ADDITIONAL ACTIONS AND STRATEGIES IDENTIFIED

There were many ideas and suggestions for reduction measures that were not included as strategies for various reasons. These were organized into three categories: Recommended Actions, Demonstration Projects, and Strategies for the Community Conservation & Climate Action Plan.

Recommended Actions. These recommended actions are known to have positive impacts in many sectors, including energy conservation, water conservation, air quality, and greenhouse gas reduction. Recommended actions differ from strategies and demonstration projects in that they are supportive in nature and enhance existing City programs and practices as well as strategies included herein.

Demonstration Projects. Like recommended actions, demonstration projects are known to have positive impacts in many sectors, including energy conservation, water conservation, air quality, and overall greenhouse gas reduction. The level to which these projects will benefit a City or community is often contingent upon region, climate, or availability of physical space for implementation, budget, and other such factors. As such, the benefits of implementation in Missoula are not fully understood or known. These projects are recommended as small scale demonstration projects, to be used to better understand the level to which full implementation of each project will benefit the City and community. With successful demonstration, each of these projects could and should become full strategies in future revisions of Missoula's Conservation & Climate Action Plan and should be implemented at appropriate larger scales.

Strategies for the Community Conservation & Climate Action Plan. These strategies were determined to be outside the scope of the Municipal Conservation & Climate Action Plan, but were important enough to be preserved for future community wide Climate Action efforts. The narratives give a brief synopsis of the strategy and its relation to the reduction of greenhouse gases in the Missoula Community, however further development and research of the strategies may be required.

Recommended Actions

FLEET AND FACILITIES

Aeration Blower Retrofit at the Wastewater Treatment Plant

A study conducted by Energy Resource Management, Inc. investigated the implementation of a retrofit of the aeration blower system at the Missoula Wastewater Treatment Plant. Typical benefits from a retrofit of older systems include updated efficiency and new technology, e.g. variable frequency drives and dissolved oxygen control.[1] The Missoula blowers already have these two technologies, thus reducing the overall impact of the retrofit to 8-12% in annual electrical savings, as opposed to a typical 35-33% savings. This increases the simple payback period to 17-26 years. The aeration blowers should continue to be monitored as they age and decrease in efficiency until such a time when they become more economically feasible to retrofit.

Deconstruction, Reuse and Recycling in Future Municipal Building Demolitions and Renovations

The City of Missoula should require a Deconstruction, Reuse and Recycling plan for future building demolitions and renovations. Deconstruction plans reduce unnecessary landfill contributions, related Greenhouse Gas emissions (primarily Methane), and waste disposal fees. Past Projects have demonstrated savings ranging from $50,000 to over $150,000.[2] In addition deconstruction can create revenue streams with sale of salvaged and recyclable materials, creates jobs and conserves energy and natural resources. According to the EPA, the waste from building demolition removal constitutes nearly half of all building related construction and demolition debris. Renovation and remodeling projects are estimated to generate an additional 40% of the total debris, and new construction makes up the rest.[1] Missoula is uniquely positioned for successfully implementing these activities with the existence of Home ReSource – who serves both as a provider of Deconstruction services and established building material reuse retail outlet.

This Recommended Action integrates with LEED New Construction & Major Renovations, LEED Existing Buildings Operations & Maintenance, Waste Stream Reduction Policy, and Sustainable Operations and Maintenance strategies.

References

1. Energy Resource Management, Inc. “Energy Optimization Study for the Missoula Wastewater Treatment Plant”. October 2011.

References

1. Environmental Protection Agency, “Analyzing What’s Recyclable in C&D Waste,” Ken Sandler, BioCycle, November 2003. http://www.epa.gov/epawaste/conserve/rrr/imr/cdm/index.htm
2. Environmental Protection Agency, “Building Savings: Strategies for Waste Reduction of Construction and Demolition Debris from Buildings”. EPA-530-F-00-001. June 2000. “Model Programs”, Page 3. http://www.epa.gov/epawaste/nonhaz/municipal/pubs/combined.pdf

Recommended Actions

FLEET AND FACILITIES

Review Operation and Maintenance Program for Municipal Conservation and Climate Action Plan Integration

