Green Building Policy Briefing Paper for the City of Missoula

The City of Missoula identified a LEED green building policy for municipal buildings as an integral component of the 2012 Missoula Conservation and Climate Action Plan. To aid policy makers, we have produced a working document that discusses the costs and benefits of high performance green buildings, compares several different certifications and standards that can be incorporated into a policy, provides case examples of existing policies, and offers brief recommendations that could serve as starting points for the City of Missoula to draft its own unique policy. We see this document as an initial step towards developing a green building policy for the City of Missoula that is cost-effective, provides benefits to the City, incorporates the concerns of City employees, and satisfies the MCCAP.

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Executive Summary

In 2007, the Missoula City Council passed Resolution 7241 to incorporate energy-efficiency measures as a priority for new municipal buildings and renovations (City of Missoula, 2007). While this is an admirable step, the resolution is not as stringent as we believe it could be, nor does it create a set of specific guidelines to ensure energy efficiency and sustainability. In the Internal Policies and Practices section, the Missoula Conservation and Climate Action Plan (MCCAP) recommends that the City create and adopt a policy that ensures all future City of Missoula new construction and major renovation building projects attain Leadership in Energy and Environmental Design (LEED) certification (Jones & Valainis, 2012). After discovering this recommendation during our study of the MCCAP, our working group recognized an opportunity for Missoula to lead by example by crafting and adopting a policy, preferably by passing a new resolution with specific requirements, which demonstrates the city's commitment to energy efficiency and cost savings for city-owned buildings.

The fundamental goal of a green building, or high-performance building, policy for the City of Missoula is to create a set of guidelines for the construction of new municipal buildings and major renovations of existing buildings that will ensure that the city and taxpayers, as long-term building owners, build better, energy-efficient buildings, and in doing so save money on energy and maintenance costs.

The benefits of green buildings are numerous. Most notably, they are more energy and resource efficient, yielding a reduction of operation costs over the lifetime of the building. Green buildings have also been shown to yield design savings, lower long-term costs, and use less water. These buildings also create healthy indoor working spaces for city employees. Furthermore, Missoula has adopted carbon-emission-reduction and climate change mitigation goals, and the reduced energy consumption of green buildings takes a marked step toward those goals.

Construction cost premiums, i.e., extra upfront costs, are typically not as high as commonly perceived. Through our research we have found them to range generally between 0 and 20%. Potentially, higher upfront costs can be offset by a decrease in long-term operation and maintenance costs, particularly in buildings that emphasize energy-efficient design and building attributes such as Energy Star appliances. A study by The Massachusetts Technology Collaborative concludes that the overall financial benefits of LEED buildings amount to $50-$70 per square foot over a 20-year period, resulting in savings of at least ten times the extra initial building costs (Kats, 2003).

A number of guidelines and models are being used to develop energy-efficient policies for local governments. We have chosen to focus on the following three for their different approaches and status as established schemas: (A) LEED Certification; (B) Green Globes Rating System; and (C) International Green Construction Code (IgCC).

LEED certification refers to a suite of rating systems developed by the United States Green Building Council (USGBC) in 1998. Since its inception, LEED standards have been applied to

over 7,000 buildings in over 30 countries covering over 10.5 billion square feet of developed area (USGBC-5). LEED certification requires third-party verification that a building was designed and built using strategies aimed at achieving high performance in key areas of human and environmental health. LEED Certification is the most well-known third-party verification system. This has resulted in the USGBC having a wealth of information and resources available. The major criticism offered toward LEED is the paper-heavy documentation and expensive, time-consuming process. USGBC has just recently introduced an online and more integrative user interface, Version4, to address these criticisms. LEED certification is specifically mentioned as a goal for the Missoula's forthcoming green building policy in the MCCAP section on Internal Policies and Practices (see implementation strategy IPP-9 in Jones and Valainis, 2012).

Green Globes is a system of third-party verification that was developed by Environment Canada and the Canadian Standards Association in 1996. In the United States, exclusive rights to the Green Globes rating system were bought by the Green Building Institute (GBI) in 2004. Green Globes for New Construction is based on ANSI Standards and utilizes weighted criteria in its assessment protocol to comprehensively assess building environmental impacts. Green Globes has not been used for United States buildings as long as LEED and is not as well known. Green Globes bills itself as a user-friendly, streamlined alternative to LEED certification; it benefits from a greater online presence as opposed to LEED's historically paper-based format. While Green Globes does require a certified reviewer to visit the site, it is framed as a program that requires far less technical expertise.

The IgCC is not a third-party verification system; rather, it is an enforceable set of standards that requires adoption by municipalities. Typically, the code is adopted to apply to all buildings in a municipality; however, it can also be adopted as part of a municipal green building policy. The American Institute of Architects (AIA) stresses the flexibility of adopting the IgCC as an overlay on existing building-code structure as well as its status as law that, once adopted, can be more enforceable than relying on third-party verification. There is a possibility that training employees to monitor and enforce the IgCC will add to the initial costs of using building codes as the foundation for a building policy; however, the authors of the IgCC have worked with other municipalities to develop comprehensive plans that incorporate IgCC Standards (International Code Council, 2012). As this is the most recent formulation of an energy-efficient framework for building policies, there is little information relating to specific cases.

Using third-party certification or mandatory minimum building standards as a basis for a municipal green building policy will address the reccomendations in the MCCAP and prepare the City of Missoula to reach its sustainability goals while positioning the City as leaders in the development of sustainable building practices. A policy should be developed with strong language to ensure that all new buildings and major renovations are built to specific energy-efficient standards. The policy should be crafted with the scale of City buildings in mind and be based on parameters such as overall construction budget, carbon footprint, or square footage to provide city managers the flexibility needed for municipal-building renovations and new buildings. LEED, Green Globes, and the IgCC all provide pathways towards energy efficiency and savings on energy costs compared to conventional buildings, yet the adoption of a specific

framework as basis for a policy should rely on thoughtful consideration of the administrative and potential upfront financial constraints as expressed by city managers.

A variety of case examples from within Montana and from outside the State, including examples from cities similar to Missoula, reveal the effectiveness as well as the potential pitfalls of green building policy implementation and model different ways of adopting the various certifications and standards.

After analyzing the components and implementation strategies of municipal green building policies across the country, we agree with the MCCAP's recommendation for a LEED green building policy for the City of Missoula. In addition, we recommend:

1. Adopting a minimum of LEED Silver Certification for new buildings and major renovations.
2. Excluding minimum payback timetables as prerequisites for construction.
3. Incorporating an overlay of IgCC standards to address smaller-scale renovations and building projects.
4. Prioritizing energy efficiency and locally-sourced building materials.
5. Using strong and specific language to minimize ambiguities and "point-chasing."
6. Maintaining a close-working relationship with city managers to minimize the administrative burden and financial costs of implementing a policy.
7. Conducting post-occupancy evaluation studies to ensure maximum benefits of green buildings are being attained.

We believe such a policy should recognize the long-term financial benefits of constructing energy-efficient buildings as well as the health and productivity of building occupants. If LEED certification is pursued, we recommend requiring a minimum of LEED Silver for new buildings or major renovations.

After considering LEED implementation in several case examples, we do not recommend including a necessary payback for LEED projects. Payback cost analyses can add additional financial and time burdens and can create the possibility of opting out of energy-efficient standards with the justification that the payback is not quick enough. If the LEED third-party certification system seems prohibitive for specific projects, (due to the size, cost, or other reasons) a green building policy could include an overlay of IgCC. This would ensure energy efficiency and cost effectiveness in buildings that are unable to be built to LEED specifications.

