Measure: Bike Share (T19)

Integration of a bike share program totaling 600 bikes into citywide multi-modal transportation system. The measure should be implemented in such a way to compliment current public transportation systems and the UA bike share program.

COT ARRA RFP Summary:

Emission reduction potential by 2020:	921 tCO_2e
Percentage of goal (2012):	0.05%
Percentage of goal (2020):	0.04%
Total annual average implementation costs:	$205K
Entity that bears the costs of implementation:	Public or private (see below for examples)
Savings per tCO_2e:	$520 / tCO_2e
Net annual savings:	$479K
Entity that realizes the financial return:	NA
Equitability (progressive/regressive, income/revenue neutral, etc):	Neutral
Potential unintended consequences:	See below

Background information:

Bike sharing is a system that facilitates short-term rental of pedal bicycles from one destination to another. According to the MWCOG application for grant funds for a region-wide bike-sharing program for the Washington DC metro area,

> "*By promoting bicycling for short trips of less than 3 miles, which currently are 17% of all commute trips, and 30% of non-work trips, and for the "last mile" of longer transit trips, bike sharing maximizes existing infrastructure by extending the reach of rail and bus transit in an effective, innovative, and low-cost way*."[1]

The system can be a valuable component of creating personal car-less mobility for Tucson residents and visitors, i.e. a system that maximizes a person's mobility through several options such as car or bike sharing, ridesharing and transit systems.

Bikes are rented and returned at automated kiosks and can be turned in to any other kiosk in the system. The system might be owned and operated by a municipal government, a non-profit organization or a for-profit company. The kiosks' small electricity needs (locking and unlocking bikes and internet access) are provided by the electric grid, solar panels or both; electricity needs increase if electric bikes (part of the bike-share system or privately-owned) are recharged at the kiosk.

Rental charges are structured to promote short-term use of the bike by increasing hourly costs for longer rentals. Typical user charges by US systems are ~$2-7 per hour including membership costs.[2] All of the *3rd Generation* programs initiated since 2008 have a tiered payment system ranging from single-use payment with credit card at the kiosk through yearly smartcard subscriptions.

Bike sharing is one way for communities to engage their constituents in a healthier, equitable, affordable, and more environmentally friendly mode of transportation that may be applicable to Tucson. Programs in cities like Denver, Washington D.C., and Minneapolis utilize sophisticated systems employ automated checkout systems, chip-enabled GPS tracking, mobile applications to track carbon offset generation, as well as better accounting and institutional practices to minimize theft and vandalism.

Business As Usual:

Currently, Tucson does not have a city-wide bike share program. Absent integration of such a program, Tucson commuters will miss out on the many co-benefits highlighted below and the City will miss out on a low-cost emission reduction potential.

Description of Measure and Implementation Scenario:

Given Tucson's growing bike-friendliness and dry climate, integrating a bike share program into citywide multi-modal transportation system could help to reduce local

vehicular emissions while providing tangible co-benefits. This analysis researches three systems of varying sizes, with a focus on a particular size that may be applicable to the metropolitan Tucson area. A full analysis of the varying business models is outside the scope of this report.

The carbon analysis assumes that a Tucson program would be partially modeled after the Denver Bike Share pilot program or the Metropolitan Washington Coalition of Governments (MWCOG), meaning it would commence with 100 bikes available from 10 stations. It would complement the University of Arizona's Cat Wheels bike share program, not replace it.

The analysis further assumes that a Tucson program would grow over time to 600 bikes at 50 stations. However, the City could choose to skip the pilot project phase and begin with the 600-bike system in 2012.

Has the Measure been implemented elsewhere and with what results?:

Many US cities are at some stage of implementing bike-sharing programs. In the cases outlined below, Minneapolis, MWCOG and Denver, the pilot projects were successfully launched in 2008 and 2010. Funding for the pilot programs have come from a variety of sources including private foundations, corporate sponsorship, and Federal grants.

Details of these programs' full implementation are: [3] (or otherwise noted)

Minneapolis' Nice Ride Minnesota:[4]

The system was launched in June 2010 with 1,000 bikes and 65 stations. Start-up costs were $3.2M capital and an estimate of $1,300/bike/year for annual operations and maintenance of which 2/3 is covered by subscriptions and trip fee revenue with the balance covered by sponsorship. Its first 150-day riding season ended in early November with over 100,000 rides taken, 1,295 one-year subscriptions sold, nearly 30,000 one-day or one-month subscriptions sold, An end-of-season survey found that 77% of users already owned a bike and 89% used the bikes for transportation as opposed to recreation.

