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Transportation and Climate Change Resource Center

REAL SOLUTIONS FOR CLIMATE CHANGE

Reducing Greenhouse Gas Emissions from U.S. Transportation - A New PEW Center Report on Climate Change

February 23, 2011

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U.S. Department of Transportation
Federal Highway Administration

Reducing Greenhouse Gas Emissions from U.S. Transportation

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Report for Pew Center on Global Climate Change

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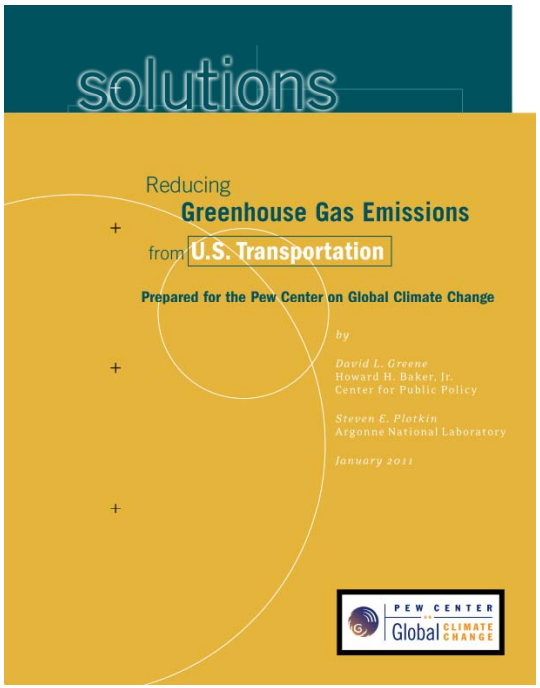

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Presentation Overview

REAL SOLUTIONS FOR CLIMATE CHANGE

- Report overview
- Mitigation scenarios
- Light-, medium-, and heavy-duty vehicles
- Moving towards compact development
- Mix of policies and levels of government

Report Overview

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- Assess the potential to substantially reduce transportation's GHG emissions cost-effectively by 2035 & 2050.
- Pew Center on Global Climate Change report focusing on entire U.S. transportation system
- Time frame is 2010-2050
- Base Case: Annual Energy Outlook 2010 Reference Case, extended to 2050
- Three scenarios with differing assumptions about technological progress, policy initiatives, and public attitudes
- Rely on existing studies to estimate impacts
- Scenario analysis uses Kaya method to integrate policy impacts and avoid double counting.

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Some believe that transportation is the most difficult sector for GHG mitigation

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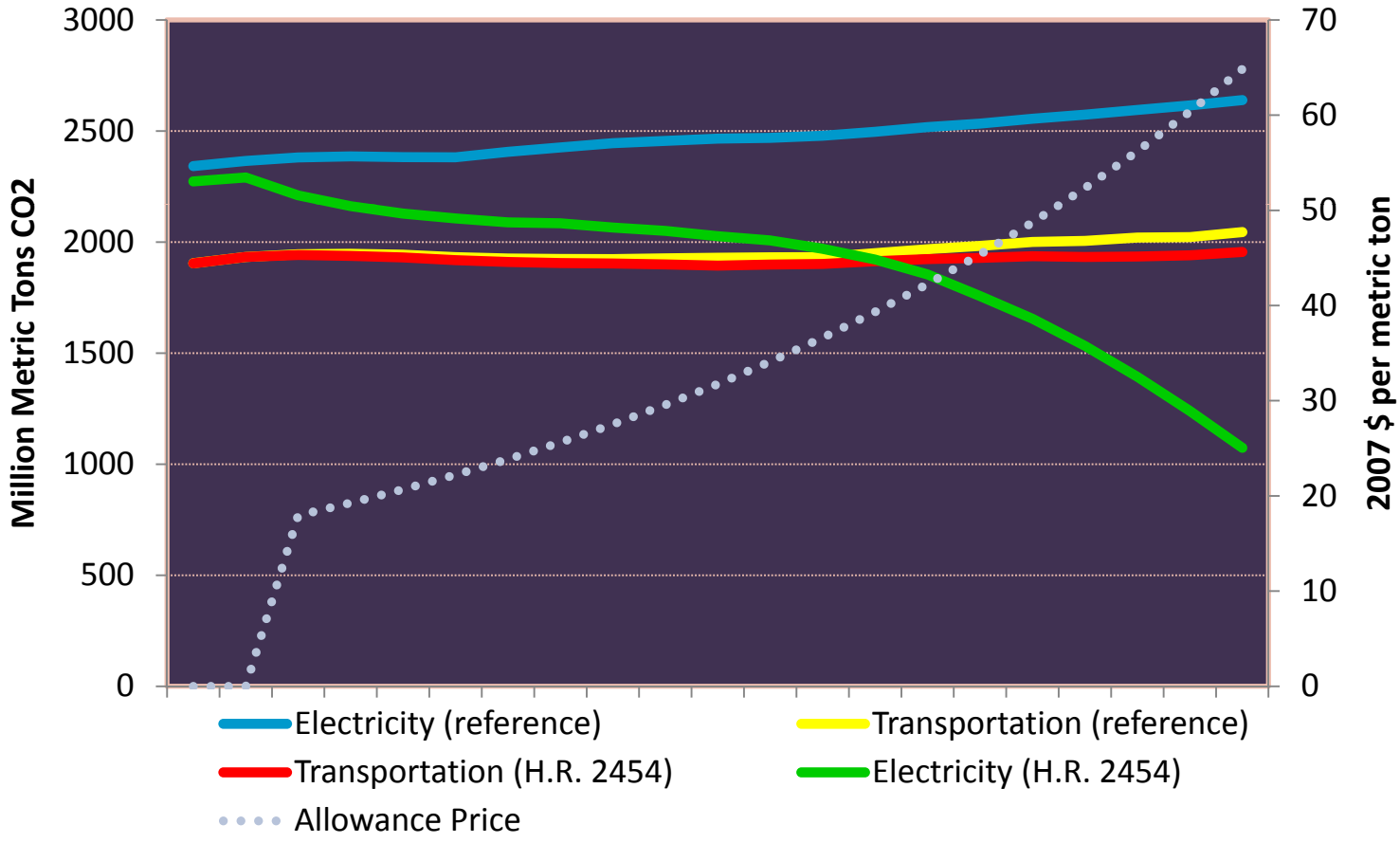

