REAL SOLUTIONS FOR CLIMATE CHANGE

Legislation, Targets, and Methodologies

MARCH 10, 2010

Presented by:

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Questions for the Presenters

During the webinar, please e-mail your questions to melvinj@pbworld.com.
REAL SOLUTIONS FOR CLIMATE CHANGE

Climate Change Legislation and Greenhouse Gas Targets

MARCH 10, 2010

Presented by:

BILL MALLEY
Partner, Perkins Coie LLP, Washington, DC
Overview

• Part I - Federal Legislative Update

• Part II - GHG Reduction Plans & Targets
Federal Legislative Update
Overview

– Timeline of Recent Events
– Major Elements of Climate Change Legislation
– Basics of Cap-and-Trade
– Impact on Transportation
  • Strategies to Reduce Transportation GHG Emissions
  • Effect on Transportation Fuel Prices
  • Effect on Transportation GHG Emissions
– Obstacles to Legislation
– Current Status and Prospects for Action in 2010
Timeline

- **House Climate Legislation**
  - 3/31/09: Waxman-Markey draft issued
  - 5/05/09: Waxman-Markey introduced
  - 06/26/09: Waxman-Markey passed by House

- **Senate Climate Legislation**
  - 09/30/09: Kerry-Boxer introduced in Senate
  - 11/05/09: Kerry-Boxer approved in Committee
  - Late 2009: Kerry-Boxer stalls; effort begins to develop bipartisan compromise bill
Major Elements of Climate Bills

- **Cap-and-Trade**
  - Mandate reductions in total GHG emissions
- **Energy Production**
  - Provides incentives and other support for production of renewable energy (and maybe nuclear, oil & gas)
- **Energy Efficiency**
  - Provides incentives and tighter regulations to promote greater efficiency.
- **Transition Assistance**
  - Provides assistance to ease impact of higher energy prices on consumers and U.S. industries
Basics of Cap-and-Trade

- **How a cap-and-trade program works:**
  - Set a cap on total GHG emissions, and reduce it over time
    - 17 to 20% reduction by 2020
    - 83% reduction by 2050
  - Issue "allowances" to emit GHGs within the cap
    - Some allowances are auctioned; others distributed free
  - **Allowances** are an economic asset that can be traded
    - Receiving a free allowance is like receiving dollars.
  - **Offsets** can be purchased in lieu of allowances
    - An offset is obtained by paying for a reduction made by sources outside the cap, including sources in other countries.
    - Example: pay to avoid deforestation in a developing country.
Strategies to Reduce Emissions of Transportation GHGs

• How would the House and Senate bills reduce GHG emissions from transportation?
  – Include transportation fuels in the cap
    • Provides a "price signal" to promote technological innovation and changes in vehicle choices, land use, and behavior
  – Promote cleaner vehicles and fuels with funding, regulation:
    • Vehicle and fuels R&D
    • Vehicle recharging infrastructure
    • GHG emission regulations
  – Create new transportation planning requirements
    • Development of models and methods
    • State and MPOs set targets for GHG emission reductions
    • States and MPOs develop strategies for achieving targets
Impact on Transportation Fuel Prices

• How would the House and Senate bills affect the price of transportation fuels?
  – EPA makes two key assumptions:
    • Relatively low cost to adopt new technologies that reduce GHG emissions, such as carbon capture and sequestration (CCS).
    • Relatively widespread use of "offsets"
  – Without these assumptions, prices could be much higher.
  – EPA has not yet released an estimate of the gasoline price impacts of the Senate bill.
# Impact on Transportation Fuel Prices

EPA Projections; Alternative Projections

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Impact on Transportation Emissions

- **Would the House and Senate bills be effective in reducing transportation GHG emissions?**
  - EPA projects that the price signal from cap-and-trade would have little effect on emissions

"The increase in gasoline prices that results from the increase in the carbon price ... is **not sufficient to substantially change consumer behavior in their vehicle miles traveled or vehicle purchases ....""

"The relatively modest indirect price signal on vehicle manufacturers from this particular cap-and-trade policy creates little incentive for the introduction of low-GHG automotive technology.""

Source:  http://www.epa.gov/climatechange/economics/economicanalyses.html
• **Impact on Consumers**
  – "Putting a price on carbon" raises price of electricity & fuel, especially in coal-dependent States.

• **Impact on Competitiveness**
  – If we put a price on carbon, but others do not, will it harm competitiveness of U.S. industries?

• **Potential for Manipulation**
  – Creates a new financial market – trading in emissions allowances. How will this be regulated?

