Greenhouse Gas Emissions and Recommendations Report for the U.S. Mayors Climate Protection Agreement in the City of Fitchburg, Wisconsin

Prepared for:
Mayor Thomas Clauder
and the
Fitchburg City Council

Prepared by:
Resource Conservation Commission:
Samuel Cooke, Chair
Steve Arnold, Council Representative
Chris Jimieson, Member
Jan Kucher, Member
David Martin, Member
Phillip Rangsuebsin, Member
Diane Streck, Member
Rick Eilertson, Staff Representative
Nick Matthews, Public Works Intern

Involved City Staff:
Tony Roach, City Administrator
Ed Bartell, City Forester
Ahna Bizjak, City Trans. Engr.
Thomas Blatter, Police Chief
John Crook, City Bldg. Inspector
Rick Eilertson, City Env'l. Engr.
Scott Endl, Parks Director
Tracy Foss, City Utility Engr.
Thomas Hovel, City Planner
Randy Pickering, Fire Chief
Paul Woodard, City Engineer
Kevin Wunder, IT Director
Mike Zimmerman, Econ. Dev. Coor.

March 2009

Executive Summary

Mayor Tom Clauder signed the USMCPA on August 12, 2008. At the request of Mayor Clauder and the Fitchburg City Council (Resolution R-55-08) Fitchburg's Resource Conservation Commission (RCC) has completed the following: 1) An inventory of Fitchburg's greenhouse gas (GHG) emissions; 2) A projection of Fitchburg's GHG emissions to 2012; and 3) A detailed list of recommendations for reducing Fitchburg's GHG emissions. The RCC and City staff conducted this work to determine how the U. S. Mayors Climate Protection Agreement (USMCPA) could be implemented in Fitchburg. The intent of the USMCPA is for local and state governments across the U.S. to take definite steps to reduce GHG emissions. The USMCPA provides a vehicle for discussion and action for climate protection initiatives by City leaders, staff, residents and businesses.

RCC's report provides information that is specific to Fitchburg, for the following:

- **GHG Inventory:** Inventory GHG emissions, project to 2012 and set reduction targets.
- **Land Use:** Adopt land-use policies that reduce sprawl, preserve open space and create compact, walkable urban communities.
- **Transportation:** Promote transportation options such as bike trails, commute trip reduction programs, incentives for car-pooling and public transit.
- **Renewable Energy:** Increase the use of clean, renewable energy.
- **Energy Efficiency:** Make energy efficiency a priority through building code improvements, retrofitting facilities with energy efficient lighting and urging conservation.
- **Energy Star:** Purchase only Energy Star equipment and appliances, or their equivalent.
- **Green Buildings:** Adopt sustainable building practices, such as those of the U.S., Green Building Council's LEED program or a similar system.
- **Fuel Efficiency:** Increase the average fuel efficiency of municipal fleet vehicles and reduce the number of vehicles.
- **Water and Wastewater:** Increase pump efficiency in water and wastewater systems and recover wastewater treatment methane for energy production.
- **Solid Waste:** Increase the community's "reduce," "reuse" and "recycle" rates.
- **Urban Forestry:** Maintain healthy urban forests.
- **Education:** Help educate the public, business and industry about reducing GHG emissions.

The GHG emissions inventory indicates that in 1998, Fitchburg's GHG emissions totaled 247,000 tonnes eCO_2, (equivalent CO_2), in 2007 the GHG emissions totaled almost 450,000 tonnes eCO_2 and by 2012, Fitchburg's annual emissions are projected to be over 500,000 tonnes eCO_2. By signing the USMCPA, Fitchburg committed to strive to reduce emissions to 230,000 tonnes eCO_2 by 2012.

RCC members developed a list of recommendations for each of the above "Action Items." For each recommendation, RCC members estimated the energy savings in 2012 and the out-of-pocket costs and then assigned a priority within that Action Item. This information was reviewed with key City staff. As detailed in the report, some recommendations result in a cost savings, some have zero out-of-pocket costs and others involve a cash outlay. It is the RCC's overall recommendation that this report be reviewed and discussed and the recommendations implemented to reduce emissions to 230,000 tonnes eCO_2 goal by 2012.

Introduction and Background Information

In 2007, at the request of Mayor Clauder and the Fitchburg City Council (Resolution R-73-07), the Resource Conservation Commission (RCC) studied the feasibility of implementing the U.S. Mayors Climate Protection Agreement (USMCPA).

The U.S. Mayors Climate Protection Agreement

1) We urge state government and the federal government, to enact policies and programs to meet or beat the greenhouse gas emission reduction target suggested for the United States in the Kyoto Protocol - 7% reduction from 1990 levels by 2012;
2) We urge the U.S. Congress to pass the bipartisan greenhouse gas reduction legislation, which would establish a national emission trading system; and
3) We will strive to meet or beat the Kyoto Protocol targets for reducing greenhouse gas emissions by taking action in our own operations and communities, such as:

- Inventory greenhouse gas emissions and set reduction targets.
- Adopt land-use policies that reduce sprawl, preserve open space and create compact, walkable urban communities.
- Promote transportation options such as bike trails, commute trip reduction programs, incentives for car-pooling and public transit.
- Increase the use of clean, alternative energy.
- Make energy efficiency a priority through building code improvements, retrofitting facilities with energy efficient lighting and urging conservation.
- Purchase only Energy Star equipment and appliances.
- Adopt sustainable building practices such as those of the U.S., Green Building Council's LEED program or a similar system.
- Increase the average fuel efficiency of municipal fleet vehicles and reduce the number of vehicles.
- Increase pump efficiency in water and wastewater systems and recover wastewater treatment methane for energy production.
- Increase recycling rates.
- Maintain healthy urban forests.
- Help educate the public, business and industry about reducing greenhouse gas emissions.

The intent of the USMCPA is for local and state governments across the United States to take definite steps to reduce greenhouse gas (GHG) emissions. Greenhouse gases reduce the amount of earth's radiation that escapes to space, warming the lower atmosphere and the earth's surface. Some of the greenhouse gases of primary concern are carbon dioxide (CO_2), methane (CH_4), nitrous oxide, perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulfur hexafluoride.

On July 22, 2008, RCC presented the results of its feasibility study to Mayor Clauder and the Fitchburg City Council. The study showed Fitchburg is already implementing or is planning to implement several initiatives to reduce Fitchburg's GHG emissions. During the July 22nd Council meeting, Mayor Clauder and the Fitchburg City Council passed

Resolution R-55-08 authorizing the Mayor to sign the USMCPA on behalf of the Council. Mayor Clauder signed the USMCPA on August 12, 2008.

Resolution R-55-08 also directs the administration and City bodies to undertake Fitchburg's obligations under the Agreement and recommends that the Public Works Department and RCC coordinate the City's efforts under the Agreement, which include GHG emissions inventories, projections and proposals for reduction. By signing the USMCPA, Fitchburg agreed, among other things, to strive to meet or beat a 7% reduction from 1990 levels in GHG emissions by 2012.

There are three parts to developing a reduction plan: 1) inventorying GHG emissions to develop a baseline against which to measure reductions; 2) forecasting future GHG emissions; and 3) developing recommendations to achieve the targeted reduction. For the past year, RCC has gathered the information necessary to inventory Fitchburg's GHG emissions and make recommendations to reduce Fitchburg's GHG emissions. 1998 is the earliest year for which complete, reliable data were available. As a result, 1998 is being used as the baseline year; Fitchburg's target is a 7% reduction from the 1998 GHG emissions level by 2012.

The GHG emissions inventory indicates that in 1998, Fitchburg's GHG emissions totaled 247,000 tonnes eCO_2, (equivalent CO_2), in 2007 the GHG emissions totaled almost 450,000 tonnes eCO_2 and by 2012, Fitchburg's annual emissions are projected to be over 500,000 tonnes eCO_2. By signing the USMCPA, Fitchburg committed to reduce the emissions to 230,000 tonnes eCO_2 by 2012.

This report includes Fitchburg's GHG emissions inventory and presents RCC recommendations for reducing Fitchburg's GHG emissions for the purpose of attaining the 7% reduction from the 1998 GHG emissions level.

USMCPA Action Item 1. Inventory global warming emissions in City operations and in the community, set reduction targets and create an action plan. *(RCC Contact: Diane Streck; Staff Contacts: Paul Woodard, John Crook, Tom Blatter, Randy Pickering, Scott Endl)*

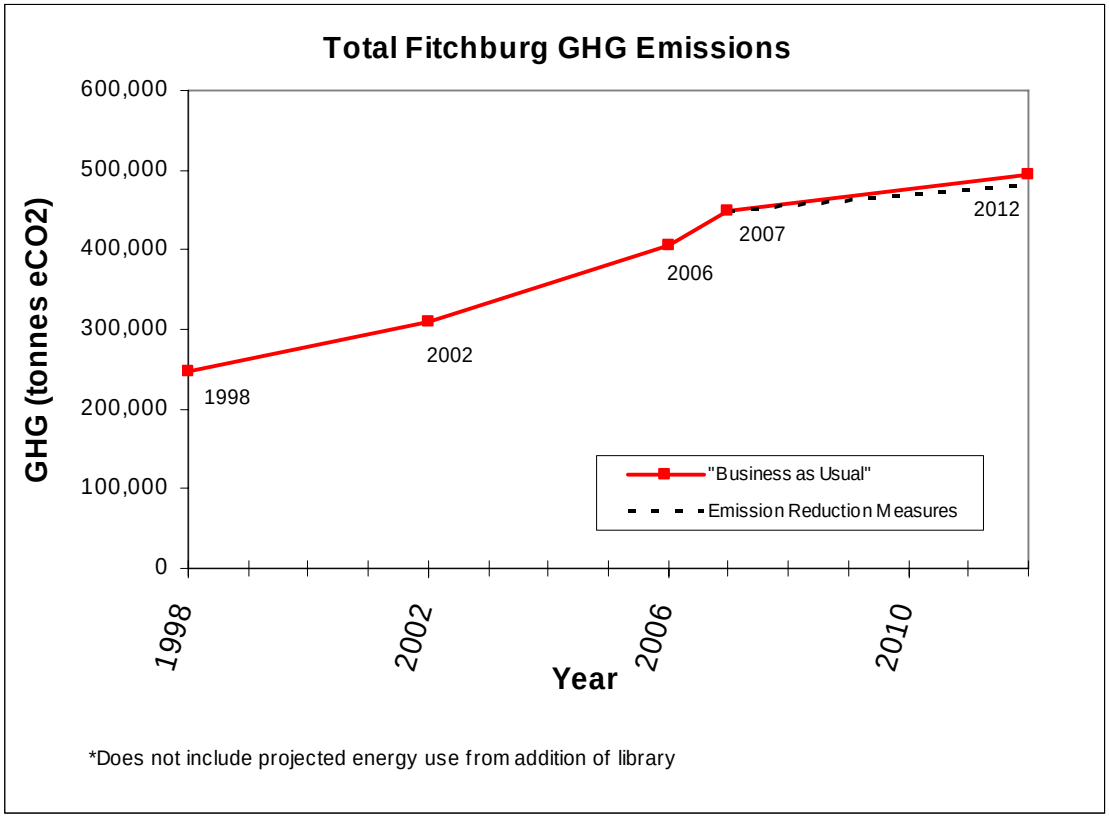
Fitchburg's GHG emissions include 'Community' emissions (those generated by residents and businesses in Fitchburg) and 'Government' emissions (those generated by City of Fitchburg-owned buildings, vehicles, and equipment). Data were gathered from City records, MG&E and Alliant Energy. With the help of Nick Matthews, Fitchburg's Public Works Utilities Intern, RCC completed Fitchburg's GHG emissions baseline inventory and projection to 2012.