We recognize the potentially high cost of a third party-verification system but believe these costs are outweighed by the recognition of the certification system, the demonstrated long-term cost savings of LEED buildings, and other benefits discussed in this briefing paper. Because LEED projects can earn points in many different categories, we recommend that Missoula's Green-Building Policy for Municipal Buildings require the prioritizing of energy efficiency and regionally sourced materials in project designs to minimize operation and maintenance costs of the buildings while contributing to the local economy. The city of Austin, Texas, for example,

prioritizes earning points in five specific LEED categories that ensure energy and maintenance savings.

We recommend that any resultant policy use strong and binding language along with clear definitions regarding the size and scope of potential projects covered under the policy. This will require amending or replacing Resolution 7241. We also recommend that the new policy maintain consideration of the potential administrative burden placed on city employees and the costs that might be incurred by third-party contractors.

Through the implementation of a high performance green building policy, Missoula will follow in the footsteps of cities already enjoying the fiscal and societal benefits of green buildings, as well as lead by example for private and commercial building owners within the community who identify with the numerous benefits of green buildings.

I. Introduction

In 2007, the Missoula City Council passed Resolution 7241to incorporate energy-efficiency measures as a priority for new municipal buildings and renovations (City of Missoula, 2007). While this is an admirable step, the language in the resolution does not ensure all future buildings are built to specific standards, nor does it create a set of specific guidelines to promote energy efficiency and sustainability. In the internal policies and practices section, the Missoula Conservation and Climate Action Plan (MCCAP) recommends that the city create and adopt a policy that all future City of Missoula new construction and major-renovation building projects attain Leadership in Energy and Environmental Design (LEED) certification (Jones and Valainis, 2012). After discovering this recommendation during our study of the MCCAP, our group recognized an opportunity for Missoula to lead by example by adopting a policy, such as a new resolution with specific requirements, which demonstrates the city's commitment to energy efficiency and cost savings for city-owned buildings.

In order to help facilitate the discussion toward a new building policy, we have assembled research on possible approaches to green buildings, as well as case examples of other cities' and local entities' building policies. There are a variety of strategies that can be implemented in a number of ways. For example, while LEED certification is certainly a viable option for a policy such as this, LEED certification can be pursued to varying degrees. There are also other certification systems or non-certification standards that could be used.

This document presents information that can be used to help formulate a green building policy. Section III compares the benefits and costs of green buildings by reviewing various published studies, for example, those comparing upfront costs and lifetime savings of LEED certified buildings. The different types of certification and standards that could be used as frameworks for a green building policy are explained in Section IV. In Section V, a variety of case examples from Montana and other states provide concrete examples of policy implementation and model different ways of adopting certifications and standards. Section VI draws broad conclusions from our research and poses a few recommendations for the formation of a green building policy for the City of Missoula. Finally, Section VII provides additional resources that provide useful information to complement this briefing paper.

We are a group of master's degree candidates in the Environmental Studies Program at the University of Montana, who have a particular interest in local opportunities for reducing municipal and community-wide energy consumption, energy costs, and greenhouse-gas emissions. We are also citizens of Missoula who appreciate the opportunity to collaborate with our local government to work towards meaningful change (see Appendix A for our contact information).

For this document, we presented our preliminary research to the Missoula City Council's Energy and Climate Team and the Mayor's MCCAP Technical Advisory Committee during their October, November, and December meetings. Through this collaboration we received a wealth of quality feedback and worked closely with many members of each team to address questions

they had regarding green building policies. We would especially like to thank the following individuals for providing us with numerous revisions and for sharing with us their expertise:

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II. Green Building Policy Goal

The fundamental goal of a green building, or high-performance building policy for the City of Missoula (or formally adopted resolution) is to create a set of guidelines for the construction of new municipal buildings and major renovations of existing buildings that will ensure that the city and its taxpayers, as long-term building owners, build better, energy-efficient buildings and in doing so save money on energy and maintenance costs.

III. Weighing the Benefits and Costs

The benefits and costs of constructing green buildings in place of standard, non-green buildings are discussed below. Although the monetary benefit of reducing operations and maintenance costs are often considered the biggest benefit of green buildings, other measurable and less-tangible benefits can also be considered valuable assets that can help create a healthy, productive, and efficient workspace.

The proficiency of green builders has improved considerably in recent years and no doubt will continue to do so. Because post-construction audits are not always conducted, few comprehensive studies within the U.S. have focused on the efficiency benefits of green buildings. The literature we reviewed showed that higher upfront premium costs often associated with constructing green are frequently considerably lower than commonly perceived, and additional upfront costs are usually quickly compensated for by significant reductions in operations and maintenance costs. In sum, our review shows that green buildings, office buildings in particular, provide monetary net benefits over conventional buildings as well as various non-monetary benefits, such as increased productivity and support for municipal sustainability goals.

A. *Benefits of Green Buildings*

1. Create a healthy indoor working space

Green buildings allow greater productivity from employees, less absenteeism, and avoid "Sick Building Syndrome" (building-related illnesses). Although the productivity and health benefits of green buildings have been recognized qualitatively for some time, researchers have begun conducting studies on how features of a green workplace translate directly into quantitative benefits for employees and employers.

A study by Michigan State University researchers found that employees moving from two conventional buildings to a LEED Platinum and LEED Gold building in Lansing, Michigan reported average perceived productivity benefits of 39 hours a year for each employee involved in the move. The researchers did, however, acknowledge potential problems with their research due to the methodological limitations of the survey regarding self-reporting and recollection (Singh, 2010).

A study by D. P. Wyon found that poor indoor air quality found in conventional buildings without proper ventilation can reduce the performance of office work by 6 to 9%. The study also found that moderately raised air temperatures have a negative effect on office work performance and that negative indoor environmental effects were accompanied by negative general symptoms such as headaches and concentration issues (Wyon, 2004).

The Center for Building Performance and Diagnostics analyzed hundreds of papers on green buildings and found approximately 50 that link high-performance building components and systems to energy and other long-term benefits. Fifteen studies were found to link improved ventilation with gains in individual productivity. Six studies demonstrated 0.48 to 11% productivity gains with the provision of fresh air. Six studies demonstrated 0.62 to 7.37% productivity gains with access to higher outside air exchange rates, and three studies demonstrated 1.1 to 3.25% increases in productivity due to the removal of primary pollutants. Twelve studies linked improved lighting design decisions with 0.7 to 23% gains in individual productivity. Eight studies connected the benefits of individual temperature control to productivity gains that ranged from 0.2 to 3%. Seven studies identified 3 to 18% increases in individual productivity and 40% increases in sales (an organizational productivity measure) as a result of introducing daylight into workplace. Finally, six studies noted that the addition of operable windows for thermal comfort, natural ventilation, or access to the outdoors, can improve productivity by 0.4 to 15% (Loftness, 2003).

2. Green buildings are more energy and resource efficient

Green buildings are designed to use significantly less energy, yielding an immediate reduction in operational costs and reducing dependence on fluctuating energy prices. Green buildings also require the use of energy efficient appliances such as Energy Star rated components to further reduce energy usage.

