



City of Boulder
LEED for Boulder – Phase I
Commercial Development Codes and Standards
Recommendations Report
March 8, 2005

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Executive Summary

LEED (Leadership in Energy and Design) is a national consensus-based, market-driven building rating system developed by the U.S. Green Building Council to accelerate the development and implementation of green building practices. LEED is a point system that awards points to strategies incorporated in the categories of site, water, energy, materials, and air quality. For the purpose of this report we are referring to LEED for New Construction and Major Renovations (LEED-NC), whose structure includes 69 total available points, with a minimum of 26 required for certification. In short, LEED is a leading-edge system for designing, constructing and certifying the world's greenest and best buildings. In five years since the development of LEED, nearly 10% of commercial buildings in the U.S. have adopted it as a standard. (More information on the LEED Rating System, and other green building resources is available at www.usgbc.org)

There are nearly 35 buildings in Colorado currently using the LEED Rating System. The State of Colorado is in the process of drafting legislation to require LEED for all State buildings, and the University of Colorado in Boulder already has set requirements for the use of LEED on campus buildings. The City of Boulder, by way of this report, is investigating the feasibility of updating commercial building codes such that all buildings constructed utilize and/or meet this national standard. It should be noted that while dozens of States, municipalities and institutions around the country have adopted LEED as a requirement for public buildings, the current efforts of the City of Boulder are among the first to consider broad application of LEED through building and land use codes for private commercial structures.

Solicited by the City of Boulder, Coburn and ENSAR collaborated in this effort to identify barriers to LEED application in commercial buildings in Boulder, and to make recommendations for code adaptation to facilitate a greater level of sustainability in Boulder buildings.

The LEED Rating System was used as a guideline, and each LEED credit was compared to existing Boulder building and land use codes. Discrepancies between the documents, and barriers to requiring and/or ensuring a LEED certified level were identified; and a preliminary set of recommendations was developed.

On December 13, 2004, an integrated planning session was held with Coburn, ENSAR, and key City of Boulder officials to review initial findings and discuss opportunities for implementation. Based on the feedback and suggestions of that session, combined with research and findings to date, recommendations have been made and outlined in this document to facilitate code changes and/or incentives that will balance LEED opportunities with appropriate strategies for optimal buildings within the Boulder climate specifically.

It should be noted that LEED was not designed to be a code, and therefore there are many areas where associated requirements can and should not be codified. In all cases this report attempts to defer to the environmental intent behind both LEED and code requirements, and ultimately provide recommendations that will help ensure that all Boulder buildings are healthy, profitable, and sustainable places to live and work. LEED certification in and of itself is secondary.

Code Comparison / Recommendations

ENSAR and Coburn jointly reviewed each LEED credit and associated Boulder code/ standard to identify barriers or discrepancies. A matrix was developed to identify key opportunities, and to weigh associated environmental benefits with cost impacts and implementation challenges.

LEED was designed by the U.S. Green Building Council as a benchmarking tool, primarily for commercial projects. It was not designed to become building code. In the process of comparison between LEED and Boulder City building and land use codes, it became apparent that while there are opportunities for Boulder to address additional concerns regarding environmental impact per LEED, it is not appropriate to require LEED for all commercial buildings. As such our recommendations are based on the premise of using LEED as a guideline to inform code upgrades and incentives, and to facilitate the eventual LEED certification of individual buildings.

Note: In the following chart, a scale of 1-5 is used to illustrate relative impact. 1 is least, 5 is most.

Cost represents costs from the perspective of the builder. This is intended to reflect costs relative to the overall project. Obviously, the larger the building, the less of a burden most of the proposed requirements would represent. Anything that is incentivized is assumed to have a cost of 1, as the incentive will have to offset the burden for a contractor or developer to choose to enact that category.

Benefit refers to the environmental benefit overall, using as a baseline the current requirements.

Therefore, benefits are the amount of improvement over either the current standard or a preceding requirement.

Implementation refers to the degree of difficulty required to implement recommended strategies for the city. Items that could be administrated within current requirements and processes will tend to have a lower difficulty level. Items needing new reviews or processes are assumed to have a higher difficulty. Items that would require a change in policy or would likely meet high public resistance are assumed to be more difficult as well. For the purposes of this scale, anything that the city chooses to incentivize is assumed to have a difficulty of 4 or more, as that would require a substantial change in the policies and/or processes currently in place.