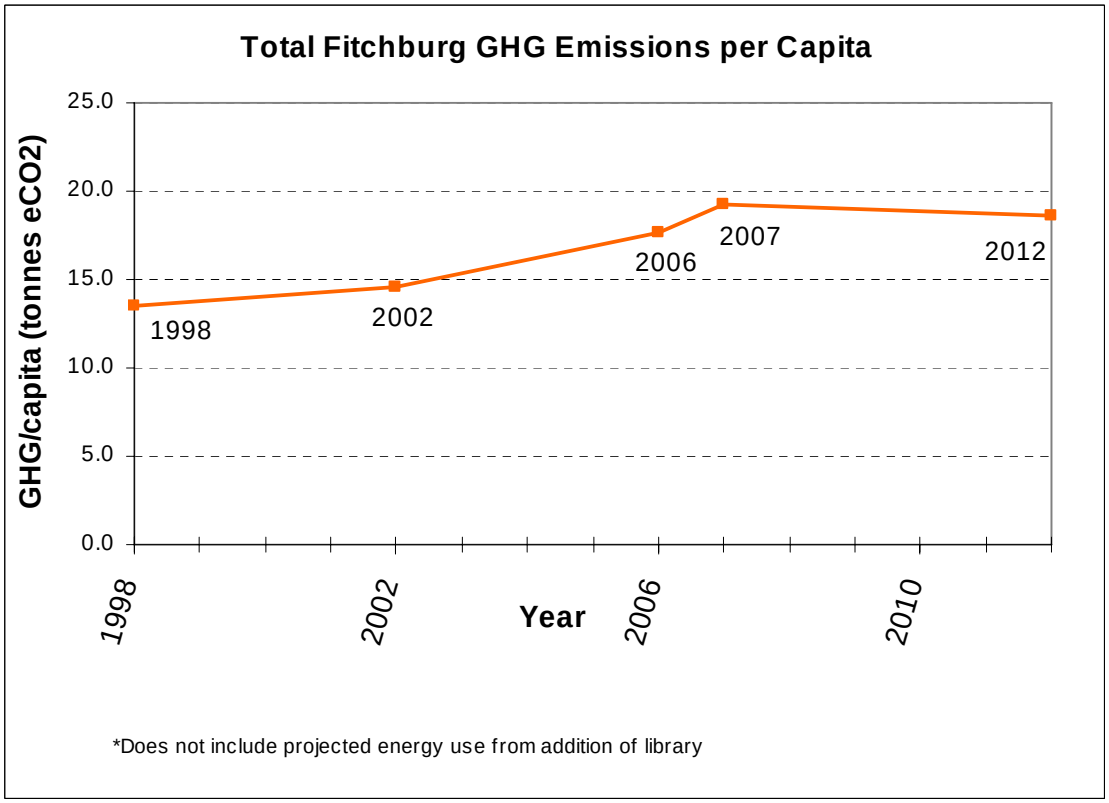
The emissions graphs show Fitchburg's GHG emissions based on actual data. In addition to the Total Fitchburg GHG Emissions graph, the graphs below show emissions from City operations, from Community operations, and within each by sector. GHG emissions were inventoried for 1998, 2002, 2006 and 2007 and entered into the Clean Air and Climate Protection Software, May 2003 Release. 1998 is the earliest year for which complete, reliable data were available. As a result, 1998 is being used as the baseline year. Fitchburg's target is a 7% reduction from the 1998 GHG emissions level by 2012.

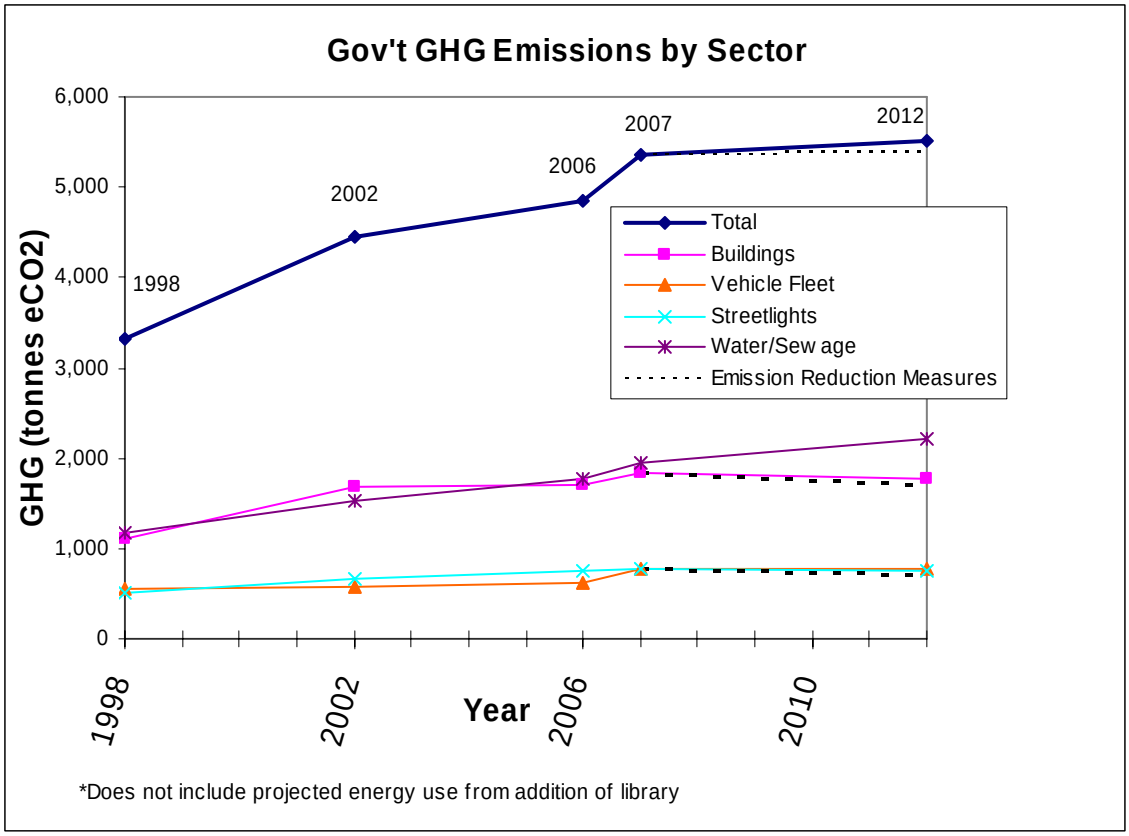
The 2012 GHG emissions level is estimated using historical and projected growth rates provided by Tom Hovel, Fitchburg's Planning Director. The GHG reduction measures are indicated by the dotted line on the graphs and reflect reduction measures implemented in 2008 and those in the 2008 Capital Budget. These GHG emissions and reduction measures are detailed in the charts following the graphs. The projected reduction in Residential, Commercial and Government from 2007 to 2012 without any emission reduction measures is the result of emission changes by the utilities providing the energy.

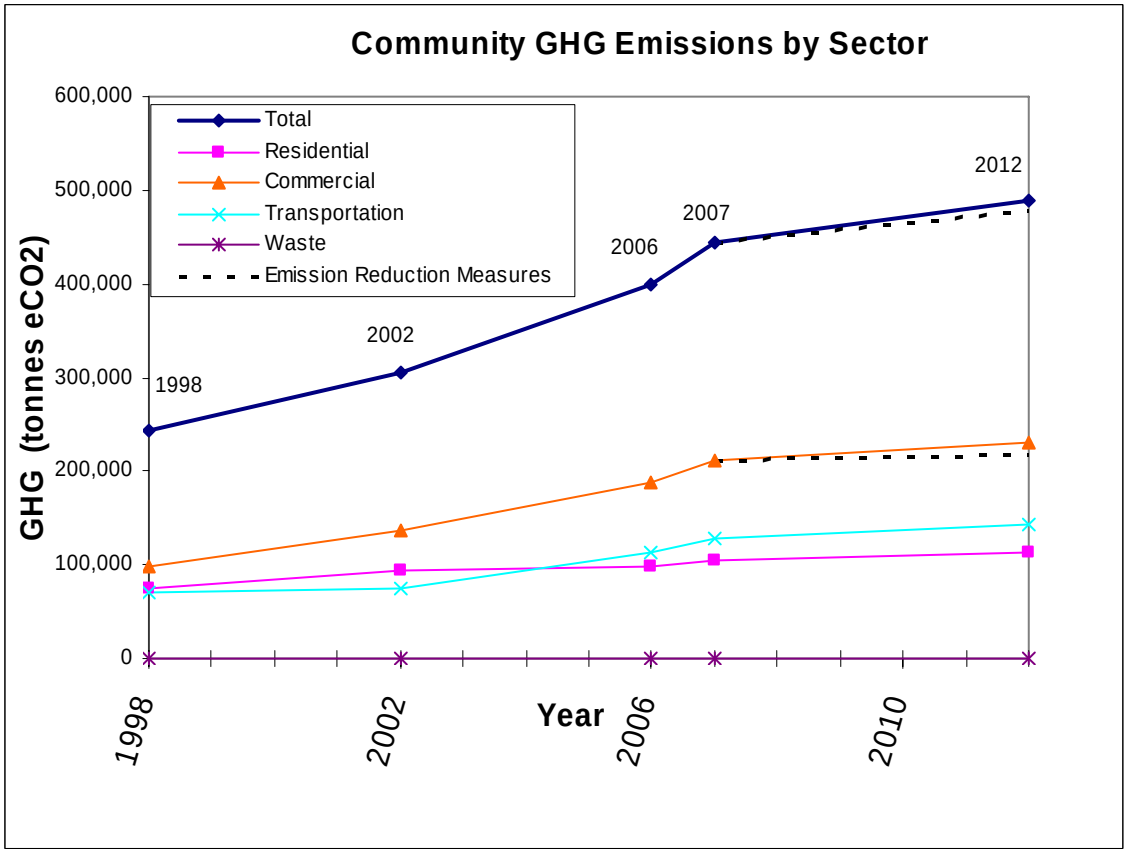
Going forward, **RCC recommends the following:**

