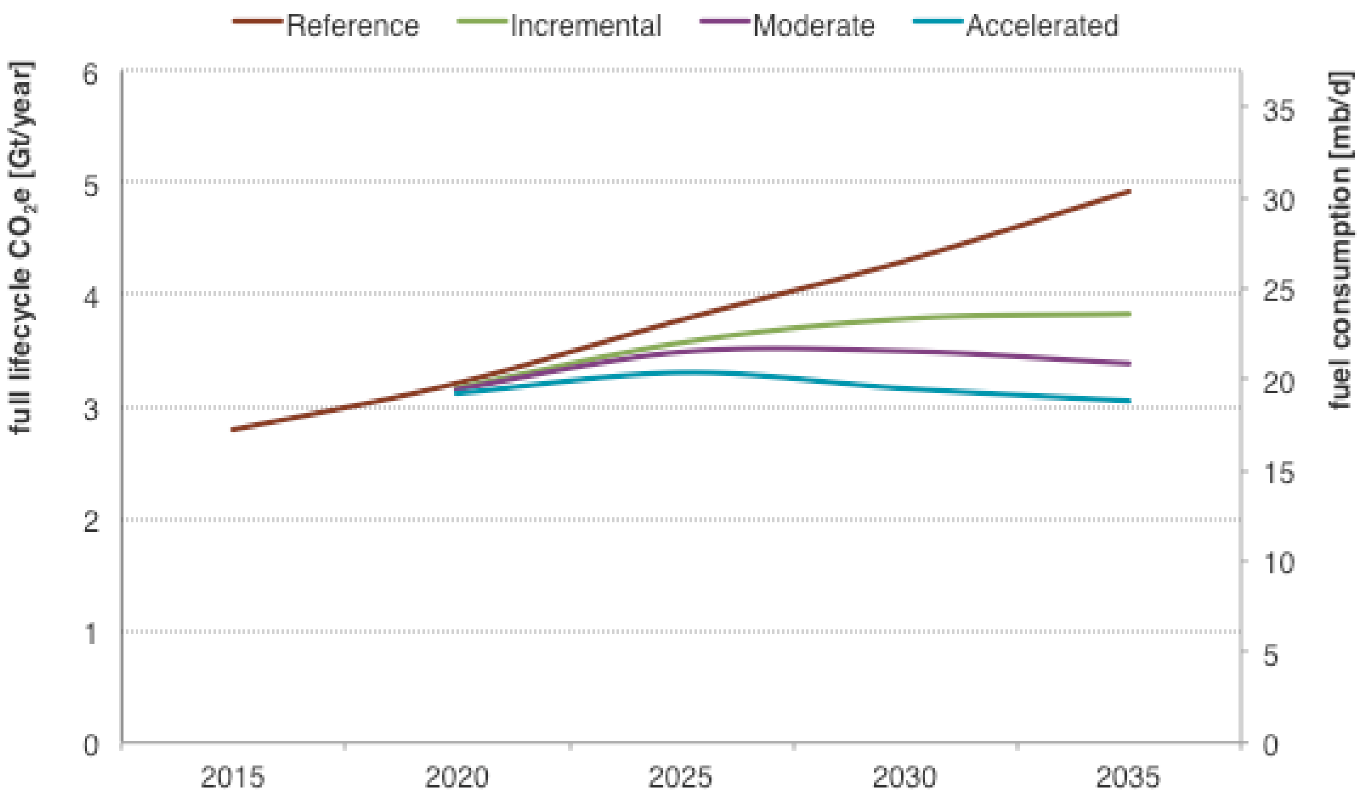
GFEI Working Paper 14: Estimating the fuel efficiency technology potential of heavy-duty trucks in major markets around the world

As the global demand for freight transport continues to grow, improving the efficiency of on-road freight vehicles is increasingly important to mitigate the resulting climate impacts. GFEI Working Paper 14 investigates the potential for more efficient freight-hauling tractor-trailers and rigid delivery trucks using known efficiency technologies. It does this by developing a baseline tractor-trailer and a representative rigid delivery truck for the 2015 EU, US, Brazil, India, and China fleets. These two truck categories account for the vast majority of road freight oil use and climate emissions. The baseline fuel consumption is determined over region-specific duty cycles and payloads.

The study models potential improvements in efficiency over the 2020 through 2040 timeframe in order to determine the potential for improvement in each market. It does this using 'technology packages' that represent the most advanced applicable technologies that have been either commercialized or demonstrated to be commercially available by 2030. Three possible emission and fuel consumption reduction scenarios are developed to quantify the range of possible benefits over time – 'incremental', 'moderate' and 'accelerated'.

Full deployment of heavy-duty vehicle efficiency technology would result in energy savings of close to 9 million barrels of oil per day in the year 2035 in the accelerated scenario. This would be equivalent to almost 2 billion tonnes of carbon dioxide emissions avoided per year in 2035. China and India each represent about one quarter of these potential long-term oil savings and climate benefits due to their growing freight activity. These two markets are followed by the US, Europe, and Brazil in terms of having the most potential energy and carbon savings from realizing their technology potential. The remaining potential is divided among countries in the Asia-Pacific, Middle East, Africa, and Latin America as well as smaller individual markets.



The report also contributes other new analysis:

- Baseline fuel consumption varies significantly across markets for both tractor-trailers and rigid delivery trucks. Under the assumptions made in this study, there is a 48% difference in fuel consumption between the most and least efficient baseline tractor-trailers and a 26% difference between the most and least efficient rigid trucks. Less than half of that difference (approximately 10-20%) is due to variations in vehicle technology and configuration while over half of the difference is due to variations in typical duty cycle and payload.
- The most consistent result across the energy audits developed for this study is that losses from engine inefficiencies are always greater than 50% of total energy loss. Although there exist theoretical limits to internal combustion engine efficiency, this result indicates that technologies to improve engine efficiency would have wide-ranging applicability across segments and markets.
- There is potential for fuel consumption reduction in the range of 40%-52% for tractor-trailers and 30%-36% for rigid delivery trucks across all regions assessed, with trucks sold in the EU having the smallest potential and trucks sold in India having the largest potential in both segments.
- Applying the technology potential as analysed here translates to sales-weighted global targets of 31% fuel consumption reduction for new Medium HDVs and 46% fuel consumption reduction for new Heavy HDVs. Deploying this level of heavy-duty vehicle efficiency technologies could result in approximately 5-9 million barrels per day of equivalent oil savings in the 2035 timeframe.

Improving truck technology in line with the accelerated scenario would require long-term stringent regulations to give vehicle and engine manufactures as well as component suppliers the certainty to invest in the commercialization of advanced efficiency technologies.

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