Please refer to Appendix A: Definitions and Abbreviations for a complete list of referenced standards

Sustainable Sites (SS)				
LEED Requirements	Notes	Cost	Benefit	Implementation
Prerequisite: Erosion and Sedimentation Control Design a plan conforming to BMPs in EPA's <i>Storm Water Management for Construction Activities</i> OR local standards and codes, whichever is more stringent.	Boulder SWAMP code is based on and as stringent as EPA.	1	3	1
1: Site Selection Avoid development on inappropriate sites (farmland, wetland, floodplain, parkland)	Incentivize	1	2	4
2: Urban Redevelopment Select sites with minimum development density of 60,000ft ² /acre	Incentivize	1	3	4
3: Brownfield Redevelopment Rehabilitate damaged sites by selecting a site classified as a brownfield	Incentivize	2	3	4
4: Alternative Transportation Use the following tactics to reduce automobile impacts:				

4.1: Locate within ½ mile of commuter rail, light rail or subway or ¼ mile of 2 or more bus lines	Incentivize	1	3	4
4.2: Provide for bicycles, changing and shower areas for 5% or more of occupants	Require increase in bike stall quantity to 5% of occupant capacity. Not appropriate to require showers in this climate. Assume for equivalency purposes 1 occupant per 100 s.f. (business/office loading.) Therefore, require 1 bike spot per 2,000 s.f. Leave current 3 bike parking spot minimum.	1	2	2
4.3: Install alternative fuel re-fueling stations for 3% of parking capacity.	Incentivize.	1	2	3
4.4: Parking not to exceed min. zoning AND provide preferred parking for car/vanpools for 5% of occupants, OR, add no new parking for rehab projects AND preferred car/vanpool parking for 5% of occupants	Addendum to IBC to require carpool parking for 5% of occupant capacity. Require carpooling and associated signage.	1	2	1
5: Reduced Site Disturbance Conserve natural areas and restore damaged areas by:				
5.1: For greenfields, limit disturbance to w/in: 40ft of building, 5ft of road/walkways & utility trenches, 25ft of parking areas. Redevelopment: plant native/adapted vegetation on 50%+ of remaining open area	NA (this will not affect enough projects in Boulder to bother with)			
5.2: Reduce development footprint (building, access roads, parking) to exceed local zoning open space 25%	Requirement not recommended. Want to maintain density.			
6: Stormwater Management Implement a plan resulting in:				
6.1: No net increase in stormwater runoff, OR, if existing imperviousness 50%+, reduce runoff 25%	Requirement not recommended due to water laws and clay soils			
6.2: Treatment systems to remove 80% of post development TSS and 40% of phosphorus	Requirement not recommended due to water laws and costs of implementation			
7: Landscape and Exterior Design to Reduce Heat Islands resulting in the following:				
7.1: Provide shade (w/in 5 yr.) on 30%+ non-roof impervious surfaces, OR use materials w/reflectance at least 0.3 on non-roof impervious surfaces, OR place 50%+ of parking underground, OR use open-grid pavement system for 50%+ of parking area	Require per LEED	3	3	1
7.2: Use high reflectance, low-e roofing for 75%+ of roof area, OR install “green” roof for 50%+ of roof area	Require for all roofs with a 2/12 or lower pitch.	2	3	1

<p>8: Light Pollution Reduction Do not exceed IESNA requirements in <i>Recommended Practice Manual: Lighting for Exterior Environments</i> AND design such that zero direct beam illumination escapes site</p>	<p>Leave current code as is. Current code satisfies or exceeds most of this LEED requirement. Additional steps may be required by building team to ensure compliance, including development of a photometric plan. Lighting planner may be required for this service.</p>			
<p>Water Efficiency (WE)</p>				
<p>1: Water Efficient Landscaping Lowers demands on potable water used for irrigation by:</p>				
<p>1.1: High efficiency irrigation OR, use rain/recycled site H₂O for 50% reduction in potable H₂O for irrigation</p>	<p>Require limit on water available per SF of land OR increase code requirement for Xeriscaping. Rebates currently available for purchase of efficient irrigations systems and/or drought tolerant grasses.</p>	2	5	2
<p>1.2: 100% use of recycled site (rain) water OR, no irrigation system</p>	<p>Cannot capture rainwater in CO but can incentivize no irrigation. Would need code change to eliminate minimum irrigation requirement for establishment period. May be problems with later additions or irrigation taps if they become necessary.</p>	1	5	4
<p>2: Innovative Wastewater Technologies: reduce potable water use for sewage conveyance by 50%+ OR, treat 100% wastewater on site to tertiary standards</p>	<p>Change permit process to include waterless urinals on fixture count form, and eliminate fixture units where these alternative fixtures do not use resources. May need to change sewer ordinance to allow composting toilets and/or waterless urinals.</p>	1	4	2
<p>3: Water Use Reduction. Reduce potable water use beyond baseline calculated for building (excluding irrigation) after meeting Energy Policy Act of 1992 fixture performance requirements by 20-30%</p>	<p>Incentivize any additional reductions desired past current City requirements. Customers that use less than 60% of water budget would pay 75% of base rate.</p>	1	4	2