Our study shows how transportation GHGs could be cost-effectively reduced by up to 65%

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- A variety of policies are required.
  - Recognize market realities
  - Address all modes
  - Market-based and regulatory
  - Land use, infrastructure, operations
- The larger the reduction, the more important it is to improve technology
  - Lower cost HEVs, PHEVs, EVs, FCVs
  - Advanced biofuels (e.g., cellulose, algae)

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Mitigation Scenario Assumptions

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	Low	Mid	High
Public Attitude Towards Climate Change	Majority think climate change is serious; unwilling to change behavior; support modest pricing policies	60-75% think climate change is serious; some preference shift; support pricing policies	Public very concerned about climate change; preferences and habits change
Public Policy Context	Carbon price; RFS, biofuel subsidies, fuel economy & emissions standards	Low + local and State governments complement federal actions	Mid + Treaty commits U.S. to reductions; feebates; stricter standards
Rate of Technological Progress	U.S. depends on Europe & Asia for vehicle technology; RDD&D continues at current rate	Public $ on RDD&D doubles; alternative vehicles costs fall dramatically; CCS is prevalent	NRC optimistic scenario for FCVs/EVs; clean electricity sector; highway automation

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All 3 scenarios illustrate a large potential for transportation GHG mitigation.

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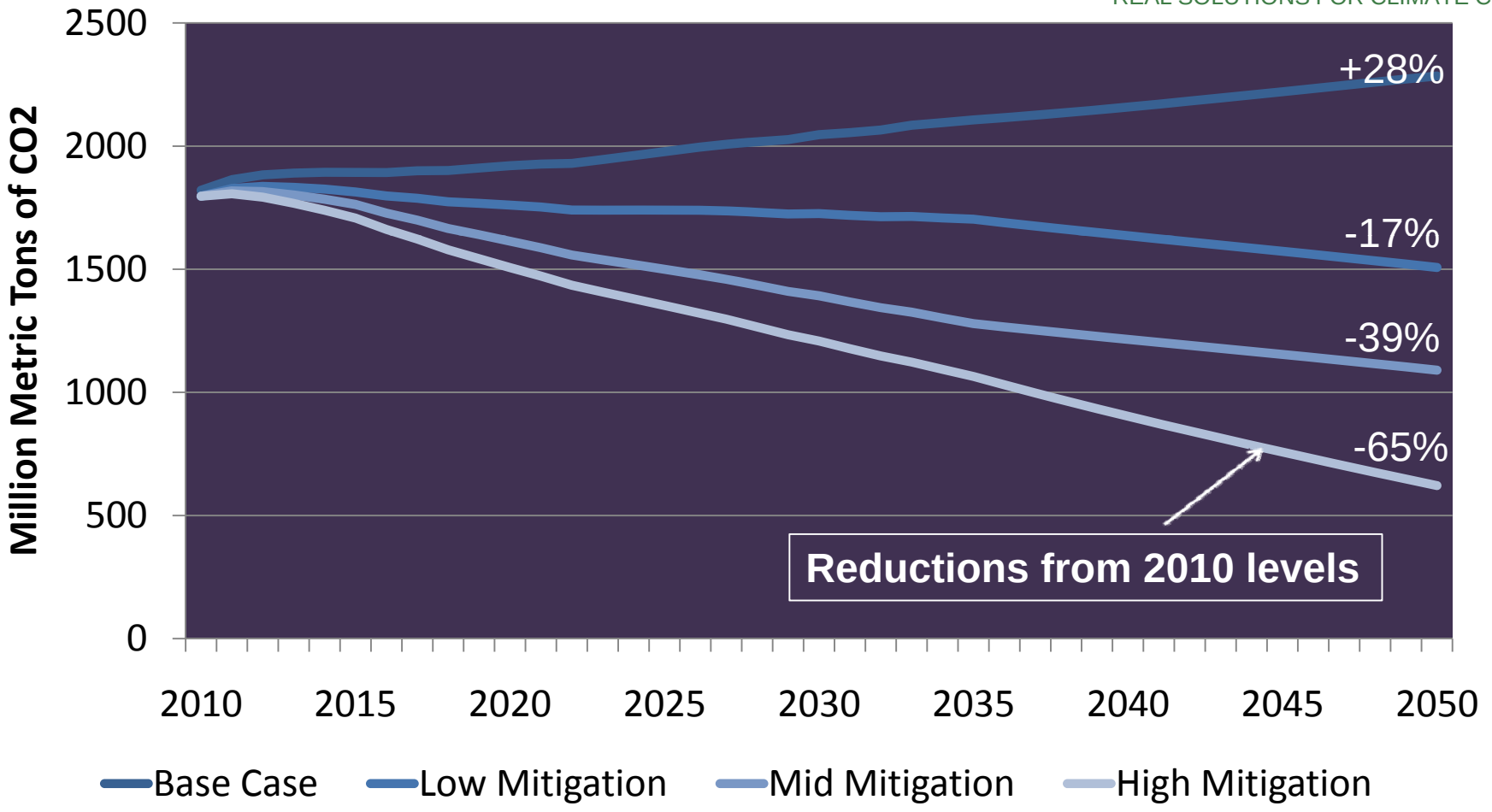

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(New) passenger car and light truck fuel economy can be doubled or tripled by 2035.