Missoula's Operations and Maintenance (O&M) program should be reviewed by a diverse team of the City Staff who are knowledgeable of current practices and will be charged with implementation. For purposes of this plan, the program scope should include 1) Establishing an O&M Team of Building Champions 2) Establishing an Energy Monitoring and Reporting System, 3) Establishing Energy Performance Targets, 4) Establishing a Building Performance Rating (such as ENERGY STAR), 5) Define a Maintenance Strategy 6) Assess Staff and Training.[1] Best-practice operation and maintenance programs increase the efficiency of facility staff, improve building operational practices, and reduce utility costs. The O&M process helps sustain a building's profitability by reducing costly equipment failure and maintaining tenant comfort and indoor air quality. The review and revision of an operations and maintenance program is generally straightforward and does not significantly affect budget. It primarily reorganizes and reallocates existing resources to be more efficient and productive. Implementing a best-practice O&M program can reduce facility energy use by 5-20% without significant capital investment.[1] Note that, depending on program design, costs could be associated with implementing revisions. For example, it could be decided that an O&M software and subscription should be purchased.

This recommended practice is closely related to LEED Existing Buildings: Operations and Maintenance and both should be considered when implementing to ensure seamless integration and that they act as complements.

References

1. BetterBricks, an initiative of the Northwest Energy Efficiency Alliance. http://www.betterbricks.com/building-operations/best-practice-om#EstablishPerformanceGoalsAndFollowUpActivities.

INTERNAL POLICIES AND PRACTICES

Incentives and Department Competitions

The City of Missoula should develop incentive programs and competitions between departments for various energy savings and sustainability activities. Success in sustainability initiatives is largely determined by buy-in from employees. One way to strengthen employee motivation is to encourage participation through incentives and/or awards. Incentives can be given for small actions as well as large accomplishments and may be awarded to a department or individual. A friendly competition between departments can determine nominees and winners or awards, and can help foster full department participation. The competition should not only inform employees of sustainable activities but also encourage their adoption. Activities can be divided into categories or footprint areas. Example categories could include energy, waste reduction and recycling, green purchasing, fleet, and water savings. A rating of bronze, silver or gold (or something Missoula-based and ecological) can be given to each department for their success. Awards may be associated with the ratings, for example, for "Sustainable Employee of the Year." To help develop these competitions, the organizers should use social marketing techniques[1] and should focus on education and outreach strategies to ensure buy in and participation.

References

1. McKenzie-Mohr, Doug. 2011. "Fostering Sustainable Behavior: An Introduction to Community Based Social Marketing." Especially sections on: "Social Diffusion: Speeding Adoption" and "Incentives: Enhancing Motivation to Act."

Recommended Actions

RENEWABLE ENERGY AND OFFSETS

Solar Thermal Hot Water Systems at Fire Stations

Solar thermal hot water systems are systems that use the sun's energy to heat water, which is then used for indoor water heating and use, space conditioning, and other applications. "Research shows that the average household with an electric water heater spends about 25% of its home energy costs on heating water."[1] Much or all of this cost could be offset with a solar thermal system. During the extensive remodel of Missoula's Fire Station 2 in 2008, a solar thermal hot water system was integrated into the design and installed in the building. The system was deemed feasible due to economies of scale. In general, fire stations are good candidates for this technology because of consistent activity through all hours of the day. Opportunities for solar thermal hot water should be considered in all future renovations and new construction of fire stations to realize the potential energy and cost savings, and environmental benefits.

References

1. U.S. Department of Energy – National Renewable Energy Laboratory. "A Consumer's Guide: Heat your water with the sun." http://www.nrel.gov/docs/fy04osti/34279.pdf

