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Carli Paine worked in the Office for Commonwealth Development, focusing on developing policies for the recently passed Massachusetts Climate Protection Plan. This plan calls for transportation planning agencies and Metropolitan Planning Organizations (MPOs) to calculate and disclose the energy intensity and resulting greenhouse gas emissions of proposed plans and projects, with the aim that energy intensity and emissions from the transportation sector will decrease as a result of the policy. Ms. Paine's work included examining the effectiveness of disclosure policies, and exploring precedents in the transportation sector. Using an initial methodology developed by New York State, she updated their methodology to reflect current fuel economy and emissions levels. Given that the policy is unfunded, she developed a set of recommendations for implementation that involved the users in the development of the policy in order to establish ownership, comprehension, and to ensure that the policy's assumptions match MPO and agency abilities.

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## MEMORANDUM

**To:** Sonia Hamel, Special Assistant, Executive Office for Commonwealth Development  
**From:** Carli Paine, Rappaport Public Policy Fellow  
**Date:** 18 August 2004  
**Re:** Greenhouse Gas Emissions and Energy Intensity Disclosure Policy in Transportation Planning: Methodology and Approach

### Summary

Focus Area 8 of the Massachusetts Climate Protection Plan (2004) expresses Massachusetts' commitment to developing "an efficient transportation system that both stops the anticipated growth of GHG emissions and reduces current emissions." The transportation sector is responsible for over 30 percent of the state's total greenhouse gas emissions and therefore is a prime sector in which to promote emissions reductions. The Plan identifies a number of policies and programs intended to reduce current and future emissions in the transportation sector; an important one that targets transportation decision-making is: *Include energy use and GHG emissions data as criteria in transportation decisions.*

The disclosure documentation required by this policy will eventually be extended to other sectors and will become part of environmental impact assessment requirements. Thus, a foundation of accurate accounting and integration into actual decision-making has importance that exceeds the immediate goal of disclosure in the transportation sector.

Currently, states of the northeastern United States are working together to generate policies and programs to address climate change. Working within individual states to promote innovative approaches to decreasing GHG emissions and promoting energy efficiency, the states have made great progress through learning from and borrowing approaches from other states. The methodology that Massachusetts will use builds on an approach developed by New York State and will, in turn, inform similar policies in other states.

This memo outlines the methodological approach and recommends a series of “next steps” that will enable the policy to be effectively implemented in Massachusetts and to be altered for relevance and use in other states. Key challenges and data needs are highlighted along with specific recommendations, including:

- Inclusion of both indirect and direct impacts;
- Embedding flexibility into calculations in order to allow for increased knowledge and calculation techniques.
- Updating data to accurately reflect current fuel economy trends and on-road vehicle mixes;
- Consistent modeling parameters and assumptions across MPOs and agencies;
- Inclusion of speed and grade impacts on fuel economy and CO2 emissions;
- Inclusion of MPO and transportation planning agency staff in the development, testing, and training of policy; and,
- Linking energy intensity and emissions to funding.

### **Background**

In May 2004, the Commonwealth of Massachusetts joined a growing number of states in passing a Climate Protection Plan, a document that commits the state to address the threats of climate change through policies and programs that decrease energy use and reduce greenhouse gas emissions and promote alternative energy and energy efficient planning and design, while protecting the state’s economy.

The Plan addresses ten focus areas, one of which is “Transportation and Sustainable Development: Increasing Choices and Reducing Emissions.” The transportation sector in Massachusetts accounts for about 30 percent of total greenhouse gas emissions, which is consistent with the sector’s share on a national level. The goal of decreasing the energy use and the resultant greenhouse gas emissions from the transportation sector relies on understanding how individual projects and plans affect the amount of vehicle miles traveled, the kinds of transportation people use, and the energy required to create, maintain and use the transportation systems across the state.

Transportation decision-making in Massachusetts involves the submission of plans and projects by individual transportation agencies (such as the MBTA) and municipal planning organizations (MPOs) for state approval and often funding assistance. Implementation of the disclosure policy will require MPOs and transportation agencies to calculate and provide totals of energy consumption and greenhouse gas emissions associated with proposed transportation projects and plans. The intention of this policy is to promote formal consideration of energy use and greenhouse gas emissions in the review of transportation planning options. The strategy that lies at the foundation of this policy – calculation and public disclosure – introduces carbon dioxide into an established tradition of chemical accounting and disclosure in the pursuit of enhanced air quality and protected public health.

### **Building on New York State’s Approach**

As part of the increasing regional efforts to decrease GHG emissions, New York State has developed an initial set of guidelines for energy assessment at transportation implementation plan- (TIP) and project-levels. The guidelines that New York State Department of Transportation (NYSDOT) have developed serve as a starting point for Massachusetts’ approach.<sup>1</sup> Their guidelines have been mandated for implementation and are being used by MPOs and transportation agencies as they submit plans and projects to NYSDOT.

