Greater Kansas City

Clean Air Action Plan

2011 Update

A product of the Mid-America Regional Council Air Quality Program and its community partners

Mid-America Regional Council

Introduction

The Kansas City Regional Clean Air Action Plan (CAAP) is a comprehensive, community-based, voluntary plan for reducing ground-level ozone in the Kansas City metro area. The plan, originally adopted in 2005, had four main strategies: diesel emission reduction, power-plant emission reduction, education and sustainability.

This document is an update to the original plan, and does not replace it. Rather, it strengthens the fourth strategy. This update also addresses sustainability-related co-benefits — including reductions in greenhouse gas emissions and other criteria pollutants — of these approaches to improving air quality in the Kansas City region.

Through this update, the CAAP becomes part of a larger set of regional sustainability priorities, and creates a mechanism for increased collaboration and integration across other target areas. The 2005 CAAP noted that:

> Promoting sustainable growth and development is essential if the region is to address its ozone problem in the long term. Land-use policies that promote a decreased reliance on the automobile, planning practices that place greater emphasis on a truly multimodal transportation network, natural resource conservation techniques that reduce the urban heat island effect, and green-building practices that increase resource efficiency would make clean air easier to achieve.

This process included a technical analysis of the recommended measures. The consultant report for that analysis is the source for most of the information included in each action unless otherwise noted.

Administrative update

New standards

The Environmental Protection Agency (EPA) strengthened the national air quality standards for ground-level ozone in 2008. The EPA is expected to designate the Kansas City region as a nonattainment area after the agency issues more stringent eight-hour standards in July 2011. Although the CAAP focuses largely on ozone and NOx, the EPA is required to reconsider the National Ambient Air Quality Standards (NAAQS) for all criteria pollutants every five years, and other standards have been or are expected to be tightened in the near future. In 2011, portions of Jackson County, Mo., will be recommended as a nonattainment area for sulfur dioxide (SO_2); changes to other standards may lead to nonattainment designations for other pollutants, such as fine particulate matter.

In addition to more stringent NAAQS, stricter Maximum Achievable Control Technology and Reasonably Available Control Technology rules will be implemented to control pollutants if the region is designated as a nonattainment area.

Progress on previous projects

A progress report evaluating successes facilitated by the 2005 CAAP was completed at the beginning of this update. That report is attached as Appendix A.

Significant progress was made on many of the projects, largely as a result of voluntary efforts and commitments made by public and private partners in the Kansas City region. The purpose of this update is not only to provide progress updates on projects outlined in the original CAAP, but also to strengthen the sustainability vision of the original plan to ensure the region continues to move forward with innovative, measurable solutions to air-quality concerns.

The Air Quality Forum, shown above, helped determine membership of an ad hoc committee known as the Clean Air Action Plan Working Group. The group met monthly and was composed of representatives from many agencies, community groups and industries.

The CAAP was never intended to be a static document; the projects included in this update — as well as the original plan — reflect thoughts and views from the time at which they were written. Future updates will refine or reframe projects to ensure they are effective, and that they match evolving community priorities and emerging technology.

Process and timeline for this update

Updating the CAAP was a yearlong process that benefited from the direction and input of dozens of local and state partners. A Working Group was formed by the Air Quality Forum in summer 2009. The Forum approved recommendations from an ad hoc committee that suggested representatives from state and local air agencies, transportation, health, planning and development, commerce and industry, and other appropriate sectors. The resulting Clean Air Action Plan Working Group included representatives from:

- Children's Mercy Hospitals and Clinics
- Clay County
- Environmental Protection Agency
- General Motors
- Greater Kansas City Chamber of Commerce
- Johnson County Environmental Department
- Kansas City Area Development Council
- Kansas Department of Health and Environment
- Kansas Department of Transportation
- Kansas City Area Transportation Authority
- Kansas City, Mo., Environmental Management
- KC AIA/180 Degrees
- KCP&L
- Lawrence/Douglas County Health Department
- Metropolitan Energy Center/Clean Cities
- Mid-America Regional Council (MARC)
- Missouri Department of Natural Resources
- Missouri Department of Transportation
- Planning Roundtable
- Platte County
- Unified Government

A consultant, Pechan/TranSystems, was chosen through a competitive procurement process in late May 2010 to assist with a technical analysis and public engagement. The Working Group, with consultant support, expanded and prioritized the plan's list of emissions-reduction projects and new voluntary actions.

Initial project brainstorming and prioritization by the Working Group was followed by a public engagement in September 2010. Nearly 70 participants

Participants at the September 2010 public meeting work in breakout groups to prioritize voluntary strategies. Nearly 70 people from various sectors participated.

attended from various sectors. Those participants helped prioritize issues by working in groups to build consensus around 12 projects, later combined into 10, that would undergo subsequent technical evaluation by the consultant.

Pechan/TranSystems released its technical analysis of those projects in March 2011. For each of the 10 voluntary actions, it identified basic (three-year), mid-level (five-year) and stretch (10-year) goals. The analysis showed clear differentiation among projects regarding their emissions and sustainability impacts. Based on that analysis, the Working Group selected four priority strategies to include in this update, along with a fifth strategy based on continuing work that is already taking place. Other strategies that scored lower on emissions-reduction potential, but are still deemed important to improving air quality, are included as supplemental strategies.

For the purposes of this update, the geographic boundary of the emission reductions was expanded to reflect a potentially larger air quality boundary in the future. The analysis included Johnson, Wyandotte, Douglas, Leavenworth and Miami counties in Kansas, and Jackson, Clay, Platte, Cass and Clinton counties in Missouri.

