City of Moscow

Greenhouse Gas & Energy Efficiency Report

July 2010

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Abstract

The following document represents the City of Moscow's commitment to becoming a sustainable community by adopting appropriate measures to reduce greenhouse gas emissions. These efforts have been instigated by climate change science indicators, which have garnered the attention and subsequent action of communities nationwide and at the global scale. With the help of City Staff, the University of Idaho Sustainability Center and the Sustainable Environment Commission, the Sustainability Intern has compiled an inventory of greenhouse gas emissions for the 2005 year. Energy consumption and budgetary data generated from six sectors including Water Production/Waste Treatment, Buildings, Street Lights/Traffic Signals, Employee Commute, Vehicle Fleet and Solid Waste are utilized for directing sustainable initiatives and City-led efforts to increase municipal and community operations efficiencies. Partnership potentials for building sustainable practices into City and community functions include, but are not limited to, the University of Idaho Sustainability Center, the Palouse Clearwater Environmental Institute and Avista Utilities.

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Endorsement by Mayor Nancy Chaney

The greenhouse gas inventory included in this document establishes a baseline from which to set emissions-reduction targets and strategies to accomplish them. Implications of relatively rapid planetary warming, such as Earth is experiencing, are dire. Predicted consequences include extreme weather events, rising sea levels, flooding, diminished snow pack, ecosystem displacement and destruction, species extinction, crop loss, disease, and economic and political instability. It is not just a problem for coastal regions or distant deserts. We can and must do our part to slow and lessen the impacts by reducing emissions that contribute to global climate change.

These ideas are not new or novel. Others around the globe have already set ambitious goals to reduce greenhouse gases, in an effort to forestall life-changing or even life-ending consequences of activities that contribute cumulatively to global climate change. The University of Idaho is one of those leaders, and is a model for many of the recommendations put forward in this report. Moscow is fortunate for our cooperative relationship with that scientifically grounded resource.

In 2005, then-President Tim White signed the Talloires Declaration for sustainability. In 2006, the President selected Sustainable Idaho as a funded Strategic Initiative. In 2007, UI hired a fulltime Sustainability Coordinator, completed its greenhouse gas emissions baseline inventory, joined the Chicago Climate Exchange, and signed the American College and University Presidents' Climate Commitment. According to the University's Climate Action Plan drafted in November 2009, the institution plans to reduce GHG emissions 25% by 2012, 50% by 2016, 83% by 2023, and to be carbon-neutral by 2030. President Nellis wrote of that effort, "If we take action now, we will have a greater chance to mitigate the impact of global climate change than if we take a 'business as usual' attitude…The University of Idaho is committed to blazing a path of action and serving as a model for other colleges and universities, and the rest of society..."

According to a 2010 White House report, "The Federal government is the single largest energy consumer in the US economy." An Executive Order "requires the Federal government to lead by example towards a clean energy economy and reduce, measure and report direct and indirect greenhouse gas pollution." The Federal government's targeted reduction for direct sources (e.g. fleet, buildings) is 28% below 2008 levels by 2020, and for indirect sources (e.g. employee commuting, travel), is 13%. Fleet and facility efficiency, resource consumption, and leadership by example can be modeled at the local level, as at the national level.

Environmental well-being, energy efficiency, cost-savings, conservation, economic prosperity, and common sense are interrelated. With encouragement from Moscow's Sustainable Environment Commission, the scientific community, concerned citizens, peers, policymakers, and grantors, the City continues to emphasize sustainable practices. We have been rational, practical, and strategic in our approach. Now that we have this GHG baseline as a measurable starting place, the next step is to set meaningful emission-reduction goals. Doing so is not an exercise in academics, politics, or histrionics. It is our chance to join others in an effort to preserve the livability of this beautiful planet.

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Introduction

A. Climate Change Indicators

The atmosphere contains a number of greenhouse gases (GHG) that retain heat to keep Earth's temperatures within a stable range. The concept of the greenhouse effect (Figure a) refers to these gases acting like the glass panes of a greenhouse, keeping temperatures hospitable for life.[1] Carbon dioxide (CO_2) is the most prevalent of these gases, but other greenhouse gases include:

- methane (CH_4),
- nitrous oxide (N_2O),
- ozone (O_3),
- chlorofluorocarbons (CFC's),
- halocarbons (HCFC's),
- perfluorocarbons (PFC's)
- some sulfur compounds

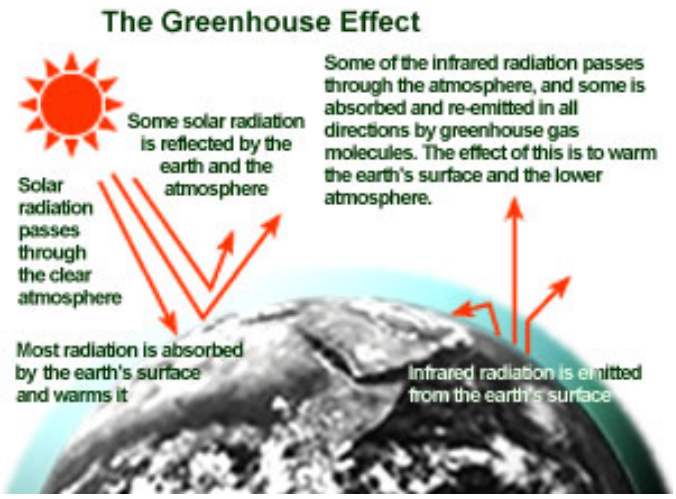

Figure a: Greenhouse Effect[1]

The increases recorded in the levels of GHGs are significant and higher than seen in thousands of years, even while accounting for natural fluctuations.[2] While GHG's in the atmosphere are necessary for sustaining life on Earth, human beings have altered the proportions of those gases, most significantly by adding CO_2 from burning fossil fuels. Proportions of GHG's present in the atmosphere vary with CO_2 being the highest at an estimated 100 ppm or 36% over the last 250 years as estimated by the International Panel on Climate Change.[3] Since 1905, methane concentration has nearly doubled, nitrous oxide levels that rarely exceeded 280 ppb reached 323 ppb in 2009, manufactured halocarbons (gases containing chlorine, fluorine, bromine, or iodine) decades ago were basically zero, but levels have increased rapidly de to industrial products and processes.[4]

[1] http://www.epa.gov/climatechange/science/index.html
[2] United States Environmental Protection Agency "Climate Change Indicators in the Unity States", page 4; http://www.epa.gov/climatechange/indicators/pdfs/ClimateIndicators_full.pdf
[3] Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 2007 Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.); Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, page 137; http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter2.pdf
[4] United States Environmental Protection Agency "Climate Change Indicators in the Unity States", page 15; http://www.epa.gov/climatechange/indicators/pdfs/ClimateIndicators_full.pdf

The concept of global warming potentials (GWP) was developed by the International Panel for Climate Change (IPCC)[5] to compare heat-trapping abilities of atmospheric GHG's (Figure b). The chemical structures of various GHG's (Table i)[6] yield different heat trapping abilities, which result in a range of these effects. For example, methane traps over 21 times more heat per molecule than does carbon dioxide, therefore the GWP for methane is 21. Nitrous oxide can absorb 310 times more heat per molecule than can carbon dioxide, so it's GWP 310.[7]

The Intergovernmental Panel on Climate Change (IPCC) is the leading body for the assessment of climate change, established by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) to provide the world with a clear scientific view on the current state of climate change and its potential environmental and socio-economic consequences.

