The Center for Climate Strategies
Helping States and the Nation Tackle Climate Change

Transportation and Land Use (TLU) Issues
Policy Analysis and Assumptions Memo

To: Florida Climate Change Action Team

From: The Center for Climate Strategies

Subject: Policy Analysis and Assumptions Memo for Transportation and Land Use Issues

Date: July 27, 2008

This memo summarizes key elements of methods of policy analysis for estimating GHG impacts and cost effectiveness for Transportation and Land Use policy options for analysis in state climate action planning processes. The process of policy analysis is intended to support state-specific design and analysis of draft policy options, while providing for both consistency and flexibility.

Key general guidelines for policy analysis as conducted by Center for Climate Strategies consultants are presented first, followed by specific elements of policy analysis methods and assumptions for Transportation and Land Use issues. For additional reference see the economic analysis guidelines developed by the Science Advisory Board of the US EPA available at: http://yosemite.epa.gov/ee/epa/eed.nsf/webpages/Guidelines.html.

1. General guidelines for policy analyses:

- Units of analysis: GHG reduction potential is estimated in units of million metric tons (MMt) of carbon dioxide equivalent (CO_2e). Cost savings and/or cost effectiveness is measured as net cost per metric ton reduced in units of dollars per metric ton of carbon dioxide equivalent ($/t$CO_2e$). Greenhouse gases other than carbon dioxide are converted to carbon dioxide equivalent on the basis of their global warming potential. The estimation of GHG reduction potential is intended for policy analysis purposes only, and does not necessarily provide a level of specificity to be used for regulatory rule-making or for investment-grade financial analysis.
- Cost savings and cost-effectiveness: Because monetized dollar value of GHG reduction benefits are not available, physical benefits are used instead, measured as dollars per metric ton of carbon dioxide equivalent ($/t$C_{O2}e$) (cost or savings per ton) or "cost effectiveness" evaluation. Both positive costs and cost savings (negative costs) are estimated as a part of compliance cost. Net savings would thus be represented as negative numbers while net costs to achieve estimated environmental GHG benefits are represented as positive numbers.

  The cost effectiveness estimations are not intended to represent full society-wide cost benefit analyses. Cost is estimated as a cost of implementation, and includes cost to government for implementation, cost to affected industries for compliance and cost to consumers. Any double counting of these costs is eliminated to the degree that reliable data is available. The

costs of achieving the estimated GHG environmental benefits are estimated. Non-environmental GHG costs and benefit are considered qualitatively and should be carefully considered to inform the policy decision-making process.

- Geographic inclusion: Best attempts are made to measure GHG impacts of activities that occur within the state, regardless of the actual location of emissions reductions. Where significant emissions impacts are likely to occur outside the state, this will be clearly indicated. These emissions reductions are counted towards the achievement of the state's emission goal, since they result from actions taken by the state.
- Direct vs. indirect impacts: "Direct impacts" are those borne by the entities having legal responsibility for implementing the policy recommendations, including implementing government agencies and regulated industries. "Indirect impacts" are defined as those borne by the entities other than those implementing the policy recommendation. Direct impacts are estimated to the best degree that reliable data is available. Indirect impacts are generally not estimated in quantitative terms for Transportation and Land Use issues, since it is well recognized that transportation and land use policies have indirect co-benefits and indirect costs that would require a more complex analysis. Instead, indirect impacts are considered in qualitative terms, with recognition that their anticipated effects should inform considered decision-making.

  Examples of direct impacts that may be estimated in analyses

  - Incremental net cost or cost savings resulting from operation of more efficient vehicles net of fuel savings.
  - Incremental cost of new capital investment for transportation infrastructure and other public infrastructure.
  - Incremental cost of fuel used.

  Examples of Indirect impacts that are not estimated in analyses

  - Health benefits of reduced air and water pollution.
  - Ecosystem benefits of reduced air and water pollution.
  - Value of quality-of-life improvements.
  - Value of improved road safety.
  - Energy security
  - Net value of employment impacts

- Non-GHG (external) impacts and costs: Include in qualitative terms where deemed important. The focus of impact analysis is upon changes in estimated GHG emissions.
- Discounting and annualizing: Discount a multi-year stream of net costs (or savings) to arrive at the "net present value cost" of the cost of implementing a policy option. Discount costs in constant 2005 dollars using a 5% annual real discount rate for the project period of 200_ through 20__ (unless otherwise specified for the particular policy option). Capital investments are represented in terms of annualized or amortized costs through 20__. Annualized cost per ton is an estimate that is equivalent to the division of the present value cost or cost savings by the cumulative reduction in tons of GHG emissions.

