AIR QUALITY AND CLIMATE CHANGE EVALUATION GUIDANCE

The following guidance provides additional details regarding the process followed by PSRC to evaluate projects for potential air quality benefits. As a reminder, air quality is a key criterion for all PSRC funding competitions, regardless of program. Continued in the 2020 project selection process is the inclusion of cost-effectiveness for projects competing for Congestion Mitigation and Air Quality Improvement Program (CMAQ) funds.

Protecting air quality is a regional goal

Projects are evaluated for their potential to reduce emissions, from the elimination of vehicle trips, reduction of vehicle miles traveled (VMT), reduction of vehicle idling, or conversion to alternative fuels or vehicle technology (e.g. engine upgrades). PSRC has adopted regional policies to support the protection of the natural environment, including addressing air quality and climate change. For example, VISION 2040 calls for the region to reduce its overall production of harmful elements that contribute to climate change, and to continue efforts to reduce pollutants from transportation activities through the use of cleaner fuels and vehicles, increasing alternatives to driving alone, as well as design and land use. Similarly, the regional transportation plan includes a strategy for reducing transportation's contribution to climate change and its impact on air pollution. These policies apply to the region as a whole, and they are not limited to the air quality boundaries that are regulated by national standards.

In addition, under the federal transportation act, Fixing America's Surface Transportation (FAST) Act, priority is given to the reduction of diesel particulates, particularly within nonattainment or maintenance areas for the national fine particulate standard,[1] for projects receiving CMAQ funds. Further, the Washington State Department of Ecology has identified diesel exhaust as the air pollutant most harmful to public health in Washington State, and according to the Puget Sound Clean Air Agency, the reduction of particulate matter (PM) – particularly diesel particulates – is the most important air quality challenge in the Puget Sound.

Based on these national, state and regional goals and policies, all projects will be evaluated based on their potential to reduce emissions, regardless of the funding source requested. Projects competing for STP and FTA funds will be evaluated based on the magnitude of the project's potential emissions reductions. Projects competing for CMAQ funds will be evaluated on their emissions reduction potential as well as their useful life and the amount of funding requested, so that projects resulting in the most cost-effective reduction of emissions will score the highest. In addition, the air quality score is of higher value for projects requesting CMAQ funds.

Project Types that Reduce Emissions

In the application, project sponsors will be asked to provide information based on the scope and extent of their projects, tailored to reflect the potential emissions reduction from each type of project. If the sponsor has reliable quantified data – e.g. from an Environmental Impact Study, traffic study, or other analytic process – they are encouraged to provide that reference information.

[1] Refer to PSRC's website for a map of the air quality maintenance areas in the Central Puget Sound region. CMAQ funds may be spent on projects located in the former ozone and CO maintenance areas, as well as the existing maintenance areas for PM.

This information will depend on the type of improvement, as well as the extent to which the improvements will extend within the regional system. The application will provide detailed questions specific to the various types of projects to assist in this evaluation, relative to the key determining factors for each project type's potential to reduce emissions.

Example questions that will be used to evaluate potential emissions reductions include:

- Diesel Particulate Emissions Reduction Projects – what kind of vehicles, engines and duty cycles are being addressed? What is the emissions vintage of the existing engines? How many vehicles will be addressed? What is the average miles driven by the existing vehicles?
- HOV/BAT Lane Projects – what are the roadway and travel conditions before and after the proposed project, including average daily traffic and speeds? How many transit routes use the facility now and are anticipated in the future? Does this project connect to or expand an existing HOV/BAT lane system? What is the length of the project and the population served? What source of data indicates the expected conversion of single occupant vehicle trips to transit or carpool?
- Transit Projects – what is the current transit ridership in the area? What is the average trip length? What is the population served that will be expected to use the new/improved service? What source of data indicates the expected conversion of single occupant vehicle trips to transit?
- ITS Projects – what is the current and expected average daily traffic and speed along the corridor? What are the expected improvements in speed from this project? What are the transit routes along the corridor, and will this project improve transit reliability on the corridor? What is the percentage of heavy trucks using the facility?
- Bicycle/Pedestrian Projects - what is the length of the facility? What are the connections to other bicycle/pedestrian facilities and to the larger system? Does the facility connect to transit? What is the expected population served, and what source of data indicates the expected conversion of single occupant vehicle trips to this mode?

