



Memo

To: Michigan Transportation and Land Use Technical Working Group
From: The Center for Climate Strategies
Subject: Common Assumptions
Date: July 21, 2008

This memorandum summarizes the key assumptions and primary data sources that are expected to be used by CCS staff in developing estimates of greenhouse gas emission reductions and associated costs for MI TLU technical work group policy options.

1. Fuel Prices

Table 1 below expresses fuel costs in constant 2006\$/gallon of fuel. The fuel price estimates for Motor Gasoline, Diesel Fuel, Jet Fuel, and E85 ethanol come from AEO 2008. The AEO data is presented as \$/MMBTU, and was then converted into \$/gallon to make the data more accessible. One notable difference in using this approach is that fuels often have a different energy content, which \$/gallon does not account for. In the case of E85 ethanol fuels, this difference is significant, because the MMBTU/gallon is 27% lower than that of gasoline. Thus, while the \$/MMBTU for E85 is typically higher than that of motor gasoline, the \$/gallon is lower.

The Energy Information Administration, as part of the DOE, publishes the *Annual Energy Outlook*. This outlook contains three estimates for fuel prices in the future, pegged to one year (2006 in this case) so as to account for inflation. The reference case estimate of world energy prices was used to develop the Table 1 estimates. The high energy price or low energy price projections are also available. There is significant difference between each of these estimates. For example, the reference case projections show oil to be \$70 per barrel (2006\$) in 2030. The low price path puts the price of oil at \$42 barrel, whereas the high price path predicts \$119 per barrel (2006\$) in 2030. The energy prices from the EIA high price path are shown in Table 2 as a comparison.

While all projections of energy prices have significant uncertainty, the EIA estimates are used because they are accessible, well documented and undated annually. Using EIA data as much as possible avoids problems that come with using different price projections at different times/for different fuels in this analysis.

The B20 biodiesel option comes from *Clean Cities Alternative Fuel Price Report*, which estimated the costs of B20 to be 16 cents cheaper per gallon annually than conventional diesel fuel (USDOE, 2008). The estimate for Fischer-Tropsch diesel is based on CEC reports stating that the analysis of a mature market assumes that the incremental cost of Fisher-Tropsch fuel is 15 cents per gallon higher than EPA diesel at the refinery gate.

**Table 1. Transportation Sector Energy (Fuel Prices) (\$ per gallon)
 EIA Reference Case Projection**

	Motor Gasoline	Diesel Fuel (distillate fuel oil)	Jet Fuel	E85	B20 ¹	Fischer- Tropsch Diesel ²	Electricity (\$/kWh)
2005	2.39	2.49	1.80	2.16	2.53	2.64	0.084
2006	2.63	2.72	2.00	2.24	2.75	2.87	0.089
2007	2.80	2.83	2.03	2.30	2.86	2.98	0.089
2008	3.05	3.14	2.12	2.25	3.17	3.29	0.091
2009	2.82	2.80	2.20	2.27	2.84	2.95	0.093
2010	2.64	2.71	2.13	2.13	2.75	2.86	0.092
2011	2.57	2.67	2.09	2.00	2.71	2.82	0.089
2012	2.49	2.56	1.99	2.09	2.60	2.71	0.088
2013	2.42	2.50	1.90	1.91	2.53	2.65	0.087
2014	2.41	2.49	1.85	1.71	2.53	2.64	0.086
2015	2.34	2.43	1.78	1.59	2.47	2.58	0.085
2016	2.27	2.37	1.72	1.59	2.40	2.52	0.085
2017	2.29	2.37	1.73	1.49	2.40	2.52	0.086
2018	2.31	2.39	1.75	1.51	2.43	2.54	0.086
2019	2.38	2.46	1.77	1.67	2.50	2.61	0.086
2020	2.44	2.52	1.79	1.64	2.55	2.67	0.086
2021	2.40	2.49	1.81	1.56	2.53	2.64	0.086
2022	2.42	2.51	1.83	1.60	2.55	2.66	0.086
2023	2.43	2.52	1.86	1.66	2.55	2.67	0.086
2024	2.43	2.52	1.88	1.70	2.56	2.67	0.086
2025	2.44	2.56	1.91	1.67	2.59	2.71	0.087
NOTES: 2006 dollars.							

¹ From the *Clean Cities Alternative Fuel Price Report*, which estimates the costs of B20 to be 16 cents cheaper per gallon than conventional diesel fuel.

