A Climate Action Plan

To Save Energy and Reduce

Greenhouse Gas Emissions

20% by 2015

Phase 1

City of Creve Coeur, Missouri

2010

Credits and Acknowledgments

The Creve Coeur Climate Action Task Force prepared this Plan. Members of the task force are:

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Executive Summary

On April 2, 2008, the Creve Coeur City Council passed a resolution committing Creve Coeur to the process of reducing its energy use and greenhouse gas emissions. In doing so, Creve Coeur joined a group of more than 950 local governments across the nation that have formally committed to take action to address these twin problems.

To accomplish these goals Creve Coeur began a five-step process: 1) Make a formal commitment by signing the U.S. Mayors' Climate Protection Agreement; 2) Conduct a Greenhouse Gas Emissions Inventory; 3) Set an Emissions Reduction Target and develop a Climate Action Plan to achieve that target; 4) Implement the Climate Action Plan; and 5) Monitor progress and amend the plan as needed.

Mayor Harold Dielmann signed the U.S. Mayors' Climate Protection Agreement April 14, 2008, and the Greenhouse Gas Emissions Inventory was completed on August 15, 2008. The inventory indicated that in 2005, the Creve Coeur municipal government used 34.1 billion Btu of energy in its operations, costing $476,049, and emitting 3,973 metric tons CO2e[1] of greenhouse gasses. In 2005, the Creve Coeur community as a whole used 6.98 trillion Btu, emitting 794,962 metric tons CO2e of greenhouse gasses.

In September 2008, the Creve Coeur City Council adopted the findings and recommendations of the Greenhouse Gas Emissions Inventory and established the Climate Action Task Force (CATF). The CATF was charged with the third step in the five-step process: setting an emissions reduction target and developing a Climate Action Plan that is flexible and dynamic, and that is periodically revised.

The CATF recommends that Creve Coeur adopt a goal of reducing energy use and greenhouse gas emissions 20% by 2015. We recommend that Creve Coeur pursue a phased campaign to achieve these reductions. Table 1 describes the first three phases of the plan as the CATF envisions them. As the plan will need to be a living document that grows and changes with Creve Coeur's progress towards its goal, future iterations of the plan may amend and/or add phases.

Table 1: Phases of the Climate Action Plan

Phase 1: Build awareness, knowledge, capacity, and commitment for reductions in energy use and greenhouse gasses. Implement high-profile initiatives that promote those goals. Pursue easy and cost-effective strategies to reduce energy use and greenhouse gas emissions in municipal operations. Lead by example.
Phase 2: Continue Phase 1, but also undertake more complex and ambitious initiatives to make reductions. Lay the groundwork to encourage the community as a whole to make reductions.
Phase 3: Continue initiatives started under the previous phases. Implement more ambitious initiatives that involve more significant change in both municipal operations and the community as a whole.

This document presents the rationale for the overall plan, the recommended target for greenhouse gas reductions, and the specific strategies recommended for Phase 1. Where possible, the CATF has attempted to provide rough estimates of GHG reductions and costs. We must emphasize, however, that many of the recommended strategies are enabling and empowering strategies. Actual results are difficult to estimate, and will depend on many factors that cannot be known in advance. The twelve recommended strategies are listed in

[1] CO2e is a standard measure of global warming effect, not weight. Different gasses have global warming effects that vary in strength. The global warming effects of other gasses are converted to a standard measurement based on the amount of CO2 it would take to have an equivalent effect. This allows the amounts for all of the gasses to be summed and presented as a single number.

Table 2, along with estimates of the amount of greenhouse gas abated, the cost to implement the strategy, and yearly savings on energy costs. A single list of all the major recommendations in this report is provided in Appendix 2.

Table 2: Recommended Reduction Strategies					
Measure	Status	Estimated CO2 Reduction (Metric Tons Municipal Operations / Community)	Estimated Annual Cost Savings ($) (Municipal Operations)	Estimated Implementation Costs ($) (Municipal Operations)	Payback (Municipal Operations)
Phase 1					
Municipal Operations					
Green Progress Reports	Proposed	119 / 7,950	7,010	Minimal	< 1 yr.
Municipal Staff Green Team	Implemented	119 / na	7,010	Minimal	< 1 yr.
Incentivize Reductions	Proposed	119 / na	7,010	Depends on program design	Depends on program design
Staff Training	Proposed	119 / 39,748	7,010	From minimal to above 10,000	From <1 yr. to 2 years
Green Purchasing Policy	Implemented	199 / na	11,684	Minimal	< 1 yr.
Municipal Moderation of Current Emissions					
Missouri Renewable Energy Standard	Implemented	139 / 21,851	Unknown	na	na
Municipal Buildings					
Energy Audits for Municipal Buildings	Proposed	0 / na	Unknown	18,000	Unknown
Upgrade HVAC and Hot Water Systems at Government Center	Proposed	103 / na	4,180	Unknown*	Unknown*
Community Buildings					
Develop List of Energy Auditors	Proposed	na / unknown	0	Minimal	na
Community Education					
Public Education Campaign	Proposed	na / na	na	Unknown	Unknown
Develop Display Promoting City's Reduction Efforts	Implemented	na / na	na	Minimal	na
Community Moderation of Current Emissions					
One Person – One Bulb Program	Proposed	0 / 1,048	na	Unknown	na
Total Reductions		917 / 70,597			
Reductions Recommended by 2015		795 / 158,992			
Percent Achieved		115% / 44%			

Costs based on cost analyses in the 2005 Creve Coeur Greenhouse Gas Emissions Inventory. "na" = "not applicable."

* Capital project, costs and savings will depend on recommendations of energy audit.

Introduction

The Industrialized nations of the world consume a tremendous amount of energy produced by burning fossil fuels: petroleum, coal, and natural gas. The impact of two forces, dwindling non-renewable resources (e.g. Peak Oil) and climate change, have led the world to re-evaluate the monetary and air quality costs of burning fossil fuels.

As demand for oil products has increased worldwide we have historically been able to increase the rate at which we produce oil. As demand continues to rise; however, the rate at which we produce oil is expected to encounter limitations based on irremediable geological factors that go beyond economic or political factors. The point in time at which the maximum of oil production is reached, and starts to decline is called Peak Oil. Most experts predict that we will encounter Peak Oil within the next two decades, and some believe that we may already have reached that point in time. When Peak Oil is encountered a great deal of oil will still be produced each year, but it will be more expensive to extract. An imbalance between supply and demand will occur, driving up the cost of all types of fuels. The increased costs are likely to cause burdens that will occur throughout the world economy, but which will fall less heavily on those who have already found ways to reduce their consumption of energy derived from fossil fuels by adopting conservation measures and innovative use of alternate sources of energy.

