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MEMO

TO: Alliance of Automobile Manufacturers

DATE: 10 April 2019

FROM: NERA Economic Consulting

SUBJECT: **Corrected Tables and Figures for NERA/Trinity Report ("Evaluation of Alternative Passenger Car and Light Truck Fuel Economy Standards for Model Years 2021-2026")**

This memo provides corrected tables and figures for the NERA/Trinity report, "Evaluation of Alternative Passenger Car and Light Truck Fuel Economy Standards for Model Years 2021-2026", dated October 26, 2018 ("NERA/Trinity Report"). The corrected tables and figures correct small rounding and coding errors related to technology cost aggregation, fuel imports, and upstream emissions.

A. Net Benefits Estimates: Original and Corrected

Table 1 and Table 2 provide the original (i.e., the values included in the October 2018 NERA/Trinity Report) and corrected net benefits estimates using a 3 percent discount rate. Table 3 and Table 4 provide the original and corrected net benefits estimates using a 7 percent discount rate.

Table 1. Net Benefits Relative to Augural Standards Baseline, 3% Discount Rate (billions of 2016$) [original]

	Scenario 8	Scenario 5	Scenario 1
Social Costs			
Technology Costs	-68.8	-113.9	-170.7
Congestion Costs	-6.3	-10.6	-17.9
Noise Costs	-0.1	-0.2	-0.3
Fatal Crash Costs	-1.1	-1.3	-1.0
Non-Fatal Crash Costs	-1.5	-1.7	-1.3
Total Social Costs	**-77.7**	**-127.7**	**-191.2**
Social Benefits			
Valuation of Fuel Economy Benefits	-28.0	-49.0	-87.2
Fuel Tax Revenue Benefits	4.3	7.4	13.2
Petroleum Market Externality Benefits	-1.3	-2.2	-3.9
GHG Damage Reduction Benefits	-1.6	-2.9	-7.1
NO_x Damage Reduction Benefits	0.0	0.1	0.0
VOC Damage Reduction Benefits	0.0	-0.1	-0.1
$PM_{2.5}$ Damage Reduction Benefits	-0.4	-0.8	-1.7
SO_2 Damage Reduction Benefits	-2.0	-3.4	-6.1
Total Social Benefits	**-29.0**	**-50.9**	**-93.0**
Net Total Benefits	**48.7**	**76.8**	**98.2**

Note: Present values calculated as of January 1, 2017 using a 3 percent discount rate for costs/benefits incurred over the 2017-2050 analysis period. The values include effects for model year vehicles up to MY 2029. All values relative to augural standards baseline. All values in billions of 2016 dollars, rounded to the nearest $0.1 billion. GHG damage reduction benefits values include benefits associated CO_2, as well as other GHG pollutants, which have been converted to CO_{2eq}. Values may not sum to totals due to rounding.

Source: NERA/Trinity calculations as explained in text.

Table 2. Net Benefits Relative to Augural Standards Baseline, 3% Discount Rate (billions of 2016$) [corrected]

	Scenario 8	Scenario 5	Scenario 1
Social Costs			
Technology Costs	-68.7	-113.8	-170.7
Congestion Costs	-6.3	-10.6	-17.9
Noise Costs	-0.1	-0.2	-0.3
Fatal Crash Costs	-1.1	-1.3	-1.0
Non-Fatal Crash Costs	-1.5	-1.7	-1.3
Total Social Costs	**-77.7**	**-127.6**	**-191.1**
Social Benefits			
Valuation of Fuel Economy Benefits	-28.0	-49.0	-87.2
Fuel Tax Revenue Benefits	4.3	7.4	13.2
Petroleum Market Externality Benefits	-1.2	-2.1	-3.7
GHG Damage Reduction Benefits	-1.6	-2.9	-7.1
NO_x Damage Reduction Benefits	0.0	0.1	0.0
VOC Damage Reduction Benefits	0.0	-0.1	-0.1
$PM_{2.5}$ Damage Reduction Benefits	-0.4	-0.8	-1.7
SO_2 Damage Reduction Benefits	-2.0	-3.4	-6.1
Total Social Benefits	**-29.0**	**-50.8**	**-92.9**
Net Total Benefits	**48.7**	**76.8**	**98.3**

Note: Present values calculated as of January 1, 2017 using a 3 percent discount rate for costs/benefits incurred over the 2017-2050 analysis period. The values include effects for model year vehicles up to MY 2029. All values relative to augural standards baseline. All values in billions of 2016 dollars, rounded to the nearest $0.1 billion. GHG damage reduction benefits values include benefits associated CO_2, as well as other GHG pollutants, which have been converted to CO_{2eq}. Values may not sum to totals due to rounding.

Source: NERA/Trinity calculations as explained in text.

Table 3. Net Benefits Relative to Augural Standards Baseline, 7% Discount Rate (billions of 2016$) [original]

	Scenario 8	Scenario 5	Scenario 1
Social Costs			
Technology Costs	-51.8	-85.4	-128.5
Congestion Costs	-3.9	-6.5	-10.9
Noise Costs	-0.1	-0.1	-0.2
Fatal Crash Costs	-0.9	-1.1	-1.0
Non-Fatal Crash Costs	-1.2	-1.4	-1.3
Total Social Costs	**-57.8**	**-94.5**	**-141.8**
Social Benefits			
Valuation of Fuel Economy Benefits	-19.1	-33.3	-59.5
Fuel Tax Revenue Benefits	2.6	4.4	8.0
Petroleum Market Externality Benefits	-0.8	-1.3	-2.3
GHG Damage Reduction Benefits	-0.2	-0.3	-0.7
NO_x Damage Reduction Benefits	0.0	0.1	0.0
VOC Damage Reduction Benefits	0.0	0.0	-0.1
$PM_{2.5}$ Damage Reduction Benefits	-0.2	-0.5	-1.0
SO_2 Damage Reduction Benefits	-1.2	-2.0	-3.6
Total Social Benefits	**-18.9**	**-32.9**	**-59.3**
Net Total Benefits	**38.9**	**61.6**	**82.6**

Note: Present values calculated as of January 1, 2017 using a 3 percent discount rate for costs/benefits incurred over the 2017-2050 analysis period. The values include effects for model year vehicles up to MY 2029. All values relative to augural standards baseline. All values in billions of 2016 dollars, rounded to the nearest $0.1 billion. GHG damage reduction benefits values include benefits associated CO_2, as well as other GHG pollutants, which have been converted to CO_{2eq}. Values may not sum to totals due to rounding.

Source: NERA/Trinity calculations as explained in text.

Table 4. Net Benefits Relative to Augural Standards Baseline, 7% Discount Rate (billions of 2016$) [corrected]

	Scenario 8	Scenario 5	Scenario 1
Social Costs			
Technology Costs	-51.8	-85.3	-128.4
Congestion Costs	-3.9	-6.5	-10.9
Noise Costs	-0.1	-0.1	-0.2
Fatal Crash Costs	-0.9	-1.1	-1.0
Non-Fatal Crash Costs	-1.2	-1.4	-1.3
Total Social Costs	**-57.8**	**-94.4**	**-141.8**
Social Benefits			
Valuation of Fuel Economy Benefits	-19.1	-33.3	-59.5
Fuel Tax Revenue Benefits	2.6	4.4	8.0
Petroleum Market Externality Benefits	-0.7	-1.2	-2.2
GHG Damage Reduction Benefits	-0.2	-0.3	-0.7
NO_x Damage Reduction Benefits	0.0	0.1	0.1
VOC Damage Reduction Benefits	0.0	0.0	-0.1
$PM_{2.5}$ Damage Reduction Benefits	-0.2	-0.4	-0.8
SO_2 Damage Reduction Benefits	-1.0	-1.8	-3.3
Total Social Benefits	**-18.7**	**-32.5**	**-58.5**
Net Total Benefits	**39.1**	**61.9**	**83.2**

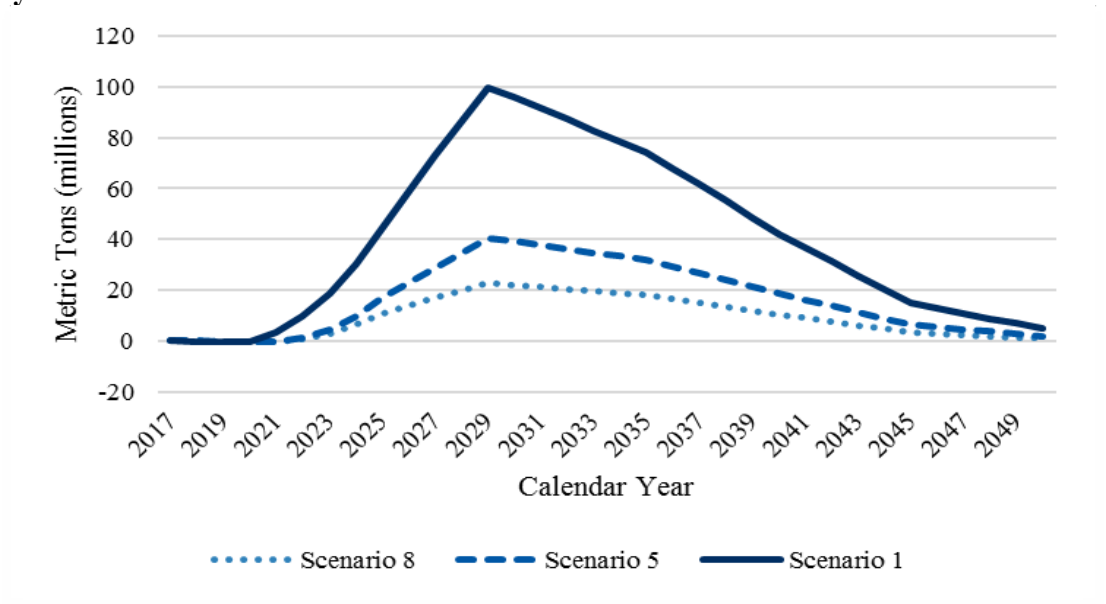
Note: Present values calculated as of January 1, 2017 using a 3 percent discount rate for costs/benefits incurred over the 2017-2050 analysis period. The values include effects for model year vehicles up to MY 2029. All values relative to augural standards baseline. All values in billions of 2016 dollars, rounded to the nearest $0.1 billion. GHG damage reduction benefits values include benefits associated CO_2, as well as other GHG pollutants, which have been converted to CO_{2eq}. Values may not sum to totals due to rounding.

