

A Look at CARB's AB32 GHG Programs, from Early Action to Today

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INTRODUCTION

California has one of the longest established greenhouse gas (GHG) legislation and regulatory programs in the United States, implemented by the California Air Resources Board (CARB) under the California Global Warming Solutions Act (AB 32, 2006).¹ This paper provides an overview of the nine discrete early action measures under AB 32 that were included in the 2008 CARB Scoping Plan, approved in September 2007, and how CARB has evolved those into the current schema that are being implemented today. The nine early action measures include:

- December 2007 – Green Ports – Ship Electrification at Ports
- June 2008 – Reduction of High GWP Gases in Consumer Products
- December 2008 – SmartWay – Heavy-Duty Vehicle Greenhouse Gas Emission Reduction (Aerodynamic Efficiency)
- February 2009 – Reduction of Perfluorocarbons from Semiconductor Manufacturing
- January 2009 – Improved Landfill Gas Capture
- January 2009 – Reduction of HFC-134a from Do-It-Yourself Motor Vehicle Servicing
- January 2009 – SF₆ Reductions from the Non-Electric Sector
- March 2009 – Tire Inflation Program
- March 2009 – Low Carbon Fuel Standard

The outcomes of the aforementioned proposed early action measures (e.g. the regulations and programs that were adopted) are discussed below. In addition, CARB's AB32 created two primary pathways for reporting and reducing GHG emissions:

- A Mandatory Reporting Program (MRP), which started in 2008, with the CARB Regulation for the Mandatory Reporting of Greenhouse Gas Emissions (Reporting Regulation)².
- In 2012, the Cap and Trade (C&T) Program was developed with the Regulation for the California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms (C&T Regulation)³.

The paper summarizes the key elements of each program, what each has accomplished thus far, and the future of the program. Looking at where AB32 started to the current CARB regulatory schema will demonstrate the ever-changing regulatory drive in California to report, regulate, and reduce GHG emissions. It will also show that CARB's regulations have created financial incentives for companies inside and outside of California to innovate, created low carbon fuels, and has generated carbon offsets to various industry sectors.

EARLY ACTION MEASURES

AB32 mandated that GHG emissions levels in California must reach 1990 levels by 2020. It required that CARB develop a Scoping Plan, with the first plan being developed in 2008, to outline ways in which California will reach this goal to combat climate change. It included nine discrete early action measures that would lead to regulations and required the policies under each program to be effective by January 1, 2010 with goals through 2020. Now that the initial timeframe has been elapsed, we can explore what has become of each of CARB's nine discrete early action measures by looking at actual data from the most current CARB GHG Emission Inventory and comparing the historical emissions to 2018 data for all source categories in the Scoping Plan.

Green Ports – Ship Electrification at Ports

The first listed early action measure in the Scoping Plan was the effort for electrification of ships at California's busiest ports. This early action measure led to implementation of:

- The Ocean-Going At-Berth Regulation, dated December 2008⁴

This regulation set forth requirements that sought to reduce diesel particulate matter (PM) and oxides of nitrogen (NO_x) emissions occurring at California ports from auxiliary engines of docked ship vessels. The program would apply to container ships, passenger ships, and refrigerated-cargo ships. The regulation proposed that beginning on January 1, 2014, at least 50 percent of fleets' visits must meet certain operational time limits and that auxiliary diesel engine power must be reduced to 50 percent of baseline power use when docked. The regulation proposed the same requirements to be met in 2017 and 2020, but with more stringent requirements, changing the 50 percent limit to 70 percent in 2017 and 80 percent in 2020. Since its implementation in 2014, the program has resulted in emissions reductions of 80 percent of PM and NO_x emissions from auxiliary diesel engines from 13,000 vessels at California ports⁵.