- Time period of analysis: Count the impacts of actions that occur during the project time period and, using annualized emissions reduction and cost analysis, report emissions reductions and costs for specific target years of 2015 and 2025.
- Accounting for overlap and 'double-counting' of cumulative impacts of policy options: In addition to "stand alone" results for individual options, estimate cumulative impacts of all options combined. In this process seek to avoid simple double counting of GHG reduction potential and cost when adding emission reductions and costs associated with all of the policy recommendations. To do so note and/or estimate interactive effects between policy recommendations using analytical methods where significant overlap or equilibrium effects are likely.
- Policy design specifications and other key assumptions: Include explicit notation of timing, goal levels, implementing parties, the type of implementation mechanism, and other key assumptions as determined by the Florida Climate Action Team. Performance goals are included for policy analysis purposes and do not represent requirements that parties are bound to legally, until and unless these goals are later incorporated into specific legislative language or judicial interpretation.
- Transparency: Include policy design choices (above) as well as data sources, methods, key assumptions, and key uncertainties. Use data and comments provided by ICCAC to ensure best available data sources, methods, and key assumptions using their expertise and knowledge to address specific issues in Florida. Modifications will be made through facilitated decisions.

2. Policy Analysis Methods and Assumptions specific to Transportation and Land Use Issues

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 analysis methods for transportation and land use as conducted by consultants for the Center for Climate Strategies is 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 sciences. The information provided here provides information about analyses relating to the potential changes in emissions of greenhouse gases resulting from the combustion of transportation fuels.

It is widely accepted that there are three general categories of factors that impact upon the emission of greenhouse gases from the transportation sector. These three general categories are often described as "the three legged stool'. The three categories (or three legs of the stool) are the vehicles, the fuels, and the travel activity. These three factors interact at different levels of carbon-intensity and different total amounts in complex fashion to have an effect on greenhouse gas emission levels.

A. Underlying Premises and Methodology
B. Outputs
C. Data Sources
D. Cost Inclusion

A. Underlying Premises and Methodology

There are a number of key premises upon which the analysis will be based, as briefly outlined below.

- *CCS role*—Unless a member of the Subcommittee offers to undertake an analysis of any of the options, we assume that we (i.e., CCS) will undertake the analysis of the options. If a Subcommittee member does offer to undertake the analysis of one or more options, we will provide analytical support (e.g., review and technical feedback) as needed.
- *Transparency*—Data sources, methods, key assumptions, and key uncertainties are clearly indicated. The document of priority policy options is intended to provide explanation regarding the specific assumptions that were used in the quantification process for each option.
- *Analytical approach*—We adopt the general analytical approach of cost-effectiveness and net present value, as widely applied to GHG mitigation policy options.[1] We include direct economic costs from the perspective of the state as a whole.
- *Bottom-up analysis*—We adopt a bottom-up approach that is amenable to transparency and is capable of reflecting the costs (and cost savings) associated with individual policy options, in contrast to macroeconomic analysis, which aims to capture flows and interactions across all sectors of the economy. Potential macroeconomic impacts, costs, or benefits that fall disproportionately on specific groups or actors, as well as external costs and benefits, are noted qualitatively where studies or other information are available.

As much as possible, the analysis will proceed using simple spreadsheet modeling techniques in which assumptions are transparent. To ensure consistent results across options, common factors and assumptions will be used for the following items:

- *Independent and integrated analyses*—Each option will first be analyzed individually and then addressed as part of an overall integrated analysis.