Table 1 below displays the range of estimated emissions reduction data from actual projects awarded CMAQ or other diesel emission reduction funds, illustrating the potential emissions reduction from a variety of project types and within a range of project magnitude.[2] The data is provided from the Puget Sound Clean Air Agency, PSRC's emissions estimation reporting and national data from the CMAQ Public Access System. Table 3 at the end of this document provides more examples of types of projects that would produce low emissions benefits and high emissions benefits within each category.

[2] Data in the national system is reported for carbon monoxide (CO), volatile organic compounds (VOCs), nitrogen oxides (NOx) and coarse particulate matter (PM_{10}). Since each pollutant behaves very differently, and since there is little data available for PM_{10} emissions given the limitations of the tools to date, CO has been selected as the representative pollutant for data illustration purposes. In addition, given the complex interactions between VOCs and NOx in the production of ozone, as well as changes in the analysis of these pollutants with the updated EPA Motor Vehicle Emission Simulator (MOVES), and since the analytical trends for estimating CO from motor vehicles has remained relatively consistent over time, the use of CO data for guidance purposes to evaluate projects seems appropriate as the most complete and reliable data set. To date, there is no required project-level reporting of carbon dioxide (CO_2), and this pollutant is not included in the national CMAQ Public Access System. However, in general, reduction of the criteria pollutants from these types of projects will result in a reduction of CO_2 emissions, so the surrogate use of CO for the purposes of these illustrative tables is reasonable. Puget Sound Clean Air Agency provided calculated PM emissions reductions for a range of diesel emissions reduction projects in the region.

Table 1: Reported Emissions Reductions		
	AQ Benefits (kg/day PM)	
Project Type	**Low Magnitude**	**High Magnitude**
Diesel Reduction	<1	9
	AQ Benefits (kg/day CO)	
Project Type	**Low Magnitude**	**High Magnitude**
Bicycle/Pedestrian		
Bike Lane/Sidewalks/Etc.	<1	9
Regional Trails	9	18
TDM/CTR	9	225
New/Expanded Transit Service		
Regional Service	360	1500
County/Corridor Service	9	860
Transit Vehicle Expansion/Replacements	<1	145
Other Transit Amenities		
park and rides, flyer stops, etc.	145	500
Service Amenities (e.g., fare systems, safety, etc.)	<1	9
HOV/BAT Lanes	1	525
Intersections/ITS	<1	100

As is illustrated by the data above, there may be a wide range of emissions benefits from projects, and the magnitude of the project's scope and the interaction with the surrounding population and transportation system are critical to the final result. The evaluation criteria and application seek information on the elements included in a project that would reduce emissions, depending on the type of improvement (e.g., number and length of trips converted from a single occupancy vehicle to transit or bicycle/pedestrian mode), as well as the extent to which the improvements will extend within the regional system. Each project's air quality score will depend on the emissions reductions estimated from each project in the competition.

Determining Emissions Reductions

PSRC staff will calculate the expected reduction in air pollutant emissions for all applications. The calculation will be made utilizing project-specific data provided in the applications, EPA emission factors, and national or regional default data, if necessary. This calculation will typically be made using the agency's project-level emissions evaluation tool. Data provided by the project sponsor will be considered on the condition that the source of the data is provided and is considered reasonable and based on sound methodology. Project types that are not captured by the tool will be evaluated by PSRC staff using project data and other available resources.

Emissions reductions will be estimated for carbon dioxide equivalent (CO_2e), fine particulate matter ($PM_{2.5}$), carbon monoxide (CO), nitrogen oxides (NO_X), and volatile organic compounds (VOC).

Air Quality Score – STP Funds

Two key factors in the final STP and FTA score are the **magnitude** of the project's potential emissions reductions, and the **timing** of the air quality benefits – i.e., when will the full potential emissions reductions occur. The timing of the air quality benefits is important to help the region continue to meet current and future air quality standards, as well as to assist the state in reaching the state's greenhouse gas emissions reduction limits.