The IPCC is a scientific body. It reviews and assesses the most recent scientific, technical and socio-economic information produced worldwide relevant to the understanding of climate change. It does not conduct any research nor does it monitor climate related data or parameters. Thousands of scientists from all over the world contribute to the work of the IPCC on a voluntary basis. Review is an essential part of the IPCC process, to ensure an objective and complete assessment of current information. Differing viewpoints existing within the scientific community are reflected in the IPCC reports.

The IPCC is an intergovernmental body, and it is open to all member countries of UN and WMO. Governments are involved in the IPCC work as they can participate in the review process and in the IPCC plenary sessions, where main decisions about the IPCC work programme are taken and reports are accepted, adopted and approved. The IPCC Bureau and Chairperson are also elected in the plenary sessions.

Because of its scientific and intergovernmental nature, the IPCC embodies a unique opportunity to provide rigorous and balanced scientific information to decision makers. By endorsing the IPCC reports, governments acknowledge the authority of their scientific content. The work of the organization is therefore policy-relevant and yet policy-neutral, never policy-prescriptive.

Figure b: IPCC Organization

Gas	GWP
Carbon dioxide (CO2)	1
Methane (CH4)*	21
Nitrous oxide (N2O)	310
HFC-23	11,700
HFC-125	2,800
HFC-134a	1,300
HFC-143a	3,800
HFC-152a	140
HFC-227ea	2,900
HFC-236fa	6,300
HFC-4310mee	1,300
CF4	6,500
C2F6	9,200
C4F10	7,000
C6F14	7,400
SF6	23,900

Table i: International Panel on Climate Change Global Warming Potential Values (100 Year Time Horizon).

[5] http://www.ipcc.ch/organization/organization.htm
[6] 2010 U.S. Greenhouse Gas Inventory Report; INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990-2008; (April 2010) U.S. EPA # 430-R-10-006 http://www.epa.gov/climatechange/emissions/downloads/ghg_gwp.pdf, Introduction 1-7
[7] "Almanac of Policy Issues." Adapted from Environmental Protection Agency documents August 14, 2002.http://www.policyalmanac.org/environment/archive/climate_change.shtml

Climatic reaction to increases in GHG is difficult to predict, because it involves a complex system of feedback loops and tipping points, which may respond in an accelerated manner to GHG related warming trends rather than in a linear fashion. For example, oceans and terrestrial ecosystems currently absorb a significant amount of CO_2 emissions. However, scientists anticipate a decrease in absorptive ability as warming continues, causing further emissions to have increasingly substantial impacts on global climate. Increased temperatures in the oceans will affect the water cycle, affecting the ways water moves on, above, and below the surface of the earth (Figure c)[8]. Acceleration of this cycle is projected to intensify storm and drought severities and rates, which could disrupt water supplies, agricultural systems and ecosystems worldwide.

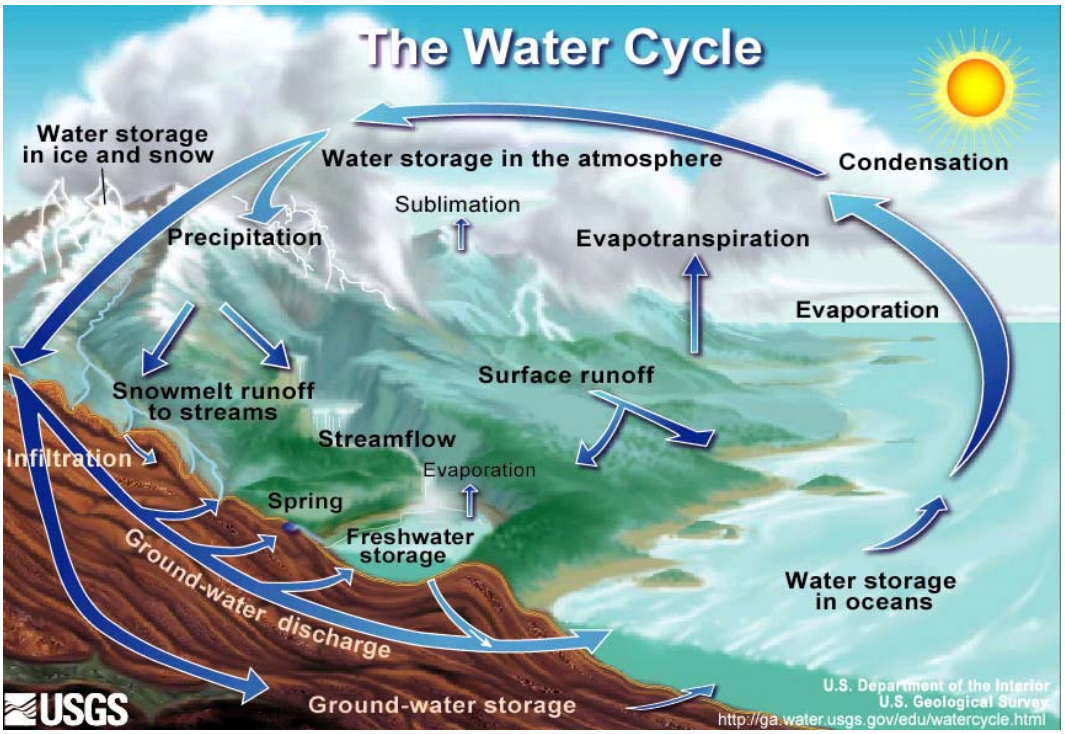

Figure c: The Water Cycle

[8] U.S. Department of the Interior, U.S. Geological Survey, http://ga.water.usgs.gov/edu/watercycle.html

Furthermore, geologists are reporting inconsistencies in the geologic record, observing and recording atypically rapid increases in global surface temperatures over the past century, following almost 2,000 years of steady or slightly declining temperatures.[9]

Regional implications of climate change vary depending on multiple factors. However, the Pacific Northwest is expected to experience several effects. According to the University of Washington Climate Impacts Group, "…[s]ea level rise is likely to occur faster than global averages, and earlier snowmelt may cause changes in river and stream flows." [10] With regard to earlier snowmelt, the Climate Impacts Group also predicts the following impacts on Washington's Cascade Mountains:

> "Snow melt patterns increase the threat for spring flooding and decrease the storage of the natural water tower in the Cascades, meaning less water will be available for agricultural irrigation, hydro-electric generation and the general needs of a growing population."

