

Global Warming



Ready, Set, Electrify: Preparing for Cleaner Cars

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*Energy and Transportation Convergence:
Challenges and Opportunities for Electric Grid Modernization*
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Deep Reductions in Transportation Emissions Will Be Needed to Achieve Climate Stabilization



World GHG Transport Emissions

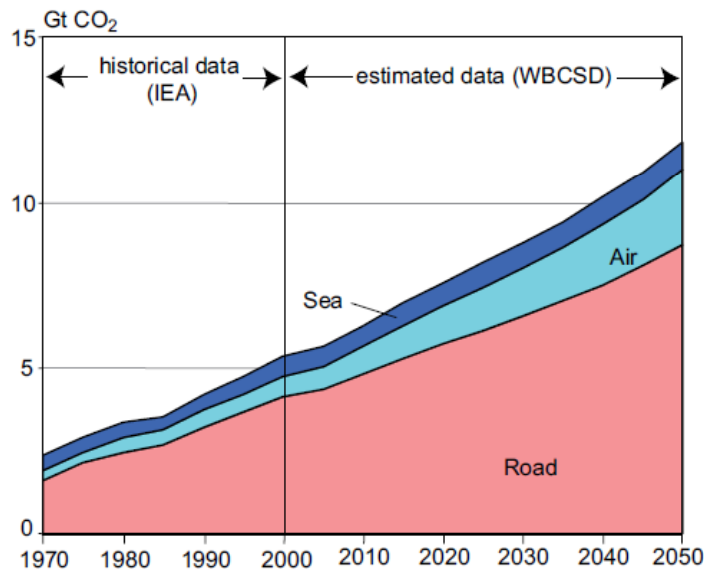
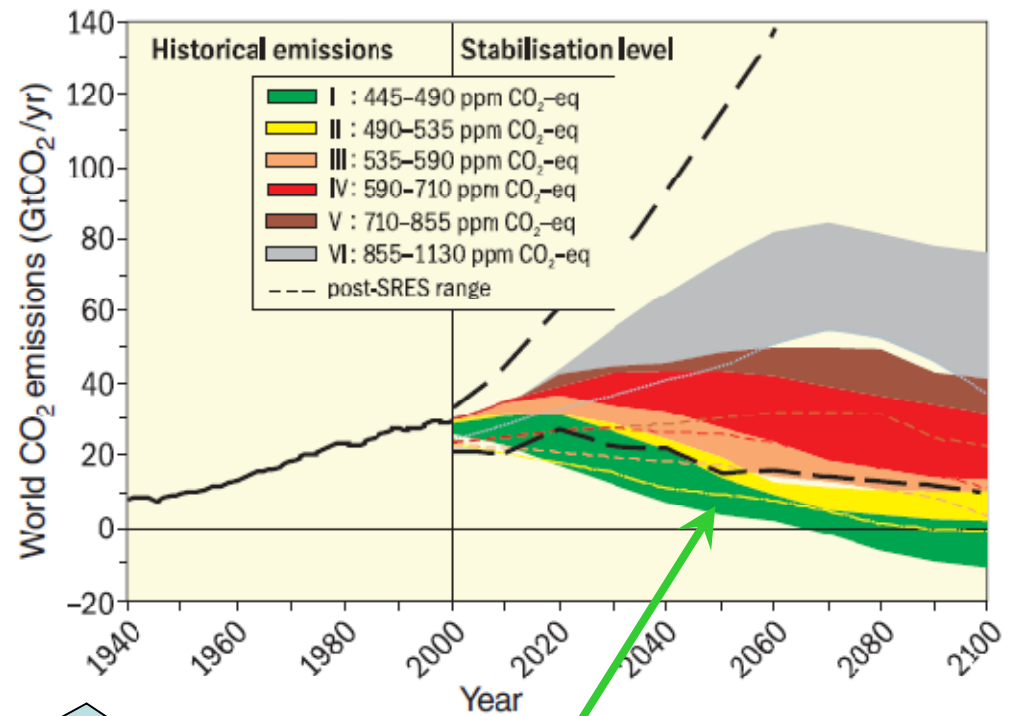


Figure 5.4: Historical and projected CO₂ emission from transport by modes, 1970–2050
Source: IEA, 2005; WBCSD, 2004b.

