Minnesota Pollution Control Agency

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May 27, 2013

U.S. Environmental Protection Agency – Ozone Advance
c/o Ms. Laura Bunte
Mail Code C304-01
109 TW Alexander Drive
Research Triangle Park, NC 27711

RE: Ozone Advance "Path Forward" for Minnesota

Dear Ms. Bunte:

The Minnesota Pollution Control Agency (MPCA) enrolled in U.S. Environmental Protection Agency's (EPA) voluntary Ozone Advance program in May 2012. This letter provides the proposed path forward for the MPCA and its partner organizations.

The MPCA has worked with the Environmental Initiative (EI) to engage in conversations with Minnesotans through an effort called the Clean Air Dialogue (Dialogue). The primary purpose of the Dialogue is to ensure Minnesota will continue to meet federal air quality standards. The Dialogue work groups have representation from state and local governments, industry sectors, and nonprofits.

The enclosed document, Minnesota's Clean Air Dialogue Final Report: A Collaborative Plan to Reduce Emissions, provides more detailed information about the proposed path forward. The report describes the participants, process and recommended actions. There are 24 initiatives in six categories. The recommendations include actions that target both ozone formation and particulates. The MPCA, EI and partners who participated in the Dialogue will work to implement these emission reduction initiatives. Efforts will continue to set priorities for action, request and gather financial resources, and develop plans for implementation of recommended actions to be supported by the MPCA and EI over the next biennium.

If you have further questions, please contact Mary Jean Fenske, of my staff, at 651-757-2354.

Sincerely,

J. David Thornton
Assistant Commissioner

JDT/BC:je

Enclosure

cc: Steve Rosenthal, EPA Region 5

Environmental
INITIATIVE

Powerful Partnerships, Effective Solutions

Minnesota's Clean Air Dialogue

Final Report: A Collaborative Plan to Reduce Emissions

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Executive Summary

Project Context

The United States Environmental Protection Agency (EPA) sets health-based National Ambient Air Quality Standards (NAAQS) for fine particulate matter (defined as particles less than 2.5 microns in diameter, noted as $PM_{2.5}$), ground level ozone and four other widespread pollutants and is required by law to periodically reevaluate them. Research suggests air pollution is linked to upper respiratory illness, cardiovascular disease and other human health problems.[1] These effects are increasingly being seen at ever-lower levels of pollution. As a result, federal air quality standards have been made more stringent over time—a trend that is likely to continue.

Minnesota is fortunate to have generally good air quality that has improved over the last decade for most pollutants thanks to advancing technology, voluntary programs, strong regulatory compliance and other factors. Despite Minnesota's emission reduction efforts and cleaner air, uncertainty about where federal standards will be set in the short- and long-term is leading to uncertainty as to whether Minnesota will remain in compliance. If all or part of Minnesota were to violate a federal ambient air standard, the economic costs to state businesses are estimated to be as high as $240 million due to federal regulations that would come into effect. At the same time, reducing fine particles and ozone would result in billions of dollars of health benefits. Minnesota is thus faced with a unique opportunity—and strong economic incentive—to proactively develop cost-effective solutions to our air quality challenges, drawing on a long and rich tradition of collaborative action.

Minnesota's Clean Air Dialogue

Between March 2012 and February 2013, Environmental Initiative facilitated a conversation amongst leaders in the business, government and nonprofit sectors to explore new opportunities for emissions reductions, lay the groundwork for future collaboration to improve air quality in Minnesota, and prepare for potential nonattainment designations. This group, the Work Group of Minnesota's Clean Air Dialogue, was tasked with identifying the most efficient and effective ways to meet or exceed potential new federal standards through a process of collective problem-solving and consensus decision-making. Work Group members, assisted by additional technical experts, developed and came to consensus on a set of complementary initiatives to voluntarily reduce emissions associated with ozone and fine particle pollution. These recommendations are accompanied by descriptions of additional activities that the Work Group recognizes as playing an important role in ongoing emissions reductions.

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[1] U.S. EPA, Ground-level Ozone: Health Effects. http://www.epa.gov/groundlevelozone/health.html
U.S. EPA, Particulate Matter (PM): Health. http://www.epa.gov/airquality/particlepollution/health.html

Recommendations of the Work Group

The Work Group recommended, by consensus[2], 24 initiatives in six categories to reduce emissions associated with ground-level ozone and fine particle pollution.

Area Source Recommended Actions

- Education and Outreach to Reduce VOC Emissions from Small to Mid-Sized Businesses
- Equipment Exchange for Landscaping Equipment with Small Engines
- Model Landscaping Services Contract
- State Matching Fund for Area Source Reduction Projects

Energy Efficiency & Renewable Energy Recommended Actions

- Air Quality Improvements and Urban Heat Island Mitigation Through Urban Forestry
- Expand Minnesota GreenCorps to Help Local Governments Achieve Energy Conservation Goals in Public Facilities

Mobile Diesel Recommended Actions

- Alternative Fuel Infrastructure Grants
- Alternative Fuel Vehicle Incentive for Fleets
- Education and Outreach to Reduce Truck Idling
- Incentives for Diesel Engine Retrofit/Repower/Rebuild/Replace
- Emissions Reduction Guidelines for Public Fleets
- Model Contract for Public Works Projects

Point Source Recommended Actions

- Air Alert Education and Best Management Practices Outreach
- Stationary Diesel Generator Outreach and Education

Transportation Demand Management & Light-Duty Vehicle Recommended Actions

- Accelerated High-Emitting Vehicle Retirement
- Develop the Transit System (Bus and Rail) in the Seven County Metro Region
- Expand Employer-Subsidized Transit Pass Program
- High-Emitting Vehicle Repair Rebates
- Infrastructure & Outreach to Expand Electric Vehicle Use in Minnesota
- Regional Telework Program

Wood Smoke Recommended Actions

- Model Ordinance to Reduce Emissions Impacts from Hydronic Heaters
- Study Options for Coordination of Seven County Metro Area Brush Management Systems
- Wood Stove/Fireplace Change-Outs
- Wood Smoke Reduction Education and Outreach

In addition, the Work Group officially recognized the long-term role of 10 concurrent activities, listed in the full project report, in maintaining and improving air quality in Minnesota.

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[2] Consensus was defined for the purposes of this project as "producing recommendations that all participants can live with." The consensus was reached through the Work Group's discussion on the package of recommended initiatives as a whole. The individual initiatives and contents of this report should not be interpreted as having been recommended, accepted, or endorsed by specific individuals or organizations participating in the Work Group. See Page 20 for a full description of the stakeholder process and consensus.

Next Steps

Minnesota's Clean Air Dialogue was envisioned to be the first step in catalyzing the implementation and expansion of projects to improve air quality throughout the state. Aided by the recommendations contained in this report, the Minnesota Pollution Control Agency, Environmental Initiative and many of the leaders who participated in Minnesota's Clean Air Dialogue will be working to implement a number of high-priority emission reduction activities over the coming months. Ongoing efforts to set priorities for action, request and gather financial resources, and develop plans for implementation of recommended actions will be supported by Clean Air Minnesota, whose steering committee members have worked together for nearly a decade to keep Minnesota's air clean through innovative public-private partnerships.

For more information about this ongoing effort or to obtain a full copy of this report, visit the project website at www.environmental-initiative.org. Questions can be directed to Environmental Initiative at info@environmental-initiative.org or 612-334-3388.

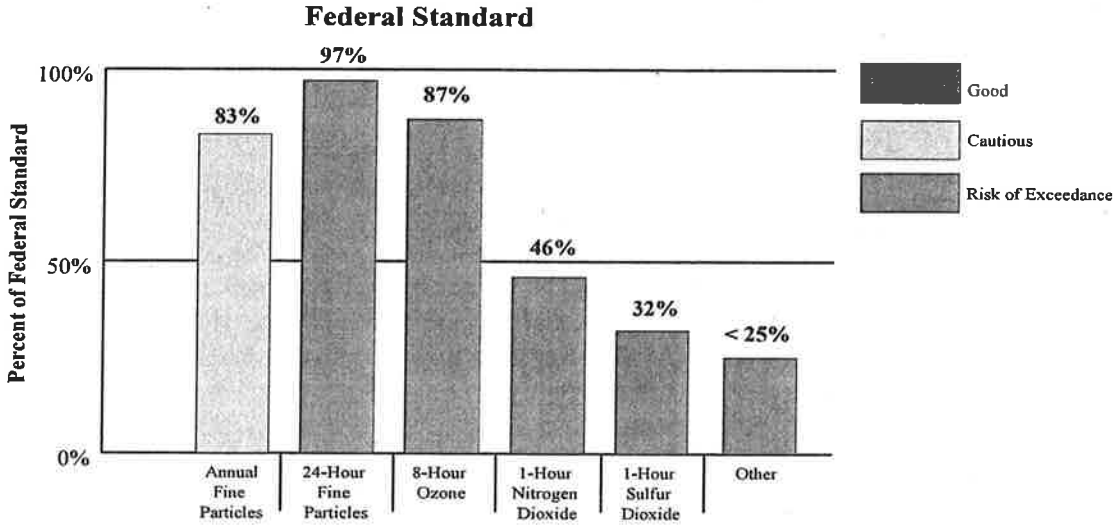
Project Background & Context

Overview of National Ambient Air Quality Standards

The federal Clean Air Act requires the U.S. Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS) at levels requisite to protect public health for pollutants that are both widespread and shown to be harmful to public health and the environment.[3] The EPA is required to review the standards for these pollutants—and the science on which those standards are based—every five years.[4] There are currently six pollutants for which the EPA sets NAAQS, particle pollution (particulate matter or PM), ground-level ozone, carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxides (NO_2), and lead. Of the six pollutants, particle pollution and ground-level ozone are considered to be the most widespread health threats.[5]

A geographic area with air quality that meets the standard for a given pollutant is called an "attainment" area. Areas that do not meet the standard are thus called "nonattainment" areas. As of the start of the Clean Air Dialogue in early 2012, the EPA was in the process of reviewing the standards for ground-level ozone and particles less than 2.5 micrometers in diameter ($PM_{2.5}$), and, despite improvements to Minnesota's air quality over time, the threat of tighter standards put the state at risk of falling out of attainment for these pollutants.

