62] See Assembly Bill 2313 (Williams, Chapter 571, Statutes of 2016); Senate Bill 1440 (Hueso, Chapter 739, Statutes of 2018); see also Assembly Bill 1900 (Gatto, Chapter 602, Statutes of 2012).
[63] See Assembly Bill 1496 (Thurmond, Chapter 604, Statutes of 2015) for monitoring; Senate Bill 1371 (Leno, Chapter 525, Statutes of 2014) and Senate Bill 887 (Pavley, Chapter 673, Statutes of 2016) for leak abatement; and Senate Bill 605 (Lara, Chapter 523, Statutes of 2014) and Senate Bill 1383 (Lara, Chapter 395, Statutes of 2016) for short-lived climate pollutant methane reduction.
[64] See Senate Bill 1371 (Leno, Chapter 525, Statutes of 2014).

- Cap-and-Trade regulation of natural gas (either distributors or users), suppliers of liquefied petroleum gas, and suppliers of liquified natural gas and compressed natural gas that emit more than 25,000 metric tons of CO_2e;[65] and
- Regulation of oil and gas facilities on private, state, and federal land and offshore property by limiting vented gas, unintentional leakage, and fugitive emissions under 17 CCR §§ 95665 et seq. (Greenhouse Emission Standards for Crude Oil and Natural Gas Facilities).

California is also in the process of introducing hydrogen as an alternative to natural gas and as a way of decreasing the carbon intensity of natural gas. This includes promoting hydrogen under Senate Bill 1369 (Skinner, Chapter 567, Statutes of 2018), which designates e-hydrogen[66] procurement as an eligible and carbon-neutral form of energy storage that can be used in the future in the renewable energy grid or to fuel certain forms of transportation. SB 1369 (2018) also authorizes investor owned utility use of this technology to achieve these requirements and makes green hydrogen a part of achieving and implementing state policy.

In terms of energy efficiency, both the Federal Government and California directly regulate end-uses of electricity and natural gas through appliance standards and/or building standards. The U.S. Department of Energy sets various appliance and equipment energy efficiency standards that preempt state and local requirements under the Energy Policy and Conservation Act (EPCA),[67] which includes residential/consumer, commercial, lighting, and regional efficiency standards.[68] California directly regulates non-preempted appliances under Title 20 and Building Efficiency Standards under Title 24 with a state mandate to double energy efficiency savings in electricity and natural gas find end-uses of retail customers by 2030 under Senate Bill 350 (De León, Chapter 547, Statutes of 2015). California further targets specific end-uses that address specific technology—such as Senate Bill 1414 (Wolk, Chapter 678, Statutes of 2016)—for energy efficiency compliant HVAC and heat pumps and connect energy efficiency to demand reduction programs per Assembly Bill 793 (Quirk, Chapter 589, Statutes of 2015) and Senate Bill 49 (Skinner, Chapter 697, Statutes of 2019), among other mandates and programs.

5.2.2 Protocol Screening Results

Of the 30 identified protocols related to activities to reduce or eliminate electricity and natural gas emissions (Table 18), there were 11 that were determined active and applicable to the San Diego region. None of the protocols reviewed for this project are considered additional.

[65] 17 CCR §§ 95810 & 95812(c).
[66] E-hydrogen is defined as: E-hydrogen is produced by using excess renewable energy to split water to produce hydrogen that can then be stored and used in the future.
[67] See 42 United States Code (U.S.C.) §§ 6291 et seq. (Part A- Energy Conservation Program for Consumer Products Other Than Automobiles); 42 U.S.C. §§ 6311 et. seq. (Part A-1- Certain Industrial Equipment).
[68] See 10 CFR Parts 430, 431, & 429.

Table 18 Protocols at Each Screening Stage in the Electricity and Natural Gas Category

GHG Emissions Subcategory/ Protocol Category	All Protocols Evaluated	Active, Applicable
End-use	**13**	**9**
Energy Efficiency	11	8
Fuel Switching	1	0
Other	1	0
Supply	**17**	**2**
Carbon Capture & Storage	1	0
Fuel Switching	3	0
Other	5	0
Renewable Electricity	1	1
Cogeneration/Thermal Energy Production	7	0
Total	**30**	**11**

Of the protocols that are active and applicable protocols, there are 20 projects in the U.S., two in California, and none in San Diego (Table 19). Of the California projects, both are associated with the CAR Climate Forward Pool Cover methodology. The Climate Forward program issues forward mitigating units on an *ex ante* basis, which differs from offset credits, which are issued on an *ex poste* basis after emissions reductions or removals are verified. The CAR Climate Forward Solar Photovoltaic methodology is on hold pending review and update, and is thus not shown here.[69]

[69] See Climate Forward, Methodologies: Solar Photovoltaic, Version 1.0, 2019, Last Accessed March 5, 2021: https://climateforward.org/program/methodologies/.

Table 19 Projects Using Active and Applicable Protocols in the Electric and Natural Gas Category

GHG Reduction Activity/Protocols	US	CA	SD Region	Additionality Determination
Energy Efficiency	**19**	**2**	**0**	
CAPCOA Boiler Efficiency Protocol	0	0	0	Likely Not Additional
CAPCOA Weatherization of Single and Multi-Family Homes (Verra)	0	0	0	Likely Not Additional
CAR Pool Covers (Climate Forward)	2	2	0	Likely Not Additional
VCS AMS-II.E.: Energy Efficiency and Fuel Switching Measures for Buildings, Version 12.0 (Efficiency only)*	1	0	0	Likely Not Additional
VCS AMS-II.J.: Demand-side Activities for Efficient Lighting Technologies, Version 7.0 (Small-scale only)	1	0	0	Likely Not Additional
VCS VM0008 Weatherization of Single Family and Multi-Family Buildings	4	0	0	Likely Not Additional
VCS VM0018 Energy Efficiency and Solid Waste Diversion Activities within a Sustainable Community*	0	0	0	Likely Not Additional
VCS VM0025 Campus Clean Energy and Energy Efficiency (Efficiency only)*	11	0	0	Likely Not Additional
VCS VMR0005 Methodology for Installation of Low-Flow Water Devices	0	0	0	Not Additional
Renewable Electricity	**1**	**0**	**0**	
CAPCOA Biomass to Energy	0	0	0	Likely Not Additional
VCS ACM0022: Alternative Waste Treatment Processes, Version 2.0*	1	0	0	Likely Not Additional
Total	**20**	**2**	**0**	

*Protocol included in more than one category.

5.2.3 Summary of Opportunity

There appear to be limited opportunities for additional offset credits in the electric and natural gas emissions category in the San Diego region. Federal and California law covers most of the viable emissions from electricity supply, natural gas supply, and end-uses and are likely not additional because of this regulation and common practices in the state around these activities. Consequently, there are limited to no opportunities for GHG reduction projects using existing protocols. Further research would be necessary to determine whether there are new or existing opportunities for offset protocol projects related to this emission category.