Timeline for future updates

The CAAP Working Group established timelines to guide future CAAP updates. Progress on projects will be reported on a yearly basis, with the understanding that some projects may not show significant advancement over the course of one calendar year. Efforts will be made to quantify results when possible. These updates will be made available to the Air Quality Forum and on the MARC Air Quality Program website.

Every five years, a more comprehensive update will be undertaken to evaluate if current efforts still reflect regional priorities, and if programs are effective and efficient. When possible, a technical analysis should accompany any new efforts being undertaken. Update processes should be inclusive of public and private stakeholders.

New projects/focus points

ACTION 1

Promote options that are pedestrian, bike and transit friendly for communities

Strategy	Basic goals (Three years)	Mid-range goals (Five years)	Stretch goals (10 years)
Promote options that are pedestrian, bike and transit friendly for communities, including MetroGreen and incentives for compact development.	1. Establish transit-oriented development (TOD) guidelines for two bus rapid transit (BRT) corridors 2. Increase bike/walk/transit to 7 percent of total trips 3. Establish an urban car-sharing program 4. Cover 10 percent of the regional population with complete streets or similar policies 5. Establish complete streets training for municipalities	1. Establish TOD guidelines for five BRT corridors 2. Increase bike/walk/transit to 9 percent of total trips 3. Increase car-sharing participation to 5,000 participants 4. Cover 20 percent of the regional population with complete streets or similar policies 5. Conduct two complete streets trainings	1. Establish TOD guidelines for all BRT corridors 2. Increase bike/walk/transit to 12 percent of total trips 3. Increase car-sharing to 12,000 4. Cover 60 percent of the regional population with complete streets or similar policies

Description

This action seeks to reduce volatile organic compounds (VOCs) and nitrogen oxide (NOx) emissions from passenger vehicles by promoting alternative commuting options such as walking, biking, car-sharing and transit, in part through a complete streets approach.

The intent of complete streets is to view all transportation improvements as opportunities to create safer, more accessible streets for all users, including pedestrians, cyclists and public-transit passengers. Strong complete streets policies integrate this holistic approach to planning all types of projects, including new construction, reconstruction, rehabilitation, repair and maintenance. The concept complements a "green streets" approach, which incorporates urban forestry and low-impact development strategies that align with Action 2.

Implementation and effectiveness

This strategy aims to reduce vehicle miles traveled (VMT) in the MARC region. Currently, 3.4 percent of trips in the MARC region are made by walking or biking, and 2

If 10 percent of the region's population was covered by complete streets policies, which encourage multiple modes of transportation, nitrogen oxide would be reduced by 168 tons each year.

percent of trips are made by transit. The basic, mid-range and stretch goals hope to increase the combined use of alternative transportation to 7 percent, 9 percent and 12 percent, by 2013, 2015 and 2020, respectively. If these modes of travel were increased to 12 percent in 2020, this would reduce VMT by 1.44 billion miles.

Bus rapid transit (BRT) is an essential element of regional transit plans, which play a vital role in decreasing VMT, and therefore VOCs and NOx. Bus rapid transit is an enhanced bus system that operates on bus lanes or other transit-ways in order to combine the flexibility of buses with the efficiency of rail. By doing so, BRT operates at faster speeds, and provides greater service reliability and increased customer convenience. And by combining advanced technologies, infrastructure and operational investments, BRT provides significantly better service than traditional bus service. Kansas City, Missouri's, existing MAX program has been a model for BRT throughout the country; expanding that program would help reduce daily VMT in the city while providing safe, fast transportation.

Transit-oriented development (TOD) guidelines would complement the expansion of BRT. *Transportation Outlook 2040*, the region's long-range transportation plan, indicates that the average per capita VMT in the MARC region is 29 miles per day. This figure underscores the fact that the Kansas City region's geographic footprint expanded tremendously in the 20th Century, with residents often living far from their workplaces. TOD situates development along major transit corridors within a 10-minute walk of a transit station. TOD creates more compact and accessible development while making transit an efficient, logical choice for commuters. As part of the CAAP's emissions-reduction strategy, this action would develop TOD guidelines for two bus rapid transit corridors by 2013, five BRT corridors by 2015 and have TOD guidelines in place for all BRT corridors by 2020.

Along with walking, biking and transit, car-sharing is another strategy to reduce VMT. In a car-sharing program, participants reserve a vehicle online and pay for the amount of time they use it, as well as a small one-time registration fee to join. Such programs make it possible for individuals without a personal vehicle to enjoy the convenience and freedom of a car without the financial responsibility of ownership and maintenance. According to Pechan/TranSystems' analysis, VMT reductions in a car-sharing program were estimated to be 44 percent per participant.

Cost and cost-effectiveness

The estimated cost of improving infrastructure to accommodate bike, pedestrian and

Table 1. Costs and benefits of pedestrian-, bike- and transit-friendly communities

	2013	2015	2020
VOC reduction (tons/year)	113	157	242
NOx reduction (tons/year)	168	207	283
Guidelines for BRT corridors	2	5	
% total trips taken by bike / walk / transit	7%	9%	12%
% regional population covered by complete streets policies	10%	20%	60%
Car-sharing participation (number of people)		5,000	12,000
Implementation cost (annually, in millions)	$3.9		

	VOC	NOx
$/ton removed	$16,357	$13,987
Potential co-benefits Reduction in GHG emissions, improved health, reduced greenfield development and traffic		

transit use by 2020 is $3.9 million annually. This estimate is based on current annual expenditures in Transportation Enhancements funding, and only addresses increasing current levels based on improvements to existing routes and infrastructure, not creation of new routes or infrastructure. The estimated costs per ton of NOx and VOCs removed are $13,987 and $16,357, respectively.

Potential co-benefits

Increased use of transit, bike and pedestrian infrastructure reduces fuel consumption. These reductions save consumers money, creating a prospective economic boost, and translate into reduced greenhouse gas emissions. Encouraging more compact development through TOD will reduce environmental impacts, decrease traffic delays and improve the region's attractiveness to businesses.