Conservation & Climate Action Plan Demonstration Projects

FLEET AND FACILITIES

Green Roofs

A green roof is a vegetative layer grown on a rooftop. Green roofs provide shade and remove heat from the air, reducing temperatures of the roof surface and the surrounding air.[1] General green roof components include conventional structural support, waterproof roofing membrane, root repellent system, drainage system, filtering layer, growing medium and plants.[2] The benefits of green roofs include reduced energy use through insulation, reduced air pollution and Greenhouse Gas emissions, reduced urban heat island effects, enhanced storm water management and quality, increased lifespan of roof surfaces, creation of wildlife habitat, and improved human health and comfort.[1,3] Common obstacles to green roof installation include higher than conventional roofing costs, possible increased maintenance, and need for additional structural support. Green Roof installation can result in 6-25% whole-building cooling energy savings.[3] It is estimated that Green Roofs can be installed for $10-$25/square foot.[1] The City of Missoula could implement a green roof demonstration project on all or part of a City of Missoula building to better understand the net impacts of widespread installations on municipal buildings considering our cooler, northern climate and unique storm water management system.

References

1. U.S. Environmental Protection Agency. http://www.epa.gov/heatisland/mitigation/greenroofs.htm.
2. Ecolife.com. http://www.ecolife.com/define/green-roof.html
3. Hodges, Matthew. "Green Roofs in the Garden City: Exploring the Opportunities for Green Roof Policies in Missoula, Montana" 2009.

Conservation & Climate Action Plan Demonstration Projects

FLEET AND FACILITIES

Composting

Organic trash in the waste stream is a major generator of methane gas in landfills.[1] Methane gas is 21 times more potent than carbon dioxide, so reducing methane gas production is very important in the fight against greenhouse gas emissions.[1] The average office worker produces over one pound of organic waste daily[1,2] in the office. Though the composting process itself produces some greenhouse gases doing so still results in a net reduction of greenhouse gas emissions through ancillary benefits. These include reduced time, money, and transport costs associated with conventional disposal and reduced cost of fertilizer when used on local gardens.[1] Most importantly, composting reduces the stress put on local landfills. The City of Missoula could implement a composting program in the office kitchens, parks waste facilities, and other organic waste sites to be removed and taken to EKO Compost.[3]

Native and Water Wise Garden at City Hall

City Hall stands at the center of Missoula as a public hub of activity. While it is in an urbanized area, there are landscaped areas or beds on the perimeter of most of the building. Current landscaping, while beautiful, is completed each year with labor, water and fertilizer-intensive plants and practices. The City of Missoula should convert these areas to a mix of native and water wise perennial grasses, wildflowers, shrubs, trees and features. In addition, water wise practices such as rainwater harvesting, drip irrigation (if needed), and mulching/ composting should be implemented. These practices will reduce operations costs over time by reducing labor costs of planting and maintenance and eliminating annual plant and fertilizer costs. Converted areas, such as those around municipal buildings, should also include interpretive signs as a public education tool to promote how these landscapes make fiscal sense at work and at home, contribute to a healthier environment, and how they encourage and celebrate local cultural heritage and promote urban wildlife habitat.

Permeable Surfaces

Non-permeable paved surfaces are direct conduits for pollutants to reach surface waterways. Permeable or pervious surfaces allow air and water to penetrate the soil strata underneath; however, CO2 outputs and inputs are believed to be negligible. Cook and Knapton 2009[1] suggest that permeable surfaces reduce "embodied carbon" by 50% when considering a given non-permeable paved site - due, largely in part, to the elimination of traditional drainage provisions. Moreover, the authors suggest that the entire paving project could be rendered carbon neutral with the addition of planting trees per paving project. The authors state that planting approximately 10 trees per 100 m^2 of permeable surface will render the project carbon neutral within 50 years. Permeable surfaces have numerous other benefits as well, including glare reduction, heat reduction (through reduction of the urban heat island effect), and provide an opportunity to use recycled materials.[2] Missoula could partner with Terra Firm Enterprises[3] and also with the Missoula Institute for Sustainable Transportation,[4] who has already expressed interest in establishing a pilot project.

