APPENDIX F

Greenhouse Gas Reduction Measures Analysis.

IRVINE CLIMATE ACTION AND ADAPTATION PLAN

Memo

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Date: April 7, 2025

To: City of Irvine – CAAP Project Team

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Subject: Irvine Climate Action and Adaptation Plan: Measures to Reduce Greenhouse Gas Emissions

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This memorandum summarizes the measures to reduce greenhouse gas (GHG) emissions for the City of Irvine's (City's) Climate Action and Adaptation Plan (CAAP) and their associated GHG reduction potential with implementation ,. The measures include a quantified GHG reduction potential for the years 2030 and 2040 (where feasible based on available data, research, and other evidence) to demonstrate technically feasible pathways that could achieve the 2030 and 2040 GHG reduction targets of the CAAP.

QUANTIFYING MEASURES TO REDUCE GHG EMISSIONS BY 2030 AND 2040

The CAAP includes a total of 54 measures to reduce communitywide GHG emissions that are organized under 20 strategies. The measures were analyzed to quantify their GHG emissions reduction potential in 2030 and 2040, where feasible, based on available data, research, and other evidence. In addition to GHG reduction potential, the quantified measures include performance metrics that could feasibly be achieved by the target years, and citations to research, data sources, and other evidence used to substantiate the calculations.

The primary reference for the quantification of GHG emission reduction potential is the California Air Pollution Control Officers Association (CAPCOA) *Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity*. The Handbook provides guidance specifically addressing appropriate procedures to apply quantification methods to achieve accurate and reliable results using the best information available. The Handbook also identifies measures that qualitatively help reduce GHG emissions, but which cannot be reliably quantified at this time. In addition, some measures are quantifiable at a project or site-specific level, but cannot be reliably quantified at the larger scale of an entire city or community. Lastly, the Handbook also provides guidance for calculating the combined reductions from multiple measures that address the same source or activity, so that synergies are accurately and reliably accounted for and potential for double-counting is avoided. This is because there are instances in which certain measures have diminishing returns when implemented together, and other instances in which there is competition among measures (CAPCOA 2021).

A total of 13 measures were quantified for future GHG reduction potential with successful implementation. An overview of the performance metrics and GHG reduction potential for each of the 13 quantified measures is provided for the years 2030 and 2040 in the following sections. Additional detail on GHG reduction quantification methods and calculations can be found in Attachment A.

Summary of 2030 Results

The measure quantification performed for 2030 shows the City reducing emissions to 51% below 2019 levels, which exceeds the GHG reduction target of reducing emissions to 44% below 2019 levels, after considering the GHG reduction impact of current State, federal, and local actions (see *Comparison of GHG Reduction Potential of Measures to GHG Reduction Targets*). A summary of all measures with quantified GHG reduction potential, and their associated performance metrics for the year 2030, is provided in Table 1.

Table 1 Summary of Measures with GHG Reduction Potential in 2030

Strategy	Measure	2030 Performance Metric	2030 GHG Emission Reduction Potential ($MTCO_2e$/year)	Percentage of Total 2030 Reductions
Energy Efficiency and Electrification	BE-1.2 Retrofit existing residential buildings (single family, and multi-family less than 20,000 square feet) to improve energy efficiency and facilitate fuel switching.	14% Target electrification rate for existing residential single-family and existing residential multi-family buildings less than 20,000 square feet	14,737	3%
Energy Efficiency and Electrification	BE-1.3 Retrofit existing multi-family (20,000 square feet and larger) and nonresidential buildings to improve energy efficiency and facilitate fuel switching.	7% Target electrification rate for existing non-residential buildings and existing residential multi-family buildings greater than 20,000 square feet	10,178	2%
Energy Efficiency and Electrification	BE-2.1 Eliminate the use of natural gas in new development.	90% Target electrification rate for new development	4,999	1%
Energy Efficiency and Electrification	BE-3.1 Enroll 100% of communitywide accounts in 100% renewable/zero-carbon option from OCPA.	5% VMT reduction from SB 743 and increased density	111,572	26%
Transportation and Land Use	TR-1.1 Increase high-density, transit-oriented development along primary corridors to reduce time spent traveling.	30% Target EV/PHEV Population (light-duty vehicles)	331	<1%
Transportation and Land Use	TR-2.1 Increase electric vehicle (EV) charging infrastructure.	15% Target EV/PHEV Population (medium/heavy-duty vehicles)	93,012	21%
Transportation and Land Use	TR-3.1 Enhance and expand transit facilities and infrastructure to access a broader ridership.	8% VMT reduction	46,586	11%
Transportation and Land Use	TR-4.1 Develop more protected bikeways.	6% VMT reduction	36,772	8%
Off-Road Vehicles and Equipment	OR-1.1 Reduce emissions from landscaping equipment such as leaf blowers by supporting a transition to electric equipment.	12% ZEV landscaping equipment	79	<1%
Off-Road Vehicles and Equipment	OR-1.2 Reduce emissions from construction equipment by supporting a transition to electric equipment.	10% ZEV construction equipment	1,856	<1%

Solid Waste	SW-1.1 Eliminate the disposal of organic solid waste in landfills to reduce methane emissions.	80% of waste diverted from landfill	111,388	26%
Water and Wastewater	W-1.1 Reduce water consumption in buildings through conservation campaigns and water efficiency measures.	5% Water consumption reduction target	378	<1%
Resilience, Green Economy, and Carbon Sequestration	MS-1.1 Protect and enhance native trees and vegetation.	5,000 Trees planted per year	1,376	<1%
Total			**433,266**	**100%**

Notes: EV = electric vehicle; GHG = greenhouse gas; $MTCO_2e$ = metric tons of carbon dioxide equivalent; OCPA = Orange County Power Authority; PHEV; plug-in hybrid electric vehicle; SB = senate bill; VMT = vehicle miles traveled; ZEV = zero emissions vehicle.

Source: Ascent 2024.

Summary of 2040 Results

The measure quantification performed for 2040 shows the City reducing emissions to 92% below 2019 levels, which exceeds the GHG reduction target of reducing emissions to 90% below 2019 levels, after considering the GHG reduction impact of current State, federal, and local actions (see *Comparison of GHG Reduction Potential of Measures to GHG Reduction Targets*). A summary of all measures with quantified GHG reduction potential, and their associated performance metrics for the year 2040, is provided in Table 2.

Table 2 Summary of Measures with GHG Reduction Potential in 2040

Strategy	Measure	2040 Performance Metric	2040 GHG Emission Reduction Potential ($MTCO_2e$/year)	Percentage of Total 2040 Reductions
Energy Efficiency and Electrification	BE-1.2 Retrofit existing residential buildings (single family, and multi-family less than 20,000 square feet) to improve energy efficiency and facilitate fuel switching.	90% Target electrification rate for existing residential single-family and existing residential multi-family buildings less than 20,000 square feet	116,730	14%
Energy Efficiency and Electrification	BE-1.3 Retrofit existing multi-family (20,000 square feet and larger) and nonresidential buildings to improve energy efficiency and facilitate fuel switching.	90% Target electrification rate for existing non-residential buildings and existing residential multi-family buildings greater than 20,000 square feet	167,554	20%
Energy Efficiency and Electrification	BE-2.1 Eliminate the use of natural gas in new development.	95% Target electrification rate for new development	19,677	2%
Energy Efficiency and Electrification	BE-3.1 Enroll 100% of communitywide accounts in 100% renewable/zero-carbon option from OCPA.	10% VMT reduction from SB 743 and increased density	45,561	5%
Transportation and Land Use	TR-1.1 Increase high-density, transit-oriented development along primary corridors to reduce time spent traveling.	90% Target EV/PHEV Population (light-duty vehicles)	241	<1%
Transportation and Land Use	TR-2.1 Increase electric vehicle (EV) charging infrastructure.	90% Target EV/PHEV Population (medium/heavy-duty vehicles)	294,313	36%
Transportation and	TR-3.1 Enhance and expand transit	10% VMT reduction	11,922	1%