From a physical health standpoint, any policy that reduces local air pollutants, such as VOCs and NOx, will result in fewer respiratory problems, including asthma, bronchitis and emphysema. Increased physical activity — a by-product of increased alternative transportation use — can also reduce health care costs, increase employee productivity and reduce absenteeism at school or work.

Reducing VMT as a part of this strategy will also reduce other air pollutants such as particulate matter (PM), which can cause severe respiratory problems. PM also reduces visibility and creates haze, increases acidity in waterways, depletes soil nutrients, and damages forests and crops. It can also damage communities' historic and culturally significant stone structures due to the creation of acid rain.

ACTION 2

Native and sustainable landscaping, streetscaping and green infrastructure for governments and residences, and best practices for commercial landscaping

Strategies	Basic goals (Three years)	Mid-range goals (Five years)	Stretch goals (10 years)
Native, sustainable landscaping and pervious pavement policies for governments and residents	25 percent of local governments and public agencies adopt native landscaping, green infrastructure protection and pervious pavement policies	1. 120,000 acres of native landscaping/sustainable stormwater site design 2. 50 percent of local governments and public agencies adopt native landscaping, green infrastructure protection and pervious pavement policies 3. Decrease residential water use for lawn care and irrigation by 5 percent	1. 243,000 acres (10 percent of the region's total acreage) of native landscaping/sustainable stormwater site design (roadside, riparian, park, large institutional landscapes) in metro area 2. Reduce mowable acreage by 10 percent in the region
Best practices training for commercial landscaping	Establish Academy for Sustainable Communities curriculum for best practices for commercial and municipal landscaping	1. Hold trainings in commercial and municipal landscaping at least twice yearly 2. Create local recognition program for businesses and municipalities using landscaping BMPs	Hold quarterly trainings in commercial and municipal landscaping

Description

This action suggests a green infrastructure approach to establish sustainable landscapes and streetscapes to reduce the urban heat island effect, manage stormwater and reduce water use for landscape maintenance. Successful implementation would involve using urban forestry practices that install native vegetation at local-government and public-agency facilities. This action also addresses best-practices training for commercial landscaping, including site landscaping plans and vegetation management.

Implementation and effectiveness

Native and sustainable landscaping and green infrastructure can mitigate smog by reducing the urban heat island effect, slowing down ozone formation and reducing emissions associated with heating and cooling.

Black-eyed susans are one of the many attractive native plants used in local landscaping.

Smart landscaping also reduces VOC and NOx emissions from mowing and chemical applications associated with maintenance, and increases ozone uptake by supporting practices that retain or establish trees and other plant communities. These techniques also reduce stormwater runoff, and increase soil infiltration and evapotranspiration rates. Conservation and restoration of green infrastructure and native vegetation in urban, suburban and rural areas is key to facilitating improved stormwater management. This strategy also calls for using permeable and high-albedo pavement in 50 percent of local-government and public-agency facilities.

Analysis conducted for this study did not explicitly include urban and community forestry because a parallel MARC research effort — in partnership with the U.S. Forest Service, the Missouri Department of Conservation and the Kansas Forest Service — was already underway. This regional forest assessment and policy-development initiative uses models developed by the Forest Service to quantify the benefits of urban forests, including energy conservation, air and water quality improvement, and carbon sequestration.

The draft report estimates that the Kansas City region's 249.4 million trees remove a total of 32,000 tons of ozone pollution each year. The estimated value of that ozone pollution removal is $158 million per year, based on nationwide estimates of the median externality costs. The region's trees and forests also conserve an estimated 62,400 megawatt-hours (MWh) and 572,800 British thermal units (Btu) of energy each year, saving an estimated $14 million per year.

Although the study was not released in time to support the development of policy recommendations for the CAAP, its policy, planning, design, management and community-engagement recommendations will closely align with those in the CAAP.

Best-practices training focuses on reducing mowing and water consumption through the installation of native grasses. Emissions associated with lawn and garden equipment are expected to decrease after 2008 with the continuing phase-in of federal emissions standards. Any measure that affects lawn and garden equipment has the potential to reduce five tons of VOCs per year for every ton of NOx reduced. With a 10 percent reduction in mowing by 2020, VOCs would be reduced by 406 tons per year, and NOx would be reduced by 80 tons per year.

Improved water management also reduces electricity use associated with delivering water to households and commercial buildings, saving an estimated 41.6 tons of NOx and 0.44 tons of VOCs per year by 2020.

Cost and cost-effectiveness

The costs of this policy, an additional $15 per square meter, are based on the cost of installing pervious, high-albedo pavement in place of conventional pavement at 50 percent of local government and public agency facilities, or a total of 3.15 square miles of pavement. These costs are partially offset by the electricity savings in this strategy, calculated by Pechan/TranSystems to be 8,176 megawatt-hours (MWh) from 2011 to 2020. This decrease in energy use would save $774,267 in electricity costs, assuming $0.0947 per kilowatt-hour (kWh).

The total cost of implementation is $145.6 million over a 10-year period. It should be noted that less expensive pavement options are

Table 2. Costs and benefits of native/sustainable landscaping

	2013	2015	2020
VOC reduction (tons/year)	24.2	60.6	121.2
NOx reduction (tons/year)	82.4	205.4	408
% local gov'ts adopting sustainable landscaping policies	25%	50%	
Decrease in residential water use		5%	
Reduction in mowable acreage			10%
Implementation cost (annually, in millions)	$145.6		
Electricity saved (millions of dollars)	$0.77		
Water saved (millions of dollars)	$1.76		

	VOC	NOx
$/ton removed (in millions)	$1.2	$0.36
Potential co-benefits Reduction in GHG emissions, improved health, reduced greenfield development and traffic, community trees and forests reduce carbon dioxide emissions from power plants by an estimated 88,500 tons per year		

available, and that this report only addresses cost-effectiveness related to pavement choice due to the difficulty of quantifying the costs of native landscaping.