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- 2035 conventional vehicle can be 50 mpg and hybrid can be 75 mpg (both on road)
- 2035 total fleet can be 15-40% higher fuel economy than base case rising to 35-80% by 2050
- Plug-in hybrids, EVs & FCVs can all contribute, but a 75 mpg hybrid is difficult competition:
  - Uses 187 gallons of gasoline/yr @ 14,000 miles/yr
  - < $1,000/yr in fuel costs even at $5 gasoline!
- **Conclusion: need dramatic cost reductions, performance improvements *and public acceptance* for new fuels to have a large impact**

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Advanced technologies boost fuel economy, but to reduce GHGs beyond HEV level requires low-carbon fuels

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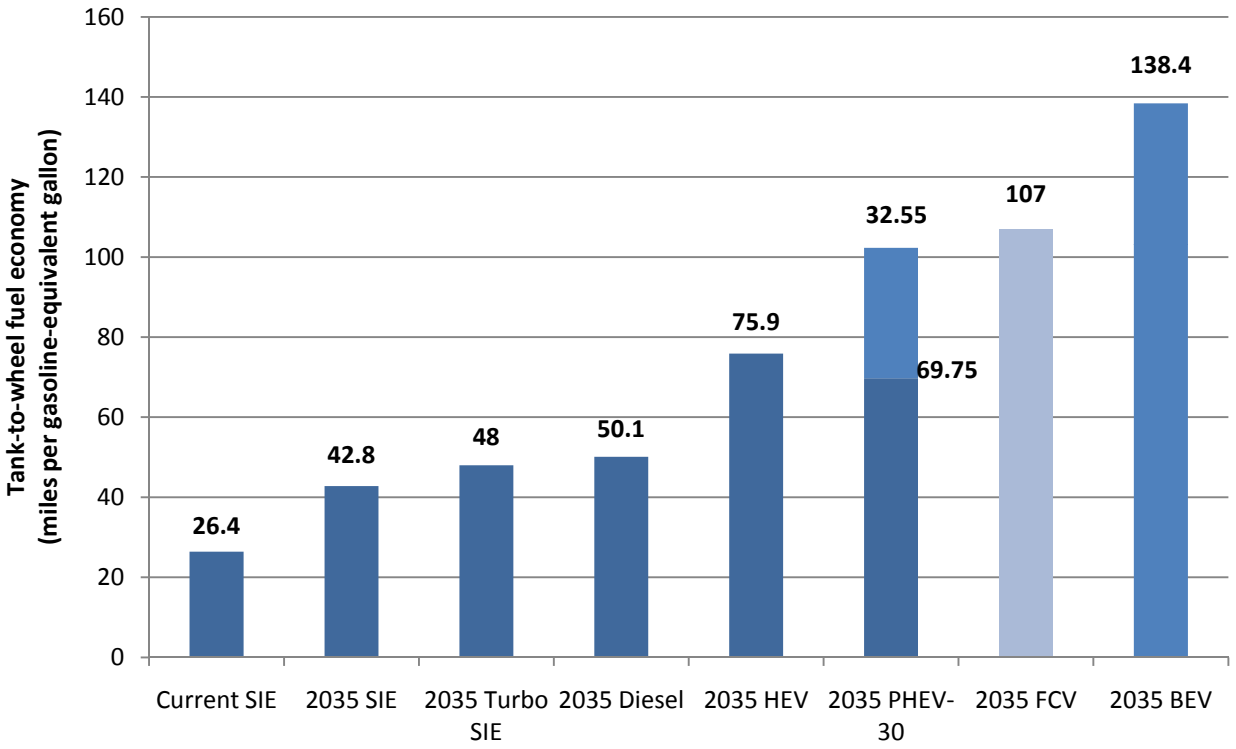

MPG	L/100 km
26.4	8.9
42.8	5.5
48.0	4.9
50.1	4.7
75.9	3.1
102.3	2.3
107.0	2.2
138.4	1.7

Source: Bandivadekar, A. et al., 2008

Note: a graph of lifecycle GHG emissions may look very different, depending on hydrogen and electricity production.

So a transition to hydrogen or electricity must deal with many issues:

- Advanced petroleum-fueled vehicles will be tough competition
- Without low-carbon hydrogen or electricity, EVs, PHEVs and FCVs have GHG emissions similar to advanced HEVs
- Can a transition to hydrogen occur without a firm government commitment….i.e., picking hydrogen as the “winner”?
  - Early buyers are getting “local” vehicles only….similar to EVs, but without home refueling, perhaps with less range anxiety
  - Potential vehicle buyers must believe fueling stations are permanent
- How do EVs cope with a major traffic jam? (think DC during the recent snow storm)

There are excellent options for Medium- & Heavy-Duty vehicles

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- 18% of transportation GHG emissions and growing
- 2/3 of trucking's energy use from tractor-trailers
- Recent National Academy report and others conclude that fuel use from tractor trailers can be reduced by half, other trucks by almost that much
- Technology options include sharp aerodynamic improvements; better drivetrain systems, including heat recovery and hybridization; improved tires; and better driving.

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The fuel economy of most heavy trucks can be cost-effectively increased by 40-50%.

