

Green Fleets: Transportation Options to Address Climate Change

National Association of Counties
County Climate Protection Forum

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What Does “Green” Mean?

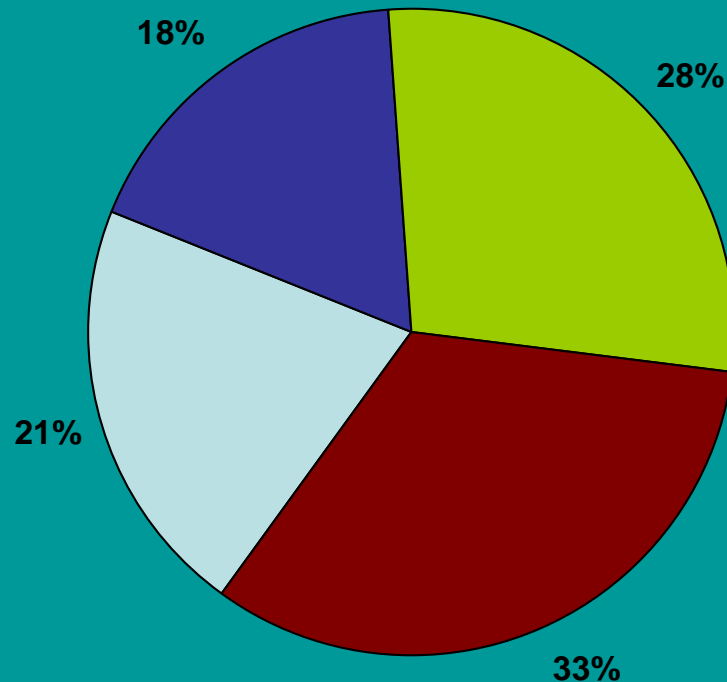
- Lower pollutant emissions?
 - Urban pollution?
 - Rural pollution?
- Lower GHG emissions?
- Better water quality?
- Improved soil?
- Lower energy dependence?



Why Vehicles?

U.S. Carbon Emissions by End-Use Sector, 2005

- Transportation accounts for roughly 1/3 of U.S. GHG emissions
- Light-duty vehicles alone account for roughly 1/5