As reported in the EPA's Climate Change Indicators in the United States document, Arctic Sea Ice Extent has decreased steadily over the past 30 years (Figure d). This has an affect on arctic mammals as birth rates are in decline and access to food sources becomes restricted.[11]

Figure d: September Average Arctic Sea Ice Extent, 1979-2009

[9] Mann et. al. 2003 "On Past Temperatures and Anomalous Late 20th Century Warmth"
EOS, TRANSACTIONS AMERICAN GEOPHYSICAL UNION, VOL. 84, NO. 44, PAGE 473
[10] Climate Impacts Group. 2006. "Pacific Northwest 20th Century Climate Change"
http://www.cses.washington.edu/cig/pnwc/cc.shtml#figure1
[11] United States Environmental Protection Agency "Climate Change Indicators in the Unity States", page 46;
http://www.epa.gov/climatechange/indicators/pdfs/ClimateIndicators_full.pdf

Figure e[12] demonstrates an example of glacial recession observed in the North Cascades glaciers. Loss of glacier volume since 1984 is estimated to represent 20-40% of the entire glacier volume. Glacial recession in this region has been so rapid that it can be seen with the naked eye.

Figure e: North Cascades Glacier Climate Project Glacial Recession

Lastly, in response to climatic changes, Pacific Northwest plant and animal species are moving further north and to higher elevations, altering the region's flowering and pollination cycles, and posing challenges especially for perennial crops.

The implications of atmospheric GHG accumulation and subsequent warming trends are numerous. Release of CO_2 through the burning of fossil fuels has accelerated the Earth's natural processes and cycles, generating global effects that are beginning to be experienced within our region. Alteration of sea levels, average temperatures and snow cover levels hold consequences that vary in severity of potential impacts for different regions, however, the merits of local action are clearly substantiated.

The following section describes how local, state and federal governments are taking steps to restructure methods of energy consumption in the direction of renewable resource use and sustainable, "net zero" best management practices.

[12] Climate Impacts Group, 2006; "Pacific Northwest 20th Century Climate Change"; http://www.cses.washington.edu

B. Action Being Taken on Climate Change

As of July 2007, 35 states were undertaking work on comprehensive climate action plans. In addition to state action, two regional coalitions have formed to coordinate interstate climate change mitigation efforts. The Western Regional Climate Action Initiative is being led by the Governors of Arizona, California, New Mexico, Oregon, Washington, Utah, and Lieutenant Governors of British Columbia, and Manitoba to establish a market-based system that cuts GHG emissions levels to 15% below 2005 levels by 2020.[13] The Northeastern and Mid-Atlantic states have also taken action by forming a similar coalition called the Regional Greenhouse Gas Initiative.[14]

At the local level, Moscow has reviewed existing movements to lower GHG emissions including the U.S. Mayor's Climate Protection Agreement (MCPA)[15] in 2007**,** a national effort initiated by the Mayor of Seattle to promote local involvement in the international goals addressed as well as the Kyoto Protocol on which those goals are based.[16] Signing the MCPA agreement, which was launched in February 2005, confirms a city's pledge to lower GHG emissions by a reduction of 7% below 1990 levels by the year 2012, whereas the Kyoto Protocol calls for an average of 5% reductions of 1990 levels to be achieved between the years 2008-2012. In Idaho, several orders have been passed by Idaho Governor C. L. "Butch" Otter in the interest of GHG reduction since 2007. Figure f below lists four orders written by the Governor over the past three years supporting emissions reductions.

SCR 128 (2008) "This Concurrent Resolution takes a step towards implementing two provisions of the Idaho Energy Plan: one calling on the state to prepare for the likelihood of future greenhouse gas regulation and another recommending policies which place the highest priority on the development of energy conservation and instate renewable resources. The Resolution requests that the Idaho Department of Environmental Quality and the Office of Energy Resources prepare a report identifying opportunities and steps the legislature could take to meet these Energy Plan goals."

Executive Order No. 2007-02 "It is the goal of the State of Idaho that 25% of Idaho's energy needs be provided through renewable resources by the year 2025 from our farm, ranch, timber, and other working lands, while continuing to produce abundant, safe, and affordable agricultural products."

Executive Order No. 2007-05 "The Director of the Department of Environmental Quality shall develop a greenhouse gas emission inventory and provide recommendations to the Governor on how to reduce greenhouse gas emissions in Idaho, recognizing Idaho's interest in continued growth, economic development and energy security."

RS 16978 (2007) "This resolution recognizes that Idaho's citizens hold an enduring property right to Idaho's natural resources and that the state of Idaho has a duty to protect these resources for the benefit of present and future citizens. Therefore, the Legislature of the State of Idaho supports the development of and education about policies and programs that reduce Idaho's greenhouse gas emissions and programs that reduce Idaho's greenhouse gases."

Figure f: Executive Orders Written by Idaho Governor C.L. "Butch" Otter for GHG Reduction

[13] Washington Department of Ecology http://www.ecy.wa.gov/climatechange/CATdocs/06052007CATsummary.pdf
[14] http://www.rggi.org/home
[15] http://www.usmayors.org/climateprotection/revised/
[16] http://unfccc.int/kyoto_protocol/items/2830.php

Additional City of Moscow action has included the following:

- Sustainability Intern: Since the spring of 2007, sustainability interns have been tasked with implementing the Employee Bike-Share Program "Sprocket," writing the Sustainable Purchasing Policy and completing the City of Moscow's Greenhouse Gas & Energy Efficient Report.

- The City of Moscow worked with more than 350 U.S. local governments and 700 local governments worldwide in the International Council for Local Environmental Initiatives (ICLEI) Cities for Climate Protection® (CCP) Campaign.[17]

- Sustainable Purchasing Policy: In the spring of 2008, the Moscow City Council approved a Sustainable Purchasing Policy that encourages those purchasing on behalf of the City to look at the economic, social and environmental impacts of their purchasing decisions.

- "Sprocket"-Employee Bike-Share Program: The employee bicycle-share program was implemented in the summer of 2008 and offers City of Moscow employees the opportunity to borrow city bicycles for errands, lunch breaks and commuting trips to and from work and other City facilities and meetings.

- City of Moscow Green Building Program: The City encourages local builders to certify residential projects as "Green" by prioritizing project design, construction and operation as a whole to reduce resource consumption and improve livability.[18] As of 2007, Leadership in Energy and Environmental Design (LEED) certification was also an option.