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Vehicle Class	Fuel Consumption Reduction	Capital Cost	Breakeven Fuel Price ($/gallon)
Tractor-trailer	51%	$84,600	1.10
Class 6 box truck	47%	$43,120	4.20
Class 6 bucket truck	50%	$49,870	5.40
Class 2b pickup	45%	$14,710	4.80
Refuse truck	38%	$50,800	2.70
Transit bus	48%	$250,400	6.80
Motor coach	32%	$36,350	1.70

Source: National Research Council

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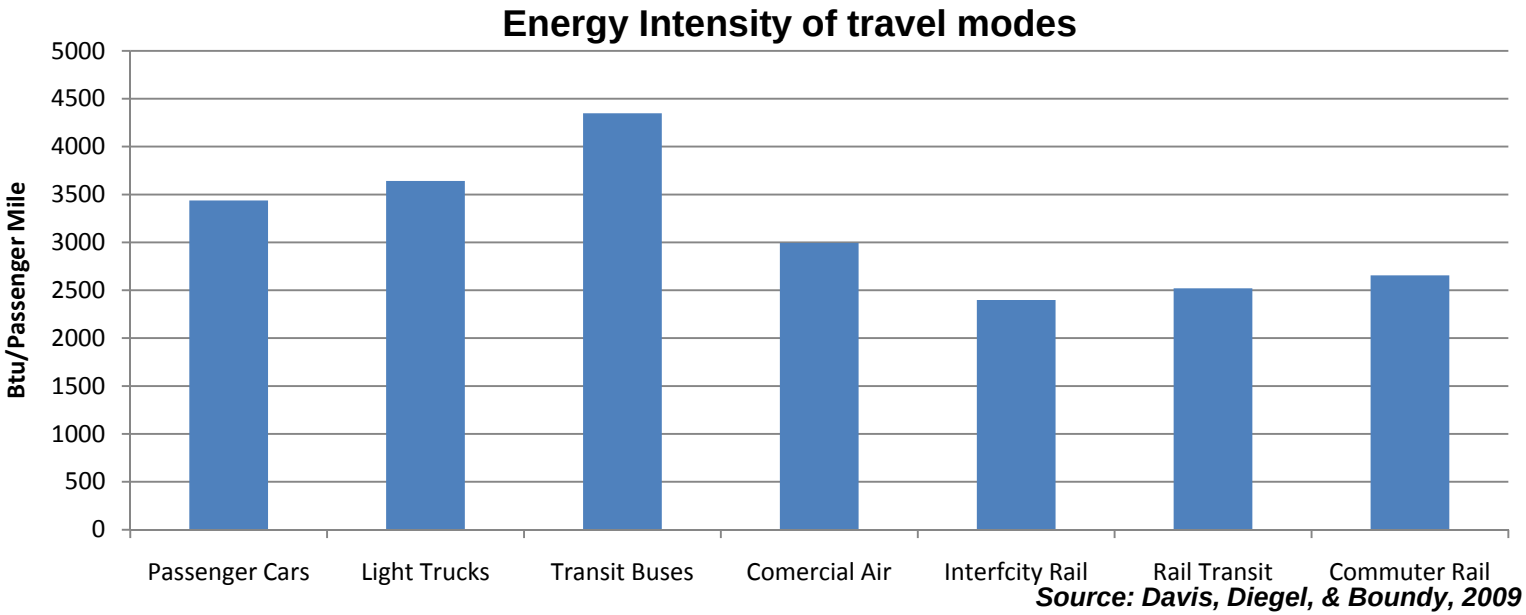
Compact development and more transit will help, but *national* GHG impact is unclear

- Transit today provides about 1% of U.S. passenger miles…so doubling or tripling it will make a modest change in national travel patterns…and
- On average, U.S. transit is not much more efficient than private vehicles



Source: Davis, Diegel, & Boundy, 2009

But these averages hide many highly efficient systems!

Reducing travel can be accomplished with technology and compact development

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- National Academy says doubling urban density can yield a 5-25% reduction in vmt (the higher end is controversial)
- Land use is locally-controlled….and strongly debated
- Lots of examples of compact development, but also of continued sprawl
- A nationwide push for compact development may vary greatly in effectiveness from place to place
- Technology can reduce vmt also; ITS can have a significant impact on trip-planning and route efficiency reducing VMT by almost 10%

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Much can be done by changing the way vehicle travel is priced, even without increasing its cost

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	Pricing Mechanism	Targeted Consumer Response	2050 GHG Impact vs. BAU
Carbon Pricing	Carbon-based Fuel Charge	Consume less carbon-based fuel	Efficiency +4% VMT -2%
PATP Insurance	Fuel Charge	Increase energy efficiency, reduce VMT	Efficiency +5% VMT -1%
Road user tax on energy	Fuel Charge	Increase energy efficiency, reduce VMT	Efficiency +2% VMT -1%
Feebates	Vehicle Purchase Subsidy/Charge	Increase vehicle efficiency and promote advanced vehicle technologies	Vehicle emissions rates -10%
Congestion pricing	Time and place varying fees	Reduced VMT	Up to 3% nationwide VMT reduction

A comprehensive policy strategy is needed

- Much of the potential future reduction in transportation GHG emissions depends on advanced technology.
  - Cheaper, higher energy density batteries
  - Cheaper, more durable fuel cells
  - Advanced biofuels
- The deepest reductions require a transition to electricity or hydrogen or both as a major new energy source.
- As a consequence, sustained investment in research, development, demonstration and deployment is essential.
- Given high uncertainty about technology development (and uncertain public acceptance), deployment strategies must be highly adaptive

A comprehensive policy strategy is needed (2)

- Reducing congestion, improving system efficiency, and creating walk-able, bike-able, communities well-served by public transit, e.g., can produce important GHG reductions as a co-benefit.
- Market and regulatory approaches both needed…get the prices right, use fuel economy standards as well, maybe feebates?

