Central New Mexico Climate Change Scenario Planning Project:

Greenhouse Gas Emission & Mitigation Strategies

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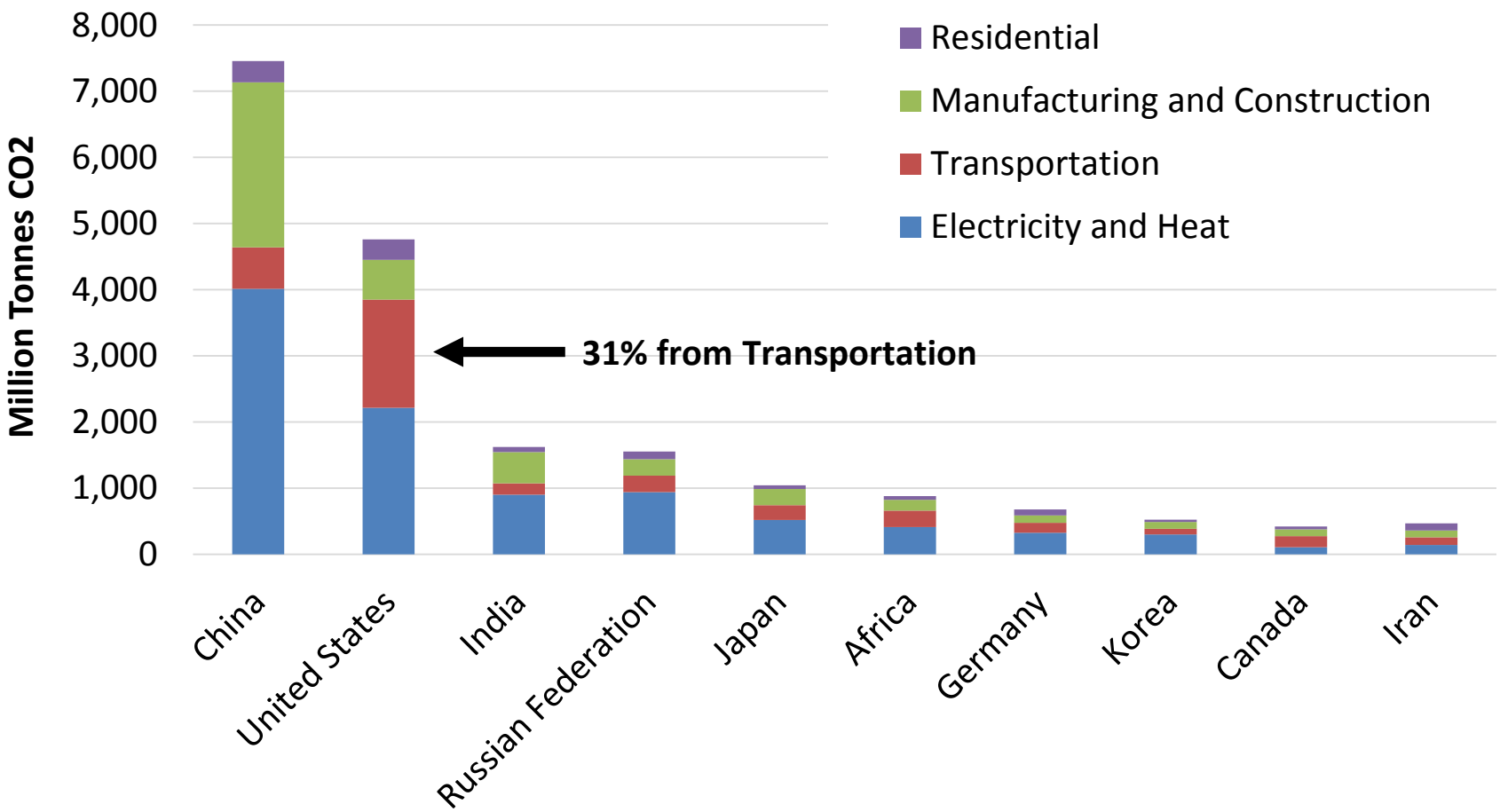
Where do greenhouse gases (GHGs) come from?



