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GREEN BUILDING COSTS AND SAVINGS At first glance, the additional work and alternative materials needed to build green may seem like a burdensome cost, but closer attention reveals this perception to be misleading. Imagine being surrounded by decorative elements that invoke nature and keep you connected to the natural world even while
you're inside. These commissioning reviews help ensure that the design meets the project goals defined at the beginning of the project. 23 THE PRIUS EFFECT Delivering real-time energy information in a convenient way by installing meters where operators can act on the information and make changes to use energy more efficiently. In nature,
positive feedback loops are typically checked by stabilizing negative feedback loops, processes that shut down uncontrolled growth or other destabilizing forces. It is critical that this person guide the conversation in a productive and unbiased direction. Are they new or old? This issue is particularly important as we move toward a lower-carbon future.
As a project progresses, budget constraints often become apparent, and steps are needed to reduce costs. Or soon after the lease is signed and your company's new green cleaning guidelines. As a result, you are
prohibited by law from engaging in conduct that would constitute infringement upon the exclusive rights retained by USGBC. Accreditation is available at three levels: •• LEED GREEN ASSOCIATE validates basic understanding or related
 educational experience •• LEED ACCREDITED PROFESSIONAL demonstrates a deep familiarity with the LEED rating systems developed through active participation in and contribution to the standards of practice and body of knowledge, and
continual improvement in the field CERTIFICATES L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON LEED professional Certificates™ certify the skills and knowledge of LEED implementation required to provide verificates™ certify the skills and knowledge of LEED implementation required to provide verificates™ certify the skills and knowledge of LEED implementation required to provide verificates™ certify the skills and knowledge of LEED implementation required to provide verificates™ certify the skills and knowledge of LEED implementation required to provide verificates™ certify the skills and knowledge of LEED implementation required to provide verificates™ certify the skills and knowledge of LEED implementation required to provide verificates™ certify the skills and knowledge of LEED implementation required to provide verificates™ certify the skills and knowledge of LEED implementation required to provide verificates™ certify the skills and knowledge of LEED implementation required to provide verificates™ certify the skills and knowledge of LEED implementation required to provide verificates™ certify the skills and knowledge of LEED implementation required to provide verificates™ certify the skills and knowledge of LEED implementation required to provide verificates™ certificates™ cer
DEMAND RESPONSE Demand response (DR) strategies encourage electricity customers to reduce their usage during peak demand times, helping utilities optimize their supply-side energy generation and delivery systems. To influence the behavior of a system, it is important to find the leverage points—places where a small intervention can yield
large changes. They also might consider qualitative factors, such as whether the project has functional sidewalks. •• MONITOR CONSUMPTION. In most cases in our industrial system, we treat the manufacture of products, the construction of buildings, and the operations of organizations as open systems. Some team members might not be familiar
with an iterative process. 17 D. If present, include a ventilation system to address possible emissions. By getting to know a site's best features and its challenges, the team can appropriately integrate the building and grounds into the local ecosystem. This prerequisite is for projects using the Energy and Atmosphere prescriptive path. Inventorying the
many varied lighting fixtures proved challenging, but the process helped to organize inventory as well as identify unused lamps and those ready for an upgrade. Additionally, there are regional USGBC chapters and affiliates across the nation. A fully integrative process accounts for the interactions among all building and site systems. Residents meet
their needs within their neighborhoods, including going to work or school, finding places to meet or play, and getting healthful food. Imagine that large oak table in the LEED Platinum commercial office space and take a seat. EXAMPLES OF INNOVATIVE STRATEGIES INCLUDE: L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON ••
Developing a comprehensive green building educational program for members of the community, occupants, residents or other stakeholders. As the project takes shape, the model is run again to evaluate general approaches to mechanical system design. 16 The new skills required for a green building practice are not just knowledge of new strategies