- City of Moscow Water Conservation Program: Moscow is committed to using its water resources responsibly, and has exceeded its water reduction goals by a variety of means, including educating the public. In addition, the City offers low-flow devices for City residents' homes, and recognizes attractive drought-tolerant landscapes with Wisescape Awards in categories such as single- and multi-family residential, business, school/institution and government.

- Minimal Waste Employee Appreciation Picnic: The City of Moscow is providing an example to the community by hosting events that produce minimal waste. The City partners with the Palouse Clearwater Environmental Institute (PCEI) Plate Project and Moscow Recycling to significantly reduce waste production at these events.

[17] http://www.iclei.org/index.php?id=800
[18] http://www.ci.moscow.id.us/comm_dev/building/green_building.aspx

Emissions Inventory

A. Inventory Process

The position of Sustainability Intern at the City of Moscow has developed methodologies to estimate and track municipal GHG emissions. Initial drafts of the GHG Report utilized ICLEI support and climate change software to conduct municipal and community emissions inventories.[19] Clean Air and Climate Protection (CACP) software utilizes coefficients to calculate equivalent CO_2 production from energy use, and implements methodologies consistent with standards established by the Intergovernmental Panel on Climate Change (IPCC 1996). CACP was used to organize municipal data from the fiscal year 2005 into the following 6 sectors:

1) Water Production/Waste Treatment
2) Buildings
3) Street Lights/Traffic Signals
4) Employee Commute
5) Vehicle Fleet
6) Solid Waste

Community energy consumption and waste production are broken up into residential, commercial, industrial, transportation and waste sectors, with the municipal inventory as a subset of the commercial sector. For each inventory, information and data were collected from a variety of sources, including Avista Utilities, Idaho Transportation Department, Latah Sanitation, Moscow Recycling, employee commute surveys and various City of Moscow municipal department records.[20]

The goal of establishing an inventory is to provide city governments with a basis for setting realistic and attainable reduction targets and quantifying expected reductions as a result of proposed measures. CACP software has provided the City of Moscow with useful instrumentation for initial calculations by aggregating and reporting emission sources (electricity, natural gas, diesel, gasoline and waste) in equivalent carbon dioxide units. Updating and refining the inventory to greater precision is a continual process, and accurate modeling is based on verifiable data for calculation purposes. In addition, all energy consumed within City limits, as well as waste exported elsewhere, was included in the inventory, including commuters and visitors passing through.

[19] ICLEI Greenhouse Gas Inventory Report Template, provided via ICLEI 2007-9 membership; www.iclei.org
[20] Appendix A: Data Collection Process & Contact Information; 2009

B. Inventory Results

Municipal Operations Emissions Inventory Overview

In the 2005 baseline year, municipal operations were responsible for roughly 3% of overall community emissions. Though this percentage reflects a small portion of the community as a whole, information drawn from municipal data can be used to direct the formation of City government objectives for community networking and partnering. The City of Moscow has an opportunity to provide a case study and potential tool kit for the community by sharing this document and the methodology used to measure and track GHG emissions and reductions as well as the cost savings and efficiency benefits realized from related activities.

Table ii[21] provides municipal stationary and transportation-related emissions data collected in 2005. Stationary municipal emissions include water treatment and production, public facility buildings, street lights and traffic signals. Transportation-related emissions include those emissions produced by employees using City vehicles while at work, as well as employees using personal vehicles for traveling to and from work. Solid waste emissions include household and commercially generated garbage (MSW) and construction and demolition debris, including inert materials and dirt, (NMSW) Non-solid waste emissions include yard-waste debris and bio-solids. The total waste equivalent CO_2 for 2005 was 306 metric tons, which does not include methane emissions from the landfill, calculated at 2,751 metric tons.[22] Total municipal emissions for the year 2005 were calculated at 48,579 million BTU's (British Thermal Units) of energy[23], which resulted in 6,034 metric tons of equivalent CO_2.

Sector	Equiv CO_2 Emitted (metric tons)	% of Total Emissions	Energy Consumed (million Btu)
Buildings	1,119	18.5	11,846
Vehicle Fleet	531	8.8	6,214
Employee Commute	553	9.2	6,475
Streetlights	787	13.0	5,069
Waste/Sewage	2,738	45.4	18,974
Waste	306	5.1	**n/a**
Total	**6,034**	**100.0**	**48,579**

Table ii: Moscow Municipal Emissions Summary

City Buildings & Electricity/Natural Gas Usage

City owned buildings in Moscow account for the release of 1,119 metric tons CO_2 each year (Figure g). Retrofits to date include window replacement at City Hall, heat, ventilation and air

[21] ICLEI Greenhouse Gas Inventory Report Template, provided via ICLEI 2007-9 membership; www.iclei.org
[22] Appendix B: Solid Waste Emissions Data; 2009
[23] http://www.physics.uci.edu/~silverma/units.html

conditioning upgrades (HVAC) at the Hamilton Indoor Recreation Center and energy efficient construction at Fire Station #3. These have offset carbon outputs by 85.19 metric tons annually[24], thereby reducing the total municipal carbon footprint by 7.6%. In addition to facilities, each emissions sector was evaluated in terms of electricity use and natural gas use in order to identify significant contributors of greenhouse gas emissions.

Figure g[25] illustrates the highest emissions from electricity use according to sector and individual facilities in the building sector**.** Highest emissions were those involved in water production, treatment and delivery and City wide street lights and traffic signals. The water production and delivery category includes electricity used by City booster stations and production wells, whereas the Sewage Management/Treatment category includes the Wastewater Treatment Plant and sewer lift stations. The Street Lights category includes emissions from all street and parking lot lights, including the 15 traffic signal intersections within the City limits.