Climate change is a different problem that is related because it, too, derives from our intensive use of fossil fuel. Over the last century or more, the temperature of the earth has warmed. If the earth continues to warm, the increase in temperature will cause significant changes in climate. These changes are difficult to predict at the regional and local level, but most scientists predict that they will cause significant disruption, and perhaps even hardship. Greenhouse gasses, especially carbon dioxide released into the atmosphere when fossil fuels are burned to create energy, are by far the largest impact from human activity on climate change. To reduce the contribution to climate change caused by human activity, we need to reduce the amount of greenhouse gasses we release into the atmosphere. The most effective means for doing so is to reduce the intensity with which we use fossil fuels. We can reduce our use of fossil fuels by increasing our energy conservation and efficiency, and by developing alternative sources of energy.

The twin problems of Peak Oil and Climate Change also provide an opportunity. Because energy is costly, and because we waste a great deal of energy, reducing our energy use can result in significant cost savings. These cost savings are distributed throughout the economy, so the result of any one project is small. Aggregated together, however, the savings are quite significant. A number of studies have indicated that many opportunities can be accessed at a net profit.

This document first summarizes the problems and opportunities. Then it describes the initial steps Creve Coeur has undertaken to date. Then it presents Phase 1 of a three-phase plan to address these twin problems and access the opportunities they present. The Climate Action Plan has been developed for presentation to the Creve Coeur City Council by the Climate Action Task Force in open meetings from October 2008 to February, 2010.

Problem: Peak Oil

Oil is primarily refined into fuel for transportation, but is also used for space heating and to fuel industrial processes. Coal is burned primarily to generate electricity. Natural gas is used for space heating, cooking, and industrial processes.

In 2008, world consumption of crude oil was 3.9 billion metric tons – more than 26 million swimming pools full. Coal consumption was 6,781 million metric tons – a square pile four miles on a side and as tall as the Gateway Arch. And in 2008 the world used 291 billion cubic feet of natural gas – a circular tank of gas five miles across and as high as the Gateway Arch – *every day!* (BP Inc., 2009) To satisfy world demand, for every unit of energy we produced in the 1960s we now have to produce almost three. As nations around the world – Brazil, Russia, India, and China – develop modern economies, the demand will continue to grow.

Fossil fuel must be mined, drilled, and pumped out of the ground. Given the huge amount we use, it is easy to see that we have to do a lot of mining, drilling, and pumping. These are large processes, often in locations that are challenging, environmentally sensitive, or geopolitically problematic. The world supply of fossil fuel is large, but not infinite. We must be concerned with the total amount of recoverable reserves in the ground, but we must also be concerned with the rate at which we can extract them from the ground, especially oil.

The natural history of oil fields has shown that as they are developed, the rate at which oil is produced from them increases. At some point, however, a maximum rate of production is reached. Thereafter, the rate at which oil can be produced declines. If overall world production is to remain the same, new oil fields have to be discovered to make up for declining production in older fields. However, the peak in oil discovery occurred between 1950 and 1970, and has declined since then. The very large oil fields discovered then are now reaching the age at which most fields begin to decline. Thus, many experts predict that total world oil production is now peaking, or will do so in the next two decades. It is already declining everywhere in the world outside of the Middle East.

Peak Oil does not mean that the world will suddenly run out of oil. However, if world oil production is unable to match demand, market imbalances will occur, leading to severe price increases in fuels derived from crude oil. In addition, because the price of oil has a significant influence on the price of other types of fuel, such as coal and natural gas, Peak Oil is likely to cause increases in the cost of those fuels, as well. The result will be economic stress that will fall most heavily on those who continue to use fossil fuel intensively.

Using secondary and tertiary extraction techniques, attempts can be made to slow the decrease in production experienced at oil fields. In addition, alternative sources of oil can be developed (such as the Canadian oil sands), and to some extent, coal and natural gas derivatives can be substituted to fill in the shortfall in oil. But they each have serious drawbacks. They are more expensive, environmentally unacceptable, or in some cases, technological dreams that have yet to be realized.

It is likely, therefore, that we are entering an epoch in which procuring fossil fuel supplies will become increasingly problematic and expensive. To paraphrase Nobuo Tanaka, the Executive Director of the International Energy Agency, the era of cheap energy is over. Creve Coeur, like other municipalities across America and around the world, is faced with preparing for a new, different energy epoch.

Problem: Climate Change

One of the larger problems related to our intensive burning of fossil fuel is climate change.

Climate change is caused by the greenhouse effect. Perhaps the most familiar demonstration is a car with its windows rolled up on a sunny summer day. Sunlight streams through the windows striking the interior of the car. Sunlight is converted to heat and re-radiated back towards the outside. Glass allows light to pass through, but not heat. Thus, the heat gets trapped inside the car. It may be only 85° outside, but 110° inside.

Greenhouse gasses have the same effect on the earth's temperature that the glass does on the temperature in the car. Sunlight penetrates the atmosphere to reach the earth's surface. The earth absorbs much of the sun's energy, creating the warmth needed for life, and radiates the rest back into the atmosphere. But if the heat is blocked by greenhouse gasses, instead of escaping into space, the heat is reflected back towards the earth, warming the earth above the historic normal temperature.

The three most important human-emitted greenhouse gasses (GHGs) are carbon dioxide, methane, and nitrous oxide. Of these three gasses, carbon dioxide causes about four times as much global warming as the other two combined. The reason is that fossil fuel consists mostly of hydrogen and carbon: when we burn fossil fuel, we release carbon dioxide into the atmosphere. Because we burn staggering amounts, we emit staggering amounts of carbon dioxide, and we do it year after year.

Because climate processes are very complex, the specific effects of climate change are difficult to predict on the regional level, much less the local level. However, there is a large majority of scientific opinion that the changes are very likely to be substantial and disruptive if they are allowed to continue without abatement. (Solomon, et al., 2007) The few recent studies that have focused on Missouri predict that climate change is likely to bring Missouri increased precipitation during the winter and spring, exacerbating the flooding that already often occurs at these times. Additionally, they predict less precipitation during the summer, exacerbating those dry periods that often occur. The number of days in St. Louis with temperatures above 90° are predicted to increase from 36 each summer to over 100. That is the entire summer! Days over 100° are predicted to increase from two or three each summer to more than 40. For comparison, in 2008, Tucson, Arizona had fewer than 20 days over 100°! Such heat causes many problems, including air quality problems in large cities, increased respiratory illness and heat-related death, water quality problems in many locations, and crop failures from heat stress. (Union of Concerned Scientists, 2009)

Human activity may not cause all of the warming that has been observed, but the contribution of human activity is a factor. We are almost certain to cause more global warming if we continue our current energy practices. However, if we reduce our greenhouse gas emissions, the consequences can be moderated and ameliorated. (Solomon, et al., 2007; Creyts, Derkach, Nyquist, Ostrowski, & Stephens, 2009)

Opportunity: An Energy-Smart Economy

The common denominator between Peak Oil and Climate Change is that they are both related to the staggering amount of fossil fuel we burn to create energy. Thus, both problems can be addressed by reducing our use of fossil fuel. Because energy has been cheap and plentiful, there has never been a strong motivation to conserve, become more efficient, or develop alternative sources.