Energy and Atmosphere (EA)				
Prerequisite 1: Fundamental Building Systems Commissioning	Require per LEED for all buildings over 10,000SF. Commissioning agent required.	2	4	2
Prerequisite 2: Minimum Energy Performance – ASHRAE 90.1-1999	Already compliant			
Prerequisite 3: CFC Reduction in HVAC&R Equipment	Require no CFCs for new construction AND new equipment	1	4	3
1: Optimize Energy Performance: Achieve levels of energy performance above ASHRAE/IESNA Standard 90.1-1999 of 20-60% in new buildings, 10-50% in existing buildings.	Require energy analysis per LEED for all buildings over 20,000SF. Energy analyst services required. The equipment utilized for this credit should be consistent with the Xcel Custom Efficiency program.	5	5	1
2: Renewable Energy Utilize on-site renewable energy: 5-20% of total energy use, expressed as a fraction of annual energy cost.	Incentivize			
3: Additional Commissioning: Implement the following: design review before construction documents phase, review construction documents near completion, review contractor submittals of commissioned equipment, develop system and energy management manual, have contract for near-warranty end or post occupancy review. First 3 items must be performed by other than design team.	Require per LEED for all buildings over 10,000SF. Independent, third party commissioning agent services required.	5	5	3
4: Elimination of HCFCs and Halons: Install HVAC&R and fire suppression systems without HCFCs/Halons	Require no CFC or HCFC for all new construction AND new equipment.	1	4	1
5: Measurement and Verification: Provide ongoing measurement/verification of energy & water consumption using US Dept. of Energy's IPMVP, Option B (see Rating System for required systems and equipment).	Cannot require. Note: if a building wishes to obtain EnergyStar certification, or meet Xcel's Custom Efficiency program, similar requirements apply.	4	4	2
6: Green Power: Engage in two-year contract to purchase power meeting CRS Green-E requirements.	Incentivize	1	3	4
Materials and Resources (MR)				
Prerequisite: Storage & Collection of Recyclables: Provide an easily accessible area serving entire building for separation, collection and storage of (at minimum) paper, glass, plastics and metals	Require specification of recycle collection on floor plans	1	1	2
1: Maintain 75-100% of existing structure and shell	Incentivize	1	5	4

2: Recycle and/or salvage 50-75% of construction, demolition and land clearing waste.	Require recycling of wood, metal, paper, cardboard. For Demo require 80% recycling of all wood, metal, paper, cardboard.	2	5	2
3: Specify salvaged or refurbished materials for 5-10% of building materials (% in terms of dollar value)	Incentivize	1	3	4
4: Specify min. 5-10% building materials w/average 20% post-consumer, OR 40% post-industrial recycled material	Incentivize	1	3	4
5.1: Specify minimum 20% of materials manufactured within 500 mile radius of project	Incentivize	1	4	4
5.2: Of these, specify minimum 50% of materials extracted, harvested or recovered within 500 miles	Incentivize	1	4	4
6: Rapidly Renewable Materials: Specify rapidly renewable materials (replenished faster than traditional extraction demand) for 5% of total building materials (see Reference Guide for calculation methodology)	Incentivize	1	3	4
7: Certified Wood: Use minimum of 50% of wood materials certified using Forest Stewardship Council guidelines	Incentivize	1	4	4
Indoor Environmental Quality (IEQ)				
Prerequisite: Minimum IAQ Performance Meet minimum IAQ requirements set forth in ASHRAE 62-1999	Require per LEED	2	3	1
Prerequisite: ETS Control Prohibit smoking in building, or design to smoking room specifications in LEED	Change city ordinance to require no smoking or separate ventilation for smoking areas.	3	1	5
1: CO ₂ Monitoring Install permanent CO ₂ monitoring system and set points to maintain indoor CO ₂ levels no higher than outdoor levels by more than 530ppm at any one time	Require per LEED for all buildings over 5,000SF.	3	3	2
2: Increase Ventilation Effectiveness Mechanically ventilated buildings: design system with air change effectiveness greater than or equal to 0.9 (ASHRAE 129-1997). Naturally ventilated buildings: demonstrate distribution and laminar flow of 90%+ of room or zone for at least 95% of hours of occupancy.	Incentivize	4	3	2
3: Construction IAQ Management Plan Develop IAQ Plan for construction and pre-occupancy by:				
3.1: Meet or exceed SMACNA IAQ Guidelines for Occupied Buildings under Construction, 1995, AND protect on-site/installed absorptive materials from moisture damage AND change filtration media prior to occupancy	Require per LEED	2	4	1
3.2: Conduct minimum two week building flushout at 100% outside air prior to occupancy, OR conduct baseline IAQ testing consistent with EPA protocol	Require test OR flush out to begin at initial final inspections.	2	4	1
4: Low-Emitting Materials Meet or exceed VOC limits as follows:				
4.1: Adhesives – use SCAQMD Rule #1168. Sealants – use BAARB Reg. 8, Rule 51	Require per LEED	1	3	4
4.2: Paints and Coatings – use VOC and chemical component limits listed in Green Seal Requirements	Incentivize	1	4	4
4.3: Carpet systems – use Carpet and Rug Institute Green Label Indoor Air Quality Test program limits	This will be hard to require and may affect quality/ options. Incentivize.	1	4	4