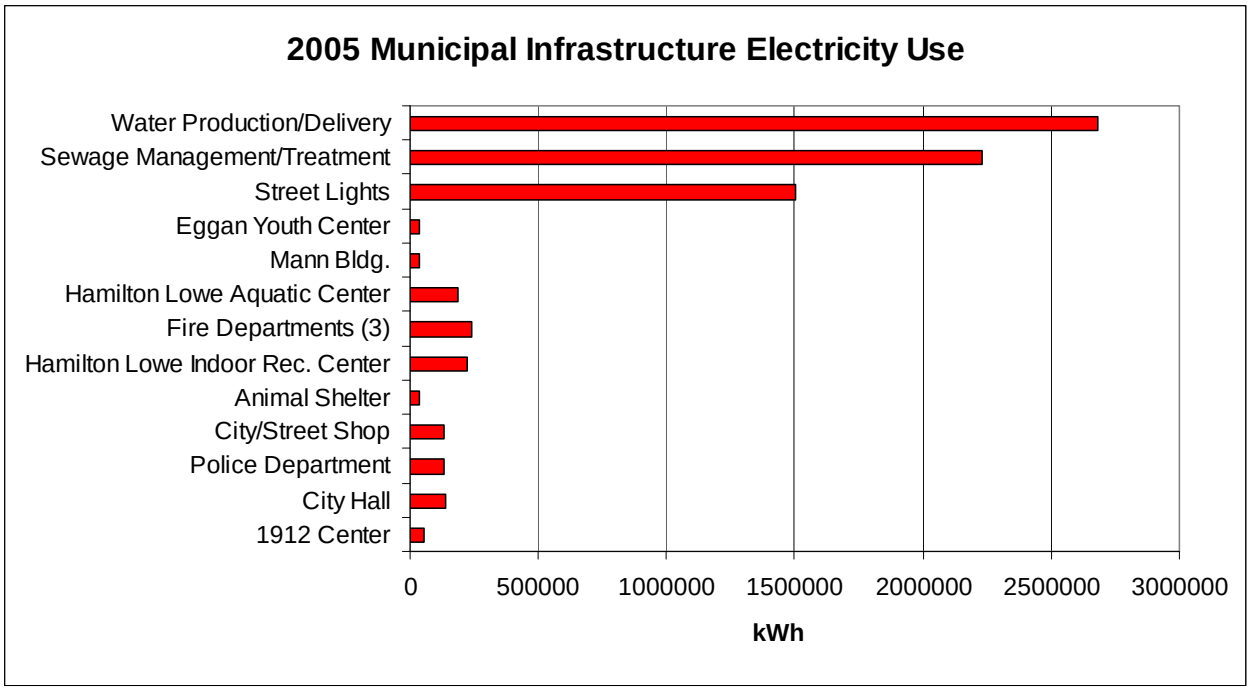

Figure g: Moscow Municipal Infrastructure Electricity Use-Year 2005

[24] Appendix C: Building Retrofits Energy Efficiency Gains; 2009
[25] ICLEI Greenhouse Gas Inventory Report Template, provided via ICLEI 2007-9 membership; www.iclei.org

Figure h[26] illustrates municipal natural gas usage. The Hamilton Lowe Aquatic Center and the Waste Water Treatment Plant are the largest consumers of natural gas, consuming over 20,000 therms, the unit used to measure natural gas consumption, annually (1 therm = 100,000 BTU's). According to the Environmental Protection Agency (EPA), "each therm of natural gas consumed results in 12 pounds of CO_2 emissions."[27]

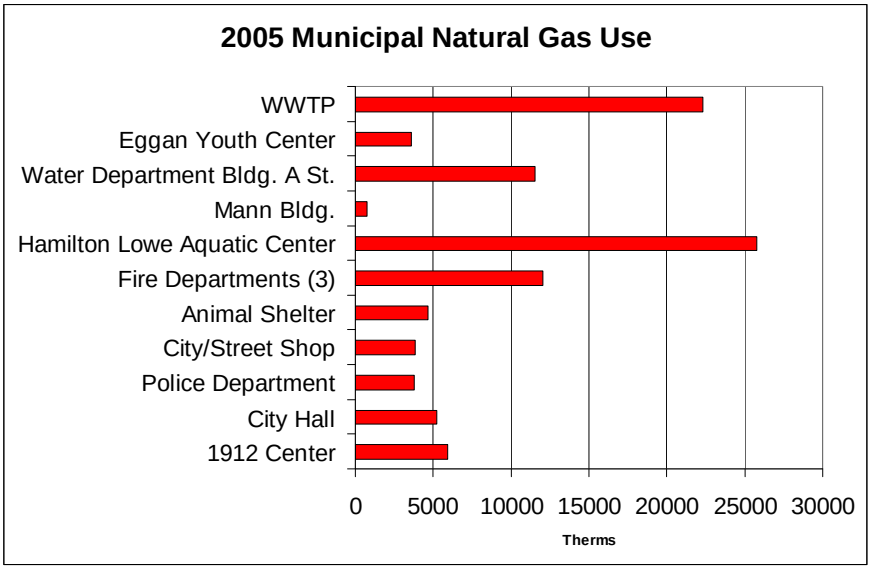

Figure h: Municipal Natural Gas Use-Year 2005

[26] ICLEI Greenhouse Gas Inventory Report Template, provided via ICLEI 2007-9 membership; www.iclei.org
[27] http://www.arlingtonva.us/portals/topics/aire/page69144.aspx

Streetlights/Traffic Signals

Streetlights and traffic signals utilize 19% of the electricity purchased by the City of Moscow purchases, accounting for 7 metric tons of CO_2 annually (Figure i).[28] Data gathered from Avista Utilities and in-house financial records were used to document potential savings and garner funds for retrofits, some of which have recently been awarded through an Energy Efficiency and Conservation Block Grant to the City. Grant monies were awarded to finance LED lighting retrofits, which will offset 80% of the CO_2 generated by lights and signals annually, reducing the total CO_2 production by 629.6 metric tons.[29] This reduction amounts to 10.94% overall carbon offsetting for the City, and will save an estimated $5,000 per year in energy costs, plus maintenance cost savings due to longer product lifespan of LED lights.

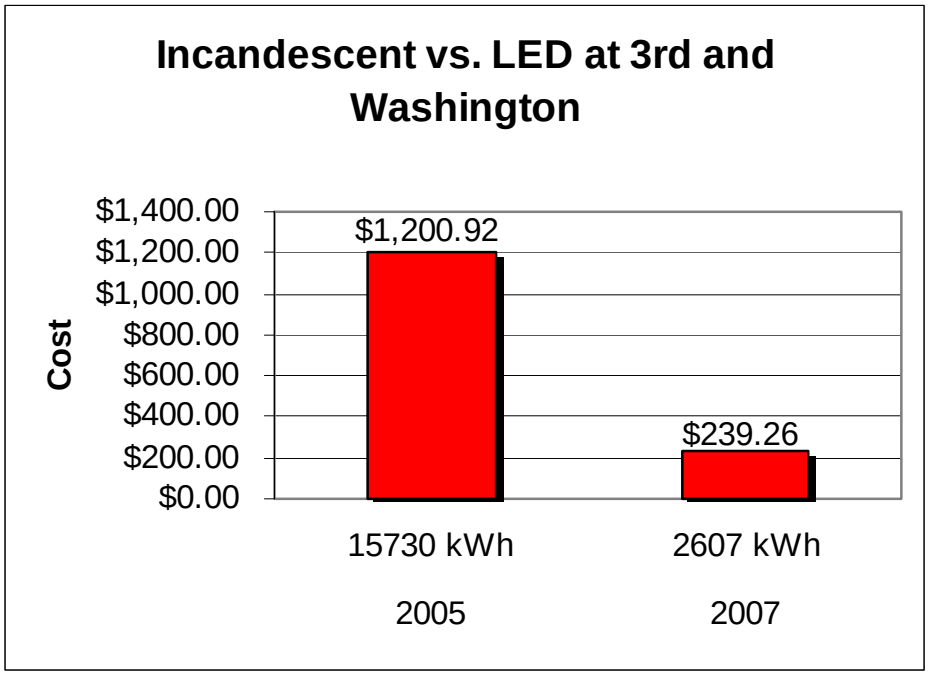

Figure i: Municipal Traffic Signal Energy Use Comparison- Year 2005

Comparison of incandescent traffic signals vs. LED lights at the intersection of 3rd Street and Washington Street (previously upgraded by ITD) has provided the City with a great opportunity to see the cost and energy savings afforded by retrofitting incandescent traffic signals to LED signals as highlighted in Figure i.