The New York guidelines use fuel economy data, fuel consumption rates, free-flow fuel consumption data, and calculated energy from construction and maintenance of transportation projects in order to quantify the total direct and indirect energy of transportation projects and plans.

Although the methodology of the New York Guidelines reflects the extent and intention of the policy that Massachusetts envisions, the data that it employs is out-of-date. Data from the 1980s comprise many of the lookup tables that the New York Guidelines uses. Fuel economy and consumption rates from the 1980s are significantly different from current rates. Updated data needs to be used in order for the assessment and calculations to be accurate and relevant. In this project, I have identified data sets that will assist in the effort to update the calculations. A list of data sources and the information they provide is attached as Appendix 2.<sup>2</sup>

### Scope of Assessment

In assessing the amount of energy used in transportation projects, it is necessary to decide the scope of inclusion; the following must be addressed in determining parameters:

- Direct Impacts vs. Indirect Impacts:* Direct impacts include the energy associated with operation and use (including that consumed by vehicles) of a facility post-construction; indirect impacts also include energy used in construction and maintenance of a facility, as well as changes in energy consumption due to land use changes or modal shifts.
  - Well-to-wheel vs. Pump-to-wheel:* Well-to-wheel accounting includes impacts from the generation of energy used by vehicles through the final fuel-burning, while pump-to-wheel is less inclusive and calculates impacts from the introduction of energy to a vehicle to its burning.
  - Electric vehicles and trains:* If using a pump-to-wheel accounting methodology, the energy and GHG impacts from electric vehicles (autos, buses, trains) will not include energy impacts at the generation source. If pump-to-wheel accounting is used in decision-making criteria, transportation alternatives that are electricity intensive will be favored over those that use other fuel sources to an extent that may exceed the actual relative energy intensities.
- Recommendation:** Decisions about the scope of inclusion should balance feasibility (availability and accuracy of data) and the intention to fully address the impacts of the transportation sector. Calculations should most accurately and completely include the energy used in transportation projects; the policy should be flexible enough to allow for the inclusion of updated information and data in the future.

### Data Challenges

Disclosure of carbon dioxide and energy use for the transportation sector is a challenge that has yet been unmet by any state. Two major data challenges that face Massachusetts are: required information inputs and accurate, up-to-date calculation data.

- Required Inputs:* In order for MPOs and transportation planners to disclose the associated carbon dioxide and energy impacts of proposed projects, they must have accurate information to enter into calculation equations. Required information ranges from vehicle miles traveled, expected speed of traffic at different grades, volume of vehicles, construction specifics (volume of materials, linear length of rail line, etc.). Inclusive project-level analysis requires a specificity of inputs that may imply an advanced level of project development. A ques-

tion of practicality arises – if energy intensity is meant to be included as a planning criteria for transportation planning decision-making, does the level of specificity required for disclosure inherently require a level of institutional commitment that chronologically follows decision-making?

-*Modeling*: Another challenge in the assessment of energy intensity in transportation in Massachusetts is that the traffic models used by MPOs are not all based on the same assumptions. Additionally, not all MPOs have their own models with which to generate the required inputs. If the ultimate intention of the policy is to use disclosure as one criteria of decision-making and funding allocation, there is a clear need for consistent models across MPOs and agencies.<sup>3</sup>

-*Specificity of Emissions Factors*: Mobile source modeling is moving toward methods that link carbon dioxide emissions factors with specific speeds and grades. The use of a single emissions factor for carbon dioxide, as used by EPA’s current MOBILE6 model, does not account for differential fuel efficiency depending on speeds and grades although the next generation of mobile model, MOVES<sup>4</sup>, will. The Center for Clean Air Policy (CCAP) has looked at vehicle carbon dioxide emissions at different speeds (on arterials and highways) and compiled data<sup>5</sup> that indicate a relationship between speed and carbon dioxide emissions. Fuel economy tables from the Transportation and Energy Data Book<sup>6</sup> also indicate that fuel consumption changes with changing speed and acceleration rates.

**Recommendation:** Modeling techniques and processes should be as consistent as possible across MPOs and transportation planning agencies in order to enable comparisons. Given the increasing emphasis and technological feasibility of including specific conditions of roadways, speed and grade should be incorporated into the carbon dioxide or energy intensity calculations as much as possible.<sup>7</sup> The inclusion of speed and grade necessitates that transportation plan- and project-proponents must have average speed and grade estimates for projects.