• **Effectiveness**
  – Are offsets "real" reductions? Will they undermine effectiveness of the cap?
AASHTO Concerns

• General AASHTO concerns:
  – Potential to raise price of fuel, making it more difficult to obtain new revenues for HTF.
  – No assurance of substantial new revenues for transportation from a cap-and-trade program.
  – New revenues, if any, may not be distributed equitably among States and regions

• Planning-related concerns:
  – Potential to slow down planning process, override State and local control over transportation policy decisions
Current Status

• Senate working on bipartisan compromise bill
  – Led by Kerry, Graham, Lieberman
  – Potentially a much different approach:
    • "Sector-specific"
    • Transportation fuels may be outside the cap, but subject to a "carbon tax" that is lined to cost of allowances
    • Increased role for nuclear power, oil & gas production.
  – Concepts being floated now
  – Bill could be introduced in next few weeks
Prospects for Action in 2010

• **Action is still possible this year.**
  – Congress focusing now on health care, jobs.
  – Window of opportunity for climate legislation *may* be open this spring.
    • First step would be in the Senate
      – Potential vehicle is K-G-L bipartisan compromise
    • If Senate passes a bill, a House-Senate conference follows
      – Major differences between Senate and House bills would heighten difficulty of reaching agreement.
      – Chances of passage this year are real, but are well below 50/50.
GHG Reduction Plans and Targets for the Transportation Sector
Overview

- Targets for Transportation: The "Fair Share"
- Targets in Federal and State Legislation
  - Federal: House and Senate Bills
  - State: California and Oregon Examples
- Key Policy Issues in Setting Targets
- Implications for Transportation Planning
"We are committed to doing our part to help achieve the goal of reducing U.S. greenhouse gas (GHG) emissions 80 percent by 2050."

AASHTO, "Real Transportation Solutions for Greenhouse Gas Emissions Reduction"

http://realsolutions.transportation.org/Pages/default.aspx
Targets: The 'Fair Share' for Transportation

• **What *is* the "fair share" for transportation?**
  - There is broad agreement on the *overall* target for reducing GHG emissions in the U.S.
  - Current legislation in House & Senate calls for
    - 17-20% from 2005 levels by 2020
    - 83% from 2005 levels by 2050
  - But there is little agreement on the *percentage reductions that can or should be achieved in the transportation sector.*
Targets: The 'Fair Share' for Transportation

• Is a proportionate reduction fair?
  – Generally, reducing GHG emissions is more costly in the transportation sector.
  – If the "carbon price" is the same in all sectors, it leads to much different results:
    • Most of the reductions come in the electricity sector
    • Relatively small reductions in the transportation sector
  – Example: See EPA analysis of House bill ...
Total US GHG Emissions & Sources of Abatement
Scenario 1 - Reference & Scenario 2 – H.R. 2454 (ADAGE)

- CO₂ emissions from the electricity sector represent the largest source of domestic reductions.
- Only about 5% of covered sector GHG reductions come from transportation, although transportation is currently responsible for 28% of GHG emissions in the U.S.
- These emission estimates do not take into account full lifecycle GHG emissions, including international land use impacts.

Source: [http://www.epa.gov/climatechange/economics/economicanalyses.html](http://www.epa.gov/climatechange/economics/economicanalyses.html)
• So, how will transportation's share be determined?
  – No single answer to this question.
  – Could be addressed in federal legislation, directly or indirectly.
  – Already being addressed at the State level, through legislation and climate action plans.
Targets: Legislative Proposals

• Federal legislation includes targets as part of new transportation planning requirements.
  – House Bill (Waxman-Markey): Section 222
  – Senate Bill (Kerry-Boxer): Section 112

• Some States already have passed laws requiring GHG reduction plans and targets.
  – California, SB 375 (2008)
  – Oregon, SB 1059 (2010)
Targets in Federal Legislation

• **Targets would be a key building block in new transportation planning requirements.**
  
  – EPA responsibilities (with USDOT input):
    • Set national "goals" for reducing transportation-related GHG emissions
    • Determine "models and methods" for States and MPOs to use when projecting future GHG emissions
  
  – States and MPO responsibilities:
    • Set "targets" for reducing transportation GHG emissions
    • Develop plans for achieving those targets
### National "Goals"

- EPA, in consultation with USDOT, sets "national transportation-related greenhouse gas emission reduction goals"
- National goals must be "commensurate with" the total GHG reduction requirements required in the legislation.