CARB approved a new At-Berth regulation on December 30, 2020, which became effective on January 1, 2021, adding auto carriers and tankers to the list of applicable vessels, as they account for 56 percent of particulate matter less than 2.5 microns (PM_{2.5})⁵. Under the new regulation, starting in 2023, California ports will expect a 55 percent reduction in potential cancer risk and a 90 percent overall reduction in pollution⁵. From 2000 to 2008, overall GHG emissions from ships and commercial boats in California had a year-to-year increase of 1.36 percent¹³. From 2008 (when the initial regulation was effective) to 2018, emissions ships and commercial boats in California had an average year-to-year increase of 1.76 percent from 2018 to 2018.¹³ Emissions occurring from 2000 to 2018 had an overall increase of 1.58 percent¹³. By 2027, all

remaining tanker vessels will be applicable to the new regulation, which may result in greater year-to-year emission reductions

Reduction of High GWP Gases in Consumer Products

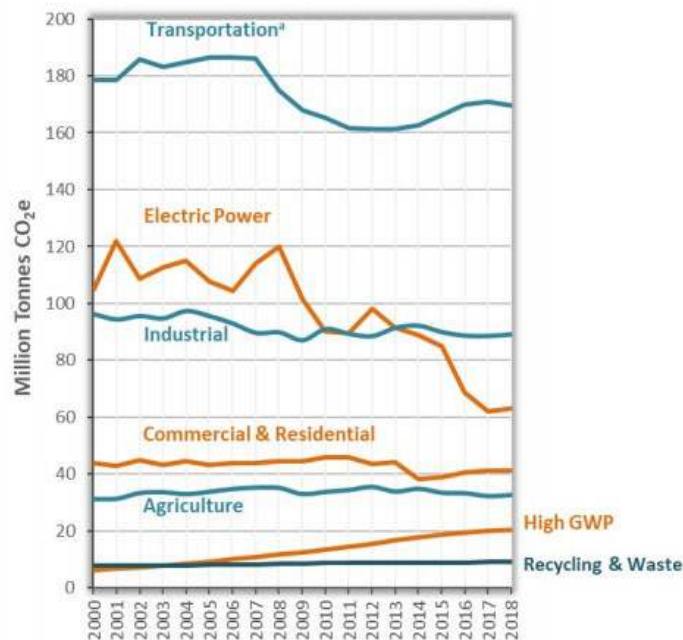
Another early action measure included in the original CARB Scoping Plan was the effort to reduce the use of high global warming potential (GWP) consumer products, such as NO_x-releasing pressurized containers for aerosol cheese and hydrofluorocarbon (HFC) propellant products including boat horn, pressurized gas dusters, and tire inflators. This measure is a part of CARB’s Consumer Products Program, which is a larger effort seeking to reduce toxic air contaminants (TACs), volatile organic compounds (VOCs), and high GWPs in consumer products. This early action measure led to implementation of:

- Regulation for Reducing Emissions from Consumer Products, dated June 2008⁶

In June 2008, amendments were made to the regulation to incorporate GHG emissions reduction efforts to limit pressurized gas duster products, which have high GWP, resulting in greater GHG emissions. It was predicted that adding these limitations would result in about 0.2 million metric tons of carbon dioxide equivalent (MMT_{CO₂e}) emissions reductions each year⁷. In May 2009, further amendments were made to the regulation to ban all compounds with GWPs of 150 or greater in all formulations for Double Phase Aerosol Air Freshener, Multi-Purpose Solvent, and Paint Thinner products.

From 2000 to 2018, there has been a steady increase of HFCs in the United States (U.S.), as shown in Figure 1⁸ below.

Figure 1. Emissions Trends in MMT_{CO₂e} per AB32 Scoping Plan Sector



The figure presents the changes in emissions by Scoping Plan sector from 2008-2018.
Source: CARB

This steady increasing trend of emissions shown above is attributed to high-GWP gases being used as replacements for ozone-depleting substances (ODS) under the 1987 Montreal Protocol. High-GWP gases used as replacements for ozone depleting substances (ODS) experienced a year-to-year average increase of 9.23 percent GHG emissions from 2000 to 2008. From 2008 (when the regulation became effective) to 2018, the average year-to-year increase of these emissions decreased slightly to 6.00 percent. From 2000 to 2018, GHG emissions had an average year-to-year increase of 7.43 percent. However, hydrofluoroolefins (HFOs), which have very low GWPs and shorter atmospheric lifetimes, are now being introduced to the U.S. as replacements for HFCs. On December 2020, CARB passed new legislation mandating that HFC emissions must be reduced 40 percent below 2013 levels by 2030, under California Senate Bill No. 1383 (SB 1383)¹⁹. By implementing this legislation and beginning to incorporate lower-GWP compounds into consumer products, such as HFOs, it is estimated that California will see annual reductions of 3.2 million metric tons of GHG by 2030³⁷.