5.3 Industrial Processes and Product Use

The industrial processes and product use emissions category comprises three subcategories: Ozone Depleting Substances (ODS) and ODS Substitutes, Other Fugitive and Process Emissions, and Other Industrial Emissions.[70] Each subcategory can be further broken down into the activities that cause emissions. ODS substances emissions comprise activities related to residential, commercial, and transportation uses of ODS and their substitutes in blowing agents, refrigeration, and insulation foam. Other fugitive and process emissions are caused by fugitive solvent use, industrial CO_2 consumption, and lubricant emissions related to fuel use. Other industrial emissions are caused by SF_6 losses from the electricity grid and high-GWP gases in semiconductor manufacturing. The Industrial category accounts for approximately 4% of regional emissions.[71] Of this, ODS substitutes represent about 80% of emissions.

[70] Note: Other Emissions are excluded from this document because there are no available protocols to reduce GHG emissions from these activities.

[71] San Diego Association of Governments, San Diego Forward: The Regional Plan, Appendix D

In general, the industrial processes and product use category offers specific opportunities for offset credit projects in the San Diego region. There is an evolving level of future regulation and common practices that may preclude many of the project types included in the related protocols. The following sections summarize the key findings of our analysis for the industrial and product use emissions category. This summary focuses on opportunities for projects to reduce ODS substitutes use by destroying, reclaiming, or otherwise abating existing uses of ODS substitutes as well as using low- or no GWP substitutes in new equipment; more efficient use and re-recycling of lubricants; and reducing industrial process inputs. A more detailed discussion is provided in Appendix III.

Key Findings for Industrial Processes and Product Use

- Emissions from ODS substitutes constitute the largest source of emissions in this category
- ODS substitutes are or will be directly regulated
- California's Cap-and-Trade regulation reduces GHG reduction opportunities
- Several potential project opportunities exist in this category
- All active and applicable protocols in this category are considered additional
- Most related projects use CARB's compliance protocol with few located in California and none in the San Diego region

5.3.1 California and the Federal Government are Increasingly Regulating ODS and ODS Substitutes

At the federal level, the U.S. EPA lists acceptable substitutes for existing refrigerants used in various end-use applications in refrigeration and air conditioning (including transportation), foam blowing, and fire suppression sectors Significant New Alternatives Policy (SNAP).[72] U.S. EPA reviews substitutes under a comparative risk framework and must prohibit the use of substitutes where it determines that there are other available substitutes that pose less risk overall to human health and environment under Section 612 of the CAA. New final SNAP regulations became effective on May 6, 2021, authorizing new refrigerant options with lower-GWP for retail food cooling as well as residential and light commercial air conditioning and heat pumps.[73] The CAA also prohibits the production and use of chlorofluorocarbons (CFCs) as well as the phasing out of hydrochlorofluorocarbons (HCFC) under Section 605. On April 30, 2021, the U.S. EPA proposed a HFC phase down regulation for refrigerants and other industrial purposes under an allowance

2012 Regional Greenhouse Gas Emission Inventory for the San Diego Region and Projections, 2015, p. 2: https://www.sdforward.com/pdfs/RP_final/AppendixD-2012GreenhouseGasEmissionsInventoryfortheSanDiegoRegionandProjections.pdf. (Note this is the last publicly available estimate of regional emissions.).

[72] 40 CFR Part 82.

[73] U.S. EPA, Final Rule: Protection of Stratospheric Ozone: Listing of Substitutes Under the Significant New Alternatives Policy Program, 40 CFR Part 82 [EPA–HQ–OAR–2019–0698; FRL–10020–41– OAR], Published Federal Register: Vol 86, No. 86, May 6, 2021: https://www.govinfo.gov/content/pkg/FR-2021-05-06/pdf/2021-08968.pdf.

allocation and trading program[74] to implement the recently passed American Innovation and Manufacturing (AMI) Act of 2020, part of the Consolidated Appropriations Act, 2021.[75]

California operates with a robust statutory and regulatory regime related to ODS and ODS substitutes to target high-GWP gases. SB 1383 (2016) requires a 40% reduction below 2013 levels in HFCs by 2030 and has adopted its own Refrigerant Management Program,[76] HFC Regulations (known as California SNAP),[77] and prohibitions on HFCs for stationary refrigerant end-uses.[78] California further regulates refrigerants in transportation uses.[79]

5.3.2 California Regulates Other Fugitive and Process Emissions

California regulates emissions from fugitive solvent use, industrial CO_2 consumption, soda ash consumption, and dolomite consumption, and lubricant emissions related to fuel use. California's Cap-and-Trade program regulates covered entities that include glass production and other stationary combustion that emit 25,000 metric tons or more of CO_2e per data year.[80] Emissions are regulated at the production and refining sites under GHG emissions standards set for crude oil and natural gas facilities. 17 CCR § 95666(a) applies these standards to owners or operators of equipment and components listed in 17 CCR § 95668 located within California, including California waters, that are associated with facilities in these related sectors. Finally, lubricant emissions are regulated indirectly through the re-refining of oil[81] and federal Testing and Labeling Standards[82] as well as directly through vehicle emission and air quality standards (discussed in Appendix V).

5.3.3 Protocol Screening Results

Of the 36 protocols identified, 12 are active and covered activities applicable to the San Diego region, and all 12 are considered additional (Table 20). Eight protocols, including six related to ODS management and two related to lubricant management, have at least one project located in the U.S. Two protocols in ODS management have at least one project in CA.

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[74] See U.S. EPA Proposed Phasedown of Hydrofluorocarbons: Establishing the Allowance Allocation and Trading Program under the American Innovation and Manufacturing Act, 40 CFR Part 82 [EPA-HQ-OAR-2021-0044; FRL-10023-08-OAR], April 30, 2021: https://www.epa.gov/sites/production/files/2021-05/documents/hfc_allocation_nprm_043021_admin.pdf.

[75] See U.S. EPA: Proposed Rule - Phasedown of Hydrofluorocarbons: Establishing the Allowance Allocation and Trading Program under the AIM Act: https://www.epa.gov/climate-hfcs-reduction/proposed-rule-phasedown-hydrofluorocarbons-establishing-allowance-allocation.

[76] 17 CCR § 95380–95398.

[77] 17 CCR §§ 95371–95377; California Air Resources Board, California Significant New Alternatives Policy (SNAP), Last Visited March 24, 2021: https://ww2.arb.ca.gov/our-work/programs/california-significant-new-alternatives-policy-snap/about. (Note California SNAP does not cover HFC uses in motor vehicle air conditioning (MVAC) systems.).

[78] See California Air Resources Board, Prohibitions on Use of Certain Hydrofluorocarbons in Stationary Refrigeration, Chillers, Aerosols-Propellants, and Foam End-Uses Regulation: https://ww2.arb.ca.gov/rulemaking/2020/hfc2020, Last Visited March 23, 2021.

[79] 13 CCR § 2500; 17 CCR §§ 95360–95370.

