TIGER Sustainability Calculations

The calculations below detail the annual carbon emissions calculations within CyRide's TIGER grant application for the Ames Intermodal Transportation Facility Phase II project. All calculations are calculated in annual tons of Carbon Emission Equivalent (CO_2e) which adds in the other 5% Greenhouse gases similar to recommendations from previous federal regulation guidance within the TIGGER federal register.

Hybrid Buses – if not funded under TIGER, and the community at some point in the future, decides to implement a circulator route from the TIGER I Intermodal project, CyRide would need to operate less fuel efficient, higher polluting vehicles at least 20 year of age currently in CyRide's Spare bus fleet. CyRide receives approximately $1.5 million each year to support the operations and capital needs of their system through formula (5307) dollars. Therefore, purchasing hybrid buses under the normal appropriation for Ames would take nearly half the allocation leaving little funds for operations or other capital needs. Therefore, hybrids purchased under TIGER will save carbon emissions.

Assumptions

CyRide annual shuttle miles = 18,999
CyRide current average miles per gallon = 3.8 mpg.
Hybrids expected miles per gallon = 6.2 mpg (per Gillig manufacturer)
Other 5% Greenhouse gases carbon dioxide equivalent (CO_2e) = CO_2 * 100/95
(Source: EPA or http://www.epa.gov/OMS/climate/420f05004.htm)
CO_2 burned per 1 gallon diesel fuel = 9.17 kg
(Source: TIGGER federal register guidance or http://edocket.access.gpo.gov/2009/pdf/E9-9469.pdf))

Calculations

Diesel Fuel = ((18,999 annual miles/3.8 mpg) – (30,056 annual miles/6.2 mpg) = 1,935 gallons diesel annually
Tons Carbon Dioxide Emissions = 1,935 gal. fuel *9.17 kg CO_2 = 17,743.95 CO_2
Carbon Equivalent = 28,078.5 * 100/95/1,000 = 18.7 annual tons CO_2e

Bicycle/Pedestrian Connections

Assumptions

12 space bike locker facility expansion = 12 bike lockers equate to 36 cars off the road (The project partners assume that bikes will turnover at least three to four times a day)
Average round trip miles driven in Ames = 8 miles
Days utilized = 255
Average vehicle miles per gallon = 27.5 mpg
(Source: NHTSA or http://www.nhtsa.gov/cars/rules/cafe/NewPassengerCarFleet.htm)
Other 5% Greenhouse gases carbon dioxide equivalent (CO_2e) = CO_2 * 100/95
(Source: EPA or http://www.epa.gov/OMS/climate/420f05004.htm)
CO_2 burned per 1 gallon gasoline fuel = 8.8 kg
(Source: EPA or http://www.epa.gov/OMS/climate/420f05001.htm)

Calculations

Vehicle miles traveled (VMT) = 36 cars * 8 miles * 255 days each year = 73,440 VMT annually
Fuel = ((73,440 annual miles/27.5 mpg) = 2,670.5 gallons gasoline each year
Tons Carbon Dioxide Emissions = 2,670.5 gal. fuel annually *8.8 kg CO_2 = 23,500 CO_2
Carbon Equivalent = 23,500 * 100/95/1,000 = 24.7 annual tons CO_2e

Circling for A Parking Space

Without the Intermodal Phase II project, campustown patrons will circle the block numerous times to locate a vacant parking space as the added parking of 385 spaces is not enough spaces and will not satisfy the Developer's anticipated redevelopment need. With the added 248 spaces the Phase II brings, this circling would cease as patrons would know they could attain a spot under covered parking.