The costs of training best management practices are relatively low, and will be far outweighed by the savings from reduced gasoline and electricity costs. The savings from reduced water consumption alone are estimated at $1.76 million by 2020.

Potential co-benefits

This action seeks to reduce VOC and NOx emissions that occur as a result of electricity production. A reduction of 8,176 MWh will reduce greenhouse gas emissions, as well as the adverse health effects of such pollutants. Reducing the urban heat island effect encourages exercise and outdoor activity, adding to the livability and sustainability of the region. Environmental benefits realized from this strategy include soil-nutrient maintenance through reduced stormwater runoff, and minimization of flash flooding through stormwater management.

Multiple co-benefits are also associated with a healthy urban forest. Improved water quality, ecosystem health, real-estate values, carbon sequestration, energy conservation, and community livability are among the benefits generated by community forests.

Reducing the amount of fuel used for lawn maintenance and the amount of electricity needed for water delivery also reduces greenhouse gas emissions. This portion of the policy is estimated to reduce electricity consumption by 18.6 gigawatt-hours by 2020.

ACTION 3

Green buildings, sustainable site design and improved building codes for local governments

Strategies	Basic goals (Three years)	Mid-range goals (Five years)	Stretch goals (10 years)
Green buildings and sustainable site design	1. Provide training for local governments and non-construction professionals on LEED, EnergyStar, IECC, etc. 2. 4 percent of local municipalities adopt new construction guidelines requiring design to LEED silver standards or higher for all buildings	1. Provide training for local governments and non-construction professionals on LEED, EnergyStar, IECC, etc. 2. 10 percent of local municipalities adopt new construction guidelines requiring design to LEED silver standards or higher for all buildings	1. Provide training for local governments and non-construction professionals on LEED, EnergyStar, IECC building codes, etc. 2. 25 percent of local municipalities adopt new construction guidelines requiring design to LEED standards level or higher for all buildings
Improved building codes	30 percent of regional population covered by 2012 IECC standards or similar for new residential and commercial construction	50 percent of regional population covered by 2012 IECC standards or similar for new residential and commercial construction	100 percent of regional population covered by 2012 IECC standards or similar for new residential and commercial construction

Description

This policy suggests municipalities adopt and enforce more stringent building codes for government buildings. Currently, Kansas has adopted the 2006 International Energy Conservation Code (IECC) as the applicable energy-efficiency standard for commercial and industrial structures in the state. At this time, no efficiency code is applicable to residential construction. In Missouri, no statewide standard exists for either residential or commercial buildings. This policy also encourages adoption of the 2012 IECC codes by all local governments by 2020.

Given the long lifetime and large square footage of government buildings, adopting guidelines for the design, construction and site management of green government buildings in the region can greatly reduce their environmental impact and increase efficiency — and reduce energy costs. Government green-building initiatives can

The Discovery Center at 4750 Troost Ave., Kansas City, Mo., showcases many green-building features for visitors.

also promote widespread adoption of green-building practices by the private sector.

LEED is an internationally recognized green-building certification system, providing third-party verification that a building was designed and built using strategies that improve performance in the areas of energy and water use, CO_2 emissions, indoor environmental quality, stewardship of resources and environmental impacts. LEED standards, developed by the U.S. Green Building Council (USGBC), provide building owners and operators with a concise framework for identifying and implementing practical and measurable green-building design, construction, operation and maintenance solutions. LEED silver-level certification decreases energy consumption in buildings by approximately 32 percent compared to the 2003 national Commercial Buildings Energy Consumption Survey.

This action also suggests that municipalities increase enforcement of more stringent building codes over time. The changes imply that new and renovated buildings adhering to the 2012 IECC codes will be designed to use 30 percent less energy than those built to current standards.

Implementation and effectiveness

This action suggests training local governments and non-construction professionals on green-building and sustainable-site design guidelines, such as LEED and other similar programs. This training will inform recommendations in local municipalities to adopt new construction guidelines that achieve LEED silver certification or higher.

The LEED Green Building Rating System is voluntary and evaluates environmental performance from a "whole-building" perspective over its life cycle. Because these measures are voluntary, local governments will have to put in place mandatory standards to require improved efficiency of new buildings.

By adopting new construction guidelines for municipal buildings, municipalities can demonstrate the economic and environmental benefits of building sustainably. These successes will ideally promote adoption of similar guidelines by the private sector.

Table 3. Costs and benefits of green building and sustainable site design

	2013	2015	2020
VOC reduction (tons/year)	2.9	5.0	10.5
NOx reduction (tons/year)	8.1	14.0	29.8
% regional population covered by 2012 IECC standards or similar	30%	50%	100%
% gov't construction achieving LEED silver or better	4%	10%	25%
Cost (millions/year)	$0.64	$1.1	$2.3
Savings (millions/year)	$0.95	$1.6	$3.5
Total savings (millions)	$4.4		
Electicity saved (GWh)	35.4		
Natural gas saved (billion Btu)	2,237.1		

	VOC	NOx
$/ton removed (in millions)	$0.22	$0.077
Potential co-benefits Improved level of comfort; reduction in sick building syndrome (SBS), asthma and other respiratory illnesses; improve worker productivity by 5%; reduction in GHG emissions		

The success of the improved building-codes strategy is dependent on the adoption of the 2012 IECC by relevant jurisdictions. The code is designed to be adopted by ordinance. Municipalities wanting to adopt the 2012 IECC as an enforceable regulation that governs energy-efficient building envelopes and installation of energy-efficient mechanical, lighting and power systems should ensure that references to the code are included in the ordinance when adoption is being considered.

