

THE ECONOMIC AND ENVIRONMENTAL IMPACT OF PHILLYCARSHARE IN THE PHILADELPHIA REGION

Final Report Submitted To:
PhillyCarShare
125 South 9th Street Suite 1000
Philadelphia PA 19107

Final Report Submitted By:
Econsult Corporation
3600 Market Street 6th Floor
Philadelphia PA 19104

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EXECUTIVE SUMMARY

In addition to providing individuals and businesses with the convenience of fractional usage of cars located throughout the City of Philadelphia at affordable hourly rates, PhillyCarShare, one of the largest car-sharing programs in North America, generates significant economic and environmental benefits to the Philadelphia region. This report focuses on four particular categories:

- Economic – (1) PhillyCarShare’s own operations have a spillover impact on the regional economy, and (2) \$13.2 million in net new purchasing power for PhillyCarShare residential members from reduced transportation costs also benefits the regional economy (see Figure ES.1).
- Environmental – (1) PhillyCarShare residential members driving fewer miles results in fewer pollutants and positive environmental consequences for the region, and (2) PhillyCarShare residential members driving fewer miles also means fewer cars on the road, reducing congestion and further reducing negative environmental impacts (see Figure ES.2).

Figure ES.1 – Estimated Total Annual Economic Impact Generated by PhillyCarShare (in 2009 \$M)

	PhillyCarShare’s Operating Expenditures		PhillyCarShare Members’ Increased Purchasing Power from Reduced Transportation Costs	
	City of Philadelphia	Commonwealth of Pennsylvania	City of Philadelphia	Commonwealth of Pennsylvania
Total Expenditures	\$13.1	\$17.3	\$14.0	\$20.1
Total Employment	67	132	150	286
Total Earnings	\$2.6	\$4.9	\$2.7	\$5.9

Source: PhillyCarShare (2010), Econsult Corporation (2010), US Department of Commerce (2009)

Figure ES.2 – Estimated Annual Negative Environmental Impacts Avoided As a Result of PhillyCarShare

Cars Taken Off the Road	4.6K
Cars Taken Off the Road for Each of PhillyCarShare’s 300 Cars	15.3
Number of Miles Not Driven by PhillyCarShare Members	17.3M
Gallons of Gas Not Consumed Because of Reduced Driving by PhillyCarShare Members	770K
Amount Not Spent on Gasoline Because of Reduced Driving by PhillyCarShare Members	\$1.8M
Barrels of Oil Not Consumed Because of Reduced Driving by PhillyCarShare Members	40K
Tons of C02 Emissions Avoided Because of Reduced Driving by PhillyCarShare Members	7K
“Externality Costs” Avoided by Reduced Emissions by Other Drivers Because of Reduced Driving by PhillyCarShare Members	\$600K
Hours of Travel Delay Avoided by Other Drivers Because of Reduced Driving by PhillyCarShare Members	47K
Gallons of Fuel Not Consumed by Other Drivers Because of Reduced Driving by PhillyCarShare Members	30K
Congestion Costs Avoided Within the Region Because of Reduced Driving by PhillyCarShare Members	\$980K

Source: Econsult Corporation (2010), Bureau of Transportation Statistics (2009), Energy Information Agency (2010), University of California at Berkeley (2008), Air Pollution Modeling and Its Application XII (1998)

1.0 INTRODUCTION

PhillyCarShare is one of the largest car-sharing programs in North America. In 2009, over 14,000 residential members made at least one reservation with one of PhillyCarShare's 300 cars. In addition to providing individuals and businesses with the convenience of fractional usage of cars located throughout the City of Philadelphia at affordable hourly rates, PhillyCarShare's existence has significant benefits to the Philadelphia region. Econsult Corporation was engaged to help articulate and quantify some of these benefits. For the purposes of this report, we focus on four particular categories of benefits:

1. **Economic Benefit #1** – PhillyCarShare's own operations, and particularly the localized nature of its maintenance expenditures, have an ongoing economic impact on the regional economy that can be expressed in the form of expenditures, employment, and earnings.
2. **Economic Benefit #2** – Reduced costs to members associated with PhillyCarShare membership versus car ownership translates into net purchasing power to members and therefore net gains in dollars circulating throughout the regional economy, which also has economic impacts that can also be expressed in the form of expenditures, employment, and earnings.
3. **Environmental Benefit #1** – Reduced miles driven because of behavioral shifts associated with PhillyCarShare membership translates into net losses in CO2 emissions, which has positive environmental consequences for the region that can be expressed in both environmental and economic terms.
4. **Environmental Benefit #2** – Reduced miles driven also means fewer cars on the road, reducing congestion and thus having an additional effect on CO2 emissions beyond the PhillyCarShare members themselves.

