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Win-Win Transportation Emission Reduction Strategies

Smart Transportation Strategies Can Reduce Pollution Emissions And Provide Other Important Economic, Social and Environmental Benefits

20 April 2017

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The Earth's surface is covered by a thin atmosphere. Photo: NASA

Abstract

Win-Win Transportation Solutions are cost-effective, technically feasible market reforms that solve transportation problems by improving mobility options and removing market distortions that cause excessive motor vehicle travel. They provide many economic, social and environmental benefits. If implemented to the degree economically justified, Win-Win Solutions can achieve 30-50% emission reductions while helping to address problems such as traffic congestion, accidents and inadequate mobility for non-drivers, and supporting economic development. This report discusses the Win-Win concept and describes various Win-Win strategies.

Originally presented at the
Metropolis Symposium On Transportation and Air Quality
12 June 2007, Seoul, Korea (www.metropolis.org)

Introduction - How Win-Win Strategies Work

People often assume that environmental and economic goals conflict. They are wrong. Some demand management strategies help achieve both economic and environmental objectives. This report identifies a dozen such strategies, called *Win-Win Transportation Solutions*. These are cost-effective, technically feasible policy reforms which correct existing market distortions that reduce transport system efficiency. They provide multiple benefits, including congestion reduction, road and parking cost savings, consumer savings, safety, improved mobility for nondrivers, plus energy conservation and emission reductions (Castillo, et al. 2007; Climate Works 2014; Creutzig and He 2009). They tend to increase overall economic productivity, employment and wealth (Litman 2010). They are *no regrets* strategies, because they are justified regardless of the actual risk of climate change.

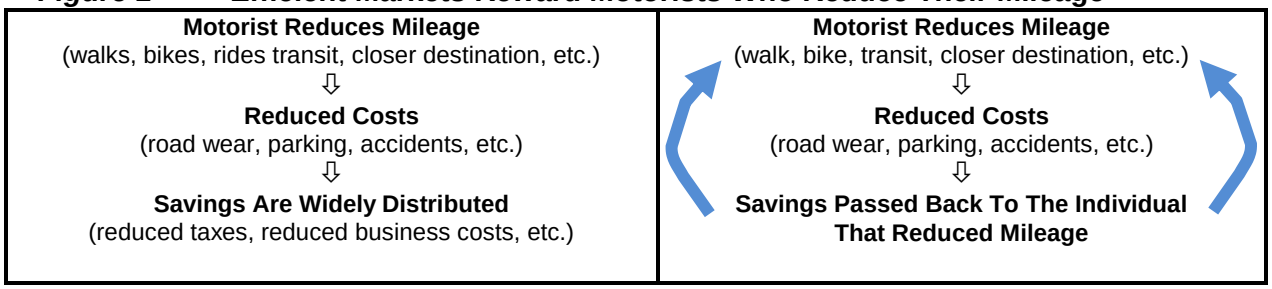
These are, admittedly, big claims. To understand why such large benefits are possible it is useful to consider some basic economic principles. Efficient markets have certain requirements, including *consumer sovereignty* (consumers have options that respond to their demands), *efficient pricing* (prices reflect production costs), and *neutrality* (public policies do not arbitrarily favor one good or group over others). Current transport markets violate these principles in various ways that reduce efficiency and exacerbate problems.

For example, many destinations offered subsidized parking but no comparable benefit for users of alternative modes. This is a market distortion that favors automobile travel options. Charging motorists directly for using parking facilities or offering travelers a choice between parking subsidies and their cash equivalent (called *parking cash-out*) typically reduces affected vehicle trips 15-25%. Another example is that many vehicle fees (insurance, registration, taxes and leases) are *fixed*, not based on how much a vehicle is driven, although the costs they represent (accidents, road wear and vehicle depreciation) increase with vehicle travel. Converting these to distance-based fees gives consumers a new opportunity to save money when they reduce their vehicle mileage, and so tends to reduce total vehicle travel.