4.4: Composite wood or agrifiber products contain no added urea-formaldehyde resins	Incentivize, consider requiring after soliciting community input.	3	4	5
5: Indoor Pollutant Source Control: Minimize cross-contamination of reg. occupied areas by chemical pollutants	Require per LEED. Use care when crafting language to distinguish between mop sink and chemical sink.	2	2	2
6: Controllability of Systems Provide high level of occupant control of thermal, ventilation and lighting				
6.1: Provide 1 operable window & 1 lighting control zone per 200ft ² for all occupied areas w/in 15ft of perimeter wall	Require individual offices to have lighting controls. Incentivize operable windows.	2	4	1
6.2: Provide controls for each occupant for airflow, temperature and lighting for 50% of non-perimeter, regularly occupied areas	Require individual offices to have lighting controls. Incentivize underfloor air and temperature controls,	3	4	2
7: Thermal Comfort. Increase occupant comfort by the following strategies:				
7.1: Comply with ASHRAE 55-1992, Addenda 1995 for thermal comfort including humidity control	NA in CO			
7.2: Install permanent temperature and humidity monitoring system to provide operator control (building automation system)	Incentivize.	3	3	1
8: Daylight and Views				
8.1: Minimum Daylight Factor of 2% (excluding all direct sunlight penetration) in 75% of all space occupied for critical visual tasks	Require x% glass per sf of floor area for specific uses and / or building types (i.e. offices). OR require per LEED.	2	5	2
8.2: Direct line of sight glazing for 90% of regularly occupied spaces (see Rating System for exempt areas)	Required for specific uses and / or building types (i.e. offices)	2	2	2
<i>Innovation in Design (ID)</i>				
LEED Accredited Professional: At least one principal participant of the project team that has successfully completed the LEED Accredited Professional exam.	Require one LEED AP OR 20% GA certified per project.	1	2	1

Case Studies

Several municipalities are currently requiring LEED certification or providing associated incentives. This is a limited list intended to reflect specific examples that may inform the Boulder initiative:

Arlington, VA

Arlington County allows commercial projects and private developments earning LEED Silver certification to develop sites at a higher density than conventional projects. All site plan applications for commercial projects are required to include a LEED Scorecard and have a LEED Accredited Professional on the project team regardless of whether or not the project intends to seek LEED certification. All projects must contribute to a green building fund for county-wide education and outreach activities. The contribution is refunded if projects earn LEED certification. Arlington sponsors a voluntary green home program that encourages builders of new single family homes to incorporate energy efficient and other green building components in their projects. The County offers "front-of-the-line" plan review, site signs, and publicity to program participants who achieve a given number of points as outlined by Arlington's Green Home Choice program.

Contact: Joan Kelsch, 703-228-3599, kelsch@co.arlington.va.us
Department of Environmental Services:
<http://www.co.arlington.va.us/des/epo/green.htm>

Berkeley, CA

The Berkeley City Council passed a new green building policy that requires municipal buildings to achieve the LEED Certified rating. Specifically, the Council required the city staff to propose within 6 months: a) the minimum building size for this standard and b) a deadline to increase this standard to LEED Silver. Details are available on the City Council website:
<http://www.ci.berkeley.ca.us/citycouncil/2003citycouncil/packet/051303/05%2D13sr.pdf> (item 65)

Contact: Rahul Young, City of Berkeley's Green Building Coordinator
RahulYoung@ci.berkeley.ca.us, 510-981-7535

Cook County, IL

Cook County Commissioner Mike Quigley proposal for an ordinance requiring LEED certification of all county building projects passed on October 21, 2002. The ordinance calls for projects to earn a minimum of 8 credits in the Energy & Atmosphere category to ensure best life-cycle returns. Cook County's Domestic Violence Courthouse is currently being designed to comply with LEED standards.

Contact: David Reynolds, Deputy Commissioner, Department of Environment, City of Chicago, dreynolds@cityofchicago.org.

Dallas, TX

The City of Dallas issued a resolution requiring all city buildings larger than 10,000 square feet to have at least LEED Silver certification. The city is exploring ways to encourage LEED buildings in the private sector.

Contact: Jill Jordan, City of Dallas, 214-670-5299

Eugene, OR

All city general funded new construction projects must meet at least LEED “Certified” level. The city is looking into requiring a higher level of LEED certification based on cost-effectiveness.

Contact: Glen Svendsen, Facility Management Division Manager,
Sustainable Building Task Force, 514-682-5008, glen.l.svendsen@ci.eugene.or.us

Frisco, TX

The City of Frisco is using LEED on capital projects and considering an ordinance requiring LEED certification of commercial projects.