Energy inefficiency abounds throughout our economy. More than half of the energy created in the United States is wasted before it ever reaches the end user. (Lawrence Livermore National Laboratory) Once energy arrives at the end user, additional waste occurs. For instance, an incandescent light bulb uses only about 10% of the energy it receives to create light. The other 90% is wasted, lost as heat that goes unused. Yet incandescent bulbs remained the standard in the U.S. for over 100 years.

Creve Coeur has a tremendous opportunity to build an energy-smart economy. We believe that doing so will result in substantial benefits to our City: energy and financial savings, better quality housing, better transportation choices, reduced congestion, new businesses, new employment opportunities, healthier citizens, and a more close-knit community.

There is no one action that will establish the energy-smart economy. Rather, there are many opportunities, each of which achieves part of the goal. Recent national studies have indicated that we can avail ourselves of many of them at a net financial profit, and of others at an affordable cost that is small compared to the costs of climate change. (Creyts, Derkach, Nyquist, Ostrowski, & Stephens, 2009)

What is really needed is a new "bottom line." Most governments, businesses, and individuals make financial cost an important element of most decisions. It may not be the only consideration, but it is rarely ignored. Similarly, governments, businesses, and individuals need to make energy use an important element of most decisions. It should not be the only consideration, but it but it needs to be considered with each decision.

Creve Coeur's Climate Action Process

Creve Coeur's Mayor and City Council understand the interrelationship among dwindling sources of energy, climate change, and an energy-smart economy. During the spring of 2008, Creve Coeur made a commitment to curb GHG emissions. At that time, the City joined the ICLEI Cities for Climate Protection Program,[2] committing itself to a five-step process:

1. Make a formal commitment to reducing GHG emissions. On April 14, 2008, with the City Council's approval, Mayor Harold Dielmann signed the U.S. Mayors' Climate Protection Agreement, becoming one of 950 communities to have done so.

2. Undertake an inventory of Greenhouse Gas Emissions. The Creve Coeur Greenhouse Gas Emissions Inventory was completed August 15, 2008, and accepted by the Mayor and the City Council on September 4, 2008. Creve Coeur was the first local government in the St. Louis Region to complete an inventory.

3. Set a GHG reduction goal and develop a Climate Action Plan to achieve that goal. The City Council established a Climate Action Task Force (CATF) and charged it with recommending to the Mayor and City Council a comprehensive Climate Action Plan, and with assisting the City in learning and implementing GHG abatement strategies. While such a plan will need to be a dynamic plan – amended, revised, and extended over the years – the current document represents a partial completion of the first version.

4. Implement the Climate Action Plan. Some efforts to "green the City" were already underway when the Greenhouse Gas Emissions Inventory was undertaken. As it was being completed and the Climate Action Plan developed, interest in reducing GHG emissions and energy use continued to grow, resulting in the implementation of a variety of energy saving strategies. A list of strategies Creve Coeur has already pursued is presented in Appendix 3.

5. Evaluate results, celebrate accomplishments, and amend the plan as needed. The Greenhouse Gas Emissions Inventory suggested that overall results be evaluated by conducting a new Greenhouse Gas Emissions Inventory in 2015. This date was chosen to give the City sufficient time to design and implement the beginning phases of its Climate Action Plan.

The Creve Coeur Recycling, Environment, and Beautification Committee (REB) formed a Cool Cities Subcommittee to pursue the Greenhouse Gas Emissions Inventory. Creve Coeur joined ICLEI-Local Governments for Sustainability, a nonprofit organization dedicated to assisting local governments take action on climate change. Creve Coeur obtained a summer intern from the Earth and Atmospheric Sciences Department at St. Louis University. Under the guidance of the REB Committee and Jaysen Christensen, Assistant to the City Administrator,

[2] ICLEI-Local Governments for Sustainability is a nonprofit organization that, through its Cities for Climate Protection program, provides technical assistance, training, and capacity building to local governments that wish to reduce their impact on climate change.

and following the protocols and processes recommended by ICLEI, the inventory was conducted and the report was written.

The Creve Coeur Greenhouse Gas Emissions Inventory provided information about energy use and greenhouse gas emissions for the operations of the municipal government and for the community as a whole. Municipal government is a subset of community as a whole in this study. The inventory was able to break down information in terms of economic sector and fuel source, it was able to study municipal energy costs, and in some cases, it was able to study the emissions of specific municipal buildings or operations.

The Creve Coeur community used 6.98 trillion Btu of energy causing the emission of 794,963 metric tons $CO2e$[3] of GHG in 2005. On a per capita basis, our GHG emissions were roughly double the U.S. national average and 68% higher than the Missouri average, (Larsen, Damassa, & Levinson, 2007). They were more than double those of Kirkwood (Heneberry & Moriarty, 2009) and about half-again as large as those of Columbia. (City of Columbia, Missouri, 2007)

Creve Coeur's Transportation Sector accounted for almost half of the community's energy use, with the Commercial Sector accounting for somewhat less than one-third. The Commercial Sector accounted for 42% of GHG emissions, however, with Transportation second at 34%. The reason that the Commercial Sector used less energy but emitted more GHGs relates to the different fuel sources. Transportation fuel is primarily gasoline and diesel fuel. The energy used in the Commercial Sector is primarily electricity, which in Missouri comes mostly from burning coal. Coal is the fuel that emits the highest amount of carbon dioxide.

The Greenhouse Gas Emissions Inventory revealed that in 2005 Creve Coeur government operations used 34.1 billion Btu of energy, at a cost of $476,049, and emitted 3,973 metric tons CO2e of GHG. About half of the energy use came from municipal buildings, which (again, because electricity is the principal energy), accounted for over 60% of our GHG emissions. The City's vehicle fleet and the energy used by employees making their daily commute each accounted for about 21% of the City's energy use and just over 14% of its emissions (combined 42% of energy use and 29% of emissions).

In the future, assuming that the intensity of energy use and greenhouse gas emissions does not increase, the report forecast that Creve Coeur's energy use is expected to grow in parallel with the City's population. That is expected to be slow, resulting principally from infill development. The Greenhouse Gas Emissions Inventory forecast that by 2015, unless steps are taken to reduce GHG emissions, they will grow 9% to 868,363 metric tons CO2e.

The Mayor and the City Council accepted the Greenhouse Gas Emissions Inventory on September 4, 2008, and passed a resolution forming a Climate Action Task Force (CATF). The Task Force began meeting October 29, 2008. It was charged with developing a plan to reduce energy use and GHG emissions in Creve Coeur, and with assisting the City in implementing reduction strategies. Membership of the CATF included members active in facilities management, governmental affairs, green building, public relations, resource conservation and recycling, plus a State Representative, a City Council Member, business owners, and several members of the general public.

[3] CO2e is a standard measure of greenhouse effect, not weight. Different gasses have greenhouse effects that vary in strength. The greenhouse effects of other gasses are converted to a standard measurement based on the amount of CO2 it would take to have an equivalent effect. This allows the amounts for all of the gasses to be summed and presented as a single number.

In addition, City staff and officials have been pursuing opportunities to reduce emissions on an ad hoc basis. A list of actions to reduce greenhouse gas emissions and energy use undertaken to date is provided in Appendix 3.