IPCC Climate Stabilization Scenarios

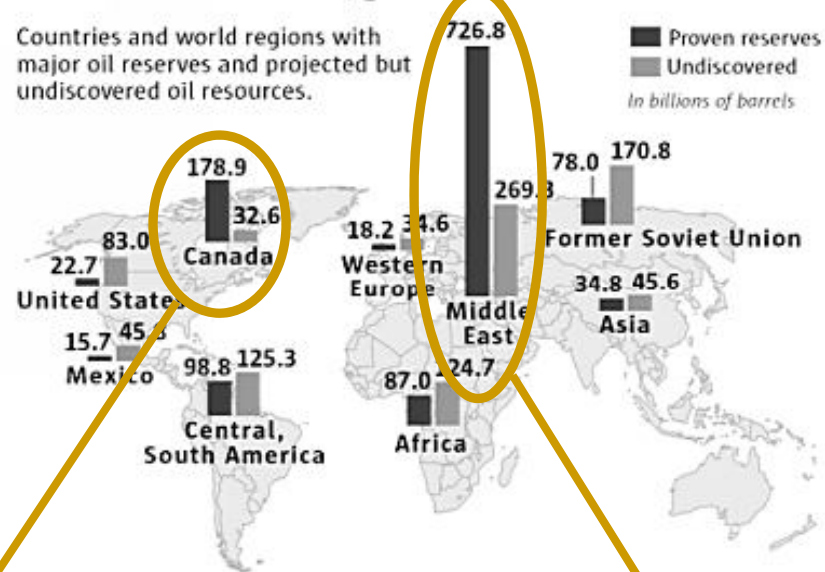


Green avoids the most severe consequences of climate change

Why Transportation is Critical: Energy Security

Oil sources, present and future

Countries and world regions with major oil reserves and projected but undiscovered oil resources.