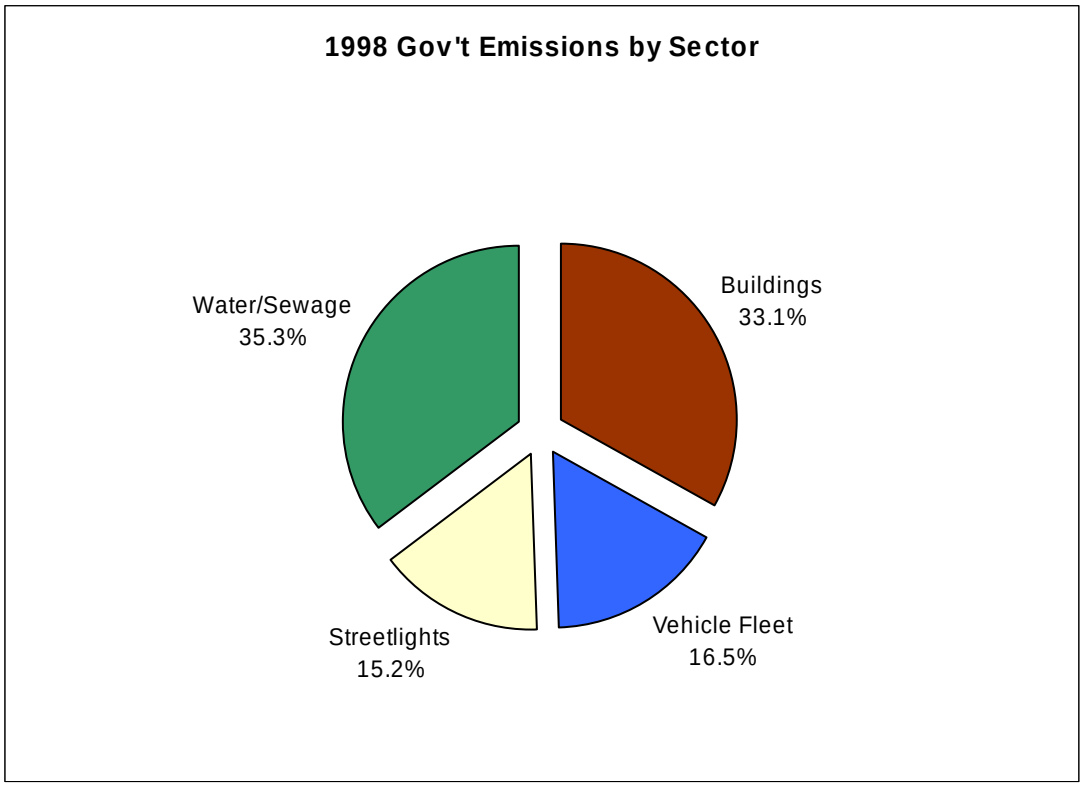
- Assign a City staff member to oversee the implementation of accepted recommendations, monitor progress and make additional suggestions.
- Evaluate version 1 of the Local Government Operation Protocol (LGOP) and any subsequent versions for adoption by Fitchburg.
- Re-inventory GHG emissions as necessary to gage progress.
- Re-inventory GHG emissions in 2012; re-evaluate the goal and necessary emission reduction measures to attain it.

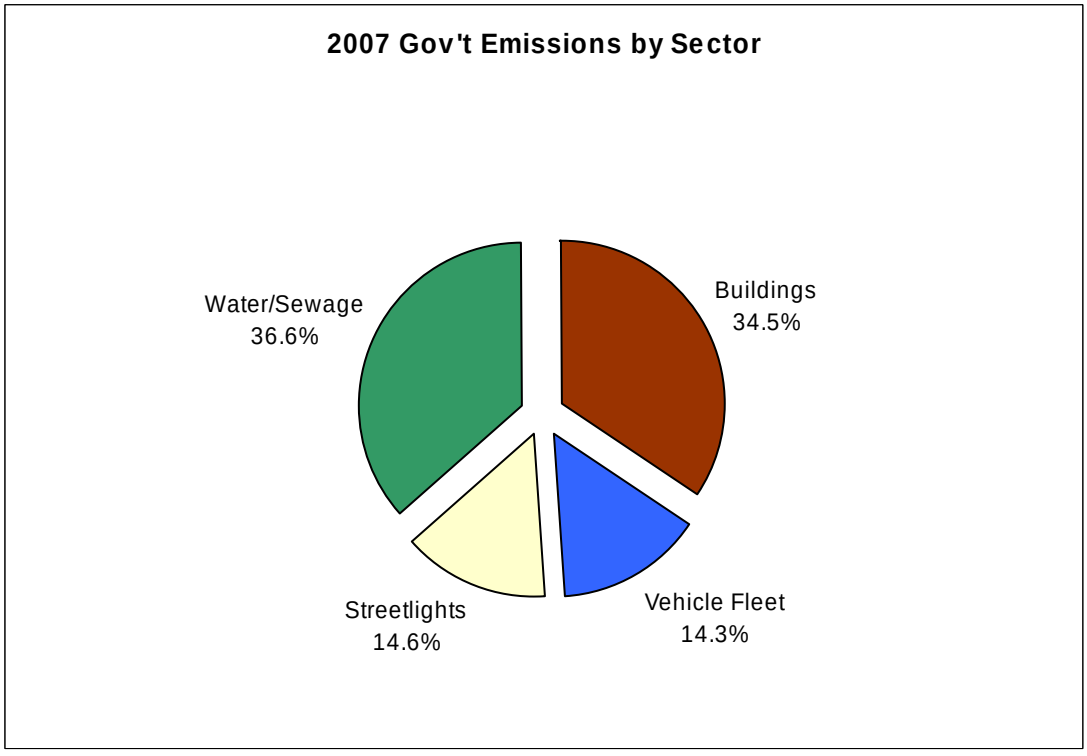

Total Fitchburg GHG Emissions
GHG (tonnes eCO2)
600,000
500,000
400,000
300,000
200,000
100,000
0
1998
2002
2006
2007
2012
"Business as Usual"
Emission Reduction Measures
1998
2002
2006
2010
Year
*Does not include projected energy use from addition of library

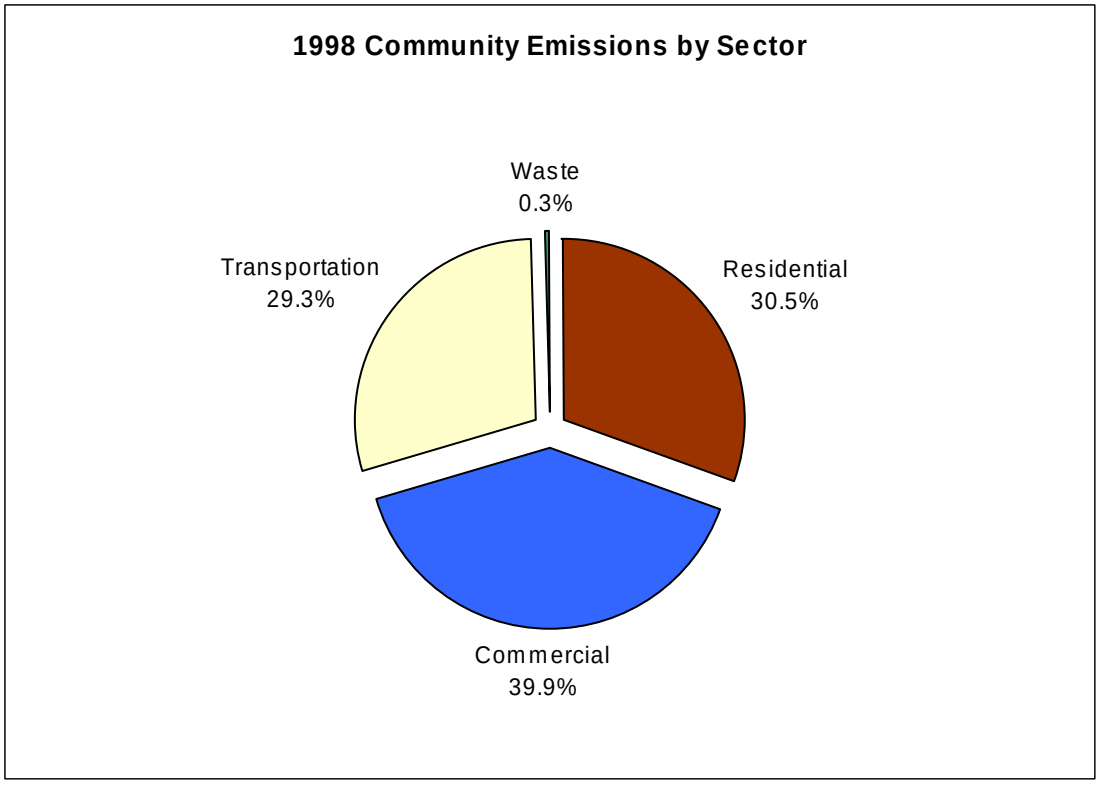

Total Fitchburg GHG Emissions per Capita
GHG/capita (tonnes eCO2)
25.0
20.0
15.0
10.0
5.0
0.0
1998
2002
2006
2007
2012
1998
2002
2006
2010
Year
*Does not include projected energy use from addition of library

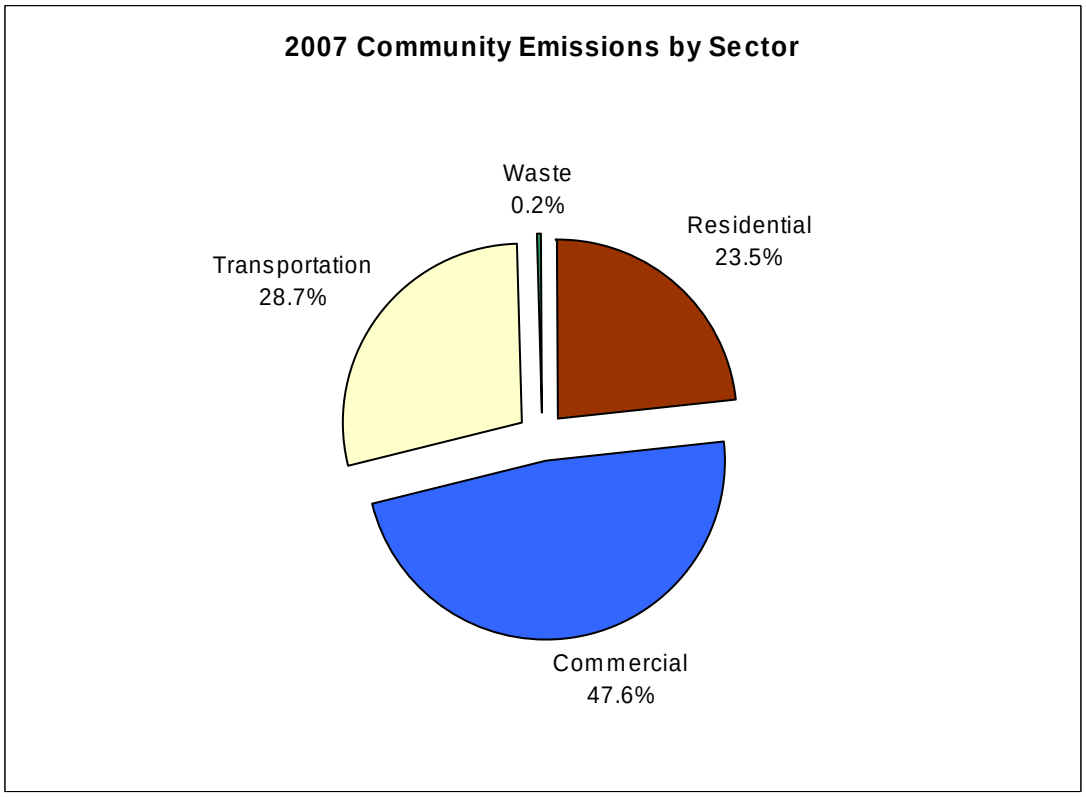

Gov't GHG Emissions by Sector
GHG (tonnes eCO2)
6,000
5,000
4,000
3,000
2,000
1,000
0
1998
2002
2006
2007
2012
Total
Buildings
Vehicle Fleet
Streetlights
Water/Sew age
Emission Reduction Measures
1998
2002
Year
2006
2010
*Does not include projected energy use from addition of library