Car usage is perceived to have high upfront (i.e. fixed) costs and low ongoing (i.e. variable) costs. In fact, from an environmentally and socially optimal standpoint, car usage's variable costs are much higher than people perceive. See, for example, "Transportation Cost and Benefit Analysis," Victoria Transport Policy Institute (January 2009), which estimates a per-mile car usage cost of as high as \$1.42, when one accounts for such societal costs as congestion, air pollution, and land use.

The typical car owner does not value each additional mile at \$1.42, and as a result is far more likely to drive that additional mile, particularly given the convenience associated with car usage. In other words, the typical car owner perceives that he or she has already borne the car's high fixed costs, and so it is marginally inexpensive to drive it one more time.

For PhillyCarShare members, on the other hand, car usage has now become more of a purely variable cost, and so it is likely that car usage will decrease. In fact, member surveys bear out this pattern. PhillyCarShare reservations are not one-for-one substitutes for car trips that used to be made with an individual's own car. Over time, members respond to the shift in their car usage expenditure from high fixed cost to high variable cost by making behavioral changes to reduce car trips, either by bundling trips or using alternative forms of transportation.

To be sure, there are other benefits than these four categories, and it is more than simply the region that benefits from PhillyCarShare's existence. Nevertheless, identifying and estimating these four categories of benefits to the region is a useful starting point in quantifying the overall usefulness of PhillyCarShare to individuals, entities, and the region as a whole.

It is impossible to precisely model the incremental effect of PhillyCarShare's existence in the City on the economy and environment. To do so would require knowing the exact behaviors of PhillyCarShare members; we only have what members have chosen to disclose about themselves through annual surveys. Furthermore, calculating the complex interactions between cars being bought or not bought and subsequently being driven and maintained or not driven and maintained, and the regional economic and environmental impacts that result, is necessarily an imprecise exercise. Nevertheless, we believe our estimates to be defensible and honest, and where possible err on the conservative side so as not to be guilty of overstating the subsequent results.

Using standard input-output methodologies,¹ we can estimate the total economic impacts generated within the region by PhillyCarShare's own operations (**Economic Benefit #1**) and by the increase in purchasing power by PhillyCarShare members as a result of their net reduction in car usage expenditures (**Economic Benefit #2**). We can also draw from the growing body of literature and data related to the environmental costs associated with driving and associated congestion to estimate the type and size of negative environmental impacts avoided by PhillyCarShare members driving less (**Environmental Benefit #1**) and by their driving less leading to less congestion in the region (**Environmental Benefit #2**).²

2.0 ECONOMIC IMPACT

2.1 Economic Benefit #1: PhillyCarShare Operating Expenditures

In order to quantify **Economic Benefit #1** (PhillyCarShare’s own direct operating expenditures), we modeled the total economic impact in expenditures, employment, and earnings associated with 2009 levels of PhillyCarShare’s operations, including salaries paid and cars maintained. In 2009, PhillyCarShare had operating expenditures of approximately \$7.8 million. Many of its major expenditures, including leasing, maintenance, and insurance, were made with vendors located within the City, further increasing its local economic impact.³

We estimate that, when accounting for both PhillyCarShare’s annual operating expenditures as well as any indirect and induced impacts associated with that composition and scale of expenditures, **the total annual economic impact is about \$13 million in expenditures supporting 70 jobs and \$2.6 million in earnings within the City of Philadelphia, and about \$17 million in expenditures supporting 130 jobs and \$5 million in earnings within the Commonwealth of Pennsylvania** (see Figure 2.1).⁴ Thus, the total cumulative economic impact of PhillyCarShare through its own operating expenditures since its inception in 2002 is something on the order of over \$50 million within the City of Philadelphia and over \$70 million within the Commonwealth of Pennsylvania.⁵

Figure 2.1 – Estimated Total Annual Economic Impact Generated by PhillyCarShare Operating Expenditures (in 2009 \$M)⁶

	City of Philadelphia	Commonwealth of Pennsylvania
Direct Expenditures	\$7.8	\$7.8
Indirect & Induced Expenditures	\$5.3	\$9.6
Total Expenditures	\$13.1	\$17.3
Total Employment	67	132
Total Earnings	\$2.6	\$4.9

Source: PhillyCarShare (2010), Econsult Corporation (2010), US Department of Commerce (2009)

2.2 Economic Benefit #2: PhillyCarShare Members Having Additional Purchasing Power

In order to quantify **Economic Benefit #2** (PhillyCarShare members having greater purchasing power by not purchasing cars and driving fewer miles), we estimated the number of PhillyCarShare members who gave up a car because of PhillyCarShare's existence, and multiplied it by an average amount of money saved per such member. In determining the number of PhillyCarShare members who gave up a car because of PhillyCarShare's existence, in a 2009 member survey, 7 percent stated they considered but then did not feel they needed to buy a car as a result of PhillyCarShare, while 25 percent stated they got rid of their car as a result of PhillyCarShare; thus, 32 percent of PhillyCarShare members either did not need to purchase a car or gave up a car because of PhillyCarShare's existence.⁷