Land Use	facilities and infrastructure to access a broader ridership.			
Transportation and Land Use	TR-4.1 Develop more protected bikeways.	6% VMT reduction	6,867	1%
Off-Road Vehicles and Equipment	OR-1.1 Reduce emissions from landscaping equipment such as leaf blowers by supporting a transition to electric equipment.	90% ZEV landscaping equipment	758	<1%
Off-Road Vehicles and Equipment	OR-1.2 Reduce emissions from construction equipment by supporting a transition to electric equipment.	30% ZEV construction equipment	7,165	1%
Solid Waste	SW-1.1 Eliminate the disposal of organic solid waste in landfills to reduce methane emissions.	90% of waste diverted from landfill	153,933	19%
Water and Wastewater	W-1.1 Reduce water consumption in buildings through conservation campaigns and water efficiency measures.	10% Water consumption reduction target	183	<1%
Resilience, Green Economy, and Carbon Sequestration	MS-1.1 Protect and enhance native trees and vegetation.	5,000 Trees planted per year	3,670	<1%
Total			**828,574**	**100%**

Notes: EV = electric vehicle; GHG = greenhouse gas; $MTCO_2e$ = metric tons of carbon dioxide equivalent; OCPA = Orange County Power Authority; PHEV; plug-in hybrid electric vehicle; SB = senate bill; VMT = vehicle miles traveled; ZEV = zero emissions vehicle.

Source: Ascent 2024.

COMPARISON OF GHG REDUCTION POTENTIAL OF MEASURES TO GHG REDUCTION TARGETS

A comparison of the combined GHG reduction potential of the CAAP Measures to the City's GHG reduction targets shows that implementation of the 13 quantified measures in the CAAP would place the City on a trajectory to reduce communitywide GHG reduction levels to meet the targets for the years 2030 and 2040. Table 3 provides a summary of the combined GHG reduction potential of all measures compared to the City's GHG reduction targets and projected GHG emissions under a legislative-adjusted business-as-usual scenario.[1]

[1] The legislative-adjusted business-as-usual scenario provides an estimate of how future GHG emissions in the City of Irvine would change from baseline levels, considering expected growth in the city and the GHG reduction impact of current State, federal, and local actions.

Table 3 GHG Reduction Potential of Measures Compared to GHG Reduction Targets ($MTCO_2e$/year)

GHG Emissions Scenario	2030	2040
Legislative-Adjusted Business-as-Usual Scenario Forecast	1,512,383	1,013,100
GHG Reductions from CAAP Measures	433,266	828,574
GHG Emissions with Implementation of CAAP Measures	1,079,117	184,526
Target GHG Emissions for CAAP GHG Reduction Targets	1,252,503	224,759
Difference Between GHG Emissions with Implementation of CAAP Measures and Target GHG Emissions	-173,385	-40,233
CAAP GHG Reduction Target Met?	Yes	Yes

Notes: CAAP = Climate Action and Adaptation Plan; GHG = greenhouse gas; $MTCO_2e$ = metric tons of carbon dioxide equivalent.

Source: Ascent 2024.

REFERENCES

California Air Pollution Control Officers Association. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. Available: https://www.caleemod.com/handbook/full_handbook.html. Accessed April 4, 2025.

CAPCOA. *See* California Air Pollution Control Officers Association.

Attachment A

BE-1.2
Building Energy Measures

Retrofit existing residential buildings (single family, and multi-family less than 20,000 square feet) to improve energy efficiency and facilitate fuel switching.	**2030**	**2040**	**Notes**
Gas Usage (therms)	25,871,975	25,871,975	
REDUCTIONS			
Target Electrification Rate [1]	14%	90%	Assumes start date of 1/1/2026 for retrofits. See BE ProrateElectrificationRates tab for more details on this calculation.
Reduced natural gas usage (therms)	3,728,116	23,284,777	
Natural gas emissions factor (MTCO2e/therm)	0.00532	0.00532	
GHG reductions from existing development natural gas savings (MTCO2e)	19,840	123,918	
INCREASES			
Total therms offset by switch to electric heating use	4,779,636	29,852,279	
Total electricity needed to offset natural gas heating (MWh)	140,044	874,675	
Electricity emissions factor (MTCO2e/MWh)	0.0364	0.0082	
Additional GHG emissions from electricity use (MTCO2e)	5,103	7,188	
Net GHG Reductions (MTCO2e)	**14,737**	**116,730**	

Sources:
[1] 2030 rate derived from Mozingo. 2021. Zero-Carbon Buildings in California: A Feasibility Study. 2040 rate set in order to meet 2040 carbon goal.

BE-1.3
Building Energy Measures

Retrofit existing multi-family (20,000 square feet and larger) and nonresidential buildings to improve energy efficiency and facilitate fuel switching.	**2030**	**2040**	**Notes**
Gas Usage (therms)	37,136,580	37,136,580	
REDUCTIONS			
Target Electrification Rate	7%	90%	Assumes start date of 1/1/2026 for retrofits.
Reduced natural gas usage (therms)	2,574,806	33,422,922	
Natural gas emissions factor (MTCO2e/therm)	0.00532	0.00532	
GHG reductions from existing development natural gas savings (MTCO2e)	13,703	177,872	
INCREASES			
Total therms offset from natural gas heating use (therms)	3,301,033	42,849,900	
Total electricity needed to offset natural gas heating (MWh)	96,721	1,255,506	
Electricity emissions factor (MTCO2e/MWh)	0.0364	0.0082	
Additional GHG emissions from electricity use (MTCO2e)	3,524	10,317	
Net GHG Reductions (MTCO2e)	**10,178**	**167,554**	

Sources:
[1] Mozingo. 2021. Zero-Carbon Buildings in California: A Feasibility Study

Calculate weighted average target electrification rates from Mozingo (for 2030 targets only)	
Residential percent electrified	14%
Non-Residential percent electrified	5%
Residential therm usage	19%
Non-residential therm usage	81%
Weighted average electrification rate	7%

BE-2.1
Building Energy Measures

Eliminate the use of natural gas in new development.	**2019**	**2030**	**2040**	**Notes**
Target electrification rate for new development		90%	95%	Assumes 01/2026 start date for measure implementation.
Reduced natural gas usage (therms)		1,264,661	3,925,134	See "BE Calculate Therm Reduction" tab for details
Natural gas emissions factor (MTCO2e/therm)		0.00532	0.00532	
GHG reductions from existing development natural gas savings (MTCO2e)		6,730	20,889	
INCREASES				
Total therms offset from natural gas heating use (therms)		1,621,361	5,032,223	
Total electricity needed to offset natural gas heating (MWh)		47,506	147,445	
Electricity emissions factor (MTCO2e/MWh)		0.0364	0.0082	
Additional GHG emissions from electricity use (MTCO2e)		1,731	1,212	
Net GHG Reductions (MTCO2e)		**4,999**	**19,677**	

BE-3.1
Building Energy Measures

Enroll 100% of communitywide accounts in 100% renewable/zero-carbon option from OCPA.		**2030**	**2040**
Total legislative-adjusted electricity emissions (MTCO2e)		97,101	23,822
Additional electricity emissions from other measures (MTCO2e)			
	BE-1.2	*5,103*	*7,188*
	BE-1.3	*3,524*	*10,317*
	BE 2.1	*1,731*	*1,212*
	TR-2.1	*3,793*	*2,760*
	OR-1.1	*14*	*26*
	OR-1.2	*305*	*236*
Adjusted electricity emissions reductions from 100% carbon-free electricity (MTCO2e)		111,572	45,561
GHG Reductions (MTCO2e)		**111,572**	**45,561**

TR-1.1
Transportation and Land Use Measures

Increase high-density, transit-oriented development along primary corridors to reduce time spent traveling.	**2019**	**2030**	**2040**
Annual passenger vehicle miles traveled (VMT)	2,776,414,419	2,806,331,343	2,833,528,546
New passenger VMT		29,916,924	57,114,128
Percent VMT reduction from SB 743 and increased density [1]		5%	10%
Reduced passenger VMT from SB 743 and increased density [1]		1,495,846	5,711,413
Passenger vehicle emissions factor (g CO2e/mile) - assuming implementation of TR-2.1		221	42
GHG reductions from passenger vehicles (MTCO2e)		331	241
GHG Reductions (MTCO2e)		**331**	**241**

Notes:
[1] Increased density is relative to General Plan growth assumptions used in the GHG emissions projections.

