

Impacted Sources: Owners of vehicle fleets containing diesel and/or gasoline-powered vehicles. Such a rebate could also be made available to individual vehicle owners.

Pollutants Reduced: Direct PM_{2.5} & NO_x

Tailpipe Emission Changes with Alternative Fuels

| Fuel Type | NO _x Emissions Reductions | PM Emissions Reductions |
|-------------------------------|--------------------------------------|-------------------------|
| Ethanol (E85) ⁵⁷ | 19% to 28% | 34% |
| Biodiesel (B20) ⁵⁸ | 0% | 12% |
| Natural Gas ⁵⁹ | 17% to 80% | 60% to 96% |
| Propane ⁶⁰ | 20% | 80% |
| Electric | Up to 100% | Up to 100% |

Cost Effectiveness: For alternative fuel non-transit vehicles including electric, CNG, LPG vehicles and fueling stations (assuming a 4:1 weighting of NO_x to VOCs):⁶¹

Median cost: \$20,800

Range: \$4,700 – \$37,000/ton

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. Rebates can be limited to projects that come in under a specified cost per ton of NO_x threshold.

Oklahoma has a rebate for 50 percent of the incremental costs of a natural gas, propane or hydrogen vehicle (or if no comparable vehicle model exists, 10 percent of the vehicle cost, with a cap of \$1,500). They also have a zero interest loan available, up to \$300,000, for the installation of refueling infrastructure, repayable over seven years.

⁵⁷ National Renewable Energy Lab. 2009. Effect of E85 on Tailpipe Emissions from Light-Duty Vehicles. http://www.afdc.energy.gov/pdfs/technical_paper_feb09.pdf

⁵⁸ U.S. Environmental Protection Agency, October 2002, A Comprehensive Analysis of Biodiesel Impacts on Exhaust Emissions Draft Technical Report Assessment and Standards Division Office of Transportation and Air Quality. EPA420-P-02-001.

⁵⁹ M. Rood Werpy, D. Santini, A. Burnham, and M. Mintz Center for Transportation Research Energy Systems Division, Argonne National Laboratory. August 2010 Natural Gas Vehicles: Status, Barriers and Opportunities. Argonne National Lab, compared with 2007 or older engines. According to the Natural Gas Vehicle Association, natural gas in newer vehicles reduces emissions by 8 – 54 percent, depending on class, etc.

⁶⁰ Roush CleanTech: <http://www.roushcleantech.com/content/emissions>

⁶¹ 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>

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)
- Reduces operating costs (depending on the fuel switched from/to)

Education and Outreach to Reduce Truck Idling**Type of Initiative:** Education & Outreach**Description:** Develop an educational campaign to reduce truck idle time during loading and unloading periods. Materials would target fleet/truck owners and operators, in addition to owners/managers of retail stores that have loading docks or receive major shipments by truck.**Impacted Sources:** Private fleet operators/fleets, retail stores that have loading docks or receive major shipments by truck**Pollutants Reduced:** Direct PM_{2.5} & NO_x**Cost Effectiveness:** N/A**Program Costs:** <.5 FTE (to develop materials and conduct outreach)**Co-benefits:**

- Saves money spent on fuel
- Provides localized health benefits for vulnerable populations (including children)
- Provides health benefits for truck drivers and workers at retail facilities where significant amounts of loading or unloading takes place

Incentives for Diesel Engine Retrofit/Repower/Rebuild/Replace**Type of Initiative:** Voluntary Financial Incentives**Description:** Create a fund to provide financial incentives to fleet and equipment owners to invest in pollution control or reduction equipment or to replace older equipment with newer, less-polluting technology. This includes retrofits for a wide range of diesel engines (private, government, on-road, off-road, stationary, etc.), as well as engine improvements or replacement with newer, cleaner equipment.

A retrofit typically involves the addition of an after-treatment device to remove emissions from the engine exhaust, improving the engine to meet newer emission standards, or replacement. Retrofits can be very effective at reducing emissions—eliminating up to 90 percent of pollutants in some cases. Many of the effective after-treatment devices require use of ultra-low sulfur diesel (ULSD).

Impacted Sources: Owners/operators of equipment with diesel engines

Pollutants Reduced: Direct PM_{2.5} & NO_x

Cost Effectiveness:⁶² Based on the EPA report, “The Cost-Effectiveness of Heavy-Duty Diesel Retrofits and Other Mobile Source Emission Reduction Projects and Programs,” which focused primarily on NO_x reductions:

NO_x: \$1,900 – \$19,000/ton (median of \$5,950/ton)

Study examples included engine upgrades, engine repowers or replacements, cleaner fuels (early use of ultra-low sulfur diesel), emission control technologies, and idle controls.

Program Costs: A minimum of \$500,000 program funding would justify approximately .75 FTE; funding exceeding \$1,000,000 would necessitate approximately 1.25 FTE; every successive \$500,000 would add approximately .25 FTE.

Co-benefits:

- Saves vehicle owners money when using technologies that improve engine efficiency
- Provides localized health benefits to drivers, passengers, and neighborhoods surrounding operating equipment
- Creates jobs (installing and manufacturing)

Emissions Reduction Guidelines for Public Fleets

Type of Initiative: Education & Outreach

Description: Develop materials and conduct outreach to state and local government agencies, transit operators, and school districts on how they can reduce emissions from their vehicle fleets (including transit and school buses). Materials would include information on idle-reduction best management practices, suggested idling time limits for drivers, template retrofit/“clean diesel” fleet standards, etc.

Impacted Sources: All public-sector fleet operators/fleets, including transit and school bus fleets

Pollutants Reduced: Direct PM_{2.5} & NO_x

Cost Effectiveness: N/A

⁶² The Cost-Effectiveness of Heavy-Duty Diesel Retrofits and Other Mobile Source Emission Reduction Projects and Programs, EPA420-B-07-006, May 2007; An Analysis of the Cost-Effectiveness of Reducing Particulate Matter Emissions from Heavy-duty Diesel Engines Through Retrofits, EPA420-S-06-002, March 2006; An Analysis of the Cost-Effectiveness of Reducing Particulate Matter and Nitrogen Oxides Emissions from Heavy-duty Nonroad Diesel Engines Through Retrofits, EPA420-R-07-005, May 2007; U.S. Dept. of Transportation, Federal Highway Administration, SAFETEA-LU Evaluation and Assessment Phase 1, §4 Project Support and Selection Practices that Support Effectiveness, updated May 31, 2012.

Program Costs: <.5 FTE (to develop materials and conduct outreach)

Co-benefits:

- Saves money spent on fuel
- Provides localized health benefits for vulnerable populations (including children)
- Provides health benefits for bus and equipment operators

Model Contract for Public Works Projects

Type of Initiative: Model Contract or Policy (Voluntary Adoption); Education & Outreach

Description: Develop a model contract for use by public agencies containing emissions performance specifications for projects above a certain size/cost threshold. The model contract could include specifications such as:⁶³

- Emissions limits
- Equipment & vehicle performance requirements
- A points system that rewards clean diesel equipment & vehicles (which could include alternative fuel options) while remaining consistent with the requirements of best-value contracting

Impacted Sources: Public works departments and contractors serving public agencies

Pollutants Reduced: Direct PM_{2.5} & NO_x

Cost Effectiveness: N/A

Program Costs: <.5 FTE (to develop model policy and conduct outreach)

Co-benefits:

- Savings vehicle owners/operators money when using technologies that improve engine efficiency
- Provides health benefits for equipment operators

⁶³ Cook County Board of Commissioners. 2009. Chapter 30 Environment, Article IX Green Construction, Sections 30-950 through 30-955

<http://www.suffredin.org/legislativelibrary/Legislation.asp?LegislationID=475&Library=cook>

Point Source Recommended Actions

Air Alert Education and Best Management Practices Outreach

Type of Initiative: Education & Outreach

Description: Initiate a coordinated outreach and education campaign to promote awareness of the Minnesota Pollution Control Agency's air alert system and increase adoption of emissions-reduction best management practices on air quality alert days.

The outreach and education campaign will target major employers, major emissions sources, and property management organizations. The goals are to increase the number of people receiving and acting upon the air alerts and to educate and encourage more organizations to voluntarily implement various emissions-reduction best management practices.

Examples of actions that organizations and individuals can take include:

- Distribute information to citizens and employees via local government/company websites and text alert systems
- Enable employees to drive less (walk, bike, telecommute, take the bus, car pool, van pool, combine trips and eliminate unnecessary trips, etc.)
- Refuel vehicles after 6:00 p.m. and do not top off (stop at the click)
- Avoid use gasoline-powered lawn equipment
- Keep vehicles and lawn equipment maintained; use the cleanest fuel available
- Avoid using oil-based paints and stains
- Save electricity by turning off lights and other equipment
- Keep electrical equipment clean and maintained (especially refrigerators and freezers)
- Don't use your fireplace, have bonfires, or burn lawn waste
- Keep your furnace and other space heaters clean and maintained

Impacted Sources: "Best management practices" can be implemented by both organizations and individuals and can include a variety of behavior changes related to mobile, area and point sources. All actions (as well as program participation) would be voluntary.

Pollutants Reduced: Potential for VOC, NO_x, and/or PM reductions from a wide range of activities

Cost Effectiveness: N/A

Program Costs: <.5 FTE (to develop materials and conduct outreach)

Co-benefits:

- Saves money (and potentially time) for individuals who elect not to engage in certain fuel-consumption activities on air alert days
- Provides localized health benefits for vulnerable populations (depending on the practices voluntarily adopted)

Stationary Diesel Generator Outreach and Education

Type of Initiative: Education & Outreach

Description: Establish an outreach and education campaign focused on minimizing stationary diesel generator emissions from routine maintenance testing and operation. This campaign would utilize materials developed by the Minnesota Pollution Control Agency (MPCA) which provide an overview of environmental and health concerns and recommended management practices for stationary diesel engines. These materials focus on management practices because add-on controls may not be feasible for many facilities because of space constraints or pollutant concentrations emitted by older units. Campaign materials could be distributed through utilities and generator vendors, as well as online through the MPCA's website.