data from: CO2 Emissions from Fuel Combustion, 2013 Edition, IEA, Paris

U.S. GHGs by Sector

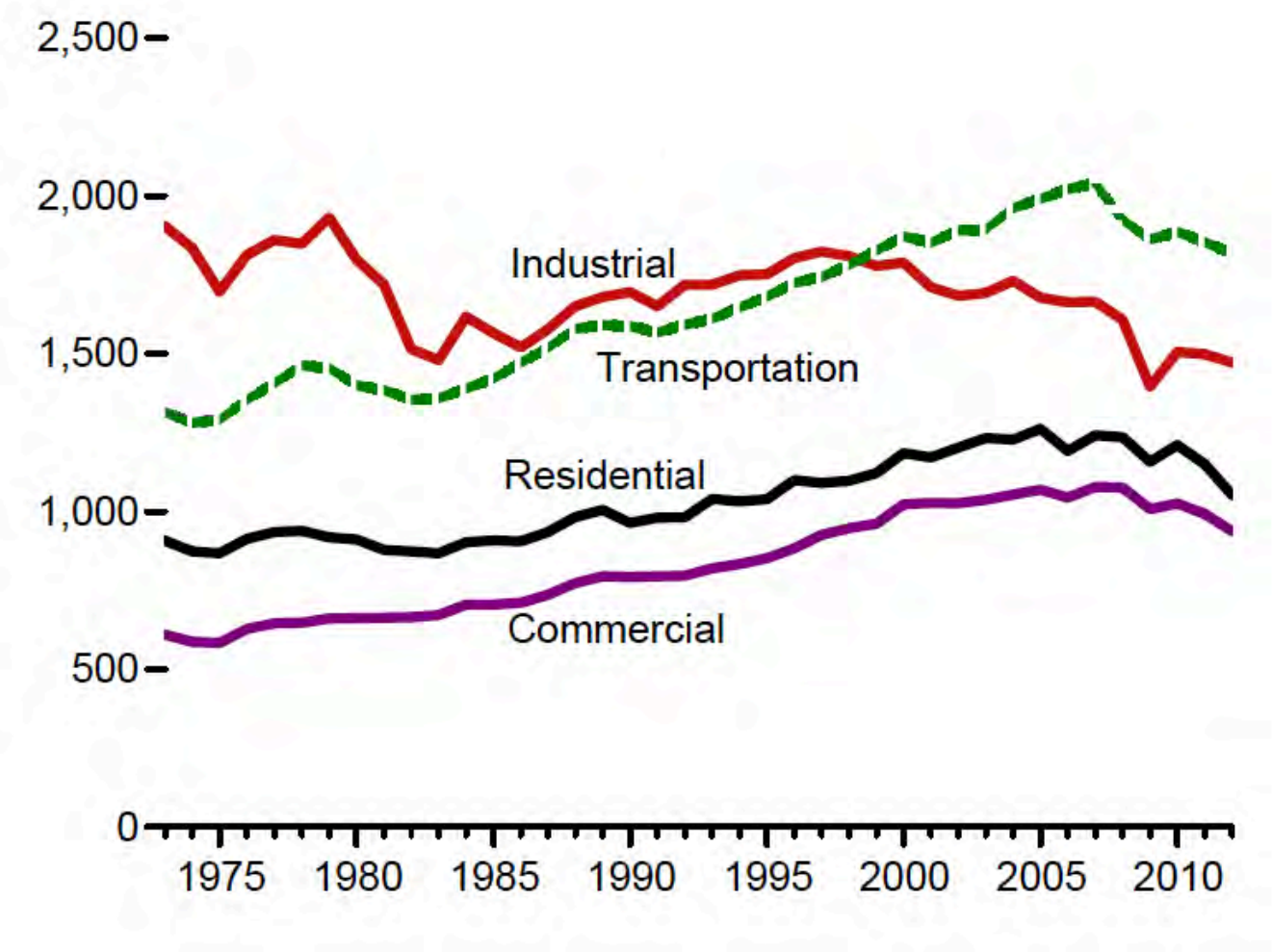
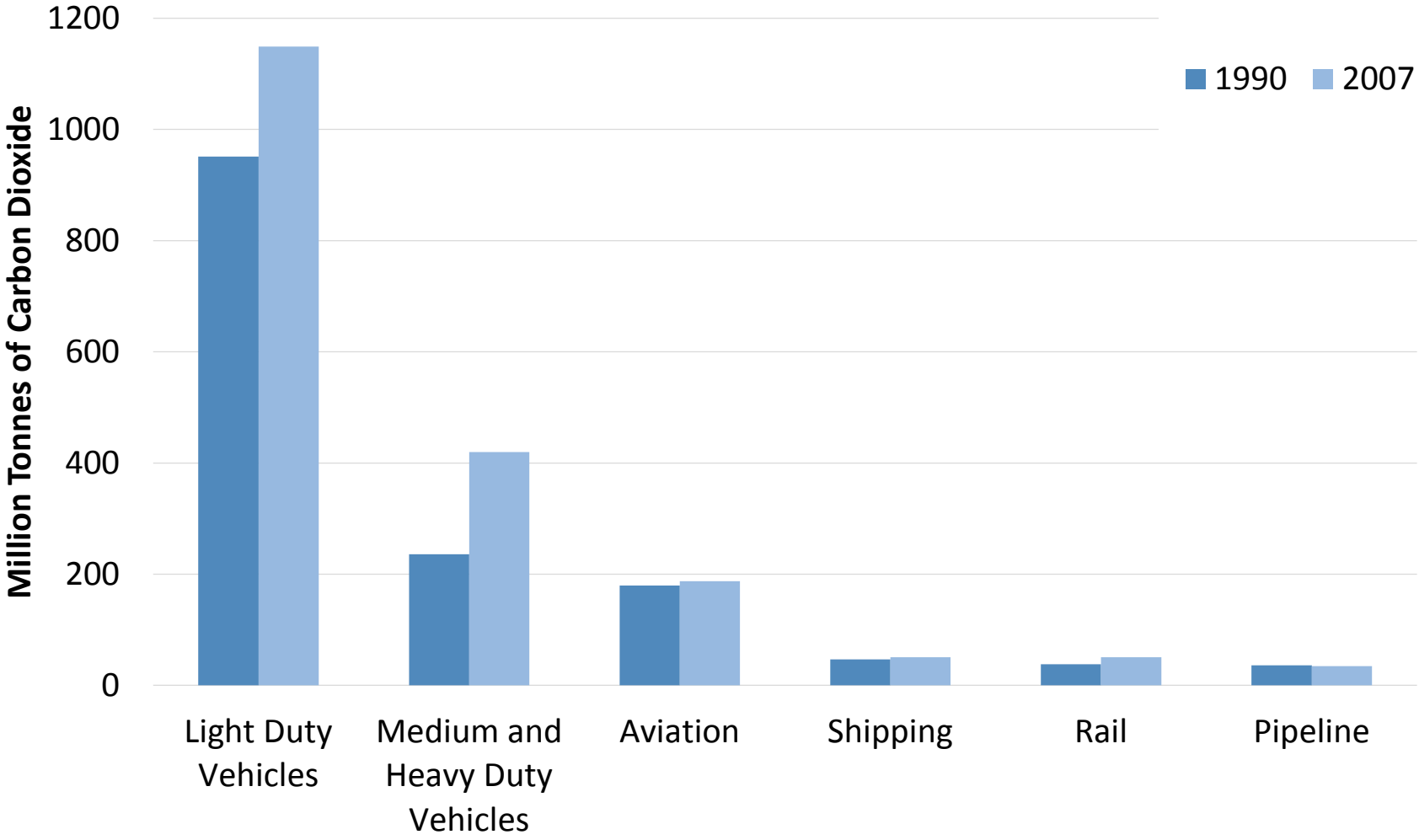