[80] Note that the California Cap-and-Trade also regulate lead, nitric acid, and lime production. These are omitted because there are no activities from these facilities in the region and therefore no emissions from these activities.

[81] See Used Oil Management: California Health & Safety Code, §§ 25250.1–25250.25; Used Oil Recycling Enhancement Act: California Public Resources Code, §§ 48600 et seq.

[82] 16 CFR Part 311.

Table 20 Protocols at Each Screening Stage in the Industrial Processes and Product Use Category

Protocol Category	All Protocols	Active, Applicable	And Additional	And at Least One Project in U.S.	And at Least One Project in CA
ODS Management	15	10	10	6	1
Lubricant Management	3	2	2	2	0
Mining Methane Management	9	0	0	0	0
Manufacturing Improvements	8	0	0	0	0
Carbon Capture & Storage	1	0	0	0	0
Total	**36**	**12**	**12**	**8**	**1**

The offset credit protocols reviewed for this project have 248 projects in the U.S., the vast majority of which are associated with protocols related to ODS Substitutes (Table 21). There are two projects located in California that use the CARB ODS compliance protocol and none in the San Diego region.

Table 21 Projects Using Active/Applicable Protocols in the Industrial Processes and Product Use Category

GHG Reduction Activity/Protocol	US	CA	San Diego Region	Additionality Determination
Ozone Depleting Substitutes	**244**	**2**	**0**	
ACR Ozone Depleting Substances Compliance Offset Protocol (CARB)	95	0	0	Additional
CAR Ozone Depleting Substances Compliance Offset Protocol (CARB)	82	2	0	Additional
CAR Ozone Depleting Substances	35	0	0	Additional
ACR Transition to Advanced Formulation Blowing Agents in Foam Manufacturing and Use	28	0	0	Additional
ACR Advanced Refrigeration Systems	3	0	0	Likely Additional
VCS VM0001 Infrared Automatic Refrigerant Leak Detection Efficiency Project Methodology (not HFC-23)	1	0	0	Additional
ACR Certified Reclaimed HFC Refrigerants	0	0	0	Likely Additional
ACR Destruction of Ozone Depleting Substances and High-GWP Foam	0	0	0	Additional
VCS Ozone Depleting Substances Compliance Offset Protocol (CARB)	0	0	0	Additional
VCS VM0016 Recovery and Destruction of Ozone-Depleting Substances (ODS) from Products, v1.1	0	0	0	Additional
Other Fugitive and Process Emissions	**4**	**0**	**0**	
ACR Re-refining Used Lubricating Oils	3	0	0	Additional
ACR Recycling of Transformer Oil	1	0	0	Additional
Total Projects	**248**	**2**	**0**	

5.3.4 Summary of Opportunity

There are opportunities for additional offset credits in the Industrial Processes and Products Use emissions category in the San Diego region. This is due to expected future decreases in available GHG reductions from ODS and ODS Substitutes as federal and California regulations ban high-GWP substances and replace them with low- or no GWP alternatives. The following summarizes the opportunities for offset credit projects in each of the subcategories within this category:

- ODS Substitutes:
    - Destruction, substitution to low- or no GWP alternatives for new or replacement equipment, and reclaiming and abatement of ODS substitutes;
- Lubricants:

    - Improvement in fuel consumption that cause emissions from industrial and transportation lubricants;
    - Collection and Re-refining of lubricant oil that would not otherwise be re-refined;
- Industrial Process Inputs:
    - Emission reduction related to glass production and stationary combustion facilities that are outside of the Cap-and-Trade program; and
    - Emission reduction through substitution of low- or no GWP solvents.

5.4 Natural and Working Lands

The Natural and Working Lands category consists of five subcategories: Forest, Other Natural Lands (Grasslands), Urban Forest, Wetlands, Soil Carbon, and Cropland Biomass. Cropland Biomass is not addressed in this report because there are no active protocols within this subcategory. In 2018 Natural and Working Lands in California accounted for approximately 5,340 million metric tons (MMT) of stored carbon.[83] Approximately 85% of this carbon is contained in forest and shrubland because these ecosystems dominate the California landscape.[84] California has been increasingly focused on the ability of Natural and Working Lands to remove CO_2 from the atmosphere.[85]

The Natural and Working Lands category has the highest number of active, applicable, and additional protocols, though there appear to be limited opportunities for offset credit projects in the San Diego region. Relatively limited land types related to identified protocols reduce the overall opportunity for this category. The following sections summarize the key findings of our analysis for the Natural and Working Lands category. A more detailed discussion is provided in Appendix IV.

Key Findings for Natural and Working Lands

- There are no requirements for activities covered by related protocols, though there is a trend towards more requirements related to Natural and Working Lands
- All active and applicable carbon offset credit protocols related to Natural and Working Lands are considered additional or likely additional
- There are few carbon offset credit projects related to Natural and Working Lands in California and one in the San Diego region
- The only carbon offset credit project located in San Diego is a forestry project
- There are limited opportunities for related projects in the San Diego region

5.4.1 California Does Not Regulate Activities Related to Protocols in the Natural and Working Lands Category

There are no laws, regulations, or legally binding mandates that require the GHG emissions reduction or removal activities to occur in this category. However, laws and regulations related to projects in the Natural and Working Lands category tend to focus on land use designations and

[83] California Air Resources Board, An Inventory of Ecosystem Carbon in California's Natural & Working Lands, 2018, p. 6: https://ww3.arb.ca.gov/cc/inventory/pubs/nwl_inventory.pdf.
[84] Id. at 6–7.
[85] See Ibid.

restrictions. All related offset credit protocols and related activities would be considered additional or likely additional as long as the activities do not violate applicable land use restrictions.

While no specific requirements exist for activities in this category, they could be required for environmental mitigation purposes at both the state and federal level when some form of development occurs that substantially harms the environment.[86] If that is the case, then the activity would be legally required and would fail the Legal Requirement Test and would be considered not additional. Only activity that goes above and beyond what is required for mitigation purposes would be considered additional.

Additionally, the Urban Forest subcategory is targeted by many cities in the region through their Climate Action Plans (CAPs). A CAP measure or related action (e.g., ordinance) may impact the additionality determinations for a given project. Where a CAP calls for the planting of a certain number of trees, if a project proponent goes above and beyond what the CAP calls for, then those additional trees would likely be considered additional. An analysis of which CAP measures have been implemented was not performed for this project; a project proponent would be required to perform a project-based analysis on how CAPs and related actions (e.g., ordinances) may impact the additionality determination of the project.

California has increasingly begun to recognize the importance of Natural and Working Lands in fighting climate change.[87] As California continues to advance its climate policies, there appears to be a trend towards regulating and requiring some of the GHG emission reduction and removal activities relevant to Natural and Working Lands. Recently, multiple state agencies developed the California Forest Carbon Plan to establish California's forests as a net carbon sink.[88] Executive Order N-82-20, signed by Governor Gavin Newsom in 2020, calls for California to conserve 30% of its land and coastal waters by 2030.[89] Given these developments, it would be necessary to monitor regulatory activity in California to determine whether the additionality determinations presented here would change for certain activities in the Natural and Working Lands category.

