

# Climate Change and Transportation: Cause and Effect Challenges

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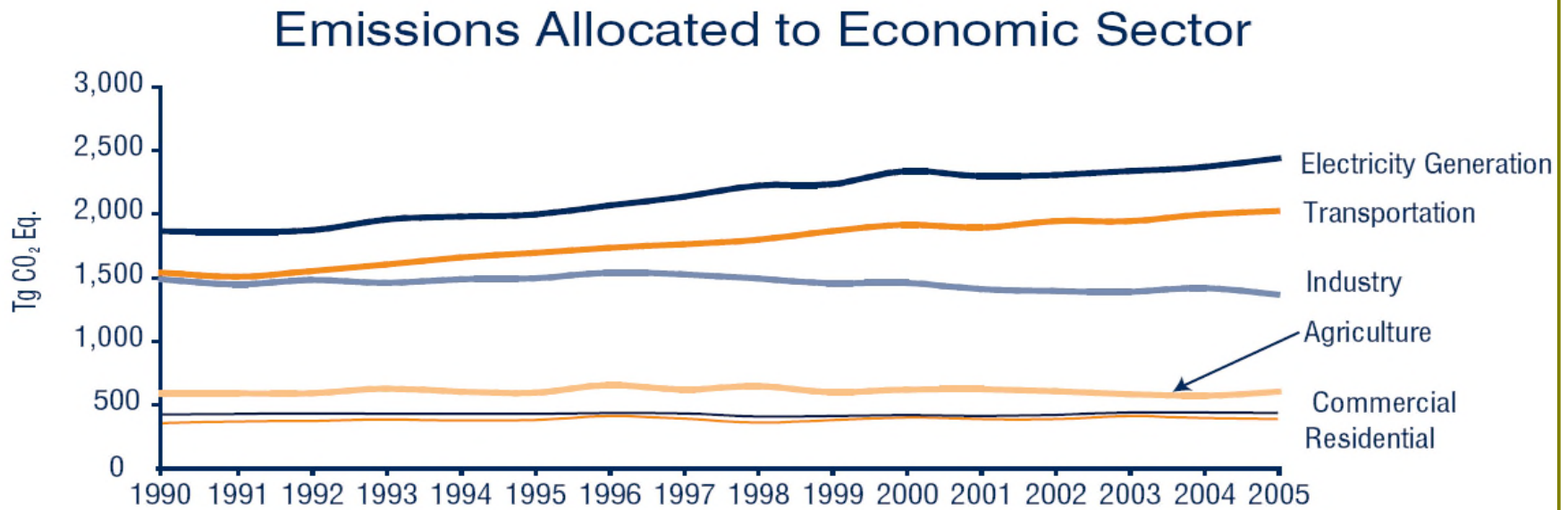
Global  
Climate  
Change:  
Transportation's  
Role in Reducing  
Greenhouse Gas  
Emissions