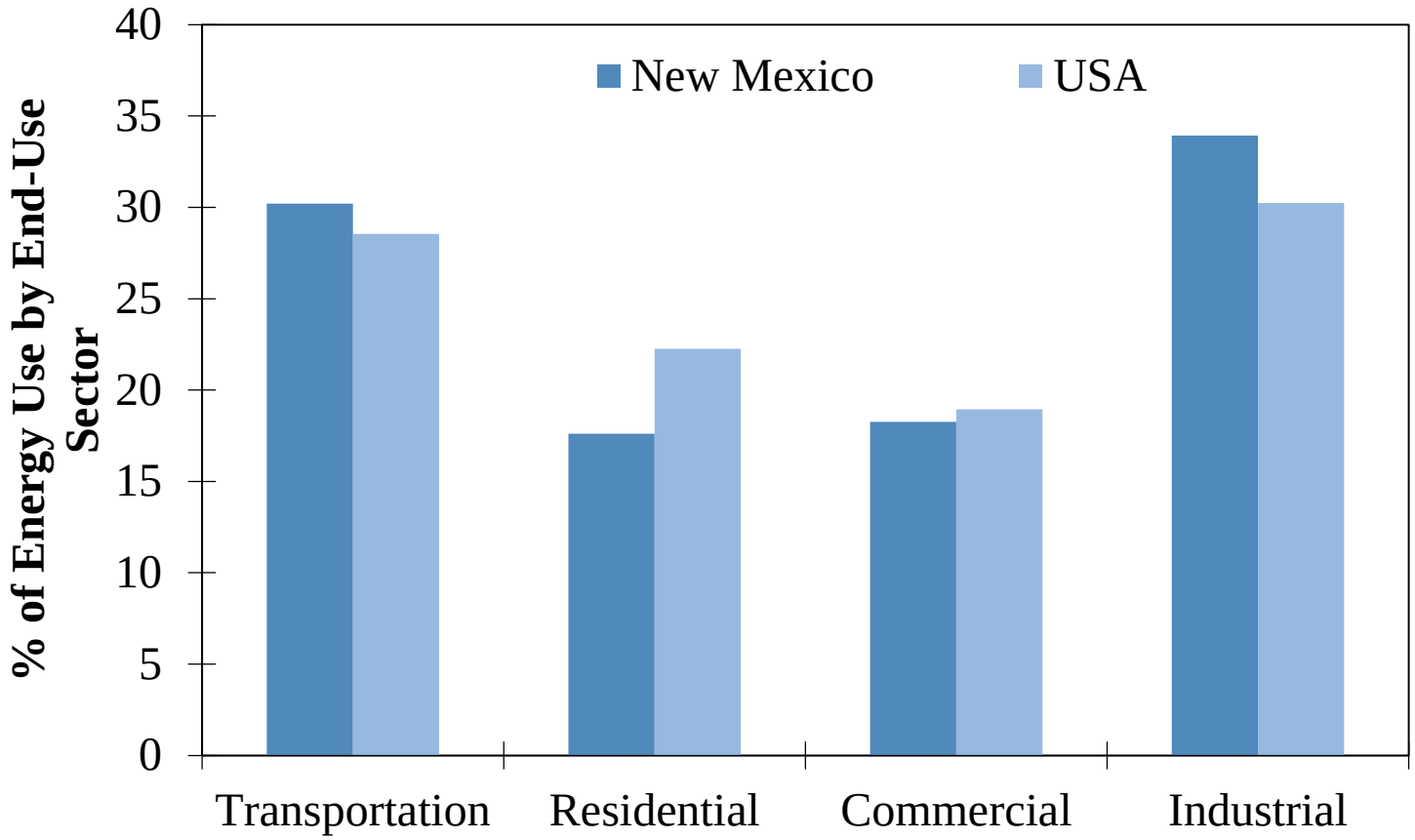
Image source: http://www.eia.gov/totalenergy/data/monthly/pdf/sec12_4.pdf