Multiplying this proportion by PhillyCarShare's membership base of approximately 14,000 residential accounts⁸ yields an estimated **4,600 cars that did not need to be purchased or that could be given up in exchange for PhillyCarShare membership**. In other words, **each of PhillyCarShare's 300 cars helped take 15 cars off the road within the Philadelphia region**. These estimates conservatively do not account for any additional impact associated with corporate accounts, whose use of PhillyCarShare reduces the need for corporate fleets, for employees to bring their cars to work if they have to make a car trip for business, and for administrative time spent reimbursing employees for those work trips.⁹

In determining the amount saved by each of these members, we must estimate the cost difference between car ownership and PhillyCarShare membership. The American Automobile Association estimates that the average cost of owning and operating a car is about \$4,300 per year and 13 cents per mile, respectively.¹⁰ The average annual vehicle miles traveled per capita in the region is about 7,000 miles,¹¹ and since city drivers in Pennsylvania tend to drive about 33 percent less than suburban drivers, we reduce this amount by a third, for a Philadelphia average miles traveled per capita of about 4,700 miles per year.¹² Thus, we can estimate that the average cost of owning and operating a car is \$4,300 plus 13 cents per miles times 4,700 miles, for an annual total of about \$4,900.

The median PhillyCarShare member incurred \$264 in membership and usage fees in 2009.¹³ However, anyone who gave up a car to switch to PhillyCarShare is likely a high-volume PhillyCarShare user, relative to the average PhillyCarShare member, since they are using PhillyCarShare in lieu of a personal car, rather than on relatively rare occasions; therefore, we consider instead the usage fee for the 90th percentile PhillyCarShare member, which is \$1,050 in usage fees.¹⁴ Assuming an additional \$1,000 in other transportation expenditures,¹⁵ the net gain to each PhillyCarShare member that gave up a car is \$5,000 minus \$1,050 and \$1,000, or \$2,850. Multiplied by the estimated 4,600 cars given up as a result of PhillyCarShare, this results in **an aggregated \$13.2 million more in local purchasing power each year**. Assuming an average marginal tax rate of 25 percent, **this is like PhillyCarShare members getting an aggregate \$18 million annual increase in their salaries**.

From an economic impact standpoint, this does not mean that the region enjoys \$13.2 million more in expenditures, merely that that amount of expenditures has shifted from car ownership to fractional ownership via PhillyCarShare, plus additional transportation expenditures, plus discretionary spending by PhillyCarShare members. Because car ownership consists of expenditures whose economic impact tends to leak outside of the region, the net economic impact to the region is higher as a result of this shift in the composition of expenditures.¹⁶

The impact in the region of this \$13.2 million increase in local purchasing power can be modeled in a similar fashion as the impact of PhillyCarShare annual operating expenditures was modeled above.¹⁷ We estimate that, when accounting for both the direct impacts associated with net new increase in purchasing power by PhillyCarShare members, as well as any indirect and induced impacts that result, **the total annual economic impact is about \$14 million in expenditures supporting 150 jobs and \$2.7 million in earnings within the City of Philadelphia, and about \$20 million in expenditures supporting 280 jobs and \$5.9 million in earnings within the Commonwealth of Pennsylvania** (see Figure 2.2).¹⁸ Thus, the total cumulative economic impact of PhillyCarShare through the increase purchasing power in provides its members since its inception in 2002 is something on the order of \$70 million within the City of Philadelphia and \$100 million within the Commonwealth of Pennsylvania.¹⁹

Figure 2.2 – Estimated Total Annual Economic Impact Generated by Increased Purchasing Power by PhillyCarShare Members Who Gave Up a Car Because of PhillyCarShare (in 2009 \$M)²⁰

	City of Philadelphia	Commonwealth of Pennsylvania
Direct Expenditures	\$9.1	\$9.1
Indirect & Induced Expenditures	\$4.9	\$11.0
Total Expenditures	\$14.0	\$20.1
Total Employment	150	286
Total Earnings	\$2.7	\$5.9

Source: PhillyCarShare (2010), Econsult Corporation (2010), US Department of Commerce (2009)

3.0 ENVIRONMENTAL IMPACT

3.1 Environmental Benefit #1: PhillyCarShare Members Driving Fewer Miles

In addition to the economic benefits enjoyed by the Philadelphia region as a result of PhillyCarShare's operating expenditures and the increased purchasing power of PhillyCarShare members, PhillyCarShare's existence has a significant positive environmental benefit. As PhillyCarShare members are reducing their expenditures by driving less, they are also logging fewer miles driven, whether by bundling trips or forgoing car travel altogether for alternative transportation modes.