[28] ICLEI Greenhouse Gas Inventory Report Template, provided via ICLEI 2007-9 membership; www.iclei.org
[29] Appendix D: Streetlight Inventory Spreadsheet; 2009

Vehicle Fleet

The City of Moscow's vehicle fleet accounts for 531 metric tons of CO_2 per year.[30] Current energy investments in this area include a Fleet Replacement Program,[31] which utilizes a rating system to monitor the condition of City vehicles and allocates funds annually for those approaching obsolescence. Figure j[32] compares vehicle fleet fuel costs for 2005 and 2008, illustrating volatility in prices, which makes investment savings difficult to track, but it should be noted that future studies that control for pricing and tracks emission based on volume would be prudent, whether based on 2005 baseline data or compiled with data from a later year.

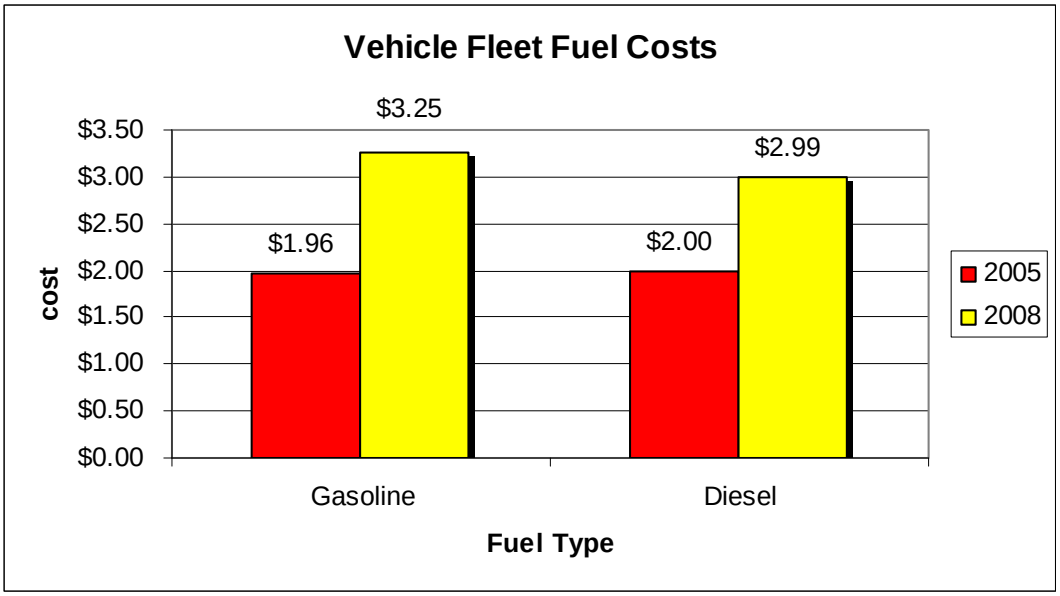

Figure j: 2005 Moscow Municipal Fuel Consumption Costs

Employee Commute

Data processed from the Employee Commute Survey[33] documents that 553 metric tons of CO_2 are generated each year through employee commutes to and from work. These data are presented in an anonymous, collective form as a reminder that carbon footprints extend beyond the bounds of the workplace, and as a means of encouraging employees and the community at large to use public transit, pedestrian and bicycle friendly transit routes when possible.

Water Production/Waste Treatment

2005 municipal emissions attributed to waste water and sewage services generated 2,738 metric tons of CO_2, accounting for almost half of Moscow's total emissions (Table iii). Realizing efficiency gains for this sector thus far has been the result of main drive motor replacements on City wells #2 and #3 and utilization of variable frequency drive motors at the Wastewater

[30] ICLEI Greenhouse Gas Inventory Report Template, provided via ICLEI 2007-9 membership; www.iclei.org
[31] Appendix E: Vehicle Fleet Replacement Program; Department of Public Works; 2009
[32] ICLEI Greenhouse Gas Inventory Report Template, provided via ICLEI 2007-9 membership; www.iclei.org
[33] Appendix F: Employee Commute Survey; 2009

Treatment Plant.[34] However, additional gains from retrofitting City wells that are currently in good working order would require a high cost to replace those systems. Replacements when necessary due to a failing unit will provide some measure of reduction. Methane capture is currently a non-issue, as anaerobic digestion bacteria that produces methane is not currently used in the wastewater treatment system.

Solid Waste

Total 2005 municipal solid waste emissions amounted to 305.75 metric tons CO_2 (Table ii, page 17). Fiscal Year 2005 Municipal Solid Waste (MSW) tonnage was recorded at 13,481.63 tons.[35] In terms of dollars, MSW disposal waste cost $39.65 per ton, which totaled $534,546 in that time period. During that period, waste was exported to Columbia Ridge Landfill, a regional sub-title D compliant landfill[36] in Arlington, Oregon, which is required by law to capture and treat landfill gas. The regional landfill currently being used to dispose of City of Moscow Municipal Solid Waste is Finley Buttes in Boardman, Oregon. The Boardman landfill pipes landfill gas to an adjacent facility, where the gas is used to produce electricity that is put back into the grid. Heat generated through the process is also used at an adjacent onion plant to aid in the dehydration processes.

Non-Municipal Solid Waste (NMSW) includes construction, demolition, yard-waste and bio-solids. Waste tonnage for 2005 was recorded at 10,313.88 tons. At $7.86 per ton, the total cost was $81,067.10. In 2005, NMSW yard-waste and bio-solids were transported to EKO Compost in Lewiston, Idaho, a distance of 64 miles round trip. In 2009, construction of a composting facility at the Latah Sanitation (LSI) waste transfer station, a distance of 12 miles round trip, has enabled transport and processing of wastes to LSI, cutting down considerably on transportation costs. However, inflating costs of waste processing have minimized savings in this sector. In 2008, the City of Moscow spent $138,380 for bio-solids fees at EKO in Lewiston, compared to 2009 processing costs of $152,648 at LSI.[37] In July of 2010 a formal agreement was reached with LSI for bio-solid waste processing. In light of that agreement it is anticipated that compost may be made available at a future date.