Contact: Jeff Witt, Comprehensive and Environmental Administrator
jwitt@ci.frisco.tx.us, 972-335-5540 x145

King County, WA

King County Executive Order FES 9-3 (AEP) requires all new public construction projects to seek LEED certification and encourages the application of LEED criteria to building retrofits and tenant improvements. A local LEED application guide is currently under development.

Contact: Theresa Koppang, King County Solid Waste Division, theresa.koppang@metrokc.gov

Pleasanton, CA

The City Council adopted Ordinance # 1873 in December 2002 requiring all commercial construction projects over 20,000 square feet to follow guidelines to meet a LEED “Certified” rating. Formal certification with USGBC is encouraged but not required.

Contact: Heidi Kline, Associate Planner, (925) 931-5609, hkline@ci.pleasanton.ca.us

Portland, OR

Portland requires LEED certification of all public projects (new and major retrofits) and has developed Portland LEED supplement. A new LEED Business Energy Tax Credit (BETC) is being administered by the state Office of Energy

(<http://www.energy.state.or.us/bus/tax/sustain.htm>)

This site also contains a link to the City of Portland cost comparison study at <http://www.green-rated.org/g Rated/resources/trpdfs/pdxleed.pdf>

Contact: Rob Bennett, Office of Sustainable Development G/Rated - City of Portland Green Building Program 503-823-7082, bennett@ci.portland.or.us

San Diego, CA

San Diego Mayor Dick Murphy included requiring LEED Silver certification of all municipal projects among his 10 goals for the year in his 2002 State of the City Address. The city has subsequently adopted LEED for all public projects. The city has also developed a sustainable building expedite program that uses LEED criteria and provides significant plan review and construction incentives. The city’s downtown library is currently in the design phase with an aim for LEED Gold certification.

Contact: Tom Blair, Environmental Services, 858-492-6001

County of San Mateo, CA

San Mateo County adopted a Sustainable Building Policy in December, 2001. The policy requires new projects and additions that are built by the County and greater than 5000 sq. ft. to achieve certification at the highest practicable LEED rating level. Smaller projects are encouraged to follow LEED standards but are not required to submit documentation for certification. In addition to the policy, the County offers information on Green Building and is developing a Countywide Green Building Program.

Contact: Jill Boone, RecycleWorks Programs Manager, Green Building Coordinator
650-599-1433, jill@RecycleWorks.org, www.RecycleWorks.org

Incentives

Based on our findings and the inherent challenges with requiring LEED, incentivizing appears to be the most effective way to incorporate LEED and other effective green building strategies on a broad basis for Boulder buildings at this time. As the community and marketplace become more familiar with LEED and associated advantages, a regulatory approach may become more applicable.

Through incentives, our hope is to entice the building community to take real action towards LEED-related practices, and ultimately transform the local building marketplace. Educating the community and providing detailed information on available incentives is critical to this approach. Specific suggestions for incentives are listed below. An incentive package, whereby teams will select a pre-determined number of these strategies and complete them in aggregate should also be discussed. The described Green Building Fund could play a critical part in the success of this implementation program.

Green Building Fund

To facilitate this process, and as modeled in Arlington, VA, we recommend introducing a Green Building Fund whereby all commercial projects constructed in Boulder must contribute money (based on the size of the project under construction) for green building application, education and outreach activities. The contribution is refunded if projects earn LEED certification.

This fund will enable the city to offer incentives for specific green building strategies, and, because LEED certification can only be granted after the building is complete, it will serve as an impetus for teams to pursue LEED certification.

As a caution, any increased submittal fee would no doubt result in heavy negative feedback from the development community, as this business arena already considers submittal fees substantial. If a Green Building Fund is to be established, then care should be taken to keep it nominal, or, preferably, consideration should be given to reducing permit fees to offset the new Fund.

Valuation Exemption

As a means of incentivizing the use of certain green products and technologies, the exception of those desired products from the Building Permit Valuation is recommended. This would provide a financial incentive to builders and owners for using these products. The potential reduction in permit valuation revenue is a concern. As a method to make up the difference consider the Green Building Fund as a funding source, raise other service fees to make up the shortfall, or limit the exemption to projects that pursue LEED certification. Alternative funding schemes should be considered by P&DS.

Density Bonus

As a way of providing financial incentives to developers that don't reduce city income, site density bonuses could be granted for various credits. These could be relatively small and still generate enough income to overcome the cost of implementing the credit.

Fast Track Review

As another method of providing financial incentives to the developer without a reduction in city income, projects that meet a certain number of LEED credits, or specific individual credits, could be "moved to the head of the line" throughout the review process. They could either go through a different review process or they could simply always take review priority over projects that don't meet the requirements. This would require teams to submit a copy of the LEED scorecard completed during the design phase and demonstrating the points the team anticipates pursuing. Some follow up and possible repercussions may be considered to ensure that teams follow through with proposed LEED points.