The recently-built Garlington, Lohn, and Robinson office building in downtown Missoula, a certified LEED Gold building, saves $42,000 in energy costs each year compared to a conventional building of the same size. The building uses 61% less energy than a minimum-

code compliant design. The heating system is a hybrid water-based ground source and gas-fired condensing boiler, and the cooling system is all water-based ground source. Occupancy sensors in offices turn off lights and adjust temperatures when the offices are unoccupied. Additionally, the building uses solar hot-water and has solar electric panels on the roof to help offset fossil fuel-use. All of these strategies contribute to make a very energy-efficient building that will be cost-effective over its lifetime (USGBC-1).

With the use of low-flow plumbing fixtures, drip irrigation, and other water efficiencies, green buildings use less indoor and outdoor water.

The Payne Family Native American Center, a LEED Platinum building on the University of Montana campus has reduced its sewage conveyance by 40.5% compared to a conventional building of the same size (USGBC-2). The Missoula Wastewater Treatment Plant owned by the City of Missoula processes Missoula's water at a cost of $0.00124 per gallon (Pers. Comm Sullivan, 2013). For every 1000 gallons of wastewater that does not have to be processed the City saves $1.24.

The First Interstate Bank and Business Center, a certified LEED Gold office building in downtown Missoula has reduced its water consumption by 44% by using low-flow plumbing fixtures and sensors. Drip irrigation and drought-tolerant landscaping reduces site water use by 65% (USGBC-3). For every 100 cubic feet of water reduction (748 gallons) the First Interstate Bank will lower its monthly water bill by $1.96 (Mountain Water Company).

3. Green buildings yield design savings

Green buildings save money due to their well-researched designs. Careful site planning reduces the footprint of the building. Efficiency in infrastructure minimizes the length of sewer and utility lines. Mechanical and electrical equipment can be downsized through the use of day-lighting, natural ventilation, and low-flow plumbing fixtures. Buildings can use locally sourced or reclaimed materials which can boost the local economy and reduce transportation costs (Nalewaik, 2009).

4. Green buildings support sustainability and climate change mitigation goals

The MCCAP identifies that LEED-certified buildings emit less greenhouse gases than non-certified buildings and can help to avoid future emissions from City building projects, helping Missoula to remain on track towards reaching its carbon-neutrality goal of 2025 (Jones and Valainis, 2012).

B. *Costs of Green Buildings*

1. Cost premiums

Construction-cost premiums, or additional upfront costs, are typically not as high as commonly perceived and through our research we have found them to generally range between 0 and 20%. Based on studies within the last 10 years, the cost premium for the construction of certified green buildings ranges from 0 to 4%, with higher certification levels (such as LEED

Silver/Gold) ranging from 0 to 10% (World Green Building Council, 2013). Even within the building industry, many professionals assume that building green increases design and construction costs by 10 to 20% and are often surprised by the very modest or negligible cost premiums (World Green Building Council, 2013). In the early years of LEED and other certifications, upfront capital costs rose in proportion to their level of environmental certification. As the green building industry continues to develop capacity and expertise, and as competition within the industry increases, the costs of green construction have declined. According to the World Green Building Council, there has been a reduction in design and construction costs associated with green buildings as building codes become stricter, supply chains for green materials and technologies improve, and the industry becomes more efficient at constructing green buildings (World Green Building Council, 2013).

2. **Lower long-term costs**

Potential higher upfront capital costs are offset by a decrease in long-term lifecycle costs, particularly in buildings that emphasize energy-efficient building systems. Life Cycle Cost Assessment (LCCA) can enable decision makers to fully evaluate the costs and savings of green buildings compared to conventional buildings. Results of LCCA can be presented as simple paybacks or as more complex models. Results of complex models can be given as Net Present Value or Internal Rate of Return.

The newest version of LEED incorporates LCCA as a tool, but it lacks comprehensive analysis because it is still a recent addition to the LEED methodology. It is presumed that more information regarding LEED's LCCA will be made available as more buildings are certified under the newest LEED framework. One requirement of green building policy could be a comprehensive LCCA that would thoroughly compare the lifetime cost of a green building with a conventional building design (World Green Building Council, 2013).

3. Proof is in the pudding

A study by The Massachusetts Technology Collaborative concludes that the overall financial benefits of a LEED building amounts to $50 to $70 per square foot over a 20-year period, resulting in savings of at least ten times the extra initial building costs. The factors analyzed for this study included energy use, emissions reductions, waste and water costs, operational and maintenance costs, and occupant productivity and health. A full breakdown of this evaluation is shown in Table 1 (Kats, 2003 cited from Capital E. Analysis).

Table 1: Financial Benefits of LEED Buildings (per square foot)

Category	20-Year Net Present Value
Energy Savings	$5.80
Emissions Savings	$1.20
Water Savings	$0.50
Operational and Maintenance Savings	$8.50
Productivity and Health Benefits	$36.90 to $55.30

Category	20-Year Net Present Value
Subtotal of Savings	$52.90 to $71.30
Average Extra Cost of Building Green	-($3.00 to $5.00)
Total 20-year Net Benefit	**$49.90 to $66.30**

Source: Capital E Analysis (2003)

Another study conducted by the Minnesota Pollution Control Agency surveyed 41 high-performance commercial buildings in Minnesota that were constructed to meet the minimum requirements of the Minnesota Energy Code, which are less stringent than LEED requirements. Under this code, payback duration was shorter, but long-term savings were considerably less than with LEED or another stricter set of requirements. Table 2 shows that the median payback time for buildings constructed under the Minnesota Energy Code ranges from 1.6 to 2.3 years, with retail buildings offering the quickest payback (MPCA, 2005).

Table 2: High-performance Building Payback (Minnesota Energy Code)

Building Type	Mean	Median
Libraries	2.1 years	2.1 years
Middle/ High Schools	2.6 years	2.1 years
Offices	2.0 years	2.3 years
Retail	1.6 years	1.6 years

Source: MPCA (2005)

This study found that payback for high-performance buildings averaged less than three years, with nine averaging just one year. Incremental initial costs averaged $1.18 per square foot, with ten having building costs of $1 per square foot while still achieving energy costs savings of more than 30%. The study also found that the savings supported a variety of beneficial uses. For example, the median energy cost savings for 14 high-performance public schools was more than $58,000 annually, which was subsequently used to enhance the schools' budgets for educational enrichment. For the five retail buildings, the median costs savings amounted to $162,000 per year, helping to increase the profitability of local businesses and spurring job creation. The number of buildings in each category is limited by the willingness of the building owner to be identified in this study.

IV. Foundations for Developing Energy-Efficient Building Policies

There are various guidelines and models that are already being used to develop energy-efficient policies for local governments. We have chosen to focus on the following three for their different approaches and status as established schemas: (A) LEED Certification; (B) Green Globes Rating System; and (C) International Green Construction Code, or IgCC. The following is a brief introduction to their methodologies and a discussion of their perceived differences.

A. *Leadership in Energy and Environmental Design (LEED) Certification*

LEED certification refers to a suite of rating systems developed by the United States Green Building Council (USGBC) in 1998. Since its inception, LEED standards have been applied to over 7,000 buildings in over 30 countries covering over 10.5 billion square feet of developed area (USGBC-5). LEED For New Construction and Major Renovation was released in 2000 to address commercial office buildings but has since been used for schools, churches, and government buildings. LEED For New Construction and Major Renovations is generally focused on the design and construction components of high-performance buildings but helps set the tone for fostering energy efficiency throughout the life of the building. LEED is not a one-size-fits-all approach. LEED allows for different levels or categories of certification, each of which has its own standards. Table 3 presents a summarized breakdown of energy use requirements for three of these categories: Certified, Silver, and Gold. A shown below, a Gold building standard offers nearly a 20% greater amount of energy savings over the Certified standard (Kats, 2003 cited from Capital E Analysis).

