

# Kansas Department of Transportation Enterprise Energy and Carbon Accounting and Utility Usage Research Phase 2B: Improving Energy and Fuel Efficiencies in KDOT Operations

Report Number: K-TRAN: KU-12-5 • Publication Date: January 2014

**Eric Nielsen**

**George Magnuson**

**George Kwok**

**Edward Peltier, Ph.D.**

**Oswald Chong, Ph.D., P.E.**

*The University of Kansas*



KDOT District One Office

## Project Description

Reducing the environmental impact of facilities and operations has become an important function for many organizations. In many cases, such as utility and fuel use, reducing these impacts can also be coupled to financial savings. The Kansas Department of Transportation (KDOT) has determined that conducting an energy and CO<sub>2</sub> audit of its building and vehicle fleets will aid in assessing KDOT energy use, prepare for any future regulations regarding CO<sub>2</sub> emissions, and help identify areas for increased savings through reduced use of commercial resources (primarily energy and fuel). Phase 1 of this project established baseline carbon and energy data from three major sources: the total energy embodied in the construction, operation and repair of KDOT-owned buildings, the total energy embodied in KDOT use of utilities (electricity, water and natural gas) and the energy expended in the operation of KDOT's vehicle fleet and other associated equipment. The work covered in this report (Phase II) focused on streamlining and improving access to this information, improving KDOT's ability to track their data, and identifying areas for reducing expenditures on energy and fuel. Related Phase II work by Kansas State University Transportation Center to conduct energy audits of KDOT buildings is described separately in a report from that institution (published as K-TRAN: KSU-12-5).

---

## Project Results

Using the compiled data from Phase 1 of this project (site location, buildings, energy use, and building square footage), a web-based database was developed to manage information on the energy use and embodied energy of KDOT campuses and individual buildings. This database can be used to identify trends of campuses to find under-performing buildings, to aid in the tracking of high performance buildings, and also aid in verifying the upgrading of inefficient systems originally found by comparing the database with EIA baseline values. An operational energy use simulator (online at <http://www2.ku.edu/~sims/cgi-bin/KDOT/index.php>) was also developed for KDOT's long-term meter tracking use. This system can show energy use by the state, district, city, county, and zip code. Using these tools and compiled records from the Phase 1 survey, we developed recommendations for projects to improve KDOT's energy efficiency and sustainability. These projects include LED fluorescent bulb replacements, retrofitting and upgrading existing HVAC systems to demand-controlled ventilation (DCV) systems, the use of lower embodied energy materials in new building projects, and changes in employee habits to conserve energy.

Fuel use by KDOT from fiscal years 2006-2011 was analyzed using a Microsoft Access database created to manage and analyze entries more effectively. Analysis of records provided by KDOT showed an overall decreasing trend in total miles traveled and fuel consumed over this time period, but an increase in diesel use over the past several years. It also found that replacing older vehicle models with new models does not show the expected increase in vehicle fleet efficiency across all major vehicle types in the fleet. This is most likely due to increases in engine capacity and fuel consumption for similar model vehicles over the past decade. Using more efficient means of transportation can significantly decrease KDOT fuel demand, in particular replacing truck travel with car travel where possible. The report also outlines specific advantages and disadvantages of more extensive biodiesel use to meet federal renewable fuel requirements, and recommends specific actions to address potential issues that could arise due to biodiesel compatibility problems with some materials and difficulties in cold weather operation.

## Report Information

For technical information on this report, please contact: Dr. Edward F. Peltier at the University of Kansas Department of Civil, Environmental, and Architectural Engineering, 2150 Learned Hall, 1530 W 15th Street, Lawrence, Kansas 66045; 785.864.2941; [epeltier@ku.edu](mailto:epeltier@ku.edu).

---

**KDOT Research Reports Catalog**

Search for:

Search In:  Document Title  Keyword  
 Reference Number  Reference Name(s)

Search Period:

Can't find it?? Check the [help](#) page for search tips.  
Learn more about the catalog [here](#).

If you have questions or comments, please send an e-mail to: [library@ksdot.org](mailto:library@ksdot.org)  
[Help page for retrieval errors](#)

## Directions for Downloading the Full Report

To download the full report, visit <http://www.ksdot.org/burmatres/kdotlib2.asp> and do the following:

1. Enter KU-12-5 in the search box.
2. Click the Search button to the right of the search box.
3. You may have to scroll to find the specific report.
4. To download the report, click on the title of the report to open the PDF file and save it to your hard drive.

If you have any questions, please email us at [library@ksdot.org](mailto:library@ksdot.org).

---