SmartWay – Heavy-Duty Vehicle GHG Emission Reduction (Aerodynamic Efficiency)

Another important early action measure proposed in the Scoping Plan was the call for Heavy-Duty Vehicle GHG Emission Reduction. This early action measure led to implementation of:

- The Heavy-Duty (Tractor-Trailer) Greenhouse Gas Regulation, dated December 2008⁹

This regulation proposed to increase fuel efficiency of heavy-duty vehicles and tractors with 53-foot or longer box-type trailers, through truck aerodynamics improvements and requiring installation of low rolling resistance tires. In 2010, the regulation was implemented based on the U.S. Environmental Protection Agency's (EPA's) SmartWay program, and required a 2011 model-year or later vehicle, applicable under this rule, may not travel on California highways unless it is an EPA-certified tractor and trailer or is retrofitted to incorporate EPA SmartWay technology. CARB specifies compliance deadlines for vehicles by model year in the regulation. Owners are required to report and update vehicle information and mileage records for travel inside and outside California to determine a compliance status on CARB's online portal, the Truck Regulation Upload, Compliance, and Reporting System (TRUCRS).

By increasing fuel efficiency, the program will reduce GHG emissions reductions and save truck and tractor owners gas expenses by significantly reducing fossil fuel consumption. The program was estimated to help reduce GHG emissions by 0.7 MMTCO_{2e} by 2020 and save vehicle owners and companies around \$5.1 billion from 2010 through 2020¹⁰. Emissions from overall heavy-duty vehicles experienced an average year-to-year increase of 0.53 percent from 2000 to 2008 compared to a 1.53 percent decrease from 2008 to 2018.¹³ From 2000 to 2018, year-to-year emissions decreased at an average rate of 0.61 percent.

Reduction of Perfluorocarbons from Semiconductor Manufacturing

CARB also proposed an early action measure to reduce perfluorocarbons (PFCs) from semiconductors. This early action measure led to implementation of:

- The Regulation to Reduce Greenhouse Gas Emissions from Semiconductor Operations, dated February 2009¹¹

The regulation applies to semiconductor operations that use fluorinated gases (FGs) or heat transfer liquids and established emission standards for operations that emit more than 0.0008 MMTCO_{2e} each year. A survey conducted by CARB in 2007, which was sent to 300 semiconductor operations, showed that for the 2006 calendar year, these operations used 100,978 kilograms (kg) of FGs, emit a very potent GHG called nitrogen fluoride (NF₃), and emitted a total of 0.27 MMTCO_{2e} (MMCO_{2e})¹². Although FGs only account for 4.8% of California’s GHG emissions, per CARB’s 2018 Inventory, these gasses have a very high GWP¹³. **Table 1** below lists the most current GWPs established by CARB from the Fourth Assessment Report (AR4) from GHGs²⁴.

Table 1. GHG GWPs Produced from Human Activities

GHG	Major Sources	Carbon dioxide equivalent (CO _{2e}) Factor
Carbon Dioxide (CO ₂)	Fossil fuel combustion, burning solid waste and trees, industrial manufacturing	1
Methane (CH ₄)	Landfills, production and transport of coal, natural gas and oil, enteric fermentation and other agricultural sources	25
Nitrous Oxide (N ₂ O)	Ammonia production, fertilizer manufacturing, other agricultural; burning transportation fuels	298
Hydrofluorocarbons (HFCs)	Refrigerants, substitutions of ozone depleting substances	124-14,800
Perfluorocarbons (PFCs)	Semiconductor manufacturing, aluminum production	7,390-17,200
Sulfur Hexafluoride (SF ₆)	Electricity transmission and distribution; magnesium production	22,800

Table 1 above features GWPs per the CARB Fourth Assessment Report (AR4) as well as examples of major source categories that generate these emissions.

