

2020 Statewide Greenhouse Gas Emissions and the 2020 Target

(base years for forecasting: 2009-2011 emissions)

This document was developed to support the Updated Scoping Plan

		Forecasted Statewide GHG Emissions (MMTCO₂e)
2020 Baseline (2008 Scoping Plan)		596
Pre-economic downturn, Business-As-Usual		↓
		Economic Downturn
Recalculated 2020 Baseline from the Scoping Plan		539
After economic downturn and AR4 GWP update, Business-As-Usual		↓
Measures newly incorporated into inventory (baseline)		↓
Pavley (vehicles model-years 2009-2016)	27 MMTCO ₂ e	Measures incorporated into baseline
<u>Renewables Portfolio Standard (20%)</u>	<u>3 MMTCO₂e</u>	
	30 MMTCO ₂ e	
2020 AB 32 Baseline (adjusted in 2014)		509
Remaining Reductions to Achieve the 2020 Emissions Limit		↓
Energy	25 MMTCO ₂ e	Remaining Reductions to Achieve 2020 Limit
Transportation	23 MMTCO ₂ e	
High-GWP	5 MMTCO ₂ e	
Waste	2 MMTCO ₂ e	
<u>Cap-and-Trade</u>	<u>23 MMTCO₂e</u>	
	78 MMTCO ₂ e	↓
2020 Emissions Limit (updated to AR4 GWP)		431

Greenhouse Gas Reductions from Ongoing, Adopted and Foreseeable Scoping Plan Measures

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Million tonnes of CO2 equivalent (Using AR4 GWP)

Total of All Measures	55.2
Measures in Capped Sectors	49.0
Transportation	22.9
T-1 Advanced Clean Cars	3.1
T-2 Low Carbon Fuel Standard	15.2
T-3 Regional Targets (SB375)	3.0
T-4 Tire Pressure Program	0.6
T-5 Ship Electrification	0.2
T-7 Heavy Duty Aerodynamics	0.9
T-8 Medium/Heavy Hybridization	0.0
Electricity and Natural Gas	25.0
E-1 Energy Efficiency and Conservation	7.8
CR-1 Energy Efficiency and Conservation	4.4
CR-2 Solar Hot Water (AB 1470)	0.1
E-3 Renewable Electricity Standard (20%-33%)	11.5
E-4 Million Solar Roofs	1.1
Industry	
I-1 Energy Efficiency and Co-Benefits Audits for Large Industrial Sources	0.0
Measures in Uncapped Sources/Sectors	7.2
H-1 Motor Vehicle A/C Refrigerant Emissions	0.2
H-3 Reduce Perfluorocarbons in Semiconductor Manufacturing	0.1
H-4 Limit High GWP use in Consumer Products	0.2
H-6 Refrigerant Tracking/Reporting/Repair Deposit Program	4.9
H-6 SF6 Leak Reduction and Recycling in Electrical Applications	0.1
RW-1 Landfill Methane Control Measure	1.8

Last Updated: 03/14/2014

2020 Forecast Update

Method Summary

- No significant change in method from previous forecast made for cap & trade;
- Base year used to forecast is an average of emissions from 2009 thru 2011. Data for 2009, 2010, and 2011 are actual emissions, not back-casted estimates;
- Forecast for a given year developed from base year emissions multiplied by a category-specific growth factor;
- Growth factors are calculated using future year activity surrogates, including fuel demand, expected equipment turnover, head of cattle, amount of waste, etc., and the average activity surrogate values for 2009 – 2011:

Example:

$$2020 \text{ BAU Forecast (MMT)} = \text{Base Year (MMT)} \times \left[\frac{\text{Growth factor}}{\text{Surrogate (2020) / Avg Surrogate (2009-2011)}} \right]$$

- Reductions from individual measures were scaled by the ratio of new forecast value to previous forecast value to update reductions in new forecast “currency”.