# The Cause



# Transportation is 28% of U.S. GHG Emissions– and Rising

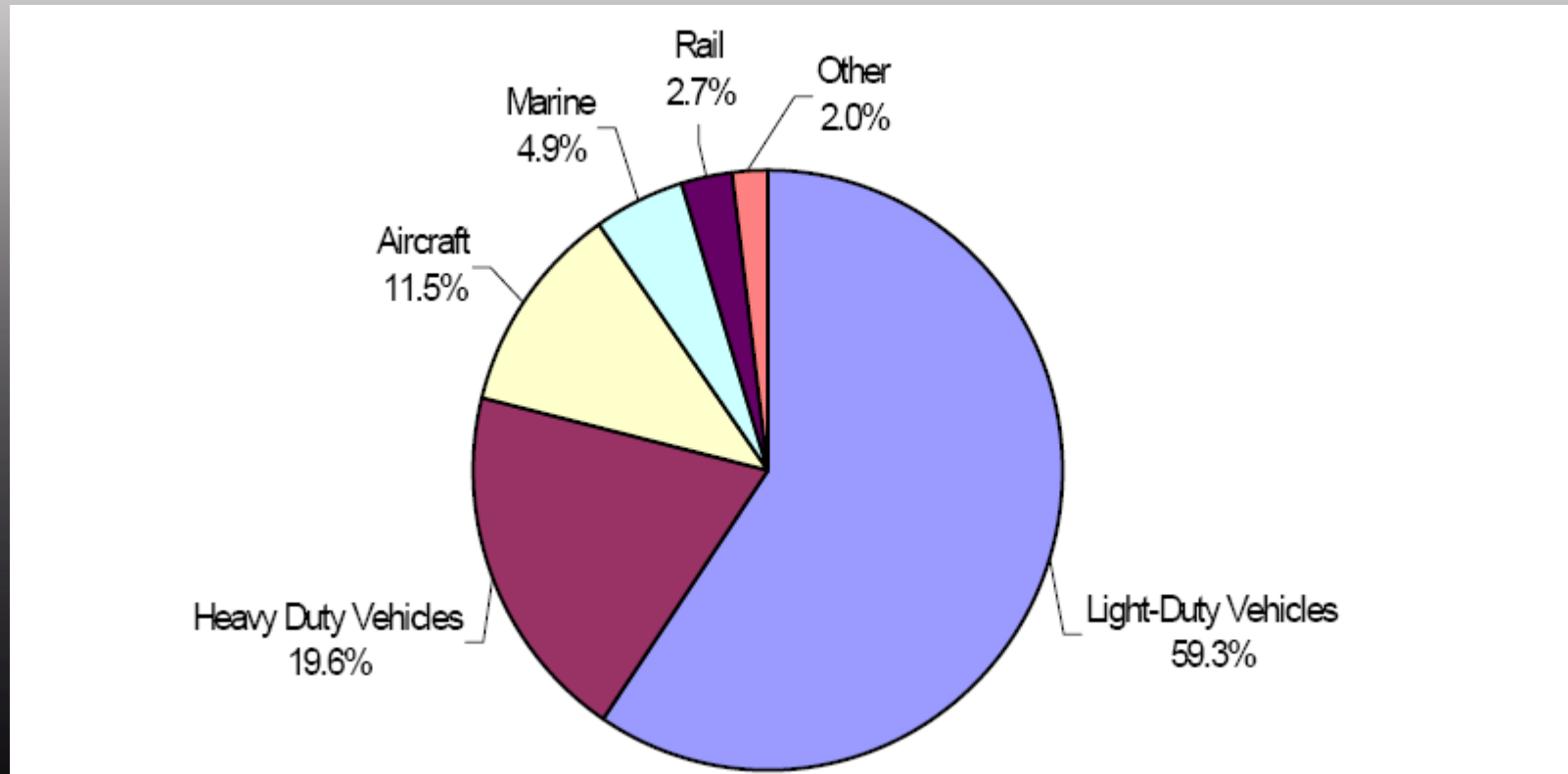


Note: Does not include U.S. territories.

Source: INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990-2005 (April 2007) Fast Facts USEPA #430-F-07-004



# Highway Vehicles (Passenger Cars and Trucks) Account for 79% of Transportation CO<sub>2</sub> Emissions (2006)



# GHG Targets Are Daunting

<b>Climate scientists</b>	<b>80% below 1990 by 2050</b>
<b>California, Montana, Florida</b>	<b>80% below 1990 by 2050</b>
<b>Oregon</b>	<b>75% below 1990 by 2050</b>
<b>Massachusetts, Vermont, New Hampshire, Connecticut, Maine, Rhode Island</b>	<b>75-85% below 2001 by 2050</b>
<b>Colorado</b>	<b>80% below 2005 by 2050</b>
<b>New Mexico</b>	<b>75% below 2000</b>
<b>Climate Security Act (Lieberman-Warner) S.2191</b>	<b>Up to 66% below current levels by 2050</b>
<b>Global Warming Reduction Act (Kerry-Snowe) S.485</b>	<b>62% below 1990 by 2050</b>
<b>Climate Stewardship and Innovation Act (McCain-Lieberman) S.280</b>	<b>60% below 1990 by 2050</b>
<b>United Kingdom</b>	<b>60% below 1990 by 2050</b>