[34] Scallorn, Tom, Water-Wastewater Manager; Personal Interview; April 2010
[35] Davis, Tim, Sanitation Operations Manager; Email correspondence interview; April 2010
[36] http://www.epa.gov/ttn/atw/landfill/landfq&a.pdf
[37] Swanstrom, Todd, Treatment Plant Supervisor; Email correspondence interview; June 2010

Data Summary

Total quantified GHG reductions (in metric tons) achieved since 2005 (as of April 2010) are reflected as follows:

629.6 (streetlights/signals) + 85.19 (building retrofits) / 6034 = 11.85%

Research thus far demonstrates the feasibility and cost-effectiveness of incorporating sustainable practices into Moscow's municipal sectors. Relatively modest investments have already yielded substantial efficiency gains, which is encouraging for future investment potentials. Balancing a local focus with global awareness also positions the Moscow community to be ready to respond appropriately and efficiently to environmental issues and regulations as they arise. Baseline inventory, networking and applied research methods with economic goals are all crucial to balancing what sustainable business strategists refer to as the "triple bottom line."[38] Andrew Savitz, founder of Sustainable Business Strategies Consulting firm, defines it as follows:

> "For businesses, sustainability is a powerful and defining idea: a sustainable corporation is one that creates profit for its shareholders while protecting the environment and improving the lives of those with whom it interacts. It operates so that its business interests and the interests of the environment and society intersect" [41]

Gary Christensen, Boise area developer of the LEED Platinum Banner Bank building, put it more succinctly by saying simply, "Green is the color of money." In an increasingly regulated environment, sustainable growth of Moscow's community and economy together, within the limitations of the natural resources that support them, is crucial to successful long term development.

[38] Savitz, Andrew. "The Triple Bottom Line." Sustainable Business Strategies, 2005. http://www.getsustainable.net/

Community Emissions Inventory Overview

For the 2005 baseline year, the community of Moscow produced approximately 551,820 tons of CO_2[39]., Table iii[40] breaks down emissions by source type. Stationary emissions include industrial, residential and commercial sectors, which also accounts for the 14% of commercially allocated emissions from the University of Idaho.

Sector	Equiv CO_2 Emitted (metric tons)	% of Total	Energy Consumed (million Btu)
Residential	63,250	30%	592,596
Commercial	88,971	41%	1,081,620
Industrial	4,284	2%	53,156
Transportation	49,964	24%	582,397
Waste	5,760	3%	n/a
TOTAL	212,229	100%	2,309,769

Table iii: Moscow Community Emissions Summary (2009)

Transportation calculations data are derived from the Idaho Transportation Department (ITD) information for vehicle miles traveled within Moscow's city limits. Waste emissions represent CO_2 released from municipal solid waste (MSW), non-municipal solid waste (NMSW), bio-solids and yard waste, excluding the transportation energy used to haul waste outside the city limits.

[39] ICLEI Greenhouse Gas Inventory Report Template, provided via ICLEI 2007-9 membership; www.iclei.org
[40] ICLEI Greenhouse Gas Inventory Report Template, provided via ICLEI 2007-9 membership; www.iclei.org

Community & Municipal Operations Measures

A. Municipal-scale measures

Moscow has also already undertaken a number of municipal operations measures resulting in reduced GHG emissions. Window replacement at City Hall, HVAC replacements and lighting retrofits have all contributed to a decrease in municipal emissions.

GHG emissions have been reduced by 11.85% since 2005

Future measures recommended for municipal scale sectors include the following:

City Buildings & Electricity/Natural Gas Usage:

- Continue to invest in energy retrofits for applicable facilities (85.19 tons CO_2 saved):
  - New HVAC systems for Police Department or Pump Building on A Street
  - Hamilton Lowe Aquatic Center
    - Solar panels or tubes to augment natural gas
    - Passive system involving heating water in pipes under the parking lot
    - Augment other activities around the Aquatics Center Research investment potentials in renewable energy sources such as solar, biomass, wind and hydro-electric
- Encourage LEED certified projects in future growth and development as part of the Green Building Program

Streetlights/Traffic Signals:

- Acquisition of grant monies to implement upgraded lighting systems has realized significant efficiency gains for the City of Moscow (629.6 tons CO_2 saved and nearly $1,000 saved annually per signal)
- Develop efficiently as we grow and use this success as encouragement to pursue future grants for upgrading in other sectors

Vehicle Fleet:

- Monitor fuel type and efficiency as part of the vehicle efficiency rating system. Despite fluctuation of fuel prices, miles-per-gallon engine efficiency and non-monetary and indirect values of purpose; fleet efficiency is relevant and applicable to carbon reduction in Moscow.
- Take advantage of and pursue opportunities to integrate reasonably and sustainably produced biodiesel as an alternative and supplemental fuel source. Encourage bolstering of market demand to reach critical mass that can attract a supplier to the region.

Employee Commute:

- Compare 2009 survey results taken for 2005 survey with future inventories and community surveys to aid City officials in decision-making for the following:
    - Investment in public transit
    - Development of pedestrian and bicycle routes
    - Identification of market thresholds for energy efficient fuel source industries that may want to service the City and surrounding area

Water Production/Wastewater Treatment:

- Partner with Avista to provide incentives to homeowners to decrease water usage (less water = less electricity)
- Provide Green Building/LEED certification educational opportunities for water conservation to contractors and homeowners (i.e. decrease run-off and supplemental water usage by developing residential rainwater harvesting systems)
- Install variable frequency drives for pumps at feasible locations such as Ponderosa Drive, Moser Court, Taylor Street, White Avenue and Indian Hills Drive
- Explore the feasibility of utilizing anaerobic digesters at the wastewater treatment plant; consider grant acquisition for funding purposes
- Explore expanding use of treated effluent instead of potable water for irrigation

Solid Waste:

- Refine composting facility processes of bio-solids and yard-waste to the point of producing a consumer attractive and pesticide free product
- Explore the feasibility of coordinating with LSI to develop a re-use program and construct a commercial facility at an appropriate site for the potential to divert items that may have been put directly into the landfill such as furniture, scrap or used lumber, etc.