One major study estimated that a combination of public transit improvements, efficient road pricing and transit-oriented development would reduce regional VMT by about 19% and increase time spent walking by about 13% and biking by about 19%, providing various economic, health and safety benefits (Rodier, et al. 2014).

Described differently, current policies fail to give motorists the savings that result when they drive less. Reducing vehicle travel reduces congestion, parking costs, accidents and pollution emissions, but these savings are not returned directly to the individual motorists who reduce their mileage (Figure 1). This is both inefficient, because it stimulates economically excessive vehicle travel (travel in which user benefits are smaller than total costs to society) and unfair, because people who drive less than average subsidize others who drive more than average, and since lower-income people tend to drive less than average these market distortions tend to be regressive.

Figure 1 **Efficient Markets Reward Motorists Who Reduce Their Mileage**



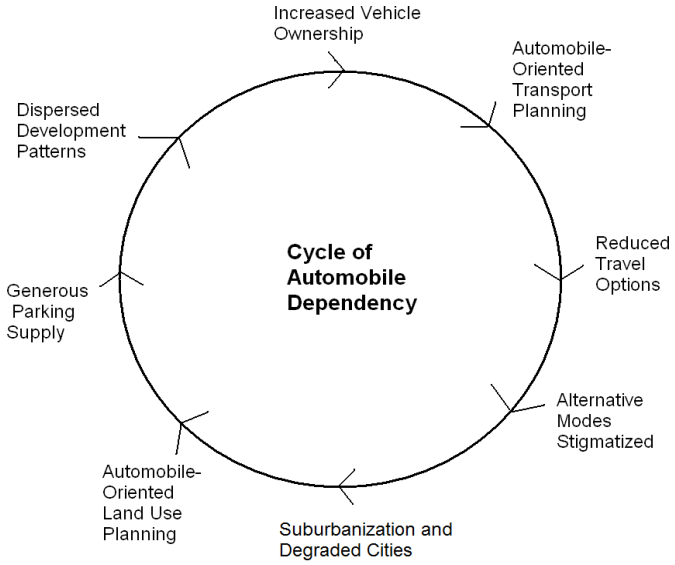
In current markets, savings that result when motorists reduce mileage are widely distributed through the economy.

In efficient markets, savings that result when motoris reduce mileage are passed back to that individual.

There are also planning distortions that favor automobile travel. Current transport planning tends to focus on certain objectives and impacts, such as traffic congestion reduction, while overlooking others, such as improving mobility for non-drivers, increasing affordability, and reducing environmental damages. Many jurisdictions have funds dedicated to roads and parking facilities that cannot be used for other transport improvements even if they are more cost effective and beneficial overall. More comprehensive and objective planning tends to increase support for alternative modes and mobility management, resulting in a more diverse and efficient transport system.

Although individual distortions may seem modest and justified, their effects are cumulative and synergistic (total impacts are greater than the sum of individual impacts), significantly increasing problems and costs. They contribute to a cycle of automobile dependency (Figure 2). Many transport problems are virtually unsolvable without market reforms. For example, urban traffic congestion will never decline significantly without improved travel options and more efficient pricing.

Figure 2 **Cycle of Automobile Dependency**



Various market distortions create a cycle of automobile dependency, leading to economically-excessive automobile ownership and use.

Many of these distortions reflect outdated goals and constrains. For example, motor vehicle underpricing may have been justified in the past to take advantage of economies of scale in vehicle and roadway production, but not now that vehicle industries and road systems are mature. Similarly, until recently collecting road tolls and parking fees was costly and incontinent to users, but new pricing systems reduce these problems.

Win-Win solutions correct market distortions, as described in Table 1. This increases overall economic efficiency and equity. Win-Win strategies are a type of preventive medicine, equivalent to putting the transport system on a healthier diet. This can avert more difficult and expensive measures otherwise required to address these problems.