Chart 1: Minnesota's 2011 Ambient Air Pollutant Concentrations in Relation to Federal Standards[6]



[3] U.S. Environmental Protection Agency, Technology Transfer Network: National Ambient Air Quality Standards, http://www.epa.gov/ttn/naaqs/

[4] MPCA. Air Quality in Minnesota 2013 Report to the Legislature. www.pca.state.mn.us/yhizb6a

[5] U.S. Environmental Protection Agency, The Plain English Guide to the Clean Air Act: Cleaning Up Commonly Found pollutants, http://www.epa.gov/air/caa/peg/cleanup.html

[6] MPCA. Air Quality in Minnesota 2013 Report to Legislature. www.pca.state.mn.us/yhizb6a.

Understanding Ozone and Particulate Pollution

One of the challenges of addressing ambient concentrations of ground-level ozone and particulate matter is that both pollutants are formed in the atmosphere as precursor chemicals combine in complex chemical reactions. In the case of ground-level ozone,[7] it is formed when NO_x and volatile organic compounds (VOCs) are found together in the presence of heat and sunlight. Because of the role of heat and sunlight in the formation of ozone, ozone is generally not a problem in Minnesota during the winter months, but on hot sunny summer days ozone concentrations can rise to what are considered to be unhealthy levels.[8]

"Particulate matter" is a broad term that refers to any small particles or droplets in the air. These particulates can be liquid or solid, organic or inorganic, and can consist of a variety of substances, including carbon, sulfates, nitrates, ammonium, metals and acids. They can also range in size, with smaller particles (known as "fine particulates" or PM2.5) posing a greater health risk due to their ability to penetrate deeper into the lungs and respiratory system.[9] On a typical day, roughly half of the $PM_{2.5}$ in urban air is due to directly emitted particles from combustion activities—such as operating vehicle engines and burning wood for residential heating. Much of the remaining fine particles form from ammonium sulfate and ammonium nitrate, compounds created when SO_x and NO_x react with ammonia in the atmosphere. Particle pollution is affected by factors such as temperature, humidity, and wind, which can transport particulates over long distances.[10]

Because ozone and PM formation are heavily influenced by weather patterns and depend on the ratios of a complex mixture of precursor chemicals that happen to be present in the air at a given time, reductions in precursor emissions do not necessarily have a linear impact on ambient concentrations of these pollutants. This makes it more difficult to translate goals for reductions in ambient concentrations into concrete plans for specific emissions reductions. It also gives special weight to any opportunities to reduce direct emissions of fine particulates, given that these reductions are more straightforwardly linked to reductions in ambient concentrations.

The Economic Consequences of Nonattainment

If any portion of the state were to be designated as a "nonattainment" area by the EPA, the Minnesota Pollution Control Agency (MPCA) would be held accountable for developing and executing a "state implementation plan" to bring the state back into compliance. However, it is not only state regulators who would be impacted by a nonattainment designation. When an area is designated as nonattainment, a series of complex regulations come into effect, and complying with these regulations would likely necessitate the imposition of numerous new requirements and restrictions on Minnesota businesses and citizens. When the state last faced the threat of nonattainment (for ground-level ozone) in 1998, the Minnesota Chamber of Commerce

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[7] Ground-level ozone, which is harmful to human health, should not be confused with ozone found in the upper atmosphere (10 to 30 miles above the Earth's surface), which forms the "ozone layer." While both types of ozone are chemically identical, they have separate and distinct impacts on humans and the environment. Ozone formed at ground level does not mix with or contribute to ozone in the upper atmosphere.

[8] Minnesota Department of Health. Air Quality: Ozone. http://www.health.state.mn.us/divs/eh/air/ozone.htm

[9] Minnesota Department of Health. Air Quality: Particles and Your Health. http://www.health.state.mn.us/divs/eh/air/pm.htm

[10] MPCA. Air Quality in Minnesota 2013 Report to the Legislature. www.pca.state.mn.us/yhizb6a

commissioned a study to assess the potential costs to Minnesota businesses of rules that would be similar to those that were instituted in the Milwaukee area when it was designated as nonattainment in 1990. The study found the potential cost of nonattainment for ground-level ozone in the Twin Cities to be anywhere from $189 million to $266 million (in 1998 dollars), depending on the emissions reduction strategies employed.[11] These costs do not include the inevitable administrative costs to the state (and by extension to taxpayers) of developing and enforcing a state implementation plan for the required emissions reductions.

In 2012 these estimates were updated through graduate research at the University of Minnesota's Humphrey School of Public Affairs. The new estimates for the potential economic impacts to Minnesota businesses of nonattainment were extended to include additional pollutants—accounting for the possibility of a nonattainment designation for fine particulates as well as ground-level ozone. The updated estimates were in a similar range, $140 million to $260 million, based on Milwaukee's experience as well as those of other areas that have been forced to address nonattainment in recent decades. These costs, it is projected, will fall most heavily on businesses, governments, other fleet owners, and the public in general as a result of having to reinstate the statewide vehicle inspection and maintenance program and the increased cost of reformulated gasoline. Other costs would fall on business and industry due to new restrictions on emissions from existing equipment and on electrical utilities due to new requirements to install best available retrofit technology (BACT) and participate in emissions cap and trade programs.[12]

Public Health Impacts of Air Pollution in Minnesota

Ground-level Ozone

According to the EPA, "Breathing ozone can trigger a variety of health problems including chest pain, coughing, throat irritation, and congestion. It can worsen bronchitis, emphysema, and asthma," and increase the frequency of asthma attacks. Over time, repeated exposure to ozone can inflame the linings of the lungs, reduce lung function and even permanently scar lung tissue. This may also make the lungs more susceptible to infection and increase the risk of premature death from lung disease. People who have existing respiratory conditions or who are active outdoors are particularly at risk from ozone exposure. This includes children, because they tend to be more active outdoors when ozone levels are high, they are more likely to have asthma, and their lungs are still developing.[13]

Fine Particulates ($PM_{2.5}$)

Exposure to particulates, especially very small or "fine" particles, can have negative impacts on both the heart and lungs. In general, the smaller the particles are, the greater the associated health concerns, since the smallest particles can get deep into lungs, and may even get into the

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[11] Aulich, Ted R. & Neusen, Kenneth. 1999. Estimated Economic Impact of Twin Cities Ozone Nonattainment. http://environmental-initiative.org/images/files/MnCAD/1999mnchamber_ozonenonattainmentimpacts.pdf
This study assumes a 15 percent reduction in volatile organic compounds (VOCs, a precursor involved in atmospheric ozone formation) from 1990 levels.

[12] Blankenheim, Courtney. 2013. Estimating the Economic Impact of Ozone and Fine Particulate Nonattainment in the Twin Cities.
This study assumes a 15 percent reduction in volatile organic compounds (VOCs), a 15 percent reduction in nitrogen oxides (NO_x) and a 20 percent reduction in directly emitted fine particulates ($PM_{2.5}$) from 2005 levels.

[13] U.S. EPA, Ground-level Ozone: Health Effects. http://www.epa.gov/groundlevelozone/health.html

bloodstream. Numerous studies have linked particle pollution exposure to health problems that include respiratory symptoms (such as irritation of the airways, coughing, difficulty breathing, aggravated asthma, and decreased lung function), as well as heart problems (such as irregular heartbeat and nonfatal heart attacks). Particulate exposure as even been linked with premature death in people with heart or lung disease.[14] Like in the case of ozone exposure, children, the elderly, people with impaired lung function or anyone who is especially active can be at higher risk of adverse impacts from particulate pollution.

Here in Minnesota, a study completed in May 2012 by the Minnesota Department of Health (MDH), the MPCA, and Olmsted Medical Center looked at the impacts of reductions in particle pollution between 2003 and 2009 on the risk of hospitalizations, emergency department (ED) visits, and mortality in the seven county metropolitan area and Olmsted County. In the metro region, hospitalizations for certain respiratory problems, including asthma, showed a statistically significant association with $PM_{2.5}$. One of the two analytical methods used also showed statistically significant associations for asthma ED visits, cardiovascular hospitalizations, and mortality. The proportions of total respiratory, and specifically asthma-related, hospitalizations attributable to short-term $PM_{2.5}$ exposures[15] declined by approximately three to four percent after the 2003 – 2005 baseline period. A supplemental sub-analysis showed an effect of vehicular traffic on asthma exacerbations in Olmstead County.[16] The authors of the study stressed that the indicators developed in this project apply only to acute health effects from short-term exposures, and thus represent only a portion of the total impact of PM.[17]

The Economic Benefits of Air Pollution Reductions

The health impacts of air pollution can come at a high cost in terms of personal and community wellbeing. While not all of these costs can be quantified, the EPA offers a modeling tool known as BenMAP "to estimate the health impacts and economic benefits occurring when populations experience changes in air quality."[18] In 2012 the MPCA used BenMAP to estimate the economic benefits associated with incremental reductions in Minnesota's fine particulate and ozone pollution. The MPCA's analysis looked at the costs associated with the health impacts of these pollutants (or the benefits of pollution reduction), including premature mortality, nonfatal heart attacks, hospital admissions, emergency room visits, asthma attacks, school absences, and lost workdays. According to this analysis, a 21 percent reduction in average daily concentrations of fine particulates from current levels in the 11-county metro region could result in the order of $4.9 billion in annual economic benefits by 2020. The possible annual benefits to the 11-county metro region associated with a 10 percent reduction in average summer-season daily maximum levels of ozone concentrations from current levels was estimated to be in the order of $250 million by 2020.[19] The following tables present the approximate economic values for each health

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[14] U.S. EPA. Particulate Matter (PM): Health. http://www.epa.gov/airquality/particlepollution/health.html

[15] Above a "policy-relevant" referent concentration of $5\mu g/m^3$

[16] Poverty was also strongly associated with asthma exacerbations.