# State Climate Plans –Transportation Elements Are All Over the Map

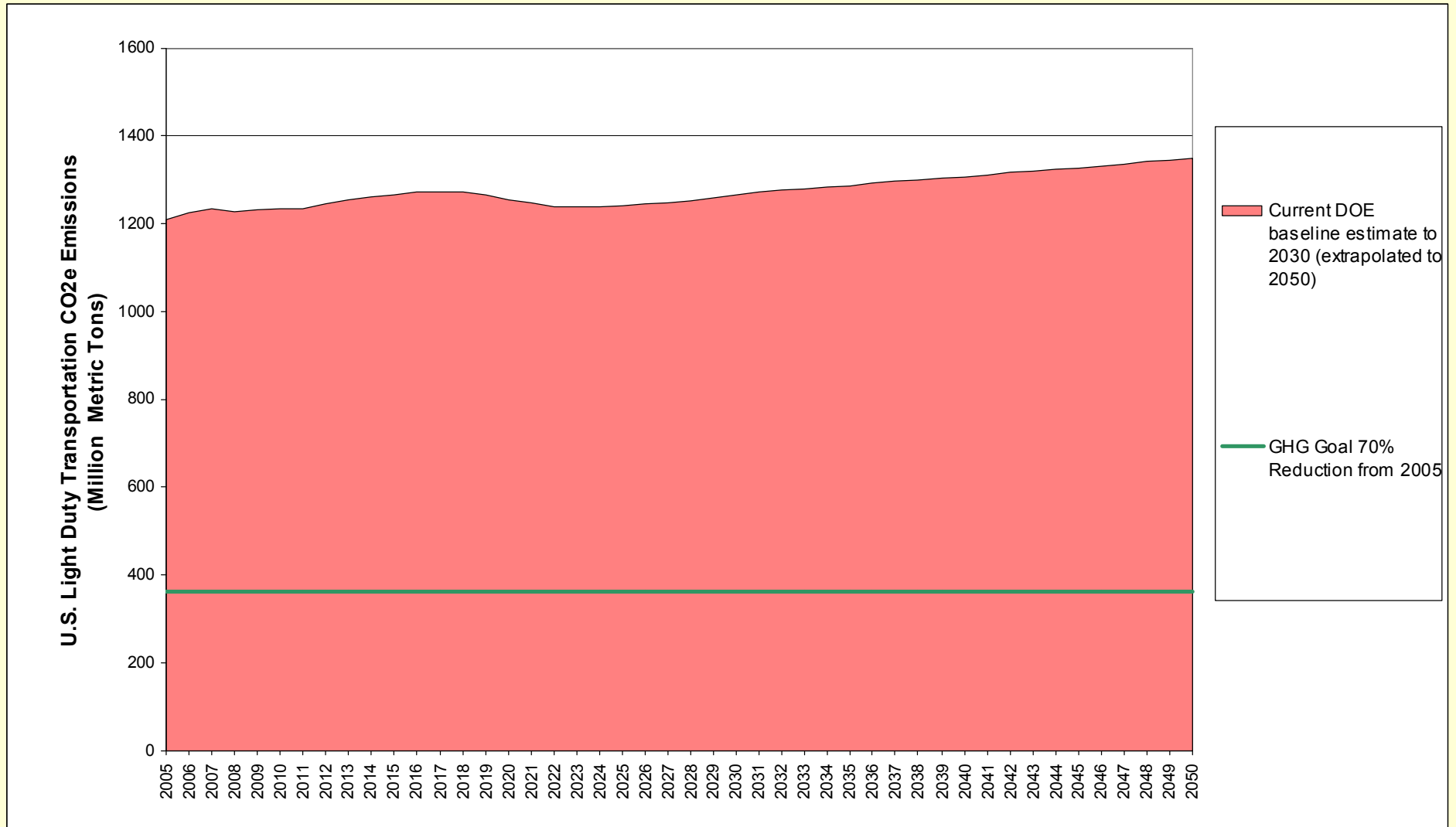
State	Year	Vehicle	Low Carbon Fuels	Smart Growth and Transit	Other
MN	2025	15%	35%	25%	25%
NC	2020	35%	12%	38%	15%
SC	2020	14%	55%	29%	1%
CT	2020	51%	38%	8%	2%
ME	2020	53%	25%	21%	1%
MD	2025	24%	12%	45%	20%
NY	2020	59%	11%	27%	4%
PA	2025	45%	36%	18%	0%
RI	2020	46%	10%	31%	14%
VT	2028	21%	14%	49%	17%