Table 1 **Win-Win Solutions Support Market Principles** (Litman 2006)

Market Requirements	Current Market Distortions	Win-Win Solutions
Options. Consumers need viable transport and location options, and information about those options.	Consumers often lack viable alternatives to automobile transport, and living in automobile dependent communities.	Many Win-Win Solutions increase travel options directly, and all increase options indirectly by stimulating demand for alternatives.
Cost-based pricing. Prices for each good should reflect its production costs.	Motor vehicle travel is significantly underpriced: many costs are either fixed or external.	Many Win-Win Solutions result in more efficient pricing.
Economic neutrality. Public policies (laws, taxes, investments, etc.) should not arbitrarily favor one activity or group.	Many laws, tax, planning and funding practices favor automobile travel over alternatives.	Many Win-Win Solutions help correct biases that favor automobile transport over other modes and goods.
Land Use. Land use policies should not favor automobile oriented development.	Many current land use policies encourage lower-density, automobile-dependent land use patterns.	Some Win-Win Solutions correct land use biases that encourage sprawl and automobile dependency.

Win-Win Solutions correct market distortions, creating a more efficient and equitable transport system.

This is not to suggest that automobile travel provides no benefits and should be eliminated. It simply indicates that in a more optimal market consumers would choose to drive less and use alternatives more than they do now. As an analogy, food is essential for life and so provides tremendous benefits. However, this does not mean that everybody should increase their food consumption or that society should subsidize all food. At the margin (relative to current consumption) many people are better off eating less. Food subsidies may be justified for undernourished people, but it is economically and medically harmful to subsidize all food for everybody. Similarly, that mobility provides benefits does not prove that *more* driving is better, that current levels of driving are optimal, or that driving should be subsidized. Given better options and more efficient pricing, many motorists would choose to drive less and be better off overall as a result.

A Dozen Excellent Win-Win Strategies

This section describes twelve Win-Win strategies. For more information see Cambridge Systematic 2009; Litman 2007; PPMC 2016; TRB 2009).

Planning Reforms

Conventional transportation planning practices tend to favor mobility over accessibility and automobile travel over alternative modes in various ways (ADB 2009; Litman 2006; Grant, et al. 2013). *Least-cost planning* (VTPI 2007) refers to more comprehensive and neutral planning that considers all significant impacts, and funds alternative modes and demand management strategies equally with roadway expansion, based on cost-effectiveness. This results in more efficient and equitable transport systems, and more accessible communities. When fully implemented such reforms typically reduce vehicle travel 10-20% compared with conventional, automobile-oriented planning (TransForm 2009).

The Role of Planning Reforms

Planning reforms provide a foundation for other win-win strategies. More comprehensive and neutral transport planning, which considers a broader set of objectives and allows the most cost-effective solution to be implemented, tends to increase transport system diversity, and land use options and supports demand management strategies such as more efficient pricing.

Increasing transport diversity (walking, cycling, ridesharing, public transit, carsharing, delivery services, etc.) allows travelers to choose the best option for each trip. Similarly, improving location options (such as more affordable housing in accessible, compact, mixed use neighborhoods) allows people to choose the location that best meets their needs. These planning reforms support and are supported by other win-win strategies.

Transportation Demand Management Programs

Transportation Demand Management (TDM) programs include various services and incentives to encourage use of alternative modes. *Commute Trip Reduction* programs target employee travel. *School and Campus Trip Management* programs target students and school staff. *Transportation Management Associations* provide transportation services in a particular area, such as a commercial district or industrial park. TDM programs typically reduce affected vehicle travel 5-15% if they rely on information and encouragement, and 10-30% if they include significant financial incentives.

Road Pricing

Road Pricing means that motorists pay directly for driving on a particular roadway or in a particular area. *Congestion Pricing* (also called *Value Pricing*) refers to road pricing with higher fees during peak periods to reduce congestion. Economists have long advocated road pricing as an efficient and equitable way to fund transport facilities and reduce traffic problems. Efficient road pricing typically reduces affected vehicle traffic 10-20%, with larger reductions if implemented with improvements to alternative modes.