The Climate Action Plan

Greenhouse Gas Reduction Goals

The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) found that an increase in average global temperature of more than 4.3°F is associated with an increased likelihood of severe climate change impacts. The IPCC found that in order to stabilize average global temperature at no more than a 4.3°F increase, a reduction in GHG emissions of 50-85% by 2050 would be required. This number is not precise, but it is the current best estimate. In addition, the IPCC has emphasized that the sooner GHG emissions are reduced, the easier it will be to stabilize climate change, and the less drastic future reductions will need to be to prevent severe climate change. (Metz, Davidson, Bosch, Dave, & Meyer, 2007)

Table 3: GHG Reduction Goals (metric tons CO2e)

	Community Reductions	City Reductions
Current levels	794,963	3,973
By 2015 (20%)	158,992	795
By 2050 (50%)	397,482	1,987

We believe that Creve Coeur should follow the best available scientific estimate and set a greenhouse gas reduction goal of 50% below 2005 levels by 2050. By then, additional data should shed light on whether additional reductions will be required.

We believe, however, that 2050 is too distant a target to serve as an effective focus for the Climate Action Plan. We recommend that Creve Coeur adopt an interim target date that is sufficiently distant to give the City time to implement the strategies in the Climate Action Plan, yet near enough to provide a focus. We recommend the City adopt 2015 as an interim target date and 20% as a reduction goal for that year.

Challenges and Basic Strategies

The opportunities to reduce greenhouse gas emissions and energy use become obstructed for numerous reasons. First, the larger goal is fragmented among many smaller opportunities. They are spread through virtually every sector of the economy and every facet of operations. Second, most of the opportunities require an initial capital outlay while cost recovery is spread over the life of the project. Even when strategies ultimately result in substantial net profit, the initial outlay may seem too large when profit may be several years in the future. Third, reducing GHG emissions and energy use are rarely the primary focus of any one entity in the economy. The opportunities are diffused across millions of organizations and individuals and not focused into concentrated beneficiaries. And fourth, savings resulting from GHG and energy use reductions may be difficult to quantify and measure. This reduces confidence in forecasts and impairs attempts at economic justification. (Creyts, Derkach, Nyquist, Ostrowski, & Stephens, 2009)

In addition, the opportunities to reduce GHG emissions and energy use may encounter obstructions that are specific to individual situations. First, several parties may be required to access the opportunity, but incentives may be split among them. The tenant-landlord problem is a classic example. Second, ownership may transfer before benefits are realized, reducing motivation to pursue reductions. Third, there may be incidental costs that cannot be reliably identified. Fourth, there may be regulatory obstructions. For instance, in some jurisdictions, obsolete municipal codes and/or restrictive neighborhood covenants have obstructed access to opportunities. Fifth, the individuals and bodies responsible for decisions may not be aware of available opportunities. Sixth, entrenched habits and customs may obstruct opportunities. Seventh, there may be elevated hurdle rates. An example would be the price premium often assigned to "green" products, even when they may be less expensive to produce. Eighth, there may be adverse bundling. In other words, the desired energy-reducing feature may only be offered with other expensive features that are not desired. Ninth, capital constraints may obstruct access to needed funding. Because opportunities so often require an initial outlay and return the investment over time, they can be facilitated by access to capital markets. But if financial mechanisms do not exist, or if there are disruptions in capital markets, it can obstruct access to the necessary capital. Tenth, because these are not yet mature markets, there may be limited product availability. And eleventh, because these are often relatively new technologies with which traditional markets may not be familiar, improper installation and use may interfere with realized benefits. (Creyts, Derkach, Nyquist, Ostrowski, & Stephens, 2009)

Until recently there has been little motivation to reduce GHG emissions and energy use. Climate change and peak oil have recently increased motivation, and many opportunities can be pursued at a net profit or small cost. However, the obstructions reviewed above have made access to the opportunities difficult.

We believe that market dynamics can become a powerful force helping Creve Coeur to

Table 4: Obstructions

General

1. Opportunity fragmented
2. Opportunity requires initial capital outlay
3. Opportunity unfocussed
4. Opportunity difficult to quantify

Situation-Specific

1. Split-incentives
2. Ownership transfer
3. Unidentifiable incidental costs
4. Regulatory obstructions
5. Decision-makers unaware of opportunity
6. Custom and habit
7. Elevated hurdle rates
8. Adverse bundling
9. Constraints in capital markets
10. Limited product availability
11. Improper installation or use

Source: Granade et al. (2009). Unlocking energy efficiency in the United States.

Table 5: Phases of the Climate Action Plan.

Phase 1:
The City focuses on building awareness, knowledge, capacity, and commitment for reductions in energy use and greenhouse gasses. These are the foundation upon which all other efforts depend. The City undertakes a couple of high-profile initiatives that promote those goals. And the City implements easy and cost effective strategies to reduce energy use and greenhouse gas emissions in municipal operations. In Phase 1 the City focuses on leading by example, making its own reductions before asking the community to do so.

Phase 2:
The City continues Phase 1, but also begins to undertake more complex and ambitious initiatives to make reductions. In addition, in Phase 2 the City lays the groundwork to encourage the community as a whole to make reductions.

Phase 3:
The City continues to pursue initiatives started under the previous phases, and begins to pursue more ambitious strategies that involve more significant change. The City implements strategies to encourage the community to make reductions, beginning with inexpensive and easy to accomplish strategies and proceeding to more ambitious ones.

achieve greenhouse gas and energy use reductions. We believe that the City of Creve Coeur should take an active role in eliminating and overcoming the obstructions, thereby unlocking opportunities and making market forces our allies. We believe that by unlocking these opportunities, and by focusing on cost-effective, easy to implement strategies first, a significant portion of the needed reductions can be achieved at relatively little cost and possibly at a net profit. Meanwhile, technological progress, as well as increased knowledge and experience with energy conservation, energy efficiency, and alternative energy sources will facilitate accomplishing the remainder and reduce its cost. We recommend, therefore, that the City of Creve Coeur pursue a phased climate action plan, (see Table 5).

The specific strategies included in the Climate Action Plan have been drawn from a variety of sources. We attended presentations and seminars, reviewed the Climate Action Plans of 11 other cities, and we gathered information from documents prepared by organizations such as the United States Government, ICLEI, the Natural Capital Institute, the McKinsey Corporation, the Sierra Club, and FOCUS St. Louis. For organizational purposes, we have grouped the strategies under a number of sectors.

Phase 1

One of the most effective directions Creve Coeur can pursue is to encourage city staff and officials to take responsibility and initiative to discover, pursue, and implement energy savings and GHG reductions. A number of individuals within the City are already motivated and actively pursuing reductions. However, to facilitate and maximize effectiveness, the City must put in place policies that systematically support such efforts. Such support is truly the foundation upon which everything else depends. By systematically supporting, organizing, and incentivizing staff efforts to reduce GHG emissions and energy use, the City will reap benefits throughout the life of this plan, in virtually every strategy contained herein.