Table 3: Energy Use Reductions of LEED Buildings Compared to Conventional Buildings

	Certified	**Silver**	**Gold**
Energy Efficiency Increase (above standard code)	18%	30%	37%
On-Site Renewable Energy	0%	0%	4%
Renewable Energy	10%	0%	7%
Total	**28%**	**30%**	**48%**

Source: Capital E Analysis (2003)

LEED certification requires third-party verification that a building was designed and built using strategies aimed at achieving high performance in key areas of human and environmental health. LEED rating systems generally have 100 base points plus a possible six Innovation in Design points and four Regional Priority points, for a possible total of 110 points. Each credit is allocated points based on the environmental impacts and human benefits of building-related impacts. The newest version, Version4, was released in November of 2013 and incorporates a Life Cycle Assessment (LCA) that takes into consideration future energy usage and is billed as a “cradle-to-the-grave” type of analysis that may suit municipal buildings very well. The LCA consists of tools such as the LCCA described in the previous section. The information gained from LCA can be used to project future energy savings and justify pursuing LEED certification and funding future energy-efficient projects. LEED v2009, the version before v4, can still be used as a framework until 2015.

LEED Certification is the most recognizable of the various third-party verification systems. This has resulted in the USGBC having a wealth of information and resources available. The major

criticism offered toward LEED is the paper-heavy documentation and expensive, time-consuming process. USGBC has recently introduced an online and more integrative user interface to address these criticisms. LEED certification is specifically mentioned as a goal for the city's buildings in the MCCAP section IPP-9 (Jones and Valainis, 2012).

A 2009 analysis of 100 LEED-certified buildings found that LEED reduces energy use in medium-energy-use buildings, such as office buildings, by 18 to 39%. However, the study also found that despite the savings, 28 to 35% of LEED buildings used more energy per floor area than their modeled conventional counterparts. Additionally, there was not a statistically significant relationship between LEED certification level and Energy Use Intensity (% energy saved vs. baseline). This result can be explained by the fact that LEED credits can be achieved in numerous areas besides energy such that it is possible for LEED-certified buildings to earn more energy credits than Gold/Platinum buildings. The authors of the study conclude that although the LEED system is building energy-efficient buildings, specific measures for which energy credits are awarded do not always meet all green building goals (Newsham, 2009). This critique is commonly referred to as "chasing credits," or a way of gaining certification by receiving the majority of points towards LEED certification in areas other than energy efficiency.

The authors of this study acknowledge that they were working with an original dataset from the earliest years of LEED certification and had a relatively small sample size. Nevertheless, if energy savings are desired, measures for achieving energy credits should be thoroughly analyzed and a post-occupancy evaluation study should be conducted to determine actual savings (Newsham, 2009). In recent years, USGBC has placed increased emphasis on measured energy performance to certify that energy credits given translate into energy performance (Newsham, 2013).

B. *Green Globes Rating System*

Green Globes is a system of third-party verification that was developed by Environment Canada and the Canadian Standards Association in 1996. In 2000, the system became an online assessment and rating tool under the Green Globes name. In the United States, exclusive rights to the Green Globes rating system were bought by the Green Building Institute (GBI) in 2004. Green Globes for New Construction is based on American National Standards Institute (ANSI) Standards and utilizes weighted criteria in its assessment protocol to comprehensively assess building environmental impacts in seven categories: Project Management; Site; Energy; Water; Materials and Resources; Emissions; and Indoor Environment. Each of these categories has an assigned number of points that quantify overall building performance including a comprehensive approach to energy performance and a practical and objective method for life cycle-assessment (GBI).

Green Globes has not been used for United States buildings as long as LEED and is not as well publicized. Montana is one of 20 states that do not officially recognize Green Globes certification. The State is described as having "neutral" language towards Green Globes (GBI) it has written into its High-Performance Building Standards that achieving two Green Globes is an alternative to LEED Silver certification. Green Globes bills itself as a user-friendly, streamlined

alternative to LEED certification that benefits from an online presence as opposed to LEED's historically paper-based format. While Green Globes does require a certified reviewer to visit the site, it has been framed as a program that requires far less technical expertise.

C. *International Green Construction Code (IgCC)*

In the spring of 2010, the International Code Commission (ICC) formed the Sustainable Building Technology Committee (SBTC) to draft the International Green Construction Code or IgCC. The SBTC was composed of 29 individuals from various sectors of the economy with expertise specifically related to energy efficiency and other topics critical to the IgCC. The goal of the SBTC was to develop a comprehensive set of standards for energy-efficient buildings consistent and coordinated with existing international building codes. In March 2012, the initial public version 1.0 of IgCC was released as result of collaboration with the American Institute of Architects (AIA), American Society for Testing and Materials (ASTM) International, The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), USGBC, and the Illuminating Engineering Society.

The IgCC is not a third party verification system; rather, it is an *enforceable set of standards* that requires adoption by municipalities. The AIA stresses the flexibility of adopting the IgCC as an overlay on existing building-code structure as well as its status as law that, once adopted, can be more enforceable than relying on third-party verification. Florida, North Carolina, Rhode Island, and Maryland have utilized the IgCC by either adopting the standards as voluntary additions to local building codes or extracting certain standards from the code to apply to local provisions. As this is the most recent formulation of an energy-efficient framework for building policies, there is a dearth of information relating to specific cases. However, the ICC is the internationally recognized leader in developing building codes and must be taken into account when vetting IgCC standards. However, the ICC, authors of the IgCC, have worked with other municipalities, such as Dallas, Texas, to develop comprehensive plans that incorporate IgCC standards (International Code Council, 2012).

D. *Discussion*

LEED and Green Globe certification are both third-party verification systems, whereas adopting IgCC are standards adoption of which reflects a commitment to *mandatory minimum standards* that must be met prior to construction. All three, LEED, Green Globes, and IgCC promote energy efficiency, occupant health, and life-cycle assessment methodology that requires building projects to focus on long-term benefits including energy efficiency. LEED and Green Globes require membership costs and separate certification costs associated with individual projects (see Appendix B). There are differences, however, in the methodologies and focus of each scheme. Prerequisites are found in LEED systems that must be considered in the design phase and need to be taken into consideration when deciding on a certification level to pursue (Smith et al., 2006). These prerequisites include building sites and locations which may become complicated in municipal settings. The weight given to each category within the rating systems are also different. The categories range from indoor air quality to sustainable building sites and "while energy seems at the center of interest in Green Globes, Material and Resource Inputs are weighted lower than in the LEED rating system" (Smith et al., 2006, p. 57). Green Globes

also recognizes four different certifications of sustainable lumber products whereas LEED recognizes only Forest Stewardship Council (FSC) certified products. The IgCC focuses more on mandatory requirements. Oregon has adopted the IgCC with amendments to serve as the Oregon Reach Code. Adopted in this way, Oregon set the baseline standards for efficiency and sustainable buildings while allowing builders to focus on project electives to meet the requirements (International Code Council, 2012).