In the same way that we conservatively estimated aggregate cost reduction to PhillyCarShare members, we can conservatively estimate aggregate reductions in miles driven by PhillyCarShare members (**Environmental Benefit #1**). We assume that the proportion of PhillyCarShare members who gave up cars because of PhillyCarShare would have otherwise driven about 4,700 miles, as previously estimated, if they had owned their own car (i.e. the estimated median number of miles driven in Philadelphia), and that the number of miles they actually drove using PhillyCarShare was around 1,000 miles (based on the fact that the 90th percentile of miles driven by PhillyCarShare residential members who made at least one trip in 2009 was 948),²¹ and thus the net reduction per PhillyCarShare member would be about 3,700 miles.²²

Using our previous assumption of 4,600 fewer cars on the road in the region, which conservatively does not account for corporate members or for residential members who did not make at least one reservation in 2009,²³ this results in **an aggregate net reduction in miles driven of 17.3 million**. Thus, the total cumulative net reduction in miles driven as a result of PhillyCarShare since its inception in 2002 is something on the order of 70 million.²⁴

Reducing the number miles driven in the region by 17.3 million has significant environmental implications.²⁵ Assuming average fuel efficiencies and the 2009 average cost of gasoline, **that represents 40,000 barrels of oil not purchased, 770,000 gallons of gasoline not consumed, and \$1.8 million in gasoline costs not incurred** (see Figure 3.1). It also means that there were about **7,000 tons of carbon dioxide (CO₂) not emitted**, among other pollutants (see Figure 3.2). It is estimated that the amount of pollutants not emitted because of fewer miles driven as a result of PhillyCarShare translates into about **\$600,000 per year in "externality costs" avoided by the region**.²⁶ The actual environmental impacts are probably even greater, since we conservatively did not account for the fact that a very large proportion of PhillyCarShare miles driven were by hybrid cars, which have higher than average fuel efficiencies and lower emissions.²⁷

Figure 3.1 – Estimated Environmental Impacts As a Result of Fewer Miles Driven in the Region Because of PhillyCarShare

Cars Taken Off the Road	4.6K
Cars Taken Off the Road for Each of PhillyCarShare’s 300 Cars	15.3
Number of Miles Not Driven by PhillyCarShare Members	17.3M
Average Fuel Efficiency (miles per gallon)	22.5
Gallons of Gas Not Consumed	770K
Average 2009 Price of Gasoline	\$2.33
Total Amount Not Spent on Gasoline	\$1.8M
Gallons of Gas Produced per Barrel of Oil Refined	18.56
Total Barrels of Oil Not Consumed	40K

Source: Econsult Corporation (2010), Bureau of Transportation Statistics (2009), Energy Information Agency (2010), University of California at Berkeley (2008)

Figure 3.2 – Estimated Annual CO2 Not Emitted As a Result of Fewer Miles Driven in the Region Because of PhillyCarShare

	Grams per VMT	VMT Not Traveled	Total Pollution Avoided (tons)
CO2	365.000	17.3M	7K

Source: Econsult Corporation (2010), Air Pollution Modeling and Its Application XII (1998)

3.2 Environmental Benefit #2: Fewer Miles Driven Means Less Congestion in the Region

Importantly, actual CO2 emissions are actually reduced by more than just that which is associated with PhillyCarShare members, for taking that many miles of car usage off the road has an incremental effect on the travel time of those drivers who are on the road, by reducing congestion (**Environmental Benefit #2**). It may seem a small and perhaps imperceptible difference, but it has significant environmental consequences, given the vast amounts of travel delay, excess fuel consumed, and overall time and money costs associated with congestion. If one were to add the 17.3 million additional miles that would be driven each year but for PhillyCarShare’s existence in the region, **the region would incur about 47,000 more hours of travel delay, consume 30,000 additional gallons of gas, and bear an additional \$980,000 in congestion costs** (see Figure 3.3).²⁸

Figure 3.3 – Estimated Annual Congestion Costs Avoided by Other Drivers As a Result of Fewer Miles Driven in the Region Because of PhillyCarShare

	2009 Region-wide Total	# Increase without PhillyCarShare	% Increase without PhillyCarShare
Total Miles Driven	41.0B	17.3M	0.04%
Travel Delay (Hours)	112M	47K	0.04%
Excess Fuel Consumed (Gallons)	71M	30K	0.04%
Congestion Costs	\$2.3B	\$980K	0.04%

Source: Econsult Corporation (2010), Delaware Valley Regional Planning Commission (2009), Texas Transportation Institute (2009), University of California at Berkeley (2008)

4.0 CONCLUSION

In summary, despite utilizing conservative assumptions throughout this analysis, we find that PhillyCarShare has a significantly economic and environmental impact on the Philadelphia region (see Figure 4.1 and Figure 4.2):

1. **Economic Benefit #1** – PhillyCarShare’s own operations have a spillover impact on the regional economy.
2. **Economic Benefit #2** – \$13.2 million in net new purchasing power for PhillyCarShare residential members from reduced transportation costs also benefits the regional economy.
3. **Environmental Benefit #1** – PhillyCarShare residential members driving fewer miles results in fewer pollutants and positive environmental consequences for the region.
4. **Environmental Benefit #2** – PhillyCarShare residential members driving fewer miles also means fewer cars on the road, reducing congestion and further reducing negative environmental impacts.