Energy Efficiency Certification

An alternative option includes the city developing criteria for professionals to be trained and licensed as energy efficiency reviewers. These licensed professionals would be available for hire by the project owner to certify that plans meet the LEED requirements and the Boulder energy code. The city would then streamline the plan submittal, accepting the energy efficiency stamp thus eliminating the need for additional energy review. While this approach promises to streamline LEED associated measures and save the city money by eliminating a stage of the plan review, the incentive may be weak in that it is often the zoning and land use reviews and not the energy review that are perceived as slowing up the permit process.

Summary of Recommended Incentives

<i>LEED Credit</i>	<i>Incentives</i>
SSc4.3 Alternative Fuel Vehicles/ Re-fueling stations	Fees under energy code -- first year as rebate from utility, then no rebate -- phased in cost shifting OR suggest to city council if they want to go under general fund. Recommend encouraging use of hybrids as well as electric vehicles.
SSc4.4 Parking Capacity	Surcharge on impervious surface in excess of L.U.C. required minimum.
WEc2 Innovative Wastewater	Reduction in PIF fees, adjust plant investment fees for use of waterless urinals, dual flush toilets, composting toilets
WEc3 Water Use Reduction	Reduction in PIF fees
EAc2 Renewable Energy	Valuation exemption. Fast track review.
EAc5 Measurement and verification	Valuation exemption. Fast track review.
EAc6 Green Power	Green Building Fund.
MRc1 Building Reuse	Valuation Exemption Density Bonus Fast track review.
MRc3 Resource reuse	Valuation exemption. Point system program you can opt into for financial incentive. Fast track review. Density bonuses. Tax credits available for donating to Resource and other recycling/ reuse agencies.
MRc4 Recycled content	Valuation exemption. Fast track review.
MRc5 Local materials	Valuation exemption. Fast track review.
MRc6 Rapidly renewable materials	Valuation exemption. Fast track review.
MRc7 certified wood	Valuation exemption. Fast track review.
EQc2 Ventilation effectiveness	Valuation exemption. Fast track review.
EQc4.2 VOC limits on Paints and Coatings	Valuation exemption. Fast track review.
EQc4.3 VOC limits on Carpet systems	Valuation exemption. Fast track review.
EQc6.1 Controllability of Systems	Valuation exemption for operable windows
EQc6.2 Controllability of Systems	Valuation exemption for underfloor air and temperature controls

LEED Certification Status

Boulder construction practices are already well above the national curve, and many of the recommendations in this report reflect only subtle changes to meet the specific requirements as outlined by LEED. That said, as it stands and as outlined in the LEED spreadsheet below, if all of the code recommendations were implemented per this report, all commercial and code compliant buildings in Boulder would earn 20 points towards LEED certification. An additional 41 points would be available either through incentives, or simple project specific design choices such as incorporating showers or low-VOC paints on a project. No barriers to LEED, with the exception of issues associated with Colorado water laws, are present in this scenario.

The basic level of LEED certification is set at a minimum of 26 points. Silver level begins with 33 points, gold with 39, and Platinum, the highest rating, with 52 points.

In order for every Boulder code compliant building to actually be within the 26 point threshold for LEED, the code implications would be significant and beyond the recommendations of this consultant team. As it stands, the LEED credits we are pursuing, in combination with other recommended green building strategies that support LEED, reflect best practice green design for our region.

20 41 8 Total Project Score

Possible Points **69**

Certified 26 to 32 points Silver 33 to 38 points Gold 39 to 51 points Platinum 52 or more points

5 4 5 Sustainable Sites Possible Points 14

Y	?	N			
Y			Prereq 1	Erosion & Sedimentation Control	
		1	Credit 1	Site Selection	1
1			Credit 2	Development Density	1
		1	Credit 3	Brownfield Redevelopment	1
1			Credit 4.1	Alternative Transportation, Public Transportation Access	1
		1	Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Rooms	1
		1	Credit 4.3	Alternative Transportation, Alternative Fuel Vehicles	1
1			Credit 4.4	Alternative Transportation, Parking Capacity	1
		1	Credit 5.1	Reduced Site Disturbance, Protect or Restore Open Space	1
		1	Credit 5.2	Reduced Site Disturbance, Development Footprint	1
		1	Credit 6.1	Stormwater Management, Rate and Quantity	1
		1	Credit 6.2	Stormwater Management, Treatment	1
1			Credit 7.1	Heat Island Effect, Non-Roof	1
1			Credit 7.2	Heat Island Effect, Roof	1
1			Credit 8	Light Pollution Reduction	1

2 3 Water Efficiency Possible Points 5

Y	?	N			
1			Credit 1.1	Water Efficient Landscaping, Reduce by 30%	1
		1	Credit 1.2	Water Efficient Landscaping, No Potable Use or No Irrigation	1
		1	Credit 2	Innovative Wastewater Technologies	1
1			Credit 3.1	Water Use Reduction, 20% Reduction	1
		1	Credit 3.2	Water Use Reduction, 30% Reduction	1