Residential Commercial Industrial Transportation

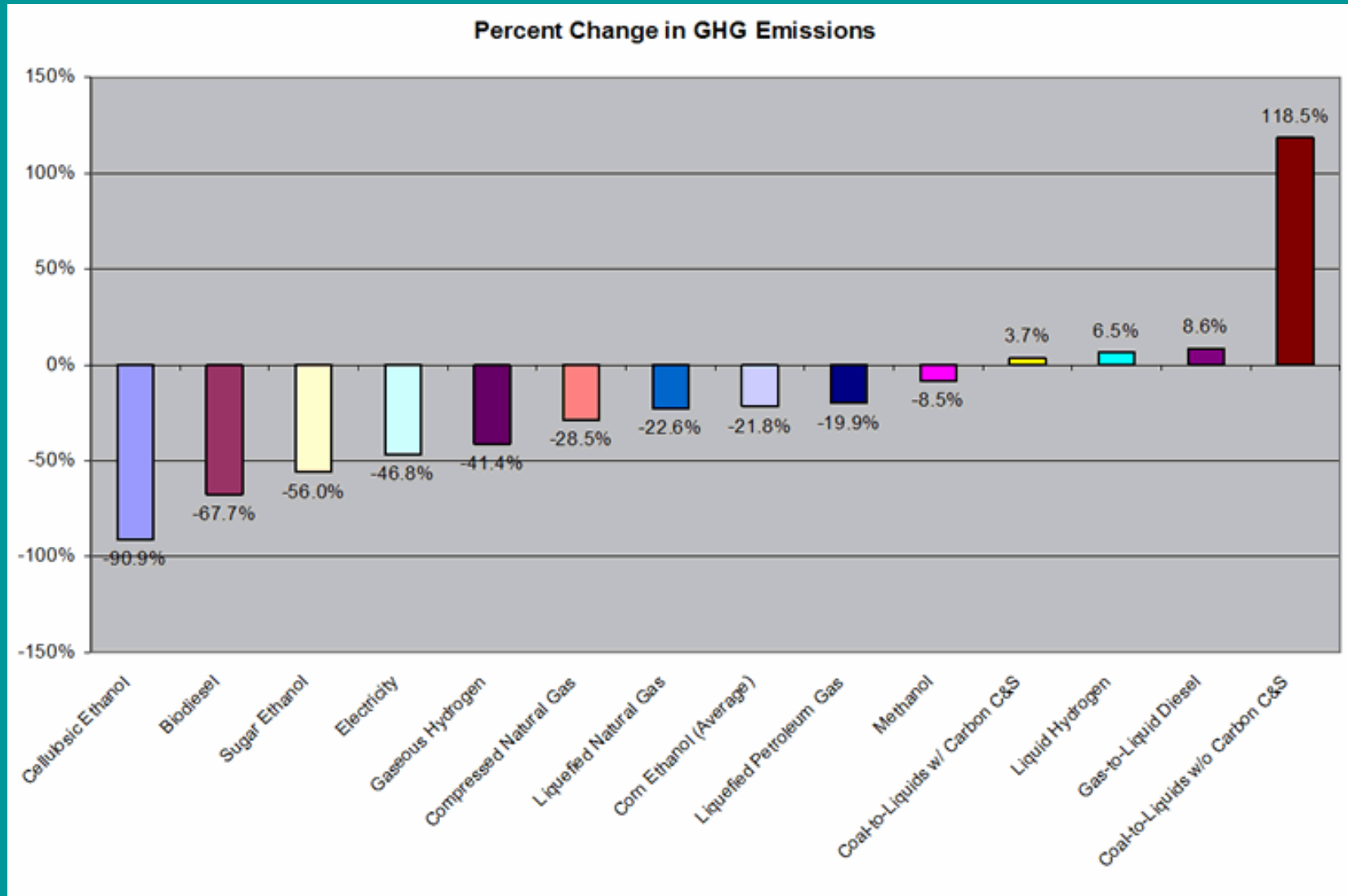
Many Options for Fleets

- Decisions vary depending on policy goal
- One technology may promote one facet of “going green” while undermining another

Climate Change Poses a Particular Challenge

- Unlike air quality, where location of emissions matters, global greenhouse gas emissions are the concern
- Entire life-cycle of fuels and vehicles must be considered
 - Much of this analysis continues under development

Fuel-Cycle Emissions



U.S. EPA, *Greenhouse Gas Impacts of Expanded Renewable and Alternative Fuels Use*, April 2007. <http://epa.gov/otaq/renewablefuels/420f07035.htm>

For Climate Change, Conservation May be More Effective than Alternative Fuels

- Simply replacing a gallon of gasoline with an alternative fuel may not lead to GHG reductions
- Each gallon of fuel conserved reduces GHG emissions

**But conservation alone will likely not be
enough to meet GHG reduction goals**

Current Options

Technologies

- Efficient Gasoline Engines
- Clean Diesel Engines
- Gasoline Hybrid Electric
- E85 Flexible Fuel Vehicles
- Natural Gas Vehicles (CNG & LNG)
- Propane Vehicles

Fuels

- Reformulated Gasoline
- Corn Ethanol
- Biodiesel and Renewable Diesel
- Natural gas
- Propane
- P-series
- Methanol

Efficient Gasoline Vehicles

- Pros
 - Available today
 - Many models with 30+ mpg
 - Use existing gasoline infrastructure
 - Lower GHG emissions
- Cons
 - Upper limits on fuel economy
 - Don't eliminate need for fossil fuels
 - Limited grant \$ available for conventional technology
 - Reduction in pollutant emissions?



Clean Diesel Vehicles

- Pros
 - Better fuel economy: some vehicles with 40+ mpg
 - Heavy-duty applications
 - Use current infrastructure
- Cons
 - Don't eliminate need for fossil fuels
 - NO_x, PM emissions may exceed conventional gasoline vehicles
 - Upper limits on fuel economy



Gasoline Electric Hybrids

- Pros

- Greater efficiency than conventional vehicles
- Federal tax incentive*
- Use current infrastructure

- Cons

- Considerably higher initial investment (lifetime fuel savings may or may not make up difference)
- Don't eliminate need for fossil fuels



* Tax-free entities may be able to negotiate a lower sale price

E85 Flexible Fuel Vehicles

- Pros
 - Somewhat lower (~15%) GHG emissions with corn ethanol
 - Only slightly higher cost than conventional
 - Can run on gasoline or E85
 - Can significantly displace petroleum consumption (but not necessarily total fossil fuel consumption)
 - Allow switch to cellulosic ethanol in the future
- Cons
 - Currently limited E85 pumps outside of Midwest
 - Some pollutants may actually increase (especially in rural areas)
 - Concerns over corn production (water quality, land use, food vs. fuel, etc.)