TR-2.1
Transportation and Land Use Measures

Transition to low- and zero-emission vehicles.	**2030**	**2040**	**Notes**
City of Irvine population	317,246	340,993	
Orange County population	3,440,882	3,531,540	
Population ratio (City vs County)	9.2%	9.7%	
Install EV charging stations for LDVs			
EV Forecasts and Targets			
EMFAC2021 ACC II Light Duty Pop - Countywide [1]	2,250,739	2,352,687	
EMFAC2021 ACC II Light Duty Pop - Irvine	207,516	227,167	
EMFAC2021 ACC II Light Duty EV/PHEV Pop - Countywide [1]	476,275	1,595,092	
EMFAC2021 ACC II Light Duty EV/PHEV Pop - Irvine	43,912	154,016	
Calculated EMFAC2021 ACC II Light Duty EV/PHEV percentage	21%	68%	
Targeted EV/PHEV Pop percentage under TR-2.1	30%	90%	
Increased EV/PHEV Pop percentage under TR-2.1	9%	22%	
Targeted EV/PHEV Pop under TR-2.1	62,255	204,450	
Additional EV/PHEV Pop under TR-2.1	18,343	50,434	
EMFAC2021 EV:PHEV Ratio with ACC II adjustments	4.7	8.1	
Additional EV Pop under TR-2.1	15,098	44,905	
Additional PHEV Pop under TR-2.1	3,245	5,529	

Additional GHG emissions from EVs		
Average annual miles per EV (mi/vehicle) [1]	15,818	14,084
New EV VMT under measure	238,812,520	632,444,028
Average Efficiency of EV LDV (kWh/100-mi) [2]	38.60	38.60
Charged amount (kWh)	92,181,633	244,123,395
Charged amount (MWh)	92,182	244,123
Electricity emissions factor (MTCO2e/MWh) (SCE and OCPA weighted average)	0.036	0.008
Additional GHG emissions from EVs (MTCO2e)	3,359	2,006
Additional GHG emissions from PHEVs		
Average annual miles per PHEV (mi/vehicle) [1]	16,388	14,878
New PHEV VMT under measure	53,175,653	82,260,077
Average emissions factor from PHEV (gCO2e/mi) [1]	129	123
Additional PHEV emissions under measure (MTCO2e)	6,836	10,150
Emissions avoided from Equivalent Gasoline/Diesel Vehicles		
Average emissions factor from Gasoline/Diesel mix (gCO2e/mi) [1]	307	300
Average annual miles per Gasoline/Diesel (mi/vehicle) [1]	12,746	9,682
Reduced Gasoline/Diesel VMT (mi)	291,988,173	714,704,106
Reduced Gasoline/Diesel emissions under TR-2.1 (MTCO2e)	89,530	214,302
Total Emission Reductions from Increased LDV EV/PHEV Mix (MTCO2e)	**79,335**	**202,146**
Install EV charging stations for Medium and Heavy-duty vehicles		

State-level EV Forecasts and Targets	2030		2040	Notes
Statewide Medium- and Heavy-Duty Population [3]	5,415,082	**NA**		The method for determining 2040 values differs from the method for 2030.
Statewide Medium- and Heavy-Duty EV population [3]	107,184	**NA**		2040 is set based on a target percentage of EVs to meet the 2040 emissions goal, whereas 2030 is set based on the 2020 Mobile Source Strategy (MSS).
Statewide MDV EV Population Target under 2020 MSS [4]	40,788	**NA**		This is why there are "NA" values in columns B and C.
Statewide HDV EV Population Target under EO N-79-20 [4]	171,176	**NA**		
		NA		
Statewide Target Percent Increase in Commercial EVs	98%	**NA**		
Irvine Target Percent Increase in Commercial EVs	98%	**NA**		
Calculated Medium/Heavy Duty EV/PHEV Pop - Irvine	743	**NA**		
Number of heavy-duty conventional vehicles (leg-adjusted forecast)	**NA**		6,819	
Number of heavy-duty EVs (leg-adjusted forecast)	**NA**		3,301	
Total heavy-duty EVs (leg-adjusted forecast)	**NA**		10,120	
Leg-adjusted percent heavy-duty EVs	**NA**		33%	
Target percent EVs	**NA**		90%	
Increased EV/PHEV Pop percentage under TR-2.1	98%	**NA**		
Targeted EV/PHEV Pop under TR-2.1	1,468	**NA**		
Additional EV/PHEV Pop under TR-2.1	726		5,807	

Additional GHG emissions from EVs		
Average annual miles per EV (mi/vehicle) [1]	19,453	17,114
New EVMT under measure	14,120,840	99,389,468
Average Efficiency of EV medium/heavy duty (kWh/100-mi) [1]	84	92
Charged amount (kWh)	11,911,664	91,770,932
Charged amount (MWh)	11,912	91,771
Electricity emissions factor (MTCO2e/MWh) (SCE and OCPA weighted average)	0.036	0.008
Additional GHG emissions from EVs (MTCO2e)	434	754
Emissions from Equivalent Gasoline/Diesel Vehicles		
Average emissions factor from Gasoline/Diesel mix (gCO2e/mi) [1]	999.24	934.92
Reduced Gasoline/Diesel VMT (mi)	14,120,840	99,389,468
Reduced Gasoline/Diesel emissions under TR-2.1 (MTCO2e)	14,110	92,921
Net GHG emissions avoided from increased MHDV EV chargers (MTCO2e)	**13,676**	**92,167**
Net GHG emissions avoided from increased EV chargers (MTCO2e)	**93,012**	**294,313**

Sources:

[1] EMFAC 2021 results for Orange County adjusted for ACC II ZEV requirements for new vehicles. Requirements pertain to both PHEVs and ZEVs.

[2] https://www.driveclean.ca.gov/pev/Charging.php

[3] EMFAC 2021. Statewide EV population. (EMFAC 2021 does not account for statewide targets under EO N-79-20)

[4] CARB's 2020 Mobile Source Strategy META Tool

TR-3.1, TR-3.2, and TR-3.3
Transportation and Land Use Measures

Enhance and expand transit facilities and infrastructure to access a broader ridership.
Increase transit ridership through incentives and more frequent, connected transit lines.
Implement an on-demand microtransit system, transporting residents from curb to curb (e.g., OC Flex or LA County Micro).

	2030	2040
Annual passenger vehicle miles traveled (VMT) after TR-1.1	2,804,835,496	2,827,817,134
Total percent reduction	7.5%	10.0%
Passenger VMT reduction	210,362,662	282,781,713
Passenger vehicle emissions factor (g CO2e/mi)	221	42
GHG reductions from passenger vehicles (MTCO2e)	46,586	11,922
GHG Reductions from TR-3.1, TR-3.2, and TR-3.3 (MTCO2e)	46,586	11,922

Notes:
In 2030, half of maximum reduction (15 percent) taken for Transit subcategory per CAPCOA 2021. 2040 assumes the maximum reduction of 15 percent.