Source: NERA/Trinity calculations as explained in text.

B. Updated Tables and Figures for NERA/Trinity Report

The following corrected tables and figures should replace the versions included in the October 2018 NERA/Trinity Report.

Figure ES-6. Differences in GHG Emissions (CO_{2eq}) relative to Augural Standards Baseline by Calendar Year



Note: GHG emissions presented as CO_2 equivalents and include CO_2, N_2O, and CH_4 emissions.

Figure ES-7. Differences in NO_X Emissions relative to Augural Standards Baseline by Calendar Year

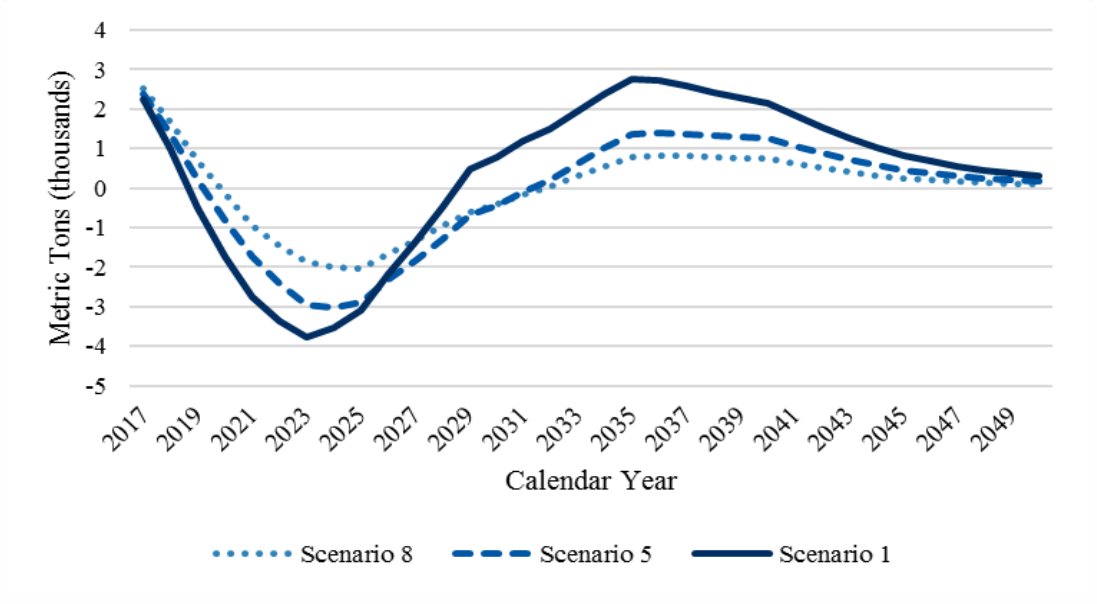


Table ES-3. Net Benefits Relative to Augural Standards Baseline, 3% Discount Rate (billions of 2016$)

	Scenario 8	Scenario 5	Scenario 1
Social Costs			
Technology Costs	-68.7	-113.8	-170.7
Congestion Costs	-6.3	-10.6	-17.9
Noise Costs	-0.1	-0.2	-0.3
Fatal Crash Costs	-1.1	-1.3	-1.0
Non-Fatal Crash Costs	-1.5	-1.7	-1.3
Total Social Costs	**-77.7**	**-127.6**	**-191.1**
Social Benefits			
Valuation of Fuel Economy Benefits	-28.0	-49.0	-87.2
Fuel Tax Revenue Benefits	4.3	7.4	13.2
Petroleum Market Externality Benefits	-1.2	-2.1	-3.7
GHG Damage Reduction Benefits	-1.6	-2.9	-7.1
NO_x Damage Reduction Benefits	0.0	0.1	0.0
VOC Damage Reduction Benefits	0.0	-0.1	-0.1
$PM_{2.5}$ Damage Reduction Benefits	-0.4	-0.8	-1.7
SO_2 Damage Reduction Benefits	-2.0	-3.4	-6.1
Total Social Benefits	**-29.0**	**-50.8**	**-92.9**
Net Total Benefits	**48.7**	**76.8**	**98.3**

Note: Present values calculated as of January 1, 2017 using a 3 percent discount rate for costs/benefits incurred over the 2017-2050 analysis period. The values include effects for model year vehicles up to MY 2029. All values relative to augural standards baseline. All values in billions of 2016 dollars, rounded to the nearest $0.1 billion. GHG damage reduction benefits values include benefits associated CO_2, as well as other GHG pollutants, which have been converted to CO_{2eq}. Values may not sum to totals due to rounding.

Source: NERA/Trinity calculations as explained in text.

Table ES-4. Net Benefits Relative to Augural Standards Baseline, 7% Discount Rate (Billions of 2016$)

	Scenario 8	Scenario 5	Scenario 1
Social Costs			
Technology Costs	-51.8	-85.3	-128.4
Congestion Costs	-3.9	-6.5	-10.9
Noise Costs	-0.1	-0.1	-0.2
Fatal Crash Costs	-0.9	-1.1	-1.0
Non-Fatal Crash Costs	-1.2	-1.4	-1.3
Total Social Costs	**-57.8**	**-94.4**	**-141.8**
Social Benefits			
Valuation of Fuel Economy Benefits	-19.1	-33.3	-59.5
Fuel Tax Revenue Benefits	2.6	4.4	8.0
Petroleum Market Externality Benefits	-0.7	-1.2	-2.2
GHG Damage Reduction Benefits	-0.2	-0.3	-0.7
NO_x Damage Reduction Benefits	0.0	0.1	0.1
VOC Damage Reduction Benefits	0.0	0.0	-0.1
$PM_{2.5}$ Damage Reduction Benefits	-0.2	-0.4	-0.8
SO_2 Damage Reduction Benefits	-1.0	-1.8	-3.3
Total Social Benefits	**-18.7**	**-32.5**	**-58.5**
Net Total Benefits	**39.1**	**61.9**	**83.2**

Note: Present values calculated as of January 1, 2017 using a 7 percent discount rate for costs/benefits incurred over the 2017-2050 analysis period. The values include effects for model year vehicles up to MY 2029. All values relative to augural standards baseline. All values in billions of 2016 dollars, rounded to the nearest $0.1 billion. GHG damage reduction benefits values include benefits associated CO_2, as well as other GHG pollutants, which have been converted to CO_{2eq}. Values may not sum to totals due to rounding.

Source: NERA/Trinity calculations as explained in text.

Table 15. GHG Emissions (millions of metric tons) for Select Calendar Years

Calendar Year	Source	Augural Stds	Scenario 8	Scenario 5	Scenario 1
2020	Tailpipe	998.5	997.9	997.7	997.0
	Upstream	347.4	347.7	347.9	348.5
	Total	**1,346.0**	**1,345.6**	**1,345.5**	**1,345.5**
2025	Tailpipe	880.9	890.0	894.7	920.1
	Upstream	285.1	286.9	288.2	290.8
	Total	**1,166.0**	**1,176.9**	**1,182.9**	**1,210.9**
2030	Tailpipe	737.4	756.3	771.1	823.9
	Upstream	241.3	244.4	246.7	251.0
	Total	**978.7**	**1,000.7**	**1,017.8**	**1,074.8**
2035	Tailpipe	422.3	438.0	450.0	489.5
	Upstream	138.7	141.1	142.8	145.7
	Total	**561.0**	**579.1**	**592.8**	**635.3**
2040	Tailpipe	192.7	201.8	209.0	230.9
	Upstream	63.6	64.9	65.9	67.4
	Total	**256.2**	**266.7**	**274.9**	**298.4**
2045	Tailpipe	64.6	67.6	70.2	78.5
	Upstream	21.1	21.5	21.9	22.5
	Total	**85.7**	**89.1**	**92.1**	**101.0**
2050	Tailpipe	18.4	19.3	20.1	22.8
	Upstream	5.9	6.1	6.2	6.4
	Total	**24.4**	**25.3**	**26.2**	**29.2**

Note: Results include both passenger cars and light trucks. GHG emissions presented as CO_2 equivalents and include CO_2, N_2O, and CH_4 emissions.
Source: NERA/Trinity calculations as explained in text.