Source: CARB and Los Angeles County Economic Development Corporation¹⁴

PFCs, which are FGs that are emitted from semiconductors, can have a CO_{2e} factor ranging anywhere from 7,390 to 17,200, with NF₃ having a GWP of 17,200. Some examples of semiconductor operations include processing of diodes, transistors, solar cells, and light-emitting devices. The regulation requires that applicable operators must report their emissions and other records to CARB annually. Projected business-as-usual (BAU) emissions related to semiconductor operations for 2020 are 0.4 MMTCO_{2e}¹⁵ per the 2014 CARB BAU Emission Inventory, and under the Scoping Plan, California is expected to see at least 0.15 MMTCO_{2e} emission reductions in 2020¹⁶.

From 2000 to 2009, GHG emissions from semiconductor manufacturing decreased at an average year-to-year rate of 11 percent. From 2009 to 2018, emissions increased by a rate of 15 percent. The overall average year-to-year emissions rate from 2000 to 2018 was 2 percent. It is important

to note, however, that the total amount of emissions from semiconductor manufacturing from 2000 to 2018 was only 2.35 MMTCO_{2e}, which was 0.03 percent of total GHG emissions in California during that time period.

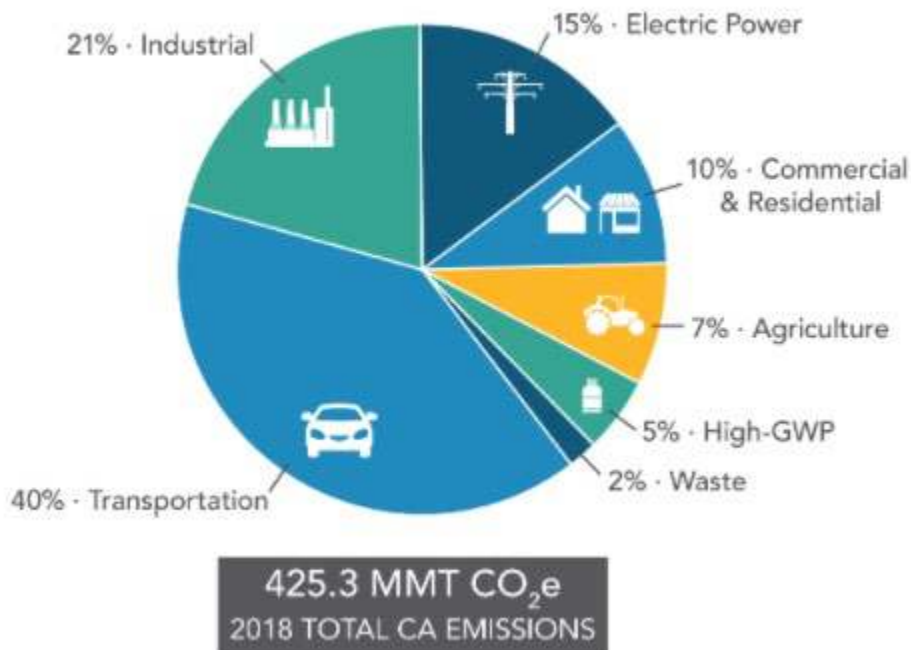
Improved Landfill Gas Capture

The improvement of capturing and collecting landfill gas (LFG) at California landfills is another early action measure, which lead to the implementation of:

- Methane Emissions from Municipal Solid Waste Landfills Regulation (LMR), dated June 2010¹⁷

The LMR requires that owners and operators of active, inactive, and closed municipal waste (MSW) landfills with 450,000 tons of waste-in-place (WIP) or greater, which have accepted waste after January 1, 1977, to install a gas collection and control system (GCCS), monitor methane surface emissions, implement source testing programs, and report records to annually to CARB to demonstrate control efficiency, unless specific exemptions can be meet (e.g. LFG heat input capacity is less than 3.0 million British thermal units per hour [MMBtu/hr]). As shown in **Figure 2** below, waste accounts for 2 percent of total GHG emissions in California, per the CARB 2018 Emission Inventory⁸.