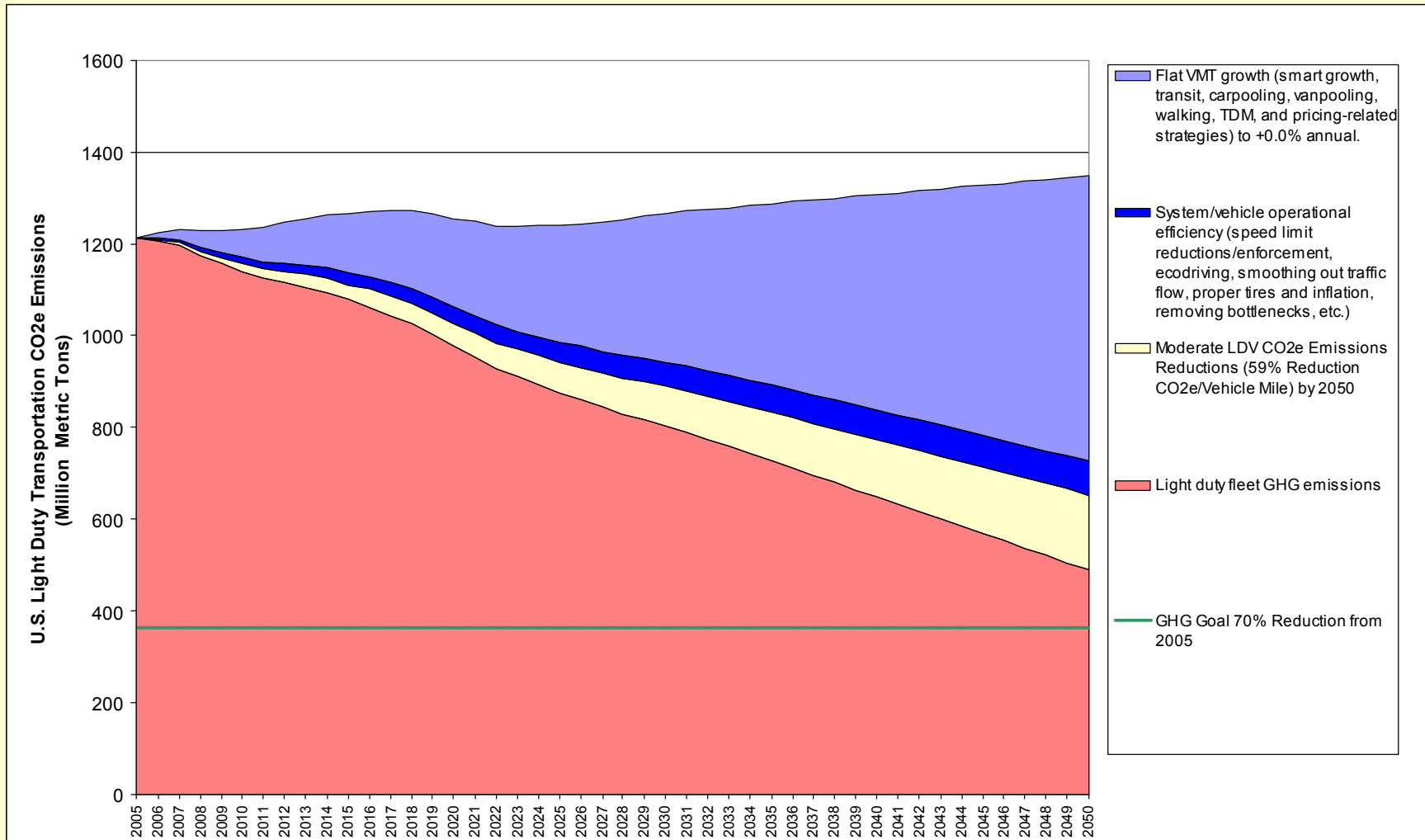
**Three scenarios  
that achieve 60 – 80% reduction in  
LDV GHG emissions below 2005  
by 2050**



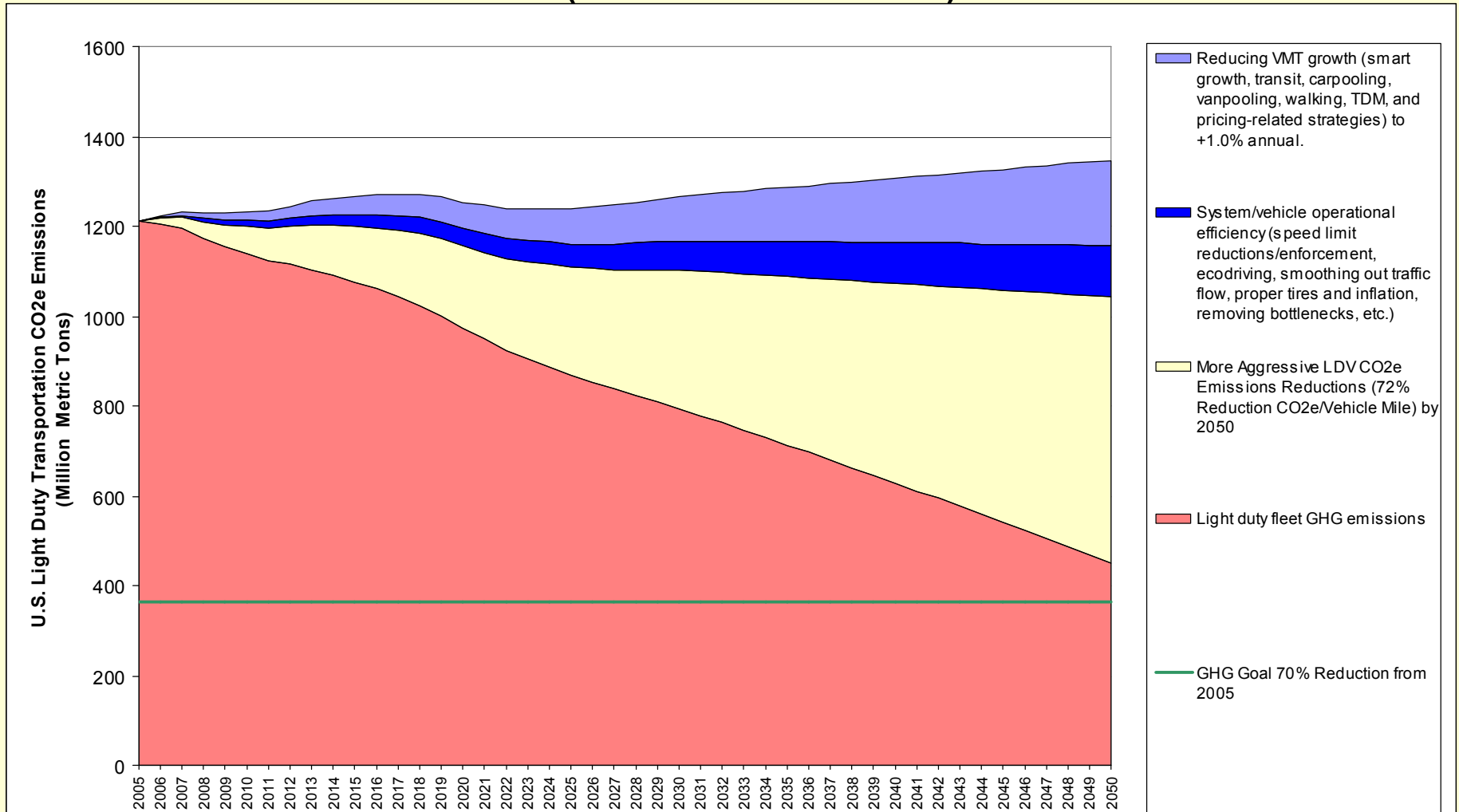
# Baseline Scenario (+11% LDV GHG)