We need multiple policies at all levels of government

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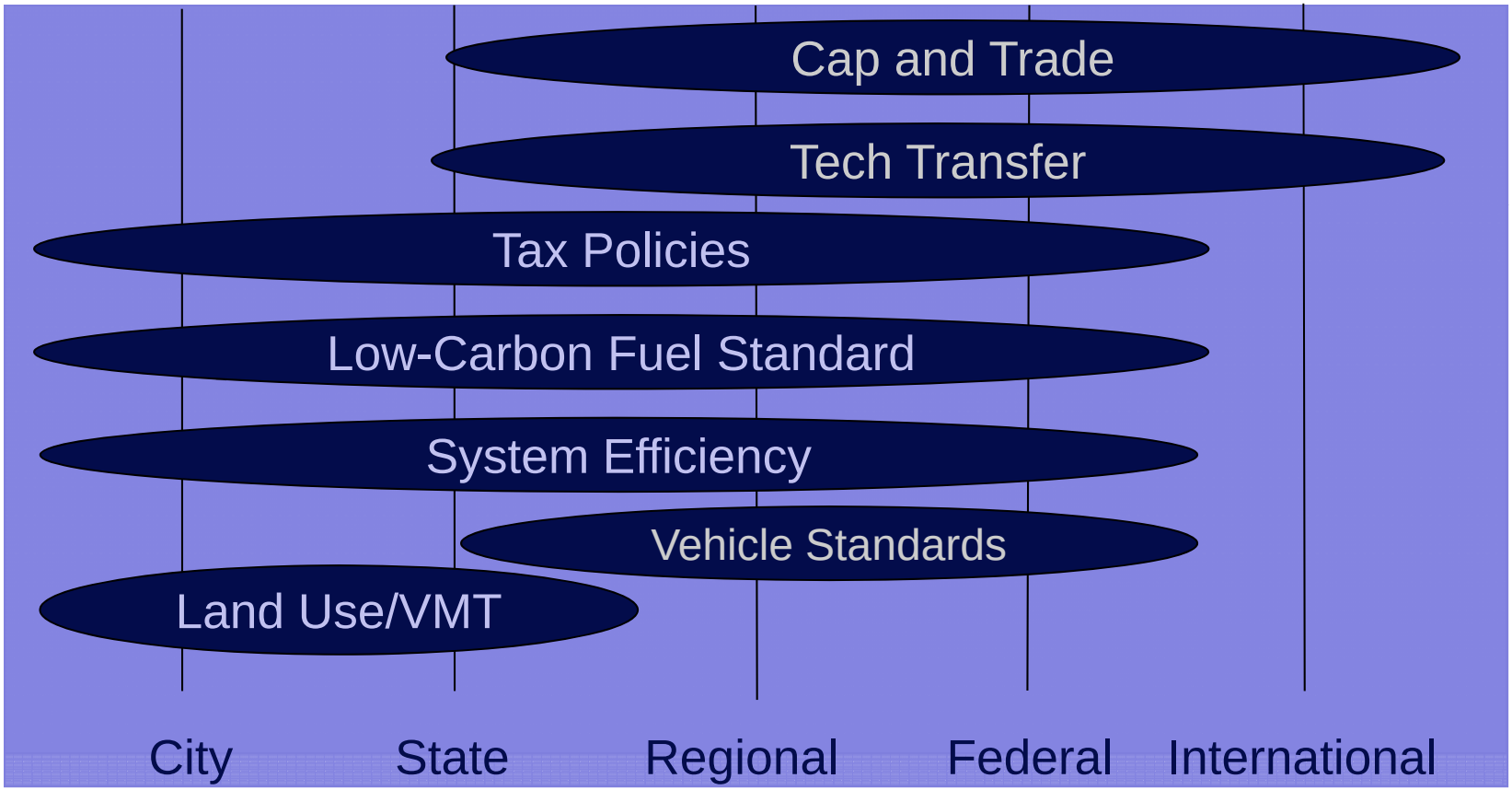

The HIGH mitigation case differs from the LOW case by greater technological progress, more extensive and intensive policies, and some degree of behavioral change

- Greater fuel economy improvement over base case:
  - LDVs: +80% vs. +35%
  - HDTs: +40% vs. + 25%
  - Aircraft fuel burn: -70% vs. -40%
- Greater reductions in the carbon intensity of energy:
  - LDVs: -47% vs. -5%
  - HDVs: -38% vs. -10%
  - Aircraft: -44% vs. -10%
- Feebates and Pay-at-the-Pump insurance added to carbon pricing and an indexed road user toll on energy.
- Greater success in improving system efficiencies and reducing VMT by means of automated highways, traffic flow improvement, trip planning and routing efficiencies, land use and infrastructure development and ridesharing.

Improving vehicle efficiency via technological change is the largest single source of CO_2 reductions, though more comes from the full range of other policies and strategies.