Figure 2. GHG Emissions by Scoping Plan Category



Source: CARB

Landfills also account for approximately 20 percent of California's methane emissions¹⁸. The LMR requires that if a site was to install a flare, that flare must have a methane destruction efficiency of at least 99 percent.. From 2000 to 2010, the average year-to-year rate of emissions was increasing by 1.09 percent. From 2010 to 2018, emissions were increasing at an average rate of 0.49 percent each year, which is more than half the rate of emissions increases that occurred before the LMR. From 2000 to 2018, emissions increased at an average rate of 0.82 percent each year.

To further decrease methane emissions from landfills, California has turned from methane collection to organic waste reduction in landfills, as is evident from SB 1383¹⁹, approved in 2016, and requires the reduction of organic waste disposal to 50 percent by 2020 and to 75 percent by 2025. CARB is working with CalRecycle, the lead agency, to implement the Short-lived Climate Pollutants (SLCP): Organic Waste Reductions Regulations²⁰, which latest draft was published October 2020.

Reduction of HFC-134a from Do-It-Yourself Motor Vehicle Servicing

CARB also included an early action measure to reduce emissions of 1,1,1,2-tetrafluoroethane (HFC-134a) from refrigerants used for self-servicing vehicles under the proposed Do-It Yourself (DIY) Motor Vehicle Servicing effort. This early action measure led to implementation of:

- HFC Regulation for Small Containers of Automotive Refrigerant, dated January 2009²¹

DIY car owners that recharge their own mobile air conditioning (MAC) systems traditionally would purchase small containers of refrigerant, containing between two ounces to two pounds of refrigerant, which is not typically used up in one session and unused contents would be vented to the atmosphere. A commonly used refrigerant for MACs was traditionally R134a, which has a GWP of 1,300.

The regulation requires that all small containers containing automotive refrigerant with a GWP of greater than 150 must have a self-sealing valve, a recycling program, an instruction program that educates consumers on best practices for refrigerant recharging, labels with improved instructions, and require a \$10 deposit from consumers to ensure return of containers for recycling. Annual reporting is required for all manufacturers, distributors, and retailers of these automotive refrigerants. Amendments were made to the regulation in 2017 to incorporate better labelling requirements, specific dates for deposits, and enhanced education programs. The program is expected to achieve emissions reductions of 250,000 MTCO₂e in 2020. Also, the EPA's Significant New Alternatives Policy (SNAP) Program, established under Section 612 of the Clean Air Act (CAA) of 1990, requires use of certain alternatives to ODS. Under, the program, the EPA implemented EPA Rule 20 in July 2015²², which mandated that MAC systems for light duty vehicles will be required to eliminate use of HFC-134a in the U.S by 2021. As mentioned before, high-GWP gases such as HFCs have been used as replacements for ODS. Emissions as a result of these replacements are increasing at an average yearly rate of 5.99 percent from 2009 to 2018, as opposed to an increase of 8.88 percent from 2000 to 2009 which occurred before the program began.

SF₆ Reductions from the Non-Electric Sector

CARB's early action measure to reduce sulfur SF₆ from non-electric sources included the effort to create deadlines to eliminate use of SF₆ from certain specified activities. This early action measure led to implementation of:

- Regulation for Reducing Sulfur Hexafluoride Emissions, dated January 2009²³

Emissions of SF₆ from tracer gas testing, magnesium casting, and military applications were banned as of January 1, 2013 and military tracer gas array applications were banned in January 1, 2020. All other unspecified non-electric activities in the regulation that emit SF₆ were banned as of January 1, 2011. The regulation requires that distributors and purchasers of SF₆ must be registered with CARB and implement recordkeeping and reporting of their usages to be submitted to CARB by March 30th of each year. SF₆ emissions reductions are important as the compound can sustain in the atmosphere for 1,000 to 3,200 years and is 22,800 times more potent than carbon dioxide (CO₂).²⁴