Table 4 provides a comparison between how LEED credits and the minimum requirements set forth in IgCC standards are presented to project managers. The "project electives" seen under IgCC Sustainable Sites refers to the different elective pathways builders can choose to follow to meet the minimum requirements. The "jurisdictional" references refer to standards that can be easily modified as an overlay to existing municipal building codes.

Table 4: Comparison between LEED and IgCC Pathways to Certification

LEED Sustainable Sites	IgCC Sustainable Sites
Prerequisite 1: Construction Activity Pollution Prevention	405.1 Soil and Water Quality Protection Plan
Credit 1: Site Selection: Prime Farmland	402.7 Building prohibited on land zoned agricultural (Jurisdictional)
Credit 1: Site Selection: Floodplain	402.2.3.1 foot freeboard in flood-hazard area 402.2.1 and 402.2.2 Flood-Hazard Area Preservation- general/ specific- prohibited in Flood areas with 1% risk or as designated on map (Jurisdictional) A104.1 Buildings moved, higher freeboard, or substantial improvement at 40% (Project Elective)
Credit 1: Site Selection: Threatened Species Habitat	402.5 No development within 50 feet of designated conservation area (Jurisdictional) A104.5 Habitat Restoration (Project Elective)
Credit 1: Site Selection: Wetland	402.3 Building prohibited in, over or within water or buffer (Jurisdictional)
Credit 1: Site Selection: Waterbody	402.4 Building prohibited in wetland or within buffer (Jurisdictional)
Credit 1: Site Selection: Parkland	402.6 Development prohibited in public park (Jurisdictional)

Source: Blake (2013)

In 2012 the United States General Services Administration (GSA) commissioned a study to evaluate the effectiveness of Green Globes and LEED certification schemes at meeting federal sustainability requirements. The study found the two systems to be similar with the many differences lying in the details (Wang 2012).

Deciding between Green Globes and LEED requirements as basis for a municipal building policy may rely upon the evidence of practical application and the degree to which a municipality

wishes to utilize a less-tested system. Certifying buildings requires dedication and additional hours spent on specific requirements for third-parties that can be accomplished either by dedicated staff or additional contractors brought in for the verification process. If the City of Missoula adopts of policy requiring third-party verification, it will be a wise use of time and resources to contrast the potential benefits of having city employees trained to verify buildings with the costs associated with bringing in contractors to assist with the certification process.

In regards to the IgCC standards, officials within the USGBC see it as an important step in enforcing energy-efficient building policies and as a complementary framework to the LEED system. When released in 2012, the IgCC was lauded by the USGBC as a "new model code that serves as an important new policy option for state and local governments looking to codify green building practice" (USGBC, 2012, p.1). Through our preliminary research, utilizing the IgCC as a framework for constructing an energy-efficient building policy may be an initial stepping stone to provide additional impetus for seeking third-party verification.

While the two third-party verification systems or the minimum mandatory standards in the IgCC that this paper discusses support energy efficiency and sustainable construction and design practices, there are legitimate concerns for implementing these systems for municipal buildings. In Missoula, energy efficiency has already been identified as important for all new construction and remodels. Concerns that inviting in external verifiers will remove some of the control over budgetary and design contributions made by city employees can be addressed with specific language in a green building policy regarding the size and scope of projects in relation to certification standards. There is also concern regarding the opportunity to "chase credits" in the LEED and Green Globes frameworks that do not always promote energy efficiency or the other benefits of green buildings. Credits in the LEED and Green Globes systems are set up to be stringent yet flexible enough to allow individual projects to pick what aspects of green buildings are most important to the building owners. The City of Missoula could choose the credits they believe to best satisfy the goals of the MCCAP and the forthcoming green building policy to ensure that energy efficiency and other valued benefits are not minimized in the certification process. The flexibility of provisions in LEED and IgCC frameworks is illustrated in Figure 1. If the City decides flexibility in its green building policy is of primary importance, utilizing IgCC standards might prohibit certain projects or initiatives.

Figure 1: Representational Credit Allocation of LEED and IgCC

Source: Blake (2013)

Using third-party certification or mandatory minimum building standards as a basis for a municipal green building policy, or resolution, will address the reccomendations in the MCCAP and prepare the City of Missoula to reach its sustainability goals while positioning the City as leaders in the development of sustainable building practices on a large scale. LEED, Green Globes, and the IgCC all provide pathways towards energy efficiency and savings on energy costs compared to conventional buildings yet the adoption of a specific framework as basis for a policy should rely on thoughtful consideration of the administrative and potential upfront financial constraints as expressed by city managers and policy makers.

V. Case Examples of Green Building Policies

We identified green building policies in Montana and across the country by internet search engines, resources provided by the USGBC, and our contacts on the Missoula Energy and Climate Team. The case examples below reflect different strategies and standards used in green building policies and illuminate some potential pitfalls in the quest for energy efficiency and better buildings. We chose policies that were adopted in locales ranging from North Carolina to Montana to reflect what is being done on a nationwide scale. Although the political and socio-economic climate of each municipality is unique, we believe the range of adoption strategies and policy language discussed below will present decision makers a starting point for modeling a green building policy for the City of Missoula.

A. *State of Montana*

In 2007, then Governor Schweitzer presented a 20X10 initiative with the goal of achieving 20% reduction in state-facility energy use by executive-branch agencies by the end of 2010. In 2013, the state legislation was passed that created minimum design standards and high-performance building standards for all new construction of state-owned or leased buildings.

Since 2007, the State has moved away from funding energy-efficiency projects using bonds and general funds and began to develop a framework for a revolving-fund program initiated with general funds, whereby energy-costs savings were collected and placed in a repayment account which is earmarked for future energy-efficiency projects in state buildings. Although the program was officially launched with federal money from the American Reinvestment and Recovery Act in 2009, “The revolving program allows the savings from the projects to be collected and then reinvested in additional projects and used to operate the program including analyzing additional buildings and evaluating projects” as opposed to repaying the initial funding for the project and having to start anew for the next projects (Energy and Telecommunications Interim Committee). Using the revolving program for funding energy-efficient projects on state-owned buildings from 2009-2012, the State of Montana completed 87 energy-conservation projects providing an estimated $1.8 million in annual energy-cost savings from electricity and natural gas that will be reinvested in future projects (Energy and Telecommunications Interim Committee, 2012).

The Montana Department of Administration, through the Architecture and Engineering Division, established High-Performance Building Standards for the construction, renovation, and maintenance of public buildings as well as all new state-leased buildings. Amended in 2013, the standards now mandate that, "All state projects shall exceed the International Energy Conservation Code by 20% above the baseline or to the extent that is cost-effective over the life of the building or major renovation" and "all state projects with a project budget of greater than $5,000,000 shall achieve a LEED certification of a minimum Silver level or a Green Globes rating of a minimum Two Globes rating or Equivalent Standard rating" (Montana High Performance Building Standards, 2009). If the High-Performance Standards are met, a building would receive between 15 and 20 points towards LEED certification with 50 points required to reach Silver Certification.

The State of Montana's first LEED-Certified building received accreditation in 2010. The DNRC/ DEQ building in Kalispell received 29 points out of a possible 69 and boasts that its heating and cooling needs are met by a high-performance variable-air volume system with efficiency 28% better than LEED credit requirements (USGBC-4).