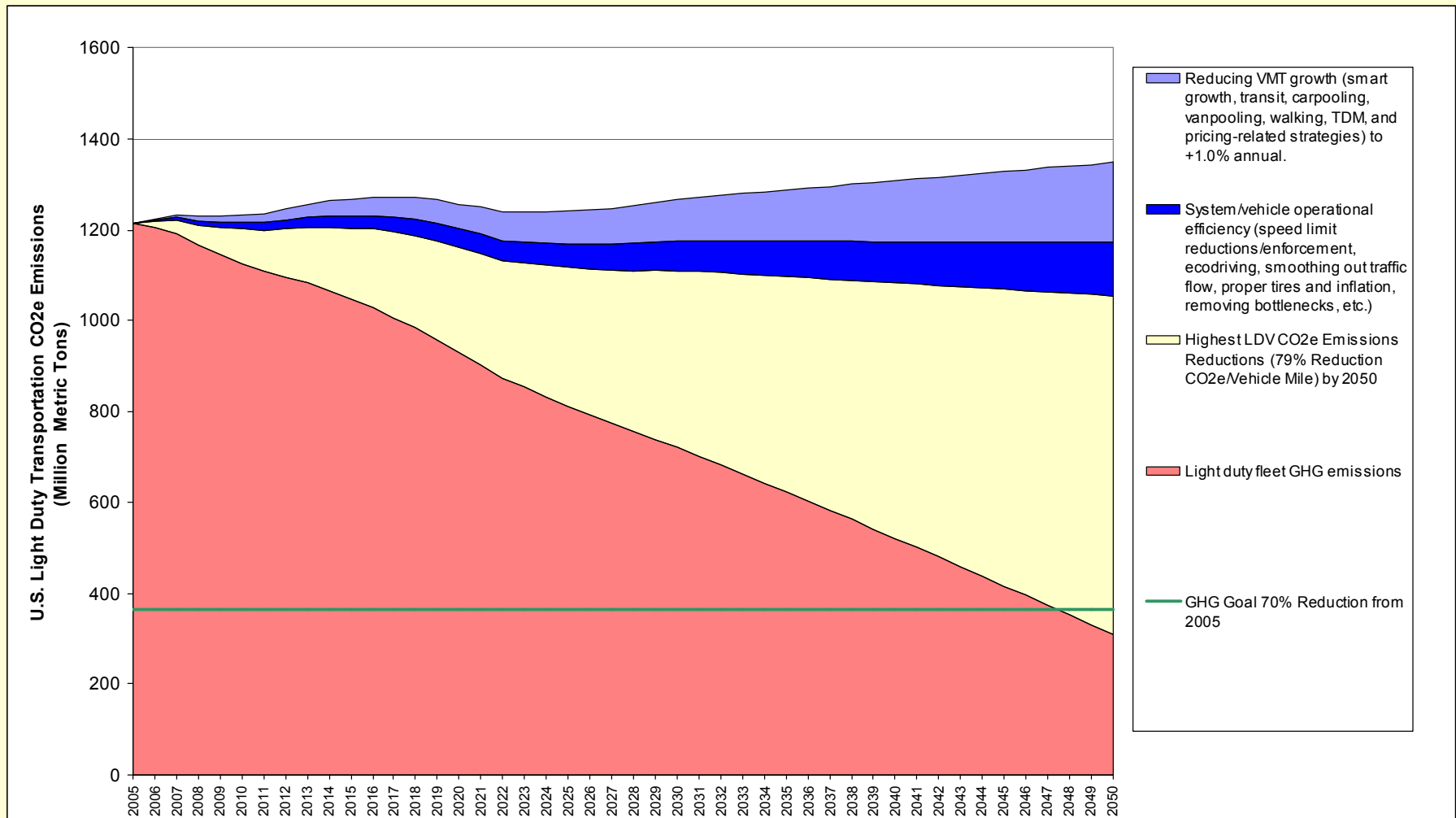
# Scenario 1: Zero VMT Growth + 50 mpgge for LDV Fleet + 5% Operational Efficiency (-60% LDV GHG)