3 12 2 Energy & Atmosphere Possible Points 17

Y	?	N			
Y			Prereq 1	Fundamental Building Systems Commissioning	
Y			Prereq 2	Minimum Energy Performance	
Y			Prereq 3	CFC Reduction in HVAC&R Equipment	
2			Credit 1.1	Optimize Energy Performance, 20% New /10% Existing	2
		2	Credit 1.2	Optimize Energy Performance, 30% New / 20% Existing	2
		2	Credit 1.3	Optimize Energy Performance, 40% New / 30% Existing	2
		2	Credit 1.4	Optimize Energy Performance, 50% New / 40% Existing	2
		2	Credit 1.5	Optimize Energy Performance, 60% New / 50% Existing	2
		1	Credit 2.1	Renewable Energy, 5%	1
		1	Credit 2.2	Renewable Energy, 10%	1
		1	Credit 2.3	Renewable Energy, 20%	1
		1	Credit 3	Additional Commissioning	1
1			Credit 4	Ozone Protection	1
		1	Credit 5	Measurement & Verification	1
		1	Credit 6	Green Power	1

1 12 Materials & Resources Possible Points 13

Y	?	N			
Y			Prereq 1	Storage & Collection of Recyclables	
		1	Credit 1.1	Building Reuse, Maintain 75% of Existing Walls, Floors and Roof	1
		1	Credit 1.2	Building Reuse, Maintain 100% of Existing Walls, Floors and Roof	1
		1	Credit 1.3	Building Reuse, Maintain 100% Shell/ Structure & 50% Non-Shell/Non-Structu	1
1			Credit 2.1	Construction Waste Management, Divert 50% from Landfill	1
		1	Credit 2.2	Construction Waste Management, Divert 75% from Landfill	1
		1	Credit 3.1	Resource Reuse, 5%	1
		1	Credit 3.2	Resource Reuse, 10%	1
		1	Credit 4.1	Recycled Content, 5% (post-consumer+ 1/2 post-industrial)	1
		1	Credit 4.2	Recycled Content, 10% (post-consumer+1/2 post-industrial)	1
		1	Credit 5.1	Regional Materials, 20% Manufactured Regionally	1
		1	Credit 5.2	Regional Materials, 50% Extracted Regionally	1
		1	Credit 6	Rapidly Renewable Materials	1
		1	Credit 7	Certified Wood	1

8 6 1 Indoor Environmental Quality Possible Points 15

Y	?	N			
Y			Prereq 1	Minimum IAQ Performance	
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	
1			Credit 1	Carbon Dioxide (CO₂) Monitoring	1
		1	Credit 2	Ventilation Effectiveness	1
1			Credit 3.1	Construction IAQ Management Plan, During Construction	1
1			Credit 3.2	Construction IAQ Management Plan, Before Occupancy	1
		1	Credit 4.1	Low-Emitting Materials, Adhesives & Sealants	1
		1	Credit 4.2	Low-Emitting Materials, Paints and Coatings	1
		1	Credit 4.3	Low-Emitting Materials, Carpet	1
1			Credit 4.4	Low-Emitting Materials, Composite Wood	1
1			Credit 5	Indoor Chemical & Pollutant Source Control	1
		1	Credit 6.1	Controllability of Systems, Perimeter Spaces	1
		1	Credit 6.2	Controllability of Systems, Non-Perimeter Spaces	1
		1	Credit 7.1	Thermal Comfort, Comply with ASHRAE 55-1992	1
		1	Credit 7.2	Thermal Comfort, Permanent Monitoring System	1
		1	Credit 8.1	Daylight & Views, Daylight 75% of Spaces	1
		1	Credit 8.2	Daylight & Views, Views for 90% of Spaces	1

1 4 Innovation & Design Process Possible Points 5

Y	?	N			
		1	Credit 1.1	Innovation in Design: Specific Title	1
		1	Credit 1.2	Innovation in Design: Specific Title	1
		1	Credit 1.3	Innovation in Design: Specific Title	1
		1	Credit 1.4	Innovation in Design: Specific Title	1
1			Credit 2	LEED™ Accredited Professional	1

The Costs of Building Green

Please refer to Appendices B and C for a more complete discussion of cost impacts.

In general and as noted in the attached articles, an effective and willing integrated design team can realize LEED certification or equivalent performance at a 0% to 2% premium over conventional, initial cost budgets. These findings are based on real numbers through various studies of LEED certified commercial buildings around the country.

It should be noted that the cost of LEED certification in and of itself is minimal. Registration and certification fees to the USGBC are based on the size of the building, and generally are in the \$1-\$2000 range. The real costs of building green are found in the design and construction process, particularly for teams without much experience with green building, and with specific material and strategy selection. In all cases while additional upfront costs may exist, from an operational and/ or life cycle costs perspective green building is usually found to be a cost effective proposition.