Transportation GHG Sources



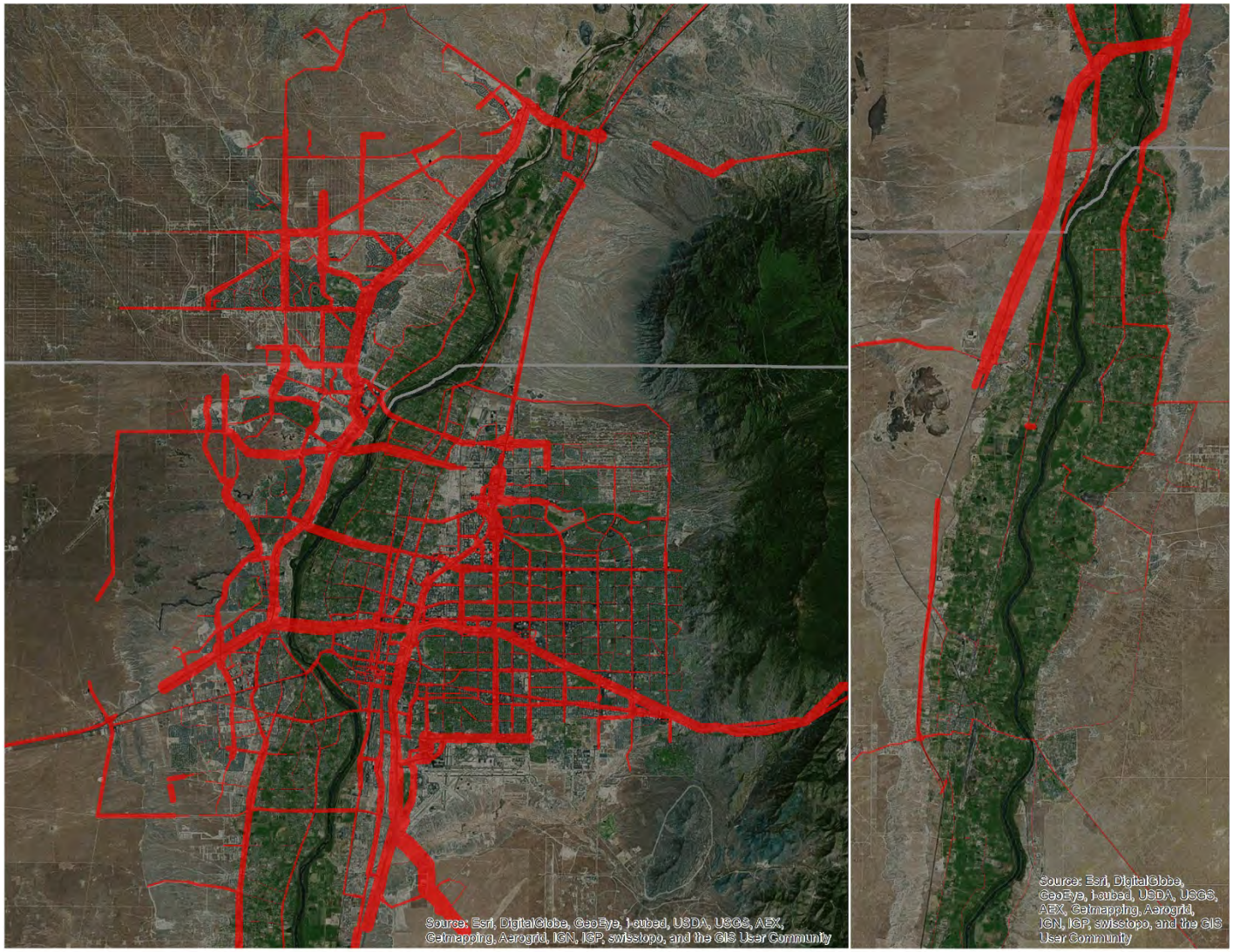
data from: Transportation Data Energy Book, Oak Ridge National Laboratory