Forecast Surrogates

Forecast Surrogate	Elements Impacted	% of Base Year
2011 IEPR Transportation Fuels	Transportation categories using gasoline, diesel, jet fuel, aviation gas, propane, and CNG	36%
(No growth)*	Stationary categories using non-natural gas fuels; electricity imports; other minor categories	26%
2011 IEPR Natural Gas	Non-Electricity Categories using natural gas	15%
ARB Electricity Model	In-state electricity generation using natural gas	9%
FAPRI Forecast**	Livestock and livestock-related emissions	4%
High GWP Model***	ODS substitutes	3%
ARB CEPAM	Fugitive emission categories	2%
ARB Landfill Model	Landfill emissions	2%
ARB Offroad Model	OGV & harborcraft, construction & mining categories	1%
(Extrapolation of historical trend)	Associated gas use in Oil & Gas category	1%
[Forestry]	[No longer in inventory]	0%

*Non-natural gas fuels for stationary sources assumed not to grow due to local air district restrictions on the use of higher polluting fuels (diesel, coke, etc.). Electricity imports not expected to grow substantially in the future due to limited transmission capacity. Other minor categories include fertilizer use, ag burning, etc., in which no substantial growth is anticipated.

** Food and Agricultural Policy Research Institute (FAPRI) is associated with Iowa State and the University of Missouri. FAPRI projections generally assume continuation of current agricultural policies and practices and are based on average weather conditions and historical rates of technological change.

*** Uses New High GWP Model created by Research Division (replaces previous use of USEPA Model)

- High, mid, and low demand forecast scenarios were included in the 2011 IEPR;
- High demand case incorporates relatively high economic/demographic growth, low electricity and natural gas rates, and low efficiency program and self-generation impacts. Low demand case includes lower economic/demographic growth, higher assumed rates, and higher efficiency program and self-generation impacts. Mid-case uses input assumptions at levels between the high and low cases;
- The mid case demand was chosen for the current and new 2020 forecasts—assumes mid-range economic and demographic growth.

Current & New Forecast Comparison

Category	Previous 2020 Forecast (MMT-SAR) [C&T Reg (2010) Version]	New 2020 (MMT-AR4)
BAU Baseline (mid case)	506.8	509.4
Included in Baseline	Pavley I & RPS 20%	Pavley I & RPS 20%
Complimentary Measures	62.0	55.2*
Cap & Trade	18.2	23.5
2020 Target	426.6	430.7

*Does not include -5.0 from Sustainable Forests—forest sector removed from the inventory

Status of Scoping Plan Recommended Measures

The estimated 2020 greenhouse gas (GHG) emission reductions for measures described in the 2008 Scoping Plan were based on the best available information as of December 2008. In support of the 2014 scoping plan update, ARB staff has revised the expected 2020 emission reductions in consideration of the economic recession and the availability of updated information from development of measure-specific regulations. The revised emissions reduction estimates for measures included in the 2008 Scoping Plan recognize the following:

- Development of measure-specific regulations. Regulations adopted by the Board include estimates of reductions anticipated by 2020. These regulations, which reflect ARB's progress towards reducing statewide GHG emissions, include comprehensive documentation detailing the data sources and methods used to develop measures recommended in the Scoping Plan. Each regulation's Initial Statement of Reasons (ISOR) contains the information necessary to evaluate how the reduction was calculated. All ISOR documents are available on ARB's website. If a more detailed explanation (beyond the brief description contained herein) of methods used to update any of the measure reductions is desired, this can be provided by ARB staff.
- Severe and prolonged economic downturn. The revised measure-specific emission reductions consider the economic downturn through the use of an updated GHG emission forecast. In most cases, the reduction was simply scaled (multiplying the original reduction by the ratio of the Updated 2020 Forecast/Old 2020 Forecast of those categories for which the reduction applies). The updated forecast was developed using average emissions over a three-year period (2009-2011) projected to 2020. For energy consuming sectors, the projection is based on future demand for electricity and transportation fuels described in the California Energy Commission's 2011 Integrated Energy Policy Report (IEPR). The IEPR accounts for the recession using economic and demographic data. The 2011 IEPR document is available on the California Energy Commission's website. http://www.energy.ca.gov/2011_energy_policy/documents/
- Use of the Forth Assessment Report (AR4) of Global Warming Potentials. The revised reductions updated the Global Warming Potentials (GWPs) from the Second Assessment Report (SAR) to the Forth Assessment Report (AR4) consistent with the Updated Scoping Plan and the Updated Forecast.