Figure 4.1 – Estimated Total Annual Economic Impact Generated by PhillyCarShare (in 2009 \$M)

	PhillyCarShare’s Operating Expenditures		PhillyCarShare Members’ Increased Purchasing Power from Reduced Transportation Costs	
	City of Philadelphia	Commonwealth of Pennsylvania	City of Philadelphia	Commonwealth of Pennsylvania
Total Expenditures	\$13.1	\$17.3	\$14.0	\$20.1
Total Employment	67	132	150	286
Total Earnings	\$2.6	\$4.9	\$2.7	\$5.9

Source: PhillyCarShare (2010), Econsult Corporation (2010), US Department of Commerce (2009)

Figure 4.2 – Estimated Annual Negative Environmental Impacts Avoided As a Result of PhillyCarShare

Cars Taken Off the Road	4.6K
Cars Taken Off the Road for Each of PhillyCarShare’s 300 Cars	15.3
Number of Miles Not Driven by PhillyCarShare Members	17.3M
Gallons of Gas Not Consumed Because of Reduced Driving by PhillyCarShare Members	770K
Amount Not Spent on Gasoline Because of Reduced Driving by PhillyCarShare Members	\$1.8M
Barrels of Oil Not Consumed Because of Reduced Driving by PhillyCarShare Members	40K
Tons of C02 Emissions Avoided Because of Reduced Driving by PhillyCarShare Members	7K
“Externality Costs” Avoided by Reduced Emissions by Other Drivers Because of Reduced Driving by PhillyCarShare Members	\$600K
Hours of Travel Delay Avoided by Other Drivers Because of Reduced Driving by PhillyCarShare Members	47K
Gallons of Fuel Not Consumed by Other Drivers Because of Reduced Driving by PhillyCarShare Members	30K
Congestion Costs Avoided Within the Region Because of Reduced Driving by PhillyCarShare Members	\$980K

Source: Econsult Corporation (2010), Bureau of Transportation Statistics (2009), Energy Information Agency (2010), University of California at Berkeley (2008), Air Pollution Modeling and Its Application XII (1998)

APPENDIX A - INPUT-OUTPUT METHODOLOGY

The economic impact estimates presented in this report were derived from the regional Input-Output (I-O) model developed and maintained by the US Department of Commerce, Bureau of Economic Analysis (BEA). This model, the Regional Input-Output Modeling System (RIMS II), is widely used to estimate the economic impacts of regional projects. The results generated from the RIMS II model are widely recognized as plausible and defensible, in cases where the input data to the model are accurate and based on reasonable assumptions. This section describes the basic concepts that underlie RIMS II.

An I-O model provides a compact means of summarizing inter-industry relationships within regions. The model itself is essentially an accounting framework, expressed as a matrix or array. For each industry in the region, the model shows the distribution of inputs purchased and outputs sold to all other regional industries. The RIMS II model is based on the BEA National I-O model, which shows the input and output structure for nearly 500 industries, and the BEA regional economic accounts, which are used to adjust the information in the national model to reflect a given regions' industrial structure and inter-industry trading patterns.

The data that drive the I-O model are the planned expenditures associated with the project being studied. In the jargon of I-O models, those expenses make up the "direct expenditures," which form one part of the program's total economic impact on the region. Assuming that the planned project is a new facility, the direct expenditures are the sum of all spending needed to construct, equip and operate that facility.

Some of that spending will be to purchase goods and services from other businesses in the region, causing those firms to increase production. In turn, the firms supplying the new facility will need to increase purchases from their suppliers, to meet their new orders. The sum of all of this inter-industry spending is the "indirect expenditures" associated with the new facility.

All of the economic activity resulting from the new facility, whether direct or indirect, will require workers who must be paid. Some of their earnings will be spent at businesses within the region on various goods and services, creating another round of economic activity like that described above. These expenditures equal the "induced expenditures" associated with the new facility.

The sum of the direct, indirect and induced expenses represents the total economic impact of the new facility on the region. In addition to measuring that impact in dollars as output or expenditures, the RIMS II model produces estimates of the proportion of that spending paid to regional households as wages and salaries. Finally, the RIMS II model generates estimates, by industry, of the number of full- and part-time jobs related to the new facility. Both the earnings and employment estimates are useful supplementary measures of the regional economic impact of the new project. The RIMS II model enables economic impact estimates to be known at the county, state, and national level.