Diesel engines used in electricity generation can be large sources of NO_x and particulates relative to other types of generation (in terms of lb/MWh).⁶⁴ In addition, they often have low stacks and poor dispersion. Some of these units are used to ensure a fully redundant power supply, such as at data centers. Many others are for emergency use only or are located at facilities that have a "load shedding" contract with their local utility in which they agree to reduce their demand for electricity from the grid during peak times. Other uses of stationary diesel engines include fire pumps, water or sewage pumps, and compressors. Because many stationary engines operate during a limited number of hours per year, they tend to last a very long time compared to other types of process equipment. Emissions from routine testing may be the largest volume of pollutants from these units. In January 2013, the EPA finalized amendments to the National Emissions Standards for Hazardous Air Pollutants (NESHAPs) for stationary reciprocating internal combustion engines (RICE), which govern emissions from stationary diesel engines, but these standards may have a limited impact on much of the current fleet of generators.

Impacted Sources: Owners and operators of buildings/facilities with diesel generators, including those in the commercial and industrial sectors

Pollutants Reduced: Direct PM_{2.5} & NO_x

Cost Effectiveness: N/A

Program Costs: <.5 FTE (to develop additional materials and conduct outreach)

Co-benefits:

- Saves money spent on fuel
- Provides localized health benefits for vulnerable populations (including children)

⁶⁴ Depending on patterns and frequency of use.

Transportation Demand Management & Light Duty Vehicle Recommended Actions

Accelerated High-Emitting Vehicle Retirement

Type of Initiative: Voluntary Financial Incentives

Description: Create a program to identify older high-emitting vehicles and offer cash rebates to retire, scrap and replace them. The effort could include a means test that limits the offer to persons with a household income below a specified level.

Given that Minnesota does not have an inspection and maintenance program in place, vehicles can be identified using the on-board diagnostics (OBD II) “check engine” light, visible emissions (generally a reliable indicator of high emissions rates⁶⁵), and vehicle age. The program could target low-income drivers and allow participants to self-identify at scheduled events and/or could use a list of candidate vehicles and state-sanctioned salvage yards. Other means of high-emitting vehicle identification, such as a smoking vehicle complaint hotline or remote sensing, would require further exploration and analysis.

This program is intended to accelerate fleet turn-over and would eventually result in diminishing returns—once the majority of vehicles produced prior to the adoption of current emissions standards had been retired it would no longer result in significant reductions. It would therefore have a limited useful life

Impacted Sources: Passenger vehicle owners (gasoline-powered)

Pollutants Reduced: Emission reduction estimates for the Carl Moyer Voluntary Accelerated Vehicle Retirement (VAVR) program (California) are 78 lb/car VOC, 67 lb/car NO_x and 1.1 lb/car PM₁₀ over the assumed 3-year remaining life of each vehicle purchased.⁶⁶

| Number of Vehicles Purchased | Annual Tons Removed VOCs | Annual Tons Removed NO _x | Annual Tons Removed PM ₁₀ | Annual Tons Removed VOC + NO _x + PM | Total Tons Removed VOC + NO _x + PM (3 years) |
|------------------------------|--------------------------|-------------------------------------|--------------------------------------|--|---|
| 500 | 7 | 6 | 0.09 | 14 | 42 |
| 1,000 | 13 | 11 | 0.18 | 28 | 83 |
| 1,500 | 20 | 17 | 0.28 | 42 | 125 |
| 2,000 | 26 | 22 | 0.37 | 56 | 167 |

⁶⁵ U.S. Environmental Protection Agency. 2008. Analysis of Particulate Matter Emissions from Light-Duty Gasoline Vehicles in Kansas City. <http://www.epa.gov/otaq/emission-factors-research/420r08010.pdf>

⁶⁶ Mark Sulzbach, Minnesota Pollution Control Agency analysis for the MnCAD process.

Cost Effectiveness:⁶⁷

| Purchase Price per Vehicle | Cost Effectiveness (\$/ton NO _x) | Cost Effectiveness (\$/ton VOC) | Cost Effectiveness (\$/ton PM) | Cost Effectiveness (\$/ton VOC + NO _x + PM) |
|----------------------------|--|---------------------------------|--------------------------------|--|
| \$1,000 | \$24,470 | \$25,675 | \$3,710,293 | \$12,500 |
| \$2,000 | \$47,999 | \$50,363 | \$7,277,883 | \$24,500 |
| \$3,000 | \$71,528 | \$75,050 | \$10,845,472 | \$36,500 |

Program Costs: ~.5 FTE per 1000 cars purchased/retired (depending upon how vehicles are identified), plus the cost of promoting the program

Co-benefits:

- Provides localized health benefits for vulnerable populations (including children)
- Provides job training opportunities (at state-sanctioned scrap/recycling facilities)

Develop the Transit System (Bus and Rail) in the Seven County Metro Region

Type of Initiative: Infrastructure Investment

Description: Given that approximately a quarter of all NO_x and human-caused VOC emissions in Minnesota currently come from gasoline-powered vehicles, decreasing vehicle miles traveled (VMT) in the metro area will almost certainly be essential to improving and protecting regional air quality over the long-term. Developing a robust local and regional transit system that is both convenient and affordable is a critical component of any strategy to reduce VMT within the region.

Impacted Sources: Owners/operators of personal passenger vehicles (light-duty vehicles)

Pollutants Reduced: NO_x & VOCs

Assuming the full build-out of the regional transit system according to the Metropolitan Council's 2030 Transportation Policy Plan*.⁶⁸

| Air Pollutant | Annual Emissions Reductions (tons) ⁶⁹ |
|-------------------|--|
| NO _x | 412.9 |
| VOCs | 80.4 |
| PM ₁₀ | 6.0 |
| PM _{2.5} | 5.7 |

⁶⁷ Mark Sulzbach, Minnesota Pollution Control Agency analysis for the MnCAD process.

⁶⁸ Metropolitan Council. 2030 Transportation Policy Plan.
<http://www.metrocouncil.org/planning/transportation/TPP/2010/index.htm>

⁶⁹ Assumes an 80 percent increase in annual transit ridership from 91 million rides in 2011 to 164 million rides in 2031 (based on Metropolitan Council research and personal communication from M. Filipi, October 18, 2012, "Change in Annual Emissions for Transit Initiative").

| Estimated Annual Emissions Reductions (tons)⁷⁰ – Arterial Bus Transitway Corridors | |
|--|------|
| NO _x | 52.6 |
| VOCs | 78.5 |
| PM _{2.5} | 0.3 |

*These numbers are meant to be illustrative of the emissions reduction potential associated with transit, not prescriptive of system design.

Cost Effectiveness: N/A

The costs associated with transit construction and operations are substantial, and attributing a subset of that cost to the goal of air quality improvement is beyond the scope of this report.

Co-benefits:

- Stimulates local economic development
- Reduces dependence on fuels imported from out-of-state/country and associated energy security benefits
- Reduces road congestion, if resulting in significant behavior changes
- Saves users money on gas, parking and vehicle maintenance
- Improves public health through increased walking and bicycling to transit
- Reduces drive time and associated quality of life benefits

Expand Employer-Subsidized Transit Pass Program

Type of Initiative: State Policy

Description: Convert the existing transit pass tax credit to a quarterly refund mechanism in order to enable program participation by all employers in the private sector and allow more employees to benefit from discounted transit passes.

Metro Transit’s Metropass Program, along with similar programs, allow employers to buy discounted transit passes and sell them to their employees at the discounted cost. Some employers also cover a portion of the discounted cost of the transit passes for their employees. In 2000, the Legislature established a tax credit for businesses that help their employees with the purchase of transit passes. Under the Transit Pass Credit for Employers, businesses can deduct 30 percent of what they contribute to the purchase of the passes from the amounts they owe for individual or corporate income tax.

⁷⁰ Assumes that, on average, the arterial bus rapid transit corridors reduce daily (weekday) VMT by 25,500 vehicle-miles each and uses an annualization factor of 300 (as opposed to 365, to account for the lower ridership on weekends) to estimate an annual VMT reduction of 68,850,000 (based on Metropolitan Council research and personal communication from M. Filipi, November 15, 2012, “Re: Transit Initiative”). Emissions calculations are based on average emissions factors given in U.S. Environmental Protection Agency. 2008. Average Annual Emissions and Fuel Consumption for Gasoline-Fueled Passenger Cars and Light Trucks (EPA-420-F-08-024). <http://www.epa.gov/otaq/consumer/420f08024.pdf>

By changing the tax credit to a quarterly rebate you enable program expansion in two ways: First, it would allow government and nonprofit employers (which do not pay income tax) to take advantage of the program. At present, nonprofits in Minnesota employ more than 298,000 individuals, almost 12 percent of the state's total workforce, and just over 50 percent of them are located in the Twin Cities, including four of the five largest private sector employers in Saint Paul. Second, the incentive for employers to participate would be increased because they could receive the rebate on a quarterly basis, rather than only when tax returns are filed.

Impacted Sources: Individuals who commute by passenger vehicle (light-duty vehicle)

Pollutants Reduced: VOCs & NO_x

A 20 percent increase in employee participation would mean an additional 6,700 riders in the Metropass Program and would result in a daily reduction of about 400 pounds of VOCs, about 450 pounds of NO_x, and 1.5 pounds of PM_{2.5}.⁷¹

On an annual basis, this would amount to reductions of 50 tons of VOCs, 56 tons of NO_x, and 0.19 tons of PM_{2.5}.