Community GHG Emissions by Sector
GHG (tonnes eCO2)
600,000
500,000
400,000
300,000
200,000
100,000
0
Total
Residential
Commercial
Transportation
Waste
Emission Reduction Measures
1998
2002
2006
2007
2012
1998
2002
Year
2006
2010


1998 Gov't Emissions by Sector
Water/Sewage
35.3%
Buildings
33.1%
Streetlights
15.2%
Vehicle Fleet
16.5%


2007 Gov't Emissions by Sector
Water/Sewage
36.6%
Buildings
34.5%
Streetlights
14.6%
Vehicle Fleet
14.3%


1998 Community Emissions by Sector
Waste
0.3%
Residential
30.5%
Transportation
29.3%
Commercial
39.9%


2007 Community Emissions by Sector
Waste
0.2%
Residential
23.5%
Transportation
28.7%
Commercial
47.6%

Fitchburg
Government & Total (Gov't & Community) Greenhouse Gas Emissions
Baseline Analysis

	1998	2002	2006	2007	w/o Reduction Measures 2012 (a)	w/ Reduction Measures 2012 (a)
Government:						
Buildings						
GHG emissions (tonnes)	1,102	1,675	1,706	1,845	1,779	1,706
Energy (MMBtu)	9,253	11,981	10,300	11,209	11,209	11,209
Vehicle Fleet						
GHG emissions (tonnes)	550 (b)	571	619	767	766	715
Energy (MMBtu)	7,056	7,330	7,968	9,835	9,835	9,168
Streetlights						
GHG emissions (tonnes)	505	666	746	778	744	744
Energy (MMBtu)	2,018	2,435	2,620	2,738	2,738	2,738
Water/Sewage						
GHG emissions (tonnes)	1,175	1,530	1,775	1,958	2,217	2,216
Energy (MMBtu)	4,750	5,692	6,306	6,973	8,323	8,323
Total Government						
GHG emissions (tonnes)	3,332	4,442	4,846	5,348	5,506	5,381
Energy (MMBtu)	23,077	27,438	27,193	30,755	32,105	31,438
Total City GHG (Comm. + Gov't)	246,867	310,154	405,026	448,691	494,517	482,905
Population	18,339	21,257	22,900	23,240	26,500 (c)	26,500 (c)
Total GHG/capita	13.5	14.6	17.7	19.3	18.7	18.2

(a) Per CACP, assumed no growth rate for Gov't GHG emissions 2012 projections; Gov't 2012 projections only include the addition of one new well.
(b) Estimated value
(c) Interpolated linearly from Census Data received from Tom Hovel; based on population in 2000 of 20,501 and projected population for 2020 of 30,431.

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Fitchburg
Community Greenhouse Gas Emissions
Baseline Analysis

	1998	2002	2006	2007	w/o Reduction Measures 2012 (a)	w/ Reduction Measures 2012
Community:						
Residential						
GHG emissions (tonnes)	74,225	94,166	98,048	103,999	113,876	113,865
Energy (MMBtu)	576,926	700,943	702,410	757,270	856,781	856,781
Commercial						
GHG emissions (tonnes)	97,246	135,877	188,422	211,170	230,305	218,829
Energy (MMBtu)	820,403	943,002	1,137,063	1,271,283	1,438,340	1,438,340
Transportation						
GHG emissions (tonnes)	71,444	74,748	112,954	127,363	143,911	143,911
Energy (MMBtu)	912,810	959,862	1,456,155	1,642,938	1,858,833	1,858,833
Waste						
GHG emissions (tonnes)	620	921	756	812	919	919
Energy (MMBtu)	0	0	0	0	0	0
Total Community						
GHG emissions (tonnes)	243,535	305,713	400,180	443,344	489,011	477,524
Energy (MMBtu)	1,503,348	2,039,282	2,968,791	3,447,394	3,807,023	3,807,023

(a) 2.5% was used as the growth rate, based on projected growth from 2000 to 2020 (Source: "Data for Climate Change Analysis", received from Tom Hovel 4/17/08)

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Fitchburg
City Government Operations GHG Emission Reduction Measures
Savings in 2012 alone (i.e., not cumulative)

	Equiv GHG (tonnes)	Equiv GHG (%)	Energy (MMBtu)
Buildings Sector			
Change in Energy Source			
McKee Farms Wind Turbine[a]	46.0	37.0	0.0
Solar Power Array at Shop	9.0	7.5	0.0
Solar Power Arrays at City Hall	19.0	15.0	0.0
Subtotal Buildings	74.0	59.5	0.0
Vehicle Fleet Sector			
Increase in Fuel Efficiency			
Anti-Idling Policy (Diesel)[b]	22.0	17.8	282.0
Anti-Idling Policy (Unleaded)[b]	13.0	10.2	168.0
Fire Dept. Replacement of Command vehicle with hybrid[c]	4.0	3.4	55.0
Fire Dept. Replacement of Command vehicle with hybrid[c]	5.0	4.1	66.0
Fire Dept. Replacement of Command vehicle with hybrid[c]	6.0	5.1	83.0
Police Administrative Vehicle, replacement of Taurus with mid-size hybrid[c]	0.0	0.0	3.0
Police Crime Scene Vehicle, hybrid SUV[c]	0.0	1.0	10.0
Subtotal Vehicle Fleet	50.0	40.5	654.0
Total GHG Emissions Reduction in 2012	**124.0**	**100.0**	**654.0**

(a) Assumed will produce just enough electricity to meet McKee Farms Park needs
(b) Assumed fuel efficiency increases by .5 mile/gallon as a result of the anti-idling policy implemented in 2008
(c) Miles/gallon obtained from gov't website

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Fitchburg
Community GHG Emission Reduction Measures
Savings in 2012 alone (i.e., not cumulative)

	Equiv GHG (tonnes)	Energy (MMBtu)
Commercial Sector		
Change in Energy Source		
Berbee - 100% Renewable	11,476.0	0.0
Residential Sector		
Change in Energy Source		
Lacy Photovoltaics	10.0	0.0
Total GHG Emissions Reduction in 2012	**11,486.0**	**0.0**

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USMCPA Action Item 2. Adopt and enforce land-use policies that reduce sprawl, preserve open space, and create compact, walkable urban communities *(RCC Contact: Steve Arnold; Staff Contact: Tom Hovel)*

Summary of Resource Conservation Commission Recommendations, as of 3/09:
A significant percentage of GHG emissions may be attributed to transportation of people and of goods to meet the needs/demands of people. Since the middle of the 20th century, four factors have driven the dramatic increase in vehicle miles traveled (VMT) per capita: 1) The emergence of the private automobile for transportation; 2) Inexpensive fossil fuels; 3) Euclidean zoning and the supportive infrastructure that separates land uses; and 4) On-site parking requirements.

Fitchburg can develop a more sustainable land use pattern that reduces transportation-related development and the GHG emissions that accompany that type of development. Fitchburg can accomplish that by developing future neighborhoods and retrofitting existing neighborhoods to provide transportation options in addition to private automobiles; and developing land more intensely so houses, workplaces and daily needs are closer together. In addition to reducing transportation-related GHG emissions, these changes will help to preserve rural land for the production of food and improve health by making walking and bicycling more feasible transportation options.

- Rewrite Fitchburg's zoning code to permit and encourage compact, diverse, mixed-use neighborhoods. High density brings more uses into close proximity, reducing trip lengths.
- Site new community facilities, including schools, libraries, community centers and retail centers, to minimize auto VMT.
- Evaluate the feasibility of adopting an urban-friendly fire code (street widths, building heights, roof slopes, etc.).
- Encourage new subdivisions to have street networks aligned in the cardinal directions to maximize opportunities for solar energy.
- Consider transfer-of-development rights (TDR) program to encourage compact building and reduce consumption of undeveloped land. Estimated cost of setting up a TDR is $50,000.
- Develop a City-wide build out plan to specify the order of neighborhood development, prioritizing infill to: 1) minimize and delay infrastructure development; 2) economize on City resources; 3) encourage compact urban development; and 4) protect environmental corridors and preserve open space.
- Avoid financial incentives for developments not promoting high density and efficiency.
- Revise Fitchburg's parking requirements to encourage compact development and transportation modes other than private autos and to discourage surface parking. Parking regulations should provide maximums, with minimums dictated by market demand and safety. Parking regulations should encourage shared-use of public and private parking structures and street parking.
- Consider establishing a Parking Utility to operate City-owned parking structures, lots and street parking. City-owned parking, in a compact urban setting, can be used by multiple users at different times of the day much more efficiently than on-site parking. Estimated annual cost of setting up a Parking Utility is $50,000.
- Encourage Fitchburg's park dedication requirements be met by providing appropriate small parks and contributions to regional park facilities for urban neighborhoods to facilitate compact developments.

- Encourage LEED Neighborhood Development (LEED ND) or similar standard.
- Encourage Transit Oriented Developments (TOD)
- Use extra-territorial jurisdiction (ETJ) to positively influence planning in adjacent jurisdictions to:
  - Reduce urban sprawl, preserve open space and create compact walkable urban communities adjacent to Fitchburg.
  - Preserve rural separation areas between urban Fitchburg and surrounding urban communities.

Priority	Action Item 2 Recommendations	Est. Annual Energy Savings by 2012	Estimated Out-of-Pocket Cost
1	Rewrite Fitchburg's zoning code to permit and encourage compact, diverse, mixed-use neighborhoods.	(a)	$0
2	Develop a City-wide build out plan to specify the order of neighborhood development, prioritizing infill. (Refer to additional text above.)	(a)	$0
3	Encourage LEED ND or similar standard.	(a)	$0
4	Encourage Transit Oriented Developments.	(a)	$0
5	Site new community facilities to minimize auto VMT.	(a)	$0
6	Avoid financial incentives for developments not promoting high density and energy efficiency.	(a)	$0
7	Encourage new subdivisions to align streets in cardinal directions to maximize opportunities for solar energy.	(a)	$0
8	Encourage Fitchburg's park dedication requirements be met with small parks and contributions to regional parks.	(a)	$0
9	Revise Fitchburg's parking requirements to encourage compact development and transportation modes other than private autos and to discourage surface parking.	(a)	$0
10	Consider establishing a Parking Utility to operate City-owned parking structure, lots and street parking.	(a)	$0
11	Use extra-territorial jurisdiction to positively influence planning in adjacent jurisdictions.	(a)	$0
12	Consider TDR program to encourage compact building and reduce consumption of undeveloped land.	(a)	$0
13	Evaluate the feasibility of adopting an urban-friendly fire code (street widths, building heights, roof slopes, etc.).	(a)	$0

(a) While these recommendations will reduce GHG emissions, they will have their greatest impact after 2012.