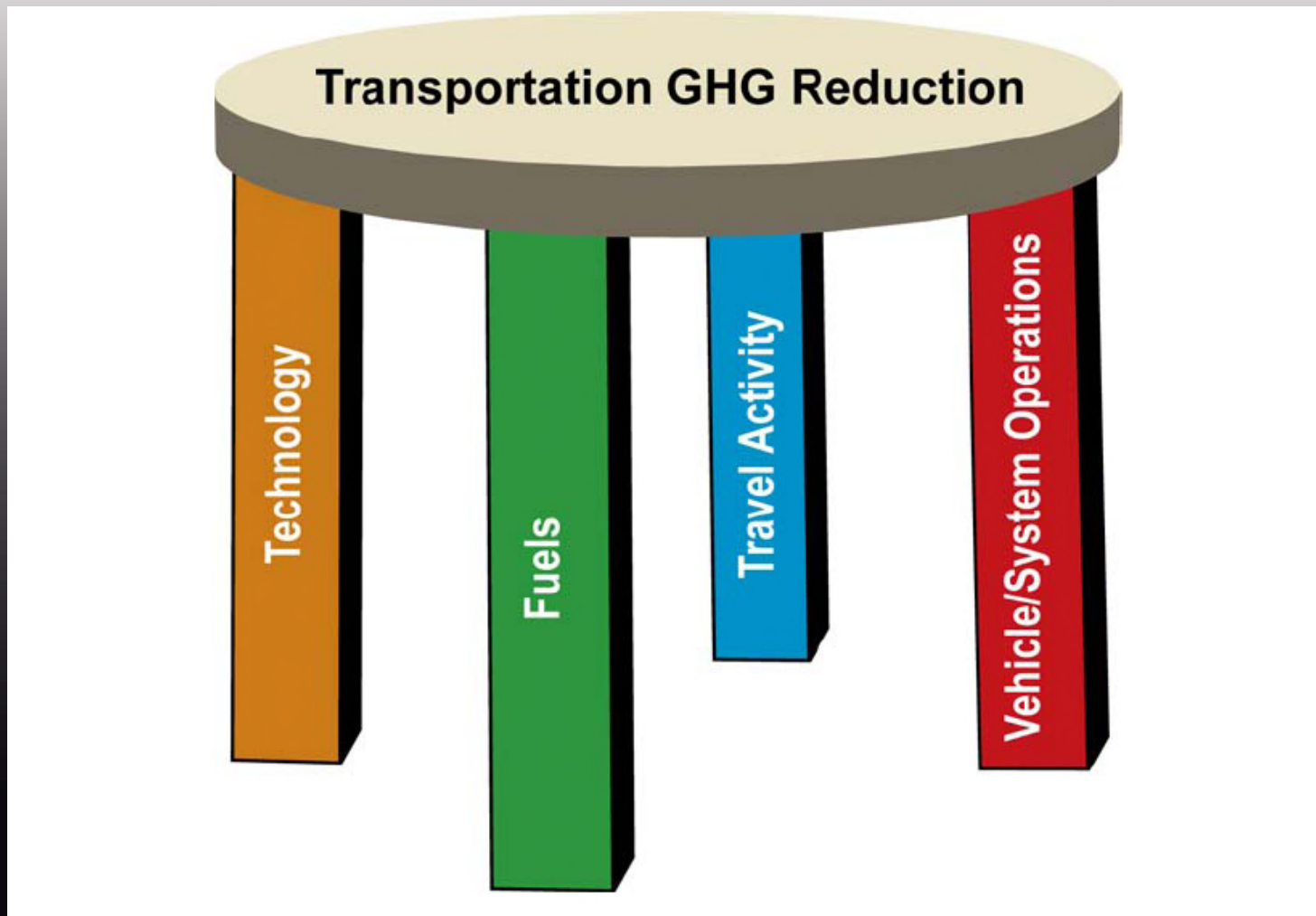
# Scenario 2: 1% Annual VMT Growth + 75 mpgge LDV Fleet + 10% Operational Efficiency (-63% LDV GHG)