Sources:

[1] CAPCOA, 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity- Final Draft.

TR-4.1, TR-4.2, TR-4.3, and TR-4.4 Transportation and Land Use Measures Develop more protected bikeways. Expand bicycling and walking options through infrastructure improvements. Develop more accessible and safer pedestrian infrastructure. Implement a community bikeshare program.		**2030**	**2040**
Annual VMT from passenger vehicles after TR-1.1 and TR-3.1 to 3.3		2,594,472,834	2,545,035,420
Emissions from on-road transportation (passenger vehicles)		574,565	107,294
Percent reduction in GHG emissions by providing Pedestrian Network Improvement (T-18, ND) [1]	6.40%	**6.4%**	**6.4%**
Percent reduction in GHG emissions from displaced vehicles on roadway with bicycle boulevard (T-19-B, ND) [1]	0.60%		
Percent reduction in GHG emissions by expanding bikeway network (T-20, ND) [1]	0.50%		
Percent reduction in GHG emissions by Implementing Electric Bikeshare Program (T-22-B, ND) [1]	0.06%		
Reduction in VMT with TR measures (miles)		**166,046,261**	**162,882,267**
GHG Reductions from TR-4.1, TR-4.2, TR-4.3, and TR-4.4 (MTCO2e)		**36,772**	**6,867**

Sources:

[1] CAPCOA, 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity-Final Draft.

OR-1.1
Off-Road Vehicles and Equipment Measures

Reduce emissions from landscaping equipment such as leaf blowers by supporting a transition to zero-emission equipment.	**2019**	**2024**	**2030**	**2040**
Landscaping equipment emissions (MTCO2e)	708	739	776	874
Target electrification rate for existing landscaping equipment [1]			12%	90%
GHG reductions from zero-emission landscaping equipment (MTCO2e)			93	784
Additional emissions from electricity use				
Gasoline Emission Factors (lbs CO2e per gal)			19.99	19.99
Reduced Gasoline usage due to transition (gal)			10,274	86,520
Gal/kWh factor for gasoline [2]			36.6	36.6
Increased electricity required to charge transitioned landscaping equipment (kwh)			376,014	3,166,626
Charged amount (MWh)			376.01	3,166.63
Electricity emissions factor (MTCO2e/MWh) (weighted for SCE and OCPA)			0.03644	0.00822
Additional GHG emissions from zero-emission construction equipment (MTCO2e)			14	26
Reduced GHG Emissions (MTCO2e)			**79**	**758**

Sources:

[1] Assuming same proportions as Statewide GHG reduction included in CARB 2020 Mobile Source Strategy; extrapolated for 2045

[2] Convertunits.com

OR-1.2
Off-Road Vehicles and Equipment Measures

Reduce emissions from construction equipment by supporting a transition to zero-emission equipment.	**2019**	**2030**	**2040**
Construction equipment emissions (MTCO2e)	19,536	21,614	24,668
Target zero-emission rate for construction equipment		10%	30%
GHG reductions from zero-emission construction equipment (MTCO2e)		2,161	7,401
Additional emissions from electricity use			
Diesel Emission Factors (lbs per gal)		23.14	23.14
Reduced Diesel usage due to transition (gal)		205,937	705,132
Gal/kWh factor for diesel [2]		40.7	40.7
Electricity required to charge transitioned construction equipment (kwh)		8,381,621	28,698,862
Charged amount (MWh)		8,381.62	28,698.86
Electricity emissions factor (MTCO2e/MWh) (weighted for SCE and OCPA)		3.64E-02	8.22E-03
Additional GHG emissions from transitioned construction equipment (MTCO2e)		305	236
Reduced GHG Emissions (MTCO2e)		**1,856**	**7,165**

Sources:

[1] Convertunits.com

SW-1.1
Solid Waste Measures

Eliminate the disposal of organic solid waste in landfills to reduce methane emissions.	**2019**	**2030**	**2040**
Solid waste emissions (MTCO2e)		175,038	188,141
Waste Diversion Targets [1]	45%	80%	90%
Increased waste diversion		35%	45%
Adjusted forecasted emissions from solid waste (MTCO2e)		63,650	34,207
Reduced GHG Emissions (MTCO2e)		**111,388**	**153,933**

Notes:

From CalRecycle 2021: Of the total materials generated in 2019, 55 percent were sent to landfill, 19 percent were exported as recyclables, 12 percent were composted, anaerobically digested or mulched, and another 6 percent were recycled or source reduced. The remainder of the material, less than 10 percent, went to alternative daily cover (ADC), beneficial reuse, transformation, alternative intermediate cover (AIC), waste-tire derived fuel, and engineered municipal solid waste (EMSW).

Sources:

[1] State of Disposal and Recycling for Calendar Year 2019. CalRecycle 2021. Available: https://www2.calrecycle.ca.gov/Publications/Details/1697

W-1.1 and W-1.2
Water and Wastewater Measures

Reduce water consumption in buildings through conservation campaigns and water efficiency measures. Reduce water consumption for irrigation and landscaping by encouraging drought tolerant landscaping practices.

	2030	2040
Total water-related fuel Use (kWh)	207,267,492	222,782,348
Annual water consumption (AF/year)	136,227	146,424
Rate of Fuel Use (kWh/AF/year)	1,521	1,521
Water consumption reduction target	5%	10%
Reduced water related consumption (AF/year)	6,811	14,642
Reduced Fuel Use (kWh)	10,363,375	22,278,235
kWh / MWh factor	1,000	1,000
Reduced Fuel Use (MWh)	10,363	22,278
Electricity emissions factor (MTCO2e/MWh) (weighted for SCE and OCPA)	0.0364	0.0082
Reduced GHG Emissions (MTCO2e)	**378**	**183**

MS-1.1 **Miscellaneous Measures**		
Protect and enhance native trees and vegetation.	**2030**	**2040**
Annual sequestration rate per tree (MTCO2) [1]	0.046	0.046
Target: Number of net new trees planted each year	5,000	5,000
Number of years (planting begins in 2025)	6	16
Number of trees planted over period in active growing stage in inventory year	30,000	80,000
Reduced GHG Emissions (MTCO2e)	**1,376**	**3,670**
UC Irvine Tree Inventory		
Number of Trees	18,240	
Carbon Sequestered Annually (MTCO2e)	837	
Carbon Sequestered Per Tree Per Year (MTCO2e/tree)	0.045876944	

Sources:

[1] University of California, Irvine. 01.16.18 i-Tree Streets Environmental Benefit Analysis. https://web.archive.org/web/20230811012618/https://www.fm.uci.edu/news/doc_news/TreeAnalysisReport_complete.pdf

Calculate electrification rates [1].

