

Appendix D

Changes in Per-Mile Fuel-Cycle Energy Use and Emissions

This appendix presents numerical changes in fuel-cycle energy use and emissions by alternative transportation fuels and advanced vehicle technologies relative to baseline gasoline vehicles. The values presented in this appendix were used to generate the charts presented in Section 6 of Volume 1 and in Appendix C of Volume 2. Numerical changes are presented in the following order: near-term passenger cars, near-term LDT1, near-term LDT2, long-term passenger cars, long-term LDT1, and long-term LDT2.

Acronyms, initialisms, and abbreviations are defined on pages xv–xviii of Volume 1.

D-I Near-Term Technologies

D-I.1 Passenger Cars

Parameter	GV: FRFG2, MTBE	GV: CARFG2, ETBE	GV: CARFG2, EtOH	CIDI: CD	Bi-fuel CNGV	Dedi. CNGV	Dedi. LPGV: crude	Dedi. LPGV: NG	M85 FFV: NG	M85 FFV: FG	M85 FFV: LFG
Total energy	0.0%	0.8%	0.4%	-29.7%	6.7%	3.3%	-8.6%	-9.6%	14.5%	16.6%	2.7%
Fossil fuels	0.0%	-3.1%	-2.6%	-29.6%	5.7%	2.3%	-8.6%	-9.3%	15.0%	-39.0%	-52.8%
Petroleum	-11.0%	-10.1%	-2.5%	-26.7%	-99.4%	-99.4%	-3.4%	-98.2%	-72.6%	-72.6%	-73.1%
VOC: Total	-15.1%	-5.5%	8.6%	-60.9%	-48.7%	-71.2%	-58.2%	-64.1%	-19.8%	-120.3%	-35.3%
VOC: Urban	-19.7%	-19.4%	5.3%	-62.8%	-45.8%	-74.8%	-63.1%	-60.3%	-20.3%	-20.3%	-22.8%
CO: Total	-19.1%	-18.9%	-19.4%	-79.5%	-34.8%	-42.7%	-39.3%	-39.7%	-37.4%	-39.1%	-46.5%
CO: Urban	-20.0%	-19.9%	-20.0%	-80.5%	-35.5%	-43.5%	-39.9%	-39.9%	-40.0%	-40.0%	-42.8%
NOx: Total	0.4%	14.6%	2.6%	51.8%	26.6%	18.6%	-17.7%	-22.4%	0.5%	-36.2%	-9.0%
NOx: Urban	-4.2%	-2.9%	-4.2%	111.4%	25.2%	14.7%	-9.1%	-9.3%	-12.0%	-12.0%	-17.4%
PM10: Total	-1.8%	78.2%	38.5%	154.8%	-35.9%	-37.8%	-34.1%	-43.0%	-26.5%	-40.3%	-255.9%
PM10: Urban	-1.4%	-0.4%	-1.3%	258.5%	-30.4%	-32.3%	-31.3%	-31.3%	-22.8%	-22.8%	-201.8%
SOx: Total	-28.9%	-0.4%	-16.3%	-31.4%	-37.5%	-39.5%	-57.3%	-77.4%	-58.7%	-59.5%	45.3%
SOx: Urban	-82.7%	-82.8%	-83.0%	-3.9%	-96.1%	-96.2%	-98.0%	-98.1%	-73.7%	-73.7%	-98.7%
CH4	18.2%	18.8%	-2.4%	-38.8%	211.0%	205.1%	-5.7%	2.8%	1.0%	-12.7%	-434.3%
N2O	0.4%	62.5%	32.4%	-42.6%	-38.4%	-19.4%	-1.8%	-1.8%	1.6%	-2.3%	-0.3%
CO2	1.2%	-0.9%	-5.1%	-25.8%	-13.9%	-16.7%	-12.6%	-14.3%	-4.7%	-69.4%	-134.6%
GHGs	1.6%	0.7%	-4.4%	-26.5%	-8.2%	-10.7%	-12.2%	-13.6%	-4.4%	-66.7%	-140.4%



D-I.1 Passenger Cars (Cont.)

Parameter	E10 GV: corn	E85 FFV: corn	E85 FFV: WB	E85 FFV: HB	EV: US mix	EV: NE US mix	EV: CA mix	GC SIDI HEV: CARFG2, ETBE, CA mix	GC SIDI HEV: CARFG2, EtOH, CA mix	GI SIDI HEV: FRFG2, MTBE	GI CIDI HEV: CD
Total energy	2.1%	17.9%	90.4%	79.1%	-14.7%	-14.0%	-16.9%	-35.9%	-36.0%	-47.4%	-52.5%
Fossil fuels	-3.4%	-41.8%	-81.8%	-72.7%	-34.7%	-46.0%	-68.6%	-52.9%	-52.7%	-47.4%	-52.5%
Petroleum	-6.3%	-73.8%	-71.2%	-73.2%	-98.4%	-96.9%	-99.5%	-64.9%	-62.0%	-53.2%	-50.6%
VOC: Total	14.4%	54.0%	4.5%	0.4%	-88.0%	-90.6%	-95.2%	-48.2%	-36.7%	-34.3%	-65.0%
VOC: Urban	10.7%	-16.0%	-16.1%	-16.1%	-99.6%	-99.4%	-99.5%	-50.8%	-33.3%	-30.4%	-63.7%
CO: Total	-35.0%	-37.4%	-30.3%	-31.7%	-98.0%	-98.0%	-98.7%	-54.7%	-54.9%	-36.0%	-80.0%
CO: Urban	-35.9%	-39.8%	-39.8%	-39.8%	-99.9%	-99.9%	-99.9%	-55.2%	-55.2%	-36.0%	-80.6%
NOx: Total	9.9%	101.9%	125.7%	139.8%	64.5%	11.5%	-51.3%	-21.6%	-26.3%	-18.1%	43.7%
NOx: Urban	0.8%	-1.1%	-2.4%	-1.7%	-94.7%	-90.9%	-93.2%	-28.6%	-29.1%	-1.8%	110.5%
PM10: Total	57.2%	615.2%	139.9%	124.4%	48.5%	10.5%	-31.7%	13.3%	-2.1%	-12.9%	148.0%
PM10: Urban	0.6%	-15.0%	-15.5%	-15.2%	-35.4%	-33.4%	-34.7%	-5.8%	-6.1%	6.0%	257.9%
SOx: Total	15.7%	168.8%	-151.8%	-95.8%	462.8%	217.2%	-13.9%	-35.4%	-41.6%	-62.6%	-53.7%
SOx: Urban	-6.7%	-78.6%	-79.1%	-78.9%	-96.9%	-90.7%	-99.0%	-93.0%	-93.1%	-90.9%	-35.2%
CH4	-1.5%	-14.3%	-62.9%	-48.9%	-15.5%	-23.5%	-49.2%	-34.3%	-42.5%	-31.3%	-58.1%
N2O	45.4%	500.3%	187.1%	607.8%	-89.9%	-90.2%	-92.9%	-4.9%	-16.6%	-1.9%	-43.4%
CO2	-2.9%	-36.4%	-113.1%	-85.5%	-24.3%	-42.8%	-70.7%	-50.4%	-51.9%	-46.8%	-49.9%
GHGs	-2.0%	-26.3%	-106.4%	-72.2%	-25.3%	-43.1%	-70.5%	-49.1%	-51.1%	-45.6%	-50.0%



D-I Near-Term Technologies

D-I.1 Light-Duty Truck 1

Parameter	GV: FRFG2, MTBE	GV: CARFG2, ETBE	GV: CARFG2, EtOH	CIDI: CD	Bi-fuel CNGV	Dedi. CNGV	Dedi LPGV: crude	Dedi. LPGV: NG	M85 FFV: NG	M85 FFV: FG	M85 FFV: LFG
Total energy	0.0%	0.8%	0.4%	-29.7%	6.7%	3.3%	-8.6%	-9.6%	14.5%	16.6%	2.7%
Fossil fuels	0.0%	-3.1%	-2.6%	-29.6%	5.7%	2.3%	-8.6%	-9.3%	15.0%	-41.8%	-52.8%
Petroleum	-11.0%	-10.1%	-2.5%	-26.7%	-99.4%	-99.4%	-3.4%	-98.2%	-72.6%	-72.6%	-73.1%
VOC: Total	-12.4%	-0.6%	8.8%	-56.4%	-48.8%	-68.1%	-53.9%	-61.3%	-20.9%	-145.5%	-40.2%
VOC: Urban	-17.6%	-17.1%	4.4%	-57.0%	-45.1%	-71.7%	-58.8%	-55.0%	-22.0%	-22.0%	-25.5%
CO: Total	-19.2%	-19.0%	-19.5%	-85.1%	-34.9%	-42.8%	-39.4%	-39.8%	-37.7%	-39.2%	-45.8%
CO: Urban	-20.0%	-19.9%	-20.0%	-86.1%	-35.6%	-43.6%	-39.9%	-39.9%	-40.0%	-40.0%	-42.5%
NOx: Total	0.3%	14.2%	2.5%	17.4%	26.0%	18.0%	-17.5%	-22.1%	0.3%	-35.6%	-9.0%
NOx: Urban	-4.2%	-3.0%	-4.2%	53.6%	24.3%	13.8%	-9.1%	-9.3%	-11.9%	-11.9%	-17.1%
PM10: Total	-2.0%	88.5%	43.6%	122.1%	-39.2%	-41.2%	-37.1%	-47.2%	-29.0%	-44.6%	-288.5%
PM10: Urban	-1.5%	-0.4%	-1.5%	227.2%	-34.5%	-36.6%	-35.5%	-35.6%	-26.1%	-26.1%	-243.5%
SOx: Total	-28.9%	-0.4%	-16.3%	-31.4%	-37.5%	-39.5%	-57.3%	-77.4%	-58.7%	-59.5%	45.3%
SOx: Urban	-82.7%	-82.8%	-83.0%	-3.9%	-96.1%	-96.2%	-98.0%	-98.1%	-73.7%	-73.7%	-98.7%
CH4	18.8%	19.4%	-2.3%	-37.3%	193.5%	187.4%	-6.6%	2.1%	2.3%	-11.8%	-433.7%
N2O	0.5%	70.3%	36.4%	-28.1%	-38.2%	-19.3%	-2.1%	-2.0%	1.7%	-2.6%	-0.3%
CO2	1.2%	-0.9%	-5.1%	-25.8%	-13.8%	-16.6%	-12.6%	-14.3%	-4.7%	-69.4%	-134.6%
GHGs	1.6%	0.8%	-4.4%	-26.2%	-8.7%	-11.2%	-12.2%	-13.7%	-4.4%	-66.8%	-140.4%



D-I.1 Light-Duty Truck 1 (Cont.)

Parameter	E10 GV: corn	E85 FFV: corn	E85 FFV: WB	E85 FFV: HB	EV: US mix	EV: NE US mix	EV: CA mix	GC SIDI HEV: CARFG2, ETBE, CA mix	GC SIDI HEV: CARFG2, EtOH, CA mix	GI SIDI HEV: FRFG2, MTBE	GI CIDI HEV: CD
Total energy	2.1%	17.9%	90.4%	79.1%	-14.7%	-14.0%	-16.9%	-35.9%	-36.0%	-47.4%	-52.5%
Fossil fuels	-3.4%	-41.8%	-81.8%	-72.7%	-34.7%	-46.0%	-68.6%	-52.9%	-52.7%	-47.4%	-52.5%
Petroleum	-6.3%	-73.8%	-71.2%	-73.2%	-98.4%	-96.9%	-99.5%	-64.9%	-62.0%	-53.2%	-50.6%
VOC: Total	14.0%	70.6%	9.1%	4.1%	-85.2%	-88.4%	-94.0%	-46.9%	-38.3%	-34.4%	-61.5%
VOC: Urban	9.0%	-16.3%	-16.5%	-16.5%	-99.5%	-99.3%	-99.4%	-49.8%	-34.4%	-29.2%	-58.2%
CO: Total	-35.1%	-37.6%	-31.3%	-32.6%	-98.2%	-98.2%	-98.8%	-54.8%	-55.0%	-36.0%	-85.5%
CO: Urban	-35.9%	-39.8%	-39.8%	-39.8%	-99.9%	-99.9%	-99.9%	-55.2%	-55.2%	-36.0%	-86.2%
NOx: Total	9.7%	99.4%	122.6%	136.5%	60.9%	9.1%	-52.3%	-21.8%	-26.3%	-17.7%	9.5%
NOx: Urban	0.8%	-1.4%	-2.7%	-2.0%	-94.9%	-91.2%	-93.4%	-28.6%	-29.1%	-1.7%	52.7%
PM10: Total	64.7%	696.9%	159.2%	141.8%	56.5%	13.6%	-34.3%	15.3%	-2.1%	-14.9%	114.4%
PM10: Urban	0.7%	-16.6%	-17.2%	-16.9%	-40.3%	-37.8%	-39.4%	-6.6%	-7.0%	6.8%	226.5%
SOx: Total	15.7%	168.8%	-151.8%	-95.8%	462.8%	217.2%	-13.9%	-35.4%	-41.6%	-62.6%	-53.7%
SOx: Urban	-6.7%	-78.6%	-79.1%	-78.9%	-96.9%	-90.7%	-99.0%	-93.0%	-93.1%	-90.9%	-35.2%
CH4	-1.5%	-15.9%	-65.8%	-51.5%	-13.3%	-21.5%	-47.9%	-34.4%	-42.8%	-32.1%	-57.1%
N2O	51.1%	562.8%	210.4%	683.7%	-88.7%	-88.9%	-92.1%	-1.8%	-15.0%	-2.1%	-29.0%
CO2	-2.9%	-36.4%	-113.0%	-85.4%	-24.3%	-42.8%	-70.7%	-50.4%	-51.9%	-46.8%	-49.9%
GHGs	-2.0%	-26.4%	-106.6%	-72.4%	-25.1%	-43.0%	-70.4%	-49.2%	-51.1%	-45.7%	-49.8%