Parking Pricing

Parking pricing means that motorists pay directly for using parking facilities. This is facilitated by using better pricing methods that accommodate various payment options and only charge

motorists for the amount of time they are parked. Cost-based parking pricing typically reduces vehicle trips 10-30% compared with unpriced parking.

Parking Cash-Out

Parking Cash Out means that commuters who are offered a subsidized parking space can instead choose the cash equivalent. For example, employees might be able to choose between a free parking space, a monthly transit pass, or $75 cash per month. This typically reduces affected employees' automobile commuting 10-30%, and is fairer, since it gives non-drivers benefits comparable to those offered motorists.

Pay-As-You-Drive (PAYD) Pricing

Pay-As-You-Drive (also called *Distance-Based* and *Mileage-Based*) pricing means that vehicle insurance, registration, taxes and lease fees are based directly on the vehicle's annual mileage. For example, a $400 annual insurance premium becomes 3¢ per mile, and a $1,200 annual premium becomes 10¢ per mile. A typical U.S. motorist would pay about 7¢ per mile for insurance, plus 3¢ for registration fees and taxes. This is more equitable and affordable, and is predicted to reduce affected vehicles' annual mileage by 10-15%, providing variety savings and benefits.

Pay-As-You-Drive pricing requires *odometer audits*, which means that somebody (a service station or insurance broker) checks the vehicle odometer and records its mileage. This typically requires 5 to 10 minutes, and less if performed with other vehicle servicing (tune ups, emission inspections, etc.), with incremental costs of $5 to $10. Once the system is established there is minimal incremental cost to pricing other fees by mileage.

Higher Fuel Taxes - Tax Shifting

Motor vehicle fuel is underpriced and subsidized in a variety of ways. Eliminating such subsidies and increasing fuel taxes are efficient ways to reduce energy consumption and pollution emissions. At a minimum, fuel taxes should recover all fuel production and roadway costs, and higher taxes are justified to internalize the economic, security and environmental costs resulting from fuel production, importation and distribution. Researchers estimate that eliminating fuel subsidies could reduce global greenhouse emissions 11% to 18% (IMF 2015; Merrill, et al. 2015).

Many economists recommend shifting from current taxes on income and business activity to more taxes on vehicles, vehicle fuel and road use in order to stimulate economic development while recovering more roadway costs and petroleum externalities, and encouraging energy efficiency and technological innovation. For example, *carbon taxes* are taxes based on fossil fuel carbon content, and therefore a tax on carbon dioxide emissions (Litman 2008). Transition costs are minimal if implementation is predictable and gradual, and tax shifting can be progressive with respect to income if revenues are used in ways that benefit lower-income people. For example, fuel taxes can be increased 10% annually for several years, offset by income tax reductions. Because carbon taxes are durable and predictable they tend to have higher elasticities than other fuel price changes. Rivers and Schaufele (2015) find that a five cent carbon tax causes an 8.4% gasoline demand reduction, about four times higher than the 2.1% reduction caused by an identical five cent increase in other market prices fluctuations.

The Role of Pricing Reforms
Roads and parking facilities are never really free, the choice is between paying for them directly or indirectly; paying directly is more efficient and equitable because it gives travelers an incentive to use facilities efficiently and provides savings to consumers who drive less. Efficient road, parking, insurance and fuel pricing give travelers incentives to use transportation resources efficiently. Their impacts can be large, particularly if implemented with improvements to alternative modes. Many transport problems are virtually unsolvable without pricing reforms.

Some pricing reforms, such as parking cash out and pay-as-you-drive insurance, benefit lower-income people directly, and others can provide indirect benefits if they substitute for more regressive taxes or provide new services valued by lower-income households.

Public Transit and Rideshare Improvements
There are many ways to improve public transit and rideshare services, including increased service, HOV priority, improved comfort, lower fares, more convenient payment options, improved user information, marketing programs, transit oriented development, improved security, and special services such as express commuter buses. High quality transit can attract 5-15% of urban trips and leverages additional travel reductions by stimulating more compact development. People who live in transit-oriented communities typically drive 10-30% less than residents of automobile-oriented areas.