Index	Year	Incremental Residential Rate	Cumulative Residential Rate	Incremental Commercial Rate	Cumulative Commercial Rate
1	2021	3.60%	3.60%	1.30%	1.30%
2	2022	3.60%	7.20%	1.30%	2.60%
3	2023	3.60%	10.80%	1.30%	3.90%
4	2024	3.60%	14.40%	1.30%	5.20%
5	2025	3.60%	18.00%	1.30%	6.50%
6	2026	3.60%	21.60%	1.30%	7.80%
7	2027	3.60%	25.20%	1.30%	9.10%
8	2028	3.60%	28.80%	1.30%	10.40%
9	2029	3.60%	32.40%	1.30%	11.70%
10	2030	3.60%	36.00%	1.30%	13.00%
11	2031	3.60%	39.60%	1.69%	14.69%
12	2032	3.60%	43.20%	1.69%	16.38%
13	2033	3.60%	46.80%	1.69%	18.07%
14	2034	3.60%	50.40%	1.69%	19.76%
15	2035	3.60%	54.00%	1.69%	21.45%
16	2036	3.60%	57.60%	2.20%	23.65%
17	2037	3.60%	61.20%	2.20%	25.84%
18	2038	3.60%	64.80%	2.20%	28.04%
19	2039	3.60%	68.40%	2.20%	30.24%
20	2040	3.60%	72.00%	2.20%	32.44%
21	2041	3.60%	75.60%	2.86%	35.29%
22	2042	3.60%	79.20%	2.86%	38.15%
23	2043	3.60%	82.80%	2.86%	41.00%
24	2044	3.60%	86.40%	2.86%	43.86%
25	2045	3.60%	90.00%	2.86%	46.72%
26	2046	3.60%	93.60%	3.71%	50.43%
27	2047	3.60%	97.20%	3.71%	54.14%
28	2048	3.60%	100.00%	3.71%	57.85%
29	2049	3.60%	100.00%	3.71%	61.57%
30	2050	3.60%	100.00%	3.71%	65.28%

Prorate reductions based on number of years policy will be in effect assuming implementation date of 2026
These calculations apply to 2030 only.

			Number of years	**Percent retrofitted**	
	Start	End	1/1/2030	Res 2030	Nonres 2030
BE 1.2	1/1/2026	1/1/2030	4.00	14.4%	
BE 1.3	1/1/2026	1/1/2030	4.00	14.4%	5.2%

Source:
[1] Mozingo. 2021. Zero-Carbon Buildings in California: A Feasibility Study.
https://crec.berkeley.edu/uploads/16RD004_CREC_ZCB_Final_Report_w__Appendices_(1).pdf

Calculate therm reduction due to electrification.

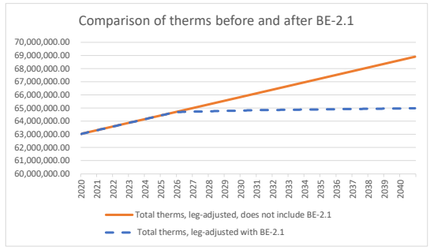
Year	Total leg-adjusted therms / year	Therms / month in new development
2019	63,008,555	
2030	66,099,949	23,420
2040	68,910,308	23,420

Therm reduction due to measure

Date	Year	Live result
12/1/2030	2030	(1,264,661)
12/1/2040	2040	(3,925,134)

1/1/2020 <-first year of forecast horizon

1/1/2026 Measure start date
90% Percent new development electrified by 2030
95% Percent new development electrified by 2040



Month Number	Month	Year	Incremental new development therms, leg-adjusted	% of new therms remaining after new ordinance implemented	New development therms, leg-adjusted with BE-2.1	Total therms, leg-adjusted with BE-2.1	Total therms, leg-adjusted, does not include BE-2.1	Therm reduction due to BE-2.1
1	1/1/2020	2020	23,420	100%	23,420	63,031,975	63,031,974.65	-
2	2/1/2020	2020	23,420	100%	23,420	63,055,394	63,055,394.31	-
3	3/1/2020	2020	23,420	100%	23,420	63,078,814	63,078,813.96	-
4	4/1/2020	2020	23,420	100%	23,420	63,102,234	63,102,233.62	-
5	5/1/2020	2020	23,420	100%	23,420	63,125,653	63,125,653.27	-
6	6/1/2020	2020	23,420	100%	23,420	63,149,073	63,149,072.93	-
7	7/1/2020	2020	23,420	100%	23,420	63,172,493	63,172,492.58	-
8	8/1/2020	2020	23,420	100%	23,420	63,195,912	63,195,912.24	-
9	9/1/2020	2020	23,420	100%	23,420	63,219,332	63,219,331.89	-
10	10/1/2020	2020	23,420	100%	23,420	63,242,752	63,242,751.54	-
11	11/1/2020	2020	23,420	100%	23,420	63,266,171	63,266,171.20	-
12	12/1/2020	2020	23,420	100%	23,420	63,289,591	63,289,590.85	-
13	1/1/2021	2021	23,420	100%	23,420	63,313,011	63,313,010.51	-
14	2/1/2021	2021	23,420	100%	23,420	63,336,430	63,336,430.16	-
15	3/1/2021	2021	23,420	100%	23,420	63,359,850	63,359,849.82	-
16	4/1/2021	2021	23,420	100%	23,420	63,383,269	63,383,269.47	-
17	5/1/2021	2021	23,420	100%	23,420	63,406,689	63,406,689.13	-
18	6/1/2021	2021	23,420	100%	23,420	63,430,109	63,430,108.78	-
19	7/1/2021	2021	23,420	100%	23,420	63,453,528	63,453,528.43	-
20	8/1/2021	2021	23,420	100%	23,420	63,476,948	63,476,948.09	-
21	9/1/2021	2021	23,420	100%	23,420	63,500,368	63,500,367.74	-
22	10/1/2021	2021	23,420	100%	23,420	63,523,787	63,523,787.40	-
23	11/1/2021	2021	23,420	100%	23,420	63,547,207	63,547,207.05	-