### State and MPO "Targets"

- States set "surface transportation-related greenhouse gas emission reduction targets" in their statewide long-range plans.
- MPOs set "surface transportation-related greenhouse gas emission reduction targets" in their metropolitan long-range plans.
Targets in Federal Legislation

- Transportation funding could be tied to progress toward achieving GHG targets.
  - Transportation funding in *climate change legislation* could be distributed on a competitive basis, based on estimated GHG emission reductions.
  - Transportation funding in *transportation legislation* also could be linked to performance, including achievement of GHG reduction targets.
• **AASHTO has expressed concerns about new planning requirements in federal legislation.**
  - No requirement to consider cost-effectiveness when setting GHG reduction goals
  - USDOT only has a 'consultation' role in EPA's rulemaking on 'models and methods'
  - Transition to new GHG planning requirements could create delays in approving Plans, TIPs
  - Over time, 'targets' could become de facto mandates, similar to conformity for GHGs
Targets in State Legislation

• **California – SB 375**
  - Enacted in 2008
  - Intended to align transportation, land use, housing, and GHG reduction efforts
  - Target-setting is a core element:
    • State Air Resources Board (ARB) sets transportation GHG reduction targets for each large MPO
    • Once targets are set, MPOs must develop plans for achieving the targets
    • If MPO's plan does not achieve its target, MPO must develop an alternative plan that will achieve the target.
Targets in State Legislation

• **Oregon – SB 1059**
  – Passed by Legislature; awaiting Gov. signature
  – Different from SB 375, but includes similar features
  – Target-setting is a core element:
    • State legislation sets overall GHG reduction targets
    • Land Conservation and Development Commission sets transportation GHG reduction targets for each MPO
    • Dep't of Environmental Quality and Dept' of Energy sets VMT budgets for each MPO
    • State DOT and MPOs develop plans for achieving GHG reduction targets
Issues to Consider in Setting Targets

• **Control**
  - Who sets the target?
  - What is the process?

• **Time Horizon**
  - What is the base year?
  - What is the horizon year?

• **Scope**
  - Which modes are covered?

• **Metric**
  - What metric is used to define the target?
  - Should all States and MPOs be required to use the same metric?

• **Feasibility**
  - What is the right balance between achievability and aggressiveness?
  - What tools are needed in order to develop realistic targets?

• **Coordination & Consistency**
  - Must States' target collectively achieve the national goal?
  - Must MPOs' targets collectively achieve the States' target?
  - Should targets be developed 'top-down' or 'bottom-up'?

• **Consequences**
  - What happens if the targets are not achieved?
  - Are there any rewards for meeting the targets?

• **Modeling Tools**
  - What are the capabilities and limitations of existing models?
  - What methodology decisions should be made at the national level?
  - What "estimating tools" are needed to project GHG reductions?
Target-Setting: Closing Thoughts

• GHG reduction targets will present new challenges for transportation planners.
  – What technical tools are needed to make meaningful forecasts?
  – What are the policy implications of adopting targets – e.g., removal of projects from plan?
  – What are the funding implications – e.g., if targets are not achieved, is funding reduced?
Overview of GHG Methodologies for Surface Transportation

MARCH 10, 2010

Presented by:

STEPHEN LAWE & KEVIN HATHAWAY
RESOURCE SYSTEMS GROUP
Transportation, Planning, and Technology Division
Outline

- Considerations for Selecting GHG Methodologies
- Challenges with GHG Calculations
- Implications of Assumptions & Data
- Conclusion
Reasons for Forecasting GHG

• Voluntary efforts
  – Only requires understanding of direction and magnitude (better/worse)
  – Ideally uses “common” methods to support comparisons/aggregations
• Assess the efficacy of policies
  – Must be highly sensitive to policy considerations
  – Must be comprehensive and sensitive to “policy feedback”
• Meet informal or formal requirements or targets
  – Must have clear baseline and future conditions
  – Must be consistent over time
  – Must be defensible
• Market-based approach – creating a price on emissions
  – Carbon Tax
  – Cap & Trade
Challenges and Confounding Issues in GHG Calculations

- Size and scope of calculation region
  - Intersection vs. Statewide
- Policy efficacy varies with geographic variation
- Uncertainty in air emissions forecasting
- Uncertainty in transportation forecasting
  - Generally speaking, transportation models are often least well-suited to forecast the policies we are most concerned with from a GHG perspective
    - TDM & TSM
    - Land use/transportation interactions
    - Pricing strategies
    - Speed & fleet mix
- Policy “Interaction” effect:

COMPETING POLICIES

SUPPORTING POLICIES
Process of selecting a GHG calculating tool

VMT Spreadsheet
- Calculates VMT from land use and trip rates (ITE or user defined)
- Aggregate emission rates from MOVES, IPCC, Climate Registry, EPA
- One example can be found at: www.coolconnections.org/vmt