USMCPA Action Item 3. Promote transportation options such as bicycle trails, commute trip reduction programs, incentives for car-pooling and public transit *(RCC Contact: Phillip Rangsuebsin; Staff Contact: Ahna Bizjak)*

Summary of Resource Conservation Commission Recommendations, as of 3/09:

- Implement the following transportation education related items:
  - Create and maintain a ride-sharing online message board for City employees, businesses and residents.
  - Educate City employees, residents and businesses on transportation options through FACTv, events, website postings, neighborhood associations, Fitchburg Updates, incentive programs, etc.
  - Promote and encourage City participation in the area's annual Car-Free Challenge and consider starting a Fitchburg Bike-to-Work Challenge.
- Pursue Madison Metro transit improvements to promote transit usage and increase ridership:
  - Encourage Metro to become a member of Google Transit Partners.
  - Establish a Fitchburg Transfer Point at Hatchery Hill.
  - Add one earlier run on Route 44 to hospital for 7 a.m. shift start.
  - Establish a new route 46 via McKee Road to SuperTarget.
  - Establish "no fare" to board in Fitchburg.
  - Establish an unlimited transit pass program for Fitchburg residents.
- Introduce and pass a resolution for the Dane County area to establish a group to guide and promote regional transit options.
- Urge State legislators and Governor Doyle to join the over two dozen other states and adopt California Vehicle Emission Standards for Wisconsin.
- Promote fuel efficient vehicle purchases by Fitchburg residents and businesses.
- Establish and promote a policy regarding the use of neighborhood electric vehicles (NEV) on local streets (<45 mph).
- Investigate the feasibility of commuter rail: evaluate activation of Fitchburg's existing rail line; continue to plan it into future developments; and work with neighboring communities on this issue.
- Adopt and implement street construction standards that promote bikes and pedestrians.

Priority	Action Item 3 Recommendations	Est. Annual Energy Savings by 2012	Estimated Out-of-Pocket Cost
1	Implement the following transportation education related items: – Create and maintain a ride-sharing online message board. – Educate City employees, residents and businesses on transportation options through FACTv, events, website postings, neighborhood associations, Fitchburg Updates and incentive programs, etc. – Promote and encourage City participation in the area's annual Car-Free Challenge and consider starting a Fitchburg Bike-to-Work Challenge.	9,300 MMBtu [(a)]	$2,000
2	Introduce and pass a resolution for the Dane County area to establish a group to guide and promote regional transit options.	(b)	$0
3	Urge State legislators and Governor Doyle to adopt California Vehicle Emission Standards for Wisconsin.	(b)	$0
4	Promote fuel efficient vehicle purchases by Fitchburg residents and businesses.	18,600 MMBtu[(c)]	$1,000
5	Establish and promote a policy regarding the use of neighborhood electric vehicles (NEV) on local streets (<45 mph).	5,600 MMBtu[(d)]	$500
6	Pursue Madison Metro transit improvements to promote transit usage and increase ridership.	(e)	$0
7	Investigate the feasibility of commuter rail.	(e)	$0
8	Adopt and implement street construction standards that promote bikes and pedestrians.	(a)	$0

(a) Assumes a 0.5% reduction in "Community" and "Government" transportation energy usage from improved transportation habits (from 2012 projected transportation energy usage).
(b) This recommendation will reduce GHG emissions, but the amount is difficult to predict.
(c) Assumes a 1% reduction in "Community" transportation usage (from 2012 projected transportation energy usage).
(d) Assumes a 0.3% reduction in "Community" transportation energy usage (from 2012 projected transportation energy usage).
(e) Studies have shown that these types of improvements decrease VMT.

USMCPA Action Item 4. Increase the use of clean, alternative energy by, for example, investing in "green tags", advocating for the development of renewable energy resources, recovering landfill gas for energy production, and supporting the use of waste to energy technology *(RCC Contact: Jan Kucher; Staff Contact: Rick Eilertson)*

Summary of Resource Conservation Commission Recommendations, as of 3/09:
At the time this report was prepared, the City of Fitchburg had already budgeted for two and planned for a third renewable energy system to be installed at City facilities. Fitchburg has also entered into an agreement with MG&E to operate and monitor a vertical wind turbine installed in McKee Farms Park in late 2008.

The text below serves as a preliminary, conceptual, and budgetary study of ideas and costs associated with renewable energy for the City of Fitchburg. Prior to making a decision, a detailed cost and financial analysis is recommended. No financing costs have been considered in these analyses. Renewable energy incentives should be confirmed and updated.

Four renewable energy technologies have been examined: photovoltaics, solar thermal, geothermal (heating and cooling) and wind power. Each system is briefly described below with examples of the associated economics:

Photovoltaics
Photovoltaic (PV) power generation is a 50-year old technology that converts sunlight to electricity. When light from the sun hits a solar PV panel, it causes electrons to flow from the panel as electricity. There are four types of manufactured PV panels, but the most common are single crystalline and polycrystalline. There are three types of PV panel mounting systems under consideration: roof-mounted; fixed ground-mounted; and ground-mounted with a solar tracking system. All systems benefit from manual snow removal to improve efficiency. The electricity generated becomes part of the power on the local electrical grid and can be used by the City, but it is essentially sold back to MG&E. When there is clear access to the sun, PV panels that are ground-mounted with a tracking system are estimated to be 20 – 25% more efficient during the summer when compared to a fixed-roof mounted system. However, the capital costs are higher due to the required sun-tracking rack. In addition, a suitably exposed area of land is required, with clear sun exposure from about 9:00 a.m. until 4:00 p.m., to justify the extra cost of the sun-tracking rack. Otherwise the money for the sun-tracking rack is better spent on additional PV panels.

Example A: 50kW roof-mounted system
Capital cost: $350,000 after current incentives ($400,000 – $50,000/system; maximum of $50,000 incentive allowed per approved system)
Operation and maintenance: $500/yr
Energy produced: 60,000 kWh/yr
Energy sold to MG&E: $15,000/yr (60,000 kWh x $0.25/kWh; assumes MG&E's $0.25/kWh buy-back rate is continued for future projects.)

Example B: The City of Fitchburg has budgeted for three PV collector arrays: one at City Hall; one at a Fire Station; and one at the Public Works Maintenance Facility. The City's Building Inspection Department is managing the installation projects and has discovered that they may be able to install more PV arrays (and/or solar thermal system(s)) than originally

anticipated, for the same amount of budgeted dollars. The size of the PV units will vary, but we have assumed each system would be about 6.3 Watts and will have a 7,500 kWh/year capacity.
Capital cost for each system: $44,750 after incentives ($55,750 - $11,000)
Operation and maintenance: $200/yr
Energy sold to MG&E: $1,875 (7,500 kWh @ $0.25/kWh; assumes MG&E's $0.25/kWh buy-back rate is continued for future projects.)

Solar Hot Water (Solar Thermal)
Solar hot water systems involve installing solar hot water panels on a roof or ground-mounted. The solar hot water panels allow the sun to heat up a solution of water and antifreeze, which is pumped through the panels. The hot solar thermal solution in the solar panels circulates through a heat exchanger so that the solar heat is transferred to the hot water system used in the building. The solar thermal solution is then pumped back up to the solar hot water panels, and the solar heating process repeats itself. The use of a solar hot water system substantially decreases (in winter) and/or eliminates (in summer) the need for a gas or electric hot water heater to operate. Solar thermal can also be used for space heating.

Example: A solar hot water system designed to provide 410 gallons of hot water per day (for this example, only domestic hot water is generated; there is no space heating).
Capital cost of the system: $17,600, assuming 35% credit ($27,000 - $9,400)
Operation and maintenance: $100/yr
Energy production/savings: 375 therms/yr

Geothermal Energy
This system saves energy by using the earth as a heat sink or heat source and then uses a heat pump to add heat or cooling for a building's HVAC system. A series of vertical wells or horizontal subsurface loops are used to circulate a heat transfer fluid to transfer heat into or from the earth to the heat pump. At depths below approximately 6 feet the earth stays a fairly constant 50 to 55 degrees F. The U.S. EPA offers that a geothermal heating system uses 48% less energy than a natural gas furnace.

A geothermal system is capital intensive because of the heat transfer wells or subsurface heat transfer loops. Geothermal systems are normally more economical for new construction when compared with an existing building retrofit. Land for the heat transfer wells or loops needs to be set aside. A geothermal system relies upon the wells or loops being able to fit into the site landscape. These systems are very reliable and have low maintenance costs.

Example: A new 7,600 square foot building (typically uses 1.26 therms/sf = 9,576 therms/yr).
Capital cost (over conventional forced-air gas system): $48,400 after incentives ($50,000 – $1,600)
Operation and maintenance (over conventional forced air natural gas system): $0/yr
Energy savings ~ 20 % or 1,915 therms/yr

Wind Power
Using the wind to produce energy has occurred for centuries. At the right location, where wind speed and frequency are sufficient to keep turbines operating, the payback on a wind power installation can be quite good. Wind speed and frequency is best during the months approaching, during and just after winter. In Fitchburg, during summer, there is usually less wind of a

sufficient speed and frequency to consistently drive wind turbines for prolonged time periods. Prior to installation of a wind farm, which is a collection of large wind turbines usually located in a rural area, the wind within the area should be studied to predict the future success of any wind farm installation. Installation of a wind farm in a rural area would be a financial windfall for the farm property owners who are compensated by the wind farm, but they can also continue farming the land around the wind turbines. Proximity to the area's main electricity transmission grid is also an important factor, so that the power that is generated can be fed back into the area's power grid. Reliable power generation from wind farms is possible for many decades.

Increasing public awareness of the advantages of wind power (long-term rural revenue generation, local power production, GHG emission reduction, etc.), along with dispelling some of the myths about wind power (e.g., negative effects on birds are minimal, decibel levels are low, etc.) are an important part of any municipality's efforts to support wind power. The installation of residential or smaller application wind power generation should be encouraged through ordinances that allow such installations to occur. However, for this analysis, a larger scale horizontal wind turbine generator was considered for economies of scale.

Horizontal Wind Turbines

For an example system, six Vestas 1.65 MW horizontal wind turbine generators (WTG) are analyzed. The six WTGs would be located south of Fitchburg on approximately 300 acres. (This area could still be farmed.) This system would be capable of generating approximately 30,353,400 kWh/yr. The capital cost estimate below includes all equipment, installation and $1,000,000 estimated cost for transmission line tie-in. The system is assumed to qualify for a Federal Renewable Electricity Production Credit, also known as a Production Tax Credit (PTC), of $0.021/kWh (with an increase of $0.001/kWh per year) for the first 10 years of energy production.

Example:
Capital cost: $25,750,000
Operation and maintenance: $500,000/yr
Energy produced: 30,353,400 kWh/yr
Annual energy sold to MG&E = $3,400,000/yr (30,353,400 kWh/yr x $0.112/kWh)
Total Production Tax Credit: $774,000/yr estimated for the first 10 years, or $7,740,000 total (30,353,400 kWh/yr x 10 yrs x $0.0255) Note: $0.0255/kWh was used as the average Renewable Electricity Production Credit.

Vertical Wind Turbines

MG&E installed a pilot scale 10 kW vertical wind turbine in McKee Farm Park in 2008. This system may be effective for residential or small applications. This system, which serves as a demonstration, will continue to be monitored by Fitchburg and MG&E.

RCC recommendations for renewable energy are as follows:

- Proceed with the installation of the budgeted renewable energy systems during 2009 currently planned for City Hall and the Public Works Maintenance Facility. Estimated energy production/savings: 15,000 kWh.
- Proceed with the installation of the budgeted renewable energy system for 2010 at one of Fitchburg's fire stations. Estimated energy production/savings: 7,500 kWh.
- Evaluate subscribing Fitchburg to MG&E's GPT program to purchase some of Fitchburg's

power from renewable sources.