24	12/1/2021	2021	23,420	100%	23,420	63,570,627	63,570,626.71	-
25	1/1/2022	2022	23,420	100%	23,420	63,594,046	63,594,046.36	-
26	2/1/2022	2022	23,420	100%	23,420	63,617,466	63,617,466.02	-
27	3/1/2022	2022	23,420	100%	23,420	63,640,886	63,640,885.67	-
28	4/1/2022	2022	23,420	100%	23,420	63,664,305	63,664,305.32	-
29	5/1/2022	2022	23,420	100%	23,420	63,687,725	63,687,724.98	-
30	6/1/2022	2022	23,420	100%	23,420	63,711,145	63,711,144.63	-
31	7/1/2022	2022	23,420	100%	23,420	63,734,564	63,734,564.29	-
32	8/1/2022	2022	23,420	100%	23,420	63,757,984	63,757,983.94	-
33	9/1/2022	2022	23,420	100%	23,420	63,781,404	63,781,403.60	-
34	10/1/2022	2022	23,420	100%	23,420	63,804,823	63,804,823.25	-
35	11/1/2022	2022	23,420	100%	23,420	63,828,243	63,828,242.90	-
36	12/1/2022	2022	23,420	100%	23,420	63,851,663	63,851,662.56	-
37	1/1/2023	2023	23,420	100%	23,420	63,875,082	63,875,082.21	-
38	2/1/2023	2023	23,420	100%	23,420	63,898,502	63,898,501.87	-
39	3/1/2023	2023	23,420	100%	23,420	63,921,922	63,921,921.52	-
40	4/1/2023	2023	23,420	100%	23,420	63,945,341	63,945,341.18	-
41	5/1/2023	2023	23,420	100%	23,420	63,968,761	63,968,760.83	-
42	6/1/2023	2023	23,420	100%	23,420	63,992,180	63,992,180.49	-
43	7/1/2023	2023	23,420	100%	23,420	64,015,600	64,015,600.14	-
44	8/1/2023	2023	23,420	100%	23,420	64,039,020	64,039,019.79	-
45	9/1/2023	2023	23,420	100%	23,420	64,062,439	64,062,439.45	-
46	10/1/2023	2023	23,420	100%	23,420	64,085,859	64,085,859.10	-
47	11/1/2023	2023	23,420	100%	23,420	64,109,279	64,109,278.76	-
48	12/1/2023	2023	23,420	100%	23,420	64,132,698	64,132,698.41	-
49	1/1/2024	2024	23,420	100%	23,420	64,156,118	64,156,118.07	-
50	2/1/2024	2024	23,420	100%	23,420	64,179,538	64,179,537.72	-
51	3/1/2024	2024	23,420	100%	23,420	64,202,957	64,202,957.38	-
52	4/1/2024	2024	23,420	100%	23,420	64,226,377	64,226,377.03	-
53	5/1/2024	2024	23,420	100%	23,420	64,249,797	64,249,796.68	-
54	6/1/2024	2024	23,420	100%	23,420	64,273,216	64,273,216.34	-
55	7/1/2024	2024	23,420	100%	23,420	64,296,636	64,296,635.99	-
56	8/1/2024	2024	23,420	100%	23,420	64,320,056	64,320,055.65	-
57	9/1/2024	2024	23,420	100%	23,420	64,343,475	64,343,475.30	-
58	10/1/2024	2024	23,420	100%	23,420	64,366,895	64,366,894.96	-
59	11/1/2024	2024	23,420	100%	23,420	64,390,315	64,390,314.61	-
60	12/1/2024	2024	23,420	100%	23,420	64,413,734	64,413,734.27	-
61	1/1/2025	2025	23,420	100%	23,420	64,437,154	64,437,153.92	-
62	2/1/2025	2025	23,420	100%	23,420	64,460,574	64,460,573.57	-
63	3/1/2025	2025	23,420	100%	23,420	64,483,993	64,483,993.23	-
64	4/1/2025	2025	23,420	100%	23,420	64,507,413	64,507,412.88	-
65	5/1/2025	2025	23,420	100%	23,420	64,530,833	64,530,832.54	-
66	6/1/2025	2025	23,420	100%	23,420	64,554,252	64,554,252.19	-
67	7/1/2025	2025	23,420	100%	23,420	64,577,672	64,577,671.85	-
68	8/1/2025	2025	23,420	100%	23,420	64,601,092	64,601,091.50	-
69	9/1/2025	2025	23,420	100%	23,420	64,624,511	64,624,511.16	-
70	10/1/2025	2025	23,420	100%	23,420	64,647,931	64,647,930.81	-
71	11/1/2025	2025	23,420	100%	23,420	64,671,350	64,671,350.46	-
72	12/1/2025	2025	23,420	100%	23,420	64,694,770	64,694,770.12	-
73	1/1/2026	2026	23,420	10%	2,342	64,697,112	64,718,189.77	(21,077.69)
74	2/1/2026	2026	23,420	10%	2,342	64,699,454	64,741,609.43	(42,155.38)
75	3/1/2026	2026	23,420	10%	2,342	64,701,796	64,765,029.08	(63,233.07)
76	4/1/2026	2026	23,420	10%	2,342	64,704,138	64,788,448.74	(84,310.76)
77	5/1/2026	2026	23,420	10%	2,342	64,706,480	64,811,868.39	(105,388.44)
78	6/1/2026	2026	23,420	10%	2,342	64,708,822	64,835,288.05	(126,466.13)
79	7/1/2026	2026	23,420	10%	2,342	64,711,164	64,858,707.70	(147,543.82)
80	8/1/2026	2026	23,420	10%	2,342	64,713,506	64,882,127.35	(168,621.51)
81	9/1/2026	2026	23,420	10%	2,342	64,715,848	64,905,547.01	(189,699.20)
82	10/1/2026	2026	23,420	10%	2,342	64,718,190	64,928,966.66	(210,776.89)
83	11/1/2026	2026	23,420	10%	2,342	64,720,532	64,952,386.32	(231,854.58)