Walking and Cycling Improvements
Walking and cycling travel can substitute for some motor vehicle trips directly, and support other modes such as public transit. There are many ways to improve walking and cycling, including better facilities (sidewalks, crosswalks, paths and bicycle parking), traffic calming, and more mixed land use (so activities are closer together). Walking and cycling provide unique benefits including mobility for non-drivers, public fitness and health, and community livability. People typically drive 5-15% less in communities with good walking and cycling conditions than in more automobile-dependent areas.

Carsharing
Carsharing refers to automobile rental services located in residential areas with short-term pricing options that substitute for private vehicle ownership. This allows households to reduce their vehicle ownership and rely more on alternative modes. Motorists who shift from car ownership to carsharing typically reduce their vehicle travel 30-60%.

Smart Growth
Current land use policies tend to favor dispersed development over more compact, infill development which increases motor vehicle travel. *Smart Growth* refers to development practices that result in more compact, mixed, accessible, multi-modal communities where travel distances are shorter, people have more travel options. Smart growth policies typically reduce per capita vehicle travel and fuel consumption by 10-30%, and more if implemented to complementary TDM strategies such as walking, cycling and public transit improvements (Lefèvre 2009; Kimball, et al. 2013). Although these land use changes take many years to be achieved, they provide diverse and durable benefits.

The Role Of Smart Growth Policies
Smart growth policies improve land use accessibility. This supports other win-win strategies, for example, by improving the cost efficiency of walking, cycling and public transit investments; supporting more efficient parking management; and supporting other transportation demand management programs.

Freight Transport Management

Freight Transport Management includes various strategies to increase the efficiency of freight and commercial transport. This includes improving distribution practices to reduce vehicle trips, shifting freight to more resource efficient modes (such as from air and truck to rail and marine), improving efficient modes such as marine and rail, and better siting of industrial locations to improve distribution efficiency Although less than 10% of total traffic consists of commercial vehicles, they tend to impose large impacts per vehicle-mile. Reductions of 5-20% of freight vehicle travel can be achieved.

Win-Win Solutions Summary

Table 2 summarizes the Win-Win strategies described in this report.

Table 2 **Win-Win Transportation Solutions**

Name	Description	Transport Impacts
Planning Reforms	More comprehensive and neutral planning and investment practices.	Increases support for alternative modes and mobility management, improving options.
Transportation Demand Management Programs	Local and regional programs that support and courage use of alternative modes.	Increased use of alternative modes.
Road Pricing	Charges users directly for road use, with rates that reflect costs imposed.	Reduces vehicle mileage, particularly under congested conditions.
Parking Pricing	Charges users directly for parking facility use, often with variable rates.	Reduces parking demand and facility costs, and encourages use of alternative modes.
Parking Cash-Out	Commuters can choose cash instead of subsidized parking.	Encourages use of alternative commute modes.
Pay-As-You-Drive Pricing	Converts fixed vehicle charges into mileage-based fees.	Reduces vehicle mileage.
Higher Fuel Taxes - Tax Shifting	Increases fuel taxes and other vehicle taxes.	Reduces vehicle fuel consumption and mileage.
Transit and Rideshare Improvements	Improves transit and rideshare services.	Increases transit use, vanpooling and carpooling.
Walking and Cycling Improvements	Improves walking and cycling conditions.	Encourages use of nonmotorized modes, and supports transit and smart growth.
Carsharing	Vehicle rental services that substitute for private automobile ownership.	Reduced automobile ownership and use.
Smart Growth Policies	More accessible, multi-modal land use development patterns.	Reduces automobile use and trip distances, and increases use of alternative modes.
Freight Transport Management	Encourage businesses to use more efficient transportation options.	Reduced truck transport.

This table summarizes various Win-Win strategies that encourage more efficient transportation.

