APPENDIX E: COST-EFFECTIVENESS LIMITS, DISCOUNT RATES, AND CAPITAL RECOVERY FACTORS

Contents

I. COST-EFFECTIVENESS LIMITS

A. Current Cost-Effectiveness Limits

Projects through the Carl Moyer Program are required to be cost-effective per H&SC Section 44283. Cost-effectiveness limits are imposed on projects to ensure this and vary by project category. Formulas and how cost-effectiveness limits are used in the Carl Moyer Program calculations can be found in Appendix C. CARB reviews and may update cost-effectiveness limits annually using the California Consumer Price Index data. Currently, projects are subject to the current cost-effectiveness limits shown in Table E-1.

B. Base Limit

For conventional on-road, off-road, locomotive, and marine projects, such as diesel replacement projects where surplus to regulations.

C. On-Road Advanced Technology Limit

For on-road heavy-duty projects that meet the optional certified advanced technology standard, like the 0.02 g/bhp-hr NOx standard engine or cleaner, air districts have the option to apply the On-Road Advanced Technology Limit listed in Table E-1. This limit can be applied to all the emission reductions achieved by a project, as long as emission reductions are surplus to applicable regulations.

D. School Bus Limit

For conventional school bus projects, such as combustion replacement projects where surplus to regulations, air districts have the option to apply the School Bus Limit listed in Table E-1. This limit can be applied to all the emission reductions achieved by a project, as long as emission reductions are surplus to applicable regulations.

E. On-Road Zero-Emission Technology Limit

For on-road heavy-duty projects that are certified zero-emission technology standard, air districts have the option to apply the On-Road Zero-Emission Technology Limit listed in Table E-1. This limit can be applied to all the emission reductions achieved by a project, as long as emission reductions are surplus to applicable regulations.

F. Off-Road Zero-Emission Technology Limit

For off-road projects that utilize zero-emission technology air districts have the option to apply the Off-Road Zero-Emission Technology Limit listed in Table E-1. Additionally, the zero-emission technology needs to be commercially available and offered for sale. This limit can be applied to all the emission reductions achieved by a project, as long as emission reductions are surplus to applicable regulations.

G. Locomotive Zero-Emission Technology Limit

For locomotive projects that utilize zero-emission technology air districts have the option to apply the Off-Road Zero-Emission Technology Limit listed in Table E-1. Additionally, the zero-emission technology needs to be commercially available and offered for sale.

This limit can be applied to all the emission reductions achieved by a project, as long as emission reductions are surplus to applicable regulations.

H. Marine Zero-Emission Technology Limit

For marine projects that are zero-emission or zero-emission capable and have an approved ZEAT application, air districts have the option to apply the Marine Zero-Emission Technology Limit listed in Table E-1. Additionally, the zero-emission technology needs to be commercially available and offered for sale. This limit can be applied to all the emission reductions achieved by a project, as long as emission reductions are surplus to applicable regulations.

Table E-1: Current Cost-Effectiveness Limit Criteria Effective October 2024

Year	Project	Applicable Categories	Description	Revised C/E Limit
2024	Base Limit	Ch.4 On-Road, Ch.5 Off-Road, Ch.6 Locomotives, Ch.7 Marine Ch.8 Light Duty Vehicles	New Base C/E Limit for conventional projects.	$60,000
2024	On-Road Advanced Technology Limit	Ch.4 On-Road	C/E Limit Retained from 2017 Guidelines for reductions from on-road advanced technologies. This limit is intended to be applied to all emission reductions that a project achieves.	$209,000
2024	School Bus Limit	Ch.4 On-Road	C/E Limit Retained from 2017 Guidelines for reductions for School Bus. This limit is intended to be applied to all emission	$313,000