Cost Effectiveness: Based on the assumption that the change from a tax credit to a refund mechanism results in a 20 percent increase in participation:

VOCs: \$10,000/ton

NO_x: \$8,930/ton

Co-benefits:

- Reduces dependence on fuels imported from out-of-state/country and associated energy security benefits
- Reduces road congestion if widely adopted
- Saves employees money on gas, parking and vehicle maintenance

High-Emitting Vehicle Repair Rebates

Type of Initiative: Voluntary Financial Incentives

Description: Create a program to identify likely high-emitting vehicles and offer cash rebates to repair emissions-related malfunctions. The effort could include a means test that limits the offer to persons with a household income below a specified level.

⁷¹ If each new rider's daily home-to-work commute trip were assumed to be 10 miles in length, a 20 percent increase in program participation would result in a reduction of 134,000 vehicle miles/day. Applying a factor of 1.05, the average number of people in vehicles making commute trips, drops the reduction to about 127,500 vehicle miles/day and almost 32,000,000 fewer vehicle miles traveled. This also assumes per mile emission rates of 0.049383 ounces/mile for VOCs, 0.056438 ounces/mile for NO_x, 0.000192 ounces/mile of PM_{2.5}, and 1.033 pounds/mile for CO₂.

Given that Minnesota does not have an inspection and maintenance program in place, vehicles can be identified using the on-board diagnostics (OBD II) “check engine” light and/or visible emissions (generally a reliable indicator of high emissions rates⁷²), particularly for vehicles older than 1996 which are not equipped with OBD II capabilities. The program could allow participants to self-identify at scheduled events and/or could use a list of candidate vehicles and state-sanctioned repair facilities. Other means of high-emitting vehicle identification, such as a smoking vehicle complaint hotline or remote sensing, would require further exploration and analysis.

Impacted Sources: Passenger vehicle owners (gasoline-powered)

Pollutants Reduced: VOCs & NO_x

The total quantity of emission reductions achieved would be dependent upon the system for identifying candidate vehicles through remote sensing and or complaint follow-up and rate of participation, which will be dependent upon reimbursement amount and the level of promotion of the effort.

Cost Effectiveness:⁷³

NO_x: \$37,125/ton
HC (including VOCs): \$20,048/ton
Aggregated: \$12,948/ton

This is based on the cost of rebates for participants and does not include program costs or reductions for evaporative or particulate emissions due to the inability to quantify those emissions.

Program Costs: ~.5 FTE

Co-benefits:

- Provides localized health benefits for vulnerable populations (including children)
- Provides job training opportunities (within state-sanctioned repair programs)

Infrastructure & Outreach to Expand Electric Vehicle Use in Minnesota

Type of Initiative: Infrastructure Investment; Technical Assistance; Education & Outreach

Description: Install more electric vehicle charging stations at public facilities such as park and rides, libraries, parks, stadiums, parking ramps/lots, etc. and provide technical assistance to

⁷² U.S. Environmental Protection Agency. 2008. Analysis of Particulate Matter Emissions from Light-Duty Gasoline Vehicles in Kansas City. <http://www.epa.gov/otaq/emission-factors-research/420r08010.pdf>

⁷³ San Joaquin Valley Clean Air Now. 2007. “The Valley Clean Air Now Tune In & Tune Up 2007 Program Final Report.” Calculations used in this report assume average emissions reductions per repaired vehicle of 27 pounds (0.0135 tons) and that the repairs were effective for 10,000 miles. http://www.valley-can.org/pdfs/titu_2007_ArvinFinalReportJuly10-2008.pdf

public and private organizations in support of electric vehicle adoption and charging. Outreach and technical assistance can be targeted to promote installation of charging stations at retail and food & beverage establishments and local government facilities, as well as support other organizations wishing to offer workplace charging. It can also include outreach to public and private sector fleet managers, targeted business clusters (delivery businesses, parts runners, etc.), and those serving the personal vehicle sector such as auto dealers and car-sharing programs.

The goal of this enhanced public charging capacity, technical assistance and outreach would be to help the state reach a greater level of electric vehicle use compared to what the market will produce on its own.

Impacted Sources: Owners of passenger vehicles (light-duty) that could be replaced by EVs

Pollutants Reduced: VOCs & NO_x

According to the Electric Power Research Institute, the air quality benefits of hitting high-end estimates of electric vehicle market penetration versus the low-end estimates scenario:⁷⁴

| Annual Air Pollutant Emissions Reduction (in tons) | | | | | | |
|--|-------------------------|-----------------|-------------------|-----------------|-------|-----------|
| Year | No. of EVs | NO _x | PM _{2.5} | SO ₂ | VOCs | GHG |
| 2015 | 15,000 (<i>low</i>) | 289 | 10 | 2 | 241 | 29,700 |
| | 30,000 (<i>high</i>) | 578 | 21 | 3 | 481 | 59,400 |
| 2020 | 62,000 (<i>low</i>) | 1,194 | 43 | 6 | 995 | 122,760 |
| | 190,000 (<i>high</i>) | 3,658 | 133 | 20 | 3,048 | 376,200 |
| 2025 | 165,000 (<i>low</i>) | 3,177 | 115 | 17 | 2,647 | 326,700 |
| | 572,000 (<i>high</i>) | 11,013 | 399 | 60 | 9,178 | 1,132,560 |

Cost Effectiveness:⁷⁵ N/A

Co-benefits:

- Reduces dependence on fuels imported from out-of-state/country (and associated energy security benefits)

⁷⁴ The GREET Model was used to determine greenhouse gas emissions calculations based on the current grid mix in Minnesota. Additional reductions due to use of solar or 100 percent wind-generated electricity for powering stations were not factored in. The 2008 EPA National Emissions Inventory Database was used for NO_x, PM, SO₂, and VOC reduction measurements. Potential increased emissions at utility power plants due to more electricity use were not factored in. Charging stations powered by solar or 100 percent wind generated electricity would not increase utility emissions. Projected vehicle numbers are from the Electric Power Research Institute (EPRI).

⁷⁵ No studies could be found that estimate cost-effectiveness of publically accessible infrastructure alone or effects of public charging stations on private vehicle ownership. For alternative fuel non-transit vehicles including electric, CNG, LPG vehicles and fueling stations (assuming a 4:1 weighting of NO_x to VOCs), median cost is \$20,800, with a range of \$4,700 to \$37,000. 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>

Regional Telework Program

Type of Initiative: Education & Outreach

Description: Implement a regional telework program through a public-private partnership that provides education, training, legal advice, and other support (such as small grants for equipment) to employers to implement or expand telework programs at their workplace.

Approximately 2,100 employees from 48 Minnesota employers participating in a telework program in the Twin Cities region (between 2009 and 2011) worked remotely between one and two days per week, which avoided over 7,000,000 vehicle miles travelled per year.⁷⁶ With the investment of additional resources this program could potentially be expanded to other employers in the area.

Impacted Sources: Individuals who commute by passenger vehicle (light-duty)

Pollutants Reduced: VOCs & NO_x

The estimated emissions reductions per vehicle mile avoided are as follows:⁷⁷

VOCs: 1.034 g/mi

NO_x: 0.693 g/mi

PM_{2.5}: 0.0041 g/mi

Cost Effectiveness: Based on the results of past programs and estimates of emissions reduced per avoided vehicle mile travelled:

NO_x: \$40,650/ton

VOCs: \$46,300/ton

Aggregate: \$21,600/ton

Co-benefits:

Societal

- Reduces dependence on fuels imported from out-of-state/country (and associated energy security benefits)
- Reduces road congestion (if widely adopted)
- Increases economic opportunity for people with disabilities

Employers

- Increases employee productivity
- Enhances recruitment and retention

Employees

- Reduces drive time
- Saves money (on gas, parking and vehicle maintenance)
- Enhances quality of life and better work/life balance

⁷⁶ University of Minnesota, Humphrey School of Public Affairs, E-Workplace Exceeding Expectations: A New Way to Stimulate the Economy. <http://www.eworkplace-mn.com/>

⁷⁷ U.S. EPA. "Sample Calculation of Emission Reductions and Fuel Savings from a Carpool Program." EPA420-F-08-028

Wood Smoke Recommended Actions

Model Ordinance to Reduce Emissions Impacts from Hydronic Heaters

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

Description: Develop a model ordinance for local governments to voluntarily adopt that addresses emissions from hydronic heaters (wood-burning heaters used for space and water heating).

As traditional sources of fuel have increased in price, the purchase and use of wood-fired hydronic heaters (also called “outdoor wood boilers” or “outdoor wood heaters,” although they can be located inside) has increased.⁷⁸ Hydronic heaters can be highly polluting and are currently unregulated on a statewide level in Minnesota. To control emissions from these units, a dozen or so states and many local governments (at least 40 in Minnesota) have passed regulations outlining emissions limits, set-back distances from property lines or buildings, and stack height. EPA supported the development of a model rule/ordinance for hydronic heaters.⁷⁹ The EPA recommends that areas consider adopting the model rule or a more stringent approach tailored to the specific needs of the community.

Impacted Sources: Anyone using or considering using a hydronic heater within a local jurisdiction adopting the model ordinance

Pollutants Reduced: Direct PM_{2.5} & VOCs

MPCA estimates of annual average statewide emissions of VOCs, NO_x and PM_{2.5} from residential outdoor hydronic heaters. The estimated numbers of hydronic heaters used in each of the five forest survey regions of the state are also shown in this table:⁸⁰

| Minnesota Residential Wood Burning - Equipment Used and 2008 Emissions (Draft) | | | | | | | | | |
|--|---|-------------|-------------------|-------|---------------|---------|---|-----------------|-------|
| Equipment Category | Numbers of Equipment Used Statewide and per Forest Region | | | | | | Statewide Annual Emissions (Tons in 2008) | | |
| | State Total | Aspen Birch | Central Hardwoods | Metro | Northern Pine | Prairie | PM _{2.5} | NO _x | VOC |
| Outdoor Hydronic Heaters | 29,000 | 1,200 | 13,000 | NA | 8,300 | 7,100 | 3,800 | 250 | 1,600 |

Cost Effectiveness: N/A

Program Costs: ~.5 FTE

Co-benefits:

⁷⁸ MPCA, DNR, and USFS. 2008. Residential Fuelwood Assessment for the State of Minnesota (2007 – 2008 Heating Season). http://files.dnr.state.mn.us/forestry/um/residentialfuelwoodassessment07_08.pdf

⁷⁹ Northeast States for Coordinated Air Use Management (NESCAUM) Model Rule <http://www.nescaum.org/topics/outdoor-hydronic-heaters>

⁸⁰ Calculated by the Minnesota Pollution Control Agency based on ibid.