Next Steps

Public Input Process

Understanding and buy-in from the community will be critical to the success of any and all of the proposed strategies herein. Community stakeholders may include developers, architects, consultants, builders, property management companies, property owners, building associations or trade groups, and the general public. Community groups should also be considered including APOB, the Chamber of Commerce, USGBC Colorado, Sierra Club, PLAN Boulder, etc. Issues including timing of review in the current city process, incorporation of new criteria into existing adopted building codes, public input process with identification of affected persons of interest, review procedures, and enforcement procedures all are relevant to this process.

We recommend the following steps to ensure that community input has been incorporated, and to facilitate effective adoption:

1. Provide draft document for review and comment by community. Include all proposed changes in one packet to facilitate clarity and community comprehension.
2. Hold a community interactive “charrette” session to discuss goals and get input from key persons in the community. This session should include breakout groups in the five LEED category areas of site, water, energy, materials, and air quality. City officials should participate in this public session.
3. Develop and publish a fact sheet outlining the green building business case; emphasizing economic vitality and combining that with environmental sustainability, architecture integrity, long-term leasing opportunities, etc.
4. Circulate a report summarizing findings from the charrette and identifying resulting recommendations and action items. Provide final draft document for review and comment by community.
5. All final changes should be addendums or alterations to code documents directly, and should not be a separate amendment or guide.

Educational Toolkit

As LEED becomes more and more prevalent in the marketplace, there is an increasing need to find ways to merge local codes with LEED criteria and intent. This Boulder effort represents one of the first of its kind in aligning commercial building codes with LEED requirements. As such, the process and associated lessons learned will be documented for use as a guide for other municipalities.

Success Factors from Boulder:

1. Multi-faceted consultant team including code and development expertise, and LEED application expertise
2. Integration efforts between consultant, City officials, and building community
3. Community buy-in at key phases of project development
4. Research other application models
5. Flexibility in application model

Lessons Learned from Boulder:

1. Challenges to implementation (code vs. LEED)
2. Need for education of community on LEED and green building
3. Need for detailed data from existing green buildings in community to inform discussion

Appendix A: Definitions and Abbreviations

Organizations and Agencies

ASHRAE	American Society of Heating, Refrigeration, and Air-conditioning Engineers, Inc.
ASTM	American Society for Testing and Materials (now international)
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
FEMA	U.S. Federal Emergency Management Agency
FSC	Forest Stewardship Council
IESNA	Illuminating Engineering Society of North America
SMACNA	Sheet Metal and Air Conditioning National Contractors Association

Referenced Standards and Legislation

ASHRAE 90.1	Building energy standard covering design, construction, operation, and maintenance.
ASHRAE 52.2	Standardized method of testing building ventilation filters for removal efficiency by particle size
ASHRAE 55	Standard describing thermal and humidity conditions for human occupancy of buildings
ASHRAE 62	Standard that defines minimum levels of ventilation performance for acceptable indoor air quality
ASHRAE 129	Standard for measuring air-change effectiveness
ASTM E408	Standard of inspection-meter test methods for total normal emittance of surfaces
ASTM E903	Standard of integrated-spheres test method for solar absorptance, reflectance, and transmittance
EPACT	U.S. Energy Policy Act of 1992

Abbreviated General Terminology

CFCs refrigerants	Chlorofluorocarbons: ozone-depleting constituent of the most widely used HVAC
ECB	Energy Cost Budget: a method of demonstrating compliance with ASHRAE 90.1
ETS systems	Environmental Tobacco Smoke, incl. that transported between spaces by ventilation
HCFCs effects	Hydrochlorofluorocarbons: alternative refrigerant type that has reduced ozone-depleting
HFCs tradeoffs	Hydrofluorocarbons: alternative refrigerant with no ozone-depleting effects but some
HVAC	Heating, Ventilation, and Air-Conditioning
HVAC&R	Heating, Ventilation, Air-Conditioning, and Refrigeration
IAQ	Indoor Air Quality with respect to human occupancy of a building
IEQ	Indoor Environmental Quality: encompasses IAQ, thermal comfort, daylighting, views, etc.
LCA impacts	Life-Cycle Assessment: a full accounting of a material's "cradle-to-grave environmental
MERV media	Minimum Efficiency Reporting Value: a measure of the effectiveness of air filtration
MSDS precautions	Material Safety Data Sheet: provides essential information on composition, hazards, &
TSS gravity settling	Total Suspended Solids: particles too small or light to be removed from a liquid by
TP	Total Phosphorous: phosphates, polyphosphates, and orthophosphates in stormwater
VOCs materials	Volatile Organic Compounds: potentially hazardous substances that offgas from certain

Appendix B:

Cost of Green Buildings: a report to California's Sustainable Building Task Force

G. H. Kats, Capital E, October 2003

Appendix C:

Costing Green: A Comprehensive Cost Database and Budget Methodology

L. F. Matthiessen and P. Morris, Davis Langdon, July 2004