Attachment

2020 Statewide Greenhouse Gas Emissions and the 2020 Target

The 2020 Business-As-Usual (BAU) emissions baseline used in the 2008 Scoping Plan was 596 MMTCO_{2e}. This estimate of statewide 2020 emissions was developed using pre-recession 2007 IEPR data and reflects GHG emissions expected to occur in the absence of any reduction measures in 2010. ARB staff re-evaluated the baseline in light of the economic downturn and updated the projected 2020 emissions using AR4 GWPs to 539 MMTCO_{2e}. Two reduction measures (Pavley I and the Renewables Portfolio Standard (12% - 20%)) not previously included in the 2008 Scoping Plan baseline were incorporated into the updated baseline, further reducing the 2020 statewide emissions projection to 509 MMTCO_{2e}. The updated forecast of 509 MMTCO_{2e} is referred to as the AB 32 2020 baseline. Reduction of an

estimated 78 MMTCO₂e are necessary to reduce statewide emissions to the AR4 updated AB 32 Target of 431 MMTCO₂e by 2020.

ESTIMATED REDUCTIONS FROM CAPPED SOURCES/SECTORS

T-1: Pavley

The Scoping Plan estimated Pavley 2020 reductions as 31.7 MMTCO₂e, of which 27.7 was identified as Pavley and 4.0 as Advanced Clean Cars. The California Energy Commission (CEC) 2011 Integrated Energy Policy Report (IEPR) fuel forecast was referenced in combination with the ARB's EMFAC 2011 model of on-road vehicle activity and emissions to estimate the reduction attributed to the Pavley portion (vehicles model-years 2009-2016) of this measure under post-economic downturn conditions, resulting in an estimated reduction of 26.8 MMTCO₂e. Pavley has been incorporated into ARB baseline inventories.

<http://www.arb.ca.gov/cc/ccms/ccms.htm>

T-1: Advanced Clean Cars

In the Scoping Plan this measure was estimated to reduce 4.0 MMTCO₂e, which has been adjusted to reflect the economic downturn as described for the Pavley regulation (see above). The resulting estimated reduction is 3.1 MMTCO₂e. The Advanced Clean Car measure is under development and focuses on vehicles model-years 2017-2025.

http://www.arb.ca.gov/msprog/clean_cars/clean_cars.htm

T-2: Low Carbon Fuel Standard (LCFS)

In the Scoping Plan, the LCFS was estimated to achieve 15.0 MMTCO₂e reductions in 2020. Based on the proposed regulation, the reduction in the ISOR was calculated as 15.8 MMTCO₂e. In order to reflect changed economic conditions, the estimated reduction from the regulation was recalculated using the same methodology as the Scoping Plan but with more recent data, resulting in an estimated reduction of 15.2 MMTCO₂e.

<http://www.arb.ca.gov/fuels/lcfs/lcfs.htm>

T-3: Regional Transportation-Related GHG Targets

The Scoping Plan identified 5.0 MMTCO₂e as a placeholder for what could be achieved by the Sustainable Communities and Climate Protection Act of 2008 (SB 375) through sustainable regional transportation and local land use planning. The SB 375 Staff Report identifies 3.0 MMTCO₂e, which is the aggregate from the regional passenger vehicle GHG reduction targets established for the 18 Metropolitan Planning Organizations approved in 2010.

http://arb.ca.gov/cc/sb375/staffreport_sb375080910.pdf

T-4: Vehicle Efficiency Measures

Vehicle efficiency measures in the Scoping Plan include Low Friction Oil, Tire Pressure Regulation, Tire Tread Program, and Solar Reflective Automotive Paint and Window Glazing. In the Scoping Plan, these measures were estimated to achieve a combined reduction of 4.5 MMTCO₂e in 2020.