D-I Near-Term Technologies

D-I.1 Light-Duty Truck 2

Parameter	GV: FRFG2, MTBE	GV: CARFG2, ETBE	GV: CARFG2, EtOH	CIDI: CD	Bi-fuel CNGV	Dedi. CNGV	Dedi. LPGV: crude	Dedi. LPGV: NG	M85 FFV: NG	M85 FFV: FG	M85 FFV: LFG
Total energy	0.0%	0.8%	0.4%	-29.7%	6.7%	3.3%	-8.6%	-9.6%	20.2%	22.4%	7.8%
Fossil fuels	0.0%	-3.1%	-2.6%	-29.6%	5.7%	2.3%	-8.6%	-9.3%	20.7%	-36.0%	-50.5%
Petroleum	-11.0%	-10.1%	-2.5%	-26.7%	-99.4%	-99.4%	-3.4%	-98.2%	-71.3%	-71.3%	-71.8%
VOC: Total	-11.7%	-6.9%	3.9%	-35.8%	-50.7%	-71.0%	-42.9%	-45.9%	-25.3%	-78.5%	-33.5%
VOC: Urban	-13.2%	-13.1%	1.8%	-33.3%	-49.7%	-72.6%	-43.0%	-41.8%	-26.7%	-26.7%	-27.9%
CO: Total	-19.5%	-19.4%	-19.7%	-92.1%	-43.3%	-51.2%	-39.7%	-39.9%	-38.6%	-39.5%	-43.5%
CO: Urban	-20.0%	-20.0%	-20.0%	-92.8%	-43.8%	-51.8%	-40.0%	-40.0%	-40.0%	-40.0%	-41.5%
NOx: Total	-2.3%	4.8%	-1.2%	-5.0%	13.2%	12.1%	-17.8%	-20.1%	-7.5%	-26.7%	-12.5%
NOx: Urban	-4.7%	-4.2%	-4.7%	3.7%	9.5%	9.1%	-14.6%	-14.6%	-15.6%	-15.6%	-17.8%
PM10: Total	-2.0%	96.8%	47.8%	125.4%	-39.3%	-41.3%	-37.0%	-48.1%	-27.9%	-45.8%	-325.5%
PM10: Urban	-1.4%	-0.1%	-1.4%	249.9%	-34.0%	-36.2%	-35.2%	-35.3%	-26.2%	-26.2%	-291.1%
SOx: Total	-28.9%	-0.4%	-16.3%	-31.4%	-37.5%	-39.5%	-57.3%	-77.4%	-56.6%	-57.5%	52.5%
SOx: Urban	-82.7%	-82.8%	-83.0%	-3.9%	-96.1%	-96.2%	-98.0%	-98.1%	-72.4%	-72.4%	-98.6%
CH4	19.2%	19.9%	-2.2%	-36.3%	182.9%	176.7%	-7.2%	1.7%	8.0%	-7.0%	-467.7%
N2O	0.4%	67.8%	35.1%	-21.2%	-38.3%	-19.4%	-2.0%	-1.9%	2.0%	-2.3%	-0.1%
CO2	1.2%	-0.9%	-5.1%	-25.8%	-13.8%	-16.5%	-12.6%	-14.3%	0.0%	-67.9%	-136.3%
GHGs	1.6%	0.8%	-4.4%	-26.0%	-9.0%	-11.5%	-12.2%	-13.7%	0.3%	-65.2%	-142.7%



D-I.1 Light-Duty Truck 2 (Cont.)

Parameter	E10 GV: corn	E85 FFV: corn	E85 FFV: WB	E85 FFV: HB	EV: US mix	EV: NE US mix	EV: CA mix	GC SIDI HEV: CARFG2, ETBE, CA mix	GC SIDI HEV: CARFG2, EtOH, CA mix	GI SIDI HEV: FRFG2, MTBE	GI CIDI HEV: CD
Total energy	2.1%	23.8%	99.9%	88.1%	-14.7%	-14.0%	-16.9%	-35.9%	-36.0%	-47.4%	-52.5%
Fossil fuels	-3.4%	-38.9%	-80.9%	-71.3%	-34.7%	-46.0%	-68.6%	-52.9%	-52.7%	-47.4%	-52.5%
Petroleum	-6.3%	-72.5%	-69.8%	-71.9%	-98.4%	-96.9%	-99.5%	-64.9%	-62.0%	-53.2%	-50.6%
VOC: Total	6.4%	13.8%	-12.4%	-14.5%	-94.0%	-95.3%	-97.6%	-48.8%	-33.4%	-31.0%	-37.9%
VOC: Urban	3.7%	-24.8%	-24.8%	-24.8%	-99.8%	-99.8%	-99.8%	-50.0%	-31.4%	-28.9%	-33.7%
CO: Total	-35.5%	-38.5%	-34.7%	-35.5%	-99.0%	-99.0%	-99.3%	-57.7%	-57.8%	-40.0%	-92.4%
CO: Urban	-36.0%	-39.9%	-39.9%	-39.9%	-100.0%	-99.9%	-99.9%	-58.0%	-58.0%	-40.0%	-92.8%
NOx: Total	4.9%	45.3%	57.8%	65.2%	-18.2%	-44.6%	-75.8%	-34.1%	-36.5%	-20.9%	-9.0%
NOx: Urban	0.3%	-11.3%	-11.8%	-11.6%	-98.0%	-96.6%	-97.4%	-39.8%	-40.0%	-15.4%	3.4%
PM10: Total	70.7%	804.5%	187.9%	167.9%	65.6%	18.6%	-33.6%	17.3%	-1.7%	-17.0%	117.0%
PM10: Urban	0.8%	-14.6%	-15.3%	-15.0%	-40.1%	-37.2%	-39.1%	-6.6%	-7.1%	6.5%	249.0%
SOx: Total	15.7%	182.2%	-154.4%	-95.6%	462.8%	217.2%	-13.9%	-35.4%	-41.6%	-62.6%	-53.7%
SOx: Urban	-6.7%	-77.5%	-78.1%	-77.8%	-96.9%	-90.7%	-99.0%	-93.0%	-93.1%	-90.9%	-35.2%
CH4	-1.6%	-13.4%	-66.6%	-51.3%	-12.0%	-20.3%	-47.1%	-34.4%	-43.0%	-32.6%	-56.4%
N2O	49.3%	570.1%	213.3%	692.5%	-89.1%	-89.3%	-92.3%	-2.8%	-15.5%	-2.0%	-22.0%
CO2	-2.8%	-32.4%	-112.8%	-83.9%	-24.3%	-42.8%	-70.7%	-50.4%	-51.9%	-46.8%	-49.9%
GHGs	-1.9%	-22.1%	-106.3%	-70.3%	-25.1%	-43.0%	-70.4%	-49.2%	-51.1%	-45.7%	-49.7%



D-II Long-Term Technologies

D-II.1 Passenger Cars

Parameter	Dedi. CNGV	Dedi. LNGV	Dedi. LPGV: crude	Dedi. LPGV: NG	Dedi. MeOHV: M90, NG	Dedi. MeOHV: M90, FG	Dedi. MeOHV: M90, LFG	Dedi. EtOHV: E90, corn	Dedi. EtOHV: E90, WB	Dedi. EtOHV: E90, HB	SIDI: FRFG2, MTBE
Total energy	-8.6%	-5.7%	-16.8%	-17.7%	8.8%	13.8%	-1.8%	10.0%	57.7%	44.4%	-20.0%
Fossil fuels	-9.5%	-5.1%	-16.9%	-17.4%	9.4%	-45.4%	-61.0%	-50.1%	-82.2%	-78.2%	-20.0%
Petroleum	-99.4%	-96.0%	-1.3%	-98.2%	-78.1%	-78.1%	-78.7%	-81.5%	-79.3%	-81.1%	-20.0%
VOC: Total	-62.6%	-55.8%	-48.6%	-56.2%	-15.8%	-156.0%	-35.9%	74.4%	4.9%	-0.1%	-11.0%
VOC: Urban	-55.1%	-56.8%	-49.0%	-45.3%	-11.1%	-11.1%	-15.0%	-8.9%	-9.0%	-9.0%	-7.3%
CO: Total	-19.9%	-18.2%	-20.6%	-21.3%	1.5%	-0.9%	-14.9%	2.1%	11.7%	9.5%	-1.0%
CO: Urban	-19.4%	-20.1%	-19.9%	-20.0%	-0.2%	-0.2%	-5.6%	0.0%	0.0%	0.0%	-0.1%
NOx: Total	26.5%	67.7%	-32.1%	-39.9%	-4.8%	-74.3%	-24.7%	147.0%	223.2%	228.4%	-16.6%
NOx: Urban	102.8%	-11.5%	-2.8%	-3.7%	-17.2%	-17.2%	-48.5%	9.4%	4.9%	6.2%	-5.2%
PM10: Total	-34.2%	-30.4%	-31.1%	-39.0%	-25.4%	-36.7%	-265.9%	409.1%	59.4%	46.8%	1.5%
PM10: Urban	-24.6%	-26.0%	-25.1%	-25.2%	-14.5%	-14.5%	-197.8%	-12.2%	-12.4%	-12.3%	11.9%
SOx: Total	-34.1%	-76.7%	-48.4%	-71.8%	-60.0%	-60.4%	50.8%	120.0%	-90.2%	-70.0%	-20.0%
SOx: Urban	-80.6%	-98.3%	-91.3%	-91.5%	-77.9%	-77.9%	-234.2%	-82.9%	-83.7%	-83.3%	-20.0%
CH4	84.4%	84.2%	-28.9%	-22.3%	-22.2%	-27.0%	-409.0%	-19.3%	-60.9%	-54.3%	-18.0%
N2O	-48.5%	-47.7%	-2.2%	-2.2%	-0.4%	-2.7%	0.4%	307.9%	91.3%	337.6%	-0.9%
CO2	-26.9%	-27.0%	-21.3%	-22.9%	-11.6%	-77.3%	-146.8%	-49.4%	-107.1%	-88.7%	-20.0%
GHGs	-23.8%	-23.9%	-21.2%	-22.5%	-11.7%	-74.3%	-152.2%	-39.9%	-101.1%	-77.5%	-19.6%



D-II.1 Passenger Cars (Cont.)

Parameter	SIDI: FRFG2, ETBE	SIDI: FRFG2 EtOH	SIDI: CARFG2, ETBE	SIDI: CARFG2, EtOH	Dedi. MeOH SIDI: M90, NG	Dedi. MeOH SIDI: M90, FG	Dedi. MeOH SIDI: M90, LFG	Dedi. EtOH SIDI: E90, corn	Dedi. EtOH SIDI: E90, WB	Dedi. EtOH SIDI: E90, HB	GI SIDI HEV: FRFG2, MTBE
Total energy	-20.0%	-20.0%	-20.0%	-20.0%	-6.7%	-2.3%	-16.1%	-3.2%	38.7%	27.1%	-47.4%
Fossil fuels	-20.0%	-20.0%	-19.0%	-19.3%	-6.2%	-68.4%	-68.1%	-56.1%	-84.4%	-80.8%	-47.4%
Petroleum	-20.0%	-20.0%	-17.2%	-19.2%	-82.1%	-82.1%	-82.6%	-83.7%	-81.8%	-83.4%	-47.4%
VOC: Total	-12.0%	-8.7%	-12.0%	-8.7%	-24.6%	-148.0%	-42.3%	57.4%	-3.8%	-8.1%	-28.0%
VOC: Urban	-7.4%	-3.0%	-7.4%	-3.0%	-15.8%	-15.8%	-19.3%	-13.9%	-14.0%	-14.0%	-32.2%
CO: Total	-1.1%	-0.9%	-1.1%	-0.9%	0.4%	-1.8%	-14.0%	1.3%	9.8%	7.8%	-2.4%
CO: Urban	-0.1%	-0.1%	-0.1%	-0.1%	-0.2%	-0.2%	-5.0%	0.0%	0.0%	0.0%	-0.1%
NOx: Total	-17.2%	-16.7%	-17.2%	-16.7%	-22.5%	-83.6%	-39.9%	119.3%	186.4%	191.0%	-39.3%
NOx: Urban	-6.2%	-5.3%	-6.2%	-5.3%	-18.3%	-18.3%	-45.8%	5.3%	1.3%	2.5%	-12.4%
PM10: Total	-7.7%	-4.4%	-7.7%	-4.4%	-23.1%	-33.1%	-234.7%	359.2%	51.4%	40.3%	-12.2%
PM10: Urban	11.6%	11.9%	11.6%	11.9%	-2.1%	-2.1%	-163.4%	0.0%	-0.2%	-0.1%	4.8%
SOx: Total	-20.0%	-20.0%	-20.0%	-20.0%	-76.3%	-76.7%	21.2%	93.6%	-91.4%	-73.6%	-47.4%
SOx: Urban	-20.0%	-20.0%	-20.5%	-20.5%	-80.6%	-80.6%	-218.1%	-85.0%	-85.7%	-85.3%	-47.4%
CH4	-18.0%	-17.6%	-18.0%	-17.6%	-35.3%	-39.5%	-375.7%	-26.8%	-63.5%	-57.6%	-42.6%
N2O	-7.2%	-4.7%	-7.2%	-4.7%	-1.5%	-3.5%	-0.7%	268.1%	77.5%	294.2%	-2.1%
CO2	-20.0%	-19.7%	-20.0%	-19.8%	-24.7%	-82.5%	-143.7%	-55.3%	-106.2%	-90.0%	-47.4%
GHGs	-19.6%	-19.3%	-19.6%	-19.3%	-24.6%	-79.7%	-148.2%	-46.7%	-100.6%	-79.8%	-46.4%



D-II.1 Passenger Cars (Cont.)