# Scenario 3: 1% Annual VMT Growth + 100 mpgge LDV Fleet + 10% Operational Efficiency (-74% LDV GHG)



# Transportation GHG Reduction is a Four-legged Stool



# 1<sup>st</sup> & 2<sup>nd</sup> Legs: Vehicles & Fuels

- **50% cut in GHG/mile is feasible by 2030 from conventional technologies and biofuels**
- **Almost complete decarbonization of transport vehicles/fuels by 2050 is a “realistic ambition,” with advanced technology/fuels**
- **Electric and hydrogen fuel cell vehicles are promising paths to decarbonization – but many technology and economic issues must be overcome**



# Vehicle Technology and Fuel Changes for Passenger Vehicles

- **Plug-in Electric Hybrids**
- **Corn-based ethanol\***
- **Sugar cane ethanol \***
- **Cellulosic biofuel \***
- **Diesel biofuel\*.**
- **Hydrogen Fuel Cells**

**\* full cost accounting**



# Strategies to Reduce GHG from the On-Road Freight Sector

- **HD Vehicle Technology**
- **HD Vehicle Fuels**
- **Idle Reduction**
- **Modal Shifts**
- **Logistics**



# Vehicle/System Operations Also Matter

**10-20% LDV GHG reduction potential by:**

- **Managing speed (40-50 MPH is optimal; speed limits/enforcement could reduce road fuel use 2-4%)**
- **Reducing congestion, accel-decel**
- **Reducing poor signal timing (could reduce 1.315 MMT CO<sub>2</sub>/yr)**
- **Reducing car and truck idling**
- **Optimizing tire inflation**
- **Encouraging “eco driving”**



# Many Strategies to Reduce LDV VMT

- Economy-wide carbon cap and trade (raises fuel prices)
- Transportation pricing (PAYD insurance, parking pricing, tolls, higher user fees, cordon pricing, congestion pricing, etc.)
- Carpooling and vanpooling (currently carry 7 times as much work trip PMT as transit)
- Bike/ped and transit (but some transit is higher GHG than LDV)
- Trip chaining
- Tele-working, tele-shopping, tele-education, tele-medicine
- Compact land use



\* Lower birth rate, lower immigration, and economic recession also reduce VMT but aren't considered

# Prices Are Key to VMT Reduction

- Higher energy prices will likely reduce VMT more than any other factor, and promote energy conservation and new technologies in all sectors
- In transport, pricing can be powerful:
  - PAYD Insurance
  - Mileage fees
  - Parking pricing
  - Congestion pricing
  - Vehicle “feebates”



# What About Land Use?

- “It is realistic to assume a 30 percent cut in VMT with compact development.”
- “... smart growth could ...reduce total transportation-related CO2 emissions from current trends by 7 to 10 percent as of 2050.”
- **Assumes:**
  - 67% of development in place in 2050 is new or rehab
  - 60-90% of that development is “smart growth” (equivalent to 15 housing units per acre)

-- “Growing Cooler” by ULI, CCAP, et al, 2007



# Transit Helps – But Small in Percentage Potential

- Transit serves 1% of PMT and 0% freight in the U.S.
- APTA: Transit reduced GHG by 6.9 MMT in 2005
- This is only 1/3 of 1% of U.S. transportation GHG
- European Ministers of Transport caution: *“Modal shift policies are usually weak in terms of the quantity of CO2 abated .... Modal shift measures can be effective when well targeted, particularly when integrated with demand management measures. They can not, however, form the corner-stone of effective CO2 abatement policy.....”*
- Serves other goals – and is seen as key to land use changes



# What are Other Metropolitan Areas Doing?

## Pittsburg

Starting in 2006 the City began the process of up-dating all traffic signals to LED light fixtures. To date the City has updated 3,668 lights to LED fixtures resulting in 958,945 kWh of annual energy savings, and an equivalent CO2 reduction of over 1,000 tons.

## Chicago

Constructed 36 green roofs (vegetated garden) including the 20,300 SF garden on top of the city hall building  
Retrofitted more than 1,000 traffic lights with LEDs



# What are Other Metropolitan Areas Doing?

## Boston

The CleanAir Cabs program is replacing existing taxis with hybrid electric vehicles such as the Toyota Camry, Ford Escape, and Ford Crown Victoria. These vehicles can save roughly 47,000 tons of CO2 per year, per vehicle.