Source: Energy Information Administration

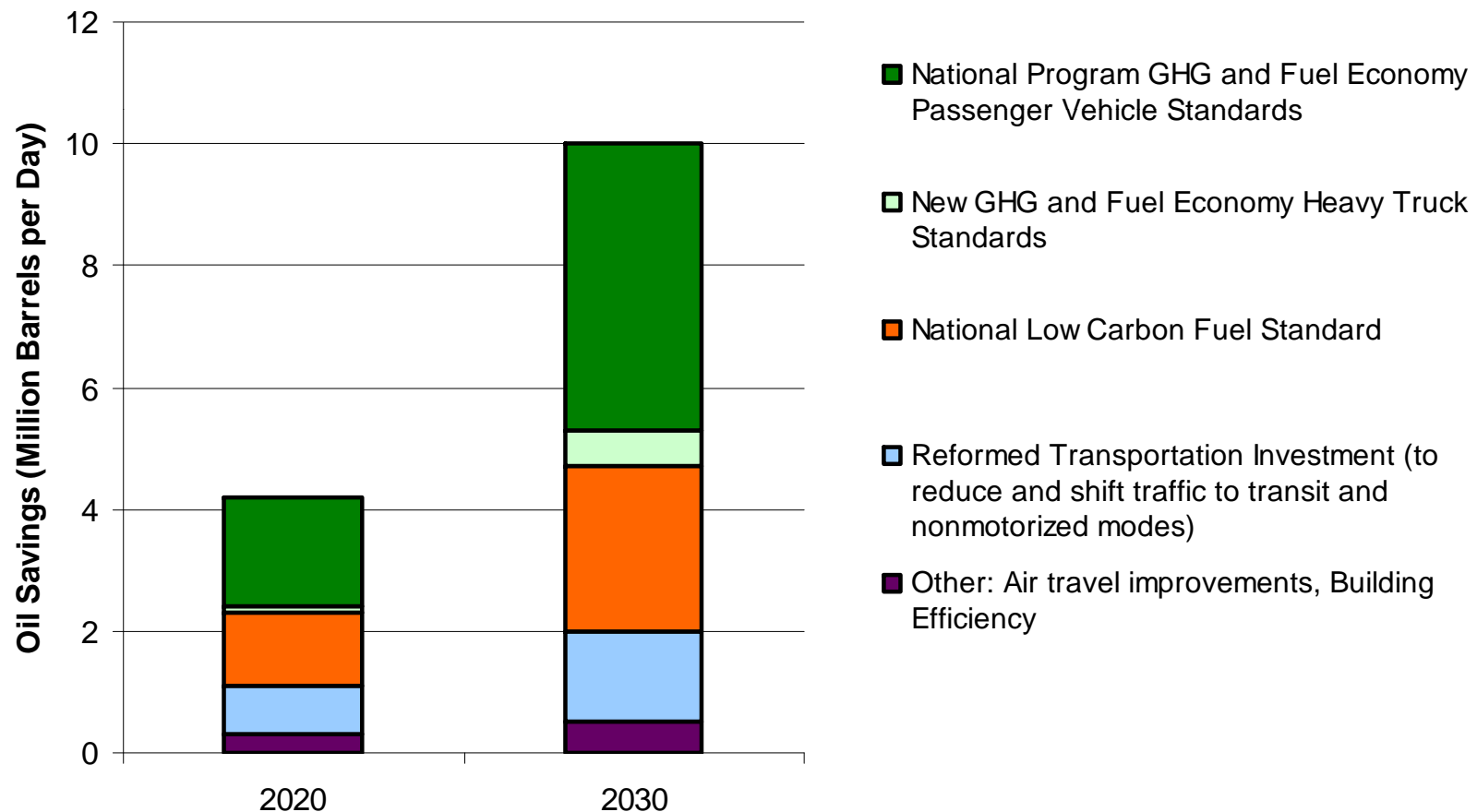
KNIGHT RIDDER NEWSPAPERS



Clean Energy Saves Oil



In 2020, U.S. can save more oil (4.2 mbd) than projected imports from the Middle East and Venezuela (3.3 mbd).

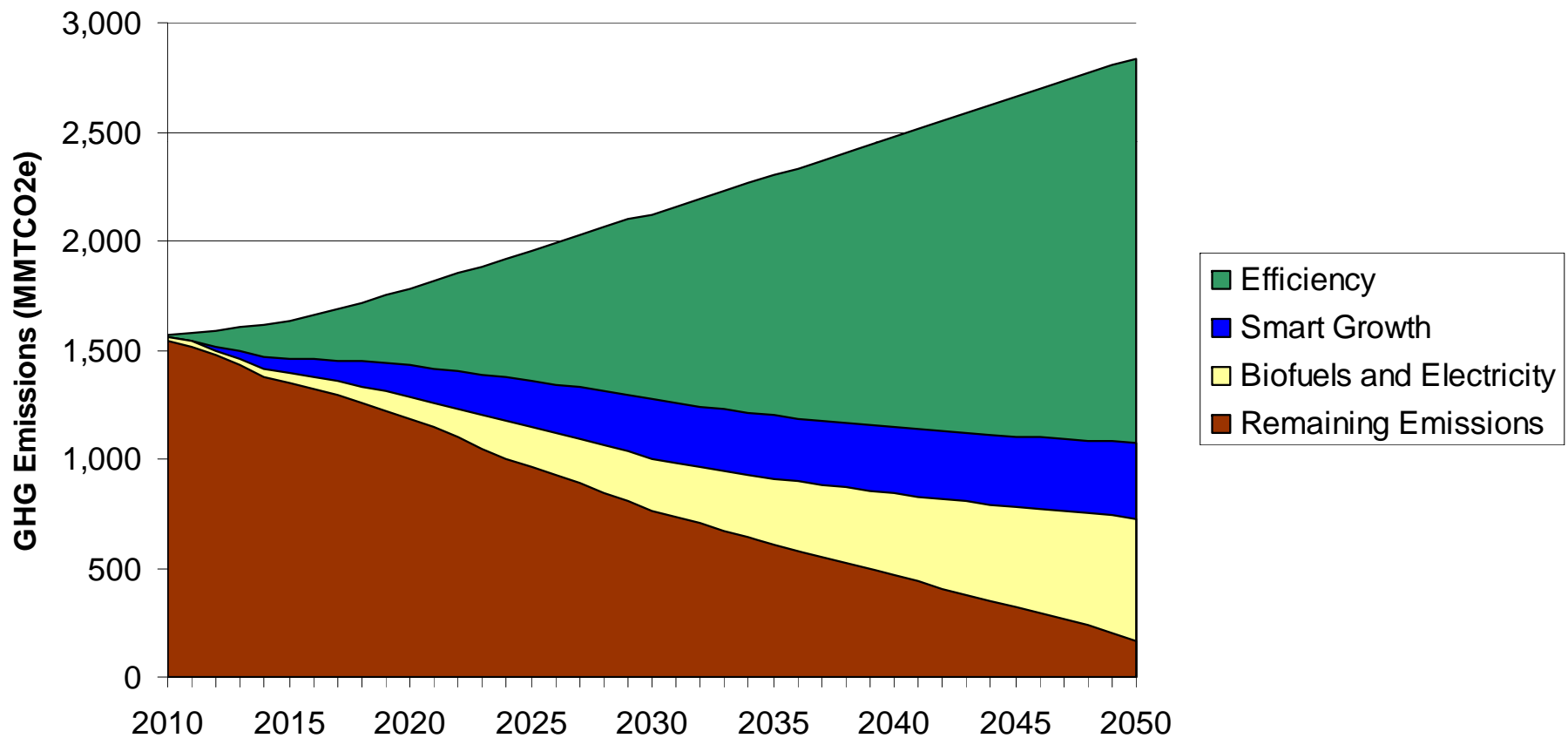


Source: NRDC Analysis

Electric Vehicles: An Essential Component of a Comprehensive GHG and Security Strategy