Integrated GHG Calculator
- Dissaggregate and/or aggregate representation of travel, fuels, vehicles, etc.
- An example is GreenSTEP which is presented in this Webinar

Travel Demand Model (TDM), Off model tools & GHG Calculator
- TDM calculates VMT, Speed, Fleet Mix
- Emission Rates come from MOVES, IPCC, Climate Registry, EPA
- One example of emission calculator can be accessed from: http://www.uvm.edu/~transctr/?Page=about_contact.html

Advanced TDM Modeling & GHG Calculator
- Integrated land use models
- Activity-based models
- Vehicle choice models
- Dynamic traffic assignment or Microsimulation

Good for small area analysis or larger areas where lower levels of accuracy are required and no transportation model exists

Region or statewide forecast at an aggregate level not relying on travel modeling

Strong where travel models exist and moderate levels of accuracy are required.

Strong where higher levels of accuracy and policy sensitivity are required.
Understanding the complex interactions of policy and planning on the transportation system is the most important element to forecasting GHG emissions.
GIS-based GHG Calculator for MPOs

• Considers Speed, Time of Day, and Fleet
  – Specify congested travel times by link and direction (A-B, B-A) using 4-step model shape files.
  – Specify up to 4 periods in a Day (scale to annual totals if desired)
  – Specify % light vehicle, medium and heavy trucks or provide network volumes

• Considers Land Cover
  – Calculates regional sinks and sequestration rates from the National Land Cover data sets

• Considers TAZ socioeconomics
  – Uses TAZ jobs and housing units to determine the amount of land cover converted (loss of C sinks) due to growth

Presented at TRB 2010 and available for free download
Consider a person making a 15 mile trip to work, assuming a constant speed.

19.6 lbs / gallon in a car that gets 23 miles / gallon.

$\text{SPEED} = \frac{40 \text{ mph}}{}$

$19.6 \text{ lbs/gallon} \times \frac{1}{23 \text{ miles/gallon}} = 0.85 \text{ lbs of CO}_2/\text{mile}$

$\text{EMISSIONS} = 0 \text{ miles}\rightarrow 12.8 \text{ lbs of CO}_2$

$\text{EMISSIONS} = 15 \text{ miles}$
Personal example: calculating carbon from mobile emissions

What if their speed actually varied?

- What Does this mean?
  - We estimated 17% more emissions by taking speed into account.
  - Over one year, this error is equivalent to ignoring 1100 lbs of CO₂

![Graph showing emissions variation with speed](image)

- **SPEED**
  - 30 mph: 0.93 lbs/mile - 5 miles
  - 65 mph: 0.92 lbs/mile - 5 miles
  - 20 mph: 1.14 lbs/mile - 5 miles

- **EMISSIONS**
  - 0 miles: 14.9 lbs of CO₂
  - 15 miles: 14.9 lbs of CO₂
MPO Example

WHEN DOES SPEED MATTER MOST?

• When most of the traffic operates at lower than optimal speeds
  – Congested regions
  – Built areas with slower posted speed limits
Including the impact of congestion on speed, the estimates are 9% higher.

Also, including heavy vehicles, the estimates are 25% higher.
Conclusions

• Different GHG methodologies are appropriate depending on the reason for forecasting

• Understanding and representing the interaction of policies is critical

• Sensitivity to speed and vehicle mix are among the most important factors in regional or statewide forecasting

• Many of the technical challenges we face today are the same as those faced in transportation forecasting for years.

• GHG forecasting will be evolutionary in terms of data and methodological advancements but we have enough information NOW to inform policy choices
Thank You

Stephen Lawe  Managing Director
slawe@rsginc.com

Kevin Hathaway  Director
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REAL SOLUTIONS FOR CLIMATE CHANGE

A Statewide Model for Estimating and Forecasting Greenhouse Gas Emissions from the Transportation Sector and its use by Oregon DOT
MARCH 10, 2010

Presented by:

BRIAN GREGOR
Oregon DOT, Transportation Planning Analysis Unit
The Challenge

• Global warming (climate change) is a very large scale problem
  – magnitude
  – geographic scope
  – system interactions

• A large number of factors affect greenhouse gas (GHG) emissions from the transportation sector

• There are many uncertainties about the future states of many of these factors

• Global warming is a different kind of air quality problem and CO₂ is different kind of “air pollutant”
Example of the Many Factors Affecting Light Vehicle GHG Emissions

New Vehicle Fuel Economy
  - Vehicle Ages
  - Vehicle Sizes
  - Fuel Economy
  - Range
  - Efficiency
  - Electric Vehicles
  - Market Penetration