APPENDIX B – BIBLIOGRAPHY OF SOURCES

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APPENDIX C – ADDITIONAL DETAIL ON ECONOMIC IMPACT

Figure C.1 – Industry Composition of Total Annual Expenditure Impact within City of Philadelphia and Commonwealth of Pennsylvania Associated with PhillyCarShare’s Operating Expenditures²⁹

Top Industries Benefitted in City	% of Total Expenditures	Top Industries Benefitted in Commonwealth	% of Total Expenditures
Finance and insurance	19%	Real estate and rental and leasing	16%
Professional, scientific, and technical services	19%	Finance and insurance	16%
Real estate and rental and leasing	19%	Professional, scientific, and technical services	16%
Other services	13%	Manufacturing	13%
Manufacturing	10%	Other services	11%
Information	4%	Health care and social assistance	4%
Utilities	4%	Information	4%
Administrative and waste management services	3%	Utilities	4%
Health care and social assistance	2%	Retail trade	3%
Transportation and warehousing	2%	Administrative and waste management services	3%
All other industries	5%	All other industries	10%

Source: PhillyCarShare (2010), Econsult Corporation (2010), US Department of Commerce (2009)

Figure C.2 – Industry Composition of Total Annual Expenditure Impact Associated with Increased Purchasing Power by PhillyCarShare Members Who Gave Up a Car Because of PhillyCarShare, and Decreased Car Purchases and Related Ownership Expenditures³⁰

Top Industries Benefitted in City	% of Total Expenditures	Top Industries Benefitted in Commonwealth	% of Total Expenditures
Transportation and warehousing	48%	Transportation and warehousing	35%
Real estate and rental and leasing	37%	Real estate and rental and leasing	28%
Professional, scientific, and technical services	14%	Professional, scientific, and technical services	11%
Health care and social assistance	9%	Health care and social assistance	9%
Utilities	9%	Utilities	7%
Accommodation and food services	5%	Accommodation and food services	4%
Arts, entertainment, and recreation	4%	Retail trade	4%
Information	3%	Wholesale trade	3%
Administrative and waste management services	3%	Information	3%
Wholesale trade	2%	Administrative and waste management services	3%
All other industries	-34%	All other industries	-7%

Source: PhillyCarShare (2010), Econsult Corporation (2010), US Department of Commerce (2009)

APPENDIX D – ADDITIONAL DETAIL ON ENVIRONMENTAL IMPACT

Figure D.1 – Estimated Annual Pollutants Not Emitted As a Result of Fewer Miles Driven in the Region Because of PhillyCarShare³¹

Operational Emissions	Grams per VMT	Total Pollution Avoided (tons)
CO2	365.000	6,978.7
SO2	0.020	0.4
CO	9.500	181.6
NOX	0.800	15.3
VOC	0.280	5.4
PM10	0.110	2.1
Non-Operational Emissions	Grams per VMT	Total Pollution (tons)
Startup - CO	2.400	45.9
Startup - NOX	0.150	2.9
Startup - VOC	0.220	4.2
Brake Wear - PM10	0.010	0.2
Tire Wear - PM10	0.010	0.2
Evaporative Losses - VOC	0.810	15.5

Source: Econsult Corporation (2010), Bureau of Transportation Statistics (2009), Energy Information Agency (2010), University of California at Berkeley (2008)

Figure D.2 – Estimated “Externality” Cost³² of Annual Pollutants Not Emitted As a Result of Fewer Miles Driven in the Region Because of PhillyCarShare (in 2009 \$)³³

Pollutant	Total Pollution Reduction (tons)	Costs per Ton (\$)	Total Benefits
CO2	6,979	\$21	\$146,553
SO2	0	\$2,370	\$906
CO	182	\$1,280	\$232,497
NOX	15	\$9,685	\$148,140
VOC	5	\$9,040	\$48,396
PM10	2	\$6,460	\$13,587
Total		Total	\$590,079

Source: Econsult Corporation (2010), *Air Pollution Modeling and Its Application XII* (1998)

APPENDIX E – END NOTES

¹ Any expenditure generates additional economic activity in a particular geographic area via the mechanism of the Keynesian consumption multiplier, an established behavioral characterization of the nature of economic activity in a market economy. In other words, in measuring the total economic impact of an initiative, one must account for the countless inter-industry relationships within a region, and specifically the manner in which an increase in output in a particular industry results in increases in outputs by other industries.

We are able to estimate this multiplier effect of expenditures directly generated by the various projects by using data collected by the US Department of Commerce's Regional Input-Output Modeling System (RIMS II). Input-output models are widely accepted economic analysis tools that are based on national, regional, and local data. However, their results should not be construed as being precise, since the spillover effects they estimate cannot possibly be directly and specifically determined. We therefore round our estimates accordingly. See Appendix A for more information on input-output methodology.

² See Appendix B for a bibliography of sources used in this report.

³ Not insignificantly, the economic impact of what PhillyCarShare is often displacing – individuals buying their own cars – is mostly enjoyed outside of the Philadelphia region: there is no major local automobile manufacturing, and local car dealers only derive a small percentage of each car's purchase price. This point is further elaborated later in this section.