Cost and cost-effectiveness

For the MARC region, net cost savings of $7,936, $21,965 and $62,085 can be achieved per year if 4 percent, 10 percent and 25 percent of all new government construction achieves LEED silver certification by 2013, 2015 and 2020, respectively. On a net present-value basis, this equals savings of about $194,020 from 2011 through 2020.

Net cost savings associated with improved building codes are estimated to be $304,377, $520,330 and $1.12 million per year in 2013, 2015 and 2020, respectively. On a 2011 net present-value basis, this equals savings of about $4.19 million from 2011 through 2020.

Potential co-benefits

In addition to reducing emissions and saving money on decreased energy use, this strategy also impacts greenhouse gas emissions, comfort, health, productivity, real-estate values and economic performance.

Project Living Proof, located near the intersection of Troost and Emanuel Cleaver II Boulevard, demonstrates how energy-saving features can be added to residences.

Green buildings generate significant energy savings compared to baseline building standards. These energy savings are linked to considerable reductions in greenhouse gases. This action will save an estimated 735 kilowatt-hours (kWh) of electricity and 39.1 billion British thermal units (Btu) of natural-gas in the MARC region from 2011 to 2020.

Because energy-efficient buildings are typically better insulated than normal buildings, they also tend to be better sealed against air infiltration. These two features can significantly improve the level of comfort in a building. Efficient HVAC systems and properly installed and sealed ductwork can also improve comfort by ensuring an even distribution of conditioned air. Sustainable design and landscaping can also improve comfort and decrease energy consumption.

Because government workers spend a considerable amount of time in their offices, air-quality issues stemming from improper air ventilation can lead to chronic allergies and asthma. Sick building syndrome (SBS) is associated with poor indoor air quality, and can cause eye, nose, throat or skin irritation. Inefficient HVAC systems and ductwork can result in dangerous concentrations of carbon monoxide or radon. Air and duct sealing and periodic maintenance of HVAC equipment can mitigate a number of these risks. Improved indoor air quality can reduce symptoms of SBS by 20 to 50 percent, asthma by 8 to 25 percent, and other respiratory illnesses by 26 to 75 percent. Comfortable rooms in government buildings can improve worker productivity and reduce sick-leave hours.

Sick building syndrome costs the nation an estimated $60 billion annually in sick days, medical costs and reduced productivity. Improved indoor air quality can increase worker productivity by as much as 5 percent. Furthermore, worker productivity is higher at certain temperatures, which can be maintained more consistently throughout a building with high-efficiency HVAC systems, and proper insulation and air sealing.

ACTION 4

Energy-efficiency incentives for homeowners and renters

Strategy	Basic goal (Three years)	Mid-range goal (Five years)	Stretch goal (10 years)
Consumer incentives to improve energy efficiency	1 percent of all eligible entities participate in an energy-efficiency incentive program	2 percent of all eligible entities participate in an energy-efficiency incentive program	5 percent of all eligible entities participate in an energy-efficiency incentive program

Description

Many cost-effective technologies can significantly improve the energy efficiency of existing buildings. High-efficiency heating and cooling systems, solar power, insulation materials and air-sealing techniques can generate 33 percent energy savings for homes and 28 percent for commercial buildings.

This action supports introducing new incentives for making energy-efficiency updates for homeowners and building owners, including:

- offering rate discounts during off-peak times and high rates during peak electricity-use periods,
- free or subsidized energy audits,
- advanced energy-efficiency evaluation and design services,
- rebates and loans to customers for purchasing energy-efficient appliances and equipment,
- consumer education on energy-efficient features and maintenance, such as insulation, building weatherization and HVAC systems.

Incentives are also available for renewable energy. The American Reinvestment and Recovery Act (ARRA) of 2009 extended consumer incentives for renewable energy installations until 2016. Consumers who install solar energy systems, including solar water-heating and solar electric systems; small wind systems; geothermal heat pumps; and residential fuel-cell and microturbine systems can receive a 30 percent tax credit for systems placed in service before Dec. 31, 2016.

The state of Kansas offers tax credits for renewable electricity facilities, a revolving-loan program, and a property-tax exemption on renewable energy equipment. Missouri has a sales tax holiday on energy-efficient appliances, a revolving-loan program, state rebates, grants, loan programs and tax deductions for home energy-efficiency improvements.

A recent MARC study estimated that adoption of the 2009 IECC would improve residential energy efficiency by 16 percent, and that these savings would approximately

Johnson County's Sunset Building is LEED Gold certified, and features a walking trail, demountable wall systems and a demonstration garden.

double if the 2012 IECC were adopted in lieu of the current standards. The analysis — which was specific to Johnson County, Kan., due to data availability — estimates that, if all 201,911 homes in Johnson County had been built to the 2009 IECC standards, county residents could have saved an estimated $62.6 million in energy costs. Furthermore, these cost-saving features would have reduced greenhouse gas emissions by 216,200 metric tons. Comparable benefits would likely be identified for other jurisdictions throughout the Kansas City region.

Implementation and effectiveness

Two programs that administer incentive options and foster residential and commercial energy-efficiency improvements are Property Assessed Clean Energy (PACE) and Home Performance with ENERGY STAR. PACE is a financial mechanism that provides easier access to energy retrofits. The proceeds of a PACE bond are provided to commercial and residential property owners to finance energy retrofits, who then repay the financing over 20 years via an annual assessment on their property taxes. PACE bonds can be issued by municipal financial districts or finance companies, and the proceeds can typically be used to retrofit both commercial and residential properties. At this time, the state of Missouri has passed legislation authorizing PACE; the state of Kansas has not.