Petroleum Based
  - Biofuels
  - Electricity

Road Design
  - Operations Management
  - System Management
  - Pricing

Vehicle Travel
  - Population Growth
  - Household Characteristics
    - Land Use
    - Mobility Options
    - Ownership Costs
  - Vehicle Ownership
    - Land Use
    - Mobility Options
    - Ownership Costs
  - Vehicle Use
    - Mobility Options
    - Prices
    - TDM Programs
Addressing the Challenge with the GreenSTEP Model

GreenSTEP = Greenhouse gas State Transportation Emissions Planning model

• A statewide planning model to help Oregon develop a statewide transportation strategy on greenhouse gas (GHG) emissions
• Complements metropolitan travel demand models and ODOT’s integrated statewide model
• Peer Review by Oregon travel modelers and experts in other disciplines
• Many elements have been estimated using 2001 NHTS data
• Open source model developed and implemented in open source software (R programming language)
• Partially developed with FHWA SPR program funds
GreenSTEP Model Sensitivity (Inputs)

- Demographic changes
- Relative amounts of development occurring in urban and rural areas
- Metropolitan and other urban area densities
- Urban form
- Amounts of metropolitan area public transit service
- Highway capacity
- Vehicle fuel efficiency
- Vehicle ages

- Electric vehicles
- Fuel & carbon pricing
- VMT pricing
- Demand management
- Effects of congestion on fuel economy
- Carbon content of fuels – including well to wheels impacts
- CO2 production from electrical power use for transportation
GreenSTEP Design Overview

Individual Household Level:
- County Population by Age
- Cohort
- Per Capita Income
- Synthetic Household Generation
- Urban area land use and transportation system characteristics
- Household vehicle ownership
- Household vehicle travel
- Household vehicle characteristics

Aggregate Level:
- Demand management program adjustments to VMT
- Heavy vehicle VMT
- MPG adjustments due to congestion
- Fuel consumption by type
- CO2 equivalent emissions by fuel type (including well to wheels)

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GreenSTEP Outputs

• Most outputs are disaggregated by county, development type (urbanized, other urban, rural), and household income level

• Example outputs:
  – Population density
  – VMT by vehicle type
  – Fuel consumed by vehicle type
  – Electric vehicle use
  – CO\textsubscript{2}e emissions by vehicle type

• In addition, household level “microsimulation” results are saved
1990 “Backcast” is Necessary to Correspond to Legislative Target Baseline

- **GreenSTEP**
- **Fuels-Based**
- **HPMS**

Annual Vehicle Miles

- $3.0e+10$
- $3.2e+10$
- $3.4e+10$
- $3.6e+10$
- $2.8e+10$

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Base Year
Testing Shows that GreenSTEP will Support Evaluation of Many Types of Policies

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Fuel Economy & Costs

Urban Planning

Vehicle & Fuel Technology

Sensitivity Test Notes:

• NOT meant to represent any proposed scenarios.
• ONLY for the purpose of evaluating model performance.
GreenSTEP Helps Provide Perspective on Scope, Measures and Potential Solutions

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Comparison of Density and Public Transportation Sensitivity Test Scenarios

Annual Per Capita VMT

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<th>Med Li Veh Eff &amp; More Den</th>
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Total Annual Statewide VMT

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<th>Year</th>
<th>Med Li Veh Eff</th>
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<th>Med Li Veh Eff, More Den &amp; More PT</th>
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Total Annual Statewide Pounds of CO₂e

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Sensitivity Test Notes:
- NOT meant to represent any proposed scenarios.
- ONLY for the purpose of evaluating model performance.
- Drop in per capita VMT from 2005 to 2010 is due in part to assumed $5/gallon gas price in 2010.
Next Steps

• **Model Development:**
  - Wrapping up light vehicle models
  - Developing multimodal long distance travel models
  - Expanding freight models (multimodal, entire freight trip)

• **Model Application for Statewide Strategy:**
  - Create a reference (e.g. business as usual) scenario & develop plausible ranges for inputs
  - Model and evaluate results for each input
  - Develop, model and evaluate combinations of inputs to meet statewide GHG emission reduction targets
  - Provide information for rulemaking on metropolitan level light vehicle emissions targets

• **For more information, contact:**
  Brian Gregor, Oregon Department of Transportation
  [Brian.J.Gregor@odot.state.or.us](mailto:Brian.J.Gregor@odot.state.or.us)
For copies of these slides and webinar recording, go to AASHTO’s website:
http://environment.transportation.org/center/products_programs/climate_change_webinars.aspx

For more information on climate change, go to AASHTO’s website:
http://realsolutions.transportation.org/Pages/default.aspx

(The above links will also be included in the post-webinar survey)

Thank you!