



**UNIVERSITY OF MICHIGAN – ANN ARBOR**

**SUSTAINABILITY GOAL REPORTING GUIDELINES**

**GOAL #2**

**DECREASE CARBON INTENSITY OF PASSENGER TRIPS ON U-M  
TRANSPORTATION OPTIONS BY 30%**

**SECTION 1: Introduction**

The University of Michigan (U-M) supports over 50,000 employees and over 45,000 students. As an institution of this size, it is necessary that the University have its own transportation options for its faculty, staff, and students. U-M also manages an extensive alternative transportation program which oversees an intercampus bus system, vanpooling, on line ride sharing, and bike options.

Demand for campus transportation has been increasing steadily at U-M as demonstrated by the fact that ridership on the campus bus system has increased 33% since FY2006. U-M buses now transport over 7.4 million passengers annually. The vehicle fleet consists of over 1,000 vehicles ranging from B-20 biofuel buses to hybrid sedans. U-M has initiated a number of programs designed to reduce the greenhouse gas (GHG) emissions associated with its fleet. The University operates more than 30 electric hybrid buses, which are assumed to reduce emissions by 30% when compared with older U-M B-20 biodiesel buses. The University also has a long tradition of using bio-derived fuels such as ethanol and biodiesel.

As announced in the fall of 2011, U-M plans to decrease carbon intensity of passenger trips on U-M transportation options by 30% by 2025. This goal is one of U-M's six 2025 sustainability goals. The goals fall under one of four themes: climate action, waste prevention, healthy environments, and community awareness. Each goal will be reevaluated in 2016 and may be adjusted based on variables such as changes in technology, the State of Michigan energy platform, economics, and peer university goals.

**SECTION 2: Overview**

The purpose of this goal is to reduce carbon intensity associated with transportation on a per ride basis. In FY2019, fossil fuel based GHG emissions for U-M owned mobile sources reached 6,800 MTCO<sub>2e</sub>, a 12% increase from FY2006. Approximately half of which are produced by the U-M campus bus system. The remainders of the mobile source emissions are associated with the U-M fleet of departmental vehicles. Currently there is no accurate way to measure fleet ridership as vehicle use is not tracked. Therefore, fleet ridership is not included in the goal calculations. In addition to U-M operated vehicles, emissions and ridership from the Ann Arbor Transportation Authority (AATA) related to the AATA-MRide program, emissions and ridership associated with the U-M sponsored vanpool program, and ridership from the recently initiated bike sharing programs on campus will be used in the measuring of this goal.

### SECTION 3: Emissions/Ride Calculations

Carbon intensity per rider is defined as:

$$\frac{(\text{Mobile source emissions} + \text{Vanpool emissions} + \text{AATA MRide emissions})}{(\text{Campus bus ridership} + \text{Vanpool ridership} + \text{AATA MRide ridership} + \text{Bike share rides})}$$

and is measured as kgCO<sub>2</sub>e/ride. This definition can be expected to change as additional programs come on line.

**TABLE 1: Emission Conversion Factors**

Fuel Source	Carbon Dioxide (CO <sub>2</sub> )			Methane (CH <sub>4</sub> )			Nitrous Oxide (N <sub>2</sub> O)		
	Conversion Factor		Global Warming Potential	Conversion Factor		Global Warming Potential	Conversion Factor		Global Warming Potential
Unleaded Fuel (gal)	8.79	kg/gal	1	1.74E-03	kg/gal	21	5.99E-04	kg/gal	310
Diesel Fuel (gal)	10.01	kg/gal	1	5.67E-04	kg/gal	21	2.57E-04	kg/gal	310
ULS Diesel (gal)	10.01	kg/gal	1	5.67E-04	kg/gal	21	2.57E-04	kg/gal	310

Mobile source emissions are calculated from information provided by U-M's Parking and Transportation Services, which accounts for emissions generated by the combustion of the fossil fuel fractions of unleaded gasoline, diesel, B-20 biodiesel, and E-85 ethanol used to fuel U-M's transportation fleet.