Combining the steps already taken, which have yielded an 11.85% reduction, with measures recommended above, **it is well within the City of Moscow's capabilities to pursue efficiency gains annually in order to achieve a 20% GHG reduction of 2005 levels by 2020**. This reduction target is relatable to other reduction targets set within the nation. Statewide government GHG reduction targets for 2020 range from 10-30%[41] and the U.S Government has pledged to cut 2005 emissions 17% by 2020[42]. Los Angeles has pledged to achieve 35% below 1990 levels by 2030; Denver has pledged 10% below 1990 levels by 2012; Chicago has pledged 25% below 1990 levels by 2020.[43] Through the efforts of local partnership potentials, departmental teamwork, the facilitation of the Sustainability Intern and commitment to leadership for the community, the City of Moscow can also grow and thrive economically, environmentally and socially.

[41] http://www.pewclimate.org/what_s_being_done/targets
[42] http://www.washingtonpost.com/wp-dyn/content/article/2010/01/28/AR2010012803632.html
[43] http://www.epa.gov/statelocalclimate/local/local-examples/action-plans.html#all

B. Community-scale measures

Existing community-scale measures that reduce GHG emissions include Moscow's free local transit system, with routes covering the eastern and western sides of Moscow. In addition, the City of Moscow encourages residents to bike and walk to their destinations by providing trail and sidewalk systems that enable safe navigation around the city. Recent implementation of the Sprocket employee bike share program has afforded City employees the opportunity to use City bikes for lunch breaks, errands, traveling between City facilities and commuting to and from work.

Partnership Potentials:

Successful sustainability efforts have required networking and strategizing from multiple parties in order to implement energy efficiency gains thus far. Additional partnerships will be necessary to ensure the implementation and success in the City of Moscow and surrounding region. Partnerships have already begun developing between the City of Moscow and Avista Utilities, as the City worked collaboratively with Avista to gather baseline inventory data in order to generate the first draft of the Greenhouse Gas Report.

ICLEI has been a valuable resource for learning how to take the first steps towards carbon reduction and renewable energy. Through ICLEI training, the Sustainability Interns have developed skills and tools necessary to equip the City for further action. Knowledge gained through ICLEI is currently being taken forward with the networking opportunities afforded through NALGEP, the National Association of Local Government Environmental Professionals, as we move beyond initial baseline inventory to assessing steps for further energy savings.[44]

The University of Idaho Sustainability Center (UISC) has recently completed a Greenhouse Gas Report and Climate Action Plan, which will serve as important resources for future inventories and sustainable developments for the City of Moscow. The UISC provides an educational resource and can aid the City in accessing carbon reduction calculation tools and research information to help with municipal climate action planning. Partnering with UISC, which affects a percentage of City functions, increases energy efficiency gains potentials and is a positive step for the City and community as a whole.

City of Moscow resources are crucial to the success of sustainability efforts. Next steps towards energy efficiency gains involve working closely with key representatives from several departments to assess the feasibility of implementing reduction goals. Recommendations for action planning include forming an in-house Sustainability Assessment Team, that includes appropriate City staff, the Sustainability Intern and representatives of the Sustainable Environment Commission. The proposed team would develop recommendations to the City Council for goals and objectives for climate action planning for the City.

Community Partnering is essential to Moscow's success as a sustainable community, and is made possible through education, advocacy and the work of the Sustainable Environment Commission. This action plan starts with the City and, building upon methodologies and

[44] http://www.nalgep.org/

processes developed by the UISC, will serve as an important model for the community as a whole. Because community emissions account for the vast majority of total emissions in Moscow, municipally led outreach efforts are key to making an impact on reduction strategies in the area as a whole. In addition, public dissemination and community proposals concerning the goals and recommendations put forth in this report, as well as a platform for public involvement and action, are best facilitated by the joint efforts of the City and the Sustainable Environment Commission (SEC). One example of a potential City-led effort to incentivize community investment in sustainable practices includes identifying water consumption per household and providing education and incentives for water conservation.

State and federal agencies such as ITD, EPA and DEQ are also important players in sustainability efforts for the City of Moscow, as they represent not only significant scientific and policy resources for local governments, but also potential granting sources for investments beyond financial capacity that can be addressed internally.

Conclusion

In addition to mitigating climate destabilization and associated effects, Moscow can realize manifold benefits from the proposed measures outlined in this report. With continued investment in energy efficiency technologies, the City of Moscow will reap the benefits of decreased energy costs. Employee hours dedicated to maintenance are saved by improved technologies such as LED traffic signals due to a longer product lifespan. The City has an opportunity to approach local challenges in a holistic way by recognizing the relationship between the ecological and economic health of the Palouse region.

Cost savings through energy reductions are not the only benefits the City of Moscow gains by committing to becoming a more sustainable community. Andrew Savitz's concept of the "Triple Bottom Line" incorporates sustainability into business planning in such a way that profit is generated for shareholders, the environment is protected and the lives of people affected by development are improved.[45] Environmental and physical health benefits are also important factors to consider. Bicycle and pedestrian friendly communities have healthier populations and daily face-to-face interactions create stronger community bonds. By embracing a Climate Action Plan, the City expands upon its reputation as a responsible community that is conscientious about resource conservation. By doing so, Moscow becomes an attractive option for sustainable businesses seeking to relocate to more environmentally progressive communities. The connection between a commitment to sustainable community development and the economic success of the City of Moscow is a clear choice.

Encouraging Moscow's growth and development in a sustainable direction will take practice, education and refinement in order for the process to be incorporated smoothly into the fabric of municipal functions. However, the networking and resources are readily available to successfully transition the City. Facilitation will take place via efforts of the Sustainability Intern in cooperation with counterparts and partners at the University of Idaho Sustainability Center and other expert resources at the state and national levels, as well as in the private sector.

A reduction goal of 20% by 2020 is an attainable and realistic goal and time frame. Next steps in achieving this goal include maintaining an eye for sustainability while weighing costs and benefits of future projects undertaken by the proposed Assessment Team. It is also important to leverage previous successes to achieve further gains when identifying smart sustainable and economically sound practices for enhancing day-to-day operations and into the future.

Moscow's commitment to sustainability is best reflected in a community that welcomes economic growth while demonstrating responsible stewardship of resources. Municipal energy consumption and resource management that maximizes efficiency makes economic sense, regardless of potential implications of changing climate patterns. The recommendations outlined in this report reflect an expressed commitment to careful analyses and implementation of measures to realize a more economically efficient, energy-conscious and sustainable future for the City of Moscow.

[45] Savitz, Andrew. "The Triple Bottom Line." Sustainable Business Strategies, 2005. http://www.getsustainable.net/

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Appendices

A) Data Collection Contact List

B) Solid Waste Data & Calculations

C) Municipal Building Retrofits & Energy Efficiency Gains

D) Jackson Street Light Utility Record

E) Vehicle Fleet Replacement Program, City of Moscow Public Works Department

F) Employee Commute Survey 2009

G) Figures & Tables

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