References

1. GreenYour.com. "Compost organic office waste." http://www.greenyour.com/node/13264
2. CanWest News Service. "Office compost system for green-conscious businesses."http://www.financialpost.com/story.html?id=1301c697-79d8-47e5-acbc-f9c5314b9fbe&k=10858
3. EKO Compost. http://www.ekocompost.com/

References

1. Cook, Ian and Knapton, John. "Assessment of Embodied Carbon in Conventional and Permeable Pavements Surfaced with Pavers." 2009. http://www.icpi.org/sites/default/files/techpapers/1453.pdf
2. City of Chicago Department of Transportation. "The Chicago Green Alley Handbook." http://brandavenue.typepad.com/brand_avenue/files/greenalleyhandbook.pdf
3. Terra Firm Enterprises. http://www.terrafirmenterprises.com/
4. Missoula Institute for Sustainable Transportation. http://www.strans.org/

Conservation & Climate Action Plan Demonstration Projects

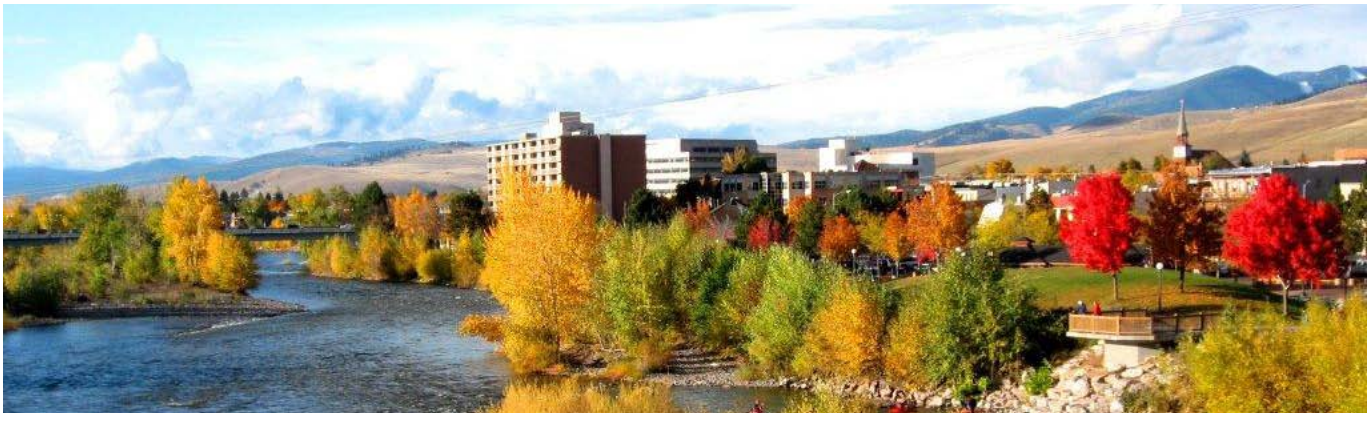
FLEET AND FACILITIES

Gray Water Systems

The Missoula Wastewater Treatment Plant currently discharges approximately 8 million gallons of treated effluent into the Clark Fork River daily – which is approximately 2.9 billion gallons of effluent yearly; effluent which still contains nutrients vital to plant growth. Gray Water Systems, or "purple pipe," is a concept which utilizes treated wastewater for a variety of irrigation purposes ranging from landscaping to golf courses. This technology is widely used in drought prone and water-shortage prone areas such as southern California. For the purpose of this report, we explore reusing effluent at the Larchmont Golf Course on South Reserve. The Environmental Institute for Golf[1] suggest that the average golf facility in the Upper/West Mountain region of the US uses approximately 98 million gallons of water a year. Ignoring water traps which may serve as additional effluent storage, this irrigation volume equates to 12 days' worth of effluent removed from the Clark Fork River. Assuming turfgrass sequesters 800 lbs of carbon per year[2] and the average Upper/West Mountain region contains an average of 103 acres of turfgrass, Larchmont Golf Course potential sequesters 82,400 lbs of carbon per year. Implementing treated nutrient rich effluent as a means of irrigation could also reduce the amount of CO2 associated with current fertilization requirements.

Hydrogen Fleet Retrofits

In the spring of 2009, the Missoula Vehicle Maintenance Division of Public Works had two hydrogen fuel canisters installed in test vehicles. One was installed in unit 174, a diesel powered pothole patching machine. The second was installed in unit 701, a gasoline powered small administrative pickup. Both vehicles have shown slight improvements in fuel consumption. Unit 174 is showing a 0.033 reduction in fuel use per hour. Unit 701 is showing a 1.04 improvement in miles per gallon. Both vehicles have a noticeable improved clarity in exhaust. More data as to the actual exhaust reductions will be available in the future.[1] This may not be a cost effective solution at the current technological levels.[2,3] It is however, a window of opportunity that needs to be left open. Electrolysis produced hydrogen is very friendly in terms of CO_2 emissions and other gases.[2] The recommendation is to continue to explore and implement hydrogen fuel cell and canister technology where it is applicable.