Table 16. Differences in GHG Emissions (millions of metric tons) Compared to Augural Standards Baseline for Select Calendar Years

Calendar Year	Source	Augural Stds	Scenario 8	Scenario 5	Scenario 1
2020	Tailpipe	--	-0.6	-0.8	-1.5
	Upstream	--	0.2	0.4	1.1
	Total	**--**	**-0.3**	**-0.4**	**-0.5**
2025	Tailpipe	--	9.0	13.8	39.2
	Upstream	--	1.8	3.1	5.7
	Total	**--**	**10.9**	**16.9**	**44.9**
2030	Tailpipe	--	18.9	33.7	86.5
	Upstream	--	3.1	5.4	9.6
	Total	**--**	**22.0**	**39.1**	**96.1**
2035	Tailpipe	--	15.6	27.7	67.2
	Upstream	--	2.4	4.1	7.0
	Total	**--**	**18.0**	**31.8**	**74.2**
2040	Tailpipe	--	9.1	16.4	38.3
	Upstream	--	1.3	2.3	3.9
	Total	**--**	**10.5**	**18.7**	**42.1**
2045	Tailpipe	--	2.9	5.6	13.9
	Upstream	--	0.4	0.8	1.4
	Total	**--**	**3.4**	**6.4**	**15.2**
2050	Tailpipe	--	0.8	1.6	4.4
	Upstream	--	0.1	0.2	0.4
	Total	**--**	**1.0**	**1.9**	**4.8**

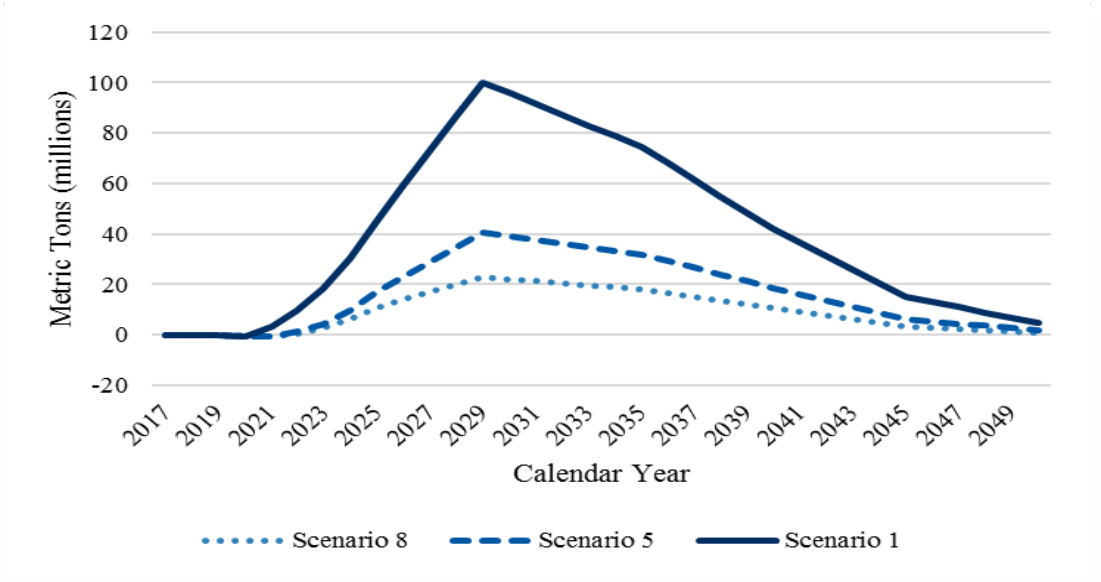
Note: Results include both passenger cars and light trucks.
Source: NERA/Trinity calculations as explained in text.

Table 17. Differences in GHG Emissions (% Change) Compared to Augural Standards Baseline for Select Calendar Years

Calendar Year	Source	Augural Stds	Scenario 8	Scenario 5	Scenario 1
2020	Tailpipe	--	-0.06%	-0.08%	-0.15%
	Upstream	--	0.07%	0.12%	0.31%
	Total	**--**	**-0.02%**	**-0.03%**	**-0.04%**
2025	Tailpipe	--	1.03%	1.56%	4.45%
	Upstream	--	0.64%	1.09%	1.99%
	Total	**--**	**0.93%**	**1.45%**	**3.85%**
2030	Tailpipe	--	2.56%	4.56%	11.72%
	Upstream	--	1.29%	2.25%	4.00%
	Total	**--**	**2.25%**	**3.99%**	**9.82%**
2035	Tailpipe	--	3.71%	6.56%	15.91%
	Upstream	--	1.71%	2.94%	5.06%
	Total	**--**	**3.21%**	**5.67%**	**13.23%**
2040	Tailpipe	--	4.74%	8.51%	19.86%
	Upstream	--	2.09%	3.61%	6.09%
	Total	**--**	**4.08%**	**7.29%**	**16.45%**
2045	Tailpipe	--	4.55%	8.64%	21.43%
	Upstream	--	2.05%	3.73%	6.54%
	Total	**--**	**3.94%**	**7.43%**	**17.77%**
2050	Tailpipe	--	4.48%	8.86%	23.81%
	Upstream	--	2.24%	4.14%	7.44%
	Total	**--**	**3.93%**	**7.71%**	**19.82%**

Note: Results include both passenger cars and light trucks.
Source: NERA/Trinity calculations as explained in text.

Figure 7. Differences in GHG Emissions (CO_{2eq}) relative to Augural Standards Baseline by Calendar Year



Note: GHG emissions presented as CO_2 equivalents and include CO_2, N_2O, and CH_4 emissions.

Table 18. NO_X Emissions (thousands of metric tons) for Select Calendar Years

Calendar Year	Source	Augural Stds	Scenario 8	Scenario 5	Scenario 1
2020	Tailpipe	733.1	732.8	732.0	730.7
	Upstream	208.9	209.0	209.2	209.6
	Total	**942.0**	**941.9**	**941.2**	**940.3**
2025	Tailpipe	414.6	411.4	409.8	407.9
	Upstream	180.2	181.4	182.2	183.8
	Total	**594.8**	**592.8**	**592.0**	**591.8**
2030	Tailpipe	264.7	262.3	260.8	259.3
	Upstream	155.4	157.4	158.8	161.5
	Total	**420.1**	**419.7**	**419.7**	**420.9**
2035	Tailpipe	157.3	156.6	156.1	155.6
	Upstream	88.6	90.1	91.2	93.1
	Total	**245.9**	**246.7**	**247.3**	**248.7**
2040	Tailpipe	78.6	78.5	78.4	78.3
	Upstream	39.5	40.4	41.0	41.9
	Total	**118.1**	**118.9**	**119.4**	**120.3**
2045	Tailpipe	29.2	29.1	29.1	29.1
	Upstream	13.3	13.5	13.8	14.1
	Total	**42.4**	**42.7**	**42.9**	**43.3**
2050	Tailpipe	8.5	8.5	8.5	8.5
	Upstream	3.8	3.9	4.0	4.1
	Total	**12.3**	**12.4**	**12.5**	**12.6**

Note: Results include both passenger cars and light trucks.
Source: NERA/Trinity calculations as explained in text.

Table 19. Differences in NO_X Emissions (thousands of metric tons) Compared to Augural Standards Baseline for Select Calendar Years

Calendar Year	Source	Augural Stds	Scenario 8	Scenario 5	Scenario 1
2020	Tailpipe	--	-0.3	-1.1	-2.4
	Upstream	--	0.1	0.3	0.7
	Total	**--**	**-0.1**	**-0.8**	**-1.7**
2025	Tailpipe	--	-3.2	-4.9	-6.7
	Upstream	--	1.2	2.0	3.6
	Total	**--**	**-2.0**	**-2.9**	**-3.1**
2030	Tailpipe	--	-2.4	-3.9	-5.4
	Upstream	--	2.0	3.5	6.2
	Total	**--**	**-0.4**	**-0.4**	**0.8**
2035	Tailpipe	--	-0.7	-1.2	-1.7
	Upstream	--	1.5	2.6	4.5
	Total	**--**	**0.8**	**1.4**	**2.8**
2040	Tailpipe	--	-0.1	-0.2	-0.2
	Upstream	--	0.8	1.4	2.4
	Total	**--**	**0.7**	**1.3**	**2.2**
2045	Tailpipe	--	0.0	0.0	0.0
	Upstream	--	0.3	0.5	0.9
	Total	**--**	**0.2**	**0.5**	**0.8**
2050	Tailpipe	--	0.0	0.0	0.0
	Upstream	--	0.1	0.2	0.3
	Total	**--**	**0.1**	**0.2**	**0.3**

Note: Results include both passenger cars and light trucks.
Source: NERA/Trinity calculations as explained in text.

Table 20. Differences in NO_X Emissions (% Change) Compared to Augural Standards Baseline for Select Calendar Years

Calendar Year	Source	Augural Stds	Scenario 8	Scenario 5	Scenario 1
2020	Tailpipe	--	-0.04%	-0.15%	-0.33%
	Upstream	--	0.07%	0.12%	0.31%
	Total	**--**	**-0.01%**	**-0.09%**	**-0.18%**
2025	Tailpipe	--	-0.77%	-1.17%	-1.61%
	Upstream	--	0.64%	1.09%	2.00%
	Total	**--**	**-0.34%**	**-0.49%**	**-0.52%**
2030	Tailpipe	--	-0.91%	-1.48%	-2.04%
	Upstream	--	1.28%	2.24%	3.98%
	Total	**--**	**-0.10%**	**-0.11%**	**0.19%**
2035	Tailpipe	--	-0.44%	-0.77%	-1.07%
	Upstream	--	1.69%	2.91%	5.02%
	Total	**--**	**0.33%**	**0.56%**	**1.12%**
2040	Tailpipe	--	-0.10%	-0.21%	-0.30%
	Upstream	--	2.07%	3.58%	6.04%
	Total	**--**	**0.63%**	**1.06%**	**1.82%**
2045	Tailpipe	--	-0.11%	-0.12%	-0.11%
	Upstream	--	2.02%	3.70%	6.50%
	Total	**--**	**0.56%**	**1.08%**	**1.96%**
2050	Tailpipe	--	0.22%	0.30%	0.39%
	Upstream	--	2.23%	4.13%	7.42%
	Total	**--**	**0.84%**	**1.48%**	**2.57%**

Note: Results include both passenger cars and light trucks.
Source: NERA/Trinity calculations as explained in text.