SF₆ emissions from the electric sector are regulated separately from the non-electric sector under the Regulation for Reducing Sulfur Hexafluoride Emissions from Gas Insulated Switchgear, which was established in 2010²⁵. Emissions from gas insulated equipment (GIE) account for most of the SF₆ emissions in California and the new program was expected to decrease GHG emissions by 25,300 metric tons carbon dioxide equivalent (MTCO₂e) each year²⁶. Per EPA's Emission Inventory of U.S. Greenhouse Gas Emissions and Sinks³⁸, SF₆ emissions from electric power transmission systems has decreased by 19.1 MMTCO₂e from 1990 to 2018 in the U.S. Emissions from electricity grid sulfur dioxide losses in California experienced an average year-to-year decrease of 6.95 percent in GHG emissions from 2000 to 2009, and an average year-to-year decrease of 2.29 percent from 2009 to 2018¹³. California expects to see an eventual shift to alternative technology for GIE units in the future, which could potentially reduce emissions further²⁶.

Tire Inflation Program

Another early action measure proposed in the original Scoping Plan was a program to provide recommendations for tire pressure ratings to decrease GHG emissions. This early action measure led to implementation of:

- Regulation for Under Inflated Vehicle Tires, dated March 2009²⁷

The regulation requirements apply to vehicles with a gross vehicle weight of 10,000 pounds or less. The regulation requires vehicle owners to inflate tires to a certain pressure rating during any maintenance activity, indicate on maintenance invoices that tire inflation was performed, perform tire inflations using a pressure gauge with total permissible error no greater than two pounds per square inch (psi), have a tire inflation reference that is current within three years of publication, and keep invoices for at least three years. Service providers that are subject to this regulation include engine repair services, oil services, and smog check services. Nitrogen has become an increasingly more popular alternative to using air for tire inflation as it is cost-

effective, leaks less, and can increase the lifespan of tires, thereby resulting in better fuel economy and reducing GHG emissions. As an example of this, in May 2010, Walmart designated Inflation Solutions Group (ISG) to install nitrogen tire inflation machines at their vehicle servicing centers.²⁸ The Tire Inflation Program is estimated to reduce 700,000 MTCO_{2e} and save consumers 75 million gallons of gasoline each year²⁹.

Low Carbon Fuel Standard (LCFS)

California's transportation sector is responsible for 50 percent (%) of GHG emissions, 80% of NO_x emissions, and 95% of PM emissions in the state. The LCFS early action measure was developed to reduce the carbon intensity (CI) of transportation fuel in California by ten percent by 2020 from a 2010 baseline with the following regulation:

- Low Carbon Fuel Standard Regulation, approved April 15, 2010 and amended November 26, 2012, November 16, 2015, January 4, 2019, and May 27, 2020³⁰

The LCFS promotes the use and manufacturing of fuels with a low CI, as determined through a life cycle analysis (LCA) process. The LCA assesses the direct and indirect effects of producing, distributing, and consuming fuel used in California. CARB establishes CI benchmarks for gasoline and diesel, and the fuels that replace them, which are reduced annually through 2030, and are compared against regulated entities' reports. The CI is measured in grams of CO_{2e} per megajoule (gCO_{2e}/MJ) and measures the GHG emissions associated with an LCA assessment. Fuels with a CI below the annual benchmark generate a credit while fuels with a CI above the annual benchmark generate a deficit.

The recent amendments set a more stringent benchmark of reducing the CI of the transportation fuel pool by at least 20% by 2030 compared to 2010 data, and provide additional opportunities to receive credits including promoting zero emissions vehicle adoption, alternative jet fuel, carbon capture and sequestration (CCS), and advanced technologies to achieve deep de-carbonization in the transportation sector. By encouraging the use of cleaner lower-CI transportation fuels, a monetization of credits tied to the decrease petroleum dependence in the transportation sector has developed to the rebirth of the alternative fuel industry. Low CI/alternative fuels can be manufactured anywhere in the U.S. or world, as long as they are used for transportation use in California, therefore, creating economic From the year 2017 to 2018, emissions in the transportation sector saw its first decrease in GHG emissions ever since 2013, with emissions reductions of 1.5 MMTCO_{2e}¹³. Average year-to-year GHG emissions from 2000 to 2010 decreased by 0.73 percent, and has been steadily increasing year-to-year at rate of 0.24 percent. From 2000 to 2018, the average annual emissions rate is a decrease of 0.26 percent¹³.