Many of the most effective strategies in the plan will not be easily visible to the public, and, therefore, they will not generate the "buzz" needed to sustain public involvement. Thus, some high-profile strategies will be needed. Such strategies will help to bring the issue to public awareness in a sustained fashion, and demonstrate the City's commitment.

With each strategy we have attempted to provide its current status, and estimates of its cost, its effect, and the amount of reductions achieved. These estimates were based on emission, energy use, and cost estimates from the Creve Coeur Greenhouse Gas Emissions Inventory. A few of the strategies permitted direct calculation of greenhouse gas emission reductions (the Missouri Renewable Energy Standard, for instance). Many of the strategies are enabling and empowering strategies, however, the results of which are impossible to forecast. For these strategies, the actual results achieved will depend on many future factors that cannot be predicted, such as opportunities that present themselves to the City, budget constraints, the availability of facilitating regional, state, or national programs, and technological advancement. For these kinds of strategies, percentage reductions that seemed reasonable to the CATF have been assumed. The numbers should be taken as rough estimates rather than as precise forecasts.

Table 6: Phase 1 GHG Emission Reductions

	Municipal Operations	**Community**
Estimated	917	70,597
Goal (2015)	795	158,992
Percent achieved	115	44

Municipal Operations

Reports to City Council

If reducing GHG emission and energy use is to be a fundamental value that is pursued consistently on a citywide basis, then it will need to be a value that is communicated and monitored in an ongoing basis at the highest level. We recommend that the City Council pass a resolution asking the City Administrator to include in the annual report progress on reductions in GHG emissions and energy use. In addition, we recommend that the City Council establish a procedure to receive less formal interim reports on reductions from the City Administrator on a quarterly basis.

We further recommend that the City Council ask all City committees, commissions, and task forces to submit a report to City Council describing their accomplishments, plans, and programs to help the City achieve its GHG and energy use reduction goals. Progress towards these goals should become an element of every committee and task force annual report.

Status: To be implemented.

Cost: Zero to minimal.

Effect: This strategy will help to bring reducing GHG emissions and energy use to awareness throughout the municipal government, communicating that it is a fundamental value that is to be pursued at all levels. The strategy will keep the issue before City officials at all levels in a sustained way over time, and it will provide City Council timely information on progress toward GHG emission and energy use goals.

Reductions: This strategy does not directly achieve reductions. It organizes the City and motivates staff and committee members to consistently pursue emission-reducing strategies. This strategy is estimated to indirectly lead to a 3% reduction in municipal emissions (119 metric tons). It is estimated to indirectly lead to a 1% reduction in community emissions (7,950 metric tons).

Form a Green Team

Many cities and commercial organizations nationwide have found that pursuing reductions in energy use and greenhouse gas emissions requires initiative, creativity, and a coordinated approach across traditional departmental boundaries. Some cities, for instance Kansas City, are sufficiently large to create dedicated staff positions or even departments to pursue climate action. Smaller municipalities have found that forming a regularly meeting staff committee to coordinate, encourage, and facilitate efforts has been an essential strategy. These committees are often called “Green Teams.”

A Green Team can be formed by City staff without direction from City Council, and indeed, one has already formed in Creve Coeur and conducted its first meeting. We believe, however, that the importance, regularity, and continuation of a Green Team can be enhanced if it becomes official City policy. Thus, we recommend that the Creve Coeur City Council pass legislation establishing a Green Team consisting of representatives from each city department, to meet on a regular, ongoing basis.

Status: Implemented, needs confirmation.

Cost: Zero to minimal.

Effect: This strategy encourages and facilitates GHG and energy use reductions in all municipal departments; it facilitates coordination of cross-departmental efforts.

Reductions: This strategy does not directly achieve reductions. It organizes the City, motivates staff to pursue strategies that do, and facilitates their efforts. It is estimated to indirectly lead to a reduction in municipal emissions of 3% (119 metric tons). It will also facilitate staff to develop strategies to reduce community emissions, but those are probably subsumed under the reductions attributed below to education.

Incentivize Reductions

A central behavioral concept holds that behaviors are controlled by the incentives and disincentives they receive. Thus, if the City of Creve Coeur wishes to consistently pursue reductions in energy use and greenhouse gas emissions, it will be useful to incentivize those behaviors. Employee incentive plans are common throughout organizations, including municipalities, for a variety of purposes. Many types of incentive programs exist, ranging from financial compensation, to contests, to perquisites. We recommend that the Creve Coeur City Council pass legislation authorizing the City Administrator to design and implement a program of staff incentives for energy and greenhouse gas reductions.

Status: To be implemented.

Cost: Depends on the incentive chosen and how costs are accounted for. If incentives involve perquisites, then costs would most likely be minimal. If incentives involve receiving payments equal to a fraction of cost savings, then the program would generate costs, but by definition would generate even larger savings.

Effect: This strategy gives City staff an incentive to pursue GHG and energy reduction behaviors that, otherwise, might be inconvenient, require change, and provide no direct benefit to the individual.

Reductions: This strategy does not itself directly achieve reductions. It motivates staff to pursue strategies that do. It is estimated to indirectly lead to a reduction in municipal emissions of 3% (119 metric tons).

Training and Education

Information is one of the key elements needed to unlock GHG and energy use reductions, especially if the reductions are to be accomplished in an efficient, cost-effective way. City staff needs to have not only the incentive to pursue reductions, but the knowledge and skills to do so. We recommend that the City of Creve Coeur provide training in green municipal operations broadly throughout the municipal government. Because the City operates many departments, the operations of which differ widely, training will need to be targeted to each department as appropriate. We believe that, since reducing GHG emissions and energy use are fundamental municipal values, focused training should occur systematically. We recommend that City Council direct the City Administrator to develop and implement a plan to provide training in green operations broadly throughout the municipal government.

Additionally, the values of reducing GHG emissions and energy use will be enhanced to the extent that they are incorporated into the criteria that are used to evaluate potential new personnel. We recommend that knowledge of green operations be incorporated into the criteria used in the hiring of new employees and the advancement of current employees.

Status: To be implemented.
Cost: The cost will depend on how training is implemented. If staff members attend concentrated series of presentations at conferences they already attend, costs could be zero to minimal. If they attend special seminars or if special training is purchased, costs could range upward of $10,000.
Effect: This strategy ensures that City staff has the information and training necessary to implement GHG and energy reducing strategies efficiently and cost-effectively.
Reductions: This strategy does not itself directly achieve reductions. It ensures that staff members have the information and training required to implement the other GHG and energy reducing strategies in the plan. Thus, it is estimated to indirectly facilitate a 3% reduction in municipal emissions (119 metric tons) and a 5% reduction in community residential and commercial emissions (39,748 metric tons).

Green Purchasing Policy

Many organizations have realized that reducing energy use and GHG emissions requires investing in equipment and products that make such reductions possible. Several analyses suggest that improving the energy efficiency of electronic equipment and of lighting can achieve large reductions in GHG emissions and energy use and yield attractive returns on investment. Consequently, many cities and commercial organizations have developed policies to give purchasing preference to products that have reduced impact on the environment. The City of Creve Coeur enacted a comprehensive Green Purchasing Policy in June 2009. It is an essential part of this plan. Training should be provided to appropriate personnel, and the policy should be fully implemented.