- Reduces hazardous air pollutants
- Provides localized health benefits for vulnerable populations (including children)

Study Options for Coordination of Seven County Metro Area Brush Management Systems

Type of Initiative: Model Contract or Policy (Voluntary Adoption); Outreach & Education

Description: Study and develop a plan for possible coordination of brush management systems and resident education with the goal of reducing back yard brush burning. One of the drivers for back yard burning may be the lack of a coordinated and flexible system around brush collection.

Impacted Sources: Any person removing and disposing of residential brush or wood waste

Pollutants Reduced: Direct PM_{2.5} & VOCs

It is unknown how much backyard burning is due to inadequate or poorly utilized local brush management systems.

Cost Effectiveness: N/A

Program Costs: ~1 FTE (for program coordination—more would be needed if new collection systems were established)

Co-benefits:

- Reduces hazardous air pollutants
- Provides localized health benefits for vulnerable populations (including children)

Wood Stove/Fireplace Change-outs

Type of Initiative: Voluntary Financial Incentives; Education & Outreach

Description: Create a program to provide incentives for homeowners to replace their old, high polluting wood stove, fireplace, fireplace insert, pellet stove, hydronic heater or forced air furnace with a natural gas or propane alternative. In other states this has generally been accomplished by offering a direct subsidy, in the form of a rebate, for the purchase of new natural gas or propane equipment.

This program can be supported by an education and outreach campaign that encourages using clean-burning alternatives to wood and raises awareness about the health concerns of wood smoke.

Impacted Sources: Anyone using residential wood-burning equipment covered by the change-out program

Pollutants Reduced: Direct PM_{2.5} & VOCs

MPCA estimates of annual average statewide emissions of VOCs, NO_x and PM_{2.5} from all types of residential wood burning equipment are shown in this table. The estimated numbers of each category of equipment used in each of the five forest survey regions are indicated in the table:⁸¹

| Minnesota Residential Wood Burning - Equipment Used and 2008 Emissions (Draft) | | | | | | | | | |
|--|---|---------------|-------------------|----------------|----------------|----------------|---|-----------------|---------------|
| Equipment Category | Numbers of Equipment Used Statewide and per Forest Region | | | | | | Statewide Annual Emissions (Tons in 2008) | | |
| | State Total | Aspen Birch | Central Hardwoods | Metro | Northern Pine | Prairie | PM _{2.5} | NO _x | VOC |
| Fireplace | 160,000 | 7,300 | 22,000 | 110,000 | 5,200 | 9,100 | 1,400 | 160 | 1,100 |
| Non-Certified Woodstove | 110,000 | 26,000 | 30,000 | 18,000 | 19,000 | 18,000 | 5,000 | 450 | 8,600 |
| Non-Certified Fireplace Insert | 55,000 | 4,300 | 23,000 | 14,000 | 3,900 | 10,000 | 1,100 | 100 | 2,000 |
| EPA-Certified Catalytic Woodstove | 37,000 | 4,700 | 3,900 | 23,000 | 2,600 | 3,000 | 1,200 | 110 | 850 |
| EPA-Certified Catalytic Fireplace Insert | 7,700 | 1,200 | | 4,600 | 870 | 1,000 | 100 | 10 | 76 |
| EPA-Certified Non Catalytic Woodstove | 35,000 | 13,000 | 7,700 | | 7,400 | 7,100 | 1,000 | 120 | 620 |
| EPA-Certified Non Catalytic Fireplace Insert | 36,000 | 1,600 | 6,400 | 23,000 | 4,400 | 1,000 | 310 | 36 | 190 |
| Pellet Stove | 14,000 | 790 | 12,000 | | 1,300 | | 36 | 45 | 0.48 |
| Outdoor Hydronic Heater | 29,000 | 1,200 | 13,000 | | 8,300 | 7,100 | 3,800 | 250 | 1,600 |
| Indoor Forced Air Furnace | 14,000 | 790 | 6,400 | | 3,000 | 4,100 | 970 | 63 | 410 |
| Fire Pit/Chimenea/Fire Ring | 410,000 | 22,000 | 81,000 | 220,000 | 50,000 | 41,000 | 2,400 | 270 | 1,900 |
| Grand Total | 910,000 | 82,000 | 200,000 | 420,000 | 110,000 | 100,000 | 17,000 | 1,600 | 17,000 |

Emissions avoided for every 100 stoves replaced with a cleaner burning stove:⁸²

VOCs: 7 tons/year (7.79 tons/year by MPCA Estimate)

PM_{2.5}: 3.5 tons/year (4.50 tons/year by MPCA Estimate)

Cost Effectiveness:⁸³

Put a gas fireplace insert into a wood-burning fireplace

PM_{2.5}: >\$11,000/ton (2012 dollars)

Replace an uncertified wood stove with a new gas stove

PM_{2.5}: \$7,200/ton (2010 dollars)

⁸¹ Minnesota Pollution Control Agency. 2012. As calculated with data from Minnesota Pollution Control Agency (MPCA), Minnesota Department of Natural Resources (DNR), and U.S. Forest Service (USFS). 2008. Residential Fuelwood Assessment for the State of Minnesota (2007 – 2008 Heating Season).

http://files.dnr.state.mn.us/forestry/um/residentialfuelwoodassessment07_08.pdf

⁸² U.S. Environmental Protection Agency. 2006. Guidance for Quantifying and Using Emission Reductions from Voluntary Woodstove Changeout Programs in State Implementation Plans.

http://www.epa.gov/burnwise/pdfs/guidance_quantifying_jan.pdf

⁸³ Strategies for Reducing Residential Woodsmoke, Appendix D, EPA-456/B-13-001, revised March 2013.

<http://www.epa.gov/burnwise/pdfs/strategies.pdf>

Co-benefits:

- Reduces hazardous air pollutants
- Provides localized health benefits for vulnerable populations (including children)

Wood Smoke Reduction Education and Outreach

Type of Initiative: Education & Outreach

Description: Create an educational campaign to motivate behavior change to reduce emissions from wood smoke. The campaign should focus on the negative health impacts of wood smoke and encourage usage of alternative fuels. Such a campaign would mutually reinforce a wood stove change-out and incentive program.

Impacted Sources: Anyone using residential wood-burning equipment or engaging in open burning of wood

Pollutants Reduced: Direct PM_{2.5} & VOCs

Residential wood smoke contributes approximately 28 percent of direct combustion PM_{2.5} emissions (2005, both metro and statewide) or 8.4 percent of total PM_{2.5} emissions (18,103 ton/yr, 2008). This would address an unknown portion of this total.

Cost Effectiveness: N/A

Program Costs: ~.75 FTE

Co-benefits:

- Reduces hazardous air pollutants
- Provides localized health benefits for vulnerable populations (including children)

Protecting and Improving Minnesota's Air Quality: Recognizing Other Important Initiatives

The Work Group of Minnesota's Clean Air Dialogue agreed by consensus to recognize the importance of the following concurrent initiatives in maintaining and improving air quality. The Work Group understands that maintaining and improving air quality in Minnesota is both a short-term and long-term process. The group recognizes the avoided costs and public health benefits associated with the following initiatives due to their impact on air quality.

B20 Biodiesel Blend Mandate

Type of Initiative: State Policy (Existing)

Description: Minnesota lawmakers have set the state on a path of increasing use of biodiesel blended into all on-road diesel fuel sold in the state. Currently all #2 diesel fuel sold in Minnesota contains a blend of five percent biodiesel (B5); use of biodiesel in #1 diesel is waived until 2015. By 2015, Minnesota vehicles are scheduled to be using 20 percent biodiesel (B20) from April through October, returning to B5 during colder months.

Impacted Sources: Owners of diesel vehicles or vehicle fleets containing diesel vehicles

Pollutants Reduced: Direct PM_{2.5} & VOCs

Assuming an estimated 600,000,000 gallons annual use in Minnesota:

| Annual Emissions Reductions from Biodiesel (tons) ⁸⁴ | | | | |
|---|-------|-------|-------|--------|
| Air Pollutant | B5 | B10* | B20* | B100 |
| PM | 101 | 159 | 271 | 1,512 |
| | 3.1% | 5.0% | 8.5% | 47.2% |
| Hydrocarbon | 137 | 214 | 357 | 1,691 |
| | 5.4% | 8.5% | 14.2% | 67.4% |
| CO | 1,120 | 1,769 | 3,007 | 16,682 |
| | 3.2% | 5.1% | 8.7% | 48.1% |
| SO ₂ | 66 | 106 | 185 | 1,323 |
| | 5.0% | 8.0% | 14.0% | 100.0% |

* B10 and B20 assume a return to B5 from November through March

Cost Effectiveness: N/A

Biodiesel's impact on the price of diesel is heavily influenced by a variety of factors, including on-and-off again federal tax incentives and the Renewable Fuels Standard. Provisions in the law enable state agency commissioners to delay implementing an increase in the biodiesel blend if there are concerns about economic impacts or the availability of biodiesel.