References

1. Golf Course Superintendents Association of America. "Golf Course Environmental Profile. Volume II: Water Use and Conservation Practices on U.S. Golf Course." 2009. http://www.gcsaa.org/Course/Environment/Environmental-Profile/Golf-Course-Environmental-Profile-Overview.aspx
2. Bremer, Dale. "Carbon Sequestration in Turfgrass: An Eco-Friendly Benefit of Your Lawn." October 2007. http://bremer.ksuturf.org/files/Turf%20C%20seq%202007.pdf

References

1. Jack Stucky, Vehicle Maintenance Superintendent
2. U.S. Energy Information Administration. "The Impact of Increased Use of Hydrogen on Petroleum Consumption and Carbon Dioxide Emissions" August 2008. http://www.eia.gov/oiaf/servicerpt/hydro/hydrogen.html
3. U.S. Department of Energy - Energy Efficiency and Renewable Energy – Fuel Cell Technologies Program. http://www1.eere.energy.gov/hydrogenandfuelcells/accomplishments.html

Conservation & Climate Action Plan Demonstration Projects

RENEWABLE ENERGY AND OFFSETS

Algae Carbon Sequestration Project at the Wastewater Treatment Plant

The City should partner with Algevolve to begin establishing a pilot project at the Wastewater Treatment Plant to use algae based technology to capture carbon for green energy and nutrient removal in wastewater. The by-product will be an algae biomass that can be used for plastics manufacture, protein animal feed supplement, pharmaceuticals supplement and organic fertilizers. A full scale operation at the WWTP has the potential to remove 30 pounds of phosphorus a day from the Clark Fork River and utilize all of the excess digester gas produced at the WWTP. This technology could eliminate the need for more expensive tertiary treatment that would do nothing to offset greenhouse gas production. A 1 MGD pilot project is estimated to cost $50,000.[1] Note that outflow from the algae process will no longer have the required nutrients to support the growth of Poplar trees, and the two may not co-exist if the algae project is implemented on a full scale. A financial and greenhouse gas cost/benefit analysis for the two projects could reveal to what extent each should be implemented at the plant.

References

1. Algevolve. 406-363-4139. http://www.algevolve.com

Strategies for the Community Conservation & Climate Action Plan

FLEET AND FACILITIES

Street Light Efficiency Retrofits

Streetlights using inefficient lighting technology should be upgraded using more energy and cost efficient technologies. LED's, for example, use 50% of the energy of the lamps currently in common use for street lighting.[1] Cost savings come from other elements of the system as well, including fewer and shorter poles, decreased light spillage (i.e. lighting areas that do not need to be lit), and lower operation and maintenance costs.[1] Certain rebates and incentives are available through Northwestern Energy, but specific guidelines must be followed to qualify. For example, LED technology must be included on a preapproved certified listing.[2]

Street Lighting Feasibility Study, Final Report. December 2011. Prepared by WGM Group for the City of Missoula.

Traffic Light Efficiency Retrofits

The same cost and energy efficiency justifications for the streetlight retrofits apply to traffic light retrofits. However, unlike streetlights that are only on at night, traffic lights are on 100% of the time. As such, an even greater amount of energy and cost can be saved annually by upgrading existing traffic lights using more efficient lighting technologies.

References

1. Northwestern Energy Light Emitting Diode (LED) Policy for Electric Conservation Project Submittal. Released and effective November 2011.

Strategies for the Community Conservation & Climate Action Plan

INTERNAL POLICIES AND PRACTICES

Community Wide Rideshare Program

The recommended strategy for this Municipal Plan regarding ridesharing should be expanded to encompass the entire community of Missoula. Currently, ridesharing is formally supported by the Missoula Ravalli Transportation Management Association (MRTMA).[1] Ridesharing is limited primarily by the difficulties of linking people together. The next "hurdle" is matching interested people together. There are many online options[1a,b,c] but they are only as successful as the number of people registered with them.