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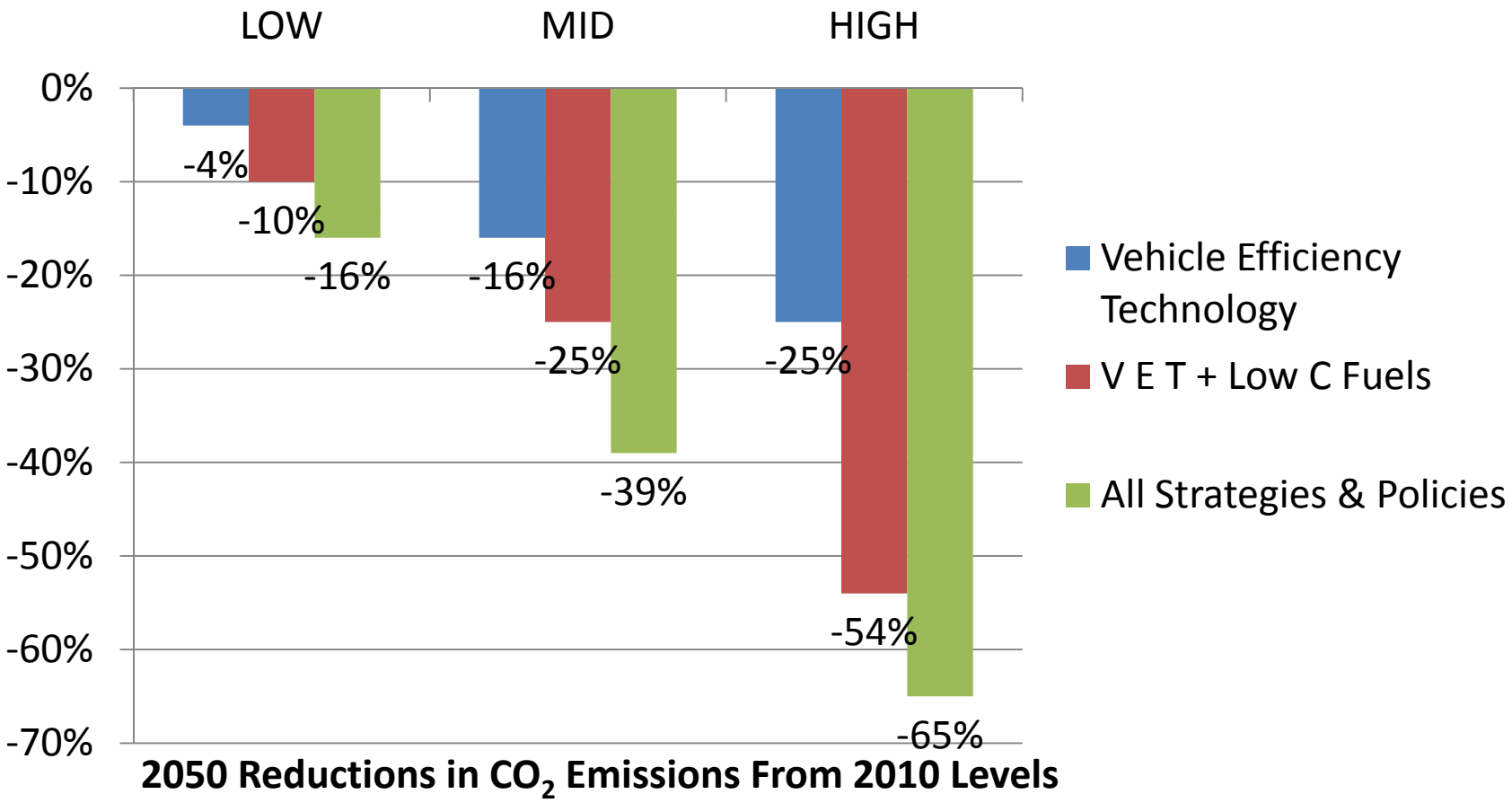

Conclusion: Take actions known to be cost-effective, invest in RDD&D, adapt policies as technology changes

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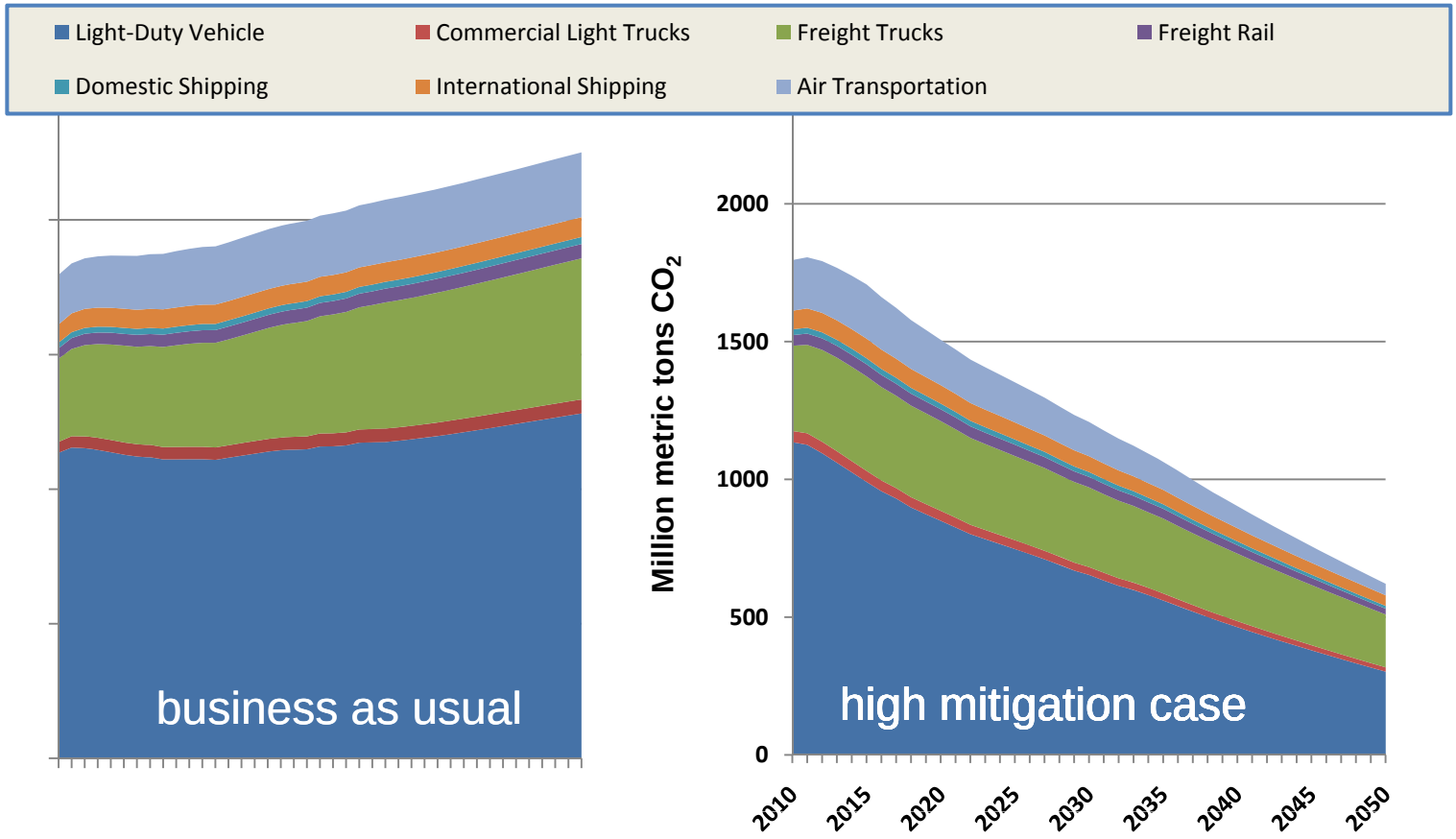