5.4.2 Protocol Screening Results

EPIC identified 51 protocols related to Natural and Working Lands. Of that total, 28 are active and covered activities applicable to the San Diego region (Table 22). All 28 protocols are also considered additional or likely additional because there are currently no laws, regulations, or legally binding mandates that require the GHG emissions reduction or removal activities to occur, nor do they appear to be common practice in the San Diego region. However, because some grazing

[86] See California Environmental Quality Act (CEQA), California Public Resources Code §§ 21000 et seq.; Clean Water Act Section 404, 33 U.S.C. § 1344; United States Environmental Protection Agency, United States Army Corps of Engineers, Compensatory Mitigation for Losses of Aquatic Resources, Final Rule, 40 CFR Part 230.
[87] See California Air Resources Board, An Inventory of Ecosystem Carbon in California's Natural & Working Lands, 2018: https:/ww3.arb.ca.gov/cc/inventory/pubs/nwl_inventory.pdf.
[88] California Department of Forestry and Fire Protection, California Environmental Protection Agency, California Natural Resources Agency, California Forest Carbon Plan Managing Our Forest Landscapes in a Changing Climate, 2018, p. 1: https://resources.ca.gov/CNRALegacyFiles/wp-content/uploads/2018/05/California-Forest-Carbon-Plan-Final-Draft-for-Public-Release-May-2018.pdf.
[89] Executive Order N-82-20, 2020: http://: https:/www.gov.ca.gov/wp-content/uploads/2020/10/10.07.2020-EO-N-82-20-.pdf.

practices related to the Other Natural Lands (Grasslands) and Soil Carbon subcategories may be common practice, project proponents should investigate before implementing an offset credit project that targets grazing on grasslands/rangelands in the region. Eleven protocols have at least one project in the U.S. and five have a project located in California.

Table 22 Protocols at Each Screening Stage in the Natural Working Lands Category

Protocol Category	All Protocols	Active, Applicable	And Additional	And at Least 1 Project in U.S	And at Least 1 Project in CA
Forestry	24	8	8	7	4
Grasslands	7	6	6	2	0
Soil Management	5	4	4	1	0
Urban Forest	5	5	5	0	0
Wetlands	10	5	5	1	1
Total	**51**	**28**	**28**	**11**	**5**

Of the active and applicable offset credit protocols reviewed for this project, there are over 240 projects in the U.S., the vast majority of which are associated with protocols related to forestry (Table 23 and Table 24). There are over 80 projects located in California and one in the San Diego region, which is the only offset credit project in the San Diego region. Of the projects in the California, they are nearly all in the forestry category. And most of the forestry projects use a CARB compliance protocol. Considering all the protocols in the Urban Forest, Wetlands, and Soil Carbon protocol categories, there are only two projects in the U.S., including one in California and none in the San Diego region.

One potential reason for the lack of Natural and Working Lands projects in the San Diego region could be the limited area of related land to implement these projects. There are about 130,870 acres of forest land in the region,[90] 208,641 acres of grassland and meadow vegetation, and 20,889 acres of field/pasturelands.[91] A study has also concluded that there are about 786 acres of wetland areas in the region suitable for restoration.[92] This lack of suitable land related to the activities covered by offset credit protocols may limit the opportunities to implement related projects in the San Diego region.

Natural and Working Lands offset credit projects, particularly using voluntary protocols, may not be feasible to implement at this time for a number of factors, including protocol requirements and offset credit prices. Permanence is another important factor related to projects in the Natural and Working Lands category. Project proponents must avoid any potential for reversals of GHG emissions reductions or removals to be eligible for offset credits. This may be difficult to do but is

[90] Dudek, Evaluation of Greenhouse Gas Emissions Offset Availability within San Diego County, 2018, p. 9: https://www.ci.oceanside.ca.us/civicax/filebank/blobdload.aspx?BlobID=49641.
[91] SanGIS, SANGIS ECO_VEGETATION_CN Map Layer: https://www.sangis.org/index.html.
[92] Sara Wanous, Carbon Offsets in San Diego County An Analysis of Carbon Offset Policy Effectiveness, Best Practices, and Local Viability in the San Diego County Region, University of California San Diego Scripps Institution of Oceanography, 2019, p. 16: https://escholarship.org/uc/item/2t48k6m7#main.

required by the major registries,[93] and a project proponent must be able to ensure that a project is, in fact, permanent and will continue to reduce and/or remove GHG emissions well into the future.

Table 23 Projects Using Active/Applicable Protocols Related to Forests and Grasslands

GHG Emission Subcategory/Protocol	US	CA	San Diego Region	Additionality Determination
Forestry	**228**	**85**	**1**	
CAR U.S. Forest Projects Compliance Offset Protocol (CARB)	90	49	0	Additional
CAR Forest	41	19	1	Additional
ACR U.S. Forest Projects Compliance Offset Protocol (CARB)	89	16	0	Additional
ACR Afforestation and Reforestation of Degraded Lands	1	1	0	Additional
CAR Mature Forest Management (Climate Forward)	2	0	0	Additional
CAR Reforestation (Climate Forward)	0	0	0	Additional
VCS AR-ACM0001: Afforestation and Reforestation of Degraded Land, Version 5.2.0	4	0	0	Additional
VCS U.S. Forest Projects Compliance Offset Protocol (CARB)	1	0	0	Additional
Grasslands	**14**	**0**	**0**	
CAR Grassland	13	0	0	Likely Additional
ACR Avoided Conversion of Grasslands and Shrublands to Crop Production	1	0	0	Additional
ACR Compost Additions to Grazed Grasslands	0	0	0	Additional
CAPCOA Optional Composting Facility Component-Grazed Grasslands Protocol (ACR-MCP)	0	0	0	Additional
VCS VM0026 Methodology for Sustainable Grassland Management (SGM)	0	0	0	Likely Additional
VCS VM0032 Methodology for the Adoption of Sustainable Grasslands through Adjustment of Fire and Grazing	0	0	0	Additional

[93] See America Carbon Registry, THE AMERICAN CARBON REGISTRY STANDARD: REQUIREMENTS AND SPECIFICATIONS FOR THE QUANTIFICATION, MONITORING, REPORTING, VERIFICATION, AND REGISTRATION OF PROJECT-BASED GHG EMISSIONS REDUCTIONS AND REMOVALS, Version 7.0: 2020: https:/americancarbonregistry.org/carbon-accounting/standards-methodologies/american-carbon-registry-standard/acr-standard-v7-0_final_dec2020.pdf; Verified Carbon Standard, AFOLU Non-Permanence Risk Tool, 2019: https://verra.org/wp-content/uploads/2019/09/AFOLU_Non-Permanence_Risk-Tool_v4.0.pdf.