Projects resulting in a substantial reduction in emissions will score the highest under this criterion. This could be from the reduction of fine particulates through diesel vehicle and equipment upgrades or the reduction of diesel truck idling (e.g. along a freight corridor), the elimination of a substantial number of vehicle trips, or the reduction of a significant amount of VMT. Projects eliminating vehicle trips would generally be expected to produce greater emissions reductions than projects solely reducing VMT, but as mentioned above, the magnitude and scale of the project and the timing of the anticipated benefits will play a role in the final score, and all projects will be evaluated against each other.

Air Quality Score – CMAQ Funds

The air quality score for the CMAQ competition will be weighted higher and will be determined differently than in the STP competition. Rather than strictly being scored on the magnitude and timing of emissions reduction, CMAQ projects will be evaluated on the cost-effectiveness of the potential emissions reductions. The CMAQ program guidance directs the use of cost-effectiveness in the selection of projects, and the *2020 Policy Framework* includes a cost-effectiveness methodology in the scoring process used to select projects applying for CMAQ funds.

A cost effectiveness value will be determined based on the following calculation:

Cost effectiveness = [(funding request) / (useful life)] / (annual emissions reduction)

Funding request: Only the requested CMAQ funds will be considered as part of the cost effectiveness evaluation. Total project cost is not applicable for this evaluation.

Useful life: The application will include a question about the project's useful life. In most cases, this value will be applied using Table 2 on page 6 below. This table is derived from FHWA and FTA guidance and project evaluation summaries. Project types that are not included in Table 2 must provide background data to support the proposed useful life value.

Annual emissions reduction: The emissions reduced will be determined by PSRC staff using the project-level emissions evaluation tool (or by other methods as described above, if necessary). Annual emissions reductions for CO_2e and $PM_{2.5}$ will be used to evaluate cost effectiveness. CO_2e is used as a representative for all gaseous pollutants because project changes result in similar emissions reduction trends from these pollutants. $PM_{2.5}$ is considered separately and on a different scale due to the emphasis placed on reduction of this pollutant in federal, state and regional policy.

Under advisement of our regional air quality consultation partners, and with RPEC concurrence, the annual emissions reduction will be applied using the following equation:

Annual emissions reduction = (annual tons of CO_2e) + (annual pounds of $PM_{2.5}$)

The cost effectiveness value will be in units of dollars requested per emissions reduced. Lower values are considered to be more cost effective than higher values. Projects resulting in the lowest cost effectiveness values will score the highest under this criterion. As an example, higher scores would be expected from projects that demonstrate high emissions reductions, request modest funding amounts, and have longer useful lives, thereby resulting in a cost effective reduction in emissions. As with STP and FTA projects, all CMAQ projects will be evaluated against each other to determine the final point values for this criterion.

Table 2: Useful Life Estimates for CMAQ Projects

Project Type	Useful Life (in years)
Traffic Flow Improvements	
Signalization	10
Freeway Management	10
HOV / Business Access Transit Lanes	20
Shared Ride Programs	
Regional Ridesharing	2
Vanpool Programs - Assistance	2
Vanpool Programs - Purchase of Vans	4
Park and Ride - Surface Lots	12
Park and Ride - Structure	12
Transportation Demand Management Programs and Activities	
Trip Reduction Programs and Outreach / Advertising	2
Bicycle / Pedestrian Facilities	
Bicycle & Pedestrian Facilities	15
Transit Improvements	
Bus	
Large Heavy-Duty Bus (35-40 ft. and articulated buses) - Purchase	12
Small Heavy-Duty Bus (approximately 30ft) - Purchase	10
Medium, Medium-Duty Bus (25-35 ft.) - Purchase	7
Medium, Light-Duty Bus (25-35 ft.) - Purchase	5
Operations - Existing Service	Tie to length of grant
Operations - New Service	Tie to length of capital investment
Ferry	
Passenger Ferry - Purchase	25
Other Ferry - Purchase	30
Rail & Trolley	
Fixed Guideway Steel-Wheeled (i.e. streetcar or light rail)	25
Fixed Guideway Electric Bus	15
Heavy Rail Vehicle	25
New Rail Services - Track & Stations/Centers	30
Other	
Amenities	2
Bus Shelters	10
Other Improvements	
Alternative Fuel Buses	4
Freight / Intermodal Projects	20
Engine Retrofit Technologies	Varies - utilize and cite resources provided by the U.S. Environmenal Protection Agency, U.S. Department of Energy, etc.