Table 3 indicates estimated vehicle travel reductions from these strategies. Each of these strategies has been successfully implemented, although no community has implemented all to the degree justified by economic principles. It is difficult to predict the total impacts of a comprehensive Win-Win program because of their overlapping and have synergistic effects. Despite these uncertainties, an integrated Win-Win program, with strategies implemented to the maximum degree economically justified, would probably reduce total vehicle travel 30-50% compared with current practices (Litman 2007b; CCAP 2008). This is the magnitude of reductions required to achieve emission reduction targets, and would provide other economic, social and environmental benefits. Although some strategies take years to implement, their effects are durable and so ideal for solving long-term problems such as climate change.

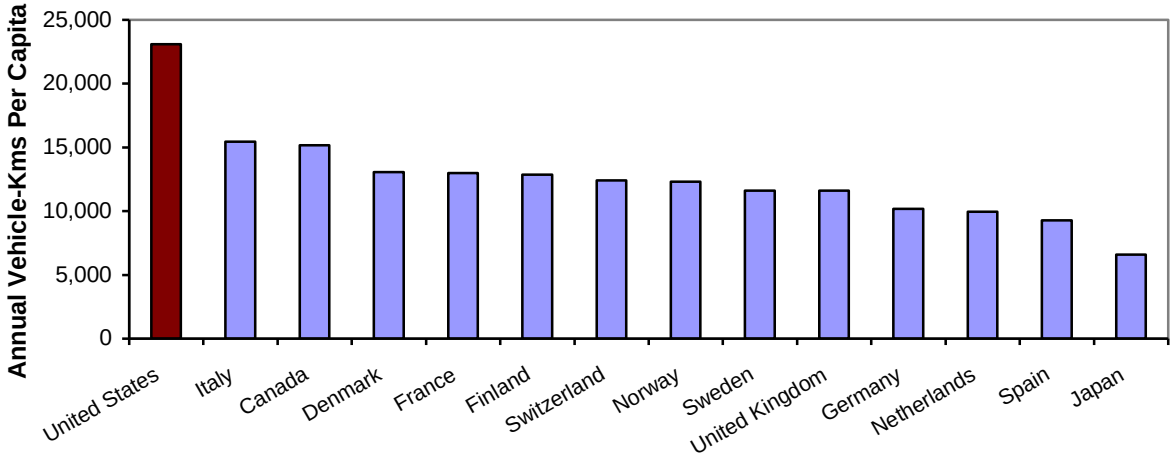
Table 3 **Travel Impacts** (Win-Win Evaluation Spreadsheet, www.vtpi.org/win-win.xls)

Name	Portion of Vehicle Travel Affected	Typical Reductions Of Affected Travel	Total Reductions
Planning Reforms	100%	10-20%	10-20%
TDM Programs	40%. Mainly urban travel.	10-20%	4-8%
Road Pricing	30%. On new or congested roads.	10-20%	3-6%
Parking Cash-Out	20%. Commute travel.	10-30%	2-6%
Parking Pricing	40%. Mainly urban travel.	10-20%	4-8%
Pay-As-You-Drive Pricing	80%. Private automobile travel.	10-12%	8-10%
Fuel Taxes - Tax Shifting	100%	5-15%	5-15%
Transit & Ridesharing	30%. Mainly urban travel.	10-30%	3-9%
Walking & Cycling	20%. Shorter-distance trips.	10-30%	2-6%
Carsharing	5%. Suitable households.	20-40%	1-2%
Smart Growth Reforms	40%. Mainly urban travel.	10-30%	4-12%
Freight Transport Man.	10%. Freight and commercial travel.	5-20%	0.5-2%

This table indicates the magnitude of reductions that could be provided by various Win-Win strategies.

International comparisons support these estimates. Residents of wealthy countries with more diverse transport systems and efficient pricing drive 30-40% less than in the U.S. (Figure 3), although none implement all cost-effective Win-Win strategies. Analysis by CCAP (2009), Johnston (2006) and Replogle and Fulton (2014) also indicate that substantial vehicle travel reductions are feasible and can provide net economic benefits.