Table 24 Projects Using Active/Applicable Protocols Related to Urban Forest, Wetlands, and Soil Carbon

GHG Emission Subcategory/Protocol	US	CA	San Diego Region	Additionality Determination
Urban Forest	**0**	**0**	**0**	
ACR Urban Forest Projects Compliance Offset Protocol (CARB)	0	0	0	Additional
CAR Urban Forest Management	0	0	0	Additional
CAR Urban Forest Projects Compliance Offset Protocol (CARB)	0	0	0	Additional
CAR Urban Tree Planting	0	0	0	Additional
VCS Urban Forest Projects Compliance Offset Protocol (CARB)	0	0	0	Additional
Wetlands	**1**	**1**	**0**	
ACR Restoration of California Deltaic and Coastal Wetlands	1	1	0	Additional
CAPCOA Restoration of California Deltaic and Coastal Wetlands (ACR)	0	0	0	Additional
CAPCOA VM0024 Methodology for Coastal Wetland Creation, v1.0 (Verra)	0	0	0	Additional
VCS VM0024 Methodology for Coastal Wetland Creation, v1.0	0	0	0	Additional
VCS VM0033 Methodology for Tidal Wetland and Seagrass Restoration, v1.0	0	0	0	Additional
Soil Carbon	**1**	**0**	**0**	
VCS VM0021 Soil Carbon Quantification Methodology, v1.0	1	0	0	Additional
CAPCOA Biochar Production Project Reporting & Addendum (Placer County APCD)	0	0	0	Additional
CAR Soil Enrichment	0	0	0	Additional
VCS VM0017 Adoption of Sustainable Agricultural Land Management, v1.0	0	0	0	Likely Additional
Total	**1**	**0**	**0**	

5.4.3 Methods for Estimating Sequestration Value of Chaparral

While the region may lack suitable land types for projects using the existing offset credit protocols, the region has significant shrublands, with more than 630,000 acres of chaparral vegetation within the San Diego region.[94] Although the incremental sequestration potential of chaparral vegetation is unknown at the moment, there are efforts to develop a formal quantification methodology for carbon sequestration by chaparral.[95]

It is important to note that sequestration potential is variable, depending on ecosystem type, water availability, the species of plant targeted, and physical changes that occur during the life of the vegetation (i.e., whether the land has been burned by fire or not). This could make projects that seek to sequester carbon difficult to implement because of the challenges in calculating the GHG impacts of such projects. Nonetheless there could be an opportunity to develop a protocol targeting chaparral vegetation if a consistent, formal method of calculating carbon sequestration is developed.

[94] County of San Diego, Chaparral Vegetation Community: https://verra.org/wp-content/uploads/2019/09/AFOLU_Non-Permanence_Risk-Tool_v4.0.pdf.

[95] The U.S. Forest Service, University of California, Davis, and San Diego State University are currently in the process of collaboratively working towards developing a sequestration value for chaparral vegetation within the San Diego region.

5.4.4 Summary of Opportunity

There are opportunities to implement offset credit projects in the San Diego region in the Natural and Working Lands category. All protocols identified and related activities are considered additional or likely additional at the time of publication. There are no local, state, or federal laws, regulations, or legally binding mandates requiring these activities, and these activities do not appear to be common practice in the region. These additionality determinations may change depending on land use restrictions, mitigation requirements of particular projects, CAP measures and related actions (e.g., ordinances), and the potential for California to require these activities in the future.

The lack of offset credit projects in the San Diego region, while not definitive, may be indicative that these activities may not be feasible for a number of reasons, including the dynamic and variable nature of the carbon sequestration process, the lack of suitable land types, implementation costs, and/or other considerations such as permanence. A project proponent should perform subsequent analyses to ensure that an offset project is feasible and valuable before implementing a project in the region on Natural and Working Lands.

5.5 On-Road Transportation

The On-road Transportation emissions category, which is a subset of the main energy category, has three subcategories: heavy-duty, medium-duty, and passenger vehicles. The On-road Transportation category accounts for over 40% of regional emissions.[96] Of this total, nearly 90% of emissions are associated with passenger cars and other light-duty vehicles. The remaining 10% is associated with heavy-duty vehicles.

California's On-road Transportation emissions category is heavily regulated in terms of emission sources, fuel types, and vehicle class and weight. High levels of regulation and common practices may also preclude many of the project types included in related protocols. As a result, there are limited opportunities for offset credits in the San Diego region. The following sections summarize the key findings of our analysis for the On-road Transportation emissions category. This summary focuses on opportunities for projects alternative fuels, carpooling, and transportation. A more detailed discussion is provided in Appendix V.

[96] San Diego Association of Governments, San Diego Forward: The Regional Plan, Appendix D 2012 Regional Greenhouse Gas Emission Inventory for the San Diego Region and Projections, 2015, p. 26: https://www.sdforward.com/pdfs/RP_final/AppendixD-2012GreenhouseGasEmissionsInventoryfortheSanDiegoRegionandProjections.pdf. (Note this is the last publicly available estimate of regional emissions.).

Key Findings for On-Road Transportation

- There are viable but limited opportunities for On-road local offset credits
- The Federal Government, California and Local Governments regulate most aspects of On-road emissions in the market place
- There are four offset credit protocols that are considered additional but there are no projects in California using these protocols
- Voluntary carbon offset credit projects are limited by regulatory and market forces that include competition from higher value Low Carbon Fuel Standard credits, increasing penetration of alternative fuel vehicles, and credit ownership issues

5.5.1 Federal, California, and Local Governments Regulates On-Road Transportation

On-road transportation is regulated by vehicle class, fuel type, fuel carbon intensity, and emissions. Federal and California regulations form the underlying framework that limits what types of activities can be considered additional. Local requirements further limit what type of activities can be considered additional on a geographically specific basis.

Federally, fuel is regulated under the Renewable Fuel Standard, emissions are regulated under the Clean Air Act (CAA) by model year, and vehicle fuel efficiency is regulated under the Corporate Average Fuel Economy (CAFE) standards with California acting with authority to create more stringent standards with regards to vehicle emissions. While the Trump Administration relaxed some of these requirements, lawsuits overturned or delayed much of the implementation, and the new Biden Administration is reinstituting more stringent requirements.

In California, the state's CAA Section 209 waiver is set to be reinstituted—ensuring that the state's more stringent emission standards will continue under its CAA State Implementation Plan (SIP). California regulates vehicles by class, use, and weight. Standards are stringent—particularly for heavy-duty vehicles. California is also instituting programs such as the Advanced Clean Cars, Advanced Clean Truck, and anti-idling regulations to transition these vehicles to lower-emitting and then zero emission vehicles (ZEV). California regulates the carbon intensity of fuel under the Low-Carbon Fuel Standard (LCFS) and continues to increase alternative low- or no-carbon fuel supplies and infrastructure. California seeks to only allow in-state sale of new zero-emission passenger vehicles by 2035 per Executive Order N-89-20 and is taking multi-prong actions to increase the deployment of electric and hydrogen vehicles. California sets regional GHG targets for transportation planning that requires accounting for and mitigating transportation GHG emissions from land-use developments under Senate Bill 375 (Steinberg, Chapter 728, Statutes of 2008).