B. *The University of Montana*

In 2002 the University of Montana began developing a comprehensive energy-efficient building policy. In 2003 Kevin Kresbach, Associate Director for Planning and Construction, attended a LEED training course and in 2004/2005 the Sustainable Campus Committee recommended the university pursue a commitment towards some level of LEED accreditation for all new construction beginning in 2007 (Sustainable Campus Committee). The 2006 version of the University's "Design and Construction, Campus Policies and Procedures Consultants Manual" includes the following commitment:

> 1. Sustainable design shall be a high priority for the design of all New Construction and Major Remodeling of Existing Facilities 10,000 GSF or greater.
>
> 2**.** The University directs the Architecture/Engineer (A/E) Consultant to include sustainable design features that would allow the facility to qualify for U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) 'Certified' Level. Anything above this level (Silver, Gold, Platinum) shall be up to the Building Committee chair and donor. It is important that this decision is made early on in the design stage for the A/E consultant.
>
> 3**.** The A/E consultant will work with the University's LEED Certified agent to prepare the necessary documentation and submittals to the USGBC.
>
> 4. Maximize, to the extent possible, construction practices that reduce the environmental impact of the current project. These practices would include: demolition, recycling waste, the handling of toxics, energy and water use, storm-water pollution, protecting soils and vegetation, and protecting building occupants from health risks (University of Montana).

The University committed, in 2007, to LEED certification for its new construction of the Payne Family Native American Center (NAC). The NAC, completed in 2010, is one of two certified LEED Platinum buildings in Missoula and was awarded 54 points out of a possible 69, exceeding the minimum for Platinum status by 2 points (USGBC-2)

Since its completion in 2010, the NAC has exceeded the expectations of campus architects and engineers. Prior to construction, the NAC was modeled to be 43% more energy efficient than conventional buildings. Since completion, the NAC has reached energy efficiency more than 55% than that of conventional buildings (USGBC-2). The initial cost of the building was about 2% over the expected cost of similar campus-quality buildings. This small percentage increase, including an estimated $0.40-$0.80 "soft cost" per square foot (Smith et al., 2006) of preparing and submitting certification paperwork, is seen by the University architect as a negligible amount when contrasted with the benefits of having third-party verified energy-efficient building (Jameel Chaudhry, email communication October 28, 2013).

C. *Bozeman, Montana*

In 2007, the Bozeman Public Library became the first LEED-Silver building in Montana. Building costs resulted in a total investment of $431,285 in order to attain LEED-Silver certification. However, on average, the building provides a net annual-energy savings of 27% over original costs.

In 2008, Bozeman's City Hall was approved by the Bozeman City Council for LEED-certified remodeling. City Hall's LEED renovations amounted to an extra $239,200 over traditional construction costs. Expected savings total $15,572 annually, resulting in a total payback period of 15.3 years. This did not take into consideration additional certification costs, which amounted to $77,670. Table 5 presents the additional renovation and certification costs of this project as well as the expected savings and payback durations of specific construction activities and the entire project (City of Bozeman, 2008). If the certification costs are considered, then the payback period would be 20.3 years.

Table 5: Additional Construction and LEED Certification Costs for Bozeman City Hall

	Cost	Annual Savings	Payback Time
Green building construction costs			
Contractor soft costs	$10,000		
Special erosion-control measures	$816		
Eco-Friendly carpet and paint	$1,500		
Additional exterior signage at parking spaces	$300		
Sustainable bamboo plywood	$8,400		
Creation of designated recycling room	$1,690		
White TPO roof for heat reduction	$12,823	Not estimated	
Replacement tinted windows	$36,000	Not estimated	

	Cost	Annual Savings	Payback Time
Openable windows	$21,463		
Skylight	$4,000	$612	6.5 years
Variable frequency drives	$10,277	$1,693	6.0 years
DDC controls and upgrades	$61,380	$10,532	5.8 years
Glycol cooler	$5,700	$588	9.7 years
High-efficiency boilers	$25,925	$1,340	19.4 years
Additional metering of mechanical systems	$10,000		
Faucet, toilet, and urinal flush-valve replacement	$28,926	$807	35 years
Sub-total of construction costs	**$239,200**	**$15,572**	**15.3 years**
Certification costs			
LEED coordinator fee	$25,000		
Additional architectural fee	$22,500		
Additional mechanical engineering fee	$9,650		
Commissioning fee	$20,520		
Sub-total of certification costs	**$77,670**		
Total	**$318,870**		**20.3 years**

D. *Boulder, Colorado*

In 2004, the City of Boulder, Colorado, incorporated energy-efficient building guidelines into their Facilities and Asset Management (FAM) Master Plan for 2005-2014. Citing the City Council's goals to implement environmental sustainability and energy improvement, the plan incorporates LEED for all new construction and major renovation projects (City of Boulder FAM 2005).

The City of Boulder's Green Building and Green Points Program requires all new residential and commercial buildings incorporate sustainable building methods. In order to lead by example, the City modeled energy efficiency and new technologies in its North Boulder Recreation Center, which achieved LEED Silver certification. This large-scale renovation expanded the existing recreation center from 35,000 square feet to 61,700 square feet. The renovation included active solar hot-water heating for the swimming pools, high-efficiency boilers, and building materials based on criteria for sustainability, indoor air quality, and energy efficiency (City of Boulder 2003).

The incremental cost of the LEED features was $540,000 or 4.6% of the $11.5M budget. The energy-efficient aspects avoid annual energy costs of $56,000 (City of Boulder 2003). This means the simple payback for the LEED certification will be less than ten years, after which the energy savings will continue to accrue thereby reducing operating costs and benefitting the recreation department budget over the long term.

E. *Scottsdale, Arizona*

In 2005, the Scottsdale City Council unanimously approved a Green Building LEED Gold Policy for new city buildings and remodels which requires achieving LEED Gold standards for all new, occupied, municipal buildings if they achieved a payback of at least five years or less. The city stipulates in its policy that if payback is anticipated to be more than five years, City staff is directed to recommend to the City Council an appropriate level of LEED certification. If LEED certification is not feasible, then the project should include as many principles of both the LEED program and the City's Green Building Program as feasible (City of Scottsdale, 2005).

Although Scottsdale was the first city in the country to adopt a LEED Gold policy, the requirement of a payback in five years or less presents distinct advantages and disadvantages. The five-year payback requirement does ensure that the City will see a quick payback for all new buildings they finance; however, it also invites the possibility that the City will not build many municipal green buildings due to the short time frame for the required payback. Requiring such a short payback period may not encourage energy-efficient or green building design in practice.

Despite the short payback period, the City of Scottsdale has built at least one green building since the policy was adopted. However, if a payback period is required in Missoula's policy, the length of this period should take into account the long-term savings of green buildings and allow flexibility in building decisions if a requirement for a short payback period is established. Such flexibility could be provided by adopting a scheme by which non-monetary or not-easily-quantifiable benefits are taken into account and valued appropriately to allow the construction of green buildings even if they do not meet a tight payback period.

F. *Austin, Texas*

Austin adopted a green building policy in 2000 during the early years of the LEED certification. The policy requires all future building projects be built to LEED Silver level. In 2007 the City Council passed a resolution that replaced and further clarified policy. The revised policy had two triggers for the LEED Silver requirement:

1. The project had to include work in 5 major LEED categories: sustainable sites, water efficiency, energy and atmosphere, materials and resources, and indoor environmental quality.
2. The project had construction costs of $2 million or more.