Mobile Source Emissions =

$$\begin{aligned} & \text{Unleaded Fuel Purchase (gal)} * \text{CO}_2 \text{ Conversion Factor} * \text{CO}_2 \text{ Global Warming Potential} \\ & + \text{Unleaded Fuel Purchase (gal)} * \text{CH}_4 \text{ Conversion Factor} * \text{CH}_4 \text{ Global Warming Potential} \\ & + \text{Unleaded Fuel Purchase (gal)} * \text{N}_2\text{O Conversion Factor} * \text{N}_2\text{O Global Warming Potential} \\ & + \text{Diesel fuel (gal)} * \text{CO}_2 \text{ Conversion Factor} * \text{CO}_2 \text{ Global Warming Potential} \\ & + \text{Diesel fuel (gal)} * \text{CH}_4 \text{ Conversion Factor} * \text{CH}_4 \text{ Global Warming Potential} \\ & + \text{Diesel fuel (gal)} * \text{N}_2\text{O Conversion Factor} * \text{N}_2\text{O Global Warming Potential} \\ & + \text{ULS Diesel (gal)} * \text{CO}_2 \text{ Conversion Factor} * \text{CO}_2 \text{ Global Warming Potential} \\ & + \text{ULS Diesel (gal)} * \text{CH}_4 \text{ Conversion Factor} * \text{CH}_4 \text{ Global Warming Potential} \\ & + \text{ULS Diesel (gal)} * \text{N}_2\text{O Conversion Factor} * \text{N}_2\text{O Global Warming Potential} \\ & + 0.8 * \text{Biodiesel (gal)} * \text{Diesel CO}_2 \text{ Conversion Factor} * \text{CO}_2 \text{ Global Warming Potential} \\ & + 0.8 * \text{Biodiesel (gal)} * \text{Diesel CH}_4 \text{ Conversion Factor} * \text{CH}_4 \text{ Global Warming Potential} \\ & + 0.8 * \text{Biodiesel (gal)} * \text{Diesel N}_2\text{O Conversion Factor} * \text{N}_2\text{O Global Warming Potential} \\ & + 0.15 * \text{Ethanol (gal)} * \text{Unleaded Fuel CO}_2 \text{ Conversion Factor} * \text{CO}_2 \text{ Global Warming Potential} \\ & + 0.15 * \text{Ethanol (gal)} * \text{Unleaded Fuel CH}_4 \text{ Conversion Factor} * \text{CH}_4 \text{ Global Warming Potential} \\ & + 0.15 * \text{Ethanol (gal)} * \text{Unleaded Fuel N}_2\text{O Conversion Factor} * \text{N}_2\text{O Global Warming Potential} \end{aligned}$$

Vanpool emissions are calculated from information provided by U-M's Parking and Transportation Services. Vanpool participants submit monthly fuel consumption and ridership reports. These reports are available starting in FY2009. Calculations previous to FY2009 therefore do not include vanpool information.

Vanpool Emissions =

$$\begin{aligned} & \text{Unleaded Fuel Purchase (gal)} * \text{CO}_2 \text{ Conversion Factor} * \text{CO}_2 \text{ Global Warming Potential} \\ & + \text{Unleaded Fuel Purchase (gal)} * \text{CH}_4 \text{ Conversion Factor} * \text{CH}_4 \text{ Global Warming Potential} \\ & + \text{Unleaded Fuel Purchase (gal)} * \text{N}_2\text{O Conversion Factor} * \text{N}_2\text{O Global Warming Potential} \end{aligned}$$

AATA MRide emissions are calculated from information provided by AATA. AATA operates under a slightly different fiscal calendar (September-August) than U-M and is not able to provide fuel data on a U-M fiscal basis. AATA emissions are adjusted to account for the fact that not all users of the AATA bus system are associated with the MRide program. Emissions include a percentage multiplier equal to the percent of AATA riders who are MRide participants.

AATA MRide emissions =

$$\begin{aligned} & \text{Diesel fuel (gal)} * \text{CO}_2 \text{ Conversion Factor} * \text{CO}_2 \text{ Global Warming Potential} * \% \text{ MRide participants} \\ & + \text{Diesel fuel (gal)} * \text{CH}_4 \text{ Conversion Factor} * \text{CH}_4 \text{ Global Warming Potential} * \% \text{ MRide participants} \\ & + \text{Diesel fuel (gal)} * \text{N}_2\text{O Conversion Factor} * \text{N}_2\text{O Global Warming Potential} * \% \text{ MRide participants} \\ & + 0.8 * \text{Biodiesel (gal)} * \text{Diesel CO}_2 \text{ Conversion Factor} * \text{CO}_2 \text{ Global Warming Potential} * \% \text{ MRide} \\ & + 0.8 * \text{Biodiesel (gal)} * \text{Diesel CH}_4 \text{ Conversion Factor} * \text{CH}_4 \text{ Global Warming Potential} * \% \text{ MRide} \\ & + 0.8 * \text{Biodiesel (gal)} * \text{Diesel N}_2\text{O Conversion Factor} * \text{N}_2\text{O Global Warming Potential} * \% \text{ MRide} \end{aligned}$$

Campus bus ridership, Vanpool ridership, and Bike share rides are calculated from information provided by U-M's Parking and Transportation Services. Campus bus drivers submit ridership reports. Vanpool participants submit monthly fuel consumption and ridership reports. These reports are available starting in FY2009. Calculations previous to FY2009 therefore do not include vanpool information. U-M is initiating a bike rental program fall and is partnering in a bike sharing program throughout the city of Ann Arbor. Data for these programs will be included when they become available.