Status: Being implemented.
Cost: Costs depend on items purchased. Some products can be purchased at net savings. Others have cost premiums. The Green Purchasing Program does not require purchase of material with a cost premium that outweighs the environmental benefits.
Effect: This strategy requires environmental characteristics, including GHG emissions and energy use, to be included in purchasing decisions.
Reductions: The reductions achieved will depend on the items purchased. Some items, recycled paper products for instance, achieve GHG reductions in locations outside the City that were not included in our Greenhouse Gas Emissions Inventory and are not easily measurable. Other items, such as energy efficient electronic equipment, achieve reductions locally that were included and can be measured. We estimate that reductions will grow with purchases over the years, reaching 5% of municipal emissions by 2015 (199 metric tons).

Municipal and Community Moderation of Current Emissions

Renewable Energy Standard

With the passage of the Missouri Renewable Energy Standard (Proposition C) in November 2008, 5% of the electricity supplied by AmerenUE is required to come from renewable energy resources by 2015, and 15% by 2021. The availability of significant amounts

of renewable energy for use by the municipal government and community as a whole will be required to achieve our recommended goal of a 50% reduction in GHG emissions by 2030. Thus, even though the Renewable Energy Standard is a statewide mandate, not a Creve Coeur initiative, it is an essential element of our Climate Action Plan.

We recommend that the City Council pass a resolution expressing its support for the implementation and continuation of Missouri renewable energy standards no less strong than those contained in Proposition C, and that a copy of the resolution be forwarded to the appropriate state authorities.

Status: To be implemented.
Cost: Not applicable.
Effect: This strategy provides support for the maintenance of effective renewable energy standards in Missouri.
Reductions: By 2015, achieve a 5% reduction in both municipal and community GHG emissions deriving from electricity. For the community, this represents 21,851 metric tons CO2e per year. For municipal operations, it represents 139 metric tons.

Municipal Buildings

The energy consumed in the buildings operated by the municipal government accounted for the largest portion of municipal energy use, and by far the largest portion of GHG emissions. Energy consumption and GHG emissions come from both the operation of buildings themselves (e.g. from HVAC and lighting systems) and from the activities conducted in them (e.g. the operation of electrical and electronic equipment). Fortunately, these are among the most cost-effective GHG abatement opportunities. Many, if not most, can be implemented at net cost savings over the life of the project, and payback often occurs in relatively few years.

The energy performance of most commercial buildings depends not only on specific equipment, but also on how the buildings function in actual use, and how the systems integrate together. Thus, to maximize efficiency, a comprehensive approach is required that treats the building as a whole system. The U.S. Green Building Council (USGBC) has emphasized that best practice begins with an overall design and plan, followed by implementation, measurement of results, and comparisons to benchmarks.

In addition to maximizing return on energy efficiency investment, green benchmarking is becoming increasingly important economically. Green building is the fastest growing segment of the building industry, cities nationwide are competing to be known as green leaders, and green building certification is gaining increasing value. Certified green buildings have, on average, higher market value, reduced energy costs, reduced maintenance costs, improved productivity, reduced absenteeism, and perhaps even reduced liability costs and improved employee retention and recruiting. In addition, pursuing green certification provides other benefits. It ensures minimum standards and a common mindset in pursuing a project. It helps define community benefits associated with a project. And it serves as an effective prerequisite for municipal incentives, entitlements, and zoning districts. Thus, we believe that Creve Coeur should commit itself to the philosophy of green building certification, first in its own buildings, but in later phases of this plan to community buildings as well.

The USGBC's Leadership in Energy & Environmental Design program is the best-known green building certification system. The system can be applied both to new construction and to the operation and maintenance of existing buildings (LEED-OM). The LEED-OM program is the one that would apply to Creve Coeur's existing major building facilities. LEED-OM requires an

energy audit, and it incorporates the leading energy efficiency benchmarking system, the Department of Energy's Energy Star Rating System. However, LEED-OM is not identical with energy conservation, as it incorporates many other values in addition. We believe that Creve Coeur will want to pursue eventual LEED-OM certification for the City's three major municipal buildings: the City Government Center, the Harold Dielmann Recreation Complex, and the Public Works Garage. We also believe that the City should commit itself to pursing over time a minimum Energy Star rating of 65 for each of those three buildings.

The transformation of the City Government Center, the Harold Dielmann Recreation Center, and the Public Works Garage to LEED-OM and Energy Star certified buildings will require significant capital projects. However, converted buildings such as the City Hall of University City, illustrate that in-use buildings can be successfully retrofitted. Overall costs and benefits cannot be estimated in a general plan such as this. However, state and federal subsidies are available in some cases, and specific capital projects can be timed to coincide with maintenance and replacement that would be required anyway due to wear and tear.

For Phase 1 of the Climate Action Plan, we recommend two specific strategies that are consistent with the goal of eventual LEED-OM certification and Energy Star certification.

Municipal Energy Audit

We recommend that Creve Coeur obtain an energy audit of the City Government Center, the Harold Dielmann Recreation Center, and the Public Works Garage by a reputable energy auditor. An audit is an essential early step in both LEED-OM and Energy Star certification. It should be performed in a way that is consistent with eventual pursuit of LEED-OM certification and Energy Star certification of these three buildings. Such an audit will allow the City to identify and prioritize opportunities to increase energy efficiency and to avoid creating inefficiencies that occur when improvements are pursued haphazardly.

Status: To be implemented.

Cost: $18,000.

Effect: The audit would identify the major energy inefficiencies in the three most important municipal buildings, prioritize them for remediation, and estimate the energy savings that would result. An audit is also one of the necessary steps should the City choose to pursue eventual green certification for its buildings.

Reductions: The size and timing of reductions will depend on the condition of the envelope and systems of the buildings and the ability of the City to undertake improvements recommended by the audit. It is not unusual for energy audits to identify yearly energy cost savings equal to 15-30% of the combined cost of the audit and remediation program. The savings will only be realized if and when the City undertakes the recommended improvements.

Upgrade Government Center HVAC and Hot Water Systems

The heating, ventilation, and air conditioning system at the City Government Center is old, and significant portions of it are failing. It is in need of replacement. The improvements recommended by the energy audit will affect the sizing and performance of the HVAC and hot water systems. Therefore, we recommend that when the replacement occurs, it be done with new energy efficient systems consistent with the recommendations of the energy audit.

Status: To be implemented.

Cost: Unknown.
Effect: This strategy maximizes energy efficiency, and hence cost savings, by ensuring the new system is right-sized in light of other efficiency programs and equipment changes recommended by the audit.
Reductions: We estimate a reduction in energy usage for HVAC and hot water of 20%. The City does not meter these functions separately, but we estimate the savings to be 103 metric tons CO2e.[4]

Community Buildings

List of State Approved Home Energy Auditors

We believe that the City should encourage residents to make energy efficiency upgrades to their homes. One very simple, non-intrusive strategy is to make a list of approved energy auditors available to citizens. Lists are maintained by the Missouri Department of Natural Resources and by the Home Performance With Energy Star Program. We recommend that Creve Coeur provide a copy of such a list to residents who request it, and to residents who contact the City for permitting related to their home.

