Measuring Progress

towards Transportation GHG Goals

Immediate Recommendations

Juan Matute
UCLA Program on Local Government Climate Action Policies

www.lewis.ucla.edu/climate

A preview of an upcoming white paper on transportation greenhouse gas modeling and regional target setting. For more information on the white paper, contact [Juan Matute] or visit [http://www.lewis.ucla.edu/climate]

Recommendation #1: The ARB should transition from using the EMFAC emissions model to a modal emissions model such as U.S. EPA's MOVES2010

Modal emissions models, such as the U.S. EPA's MOVES2010 model, have three advantages over existing models: modal models can be more accurate, modal models allow for space/time explicit emissions estimation, and modal models allow for emissions analysis at a variety of geographic scales. The MOVES model uses a different architecture to calculate vehicle emissions than previous emissions models based on vehicle miles traveled (VMT) and average vehicle speed. MOVES uses second-by-second vehicle specific power (VSP), which has been found to better correlate with emissions than average vehicle speed (Koupal, et al. 2002).

Researchers have found that modal emissions models, including MOVES, are better able to account for congestion, road grade, and other factors which can affect vehicle engine load but not average speed. Barth and Boriboonsomsin (2008) found that a microscale modal emissions model that is sensitive to second-by-second variations of fuel consumption and emissions is more appropriate for measuring emissions from congestion than regional emissions inventory models. Song, Eisnger and Niemeier (2009) write that, versus MOBILE and EMFAC, MOVES "should be more responsive to variations in traffic dynamics and roadway congestion levels." MOVES can account for road grade, which has a significant effect on fuel consumption (Fernández and Long 1995) (Park and Rakha 2006).

The MOVES architecture allows for emissions analyses that are space and time explicit, which enables their use at variety of geographic scales. The two expressions of vehicle activity that MOVES is based on, service hours operating and vehicle specific power, can be attributed to a specific geographic point. This allows the MOVES model engine to be used for a variety of geographic scales: from the intersection, to the project, to the region, to the state. Because of this flexibility of analysis scale, and incorporation of operating time and mode inputs, "MOVES is anticipated to be a superior analysis tool" than MOBILE and EMFAC" (Song, Eisinger and Niemeier 2009).

In transitioning to MOVES, the ARB and other users of emissions models should substitute appropriate local inputs on vehicle activity, vehicle mix, and emissions factors instead of the standardized national inputs provided with the MOVES model (J. Koupal 2010).

Recommendation #2: Consider effect of regional growth rate on ability to utilize land use strategies when establishing targets

SB 375 requires the ARB set regional greenhouse gas reduction targets for 2020 and 2035 by September 30, 2010. The RTAC recommended that emission targets be set on a percent per-capita basis, based on 2005 emissions levels. One concern with such a baseline is that, while it is sensitive to population change, is not sensitive to the *rate* of population change. Faster growing regions will be better able to use land use strategies to meet their regional greenhouse gas reduction goals.

The following hypothetical situation describes two regions, A and B, which expect different rates of population growth but similar SB 375 targets expressed as a per capita reduction. While both regions must reduce per capita transportation GHG by 5%, they have different per capita GHG requirements for new residents. Region B, which has a high growth rate (10%) may be able to fulfill its reduction targets with land use strategies alone – by achieving average transportation emissions of 8.1 MT CO_2-e per capita for all new growth. With a marginal per capita GHG target of -4.5 MT CO_2-e per capita, Region A will not be able to meet its target with land use strategies alone.

Figure 1 - Hypothetical Difference in Growth Rates and New Resident Emissions

	Region A	Region B
2012 Population	1,000,000	800,000
Per Capita CO2-e	15.0	18.0
Region-wide CO2-e (MT)	15,000,000	14,400,000
Per Capita GHG Reduction Goal	5%	5%
2017 Population Projections	1,040,000	880,000
Population Growth	40,000	80,000
Population Growth Rate	4.0%	10.0%
New Region-wide Per Capita CO2-e	14.3	17.1
Region-wide CO2-e (MT)	14,820,000	15,048,000
Per Capita CO2-e for New Residents	**-4.5**	**8.1**

The RTAC report acknowledges that differences in regional growth rates affects the results a region may achieve with land use and transportation strategies. However, only if the rate of population change is considered will a per capita reduction metric ensure "that both fast and slow growth regions take reasonable advantage of any established transit systems and infill opportunity sites to reduce their average regional greenhouse gas emissions" (Regional Targets Advisory Committee 2009, 24).