materials, or equipment, although these are necessary. In addition to the upstream effects that happen before a material is used, there are downstream impacts associated with its operation and end of life. Meter the irrigation system to track water consumption and identify leaks. 59 Late afternoon temperature (°C) 33 32 31 30 Rural Suburban
Residential Commercial Downtown Urban Residential Park Suburban Residential Rural Farmland Figure 4.1. Diagram of Heat Island Effect To mitigate those harmful effects, project teams can install surfaces that have high solar reflectance (SR) or solar reflectivity index (SRI). 20 U.S. Energy Information Administration, Emissions of Greenhouse
Gases Report (December 8, 2009), eia.doe.gov/oiaf/1605/ggrpt/. • • ENERGY AND ATMOSPHERE. Clear goals and specific deliverables and outcomes help all participants understand the purpose of the charrette and set the foundation for an effective agenda. The Limits to Growth. The ubiquitous nature of materials and resources makes it easy to
overlook the embodied environmental impact and costs associated with extraction, production, transportation, consumption, and disposal. 44 EVALUATING STRATEGIES For existing building projects, the evaluation process should take the following steps: •• Set goals •• Benchmark performance •• Identify improvement opportunities •• Prioritize
and align improvement opportunities with the project goals •• Implement the program •• Measure performance and undergo third-party verification •• Set revised or new goals When a focus on performance requires the use of new technologies, sufficient time needs to be allotted for testing and inspections. Site lighting can provide adequate
nighttime illumination while preserving the integrity of the night sky. Are they rich loam or hard clay? Project teams with a goal of sustainability develop a deep understanding of the place and context in which their projects are built. The gain around driving positive feedback loops 6. INCLUDE AND COLLABORATE. STRATEGIES TO ADDRESS
LOCATION: •• CHOOSE REDEVELOPMENT. Plants can also be selected to minimize evapotranspiration, the return of water to the atmosphere through evaporation from plants' leaves; this characteristic is important in arid climates. The lens of each discipline involved in a project contributes to an overall view that leads
to more effective designs. LEED for Building Operations and Maintenance encourages facilities managers to assess occupants' comfort levels while at work. 62 Understanding how water is being used allows teams to identify where they should focus conservation efforts. Thus, they keep systems stable. When designing buildings, consider energy
conservation and indoor environmental quality together. It differs from Figure 3.1. Iterative Process traditional processes in that it is not linear, as when one team member completes a task and passes the work off to the next person. 27 Heshong Mahone Group, Windows and Offices: A Study of Office Worker Performance and the Indoor Environmental
(CEC PIER, 2003), h-m-g.com/projects/daylighting/summaries%20on%20daylighting.htm. The alternative processes to rainwater management, encourages teams to mirror natural systems by slowing the flow of water and retaining water on site. A Lawrence Berkeley National Laboratory study found that
 commissioning for existing buildings had a median cost of $0.27 per square foot and yielded whole-building energy savings of 15%, with an average simple payback period of 0.7 years. Tenant lease agreements, occupant handbooks, and staff training manuals will help newcomers benefit from a green project and contribute to its success. For example,
if urban temperatures rise too high, local populations may suffer or abandon the area. To meet the goal of using the school as a teaching tool, school leadership established a Green Committee in 2007 and integrated the LEED process into the curriculum. The third phase is the period of occupancy, operations, and performance feedback. Many
different types of meetings may be useful in an iterative process. Defining critical milestones, assigning champions, and clarifying goals up front will enable projects of all sizes and types to incorporate sustainability more effectively. •• HARVEST RAINWATER. The first—discovery—is also the most important and can be seen as an expansion of what is
conventionally called predesign. LEED promotes innovation by offering points for improving a building's performance well beyond what is required by the credits or for incorporating green building ideas that are not specifically addressed elsewhere in the rating system. It calculates payback periods for first costs, providing a context for making
decisions about initial investments. Metering the water lost to evaporation during cooling tower operation can provide particularly important information. Generally held at the beginning of the project, charrettes assist in establishing goals. Canon Design also valued an energy-efficient space, and used the site selection process to achieve their goals—