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For More Information Please Visit

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www.pewclimate.org

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Implications to State DOTs of the New PEW Center Report on Climate Change Reducing Greenhouse Gas Emissions from U.S. Transportation -

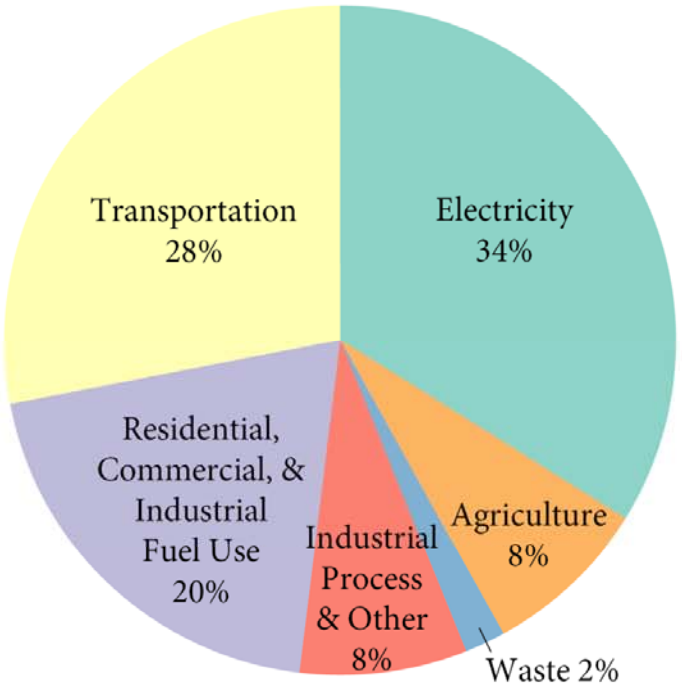
February 23, 2011

Presented by:

Paula J. Hammond
Secretary of Transportation
Washington State Department of Transportation

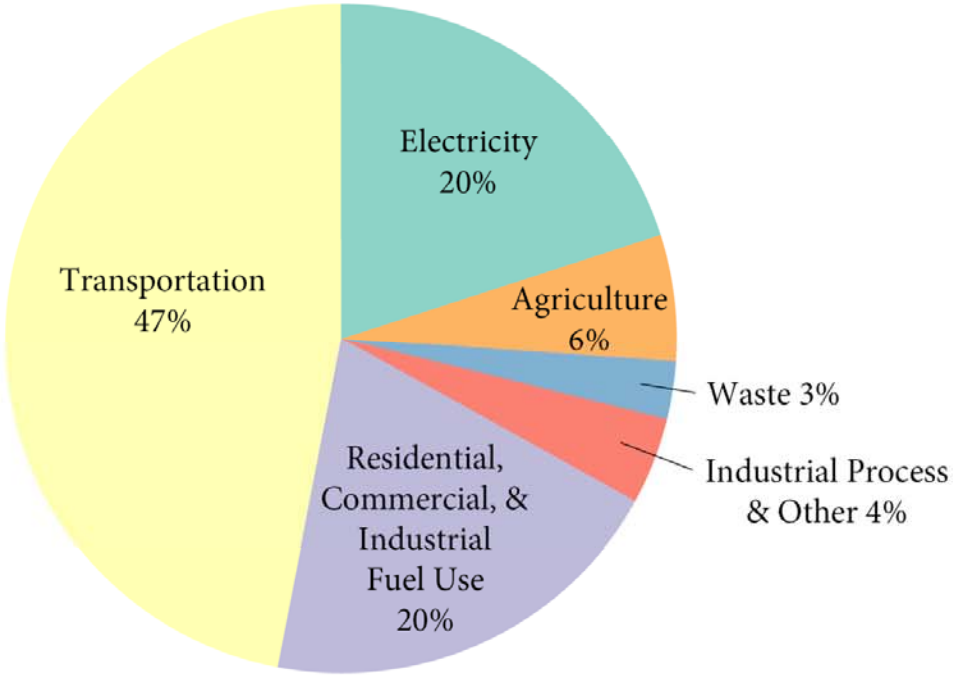
Transportation accounts for 47% of Greenhouse Gas in Washington

U.S. Greenhouse Gas Emissions



Source: Washington State Department of Ecology, 2005

Washington Greenhouse Gas Emissions



Source: Washington State Department of Ecology, 2005

WSDOT's Definition of Sustainable Transportation

At WSDOT, a sustainable transportation system is:

- A system that preserves the environment
- Durable and takes into account how we build and the materials we use
- Managed and operated using policies and strategies that meet society's present needs

without compromising the ability of future generations to meet their own needs

Moving Washington – Our practices make good environmental sense and good economic sense for Washington.

