A Tool-Based Approach to Policy Analysis in Transportation and Land Use GHG Mitigation Policy Analysis

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Authors:
Judith Mueller (corresponding author)
Columbia University, School of Public and International Affairs
420 West 118th Street, New York, NY 10027
Tel: (508) 333 1184 E-Mail: Judith.mueller09@gmail.com

Lewison Lem, M.P.A., Ph.D.
Jack Faucett Associates
West Coast Office, San Francisco, CA 94131
Tel: (415) 525-6163 E-Mail: Lem.JFA@gmail.com

Scott Williamson
Jack Faucett Associates
4550 Montgomery Avenue, Suite 300N
Bethesda, MD 20814

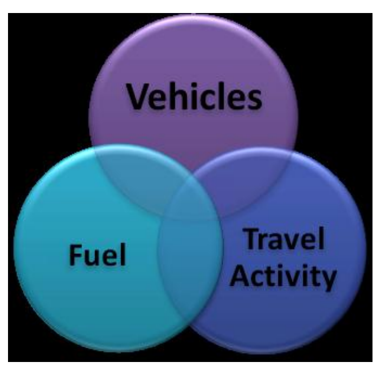
Rami Chami
Jack Faucett Associates
4550 Montgomery Avenue, Suite 300N
Bethesda, MD 20814

INTRODUCTION

Greenhouse gas policy analysis of transportation and land use issues is inherently complex, given the inter-relationships between transportation systems, land use, and other important aspects of societal well-being. Policy analyses for transportation and land use are based upon many years of well-established professional practice and methods that are widely accepted in the fields of public policy analysis, urban and transportation planning, transportation engineering, and environmental science.

It is widely accepted that there are three general categories of factors that impact the emissions of GHGs from the transportation sector, which are often described as "the three-legged stool." The three categories are commonly described as:

- Vehicle Efficiency
- Fuel Emissions Intensity
- Travel Activity



Transportation GHG emissions are a result of vehicles, fuels and vehicle miles traveled (VMT). Climate change experts working to reduce emissions from the transport sector refer to the need to take action on all three “legs of the stool”: there is a need for increasingly efficient vehicles, decarbonized fuels, and to reduce vehicle miles traveled (VMT). However, numerous climate policy proposals have focused on reducing GHG emissions from vehicles and fuels, with little attention to slowing growth in VMT. This paper seeks to emphasize the importance of analyzing all three legs of the stool using a comprehensive list of tools that allows for the analysis of a variety of transportation and land use policies. The tools simplify the process of analyzing different GHG reduction strategies.

The work over a number of years across multiple state and regional climate action planning analyses, has resulted in the development and use of a wide array of different GHG analysis tools for transportation sector energy and greenhouse gas analysis. Increasingly, this work has evolved towards a system of integrated and comprehensive set of data analysis tools that allows for the analysis of a variety of transportation related greenhouse gas reduction strategies. These tools greatly simplify the process of analyzing different GHG reduction strategies, and significantly improve the reliability of results.

Before the use of tools, the general state of the professional practice had been to develop individual spreadsheet analyses of strategies for greenhouse gas emissions analysis. In a limited number of cases, some regional analyses have attempted to have economy-wide integrated models for analysis. Each of these two basic approaches has resulted in improvements to practice, but has also had drawbacks and limitations.

The first successful projects to model an integrated set of strategy analyses for the transportation sector was conducted for the New Mexico Department of Transportation, using an ‘off-the shelf’ tool developed by the United States Department of Energy (USDOE) called VISION. The next state to use a similar tool was the State of Florida, where a customized tool was developed and used called VEGA. Over time, the “off-the-shelf” use of the USDOE VISION tool has been demonstrated to be the most cost-effective and also most reliably usable integrated tool for transportation sector GHG analysis. The use of this tool does not attempt to model the entire energy system, and but it has been able to integrate analyses of multiple strategies, something that has been a significant weakness of the individual spreadsheet based approach.

With the comprehensive tool approach emission impacts of policies targeting (1) Vehicle efficiency, (2) Fuel Carbon Content, (3) Land Use and Urban Design and (4) Transportation Demand Management can be analyzed in a timely and efficient manner. This approach has been illustrated successfully in the Climate Action Plans of numerous states including the State of Kentucky and the State of New York. This paper will focus on the use of tools in the stand-alone and integrated analysis of the policies analyzed in the Climate Action Plan in the State of Kentucky.

Overview of Tool-Based Policy Analysis

The different factors related to the transportation system interact in a complex fashion to affect GHG emission levels. For example, a policy that reduces VMT will *reduce* the GHG benefits of a policy that improves fuel economy or one that reduces fuel carbon intensity. The cumulative GHG emissions reduction that would result if a basket of strategies were implemented together is estimated by identifying the potential for overlap between the policies and accounting for any overlap in order to avoid double counting.