84	12/1/2026	2026	23,420	10%	2,342	64,722,874	64,975,805.97	(252,932.27)
85	1/1/2027	2027	23,420	10%	2,342	64,725,216	64,999,225.63	(274,009.96)
86	2/1/2027	2027	23,420	10%	2,342	64,727,558	65,022,645.28	(295,087.65)
87	3/1/2027	2027	23,420	10%	2,342	64,729,900	65,046,064.94	(316,165.33)
88	4/1/2027	2027	23,420	10%	2,342	64,732,242	65,069,484.59	(337,243.02)
89	5/1/2027	2027	23,420	10%	2,342	64,734,584	65,092,904.24	(358,320.71)
90	6/1/2027	2027	23,420	10%	2,342	64,736,925	65,116,323.90	(379,398.40)
91	7/1/2027	2027	23,420	10%	2,342	64,739,267	65,139,743.55	(400,476.09)
92	8/1/2027	2027	23,420	10%	2,342	64,741,609	65,163,163.21	(421,553.78)
93	9/1/2027	2027	23,420	10%	2,342	64,743,951	65,186,582.86	(442,631.47)
94	10/1/2027	2027	23,420	10%	2,342	64,746,293	65,210,002.52	(463,709.16)
95	11/1/2027	2027	23,420	10%	2,342	64,748,635	65,233,422.17	(484,786.85)
96	12/1/2027	2027	23,420	10%	2,342	64,750,977	65,256,841.82	(505,864.54)
97	1/1/2028	2028	23,420	10%	2,342	64,753,319	65,280,261.48	(526,942.22)
98	2/1/2028	2028	23,420	10%	2,342	64,755,661	65,303,681.13	(548,019.91)
99	3/1/2028	2028	23,420	10%	2,342	64,758,003	65,327,100.79	(569,097.60)
100	4/1/2028	2028	23,420	10%	2,342	64,760,345	65,350,520.44	(590,175.29)
101	5/1/2028	2028	23,420	10%	2,342	64,762,687	65,373,940.10	(611,252.98)
102	6/1/2028	2028	23,420	10%	2,342	64,765,029	65,397,359.75	(632,330.67)
103	7/1/2028	2028	23,420	10%	2,342	64,767,371	65,420,779.41	(653,408.36)
104	8/1/2028	2028	23,420	10%	2,342	64,769,713	65,444,199.06	(674,486.05)
105	9/1/2028	2028	23,420	10%	2,342	64,772,055	65,467,618.71	(695,563.74)
106	10/1/2028	2028	23,420	10%	2,342	64,774,397	65,491,038.37	(716,641.43)
107	11/1/2028	2028	23,420	10%	2,342	64,776,739	65,514,458.02	(737,719.11)
108	12/1/2028	2028	23,420	10%	2,342	64,779,081	65,537,877.68	(758,796.80)
109	1/1/2029	2029	23,420	10%	2,342	64,781,423	65,561,297.33	(779,874.49)
110	2/1/2029	2029	23,420	10%	2,342	64,783,765	65,584,716.99	(800,952.18)
111	3/1/2029	2029	23,420	10%	2,342	64,786,107	65,608,136.64	(822,029.87)
112	4/1/2029	2029	23,420	10%	2,342	64,788,449	65,631,556.30	(843,107.56)
113	5/1/2029	2029	23,420	10%	2,342	64,790,791	65,654,975.95	(864,185.25)
114	6/1/2029	2029	23,420	10%	2,342	64,793,133	65,678,395.60	(885,262.94)
115	7/1/2029	2029	23,420	10%	2,342	64,795,475	65,701,815.26	(906,340.63)
116	8/1/2029	2029	23,420	10%	2,342	64,797,817	65,725,234.91	(927,418.32)
117	9/1/2029	2029	23,420	10%	2,342	64,800,159	65,748,654.57	(948,496.00)
118	10/1/2029	2029	23,420	10%	2,342	64,802,501	65,772,074.22	(969,573.69)
119	11/1/2029	2029	23,420	10%	2,342	64,804,842	65,795,493.88	(990,651.38)
120	12/1/2029	2029	23,420	10%	2,342	64,807,184	65,818,913.53	(1,011,729.07)
121	1/1/2030	2030	23,420	10%	2,342	64,809,526	65,842,333.19	(1,032,806.76)
122	2/1/2030	2030	23,420	10%	2,342	64,811,868	65,865,752.84	(1,053,884.45)
123	3/1/2030	2030	23,420	10%	2,342	64,814,210	65,889,172.49	(1,074,962.14)
124	4/1/2030	2030	23,420	10%	2,342	64,816,552	65,912,592.15	(1,096,039.83)
125	5/1/2030	2030	23,420	10%	2,342	64,818,894	65,936,011.80	(1,117,117.52)
126	6/1/2030	2030	23,420	10%	2,342	64,821,236	65,959,431.46	(1,138,195.21)
127	7/1/2030	2030	23,420	10%	2,342	64,823,578	65,982,851.11	(1,159,272.89)
128	8/1/2030	2030	23,420	10%	2,342	64,825,920	66,006,270.77	(1,180,350.58)
129	9/1/2030	2030	23,420	10%	2,342	64,828,262	66,029,690.42	(1,201,428.27)
130	10/1/2030	2030	23,420	10%	2,342	64,830,604	66,053,110.08	(1,222,505.96)
131	11/1/2030	2030	23,420	10%	2,342	64,832,946	66,076,529.73	(1,243,583.65)
132	12/1/2030	2030	23,420	10%	2,342	64,835,288	66,099,949.38	(1,264,661.34)
133	1/1/2031	2031	23,420	5%	1,249	64,836,537	66,123,369.04	(1,286,831.95)
134	2/1/2031	2031	23,420	5%	1,249	64,837,786	66,146,788.69	(1,309,002.55)
135	3/1/2031	2031	23,420	5%	1,249	64,839,035	66,170,208.35	(1,331,173.16)
136	4/1/2031	2031	23,420	5%	1,249	64,840,284	66,193,628.00	(1,353,343.76)
137	5/1/2031	2031	23,420	5%	1,249	64,841,533	66,217,047.66	(1,375,514.37)
138	6/1/2031	2031	23,420	5%	1,249	64,842,782	66,240,467.31	(1,397,684.98)
139	7/1/2031	2031	23,420	5%	1,249	64,844,031	66,263,886.97	(1,419,855.58)
140	8/1/2031	2031	23,420	5%	1,249	64,845,280	66,287,306.62	(1,442,026.19)
141	9/1/2031	2031	23,420	5%	1,249	64,846,529	66,310,726.27	(1,464,196.79)
142	10/1/2031	2031	23,420	5%	1,249	64,847,779	66,334,145.93	(1,486,367.40)
143	11/1/2031	2031	23,420	5%	1,249	64,849,028	66,357,565.58	(1,508,538.01)
144	12/1/2031	2031	23,420	5%	1,249	64,850,277	66,380,985.24	(1,530,708.61)
145	1/1/2032	2032	23,420	5%	1,249	64,851,526	66,404,404.89	(1,552,879.22)
146	2/1/2032	2032	23,420	5%	1,249	64,852,775	66,427,824.55	(1,575,049.83)
147	3/1/2032	2032	23,420	5%	1,249	64,854,024	66,451,244.20	(1,597,220.43)
148	4/1/2032	2032	23,420	5%	1,249	64,855,273	66,474,663.86	(1,619,391.04)
149	5/1/2032	2032	23,420	5%	1,249	64,856,522	66,498,083.51	(1,641,561.64)
150	6/1/2032	2032	23,420	5%	1,249	64,857,771	66,521,503.16	(1,663,732.25)
151	7/1/2032	2032	23,420	5%	1,249	64,859,020	66,544,922.82	(1,685,902.86)
152	8/1/2032	2032	23,420	5%	1,249	64,860,269	66,568,342.47	(1,708,073.46)
153	9/1/2032	2032	23,420	5%	1,249	64,861,518	66,591,762.13	(1,730,244.07)
154	10/1/2032	2032	23,420	5%	1,249	64,862,767	66,615,181.78	(1,752,414.68)
155	11/1/2032	2032	23,420	5%	1,249	64,864,016	66,638,601.44	(1,774,585.28)
156	12/1/2032	2032	23,420	5%	1,249	64,865,265	66,662,021.09	(1,796,755.89)
157	1/1/2033	2033	23,420	5%	1,249	64,866,514	66,685,440.74	(1,818,926.49)
158	2/1/2033	2033	23,420	5%	1,249	64,867,763	66,708,860.40	(1,841,097.10)
159	3/1/2033	2033	23,420	5%	1,249	64,869,012	66,732,280.05	(1,863,267.71)
160	4/1/2033	2033	23,420	5%	1,249	64,870,261	66,755,699.71	(1,885,438.31)
161	5/1/2033	2033	23,420	5%	1,249	64,871,510	66,779,119.36	(1,907,608.92)
162	6/1/2033	2033	23,420	5%	1,249	64,872,759	66,802,539.02	(1,929,779.52)
163	7/1/2033	2033	23,420	5%	1,249	64,874,009	66,825,958.67	(1,951,950.13)
164	8/1/2033	2033	23,420	5%	1,249	64,875,258	66,849,378.33	(1,974,120.74)
165	9/1/2033	2033	23,420	5%	1,249	64,876,507	66,872,797.98	(1,996,291.34)
166	10/1/2033	2033	23,420	5%	1,249	64,877,756	66,896,217.63	(2,018,461.95)
167	11/1/2033	2033	23,420	5%	1,249	64,879,005	66,919,637.29	(2,040,632.56)
168	12/1/2033	2033	23,420	5%	1,249	64,880,254	66,943,056.94	(2,062,803.16)
169	1/1/2034	2034	23,420	5%	1,249	64,881,503	66,966,476.60	(2,084,973.77)
170	2/1/2034	2034	23,420	5%	1,249	64,882,752	66,989,896.25	(2,107,144.37)
171	3/1/2034	2034	23,420	5%	1,249	64,884,001	67,013,315.91	(2,129,314.98)
172	4/1/2034	2034	23,420	5%	1,249	64,885,250	67,036,735.56	(2,151,485.59)
173	5/1/2034	2034	23,420	5%	1,249	64,886,499	67,060,155.22	(2,173,656.19)
174	6/1/2034	2034	23,420	5%	1,249	64,887,748	67,083,574.87	(2,195,826.80)
175	7/1/2034	2034	23,420	5%	1,249	64,888,997	67,106,994.52	(2,217,997.41)
176	8/1/2034	2034	23,420	5%	1,249	64,890,246	67,130,414.18	(2,240,168.01)
177	9/1/2034	2034	23,420	5%	1,249	64,891,495	67,153,833.83	(2,262,338.62)