Additionally, smaller renovations, additions, and interior finishing's costing more than $300,000 and requiring work that falls under the LEED categories of Energy and Atmosphere, Material and Resources, and Indoor Environmental Quality must achieve Silver certification at a minimum. The city manager was tasked with developing best-practice design criteria for buildings that did not meet the above trigger (Database of State Incentives for Renewables & Efficiency).

These specifications for the LEED Silver requirement focuses Austin on building green for the largest projects, where cost premiums are likely to be a smaller percentage of the total cost and energy savings over the life of the building are likely to be most significant. Austin's policy is notable for requiring incorporation of five LEED categories into new city buildings.

G. *Seattle, Washington*

Seattle adopted a rigorous Sustainable Buildings and Site Policy in 2011. The City requires all city-owned new construction projects and major renovations to meet a minimum LEED Gold standard (Staley, 2011). Although Seattle's successful built 28 green buildings since the adoption of the first green building policy in 2000, it also recognizes that the remainder of their 650 city-owned buildings meets varying levels of energy efficiency and green building benchmarks. To meet the city's goal of reducing energy use by city-owned buildings by 20% by 2020 the city decided to track the energy use of existing buildings and decide where they can best improve their efficiency. The Energy Benchmarking and Reporting Program helps establish a baseline for city energy usage and determine where energy-efficient improvements will be most effective. (Uhlig, 2013).

H. *Asheville, North Carolina*

In Asheville, North Carolina, a city similar in size to Missoula (73,875), the City Council voted in 2007 to require that all new, occupied, city-owned buildings greater than 5,000 square feet achieve a minimum LEED Gold certification where project resources and conditions permit. City-owned buildings less than 5,000 sq. ft. must be built to a building standard that would allow them to be certified at a LEED silver certification level but they do not need to pursue the actual certification. Buildings over 5000 sq. ft. built to LEED Gold certification level require an energy savings payback period of less than 10 years. If the payback period is greater than 10 years, the facility should be built to LEED Silver certification standards (City of Asheville, 2007).

Unlike Scottsdale, Asheville requires a more reasonable payback period for new LEED buildings. The requirement of building a LEED Silver building if the payback extends beyond 10 years ensures that energy-efficient green buildings are still built if they have a longer payback period.

I. *Dallas, Texas*

Dallas adopted the 2012 IgCC as an overlay on its existing codes. The code is mandatory for all new construction within the city with some notable exceptions including some residential buildings. The code does not apply to renovations and is a part of the second phase of a green building ordinance that began in 2009 and focused on energy efficiency, water conservation, and the heat-island effect. The code was recommended by the Green Building Task Force consisting of industry professionals and City of Dallas voters (City of Dallas, 2012) (Beckman, 2012).

J. *Discussion*

The case examples presented in this section model a wide variety of municipal green building policies. In our research of municipal green building policies, LEED was found to be the most

commonly used third-party verification system as part of a policy. However, as the case examples show, it's possible to build LEED certified buildings with various qualifications and overlays. For many cities, a municipal LEED green building policy is part of a larger city effort to meet city-wide energy efficiency, sustainability and climate action goals.

The first case examples present a precedent for green building policies within Montana at the State, University, and City level. The state has adopted a revolving fund to help pay for its energy-efficient buildings and requires a unique combination of third-party verification and building standards as part of its green building policy. The University has shown a steadfast commitment to its green building policy by building its first high-performance building to a LEED Platinum level.

The case examples outside of Montana offer both positive and negative aspects that Missoula can learn from. Several policies, notably Scottsdale, Austin, and Asheville include qualifications or paybacks in their LEED policies. Though cost-effectiveness should always be an essential goal of a green building policy, requiring paybacks of any length can provide a loophole, as in the case of Scottsdale, Arizona, that enables new buildings to be built that are not always energy efficient. Payback cost analyses can also add an undue financial and time burden to the implementation of the policy. If payback timetables are included as part of a LEED policy, it may be necessary to overlay a code or other standards to ensure that energy-efficient buildings are still built.

Cities have been hesitant to take up IgCC as their sole municipal green building policy, due in part to its unproven track record and the differences between third-party verification systems and mandatory minimum standards. However, with a major city such as Dallas adopting the IgCC, it is likely that more cities will follow suit and include this code as either a component or as the central pillar of their green building policy.

VI. Conclusions and Recommendations

The benefits of green building initiatives are many: they allow for healthier and more productive indoor spaces, they reduce energy and water use, and they allow for significant cost savings over the life of a building. This document serves as an informational foundation with which to build a policy for Missoula. It explores the various options available to Missoula – namely, LEED, Green Globes, and the International Green Construction Code – and the benefits and criticisms of each. Case examples model how cities around the U.S. have implemented municipal green building policies and provide examples of the direction Missoula could pursue in writing a policy.

The Missoula Conservation and Climate Action Plan (MCCAP) calls for the adoption of a LEED green building policy for all new municipal buildings and major renovations. The MCCAP

suggests that a policy should include a minimum level of LEED certification over a certain square footage or cost but does not specify the level of certification or any specifications.

We agree with the MCCAP's recommendation for a LEED green building policy for the City of Missoula, preferably in the form of a new resolution passed by City Council. In addition, we recommend:

1. Adopting a minimum of LEED Silver Certification for new buildings and major renovations.
2. Excluding minimum payback timetables as prerequisites for construction.
3. Incorporating an overlay of IgCC standards to address smaller-scale renovations and building projects.
4. Prioritizing energy efficiency and locally sourced building materials.
5. Using strong and binding language to minimize ambiguities and "point-chasing."
6. Maintaining a close-working relationship with city managers to minimize the administrative burden and costs of implementing a policy.
7. Conducting post-occupancy evaluation studies to ensure maximum benefits of green buildings.

We believe such a policy should recognize the long-term financial benefits of constructing energy-efficient buildings as well as the health and productivity of building occupants. If LEED certification is pursued, *we recommend requiring a minimum of LEED Silver for new buildings and major renovations.* Additional costs incurred for higher certification levels have lowered significantly, and a minimum of a LEED Silver certification commits City buildings to being built to a level significantly above the standard code.

After considering LEED implementation in several case examples, *we do not recommend including a necessary payback for LEED projects.* Payback cost analyses can add additional financial and time burdens and can create ambiguities that enable the construction of buildings that are not energy efficient. If the LEED third-policy certification system seems prohibitive for specific projects (for size, cost, or other reasons), a green building policy could include an overlay of IgCC standards. This would ensure energy efficiency and cost effectiveness in buildings that are unable to build to LEED specifications.

We recognize the potentially high-cost of a third party verification system but believe these costs are outweighed by the quality and recognition of the certification system and the demonstrated lifecycle cost savings of LEED buildings that have been discussed in this briefing paper. Since LEED projects can earn points in many different categories, *we recommend prioritizing energy efficiency, and regionally sourced materials in project designs to minimize operational and maintenance costs of the buildings and to contribute to the local economy*.

We recommend that any resultant policy use strong and binding language, along with clear definitions regarding the size and scope of potential projects, while maintaining consideration of

the administrative burden placed on city employees and the costs incurred by third-party contractors. This will require amending or replacing Resolution 7241.

Through implementation of a high performance green building policy, Missoula will follow in the footsteps of cities already enjoying the fiscal and social benefits of green buildings, as well as lead by example for private and commercial building owners in the community who identify with the numerous benefits of green buildings.