Denver's B-cycle:

Building on the success of the temporary bike share program set up for the Democratic National Convention in 2008, Denver Bike Share was established to continue bike sharing in the Denver area in spring 2010. The independent non-profit organization was developed by the City of Denver; a major private-sector partner is the Kaiser Permanente Healthcare System. Its first phase consists of 50 stations and over 600 bikes. The implementation costs were approximately $2M (approx. $3,333/per bike) with annual O&M costs projected to be $1.5M. Denver's B-cycle is projected to have year O&M expenses of $1.5M with revenue

from "*user and member fees, grants and sponsorships of bike stations*" totaling $1.53M.[5]

MWCOG SmartBike:[6]

Through a 2010 application for a Transportation Investments Generating Economic Recovery (TIGER) grant, MWCOG has an ambitious 20-year plan for their bike share program. The pilot program began with 120 bikes with 10 stations funded through a 20-year advertising contract on bus shelters with Clear Channel Outdoors. The full implementation costs for a year 1 launch with 3,250 bikes is projected to be $12.0M for capital and $4.6M for O&M. The annual O&M costs are a function of the quantity of bikes ($1,400/bike which contemplates and 8% cost for vandalism and theft) and bike replacements every 5 years.

The University of Arizona's Cat Wheels program:[7]

The university's Cat Wheels programs makes bikes available at any of four garages plus the Campus Recreation Outdoor Adventure Center from 7:30 to 4:00 pm on weekdays. A single rental is good for 24 hours but bikes must be returned to their original home by end of business the following work day or a $10/day late fee applies. The program's 25 bikes are available at no cost to UA students or employees.

Energy/Emission analysis:

The GHG analysis will use a cost assumption of $3,441 per bike, which is an average of the per bike capital expenditure of Denver, MWCOG, and Minneapolis (actual per bike capital cost are $3,333, $3,700, and $3,200, respectively):

Description	***Input***	***Notes***
Average bike trip length	1.5 miles	From MWCOG
QTY of riders/bike/day	7	From MWCOG
gCO_2e/mi (light-duty)	319	Assuming annual 2% reduction due to CAFE, the 10-year AVG. Converted from 0.77 pound CO_2e/mi.
gCO_2e/mi (transit)	454	Converted from 1.0 lb CO_2e/mi
% of riders shifted from single occupant light-duty vehicles	20%	Assumptions from MN[8] and MWCOG[9]
% of riders shifted from transit users	20%	
% of riders shifted from ridesharing	15%	
% of riders shifted from walkers	30%	
% of recreational riders or wouldn't have taken trip at all	15%	

Pilot		
Quantity of Bikes	100	
Capital Costs	$341K	
Daily ridership (bikes * riders/day)	700	
QTY of trips per day (2 trips/rider)	1400	
VMT reduced per day (SOV)	420	
VMT reduced per day (transit)	420	
VMT reduced per day (rideshare)	315	
CO_2e avoided (VMT reduced per day * CO_2e/mile) / 1,000,000g/t * 365 * 10yrs	1,552	tCO_2e. Assumes a 10-yr life
Full Program		
QTY of Bikes	600	
Capital Costs	$2.05M	
Daily ridership (bikes * riders/day)	4200	
# of trips per day (2 trips per rider)	8400	
VMT reduced per day (SOV)	2520	
VMT reduced per day (transit)	2520	
VMT reduced per day (rideshare)	1890	
CO_2 avoided (in 2020)	921	tCO_2e

Contribution analysis:		
COT 1990 Citywide GHG emissions (baseline)[10]:	5,461,020	tCO_2e
MCPA 7% reduction target for COT:	5,078,749	
2012 BAU GHG emissions projection:	7,000,000	
2020 BAU GHG emissions projection:	7,343,141	
GHG emissions reduction to meet 7% goal (2012):	1,921,251	
GHG emissions reduction to meet 7% goal (2020):	2,264,392	
Full Program		
Contribution of T19 Bike Share Measure (in 2020):	921	tCO_2e
2020 Contribution of T19 Bike Share Measure:	0.04	%

Economic analysis:.

This economic analysis is based on the following assumptions:

- A bike-sharing system's capital costs are spread over a ten-year lifetime for the kiosks and bikes. A pilot project of 100 bikes has capital costs of $341,111 and a full project of 600 bikes has capital costs of $2.05M. Interest charges on capital costs are zero (i.e. capital is provided as a government grant or private-sector investment rather than a loan).

- Operation and maintenance costs are assumed to be fully covered by user charges and other revenue sources.[11] Therefore, the annual net costs to citizens of the bike-sharing system are the capital costs divided by ten years.

- Each bike is used by an average of 7 riders 2 times per day with an average trip distance of 1.5 miles. Therefore, each bike travels 7,665 miles per year.