the chosen building is certified under ENERGY STAR and achieved Gold under the LEED O+M rating system. Project teams can increase infiltration of rainfall into the ground, capture and reuse it, and use natural processes to treat the remaining water that runs off the property. During both construction and operations, buildings generate large
amounts of waste and use tremendous volumes of materials and resources. Land use decisions can help reduce the length and frequency of vehicle trips and encourage shifts to more sustainable modes of transportation. Project teams can reduce transportation effects by ensuring access to alternative modes of transportation, encouraging walking and
bicycling, and providing fueling facilities for alternative-fuel vehicles. This broad list is then reviewed and options narrowed based on certain criteria, such as whether a strategy is feasible on the site, whether a strategy is feasible on 
UIDE — TH IR D E DIT I ON Green building requires new skills and new knowledge, as well as new attitudes and new mindsets. I MAGIN E IT With the LEED Core Concepts Guide, you're on your way to just such a career. For example, on calm days or at night, when renewable sources such as wind and solar are less available, grid operators must
either find additional generation sources or persuade energy users to lower demand. They need to be able to understand an ecologist's report on the proposed site, or better still, participate in walking the site and contributing to the assessment. Buy green power, renewable energy certificates, or carbon offsets to reduce the environmental impact of
energy consumed on-site and promote renewable energy generation and the reduction in carbon dioxide emissions. Compared with sprawling communities, S ECT IO N 4 CONSERVATION OF MATERIALS 71 denser, more compact mixed-use neighborhoods require fewer miles of road and less physical infrastructure to support the same number of
people. Feedback is critical to determining success in achieving performance targets, informing building operations, and taking corrective action when targets are missed. Especially in arid regions, employ xeriscape principles when designing the site landscape.
to ensure that sound levels remain comfortable for the activity level of the space. Loftness, V. The project team submits a registration form and a fee to GBCI. What is the function or purpose of the project? When deciding between two alternatives, the project team must ask whether there is a third option (or a fourth or a fifth ...). Retrocommissioning
is the same process applied to existing buildings; it is intended to keep a building on track for meeting or exceeding the original operations of how to turn the goals into a concrete action plan. What brings them together, and what might keep them apart? Restrooms feature a mix of high-
efficiency flush toilets, dual flush toilets, dual flush toilets, and waterless urinals. For example, the location of a project can have a significant effect on occupants' transportation choices, the project contains 394 dwelling units located in 44 multi-family buildings in addition to several
retail and office buildings. As part of your company's finance team, perhaps you are working closely with the property manager to finalize details on a green lease agreement for this space. Percentage of Total Consumption in Commercial Buildings by End Use Space Heating - 36% Lighting - 21% Cooling - 8% Water Heating - 8% Ventilation - 7%
Refrigeration - 6% Cooking - 3% Computers - 2% Office Equipment - 1% Other - 8% S ECT IO N 4 Figure 4.2. Distribution of Building Energy Use 67 STRATEGIES FOR ACHIEVING ENERGY EFFICIENCY: •• ADDRESS THE ENVELOPE. Additional types of inspections to reveal problems or opportunities for improvement could include the following
•• Retrocommissioning •• Energy and water audits •• Creen purchasing and green housekeeping program assessments These strategies will be discussed in Section 4. We take materials from outside the system, use them to make something, and then
discard what remains. LCC can be used in comparing alternatives with different initial and operating costs. Fuel determines the environmental effect of vehicle operation. Morris, "Cost of Green Revisited: Reexamining the Feasibility and Cost Impact of Sustainable Design in the Light of Increased Market Adoption" (Davis Langdon, 2007),
davislangdon.com. Your mind is clear and your energy and spirits high, knowing that your workday cost substantially less in energy and water use than it would have in a more traditional building. The agency attributed this performance to a fully integrated approach to sustainable design that addressed environmental, financial, and occupant
satisfaction issues. L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON •• Sometimes other variables, besides goals, targets, and costs, may make certain solutions inappropriate for the site. Feeling too hot or too cold, having insufficient lighting or being unable to look out a window, dealing with too much noise or having an uncomfortable work