Figure 8. Differences in NO_X Emissions relative to Augural Standards Baseline by Calendar Year

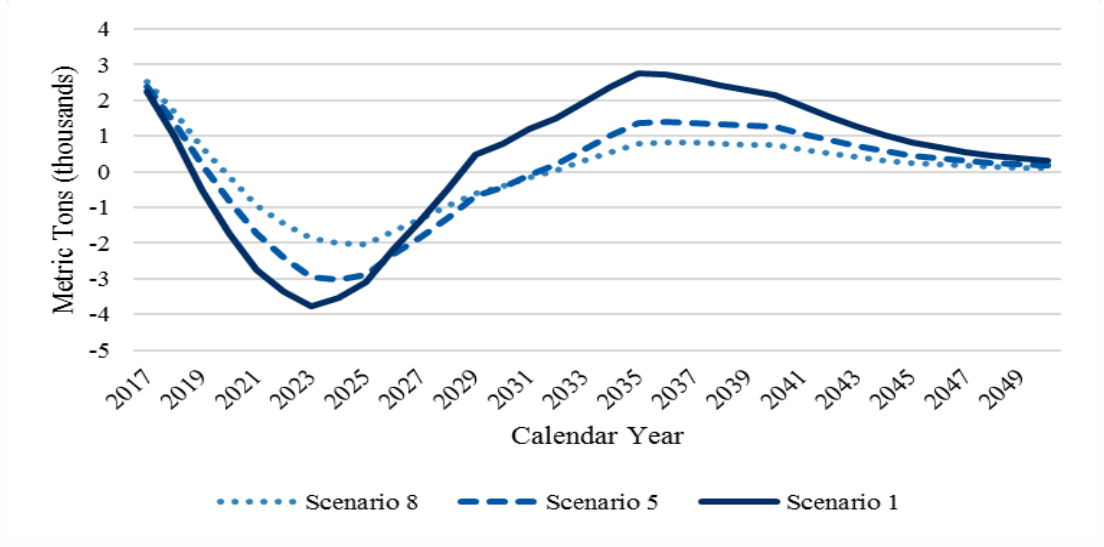


Table 21. VOC Emissions (thousands of metric tons) for Select Calendar Years

Calendar Year	Source	Augural Stds	Scenario 8	Scenario 5	Scenario 1
2020	Tailpipe	496.4	496.8	496.3	495.6
	Upstream	329.1	329.3	329.5	330.1
	Total	**825.5**	**826.1**	**825.8**	**825.7**
2025	Tailpipe	316.6	314.7	313.7	312.7
	Upstream	305.0	307.0	308.3	311.1
	Total	**621.7**	**621.7**	**622.0**	**623.8**
2030	Tailpipe	213.3	211.7	210.7	209.9
	Upstream	262.6	266.0	268.5	273.1
	Total	**475.9**	**477.7**	**479.2**	**483.0**
2035	Tailpipe	130.0	129.6	129.2	128.9
	Upstream	150.7	153.3	155.1	158.3
	Total	**280.7**	**282.8**	**284.3**	**287.2**
2040	Tailpipe	66.5	66.5	66.4	66.4
	Upstream	68.7	70.1	71.1	72.8
	Total	**135.2**	**136.6**	**137.5**	**139.2**
2045	Tailpipe	25.0	24.9	24.9	24.9
	Upstream	22.9	23.4	23.8	24.4
	Total	**47.9**	**48.3**	**48.7**	**49.4**
2050	Tailpipe	7.5	7.5	7.5	7.5
	Upstream	6.5	6.6	6.8	7.0
	Total	**14.0**	**14.2**	**14.3**	**14.5**

Note: Results include both passenger cars and light trucks.
Source: NERA/Trinity calculations as explained in text.

Table 22. VOC Emissions (thousands of metric tons) Compared to Augural Standards Baseline for Select Calendar Years

Calendar Year	Source	Augural Stds	Scenario 8	Scenario 5	Scenario 1
2020	Tailpipe	--	0.4	-0.1	-0.8
	Upstream	--	0.2	0.4	1.0
	Total	**--**	**0.6**	**0.3**	**0.2**
2025	Tailpipe	--	-1.9	-2.9	-3.9
	Upstream	--	1.9	3.3	6.1
	Total	**--**	**0.1**	**0.4**	**2.1**
2030	Tailpipe	--	-1.5	-2.5	-3.3
	Upstream	--	3.4	5.9	10.5
	Total	**--**	**1.8**	**3.4**	**7.1**
2035	Tailpipe	--	-0.5	-0.8	-1.1
	Upstream	--	2.6	4.4	7.6
	Total	**--**	**2.1**	**3.6**	**6.5**
2040	Tailpipe	--	0.0	-0.1	-0.1
	Upstream	--	1.4	2.5	4.2
	Total	**--**	**1.4**	**2.4**	**4.0**
2045	Tailpipe	--	0.0	0.0	0.0
	Upstream	--	0.5	0.8	1.5
	Total	**--**	**0.4**	**0.8**	**1.5**
2050	Tailpipe	--	0.0	0.0	0.0
	Upstream	--	0.1	0.3	0.5
	Total	**--**	**0.2**	**0.3**	**0.5**

Note: Results include both passenger cars and light trucks.
Source: NERA/Trinity calculations as explained in text.

Table 23. VOC Emissions (% Change) Compared to Augural Standards Baseline for Select Calendar Years

Calendar Year	Source	Augural Stds	Scenario 8	Scenario 5	Scenario 1
2020	Tailpipe	--	0.08%	-0.01%	-0.16%
	Upstream	--	0.07%	0.12%	0.31%
	Total	**--**	**0.07%**	**0.04%**	**0.02%**
2025	Tailpipe	--	-0.59%	-0.92%	-1.25%
	Upstream	--	0.63%	1.08%	1.99%
	Total	**--**	**0.01%**	**0.06%**	**0.34%**
2030	Tailpipe	--	-0.72%	-1.18%	-1.57%
	Upstream	--	1.28%	2.24%	3.99%
	Total	**--**	**0.39%**	**0.71%**	**1.50%**
2035	Tailpipe	--	-0.36%	-0.64%	-0.85%
	Upstream	--	1.70%	2.92%	5.04%
	Total	**--**	**0.75%**	**1.27%**	**2.31%**
2040	Tailpipe	--	-0.04%	-0.12%	-0.18%
	Upstream	--	2.08%	3.59%	6.06%
	Total	**--**	**1.04%**	**1.76%**	**2.99%**
2045	Tailpipe	--	-0.07%	-0.07%	-0.04%
	Upstream	--	2.03%	3.71%	6.51%
	Total	**--**	**0.94%**	**1.74%**	**3.10%**
2050	Tailpipe	--	0.25%	0.34%	0.44%
	Upstream	--	2.22%	4.13%	7.43%
	Total	**--**	**1.16%**	**2.10%**	**3.68%**

Note: Results include both passenger cars and light trucks.
Source: NERA/Trinity calculations as explained in text.

Figure 9. Differences in VOC Emissions relative to Augural Standards Baseline by Calendar Year