- Implement a renewable energy plan:
  1) Evaluate additional installations of traditional renewable energy systems for City-owned facilities, including: photovoltaics, solar thermal, solar daylighting, passive solar heating, geothermal, wind power generation and biomass heating.
  2) Prepare a report showing recommendations, financial incentives and anticipated energy savings/production.
  3) Develop a renewable energy plan.
  4) Implement the renewable energy plan.
- Evaluate the installation of less traditional renewable energy systems, including: waste-to-energy technologies (anaerobic digester for animal waste and other biomass materials), extraction of heat from wastewater flowing through Fitchburg, landfill gas recovery, etc.
- Consider assisting residents and businesses with additional incentives for the installation of renewable energy systems. Estimated energy savings: depends on incentives offered and number of residents and businesses who participate.

Priority	Action Item 4 Recommendations	Est. Annual Energy Savings by 2012	Estimated Out-of-Pocket Cost
1	Proceed with the installation of the budgeted City renewable energy systems during 2009.	15,000 kWh	$90,000[(a)]
2	Proceed with the installation of the budgeted City renewable energy system in 2010.	7,500 kWh	$45,000[(a)]
3	Evaluate subscribing Fitchburg to MG&E's Green Power Tomorrow (GPT).	(b)	$.01/kWh
4	Implement a renewable energy plan. (Refer to additional text above.)	(c)	$3,000[(d)]
5	Evaluate the installation of less traditional renewable energy systems, including: waste-to-energy technologies (anaerobic digester for animal waste and other biomass materials), extraction of heat from wastewater flowing through Fitchburg, landfill gas recovery, etc.	(e)	$3,000[(d)]
6	Consider providing additional incentives to residents and businesses for the installation of renewable energy systems.	(f)	(g)

(a) Already included in 2009 CIP budget.
(b) Amount of GHG emissions reduction depends on percent of subscription.
(c) This has the potential for significant GHG emissions reduction; the amount depends on the systems chosen.
(d) Estimated cost of $3,000 assumes City staff works with renewable energy contractors/suppliers to produce the draft report and a paid consultant reviews it for accuracy.
(e) GHG emissions reduction depends on the systems chosen.
(f) This has the potential for significant GHG emissions reduction.
(g) Cost depends on the incentives offered.

USMCPA Action Item 5: Make energy efficiency a priority through building code improvements, retrofitting City facilities with energy efficient lighting and urging employees to conserve energy and save money. *(RCC Contact: Phillip Rangsuebsin; Staff Contact: John Crook)*

Summary of Resource Conservation Commission Recommendations, as of 3/09:

- Implement energy conservation practices for City buildings:
  - Use motion sensors for most exterior lights.
  - Use solar lights for park trails and shelters.
  - Eliminate aesthetic park lighting.
  - Use tamper-resistant solar lighting when possible.
  - Evaluate all City HVAC equipment and plan to replace inefficient units with efficient ones.
  - Evaluate insulation needs and possible thermal bridging problems at all City facilities.
  - Seasonally adjust the temperature on thermostats at all unoccupied City facilities.
  - Add motion sensors to light switches in all City buildings.
- Increase energy conservation awareness:
  - Educate City employees on the importance of energy conservation in the workplace.
  - Make energy conservation information available to residents and business owners.
  - Create and install signs in City buildings encouraging specific energy efficient actions.
  - Hold events that emphasize energy efficiency (e.g., City employee, resident & business events that feature energy conservation methods).
- Replace all incandescent "Exit" signs in City buildings with LED "Exit" signs.
- Set up an Environment-friendly Suggestion Box for City staff suggestions.
- Implement real-time monitoring of the electricity and natural gas usage in individual City buildings and use this information to improve energy efficiency.
- Amend the City's Purchasing Policy to include GHG emission reductions/energy efficiency as a purchasing criterion and emphasize that the Policy allows for purchase orders and contracts to be awarded based on life-cycle costs.
- Replace any remaining incandescent light bulbs with compact fluorescent light bulbs (even if not burned out).
- Work with Focus on Energy, MG&E and Alliant Energy to develop and implement a plan to assist businesses and residents with implementation of energy efficient methods and equipment.

Priority	Action Item 5 Recommendations	Est. Annual Energy Savings by 2012	Estimated Out-of-Pocket Cost
1	Increase energy conservation awareness. (Refer to additional text above.)	225 MMBtu[(a)]	$750
2	Amend the City's Purchasing Policy to include GHG emission reductions/energy-efficiency as a purchasing criterion and emphasize that the Policy allows for purchase orders and contracts to be awarded based on life-cycle costs.	(b)	Cost saving recommendation
3	Implement real-time monitoring of the electricity and natural gas usage in individual City buildings and use this information to improve energy efficiency.	560 MMBtu[(c)]	$4,800
4	Set up an Environment-friendly Suggestion Box for City staff suggestions.	(d)	$0
5	Replace all incandescent "Exit" signs in City buildings with LED "Exit" signs.	23,700 kWh[(e)]	$5,100
6	Implement energy conservation policies for City buildings. (Refer to additional text above.)	560 MMBtu[(c)]	$36,500
7	Replace any remaining incandescent light bulbs with compact fluorescent light bulbs.	225 MMBtu[(a)]	$4,300
8	Work with Focus on Energy, MG&E and Alliant Energy to develop and implement a plan to assist businesses and residents with implementation of energy efficient methods and equipment.	(f)	$10,000

(a) Assumes a 2% decrease in the projected 2012 government building energy usage.
(b) This recommendation will likely save money and reduce GHG emissions.
(c) Assumes a 5% decrease in the projected 2012 government building energy usage.
(d) This recommendation will likely reduce GHG emissions, but the amount is difficult to predict.
(e) Assumes 100 "Exit" signs are replaced. Incandescent "Exit" signs changed to LED will decrease electricity usage by 237 kWh/sign/year x 100 signs =23,700 kWh/year. LED "Exit "signs are $32 each, plus labor.
(f) While this recommendation will reduce GHG emissions, the amount depends on the methods implemented and the equipment replaced.

USMCPA Action Item 6. Purchase only Energy Star equipment and appliances for City use. *(RCC Contacts: Chris Jimieson & Samuel Cooke; Staff Contacts; Tony Roach & Department Heads)*

Summary of Resource Conservation Commission Recommendations, as of 3/09:

- Implement a City purchasing/leasing policy that new equipment and appliances are Energy Star certified or equally energy efficient.
- Follow-up on implementation of City's computer "power off" policy at the end of each business day for non-emergency employees/workstations.
- Evaluate additional winterizing measures at McKee Park Shelter during winter months (i.e. turn off the water heater; replace old electric heaters with a more energy efficient heat source).
- Implement a Green IT (Information Technology) Program (e.g. minimizing e-waste, evaluate telecommuting options for employees).
- Reduce physical servers 50% by 2012 and replace with more virtual servers.

Priority	Action Item 6 Recommendations[a]	Est. Annual Energy Savings by 2012	Estimated Out-of-Pocket Cost
1	Implement a City purchasing/leasing policy that new equipment and appliances are Energy Star certified or equally energy efficient.	40,800 kWh[b]	$0
2	Follow-up on implementation of the City's computer "power off" policy.	3,900 kWh[c]	Cost savings recommendation
3	Evaluate additional winterizing measures at McKee Park Shelter during winter months.	2,000 kWh[d]	Cost savings recommendation
4	Implement a Green IT Program.	1,240 kWh + 1,400 gal. gas[e]	~$1,000
5	Reduce physical servers 50% by 2012 and replace with more virtual servers.	5,000 kWh[f]	~$20,000

(a) Priority items 1 through 3 are high priority recommendations because they require no additional out-of-pocket costs for implementation.
(b) Assumes the current purchasing/leasing program pace for the City of Fitchburg is not accelerated. Annual anticipated energy savings based on the following estimates: 20 new computers (non-Energy Star converted to Energy Star), 4 laser printers, 1 copier, 1 refrigerator, 20 smaller equipment appliance items not including lighting items covered under USMCPA Action Item 5.
(c) Assumes current 90% computer shutdown rate among City of Fitchburg employees could be improved to 95% through this policy.
(d) Assumes 400 kWh savings per month over the 5-month winter period.
(e) Assumes annual increases of 5% in telecommuting by City of Fitchburg employees, 10% in additional IT savings per year through various measures.
(f) Assumes 4 physical servers replaced by virtual servers at $5,000 each and average of 5,000 kWh saved annually.

USMCPA Action Item 7. Practice and promote sustainable building practices using the U.S. Green Building Council's LEED program or a similar system *(RCC Contact: Samuel Cooke; Staff Contacts: Mike Zimmerman, John Crook, Tom Hovel)*

Summary of Resource Conservation Commission Recommendations, as of 3/09:
The following recommendations are provided by the Resource Conservation Commission, working with City staff, to reduce GHG emissions:

- Evaluate the modified version of the U.S. Green Building Council's (USGBC) LEED for New Construction (LEED NC) sustainable building standard developed for the Green Tech Village. This modified standard is proposed to be Fitchburg's version of the LEED NC standard. This City standard should, at least, be required of all projects receiving tax incremental financing (TIF) and should be phased-in for future projects. Depending on what is proposed, this could significantly influence future energy usage. The energy use reductions are estimated to be 30% to 50% per new building, which translates into an annual energy savings of an estimated 2,100 to 3,500 therms and 60,000 to 100,000 kWh per commercial building.[(a)]
- Plan for full implementation of the Fitchburg version of the LEED NC standard for all new commercial buildings. Should the Fitchburg version of the LEED NC standard (above) not be adopted or is not adequate to reach the goals stated in LEED NC, then develop a plan and target date to phase-in LEED NC for commercial buildings. A significant reduction in future energy usage is expected to occur when compared with conventional construction standards.
- Hire a consultant to evaluate the use of LEED NC standard for all future City buildings and the application of LEED for Existing Building (LEED EB) standard to existing City buildings. The evaluation report should include recommendations for upgrading existing City buildings and the related cost. This could reduce future energy usage by 30% to 50%, which translates into annual, per building, energy savings of 2,100 to 3,500 therms and 60,000 to 100,000 kWh when compared with current standard construction methods.[(a)]
- Evaluate the "LEED for Homes," "Energy Star" and "GreenBuilt Homes" building standards for either incorporation into an incentive-based program or phased-in as a part of residential new construction standards in Fitchburg. This would lead to a significant reduction in future energy usage (energy use reduction from 30% to 60% translates into annual, per residence, energy savings of an estimated 280 to 570 therms and 2,600 to 5,300 kWh when compared with standard construction methods).[(b) (c)]
- Work with Focus on Energy to develop and implement Fitchburg programs to encourage existing buildings to become more energy efficient. This would include a review of the LEED for Existing Buildings (LEED EB) standard and development of incentive programs to promote an increase in energy efficiency of existing commercial buildings. This would also include a review of the LEED for Homes standard and development of incentive programs to promote an increase in energy efficiency of existing residential buildings. For example, Fitchburg could provide a subsidy to qualifying residents and businesses for Focus on Energy's residential and commercial building performance inspections (energy audits). (Focus on Energy provides rebates for implementing specific parts of their recommendations.) If Focus on Energy's energy efficiency recommendations are implemented, annual savings are estimated at 280 therms and 2,600 kWh per average residence and 2,100 therms and 60,000 kWh per average commercial building.[(c) (d)]