[17] Johnson, Jean; Pratt, Greg; Yawn, Barbara. 2012. Measuring the Impact of Particulate Matter Reductions by Environmental Health Outcome Indicators. http://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.abstractDetail/abstract/8644/report/F

[18] U.S. EPA. Environmental Benefits Mapping and Analysis Program (BenMAP). http://www.epa.gov/air/benmap/

[19] The percentage pollutant reduction targets used for this analysis were based on several plausible scenarios for new $PM_{2.5}$ and ozone NAAQS as described later in this report. This analysis was intended to produce a rough estimate of the potential benefits associated with incremental improvements to air quality and does not take into consideration

incident attributed to fine particulate and ozone pollution and show the estimated annual economic benefits resulting from incremental reductions in ambient concentrations of these pollutants.

Table 1: Approximate[20] Value per Incident Associated with Each Health Endpoint Included in the Evaluation[21]

Health Endpoint	**Value/Incident (2010 US$)**	**Valuation Method**
Premature Mortality	$8,900,000	What EPA currently uses for the value of a statistical life based on willingness-to-pay studies
Nonfatal Heart Attacks	$106,000	Based on cost-of-illness studies that consider medical expenses and lost earnings incurred over five years from the date of the event
Hospital Admissions, Respiratory	$24,000	Based on cost-of-illness studies that consider medical costs and lost earnings
Hospital Admissions, Cardiovascular	$33,000	
Acute Bronchitis (Children)	$450	Derived from several willingness-to-pay studies of parents to avoid a typical illness for their children
Emergency Room Visits, Respiratory	$370	Average of estimates from two cost-of-illness studies
Work Loss Days	$150	Based on county-specific median daily wages
Lost School Days	$85	Value of lost productivity of parent
Acute Respiratory Symptoms (Adults)	$63	Derived from multiple willingness-to-pay studies
Upper Respiratory Symptoms (Children)	$31	Derived from three willingness to pay studies of parents to avoid these outcomes for their children
Lower Respiratory Symptoms (Children)	$20	

Table 2: Estimated Annual Economic Benefits Resulting from Incremental Reduction in Daily $PM_{2.5}$ Concentrations[22]

Geographic Area	**Total Annual Value per 1μg/m^3 Reduced in 2020 (2010 US$)**
State-Wide	$1.6 billion
11 County Metro Area	$850 million

total costs of current pollution levels or all health and welfare benefits associated with reduced pollution. It is also important to note that these numbers do not consider baseline pollution levels for each part of the state—in other words, pollution reductions are assumed to be evenly distributed across the given geographic area.

[20] Some economic values of some health impacts vary with location. For example, when lost earnings are part of the valuation, average income levels vary by county. Thus, these estimates are approximate, and represent best estimates for the Twin Cities metro area and the State of Minnesota

[21] Minnesota Pollution Control Agency analysis conducted for Minnesota's Clean Air Dialogue.

[22] ibid

Table 3: Estimated Annual Economic Benefits Resulting from Incremental Reduction in Average Summer-Season Daily Eight Hour Maximum Ozone Levels[23]

Geographic Area	Total Annual Value per 1 ppb Reduced in 2020 (2010 US$)
State-Wide	$38 million
11 County Metro Area	$21 million

Improving Minnesota's Air Quality

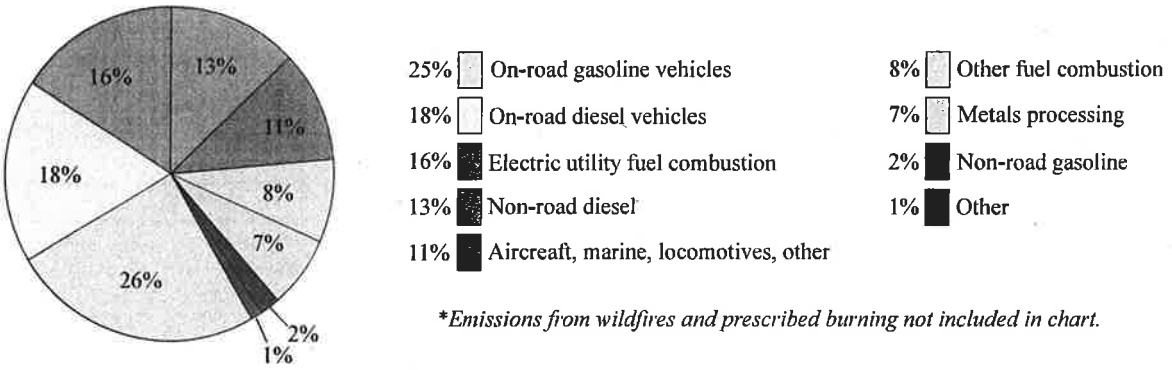
Sources of Emissions in Minnesota

Historically, air pollution has been viewed as coming from point source contributors like power plants and other factories with smoke stacks. While they are still important contributors, point sources have decreased their emissions significantly over the past 20 years and, for $PM_{2.5}$, VOCs, NO_x, and SO_2, point sources contribute only about one quarter of emissions statewide. In fact, for these pollutants, the majority of emissions come from smaller widespread sources that are not regulated in the way power plants and factories are. These sources include:

- On-road vehicles, including cars, trucks, and buses
- Off-road vehicles, such as construction and other heavy equipment, recreational vehicles, trains, planes, and boats
- Residential wood burning for heat or recreation
- Residential and commercial fuel combustion
- Uncontrolled volatile organic compounds (VOCs) from small businesses and consumer products

These sources also produce multiple pollutants of concern in Minnesota. Dealing effectively with the various sources of air pollution must move beyond individual pollutants or individual facilities to include the diverse array of area sources and non-point sources. This is especially true because, while concentrations of $PM_{2.5}$ and ozone have improved over time, variations in meteorology, movement of air pollution from other states, and reactions in the atmosphere also affect the levels of these pollutants.

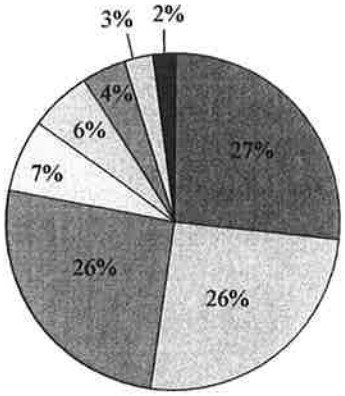
Chart 2: Sources of 2008 Nitrogen Oxide Emissions[24]



**Emissions from wildfires and prescribed burning not included in chart.*

[23] Minnesota Pollution Control Agency analysis conducted for Minnesota's Clean Air Dialogue.
[24] MPCA. 2008 Minnesota Criteria Pollutant Emission Inventory, version 1. Data provided by the Air Data Analysis Unit on March 1, 2013.

Chart 3: Sources of 2008 VOC Emissions[25]

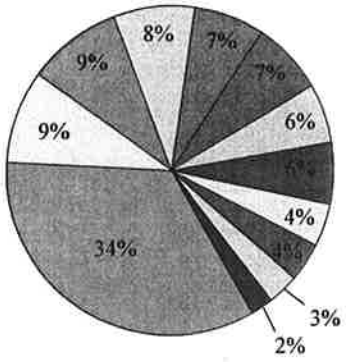


27% On-road gasoline vehicles
26% Non-road gasoline vehicles
26% Solvent utilization
7% Storage and transport of petroleum and solvents
6% Residential wood combustion
4% On-road and non-road diesel vehicles
3% Other
2% Other industrial processes

**Emissions from wildfires and prescribed burning not included in chart.*

While the top three sources of fine particulates in Minnesota are forest and agricultural fires, agricultural tilling, and dust, these sources are of less immediate concern due to the belief that they result in larger particles, tend to settle out of the air more quickly, are difficult or impossible to prevent (e.g. forest wild fires), and are found in less populated areas of the state. The Work Group therefore focused its efforts on reduction of emissions from human combustion sources.