Figure 3 **Per Capita Vehicle Travel, 2004** (OECD in Figures 2005)



Per capita vehicle travel is significantly lower in wealthy countries that have Win-Win type policies. Residents of wealthy countries such as Switzerland, Norway and Sweden drive about half as much as in the U.S. due to policies and planning practices that increase transport system efficiency.

Some strategies, such as commute trip reduction programs and transit improvements, provide particularly large benefits because they reduce urban-peak vehicle traffic. For example, a 5% reduction in urban-peak driving typically reduces congestion, parking, and emission costs by

10%. Similarly, reductions in heavy freight vehicle travel provide proportionally large congestion, road and accident cost reductions.

Consumer Impacts

Some people assume that Win-Win strategies which reduce vehicle travel must harm consumers. But Win-Win strategies improve transport options and provide efficient incentives; mileage foregone consists of lower-value vehicle travel that consumers willingly forego in return for savings and benefits. Higher value travel continues, and benefits from reduced congestion, accident risk and pollution exposure.

Win-Win Solutions tend to increase equity. For example, Parking Cash Out gives non-drivers benefits comparable in value to parking subsidies given motorists. Pay-As-You-Drive insurance avoids cross-subsidies from low- to high-mileage motorists. Virtually all Win-Win Solutions increase travel options, either directly, by improving alternative modes (walking, cycling, ridesharing, public transit and carsharing), or indirectly, by stimulating demand and therefore more support for these modes.

Although few motorists want to give up driving altogether, at the margin, that is, compared with their current travel patterns, many people would prefer to drive less and rely more on alternatives, provided they are convenient, comfortable, safe and affordable. Win-Win strategies provide such options, making consumers better off overall. This is similar to other consumer behavior changes, such as reductions in smoking, and increases in recycling and seat belt use. In each case, a combination of public education, improved options, and financial incentives caused people to shift behavior, indicating that many people want to change, provided they receive suitable support.

Economic Impacts

Many people assume that since mobility tends to increase with economic development, reforms that reduce vehicle travel are economically harmful. Transport planning decisions are sometimes portrayed as a tradeoff between the economic development benefits and environmental costs of increased vehicle traffic. But Win-Win strategies can support economic development in various ways (Litman 2010).

Although a certain amount of mobility contributes to economic development, beyond an optimal level, additional mobility is economically harmful (marginal costs exceed marginal benefits). Many win-Win strategies reflect economic principles (consumer sovereignty, cost-based pricing, economic neutrality), and so tend to increase overall transport system efficiency and land use accessibility. These strategies help reduce specific costs imposed on governments and businesses, such as traffic congestion, road and parking faculty costs, crash and pollution damages.

By reducing per capita vehicle and fuel consumption Win-Win strategies tend to reduce the economic costs of importing vehicles and fuel, leaving consumers with more money to spend on other, more locally-produced goods. These benefits are likely to increase in the future as petroleum costs rise, increasing the economic burden on oil importers.

Current Analysis

Several recent reports have evaluated emission reduction strategies according to their cost effectiveness (McKinsey 2007), and numerous emission reduction policies are being proposed, often involving cap-and-trade. However, these studies tend to be biased against mobility management for the following reasons (Litman 2007c):

- Co-benefits ignored. Although a few studies include air emission reduction benefits (Nemet, Holloway and Meier 2010), virtually none consider other mobility management benefits such congestion reduction, road and parking facility cost savings, consumer savings, accident reductions, and improved mobility for non-drivers, although these benefits are often large in value. When all impacts are considered, mobility management strategies are often among the most cost effective GHG emission reduction strategies because they are justified on economic grounds and so provide "free" environmental benefits.
- Current analysis generally ignores the additional external costs that result when increased vehicle fuel efficiency and subsidized alternative fuels stimulates additional vehicle travel, called a *rebound effect* (Litman 2005; UKERC 2007).
- Mobility management emission reductions are considered difficult to predict. Although case studies and models are available for many of these strategies (CCAP 2005), this information is not widely applied to energy planning.
- Mobility management programs are considered difficult to implement. Such programs often involve multiple stakeholders, such as regional and local governments, employers and developers, and various special interest groups. As a result, they tend to seem difficult and risky compared with other emission reduction strategies that only require changes to utility operations, fuel production or vehicle designs.
- Analysis often assumes that vehicle travel reductions harm consumers and the economy. In fact, many mobility management strategies benefit consumers directly and increase economic productivity (Concas and Winters 2007).