Natural Gas Vehicles

- Pros

- Greater efficiency than conventional vehicles
- Federal tax incentive*
- Use existing natural gas supply infrastructure
- ~20%-30% lower GHG emissions
- Generally lower pollutant emissions
- Heavy-duty applications



- Cons

- Considerably higher initial investment (lifetime fuel savings may or may not make up difference)
- Does not eliminate need for fossil fuels
- Requires additional pumping systems



* Tax-free entities may be able to negotiate a lower sale price

Propane Vehicles

- Pros
 - Significant supply infrastructure
 - ~20% lower GHG emissions
 - Generally lower pollutant emissions
- Cons
 - Does not eliminate reliance on fossil fuels
 - May require new pumping equipment

Fuels

- Reformulated Gasoline (RFG)
 - Lower pollutant emissions
 - May lead to slight increase in fuel-cycle GHG emissions relative to conventional gasoline
 - Still dependent on fossil fuels
- Corn Ethanol
 - Production expanding rapidly
 - Tax incentives lower pump price
 - ~15% to ~20% reduction in GHGs
 - Significant petroleum displacement
 - Limited reductions in total fossil fuel use
 - Concerns over air, water quality

Fuels

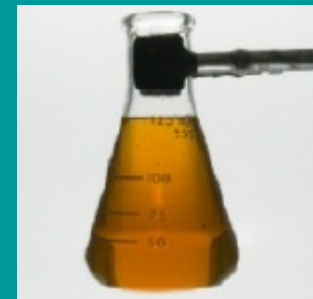
- Biodiesel and Renewable Diesel
 - Can be used in existing diesel engines
 - Can be blended with conventional diesel
 - Lower GHG emissions
 - Generally lower pollutant emissions
 - Higher cost
- Natural Gas, Propane, Methanol, P-Series
 - Still dependent on fossil fuels
 - Lower GHG emissions
 - Pollutant emissions may increase or decrease

Emerging Technologies

- Plug-in Hybrids



- Fuel Cell Vehicles



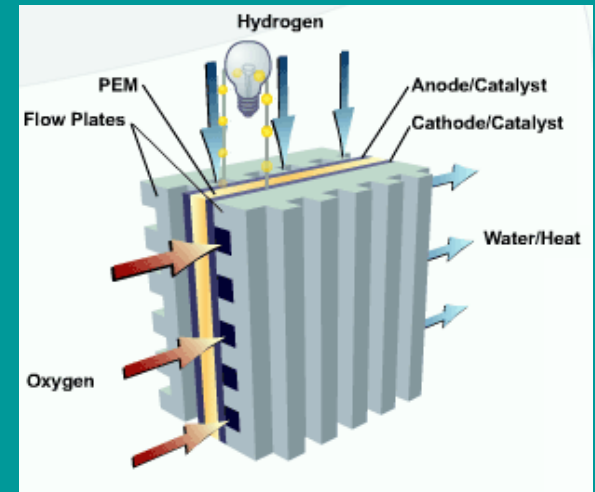
- Cellulosic Biofuels

Plug-in Hybrids

- Larger batteries and additional electronics permit charging on grid power
- Allow use of “all-electric” mode
- When batteries are depleted, combustion engine engages
- Development of high-capacity, long-life batteries is key
- Electricity can be generated from any primary energy source
- **GHG effects dependent on electricity source**

Fuel Cell Vehicles

- Can operate on hydrogen from any energy source
 - Renewable energy, coal, nuclear, etc.
- Zero or near-zero emissions from vehicle
 - But fuel cycle emissions can be high, depending on primary energy source
- Currently very expensive
- On-board fuel storage still a key question



Cellulosic Biofuels

- Liquid fuel: easy storage
- Can be used in existing and future engines
- Generally better environmental footprint than corn ethanol or soy diesel
- Significant GHG reductions (up to ~90%)
- Industry is still in R&D stage
 - First commercial scale U.S. demonstration plants online 2009-2011, with significant government support

Resources for Fleets

Department of Energy

- Clean Cities Program:
<http://www.eere.energy.gov/cleancities/>
 - Information resources, contacts, funding opportunities
- State Energy Program:
http://www.eere.energy.gov/state_energy_program/
 - Funding for various state programs

Resources for Fleets Foundations

- StEPP (Strategic Environmental Project Pipeline) Foundation:
<http://www.stepfoundation.org/main.htm>
 - Funding for clean energy projects
- Center for a New American Dream – Responsible Purchasing Network:
http://www.responsiblepurchasing.org/purchasing_guides/fleets/
 - Purchasing guides, carbon-neutral fleets

Conclusion

- Types of “Green” fleet vehicles depends on policy goals
 - Climate, Air Quality, Petroleum Use, etc.
- Wide range of options
- Most reduce GHG emissions by some amount

Discussion

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