⁸⁴ National Biodiesel Board, U.S. EPA <http://www.afdc.energy.gov/laws/state>

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)

Benchmarking & Disclosure of Energy Performance of Buildings

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

Description: Benchmarking provides a mechanism for measuring how efficiently a building uses energy relative to the same building over time, other similar buildings, or modeled simulations of a building built to a desired code or standard. Building energy use is typically measured in energy use per square foot.

Commercial buildings comprise nearly half of building energy use and roughly 20 percent of total energy consumption in the United States.⁸⁵ Benchmarking building performance is an important first step in identifying energy efficiency opportunities, helps to prioritize energy efficiency projects (including targeting public funds), and encourages building owners and operators to take action.⁸⁶

Disclosure of building energy performance can improve information available for market transactions, which can then further motivate building owners and operators to make improvements. The greatest impact from disclosure will come when all parties understand that the data is available, where to access it and how to compare buildings. This can be accomplished through incorporation of the data into county and city property information searches, real estate databases and lease agreements.

Benchmarking and disclosure policies should be supported with education, outreach, and technical assistance. Since disclosure of building energy use is intended to drive energy efficiency improvements, building owners should also be connected with audit, commissioning and financing tools available from utilities and vendors. Likewise, barriers and other costs to benchmarking should be identified. The increase in building retrofits should be tracked through surveys, energy use analysis and other methods.

⁸⁵ Department of Energy. 2012. Existing Commercial Buildings Working Group, Energy Benchmarking, Rating, and Disclosure for State Governments Fact Sheet.

http://www1.eere.energy.gov/seeaction/pdfs/commercialbuildings_factsheet_benchmarking_stategovt.pdf

http://www1.eere.energy.gov/seeaction/pdfs/commercialbuildings_benchmarking_policy.pdf

⁸⁶ Based on recent U.S. Environmental Protection Agency research, buildings that entered complete energy data in Portfolio Manager and received ENERGY STAR scores for 2008 through 2011 realized savings every year, as measured by average weather-normalized energy use intensity and the ENERGY STAR score (which accounts for business activity). Their average annual savings was 2.4 percent. This suggests that when building managers consistently track and benchmark energy consumption there is a tendency to increase building efficiency.

U.S. Environmental Protection Agency. ENERGY STAR PortfolioManager Data Trends Benchmarking and Energy Savings. http://www.energystar.gov/ia/business/downloads/datatrends/DataTrends_Savings_20121002.pdf?bb67-a147

Benchmarking is already required for public buildings in Minnesota. Several major cities and states have required or are considering requiring private sector benchmarking (e.g. California, New York City, San Francisco, District of Columbia, Seattle, Minneapolis).

Impacted Sources: Private buildings that consume energy and electric generation facilities

Pollutants Reduced: NO_x & SO₂

Cost Effectiveness: N/A

Co-benefits:

- Reduces energy use (and associated benefits)
- Reduces dependence on fuels imported from out-of-state/country (and associated energy security benefits)
- Saves building/facility owners, operators and tenants money on energy costs

Car Sharing in the Twin Cities

Type of Initiative: Infrastructure Investment

Description: Car sharing makes life without car ownership possible and, for some individuals, even preferable. Shared cars are available at all times, extending the travel ranges, cargo capacities, and overall flexibility of people who do not own cars. By providing an auto for this occasional but critical demand, car sharing allows households to sell or reduce the number of vehicles they own. This discourages unnecessary driving and reduces overall household travel by single occupancy vehicle.

In addition, employers of all kinds seek ways to minimize expenditures on employee travel and parking accommodation. Car sharing serves organizations by offering corporate and nonprofit member plans that include preferential rates and clear account tracking for departmental cost allocation. An on-site or nearby shared vehicle gives employees the flexibility to commute using transit, bicycles, or carpools, while accessing the shared vehicle for off-site work appointments or errands. This supports right-sized company fleets where the high fixed costs of fleet vehicle ownership and management are minimized.

Impacted Sources: Owners/operators of personal passenger vehicles (light-duty vehicles)

Pollutants Reduced: NO_x & VOCs

Car sharing has been shown to result in an average annual vehicle miles travelled (VMT) reduction of 27 percent per user.⁸⁷ Drivers in Minneapolis and St. Paul (where new car-sharing

⁸⁷ Elliot Martin & Susan Shaheen, Greenhouse Gas Emission Impacts of Carsharing in North America, *IEEE Transactions on Intelligent Transportation Systems*, 73 (December 2011): 1074-1086.

hubs would most likely be located) drive an average of 9,205 miles per year.⁸⁸ This would amount to an average annual reduction of 2,485 VMT per member/driver. With approximately 46 members served per car,⁸⁹ this works out to be a reduction of 114,310 VMT per car, per year.

Cost Effectiveness:

| Air Pollutant | Annual Tons Reduced/Car | Cost/Ton Reduced |
|---|-------------------------|------------------|
| VOCs | 0.18 | \$141,699.11 |
| NO _x | 0.20 | \$123,986.10 |
| PM _{2.5} | 0.0007 | \$36,445,454.42 |
| Total (VOCs + NO _x + PM _{2.5}) | 0.38 | \$66,006.31 |

Co-benefits:

- Reduces dependence on fuels imported from out-of-state/country (and associated energy security benefits)
- Reduces road congestion (if widely adopted)
- Saves users money (on gas, parking and vehicle maintenance)
- Reduces drive time (and associated quality of life benefits)
- Supports wealth retention in low-income households

Conservation Improvement Program 1.5% Energy Savings Goal

Type of Initiative: State Policy (Existing)

Description: The Next Generation Energy Act of 2007 established a statewide energy conservation goal of 1.5 percent of annual retail electric and gas sales.⁹⁰

Utilities in the state of Minnesota file either a triennial Conservation Improvement Program (CIP) plan or an annual CIP plan, depending on the type of utility. These plans include a wide variety of programs that help promote/incentivize energy efficiency projects throughout Minnesota. Many utilities are on track to meet their goals through direct conservation improvement programs that meet the needs of their customer bases. Some of these programs include:

- New construction design assistance
- Lighting efficiency rebates
- Process efficiency assistance
- Custom efficiency project analysis
- Assistance focused on low-income multi-family housing

⁸⁸ Personal communication from M. Filipi, November 26, 2012, "RE: Q for Mark: Revised proposal from HOURCAR" (based on data from Metropolitan Council. 2000 Travel Behavior Inventory. http://www.metrocouncil.org/planning/transportation/TBI_2000.htm)

⁸⁹ Personal communication from M. Morse, November 20, 2012, "RE: Revised proposal from HOURCAR"

⁹⁰ Minnesota House of Representatives. Next Generation Energy Act (HF436/SF145/CH136). <http://www.house.leg.state.mn.us/hinfo/newlawsart2007-0.asp?yearid=2007&storyid=608>

- Industrial systems (e.g. compressed air, motors, variable frequency drives, etc.) efficiency incentives
- Public-private partnerships to provide low interest commercial and industrial loans (e.g. the Saint Paul Port Authority's Trillion BTU Energy Efficiency Improvement Program⁹¹)
- Residential ENERGY STAR home certification
- Building envelope improvement incentives
- Heating efficiency for natural gas and electric customers
- Air conditioning efficiency for residential and commercial customers
- Recommissioning study subsidizations
- Compressed air leak repair
- Dust collection and vacuum system studies
- Domestic hot water for commercial and residential customers

In 2010, through the Minnesota Environmental Initiative 1.5% Energy Efficiency Solutions Project,⁹² several barriers that pose challenges and opportunities for achievement of the goal were identified as follows:

- Behavioral Programs
- Low-Income Conservation Programs
- Codes and Standards
- Electric Utility Infrastructure Improvements

The Department of Commerce, in collaboration with utilities and other industry stakeholders, has actively been working on reducing these barriers through additional stakeholder meetings, commissioned studies, additional policy guidance, and a variety of other mechanisms. As these barriers are reduced, the opportunities for energy savings and sustained achievement of the 1.5 percent energy savings goal increase, resulting in reduced air emissions.

Impacted Sources: Private buildings and facilities that consume energy and electric generation facilities

Pollutants Reduced: NO_x & SO₂

| 2013-2015 Average Annual Additional Avoided Emissions | |
|--|---------|
| Electricity Saved (MWh) | 861,774 |
| SO _x avoided (tons) | 1,854 |
| NO _x avoided (tons) | 950 |
| PM ₁₀ (primary) avoided (tons) | 70 |

⁹¹ Saint Paul Port Authority. Trillion BTU Energy Efficiency Improvement Program. http://www.sppa.com/wp-content/uploads/2011/03/SPPA_Trillion_Brochure8.pdf

⁹² Minnesota Environmental Initiative. 2011. 1.5% Energy Efficiency Solutions Project. http://www.environmental-initiative.org/images/files/1_5EESolutionsFinalReportwithoutAppendices.pdf

The estimated energy savings for a three-year period starting in 2013 will be over 2.5 billion kWh of electricity and over 8 million decatherms (Dth) of natural gas. The numbers above are for the electricity savings only, due to the complexity of estimating NO_x emissions reductions from natural gas savings. CIP assumes a 15-year measure-life for all energy efficiency measures. This figure is important to note because, while the energy savings goal tracks only first-year savings to achieve the 1.5 percent, there are ongoing savings throughout the life of the efficiency measure that are no longer counted toward the goal. Assuming a 15-year measure-life and ongoing energy savings as a result of the efficiency measure provides a more accurate estimate of the emissions reduced as a result of the energy savings.

It should be noted that these emissions savings are emissions avoided, not necessarily emissions reduced below a baseline. Because of this, achieving the 1.5 percent annual savings goal does not automatically translate into decreased total emissions of criteria air pollutants. The intention is to recognize the role of avoided emissions from energy consumption in supporting an overall downwards, rather than upwards, trend in criteria air pollutants.