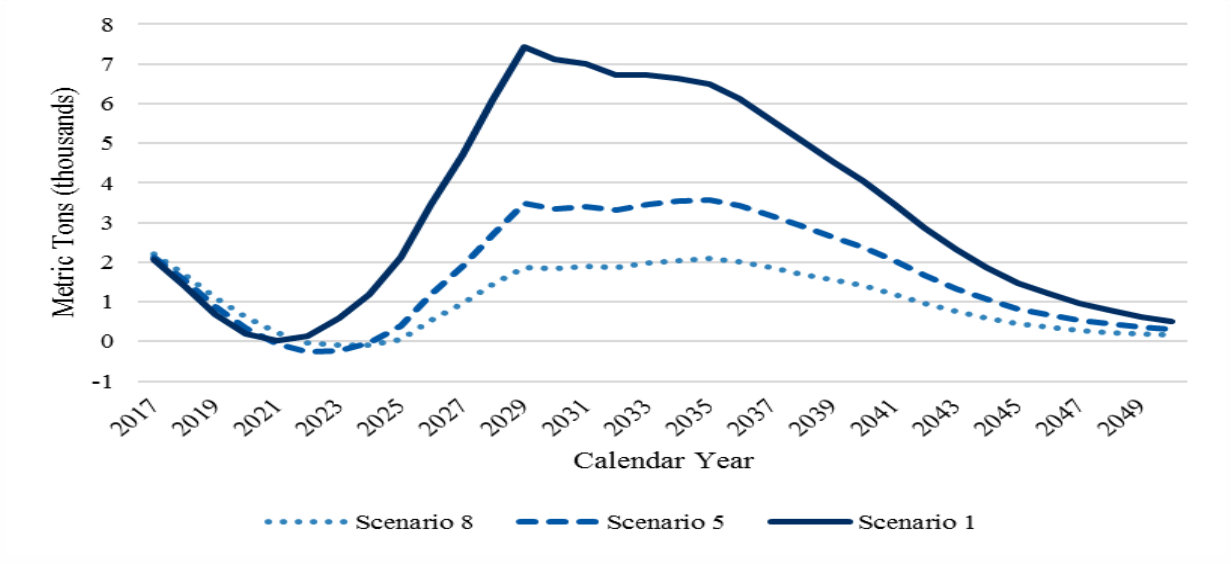


Table 24. $PM_{2.5}$ Emissions (metric tons) for Select Calendar Years

Calendar Year	Source	Augural Stds	Scenario 8	Scenario 5	Scenario 1
2020	Tailpipe	16,752.1	16,738.6	16,727.0	16,706.3
	Upstream	16,787.1	16,798.7	16,807.7	16,839.2
	Total	**33,539.2**	**33,537.2**	**33,534.7**	**33,545.5**
2025	Tailpipe	13,410.2	13,333.1	13,293.5	13,245.8
	Upstream	13,528.6	13,614.9	13,676.2	13,799.1
	Total	**26,938.8**	**26,948.0**	**26,969.7**	**27,044.9**
2030	Tailpipe	10,802.9	10,716.9	10,661.5	10,601.6
	Upstream	11,693.3	11,843.5	11,955.3	12,159.0
	Total	**22,496.2**	**22,560.4**	**22,616.8**	**22,760.7**
2035	Tailpipe	7,192.5	7,155.5	7,130.1	7,104.2
	Upstream	6,658.8	6,771.4	6,852.8	6,993.3
	Total	**13,851.2**	**13,926.9**	**13,982.8**	**14,097.6**
2040	Tailpipe	3,843.1	3,837.9	3,833.1	3,828.1
	Upstream	2,998.3	3,060.3	3,105.5	3,179.4
	Total	**6,841.4**	**6,898.2**	**6,938.7**	**7,007.5**
2045	Tailpipe	1,554.8	1,553.4	1,553.5	1,553.7
	Upstream	1,006.8	1,027.1	1,044.0	1,072.2
	Total	**2,561.6**	**2,580.5**	**2,597.5**	**2,625.9**
2050	Tailpipe	489.6	490.6	491.2	491.7
	Upstream	288.2	294.6	300.1	309.6
	Total	**777.8**	**785.2**	**791.3**	**801.4**

Note: Results include both passenger cars and light trucks.
Source: NERA/Trinity calculations as explained in text.

Table 25. $PM_{2.5}$ Emissions (metric tons) Compared to Augural Standards Baseline for Select Calendar Years

Calendar Year	Source	Augural Stds	Scenario 8	Scenario 5	Scenario 1
2020	Tailpipe	--	-13.6	-25.1	-45.9
	Upstream	--	11.6	20.6	52.1
	Total	**--**	**-2.0**	**-4.5**	**6.3**
2025	Tailpipe	--	-77.1	-116.8	-164.4
	Upstream	--	86.3	147.6	270.5
	Total	**--**	**9.2**	**30.9**	**106.1**
2030	Tailpipe	--	-86.0	-141.4	-201.3
	Upstream	--	150.2	262.0	465.7
	Total	**--**	**64.2**	**120.6**	**264.4**
2035	Tailpipe	--	-37.0	-62.4	-88.2
	Upstream	--	112.6	194.0	334.6
	Total	**--**	**75.6**	**131.6**	**246.4**
2040	Tailpipe	--	-5.2	-10.0	-15.0
	Upstream	--	62.0	107.2	181.1
	Total	**--**	**56.8**	**97.3**	**166.1**
2045	Tailpipe	--	-1.4	-1.3	-1.1
	Upstream	--	20.3	37.2	65.4
	Total	**--**	**18.9**	**35.9**	**64.3**
2050	Tailpipe	--	1.0	1.6	2.2
	Upstream	--	6.4	11.9	21.4
	Total	**--**	**7.4**	**13.5**	**23.6**

Note: Results include both passenger cars and light trucks.
Source: NERA/Trinity calculations as explained in text.

Table 26. $PM_{2.5}$ Emissions (% Change) Compared to Augural Standards Baseline for Select Calendar Years

Calendar Year	Source	Augural Stds	Scenario 8	Scenario 5	Scenario 1
2020	Tailpipe	--	-0.08%	-0.15%	-0.27%
	Upstream	--	0.07%	0.12%	0.31%
	Total	**--**	**-0.01%**	**-0.01%**	**0.02%**
2025	Tailpipe	--	-0.58%	-0.87%	-1.23%
	Upstream	--	0.64%	1.09%	2.00%
	Total	**--**	**0.03%**	**0.11%**	**0.39%**
2030	Tailpipe	--	-0.80%	-1.31%	-1.86%
	Upstream	--	1.28%	2.24%	3.98%
	Total	**--**	**0.29%**	**0.54%**	**1.18%**
2035	Tailpipe	--	-0.51%	-0.87%	-1.23%
	Upstream	--	1.69%	2.91%	5.02%
	Total	**--**	**0.55%**	**0.95%**	**1.78%**
2040	Tailpipe	--	-0.13%	-0.26%	-0.39%
	Upstream	--	2.07%	3.58%	6.04%
	Total	**--**	**0.83%**	**1.42%**	**2.43%**
2045	Tailpipe	--	-0.09%	-0.08%	-0.07%
	Upstream	--	2.02%	3.70%	6.50%
	Total	**--**	**0.74%**	**1.40%**	**2.51%**
2050	Tailpipe	--	0.20%	0.32%	0.44%
	Upstream	--	2.23%	4.13%	7.42%
	Total	**--**	**0.95%**	**1.73%**	**3.03%**

Note: Results include both passenger cars and light trucks.
Source: NERA/Trinity calculations as explained in text.

Figure 10. Differences in $PM_{2.5}$ Emissions relative to Augural Standards Baseline by Calendar Year

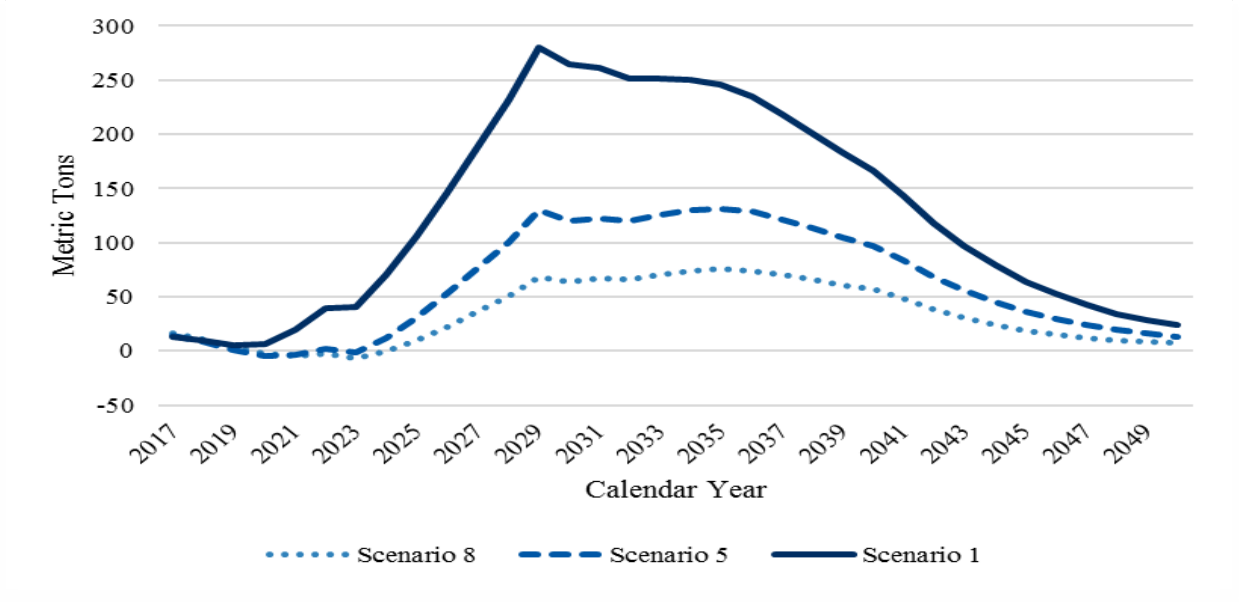


Table 27. SO_2 Emissions (metric tons) for Select Calendar Years

Calendar Year	Source	Augural Stds	Scenario 8	Scenario 5	Scenario 1
2020	Tailpipe	6.5	6.5	6.5	6.5
	Upstream	186.8	187.0	187.1	187.4
	Total	**193.4**	**193.5**	**193.6**	**193.9**
2025	Tailpipe	5.8	5.8	5.8	5.8
	Upstream	130.6	131.4	132.0	133.2
	Total	**136.4**	**137.2**	**137.7**	**138.9**
2030	Tailpipe	4.9	4.8	4.8	4.8
	Upstream	112.5	114.0	115.1	117.0
	Total	**117.4**	**118.8**	**119.9**	**121.8**
2035	Tailpipe	2.8	2.8	2.8	2.8
	Upstream	63.9	64.9	65.7	67.1
	Total	**66.6**	**67.7**	**68.5**	**69.8**
2040	Tailpipe	1.3	1.3	1.3	1.3
	Upstream	28.6	29.2	29.7	30.4
	Total	**29.9**	**30.5**	**30.9**	**31.6**
2045	Tailpipe	0.4	0.4	0.4	0.4
	Upstream	9.6	9.8	9.9	10.2
	Total	**10.0**	**10.2**	**10.4**	**10.6**
2050	Tailpipe	0.1	0.1	0.1	0.1
	Upstream	2.7	2.8	2.8	2.9
	Total	**2.9**	**2.9**	**3.0**	**3.1**

Note: Results include both passenger cars and light trucks.
Source: NERA/Trinity calculations as explained in text.