² Based on a CEC estimate that the incremental cost of Fisher-Tropsch fuel is 15 cents per gallon higher than EPA diesel at the refinery gate.

Table 2. Transportation Sector Energy (Fuel Prices) (\$ per gallon)
EIA High Energy Price Scenario

	Motor Gasoline	Diesel Fuel (distillate fuel oil)	Jet Fuel	E85	Electricity (\$/kWh)
2005	2.39	2.49	1.80	2.16	0.084
2006	2.63	2.72	2.00	2.24	0.089
2007	2.80	2.83	2.03	2.30	0.089
2008	3.05	3.14	2.12	2.25	0.091
2009	2.85	2.83	2.29	2.25	0.094
2010	2.94	2.82	2.31	2.36	0.093
2011	2.98	2.92	2.37	2.41	0.091
2012	3.00	2.92	2.40	2.43	0.091
2013	3.05	3.00	2.46	2.17	0.090
2014	3.11	3.06	2.52	2.17	0.090
2015	3.12	3.09	2.53	2.02	0.090
2016	3.17	3.14	2.58	2.28	0.090
2017	3.23	3.23	2.66	2.34	0.090
2018	3.27	3.28	2.72	2.38	0.091
2019	3.33	3.34	2.79	2.41	0.091
2020	3.40	3.41	2.85	2.45	0.089
2021	3.49	3.50	2.94	2.49	0.089
2022	3.53	3.55	2.96	2.47	0.090
2023	3.53	3.55	2.99	2.49	0.090
2024	3.55	3.57	3.02	2.50	0.090
2025	3.52	3.57	3.00	2.49	0.090

2. The relationship between fuel price and VMT:

A 2004 study found that a 10% increase in fuel price would reduce the volume of traffic by approximately 1% within a year, and about 3% over the next 5 years. In addition, the amount of fuel consumed would fall by approximately 2.5% within a year, eventually leading to a 6% reduction over the next five years (Goodwin, 2004). This would mean an elasticity between fuel price and VMT of -0.1. Other studies have found this elasticity to be higher. For example, a recent article in the Sacramento Bee suggests a roughly -0.2 elasticity in California (Glover, 2008). CCS plans to use the -0.1 price elasticity value in evaluating fuel price effects in this project.

3. Per public dollar, a Transportation Management Organization can accommodate seven times as many commuters as new highway investment.
4. Full cost of a mile of auto travel in a U.S. urban area was between \$0.84 and \$1.62, with a mid-range estimate of \$1.14, in 2020 (Anderson and McCullough, 2000).
Alternative: Federal mileage reimbursement rate – 58.5 cents per mile effective July 1, 2008.
5. Key Assumption: that doubled transit provision will produce doubled ridership.
6. The assumed order of measure adoption in computing benefit estimates can influence the expected GHG reduction for transportation sources. Propose to count technology and fuel benefits first, then activity and transportation system efficiency second.
7. Idling a car burns ½ miles worth of gasoline every minute. Idling heavy-duty diesel trucks burn 1 gallon of diesel fuel every hour spent idling.

Anderson and McCullough, 2000: David Anderson and Gerard McCullough, “The Full Costs of Transportation in the Twin Cities Region,” University of Minnesota, http://www.cts.umn.edu/trg/research/reports/TRG_05.html, 2000.

Goodwin, 2004: Phil Goodwin, Joyce Dargay, and Mark Hanly, “Elasticities of Road Traffic and Fuel Consumption with Respect to Price and Income: A Review,” *Transport Reviews*, Vol. 24, Issue 4, <http://www2.cege.ucl.ac.uk/cts/tsu/papers/transprev243.pdf>, May 2004.

Glover, 2008: Mark Glover, “State’s drivers reduce gas use,” Sacramento Bee, <http://www.sacbee.com/wheels/story/903743.html>, May 1, 2008.

US DOE, 2008a: U.S. Department of Energy, “Clean Cities Alternative Fuel Price Report,” Office of Energy Efficiency and Renewable Energy, http://www.eere.energy.gov/afdc/pdfs/afpr_apr_08.pdf, April 2008.

US DOE, 2008b: U.S. Department of Energy, *Annual Energy Outlook 2008*, Table A3, <http://www.eia.doe.gov/oiaf/aeo/index.html>, Energy Information Administration, 2008.