Reaching 80% Reduction Targets in the Light-Duty Vehicles



Source: NRDC Analysis

Study Demonstrates Environmental Benefits of Plug-in Vehicles



Environmental Assessment of Plug-in Hybrid Vehicles

Volume 1: Nationwide Greenhouse Gas Emissions

Volume 2: United States Air Quality Analysis Based on AEO-2006 Assumptions for 2030

Joint report available at: www.epri-reports.org

NRDC plug-in info: www.nrdc.org/energy/pluginhybrids.asp

Electric Drive will Significantly Reduce GHG Emissions and Oil Consumption



EPRI-NRDC Study Results:

GHG Emission Reductions (MMT _{CO₂e})		Electric Sector CO ₂ Intensity [2050 Annual Emissions Change from 2010]		
		High [+25%]	Medium [-41%]	Low [-85%]
PHEV Fleet Penetration [2050 % New Vehicles]	Low [20%]	163	177	193
	Medium [62%]	394	468	478
	High [80%]	474	517	612

- All regions experience GHG reductions
- Middle case (468 MMT) equivalent to taking 82 million cars off the road and saving 3.7 million barrels of oil per day
- Max benefit case (612 MMT) provides additional 31% savings

How can plug-in vehicles encourage renewables in the grid?

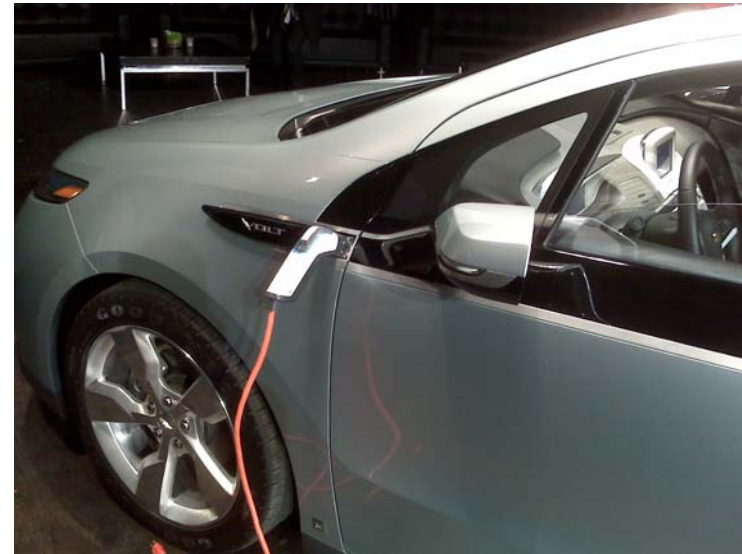


- Flexible demand of plug-ins can be aligned with renewables generation
 - Requires intelligent charging but not V2G
- If plug-ins can be a flexible supply, then renewables can be a larger portion of the generation mix
 - Potentially allows wind to displace coal or older natural gas
 - Value of storage comes from handling long-duration (multi-hour) variability of renewables
 - Denmark can support high wind penetration (~20%) because inter-connected Norway & Sweden hydro systems can be adjusted for long time periods, effectively acting as storage for the wind
 - V2G required but challenges are significant
 - Grid and vehicle management
 - Deep battery cycling, driving up costs



Plug-Ins Are Coming: Time to Prepare

- Chevy Volt E-REV
- Ford Escape Flex-fuel Plug-in Hybrid
- Ford Focus EV
- Mitsubishi iMiEV
- Nissan Leaf
- Toyota Prius Plug-in Hybrid
- Tesla, Fisker, Coda...



Source: Mitsubishi Press iMiEV Press Kit from Autobloggreen.com

Guiding Principles for Utility Commission Electric Transportation Programs



- Reduce barriers for consumers to “fuel switch” through plug-in electric vehicles.
- Ensure the environmental benefits of plug-in electric vehicles are maximized.
- Minimize electricity grid impacts and maximize potential grid benefits.
- Ensure cost-effective service for utility customers.