[1] See, for example, Section 2.4 of the IPCC Fourth Assessment Report, Working Group III, for more discussion of various economic analysis approaches, available at: http://www.mnp.nl/ipcc/pages_media/AR4-chapters.html

- *Fuel costs and projected escalation*—Fuel cost estimates will be based on common sources wherever possible. For example, fossil fuel price escalation will be indexed to the U.S. Department of Energy (DOE) projections as indicated in their most recent Annual Energy Outlook (AEO).
- *Consumption-based approach*—The analysis uses a consumption-based approach where emissions are calculated on the basis of the consumption of transportation fuels to provide energy to Florida consumers, as opposed to a production-based approach, which considers the emissions from in-state production of transportation fuels.
- *Life cycle greenhouse gas approach*—Life cycle greenhouse gas emissions are considered on a case-by-case basis. The primary focus of the analysis of Transportation and Land Use issues is upon the direct combustion of transportation fuels to provide energy.
- *Overlap with other Subcommittees*—Where TLU options overlap with options being considered in other subcommittees, the analysis for these options will be conducted in close coordination with the assumptions and other inputs used in other CCS analyses.

B. Outputs

The analysis of mitigation options produces the following results:

- *Net GHG reduction potential* in million metric tons of carbon dioxide equivalent ($MMtCO_2e$) is calculated from the 100-year global warming potentials used by the Intergovernmental Panel on Climate Change (IPCC). The GHG reductions are calculated on an annual basis as well as cumulatively. Where significant additional GHG reductions or costs occur beyond the project period as a direct result of actions taken during the project period, these will be indicated as appropriate. Positive numbers represent GHG reductions.
- *Net present value* (NPV) *cost* (or cost savings) is calculated in 2005 constant dollars, using a 5% real discount rate, for a range of periods from project launch through 20__, 20__ and 20__.[2] Positive numbers represent options with net costs; negative numbers represent options with net cost savings.
- *Costs per tCO_2e* emissions reduced (or avoided) are given in units of dollars per metric ton of carbon dioxide equivalent ($/tCO_2e$). This figure represents the NPV cost divided by the cumulative emission reductions, and it is calculated for each year as well as cumulatively.

C. Data Sources

Subcommittee members are often in a good position to obtain and provide data sources that are specific to Florida, and these will be used as much as possible. The success of this approach depends on such information being provided to the CCS analysis team as early in the process as possible. Where Florida-specific information cannot be readily obtained from the Subcommittee, the analysis relies on published data from the DOE, national laboratories, and other state climate change processes.

[2] Capital investments with lifetimes longer than 2030 are represented in terms of levelized or amortized costs to avoid "end effects."

1. **Baseline Historical Energy Consumption By Sector**

   Historical energy consumption in the state, by sector, is from the DOE Energy Information Administration (EIA) State Energy Data available at http://www.eia.doe.gov/emeu/states/_seds.html.

2. **Baseline Historical Vehicle Fleet, Fuel Use, and Travel Activity Data:**

   Baseline data on the state vehicle fleet is incorporated from the MOBILE model, as specified in the inventory and forecast report, unless state-specific data is provided. Baseline fuel use is obtained from the most recent United States Department of Energy (DOE) Energy Information Agency (EIA) reports, as described in the inventory and forecast report. Baseline travel activity data in the form of vehicle miles of travel is based upon reports from the United States Department of Transportation (DOT) Federal Highway Administration (FHWA) or state-specific data from the state Department of Transportation.

3. **Baseline Forecast GHG Emissions**

   Baseline forecasts of future GHG emissions for the transportation and land use sector, data sources, and methods of analyses for these forecasts are described in the inventory and forecast report.

4. **Energy Price Projections through 2030**

   Energy prices by region are from the EIA Supplemental Tables to the AEO 2007, with projections through 2030. Adjustments to the EIA projections are made on a case-by-case basis.

D. Cost Inclusion

The analytical methods being used can incorporate a wide variety of costs, depending on the availability of cost state. Fuel costs are incorporated into all analyses where relevant. Other types of costs will be explicitly considered in the analysis if they can be readily estimated. Types of costs that are incorporated include

- Annualized Capital costs levelized (amortized);
- Operations and maintenance cost; and
- Administrative costs.

Types of costs that are not incorporated include

- External costs, such as the monetized environmental or social benefits and impacts (e.g., the cost of damage by air pollutants on structures and crops), quality-of-life improvements, and health impacts and benefits (e.g., improved road safety);
- Energy security benefits; and
- Macroeconomic impacts related to reduced or increased consumer spending, and shifting of cost and benefits among different sectors of the economy.