## Phoenix

Comprehensive revision of design standards for City to include additional energy standards and sustainable features.... all new City facilities will be designed and constructed to meet Leadership in Energy and Environmental Design (LEED) “Certified” level at a minimum.



# What are Other Metropolitan Areas Doing?

## Denver

Encourage best practices in conservation, use of renewables, and waste reduction commercial and residential sectors; incentivization of energy consumption; retrofitting existing homes for energy conservation and advocating better efficiency standards in new construction; and providing incentives to increase density inside an urban growth boundary.



# What are Other Metropolitan Areas Doing?

## Los Angeles

Strong focus on improving transit, fostering transit friendly land use patterns, and improving fleet efficiency...expanding the regional rail network; making underutilized city land within 1,500 feet of transit available for housing and mixed-use development; and converting 100% of Metropolitan Transportation Authority (MTA) buses to alternative fuels.



# What are Other Metropolitan Areas Doing?

## Seattle

### Mayor's Plan

#### Reduce City's Dependence on Cars

- Significantly increase supply of public transportation
- Expand bicycle and pedestrian infrastructure
- Develop and implement road tolls
- Implement new commercial parking tax
- Create more compact and walkable urban neighborhoods

#### Increase Fuel Efficiency and Use of Biofuels

- Improve fuel efficiency of city's cars and trucks
- Increase use of biofuels
- Reduce emissions from diesel sources

#### More Efficient, Cleaner Energy

- Keep City Light at net zero GHG emissions
- Increase natural gas conservation
- Strengthen state energy code
- Reduce Seattle Steam's use of natural gas



# What are Other Metropolitan Areas Doing?

## Washington State Governor's Executive order:

- Requiring the Department of Ecology to make emission-reductions plans for all of the state's top industrial greenhouse-gas polluters by next year;
- Requiring the Departments of Commerce and Transportation to come up with a way to set standards on the amount of carbon emitted during production, distribution and use of certain vehicle fuels;
- Requiring the Transportation department to negotiate new plans with the state's largest counties and regional councils to reduce driving.



# The Effect



Transportation Research Board  
Special Report 290

# Potential Impacts of Climate Change on U.S. Transportation

Prepublication Copy • Uncorrected Proofs

NATIONAL RESEARCH COUNCIL  
OF THE NATIONAL ACADEMIES



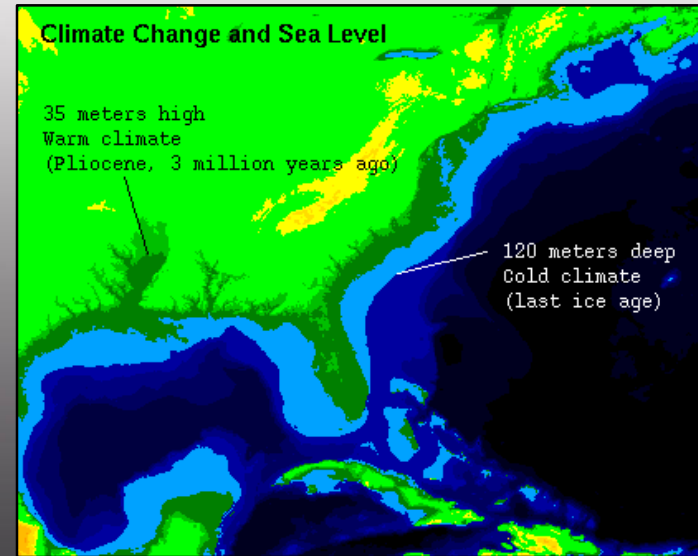
# Extreme events







# Long-term environmental changes





New 6' caps added  
to bridge piers

RailPictures.Net - Image Copyright © Trey Kunz



# Climate Adaptation Will be as Important as GHG Reduction

- “Climate change will affect transportation primarily through increases in several types of weather and climate extremes... very hot days; intense precipitation events; intense hurricanes; drought; and rising sea levels, coupled with storm surges and land subsidence.”
- “The impacts .... will be widespread and costly in both human and economic terms and will require significant changes in the planning, design, construction, operation, and maintenance of transportation systems.”

-- TRB Special Report, March 2008



Safe roads, Reliable journeys, Informed travellers



# Climate Change Adaptation Strategy

Volume 1



Department for  
**Transport**



# Conclusion

**To reduce LDV GHG by 60 – 80% by 2050:**

- Significant improvement in vehicles and fuels needed**
- Annual VMT growth ~ roughly 0% to 1%**
- By 2050 per capita VMT would be 29% less to 7% more than 2005**
- 10% to 20% improvement in network efficiency**
- Comprehensive examination of both transportation and development strategies**