Priority	Action Item 7 Recommendations	Est. Annual Energy Savings by 2012	Estimated Out-of-Pocket Cost
1	Evaluate and implement Fitchburg's modified version of the LEED NC sustainable building standard being developed for buildings in the Green Tech Village.	550 MMBtu per bldg [(a) (b)]	$5,000
2	Develop a plan to phase-in either the Fitchburg version of LEED NC standard or the USGBC's LEED NC standard for new commercial buildings.	550MMBtu per bldg [(a) (b)]	$0
3	Develop and implement programs tailored to Fitchburg to encourage existing commercial and residential buildings to become more energy efficient.	415 MMBtu (com. bldg) 40 MMBtu (res. bldg) [(c)]	$15,000 [(d)]
4	Evaluate the use of LEED NC standard for all future City buildings. Evaluate applying LEED EB standard to existing City buildings.	550 MMBtu per bldg [(a) (b)]	$24,000
5	Evaluate the "LEED for Homes," Energy Star and "GreenBuilt Homes" building standards for either incorporation into an incentive-based program or phased-in as a part of residential new construction standards.	56 MMBtu per bldg [(a) (e)]	$0

(a) Average Natural Gas and Electricity Usage for Buildings (2008)

Type of Building	Therms/yr (Avg.)[(f)]	kWh/yr (Avg.) [(f)]
Retail Building (10,000 sq ft^2 - MG&E area)	9,300	240,000
Avg. Commercial Bldg (10,000 ft^2 - MG&E area)	7,000	200,000
Office Building (10,000 sq ft^2 - MG&E area)	4,300	162,000
Avg. Single Family Home (MG&E area)	940	8,700
Avg. Residence (Single Family & Rental - Fitchburg)	565	6,750
Avg. Rental Unit (MG&E area)	200	4,950

Note: MG&E area and Fitchburg residential energy usage data were provided by MG&E for 2008.

(b) A 30% to 50% reduction in energy usage translates into an annual energy savings of an estimated 2,100 to 3,500 therms and 60,000 to 100,000 kWh per average commercial building, when compared with current standard construction methods. Using the average energy savings of 40% results in an average annual natural gas savings of 2,800 therms (280 MMBtu) and an average annual electric energy savings of 80,000 kWh (272 MMBtu). That results in a total average annual energy savings of 550 MMBtu per average commercial building.[(f)]

(c) Based on the assumption that the annual energy consumption of an average single family residence equals 940 therms and 8,700 kWh. According to Energy Star, "U.S. households typically use up to 30 percent more energy than necessary to achieve the desired level of performance and comfort." The commercial building assumption is based on a 30% reduction in a 10,000 sq ft commercial building using an annual average of 7,000 therms and 200,000 kWh. (see footnote (a) above.) The 30% reduction in annual energy usage results in a 415 MMBtu savings per average commercial building and 40 MMBtu savings per average single family home.

(d) Based on subsidizing the inspection of 200 commercial or residential buildings in one year at $75/building.

(e) Based on Home Energy Rating System (HERS) tests performed on homes certified through the LEED for Homes program during 2008, the average home approved at the LEED for Homes "Certified" level is predicted to have potential energy savings of up to 30% over homes built to the International Energy Conservation Code, a widely used standard. The average LEED for Homes "Platinum" level home could have as much as 60% or more energy savings than an IECC-built home. (LEED information obtained from the USGBC's website - 2008). See footnote (a) for 2008 average usage information.

(f) There are 10 therms per MMBtu and 293 kWh per MMBtu.

USMCPA Action Item 8. Increase the average fuel efficiency of municipal fleet vehicles; reduce the number of vehicles; launch an employee education program including anti-idling messages; convert diesel vehicles to bio-diesel *(RCC Contact: Diane Streck; Staff Contacts: Paul Woodard, Tom Blatter, Randy Pickering, Scott Endl)*

Summary of Resource Conservation Commission Recommendations, as of 3/09:

- Continue to evaluate the potential for no-mow zones, combined with public education on the advantages of no-mow zones.
- Raise the height of City mowers during the middle of the summer which will reduce the frequency of mowing and therefore GHG emissions; increase rainwater infiltration; reduce weeds; and reduce grass burn-out.
- Encourage vehicle-sharing between departments and/or reimburse employees for the use of their personal vehicles instead of using plow trucks to run errands for the Parks Department.
- Use monthly Fuel Consumption Reports, which could be generated by Public Works and distributed to department heads, to manage fuel use and to monitor significant decreases in efficiency.
- Formalize the City/Department's policy for car-pooling to meetings, seminars, conventions and training sessions. Encourage teleconferencing whenever possible.
- Encourage the purchase of hybrids to replace retiring vehicles. Amend the City's Purchasing Policy to include GHG emission reductions as a purchasing criterion. Remind decision-makers that according to the City's Purchasing Policy, purchase orders and contracts may be awarded based on life-cycle costs.
- Study the current EMS location to determine if it is located centrally enough to minimize response time and thereby decrease fuel consumption.
- Conduct an Anti-Idling Awareness Campaign for City employees and residents, via RCC Forum, Fitchburg Star and handouts to employees.
- Engage a consultant to review vehicle idling in the Police and Fire Departments and present options. Fire and Police Department vehicles are often idled for long periods of time. Eliminating the need to keep vehicles running to power emergency equipment will significantly increase fuel efficiency and reduce GHG emissions. The fuel savings may more than offset the cost of the consultant.
- Continue to evaluate the use of Low Carbon Fuel Standard (LCFS) vehicle fuels for City fleet use. LCFS vehicle fuels include ethanol blends, biodiesel blends, low carbon electricity for plug-in hybrid electric vehicles, etc.
- Encourage residents to minimize their use of small engines (e.g., riding lawn mowers, snow blowers/throwers, gas/electric push mowers, leaf blowers). Evaluate ways to reduce the City's small engine usage. According to the Environmental Defense Fund, one riding lawn mower emits as much pollution each hour as 34 cars.

Priority	Action Item 8 Recommendations	Est. Annual Energy Savings by 2012	Estimated Out-of-Pocket Cost
1	Encourage the purchase of hybrids to replace retiring vehicles. Amend the City's Purchasing Policy to include GHG emissions as a purchasing criterion.	(a)	$0
2	Conduct an Anti-Idling Awareness Campaign.	75,000 gal[(b)]	Cost saving recommendation
3	Engage a consultant to review vehicle idling in the Police and Fire Departments.	(c)	$2,500[(c)]
4	Encourage vehicle-sharing between departments and/or reimburse employees for the use of their personal vehicle. Encourage teleconferencing.	(d)	Cost saving recommendation [(e)]
5	Formalize the City's policy for car-pooling to meetings, seminars, training sessions, etc.	(d)	Cost saving recommendation
6	Raise the height of City mowers during the summer.	520 gal[(f)] [(g)]	Cost saving recommendation[(h)]
7	Continue to evaluate the potential for no-mow zones.	(g) (i)	Cost saving recommendation[(h)]
8	Study EMS location to determine if it is located centrally enough to minimize response time and thereby decrease fuel consumption.	(j)	$5,000
9	Use monthly Fuel Consumption Reports to manage fuel use and to monitor significant decreases in efficiency.	(k)	$0
10	Continue to evaluate the use of Low Carbon Fuel Standard (LCFS) vehicle fuels for City fleet use.	(j)	$0
11	Encourage residents to minimize their use of small engines. Evaluate ways to reduce the City's small engine usage.	(d) (g)	$0

(a) Will definitely reduce GHG emissions; the amount depends on the vehicles replaced and the vehicles purchased.
(b) An average of 15 gal of gasoline/year/vehicle can be saved by eliminating 5 minutes of idling per day. Assuming an Anti-Idling Campaign reduces the idling of half of Fitchburg's estimated 10,000 vehicles, the savings would be 75,000 gal/year.
(c) Fire and Police Department vehicles are often idled for long periods of time. Eliminating the need to keep vehicles running to power emergency equipment will significantly increase fuel efficiency and reduce GHG emissions. The fuel savings may more than offset the cost of the consultant.
(d) Will definitely reduce GHG emissions, but difficult to forecast amount.
(e) The Parks Department currently uses plow trucks to run errands. Any reimbursements paid to employees for use of their personal vehicles would be more than offset by fuel savings for the plow trucks.
(f) At least 2,600 gallons of gas are used annually by City mowers. Raising the height of the mower is assumed to reduce the need for mowing by 20%, saving both lawnmower gas and transportation gas.
(g) One riding lawn mower emits as much pollution each hour as 34 cars (Environmental Defense Fund).
(h) Savings will be realized from reduced labor costs and reduced fuel consumption.
(i) As no-mow zones are expanded, GHG emissions from mowers will decrease.
(j) Fuel savings and related emissions reduction depend on the results of the study/evaluation.
(k) Monthly monitoring may reveal other areas where fuel consumption can be reduced.

USMCPA Action Item 9. Evaluate opportunities to increase pump efficiency in water and wastewater systems; recover wastewater treatment methane for energy production *(RCC Contact: Samuel Cooke; Staff Contact: Tracy Foss (and Paul Nehm for MMSD))*

Summary of Resource Conservation Commission Recommendations, as of 3/09:
The following recommendations are provided by the Resource Conservation Commission, working with City staff (Tracy Foss, Utility Engineer):

- Water Conservation - Be proactive regarding critical summer water conservation by declaring Water Watch/Warning/Emergency designations as circumstances are anticipated instead of after-the-fact. Projected Energy Savings: 50,000 kWh.[(a)]
- Water Conservation - Evaluate and propose additional restrictions to the alternate side street watering restriction, such that lawn watering would only be allowed from 9:00 p.m. until 5:00 a.m. Projected Energy Savings: The associated energy reduction is included in the Water Watch/Warning/Emergency recommendation, above.
- Implement changes necessary to either resolve the issues with Well No. 9 (e.g., increase the diameter of the well in order to drop the well pump lower in the well) or abandon Well No. 9. This work has other major benefits and is already projected to be done. Projected Energy Savings: 84,000 kWh (Water Well Solutions, Inc.'s projection).
- Evaluate and review the current preventative maintenance procedures to ensure that the current water utility pumps and other mechanical equipment are operating and being maintained optimally. Projected Energy Savings: 0 to 8,000 kWh, depending on what is found.
- Engage a company to conduct an energy audit of the water utility in order to identify technologies and/or methods that would improve the water utility's energy efficiency. This audit should include possible installation of energy saving items such as VFDs, newer space heating systems or newer pump motors and identify any grants and/or incentives available for the installation. Projected Energy Savings: Depends on what is found.
- Evaluate which additional water utility facilities would benefit the most from variable frequency drives (VFDs) being installed. VFDs should be paired with pumps that would yield the highest energy savings. (Well Nos. 4 and 11 already have VFDs.)
  - Well No. 5 - VFDs still needed. Cost: $17,000. Projected Energy Savings: 0 to 6,500 kWh.
  - Well No. 9 - VFDs would only be considered for Well No. 9 if the repair items, mentioned above, work. Cost: $17,000. Projected Energy Savings: 0 to 6,500 kWh.
  - Well No. 10 - VFD budgeted for installation in 2009. Cost: $17,000. Projected Energy Savings: 0 to 6,500 kWh.
- Water Conservation - Provide information to residents and businesses about water conservation. This includes dual flush toilets, toilet bowl water displacement, water efficient dishwashers, water conserving washing machines, faucet aerators and low flow showerheads. In addition, work with teachers in schools to teach children about water conservation. Part of the instruction could include the children working with their parents or caregivers on water conservation. Projected Energy Savings: This should reduce energy consumption, but it is difficult to quantify. Will yield dividends into the future.
- Prior to, or as, the North McGaw Park Neighborhood is developed, install the additional pipes necessary to connect the Greenfield Neighborhood domestic water system to the rest of Fitchburg's water utility, eliminating the need for the smaller and less efficient

well pumps currently being used to supply the Greenfield Neighborhood with water. This would yield multiple benefits in addition to energy reduction. Projected Energy Savings: 3,000 kWh.[g]