Chart 4: 2008 $PM_{2.5}$ Emissions from Combustion and Metallurgical Processes[26]



34% Residential wood combustion
9% On-road diesel vehicles
9% Waste disposal and recycling
8% Non-road diesel
7% Electric utility fuel combustion
7% On-road gasoline vehicles
6% Industrial and metal processing
6% Industrial fuel combustion
4% Other industrial processes
4% Non-road gasoline
3% Aircraft, marine locomotives, other
2% Other

**Emissions from wildfires and prescribed burning not included in chart.*

Emissions Trends and Projections

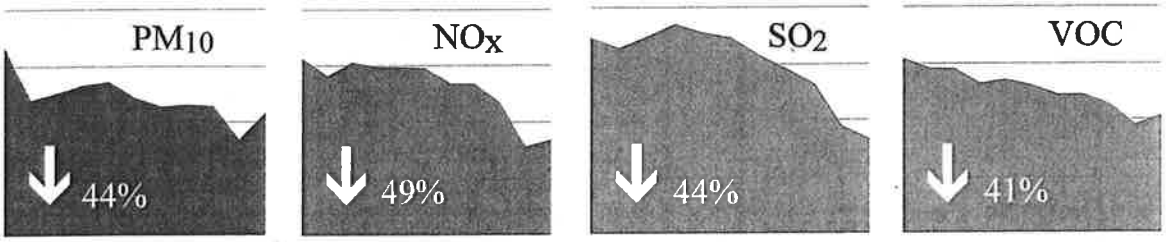
Point Sources

When identifying opportunities and priorities for emissions reduction, it is important to note that over the past decade emissions from point sources—the facilities that we normally associate with

[25] MPCA. 2008 Minnesota Criteria Pollutant Emission Inventory, version 1. Data provided by the Air Data Analysis Unit on March 1, 2013.
[26] ibid.

air pollution—have been falling due to new federal regulations and state initiatives. Some of the federal regulations have driven, and will continue to drive, emissions down from larger permitted sources include NAAQS for SO_2, NO_2 and lead, as well as requirements to use newer pollution control technology (i.e. "best available retrofit technology") and rules related to visibility (also known as regional haze) and to the movement of air pollution across state lines. Minnesota's Renewable Energy Standard, enacted in 2007, is also helping to drive emissions from the electric power sector down significantly. Reductions are projected to be even more dramatic for the state's and the seven county metro area's top ten emitters.[27]

Chart 5: Point Source Pollutants Declines (2000-2010)[28]



For the period 2000-2010, percent decrease in total emissions for specific pollutants *Minnesota PointSource Criteria Pollutant Inventory*

Mobile Sources

Emissions from mobile sources have also been on a downward trend over the last 10 years, thanks to new technologies and a range of federal policies. Since the late 1990s sulfur emissions have decreased significantly due to the introduction of low-sulfur diesel requirements. Nitrogen oxides and particulates have also been declining thanks to new rules for off-road and heavy-duty diesel vehicles and tightened NAAQS. New fuel efficiency standards for vehicles will also continue to drive emissions downwards as the fleet turns over across the state and country.

Table 4: Projected Mobile Source Emissions Reductions (Minnesota) 1999 – 2020[29]

Pollutant	1999 Emissions (tons)	Estimated 2020 Emissions (tons)	Change
NO_x	268,642	129,326	-52%
VOC	174,340	128,358	-26%
PM_{10}	17,581	10,247	-42%
SO_2	5,006	5,129	2%

[27] Hansel, Michael. (October 19, 2012). *Point Source Emissions Reductions.* Presented to the Work Group of Minnesota's Clean Air Dialogue, Edina, MN. http://www.environmental-initiative.org/images/files/Point%20Source%20Emission%20Reductions%20v_4%2010_31_12.pdf

[28] MPCA. Air Quality in Minnesota 2013 Report to the Legislature. www.pca.state.mn.us/yhizb6a

[29] Hansel, Michael. (October 19, 2012). *Mobile Source Emissions Reductions.* Presented to the Work Group of Minnesota's Clean Air Dialogue, Edina, MN

Chart 6: Projected Mobile Source Emissions Reductions in Minnesota[30]

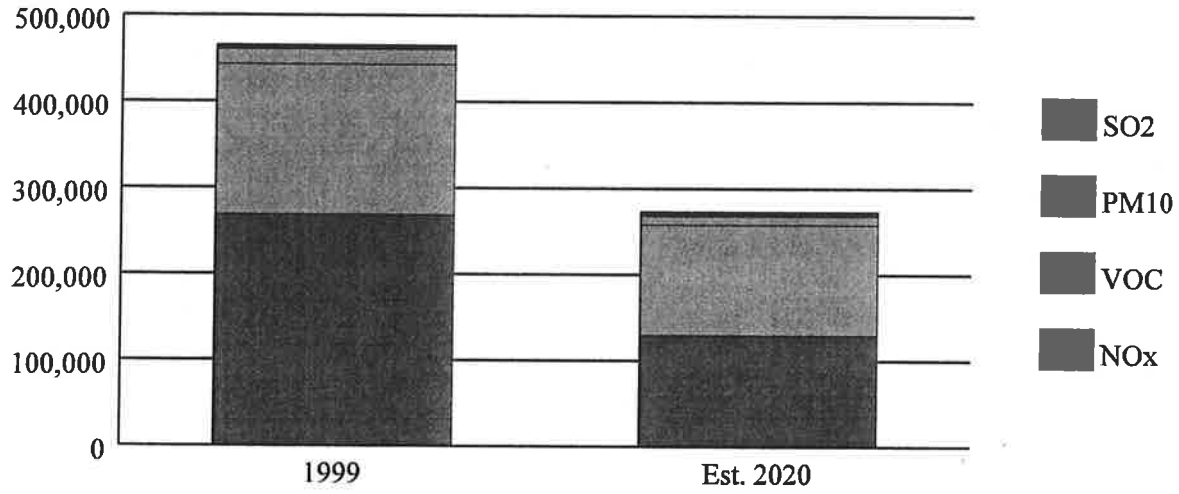
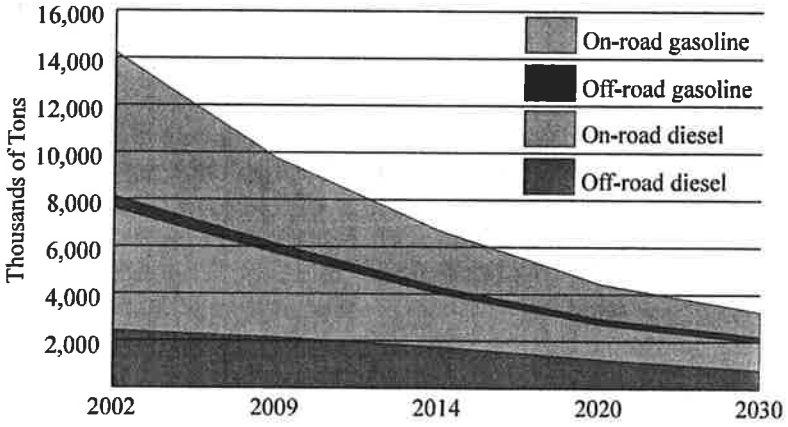


Chart 7: Annual Mobile Source NO_x Emission Projections (United States) 2002 – 2030[31]



Nox emissions from on- and off- road mobile sources are projected to significantly decrease across the country over the next two decades. Similar trends are expected for PM2.5. Because PM2.5 emissions increase in colder weather, Minnesota's emissions projections are expected to be somewhat different from national projections.

Area Sources

Area sources include small sources like printers, dry cleaners, auto body paint shops, and gas stations. The EPA defines area sources as sources that emit less than 10 tons per year of a criteria

[30] Hansel, Michael. (October 19, 2012). *Mobile Source Emissions Reductions.* Presented to the Work Group of Minnesota's Clean Air Dialogue, Edina, MN

[31] MPCA. Air Quality in Minnesota 2013 Report to the Legislature. www.pca.state.mn.us/yhizb6a

or hazardous air pollutant or less than 25 tons per year of a combination of pollutants. The category also includes commercial buildings (heaters, coatings, cooking/fire pits), residential buildings (fireplaces, heaters, consumer solvents), fuel combustion in non-road machinery, boats, railroads, lawn and garden equipment and other forms of burning. Though emissions from individual area sources are relatively small, collectively their emissions can be of concern, particularly where large numbers of sources are located in heavily populated areas.

Because area sources are, by definition, smaller, more dispersed and more diverse, they have been less impacted by federal action in recent years. While there have been some likely emissions reductions from these sources due to required control technologies, area sources represent significant opportunities for reductions, particularly in VOCs.

Table 5: Area Source Emissions Reductions 2008 – 2020[32]

Pollutant	1999 Emissions (tons)	Estimated 2020 Emissions (tons)	Change
NO_x	18,139	17,974	-1%
VOC	111,470	108,578	-3%
PM_{10}	23,209	11,112	-52%
SO_2	8,045	7,990	-1%

Despite these declines, the likelihood that federal standards will continue to be tightened, along with the fact that projected emissions declines do not necessarily match up with the geographic areas where pollutant reductions are most important for public health or other policy reasons, gives value to additional focused emissions reduction efforts.

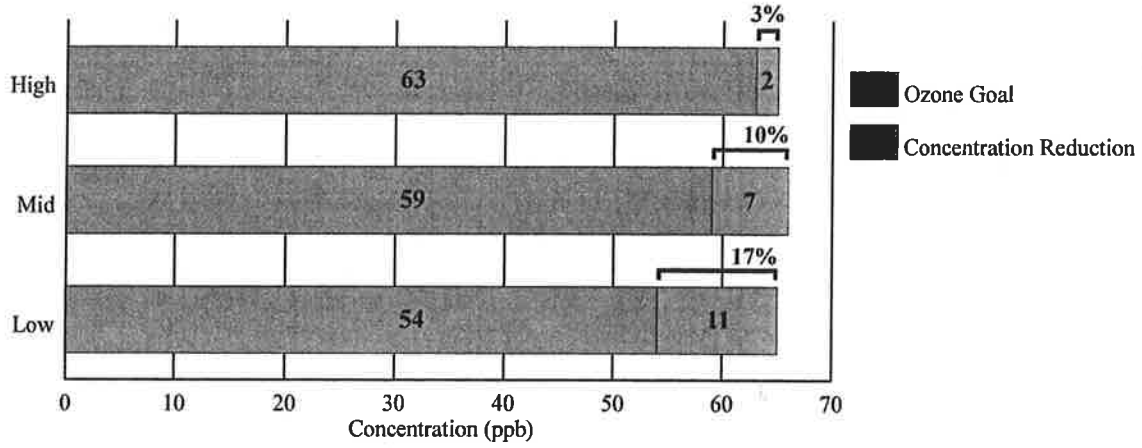
Setting Goals for Air Quality Improvements

In order to give additional context to the task of proposing strategies to reduce emissions for Minnesota's Clean Air Dialogue, the MPCA estimated the total reduction in ambient pollution concentrations that Minnesota would need to achieve in order to avoid nonattainment and provide a margin of safety for the future under three plausible scenarios of tightened standards. The three scenarios were based on standards that had been indicated or suggested by the Clean Air Scientific Advisory Committee.[33] For ozone, reasonable goals for ambient concentrations—assuming a 10 percent margin of safety below likely new standards—ranged from 63 to 54 parts per billion (ppb) (see Chart 8). This would mean a two to 11 percent reduction from a 2011 baseline value.