The Tire Pressure Regulation is approved and the estimated reduction identified in the ISOR is unchanged from the Scoping Plan estimate of 0.6 MMTCO₂e. The Tire Tread Program (0.3 MMTCO₂e in the Scoping Plan) is under evaluation and potential reductions are uncertain at this time. Low Friction Oil has been achieved in practice (2.8 MMTCO₂e in the Scoping Plan). Potential reductions through cool car design are to be considered as part of the Advanced Clean Cars measure.

<http://www.arb.ca.gov/regact/2009/tirepres09/tireisor.pdf>

T-5: Ship Electrification

The Scoping Plan attributed 0.2 MMTCO₂e of reductions to the Shore Power for Ocean-going Vessels measure. The ISOR for this regulation estimated potential reductions to range between 0.12 and 0.24 MMTCO₂e. The estimated reduction of 0.2 MMTCO₂e identified in the Scoping Plan is considered representative of this measure.

<http://www.arb.ca.gov/ports/shorepower/shorepower.htm>

T-6: Goods Movement

Goods Movement includes measures to reduce emissions from shipping and port operations including such actions as reducing vessel speed and electrifying port equipment. The Scoping Plan attributed 3.5 MMTCO₂e to these system-wide measures. System-wide efficiency improvements are in progress but are not likely to provide significant GHG reductions by 2020.

<http://www.arb.ca.gov/planning/gmerp/gmerp.htm>

T-7 & T-8: Medium/Heavy Duty Vehicles

The Scoping Plan identified potential reductions of 0.9 MMTCO₂e from the Heavy Duty Aerodynamic Efficiency measure and 0.5 MMTCO₂e from the Medium/Heavy Hybridization measure.

The Heavy Duty Aerodynamics measure is approved and the ISOR identifies 1.0 MMTCO₂e of reductions, which has been adjusted proportional to the economic downturn resulting in an estimated reduction of 0.9 MMTCO₂e in 2020. The hybridization measure is under evaluation and potential reductions are uncertain at this time.

<http://www.arb.ca.gov/regact/2008/ghghdv08/ghqisor.pdf>

T-9: High Speed Rail

The Scoping Plan attributed 1.0 MMTCO₂e of reductions to the development of High Speed Rail. This measure is being implemented under an approved bond measure and Federal grant; but is not likely to provide significant GHG reductions by 2020.

E-1: Energy Efficiency

Energy efficiency consists of several programs that include building and appliance efficiency. The measure has been adjusted to reflect changed economic conditions using the methodology in the Scoping Plan but with more current data from the 2011 IEPR. The updated forecast includes the E-3: Renewable Portfolio Standard (20%) as part of the baseline and this causes the updated reductions to decrease. The estimated reduction is updated from 15.2 MMTCO₂e to 7.8 MMTCO₂e. Achievement of these emission reductions is dependent on continued funding and implementation of efficiency programs.

CR-1 & CR-2: Conservation and Solar Hot Water

These measures include building and appliance efficiency and solar water heating (AB 1470 goal).

The reduction attributed to Conservation and Solar Water Heating in the Scoping Plan, 4.4 MMTCO₂e, has been adjusted to reflect the changed economic conditions, resulting in an estimated reduction of 4.5 MMTCO₂e in 2020. The Solar Water Heating measure is being implemented and funded by the CPUC as a component of the California Solar Initiative, Thermal Development Program.

<http://www.cpuc.ca.gov/PUC/energy/Solar/thermhistory.htm>

E-2: Increasing Combined Heat and Power

The reduction attributed to this measure in the Scoping Plan was 6.7 MMTCO₂e. The CPUC recently approved a settlement designed to increase the amount of CHP operated by Independently Owned Utilities (IOUs) in the State. The settlement identifies a 4.8 MMTCO₂e incremental GHG emission reduction goal by 2020. However, due to accounting differences between the Scoping Plan and the settlement, actual reductions in 2020 may differ from the 4.8 MMTCO₂e. Actual reductions associated with this measure remain uncertain at this time.