Cost Effectiveness: N/A

Co-benefits:

- Reduces energy use (and associated benefits)
- Saves building/facility owners, operators and tenants money on energy costs
- Avoids generation, transmission, and distribution costs

Converting Vehicle Trips to Bicycling and Walking Trips

Type of Initiative: Infrastructure Investment; Education & Outreach

Description: Targeted infrastructure and outreach investments between 2007 and 2011 contributed to reductions in motor vehicle trips in the Twin Cities by increasing bicycling and walking. In 2011, people in Minneapolis made an estimated 7.7 million trips by walking or bicycling rather than by motor vehicle, resulting in an estimated 8.4 million miles not driven and 354,000 gallons of gasoline not burned.⁹³ Coordinated investments in planning, infrastructure, communications, and education contributed to the increases in walking and bicycling trips.

Impacted Sources: Owners/operators of personal passenger vehicles (light-duty vehicles)

Pollutants Reduced: NO_x & VOCs

Many of these investments (totaling approximately \$4 million annually) were made through Bike Walk Twin Cities—part of the federal Non-motorized Transportation Pilot Program (NTPP), which focused on four pilot communities nationwide, including the City of Minneapolis with connections to adjoining municipalities. Funded projects included Nice Ride bike sharing, three Bike/Walk Centers, on and off-road trails, new sidewalk segments, and many outreach and educational efforts. Funding for the federal pilot program ends in December 2013.

⁹³ US Department of Transportation, Federal Highway Administration. The Nonmotorized Transportation Pilot Program: 2012 Progress Update. http://www.fhwa.dot.gov/environment/bicycle_pedestrian/npp/2012_update/

Annual estimates for the NTPP Minneapolis pilot (2010 and 2011).⁹⁴

| Air Pollutant | 2010 Reduction/Savings (tons) | 2011 Reduction/Savings (tons) |
|-----------------|-------------------------------|-------------------------------|
| NO _x | 7.6 | 8.8 |
| Hydrocarbons | 10.9 | 12.6 |
| PM | 0.04 | 0.05 |
| CO | 99.2 | 115.3 |
| CO ₂ | 2,950 | 3,431 |

Cost Effectiveness: N/A

Co-benefits:

- Improves public health through increased walking and bicycling
- Stimulates local economic development
- Reduces dependence on fuels imported from out-of-state/country (and associated energy security benefits)
- Reduces road congestion (if resulting in significant behavior changes)
- Saves users money (on gas, parking and vehicle maintenance)
- Reduces drive time (and associated quality of life benefits)

Financing Models to Scale Up Clean Energy Projects in the Private Sector, Including Property Assessed Clean Energy

Type of Initiative: Voluntary Financial Incentives; Local/State Policy

Description: The Department of Commerce (DOC) is currently leading an initiative to scale up energy efficiency and renewable energy projects in Minnesota by identifying the most effective financing models for Minnesota’s commercial and industrial sectors and working with stakeholders to develop a plan of action to overcome barriers and address identified gaps. The energy financing models being evaluated include commercial Property Assessed Clean Energy (PACE), on-bill financing, energy services and managed energy services agreements, and equipment lease and master lease arrangements. Successful models will provide convenient, low-cost, contractor-centric, and secure financing that does not impinge on borrowing capacity of property owners (off-balance sheet) and will match financing repayment with realized energy savings.

Taking full advantage of the opportunities that PACE presents will require reducing transaction and first cost for all program participants and making PACE an easier opt-in opportunity for Minnesota local governments with assessment authority, as well as creating a structure that will facilitate participation by the investment community. This will likely involve developing a unified PACE platform that relies on standardized forms, legal documents, program design and guidelines, and a centralized approach to marketing, intake and project approval.

⁹⁴ US Department of Transportation, Federal Highway Administration. The Nonmotorized Transportation Pilot Program: 2012 Progress Update. http://www.fhwa.dot.gov/environment/bicycle_pedestrian/ntpp/2012_update/

Impacted Sources: Private buildings and facilities that consume energy and electric generation facilities

Pollutants Reduced: NO_x & SO₂

Cost Effectiveness: N/A

Co-benefits:

- Reduces energy use (and associated benefits)
- Reduces dependence on fuels imported from out-of-state/country (and associated energy security benefits)
- Saves building/facility owners, operators, and tenants money on energy costs (over the long term)

New Source Performance Standards for Wood Heaters

Type of Initiative: Federal Policy

Description: The U.S. Environmental Protection Agency's (EPA) New Source Performance Standards (NSPS) for wood heaters—the standards that govern allowable emissions from new residential wood-burning appliances used for space heating—are currently undergoing their first update in over 20 years. The wood heater standard revisions will likely be proposed during 2013 and the revisions under consideration include:⁹⁵

- Strengthening particulate emission limits to reflect current demonstrated “best systems of emissions reductions” (taking costs into account)
- Adding efficiency reporting or standards to also reduce carbon monoxide emissions
- Including pellet stoves and single-burn rate appliances explicitly
- Including indoor and outdoor wood “boilers” (hydronic heaters) and wood-fired furnaces
- Revising testing methods (as appropriate)

Initiated in 1988 under Section 111 of the Clean Air Act, the standards impact the manufacturing and import of wood heaters by defining what equipment can be legally sold in the U.S. The NSPS for wood-burning residential heaters require manufacturers to design new residential wood heaters to meet specific particulate emission limits, have representative samples from each model line tested by an EPA-accredited lab, and attach an EPA label to each unit (certifying approval by the Agency of that particular model line).⁹⁶

Impacted Sources: Anyone making a future purchase of new residential wood-burning equipment

⁹⁵ Wood, Gill. “Residential Wood Heaters: New Source Performance Standards (NSPS).” Presentation delivered via webinar on February 9, 2012. <http://www.epa.gov/burnwise/ordinances.html>

⁹⁶ Ibid.

Pollutants Reduced: Direct PM_{2.5} & VOCs

New performance standards would reduce the future VOC and PM_{2.5} and additional pollutant emissions from the fleet of residential wood heating equipment added to Minnesota in the future. It would also increase the energy efficiency of residential wood heating. This NSPS for consumer products has not targeted emissions or maintenance of existing equipment; therefore any resulting emissions reductions would occur as older equipment is voluntarily replaced.

Cost Effectiveness: N/A

Co-benefits:

- Reduces hazardous air pollutants
- Provides localized health benefits for vulnerable populations (including children)

Phase-Out of Coal Tar-Based Pavement Sealers

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

Description: The 2009 Legislature enacted a bill that restricts state agencies from purchasing undiluted coal tar-based sealant and directed the Minnesota Pollution Control Agency to study its environmental effects and to develop management guidelines and a model ordinance for cities considering local restrictions on coal tar-based sealants. In addition, since 2011 the MPCA has been promoting the phase-out of coal tar-based seal coats in Minnesota through a grant awarded by the U.S. Environmental Protection Agency's Great Lakes Restoration Initiative. To date, 17 municipalities in Minnesota have banned the use of coal tar-based pavement sealers, mainly for water quality concerns.

Impacted Sources: Individuals or facility owners with paved surfaces (using pavement sealers)

Pollutants Reduced: VOCs

There is significant evidence that there is a contribution from coal tar-based pavement sealers to air pollution due to their high VOC content. Sealcoat products containing coal tar have been shown to have an average of 66,000 mg/kg of polycyclic aromatic hydrocarbons (PAHs), a type of VOC.⁹⁷ A different study estimates that up to half of the PAHs contained in the product volatilize into the atmosphere within 45 days of application.⁹⁸ There is no current estimate for Minnesota specifically, but one national estimate for the PAHs released in the US from coal tar-based pavement sealers is 1000 Mg per year.⁹⁹ A rough conversation would suggest that PAH releases in Minnesota would be in the order of 20 tons per year.

⁹⁷ Mahler BJ, Metre PC, Crane JL, Watts AW, Scoggins M, Williams ES. 2012. Coal-tar-based pavement sealcoat and PAHs: implications for the environment, human health, and stormwater management. *Environ Sci Technol*. Mar 20;46(6):3039-45. doi: 10.1021/es203699x. Epub 2012 Feb 13.

⁹⁸ Van Metre, P. C.; Majewski, M. S.; Mahler, B. J.; Foreman, W. T.; Braun, C. L.; Wilson, J. T.; Burbank, T. 2012. PAH volatilization following application of coal-tar-based pavement sealant. *Atmos. Environ*.

⁹⁹ Ibid.