[32] Hansel, Michael. (October 19, 2012). *Area Source Emissions Reductions.* Presented to the Work Group of Minnesota's Clean Air Dialogue, Edina, MN.

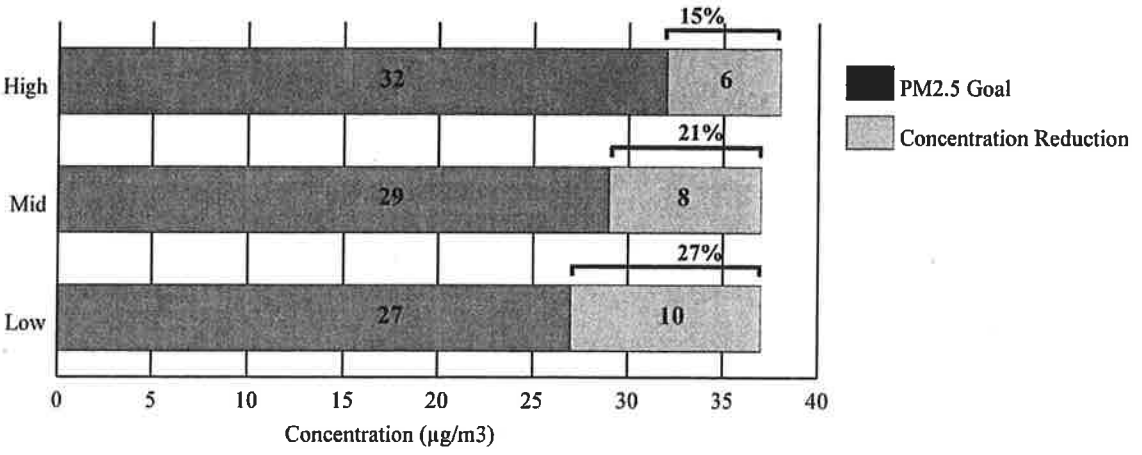
[33] U.S. EPA. Clean Air Scientific Advisory Committee (CASAC). http://yosemite.epa.gov/sab/sabpeople.nsf/Webcommittees/CASAC

Chart 8: 8-Hour Ozone Concentration Reductions[34]



For $PM_{2.5}$, reasonable goals for ambient (daily) concentrations—again assuming a 10 percent margin of safety below likely new standards—ranged from 35 to 30 micrograms per cubic meter (µg/m3) (see Chart 9). This would mean a 15 to 27 percent reduction from a 2010 baseline value.

Chart 9: Daily PM2.5 Concentration Reductions[35]



Because (with the exception of direct particulate emissions) the relationship between emissions reductions and reductions in ambient ozone and particulate concentrations is not one to one (in

[34] Cassie McMahon, Minnesota Pollution Control Agency analysis for the MnCAD process.

[35] Cassie McMahon, Minnesota Pollution Control Agency analysis for Minnesota's Clean Air Dialogue.

scientific terms, it is highly nonlinear), translating these goals for ambient concentrations into goals for emissions reductions would require complex modeling and many assumptions. For the purposes of this project, these goals were used as an aspirational illustration of the degree to which pollution levels may need to be reduced in relation to current levels if Minnesota is to avoid nonattainment over the coming years.

Voluntary Emissions Reduction Efforts

Concentrations of many air pollutants have decreased in Minnesota over the past decade thanks not only to federal regulations, but also to a number of voluntary efforts to proactively reduce pollution beyond what is required by the federal Clean Air Act. In 2001, state legislation often referred to as the "emissions reduction rate rider" took effect that has resulted in utilities undertaking large emissions reduction projects in advance of federal requirements.[36] Both Xcel Energy and Minnesota Power took advantage of an incentive to recover the costs of emission reductions through use of a rate rider. Since 2000, emissions of NO_x and SO_2 from in-state power generation sources have declined by 58 percent and 54 percent respectively[37].

Many additional efforts have been organized through Clean Air Minnesota (CAM),[38] a partnership of businesses, units of government, and environmental organizations that has been coordinated by Environmental Initiative since 2003. Over the last decade the Clean Air Minnesota Steering Committee has spearheaded projects to reduce emissions from the auto body refinishing and printing industries, as well as from diesel-fueled vehicle fleets—with a special focus on reducing diesel emissions from school buses through Project Green Fleet.[39] Emissions reductions have also occurred through the Minnesota Technical Assistance Program, which works with businesses to save money and protect employee health through pollution prevention.[40] Ongoing efforts to address vehicle emissions through behavior change[41] and transportation planning[42] have also helped to reduce pollutant levels, as have numerous MPCA education, outreach, technical assistance and small business grant programs.[43]

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[36] Minn. Stat. § 216B.192

[37] MPCA. Air Quality in Minnesota 2013 Report to the Legislature. www.pca.state.mn.us/yhizb6a.

[38] Environmental Initiative. Clean Air Minnesota. http://www.environmental-initiative.org/projects/past-projects/clean-air-minnesota

[39] Environmental Initiative. Project Green Fleet. http://www.projectgreenfleet.org/

[40] University of Minnesota. Minnesota Technical Assistance Program. http://www.mntap.umn.edu/

[41] Metro Transit. Outreach. http://metrotransit.org/outreach

[42] Metropolitan Council. Transportation Planning. http://www.metrocouncil.org/services/transportation.htm

[43] Minnesota Pollution Control Agency. Preventing Waste and Pollution. http://www.pca.state.mn.us/index.php/topics/preventing-waste-and-pollution/index.html

Project Methodology & Stakeholder Groups

Work Group

In 2012 Environmental Initiative formed a 26-member stakeholder Work Group (see Appendix C: Work Group Roster) comprised of leaders from business, state and local government, and environmental organizations. The group was tasked with identifying the challenges we may face in remaining in attainment with federal air quality standards, and developing a set of recommended strategies to address these challenges, and protecting public health, through proactive measures to reduce relevant emissions. Lee Paddock, former director of environmental policy for the Minnesota Attorney General's Office and currently the associate dean for environmental law studies at The George Washington University School of Law, was retained to facilitate the process.

In total, the full Work Group met 10 times between April 13, 2012 and February 8, 2013. The first several Work Group meetings focused on:

- Developing a common understanding of air quality knowledge amongst Work Group members.
- Agreeing on a set of goals for the process, including the Work Group's charge and a set of ground rules for the conversation *(see Appendix B: Work Group Charge & Ground Rules)*.
- Reviewing in-depth information on relevant emissions sources (*see Appendix E: 2008 Emissions Sources Breakdown*) and the dynamics of ozone and fine particulate formation.
- Providing an overview of federal air quality policy and standards, as well as state programs to reduce emissions in nonattainment areas.

Beginning in July of 2012, the Work Group divided into six Technical Working Groups (TWGs) for the purpose of identifying emissions reduction opportunities and proposing specific emissions reduction initiatives for inclusion in the final recommendations (see below). In September the Work Group began the process of providing feedback on initial emissions reduction proposals developed by the TWGs, and this iterative proposal revision process continued through the remainder of 2012. In January of 2013 the Work Group discussed and agreed on how the recommendations and other proposed emissions reduction initiatives developed by the TWGs would be handled in the final report, and in February the Work Group came to consensus—defined as producing recommendations that all participants can live with.

Technical Working Groups

Six Technical Working Groups (TWG) were formed during the project in order to focus on areas where specific emissions reduction opportunities existed and to propose concrete initiatives to respond to those opportunities. The TWGs also allowed the Work Group to bring in outside technical expertise.

Each TWG was charged with proposing emissions reduction activities for their area of focus, spanning the range of reasonable options (based on evaluation criteria provided by the Work Group—see Appendix B). TWGs were formed based on six distinct emissions sources that contribute to Minnesota's ozone and fine particulate pollution:

- Area Sources
  Smaller, geographically dispersed emissions sources
- Energy Efficiency & Renewable Energy
  Emissions from the energy sector that can be impacted by demand-side/customer activities and programs
- Mobile Diesel
  Heavy-duty vehicles and mobile equipment with diesel engines
- Point Sources
  Larger permitted facilities, including those using stationary diesel generators, targeting supply-side actions and emissions controls
- Transportation Demand Management & Light-Duty Vehicles
  Passenger vehicles with a gasoline engine and emissions reductions through changes to how and when vehicles are operated
- Wood Smoke
  From residential burning for heating and recreational purposes, and brush disposal

The organizations represented on the Work Group sat on anywhere from one to five of the TWGs, and a range of additional experts and impacted stakeholders were invited to participate (see Appendix D: Technical Working Groups Rosters). Each TWG met from four to six times between July and December of 2012 in order to develop and refine emissions reduction proposals for the Work Group. TWG members then participated in the process of presenting these proposed emissions reduction initiatives to the full Work Group between September and December of 2012.