Parameter	GI SIDI HEV: FRFG2, ETBE	GI SIDI HEV: FRFG2, EtOH	GI SI HEV: CNG	GI SI HEV: LNG	GI SI HEV: LPG, crude	GI SI HEV: LPG, NG	GI SIDI HEV: M90, NG	GI SIDI HEV: M90, FG	GI SIDI HEV: M90 LFG	GI SIDI HEV: E90, corn	GI SIDI HEV: E90, WB
Total energy	-47.4%	-47.4%	-43.5%	-41.7%	-46.2%	-46.7%	-37.0%	-34.1%	-43.2%	-36.3%	-8.7%
Fossil fuels	-47.4%	-47.4%	-44.1%	-41.4%	-46.2%	-46.6%	-36.7%	-68.4%	-77.4%	-71.1%	-89.7%
Petroleum	-47.4%	-47.4%	-99.6%	-97.5%	-36.1%	-98.8%	-87.3%	-87.3%	-87.7%	-89.3%	-88.0%
VOC: Total	-30.2%	-26.3%	-65.5%	-61.3%	-55.2%	-60.1%	-35.0%	-116.2%	-46.7%	16.3%	-24.0%
VOC: Urban	-32.3%	-23.6%	-56.2%	-57.2%	-50.7%	-48.3%	-25.7%	-25.7%	-28.0%	-24.3%	-24.3%
CO: Total	-2.5%	-2.1%	-21.5%	-20.4%	-21.8%	-22.2%	-1.2%	-2.7%	-10.7%	-0.7%	4.9%
CO: Urban	-0.2%	-0.1%	-19.7%	-20.1%	-20.0%	-20.0%	-0.2%	-0.2%	-3.4%	-0.1%	-0.1%
NOx: Total	-40.8%	-39.5%	-15.4%	10.1%	-50.0%	-55.1%	-37.8%	-78.0%	-49.2%	50.0%	94.1%
NOx: Urban	-14.7%	-12.5%	53.5%	-17.1%	-11.1%	-11.7%	-21.0%	-21.0%	-39.1%	-4.9%	-7.6%
PM10: Total	-27.2%	-21.8%	-34.5%	-32.1%	-32.0%	-37.1%	-27.5%	-34.1%	-166.8%	216.1%	13.6%
PM10: Urban	4.4%	4.8%	-16.5%	-17.4%	-16.8%	-16.8%	-7.1%	-7.1%	-113.2%	-5.6%	-5.7%
SOx: Total	-47.4%	-47.4%	-59.3%	-85.6%	-66.6%	-81.7%	-76.8%	-77.1%	-12.7%	27.4%	-94.3%
SOx: Urban	-47.4%	-47.4%	-88.0%	-98.9%	-94.4%	-94.5%	-87.2%	-87.2%	-177.7%	-90.1%	-90.6%
CH4	-42.7%	-41.7%	33.0%	32.8%	-50.1%	-45.8%	-52.8%	-55.6%	-276.8%	-45.7%	-69.8%
N2O	-16.9%	-11.2%	-50.0%	-49.4%	-3.0%	-3.0%	-2.1%	-3.4%	-1.6%	168.3%	42.9%
CO2	-47.4%	-47.2%	-55.0%	-55.0%	-49.1%	-50.1%	-48.8%	-86.9%	-127.1%	-70.3%	-103.8%
GHGs	-46.4%	-46.2%	-52.1%	-52.1%	-48.3%	-49.1%	-48.1%	-84.3%	-129.4%	-63.9%	-99.3%



D-II.1 Passenger Cars (Cont.)

Parameter	GI SIDI HEV: E90, HB	GC SIDI HEV: FRFG2, MTBE, US mix	GC SIDI HEV: FRFG2, ETBE, US mix	GC SIDI HEV: FRFG2, EtOH, US mix	GC SIDI HEV: FRFG2, MTBE, CA mix	GC SIDI HEV: FRFG2, ETBE, CA mix	GC SIDI HEV: FRFG2, EtOH, CA mix	GC SI HEV: CNG, US mix	GC SI HEV: CNG, CA mix	GC SI HEV: LNG, US mix	GC SI HEV: LNG, CA mix
Total energy	-16.4%	-43.7%	-43.8%	-43.7%	-43.9%	-44.0%	-43.9%	-40.8%	-41.0%	-39.5%	-39.7%
Fossil fuels	-87.4%	-48.2%	-47.1%	-47.3%	-55.5%	-54.8%	-54.9%	-45.7%	-53.0%	-43.8%	-51.1%
Petroleum	-89.1%	-60.7%	-60.4%	-61.4%	-61.0%	-60.7%	-61.7%	-99.4%	-99.6%	-97.8%	-98.1%
VOC: Total	-26.9%	-46.1%	-47.9%	-45.0%	-48.2%	-49.8%	-47.0%	-72.6%	-74.8%	-69.6%	-71.7%
VOC: Urban	-24.4%	-43.8%	-43.9%	-40.8%	-43.8%	-43.9%	-40.8%	-69.2%	-69.2%	-70.0%	-70.0%
CO: Total	3.6%	-30.9%	-31.0%	-30.7%	-31.2%	-31.3%	-31.0%	-44.3%	-44.5%	-43.5%	-43.8%
CO: Urban	-0.1%	-30.1%	-30.1%	-30.1%	-30.1%	-30.1%	-30.0%	-43.8%	-43.7%	-44.1%	-44.1%
NOx: Total	97.1%	4.4%	-7.7%	2.9%	-37.8%	-42.2%	-38.3%	21.7%	-20.4%	40.1%	-2.0%
NOx: Urban	-6.8%	-32.7%	-34.6%	-32.7%	-31.1%	-33.1%	-31.1%	14.9%	16.5%	-36.0%	-34.5%
PM10: Total	6.3%	-2.9%	-28.2%	-19.1%	-19.2%	-37.6%	-31.0%	-18.6%	-34.9%	-16.9%	-33.2%
PM10: Urban	-5.7%	-6.3%	-6.8%	-6.3%	-6.2%	-6.7%	-6.2%	-21.2%	-21.1%	-21.9%	-21.7%
SOx: Total	-82.6%	81.0%	53.4%	68.0%	-40.0%	-44.3%	-42.1%	72.6%	-48.5%	53.6%	-67.5%
SOx: Urban	-90.4%	-59.2%	-59.2%	-59.2%	-61.3%	-61.4%	-61.4%	-88.1%	-90.3%	-96.0%	-98.2%
CH4	-65.9%	-43.6%	-43.7%	-39.7%	-49.9%	-50.0%	-47.3%	10.2%	3.9%	10.1%	3.8%
N2O	185.5%	-28.2%	-39.4%	-35.0%	-29.9%	-40.5%	-36.4%	-61.7%	-63.4%	-61.3%	-63.0%
CO2	-93.1%	-46.1%	-46.5%	-45.8%	-56.0%	-56.2%	-55.8%	-51.4%	-61.3%	-51.4%	-61.4%
GHGs	-85.6%	-45.6%	-46.3%	-45.4%	-55.3%	-55.6%	-55.1%	-49.6%	-59.3%	-49.7%	-59.3%



D-II.1 Passenger Cars (Cont.)

Parameter	GC SI HEV: LPG, crude, US mix	GC SI HEV: LPG, NG, US mix	GC SI HEV: LPG, crude, CA mix	GC SI HEV: LPG, NG, CA mix	GC SIDI HEV: M90, NG, US mix	GC SIDI HEV: M90, FG, US mix	GC SIDI HEV: M90, LFG, US mix	GC SIDI HEV: M90, NG, CA mix	GC SIDI HEV: M90, FG, CA mix	GC SIDI HEV: M90, LFG, CA mix	GC SIDI HEV: E90, corn, US mix
Total energy	-42.7%	-43.1%	-42.9%	-43.3%	-36.2%	-34.1%	-40.6%	-36.4%	-34.3%	-40.8%	-35.8%
Fossil fuels	-47.2%	-47.5%	-54.6%	-54.8%	-40.5%	-63.3%	-69.8%	-47.8%	-70.7%	-77.1%	-64.7%
Petroleum	-53.6%	-98.8%	-53.8%	-99.0%	-90.5%	-90.5%	-90.7%	-90.8%	-90.8%	-91.0%	-91.9%
VOC: Total	-65.9%	-68.8%	-67.4%	-70.9%	-51.1%	-109.5%	-59.5%	-53.3%	-111.6%	-61.7%	-14.4%
VOC: Urban	-66.3%	-63.6%	-65.3%	-63.6%	-47.9%	-47.9%	-49.5%	-47.8%	-47.8%	-49.5%	-46.9%
CO: Total	-44.7%	-44.8%	-44.8%	-45.1%	-30.1%	-31.1%	-36.9%	-30.3%	-31.4%	-37.2%	-29.7%
CO: Urban	-44.0%	-44.0%	-44.0%	-44.0%	-30.1%	-30.1%	-32.4%	-30.1%	-30.1%	-32.4%	-30.0%
NOx: Total	-2.1%	-6.9%	-45.4%	-49.0%	5.5%	-23.4%	-2.7%	-36.6%	-65.5%	-44.9%	67.5%
NOx: Urban	-32.0%	-32.1%	-30.1%	-30.5%	-38.8%	-38.8%	-51.9%	-37.3%	-37.3%	-50.3%	-27.2%
PM10: Total	-16.0%	-20.5%	-33.1%	-36.8%	-13.8%	-18.5%	-113.9%	-30.1%	-34.8%	-130.2%	152.1%
PM10: Urban	-21.6%	-21.4%	-21.3%	-21.3%	-14.7%	-14.7%	-91.0%	-14.6%	-14.6%	-90.9%	-13.6%
SOx: Total	67.3%	56.4%	-53.8%	-64.7%	59.9%	59.7%	106.0%	-61.2%	-61.4%	-15.1%	121.8%
SOx: Urban	-92.7%	-92.8%	-94.9%	-95.0%	-87.6%	-87.6%	-152.6%	-89.8%	-89.8%	-154.8%	-89.6%
CH4	-49.5%	-45.8%	-55.2%	-52.1%	-50.8%	-52.8%	-211.8%	-57.1%	-59.1%	-218.1%	-42.8%
N2O	-28.5%	-28.9%	-30.5%	-30.5%	-28.3%	-29.2%	-27.9%	-29.9%	-30.9%	-29.5%	40.5%
CO2	-47.2%	-47.9%	-57.1%	-57.8%	-47.1%	-74.4%	-103.4%	-57.1%	-84.4%	-113.3%	-62.4%
GHGs	-47.0%	-47.5%	-56.6%	-57.1%	-46.9%	-72.9%	-105.3%	-56.5%	-82.6%	-115.0%	-59.4%



D-II.1 Passenger Cars (Cont.)

Parameter	GC SIDI HEV: E90, WB, US mix	GC SIDI HEV: E90, HB, US mix	GC SIDI HEV: E90, corn, CA mix	GC SIDI HEV: E90, WB, CA mix	GC SIDI HEV: E90, HB, CA mix	CIDI: RFD	CIDI: DME, NG	CIDI: DME, FG	CIDI: FT50, NG	CIDI: FT50, FG	CIDI: BD20
Total energy	-15.9%	-21.5%	-36.0%	-16.1%	-21.7%	-35.1%	-17.7%	-14.4%	-21.3%	-13.2%	-31.4%
Fossil fuels	-78.1%	-76.4%	-72.3%	-85.7%	-84.0%	-35.0%	-17.2%	-67.4%	-21.1%	-38.6%	-31.6%
Petroleum	-91.0%	-91.8%	-92.2%	-91.3%	-92.0%	-25.0%	-97.9%	-97.9%	-59.9%	-59.9%	-36.7%
VOC: Total	-43.3%	-45.4%	-16.4%	-45.3%	-47.4%	-61.9%	-74.3%	-192.5%	-67.4%	-135.9%	-38.0%
VOC: Urban	-46.9%	-46.9%	-46.8%	-46.9%	-46.9%	-63.4%	-76.0%	-76.0%	-65.0%	-65.0%	-61.3%
CO: Total	-25.6%	-26.6%	-29.9%	-25.9%	-26.8%	-2.4%	-0.5%	-3.1%	-2.1%	-3.1%	-0.2%
CO: Urban	-30.0%	-30.0%	-30.0%	-30.0%	-30.0%	-0.1%	-0.3%	-0.3%	-0.2%	-0.2%	0.5%
NOx: Total	99.2%	101.4%	26.1%	57.8%	60.0%	-24.4%	-23.2%	-90.0%	-32.7%	-64.7%	17.7%
NOx: Urban	-29.1%	-28.5%	-25.5%	-27.4%	-26.9%	43.1%	32.6%	32.6%	38.2%	38.2%	78.5%
PM10: Total	6.5%	1.2%	140.2%	-5.4%	-10.6%	-13.7%	-36.0%	-47.9%	-28.6%	-33.0%	-7.0%
PM10: Urban	-13.6%	-13.6%	-13.4%	-13.5%	-13.5%	-1.4%	-12.0%	-12.0%	-8.3%	-8.3%	-0.8%
SOx: Total	34.3%	42.7%	11.7%	-75.8%	-67.4%	-34.1%	-82.2%	-83.3%	-58.4%	-58.0%	-32.6%
SOx: Urban	-90.0%	-89.8%	-91.8%	-92.2%	-92.0%	6.8%	-95.7%	-95.7%	-42.2%	-42.2%	-9.6%
CH4	-60.1%	-57.3%	-50.4%	-67.7%	-64.9%	-51.9%	-50.0%	-49.9%	-52.1%	-51.6%	-53.9%
N2O	-49.6%	52.9%	39.2%	-51.0%	51.5%	-42.7%	-44.6%	-47.4%	-44.9%	-45.4%	-35.4%
CO2	-86.5%	-78.8%	-72.5%	-96.5%	-88.8%	-32.3%	-35.7%	-94.6%	-31.6%	-61.2%	-40.1%
GHGs	-84.9%	-75.1%	-69.2%	-94.6%	-84.8%	-33.1%	-36.3%	-92.3%	-32.5%	-60.6%	-40.5%



D-II.1 Passenger Cars (Cont.)

Parameter	GI CIDI HEV: RFD	GI CIDI HEV: DME, NG	GI CIDI HEV: DME, FG	GI CIDI HEV: FT50, NG	GI CIDI HEV: FT50, FG	GI CIDI HEV: BD20	GC CIDI HEV: RFD, US mix	GC CIDI HEV: RFD CA mix	GC CIDI HEV: DME, NG, US mix	GC CIDI HEV: DME, FG, US mix	GC CIDI HEV: DME, NG, CA mix
Total energy	-57.7%	-46.3%	-44.2%	-43.3%	-48.7%	-55.3%	-53.5%	-53.3%	-42.2%	-40.7%	-42.4%
Fossil fuels	-57.6%	-46.0%	-78.7%	-43.1%	-57.6%	-55.4%	-65.2%	-57.8%	-46.5%	-70.5%	-53.9%
Petroleum	-51.1%	-98.6%	-98.6%	-73.8%	-73.8%	-58.7%	-67.3%	-67.1%	-98.6%	-98.6%	-98.9%
VOC: Total	-67.0%	-77.5%	-154.6%	-115.3%	-70.6%	-51.4%	-76.2%	-74.1%	-80.9%	-137.4%	-83.1%
VOC: Urban	-41.2%	-48.6%	-48.6%	-65.6%	-65.6%	-63.2%	-75.2%	-75.2%	-83.3%	-83.3%	-83.3%
CO: Total	-3.3%	-2.1%	-3.8%	-3.8%	-3.1%	-1.9%	-31.9%	-31.7%	-30.6%	-31.9%	-30.9%
CO: Urban	-0.1%	-0.1%	-0.1%	-0.2%	-0.2%	0.2%	-30.2%	-30.2%	-30.2%	-30.2%	-30.1%
NOx: Total	-40.4%	-39.6%	-83.1%	-66.7%	-45.8%	-12.9%	-40.3%	1.8%	4.4%	-27.5%	-37.8%
NOx: Urban	6.5%	5.3%	5.3%	35.1%	35.1%	61.3%	-2.1%	-3.7%	-2.2%	-2.2%	-0.6%
PM10: Total	-21.0%	-37.7%	-45.5%	-35.0%	-32.2%	-17.3%	-26.2%	-9.9%	-21.0%	-26.7%	-37.3%
PM10: Urban	-1.9%	-11.4%	-11.4%	-8.6%	-8.6%	-2.7%	-11.7%	-11.8%	-18.2%	-18.2%	-18.1%
SOx: Total	-57.0%	-88.4%	-89.1%	-72.6%	-72.9%	-56.1%	-49.3%	71.8%	51.7%	51.2%	-69.4%
SOx: Urban	-4.7%	-14.9%	-14.9%	-62.3%	-62.3%	-41.1%	-54.9%	-52.7%	-94.7%	-94.7%	-96.9%
CH4	-68.1%	-66.3%	-66.3%	-67.9%	-68.2%	-69.4%	-69.6%	-63.3%	-60.1%	-60.1%	-66.4%
N2O	-43.5%	-44.8%	-46.6%	-45.3%	-45.0%	-38.8%	-59.0%	-57.3%	-58.1%	-59.5%	-59.8%
CO2	-55.8%	-58.1%	-96.5%	-74.7%	-55.4%	-60.9%	-64.5%	-54.5%	-53.2%	-81.3%	-63.2%
GHGs	-56.0%	-58.1%	-94.6%	-74.0%	-55.6%	-60.7%	-64.5%	-54.8%	-53.5%	-80.2%	-63.2%



D-II.1 Passenger Cars (Cont.)