178	10/1/2034	2034	23,420	5%	1,249	64,892,744	67,177,253.49	(2,284,509.22)
179	11/1/2034	2034	23,420	5%	1,249	64,893,993	67,200,673.14	(2,306,679.83)
180	12/1/2034	2034	23,420	5%	1,249	64,895,242	67,224,092.80	(2,328,850.44)
181	1/1/2035	2035	23,420	5%	1,249	64,896,491	67,247,512.45	(2,351,021.04)
182	2/1/2035	2035	23,420	5%	1,249	64,897,740	67,270,932.11	(2,373,191.65)
183	3/1/2035	2035	23,420	5%	1,249	64,898,990	67,294,351.76	(2,395,362.25)
184	4/1/2035	2035	23,420	5%	1,249	64,900,239	67,317,771.41	(2,417,532.86)
185	5/1/2035	2035	23,420	5%	1,249	64,901,488	67,341,191.07	(2,439,703.47)
186	6/1/2035	2035	23,420	5%	1,249	64,902,737	67,364,610.72	(2,461,874.07)
187	7/1/2035	2035	23,420	5%	1,249	64,903,986	67,388,030.38	(2,484,044.68)
188	8/1/2035	2035	23,420	5%	1,249	64,905,235	67,411,450.03	(2,506,215.29)
189	9/1/2035	2035	23,420	5%	1,249	64,906,484	67,434,869.69	(2,528,385.89)
190	10/1/2035	2035	23,420	5%	1,249	64,907,733	67,458,289.34	(2,550,556.50)
191	11/1/2035	2035	23,420	5%	1,249	64,908,982	67,481,709.00	(2,572,727.10)
192	12/1/2035	2035	23,420	5%	1,249	64,910,231	67,505,128.65	(2,594,897.71)
193	1/1/2036	2036	23,420	5%	1,249	64,911,480	67,528,548.30	(2,617,068.32)
194	2/1/2036	2036	23,420	5%	1,249	64,912,729	67,551,967.96	(2,639,238.92)
195	3/1/2036	2036	23,420	5%	1,249	64,913,978	67,575,387.61	(2,661,409.53)
196	4/1/2036	2036	23,420	5%	1,249	64,915,227	67,598,807.27	(2,683,580.14)
197	5/1/2036	2036	23,420	5%	1,249	64,916,476	67,622,226.92	(2,705,750.74)
198	6/1/2036	2036	23,420	5%	1,249	64,917,725	67,645,646.58	(2,727,921.35)
199	7/1/2036	2036	23,420	5%	1,249	64,918,974	67,669,066.23	(2,750,091.95)
200	8/1/2036	2036	23,420	5%	1,249	64,920,223	67,692,485.89	(2,772,262.56)
201	9/1/2036	2036	23,420	5%	1,249	64,921,472	67,715,905.54	(2,794,433.17)
202	10/1/2036	2036	23,420	5%	1,249	64,922,721	67,739,325.19	(2,816,603.77)
203	11/1/2036	2036	23,420	5%	1,249	64,923,970	67,762,744.85	(2,838,774.38)
204	12/1/2036	2036	23,420	5%	1,249	64,925,220	67,786,164.50	(2,860,944.98)
205	1/1/2037	2037	23,420	5%	1,249	64,926,469	67,809,584.16	(2,883,115.59)
206	2/1/2037	2037	23,420	5%	1,249	64,927,718	67,833,003.81	(2,905,286.20)
207	3/1/2037	2037	23,420	5%	1,249	64,928,967	67,856,423.47	(2,927,456.80)
208	4/1/2037	2037	23,420	5%	1,249	64,930,216	67,879,843.12	(2,949,627.41)
209	5/1/2037	2037	23,420	5%	1,249	64,931,465	67,903,262.77	(2,971,798.02)
210	6/1/2037	2037	23,420	5%	1,249	64,932,714	67,926,682.43	(2,993,968.62)
211	7/1/2037	2037	23,420	5%	1,249	64,933,963	67,950,102.08	(3,016,139.23)
212	8/1/2037	2037	23,420	5%	1,249	64,935,212	67,973,521.74	(3,038,309.83)
213	9/1/2037	2037	23,420	5%	1,249	64,936,461	67,996,941.39	(3,060,480.44)
214	10/1/2037	2037	23,420	5%	1,249	64,937,710	68,020,361.05	(3,082,651.05)
215	11/1/2037	2037	23,420	5%	1,249	64,938,959	68,043,780.70	(3,104,821.65)
216	12/1/2037	2037	23,420	5%	1,249	64,940,208	68,067,200.36	(3,126,992.26)
217	1/1/2038	2038	23,420	5%	1,249	64,941,457	68,090,620.01	(3,149,162.87)
218	2/1/2038	2038	23,420	5%	1,249	64,942,706	68,114,039.66	(3,171,333.47)
219	3/1/2038	2038	23,420	5%	1,249	64,943,955	68,137,459.32	(3,193,504.08)
220	4/1/2038	2038	23,420	5%	1,249	64,945,204	68,160,878.97	(3,215,674.68)
221	5/1/2038	2038	23,420	5%	1,249	64,946,453	68,184,298.63	(3,237,845.29)
222	6/1/2038	2038	23,420	5%	1,249	64,947,702	68,207,718.28	(3,260,015.90)
223	7/1/2038	2038	23,420	5%	1,249	64,948,951	68,231,137.94	(3,282,186.50)
224	8/1/2038	2038	23,420	5%	1,249	64,950,200	68,254,557.59	(3,304,357.11)
225	9/1/2038	2038	23,420	5%	1,249	64,951,450	68,277,977.25	(3,326,527.71)
226	10/1/2038	2038	23,420	5%	1,249	64,952,699	68,301,396.90	(3,348,698.32)
227	11/1/2038	2038	23,420	5%	1,249	64,953,948	68,324,816.55	(3,370,868.93)
228	12/1/2038	2038	23,420	5%	1,249	64,955,197	68,348,236.21	(3,393,039.53)
229	1/1/2039	2039	23,420	5%	1,249	64,956,446	68,371,655.86	(3,415,210.14)
230	2/1/2039	2039	23,420	5%	1,249	64,957,695	68,395,075.52	(3,437,380.75)
231	3/1/2039	2039	23,420	5%	1,249	64,958,944	68,418,495.17	(3,459,551.35)
232	4/1/2039	2039	23,420	5%	1,249	64,960,193	68,441,914.83	(3,481,721.96)
233	5/1/2039	2039	23,420	5%	1,249	64,961,442	68,465,334.48	(3,503,892.56)
234	6/1/2039	2039	23,420	5%	1,249	64,962,691	68,488,754.14	(3,526,063.17)
235	7/1/2039	2039	23,420	5%	1,249	64,963,940	68,512,173.79	(3,548,233.78)
236	8/1/2039	2039	23,420	5%	1,249	64,965,189	68,535,593.44	(3,570,404.38)
237	9/1/2039	2039	23,420	5%	1,249	64,966,438	68,559,013.10	(3,592,574.99)
238	10/1/2039	2039	23,420	5%	1,249	64,967,687	68,582,432.75	(3,614,745.60)
239	11/1/2039	2039	23,420	5%	1,249	64,968,936	68,605,852.41	(3,636,916.20)
240	12/1/2039	2039	23,420	5%	1,249	64,970,185	68,629,272.06	(3,659,086.81)
241	1/1/2040	2040	23,420	5%	1,249	64,971,434	68,652,691.72	(3,681,257.41)
242	2/1/2040	2040	23,420	5%	1,249	64,972,683	68,676,111.37	(3,703,428.02)
243	3/1/2040	2040	23,420	5%	1,249	64,973,932	68,699,531.03	(3,725,598.63)
244	4/1/2040	2040	23,420	5%	1,249	64,975,181	68,722,950.68	(3,747,769.23)
245	5/1/2040	2040	23,420	5%	1,249	64,976,430	68,746,370.33	(3,769,939.84)
246	6/1/2040	2040	23,420	5%	1,249	64,977,680	68,769,789.99	(3,792,110.44)
247	7/1/2040	2040	23,420	5%	1,249	64,978,929	68,793,209.64	(3,814,281.05)
248	8/1/2040	2040	23,420	5%	1,249	64,980,178	68,816,629.30	(3,836,451.66)
249	9/1/2040	2040	23,420	5%	1,249	64,981,427	68,840,048.95	(3,858,622.26)
250	10/1/2040	2040	23,420	5%	1,249	64,982,676	68,863,468.61	(3,880,792.87)
251	11/1/2040	2040	23,420	5%	1,249	64,983,925	68,886,888.26	(3,902,963.48)
252	12/1/2040	2040	23,420	5%	1,249	64,985,174	68,910,307.92	(3,925,134.08)