⁴ These economic impact figures represent amounts enjoyed within these respective government jurisdictions. Because the City of Philadelphia is completely located within the Commonwealth of Pennsylvania, the Commonwealth figures include the City figures. Thus, the difference between the two sets of figures represents the economic impact in the parts of the Commonwealth outside of the City.

⁵ These estimates assume that PhillyCarShare has grown evenly from its inception in 2002 to 2009 levels. In fact, PhillyCarShare grew rapidly, particularly to 2007, and its growth has slowed since. Therefore, its cumulative economic impact is likely much larger than what is estimated here.

⁶ Totals may not add up exactly due to rounding. See Appendix C for additional detail on the industry composition of this scale of expenditure impact.

⁷ This proportion may be too low. In the 2008 member survey, 26 percent of respondents decided not to buy a car because of PhillyCarShare, and 20 percent got rid of a car or intended to do so upon joining PhillyCarShare.

As a point of reference, a recent paper presented at Transportation Research Board's 2010 Annual Meeting found that in a survey of 6,000+ car share members, the number of cars owned by such households was reduced by 47 percent in the US and by 58 percent in Canada, from pre-membership to post-membership. "Carsharing's Impact on Household Vehicle Holdings: Results from a North American Shared-Use Vehicle Survey," University of California at Berkeley (November 15, 2009).

Nevertheless, we conservatively use the lower proportion of 32 percent. It may be that PhillyCarShare's role in taking cars off the road is reduced by the fact that Philadelphia is not very auto-dependent to begin with. A very high proportion of PhillyCarShare members do not own a car: it was 65 percent of respondents in 2008 and 71 percent of respondents in 2009.

⁸ In 2009, 14,351 residential account holders made at least one reservation with PhillyCarShare. PhillyCarShare has approximately 10,000 additional residential account holders who did not make at least one reservation in 2009, but we conservatively do not include them in our estimates.

⁹ Approximately 30 percent of PhillyCarShare membership accounts are corporate accounts. It is likely that PhillyCarShare's existence led to positive economic impacts for the region on account of these corporate memberships: firms that previously had to incur the cost of owning a car or cars for business purposes, could now have access to cars via PhillyCarShare, and employees that previously had to drive their own cars into work in order to make car trips during the day could now leave their cars at home and make those car trips using PhillyCarShare. These economic impacts, while likely positive and potentially significant, are more difficult to model, and are dwarfed in impact by the gains associated with individual members. Therefore, to be conservative, we do not include any positive gains from corporate memberships in our economic impact estimates.

¹⁰ Conservatively assuming a small sedan and lower depreciation from reduced driving. PhillyCarShare's membership base is relatively young, so on the one hand they may be more likely to buy less expensive or used cars, but on the other hand their insurance costs are higher. "Your Driving Costs: 2009 Edition," American Automobile Association (2009) and "Your Driving Costs: 2008 Edition," American Automobile Association (2008).

¹¹ Based on 2005 data, average vehicle miles traveled per capita for the Philadelphia Metropolitan Statistical Area was 7,088.8. This number includes a not insignificant proportion of non-drivers and those who otherwise do not own a car. In related calculations, both the American Automobile Association and the American Public Transportation Association typically use an average vehicle miles traveled per capita of 15,000. Nevertheless, it is probably fair to be this conservative, since it is reasonable to expect that someone who is deciding not to buy a car or is able to get rid of a car is likely to be driving relatively fewer miles than might be expected. "Blueprint for American Prosperity," Brookings Institution (2008).

¹² In Pennsylvania, vehicle miles traveled per capita is about 50 percent more in suburbs than in cities, or, said another way, it is about 33 percent less in cities than in suburbs. Since the average vehicle miles traveled figure for the region includes Philadelphia, it is conservative to reduce that average by 33 percent to use as the Philadelphia average. "The Costs of Sprawl in Pennsylvania," Clarion Associates (2000).

¹³ Again, we include only the 14,000 residential members who made at least one reservation with PhillyCarShare in 2009, thus excluding the 10,000 residential members who did not.

¹⁴ Median equals 50th percentile; 90th percentile means a usage fee level at which there are nine times more members who incur lower usage fees than those who incur higher usage fees.

¹⁵ This assumes that part of utilizing PhillyCarShare instead of owning a car involves having to make net new expenditures in public transportation and/or walking and bicycling items. In reality, the majority of PhillyCarShare members who gave up cars as a result of PhillyCarShare would already be incurring some or all of these transportation costs.

Nevertheless, to be conservative, we account for such members having to incur an additional \$1,000 in transportation costs. As a point of reference, a monthly TransPass for SEPTA costs \$78, or \$936 for a year.