The analysis completed in the Transportation and Land Use strategies in the Climate Action Plan in the State of Kentucky uses a tool-based approach that allows the estimation of the impacts of either single policies or multiple policies acting in concert with each other. The tools used in the analysis can not only measure the stand-alone effect but also the aggregate effects of multiple policies in addition to also measuring the overlap and synergistic effects of policies. The three main tools used in the analysis for the State of Kentucky include the USDOE VISION tool, the USEPA COMMUTER Model, and the TARRGET tool, which has been based upon recommended methods of analysis prepared by the American Public Transit Association (APTA).

Summary of the VISION Tool and the COMMUTER Model

The VISION Model has been developed to provide estimates of the potential energy use, oil use, and carbon emission impacts of advanced LDV and HDV technologies and alternative fuels through the year 2100. Its base case projections are drawn directly from DOE's most recent AEO report. The model is built around a detailed population of the on-road vehicle fleet, including data for cars, light trucks, and HDVs by fuel type. For analyses of policies and scenarios, the model applies a perpetual-inventory approach to allow changes in the fleet in a single year to be reflected in future years as those modified vehicles gradually age and move out of the fleet.

COMMUTER is a spreadsheet-based computer model that estimates the travel and emission impacts of transportation air quality programs focused on commuting. The model is particularly useful for programs, such as those recognized under EPA's Best Workplaces for Commuters and other Commuter Choice Programs. The EPA COMMUTER Model was used to evaluate the Best Workplaces for Commuters program in the Iowa State Climate Action Plan, and is commonly used for other analyses of commuter transportation demand management programs.

Overview of Methods and Outputs in the Analysis of Policies

This section briefly summarizes key elements of methods of analysis aimed at estimating potential greenhouse gas (GHG) emission reductions from and the cost-effectiveness of Transportation and Land Use (TLU) policy options. The key outputs of both the stand alone and integrated analysis include:

GHG Emission Reductions: Net GHG reduction potential in physical units of million metric tons (MMt) of CO_2e are estimated for each quantifiable policy for target years 2020 and 2030, as well as the total for the entire analysis period.

Costs: Net capital, operating and maintenance (O&M), and fuel costs are estimated for each of the policies that are determined quantifiable. Costs are discounted in constant 2005 dollars as a multi-year stream of net costs to arrive at the "NPV cost" associated with implementing new technologies and best practices. Cost savings (e.g., fuel savings) are included, represented as a negative cost.

Cost-Effectiveness: The cost-effectiveness—cost or savings per ton—for each quantified policy, represented as dollars per $MMtCO_2e$, is calculated by dividing the NPV cost by the cumulative (undiscounted) reduction in GHG emissions.

Tool-Based Approach to Integrated Strategy Analysis in the State of Kentucky

In addition to estimating the impacts of each individual policy recommendation, the combined impact of the TLU policy recommendations are estimated for the State of Kentucky, assuming that all policies were implemented together. This involved eliminating any overlaps in coverage that would occur to avoid double counting of impacts. Since many of these policies will interact in some manner if implemented together, the stand-alone analysis does not give a fully accurate estimate of the emission reductions or costs that would result from implementation of a set of policies. The raw sum of stand-alone estimates may overestimate or underestimate the combined effects, if interaction is not taken into account.

The key objectives for an integration analysis are to (a) identify potential synergies that can enhance the efficacy of the set of policies taken as a whole, (b) identify any potential overlaps that would limit GHG reductions achieved from the set of policies, and develop an integrated analysis framework that accounts for all synergies and overlaps. Stand-alone analysis measures impact of each policy without interaction of other policies. Sum of stand-alone estimates is not a fully accurate estimate of the impacts from policy bundles. Policies may affect each other many ways:

- Synergistic (one policy positively influences other policies' effect)
- Overlapping (one policy overlaps with another policy's effect)
- Enabling (One policy enables another policies' impact)
- Countervailing (one policy has a negative influence upon another policy's effect)

This paper describes the integration analysis methods for the different transportation related strategies included in the Kentucky Climate State Action Plan. The basic method of estimation for integration analysis is to use analysis tools to estimate values for interaction effects by running multiple comparable scenarios with tools. First, the individual Stand Alone Estimates are created with "Stand Alone Scenarios'. Second, the combined Scenarios also run through the models to estimate values of effects when multiple strategies implemented together. The difference between the results from the 'multiple-strategies scenarios' and the 'stand-alone scenarios' provides an estimate of potential overlap between policies.

SUMMARY

The experience using this integrated suite of data analysis tools for analysis of transportation related greenhouse gas reduction strategies included in the Kentucky State Climate Action Plan has proven to be a very effective means for estimating emission impacts of policies that apply to all three legs of the stool in stand-alone analysis as well as integrated analysis. The tool based approach is of particular importance in that it allows not only for the analysis on a state wide level, but uses a bottom-up approach as illustrated in the ability to show GHG reduction potential of the policy in different cities in Kentucky. This tool based approach can therefore be helpful to local level governments when analyzing regionally specific policies. Furthermore, the tool based approach can be used when completing integrated analysis and provides a timely and more accurate GHG estimate from policy bundles.

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