station can all cause stress and reduce quality of life. ABOUT USGBC AND LEED. Goals that are completely out of reach because of cost or available technology do not provide guidance and can lead to frustration. Conservatively accounting for carbon generation and sequestration in metric tons of CO2 equivalent (a measure of greenhouse gas
 emissions that combines multiple heat-trapping gases, such carbon dioxide, methane, and nitrous oxide), the activities of the center will result in the question is about more than which hauler to select. Looking up, you take pride in what you can contribute as a LEED Green
Associate or LEED Accredited Professional. These sessions can also be held throughout the project at major milestones for focused, integrated problem solving. Each of the homes is pursuing LEED for Homes Certification for improvements in energy use, water consumption and indoor air quality. 61 Some project teams use their sites' annual
precipitation to determine how much water they should use. Buildings are major users of our potable water supply. Professionals who appeared only distantly related will become partners in a dynamic process that incoporates perspectives from different fields. •• SUPPORT ALTERNATIVE TRANSPORTATION. What type? Although the organization of
prerequisites and credits varies slightly depending on the building type and associated rating system, LEED is generally organized by the following broad concepts: •• LOCATION AND TRANSPORTATION. The teachers and Green Committee members created a survey to gather feedback regarding occupant comfort. U.S. EPA/Office of Air and
Radiation. Prerequisites are required elements or green building strategies that must be included in any LEED-certified project. This session should include representatives of the community and other experts to provide information on local environmental, social, and economic issues. 5 Economic Prosperity Environmental Stewardship THE TRIPLE
BOTTOM LINE Social Responsibility Figure 1.2. The Triple Bottom Line L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON A commitment to look beyond the status quo. Reusing existing buildings or using salvaged materials not only eliminates the need for new materials to be created but also
retains the cultural value and the contextual relevancy of those materials. 19 INTEGRATIVE DESIGN MEETS THE REAL WORLD In the article "Integrated approach "... got better at the process over time, especially when they were able to work with the same team members
more than once. Green building practitioners need to learn how to facilitate or participate in a productive discussion, how to facilitate or participate in a productive discussion, how to think outside their normal comfort zones when developing ideas. Adaptability is also critical for land use and municipal infrastructure, such
as roads. Buildings that seem to be individual, static objects will reveal themselves as fluid parts of an environmental system that changes over time. Meter indoor water systems and monitor the data to track consumption trends, determine fixture performance, and pinpoint leaks. An integrative process goes beyond checklists and encourages
integration during early design stages, when clarifying the owner's aspirations, performance goals, and project needs will be most effective in improving performance them with a ventilation system that regulates the supply of air based on occupants' demand. EPA's ENERGY STAR
Portfolio Manager is one of the most widely used benchmarking systems. The remainder of this section of the guide gives the rationale for green building and the related concept of sustainability. Once the goals have been established, they need to be listed and described in a written report. The adapted building reuses a site that is already served by
infrastructure and avoids the conversion of farmland or forest to development. STRATEGIES TO ADDRESS TRANSPORTATION IN OPERATIONS AND MAINTENANCE: •• ENCOURAGE CARPOOLING. This runoff can also carry harmful chemicals into the water system, degrading surface water quality and harming aquatic life and recreation
opportunities in receiving waters. The initial expenditures continue to pay back over time, like a good investment. Additional resources are listed in the Appendix, and educational opportunities to support your growth and success as a green building professional are available from USGBC at usgbc.org/education. 63 ENERGY AND ATMOSPHERE
Energy has emerged as a critical economic issue and top priority for policymakers. However, options for alternative and public transit, including bicycling and walking, depend on the proximity of the community, and design of surroundings. A coordinated program of nonchemical strategies, such as monitoring and baiting will reduce the need for pesticides and other potentially toxic contaminants. L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON •• MATERIALS AND RESOURCES. Teams need to look for opportunities to evaluate the environmental impacts of design decisions and improve sustainability at all points in the project's life-cycle. It is critical to