At the local level, Title 24 statewide building code requirements implemented by local government require new buildings or major remodels to install electric vehicle supply equipment with the amount of equipment installed determined by building type. This regulation also requires that new buildings be EV Ready. Local governments are making these requirements more stringent, using their own authority to modify Title 24. Many local governments are decreasing emissions from their municipal fleets by procuring ZEV to meet climate action plan targets as well as to decrease fuel

costs. Carpooling is another measure that is used to reduce GHG emissions under climate action planning in the region.

5.5.2 Protocol Screening Results

Of the six protocols identified, five are active and covered activities applicable to the San Diego region, and four are considered additional (Table 27). Two have at least one project in the U.S. and none have projects in CA. One protocol, ACR's Improved Efficiency of Vehicle Fleets, is inactive.

Table 25 Protocols at Each Screening Stage in the On-Road Transportation Category

Protocol Category	All Protocols	Active, Applicable	And Additional	And at Least 1 Project in U.S
Alternative Fuels	3	3	2	2
Carpooling	1	1	1	0
Transportation Efficiency	1	1	1	0
Vehicle Efficiency	1	0	0	0
Total	**6**	**5**	**4**	**2**

Of the five active and applicable protocols, there are 35 projects in the U.S. and one in California (Table 26). Nearly all of the projects related to alternative fuels, including the one in California, are associated with the ACR Truck Stop Electrification protocol. This protocol has not been generating offsets or considered additional since 2008 in light of California's anti-idling regulations going into effect.

Table 26 Projects Using Active and Applicable Protocols in the On-Road Transportation Category

GHG Reduction Activity/Protocol	US	CA	San Diego Region	Additionality Determination
Alternative Fuels	**35**	**1**	**0**	
ACR Truck Stop Electrification	33	1	0	Not Additional
VCS VM0019 Fuel Switch from Gasoline to Ethanol in Flex-Fuel Vehicle Fleets	0	0	0	Likely Additional
VCS VM0038 Methodology for Electric Vehicle Charging Systems	2	0	0	Additional
Carpooling	**0**	**0**	**0**	
VCS VM0028 Methodology for Carpooling	0	0	0	Additional
Transportation Efficiency	**0**	**0**	**0**	
VCS VM0020 Transport Energy Efficiency from Lightweight Pallets	0	0	0	Additional
Total	**35**	**1**	**0**	

5.5.3 Summary of Opportunity

There are limited opportunities for additional offset credits in the On-road Transportation emissions category in the San Diego region. This is due to high levels of regulation related to vehicles, emissions, fuels, and resulting common practices. Four of the five On-road Transportation protocols are considered additional, though ongoing state regulation and potential federal regulation, as well as the implementation of these regulation(s) to reduce transportation GHG emission will limit the

viability of projects under these protocols. Project proponents seeking to implement one of the GHG emissions reduction activities in the San Diego region would need to determine how, if at all, current local requirements relate to the project. For example, it is not clear whether such GHG reductions would be considered common practice or part of a conservative BAU scenario for activities like carpooling. Also, the significant value of LCFS credit values compete directly with protocol project offsets as well as complicate ownership and double counting evaluations. Any analysis to determine whether such activities are additional would have to be project-specific and focus on the specific type of GHG reduction activity undertaken.

5.6 Waste

The Waste emissions category comprises two subcategories: solid waste and wastewater. Each subcategory can be further broken down into the activities that cause emissions. Solid waste emissions comprise activities related to waste disposal, waste-in-place at landfills, and waste composting. Wastewater emissions are caused by domestic and industrial wastewater treatment and discharge. The Waste category accounts for about 5% of regional emissions.[97] Of this total, most emissions are associated with the solid waste subcategory.

In general, the Waste category has limited opportunities for offset credit projects in the San Diego region. High levels of regulation and common practices preclude many of the project types included in related protocols. The following sections summarize the key findings of our analysis for the waste emissions category. This summary focuses on opportunities for projects to divert solid waste from landfills and capture and use landfill gas (LFG). A more detailed discussion is provided in Appendix VI.

Key Findings for Waste

- California regulates organic waste and emissions from landfills
- No waste-related carbon offset credit protocols are considered additional
- There are few waste-related carbon offset credit projects in California and none in the San Diego region
- There are limited opportunities for related projects in the San Diego region

5.6.1 California Regulates Organic Waste

The main method to reduce emissions from waste disposed is to divert waste from landfills to compost or digest the organic matter. These processes reduce methane emissions by avoiding the anaerobic decomposition of organic matter that would otherwise occur in landfills. Existing regulations and requirements in California affect much of the organic waste available for diversion and activities related to the identified protocols. SB 1383 (2016) sets a target for 75% organic

[97] San Diego Association of Governments, San Diego Forward: The Regional Plan, Appendix D 2012 Regional Greenhouse Gas Emission Inventory for the San Diego Region and Projections, 2015, p. 26: https://www.sdforward.com/pdfs/RP_final/AppendixD-2012GreenhouseGasEmissionsInventoryfortheSanDiegoRegionandProjections.pdf. (Note this is the last publicly available estimate of regional emissions.).

diversion by 2025. Further, Assembly Bill 1826 (Chesbro, Chapter 727, Statutes of 2014) requires businesses generating two cubic yards or more of commercial solid waste to recycle organic waste.

California has demonstrated a trend toward increasingly strict regulation of organic waste and California has developed a strategy for Short-lived Climate Pollutants, which includes landfills. The Short-Lived Climate Pollutant Reduction Strategy states that California "has already established its intent to phase out the disposal of organics from landfills."[98]

The State's current and potential future regulation of organic waste would limit feedstocks available for projects that use diverted organic waste. One related protocol acknowledges that "[b]ased upon the results of the performance standard [common practice] research, food waste and co-mingled non-recyclable food soiled paper waste are the sole composting feedstocks deemed eligible per this protocol."[99]

5.6.2 California Regulates Landfill Gas

Similar to solid waste diversion, California regulates most emissions from waste-in-place at landfills. It appears that collection and control technologies are also common practice among landfills, even among those not currently covered by the CARB Landfill Methane Control Measure (LMCM). CARB's LMCM applies to most of the active landfills in the region.

The EPA's Landfill Methane Outreach Program (LMOP)[100] reports data on 14 landfills in San Diego County.[101] Of the 14 landfills listed on the EPA's Landfill Methane Outreach Program (LMOP), eight are closed and seven already operate gas collection systems. Data is not reported for the South Miramar Landfill. There are six open landfills, four of which have greater than 450,000 tons of waste in place. All of them have gas collection systems, and several have energy conversion projects. The two open landfills without reported LFG collection systems (San Onofre and Borrego) both fall below the CARB LMCM waste-in-place threshold. It is not clear whether closed or smaller landfills have sufficient gas production to make projects viable.