AATA MRide ridership information is provided by AATA. AATA operates under a slightly different fiscal calendar (September-August) than U-M and is not able to provide fuel data on a U-M fiscal basis. Ridership data is provided on a monthly basis, therefore MRide ridership as reported in the U-M Annual Sustainability Report correlates to the U-M fiscal year, but for the purposes of goal tracking will be reported under the same time frame as AATA emissions (Sept-Aug).

#### **SECTION 4: Goal Reporting**

The 2006 baseline for this 2025 goal is 1.167 kgCO<sub>2</sub>e/ride. Calculations were completed using the equation outlined in section 3:

$$\frac{(\text{Mobile source emissions} + \text{Vanpool emissions} + \text{AATA MRide emissions})}{(\text{Campus bus ridership} + \text{Vanpool ridership} + \text{AATA MRide ridership} + \text{Bike share rides})}$$

FY2006 baseline:

$$\frac{(6,071,000 + 0 + 2,841,250)}{(5,596,054 + 0 + 2,040,282 + 0)} = 1.167 \text{ kgCO}_2\text{e/ride}$$

FY2007:

$$\frac{(6,128,000 + 0 + 2,352,418)}{(5,850,234 + 0 + 2,103,611 + 0)} = 1.066 \text{ kgCO}_2\text{e/ride}$$

FY2008:

$$\frac{(6,313,000 + 0 + 2,160,171)}{(5,940,576 + 0 + 2,254,026 + 0)} = 1.034 \text{ kgCO}_2\text{e/ride}$$

FY2009:

$$\frac{(6,472,000 + 715,552 + 2,059,243)}{(6,010,276 + 188,829 + 2,368,474 + 0)} = 1.079 \text{ kgCO}_2\text{e/ride}$$

FY2010:

$$\frac{(6,132,000 + 757,052 + 2,093,208)}{(6,507,915 + 203,684 + 2,306,942 + 0)} = 0.996 \text{ kgCO}_2\text{e/ride}$$

FY2011:

$$\frac{(6,587,000 + 722,502 + 2,126,759)}{(6,880,323 + 190,224 + 2,410,441 + 0)} = 0.995 \text{ kgCO}_2\text{e/ride}$$

FY2012:

$$\frac{(6,564,000 + 771,563 + 2,184,335)}{(7,418,841 + 210,796 + 2,674,019 + 0)} = 0.924 \text{ kgCO}_2\text{e/ride}$$

FY2013:

$$\frac{(6,526,000 + 733,306 + 2,149,147)}{(7,395,131 + 191,081 + 2,736,931 + 0)} = 0.911 \text{ kgCO}_2\text{e/ride}$$

FY2014:

$$\frac{(7,203,000 + 614,810 + 2,594,213)}{(7,406,088 + 222,844 + 2,684,023 + 0)} = 1.01 \text{ kgCO}_2\text{e/ride}$$

FY2015:

$$\frac{(6,796,000 + 673,455 + 2,153,020)}{(7,358,251 + 234,226 + 2,462,137 + 968)} = 0.957 \text{ kgCO}_2\text{e/ride}$$

FY2016:

$$\frac{(6,601,000 + 691,253 + 2,407,602)}{(7,022,036 + 220,115 + 2,469,447 + 6835)} = 0.998 \text{ kgCO}_2\text{e/ride}$$

FY2017:

$$\frac{(6,804,000 + 621,871 + 2,568,782)}{(7,461,222 + 218,960 + 2,518,930 + 5535)} = 0.979 \text{ kgCO}_2\text{e/ride}$$

FY2018:

$$\frac{(6,786,000 + 387,634* + 2,726,037)}{(7,876,102 + 72,712* + 2,644,386)} = 0.935 \text{ kgCO}_2\text{e/ride}$$

\* Van Pool data was only available from January-June

FY2019:

$$\frac{(6,787,000 + 675,388 + 2,827,396)}{(7,473,296 + 134,937 + 2,546,573)} = 1.013\text{kgCO}_2\text{e/ride}$$

To achieve this goal U-M must reduce transportation greenhouse gas emissions to 0.817 kgCO<sub>2</sub>e/ride.

Continued monitoring of the goal status will be conducted annually and reported through the University of Michigan Annual Sustainability Report and will be available to the public via the Office of Campus Sustainability web site: <http://sustainability.umich.edu/ocs/goals/fuel>.