Parameter	GC CIDI HEV: DME, FG, CA mix	GC CIDI HEV: FT50, NG, US mix	GC CIDI HEV: FT50, FG, US mix	GC CIDI HEV: FT50, NG, CA mix	GC CIDI HEV: FT50, FG, CA mix	GC CIDI HEV: BD20, US mix	GC CIDI HEV: BD20, CA mix	EV: US mix	EV: NE US mix	EV: CA mix	H2 FCV: NG, C. gaseous
Total energy	-40.9%	-43.9%	-40.1%	-44.1%	-40.3%	-48.8%	-49.0%	-38.4%	-39.7%	-39.0%	-59.7%
Fossil fuels	-77.8%	-48.3%	-56.7%	-55.7%	-64.0%	-53.4%	-60.7%	-53.4%	-57.2%	-77.9%	-60.3%
Petroleum	-98.9%	-80.5%	-80.5%	-80.7%	-80.7%	-69.4%	-69.7%	-98.7%	-98.2%	-99.6%	-99.7%
VOC: Total	-139.5%	-76.1%	-108.8%	-78.2%	-111.0%	-62.0%	-64.2%	-89.6%	-92.5%	-96.7%	-95.8%
VOC: Urban	-83.3%	-75.8%	-75.8%	-75.8%	-75.8%	-74.1%	-74.0%	-99.7%	-99.5%	-99.7%	-98.3%
CO: Total	-32.1%	-31.4%	-31.9%	-31.7%	-32.1%	-30.5%	-30.8%	-97.5%	-97.3%	-98.5%	-97.1%
CO: Urban	-30.1%	-30.1%	-30.1%	-30.1%	-30.1%	-29.8%	-29.8%	-99.9%	-99.8%	-99.9%	-99.5%
NOx: Total	-69.6%	-0.2%	-15.5%	-42.3%	-57.6%	23.9%	-18.3%	103.6%	44.7%	-36.8%	-41.5%
NOx: Urban	-0.6%	0.5%	0.5%	2.1%	2.1%	19.7%	21.3%	-80.8%	-60.2%	-75.5%	-23.4%
PM10: Total	-43.0%	-17.0%	-19.1%	-33.3%	-35.4%	-6.2%	-22.5%	17.7%	-8.2%	-36.7%	-47.4%
PM10: Urban	-18.1%	-15.7%	-15.7%	-15.6%	-15.6%	-11.5%	-11.3%	-32.4%	-30.5%	-32.0%	-32.2%
SOx: Total	-69.9%	63.1%	63.3%	-58.0%	-57.8%	75.4%	-45.7%	377.4%	147.0%	-26.2%	-66.0%
SOx: Urban	-96.9%	-69.2%	-69.2%	-71.4%	-71.4%	-53.6%	-55.8%	-89.3%	-78.7%	-96.5%	-99.0%
CH4	-66.3%	-61.4%	-61.2%	-67.7%	-67.5%	-62.3%	-68.6%	-48.8%	-45.9%	-69.7%	-62.6%
N2O	-61.1%	-58.3%	-58.5%	-59.9%	-60.2%	-53.7%	-55.4%	-89.3%	-90.2%	-94.9%	-98.2%
CO2	-91.3%	-51.2%	-65.4%	-61.2%	-75.4%	-55.3%	-65.2%	-46.3%	-56.7%	-79.4%	-68.6%
GHGs	-89.9%	-51.7%	-65.1%	-61.4%	-74.8%	-55.5%	-65.1%	-47.2%	-57.0%	-79.4%	-69.0%



D-II.1 Passenger Cars (Cont.)

Parameter	H2 FCV: NG, station gaseous	H2 FCV: solar, gas	H2 FCV: solar, liquid	H2 FCV: NG, liquid	FCV: MeOH, NG	FCV: MeOH, FG
Total energy	-53.2%	-65.5%	-71.8%	-58.8%	-52.3%	-49.7%
Fossil fuels	-52.9%	-93.1%	-98.3%	-58.5%	-52.0%	-80.3%
Petroleum	-99.7%	-99.9%	-98.1%	-97.8%	-98.6%	-98.6%
VOC: Total	-94.5%	-95.8%	-92.3%	-89.8%	-72.8%	-145.1%
VOC: Urban	-94.9%	-97.6%	-97.8%	-97.7%	-73.6%	-73.6%
CO: Total	-95.9%	-98.4%	-98.8%	-96.7%	-78.0%	-79.3%
CO: Urban	-97.1%	-99.3%	-99.8%	-99.8%	-80.0%	-80.0%
NOx: Total	-30.8%	-35.8%	-71.0%	-44.6%	-63.3%	-99.1%
NOx: Urban	93.3%	7.2%	-75.4%	-73.0%	-82.8%	-82.8%
PM10: Total	-46.4%	-46.4%	-43.6%	-38.8%	-49.5%	-55.4%
PM10: Urban	-25.6%	-31.4%	-30.8%	-30.6%	-34.0%	-34.0%
SOx: Total	-91.7%	-63.5%	-97.5%	-90.6%	-87.8%	-88.0%
SOx: Urban	-99.4%	-98.8%	-97.2%	-97.1%	-97.0%	-97.0%
CH4	-47.1%	-86.9%	-98.8%	-63.3%	-68.0%	-70.5%
N2O	-96.7%	-98.1%	-99.4%	-97.8%	-79.2%	-80.4%
CO2	-63.7%	-93.4%	-98.3%	-67.7%	-62.8%	-96.7%
GHGs	-63.8%	-93.3%	-98.3%	-68.1%	-63.3%	-95.6%



D-II.1 Passenger Cars (Cont.)

Parameter	FCV: MeOH, LFG	FCV: RFG	EtOH FCV: corn	EtOH FCV: WB	EtOH FCV: HB	NG FCV: CNG
Total energy	-57.8%	-50.0%	-37.7%	-7.1%	-15.6%	-52.0%
Fossil fuels	-88.3%	-50.0%	-77.4%	-97.3%	-94.8%	-52.5%
Petroleum	-98.9%	-50.0%	-96.5%	-94.9%	-96.2%	-99.7%
VOC: Total	-83.2%	-52.9%	-5.8%	-53.0%	-56.4%	-88.5%
VOC: Urban	-75.6%	-54.1%	-72.0%	-72.0%	-72.1%	-87.9%
CO: Total	-86.5%	-78.5%	-77.2%	-71.1%	-72.5%	-78.9%
CO: Urban	-82.8%	-79.9%	-79.8%	-79.9%	-79.8%	-79.6%
NOx: Total	-73.5%	-55.1%	46.7%	96.4%	99.8%	-39.1%
NOx: Urban	-98.9%	-72.1%	-55.1%	-59.5%	-58.2%	-17.5%
PM10: Total	-173.5%	-38.4%	349.9%	42.2%	31.1%	-46.7%
PM10: Urban	-128.6%	-32.8%	-31.6%	-31.8%	-31.7%	-32.5%
SOx: Total	-30.6%	-54.1%	45.9%	-102.1%	-87.9%	-66.2%
SOx: Urban	-177.6%	-94.9%	-95.8%	-96.6%	-96.1%	-99.1%
CH4	-267.5%	-53.0%	-70.7%	-92.8%	-89.3%	-9.4%
N2O	-78.7%	-78.7%	182.0%	8.6%	205.8%	-79.0%
CO2	-132.5%	-50.0%	-76.4%	-113.1%	-101.4%	-61.6%
GHGs	-135.8%	-50.6%	-71.2%	-110.1%	-95.1%	-60.3%



D-II Long-Term Technologies

D-II.2 Light-Duty Truck 1

Parameter	Dedi. CNGV	Dedi. LNGV	Dedi. LPGV: crude	Dedi. LPGV: NG	Dedi. MeOHV: M90, NG	Dedi. MeOHV: M90, FG	Dedi. MeOHV: M90, LFG	Dedi. EtOHV: E90, corn	Dedi. EtOHV: E90, WB	Dedi. EtOHV: E90, HB	SIDI: FRFG2, MTBE
Total energy	-8.6%	-5.7%	-16.8%	-17.7%	8.8%	13.8%	-1.8%	10.0%	57.8%	44.5%	-20.0%
Fossil fuels	-9.5%	-5.1%	-16.9%	-17.4%	9.4%	-45.4%	-61.0%	-52.1%	-83.1%	-79.2%	-20.0%
Petroleum	-99.4%	-96.0%	-1.3%	-98.2%	-78.1%	-78.1%	-78.7%	-80.1%	-77.7%	-79.6%	-20.0%
VOC: Total	-64.7%	-56.8%	-49.2%	-58.1%	-18.5%	-183.5%	-42.2%	98.5%	11.9%	5.7%	-12.1%
VOC: Urban	-56.3%	-58.5%	-49.9%	-45.3%	-14.0%	-14.0%	-19.0%	-12.0%	-12.1%	-12.2%	-8.0%
CO: Total	-19.9%	-17.6%	-20.8%	-21.7%	2.0%	-1.2%	-19.5%	1.8%	14.4%	11.5%	-1.3%
CO: Urban	-19.2%	-20.1%	-19.9%	-19.9%	-0.3%	-0.3%	-7.5%	-0.1%	-0.1%	-0.1%	-0.1%
NOx: Total	27.6%	70.7%	-33.5%	-41.7%	-5.1%	-77.6%	-25.7%	154.3%	235.4%	240.9%	-17.3%
NOx: Urban	126.1%	-14.1%	-3.5%	-4.5%	-21.1%	-21.1%	-59.5%	5.3%	-0.1%	1.5%	-6.4%
PM10: Total	-35.9%	-31.2%	-32.1%	-41.6%	-27.8%	-41.4%	-315.3%	713.4%	138.8%	118.1%	-0.7%
PM10: Urban	-24.2%	-26.0%	-24.9%	-25.0%	-15.1%	-15.1%	-257.0%	-12.4%	-12.6%	-12.5%	11.6%
SOx: Total	-34.1%	-76.7%	-48.4%	-71.8%	-60.0%	-60.4%	50.8%	140.7%	-90.6%	-68.3%	-20.0%
SOx: Urban	-80.6%	-98.3%	-91.3%	-91.5%	-77.9%	-77.9%	-234.2%	-83.0%	-83.8%	-83.3%	-20.0%
CH4	76.3%	76.1%	-29.9%	-23.1%	-21.5%	-26.4%	-418.2%	-33.6%	-69.0%	-63.3%	-18.5%
N2O	-48.1%	-47.0%	-2.9%	-2.9%	-0.6%	-3.6%	0.6%	534.4%	178.5%	583.1%	-1.2%
CO2	-26.9%	-26.9%	-21.3%	-22.9%	-11.6%	-77.3%	-146.8%	-50.1%	-107.4%	-89.1%	-20.0%
GHGs	-24.0%	-24.0%	-21.3%	-22.6%	-11.8%	-74.6%	-153.0%	-41.0%	-102.0%	-78.4%	-19.7%



D-II.2 Light-Duty Truck 1 (Cont.)

Parameter	SIDI: FRFG2, ETBE	SIDI: FRFG2, EtOH	SIDI: CARFG2, ETBE	SIDI: CARFG2, EtOH	Dedi. MeOH SIDI: NG	Dedi. MeOH SIDI: M90, FG	Dedi. MeOH SIDI: M90, LFG	Dedi. EtOH SIDI: E90, corn	Dedi. EtOH SIDI: E90, WB	Dedi. EtOH SIDI: E90, HB	GI SIDI HEV: FRFG2, MTBE
Total energy	-20.0%	-20.0%	-20.0%	-20.0%	-6.7%	-2.3%	-16.1%	-3.2%	38.9%	27.1%	-47.4%
Fossil fuels	-20.0%	-20.0%	-19.0%	-19.3%	-6.2%	-54.4%	-68.1%	-57.9%	-85.1%	-81.7%	-47.4%
Petroleum	-20.0%	-20.0%	-17.2%	-19.2%	-82.1%	-82.1%	-82.6%	-82.5%	-80.3%	-82.1%	-47.4%
VOC: Total	-13.1%	-10.1%	-13.1%	-12.6%	-28.0%	-173.2%	-48.9%	78.4%	2.2%	-3.3%	-30.3%
VOC: Urban	-8.0%	-3.8%	-8.0%	-7.9%	-18.7%	-18.7%	-23.1%	-17.0%	-17.0%	-17.1%	-32.9%
CO: Total	-1.4%	-1.2%	-1.4%	-1.2%	0.5%	-2.3%	-18.4%	0.8%	11.9%	9.4%	-3.1%
CO: Urban	-0.1%	-0.1%	-0.1%	-0.1%	-0.3%	-0.3%	-6.6%	-0.1%	-0.1%	-0.1%	-0.2%
NOx: Total	-17.8%	-17.4%	-17.8%	-17.4%	-23.5%	-87.3%	-41.7%	125.4%	196.8%	201.6%	-41.1%
NOx: Urban	-7.5%	-6.5%	-7.5%	-6.5%	-22.5%	-22.5%	-56.2%	0.8%	-4.0%	-2.6%	-15.2%
PM10: Total	-9.8%	-6.7%	-9.8%	-6.7%	-27.6%	-39.6%	-280.6%	629.4%	123.8%	105.6%	-15.8%
PM10: Urban	11.2%	11.6%	11.2%	11.6%	-2.8%	-2.8%	-215.8%	-0.4%	-0.7%	-0.6%	4.3%
SOx: Total	-20.0%	-20.0%	-20.0%	-20.0%	-76.3%	-76.7%	21.2%	111.8%	-91.7%	-72.1%	-47.4%
SOx: Urban	-20.0%	-20.0%	-20.5%	-20.5%	-80.6%	-80.6%	-218.1%	-85.0%	-85.7%	-85.3%	-47.4%
CH4	-18.5%	-18.1%	-18.5%	-18.1%	-34.9%	-39.3%	-384.0%	-40.1%	-71.3%	-66.3%	-43.7%
N2O	-8.5%	-5.8%	-8.5%	-5.8%	-1.9%	-4.5%	-0.9%	469.5%	156.4%	512.4%	-2.8%
CO2	-20.0%	-19.7%	-20.0%	-19.8%	-24.7%	-82.5%	-143.7%	-56.0%	-106.4%	-90.3%	-47.4%
GHGs	-19.7%	-19.4%	-19.7%	-19.4%	-24.7%	-80.0%	-149.0%	-47.8%	-101.5%	-80.7%	-46.6%



D-II.2 Light-Duty Truck 1 (Cont.)