Sources:

Federal Highway Administration, 2008. SAFETEA-LU: CMAQ Evaluation and Assessment - Phase I Final Report

Federal Transit Administration, 2015. Circular 5300.1 State of Good Repair Grants Program: Guidance & Application Instructions

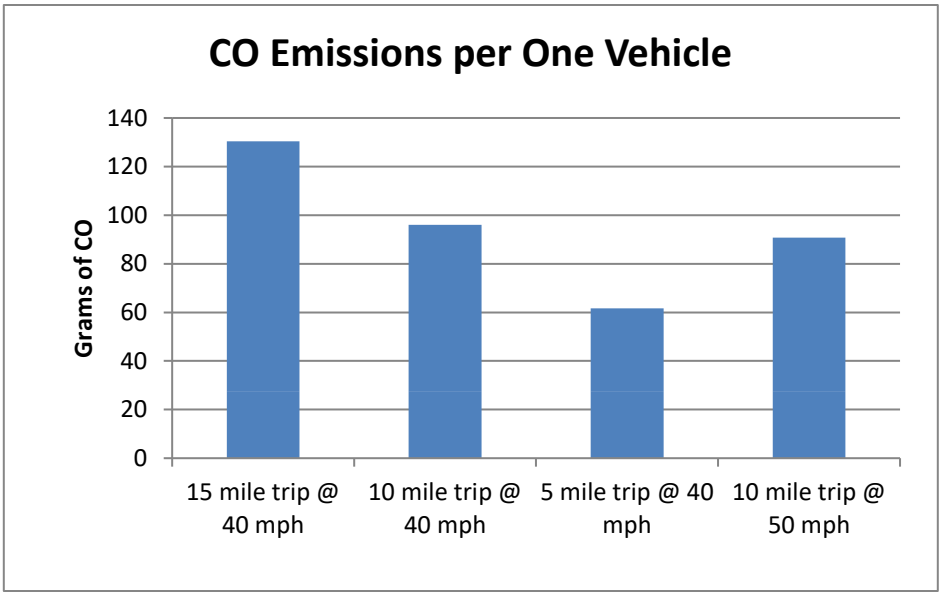
ADDITIONAL AIR QUALITY EMISSIONS BACKGROUND

The following information provides additional background data related to the comparison of emission benefits.

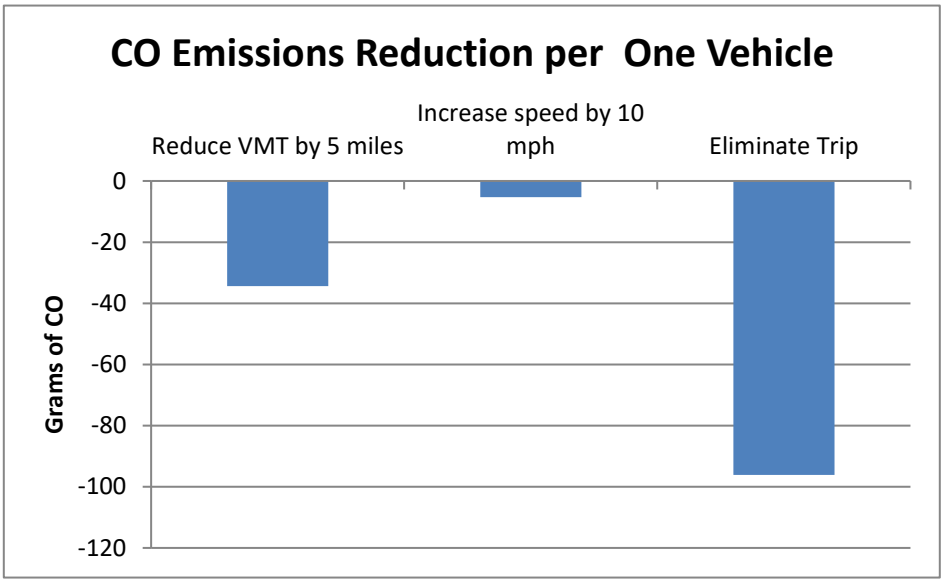
According to the 2011 EPA report, “Potential Changes in Emissions Due to Improvements in Travel Efficiency:”