## Next Steps and Proposed Process

Moving forward with the development and implementation of the energy intensity disclosure policy requires further data development as well as outreach to the MPOs and transportation planning agencies that will be implementing the procedures. The following outlines a set of recommended steps so that the resultant policy is robust in its accuracy and well accepted politically by its users:

1. *Involve MPO staff in development of the guidelines.* Involvement of the users upfront will diminish the actual and perceived difficulty in the implementation that would be present if the policy and process were handed to them as finished products.<sup>8</sup> Benefits to inclusion of MPO and transportation agency members at this stage include the ability to confirm the methodology’s assumptions regarding MPO inputs, and the development of a trained base of users familiar with the motivations behind and the workings of the policy.
2. *Fill data gaps:* Updating, refining for Massachusetts, and assembling data that does not exist will make the methodology relevant. Table 1 in Appendix 2 outlines existing data that may be used as the foundation of an updated set of lookup tables and values for the Massachusetts guidelines. The 1980s-based data used by NYSDOT must be replaced with data that accurately represents current relationships between transportation related activities and energy intensity.
3. *Test methodology:* It may be helpful for the MPO members that are involved in the development of the policy and methodology to apply the procedures to projects in a test phase to gain experience with the procedures; this will enable them to train others. Test cases will enable the identification of potential user difficulties given the reality of input data and the calculation

methodology. The development of step-by-step case calculations and reporting documents can serve as resources during both training and in implementation.

4. *Train MPO staff and other users:* Training should bring together the transportation staff that will be completing the energy calculations and the state-level reviewers of the submissions to ensure that all parties have the same understandings. Active participation of already-involved MPO staff will communicate that a) MPO interests were incorporated into the policy, b) the policy being introduced is feasible for MPO completion, and c) there is an existing set of user experts available for support and assistance. This is also an opportunity to provide a thorough background of the issues associated with energy and ghg emissions as well as to highlight successful strategies for decreasing energy intensity.
5. *Provide technical assistance for MPOs in implementing first round of disclosure and reporting:* The Commonwealth should provide funding to support MPOs and agency members that continue their participation through training others in the implementation and reporting.
6. *Connect disclosure and reductions in greenhouse gas emissions and energy use with funding priorities:* Continued education and success-sharing information will enable MPOs and transportation agencies to: (a) learn from each other, (b) leverage their own reduction successes to obtain state resources and, (c) share a sense of collaboration in bringing Massachusetts closer to its transportation sector reduction goals. Clearly identifying connections between disclosure, reductions and other state priorities and programs will initiate the integration of the policy into internal planning and decision-making. Providing a listing of funding sources that will promote and support emissions reductions will further incentivize the outcomes of the assessment.

## Conclusion

The framework is established for the actualization of a policy to assess and disclose the energy intensity and greenhouse gas emissions for transportation plans and projects in Massachusetts. Updating the data used in calculations to reflect current fuel economies and for Massachusetts-specificity will ensure that the assessment presents and accurate estimate of the energy intensity of proposed plans and projects. The inclusion of MPO members in fully developing the policy's procedures will help to connect policy-maker expectations with the realities of the MPOs and may develop a set of assessment-trained practitioners who can function as technical assistants. Incentives or compensation for MPO members and transportation planners who participate in the planning and development process is important since funding has not been established to support the policy's implementation. Finally, recognition of the ever-changing state of emissions science and energy technology is integral to the formation of an enduring policy. Building a policy framework and process that enables revisions and the inclusion of new information and approaches will ensure that the policy remains relevant and important in Massachusetts transportation planning and decision-making.

1. NYS DOT "Draft Energy Analysis Guidelines for Project Level Analysis" are attached as Appendix 1. Due to confidentiality this appendix has not been added.
2. Appendix 2 also includes a table listing relevant contacts and the information they have provided. Due to confidentiality this appendix has not been added.
3. In Massachusetts, MPOs use traffic models to calculate inputs (ex: VMT), highway department puts the inputs into broader models that calculate emissions. Many MPOs in Massachusetts may be unfamiliar with emissions calculations and lack the technology to support calculations of greenhouse gas emissions and energy intensity. Massachusetts is moving towards the use of a single large-scale state model, which will be used to incorporate information and plans from various MPOs (although it does not currently include all transportation agencies). The use of a statewide model may be helpful in ensuring the consistency of assumptions and functions/values. However, the current statewide model, in addition to being incomplete, does not currently calculate carbon dioxide emissions.
4. MOVES is EPA's Motor Vehicle Emissions Simulator.
5. From Memo: "CO2 vs. Speed for Cars and Light Trucks on Arterials and Highways," from Greg Diekers and Steve Winkelman, July 7, 2004.
6. Oak Ridge National Laboratory, Edition 23, 2003.
7. Look-up tables (based on 1980s data) are included in the New York State Guidelines; volume 23 of TEDB (Oak Ridge National Laboratory, 2003) most closely provides updated data.
8. Conversations with MPOs in New York who have been issued a similar mandate to disclose energy intensity of transportation projects and plans indicate that the process would be more accepted, better understood, and effectively integrated into decision-making process if members of MPOs and transportation planners had been more included in developing the methodology.