E-3: Renewables Portfolio Standard (RPS, 20% by 2012)

In the 2008 Scoping Plan, renewables were estimated to achieve 21.3 MMTCO₂e of GHG reductions in 2020, of which 7.9 MMTCO₂e would be achieved by the RPS (12%-20%) and 13.4 MMTCO₂e would be achieved by the Renewable Electricity Standard (RES, 20%-33%). Estimated RPS reductions in 2020 have been updated to reflect changed economic conditions based on the 2011 IEPR demand forecast, but most importantly, to reflect that this program has almost achieved its 2012 goal. The updated forecast begins with a base year of 2009-2011, and that means very little

remains for this program to obtain by 2012, having already obtained the majority of its impact. The reductions yet to be obtained are 3.1 MMTCO₂e. The updated RPS reduction has been incorporated into ARB baseline inventories. The RPS program is administered by the California Public Utilities Commission (CPUC).

<http://www.cpuc.ca.gov/PUC/energy/Renewables/>

E-3: Renewable Electricity Standard (RES, 33%)

The RES measure was estimated to provide 13.4 MMTCO₂e of reductions in the Scoping Plan (see above). Estimated emission reductions are presumed to be substantially equivalent to those identified in a Staff Report (ISOR) prepared by ARB in 2010 which estimated reductions as 12.0 MMTCO₂e. Reductions associated with unbundled Renewable Energy Credits (RECs) were subtracted from the ISOR value and then adjustments were made to reflect changed economic conditions based on the 2011 IEPR demand forecast, yielding a final value of 11.5 MMTCO₂e. This measure is being implemented by the CEC and CPUC under SBX1-2, signed by Governor Brown in April 2011.

<http://www.energy.ca.gov/renewables/>

<http://www.arb.ca.gov/regact/2010/res2010/res10isor.pdf>

http://leginfo.ca.gov/pub/11-12/bill/sen/sb_0001-0050/sbx1_2_bill_20110412_chaptered.pdf

E-4: Million Solar Roofs

The Scoping Plan estimated this measure, part of The California Solar Initiative, could obtain 2.1 MMTCO₂e of reductions in 2020. The estimated reduction has been recalculated using the same methodology as that presented in the Scoping Plan with an updated grid emission factor, then proportionally adjusted to reflect the economic downturn, resulting in an estimated reduction of 1.1 MMTCO₂e in 2020. The measure is being implemented and funded by the CEC and CPUC as a component of the California Solar Initiative program.

http://www.energy.ca.gov/ghg_emissions/index.html

<http://www.cpuc.ca.gov/PUC/energy/Solar/aboutsolar.htm>

I-1 Through I-5: Industrial Measures (for sources covered under cap-and-trade program)

Industrial measures include Refinery Measures, Oil & Gas Extraction and Transmission Measures, and Energy Efficiency & Co-Benefits Audits. The Scoping Plan identified potential reductions of 1.4 MMTCO₂e in 2020. These measures are under evaluation, so potential reductions are uncertain at this time.

<http://www.arb.ca.gov/cc/energyaudits/energyaudits.htm>

<http://www.arb.ca.gov/cc/oil-gas/oil-gas.htm>

<http://www.arb.ca.gov/cc/gas-trans/gas-trans.htm>

Cap-and-Trade

The cap-and-trade regulation would establish a declining limit (cap) on 85-percent of statewide GHG emissions. The declining cap established in the regulation would

ensure that all necessary reductions occur to meet the 2020 target, even if the estimated reductions from other measures discussed above fall short.

<http://www.arb.ca.gov/cc/capandtrade/capandtrade.htm>

ESTIMATED REDUCTIONS FROM UNCAPPED SOURCES/SECTORS

High Global Warming Potential (GWP) Gas Measures

The Scoping Plan identified seven high GWP measures with the potential to reduce an estimated 20.2 MMTCO_{2e}. The Scoping Plan value now reflects only feasible measures, adjusted proportional to the economic downturn and corrected to reflect AR4 GWPs, resulting in an estimated overall reduction of 5.4 MMTCO_{2e}.