> “The TCMs *(transportation control measures)* that would result in a measurable regional reduction in automobile trips and VMT are those which affect regional mode share and speeds, and would consequently have the highest impact on regional emissions. These tend to be strategies involving regional transit expansion and service improvement, incentives for vanpools and carpools including construction of HOV/HOT lanes, and regional pricing strategies. For strategies that are implemented at a regional scale, impacts can be expected to be greater in larger regions where the absolute number of trips and VMT is larger. Even a small percentage reduction in regional VMT and automobile trips can potentially have a significant effect on regional emissions.
>
> Although both speed and VMT are used in emissions analysis, speed represents a response to congestion rather than a change in travel behavior as indicated by a reduction in VMT. It is true that congestion can have an impact on emissions; however, these impacts tend to be smaller and more localized than the impacts of VMT reduction.”

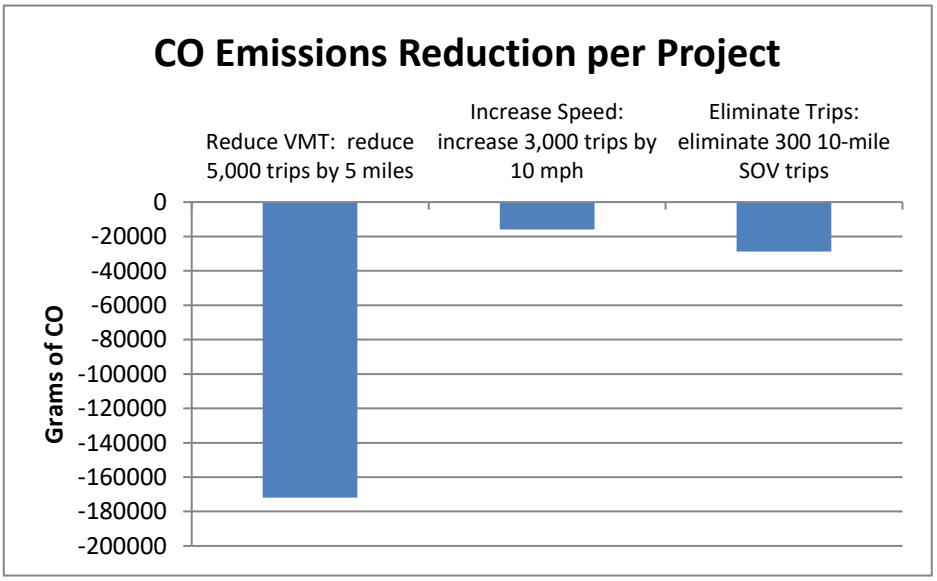
The charts on the next page provide more information illustrating the emissions behavior at various scenarios.



CO emissions vary as a product of VMT and speed.
A 5-mile trip is not equal to half the emissions from a 10-mile trip because engine starts are a significant source of emissions.