Energy use in New Mexico



data from: US Department of Energy, Energy Information Administration, State Data System 2011, Consumption Estimates

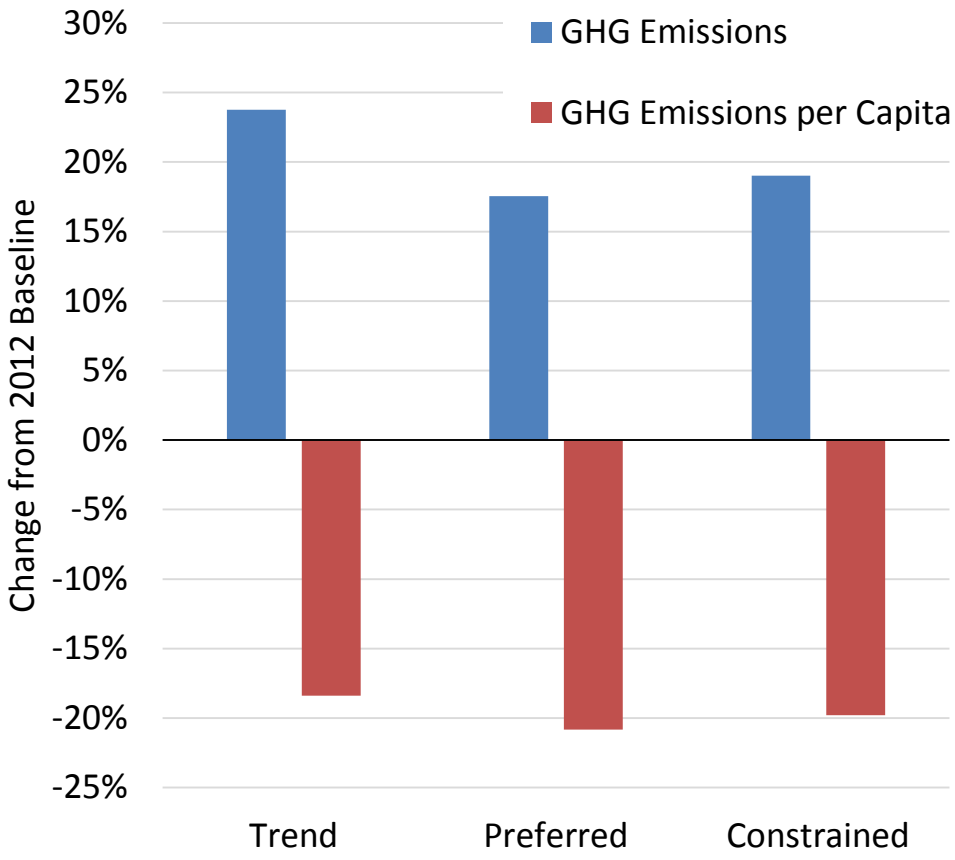
A Large Increase in Driving Expected



Change in Daily Traffic Volume (2040 Trend - 2012 Baseline)