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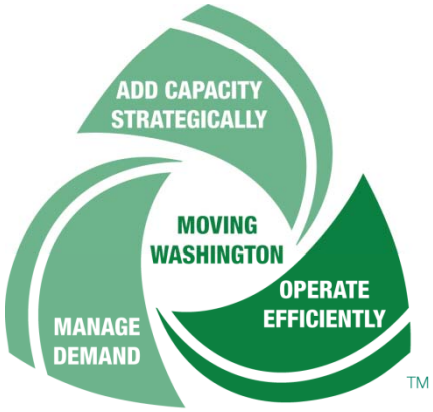

Operating Roadways Efficiently

Moving Washington improves the system's performance and generates revenue through variable pricing and other traffic management tools

Managing Demand

Providing more travel choices and options for people and freight helps improve the efficiency and effectiveness of our transportation system

Adding Capacity Strategically

Adding new capacity to our currently over-stressed transportation system is a critical component of Moving Washington

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Greenhouse Gas Reduction Strategies

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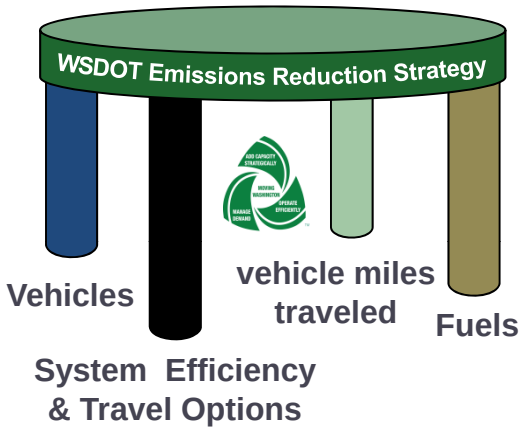
Four Legs of the Stool Plus Land Use



- **Improve fuel**
  - Lowering the carbon content of fuels
- **Advance Vehicle Technology**
  - Support improved vehicle technology
- **System Efficiency**
  - Operate our transportation system to maximize efficiency and improve traffic flow
- **Increase Options and reduce Vehicle Miles Traveled**
  - Support efficient transportation options like carpooling; working from home; riding a bus, train or bicycle; walking; or telecommuting.

PLUS

- **Land Use**
  - Leveraging transportation investments to encourage land uses that are accessible to alternative travel options

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Governor Gregoire's Executive Order 09-05

Washington's Leadership on Climate Change

Section 2(a) of the Executive Order directed WSDOT to:

- Estimate current and future statewide levels of VMT,
- Evaluate potential changes to the VMT benchmarks established in RCW 47.01.440 as appropriate to address low- or no-emission vehicles, and
- Develop additional strategies to reduce GHG emissions from the transportation sector.

Executive Order 09-05 Findings:

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- WSDOT's analysis suggests that implementing combinations of aggressive transportation emission reduction strategies **can achieve roughly a 10 percent reduction in <u>total statewide GHG emissions</u>** compared to the 2050 baseline.
- Implementing many of these strategies would require changes in policy, funding, and authority, and also **assumes ambitious improvements in vehicles and fuels.** WSDOT did not assess the political or financial feasibility of implementing the strategies.

Comparison WSDOT Report & Pew Center Report

Overall, WSDOT's scenario analysis is consistent with the Pew analysis of the reduction potential for transportation greenhouse gas emissions.

Differences:

- WSDOT analysis looked **only at on-road transportation emissions**; WSDOT did not include rail, shipping, or air.
- WSDOT's final published result was presented in terms of a **reduction in total statewide GHG emissions from an estimated 2050 baseline – roughly 10%.**

Comparison WSDOT Report & Pew Center Report

Differences: (continued)

- WSDOT results show somewhat lower reductions because WSDOT made less aggressive assumptions about the potential of reduction strategies, especially in the latter years of the analysis.
- Also, WSDOT analysis did not include eco-driving as a strategy.
  - The Pew report identifies eco-driving as having the potential for about a 10% improvement in fuel efficiency for the average driver.

What's this mean for State DOTs?

- A "sobering" assessment of the challenges we face in the transportation sector: **there is no silver bullet!**
- Even if we go ALL OUT on GHG reduction strategies, achieving a proportional GHG reduction is not a given.
- We need to make the effort now to reduce greenhouse gases, or lose opportunities to make significant reductions later.
- Sustainability and climate change efforts still make good economic sense and good environmental sense.

Resources:

- WSDOT 2010 Sustainable Transportation Report:

  http://www.wsdot.wa.gov/SustainableTransportation/report.htm

- WSDOT Sustainable Transportation Webpage:

  http://www.wsdot.wa.gov/SustainableTransportation/

For copies of these slides and webinar recording, go to AASHTO's website:
http://environment.transportation.org/center/products_programs/climate_change_webinars.aspx

These materials will also be available on AASHTO's climate change website, where you can also find more information on climate change:
http://climatechange.transportation.org/webinars/

Thank you!

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