Cost Effectiveness: N/A

Co-benefits:

- Prevents water pollution
- Reduces hazardous air pollutants

State Energy Efficiency Programs for the Public Sector

Type of Initiative: State Policy (Existing); Education & Outreach

Description: Energy efficiency and renewable energy projects in the public sector are being identified and implemented through three current initiatives occurring within the state of Minnesota:

Public Building Enhanced Energy Efficiency Program (PBEEEP) – Local¹⁰⁰

- Targets newer buildings and/or systems
- Goal is to make existing systems more efficient
- Includes retro-commissioning, controls, lighting and other less-equipment-intensive energy saving retrofits
- Comprehensive projects that are too small for GESP

Guaranteed Energy Savings Program (GESP)¹⁰¹

- Targets older buildings and/or systems
- Goals are to address deferred maintenance and renew building infrastructure, in addition to making existing systems more efficient
- Deep energy efficiency retrofits (i.e. redesigns & replacements), in addition to PBEEEP type retrofits (i.e. modifications)

Sustainable Building 2030 (SB 2030)¹⁰²

- Outlines specific performance targets (energy standards) for energy use in buildings until 2030
- Standards are required for all state bonded buildings that have started Schematic Design after Aug.1, 2009
- Offers voluntary, cost-effective energy efficiency performance standards for new and substantially reconstructed commercial, industrial, and institutional buildings
- Every five years, the total carbon emissions from the operations of buildings is to be reduced so that in 2030 a 100 percent reduction (net zero carbon) is achieved

Energy Savings Partnership (ESP)

¹⁰⁰ Minnesota Department of Commerce. 2012. PBEEEP Report: Local Government Public Enhanced Energy Efficiency Program Report. <http://mn.gov/commerce/energy/images/PBEEEP-Report-2011.pdf>

¹⁰¹ Minnesota Department of Commerce. Energy Savings Program. <http://mn.gov/commerce/energy/topics/financial/Energy-Savings-Program/>

¹⁰² Minnesota Sustainable Building 2030. <http://www.mn2030.umn.edu/>

- Partnership between Saint Paul Port Authority and U.S. Bank
- Offers 100 percent financing for any public project that provides energy efficiencies, energy savings, or renewable energy
- Minimum loan size is \$50,000 with no maximum

Impacted Sources: Public buildings and electric generation facilities

Pollutants Reduced: NO_x & SO₂

The following table demonstrates potential savings based on the existing goal of 20 percent aggregate energy reduction by public agencies by 2020 (Executive Order 11-12):

| Branch of Government | B3 Baseline Energy Usage (MMBTU) ¹⁰³ | Annual Savings Goal (MMBTU) ¹⁰⁴ | SO ₂ (tons) | NO _x (tons) |
|----------------------|---|--|------------------------|------------------------|
| City | 2,298,688 | 459,738 | 67.1 | 53.4 |
| County | 1,467,779 | 293,556 | 42.8 | 34.1 |
| Higher Ed | 6,171,425 | 1,234,285 | 180.0 | 143.4 |
| Public Schools | 8,723,799 | 1,744,760 | 254.5 | 202.7 |
| State | 2,034,093 | 406,819 | 59.3 | 47.3 |
| Total | 20,695,784 | 4,139,157 | 603.7 | 480.8 |

Cost Effectiveness: N/A

Co-benefits:

- Reduces energy use (and associated benefits)
- Saves government agencies (i.e. taxpayers) money on energy costs
- Avoids generation, transmission, and distribution costs

Updating Minnesota State Policy to Facilitate Development of Distributed Generation and Combined Heat and Power

Type of Initiative: State Policy

Description: Most electricity is generated in large centralized facilities that require electricity to be transmitted over long distances. Distributed generation (DG) is the generation of electricity on-site, or close to where it is needed, in small facilities designed to meet local needs. DG is sometimes referred to as on-site generation, dispersed generation, or decentralized generation and can include both renewable power sources like wind and solar and combined heat and power (also known as co-generation) facilities. Distributed generation may result in lower environmental impacts and improved security of supply.

¹⁰³ Only 80 percent of buildings have 12 consecutive months of utility data in B3. Therefore the numbers in this column represent 80 percent of total square footage.

¹⁰⁴ This assumes that energy savings performance contract projects achieve a savings of 1/9th of the 20 percent total energy reduction goal each year over the nine-year term from 2012 to 2020.

Advances in technology and current economic conditions are contributing to increasing interest in DG in Minnesota. In response, the Department of Commerce, Division of Energy Resources (DER) is conducting an initial assessment of Minnesota distributed generation. This initial assessment will include determining a baseline (historical and current) for Minnesota DG and net metering installations; benchmarking Minnesota practices and installations against other states and national best practices; reviewing the current Minnesota DG interconnection process and requirements; and identifying DG impacts on energy costs, benefits, and reliability. This assessment is informed and guided by an ongoing dialogue with stakeholders. Key initial findings have included:

- Customer requests for DG have increased in recent years and are expected to increase even more in future years. Minnesota's grid is evolving to a more distributed system as DG technologies continue to mature.
- By all measures, only a small amount of DG has been developed to date in Minnesota; net metering generation is less than 0.03 percent of retail electricity sales in the state.
- The Minnesota interconnection process and requirements provides the needed tools to address reliability and safety. DG levels are not currently causing reliability and/or safety issues and are not anticipated to in the near term, but some updating may be needed to incorporate current standards and certifications and to incorporate more explicit tiers.

As of late-2012 the DER has identified several key areas that need to be addressed in Minnesota:

- Development of a shared understanding of the range and complexity of Minnesota DG and net metering impacts (values and costs)
- Identification of needs for long-term solutions to align DG values and costs to the system with customer choices
- Development of options for near-term improvements to policies (e.g. updated net metering or alternatives, provisions for "solar gardens," stand-by/demand/solar rates, etc.)
- Identification of knowledge gaps

Impacted Sources: Private buildings and facilities that consume energy and electric generation facilities

Pollutants Reduced: NO_x & SO₂

Cost Effectiveness: N/A

Co-benefits:

- Reduces dependence on fuels imported from out-of-state/country (and associated energy security benefits)
- Saves building/facility owners, operators, and tenants money on energy costs (over the long term)



Appendix A: Options for Possible Future Consideration

The Working Group of Minnesota's Clean Air Dialogue recognizes the following initiatives as options that may warrant future consideration for the purpose of maintaining or improving air quality, but reached no consensus supporting these initiatives at this time.

Encourage Local Land Use and Zoning Choices that Reduce Vehicle Miles Travelled

No Consensus Reached

Type of Initiative: Infrastructure Investment; Local Policy

Description: Encourage and incentivize local governments, which control land use decisions, to make land use and zoning choices that decrease vehicle miles travelled (VMT) and reduce associated emissions. This would include the following components:

1. Reorienting the development projections and goals as stated in the Metropolitan Council's Regional Development Framework such that a greater proportion of new development would be directed to "Developed Communities." Associated incentives and guidance would need to be realigned accordingly, including criteria for the Sustainable Communities Grants program.
2. Outside of the seven county metropolitan area there should be efforts to educate and support local governments in making land use decisions that reduce VMT. There are a number of existing efforts, including the GreenStep Cities program.

The state of Minnesota is projected to add over 878,000 residents between 2010 and 2030 and almost 1,234,000 by 2040. In the Twin Cities metropolitan region, population is forecast to grow by 597,000 residents (346,000 households) between 2010 and 2030 and 893,000 residents (458,000 households) by 2040.¹⁰⁵ The pattern in which this new growth occurs, along with the opportunities offered through the redevelopment of existing land uses, can significantly affect the driving habits of the region's residents.

Studies of alternative land development and zoning around the country have quantified these potential VMT impacts. Changes in VMT are most strongly related to the accessibility of destinations and to street network design variables.¹⁰⁶ The potential to influence travel demand through changes to the build environment have been found to fall broadly into five categories:

| | |
|-----------|---------------------------|
| Density | Destination Accessibility |
| Diversity | Distance to Transit |
| Design | |

The Metropolitan Council has developed a spreadsheet-based analysis tool to provide local decision makers with information on the potential impacts of their land use and development

¹⁰⁵ Minnesota Department of Administration. State Demographic Center. <http://www.demography.state.mn.us/>

¹⁰⁶ Ewing, Reid and Cervero, Robert. 2010. Travel and the Built Environment. Journal of the American Planning Association, Vol. 76, No. 3

decisions on air quality. The elasticities of the strategies selected for inclusion in the tool (shown below) are additive.

| Strategy | Built Environment Variable | Elasticity |
|--|-------------------------------------|------------|
| Density (Concentration of Population and Households) | Population and/or Household Density | -0.04 |
| Diversity of Land Uses | Land Use Mix | -0.09 |
| | Jobs/Housing Balance | -0.02 |
| Design of Street Network | Intersection/Street Density | -0.12 |
| | Percent 4-Way Intersections | -0.12 |
| Destination Accessibility | Job Accessibility by Automobile | -0.20 |
| | Job Accessibility by Transit | -0.05 |
| Distance to Transit | Distance to Nearest Transit Stop | -0.05 |

Impacted Sources: Owners/operators of personal passenger vehicles (light-duty vehicles)

Pollutants Reduced: NO_x & VOCs

If the density of the 458,000 new households to be created by 2040 were increased by 50 percent this would result in an estimated reduction of over 467,000 daily vehicle miles travelled (based on a regional average of 51 VMT per household for home-based trips). The annual reduction in air pollutants would be as follows:

| Air Pollutant | Reduction (tons/year) |
|-----------------------------|-----------------------|
| NO _x | 463.1 |
| Total Gaseous Hydrocarbons | 188.8 |
| PM ₁₀ Total | 14.3 |
| PM _{2.5} Total | 13.8 |
| Ammonia | 9.0 |
| SO ₂ | 9.0 |
| Carbon Monoxide (CO) | 1,689.7 |
| Atmospheric CO ₂ | 93,120.2 |
| CO ₂ Equivalent | 94,879.4 |

Cost Effectiveness: N/A

Co-benefits:

- Improves public health through increased walking and bicycling
- Stimulates local economic development
- Reduces dependence on fuels imported from out-of-state/country (and associated energy security benefits)
- Reduces road congestion (if resulting in significant behavior changes)
- Saves users money (on gas, parking and vehicle maintenance)
- Reduces drive time (and associated quality of life benefits)

Limit the VOC Content of Select Consumer Products

No Consensus Reached

Type of Initiative: State Policy

Description: Limit the legal VOC content of select VOC-emitting consumer products. High-emitting product categories include paints, cosmetics, cleaners, and adhesives.

There are standard VOC content limits for consumer products set in the states of California, Connecticut, Delaware, Illinois, Indiana, Maine, Maryland, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, Virginia, and Washington D.C. These regulations are virtually the same for every state that adopts the limits and cover over 150 different product types (some states exempt certain product types from their VOC limit rules).

Impacted Sources: Anyone selling or seeking to purchase products with a high-VOC content

Pollutants Reduced: VOCs

Solvents are responsible for 7.5 percent of Minnesota VOC emissions (82,841 tons).