Planning Team

A Planning Team made up of a representative sub-set of eight Work Group members supported Environmental Initiative's staff throughout the process. The Planning Team met via conference call once a month between May 2012 and February 2013 to give feedback on the process and progress of the dialogue, as well as provide input on draft meeting agendas and Work Group materials.

Minnesota Pollution Control Agency's Role

In addition to their role as funder, the Minnesota Pollution Control Agency (MPCA) provided both strategic and technical support throughout the duration of the project via a range of activities. From the beginning of the project, a core team of MPCA staff from across the agency met monthly with Environmental Initiative project staff to provide strategic insight and input into the process overall, as well as the agendas and materials for each Work Group meeting. MPCA staff members also delivered detailed presentations to the Work Group on Minnesota emissions sources, atmospheric processes, economic impacts of air pollution, and federal air quality standards. In addition, MPCA's technical experts served on all six TWGs as technical resources and as links to ongoing and emerging agency activities related to each TWG's focus. Assistant Commissioner David Thornton also participated in the Work Group on behalf of the Agency, supported by Air Policy Unit staff.

Additional Stakeholder Education and Input

Air Quality Forums

In conjunction with the activities of the Work Group, the project also included a number of events designed to educate a wider audience of stakeholders on the issues of air quality and possible nonattainment in Minnesota and to engage other interested parties in building a common vision for what will be necessary to address air quality challenges. These events included three educational forums, which were held in Minneapolis, Duluth and Rochester during the spring of 2012—prior to the first meetings of the Work Group. Each event featured locally relevant speakers who addressed the following questions:

- What do we know about air quality in Minnesota and its impacts on public health?
- How might proposed changes to federal air quality standards impact Minnesota industries?
- What sectors are most likely to be impacted?
- What can Minnesota businesses and communities do to proactively reduce harmful emissions in order to avoid federal nonattainment designations?

Event attendees were given the opportunity to raise concerns and propose solutions that were collected as input into the dialogue.

A fourth forum was held in April of 2013 to announce the outcomes of the dialogue, celebrate progress thus far to reduce emissions and inspire engagement in future work to improve Minnesota's air quality. Work Group members presented their recommendations to participants and outlined next steps for funding and either beginning new or expanding existing projects. They also outlined the framework for ongoing stakeholder coordination and leadership on emissions reductions through a reinvigorated Clean Air Minnesota partnership.

Public Meeting & Additional Stakeholder Outreach

In addition to the air quality forums, the process included a participatory public meeting focused on gathering input from a wider group of stakeholders and interested parties on the emissions reduction options proposed by the TWGs (prior to of the Work Group's decisions regarding final recommendations). The public meeting was held on December 4, 2012 and was attended by more than 60 individuals. Meeting participants were given background information and an update on the process to date, then asked to join one of five break-out groups to discuss the emissions reduction proposals developed by the TWG of their choice:

- Point Sources and Energy Efficiency & Renewable Energy
- Area Sources
- Mobile Diesel
- Transportation Demand Management & Light Duty Vehicles
- Wood Smoke

Participant feedback was documented and given to the Work Group for consideration as the emissions reduction proposals were refined and finalized into recommendations.

Ongoing Partnership to Improve Minnesota's Air Quality

While the Work Group completed its charge in February of 2013 when it came to consensus on its recommendations, this report and the project outcomes are intended to be a starting point for ongoing stakeholder collaboration on air quality. After the formal conclusion of the project, Environmental Initiative will continue to convene a cross-sector group of stakeholders with the intention of maintaining momentum for the full range of solutions needed to reduce emissions and maintain Minnesota's position as a leader in environmental quality.

Clean Air Minnesota

Clean Air Minnesota was first established over a decade ago as a broad partnership between business, environmental organizations, and government. Clean Air Minnesota provided an on-going opportunity for statewide dialogue on air quality improvement strategies, focusing on projects with potential to reduce air emissions from area and mobile sources. In recent years, the partnership was focused primarily on reducing diesel emissions from mobile sources.

Environmental Initiative launched Minnesota's Clean Air Dialogue in 2012 to broaden the conversation with a larger group of air quality leaders and to develop a more comprehensive set of strategies to reduce emissions associated with ground level ozone and fine particulate matter. As Minnesota's Clean Air Dialogue concludes, Environmental Initiative will work with the Minnesota Pollution Control Agency to re-establish Clean Air Minnesota as the on-going partnership between business, government, and nonprofit air quality leaders to:

- Sustain the cross-sector conversation on air quality, in order to identify, evaluate and prioritize viable strategies for emissions reductions.
- Catalyze partnerships to support and coordinate across organizations that are implementing the recommendations of Minnesota's Clean Air Dialogue.
- Track emissions reductions achieved by the public and private sectors and report those reductions to the community and stakeholders on a regular basis.
- Serve as the stakeholder group for Minnesota's participation in EPA's Ozone and PM Advance Programs.

Ozone and PM Advance

In the spring of 2012, as the Work Group was beginning its meetings, the EPA announced a new air quality program designed for geographic areas that, like Minnesota, are currently in attainment with national air quality standards. Known as the "Advance" program, it is intended to encourage proactive emission reductions in ozone and fine particulate ($PM_{2.5}$) attainment areas and to efficiently direct technical resources and support in order help these areas continue to meet the NAAQS and protect public health.[44] The Work Group endorsed the State of Minnesota's official (statewide) participation in the Ozone Advance program in May of 2012 and the PM Advance program in February of 2013.

Ozone and PM Advance are collaborative efforts by EPA, states, tribes, and local governments to obtain emission reductions in attainment areas nationwide to maintain the National Ambient Air Quality Standard (NAAQS) for ozone and $PM_{2.5}$. The stated goals of the programs are:

[44] U.S. EPA. Advance Program. http://www.epa.gov/ozoneadvance/

1) Help attainment areas take action in order to keep pollution levels below the level of the ozone and $PM_{2.5}$ NAAQS to ensure continued health protection
2) Better position areas to remain in attainment
3) Efficiently direct available resources toward actions to address ozone and $PM_{2.5}$ problems quickly

While there are no promises of regulatory flexibility, actions taken by areas under the PM and Ozone Advance programs that are State Implementation Plan (SIP) applicable[45] could potentially be taken into account by the EPA if the area was to fall into nonattainment, either in terms of a lower baseline or as a measure that shows progress towards attainment.

Requirements for the EPA Ozone and PM Advance programs include maintaining an ongoing stakeholder group to help inform recommendations and early actions on the part of the advance area. There is also a requirement for the area to submit an action plan that includes a description of the measures and programs, responsible parties, how each measure and program will be implemented (including an implementation schedule), and provisions for public and stakeholder involvement. This report outlines the measures and programs to be implemented. The Clean Air Minnesota (CAM) Steering Committee will be the body for ongoing stakeholder involvement and public engagement.

[45] A SIP is a state plan for complying with the federal Clean Air Act. A SIP consists of narrative, rules, technical documentation, and agreements that an individual state will use to clean up polluted areas. In order to receive emission reduction credit as a measure in a SIP, the measure would need to be quantifiable, surplus (in terms of not being double counted both as part of the baseline and as a control measure in the SIP), federally enforceable, and permanent. It would also need to meet any other relevant requirement in CAA section 110 and/or 172, and if the measure is voluntary, the state would need to make an enforceable commitment to ensure that the estimated emissions reductions are achieved (http://www.epa.gov/ozoneadvance/pdfs/2012404guidance.pdf).

Introduction to the Work Group's Recommendations

Interpreting the Recommendations

In February 2013 the Work Group of Minnesota's Clean Air Dialogue came to consensus on a package of 24 recommended initiatives to reduce emissions associated with ground-level ozone and fine particulate pollution.

> **Consensus as defined in the process:** Consensus was defined for the purposes of this project as "producing recommendations that all participants can live with." The consensus was reached through the Work Group's discussion on the package of recommended initiatives as a whole. The individual initiatives and contents of this report should not be interpreted as having been recommended, accepted, or endorsed by specific individuals or organizations participating in the Work Group.

The group did not prioritize individual recommendations, but recognizes them as a set of complementary approaches that together address emissions from all of the major source sectors in the state. Notably, the Work Group's recommendations focus on voluntary approaches—cost-effective "win-win" solutions that will proactively improve air quality and avoid the federal mandates that come with nonattainment. While the recommendations were not evaluated to determine their aggregate potential for reductions (and thus do not necessarily "add up" to achieve the aspirational goals set for reductions in ambient concentrations), the Work Group's hope is that together they keep Minnesota on a path of improving air quality.

A key factor in the recommendations is that, due to existing federal and state policies, many of the state's largest emitters are already regulated and will continue to reduce emissions in the coming years. This leaves much of the greatest potential for additional emissions reductions in the hands of consumers, drivers and small businesses. These sources received a significant focus in the Work Group's recommendations, and many of the recommended approaches provide these groups with significant co-benefits by incentivizing, rather than requiring, actions that reduce emissions. The Work Group also made a special point to consider opportunities to strengthen our local economy and promote the creation of future-oriented, well-paying green jobs through air quality improvement initiatives. Many of the recommendations selected by the Work Group are intended to promote a thriving local business community by providing financial support for actions that improve energy and process efficiency, save small and mid-size business owners money, and drive demand for local jobs manufacturing and installing next-generation technologies.