Priority	Action Item 9 Recommendations	Est. Annual Energy Savings by 2012	Estimated Out-of-Pocket Cost
1	Water Conservation - Be proactive regarding critical summer water conservation.	50,000 kWh[a]	$1,000[b]
2	Water Conservation - Evaluate and propose additional watering restrictions.	(c)	$0
3	Address Well No. 9 issues.	84,000 kWh	$175,000[d]
4	Evaluate and review the current preventative maintenance procedures.	0 – 8,000 kWh	$0
5	Energy audit of the water utility.	(e)	$1,500
6	Evaluate additional water utility facilities for VFDs.	0- 19,500 kWh	$0 - $51,000
7	Provide information to residents, businesses and children/teachers about water conservation.	(f)	$0
8	Install the additional water pipes necessary to connect the Greenfield Neighborhood domestic water system to the City.	3,000 kWh[g]	$100,000

(a) Based on a review of previous monthly energy usage data and comparing the energy usage prior to and after a water warning designation was announced.
(b) To distribute printed announcements.
(c) The associated energy reduction is included in the Water Watch/Warning/Emergency, priority #1above.
(d) Already included in 2009 CIP Budget.
(e) Energy savings depend on what is found.
(f) Projected to reduce GHG, but difficult to forecast amount.
(g) Based on a comparison of 4.5 kWh/1,000 gal of water energy usage for the Greenfield Neighborhood wells compared with 2 kWh/1,000 gal of water at Well No. 4. Energy savings comes from the fact that the larger pumps associated with the main water utility are more energy efficient than the smaller pumps being used in the Greenfield wells.

USMCPA Action Item 10. Increase recycling rates in City operations and in the community *(RCC Contact: David Martin; Staff Contact: Rick Eilertson)*

Summary of Resource Conservation Commission Recommendations, as of 3/09:

- Assess the extent to which recyclables wind up in the waste stream (and waste in the recyclable stream); re-inventory the waste stream. The previous inventory took place in 1999. Re-inventorying the waste stream is already included in the 2009 Budget and is the foundation for the other recommendations under this Action Item.
- Reinforce "reduce" ethic. Through the quarterly Fitchburg Update, promote the "reduce" leg of the reduce/reuse/recycle triangle. Take reduced consumption of virgin materials to the next level.
- Promote composting. Through workshops, videos and tours ratchet up the City's efforts to introduce residents to the benefits of composting. In the short term, composting reduces emissions of carbon in two ways: 1) by sequestering carbon (increasing the organic content of the soil); and 2) by saving fuel required to transport material from source to landfill. In the long term, composting may yield more and more benefits because of methane emissions from landfilled refuse.
- Increase recycling in multi-family dwellings. Increased recycling yields gains in two ways: less energy used in materials processing; and longer life for the landfill.
- Increase recycling at businesses.
- Reduce the frequency of brush pickups by half (from 16 per year to 8).
- Enhance recycling in City operations.

Priority	Action Item 10 Recommendations	Est. Annual Energy Savings by 2012	Estimated Out-of-Pocket Cost
1	Re-inventory the waste stream.	0[(a)]	$5,000[(a)]
2	Reinforce "reduce" ethic.	50 tonnes CO_2[(b)]	$3,000
3	Promote composting.	5 tonnes CO_2[(c)]	$3,000
4	Increase recycling in multi-family dwellings.	220 tonnes CO_2[(d)]	$5,000
5	Increase recycling at businesses.	22 tonnes CO_2[(e)]	$1,000
6	Reduce frequency of brush pickups (from 16 to 8/year).	800 gal diesel	Cost saving recommendation[(f)]
7	Enhance recycling in City operations.	5 tonnes CO_2	$0

(a) Re-inventorying the waste stream is carbon-neutral but is the foundation for the other recommendations.
(b) The carbon savings from reinforcing the "reduce" ethic is assumed to be roughly ten times the savings from promoting recycling in City operations.
(c) The assumption was made that fuel savings would not exceed 1% of the City's fuel usage.
(d) The emission savings for greater recycling at apartment complexes were estimated using the EPA Personal Emissions Calculator. This calculation was compared with estimates of the energy used to smelt aluminum and reprocess glass. (The two numbers agreed to within 25%.)
(e) Cost and carbon savings were estimated on the basis of the multi-family dwelling calculation: one-fifth of the cost and one-tenth of the savings.
(f) This would reduce collection costs by $24,000/year. (Based on $1.50/unit/collection for 8 collections and $1.05/unit/collection for 16 collections.) The total cost/resident/year is $12.00/unit/year for 8 collections and $16.80/unit/year for 16 collections, for a difference of $4.80/unit/year. $4.80 times 5,000 (the number of units for which the City contracts collection) = $24,000/year.

USMCPA Action Item 11. Maintain healthy urban forests; promote tree planting to increase shading and to absorb CO_2 *(RCC Contact: David Martin; Staff Contact: Ed Bartell)*

Summary of Resource Conservation Commission Recommendations, as of 3/09:

- Examine Forestry operations for ways to cut emissions.
- Update Tree Inventory; identify what we have and possible planting sites. This is already included in the 2009 Budget.
- Purchase CITYgreen software. CITYgreen is a software package for calculating the benefits, including carbon sequestration, of trees and forests.
- Establish a Tree Board. Currently the Park Commission serves this role, but a dedicated group might be better able to concentrate more on just urban forestry.
- Plant trees in open sites in neighborhoods developed before the City passed its tree-planting ordinance, through a cost-sharing program by the City and perhaps a matching grant. The annual budget of $15,200 for Park and Street Tree Replacement could be considered for this.
- Draft "Forest Management Plans" for all public woodlots using the Nobel Woods Forest Management Plan as a model. Create plans for all other publicly-owned woodlots to improve health and sustainability. Maintain and protect trees on public property.
- Develop a commemorative tree-planting program which would allow individuals and families to commemorate a loved one or celebrate an event (e.g., graduation, wedding, birth, death, etc.) by planting a tree in their honor. The tree would be a native hardwood or other appropriate species, and the tree planting would be coordinated with the City Forester, regarding location and schedule. A small plaque with the person's name on it would accompany the planting, as part of the commemoration.

Priority	Action Item 11 Recommendations	Est. Annual Energy Savings by 2012	Estimated Out-of-Pocket Cost
1	Examine Forestry operations for ways to cut emissions.	5 tonnes CO_2[(a)]	$0[(b)]
2	Update Tree Inventory; identify planting sites.	0[(c)]	$0[(d)]
3	Develop a cost-sharing tree-planting program.	0[(c)]	$14,250[(e)]
4	Establish a Tree Board.	0[(c)]	$0
5	Purchase CITYgreen software.	0[(c)]	$3,000[(f)]
6	Draft "Forest Management Plans" for all public woodlots.	1 tonnes CO_2	$5,000
7	Develop a commemorative tree-planting program.	0[(c)]	$0

(a) Assumes the energy savings equals the product of forestry emissions times a savings factor (0.3). Forestry emissions is estimated as the product of 2007 Vehicle Fleet eCO2 times 0.02 (i.e. the carbon emissions from Forestry operations amount to 2% of emissions from Fitchburg's fleet of vehicles.

(b) Assumes this would be done by an intern.

(c) Use of land for urban forestry is known to sequester carbon through photosynthesis (CO_2 is converted to cellulose). By maintaining the "carbon storage" in existing trees, GHG emissions are avoided. In addition, carbon storage can be increased by planting additional trees (and through changing from conventional to conservation tillage practices on agricultural lands). The carbon sequestration rates for trees vary by tree species, regional climate, topography and management practice. A number of tree species have been identified as sequestering a higher amount of carbon, when compared with all tree species. It is estimated that Wisconsin trees have a 26% canopy yet store $42 million worth of carbon and sequester an additional $2.4 million worth of carbon annually. In addition, trees reduce heating and cooling expenses by $24 million annually (e.g., providing summer shade and blocking winter winds), resulting in an additional $1 million worth of carbon production being avoided because of reduced energy demand (Sources: U.S. EPA and WDNR websites).

(d) Already included in the City's budget.

(e) $190/tree x 50% resident cost-sharing x 150 trees. Annual capital budget for Parks and Street Tree Replacement of $15,200 could be considered for this project. DNR Grants may be available to reduce cost.

(f) Cost includes training.

USMCPA Action Item 12. Help educate the public, schools, other jurisdictions, professional associations, business and industry about reducing global warming pollution. *(RCC Contact: Chris Jimieson / Samuel Cooke; Staff Contact: Rick Eilertson)*

Summary of Resource Conservation Commission Recommendations, as of 3/09:

- Identify businesses providing services or products that reduce greenhouse gases and promote them to Fitchburg's residents and/or businesses.
- Recommend sustainability speakers to Fitchburg's Chamber of Commerce to educate businesses on ways to reduce their carbon footprint.
- Develop a social networking website for Fitchburg residents to share ideas on reducing their carbon footprint.
- Solicit additional input from residents, businesses, City staff and others regarding how Fitchburg could best implement the USMCPA and how best to educate and inspire everyone involved.
- Promote EnACT and Sustain Dane programs to Fitchburg residents and businesses.
- Organize presentations at schools of Fitchburg residents (Madison, Verona, and Oregon) to educate children on ways they can help to reduce GHG emissions.
- Promote USMCPA-related topics on FACTv and in Fitchburg Updates.

Priority	Action Item 12 Recommendations	Est. Annual Energy Savings by 2012	Estimated Out-of-Pocket Cost
1	Conduct a Fitchburg Resource Conservation Commission Forum on the USMCPA (2009).	(a)	$200[(b)]
2	Solicit additional input from residents, businesses, City staff and others regarding how Fitchburg could best implement the USMCPA recommendations and how best to educate and motivate those willing to make changes.	(a)	$500
3	Identify and promote businesses providing services or products that reduce greenhouse gases.	(a)	$0
4	Recommend sustainability speakers to Fitchburg's Chamber of Commerce.	(a)	$0
5	Develop a networking website for Fitchburg residents to share ideas on reducing their carbon footprint.	(a)	$0
6	Promote EnACT and Sustain Dane programs to Fitchburg residents and businesses.	(a)	$0
7	Organize presentations at schools of Fitchburg residents.	(a)	$500
8	Promote USMCPA-related topics on FACTv and in Fitchburg Updates.	(a)	$500

(a) Education and awareness are both critical to the adoption of GHG emission reduction measures in a community and City government operation. However, action is needed along with education. The education recommendations presented are the precursors to the implementation of the actions listed in previous USMCPA Action Items 2 through 11. Therefore, no energy savings or GHG emission reductions have been credited to education alone, despite its vital importance.

(b) Already included in 2009 Budget.