Institute of Transportation Studies
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Research Challenges: Reducing Transportation GHGs and Oil Use

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Context

- I will focus on analytical and policy issues relevant to transport community (vs technology and energy R&D)
- Will most address surface transport (not air and water transport)
- Just a few suggestions for freight

<u>General thoughts</u>

- Transport is least innovative sector
- VMT largely ignored in energy/climate debates
- Huge transformations likely … does anyone appreciate how huge this is?!
- ***Dramatic increase in research is needed to study these policies and strategies (at UC Davis and elsewhere)***

3 Strategies to Reduce GHG Emissions from Transport Sector

I. More Efficient Vehicles

II. Lower Carbon Fuels

III. Less VMT (via changes in land use, infrastructure, modal shifts, travel policies)

Two Observations

- ***80% reduction (or even 30% or so) will require transformation of oil and automotive industries, and eventually transport sector.***
  - ***Probably possible to get these reductions via technology, but it would result in a very expensive and inefficient transportation system)***
- ***I don't necessarily agree with Dr. Lew Fulton that GHG reductions are more difficult and expensive for transport than other sectors. (that is conventional wisdom that largely ignores innovation processes and changes in consumer behavior)***

A Few Thoughts on Freight Research

- How to reduce fuel consumption/GHGs of HD trucks?
  - Addressed in US Energy Act of 2007
  - New methods, approaches, data, and models needed
  - Imitate new Japanese mathematical simulation approach (accounting for different vehicle-trailer combinations and different vehicle applications)
- Very little systems data available to evaluate freight energy use
  - Implications of “just-in-time” systems, multi-modal containerization, etc?
- Ports
  - Much research needed on technologies and policies to reduce local pollution and GHGs for expanding ports (environmental justice issues)

I. Vehicles

- CAFE/GHG studies:
  - Synergies between CAFE and consumer/industry incentives (feebates, taxes, etc)
  - Policies/strategies to switch to GHG regime (eg credit trading)
- Pathways to advanced vehicle technologies
  - BEVs, HEVs, PHEVs, FCVs
  - Costs, policies, impacts, lifecycle analyses
  - New testing protocol, coordination with fuel supply, R&D gaps, demos, …

<u>Policy</u>

- Regulatory: CAFE, GHG stds, ZEV mandate
- Market: interface with carbon markets (eg, cap and trade)
- Better information feedback (eg, fuel consumption gauge and carbon-optimized nav aids for drivers, tire inflation gauge, …)

US is lagging Europe and Japan (and California?) in Reducing GHGs and Fuel Use

EU:	51 mpg in 2012 (120 g/km)	
CA:	~37 mpg in 2016	*If EPA loses (another) lawsuit and/or approves waiver request*
	~44 mpg in 2020	
US:	35 mpg in 2020	