Another consideration was how new initiatives to improve air quality could be targeted such that they simultaneously address existing health disparities, help (rather than hurt) those struggling financially, and promote greater equity. While neither the recommended nor recognized actions were defined in a way that is prescriptive of program design, most of the options endorsed by the Work Group are intentionally scoped to allow resources to be focused on low-income individuals, neighborhoods or groups that bear disproportionate impacts from air pollution. Given limited resources, and recognizing that the ultimate driver of all air quality standards and programs is concern for human health—particularly that of vulnerable and already overburdened

populations—the Work Group, and the MPCA in particular, expressed a strong commitment to incorporating issues of equity into the implementation of any of the recommendations.

The benefits of improving public health and preventing a nonattainment designation from the EPA for any of the NAAQS are the primary intended benefits for which the recommendations were chosen. The Work Group also gave considerable thought and attention to the role of co-benefits in selecting a package of recommended emission reduction actions. The Work Group recognizes that in many cases the co-benefits of the recommended actions are substantial, and may, depending on one's focus and priorities, dwarf the value of the air quality improvements for which they were selected. There are a number of benefits that apply to every (or nearly every) proposed initiative, and are therefore not listed with each one individually.

For example, the benefit of reductions in greenhouse gas emissions is not specifically listed, since it comes along with any strategy that reduces combustion of a carbon-based fuel, along with associated reductions in carbon monoxide emissions and other toxic by-products of combustion. The Work Group recognizes these and the listed co-benefits deserve weight in any decisions related to prioritizing actions for funding and implementation, but have focused any quantitative analysis and descriptions on direct reductions in the targeted pollutants (NO_x, VOCs and PM).

Other Emissions Reduction Options Included in the Report

In addition to making recommendations for action, the Work Group officially recognized the long-term role of ten concurrent activities in maintaining and improving air quality in Minnesota. There is both an immediate and a long-term need to reduce air pollution if we are to continue to not only stay in compliance with federal standards, but to provide leadership nationally in addressing air quality challenges in innovative and cost-effective ways. Many of the concurrent initiatives described here are related to tackling the long-term challenges of significantly reducing energy use, switching to cleaner sources of energy, and changing driving habits in a way that reverses prior trends towards ever-increasing vehicle miles travelled. The social and environmental reasons for engaging in these activities are numerous, and in many cases air quality is not the primary driver for action, but over time these types of increasing efficiencies will be necessary components of any strategy to continue to reduce emissions.

There were also seven actions, programs or policies that the TWGs developed, but which the Work Group did not come to consensus on. While not recommended at this time, these ideas are included in this report with the understanding that they could be revisited by future stakeholder groups in the event of changes to the severity of our air quality challenges or status in relation to federal standards.

Protecting and Improving Minnesota's Air Quality: Recommended Actions

The Working Group of Minnesota's Clean Air Dialogue supports the creation or expansion of the following initiatives for the purpose of directly maintaining and improving Minnesota's air quality and avoiding the costs associated with falling into nonattainment with federal air quality standards for ozone and fine particulates ($PM_{2.5}$).

Area Source Recommended Actions

Education and Outreach to Reduce VOC Emissions from Small to Mid-sized Businesses

Type of Initiative: Education & Outreach; Technical Support

Description: Expand and support existing outreach and education activities aimed at small and medium-sized businesses on the use of low-VOC solvents and products.

As an example, coordinate with local governments, chambers of commerce and others to conduct outreach to cleaning companies, encouraging them to switch to cleaning solvents with a lower VOC content.

Impacted Sources: Small to medium-sized businesses that use solvents and products that contain VOCs.

Pollutants Reduced: VOCs

Cost Effectiveness: N/A

Co-benefits:

- Improves indoor air quality
- Enhances worker safety and health for those using solvents
- Provides localized benefits to those living near high-emitting commercial and industrial facilities

Equipment Exchange for Landscaping Equipment With Small Engines

Type of Initiative: Voluntary Incentive Program; Education & Outreach

Description: Offer a cash rebate to individuals and services companies to retire and replace old, high-polluting lawn and garden equipment and other small engines with new low- or no-emissions equipment.
Any financial incentives should be supported by education and outreach activities explaining the importance of limiting combustion activity on air quality alert days and by the promotion of model contract language encouraging landscaping services companies to adopt air quality best management practices.

Impacted Sources: Users of lawnmowers, leaf blowers, snow blowers, and other landscaping equipment that contains small engines. This includes both residential users and companies that utilize such equipment for commercial landscaping.

Pollutants Reduced: VOCs & NO_x

Cost Effectiveness:[46] Assume a $100 credit per piece of equipment changed out (standard for other programs). Reductions range between 8 and 19 lbs VOC/year per piece of equipment (NO_x reductions are much lower at ~0.5 lbs/year). The replacement of every 1000 gas mowers with non-motorized mowers would reduce VOC emissions by 9.8 tons (~$10,000/ton VOC).

VOCs: $10,000 – $25,000/ton
NO_x: ~$400,000/ton

Co-benefits:

- Creates local manufacturing jobs
- Enhances worker safety and health for those using equipment for extended periods

Model Landscaping Services Contract

Type of Initiative: Model Contract or Policy (Voluntary Adoption)

Description: Create a state-supported model contract for voluntary use by public or private institutions to reduce the air quality impacts of their landscaping services. The model contract would encourage activities that limit air emissions, such as suggesting a preferred equipment type or age, limiting usage times or days, or providing a menu of air quality best management practices. It would mutually support any equipment exchange and education program(s) targeting the landscaping services sector.

Impacted Sources: Commercial service providers that use lawnmowers, leaf blowers, snow blowers, and other landscaping equipment that contains small engines.

Pollutants Reduced: VOCs & NO_x

Cost Effectiveness: N/A

Program Costs: <0.5 FTE (to draft and support the model contract)

Co-benefits:

- Enhances worker safety and health for those using equipment for extended periods

[46] Maryland Department of Environment. 2012. Cash for Clippers and the Great Lawnmower exchange data. http://www.mde.state.md.us/programs/

State Matching Fund for Area Source Reduction Projects

Type of Initiative: Voluntary Incentive Program

Description: Create a state fund to support the implementation of pollution reduction projects at area sources (small, widespread, stationary sources). The fund would provide financial incentives—in the form of competitively awarded matching grants—for small businesses to install pollution control equipment or to switch to processes that reduce air pollution.

These small sources typically are not required to have a state- or federally-issued air emission permit. However, it is becoming increasingly clear that they are an important part of overall air quality, particularly in urban areas.

Impacted Sources: Small businesses would apply for the funding. The types of sources that are envisioned as participating in this program are dry cleaners, restaurants, bakeries, autobody shops, printers/graphic arts services, etc. Other types of projects that could be considered include (but are not limited to) the following:

Equipment swaps or emission reduction equipment for combustion devices Boilers

- Heaters
- Steam generators
- Ovens
- Dryers
- Dehydrators
- Process Heaters
- Internal Combustion Engines
- Stationary Gas Turbines

Process improvement or control equipment for specialized industrial processes

- Reduction of Animal Matter
- Flares
- Lime Kilns
- Glass Melting Furnaces
- Brewing
- Sand and Gravel Operations
- Fireworks
- Asphalt/Concrete Operations
- Nut Hulling and Shelling Operations
- Material Screening/Shaking Operations
- Tub Grinding
- Abrasive Blasting

Residential and commercial emissions control equipment or solvent swaps

- Residential Furnaces
- Graphic Arts
- Auto Body Shops
- Commercial Charbroiling
- Increased Vapor Recovery at Gas Stations
- Residential and Commercial Water Heaters

Pollutants Reduced: Depending on the sources, a variety of pollutants could be reduced. This program would particularly target reductions in VOCs, NO_x, and direct $PM_{2.5}$.

Cost Effectiveness:[47] General facility modernization (ensure facilities upgrade to best available control technology with retrofitting & equipment replacement):

NO_x: $10,000 – $17,000/ton
VOCs: $10,000/ton
PM: $19,000/ton

Install a filter at a restaurant operating an under-fired grill:

PM: $8,400/ton

Switch any business operating ovens, dryers, furnaces, or incinerators to low NO_x burners:

NO_x: $10,000/ton (average)

Change natural gas-fired fan furnaces out for low-NO_x burners:

NO_x: $10,000 – $16,000/ton

These numbers are based on the full cost of installation, not a specified level of matching funds.

Co-benefits:

- Creates jobs
- Supports small business
- Improves indoor air quality
- Enhances worker safety and health for those using solvents
- Provides localized benefits to those living near high-emitting commercial and industrial facilities

Energy Efficiency & Renewable Energy Recommended Actions

Air Quality Improvements and Urban Heat Island Mitigation Through Urban Forestry

Type of Initiative: Infrastructure Investment; Education & Outreach

Description: Strengthen and maintain the Twin Cities Metro Area's urban forests (including tree planting, tree maintenance, tree removal, and involvement of community members in preserving and increasing urban trees). Efforts would be most successful if they also include a plan to measure and assess the current state of the Twin Cities Metro Area's urban tree canopy and to model the impact of the current and potential scenarios on air quality and urban temperatures.

The annual mean air temperature of a city with 1,000,000 people or more can be 1.8 – 5.4°F (1 – 3°C) warmer than its surroundings. In the evening, the difference can be as high as 22°F (12°C). Increased air temperature can have a significant impact on air quality by increasing formation of ozone and particulate matter. Higher air temperatures can also lead to increased demand for air conditioning, resulting in greater air emissions from electricity generation. Trees can also remove air pollutants already emitted/formed.

[47] South Coast Air Quality Management District. 2007. Final 2007 Air Quality Management Plan. http://www.aqmd.gov/aqmp/

Opportunities to reduce the urban heat island through the use of green roofs, cool roofs, and cool pavements should also be assessed, including the role of state and local governments in promoting this type of infrastructure through incentives, policies and ordinances.