H-1: Motor Vehicle Air/Conditioning

The Scoping Plan estimated this measure to achieve 0.3 MMTCO_{2e} of reductions by 2020. This regulation is adopted. The Scoping Plan value has been adjusted proportional to the economic downturn and corrected to reflect AR4 GWPs, resulting in an estimated reduction of 0.2 MMTCO_{2e}.

H-2: SF₆ Reductions from Non-Utility and Non-Semiconductor Applications

This measure is adopted, and was estimated by the Scoping Plan to achieve 0.3 MMTCO_{2e} of reductions in 2020. However, these particular SF₆ emissions are not in the ARB inventory and therefore cannot be tracked, so potential reductions are considered uncertain.

H-3: Semiconductor Manufacturing

Semiconductor manufacturing was estimated to achieve 0.2 MMTCO_{2e} of reductions by 2020 in the Scoping Plan. This regulation is adopted. The Scoping Plan value has been adjusted proportional to the economic downturn and corrected to reflect AR4 GWPs, resulting in an estimated reduction of 0.1 MMTCO_{2e}.

H-4: Consumer Products

Consumer Products was estimated to achieve 0.3 MMTCO_{2e} of reductions by 2020 in the Scoping Plan. This regulation is adopted and the ISOR calculated value, adjusted proportional to the economic downturn and corrected to reflect AR4 GWPs, is 0.2 MMTCO_{2e}.

H-5: High GWP Reductions from Mobile Sources

High GWP reductions from mobile sources were estimated to achieve 3.3 MMTCO_{2e} of reductions by 2020 in the Scoping Plan. The mobile air conditioning component of this measure will be considered in the Advanced Clean Cars measure. The leak test,

refrigerant recovery, and Federal ban components are under evaluation and potential reductions are uncertain at this time.

H-6: High GWP Reductions from Stationary Sources

High GWP reductions from Stationary Sources includes refrigerant management, foam recovery and destruction, SF₆ leak reduction, the use of alternative suppressants in fire protection, and early retirement of residential refrigerators, which combined were estimated to achieve 10.9 MMTCO₂e of reductions by 2020 in the Scoping Plan. The estimated reduction identified in the Refrigerant Management Program ISOR is 7.2 which adjusted proportionally to the economic downturn and corrected to reflect AR4 GWPs results in an estimated reduction of 4.9 MMTCO₂e. The ISOR for SF₆ leak reduction corrected to reflect AR4 GWPs identifies a potential reduction of 0.1 MMTCO₂e. The remaining components of H-6 are under evaluation and potential reductions are uncertain at this time.

H-7: Mitigation Fee on High GWP Gases

The Mitigation Fee on High GWP Gases was estimated to achieve 5.0 MMTCO₂e of reductions by 2020 in the Scoping Plan. Implementation of a mitigation fee on high GWP gases is not considered feasible at this time.

<http://www.arb.ca.gov/regact/2009/semi2009/semiisor.pdf>

<http://www.arb.ca.gov/regact/2008/cp2008/cpisor08.pdf>

<http://www.arb.ca.gov/regact/2009/gwprmp09/isorref.pdf>

RW-1: Recycling and Waste (landfill methane capture)

The Scoping Plan estimated the potential reduction from landfill methane capture as 1.0 MMTCO₂e. The ISOR estimate corrected to reflect AR4 GWPs is 1.8 MMTCO₂e by 2020.

<http://www.arb.ca.gov/regact/2009/landfills09/isor.pdf>

F-1: Sustainable Forests

The Scoping Plan estimated that sustainable forest practices could achieve 5.0 MMTCO₂e of reduction through sequestration. The forestry sector now resides in the forest and natural land inventory apart from the GHG Inventory focused on anthropogenic emissions, and is in process of incorporating much improved emissions estimates. Until the studies underway undergirding these improvements are completed and updated estimates can be made, revised reductions from this measure are unavailable.

<http://www.arb.ca.gov/cc/forestry/forestry.htm>