EARLY GHG REGULATIONS

AB32 created two separate GHG reporting/reduction pathways which CARB implements. The first step in determining if an entity is subject to the CARB programs is to look at the applicability, reporting, and verification requirements under the MRP, and the second step for an entity to meet its compliance obligation, reducing emissions, and determining the best method for future compliance under the C&T Program. The MRP and C&T Program paved the way and

still set an example for U.S. GHG reporting and compliance programs that work. Below each one is explored.

Mandatory Reporting Program

The Mandatory Reporting Program (MRP) was established under AB32 and requires applicable facilities to report their annual GHG emissions in an emissions data report (EDR) to CARB as required by Reporting Regulation. A unique element of CARB's MRP applicability is that most entities (including facilities, fuel suppliers, CO₂ suppliers, petroleum and natural gas systems) with emission over 10,000 MTCO₂e, mandated facility types required to report regardless of emissions levels (e.g. cement plants and Part 75 electricity generation units), and all electric power entities are required to report under the Reporting Regulation.

In addition to emissions data, reporters must report general information, facility level energy input and output, total GHG emissions, product data, and if applicable, additional reporting requirements (e.g. product data that an range from total clinker produced annually to tomatoes processed annually). Emissions required to be reported include anthropogenic (e.g. combustion of fossil fuels [natural gas or diesel]) and biogenic (e.g. combustion of biogenic fuels [biodiesel or landfill gas] CO₂e emissions. Reporters not subject to the verification or compliance obligations, and have emissions between 10,000 MTCO₂e and 25,000 MTCO₂e, and are able to submit abbreviated reports. All reporters with over 25,000 MTCO₂e or mandated facilities are subject to third party verification by an accredited body. Verifiers must evaluate all reported data and submit a verification statement to CARB stating a positive, qualified positive, or adverse statement of emissions and/or data evaluation.

In 2019, CARB announced that annually reported GHG emissions under the MRR were staying below 1990 levels³². Data showed that California saw a decrease in emissions rates of 1.9 percent³². GHG emissions in the electricity sector were decreased by 4.7 MMTCO₂e (7.4 percent) and emissions from transportation fuels decreased by 3.0 MMTCO₂e (1.7 percent) from 2018 to 2019, with a similar trend expected in the future³². By CARB enforcing programs like the MRP and reporting programs developed as a result of the early action measures in the Scoping Plan, emissions reductions are mandatory; however, as will be explored in the next section, emissions reductions also can provide certain benefits to entities as well.

Cap and Trade Program

The C&T Program takes the total verified covered emissions and product data reported under the MRP to use as an entity's compliance obligation. Inclusions thresholds in Section 95811 of the C&T Regulation include facilities/entities with emission of 25,000 MTCO₂e or more, first deliverers of electricity, and opt-in facilities. Companies reporting in the C&T program account for 80 percent of California's GHG emissions. The program creates a "cap" which is a declining limit occurring each year on GHG emissions for major sources in California and allows companies to buy and sell emissions allowances through a "trade" aspect, creating incentive for entities to reduce emissions.

Covered entities are required to have a Compliance Instrument Tracking System Service (CITSS) account to track compliance instruments that are purchased or sold. An entity's full compliance

period obligations are calculated as total emissions with a compliance obligation (covered emissions) that received a positive, or qualified positive, verification statement. Entities receiving an adverse verification statement would be assigned an emissions level and compliance level by CARB. On November 1st of the preceding calendar year, covered entities must have the required compliance obligation in their CITSS account. One compliance instrument is equal to 1 MTCO_{2e}. Covered entities can meet their compliance obligations through a broker, obtaining allowances through auctions, another party with a CITSS account/compliance obligation or a linked program to obtain compliance instruments such as:

- California GHG Emission Allowances created by CARB (allocations provided by CARB or purchased in an auction)
- CARB Issued Compliance Offset Program Credits called Air Resources Board Offset Credits (ARBOCs) (for the current compliance period up to 4 percent of a compliance obligation can be met using offset credits)
- Compliance instruments issued by a CARB-approved program (e.g. Government of Quebec [effective January 1, 2014] and Government of Ontario [effective January 1, 2018 through June 15, 2018]).