- Bike-share trips occur for the following reasons:
  - 20% are a substitute for a single-occupant light-duty vehicle trip achieving 26 MPG therefore emitting 0.77 pounds of CO_2e per mile.
  - 20% are a substitute for a transit bus achieving 1 pound of CO_2e per passenger mile, the City of Tucson's rate as of 2006.
  - 15% are a substitute for ridesharing in light-duty vehicle trips with the same emissions listed above.

Economic Results:

- Full program, 600 bikes and 50 stations, life of 10-years commencing 2012
  - Total costs to citizens: $2.05 million
  - Savings (from fuel): $6.84 million
  - Net savings over 10-year life of program: $4.79 million
  - Annual miles ridden: 4.60 million miles
  - Cumulative CO_2e savings: ***9,211 tCO_2e***
  - Net savings per ton of CO2e savings: ***$520/$tCO_2e$***[12]

Co-benefits:

Many co-benefits exist in a bike share program. The MWCOG *Bike Sharing Cost Benefit Analysis* lists the following benefits:[2]

- Increased transit use
- Reduced transportation costs to households
- Public health improvement
- Increase traffic safety for cyclists b/c of critical mass
- Increased transportation access
- Congestion relief

Through the increased use of transit and reduced dependence on fuel, this measure should be in alignment with Tucson's other GHG adaptation measures.

Bike-sharing systems have the potential for increasing the use of personal bikes or electric bikes if they stimulate demand for bike-friendly infrastructure such as secure/covered storage, charging systems, shower/locker facilities, etc. at buildings. Some systems are designed to be grid-free, relying solely or partially on solar energy generated at the.

Equitability:

This measure is income neutral due to the transportation cost effectiveness of the program.

Potential unintended consequences:

As a result of increased bicycle transportation, some implementing communities project a small uptick in cycling accidents. Even in these situations, overall healthcare and auto-accident cost-benefit projections are net positive (for example, please see Works Cited 2). Finally, it is worth noting that during the first season of the Nice Ride Minnesota system resulted in only 2 accidents and zero injuries in over 100,000 rides.

Increased bike traffic can increase vehicle congestion unless bikes are given their own rights of way systems that minimize vehicle interactions – something that both bike and vehicles users desire. Congestion problems are somewhat reduced by use of electric bikes that will typically achieve speeds of 20 MPH without pedaling – which reduces the speed differential between bikes and vehicles.

General Note: All references retrieved October through December of 2010 unless otherwise noted.

Endnotes:

[1] Metropolitan Washington Council of Governments, "A Regional Bike-sharing System for the National Capital Region," application for US DOT TIGER grant funding, August 2010.

[2] Denver's system charges include a membership fee to access a bike plus an hourly charge. Membership fees range from $5 for a one-day pass to $65 for annual membership. Charges range from no charge for less than 30 minutes to $6.60 for the fourth half-hour of rental (91-120 minutes) and $4.40 per additional 30 minutes. A one-hour rental 24 times per year would average $3.81 per hour; a one-hour rental 52 times per year would average $2.35 per hour. See: http://denver.bcycle.com/pricing.aspx.

Nice Ride Minnesota also charges $5 for a one-day subscription and allows a 30-minute ride at no additional cost. Other charges are slightly different than Denver: $60 for one-year subscription; a total of $4.50 for a 90-minute rental and $6.00 per additional thirty minutes. A one-hour rental 24 times per year would average $4 per hour total costs; a one-hour rental 52 times per year would average $2.65 per hour. In both systems, a "casual" single-day user, such as a tourist, would pay $6+ for a one-hour ride.

[3] CityRyde, LLC. (2010, Sept 21). CityRyde-Products-Whitepapers. Retrieved Nov 13, 2010, from CityRyde: http://www.cityryde.com/what-we-do/products/whitepapers/

[4] Information obtained from website of Nice Ride Minnesota: www.niceridemn.org.

[5] http://blogs.westword.com/latestword/2009/05/denvers_bike-share_program_lau.php

[6] http://www.mwcog.org/transportation/activities/tigerii/documents.asp?COMMITTEE_ID=262

[7] Information obtained from website of Cat Wheels: https://parking.arizona.edu/bikeshare.

[8] Nice Ride survey results: http://appv3.sgizmo.com/reportsview/?key=102593-416326-6d13ea0276ea0822c9f59f4411b6c779

[9] Washington bike share pilot survey results: http://bike-sharing.blogspot.com/2009/06/washington-bike-sharing-survey-results.html

[10] PAG Regional Greenhouse Gas Inventory Addendum - 2009

[11] Transcript of interview with B-cycle CMO: http://www.bikewaycentral.com/2010/06/interview-andrew-davison-b-cycle-cmo-on.html

[12] Note the small increase in the normalized cost per tonne is due to the assumed 2% decrease in grams of CO_2e per mile driven by increased CAFE standards.