Recommendation #3: Recognize SB 375's bias towards strategies with early maturities and communicate the value of land use strategies to MPOs

The legislative intent of SB 375 is clear: a changes in land use patterns and transportation policy are necessary to achieve the GHG reduction goals of AB 32. In order to achieve these reductions, MPOs must pursue strategies which meet targets for GHG reductions from transportation in 2020 and 2035. This structure favors the implementation of transportation strategies over land use strategies for two reasons. First, land use strategies have complimentary effects to transit and pricing strategies, and in isolation are less effective. Second, land use strategies have a longer maturity term than transit and pricing strategies. The potential GHG reduction effects of a change in regional land use patterns will not be fully realized until well after 2035. While the implementation of land use strategies may have limited GHG reduction effects prior to 2020 or 2035, an MPO may seek to implement land use strategies for their non-GHG benefits.

Table 1 below shows the percentage of projected 2050 GHG reductions achieved by various strategies in 2020 and 2030. The *Moving Cooler* report forecasts the nationwide GHG reduction effects of various transportation and land use strategies at three deployment levels[1]. At all levels of deployment, pricing strategies reach their 2050 level of effectiveness by 2030. Land use strategies, however, achieve less than half of their 2050 GHG reduction levels by 2030.

Table 1 - Percentage of 2050 GHG Reduction Potential for Various Strategies in 2020 and 2030

PERCENTAGE OF 2050 REDUCTION BY YEAR AND DEPLOYMENT LEVEL						
	Expanded Current		Aggressive		Maximum	
Strategy	2020	2030	2020	2030	2020	2030
Pricing						
Congestion Pricing	28%	100%	31%	100%	46%	110%
PAYD Insurance	105%	100%	89%	107%	95%	107%
VMT fee	114%	114%	114%	109%	112%	108%
Carbon Pricing (VMT)	110%	100%	114%	111%	103%	105%
Carbon Pricing (fuel economy)	63%	97%	66%	97%	73%	100%
Land Use						
Combined Land Use	10%	30%	16%	49%	16%	52%
Combined Pedestrian	100%	100%	100%	100%	100%	117%
Transit						
Transit Frequency	50%	100%	33%	67%	22%	44%
Urban Transit Expansion	29%	57%	33%	58%	31%	54%
Commute Strategy						
Employer-Based Strategy	100%	100%	115%	108%	113%	110%
Regulatory Measures						
Urban Parking Restrictions	7%	14%	8%	31%	17%	50%
Speed Limit Reduction	29%	107%	56%	106%	71%	106%
System Management						
Eco-Driving	22%	50%	28%	54%	58%	77%

KEY
< 33%
33% to 66%
> 66%

Based on (Cambridge Systematics 2009, 44-45)

Land use strategies are complementary to pricing and transit strategies: they allow urban and regional form to adapt to a new regime of transportation pricing and travel mode options. Land use strategies that reduce demand for distance traveled and promote the use of alternative

[1] For scoping purposes: the carbon pricing represents a new fuel tax of $0.40 per gallon at the expanded current practice level, $0.82 per gallon at the aggressive level, and $2.71 per gallon at the maximum level.

modes not subject to carbon pricing will mitigate the impact of pricing on quality of life and social equity.

There is limited cause for concern about SB 375's favor towards pricing strategies, as MPOs will likely find available land use strategies (infill development, strategic density increases, and the mixing of land uses) politically preferable to potentially available pricing strategies (congestion pricing, VMT fees, and carbon-linked gasoline fees). Nevertheless, the ARB should be aware of SB 375's systematic bias towards strategies with early maturities and work with MPOs to communicate the benefits of land use strategies.

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