Described differently, there are two general ways to reduce transport emissions: reduce per-mile emission rates or reduce total vehicle-travel. The first often seems easier but the second, if done correctly, provides more benefits and is often best overall (Litman 2013). Currently proposed emission reduction programs (particularly those involving emission trading) will not implement mobility management as much as optimal and so will miss opportunities to help address other planning objectives such as reduced congestion and crash risk, consumer savings and improved mobility for non-drivers (Wright and Fulton 2005). The following steps can help overcome these barriers:

- Educate decision-makers about these issues, and build partnerships with interest groups interested in other mobility management benefits, such as congestion reduction, consumer cost savings, traffic safety and improved mobility for non-drivers.
- Develop better models for predicting the travel impacts, emission reductions and total benefits of mobility management programs (ITDP 2010).
- Develop mobility management strategies and programs that are easy to implement, suitable for funding through emission trading programs.

Conclusions

There are many possible ways to conserve energy and reduce pollution emissions. Some provide more total benefits than others. Strategies that reducing vehicle travel can provide far greater benefits than increasing vehicle fuel efficiency because they also reduce congestion, roadway and parking costs, accidents and sprawl. This is not to suggest that other energy conservation strategies should be ignored, but the additional benefits of mileage-reduction strategies should be recognized in evaluation.

Win-Win Transportation Solutions are market-based policy reforms that increase efficiency by removing distortions that limit consumer choice and stimulate motor vehicle travel. They help create a more equitable and efficient transport system that benefits consumers, supports economic development, and provides other benefits. If fully implemented to the degree economically justified Win-Win Solutions can reduce motor vehicle costs 30-50% while providing consumer benefits and economic development. Many transport problems are virtually unsolvable without such reforms.

To appreciate Win-Win solutions it is necessary to use comprehensive analysis. Many transport improvement strategies help solve one or two problems but exacerbate others. For example, roadway expansion reduces congestion but tends to increase total vehicle travel, which increases downstream congestion, parking, accident and pollution problems. Similarly, increasing vehicle fuel efficiency conserves energy but by reducing vehicle operating costs tends to increase total vehicle travel and therefore traffic problems. Win-Win strategies tend to achieve many planning objectives, and so are often the best solutions to transport problems, considering all impacts. Table 4 illustrates this concept.

Table 4 **Comparing Strategies** (Litman 2007a)

Planning Objective	Fuel Efficient Vehicles	Roadway Expansion	Win-Win Solutions
Motor Vehicle Travel	*Increased*	*Increased*	*Reduced*
User convenience and comfort		✓	✓
Congestion reduction	✓/✗[1]	✓	✓
Road and parking cost savings	✗	✗	✓
Consumer savings	✗/✓[2]		✓/✗[3]
Reduced traffic accidents	✗	✗	✓
Improved mobility options			✓
Energy conservation	✓		✓
Pollution reduction	✓	✗	✓
Physical fitness and health			✓
Land use objectives	✗	✗	✓

(✓ = Achieve objectives. ✗ = Contradicts objective.) Roadway expansion and more fuel efficient vehicles provide few benefits, and by increasing total vehicle travel they can exacerbate other problems such as congestion, accidents and sprawl. Win-Win Solutions reduce total vehicle travel and increases economic efficiency. This helps achieve many planning objectives.

[1] Congetion is reduced on the expanded facility, but often increases downstream, such as on surface streets.
[2] More fuel efficient vehicles tend to have higher purchase costs but lower operating costs.
[3] Win-Win strategies often increase some consumer costs but reduce others, such as road and parking pricing which reduces general taxes used to finance roads and parking facilities.

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