0 1,000 5,000 10,000 22,000

Planning Scenario GHG Emissions Comparison



- 37% to 42% <u>increase</u> in total miles driven
- 6% to 10% <u>decrease</u> in per capita distance driven
- 13% to 14% <u>decrease</u> in vehicle GHG emission rates

GHG Mitigation Strategies

$$GHG = Activity \cdot Energy\ Intensity \cdot Energy\ Carbon\ Intensity$$

<u>Reduce Polluting Activity – Less Vehicle Use</u>

- Use non-motorized modes (walk and bike)

<u>Reduce Energy Intensity – Alterative Transportation Modes</u>

- Transit
- Carpooling
- Reduce Congestion

<u>Energy Carbon Intensity</u>

- Low carbon fuels

Strategy	GHG Mitigation Potential	Analysis Capability
Zoning changes	●●●●○ L	●●●●● U
Infill development	●●●●○ L	●●●●○ U
Transit oriented development	●●●●○ L	●●●●○ U,C
Building design standards	●●○○○ L	●○○○○ Q
Urban growth boundaries	●●●●● M	●●●●● U
Bicycle and pedestrian infrastructure improvements	●●●○○ S	●●○○○ O,P,Q
Improving public transportation	●●●○○ S	●●●○○ C
Establishing a complete streets policy	●●○○○ L	●○○○○ Q
Road pricing (HOT lanes/congestion charging)	●●●○○ S	●●○○○ C,P
HOV facilities	●○○○○ M	●○○○○ Q,P
Parking management	●●●○○ S	●●●○○ C
Car sharing	●○○○○ S	●○○○○ Q
Bike sharing	●○○○○ S	●○○○○ Q
Ride sharing	●○○○○ S	●●●○○ Q,C
Travel demand management-educational	●○○○○ S	●○○○○ Q
Travel demand management-transit incentives	●●●○○ S	●●○○○ Q,P
“Wheels” tax (VMT charging)	●●●●● S	●●●●○ C
Traffic signal enhancement	●●●○○ S	●●●○○ C,P
Incident management	●●○○○ S	●○○○○ Q
Intersection improvement	●○○○○ S	●●●●○ P,C
Establishing roadway connectivity standards	●●●○○ L	●●●●○ C
Electric vehicle infrastructure support	●●○○○ M	●○○○○ Q,M
Heavy-duty vehicle retrofit	●○○○○ M	●●●●○ Q,M
Truck-stop electrification technologies	●○○○○ S	●●○○○ M

●○○○○ → ●●●●●
Low High

L = long term
M = medium term
S = short term

U = UrbanSim, C = CUBE,
M = MOVES, O = Off Model,
P = Post Process, Q = Qualitative

GHG Mitigation Strategies

Signal Coordination/ITS (Reduce Energy Intensity)