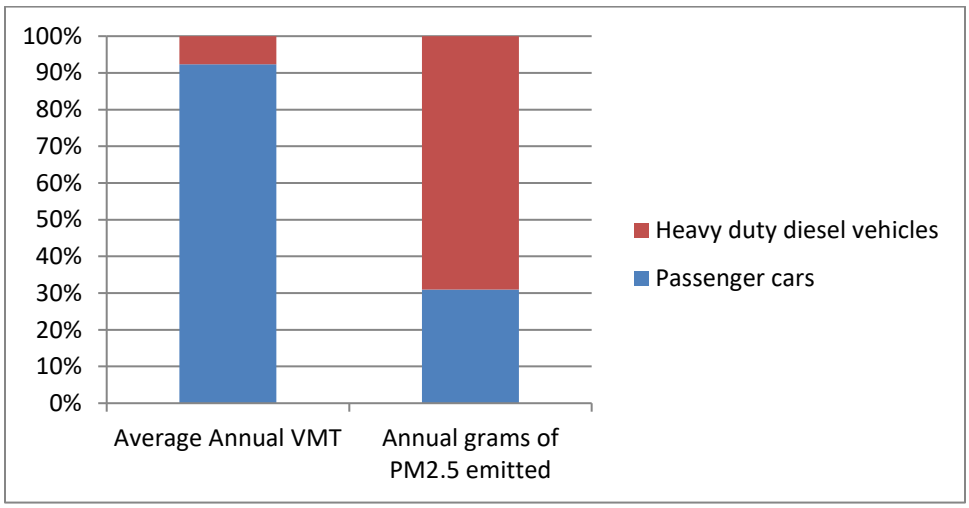


Using a 10-mile trip at 40 mph as a base, this chart shows the difference in emissions reductions from 3 options:
-Reduce VMT
-Increase speed
-Eliminate trip



The emissions benefit from a project is driven by the number of affected vehicles.
This chart compares the emissions benefits of three common types of projects in our region, illustrating how the magnitude of the project plays a key role in the emissions benefits produced.

Heavy duty on-road vehicles, construction equipment and marine vessels account for a significant portion of the total diesel particulate matter emissions in the Puget Sound region[3]. The chart below illustrates that while heavy duty diesel vehicles make up a small percentage of the VMT traveled within our regional annually, they account for almost 2/3 of the on-road $PM_{2.5}$ emissions. Diesel reduction projects are a priority because, depending on the technology used, diesel engine replacement and retrofits can provide between a 25-90% reduction of fine particulate matter emissions.



* This does not represent 100% of the VMT in the region, but provides a comparison between these two particular vehicle classes. Light duty passenger trucks, motorcycles and other commercial vehicles are not represented in the chart above.

[3] Puget Sound Clean Air Agency. https://pscleanair.gov/162/Air-Toxics

Table 3: Example Projects, Low to High Magnitude Emission Benefits	
Low Magnitude Diesel Reduction	Installation of engine preheaters on 20 transit buses.
High Magnitude Diesel Reduction	Replacement of 280 port drayage trucks.
Low Magnitude Bicycle/Pedestrian	Sidewalk repair, completion of missing segments; addition of bicycle lane for 1-2 miles.
High Magnitude Bicycle/Pedestrian	New separated pathway connecting to transit center in an urban core.
Low Magnitude TDM/CTR	Corridor-based marketing approach to encourge alternatives to drive-alone travel.
High Magnitude TDM/CTR	TDM programs in multiple urban centers, to include marketing and outreach, incentives, parking management policies and minor capital impovements such as bicycle racks and signage.
Low Magnitude Transit Service	1-mile corridor extension of an existing system in a dense urban area with strong existing transit ridership and nonmotorized travel.
High Magnitude Transit Service	New regional transit service on separated alignment for 14 miles.
Low Magnitude Transit Vehicles	Replacement of less than 10 buses or shuttles, with no corresponding expansion of service.
High Magnitude Transit Vehicles	Replacement of a significant number of buses or shuttles for expansion of transit service.
Low Magnitude Transit Amenities / Infrastructure	Improvements to bus shelters, lighting, boarding and other passenger amenities.
High Magnitude Transit Amenities / Infrastructure	Parking structure and flyer stop for major regional transit route.
Low Magnitude HOV/BAT Lanes	Transit queue jump for a single intersection.
High Magnitude HOV/BAT Lanes	Completion of HOV system along an interstate.
Low Magnitude Intersections/ITS	Signalization or other ITS investments at a single intersection.
High Magnitude Intersections/ITS	ITS infrastructure on multiple interstates and state routes.

As mentioned previously, the information in the tables above for average emissions by project type, as well as examples of low to high magnitude projects within each category, should be used as a starting point for the evaluation of projects. Additional information should then be taken into account to produce a final air quality score, which is based on the magnitude and timing of emissions reductions for STP and FTA applicants, or cost-effectiveness for CMAQ applicants.