Assumptions

200 Existing Campustown parking spaces
85% of campustown patrons would park in available campustown on-street parking; utilizing the available 200 spaces before starting to circle to find the closest spot.
120% maximum demand
35% of cars circle (120%-85%) during peak periods
3 peak periods daily
180 peak days each year (when university is in session)
6 average block lengths circulated (before parking or going elsewhere)
425 feet = typical block length
5,280 ft = 1 mile
Average vehicle miles per gallon = 27.5 mpg
(Source: NHTSA or http://www.nhtsa.gov/cars/rules/cafe/NewPassengerCarFleet.htm)
Other 5% Greenhouse gases carbon dioxide equivalent (CO_2e) = CO_2 * 100/95
(Source: EPA or http://www.epa.gov/OMS/climate/420f05004.htm)
CO_2 burned per 1 gallon gasoline fuel = 8.8 kg
(Source: EPA or http://www.epa.gov/OMS/climate/420f05001.htm)

Calculations

Vehicle miles traveled (VMT) = 200 spaces * 35% circling * 3 peak times daily * 180 peak days each year * 6 block lengths * 425 ft)/5,280 feet = 18,256 annual vehicle miles traveled
Fuel = ((18,256 miles/27.5 mpg) = 663.9 gallons gasoline annually
Tons Carbon Dioxide Emissions = 663.9 gal. fuel *8.8 kg CO_2 = 5,842.3 CO_2
Carbon Equivalent = 5,842.3 * 100/95/1,000 = 6.1 annual tons CO_2e

Vanpool/Carpool Parking Expansion – 20 additional parking spaces

Assumptions

Average vehicle miles per gallon = 27.5 mpg
(Source: NHTSA or http://www.nhtsa.gov/cars/rules/cafe/NewPassengerCarFleet.htm)
Other 5% Greenhouse gases carbon dioxide equivalent (CO_2e) = CO_2 * 100/95
(Source: EPA or http://www.epa.gov/OMS/climate/420f05004.htm)
CO_2 burned per 1 gallon gasoline fuel = 8.8 kg
(Source: EPA or http://www.epa.gov/OMS/climate/420f05001.htm)
15 new vanpools operating via ISU's vanpool program
5 persons per/van added trips/day estimated
5 new formalized carpools operating through facility (3-4 person carpools so at least 2 individuals are saving emissions daily)
255 work days per year
120 miles average round trip

Calculations - Vanpools

15 vanpools * 5 persons/van/trips/day * 255 days each year = 19,125 trips annually
Vehicle miles traveled (VMT) = 19,125 trips * 120 miles/round trip = 2,295,000 VMT annually
Fuel Saved = (2,295,000/27.5mpg) = 83,455 gallons gasoline annually
Tons Carbon Dioxide Emissions = 83,455 gal. fuel *8.8 kg CO_2 = **734,400 CO_2**

Calculations - Carpools

5 carpools * 2 persons/van/trips/day * 255 days/year = 2,550 trips annually
Vehicle miles traveled (VMT) = 2,550 trips * 120 miles/trip = 306,000 VMT annually
Fuel Saved = (306,000/27.5mpg) = 11,127.3 gallons gasoline annually
Tons Carbon Dioxide Emissions = 11,127.3 gal. fuel *8.8 kg CO_2 = **97,920 CO_2**

Calculations – VANPOOL + CARPOOL

Carbon Equivalent = (734,400 **CO_2**+97,920 **CO_2**) * 100/95/1,000 = 876.1 annual tons CO_2e

Connected Transportation Modes

Airport Shuttle (Executive Express connects individuals to DSM Airport)

Assumptions

20% of Airport Executive Express riders would NOT take the Airport Executive Express service if transit service didn't connect to the facility (some would opt to drive/park at the facility while others would look for a ride to Des Moines.) Executive Express is already traveling to the Des Moines Airport; therefore their added carbon emissions from their vans is part of the initial Intermodal Facility carbon emission calculation. These calculations below are just individuals not taking Executive Express due to no public transit connection but would be saved if public transit were part of the project through the expansion.