			reductions that a project achieves.	
2024	On-Road Zero-Emission Technology Limit	Ch.4 On-Road	C/E Limit Retained from 2017 Guidelines for reductions from on-road zero- emission technologies. This limit is intended to be applied to all emission reductions that a project achieves.	$522,000
2024	Off-Road Zero-Emission Technology Limit	Ch.5 Off-Road	New C/E Limit for reductions from off-road zero- emission technologies. This limit is intended to be applied to all emission reductions that a project achieves.	$120,000
2024	Locomotive Zero-Emission Technology Limit	Ch.6 Locomotives	New C/E Limit for reductions from off-road zero- emission technologies. This limit is intended to be applied to all emission reductions that a project achieves.	$200,000
2024	Marine Zero-Emission Technology Limit	Ch.7 Marine	New C/E Limit for reductions from marine zero- emission technologies. This limit is intended to be applied to all emission reductions that a project achieves.	$522,000

II. HISTORICAL COST-EFFECTIVENESS LIMITS

Cost-effectiveness limits have been assessed and changed throughout existence of the Carl Moyer Program. Over the years, changes in the cost-effectiveness limits have been based on changes in the California Consumer Price Index. Historically, one limit has been applied to all Moyer Program projects. Per SB 513, a second cost-effectiveness limit for school buses was added in 2016 as shown in Table E-2.

Table E-2: Historical Cost-Effectiveness Limit Criteria 1998-2017

Year	Annual CA CPI	Percentage change (inflation rate)	Annual Change	Revised C/E Limit
1998	163.7	NA	NA	$12,000
1999	168.5	2.93%	$352	$12,352
2000	174.8	3.74%	$462	$12,814
2001	181.7	3.95%	$506	$13,319
2002	186.1	2.42%	$323	$13,642
2003	190.4	2.31%	$315	$13,957
2004	195.4	2.63%	$367	$14,324
2005	202.6	3.68%	$528	$14,852
2006	210.5	3.90%	$579	$15,431
2007	217.4	3.28%	$506	$15,938
2008	224.8	3.40%	$541	$16,479
2009	224.1	-0.31%	($51)	$16,428
2010	227	1.29%	$212	$16,640
2011	233	2.66%	$443	$17,084
2012	238.3	2.25%	$385	$17,469
2013	241.8	1.46%	$255	$17,724
2014	246.1	1.77%	$313	$18,037
2015	249.1	1.25%	$225	$18,262

Year	Annual CA CPI	Percentage change (inflation rate)	Annual Change	Revised C/E Limit
2016 Base	No C/E update pending 2017guideline update	n/a	n/a	$18,262
2016 School Bus	New C/E Limit under SB 513	n/a	n/a	$276,230
2017 Base	New C/E Limit under SB 513	n/a	n/a	$30,000
2017 Optional Advanced Technology	New C/E Limit under SB 513	n/a	n/a	$100,000

The 2017 Carl Moyer Program Guidelines had its cost-effectiveness limits adjusted for inflation multiple times, as shown in Tables E-3 and E-4. Table E-3 shows the 2021 cost-effectiveness limits adopted by the Board in 2021. Table E-4 shows the 2022 cost-effectiveness limits adopted by the Board in 2022. As shown, the following cost-effectiveness limits were available:

- A base limit to support conventional projects,
- A limit specific to school bus projects,
- and optional advanced or zero-emission technology cost-effectiveness limits that could apply to the additional reductions provided by the cleanest engines or equipment, including those needed for long-term SIP commitments.

The optional Advanced Technology's higher cost-effectiveness limits were applied only to the incremental emission reductions beyond what the conventional project would achieve. An air district would apply the base cost-effectiveness limit for costs associated with getting engines to the cleanest required standard, and then could apply the appropriate advanced technology limit to the additional costs of getting emissions down to or below the cleanest optional standard.

For projects in source categories without optional standards, only vehicles certified as zero-emission would be eligible for the higher cost-effectiveness limit. In these cases, the higher limit would apply to the incremental reductions below the most stringent standard for that category.