Impacted Sources: Electric utilities & their customers (through reduction in summer energy use)

Pollutants Reduced: A 2010 USDA Forest Service study,[48] which includes Minnesota, reports the following air quality benefits for the estimated 137,000,000 **existing** urban or community trees in Minnesota:

Air Pollutant	Quantity Removed
O_3	8,160 metric tons/year
NO_2	3,555 metric tons/year
PM_{10}	3,063 metric tons/year
SO_2	486 metric tons/year
CO	500 metric tons/year
Total	**15,760 metric tons/year**

Another recent USDA Forest Service study, "Assessing Urban Forest Effects and Values: Minneapolis' Urban Forest," estimates that the urban forest (trees and shrubs) in the City of Minneapolis alone removes 384 tons of air pollutants each year. According to the study, pollution removal was greatest for PM_{10}, followed by O_3, NO_2, SO_2, and CO.[49]

Cost Effectiveness: Over the lifetime of the trees:[50]
PM_{10}, O_3, NO_2, SO_2 (aggregated): ~$6,600/ton

Co-benefits:

- Reduces energy use (and associated benefits)
- Lowers risk of heat-related illnesses and deaths
- Controls and retains storm water (and associated improvements to water quality)
- Improves aesthetics and quality of life
- Increases property values
- Reduces noise levels
- Provides wildlife habitat
- Sequesters/stores carbon
- Reduces crime

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[48] Nowak, David J.; Greenfield, Eric. 2010. Urban and Community Forests of the North Central West Region. U.S. Department of Agriculture, Forest Service. http://www.nrs.fs.fed.us/pubs/gtr/gtr_nrs56.pdf

[49] Nowak, David J.; Hoehn, Robert E. III; Crane, Daniel E.; Stevens, Jack C.; Walton, Jeffrey T. 2006. Assessing urban forest effects and values, Minneapolis' urban forest. Resour. Bull. NE-166. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station. http://www.treesearch.fs.fed.us/pubs/23593

[50] Based on ibid. and assuming that trees live an average of 50 years and cost $100 each to plant. This looks only at the benefit of pollutant deposition and removal and does not count any urban heat island mitigation benefits.

Expand Minnesota Green Corps to Help Local Governments Achieve Energy Conservation Goals in Public Facilities

Type of Initiative: Education & Outreach; Technical Support

Description: Increase the number of Minnesota GreenCorps members who are placed with Minnesota local governments to carry out energy conservation projects for non-residential buildings. Minnesota GreenCorps is an AmeriCorps program coordinated by the Minnesota Pollution Control Agency. Members conduct focused and measurable activities over an 11-month period at competitively selected "host sites." Each Minnesota GreenCorps Energy Conservation member provides benchmarking data entry and analysis for the host site's facilities and/or those of related entities, and helps to institutionalize the benchmarking process within the organization. Buildings that consistently benchmark energy performance save energy, according to an analysis by the EPA Energy Star Program.

Public sector buildings present an important opportunity to improve energy efficiency and conservation. A key barrier is that local government personnel often lack the time to advance energy projects that involve benchmarking past energy usage, seeking bids from qualified energy service providers, arranging financing, awarding contracts, and monitoring project implementation. Minnesota GreenCorps Energy Conservation members can add capacity to local governments with limited staffing resources.

Impacted Sources: Local government buildings and the electricity generation facilities and other utilities that serve them.

Pollutants Reduced: NO_x & SO_2

Cost Effectiveness: Energy projects implemented during a Minnesota GreenCorps service year provide ongoing annual savings for the host site. Estimates of cost per ton assume:

1. The additional cost incurred by the State is $20,000 for each member service term (therefore the given cost effectiveness is for State of Minnesota costs only).
2. An *effective useful life* (EUL), the point at which half the installed measures are assumed to have failed, of seven years.[51]
3. Each Minnesota GreenCorps Energy Conservation member will save a host site 100,000 KWh (100 MWh) per year (on average) over the effective useful life.
4. This energy would not otherwise be saved because it is unlikely that local government staff would be available to benchmark historical energy use or move projects forward.
5. Emissions rates are the 2009 Regional Average Emission Rates for the Midwest Reliability Organization's service region.[52]

[51] Roberts, John and Tso, Bing, SBW Consulting, Inc. 2010. "Do Savings from Retro-commissioning Last? Results from an Effective Useful Life Study." Presented at the 2010 ACEEE Summer Study on Energy Efficiency in Buildings.

[52] "RE: In the Matter of Disclosure of Environmental Information to Utility Customers MPUC Docket No.: E,G-999/CI-00-1343; Updated Emission Averages" letter from Anne Claflin to Dr. Burl W. Haar, Minnesota Public Utilities Commission, May 22, 2012.

SO_2: ~$6,500/ton
NO_x: ~$13,000/ton
$PM_{2.5}$: ~$261,000/ton
Aggregated: ~$4,300/ton

Co-benefits:

- Reduces energy use and associated benefits
- Saves host local governments money on staffing and ongoing energy savings
- Provides experiential training and mentoring to a new generation of energy conservation and environmental professionals
- Increases public sector employee knowledge of and engagement in energy conservation and efficiency
- Keeps more Minnesota taxpayer dollars in the local economy
- Helps expedite needed local government infrastructure projects

Mobile Diesel Recommended Actions

Alternative Fuel Infrastructure Grants

Type of Initiative: Voluntary Financial Incentives

Description: Offer a rebate to cover a portion of the costs associated with the installation of infrastructure to dispense alternative fuels[53], provided that the equipment is available to the public. The expense of installing refueling infrastructure has the potential to inhibit adoption of alternative fuel vehicles or to diminish the associated return on investment for fleet operators. Decreasing infrastructure costs and increasing the number of publicly available refueling sites reduces this barrier to adoption for fleet operators and makes alternatively fueled options more feasible for anyone purchasing a vehicle.

Impacted Sources: Owners of vehicle fleets containing diesel and/or gasoline-powered vehicles and (to a lesser extent) individual vehicle owners.

Pollutants Reduced: Direct $PM_{2.5}$ & NO_x (see relative reductions by fuel type under "Alternative Fuel Vehicle Incentive for Fleets")

Cost Effectiveness: Estimated infrastructure costs (installed) vary greatly by fuel type:

- Electric Vehicle Supply Equipment (EVSE): $5,000-10,000

[53] The following fuels are defined as alternative fuels by the Energy Policy Act (EPAct) of 1992: pure methanol, ethanol, and other alcohols; blends of 85 percent or more of alcohol with gasoline; natural gas and liquid fuels domestically produced from natural gas; liquefied petroleum gas (propane); coal-derived liquid fuels; hydrogen; electricity; pure biodiesel (B100); fuels, other than alcohol, derived from biological materials; and P-Series fuels. In addition, the U.S. Department of Energy may designate other fuels as alternative fuels, provided that the fuel is substantially nonpetroleum, yields substantial energy security benefits, and offers substantial environmental benefits. For more information, see the EPAct website. (Reference 42 U.S. Code 13211)

- Biofuel Blender Pump (ethanol or biodiesel): $50,000
- Propane site: $40,000[54]
- Natural Gas site: $400,000 – $1,500,000

For alternative fuel non-transit vehicles including electric, CNG, LPG vehicles and fueling stations (assuming a 4:1 weighting of NO_x to VOCs):[55]

Median cost: $20,800
Range: $4,700 – $37,000

It is important to note that these numbers are estimated for a *combination of vehicle and infrastructure* subsidies working in tandem to boost alternative fuel use by fleets, and do not represent estimates related to incentivizing personal ownership or use of alternative fuel vehicles. In addition, cost per ton varies significantly depending on the type of fuel converted from and to, the vehicle weight class, age/condition of the replaced engine, the amount of the rebate and many other factors.

Co-benefits:

- Reduces dependence on fuels imported from out-of-state/country (and associated energy security benefits)
- Supports markets for Minnesota biofuels industries (local economy)

Alternative Fuel Vehicle Incentive for Fleets

Type of Initiative: Voluntary Financial Incentives

Description: Offer a rebate to cover a portion of the incremental costs associated with purchasing new fleet vehicles that use alternative fuels. Incremental costs for purchasing alternatively fueled vehicles can range from a few thousand dollars for a light- or medium-duty vehicle to $40,000 or more for a heavy-duty vehicle. A rebate could be used to reduce cost as a barrier to broader adoption of alternative fuel vehicles. The rebate could also apply to engine conversions, if desired. Several other states including Illinois, Texas and Oklahoma have implemented rebate programs of this type, which could be used as models.[56]

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[54] Some propane providers will lease or install the equipment at low or no cost in exchange for the fuel contract.

[55] U.S. Environmental Protection Agency. 2007. The Cost-Effectiveness of Heavy-Duty Diesel Retrofits and Other Mobile Source Emission Reduction Projects and Programs. http://www.epa.gov/cleandiesel/documents/420b07006.pdf

[56] A program in Illinois offers an incentive (for fleets and individuals) of up to 80 percent of the incremental costs, with a maximum amount of $4,000 (or if no comparable vehicle model exists, 10 percent of the vehicle cost).

Texas has a variety of rebate programs, depending on fuel type, location and other criteria. Rebates appear to range from 50 to 90 percent of incremental costs. Rebates are capped to limit the amount to no more than $10,000/ton of NO_x reduced (based on vehicles replaced and expected use). Incentives also exist for offsetting refueling infrastructure costs (for example, $100,000 for installing a natural gas refueling site, but it must be available in some way to the public).