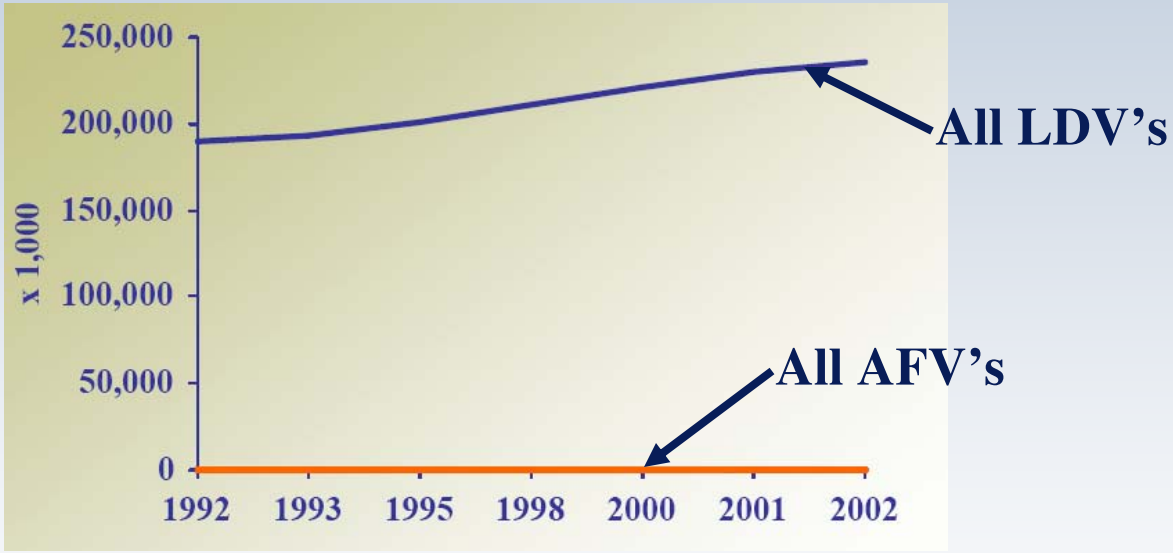
II. Fuels

- Land use effects of biofuels (biggest single issue!)
- Integrate LCFS/RFS with cap and trade?
- Compliance models for fuel providers
- Design and evaluate biofuel mandates vs RFS vs LCFS vs cap/trade vs carbon taxes
- Restructure gasoline taxes to reflect carbon content
- Fuel infrastructure strategy for alt fuels

<u>Policy</u>

- RFS, LCFS, mandates
- Market instruments: cap and trade, carbon taxes, carbon-adjusted gasoline taxes, VMT taxes, oil price floor

Many promising fuel alternatives, but long history of failures



Biofuels

Hydrogen

Electricity

III. Traveler (a): Demand for New Vehicles and Fuels

- Understand consumer behavior and increasing awareness of link between fuel consumption and global warning
- Niche markets for new fuels and vehicles: how large, demand?
- Demand for BEVs, PHEVs, HEVs, FCVs
  - Role of societal benefits and social marketing ("doing good")
  - Refueling issues (home refueling, sparse networks, GIS aids)
- Demand elasticity: price effects on vehicle purchase behavior (short and long term)
- Who buys new vehicles (top 30% income?) and implications for efficiency demand

<u>Policy</u>

- Analyze feebates and other incentives
- Analyze non-monetary incentives (parking, HOV access)

III. Traveler (b): VMT

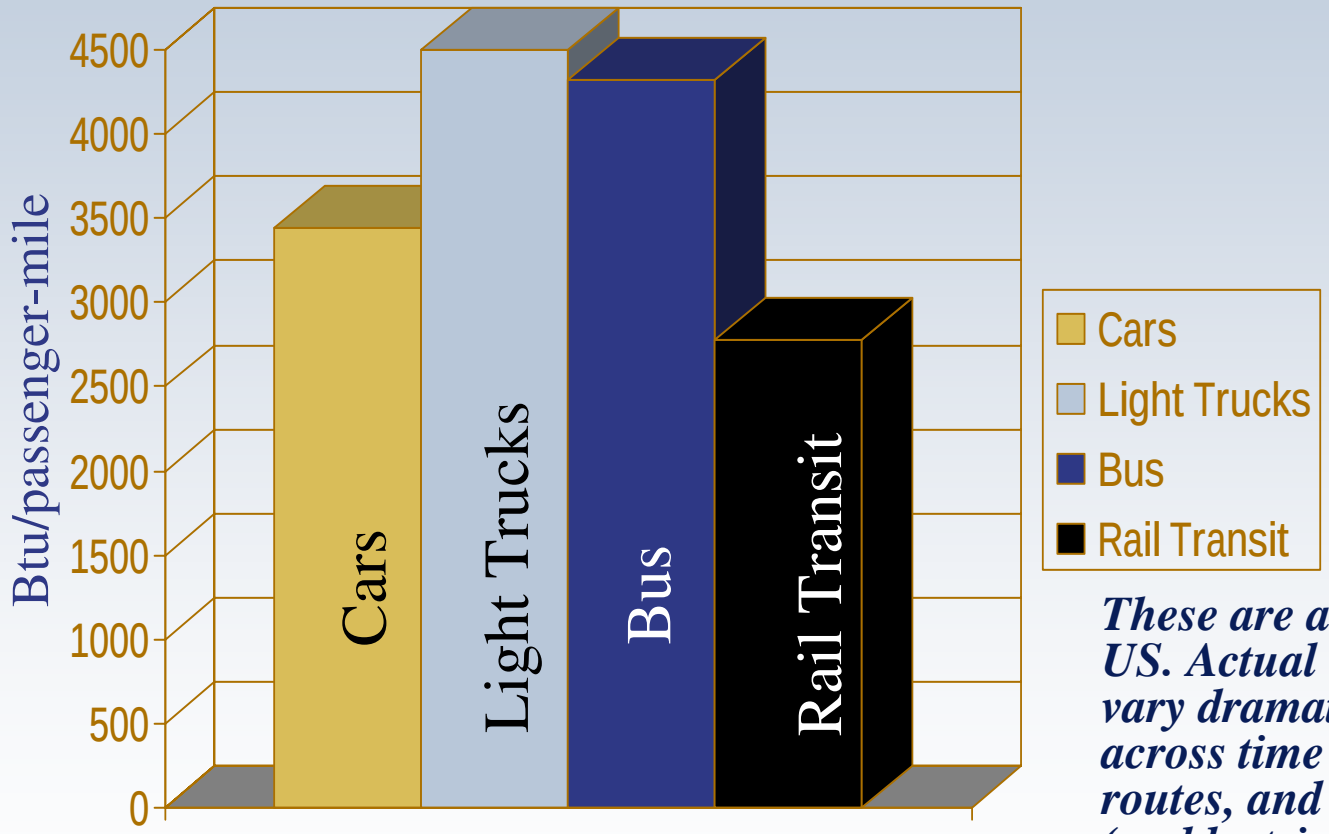
- How to fragment transportation monoculture -- to create more mobility choices that result in less carbon intensive system
- Should VMT reduction be a key strategy in GHG mitigation?
- Potential VMT and mode choice responses to pricing and other policy instruments?
- Effect of land use mgt policies?
- Need integrated LU/VMT models to analyze strategies and policies
- Need simpler compliance models for cities/counties to use with future carbon budget requirements