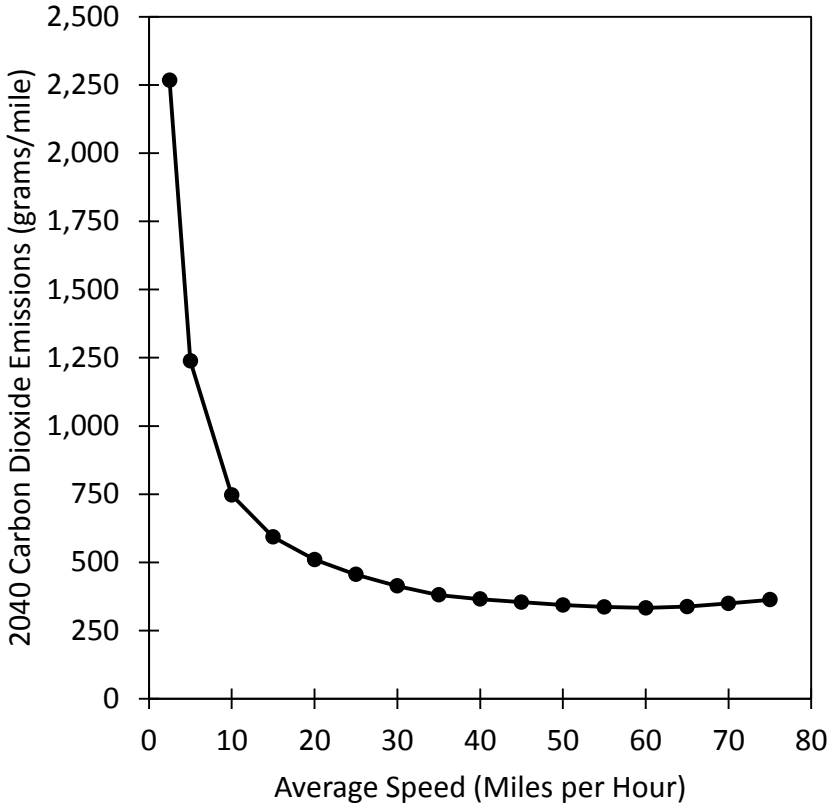
less congestion = fewer GHG emissions

Alameda Adaptive Signal Project

Period	Average travel time reduction	GHG Reduction
AM peak	21%	
Noon (Off peak)	-1%	2.70%
PM peak	11%	

Applying Similar Improvements to Montgomery/Montano & Coors

	GHG (tonnes/day)				
Road	**Before**	**After**	**Reduction**	**% Change**	**% of Total**
Montgomery & Montano	288	276	-12.0	-4.2%	-0.09%
Coors	442	426	-15.6	-3.5%	-0.12%



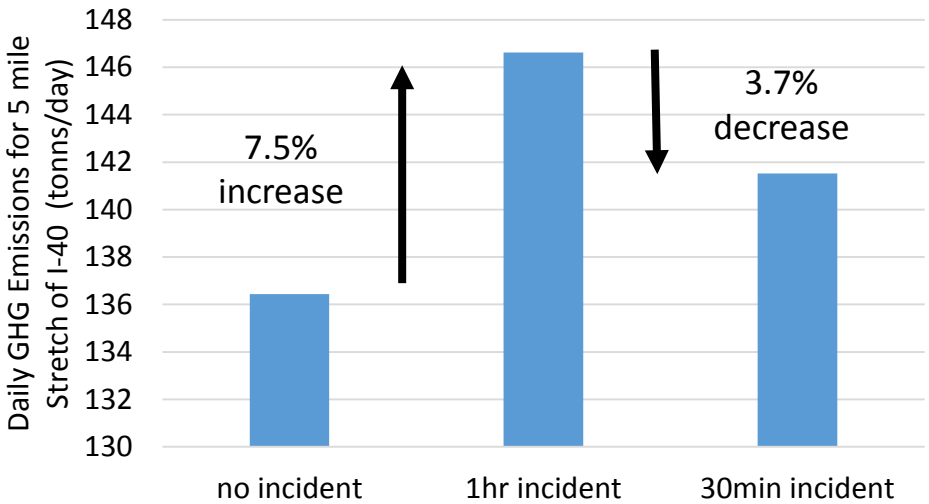
GHG Mitigation Strategies

Incident Management (Reduce Energy Intensity)

quicker accident response = less congestion = fewer GHG emissions

<u>Example of Potential Benefits for I-40 in the Albuquerque Metro</u>

- Average speed = 60-65MPH with no accidents
- Assume average speed = 10MPH with an accident for 5 miles



GHG Mitigation Strategies

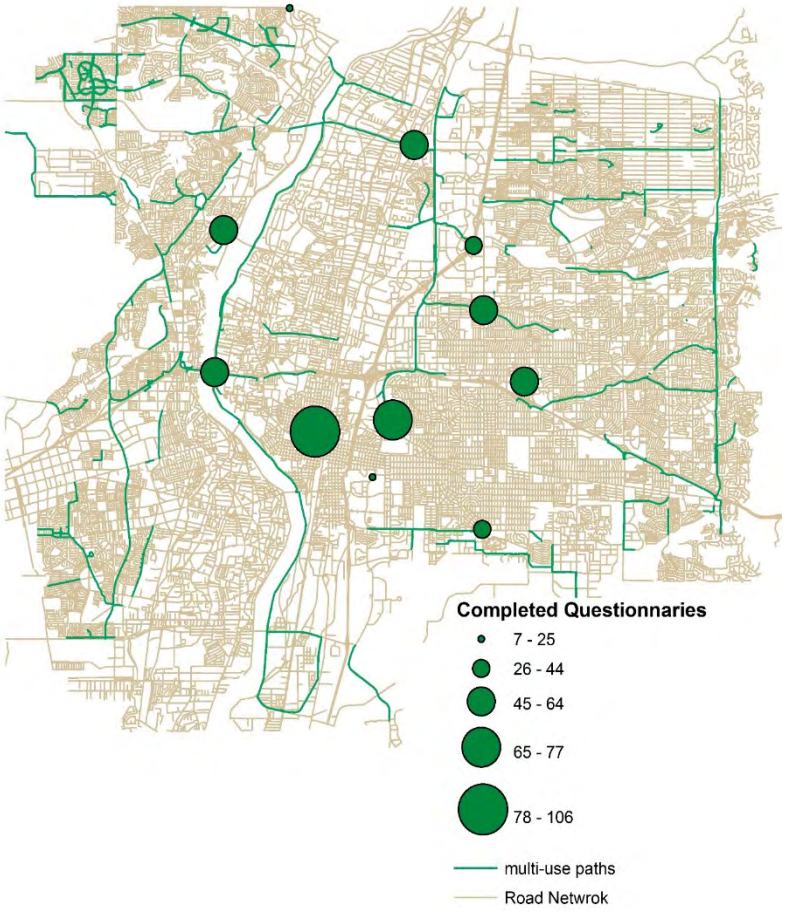
Pedestrian and Bicycle Infrastructure (Less Vehicle Activity)