¹⁶ Stated another way, it is an overstatement to simply model the economic impact of the increase in local purchasing power by PhillyCarShare members, because that does not account for the economy impact that would have resulted from expenditures associated with what PhillyCarShare members would have had to spend on car ownership if PhillyCarShare did not exist.

Therefore, to more fairly make such a comparison, one must model the difference in economic impact between PhillyCarShare members otherwise having to buy their own car, versus being able to use PhillyCarShare, incurring additional transportation costs (i.e. buying a TransPass), and being able to save or spend the remaining amount according to their discretion.

¹⁷ As noted previously, what is being modeled is the economic impact of increased purchasing power, increased transportation costs (i.e. buying a TransPass), and fees paid to PhillyCarShare, versus the typical costs associated with car ownership.

We conservatively assume, for the economic impacts associated with car ownership, that for expenditures that typically leak out of the region, such as the initial purchase and/or ongoing financing of the car itself, 25 percent of the economic impact is enjoyed within the region; in reality, in many cases the proportion of economic impact enjoyed locally is far lower.

We also conservatively assume, for the economic impacts associated with increased purchasing power, that only 75 percent of that economic impact is enjoyed within the region, to account for consumption outside the region and delayed consumption (i.e. savings).

The distribution of consumption is assumed to be consistent with 2009 Consumer Expenditure Survey data, as provided by Geolytics. This is likely conservative, since PhillyCarShare members who save on transportation costs may not mimic their regular spending patterns but may instead spend disproportionately on discretionary items, including expenditures such as dining and entertainment whose spillover impact tends to be more localized.

¹⁸ These economic impact figures represent amounts enjoyed within these respective government jurisdictions. Because the City of Philadelphia is completely located within the Commonwealth of Pennsylvania, the Commonwealth figures include the City figures. Thus, the difference between the two sets of figures represents the economic impact in the parts of the Commonwealth outside of the City.

¹⁹ As noted previously, these estimates assume that PhillyCarShare has grown evenly from its inception in 2002 to 2009 levels. In fact, PhillyCarShare grew rapidly, particularly to 2007, and its growth has slowed since. Therefore, its cumulative economic impact is likely much larger than what is estimated here.

²⁰ Totals may not add up exactly due to rounding. See Appendix C for additional detail on the industry composition of this scale of expenditure impact.

²¹ As a point of comparison, the median miles driven by PhillyCarShare residential members who made at least one trip in 2009 was 142.

²² As a point of reference, a 2005 Transportation Research Board report concluded from a survey of PhillyCarShare members who gave up cars as a result of PhillyCarShare's existence that miles not driven per such member appeared to be several hundred miles but not greater than 522 miles." Interestingly, the report also concluded that a small universe of PhillyCarShare members increased their miles driven as a result of PhillyCarShare's existence, trading from not using a car to using a PhillyCarShare car; but these increases were estimated to lead to an increase on average of 30 more miles driven per month.

²³ Once again, we conservatively not include in our estimates the likely positive effect of PhillyCarShare's corporate members, even though it is reasonable to assume that corporate memberships lead to fewer miles driven by organizations and by the individuals that they consist of. We will also conservatively not include in our estimates the 10,000 PhillyCarShare members who did not make at least one trip in 2009.

²⁴ As noted previously, these estimates assume that PhillyCarShare has grown evenly from its inception in 2002 to 2009 levels. In fact, PhillyCarShare grew rapidly, particularly to 2007, and its growth has slowed since. Therefore, its cumulative environmental impact is likely much larger than what is estimated here.

²⁵ Congestion costs do not have a linear relationship to vehicle miles driven: during off-peak times, adding one additional car may have no discernible impact on congestion, while during peak times, adding one additional car may have a disproportionately high impact on congestion. It is likely that PhillyCarShare's impact of reducing vehicle miles traveled is disproportionately high, given that relatively few PhillyCarShare trips are long, uncongested drives during off-peak times, but to be conservative, we will assume a straight one-to-one relationship between vehicle miles not driven and congestion reduced.

²⁶ See Appendix D for additional detail on how this figure was estimated.

²⁷ For example, 45 percent of miles driven in 2009 were by hybrid cars. See Appendix D for additional detail on environmental impacts.

²⁸ See Appendix D for additional detail on environmental impacts.

²⁹ Totals may not add up exactly due to rounding.

³⁰ Totals may not add up exactly due to rounding. Industries may have negative proportions because both additions and subtractions were accounted for.

³¹ CO₂ = carbon dioxide, SO₂ = sulfur dioxide, CO = carbon monoxide, NO_x = nitrogen oxide, VOC = volatile organic compounds, PM₁₀ = particulate matter of 10 micrometers or less.

³² "Externality cost" estimates attempt to translate pollutants emitted into social and economic costs incurred, in the form of such negative impacts as reduction in air and water quality. "Modeling the Effects of Urban Vegetation on Air Pollution," Air Pollution Modeling and Its Application XII (1998).

³³ Totals may not add up exactly due to rounding.