Further, the regional GHG inventory assumes a 75% LFG capture rate in 2020 and beyond, which also suggests that even if not all landfill gas is captured, the remaining portion could be relatively small.[102]

5.6.3 Protocol Screening Results

Of the thirteen protocols identified, eleven are active and covered activities applicable to the San Diego region, and none are considered additional (Table 27).

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[98] California Air Resources Board, Short-Lived Climate Pollutant Reduction Strategy, 2017, p. 73: https://ww2.arb.ca.gov/sites/default/files/2020-07/final_SLCP_strategy.pdf.
[99] Climate Action Reserve, Organic Waste Composting Protocol, Version 1.1, 2013, p. 7: http://www.climateactionreserve.org/how/protocols/organic-waste-composting/.
[100] United States Environmental Protection Agency, Landfill Methane Outreach Program (LMOP) Landfill Gas Energy Project Data, November 18, 2020: https:/www.epa.gov/lmop/landfill-gas-energy-project-data.
[101] United States Environmental Protection Agency, Landfill Methane Outreach Program (LMOP) Landfill Technical Data, November 17, 2020: https://www.epa.gov/lmop/landfill-technical-data.
[102] San Diego Association of Governments, San Diego Forward: The Regional Plan, Appendix D 2012 Regional Greenhouse Gas Emission Inventory for the San Diego Region and Projections, 2015, p. 26. (Note this is the last publicly available estimate of regional emissions.).

Table 27 Protocols at Each Screening Stage in the Waste Category

Protocol Category	All Protocols Evaluated	Active, Applicable
Landfill Gas Capture & Combustion	5	3
Solid Waste Diversion	6	6
Wastewater Treatment	2	2
Total	**13**	**11**

Of the offset credit protocols reviewed for this project, there are over 160 projects in the U.S., the vast majority of which are associated with protocols related to landfill gas capture and combustion (Table 28). Seven projects are located in California and none in the San Diego region. Of the projects in California, they are about evenly split between landfill gas capture and combustion, solid waste diversion, and wastewater treatment.

Table 28 Projects Using Active and Applicable Protocols in the Waste Category

	Number of Projects			
GHG Reduction Activity/Protocol Category/Protocol	**US**	**CA**	**San Diego Region**	**Additionality Determination**
Solid Waste	**149**	**5**	**0**	
Landfill Gas Capture & Combustion	**137**	**3**	**0**	
CAR U.S. Landfill	116	3	0	Not Additional
VCS ACM0001: Flaring or Use of Landfill Gas, Version 19.0	19	0	0	Not Additional
VCS AMS-III.G.: Landfill Methane Recovery, Version 10.0	2	0	0	Not Additional
Solid Waste Diversion	**12**	**2**	**0**	
CAPCOA Updated Organic Waste Digestion Version 2.1 (CAR)	0	0	0	Likely Not Additional
CAR Organic Waste Composting	7	1	0	Likely Not Additional
CAR Organic Waste Digestion*	2	1	0	Likely Not Additional
VCS ACM0022: Alternative Waste Treatment Processes, Version 2.0*	1	0	0	Likely Not Additional
VCS AM0025: Avoided Emissions from Organic Waste through Alternative Waste Treatment Processes	2	0	0	Likely Not Additional
VCS VM0018 Energy Efficiency and Solid Waste Diversion Activities within a Sustainable Community*	0	0	0	Likely Not Additional
Wastewater Process emissions	**13**	**2**	**0**	
Wastewater Treatment	**13**	**2**	**0**	
VCS ACM0014: Treatment of Wastewater, Version 8.0	5	0	0	Likely Not Additional
VCS AMS-III.Y.: Methane Avoidance through Separation of Solids from Wastewater or Manure Treatment Systems, Version 4.0 (VMR0003)*	8	2	0	Likely Not Additional
Total	**162**	**7**	**0**	

*Protocol included in more than one category.

5.6.4 Summary of Opportunity

There are limited opportunities for additional offset credits in the Waste emissions category in the San Diego region. This is due to high levels of regulation related to organic waste and emissions from landfills and common practice of capturing methane for beneficial use at landfills and wastewater treatment plants. The following summarizes the opportunities for offset credit projects in each of the subcategories within the Waste category.

- **Solid Waste Disposal** – Given regulations for diversion, we assume that all related protocols are "Likely Not" or "Not" additional. There may be limited opportunities in exempted activities and on tribal lands.
- **Waste-in-place at Landfill within Boundary** – CARB regulation requires methane recovery and control for active landfills, and many landfills in the region already collect and use LFG. Of the 15 active landfills in the region with data reported by the U.S. EPA, only two are below the 450,000 ton waste in place threshold. Of the 11 closed landfills only one, South Miramar, does not have any reported data of waste-in-place or collection and control systems. For these reasons, we consider all protocols related to landfill gas recovery as "Not Additional."
- **Domestic Wastewater** – While not directly required, capture and beneficial use of methane at wastewater treatment plants is common practice; therefore, we consider related protocols "Likely Not Additional."

5.7 Water

The water emissions category is a subset of the electric and natural gas category[103] and is often broken out to highlight the importance of water efficiency and conservation. Emissions associated with water, which represent about 1% of regional emissions[104], result from energy use at three different stages in the water cycle: conveyance, treatment, and distribution; end use; and wastewater collection, treatment, and discharge.[105] This section focuses on emissions from end-use—in particular indoor water use associated with plumbing fixtures (e.g., faucets and showerheads), toilets and urinals—and outdoor water use in landscape irrigation. Agricultural water use is not considered and emissions associated with other water-related appliances—like water heaters—is accounted for in emissions considered in the electricity and natural gas sector (Appendix II).

Given the state regulation of plumbing fixtures, general availability of water efficient fixtures in the marketplace, and existence of only one voluntary offset credit protocol, there are limited to no opportunities for additional GHG emission reductions in this category.

[103] The electricity and natural gas category is a subset of the main energy category.
[104] San Diego Association of Governments, San Diego Forward: The Regional Plan, Appendix D 2012 Regional Greenhouse Gas Emission Inventory for the San Diego Region and Projections, 2015, p. 26: https://www.sdforward.com/pdfs/RP_final/AppendixD-2012GreenhouseGasEmissionsInventoryfortheSanDiegoRegionandProjections.pdf. (Note this is the last publicly available estimate of regional emissions.).
[105] See Energy Policy Initiatives Center, Energy-for-Water Nexus in Cities in San Diego County, 2018: https://www.sandiego.edu/epic/documents/20181017_Final TSDF Water-Energy Report_FINAL.pdf.