Home Performance with ENERGY STAR is a comprehensive, whole-house approach to improving energy efficiency. It allows owners to assess their homes through energy evaluations, and then implement retrofits such as insulation, air sealing and HVAC improvements. The program usually provides financial incentives such as tax credits or utility-bill credits for efficiency upgrades. A local Home Performance with ENERGY STAR sponsor — such as a state energy office, utility or nonprofit — is responsible for ensuring quality standards. This typically includes providing specialized training for contractors and conducting quality-assurance inspections to verify that projects are properly completed.

Cost and cost-effectiveness

For the MARC region, net cost savings of $1.9 million, $3.8 million and $9.3 million can be achieved per year if 1 percent, 2 percent and 5 percent of eligible entities participate in an energy-efficiency-incentive program by 2013, 2015 and 2020, respectively. On a net present-value basis, this represents savings of about $32.5 million from 2011 through 2020.

Potential co-benefits

Besides reducing VOC and NOx emissions and saving money, this action also impacts greenhouse gas emissions, comfort, health, employment, productivity and the region's standard of living. Energy-efficient buildings

Table 4. Costs and benefits of energy-efficiency incentives

	2013	2015	2020
VOC reduction (tons/year)	10.3	21.5	55.9
NOx reduction (tons/year)	131.5	267.2	694.7
% eligible entities participating in energy-efficiency programs	1%	2%	5%
Cost (millions/year)	$3.5	$7.2	$19.5
Savings (millions/year)	$5.4	$11	$28.8
Total savings (millions)	$32.6		
Electicity saved (GWh)	10.1		
Natural gas saved (billion Btu)	100.3		

	VOC	NOx
$/ton removed (in millions)	$0.35	$0.028
Potential co-benefits Create new jobs in the energy-retrofit sector; raise standard of living by reducing energy costs; improved level of comfort; reduce sick building syndrome (SBS), asthma and respiratory illnesses; improve worker productivity by 5%; reduction in GHG emissions		

generate significant energy savings compared to baseline building standards, and these energy savings are linked to considerable reductions in greenhouse gas emissions. The cumulative net effect of these energy savings was estimated at 10.1 GWh of electricity and 100.3 billion Btu of natural gas savings in the MARC region from 2011 to 2020.

Although new construction occurs whether a building is efficient or not, retrofits are an additional service requiring qualified workers. The Home Star Program, which provides financial incentives to customers for energy evaluations and retrofits, may create about 168,000 jobs in the U.S.

The average household spends more than $2,200 per year on energy bills, with nearly half of this going to heating and cooling costs. Although energy efficiency can result in substantial savings for the average household, these savings can have an even larger impact on quality of life for low-income households. Although the average household spends approximately 5 percent of its income on energy bills, the average low-income household spends 15 percent, and some households on fixed incomes can spend as much as 35 percent. Savings achieved through more efficient buildings can significantly increase a household's standard of living, with more funds available for food, education or leisure.

Continuing efforts

The region was successful in reducing power-plant emissions by 71 tons per day because KCP&L's La Cygne, Iatan and Sibley plants were all upgraded with selective catalytic reductions (SCRs) and no/low-NOx burners. MARC has led continued efforts to reduce diesel emissions by retrofitting vehicles and equipment with idle-control devices. More than 620 buses have been retrofitted with diesel oxidation catalysts and 224 fuel-operated heaters to reduce emissions from idling school buses.

Retrofitting equipment and vehicles

Diesel-fueled vehicles and equipment have a reputation for reliability, power and longevity. The high cost of diesel engines and their extended lifespan make them ideal for retrofit projects. Since the adoption of the original CAAP, the Kansas City region has made significant strides in reducing diesel emissions by retrofitting vehicles and equipment.

In 2006, EPA's Clean School Bus USA program and the Federal Highway Administration's Congestion Mitigation and Air Quality (CMAQ) program provided additional funding for diesel retrofits. Over the next three years, those funds were used to retrofit 628 older school buses with diesel oxidation catalysts (DOCs) to reduce particulate matter and VOCs from tailpipe exhaust.

In order to comply with tighter emissions-control standards, most diesel vehicles have been equipped with tailpipe-emissions controls as part of the standard manufacturers' specifications since 2004. Tougher standards, implemented from 2004 to 2010, motivated the automotive industry to aggressively research and develop new technology and approaches to controlling emissions. Although tailpipe controls continue to be a critical element in reaching air quality compliance, lower emissions are now achieved through a series of more holistic, system-wide refinements instead of end-user solutions.

Current retrofit activities have expanded to include more idle-reduction technology such as fuel-operated heaters (FOH) on school buses, auxiliary power units (APUs) on over-the-road (OTR) tractor trailers, and automatic engine shutdown/startup devices (AESSDs) on locomotives. These technologies, designed for traditional mobile sources, are heavily relied on to meet the 2013 goal.

An FOH allows engine warm-up and some cab heating from a heater directly fired from the fuel tank, eliminating the need for vehicle idling. An APU, though heavier and more expensive than an FOH, enables a driver to operate electronics and environmental controls through the use of a small generator. An AESSD can be programmed to turn an engine off after a set period of idling, but turn it back on in response to cabin conditions, battery charge or a host of other indicators. This ensures that the locomotive is not left idling for extended periods, but can manage any critical engine-system conditions.

This next generation of retrofit projects has been supported by EPA's National Clean Diesel Campaign funding through the Diesel Emissions Reduction Act (DERA). Over 200 FOHs have been purchased in the Kansas City region with the use of DERA funding, and several school districts — including Blue Springs, Lee's Summit, Independence and Liberty — have made these retrofits a priority.