Table 28. SO_2 Emissions (metric tons) Compared to Augural Standards Baseline for Select Calendar Years

Calendar Year	Source	Augural Stds	Scenario 8	Scenario 5	Scenario 1
2020	Tailpipe	--	0.0	0.0	0.0
	Upstream	--	0.1	0.2	0.6
	Total	**--**	**0.1**	**0.2**	**0.6**
2025	Tailpipe	--	0.0	0.0	0.0
	Upstream	--	0.8	1.4	2.6
	Total	**--**	**0.8**	**1.4**	**2.6**
2030	Tailpipe	--	0.0	0.0	-0.1
	Upstream	--	1.4	2.5	4.5
	Total	**--**	**1.4**	**2.5**	**4.4**
2035	Tailpipe	--	0.0	0.0	0.0
	Upstream	--	1.1	1.9	3.2
	Total	**--**	**1.1**	**1.8**	**3.2**
2040	Tailpipe	--	0.0	0.0	0.0
	Upstream	--	0.6	1.0	1.7
	Total	**--**	**0.6**	**1.0**	**1.7**
2045	Tailpipe	--	0.0	0.0	0.0
	Upstream	--	0.2	0.4	0.6
	Total	**--**	**0.2**	**0.4**	**0.6**
2050	Tailpipe	--	0.0	0.0	0.0
	Upstream	--	0.1	0.1	0.2
	Total	**--**	**0.1**	**0.1**	**0.2**

Note: Results include both passenger cars and light trucks.
Source: NERA/Trinity calculations as explained in text.

Table 29. SO_2 Emissions (% Change) Compared to Augural Standards Baseline for Select Calendar Years

Calendar Year	Source	Augural Stds	Scenario 8	Scenario 5	Scenario 1
2020	Tailpipe	--	-0.06%	-0.08%	-0.15%
	Upstream	--	0.07%	0.12%	0.31%
	Total	**--**	**0.06%**	**0.12%**	**0.29%**
2025	Tailpipe	--	-0.35%	-0.54%	-0.82%
	Upstream	--	0.64%	1.09%	2.00%
	Total	**--**	**0.60%**	**1.02%**	**1.88%**
2030	Tailpipe	--	-0.51%	-0.85%	-1.34%
	Upstream	--	1.28%	2.24%	3.98%
	Total	**--**	**1.21%**	**2.11%**	**3.76%**
2035	Tailpipe	--	-0.31%	-0.52%	-0.82%
	Upstream	--	1.69%	2.91%	5.02%
	Total	**--**	**1.61%**	**2.77%**	**4.78%**
2040	Tailpipe	--	-0.03%	-0.06%	-0.15%
	Upstream	--	2.07%	3.57%	6.04%
	Total	**--**	**1.98%**	**3.42%**	**5.78%**
2045	Tailpipe	--	-0.01%	0.06%	0.11%
	Upstream	--	2.02%	3.69%	6.49%
	Total	**--**	**1.93%**	**3.54%**	**6.22%**
2050	Tailpipe	--	0.18%	0.29%	0.40%
	Upstream	--	2.22%	4.13%	7.42%
	Total	**--**	**2.14%**	**3.96%**	**7.13%**

Note: Results include both passenger cars and light trucks.
Source: NERA/Trinity calculations as explained in text.

Figure 11. Differences in SO_2 Emissions relative to Augural Standards Baseline by Calendar Year

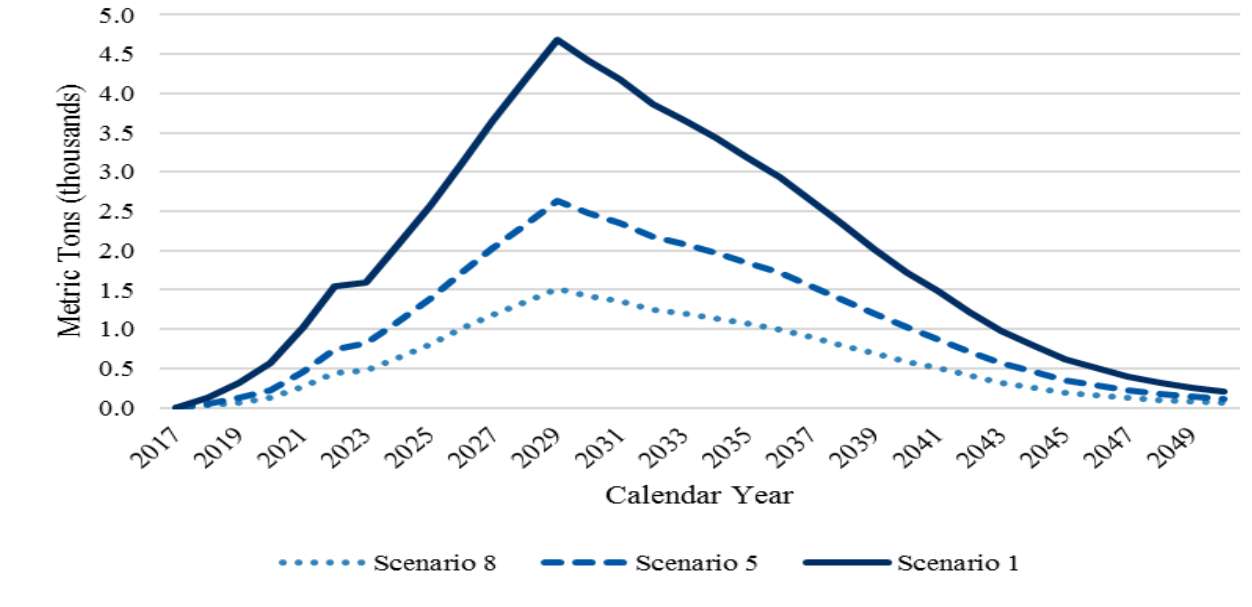


Table 30. CO Emissions (thousands of metric tons) for Select Calendar Years

Calendar Year	Source	Augural Stds	Scenario 8	Scenario 5	Scenario 1
2020	Tailpipe	9,036.9	9,031.5	9,025.1	9,013.7
	Upstream	97.3	97.4	97.4	97.6
	Total	**9,134.2**	**9,128.9**	**9,122.5**	**9,111.4**
2025	Tailpipe	6,792.1	6,752.4	6,731.7	6,707.7
	Upstream	87.7	88.3	88.7	89.5
	Total	**6,879.8**	**6,840.7**	**6,820.4**	**6,797.1**
2030	Tailpipe	4,862.7	4,822.9	4,797.2	4,770.6
	Upstream	76.1	77.0	77.8	79.1
	Total	**4,938.7**	**4,899.9**	**4,874.9**	**4,849.7**
2035	Tailpipe	2,997.4	2,982.7	2,972.3	2,962.0
	Upstream	43.6	44.4	44.9	45.8
	Total	**3,041.0**	**3,027.1**	**3,017.2**	**3,007.8**
2040	Tailpipe	1,478.1	1,476.4	1,474.5	1,472.6
	Upstream	19.7	20.1	20.4	20.9
	Total	**1,497.9**	**1,496.5**	**1,494.9**	**1,493.6**
2045	Tailpipe	544.3	543.6	543.5	543.5
	Upstream	6.6	6.7	6.9	7.0
	Total	**550.9**	**550.3**	**550.4**	**550.5**
2050	Tailpipe	160.8	161.1	161.3	161.5
	Upstream	1.9	1.9	2.0	2.0
	Total	**162.7**	**163.1**	**163.3**	**163.5**

Note: Results include both passenger cars and light trucks.
Source: NERA/Trinity calculations as explained in text.

Table 31. CO Emissions (thousands of metric tons) Compared to Augural Standards Baseline for Select Calendar Years

Calendar Year	Source	Augural Stds	Scenario 8	Scenario 5	Scenario 1
2020	Tailpipe	--	-5.4	-11.8	-23.2
	Upstream	--	0.1	0.1	0.3
	Total	**--**	**-5.4**	**-11.7**	**-22.9**
2025	Tailpipe	--	-39.7	-60.4	-84.4
	Upstream	--	0.6	1.0	1.8
	Total	**--**	**-39.2**	**-59.4**	**-82.7**
2030	Tailpipe	--	-39.8	-65.5	-92.0
	Upstream	--	1.0	1.7	3.0
	Total	**--**	**-38.8**	**-63.8**	**-89.0**
2035	Tailpipe	--	-14.6	-25.1	-35.4
	Upstream	--	0.7	1.3	2.2
	Total	**--**	**-13.9**	**-23.8**	**-33.2**
2040	Tailpipe	--	-1.8	-3.6	-5.5
	Upstream	--	0.4	0.7	1.2
	Total	**--**	**-1.4**	**-2.9**	**-4.3**
2045	Tailpipe	--	-0.7	-0.8	-0.8
	Upstream	--	0.1	0.2	0.4
	Total	**--**	**-0.6**	**-0.5**	**-0.3**
2050	Tailpipe	--	0.3	0.5	0.6
	Upstream	--	0.0	0.1	0.1
	Total	**--**	**0.4**	**0.5**	**0.8**

Note: Results include both passenger cars and light trucks.
Source: NERA/Trinity calculations as explained in text.