More details in Environmental Coalition filing to CA PUC, Proceeding R0908009, <http://docs.cpuc.ca.gov/PUBLISHED/proceedings/R0908009.htm>

1. Reduce barriers for consumers to “fuel switch” through plug-in electric vehicles.



- Foster coordination between utilities, automakers and permitting authorities to:
 - Install and/or upgrade infrastructure at consumer locations to allow utilities to manage load in efficient and environmentally preferred manner
 - Update building codes
 - Streamline permitting processes for charging equipment so consumers can operate vehicles ASAP after purchase
 - Reduce battery costs
 - Explore stationary batteries as first and second use
 - Explore battery leasing arrangements
 - Develop voluntary pilot programs to understand charging behavior, vehicle use patterns, local grid impacts and effectiveness of TOU rate structures

2. Ensure the environmental benefits of plug-in electric vehicles are maximized.



- Encourage development of utility programs that:
 - Provide additional incentives for customers who install renewable, distributed generation such as solar either at their home or business, or purchase renewable energy in order to charge their vehicles;
 - Provide customers with timely information on the net energy, cost, and emission savings associated with plug-in vehicles;
 - Educate customers on the desirability of selecting time-of-use rates and allowing for efficient load management services;
 - Encourage the most energy efficient types of plug-in vehicles, on a kWh per mile basis, by developing consumer energy efficiency programs modeled on successful state and/or federal appliance efficiency programs;
 - Encourage utilities to maximize the integration of intermittent, renewable resources with plug-in vehicles, including maximizing the potential for demand response and vehicle-to-home or vehicle-to-grid applications. Utilities can partner with automakers that are currently developing communication technologies for the vehicle and grid.

3. Minimize electricity grid impacts and maximize potential grid benefits.



- Develop policies that encourage utilities and third party providers to deploy devices and policies that support load management
 - Avoid charging during peak demand periods
 - Requires understanding of consumer needs
 - Align electric vehicle demand with renewable generation
- Continue to explore V2G for regulation services and storage

4. Ensure cost-effective service for utility customers.



- As plug-in demand increases, utility costs to meet load will increase. Utilities and plug-in vehicle owners can help minimize costs by investing in active load management.
 - Energy efficiency programs are key
 - In theory, plug-in demand could lower generation costs by better utilization of existing baseload capacity → faster cost recovery on assets and increased plant efficiencies.

Federal Policies to Encourage Electric Transportation



- National Program for New Vehicle GHG Emissions and Fuel Economy
 - Harmonizes CAFE, EPA GHG and CA GHG authorities;
 - Proposed rules reach 250 gCO₂/mi and about 35 mpg in 2016
- Federal Clean Energy and Climate bills
 - H.R. 2454, American Clean Energy and Security Act (“Waxman-Markey”)
 - S. 1733, Clean Energy Jobs and American Power Act (“Kerry-Boxer”)
 - Through allocations, funds approximately \$25B in advanced vehicle development and manufacturing retooling
 - \$4-5B dedicated to electric-drive vehicle efforts
 - Specifically encourage or require development of utility programs for electric vehicle integration with the grid
- Low Carbon Fuel Standards (LCFS)



A LCFS Will Generate Investment in the Fuels Market for Activities that Reduce GHGs



- Performance-based, technology-neutral approach as opposed to specific volume mandates
- Guarantees specific reductions in emissions intensity and necessarily reduces petroleum use
- Inclusive of all transportation fuels including electricity, natural gas, hydrogen → RFS leaves non-biofuels out
- Provides certainty and value for fuel producers of low-carbon fuel production. Provides long-term direction to investors and fuel producers.
- Ensures full carbon accounting and requires fuel producers to account for high carbon liability
- With proper safeguards, the LCFS can prevent unintended consequences (e.g. indirect land use change, extraterritorial emissions, losses of ecosystem services)

Conclusion



- Plug-in vehicles are essential part of a clean energy strategy to cut global warming pollution and wean us off oil.
 - Over the next few decades, both the electric power and transportation sectors must make very large reductions in emissions to avoid dangerous consequences of climate change. Key to reaching this goal is the coordination of the auto and electric power industries
- Utility commissions and utilities should work with other stakeholders and authorities to encourage:
 - Consumer switching to plug-in vehicles by making it easy
 - Maximization of environmental benefits with renewable integration (concentrated and distributed), vehicle performance incentives, education, pricing structures and load management
 - Minimize grid impacts and costs through energy efficiency programs and load management
 - Maximize potential grid benefits by continuing to explore V2G potential