APUs have been installed on both independent truck-driver operations and on several tractor trailers in fleets of larger trucking companies. APUs provide a flexible source of power that reduces costs and preserves air quality by allowing the driver to

Table 5. Costs and benefits of retrofitting vehicles

	2013	2015	2020
VOC reduction (tons/year)	0.00	3.4	8.5
NOx reduction (tons/year)	63.9	166.1	935.8
% vehicles at 2010 emissions standards or better	4%	8%	20%
Cost (millions/year)	$3.4	$6.9	

	VOC	NOx
$/ton removed (in millions)	$0.046	$0.047
Potential co-benefits Reduction in GHG and particulate matter; improved public health		

sleep in a truck's sleeper compartment without idling the engine. Despite the expense, APUs are becoming popular in the region. BNSF received DERA funding for eight AESSDs with a pending request for five more. The company has committed to keep at least two-thirds of its switcher locomotive fleet equipped with AESSDs, and has privately funded these retrofits.

For all the project partners, the renewed focus on idle-reduction technology supports the region's shared goals of efficient energy use, decreased operational costs and emissions reduction by decreasing the amount of time an engine is running. Industries have been tireless in developing innovative ways to improve emissions that result from operating engines.

Manufacturers straining to meet the 2010 emission standards for heavy-duty vehicles have re-engineered their engines for fuel efficiency and adopted novel approaches to reduce emissions. In addition to modifying engine configurations, new vehicles on the market incorporate advanced diesel particulate filters (DPFs), engine-gas recycling (EGR) and selective catalytic reduction (SCR) technology to achieve compliance. Through engine retrofits such as closed crankcase ventilation (CCV) systems, repowers and engine replacements, older vehicles can be upgraded to a higher standard of emissions compliance.

In addition to on-highway and locomotive traffic, construction equipment is also considered a prime candidate for potential engine replacements and repowers. These types of retrofits will be critical to making progress toward the 2015 goal. Some early opportunities to install these retrofits have been provided via DERA. The Kansas City region has used DERA funding to upgrade engines on two Kansas City Southern locomotives, install CCVs on government fleet vehicles and school buses, and is looking to support engine replacements on construction equipment. These retrofits are considered a natural next step because replacing or retooling an engine is much more cost-effective than purchasing new equipment, and helps achieve emissions reductions years ahead of the normal replacement cycle for such equipment.

Engine replacement or upgrades can be very expensive, and some less expensive retrofit technology alternatives are being employed in the Kansas City region and across the country. Two examples of this are the use of

aerodynamic technologies and low-rolling resistance tires. Although they do not reduce emissions directly, these items enable an OTR tractor trailer to achieve greater fuel efficiency and release fewer emissions. With increasing fuel costs, the relatively low cost of investing in these technologies encourages both independent truck drivers and long-haul companies to invest in them even without grant assistance.

In addition to on-board emissions reduction and idle-reduction technologies, local governments have moved to regulatory controls on idling of heavy-duty vehicles. The current air-quality boundary is under idle reduction rules as a contingency measure from the most recent Ozone Maintenance Plan. Johnson County, Kan., has further restricted idling in its unincorporated areas, and some municipalities within the county have done the same.

Looking ahead

Alternative fuels – CNG/biodiesel

As the region continues to make progress on reducing diesel emissions through retrofits and idle-control measures, community leaders are working to develop physical infrastructure and technical support for clean, alternative fuels. The table on the next page shows emissions reductions compared to gasoline-fueled vehicles. By 2020, it is anticipated that emissions from gas-powered vehicles will be reduced to the level of alternative-fuel vehicles. Despite this prediction, interest remains in diversifying the nation's sources of energy, with a focus on sustainable, clean fuels that are sourced locally.

The Kansas City region has been proactive in pushing adoption of alternative fuels, and has capitalized on the nation's energy concerns. Funding obtained through the American Recovery and Reinvestment Act (ARRA) funding led to the development of 31 new alternative-fueling facilities in the Midwest. While continuing to promote the availability of ethanol and propane, two new additional alternative fuels have begun to achieve broader appeal: compressed natural gas (CNG) and biodiesel.

CNG provides a clean source of energy to power vehicles and equipment, but vehicles must be modified to run on CNG, and filling infrastructure must be available. Through a combination of CMAQ and Department of Energy (DOE) funds, the city of Kansas City, Mo., and the Kansas City, Kan., School District have developed substantial fleets of CNG-powered vehicles and the necessary fueling infrastructure. Johnson County, Kan., is also evaluating developing CNG capacity.

As local governments embrace the CNG alternative and demonstrate its value and viability, the private sector and individual citizens will become less skeptical of this option, and private investment may follow. Despite interest in developing the Kansas City market, public CNG station developers still feel the critical threshold of potential buyers has not yet been reached.

Unlike CNG, biodiesel is a more widely available commodity is in the Kansas City region. Moving to 20 percent or higher biodiesel blends would reduce emissions and be a more sustainable form of fuel. The question surrounding biodiesel is the amount of blending that should occur in order to reduce potential performance problems related to high concentrations of biodiesel. In warm temperatures, a high concentration poses little risk, but as temperatures drop, biodiesel can gel and clog an engine. Individuals who have experienced this problem have clearly impacted the market by sharing their accounts with others. Efforts to educate operators about the extent of the problem and how to prevent it have been largely successful. However, lingering concerns with temperature have influenced

Table 6. Costs and benefits of CNG/biodiesel vehicles

	2013	2015	2020
VOC reduction (tons/year)	0.01	0.00	0.00
NOx reduction (tons/year)	0.52	0.72	0.00
% CNG/biodiesel vehicles	4.2%	7%	14%

Table 7. Costs and benefits of electric vehicles

	2013	2015	2020
VOC reduction (tons/year)	1.2	0.9	1.6
NOx reduction (tons/year)	0.5	−0.3	−1.4
Miles to a charging station	75	45	15
% electric fuel vehicles	1.8%	3%	6%
Cost (millions)	$7.6		

	VOC
$/ton removed (in millions)	$1.1
Potential co-benefits Reduction in GHG and particulate matter; improved public health	

blenders to decrease the amount of biodiesel in their blends. As additive technology improves and positive experiences accumulate, those fears will most likely be allayed, and fleet owners will be more confident about using greater concentrations of biodiesel.