- Prior research finds strong associations between the amount of bicycle infrastructure and the number of cycling trips
- For example, a study of 90 US cities[a] finds that a 10% increase in the amount of bicycle lanes and paths is associated with a 2.5% to 3% increase in bicycle commuting per 10,000 residents.

[a]*Buehler, R., and J. Pucher. Cycling to work in 90 large American cities: new evidence on the role of bike paths and lanes. Transportation, Vol. 39, No. 2, Mar. 2012, pp. 409–432*

UNM/MRCOG Bicycle Study

Intercepted cyclists commuting to work on national bike to work day and asked questions about cycling preferences and route choice



[a]Rowangould Gregory M., Tayarani Mohammad. The effect of bicycling paths on the decision to commute by bicycle. Submitted for presentation at the Transportation Research Board 93th Annual Meeting, Washington DC, 12-16 January, 2015

UNM/MRCOG 2014 Bicycle Survey Results

	Do Not Continue to Bike	Continue to Bike
Cyclists Using a Bike Path	29.8%	70.2%
Trip Frequency		
5 or more times per week	14.4%	24.1%
3-4 times per week	42.8%	50.4%
1-2 times per week	23.7%	17.5%
few times per month	14.4%	5.3%
I do not regularly make this trip	5.2%	2.6%
Most Influential Factor in Alternative Mode Choice in Absence of Bicycle Path		
Travel Time	10.3%	9.2%
Trip Distance	3.1%	4.0%
Safety	71.1%	48.7%
Exercise/Physical activity	10.3%	29.4%
Concern about the environment	3.1%	5.3%
Cost	1.0%	1.3%
Other	1.0%	2.2%
Route Choice Factors (mean 5 point Likert scale response)		
Shortest distance	2.2 (2.0, 2.4)	2.0 (1.9, 2.1)
Quickest(Shortest time)	2.4 (2.1, 2.6)	2.3 (2.2, 2.5)
Least hilly	1.8 (1.6, 2.0)	1.8 (1.7, 1.9)
Presence of bicycle path	4.3 (4.1, 4.5)	3.8 (3.6, 3.9)
Presence of bicycle lane	3.9 (3.6, 4.1)	4.0 (3.85, 4.1)
Less vehicle traffic	3.9 (3.7, 4.1)	3.8 (3.7, 4.0)
Slower vehicle speeds	3.4 (3.2, 3.7)	3.5 (3.3, 3.6)
Number of Observation	97	228

Find similar results for bicycle lanes (25% would not cycle without a bicycle lane)

GHG Mitigation Strategies

Street Connectivity (Reduce Activity)

A 10% increase in 4-way intersections = 1.2% decrease in vehicle travel[a]

[a]*Ewing, R., and R. Cervero. Travel and the Built Environment. Journal of the American Planning Association, Vol. 76, No. 3, 2010, pp. 265–294.*

GHG Mitigation Strategies
Complete Streets (Reduce Activity)

Central Ave & Jefferson, Albuquerque

4th & Santa Monica Blvd, Santa Monica

GHG Outlook for Central New Mexico Transportation System

- Per capita driving and GHG emissions are expected to decline.
- Per capita reductions are not enough to counteract expected population growth.
- Additional mitigation strategies needed beyond zoning and transportation infrastructure.
- Low cost/popular strategies can help:
  - Bicycle and Pedestrian infrastructure
  - ITS/Traffic Signal Improvements
  - Street Design
  - Incident Management
- Much more will be needed if we want to reduce GHG emissions <u>below today's levels</u>:
  - Increase gas tax or adopt a new vehicle miles driven tax
  - Urban growth boundary
  - Rapid introduction of alterative fuel vehicles