Status: To be implemented.
Cost: Zero to minimal.
Effect: This strategy brings the idea of making energy efficiency upgrades to the attention of homeowners. It provides a direction homeowners who would like to consider energy efficiency upgrades, but don't know where to start.
Reductions: This strategy will not result in reductions in municipal GHG emissions or energy use. It will indirectly facilitate reductions in the community.

Community Education

Public Education Campaign

Despite the fact that there has been a sizable amount of publicity regarding climate change, peak oil, and energy conservation, there has also been a significant amount of misinformation. Information regarding simple, cost effective strategies to reduce energy use and GHG emissions is particularly needed. In addition, as Creve Coeur implements the various initiatives that will put this plan into effect, it will be necessary to inform the public about them. Thus, Creve Coeur will need an ongoing climate action public education campaign. It should be designed around an informative website, but should also involve other types of public information outreach as possible and appropriate. The beginning of such a program is already under development by the Assistant to the City Administrator and the Public Information Officer in consultation with the Climate Action Task Force and the Recycling, Environment and Beautification Committee. However, this program needs to be established on a firm foundation that will ensure its continuation and funding over the life of the Climate Action Plan (at least to 2015). We recommend that the City Council establish a climate action public information campaign to be called "ONEDAY Creve Coeur…" under the direction of the City Administrator

[4] Calculation: From GHG inventory, Gov't Center used 995,040 kWh of electricity, 80% of which is coal generated and 20% nuclear (no CO2). It used 23,660 therms of natural gas. It emitted 878 metric tons CO2e. Using EIA conversion factors, it can be calculated that 68% of emissions derived from electricity and 32% from natural gas. If 33% of the building's electricity use is related to HVAC and hot water, and if all of the natural gas usage is, then it can be calculated that emissions will be reduced by 11.33%. This yields a result of 103 metric tons CO2e.

in consultation with the Climate Action Task Force, the Recycling Environment and Beautification Committee, and other City committees as appropriate.

Status: Being implemented.
Cost: None or minimal for the website. Other costs will depend on the forms of outreach selected.
Effect: This strategy informs citizens about the need to reduce GHG emissions and energy use; it informs citizens about basic strategies for doing so; it informs citizens of specific strategies being pursued by the City; and it informs citizens of other available resources.
Reductions: This strategy does not achieve direct reductions. Rather, it informs citizens about the need to make reductions and helps connect them to resources that make reductions possible.

Greenhouse Gas Reduction Display

With the assistance of St. John's Mercy Medical Center the Climate Action Task Force developed a portable display encouraging citizens to reduce GHG emissions and energy use, and illustrating efforts that have been made by the City of Creve Coeur and a number of community members. It has been on display in the lobby of the City Government Center since late February 2009. It should continue to be displayed either at the City Government Center or in the lobby of the Harold Dielmann Recreation Center.

Status: Implemented.
Cost: None.
Effect: This strategy informs the public about the need to reduce GHG emissions and energy use; informs the public about efforts by the City and others to do so.
Reductions: This strategy does not directly reduce GHG emissions or energy use. Rather, it informs the public about the need to do so and that others in their community are already doing so.

Community Moderation of Current Emissions

One Person-One Bulb Program

Upgrading lighting efficiency is one of the largest, most cost-effective strategies for reducing GHG emissions and energy use. Switching from incandescent lamps to compact fluorescent lamps is one large, easy opportunity. Consequently, many cities have included CFL swaps in their Climate Action Plans. Perhaps the best known is the *Million Lamp Program* by Kansas City. In the St. Louis Region, AmerenUE has coordinated the largest CFL swaps. We recommend that Creve Coeur establish a *One Person-One Bulb* program in partnership with other local resources, with the goal of swapping one incandescent bulb for a CFL for every Creve Coeur resident, and provide information about CFLs and how to use them.

Status: Needs implementation.
Cost: Depends on the participation achieved with partners.
Effect: This strategy replaces energy intensive light sources with what is the current energy efficient standard light source; it introduces residents who are not familiar with CFLs to them, thereby facilitation the transition.

Reductions: The population of Creve Coeur is estimated to be near 17,000. Replacing one 60 watt incandescent bulb with the CFL equivalent for each person is estimated to abate 1,048 metric tons of CO2e in the community.

Conclusion

The Climate Action Task Force recommends that Creve Coeur reduce its greenhouse gas emissions and energy use by 20% by 2015 from the baseline levels measured in the 2005 Creve Coeur Greenhouse Gas Emissions Inventory.

The twelve specific strategies recommended in this document represent Phase 1 of an eventual three-phase plan. They were drawn from the climate action plans of cities that have preceded Creve Coeur down this path. They have also been drawn from the published recommendations of nonprofit organizations that help cities to reduce their greenhouse gas emissions and energy use.

The twelve strategies are estimated to achieve more than 100% of the reduction target for municipal operations, and 44% of the reduction target for community emissions. However, the CATF emphasizes that many of the twelve strategies are enabling strategies. As such, their actual results depend on many factors the CATF does not control and cannot predict.

Perhaps more than anything else, the results of the twelve recommended strategies will depend on full implementation and on good faith efforts by Creve Coeur staff and officials to make the needed changes. If the strategies receive full implementation and a good faith effort, there is no reason that they cannot be successful in achieving meaningful reductions in greenhouse gas emissions and energy use in Creve Coeur.

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Appendix 1: Glossary

Btu (British thermal unit): a traditional unit of energy, approximately equal to the amount of energy needed to heat one pound of water one degree Fahrenheit.

Carbon dioxide (CO2): a chemical compound composed of oxygen and carbon that exists as a gas in earth's atmosphere. It is produced by many organisms during respiration and also by the combustion of carbon-containing fuels, such as fossil fuels and vegetable matter. It is thought to be the most important greenhouse gas, accounting for about 80% of human-caused global warming.

Carbon dioxide equivalent (CO2e): a measure of global warming effect. For a quantity and mixture of gasses, it describes the amount of carbon dioxide (CO_2) that would have the same global warming effect. It allows the global warming effect of various gasses to be compared using a standard measure. In general practice, the amount of each greenhouse gas released into the atmosphere is converted to its carbon dioxide equivalent. This practice allows the effects of the individual gasses to be compared and/or summed to yield a total effect.

Climate: the distribution of weather characteristics over periods of time that can range from decades to millions of years. Climate can refer to small, medium, and large regions, or even to the whole earth. It can also refer to average weather (e.g. average temperature) or to the distribution of weather events around an average (e.g. periods of extreme temperature).

Climate change: changes in modern climate occurring over periods ranging from the last few decades to the last few centuries that are thought to be caused by global warming.

Crude oil: a naturally occurring, flammable liquid found in geological formations in the Earth's crust. Crude oil, also called *petroleum,* consists of a complex mixture of hydrocarbons. It is the source from which many common fuels are distilled, such as gasoline, aviation fuel, heating oil, bunker oil, kerosene, butane, and propane.