Parameter	GI SIDI HEV: FRFG2, ETBE	GI SIDI HEV: FRFG2, EtOH	GI SI HEV: CNG	GI SI HEV: LNG	GI SI HEV: LPG, crude	GI SI HEV: LPG, NG	GI SIDI HEV: M90, NG	GI SIDI HEV: M90, FG	GI SIDI HEV: M90 LFG	GI SIDI HEV: E90, corn	GI SIDI HEV: E90, WB
Total energy	-47.4%	-47.4%	-43.5%	-41.7%	-46.2%	-46.7%	-37.0%	-34.1%	-43.2%	-36.3%	-8.6%
Fossil fuels	-47.4%	-47.4%	-44.1%	-41.4%	-46.2%	-46.6%	-36.7%	-68.4%	-77.4%	-72.3%	-90.2%
Petroleum	-47.4%	-47.4%	-99.6%	-97.5%	-36.1%	-98.8%	-87.3%	-87.3%	-87.7%	-88.5%	-87.1%
VOC: Total	-32.5%	-28.9%	-68.2%	-63.2%	-56.9%	-62.7%	-38.6%	-134.1%	-52.3%	29.2%	-20.9%
VOC: Urban	-33.0%	-24.7%	-57.8%	-59.1%	-52.1%	-49.1%	-28.5%	-28.5%	-31.4%	-27.4%	-27.4%
CO: Total	-3.3%	-2.8%	-22.0%	-20.6%	-22.4%	-22.9%	-1.6%	-3.5%	-14.1%	-1.7%	5.5%
CO: Urban	-0.2%	-0.2%	-19.6%	-20.2%	-20.1%	-20.1%	-0.3%	-0.3%	-4.5%	-0.2%	-0.2%
NOx: Total	-42.3%	-41.2%	-16.1%	10.5%	-52.3%	-57.6%	-39.4%	-81.4%	-51.4%	52.8%	99.8%
NOx: Urban	-17.8%	-15.3%	65.6%	-21.0%	-13.6%	-14.3%	-25.8%	-25.8%	-48.0%	-10.4%	-13.6%
PM10: Total	-30.7%	-25.6%	-38.1%	-35.2%	-35.0%	-41.2%	-32.0%	-39.8%	-198.4%	397.1%	64.5%
PM10: Urban	3.7%	4.3%	-16.6%	-17.8%	-17.0%	-17.0%	-7.9%	-7.9%	-147.9%	-6.3%	-6.4%
SOx: Total	-47.4%	-47.4%	-59.3%	-85.6%	-66.6%	-81.7%	-76.8%	-77.1%	-12.7%	39.4%	-94.5%
SOx: Urban	-47.4%	-47.4%	-88.0%	-98.9%	-94.4%	-94.5%	-87.2%	-87.2%	-177.7%	-90.1%	-90.6%
CH4	-43.8%	-43.0%	23.6%	23.4%	-51.6%	-47.2%	-52.9%	-55.8%	-282.6%	-56.7%	-77.2%
N2O	-20.2%	-13.8%	-49.9%	-49.2%	-3.9%	-4.0%	-2.8%	-4.5%	-2.1%	306.9%	100.9%
CO2	-47.4%	-47.2%	-54.9%	-54.9%	-49.1%	-50.1%	-48.8%	-86.9%	-127.1%	-70.8%	-104.0%
GHGs	-46.6%	-46.4%	-52.4%	-52.4%	-48.5%	-49.3%	-48.3%	-84.7%	-130.1%	-64.8%	-100.2%



D-II.2 Light-Duty Truck 1 (Cont.)

Parameter	GI SIDI HEV: E90, HB	GC SIDI HEV: FRFG2, MTBE, US mix	GC SIDI HEV: FRFG2, ETBE, US mix	GC SIDI HEV: FRFG2, EtOH, US mix	GC SIDI HEV: FRFG2, MTBE, CA mix	GC SIDI HEV: FRFG2, ETBE, CA mix	GC SIDI HEV: FRFG2, EtOH, CA mix	GC SI HEV: CNG, US mix	GC SI HEV: CNG, CA mix	GC SI HEV: LNG, US mix	GC SI HEV: LNG, CA mix
Total energy	-16.4%	-43.7%	-43.8%	-43.7%	-43.9%	-44.0%	-43.9%	-40.8%	-41.0%	-39.5%	-39.7%
Fossil fuels	-87.9%	-48.2%	-47.1%	-47.3%	-55.5%	-54.8%	-54.9%	-45.7%	-53.0%	-43.8%	-51.1%
Petroleum	-88.2%	-60.7%	-60.4%	-61.4%	-61.0%	-60.7%	-61.7%	-99.4%	-99.6%	-97.8%	-98.1%
VOC: Total	-24.5%	-47.1%	-49.0%	-46.3%	-49.6%	-51.2%	-48.7%	-73.9%	-76.4%	-70.4%	-72.9%
VOC: Urban	-27.5%	-44.7%	-44.8%	-41.8%	-44.7%	-44.8%	-41.7%	-70.3%	-70.3%	-71.2%	-71.2%
CO: Total	3.9%	-31.2%	-31.3%	-30.9%	-31.5%	-31.7%	-31.3%	-44.4%	-44.7%	-43.3%	-43.7%
CO: Urban	-0.2%	-30.1%	-30.1%	-30.1%	-30.1%	-30.1%	-30.1%	-43.7%	-43.7%	-44.1%	-44.1%
NOx: Total	103.0%	5.9%	-6.9%	4.3%	-38.1%	-42.6%	-38.7%	24.0%	-20.0%	43.2%	-0.8%
NOx: Urban	-12.7%	-33.3%	-35.6%	-33.3%	-31.3%	-33.8%	-31.4%	25.1%	27.0%	-37.4%	-35.5%
PM10: Total	52.5%	-2.4%	-30.6%	-21.0%	-21.9%	-40.9%	-34.5%	-18.2%	-37.7%	-16.1%	-35.6%
PM10: Urban	-6.4%	-6.7%	-7.3%	-6.7%	-6.5%	-7.1%	-6.5%	-21.3%	-21.1%	-22.1%	-22.0%
SOx: Total	-81.7%	81.0%	53.4%	68.0%	-40.0%	-44.3%	-42.1%	72.6%	-48.5%	53.6%	-67.5%
SOx: Urban	-90.3%	-59.2%	-59.2%	-59.2%	-61.3%	-61.4%	-61.4%	-88.1%	-90.3%	-96.0%	-98.2%
CH4	-73.9%	-43.9%	-44.1%	-40.1%	-50.4%	-50.5%	-47.9%	4.1%	-2.4%	4.0%	-2.5%
N2O	335.1%	-27.7%	-41.1%	-36.2%	-29.9%	-42.5%	-37.9%	-60.7%	-62.9%	-60.2%	-62.4%
CO2	-93.4%	-46.1%	-46.5%	-45.8%	-56.0%	-56.2%	-55.8%	-51.4%	-61.3%	-51.4%	-61.3%
GHGs	-86.5%	-45.7%	-46.3%	-45.5%	-55.5%	-55.7%	-55.3%	-49.8%	-59.5%	-49.8%	-59.5%



D-II.2 Light-Duty Truck 1 (Cont.)

Parameter	GC SI HEV: LPG, crude, US mix	GC SI HEV: LPG, NG, US mix	GC SI HEV: LPG, crude, CA mix	GC SI HEV: LPG, NG, CA mix	GC SIDI HEV: M90, NG, US mix	GC SIDI HEV: M90, FG, US mix	GC SIDI HEV: M90, LFG, US mix	GC SIDI HEV: M90, NG, CA mix	GC SIDI HEV: M90, FG, CA mix	GC SIDI HEV: M90, LFG, CA mix	GC SIDI HEV: E90, corn, US mix
Total energy	-42.7%	-43.1%	-42.9%	-43.3%	-36.2%	-34.1%	-40.6%	-36.4%	-34.3%	-40.8%	-35.7%
Fossil fuels	-47.2%	-47.5%	-54.6%	-54.8%	-40.5%	-63.3%	-69.8%	-47.8%	-70.7%	-77.1%	-66.1%
Petroleum	-53.6%	-98.8%	-53.8%	-99.0%	-90.5%	-90.5%	-90.7%	-90.8%	-90.8%	-91.0%	-91.3%
VOC: Total	-65.9%	-70.0%	-68.4%	-72.5%	-53.0%	-121.7%	-62.9%	-55.5%	-124.2%	-65.4%	-4.3%
VOC: Urban	-66.3%	-64.1%	-66.2%	-64.1%	-49.8%	-49.8%	-51.9%	-49.8%	-49.8%	-51.9%	-49.0%
CO: Total	-44.7%	-45.0%	-45.0%	-45.4%	-30.1%	-31.4%	-39.0%	-30.4%	-31.8%	-39.4%	-30.2%
CO: Urban	-44.0%	-44.0%	-44.0%	-44.0%	-30.2%	-30.2%	-33.2%	-30.2%	-30.2%	-33.2%	-30.1%
NOx: Total	-2.1%	-5.9%	-46.1%	-49.9%	7.1%	-23.1%	-1.5%	-36.9%	-67.1%	-45.5%	73.4%
NOx: Urban	-32.0%	-32.5%	-30.1%	-30.6%	-40.8%	-40.8%	-56.8%	-38.9%	-38.9%	-54.9%	-29.8%
PM10: Total	-16.0%	-20.4%	-35.5%	-39.9%	-13.9%	-19.6%	-133.6%	-33.4%	-39.1%	-153.1%	294.6%
PM10: Urban	-21.6%	-21.6%	-21.4%	-21.4%	-15.2%	-15.2%	-115.9%	-15.1%	-15.1%	-115.8%	-14.1%
SOx: Total	67.3%	56.4%	-53.8%	-64.7%	59.9%	59.7%	106.0%	-61.2%	-61.4%	-15.1%	143.4%
SOx: Urban	-92.7%	-92.8%	-94.9%	-95.0%	-87.6%	-87.6%	-152.6%	-89.8%	-89.8%	-154.8%	-89.7%
CH4	-49.5%	-46.4%	-56.0%	-52.8%	-50.5%	-52.5%	-215.6%	-56.9%	-59.0%	-222.0%	-53.3%
N2O	-28.5%	-28.5%	-30.7%	-30.7%	-27.7%	-28.9%	-27.2%	-29.9%	-31.1%	-29.4%	129.0%
CO2	-47.2%	-47.9%	-57.1%	-57.8%	-47.1%	-74.4%	-103.4%	-57.1%	-84.4%	-113.3%	-62.9%
GHGs	-47.0%	-47.6%	-56.7%	-57.3%	-46.9%	-73.1%	-105.7%	-56.7%	-82.8%	-115.4%	-59.8%



D-II.2 Light-Duty Truck 1 (Cont.)

Parameter	GC SIDI HEV: E90, WB, US mix	GC SIDI HEV: E90, HB, US mix	GC SIDI HEV: E90, corn, CA mix	GC SIDI HEV: E90, WB, CA mix	GC SIDI HEV: E90, HB, CA mix	CIDI: RFD	CIDI: DME, NG	CIDI: DME, FG	CIDI: FT50, NG	CIDI: FT50, FG	CIDI: BD20
Total energy	-15.8%	-21.4%	-35.9%	-16.0%	-21.6%	-35.1%	-17.7%	-14.4%	-21.3%	-13.2%	-31.4%
Fossil fuels	-79.0%	-77.4%	-73.4%	-86.3%	-84.7%	-35.0%	-17.2%	-67.4%	-21.1%	-38.6%	-31.6%
Petroleum	-90.3%	-91.1%	-91.6%	-90.6%	-91.4%	-25.0%	-97.9%	-97.9%	-59.9%	-59.9%	-36.7%
VOC: Total	-40.3%	-42.9%	-6.8%	-42.8%	-45.4%	-49.0%	-65.4%	-204.5%	-55.5%	-136.0%	-20.9%
VOC: Urban	-49.0%	-49.0%	-49.0%	-49.0%	-49.0%	-44.1%	-62.9%	-62.9%	-46.2%	-46.2%	-41.5%
CO: Total	-24.9%	-26.1%	-30.5%	-25.3%	-26.5%	90.2%	92.7%	89.3%	90.6%	89.3%	93.1%
CO: Urban	-30.1%	-30.1%	-30.1%	-30.1%	-30.1%	99.4%	99.3%	99.3%	99.4%	99.4%	100.3%
NOx: Total	107.2%	109.5%	29.4%	63.2%	65.5%	-2.2%	-1.0%	-70.7%	-10.9%	-44.3%	41.7%
NOx: Urban	-32.1%	-31.4%	-27.9%	-30.2%	-29.5%	171.6%	158.7%	158.7%	165.6%	165.6%	215.0%
PM10: Total	55.4%	46.8%	275.1%	35.9%	27.3%	2.5%	-27.9%	-42.1%	-17.8%	-23.0%	9.3%
PM10: Urban	-14.2%	-14.2%	-13.9%	-14.0%	-14.0%	29.1%	8.9%	8.9%	16.0%	16.0%	27.8%
SOx: Total	47.2%	56.4%	22.3%	-73.9%	-64.7%	-34.1%	-82.2%	-83.3%	-58.4%	-58.0%	-32.6%
SOx: Urban	-90.0%	-89.8%	-91.9%	-92.2%	-92.0%	6.8%	-95.7%	-95.7%	-42.2%	-42.2%	-9.6%
CH4	-68.1%	-65.7%	-59.8%	-74.5%	-72.1%	-50.7%	-48.9%	-48.8%	-50.9%	-50.5%	-52.8%
N2O	-19.1%	149.3%	126.9%	-21.2%	147.1%	-16.2%	-18.7%	-22.4%	-19.1%	-19.7%	-6.6%
CO2	-86.8%	-79.2%	-72.9%	-96.7%	-89.1%	-32.3%	-35.7%	-94.6%	-31.6%	-61.2%	-40.0%
GHGs	-85.2%	-75.4%	-69.5%	-94.9%	-85.1%	-32.6%	-35.9%	-92.2%	-32.0%	-60.3%	-39.9%



D-II.2 Light-Duty Truck 1 (Cont.)