An online rideshare matching service should be established, and then people directed there. There should also be opportunities created to meet other members in the rideshare program, to help remove the hesitancy to share rides. The City of Missoula has a population of approximately 66,000 people. Realizing even a 1 percent reduction in commute vehicle trips due to implementation of this program could save up to 86,000 gallons of gasoline and avoid emitting 812 mtCO2e per year.[2]

References

1. Missoula Ravalli Transportation Management Association. http://www.mrtma.org/
   a. GoLoco. http://www.goloco.org/
   b. Zimride. http://www.zimride.com/
   c. iCarpool. http://www.icarpool.com/
2. ICLEI – CAPPA v1.5 © 2010. "Promote Carpooling and Vanpooling". Inputs: 66,000 employees; $3.45/gallon (EIA Fuel Update. November 2011), 5.8 miles average one way commute length (Missoula in Motion Way to Go! Club data), 21.3 mpg average fuel economy (FuelEconomy.gov. Avg. combined fuel economy of 2008 Ford Focus, Subaru Outback, and Ford F150).

Strategies for the Community Conservation & Climate Action Plan

RENEWABLE ENERGY AND OFFSETS

Community Solar PV Project

A community solar project can be defined as "a solar-electric system that, through a voluntary program, provides power and/or financial benefit to, or is owned by, multiple community members."[1] Essentially, community members interested in solar installations pool resources to build a large, centralized project where economies of scale come into play. Many different ownership models exist depending upon the circumstances of the proposed project. A compelling reason for such a project is that many interested citizens may not be able to independently install solar PV on their residences due to terrain obstacles (tree, buildings), ownership issues (rental tenants or deed restrictions) or financial reasons. Before setting up a program, further research and public input should be used to determine which model(s) would best fit the Missoula Community. Models to explore include installations placed on residences of some of the investors,[2] or installations placed in a separate, central location.[1] The included reference from the DOE[1] provides detailed information on several models and the differences in allocation of costs and benefits of each.

Further investigations into tax incentives and credits and utility incentives[3,4,5] should also be included in future development of such projects, which can significantly lower implementation and life cycle costs.

Wetland Development and Riparian Enhancement

Wetland Development and Riparian Enhancement strategies have potential to act as an offset to the City's Greenhouse Gas emissions through carbon sequestration as well as a source of renewable energy through aquatic biomass. In addition, such strategies could contribute to improved wastewater treatment and river health. Success of these strategies would require application that includes City property as well as adjacent lands not owned by the City. The following sites are being presented as potential location for implementation of strategies.

EKO Compost and Clouse Property. EKO Compost is located adjacent to the treatment plant and has land feasible for wetland development. The Clouse Property is also within close proximity to the treatment plant and located on the west side of the EKO Compost Property. The Clouse Property is currently being considered for a Poplar plantation to utilize wastewater and operate a sustainable wood business. The Clouse Property has additional lands that exist outside the proposed plantation that may be useful for wetland development or enhancement to the floodplain and riparian areas. These areas and proposed strategies will provide emissions offsetting, wastewater treatment, and / or wetland mitigation / banking.

Grant and Rattlesnake Creeks. Both creeks have segments within the city limits. Sites may exist along the floodplain and riparian areas with potential for enhancements. These areas offer potential sites that would provide emissions offsetting, wetland development and the other intrinsic benefits for natural resources.

References

1. U.S. Department of Energy - Energy Efficiency and Renewable Energy. "A Guide to Community Solar: Utility, Private, and Non-profit Project Development." November 2010.
2. "Clean Energy Collective, LLC, Colorado" Page 17.
3. Solarize Portland. http://www.portlandonline.com/bps/index.cfm?c=51902
4. Database of State Incentives for Renewables and Efficiency: Montana http://www.dsireusa.org/
5. Northwestern Energy E+/Renewable Energy Program. http://www.northwesternenergy.com/display.aspx?Page=Renewable_Energy_Program