Fossil fuel: fuel formed by natural resources, such as the decay of buried organisms. Such decay occurs slowly, and fossil fuel deposits typically form over millions of years. Three fossil fuels, crude oil, natural gas, and coal, form the three most important modern energy sources. Fossil fuels contain carbon, which is released into the atmosphere during combustion.

Global warming: an increase in the average temperature of the Earth's atmosphere occurring over the last century or more. Global warming is theorized to result from the greenhouse effect of carbon dioxide and other greenhouse gasses released into the atmosphere. Global warming is theorized to be the factor driving climate change.

Greenhouse gas: gasses in the atmosphere that allow visible light to pass through, warming the Earth, but that trap heat radiated from Earth back towards space, causing the atmosphere to warm. Some greenhouse gasses, water vapor for example, are not theorized to be significantly

affected by human activities. Others are thought to be significantly affected by human activities. The three most important of these are carbon dioxide, methane, and nitrous oxide, which together are theorized to cause over 80% of human-caused global warming.

ICLEI–Local Governments for Sustainability: a nonprofit organization with offices around the world that specializes in helping local governments to develop the capacity to reduce their impact on climate change. ICLEI assisted Creve Coeur to conduct its Greenhouse Gas Emissions Inventory.

Intergovernmental Panel on Climate Change (IPCC): a scientific body established in 1988 by the World Meteorological Organization and the United Nations Environment Programme. Their fourth comprehensive review of the climate change literature, the *Fourth Assessment Report,* was issued in 2007, and constitutes the most comprehensive review of the climate change literature to date.

Methane: the primary constituent of natural gas. It is a powerful greenhouse gas, but when burned, creates less pollution and carbon dioxide than the other fossil fuels.

Natural gas: one of the fossil fuels. It consists primarily of methane, but also includes naturally occurring contaminants, as well as adulterants added by humans to provide a powerful, characteristic "natural gas smell."

Peak oil (individual oil fields): literally, a point in time at which a maximum rate of crude oil extraction is reached. As an oil field is developed, the rate at which crude oil is produced typically increases. At some point, however, various natural factors cause the rate to stop increasing and to decline. The point of maximum production is peak oil.

Peak oil (world): as oil fields around the world transition from increasing to decreasing production, total world crude oil production faces a similar transition unless new sources can be discovered. The concept of world peak oil holds that the discovery of new sources will not keep pace with the decline in current sources, and that the rate of world crude oil production will begin to decline. Most proponents of the theory of peak oil do not predict that the world will soon run out of crude oil, but rather that the failure of production to match demand will cause severe market disruptions.

Appendix 2: Major Phase 1 Recommendations

The Climate Action Task Force recommends:

A goal of reducing energy use and greenhouse gas emissions 20% by 2015, with an eventual goal of 50% by 2050.

A three-phase campaign to achieve these reductions:

Phase 1: The City focuses on building awareness, knowledge, capacity, and commitment for reductions in energy use and greenhouse gasses. These are the foundation upon which all other efforts depend. The City undertakes a couple of high-profile initiatives that promote those goals. And the City implements easy and cost effective strategies to reduce energy use and greenhouse gas emissions in municipal operations. In Phase 1 the City focuses on leading by example, making its own reductions before asking the community to do so.

Phase 2: The City continues Phase 1, but also begins to undertake more complex and ambitious initiatives to make reductions. In addition, in Phase 2 the City lays the groundwork to encourage the community as a whole to make reductions.

Phase 3: The City continues to pursue initiatives started under the previous phases, and begins to pursue more ambitious strategies that involve more significant change. The City implements strategies to encourage the community to make reductions, beginning with inexpensive and easy to accomplish strategies and proceeding to more ambitious ones.

Twelve initial strategies to reduce energy use and greenhouse gas emissions:

1. Reports to City Council:
   A. A formal annual report by the City Administrator to the City Council of progress in reducing energy use and greenhouse gas emissions.
   B. Less formal quarterly reports by the City Administrator to the City Council of progress in reducing energy use and greenhouse gas emissions.
   C. Reports by each city committee, commission, or task force to City Council describing their accomplishments, plans, and programs to help the City achieve its GHG and energy use reduction goals.

2. Creation of a staff Green Team to meet on a regular basis.

3. A program to incentivize staff for reducing GHG emissions and energy use.

4. Training and education:
   A. The provision of training in municipal green operations broadly throughout the municipal government.

B. The incorporation of knowledge about green municipal operations into the criteria used in the hiring new employees and the advancement of current employees.

5. The establishment and full implementation of a green purchasing policy.

6. A resolution supporting the continued existence of a Missouri Renewable Energy Standard no less strong than Proposition C, passed in November, 2008.

7. An energy audit of the three major City buildings

8. An upgrade of the City Government Center's HVAC and hot water systems consistent with the recommendations of the energy audit.

9. Development of a list of certified energy auditors to be provided to those seeking permits related to construction and occupancy.

10. A public education campaign.

11. A poster for public display about the City's efforts to reduce GHG emissions and energy use.

12. A light bulb program to exchange more efficient light bulbs for less efficient ones.

Appendix 3: Specific Measures Already Pursued by Creve Coeur

(Updated 2009-10-20)

- US Mayors' Climate Protection Agreement signed – Creve Coeur becomes Cool City.
- Greenhouse Gas Emissions Inventory completed.
- Climate Action Task Force formed.
- Green Purchasing Policy adopted.
- Annual Spring Seminar expanded to include Environmental Expo.
- Hosted St. Louis County Municipal League Environmental workshop.
- City Building Department included energy efficiency presentation in 2009 residential renovation seminar.
- Poster with examples of energy savings created & displayed in City facilities.
- Tips about energy sustainability added to City's monthly newsletter.
- City works with Solomon Schechter Day School on yearly student energy saving project.
- Ice arena compressor upgraded to improve energy efficiency.
- Radiant heating system installed at Public Works Garage.
- Motion sensors installed to control lighting in Government Center meeting rooms.
- Programmable thermostats installed in City Government Center.
- Paperless document system for City Council and P&Z meetings implemented.
- Lamps in Government Center exit-signs replaced with LEDs.
- Purchased 2 compact-size pickup trucks for public works instead of full-sized.
- Installed moisture sensors to control irrigation systems.
- Installed reminder signs throughout Government Center to turn off lights.
- Installed additional recycling containers at city buildings and at city parks.
- System to use reclaimed water installed at Millennium Park spray ground.
- Reclaimed pavement used in street projects.
- Purchased flex fuel 1/2 ton truck.
- Diesel emissions filters/scrubbers purchased on new 2-ton trucks.
- Native species planted in City parks.
- Thermal camera analysis of City Hall performed.
- Initiated ongoing program to replace T12 ballasts and tubes with T8s as replacements are required.

- Program to encourage employees to save energy initiated: e.g. turn off lights and computers, use double-sided printing, avoid printing when electronic copies will suffice, etc.

- Stopped using bottled water at some City functions.

- Polymer spray made from soybeans & used tires used to rejuvenate roads.