Average vehicle miles per gallon = 27.5 mpg
(Source: NHTSA or http://www.nhtsa.gov/cars/rules/cafe/NewPassengerCarFleet.htm)
Other 5% Greenhouse gases carbon dioxide equivalent (CO_2e) = CO_2 * 100/95
(Source: EPA or http://www.epa.gov/OMS/climate/420f05004.htm)
CO_2 burned per 1 gallon gasoline fuel = 8.8 kg
(Source: EPA or http://www.epa.gov/OMS/climate/420f05001.htm)
8.4 persons/trip (60% full on average; 14 seat van)
8.4 * 1.5 persons per private auto
5.6 autos removed per shuttle trip (8.4/1.5 persons)
9 trips/*day* (current Executive Express schedule)
362 days each year operated (doesn't run Thanksgiving Day Christmas Day , or New Years Day)

Calculations

Airport Express private vehicle annual trips removed= (5.6 autos/trip * 9 trips * 362/yr.)= 18,244.8
20% Decide not to Take Airport Express and drive down via a friend to Des Moines due to no transit connection (can't afford parking rate)= 18,244.8 * 20% = 3,649.0 vehicle trips annually
Vehicle miles traveled (VMT) = 3, 649.0 * 65 miles to Airport = 237,185 VMT annually
Fuel Saved = (237,185 VMT/27.5mpg) = 8,696.3 gallons gasoline annually
Tons Carbon Dioxide Emissions = 8,624.9 gal. fuel *8.8 kg CO_2 = 75,899.2 CO_2
Carbon Equivalent = 75,899.2 * 100/95/1,000 = 79.9 annual tons CO_2e

Intercity Buses (Jefferson Lines/Burlington Trailways)

Assumptions

20% of Intercity riders would NOT take the Intercity bus service to Ames if transit service didn't connect to the facility
Average vehicle miles per gallon = 27.5 mpg
(Source: NHTSA or http://www.nhtsa.gov/cars/rules/cafe/NewPassengerCarFleet.htm)
Other 5% Greenhouse gases carbon dioxide equivalent (CO_2e) = CO_2 * 100/95
(Source: EPA or http://www.epa.gov/OMS/climate/420f05004.htm)
CO_2 burned per 1 gallon gasoline fuel = 8.8 kg
(Source: EPA or http://www.epa.gov/OMS/climate/420f05001.htm)
15 person added trips/day estimated (assume no vehicle is available for all travelers)
362 days each year operated
120 miles average trip

Calculations

15 person added trips/day * 362 days/year = 5,430 trips annually
5,430 * 20% = 1,086 trips annually not taking intercity buses due to no transit connection
Vehicle miles traveled (VMT) = 1,086 annual trips * 120 miles/trip = 130,320 VMT annually
Fuel Saved = (130,320 VMT/yr./27.5mpg) = 4,739 gallons gasoline annually
Tons Carbon Dioxide Emissions = 4, 739 gal. fuel annually *8.8 kg CO_2 = 41,702.4 CO_2
Carbon Equivalent = 41,702.4 * 100/95/1,000 = 43.9 annual tons CO_2e

PHASE II Sustainability Calculations Summary

The table below illustrates and summarizes the above calculations, as well as, placing an annual dollar savings to the project. Specifically, a total of **1,049.4 tons of carbon emissions equivalent (CO_{2e})** are reduced from the community as well as a reduction of **113,287 gallons of fuel**. The result is that **$412,080 can be saved in fuel and carbon emissions each year due to the Intermodal Facility – Phase II!**

Savings Derived Through Intermodal Facility Phase II	Carbon Emissions Equivalent (CO_{2e})	DIESEL Fuel Savings (Gallons)	UNLEADED Fuel Savings (Gallons)	TOTAL Fuel SAVED (Gallons)
Hybrid Buses (diesel	18.7	1,935		1,935
Bicycle Pedestrian Connections	24.7		2,670.5	2,670.5
Circling for a Parking Space	6.1		663.9	663.9
Vanpool/Carpool	876.1		94,582.3	94,582.3
Airport Shuttle	79.9		8,696.3	8,696.3
Intercity Buses	43.9		4,739.0	4,739.0
TOTAL CO_{2e} or Gal. Fuel	**1,049.4**	**1,935**	**111,352.0**	**113,287**
* 33/metric ton CO_{2e} TIGGER federal register guidance	* **$33.00**			
* 2.86/gallon diesel fuel (CyRide FY2011 avg. price Ethanol)		* **$2.86**		
* 3.34/gallon unleaded fuel (Avg. Ames price 10/2011)			* **$ 3.34**	
TOTAL $ SAVED	**$34,630**	**$5,534**	**$371,916**	**$412,080 SAVED ANNUALLY**