Parameter	GI CIDI HEV: RFD	GI CIDI HEV: DME, NG	GI CIDI HEV: DME, FG	GI CIDI HEV: FT50, NG	GI CIDI HEV: FT50, FG	GI CIDI HEV: BD20	GC CIDI HEV: RFD, US mix	GC CIDI HEV: RFD CA mix	GC CIDI HEV: DME, NG, US mix	GC CIDI HEV: DME, FG, US mix	GC CIDI HEV: DME, NG, CA mix
Total energy	-57.7%	-46.3%	-44.2%	-48.7%	-43.3%	-55.3%	-53.3%	-53.5%	-42.2%	-40.7%	-42.4%
Fossil fuels	-57.6%	-46.0%	-78.7%	-48.5%	-59.9%	-55.4%	-57.8%	-65.2%	-46.5%	-70.5%	-53.9%
Petroleum	-51.1%	-98.6%	-98.6%	-73.8%	-73.8%	-58.7%	-67.1%	-67.3%	-98.6%	-98.6%	-98.9%
VOC: Total	-55.0%	-69.2%	-159.9%	-59.2%	-111.8%	-36.6%	-65.2%	-67.7%	-74.5%	-140.9%	-77.0%
VOC: Urban	-30.7%	-42.6%	-42.6%	-47.0%	-47.0%	-43.9%	-62.0%	-61.9%	-74.2%	-74.2%	-74.2%
CO: Total	89.0%	90.6%	88.4%	89.2%	88.4%	90.9%	33.2%	32.8%	34.5%	32.9%	34.2%
CO: Urban	33.3%	33.3%	33.3%	99.3%	99.3%	99.9%	39.5%	39.5%	39.5%	39.5%	39.5%
NOx: Total	-18.9%	-18.1%	-63.5%	-24.5%	-46.3%	9.8%	19.5%	-24.5%	22.2%	-11.1%	-21.8%
NOx: Urban	22.1%	21.0%	21.0%	161.7%	161.7%	193.9%	85.4%	87.3%	87.2%	87.2%	89.2%
PM10: Total	-6.2%	-30.0%	-39.2%	-22.0%	-25.5%	-3.1%	3.3%	-16.2%	-12.6%	-19.4%	-32.1%
PM10: Urban	24.6%	7.6%	7.6%	15.5%	15.5%	25.4%	9.2%	9.4%	-3.6%	-3.6%	-3.4%
SOx: Total	-57.0%	-88.4%	-89.1%	-72.9%	-72.6%	-56.1%	71.8%	-49.3%	51.7%	51.2%	-69.4%
SOx: Urban	-4.7%	-14.9%	-14.9%	-62.3%	-62.3%	-41.1%	-52.7%	-54.9%	-94.7%	-94.7%	-96.9%
CH4	-67.3%	-65.6%	-65.6%	-67.5%	-67.2%	-68.7%	-62.5%	-68.9%	-59.2%	-59.1%	-65.6%
N2O	-17.3%	-18.9%	-21.3%	-19.2%	-19.6%	-11.0%	-37.9%	-40.1%	-39.0%	-40.8%	-41.2%
CO2	-55.8%	-58.1%	-96.5%	-55.4%	-74.7%	-60.8%	-54.5%	-64.5%	-53.2%	-81.3%	-63.2%
GHGs	-55.6%	-57.8%	-94.5%	-55.2%	-73.7%	-60.3%	-54.5%	-64.2%	-53.2%	-80.1%	-62.9%



D-II.2 Light-Duty Truck 1 (Cont.)

Parameter	GC CIDI HEV: DME, FG, CA mix	GC CIDI HEV: FT50, NG, US mix	GC CIDI HEV: FT50, FG, US mix	GC CIDI HEV: FT50, NG, CA mix	GC CIDI HEV: FT50, FG, CA mix	GC CIDI HEV: BD20, US mix	GC CIDI HEV: BD20, CA mix	EV: US mix	EV: NE US mix	EV: CA mix	H2 FCV: NG, C. gaseous
Total energy	-40.9%	-43.9%	-40.1%	-44.1%	-40.3%	-48.8%	-49.0%	-38.4%	-39.8%	-39.0%	-59.7%
Fossil fuels	-77.8%	-48.3%	-56.7%	-64.0%	-51.8%	-53.4%	-60.7%	-53.4%	-55.5%	-77.9%	-60.3%
Petroleum	-98.9%	-80.5%	-80.5%	-80.7%	-80.7%	-69.4%	-69.7%	-98.7%	-98.3%	-99.6%	-99.7%
VOC: Total	-143.4%	-67.5%	-106.1%	-70.0%	-108.6%	-51.0%	-53.5%	-87.7%	-91.7%	-96.1%	-95.1%
VOC: Urban	-74.2%	-62.7%	-62.7%	-62.7%	-62.7%	-60.5%	-60.5%	-99.7%	-99.3%	-99.6%	-97.8%
CO: Total	32.5%	33.5%	32.9%	33.2%	32.6%	34.7%	34.4%	-96.8%	-96.5%	-98.0%	-96.2%
CO: Urban	39.5%	39.6%	39.6%	39.6%	39.6%	40.0%	40.0%	-99.9%	-99.7%	-99.8%	-99.3%
NOx: Total	-55.1%	17.4%	1.5%	-26.6%	-42.5%	42.5%	-1.5%	112.7%	47.5%	-34.0%	-38.9%
NOx: Urban	89.2%	90.5%	90.5%	92.5%	92.5%	114.1%	116.0%	-76.4%	-51.4%	-69.9%	-6.1%
PM10: Total	-38.9%	-6.9%	-9.4%	-26.5%	-29.0%	6.8%	-12.7%	27.5%	-33.5%	-37.6%	-50.3%
PM10: Urban	-3.4%	1.1%	1.1%	1.3%	1.3%	8.2%	8.4%	-32.5%	-29.9%	-31.9%	-32.2%
SOx: Total	-69.9%	63.1%	63.3%	-58.0%	-57.8%	75.4%	-45.7%	377.4%	124.5%	-26.2%	-66.0%
SOx: Urban	-96.9%	-69.2%	-69.2%	-71.4%	-71.4%	-53.6%	-55.8%	-89.3%	-78.5%	-96.5%	-99.0%
CH4	-65.6%	-60.5%	-60.3%	-66.9%	-66.7%	-61.4%	-67.8%	-47.5%	-32.7%	-69.0%	-61.7%
N2O	-43.0%	-39.2%	-39.5%	-41.4%	-41.7%	-33.3%	-35.4%	-86.0%	-90.3%	-93.3%	-97.7%
CO2	-91.3%	-51.3%	-65.4%	-61.2%	-75.4%	-55.2%	-65.2%	-46.3%	-56.4%	-79.4%	-68.6%
GHGs	-89.8%	-51.4%	-64.9%	-61.1%	-74.6%	-55.1%	-64.8%	-46.9%	-56.4%	-79.3%	-68.8%



D-II.2 Light-Duty Truck 1 (Cont.)

Parameter	H2 FCV: NG, station gaseous	H2 FCV: solar, gas	H2 FCV: solar, liquid	H2 FCV: NG, liquid	FCV: MeOH, NG	FCV: MeOH, FG
Total energy	-53.2%	-65.5%	-71.8%	-58.8%	-52.3%	-49.7%
Fossil fuels	-52.9%	-93.1%	-98.3%	-58.5%	-52.0%	-80.3%
Petroleum	-99.7%	-99.9%	-98.1%	-97.8%	-98.6%	-98.6%
VOC: Total	-93.5%	-95.1%	-90.9%	-88.0%	-73.3%	-158.4%
VOC: Urban	-93.5%	-97.0%	-97.3%	-97.0%	-74.6%	-74.6%
CO: Total	-94.7%	-97.9%	-98.4%	-95.7%	-77.4%	-79.1%
CO: Urban	-96.2%	-99.1%	-99.7%	-99.7%	-80.0%	-80.0%
NOx: Total	-27.7%	-33.0%	-69.8%	-42.1%	-62.5%	-99.9%
NOx: Urban	137.0%	31.5%	-69.9%	-66.8%	-83.5%	-83.5%
PM10: Total	-49.2%	-49.2%	-45.9%	-40.1%	-52.9%	-59.9%
PM10: Urban	-23.5%	-31.2%	-30.3%	-30.1%	-34.6%	-34.6%
SOx: Total	-91.7%	-63.5%	-97.5%	-90.6%	-87.8%	-88.0%
SOx: Urban	-99.4%	-98.8%	-97.2%	-97.1%	-97.0%	-97.0%
CH4	-45.7%	-86.6%	-98.7%	-62.3%	-67.7%	-70.3%
N2O	-95.7%	-97.5%	-99.2%	-97.2%	-78.9%	-80.5%
CO2	-63.7%	-93.4%	-98.3%	-67.7%	-62.8%	-96.7%
GHGs	-63.6%	-93.3%	-98.3%	-68.0%	-63.2%	-95.6%



D-II.2 Light-Duty Truck 1 (Cont.)

Parameter	FCV: MeOH, LFG	FCV: RFG	EtOH FCV: corn	EtOH FCV: WB	EtOH FCV: HB	NG FCV: CNG
Total energy	-57.8%	-50.0%	-37.8%	-7.2%	-15.7%	-52.0%
Fossil fuels	-88.3%	-50.0%	-77.5%	-97.4%	-94.9%	-52.5%
Petroleum	-98.9%	-50.0%	-96.5%	-94.9%	-96.2%	-99.7%
VOC: Total	-85.5%	-52.5%	5.3%	-50.2%	-54.2%	-88.7%
VOC: Urban	-77.2%	-53.9%	-72.6%	-72.6%	-72.7%	-88.1%
CO: Total	-88.5%	-78.0%	-76.5%	-68.4%	-70.2%	-78.5%
CO: Urban	-83.8%	-79.9%	-79.8%	-79.8%	-79.8%	-79.5%
NOx: Total	-73.2%	-54.0%	49.9%	101.8%	105.3%	-37.3%
NOx: Urban	-103.2%	-70.4%	-53.2%	-58.7%	-57.1%	-3.4%
PM10: Total	-201.1%	-39.6%	424.4%	56.5%	43.3%	-49.5%
PM10: Urban	-159.4%	-33.0%	-31.5%	-31.7%	-31.6%	-32.5%
SOx: Total	-30.6%	-54.1%	45.9%	-102.2%	-87.9%	-66.2%
SOx: Urban	-177.6%	-94.9%	-95.8%	-96.6%	-96.1%	-99.1%
CH4	-272.3%	-52.3%	-70.9%	-93.5%	-89.9%	-12.2%
N2O	-78.3%	-78.2%	264.2%	36.4%	295.4%	-78.6%
CO2	-132.5%	-50.0%	-76.5%	-113.2%	-101.5%	-61.6%
GHGs	-136.1%	-50.5%	-71.3%	-110.4%	-95.3%	-60.3%



D-II Long-Term Technologies

D-II.3 Light-Duty Truck 2

Parameter	Dedi. CNGV	Dedi. LNGV	Dedi. LPGV: crude	Dedi. LPGV: NG	Dedi. MeOHV: M90, NG	Dedi. MeOHV: M90, FG	Dedi. MeOHV: M90, LFG	Dedi. EtOHV: E90, corn	Dedi. EtOHV: E90, WB	Dedi. EtOHV: E90, HB	SIDI: FRFG2, MTBE
Total energy	-4.0%	-1.0%	-12.9%	-13.8%	14.0%	19.3%	2.9%	15.1%	65.0%	51.1%	-20.0%
Fossil fuels	-5.0%	-0.4%	-12.9%	-13.5%	14.6%	-42.8%	-59.2%	-47.9%	-81.5%	-77.3%	-20.0%
Petroleum	-99.4%	-95.8%	3.4%	-98.1%	-77.1%	-77.1%	-77.7%	-80.6%	-78.3%	-80.2%	-20.0%
VOC: Total	-66.0%	-58.0%	-47.5%	-56.5%	-16.5%	-182.2%	-40.3%	89.4%	7.8%	1.9%	-11.7%
VOC: Urban	-59.3%	-61.4%	-48.6%	-44.0%	-12.9%	-12.9%	-17.8%	-10.4%	-10.4%	-10.5%	-7.7%
CO: Total	-19.8%	-18.3%	-20.4%	-20.9%	1.5%	-0.6%	-12.1%	1.8%	9.7%	7.9%	-0.8%
CO: Urban	-19.5%	-20.1%	-19.9%	-20.0%	-0.2%	-0.2%	-4.6%	0.0%	0.0%	0.0%	0.0%
NOx: Total	25.8%	60.7%	-23.9%	-30.5%	-0.9%	-59.6%	-17.7%	125.3%	190.1%	194.5%	-13.4%
NOx: Urban	53.6%	-5.3%	-0.8%	-1.3%	-8.3%	-8.3%	-24.3%	3.9%	1.5%	2.2%	-2.6%
PM10: Total	-42.4%	-37.8%	-38.7%	-47.9%	-29.9%	-43.1%	-309.5%	462.9%	68.0%	53.8%	4.3%
PM10: Urban	-36.9%	-38.6%	-37.6%	-37.7%	-21.2%	-21.2%	-246.2%	-18.4%	-18.6%	-18.5%	18.1%
SOx: Total	-30.8%	-75.5%	-45.9%	-70.4%	-58.0%	-58.5%	58.0%	130.5%	-89.8%	-68.6%	-20.0%
SOx: Urban	-79.6%	-98.2%	-90.9%	-91.1%	-76.9%	-76.9%	-240.6%	-82.1%	-82.9%	-82.5%	-20.0%
CH4	85.6%	85.3%	-26.7%	-19.6%	-18.1%	-23.3%	-430.7%	-18.5%	-63.1%	-55.9%	-18.3%
N2O	-48.2%	-47.2%	-2.3%	-2.3%	-0.3%	-2.8%	0.7%	345.7%	103.3%	378.8%	-1.0%
CO2	-23.2%	-23.3%	-17.6%	-19.2%	-7.4%	-76.2%	-149.0%	-46.9%	-107.4%	-88.1%	-20.0%
GHGs	-20.3%	-20.3%	-17.6%	-18.9%	-7.6%	-73.3%	-155.1%	-37.2%	-101.5%	-76.7%	-19.6%



D-II.3 Light-Duty Truck 2 (Cont.)