A New Jersey study looking at the potential impacts of implementing consumer product VOC content limits on 45 consumer product categories estimated a reduction potential of 14.6 percent. For Minnesota this would mean a reduction of 12,080 tons of VOCs.¹⁰⁷

Cost Effectiveness:¹⁰⁸

VOCs: \$2,300/ton

Co-benefits:

- Improves indoor air quality
- Protects the health of consumers and manufacturers of impacted products

Model Recreational Wood Burning Nuisance Ordinance

No Consensus Reached

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

Description: Develop and support a model ordinance that restricts the acceptable conditions and hours during which recreational wood burning is legally permitted and that allows for more rigorous enforcement of burning restrictions, including the use of first responders to address

¹⁰⁷ The State of New Jersey Department of Environmental Protection. 2003. Estimated VOC Emission Reductions and Economic Impact Analysis for Proposed Amendments to Chemically Formulated Consumer Products. www.nj.gov/dep/aqm/BBattCP3.pdf

¹⁰⁸ Ibid.

citizen complaints regarding violations. Examples of possible restrictions on recreational wood burning include:

- Restrictions in the hours during which wood burning is legally permitted
- Prohibition of wood burning on days when an air quality alert is in effect
- Restrictions on or prohibition of recreational wood burning when warnings are in effect due to dry conditions
- Prohibition of wood burning when wind speeds exceed a specified threshold

Impacted Sources: Anyone engaging in recreational burning of wood

Pollutants Reduced: Direct PM_{2.5} & VOCs

Cost Effectiveness: N/A

For local governments implementing such an ordinance, there could be considerable costs associated with the additional deployment of first responders in non-emergency situations.

Co-benefits:

- Reduces hazardous air pollutants
- Provides localized health benefits for vulnerable populations (including children)

Model Transportation Demand Management Planning Requirement

No Consensus Reached

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

Description: Develop and promote a model ordinance based on the City of Bloomington's Transportation Demand Management (TDM) Ordinance, which requires employers to submit a TDM plan to the local government with strategies to reduce single occupant vehicle trips by seven to ten percent below their baseline mode split. Employers would also submit a financial guarantee that is held by the local government (or could be held by the Metropolitan Council), which would be refunded after a set number of years if they have achieved the goals outlined in their TDM plan. If, after the specified deadline, there has not been a good faith effort toward trip reduction and strategy implementation, the financial guarantee could be used to purchase transit passes or provide a financial incentive for non-drive alone commuters.

Many areas that have fallen into non-attainment have implemented a state-, metro-, or county-wide TDM plan requirement as a way to engage employers in peak-period trip reduction. Areas on the east coast have implemented a retroactive TDM plan requirement (without a financial guarantee) whereby area businesses must work with their transportation management organization/association (TMO/TMA) to implement TDM strategies to achieve trip reduction. The compliance rate is approximately 50 percent.¹⁰⁹ Generally there are not penalties for non-compliance, however, the Cities of Bloomington and Eden Prairie require the TDM plan and financial guarantee as a condition of approval for new and redevelopments.

¹⁰⁹ National Association for Commuter Transportation.

Companies that implement TDM plans are generally able to triple the mode split for alternative transportation options (modes other than driving alone) over companies that do not implement TDM plans. For example, the drive alone rate for commuters along I-494 is 95 percent, but when a TDM plan is required, companies typically reduce their drive alone rate to 85 percent.¹¹⁰

Impacted Sources: Major employers (with over 250 employees) in the Twin Cities metro area and their employees that commute by personal passenger vehicle (light-duty vehicle)

According to the Department of Employment and Economic Development, in 2011 there were 730 companies in the seven county metro area with over 250 employees, representing a total of 493,548 employees.¹¹¹

| <u>Size of Firm</u> | <u>Number of Firms</u> | <u>Total # of Employees in Firms</u> |
|---------------------|------------------------|--------------------------------------|
| 100 – 249 | 1,596 | 244,035 |
| 250 – 499 | 442 | 150,074 |
| 500+ | 288 | 343,474 |

Pollutants Reduced: NO_x & VOCs

In 2011, 494 Commuter Services converted 5,300 drive alone commuters into an alternative mode (three or more days per week) resulting in 29 million vehicle miles avoided*.¹¹²

| Air Pollutant | Emissions Reduction (tons) |
|----------------------|-----------------------------------|
| NO _x | 51 |
| VOCs | 45 |
| PM ₁₀ | 0.19 |
| PM _{2.5} | 0.17 |
| CO | 12,429 |
| CO ₂ | 14,979 |

*Note that these are results based on past efforts to demonstrate the scale of potential emissions reductions, not estimated reductions associated with implementation of the proposed policy.

Cost Effectiveness: N/A

Program Costs: ~14 FTE (outreach staff to serve all 730 companies in the metro area with over 250 employees in a single year)

¹¹⁰ Personal communication from M. Madison, November 5, 2012, “Revised vanpool and TDM Requirement proposals.”

¹¹¹ Minnesota Department of Employment and Economic Development. Quarterly Census of Employment and Wages. http://www.positivelyminnesota.com/Data_Publications/Data/All_Data_Tools/Quarterly_Census_of_Employment_Wages_%28QCEW%29.aspx

¹¹² Personal communication from M. Madison, September 27, 2012, “two commuter strategies attached.”

There would be a cost to employers to develop and implement TDM plans, but this cost would vary significantly depending on the level of effort dedicated to plan implementation. The average current employer expenditure on a conversion from driving a single occupant vehicle to taking another mode of transportation is \$1,400.¹¹³

Co-benefits:

Societal

- Reduces dependence on fuels imported from out-of-state/country (and associated energy security benefits)
- Reduces road congestion (if widely adopted)
- Increases economic opportunity for people with disabilities

Employers

- Increases employee productivity
- Enhances recruitment and retention

Employees

- Reduces drive time
- Saves money (on gas, parking and vehicle maintenance)
- Enhances quality of life and better work/life balance
- Improves public health through increased walking and bicycling

Prohibit Wood Burning on Days When an Air Quality Alert Is in Effect

No Consensus Reached

Type of Initiative: State Policy

Description: Prohibit the burning of wood days when an air quality alert is in effect. This ban should be paired with an improved system of forecasting and public notification on days with poor air quality and include limited enforcement activities. There would be exemptions for burning wood for cultural purposes or for essential heating.

Impacted Sources: Anyone using residential wood-burning equipment or engaging in open burning of wood

Pollutants Reduced: Direct PM_{2.5} & VOCs

Cost Effectiveness: N/A

Co-benefits:

- Reduces hazardous air pollutants
- Provides localized health benefits for vulnerable populations (including children)

¹¹³ Personal communication from M. Madison, November 5, 2012

Prohibition of Recreational Wood Burning

No Consensus Reached

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

Description: Develop resources to support local governments in implementing wood burning bans. The list below describes the types of bans that could be instituted to address emissions from residential wood burning:

- Require that the cleanest fuel available be used for home heating and recreational purposes
- Prohibit all recreational wood burning
- Prohibit outdoor wood boilers
- Prohibit all outdoor wood appliances
- Prohibit wood burning in parks and at public events
- Prohibit wood burning within a one mile radius of health care facilities and hospitals
- Prohibit the use of wood and coal as cooking fuels in commercial kitchens

Impacted Sources: Anyone engaging in recreational or home heating burning of wood

Pollutants Reduced: Direct PM_{2.5} & VOCs

Residential wood smoke contributes approximately 28 percent of combustion-generated PM_{2.5} emissions (2005, both metro and statewide) or 8.4 percent of total direct PM_{2.5} emissions (18,103 ton/year, 2008). This would address an unknown portion of this total.

Cost Effectiveness: N/A

Co-benefits:

- Reduces hazardous air pollutants
- Provides localized health benefits for vulnerable populations (including children)

Remove Wood-Burning Equipment on Resale of Properties

No Consensus Reached

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

Description: Develop and support a model ordinance for local governments to adopt that would mandate the removal and destruction of any wood stove or outdoor wood boiler that is not EPA certified on the resale of homes/residential property. Alternately, a provision could be inserted into the Minnesota State Building Code.

Old wood stoves are often made of metal, weigh hundreds of pounds and last for decades, causing many homeowners to continue to use high-polluting outdated models. To help get these older stoves out of use some municipalities have instituted such a policy.¹¹⁴

Impacted Sources: Anyone buying or selling property that contains residential wood-burning equipment

Pollutants Reduced: Direct PM_{2.5} & VOCs

Residential wood smoke contributes approximately 28 percent of combustion-generated PM_{2.5} emissions (2005, both metro and statewide) or 8.4 percent of total direct PM_{2.5} emissions (18,103 ton/year, 2008). This would address an unknown portion of this total.

Cost Effectiveness:¹¹⁵

Costs would be borne by property buyers and sellers. Cost effectiveness would be greater if equipment was not replaced.

Co-benefits:

- Reduces hazardous air pollutants
- Provides localized health benefits for vulnerable populations (including children)

¹¹⁴ For example Mammoth Lakes, CA requires all non-EPA-certified wood burning appliances to be removed or rendered inoperable on the sale of a dwelling. Between 1990 and 2008 this resulted in the removal of 2,400 units and the retrofitting of 2,500 units. See http://www.arb.ca.gov/pm/pmmeasures/ceffect/rules/gbuapcd_431.htm

¹¹⁵ Calculated based on MPCA, DNR, and USFS. 2008. Residential Fuelwood Assessment for the State of Minnesota (2007 – 2008 Heating Season). http://files.dnr.state.mn.us/forestry/um/residentialfuelwoodassessment07_08.pdf and U.S. Environmental Protection Agency. 2006. Guidance for Quantifying and Using Emission Reductions from Voluntary Woodstove Changeout Programs in State Implementation Plans. http://www.epa.gov/burnwise/pdfs/guidance_quantifying_jan.pdf