Key Findings for Water

- California regulates faucets, toilets, urinals, and showerheads
- California requires new and existing buildings to install water efficient equipment
- There is only one protocol related to water and it is considered not additional
- There are no protocols related to outdoor water use, but California regulates some aspects

5.7.1 Regulation

California has a long history of regulating and encouraging water efficiency. California has adopted standards stricter than federal standards for faucets, toilets and urinals, and showerheads.[106] All regulated products sold or offered for sale in California must meet these standards; therefore, all products available in the retail market are as efficient or more efficient than those being replaced.

In addition, California's Green Building Code requires all new buildings to include water efficient equipment. California law also requires all existing buildings to upgrade noncompliant fixtures.[107] Because California has a Cap-and-Trade regulation that covers the electric power generation sector, it can be difficult to discern ownership of the offset credits. For example, if an appliance reduces energy consumption, this will, in turn, reduce the emissions of the electric generation sources that are covered by the Cap-and-Trade regulation. Registries generally do not recognize energy reductions in jurisdictions where a Cap-and-Trade regulation exists due to complications around ownership. This would apply to water reduction projects that derive GHG emissions reductions from lower energy use.

5.7.2 Protocol Screening

EPIC identified one protocol related to water use reduction. The VCS VMR0005 Low Flow Water Devices protocol covers installation of low-flow hot water savings devices used in existing residential and non-residential buildings, excluding industrial buildings.[108] Given California's current regulation of low-flow water devices, this protocol would be considered not additional. Also, there are no projects in the U.S. using this protocol.

There are no protocols to reduce outdoor water use. California has adopted standards for spray sprinkler bodies and sets standards for water efficiency in landscape irrigation. Related GHG reductions would have to exceed these standards to be considered additional.

[106] California Energy Commission, CEC-400-2015-030, Appliance Efficiency Regulations; 20 CCR §§ 1601–1609.
[107] California Civil Code §§ 1101.1–1101.9.
[108] Verra, Methodology for Installation of Low-Flow Water Devices, Approved VCS Methodology VMR0005, Version 1.0, 2014, p. 5: http://: https:/verra.org/wp-content/uploads/2018/03/VMR0005-Methodology-for-Installation-of-Low-Flow-Water-Devices-v1.0.pdf.

5.7.3 Summary of GHG Opportunity

There are no offset credit protocols covering indoor, low-flow water that are considered additional. There may be limited opportunities to realize additional minimal GHG emissions reductions by exceeding State regulations.

6 LIMITATIONS

There are inherent limitations with any analysis that result in a degree of uncertainty. This analysis used the best information, data, and methods available at the time. Nonetheless, the following limitations should be considered.

6.1 Snapshot in Time

This analysis is based on information available at the time of the project. The number of available protocols, data on the number of projects associated with each protocol, and the current regulations and policies all can change over time. These changes could affect the findings in this report.

Projects included in this report represent those publicly available in Fall 2020. Project values reported here represent totals and no analysis was conducted to assess how the number of projects changed over time. Also, projects may reflect current offset pricing; if offset credit prices increase, more projects may be considered feasible.

6.2 Focus on Carbon Offset Credit Protocols

This analysis focuses on local offset credit project opportunities. Using existing offset credit protocols, we sought to determine which protocols were relevant to the San Diego region and would be additional to what would have happened either due to regulation or because of common practices. This review of protocols provides a preliminary survey of potential opportunities, as protocols can be viewed as a reasonable proxy for opportunities in a given emissions category. Nonetheless, it is possible that projects could be developed for purposes of carbon reductions or removals outside of the offset credit protocol framework. Further research is required to identify a representative list of GHG reduction and removal project types to determine whether and how they could be used for voluntary GHG reduction commitments.

6.3 Additionality Determination

For purposes of identifying GHG opportunities, this analysis makes a preliminary and general determination about additionality for a category of projects or activities. Additionality is often determined at the project level; therefore, the additionality determinations provided here should be seen as general guidance rather than a specific determination about a single project. It is possible that a category of activities considered not additional here could contain a specific project that is additional, and vice versa. Specific project level analysis would be needed to determine additionality.

Project specific analysis is particularly important to determine whether a common practice already exists in the region for the proposed emission reduction activity. A defensible study that provides a clear understanding of existing practices and market actions is necessary to fully vet common practice additionality.

Also, changes in regulations can cause the additionality determination to change over time. A project may no longer generate offset credits once the underlying activity becomes regulated. This

may limit the economic feasibility of certain activities if the underlying GHG reduction activity can no longer generation offset credits in year ten, for example.

6.4 Other Carbon Offset Credit Factors Not Considered

While determining whether an activity would result in additional GHG reductions or removals is an important criterion, there are other important factors to consider when assessing the viability of offset credits. For example, for CARB compliance offset credits, the project proponent must demonstrate additionality but also that the GHG reduction or removal is real, verifiable, permanent, quantifiable, enforceable. A subset of verification and enforceability includes demonstrating clear proof of ownership of the offset credit. This report summarizes analysis on additionality but only briefly discusses the implications of the other criteria. For example, general determinations can be made about whether an activity would yield additional reductions or removals; however, it is more difficult to determine ownership of an offset credit without knowledge of the particular project and its contractual arrangements. Where applicable, we acknowledge these other issues, but project-level analysis would be required.

This analysis did not consider the cost to implement related projects or estimate the amount of GHG emissions that could be reduced. These considerations are important to determining both individual project feasibility and the potential scale a particular project category.

6.5 Focus on Local Opportunities

The goal of this project is on the supply side of the offset credit equation—to identify offset credit project opportunities that could be developed in the region in order to capture co-benefits, like economic, air quality, social justice, habitat preservation, etc. This geographic constraint limits the supply of offset credits options from local projects that can be used by local jurisdictions, public agencies, and businesses in the San Diego region. Expanding the scope to projects that could be developed outside the San Diego region would likely yield different results.

7 CONCLUSION

The overall purpose of this project is to identify opportunities to develop projects in the San Diego region to reduce or remove GHG emissions that could be used to acquire offset credits. To that end, EPIC developed a process to identify offset credit protocols that are active, geographically relevant, comprised activities that take place in the San Diego region, and could result in GHG reductions or removals that could be considered additional to what would have occurred otherwise as a result of regulation or common practices. Of the 166 protocols identified, 81 are active and applicable to the San Diego regional context, 57 are considered additional, and 27 have at least one project located in the U.S. Further screening for protocols with projects located in California yielded 11 protocols, including seven voluntary protocols and four CARB compliance protocols.

Protocols considered additional with project activity in California are associated with three categories: Agriculture, Industrial Processes and Product Use, and Natural and Working Lands. While these represent the most likely categories for offset credit projects in the San Diego region, minimal activity in the San Diego region related to dairy farming and industrial processes, and relatively small acreage of relevant land types (e.g., forests), limit the overall opportunity for projects. Additional research is needed to determine whether any specific project would meet the eligibility criteria of related protocols and would be feasible to implement.

Determining whether additional GHG opportunities exist is a dynamic process. As regulations and the status of protocols change, additional analysis would be necessary to update the findings provided here.