Parameter	SIDI: FRFG2, ETBE	SIDI: FRFG2, EtOH	SIDI: CARFG2, ETBE	SIDI: CARFG2, EtOH	Dedi. MeOH SIDI: NG	Dedi. MeOH SIDI: M90, FG	Dedi. MeOH SIDI: M90, LFG	Dedi EtOH SIDI: E90, corn	Dedi. EtOH SIDI: E90, WB	Dedi. EtOH SIDI: E90, HB	GI SIDI HEV: FRFG2, MTBE
Total energy	-20.0%	-20.0%	-20.0%	-20.0%	-6.7%	-2.3%	-16.1%	-3.3%	38.6%	26.9%	-47.4%
Fossil fuels	-20.0%	-20.0%	-19.0%	-19.3%	-6.2%	-54.4%	-68.1%	-56.2%	-84.5%	-80.9%	-47.4%
Petroleum	-20.0%	-20.0%	-17.2%	-19.2%	-82.1%	-82.1%	-82.6%	-83.7%	-81.8%	-83.4%	-47.4%
VOC: Total	-12.8%	-9.7%	-12.8%	-9.7%	-27.0%	-166.2%	-47.0%	64.7%	-3.8%	-8.7%	-29.5%
VOC: Urban	-7.8%	-3.6%	-7.8%	-3.6%	-17.8%	-17.8%	-21.9%	-15.6%	-15.6%	-15.7%	-33.9%
CO: Total	-0.8%	-0.7%	-0.8%	-0.7%	0.3%	-1.4%	-11.0%	0.9%	7.6%	6.1%	-1.9%
CO: Urban	-0.1%	0.0%	-0.1%	0.0%	-0.2%	-0.2%	-3.9%	0.0%	0.0%	0.0%	-0.1%
NOx: Total	-14.4%	-13.5%	-14.4%	-13.5%	-18.2%	-67.5%	-32.2%	94.5%	148.9%	152.6%	-31.7%
NOx: Urban	-3.2%	-2.6%	-3.2%	-2.6%	-9.0%	-9.0%	-22.5%	1.3%	-0.6%	0.0%	-6.1%
PM10: Total	-6.7%	-2.9%	-6.7%	-2.9%	-25.6%	-36.7%	-260.5%	386.9%	55.2%	43.3%	-12.2%
PM10: Urban	17.7%	18.1%	17.7%	18.1%	-2.5%	-2.5%	-191.6%	-0.1%	-0.3%	-0.2%	7.8%
SOx: Total	-20.0%	-20.0%	-20.0%	-20.0%	-76.3%	-76.7%	21.2%	93.6%	-91.4%	-73.6%	-47.4%
SOx: Urban	-20.0%	-20.0%	-20.5%	-20.5%	-80.6%	-80.6%	-218.1%	-85.0%	-85.7%	-85.3%	-47.4%
CH4	-18.3%	-18.0%	-18.3%	-18.0%	-35.0%	-39.3%	-381.6%	-29.1%	-66.6%	-60.6%	-43.4%
N2O	-7.6%	-5.0%	-7.6%	-5.0%	-1.6%	-3.8%	-0.7%	286.3%	82.7%	314.2%	-2.3%
CO2	-20.0%	-19.7%	-20.0%	-19.8%	-24.7%	-82.5%	-143.7%	-55.2%	-106.0%	-89.9%	-47.4%
GHGs	-19.6%	-19.3%	-19.6%	-19.4%	-24.7%	-79.8%	-148.5%	-46.8%	-100.7%	-79.9%	-46.5%



D-II.3 Light-Duty Truck 2 (Cont.)

Parameter	GI SIDI HEV: FRFG2, ETBE	GI SIDI HEV: FRFG2, EtOH	GI SI HEV: CNG	GI SI HEV: LNG	GI SI HEV: LPG, crude	GI SI HEV: LPG, NG	GI SIDI HEV: M90, NG	GI SIDI HEV: M90, FG	GI SIDI HEV: M90 LFG	GI SIDI HEV: E90, corn	GI SIDI HEV: E90, WB
Total energy	-47.4%	-47.4%	-43.5%	-41.7%	-46.2%	-46.7%	-37.0%	-34.1%	-43.2%	-36.4%	-8.8%
Fossil fuels	-47.4%	-47.4%	-44.1%	-41.4%	-46.2%	-46.6%	-36.7%	-68.4%	-77.4%	-71.2%	-89.8%
Petroleum	-47.4%	-47.4%	-99.6%	-97.5%	-36.1%	-98.8%	-87.3%	-87.7%	-87.7%	-89.3%	-88.0%
VOC: Total	-31.7%	-28.1%	-67.0%	-62.3%	-55.9%	-61.5%	-37.4%	-129.0%	-50.6%	20.0%	-25.0%
VOC: Urban	-34.0%	-25.8%	-56.6%	-57.9%	-50.9%	-48.1%	-27.4%	-27.4%	-30.2%	-25.8%	-25.9%
CO: Total	-2.0%	-1.7%	-21.2%	-20.3%	-21.5%	-21.8%	-1.0%	-2.1%	-8.5%	-0.6%	3.8%
CO: Urban	-0.1%	-0.1%	-19.8%	-20.1%	-20.0%	-20.0%	-0.2%	-0.2%	-2.6%	-0.1%	-0.1%
NOx: Total	-34.1%	-32.0%	-12.4%	8.1%	-40.4%	-44.5%	-30.5%	-62.9%	-39.7%	39.1%	74.9%
NOx: Urban	-7.5%	-6.1%	26.2%	-8.4%	-5.4%	-5.7%	-10.3%	-10.3%	-19.2%	-3.2%	-4.5%
PM10: Total	-28.1%	-22.6%	-41.6%	-38.9%	-38.8%	-44.5%	-31.5%	-38.9%	-186.1%	232.1%	13.8%
PM10: Urban	7.2%	7.7%	-24.5%	-25.5%	-24.9%	-24.9%	-9.9%	-9.9%	-134.3%	-8.2%	-8.3%
SOx: Total	-47.4%	-47.4%	-59.3%	-85.6%	-66.6%	-81.7%	-76.8%	-77.1%	-12.7%	27.4%	-94.4%
SOx: Urban	-47.4%	-47.4%	-88.0%	-98.9%	-94.4%	-94.5%	-87.2%	-87.2%	-177.7%	-90.1%	-90.6%
CH4	-43.4%	-42.6%	26.4%	26.2%	-51.2%	-46.8%	-52.9%	-55.7%	-280.9%	-48.2%	-72.8%
N2O	-17.9%	-11.9%	-49.9%	-49.4%	-3.3%	-3.3%	-2.3%	-3.7%	-1.8%	179.8%	45.8%
CO2	-47.4%	-47.2%	-54.9%	-54.9%	-49.1%	-50.1%	-48.8%	-86.9%	-127.1%	-70.2%	-103.6%
GHGs	-46.5%	-46.3%	-52.3%	-52.3%	-48.4%	-49.2%	-48.1%	-84.4%	-129.6%	-63.9%	-99.4%



D-II.3 Light-Duty Truck 2 (Cont.)

Parameter	GI SIDI HEVs: E90, HB	GC SIDI HEV: FRFG2, MTBE, US mix	GC SIDI HEV: FRFG2, ETBE, US mix	GC SIDI HEV: FRFG2, EtOH, US mix	GC SIDI HEV: FRFG2, MTBE, CA mix	GC SIDI HEV: FRFG2, ETBE, CA mix	GC SIDI HEV: FRFG2, EtOH, CA mix	GC SI HEV: CNG, US mix	GC SI HEV: CNG, CA mix	GC SI HEV: LNG, US mix	GC SI HEV: LNG, CA mix
Total energy	-16.5%	-43.7%	-43.8%	-43.7%	-43.9%	-44.0%	-43.9%	-40.8%	-41.0%	-39.5%	-39.7%
Fossil fuels	-87.5%	-48.2%	-47.1%	-47.3%	-55.5%	-54.8%	-54.9%	-45.7%	-53.0%	-43.8%	-51.1%
Petroleum	-89.1%	-60.7%	-60.4%	-61.4%	-61.0%	-60.7%	-61.7%	-99.4%	-99.6%	-97.8%	-98.1%
VOC: Total	-28.3%	-46.7%	-48.6%	-45.9%	-49.1%	-50.7%	-48.1%	-73.2%	-75.7%	-69.8%	-72.3%
VOC: Urban	-25.9%	-44.3%	-44.4%	-41.4%	-44.3%	-44.4%	-41.3%	-69.5%	-69.5%	-70.4%	-70.4%
CO: Total	2.8%	-30.7%	-30.8%	-30.5%	-30.9%	-31.0%	-30.8%	-44.2%	-44.4%	-43.6%	-43.8%
CO: Urban	-0.1%	-30.0%	-30.1%	-30.0%	-30.0%	-30.1%	-30.0%	-43.8%	-43.8%	-44.0%	-44.0%
NOx: Total	77.3%	-2.2%	-11.3%	-3.3%	-36.3%	-40.2%	-36.7%	11.8%	-22.3%	26.6%	-7.4%
NOx: Urban	-4.1%	-31.3%	-32.3%	-31.3%	-30.5%	-31.6%	-30.6%	-8.0%	-7.2%	-33.0%	-32.2%
PM10: Total	6.0%	-4.2%	-30.5%	-21.3%	-22.4%	-40.4%	-34.1%	-25.0%	-43.1%	-23.1%	-41.2%
PM10: Urban	-8.3%	-9.1%	-9.6%	-9.1%	-8.9%	-9.4%	-8.9%	-31.6%	-31.5%	-32.4%	-32.2%
SOx: Total	-82.7%	81.0%	53.4%	68.0%	-40.0%	-44.3%	-42.1%	72.6%	-48.5%	53.6%	-67.5%
SOx: Urban	-90.3%	-59.2%	-59.2%	-59.2%	-61.3%	-61.4%	-61.4%	-88.1%	-90.3%	-96.0%	-98.2%
CH4	-68.9%	-43.8%	-44.0%	-40.0%	-50.2%	-50.3%	-47.7%	5.9%	-0.5%	5.8%	-0.6%
N2O	198.1%	-28.1%	-39.9%	-35.4%	-29.9%	-41.1%	-36.8%	-61.4%	-63.2%	-61.0%	-62.8%
CO2	-92.9%	-46.1%	-46.5%	-45.8%	-56.0%	-56.2%	-55.8%	-51.4%	-61.3%	-51.4%	-61.3%
GHGs	-85.7%	-45.7%	-46.3%	-45.4%	-55.4%	-55.6%	-55.2%	-49.8%	-59.5%	-49.8%	-59.5%



D-II.3 Light-Duty Truck 2 (Cont.)

Parameter	GC SI HEV: LPG, crude, US mix	GC SI HEV: LPG, NG, US mix	GC SI HEV: LPG, crude, CA mix	GC SI HEV: LPG, NG, CA mix	GC SIDI HEV: M90, NG, US mix	GC SIDI HEV: M90, FG, US mix	GC SIDI HEV: M90, LFG, US mix	GC SIDI HEV: M90, NG, CA mix	GC SIDI HEV: M90, FG, CA mix	GC SIDI HEV: M90, LFG, CA mix	GC SIDI HEV: E90, corn, US mix
Total energy	-42.7%	-43.1%	-42.9%	-43.3%	-36.2%	-34.1%	-40.6%	-36.4%	-34.3%	-40.8%	-35.8%
Fossil fuels	-47.2%	-47.5%	-54.6%	-54.8%	-40.5%	-63.3%	-69.8%	-47.8%	-70.7%	-77.1%	-64.8%
Petroleum	-53.6%	-98.8%	-53.8%	-99.0%	-90.5%	-90.5%	-90.7%	-90.8%	-90.8%	-91.0%	-91.9%
VOC: Total	-65.3%	-69.3%	-67.8%	-71.7%	-52.4%	-118.2%	-61.8%	-54.8%	-120.6%	-64.2%	-11.2%
VOC: Urban	-65.5%	-63.4%	-65.4%	-63.4%	-49.1%	-49.1%	-51.0%	-49.0%	-49.0%	-51.0%	-47.9%
CO: Total	-44.4%	-44.6%	-44.6%	-44.8%	-30.0%	-30.9%	-35.4%	-30.3%	-31.1%	-35.6%	-29.8%
CO: Urban	-44.0%	-44.0%	-44.0%	-44.0%	-30.1%	-30.1%	-31.9%	-30.1%	-30.1%	-31.9%	-30.0%
NOx: Total	-8.4%	-11.3%	-42.4%	-45.4%	-1.3%	-24.7%	-8.0%	-35.4%	-58.7%	-42.0%	48.0%
NOx: Urban	-30.8%	-31.0%	-30.0%	-30.2%	-34.3%	-34.3%	-40.7%	-33.6%	-33.6%	-40.0%	-29.2%
PM10: Total	-22.9%	-27.0%	-41.1%	-45.2%	-18.0%	-23.2%	-129.1%	-36.1%	-41.3%	-147.2%	161.9%
PM10: Urban	-31.9%	-31.9%	-31.7%	-31.7%	-21.4%	-21.4%	-110.9%	-21.3%	-21.3%	-110.7%	-20.2%
SOx: Total	67.3%	56.4%	-53.8%	-64.7%	59.9%	59.7%	106.0%	-61.2%	-61.4%	-15.1%	121.8%
SOx: Urban	-92.7%	-92.8%	-94.9%	-95.0%	-87.6%	-87.6%	-152.6%	-89.8%	-89.8%	-154.8%	-89.6%
CH4	-49.3%	-46.2%	-55.7%	-52.6%	-50.6%	-52.6%	-214.5%	-57.0%	-59.0%	-220.9%	-44.1%
N2O	-28.8%	-28.8%	-30.6%	-30.6%	-28.1%	-29.1%	-27.7%	-29.9%	-30.9%	-29.5%	50.1%
CO2	-47.2%	-47.9%	-57.1%	-57.8%	-47.1%	-74.4%	-103.4%	-57.1%	-84.4%	-113.3%	-62.3%
GHGs	-46.9%	-47.5%	-56.6%	-57.2%	-46.9%	-73.0%	-105.5%	-56.6%	-82.6%	-115.2%	-59.3%



D-II.3 Light-Duty Truck 2 (Cont.)