Table 32. CO Emissions (% Change) Compared to Augural Standards Baseline for Select Calendar Years

Calendar Year	Source	Augural Stds	Scenario 8	Scenario 5	Scenario 1
2020	Tailpipe	--	-0.06%	-0.13%	-0.26%
	Upstream	--	0.07%	0.12%	0.31%
	Total	**--**	**-0.06%**	**-0.13%**	**-0.25%**
2025	Tailpipe	--	-0.58%	-0.89%	-1.24%
	Upstream	--	0.64%	1.09%	2.00%
	Total	**--**	**-0.57%**	**-0.86%**	**-1.20%**
2030	Tailpipe	--	-0.82%	-1.35%	-1.89%
	Upstream	--	1.29%	2.24%	3.99%
	Total	**--**	**-0.79%**	**-1.29%**	**-1.80%**
2035	Tailpipe	--	-0.49%	-0.84%	-1.18%
	Upstream	--	1.70%	2.92%	5.03%
	Total	**--**	**-0.46%**	**-0.78%**	**-1.09%**
2040	Tailpipe	--	-0.12%	-0.24%	-0.37%
	Upstream	--	2.07%	3.59%	6.05%
	Total	**--**	**-0.09%**	**-0.19%**	**-0.29%**
2045	Tailpipe	--	-0.13%	-0.14%	-0.14%
	Upstream	--	2.03%	3.70%	6.51%
	Total	**--**	**-0.10%**	**-0.09%**	**-0.06%**
2050	Tailpipe	--	0.19%	0.29%	0.39%
	Upstream	--	2.23%	4.13%	7.43%
	Total	**--**	**0.22%**	**0.34%**	**0.48%**

Note: Results include both passenger cars and light trucks.
Source: NERA/Trinity calculations as explained in text.

Figure 12. Differences in CO Emissions relative to Augural Standards Baseline by Calendar Year

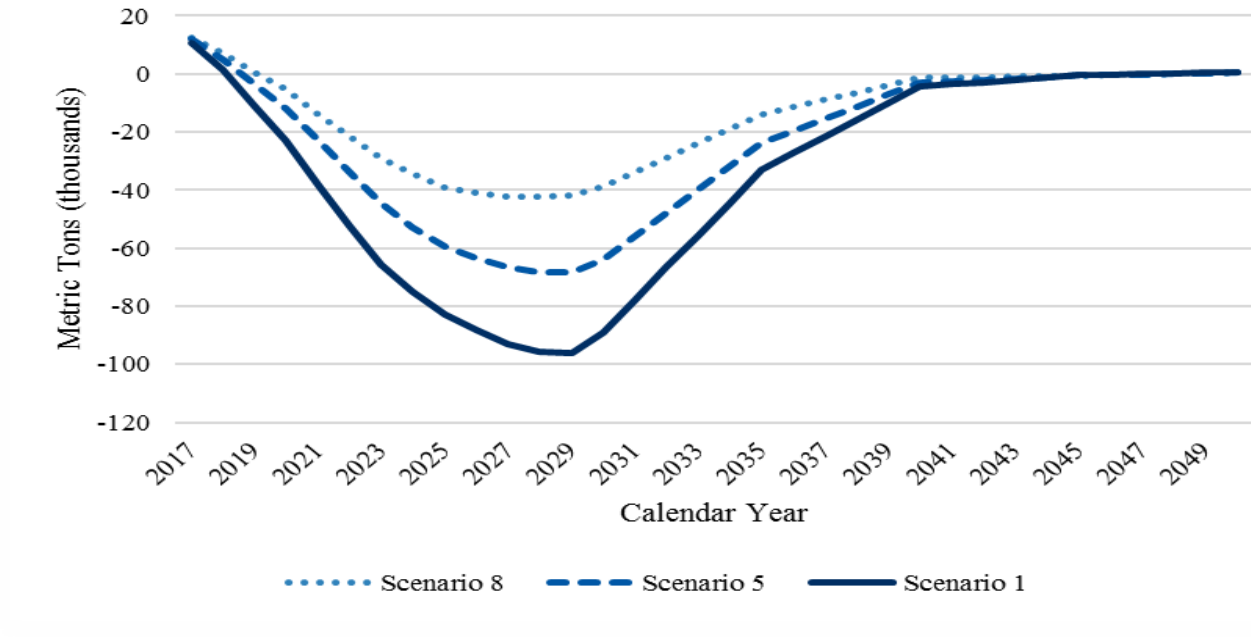


Table 33. Technology Costs Relative to Augural Standards Baseline (billions of 2016$)

	Scenario 8		Scenario 5		Scenario 1	
	3%	7%	3%	7%	3%	7%
Technology Costs	-$68.7	-$51.8	-$113.8	-$85.3	-$170.7	-$128.4

Note: Present values calculated as of January 1, 2017 using 3 percent and 7 percent discount rates for costs/benefits incurred over the 2017-2050 analysis period. The values include effects for model year vehicles up to MY 2029. All values relative to augural standards baseline. All values in billions of 2016 dollars, rounded to the nearest $0.1 billion.

Source: NERA/Trinity calculations as explained in text.

Table 39. Social Costs Relative to Augural Standards Baseline (billions of 2016$)

	Scenario 8		Scenario 5		Scenario 1	
Social Cost Category	**3%**	**7%**	**3%**	**7%**	**3%**	**7%**
Technology Costs	-$68.7	-$51.8	-$113.8	-$85.3	-$170.7	-$128.4
Congestion Costs	-$6.3	-$3.9	-$10.6	-$6.5	-$17.9	-$10.9
Noise Costs	-$0.1	-$0.1	-$0.2	-$0.1	-$0.3	-$0.2
Fatal Crash Costs	-$1.1	-$0.9	-$1.3	-$1.1	-$1.0	-$1.0
Non-Fatal Crash Costs	-$1.5	-$1.2	-$1.7	-$1.4	-$1.3	-$1.3
Total	**-$77.7**	**-$57.8**	**-$127.6**	**-$94.4**	**-$191.1**	**-$141.8**

Note: Present values calculated as of January 1, 2017 using 3 percent and 7 percent discount rates for costs/benefits incurred over the 2017-2050 analysis period. The values include effects for model year vehicles up to MY 2029. All values relative to augural standards baseline. All values in billions of 2016 dollars, rounded to the nearest $0.1 billion. Values may not sum to totals due to rounding.
Source: NERA/Trinity calculations as explained in text.

Table 43. Petroleum Market Externality Benefits Relative to Augural Standards Baseline (billions of 2016$)

	Scenario 8		Scenario 5		Scenario 1	
	3%	**7%**	**3%**	**7%**	**3%**	**7%**
Petroleum Market Externality Benefits	-$1.2	-$0.7	-$2.1	-$1.2	-$3.7	-$2.2

Note: Present values calculated as of January 1, 2017 using 3 percent and 7 percent discount rates for costs/benefits incurred over the 2017-2050 analysis period. The values include effects for model year vehicles up to MY 2029. All values relative to augural standards baseline. All values in billions of 2016 dollars, rounded to the nearest $0.1 billion.
Source: NERA/Trinity calculations as explained in text.

Table 46. Criteria Pollutant Emissions Reductions Benefits Relative to Augural Standards Baseline (billions of 2016$)

	Scenario 8		Scenario 5		Scenario 1	
	3%	7%	3%	7%	3%	7%
NO_x Damage Reduction Benefits	$0.0	$0.0	$0.1	$0.1	$0.0	$0.1
VOC Damage Reduction Benefits	$0.0	$0.0	-$0.1	$0.0	-$0.1	-$0.1
$PM_{2.5}$ Damage Reduction Benefits	-$0.4	-$0.2	-$0.8	-$0.4	-$1.7	-$0.8
SO_2 Damage Reduction Benefits	-$2.0	-$1.0	-$3.4	-$1.8	-$6.1	-$3.3
Total	**-$2.4**	**-$1.2**	**-$4.2**	**-$2.1**	**-$8.1**	**-$4.1**

Note: Present values calculated as of January 1, 2017 using 3 percent and 7 percent discount rates for costs/benefits incurred over the 2017-2050 analysis period. The values include effects for model year vehicles up to MY 2029. All values relative to augural standards baseline. All values in billions of 2016 dollars, rounded to the nearest $0.1 billion. Values may not sum to totals due to rounding.

Source: NERA/Trinity calculations as explained in text.

Table 47. Social Benefits Relative to Augural Standards Baseline (billions of 2016$)

	Scenario 8		Scenario 5		Scenario 1	
Social Benefits Category	**3%**	**7%**	**3%**	**7%**	**3%**	**7%**
Valuation of Fuel Economy Benefits	-$28.0	-$19.1	-$49.0	-$33.3	-$87.2	-$59.5
Fuel Tax Revenue Benefits	$4.3	$2.6	$7.4	$4.4	$13.2	$8.0
Petroleum Market Externality Benefits	-$1.2	-$0.7	-$2.1	-$1.2	-$3.7	-$2.2
GHG Damage Reduction Benefits	-$1.6	-$0.2	-$2.9	-$0.3	-$7.1	-$0.7
NO_x Damage Reduction Benefits	$0.0	$0.0	$0.1	$0.1	$0.0	$0.1
VOC Damage Reduction Benefits	$0.0	$0.0	-$0.1	$0.0	-$0.1	-$0.1
$PM_{2.5}$ Damage Reduction Benefits	-$0.4	-$0.2	-$0.8	-$0.4	-$1.7	-$0.8
SO_2 Damage Reduction Benefits	-$2.0	-$1.0	-$3.4	-$1.8	-$6.1	-$3.3
Total Social Benefits	**-$29.0**	**-$18.7**	**-$50.8**	**-$32.5**	**-$92.9**	**-$58.5**

Note: Present values calculated as of January 1, 2017 using 3 percent and 7 percent discount rates for costs/benefits incurred over the 2017-2050 analysis period. The values include effects for model year vehicles up to MY 2029. All values relative to augural standards baseline. All values in billions of 2016 dollars, rounded to the nearest $0.1 billion. GHG damage reduction benefits values include benefits associated CO_2, as well as other GHG pollutants, which have been converted to CO_{2eq}. Values may not sum to totals due to rounding.