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Montana LEED Building Profiles

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Green Roofs in the Garden City

- *Green Roofs in the Garden City: Exploring the Opportunities for Green Roof Policies in Missoula, Montana.* University of Montana professional paper by Matthew R. Hodges http://catalog.lib.umt.edu/vwebv/holdingsInfo?searchId=108927&recCount=20&recPointer=0&bibId=2310729

Green Building Tools

- New Building Institute. Advanced Building. An innovative tool for analysis and screening of commercial building energy use and the impact of retrocommissioning measures. http://advancedbuildings.net/ez-sim

Improving Conditions for Green Building Construction in North America

- Commission for Environmental Cooperation. http://www3.cec.org/islandora/en/green-economy

Green Building Policies and Resolutions

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- Austin, Texas. "Resolution No. 20071129-045" http://www.cityofaustin.org/edims/document.cfm?id=110795

- Dallas, Texas. "Ordinance 28813" http://www.dallascityhall.com/building_inspection/pdf/2012_City_of_Dallas_Green_Ordinance.pdf
  "Resolution 03-0367" http://www.dsireusa.org/documents/Incentives/TX18R.pdf

- Scottsdale, Arizona. "Resolution No. 6644" http://www.scottsdaleaz.gov/Assets/Public+Website/greenbuilding/Resolution+6644.pdf

- Seattle, Washington. "Sustainable Buildings and Sites Policy." http://www.seattle.gov/dpd/GreenBuilding/docs/dpdp021677.pdf

- State of Montana. "High-Performance Building Standards" http://architecture.mt.gov/content/designconstruction/docs/High_Permforance_Building_Informaiton_Public_Review_Draft

Appendix A: Authors' Contact Information

This report was prepared by graduate students in the Environmental Studies Program at the University of Montana. We conducted this research as part of a course called Local Solutions to Climate Change taught by Professor Robin Saha. If you have questions about this report or would like further information, please contact the authors or Professor Saha at (406) 243-6285 or by email at robin.saha@umontana.edu .

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Appendix B: Comparison of LEED and Green Globes Third-party Verification Systems

(Adopted from Smith et al., 2006)

	Green Globes v.0	LEED-New Construction v 2.2
Certification Process	**Step 1:** Register a project by purchasing the Green Globes online assessment tool. One tool can be used by multiple users and can show all questions or highlight questions specific to one of the 21 areas of expertise within a team (architect, engineer, interior designer, etc.).	**Step 1:** Determine building eligibility under the standard specified for building type (i.e. commercial buildings are defined as—but are not limited to—offices, retail and service establishments, institutional buildings, hotels, and residential buildings of four or more habitable stories
	Step 2: Login to online assessment tool, choose from one of the eight project stages—project initiation, site analysis, programming, schematic design, design development, construction documents, contracting and construction, commissioning. Each area of assessment contains relevant questions for each project stage. Once a project stage is chosen the team may begin answering the set questions—which are in lay terms (mostly general yes/no/not applicable)—about the building project attributes. Online assessment takes about two to three hours to complete.	**Step 2:** Register project to express company/organizations intent for future LEED certification and begin dialogue with USGBC. Also gives online access to LEED templates and credit interpretations. Process takes about 30 minutes to complete.
	Step 3: Once the schematic design stage is assessed--which should be conducted in conjunction with the planning approval--the project team will receive a preliminary rating from which they should evaluate steps for meeting the desired Green Globes rating.	**Step 3:** Document all necessary calculations and requirements needed to satisfy the prerequisites and any additionally desired credits. Procure a LEED Accredited Professional.
	Step 4: once the construction document stage is assessed—which should corresponds with the building permit approval—the project team will receive a final rating.	**Step 4:** Submit two copies of completed application—which includes LEED Letter Templates for each prerequisite and desired credit, registration information, project checklist showing estimated rating results, drawings and photos of the project.

	Step 5: Once the project team has completed the online questionnaire, Green Globes produces a report highlighting project achievements and suggesting areas for further improvement in building performance. Report also provides links to web and paper-based resources for sustainability.	**Step 5:** After checking each credit for compliance, USGBC issues administrative approval noting anticipated, pending or denied credit achievements within 30 days of submittal. Project team has 30 days to provide corrections or additional material. USGBC conducts the final review of the application within three weeks of the resubmittal and notifies the project contact with certification status.
	Step 6: To become Green Globes certified the project team must receive 35% of the total points in the Green Globes assessment and the assessment results must be verified by an independent third-party. A Verifier is either a licensed architect or building engineer with proven knowledge & experience of green building technologies & integrated design. Upon verification project team receives a certificate or plaque for display, proving the project's sustainability and environmental performance.	**Step 6:** Upon notification, the project team has 30 days to accept or appeal the awarded certification. After 30 days the awarded certification level is final and USGBC will present the team with a plaque and award letter.
Soft costs associated with certification	**Registration Cost:** Online Assessment tool = $500 per project	**Registration Costs:** *NonMembers* - 1) Less than 75,000 square feet = $950.00, 2) 75,000 - 300,000 sq. ft. = $0.0125 per sq. ft. ($937.50 - $3,750), 3) More than 300,000 sq. ft. = $3,750; *Members* - 1) Less than 75,000 square feet = $750.00, 2) 75,000 - 300,000 sq. ft. = $0.01 per sq. ft. ($750 - $3,000),3) More than 300,000 sq. ft. = $3,000
	Certification Costs: Third party assessment verification costs depend on the building's square footage, but typically costs between $3,000 - $6,000 but depends on the building's square footage. Independent verifiers will specify their own fees.	**Certification Costs:** *NonMembers* - 1) Less than 75,000 square feet = $1,875.00, 2) 75,000 -300,000 sq. ft. = $0.025 per sq. ft. ($1,875 - $7,500), 3) More than 300,000 sq. ft. = $7,500; *Members* - 1) Less than 75,000 square feet = $1,500.00, 2) 75,000 - 300,000 sq. ft. = $0.02 per sq. ft. ($1,500 - $6,000), 3) More than 300,000 sq. ft. = $6,000
Certification appeals	**No:** However, building parameters can be updated for one year from the time of project registration. The option to update parameters can be extended past one year.	**Yes:** After receiving USGBC's Final Review of the project, a team has 30 days to file an appeal. A review of the appeal takes place within 30 days, after which time the applicants are informed of their appeal status.
Cost of appeals	**N/A** - Building parameters can be updated for one year after registration; update cycle can be extended for an undisclosed fee.	**$500** per credit appealed

Training for professionals	**Yes** - Various classes are conducted throughout the U.S. but the process of becoming a Green Globes verifier is unclear.	**Yes** - LEED Accredited Professionals must pass an examination on LEED methods/solutions/practices.
Membership and costs	For organizations- **Yes** For individuals- **No** Associate Membership- **Free**	For organizations- **Yes** For individuals- **No** Cost depends on member category (Silver, Gold, Platinum) and company's gross annual revenue. Varies from **$300-$12,500**
Decision making included in membership	**No**	**Yes**
Additional membership benefits	Inclusion GBI materials; seminar discounts; latest green building news, information and technologies;	Inclusion in membership directory; discounts for all employees; access to newsletters and information on leading green building technology; access to CIRs submitted by LEED projects.
Trade association relations	**Yes** - National Association of Home Builders & Local home building associations	**Yes -** Until recently, trade associations were not allowed to join USGBC as members, but that policy has changed. However, none of the current LEED versions in the marketplace reflect voting from this new membership segment.