Parameter	GC SIDI HEV: E90, WB, US mix	GC SIDI HEV: E90, HB, US mix	GC SIDI HEV: E90, corn, CA mix	GC SIDI HEV: E90, WB, CA mix	GC SIDI HEV: E90, HB, CA mix	CIDI: RFD	CIDI: DME, NG	CIDI: DME, FG	CIDI: FT50, NG	CIDI: FT50, FG	CIDI: BD20
Total energy	-16.0%	-21.5%	-36.0%	-16.2%	-21.7%	-35.1%	-17.7%	-14.4%	-21.3%	-13.2%	-31.4%
Fossil fuels	-78.2%	-76.5%	-72.4%	-85.8%	-84.1%	-35.0%	-17.2%	-67.4%	-21.1%	-38.6%	-31.6%
Petroleum	-91.0%	-91.8%	-92.2%	-91.3%	-92.0%	-25.0%	-97.9%	-97.9%	-59.9%	-59.9%	-36.7%
VOC: Total	-43.6%	-46.0%	-13.5%	-45.9%	-48.2%	-45.0%	-62.6%	-196.0%	-51.2%	-128.5%	-18.1%
VOC: Urban	-47.9%	-48.0%	-47.9%	-47.9%	-47.9%	-38.5%	-58.9%	-58.9%	-40.4%	-40.4%	-36.0%
CO: Total	-26.6%	-27.3%	-30.0%	-26.8%	-27.5%	-1.9%	-0.4%	-2.4%	-1.7%	-2.4%	-0.2%
CO: Urban	-30.0%	-30.0%	-30.0%	-30.0%	-30.0%	-0.1%	-0.2%	-0.2%	-0.2%	-0.2%	0.4%
NOx: Total	73.8%	75.5%	14.5%	40.2%	42.0%	-19.0%	-18.0%	-71.9%	-25.7%	-51.5%	15.0%
NOx: Urban	-30.1%	-29.8%	-28.4%	-29.3%	-29.1%	23.0%	17.9%	17.9%	20.6%	20.6%	40.4%
PM10: Total	5.0%	-0.6%	149.1%	-7.8%	-13.4%	-15.2%	-42.0%	-55.1%	-31.6%	-36.4%	-8.4%
PM10: Urban	-20.3%	-20.2%	-20.0%	-20.1%	-20.1%	-1.7%	-17.2%	-17.2%	-9.4%	-9.4%	-2.0%
SOx: Total	34.3%	42.7%	11.7%	-75.8%	-67.4%	-34.1%	-82.2%	-83.3%	-58.4%	-58.0%	-32.6%
SOx: Urban	-90.0%	-89.8%	-91.8%	-92.2%	-92.0%	6.8%	-95.7%	-95.7%	-42.2%	-42.2%	-9.6%
CH4	-61.8%	-59.0%	-51.8%	-69.5%	-66.7%	-51.0%	-49.2%	-49.1%	-51.2%	-50.8%	-53.1%
N2O	-46.2%	63.3%	48.6%	-47.7%	61.8%	-21.3%	-23.4%	-26.4%	-23.7%	-24.2%	-13.4%
CO2	-86.4%	-78.7%	-72.4%	-96.4%	-88.7%	-32.3%	-35.7%	-94.6%	-31.6%	-61.2%	-40.1%
GHGs	-84.8%	-75.0%	-69.1%	-94.6%	-84.7%	-32.7%	-35.9%	-92.0%	-32.1%	-60.2%	-40.0%



D-II.3 Light-Duty Truck 2 (Cont.)

Parameter	GI CIDI HEV: RFD	GI CIDI HEV: DME, NG	GI CIDI HEV: DME, FG	GI CIDI HEV: FT50, NG	GI CIDI HEV: FT50, FG	GI CIDI HEV: BD20	GC CIDI HEV: RFD, US mix	GC CIDI HEV: RFD CA mix	GC CIDI HEV: DME, NG, US mix	GC CIDI HEV: DME, FG, US mix	GC CIDI HEV: DME, NG, CA mix
Total energy	-57.7%	-46.3%	-44.2%	-48.7%	-43.3%	-55.3%	-49.4%	-49.6%	-39.6%	-38.0%	-39.8%
Fossil fuels	-57.6%	-46.0%	-78.7%	-48.5%	-59.9%	-55.4%	-54.5%	-62.9%	-44.5%	-68.5%	-52.9%
Petroleum	-51.1%	-98.6%	-98.6%	-73.8%	-73.8%	-58.7%	-65.5%	-65.8%	-98.6%	-98.5%	-98.9%
VOC: Total	-50.7%	-66.2%	-153.2%	-54.8%	-105.3%	-33.1%	-61.5%	-64.3%	-72.1%	-135.8%	-74.9%
VOC: Urban	-9.4%	-13.9%	-13.9%	-41.2%	-41.2%	-38.3%	-57.9%	-57.8%	-71.3%	-71.3%	-71.3%
CO: Total	-2.6%	-1.6%	-3.0%	-2.5%	-3.0%	-1.5%	-31.2%	-31.4%	-30.4%	-31.4%	-30.7%
CO: Urban	0.0%	-0.1%	-0.1%	-0.2%	-0.2%	0.2%	-30.1%	-30.1%	-30.1%	-30.1%	-30.1%
NOx: Total	-31.9%	-31.2%	-66.4%	-36.2%	-53.1%	-9.7%	4.0%	-34.9%	5.3%	-20.4%	-33.6%
NOx: Urban	2.7%	2.2%	2.2%	19.1%	19.1%	32.0%	-15.3%	-14.5%	-14.6%	-14.6%	-13.7%
PM10: Total	-23.3%	-43.9%	-52.5%	-35.5%	-38.7%	-19.9%	-9.0%	-29.7%	-23.2%	-29.5%	-43.9%
PM10: Urban	-2.6%	-19.7%	-19.7%	-9.8%	-9.8%	-4.2%	-16.9%	-16.7%	-26.6%	-26.6%	-26.4%
SOx: Total	-57.0%	-88.4%	-89.1%	-72.9%	-72.6%	-56.1%	93.7%	-44.7%	72.2%	71.7%	-66.2%
SOx: Urban	-4.7%	-15.0%	-15.0%	-62.3%	-62.3%	-41.1%	-50.1%	-52.6%	-94.3%	-94.3%	-96.8%
CH4	-67.5%	-65.8%	-65.7%	-67.6%	-67.4%	-68.9%	-59.5%	-66.8%	-57.2%	-57.1%	-64.5%
N2O	-22.2%	-23.5%	-25.5%	-23.8%	-24.1%	-17.0%	-41.6%	-43.6%	-42.5%	-44.0%	-44.6%
CO2	-55.8%	-58.1%	-96.5%	-55.4%	-74.7%	-60.8%	-50.8%	-62.2%	-50.9%	-79.0%	-62.3%
GHGs	-55.6%	-57.7%	-94.3%	-55.2%	-73.6%	-60.3%	-50.9%	-62.0%	-51.0%	-77.7%	-62.1%



D-II.3 Light-Duty Truck 2 (Cont.)

Parameter	GC CIDI HEV: DME, FG, CA mix	GC CIDI HEV: FT50, NG, US mix	GC CIDI HEV: FT50, FG, US mix	GC CIDI HEV: FT50, NG, CA mix	GC CIDI HEV: FT50, FG, CA mix	GC CIDI HEV: BD20, US mix	GC CIDI HEV: BD20, CA mix	EV: US mix	EV: NE US mix	EV: CA mix	H2 FCV: NG, C. gaseous
Total energy	-38.2%	-41.3%	-37.4%	-41.5%	-37.6%	-46.1%	-46.4%	-29.6%	-31.1%	-30.3%	-59.7%
Fossil fuels	-76.9%	-46.3%	-54.7%	-54.7%	-63.1%	-51.4%	-59.8%	-46.8%	-51.1%	-74.7%	-60.3%
Petroleum	-98.9%	-80.4%	-80.4%	-80.7%	-80.7%	-69.3%	-69.6%	-98.5%	-97.9%	-99.6%	-99.7%
VOC: Total	-138.5%	-64.1%	-101.1%	-66.9%	-103.8%	-48.3%	-51.0%	-86.6%	-90.3%	-95.8%	-95.3%
VOC: Urban	-71.3%	-58.7%	-58.7%	-58.7%	-58.7%	-56.6%	-56.6%	-99.6%	-99.3%	-99.6%	-97.9%
CO: Total	-31.6%	-31.0%	-31.4%	-31.3%	-31.6%	-30.3%	-30.5%	-97.8%	-97.6%	-98.6%	-97.7%
CO: Urban	-30.1%	-30.1%	-30.1%	-30.1%	-30.1%	-29.8%	-29.8%	-99.9%	-99.8%	-99.9%	-99.6%
NOx: Total	-59.3%	1.6%	-10.7%	-37.2%	-49.6%	21.0%	-17.9%	87.9%	33.5%	-41.7%	-52.8%
NOx: Urban	-13.7%	-13.3%	-13.3%	-12.4%	-12.4%	-3.9%	-3.0%	-89.2%	-77.7%	-86.2%	-62.4%
PM10: Total	-50.2%	-17.2%	-19.6%	-37.9%	-40.3%	-5.9%	-26.6%	24.6%	-8.3%	-44.4%	-59.2%
PM10: Urban	-26.4%	-21.3%	-21.3%	-21.1%	-21.1%	-17.2%	-17.0%	-48.1%	-45.4%	-47.5%	-48.2%
SOx: Total	-66.7%	83.5%	83.7%	-54.8%	-54.6%	95.8%	-42.5%	445.6%	182.3%	-15.6%	-66.0%
SOx: Urban	-96.7%	-68.7%	-68.7%	-71.2%	-71.2%	-53.2%	-55.7%	-87.7%	-75.6%	-96.0%	-99.0%
CH4	-64.4%	-58.5%	-58.3%	-65.8%	-65.6%	-59.4%	-66.7%	-40.4%	-37.1%	-64.8%	-62.0%
N2O	-46.0%	-42.7%	-42.9%	-44.7%	-45.0%	-37.7%	-39.8%	-86.8%	-87.9%	-93.6%	-98.1%
CO2	-90.4%	-48.9%	-63.1%	-60.3%	-74.5%	-52.9%	-64.3%	-38.6%	-50.5%	-76.5%	-68.6%
GHGs	-88.8%	-49.1%	-62.6%	-60.2%	-73.7%	-52.9%	-63.9%	-39.5%	-50.8%	-76.5%	-68.9%



D-II.3 Light-Duty Truck 2 (Cont.)

Parameter	H2 FCV: NG, station gaseous	H2 FCV: solar, gas	H2 FCV: solar, liquid	H2 FCV: NG, liquid	FCV: MeOH, NG	FCV: MeOH, FG
Total energy	-53.2%	-65.5%	-71.8%	-58.8%	-52.3%	-49.7%
Fossil fuels	-52.9%	-93.1%	-98.3%	-58.5%	-52.0%	-80.3%
Petroleum	-99.7%	-99.9%	-98.1%	-97.8%	-98.6%	-98.6%
VOC: Total	-93.8%	-95.3%	-91.3%	-88.5%	-73.3%	-154.9%
VOC: Urban	-93.9%	-97.1%	-97.4%	-97.2%	-74.5%	-74.5%
CO: Total	-96.8%	-98.7%	-99.0%	-97.4%	-78.4%	-79.5%
CO: Urban	-97.8%	-99.5%	-99.8%	-99.8%	-80.0%	-80.0%
NOx: Total	-44.1%	-48.2%	-76.6%	-55.3%	-66.5%	-95.4%
NOx: Urban	-5.1%	-47.4%	-87.9%	-86.7%	-81.4%	-81.4%
PM10: Total	-58.2%	-58.1%	-55.1%	-49.7%	-61.6%	-68.1%
PM10: Urban	-40.4%	-47.2%	-46.5%	-46.3%	-50.3%	-50.3%
SOx: Total	-91.7%	-63.5%	-97.5%	-90.6%	-87.8%	-88.0%
SOx: Urban	-99.4%	-98.8%	-97.2%	-97.1%	-97.0%	-97.0%
CH4	-46.1%	-86.7%	-98.8%	-62.6%	-67.8%	-70.3%
N2O	-96.4%	-97.9%	-99.3%	-97.7%	-79.1%	-80.4%
CO2	-63.7%	-93.4%	-98.3%	-67.7%	-62.8%	-96.7%
GHGs	-63.7%	-93.3%	-98.3%	-68.1%	-63.3%	-95.6%



D-II.3 Light-Duty Truck 2 (Cont.)

Parameter	FCV: MeOH, LFG	FCV: RFG	EtOH FCV: corn	EtOH FCV: WB	EtOH FCV: HB	NG FCV: CNG
Total energy	-57.8%	-50.0%	-37.8%	-7.2%	-15.7%	-52.0%
Fossil fuels	-88.3%	-50.0%	-77.5%	-97.4%	-94.9%	-52.5%
Petroleum	-98.9%	-50.0%	-96.5%	-94.9%	-96.2%	-99.7%
VOC: Total	-85.0%	-52.9%	2.0%	-51.1%	-54.9%	-88.6%
VOC: Urban	-76.9%	-54.3%	-72.6%	-72.6%	-72.7%	-87.9%
CO: Total	-85.1%	-78.8%	-77.9%	-73.0%	-74.1%	-79.1%
CO: Urban	-82.2%	-79.9%	-79.9%	-79.9%	-79.9%	-79.7%
NOx: Total	-74.7%	-59.9%	20.4%	60.5%	63.3%	-47.0%
NOx: Urban	-89.3%	-76.1%	-68.6%	-70.9%	-70.3%	-49.3%
PM10: Total	-199.2%	-49.2%	381.5%	40.0%	27.7%	-58.4%
PM10: Urban	-161.1%	-48.8%	-47.4%	-47.6%	-47.5%	-48.5%
SOx: Total	-30.6%	-54.1%	45.9%	-102.2%	-87.9%	-66.2%
SOx: Urban	-177.6%	-94.9%	-95.6%	-96.4%	-96.0%	-99.1%
CH4	-270.9%	-52.5%	-70.9%	-93.4%	-89.8%	-11.4%
N2O	-78.6%	-78.5%	204.7%	16.3%	230.5%	-78.9%
CO2	-132.5%	-50.0%	-76.4%	-113.1%	-101.4%	-61.6%
GHGs	-135.9%	-50.6%	-71.2%	-110.2%	-95.2%	-60.3%







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