

**Project Information Form**

Project Title:	Fuel and Emissions Calculator (FEC), Version 3.0, Summary Report
University:	Georgia Institute of Technology
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Start and End Dates:	November 2013 – October 2018
Brief Description of Research Project:	<p>The Fuel and Emissions Calculator (FEC) is an operating-mode-based, life-cycle energy and emissions modeling tool developed by Georgia Institute of Technology researchers. The primary purpose of the FEC is to assist fleet owners and managers, regulatory agencies, and policy analysts in assessing the energy and emissions impacts of fleet alternatives. The FEC’s modeling approach estimates emissions as a function of engine load, which in turn is a function of vehicle operating parameters, allowing modelers to account for local on-road operating mode conditions as model inputs. The functional modules are embedded in an Excel spreadsheet platform for all current model versions. The open platform allows users to see all input data and every calculation, which makes the model transparent and accessible for most users. With FEC Version 2.0 and Version 3.0, the research team also created an online Python version of the model. The Python version enhances model performance and provides functionality for advanced users who may wish to link the FEC with other modeling tools, such as travel demand or simulation models.</p> <p>The first Fuel and Emissions Calculator (Version 1.0), known as ‘FEC for transit fleets,’ was originally developed by Georgia Tech researchers in 2013-2014 for transit bus, shuttle bus, and rail systems (ORNL and Georgia Tech, 2014). The first major update of the model was finished in 2016 (FEC Version 2.0). FEC Version 2.0 expanded the initial FEC to include a heavy-duty truck calculator and an online Python version of the transit fleet model (transit bus and shuttle bus). Version 2.0 also significantly improved the model performance by incorporating the latest emission rates, advancing the methodologies, and fixing some errors. The research team completed the next major updates in 2018, releasing FEC Version 3.0. Version 3.0 is the “FEC for all transportation modes”, with mode-specific calculators for light-duty passenger vehicles,</p>



	<p>buses, heavy-duty trucks, and rail. This report first summarizes the FEC Version model's main features in Version 3.0. The generic methodology that is applied to all transportation modes is introduced in Chapter 2, which includes modules for scenario setting, energy consumption, on-road emission rates, life-cycle assessment, and cost-effectiveness. The model specifications for individual transportation modes are introduced in Chapter 3, where case study examples are provided to help users prepare customized analysis of their own fleets. The key considerations for establishing the online FEC are discussed in Chapter 4. Ongoing work to verify model elements and calibrate the FEC is introduced in Chapter 5. Current research achievements and future work to update and improve the FEC are provided in the final Chapter.</p>
<p>Describe Implementation of Research Outcomes (or why not implemented):</p> <p>Place any photos here</p>	<p>The FEC has been applied to analysis of transit vehicles in three peer-reviewed conference papers and one journal manuscript. Additional papers are being developed.</p>
<p>Impacts/Benefits of Implementation (actual, not anticipated):</p>	<p>Impacts will become evident as the model becomes used on a more widespread basis for technical and policy analysis.</p>
<p>Web Links</p> <ul style="list-style-type: none"><li>• Reports</li><li>• Project website</li></ul>	<p>Project: <a href="https://ncst.ucdavis.edu/project/gt-dot-012/">https://ncst.ucdavis.edu/project/gt-dot-012/</a></p> <p>Spreadsheet Tool: <a href="http://fec.ce.gatech.edu/spreadsheetsheettool.html">http://fec.ce.gatech.edu/spreadsheetsheettool.html</a></p> <p>Online Tool: <a href="http://fec.ce.gatech.edu/onlinetool.html">http://fec.ce.gatech.edu/onlinetool.html</a></p> <p>FEC Version 3.0, Summary Report: <a href="https://escholarship.org/uc/item/59z12905">https://escholarship.org/uc/item/59z12905</a></p> <p>FEC Version 2.0, Summary Report: <a href="https://ncst.ucdavis.edu/wp-content/uploads/2014/09/Fuel-and-Emissions-Calculator-FINAL-092216.pdf">https://ncst.ucdavis.edu/wp-content/uploads/2014/09/Fuel-and-Emissions-Calculator-FINAL-092216.pdf</a></p>