<u>Policy</u>

- Pricing of roads, vehicle use
- Conformity of transport and GHG plans
- City/country carbon budgets
- Modal policies ….
- Reform transit and taxi monopolies to encourage innovation
- Reform transport financing to support innovative mobility services

VMT: Need Integrated Solutions …

Expanding transit by itself does not reduce oil use and GHGs (on average). Energy intensity of buses is about same as cars. Need to combine transit reform with other strategies.



These are averages for US. Actual intensities vary dramatically across time of day, routes, and regions (and by trip purpose for cars).

Source: US DOE and ORNL, Transportation Energy Data Book, Edition 26, 2007

Two VMT Strategies (that must be pursued together)

1. Create more mobility choices so that new policy initiatives are possible
   - Use IT for smart paratransit, smart ridesharing, smart car sharing
   - Encourage neighborhood cars
   - BRT
   - Manage land use to facilitate transit, bikes, walking
2. Create durable policy framework for cities and countries
   - carbon budgets (to make them accountable for GHG impacts):

     for zoning, approvals of subdivisions, transport infrastructure decisions (California Attorney General is suing cities that don't analyze GHG impacts)

Given the huge inefficiencies and lack of innovation in the transport sector, many opportunities to create a better and less expensive system

Policy Principles

- **<u>Not</u>** pick winners
- Push responsibility downstream as much as possible (cities, HHs, companies)
- Create choice (vehicles, modes, fuels), which opens up the policy/politics envelope
- Create durable policy frameworks for carbon
  - Vehicle and fuel stds, feebates, fuel tax restructuring, “conformity” of GHG and transport plans, perhaps carbon caps for cities/counties
- Target market failures and start-up barriers (esp for non-liquid fuels)
- Reform transport sector (together with MPOs and locals)
  - Reform “transit” (esp use of innovative mobility services)
  - Encourage private investment (and innovation)
- Encourage bottom-up and top-down policy experimentation (within overlapping federal-state-local responsibilities)

Overarching Policy/Research Issues

- Should transport assume “fair share” of GHG reductions?
- Are transport GHG mitigation costs higher than other sectors? Unique market failures? (oil supply, consumer demand, R&D, etc)
- Implications of expanded mobility choices (that reduce SOV use)
  - For integrated systems of smart paratransit, dynamic ridesharing, telecommunications, smart carsharing, BRT, small vehicles, w/pricing and LU management
- Need to (re)calculate modal energy/GHG Intensities
  - Full lifecycle GHG/energy use (rail, airline)
  - More context and application specific
- Who’s in charge for GHG mgt: MPOs vs AQMDs, state vs federal. New institutional structure needed?
- How to stimulate innovation in transport community?

<u>Policy</u>

- Is transport unique? Attractiveness and effectiveness of cap and trade vs carbon taxes vs more targeted sector-specific policies
- How to integrate vehicle (CAFE), fuels (RFS/LCFS), and VMT policies
- Need US and international regulation of planes and ships

Thank You

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