The C&T Program's Compliance Offset Program, allows for offset projects to be located outside of California, and in most of the U.S, subject to the requirements of each Compliance Offset Protocol. As such, this has created opportunities for dairies in Wisconsin, coal mines in West Virginia, ODS destruction facilities in Ohio, and forest in Washington to all generate revenue by reducing GHG emissions outside of California.

In 2019, CARB announced that all California businesses in the C&T program had met their compliance obligation, and achieved a full 100 percent compliance status,³². Today, California is now tackling the next goal to reduce GHG emissions by 40 percent below 1990 levels by the year 2030, which was mandated in Senate Bill 32 (SB 32) of 2016, and is an effort that is also being driven by the C&T program.

SCOPING PLAN UPDATES

Following the success of the initial goals included in the 2008 Scoping Plan, which outlined regulatory framework and recommendations seeking to reduce California's GHG emissions to 1990 levels by 2020, California has since updated the Scoping Plan in 2013 and in 2017 to establish frameworks to continue emissions reductions beyond 2020. In 2013, the Scoping Plan update³³ declared a need for action to reduce emissions mid-century to 80 percent of 1990 levels. This plan recommended new scientific and technological approaches to achieve midterm and long-term emission reductions. The 2017 Scoping Plan³⁴ identified other methods to achieving emissions reductions to 40 percent below the 1990 levels by 2030 and achieving emissions reductions of 80 percent below 1990 levels by 2050, which were mandated in SB 32 of 2016. *Figure 3* below shows emissions reductions estimates for the year 2030, as included in the 2017 Scoping Plan.

Figure 3. Estimated Change in GHG Emissions by Sector (MMTCO_{2e})

	1990	2030 Scoping Plan Ranges ²⁶	% change from 1990
Agriculture	26	24-25	-8 to -4
Residential and Commercial	44	38-40	-14 to -9
Electric Power	108	30-53 ²⁷	-72 to -51
High GWP	3	8-11 ²⁸	267 to 367
Industrial	98	83-90 ²⁹	-15 to -8
Recycling and Waste	7	8-9 ³⁰	14 to 29 ^{**}
Transportation (Including TCU)	152	103-111	-32 to -27
Natural Working Lands Net Sink*	-7 ^{***}	TBD	TBD
Sub Total	431	294-339	-32 to -21
Cap-and-Trade Program	n/a	34-79	n/a
Total	431	260	-40

* Work is underway through 2017 to estimate the range of potential sequestration benefits from the natural and working lands sector.

** The SLCP will reduce emissions in this sector by 40 percent from 2013 levels. However, the 2030 levels are still higher than the 1990 levels as emissions in this sector have grown between 1990 and 2013.

*** This number reflects net results and is different than the intervention targets discussed in Chapter 4.

Source: CARB

SUMMARY

California’s AB 32 legislation has proven to be one of the most successful legislation in the U.S. regarding statewide efforts to reduce GHG emissions. This has been started with the implementation of the early action measures stated in the Scoping Plan, which included early regulations to reduce GHG emissions in many different industry sectors, and then moved to the establishment of the MRP and C&T programs, which have created incentives for facilities to reduce their GHG emissions. The nine early action measures have been documented to reduce California’s GHG emissions with an estimated reduction of 13.16 percent from 1990 emissions in the year 2018¹³. As a result of these programs’ implementations, California has met its goal to reach 1990 emissions levels by 2020 and had done so by 2016, four years prior to its proposed target year.

With the continued implementation of new programs at the state, local, and federal level, growing economic incentives to reduce emissions, and drive that led to the success of the emissions reduction goals of AB32, California is on a very promising path to achieving its latest goals to combat climate change.

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