Source: NERA/Trinity calculations as explained in text.

Table 48. Net Benefits Relative to Augural Standards Baseline, 3% Discount Rate (billions of 2016$)

	Scenario 8	Scenario 5	Scenario 1
Social Costs			
Technology Costs	-68.7	-113.8	-170.7
Congestion Costs	-6.3	-10.6	-17.9
Noise Costs	-0.1	-0.2	-0.3
Fatal Crash Costs	-1.1	-1.3	-1.0
Non-Fatal Crash Costs	-1.5	-1.7	-1.3
Total Social Costs	**-77.7**	**-127.6**	**-191.1**
Social Benefits			
Valuation of Fuel Economy Benefits	-28.0	-49.0	-87.2
Fuel Tax Revenue Benefits	4.3	7.4	13.2
Petroleum Market Externality Benefits	-1.2	-2.1	-3.7
GHG Damage Reduction Benefits	-1.6	-2.9	-7.1
NO_x Damage Reduction Benefits	0.0	0.1	0.0
VOC Damage Reduction Benefits	0.0	-0.1	-0.1
$PM_{2.5}$ Damage Reduction Benefits	-0.4	-0.8	-1.7
SO_2 Damage Reduction Benefits	-2.0	-3.4	-6.1
Total Social Benefits	**-29.0**	**-50.8**	**-92.9**
Net Total Benefits	**48.7**	**76.8**	**98.3**

Note: Present values calculated as of January 1, 2017 using a 3 percent discount rate for costs/benefits incurred over the 2017-2050 analysis period. The values include effects for model year vehicles up to MY 2029. All values relative to augural standards baseline. All values in billions of 2016 dollars, rounded to the nearest $0.1 billion. GHG damage reduction benefits values include benefits associated CO_2, as well as other GHG pollutants, which have been converted to CO_{2eq}. Values may not sum to totals due to rounding.

Source: NERA/Trinity calculations as explained in text.

Table 49. Net Benefits Relative to Augural Standards Baseline, 7% Discount Rate (billions of 2016$)

	Scenario 8	Scenario 5	Scenario 1
Social Costs			
Technology Costs	-51.8	-85.3	-128.4
Congestion Costs	-3.9	-6.5	-10.9
Noise Costs	-0.1	-0.1	-0.2
Fatal Crash Costs	-0.9	-1.1	-1.0
Non-Fatal Crash Costs	-1.2	-1.4	-1.3
Total Social Costs	**-57.8**	**-94.4**	**-141.8**
Social Benefits			
Valuation of Fuel Economy Benefits	-19.1	-33.3	-59.5
Fuel Tax Revenue Benefits	2.6	4.4	8.0
Petroleum Market Externality Benefits	-0.7	-1.2	-2.2
GHG Damage Reduction Benefits	-0.2	-0.3	-0.7
NO_x Damage Reduction Benefits	0.0	0.1	0.1
VOC Damage Reduction Benefits	0.0	0.0	-0.1
$PM_{2.5}$ Damage Reduction Benefits	-0.2	-0.4	-0.8
SO_2 Damage Reduction Benefits	-1.0	-1.8	-3.3
Total Social Benefits	**-18.7**	**-32.5**	**-58.5**
Net Total Benefits	**39.1**	**61.9**	**83.2**

Note: Present values calculated as of January 1, 2017 using a 7 percent discount rate for costs/benefits incurred over the 2017-2050 analysis period. The values include effects for model year vehicles up to MY 2029. All values relative to augural standards baseline. All values in billions of 2016 dollars, rounded to the nearest $0.1 billion. GHG damage reduction benefits values include benefits associated CO_2, as well as other GHG pollutants, which have been converted to CO_{2eq}. Values may not sum to totals due to rounding.
Source: NERA/Trinity calculations as explained in text.

Table J-3. Petroleum Market Externality Benefits Relative to Augural Standards Baseline (billions of 2016$)

	Scenario 8		Scenario 5		Scenario 1	
	3%	7%	3%	7%	3%	7%
Petroleum Market Externality Benefits	-$1.2	-$0.7	-$2.1	-$1.2	-$3.7	-$2.2

Note: Present values calculated as of January 1, 2017 using 3 percent and 7 percent discount rates for costs/benefits incurred over the 2017-2050 analysis period. The values include effects for model year vehicles up to MY 2029. All values relative to augural standards baseline. All values in billions of 2016 dollars, rounded to the nearest $0.1 billion.
Source: NERA/Trinity calculations as explained in text.

Table J-4. Petroleum Market Benefits Relative to Augural Standards Baseline using NHTSA/EPA PRIA Estimates of Oil Price Shock Externalities (billions of 2016$)

	Scenario 8		Scenario 5		Scenario 1	
	3%	7%	3%	7%	3%	7%
Petroleum Market Externality Benefits	-$2.3	-$1.4	-$3.9	-$2.3	-$7.0	-$4.2

Note: Present values calculated as of January 1, 2017 using 3 percent and 7 percent discount rates for costs/benefits incurred over the 2017-2050 analysis period. The values include effects for model year vehicles up to MY 2029. All values relative to augural standards baseline. All values in billions of 2016 dollars, rounded to the nearest $0.1 billion.
Source: NERA/Trinity calculations as explained in text.

Table J-5. Petroleum Market Externality Benefits Relative to Augural Standards Baseline using "Old Literature" Values from Brown (2018) (billions of 2016$)

	Scenario 8		Scenario 5		Scenario 1	
	3%	7%	3%	7%	3%	7%
Petroleum Market Externality Benefits	-$1.7	-$1.0	-$3.0	-$1.8	-$5.3	-$3.2

Note: Present values calculated as of January 1, 2017 using 3 percent and 7 percent discount rates for costs/benefits incurred over the 2017-2050 analysis period. The values include effects for model year vehicles up to MY 2029. All values relative to augural standards baseline. All values in billions of 2016 dollars, rounded to the nearest $0.1 billion.
Source: NERA/Trinity calculations as explained in text.

Table J-6. Petroleum Market Externality Benefits Relative to Augural Standards Baseline using "New Literature" Values from Brown (2018) (billions of 2016$)

	Scenario 8		Scenario 5		Scenario 1	
	3%	7%	3%	7%	3%	7%
Petroleum Market Externality Benefits	-$0.4	-$0.2	-$0.7	-$0.4	-$1.3	-$0.8

Note: Present values calculated as of January 1, 2017 using 3 percent and 7 percent discount rates for costs/benefits incurred over the 2017-2050 analysis period. The values include effects for model year vehicles up to MY 2029. All values relative to augural standards baseline. All values in billions of 2016 dollars, rounded to the nearest $0.1 billion.

Source: NERA/Trinity calculations as explained in text.

Table L-6. Criteria Pollutant Emissions Reductions Benefits Relative to Augural Standards Baseline (billions of 2016$)

	Scenario 8		Scenario 5		Scenario 1	
	3%	7%	3%	7%	3%	7%
NO_x Damage Reduction Benefits	$0.0	$0.0	$0.1	$0.1	$0.0	$0.1
VOC Damage Reduction Benefits	$0.0	$0.0	-$0.1	$0.0	-$0.1	-$0.1
$PM_{2.5}$ Damage Reduction Benefits	-$0.4	-$0.2	-$0.8	-$0.4	-$1.7	-$0.8
SO_2 Damage Reduction Benefits	-$2.0	-$1.0	-$3.4	-$1.8	-$6.1	-$3.3
Total	**-$2.4**	**-$1.2**	**-$4.2**	**-$2.1**	**-$8.1**	**-$4.1**

Note: Present values calculated as of January 1, 2017 using 3 percent and 7 percent discount rates for costs/benefits incurred over the 2017-2050 analysis period. The values include effects for model year vehicles up to MY 2029. All values relative to augural standards baseline. All values in billions of 2016 dollars, rounded to the nearest $0.1 billion. Values may not sum to totals due to rounding.

Source: NERA/Trinity calculations as explained in text.

Table L-7. Criteria Pollutant Emissions Reductions Benefits Relative to Augural Standards Baseline using NHTSA/EPA PRIA Benefit-per-Ton Values (billions of 2016$)

	Scenario 8		Scenario 5		Scenario 1	
	3%	**7%**	**3%**	**7%**	**3%**	**7%**
NO_x Damage Reduction Benefits	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
VOC Damage Reduction Benefits	$0.0	$0.0	-$0.1	$0.0	-$0.1	-$0.1
$PM_{2.5}$ Damage Reduction Benefits	-$0.3	-$0.1	-$0.5	-$0.3	-$1.0	-$0.6
SO_2 Damage Reduction Benefits	-$0.7	-$0.4	-$1.2	-$0.7	-$2.1	-$1.3
Total	**-$1.0**	**-$0.6**	**-$1.7**	**-$0.9**	**-$3.2**	**-$1.9**

Note: Present values calculated as of January 1, 2017 using 3 percent and 7 percent discount rates for costs/benefits incurred over the 2017-2050 analysis period. The values include effects for model year vehicles up to MY 2029. All values relative to augural standards baseline. All values in billions of 2016 dollars, rounded to the nearest $0.1 billion. Values may not sum to totals due to rounding.

Source: NERA/Trinity calculations as explained in text.