Table E-3 Cost-Effectiveness Limit Criteria 2021

Year	Project	Proposed Change or Status	Revised C/E Limit
2021	Base Limit	New C/E Limit	$33,000
2021	Optional Advanced Technology Limit	New C/E Limit for incremental reductions from specified advanced technologies	$109,000
2021	On-road Optional Advanced Technology Limit	New C/E Limit for incremental reductions from on-road advanced technologies	$200,000
2021	On-road Zero-Emission Technology Limit	New C/E Limit for incremental reductions from on-road zero- emission technologies	$500,000
2021	School Bus	2016 C/E Limit retained in 2017 Guidelines	$300,000

Table E-4: Cost-Effectiveness Limit Criteria 2022

Year	Project	Proposed Change or Status	Revised C/E Limit
2022	Base Limit	New C/E Limit	$34,000
2022	Off-road Zero-Emission Technology Limit	New C/E Limit for incremental reductions from off-road zero-emission technologies	$522,000
2022	On-road Optional Advanced Technology Limit	New C/E Limit for incremental reductions from on-road advanced technologies	$209,000
2022	On-road Zero-Emission Technology Limit	New C/E Limit for incremental reductions from on-road zero-emission technologies	$522,000
2022	School Bus	2016 C/E Limit retained in 2017 Guidelines	$313,000

III. DISCOUNT RATES

A discount rate is an interest rate used in the Carl Moyer Program cost-effectiveness calculations to determine the rate at which earnings could reasonably be expected to accrue if the same funds were invested over a length of time. Formulas and how the discount rate is used in the Carl Moyer Program calculations can be found in Appendix C. CARB evaluates the discount rate annually using the average rates of return for U.S. Treasury securities to determine if a change is necessary. For this reason, discount rates can potentially change on an annual basis. Table E-5 shows the current discount rate as well as historical discount rates.

Table E-5: Discount Rate

Discount Rate	Guidelines	Effective Date
4% (Current)	2024	10/24/2024
1%	2017	01/01/2016
2%	2011	04/01/2015
2%	2011	04/01/2014
1%	2011	04/01/2013
1%	2011	04/01/2013
2%	2011	04/01/2012
2%	2011	04/28/2011
2%	2008	03/25/2010
4%	2008	04/22/2008
4%	2008	11/14/2005

IV. CAPITAL RECOVERY FACTORS

The capital recovery factor (CRF) is based on a discount rate and a project life to determine the rate at which earnings could reasonably be expected to accrue if the same funds were invested over that length of time. Formulas and how the capital recovery factor is calculated can be found in Appendix C. The current discount rate should always be used in Moyer grant calculations. Tables E-6 through E-9 show the capital recover factor for different discount rates and project lives.

Table E-6: CRF for Various Project Lives At a 1% Discount Rate

Project Life (in years)	CRF
1	1.010
2	0.508
3	0.340
4	0.256
5	0.206
6	0.173
7	0.149
8	0.131
9	0.117
10	0.106
11	0.096
12	0.089
13	0.082
14	0.077
15	0.072
16	0.068
17	0.064
18	0.061
19	0.058
20	0.055

Table E-7: CRF for Various Project Lives At a 2% Discount Rate

Project Life (in years)	CRF
1	1.020
2	0.515
3	0.347
4	0.263
5	0.212
6	0.179
7	0.155
8	0.137
9	0.123
10	0.111
11	0.102
12	0.095
13	0.088
14	0.083
15	0.078
16	0.074
17	0.070
18	0.067
19	0.064
20	0.061

Table E-8: CRF for Various Project Lives At a 3% Discount Rate

Project Life (in years)	CRF
1	1.030
2	0.523
3	0.354
4	0.269
5	0.218
6	0.185
7	0.161
8	0.142
9	0.128
10	0.117
11	0.108
12	0.100
13	0.094
14	0.089
15	0.084
16	0.080
17	0.076
18	0.073
19	0.070
20	0.067

Table E-9: CRF for Various Project Lives At a 4% Discount Rate

Project Life (in years)	CRF
1	1.040
2	0.530
3	0.360
4	0.275
5	0.225
6	0.191
7	0.167
8	0.149
9	0.134
10	0.123
11	0.114
12	0.107
13	0.100
14	0.095
15	0.090
16	0.086
17	0.082
18	0.079
19	0.076
20	0.074