Alternative fuels – electric vehicles

Although biodiesel and CNG already have a firm foothold in the region, another alternative capturing attention in the Kansas City region is the development of electric vehicles and supporting infrastructure. The Plug-In Readiness Initiative is adapting lessons learned from around the country to plan for mass availability of plug-in electric vehicles in the Kansas City region. The initiative intends to ensure that sufficient charging infrastructure is in place across the region to support the needs of an emerging market for electric cars, and promote the advantages of electric-car ownership to the region's citizens. It also alerts consumers to the limitations of plug-in electric vehicles, encourages vehicle manufacturers to direct vehicles to the Kansas City area for sale, and makes sure that sufficient technical expertise is available to maintain and service these vehicles. Although electric cars are not yet widely available, some initial infrastructure has been put in place with the help of the Department of Energy and KCP&L, allowing early adopters of the technology to test its viability.

Expanding the electric-car market is viewed as a way to reduce emissions and facilitate a nationwide move toward energy independence. The table on this page compares electric vehicle emissions to emissions from gasoline-powered vehicles, assuming that 6 percent of the regional population drives an electric vehicle. VOC emissions are expected to be near zero with an electric car; however, the increased amount of NOx reflects the emissions released by the coal-based power plants needed to generate the electricity used to charge an electric car.

Synergies

The CAAP's focus on sustainability identifies strategies that have multiple, synergistic outcomes that provide benefits to air quality, public and environmental health, community and economic development, and social equity. The four strategies identified create multipurpose, multipollutant and multisector benefits through the application of an integrated, holistic approach.

Overall, the CAAP should be considered to be embedded within the larger Regional Plan for Sustainable Development. In this context, strategies to improve regional air quality are fundamentally interrelated with other efforts that address transportation, land use, green infrastructure, waste reduction, energy efficiency and conservation, housing, climate protection and economic development. In every instance, the goal of simultaneously enhancing the vitality of the community's economic, environmental and social systems should drive the formulation and application of policies, plans and programs.

During the CAAP development process, the CAAP Working Group identified three areas as having substantial synergistic benefits that were not easily quantified. These include waste management, water efficiency and conservation, and integrated transportation, land-use and environmental planning (e.g., *Transportation Outlook 2040*). The descriptions that follow briefly summarize those areas of practice, and suggest potential next steps for developing and implementing activities that benefit those areas.

Waste management

Waste reduction, recycling and reuse are embraced regionally and nationally as fundamental to sustainable community-development strategies. The MARC Solid Waste Management District, together with many regional partners, established an aggressive goal to divert 80 percent of waste from area landfills by 2023. A diverse set of strategies have been identified to achieve this goal through efforts focused on residential, commercial, institutional and construction/demolition waste streams.

The strategy embraces emerging concepts — such as sustainable-materials management, green building and industrial ecology/by-product synergy — to help achieve overall goals. Although direct links between waste diversion and air quality are often difficult to quantify because of the lack of life-cycle analyses, clear consensus exists on the multiple benefits associated with waste diversion efforts.

Implementation of the district's sustainable solid-waste management strategy will rely on a variety of strategies in the coming decade. In every instance, these strategies will be framed to provide multiple community benefits.

Water efficiency and conservation

A clear nexus exists between energy, water management and air quality. Water treatment is one of the community's largest energy users, resulting in substantial NOx and other emissions. Water conservation, efficient use and reuse, and integrated water-resource management provide opportunities for multiple community benefits — from improved air quality to energy conservation and natural-resource protection.

Water conservation intersects with the CAAP's focus on green infrastructure, urban forestry and native vegetation. Benefits from this approach include reducing urban heat islands, reducing VOC emissions associated with chemical applications for landscaping and reduced ozone formation.

The development of new strategies to support efficient water use and water conservation will

Native plantings, such as the rain garden above, reduce runoff, increase soil infiltration and benefit air quality.

be explored in tandem with regional efforts to conserve green infrastructure and to facilitate more integrated water-resource management at the regional and watershed scales.

Transportation Outlook 2040

Sustainable community design derives from a vision of more integrated land-use, transportation and environmental planning. The region's long-range transportation plan, *Transportation Outlook 2040*, reflects a clear commitment to this vision. Air quality clearly benefits from this approach. Implementation of the region's long-range transportation plan offers opportunities to integrate transportation and strategies that protect air quality in creative ways. Support has been articulated for new concepts embedded in this plan, such as ecosystem-based "above-and-beyond" mitigation; sustainable urban design and place-making; transit-oriented development and climate protection. Integrated implementation efforts will continuously strive to maximize "triple-bottom-line" benefits.

Conclusion

At the writing of this update, the Kansas City region is expected to be designated as a nonattainment area under a new eight-hour ozone standard. It is unclear what new regulations and requirements will be associated with that designation, but the intent is that these strategies will help inform the development of potential State Implementation Plan (SIP) strategies and voluntary measures. The CAAP is part of a larger regional sustainability strategy; the synergies that occur when integrating planning far outweigh the benefits of individual program work.

This plan continues to be the primary resource for voluntary, clear, actionable steps that improve the region's air quality. With subsequent evaluation and future updates, the plan will continue to evolve and address the needs of a vibrant, connected and green region.