6.5 Summary

Of the near- and long-term fuels and vehicle technologies evaluated in this study, the near-term technologies offer smaller energy and emission benefits than do the long-term technologies, especially with respect to energy use and GHG emissions. For emissions of criteria pollutants, the baseline GVs for the long-term technologies were assumed to meet the proposed federal Tier 2 vehicle emission standards. Although emission reductions by long-term alternative fuels and advanced technologies are relatively large in percentages, per-mile emission reductions achieved by long-term technologies are smaller than those achieved by near-term technologies.

Long-term technologies offer great energy and emission benefits, but most of them are not ready for commercial use. The market viability of these technologies will depend very much on the success of research and development efforts to overcome their technological hurdles. Evaluating the market readiness of these technologies is beyond the scope of this study.

Most of the technology options analyzed in this report have tradeoffs among energy use, emissions of GHGs, and emissions of criteria pollutants. That is, there is no single technology or technology/fuel combination — no "silver bullet" — that solves energy, GHG emissions, and urban pollution problems. One technology may have positive energy and GHG emission impacts but adverse urban air pollution impacts. Considering the tradeoffs and uncertainties in market viability of these technologies, it may be necessary to pursue multiple technology pathways to achieve energy, GHG emissions, and urban air pollution benefits for the transportation sector.

GREET is a fuel-cycle model based on conventional fuel-cycle analysis methodologies and approaches. The model addresses technological potentials of energy and emission impacts of given transportation fuels and technologies. As a new transportation technology is introduced into the marketplace, it could affect the use of existing technologies through some market mechanisms. That is, while energy and emission changes, as calculated in GREET, are based on mile-for-mile displacement between a new technology and the existing technology, the displacement in the real world may not be on a mile-for-mile ratio. Although the market effects of a few issues (such as land use changes from increased production of corn ethanol, coproducts of corn ethanol, and electricity credits of cellulosic ethanol) are addressed in GREET, the effects are generally beyond GREET's modeling capability.

The results of our study represent our estimates of fuel-cycle energy and emission impacts of new technologies based on our own best judgments of technology advances over time. By nature, the evaluated technology options, especially the more speculative long-term technology options, are subject to uncertainties. These uncertainties will undoubtedly affect the outcomes of fuel-cycle assessments. For a given technology, we could have run the GREET model using different sets of assumptions to provide a range of estimates. However, because of the large number of technology options involved in this study and because our resources are limited, we were unable to conduct such a series of simulations using the GREET model. The results presented here provide a "snapshot" of potential technology effects based on our current understanding of technology advancements. As more information becomes available for new

technologies, we will revise key assumptions in the GREET model regularly, and the results will change. Preferably, readers will study the assumptions used in this study, develop their own assumptions, and use those assumptions in the GREET model to generate their own results.

Section 7
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