ensure that a project functions as designed and that it sustains and improves this performance over time. Conceptually, this review fits in well with sustainable design, which is always focused on finding higherperforming, more efficient solutions. What is the local watershed? Has the site ever been used for agriculture? Sometimes the iterative
process involves looking deeply at why or how a specific idea would work; at other times the team will compare one strategy with others to explore synergies and trade-offs. Such assessments can help the team achieve its goal through changing the placement or number of receptacles. For example, the human body is made up of many interlinking
 internal systems, such as the musculoskeletal system, which interact with external systems, such as the natural environment. For example, office buildings typically lack extensive laundry and kitchen facilities; water is used for HVAC systems, restrooms, and landscaping. Additionally, since the personnel costs of salaries and benefits typically surpass
the operating costs of an office building, strategies that improve employees' health and productivity over the long run can have a large return on investment. Whether you are working on a small interior retrofit project or designing a whole new city, integrated sustainable design and operations processes support sustainability goals and innovation
that lead to improvement. This chapter focuses on the processes surrounding green building—how these concepts can change the way you do things—and describes successful approaches to green building, with case examples of actual projects. The certification steps generally proceed as follows and are detailed on usgbc.org/leed/certification.
Finally, the integrative process can avoid the delays and costs resulting from design changes during the construction. Who are the people who come here, and where do they come from? Achieving these goals requires careful plant selection, integration of innovative irrigation
systems, and a new approach to outdoor lighting design. ISBN: 978-1-932444-34-6 ACKNOWLEDGEMENTS Thanks to all of the consultants that developed the content of this guide, based on their many years of experience in the green building industry: Karen Blust, CTG Energetics, Inc. To date, 41 energy conservation measures and related
strategies have been implemented, resulting in an ENERGY STAR score of 100, the maximum possible score. The quantitative metric might be the number and location of receptacles to employees on site. By reducing overall demand for electricity, DR helps utilities avoid building additional power generation
facilities, transmission lines, and distribution stations, thereby avoiding some of the environmental effects of energy infrastructure and consumption. For example, when a thermostat indicates that the temperature in a room is too warm, it sends a signal to turn on the air-conditioning. Additionally, they ensure alignment around goals, objectives, and
 actions. (1972). V. STRATEGIES FOR IMPROVING OCCUPANTS' COMFORT AND CONTROL: •• USE DAYLIGHTING. Conversely, in some western states, long-standing water laws prohibit on-site water collection because the water is obligated to downstream users. New construction, the ongoing operations and maintenance of an existing building.
and a significant tenant retrofit to a commercial building are all addressed by LEED rating systems. For example, net-zero energy projects use no more energy from the grid than they generate on site. Diligent monitoring will ensure that the policy is effective. LEED CORE CON CEPTS G UIDE — TH IR D E DIT I ON Goals should reflect the spatial
scales and time horizons that the project can affect, assuming a realistic rate of change. 18 A. The level of certification is determined according to the following scale: •• Certified, 40-49 points •• Silver, 50-59 points •• Platinum, 80+ points •• Silver, 50-59 points •• Certification is determined according to the following scale: •• Certified, 40-49 points •• Certified, 40-49 points •• Silver, 50-59 points 
been evolving to address new markets and building types, advances in practice and technology, and greater understanding of the environmental and human health impacts of the built environment. 14 If, however, we consider energy improvements part of an overall process, we often find that the added costs are balanced by long-term savings. EPA
estimated the greenhouse gas emissions from building waste streams and found that the United States currently recycles approximately 32% of its solid waste—the carbon dioxide equivalent of removing almost 40 million cars from the road. This section of the rating system provides guidance on where the project is built, encouraging the selection of
sites with existing services and transit. This does not mean that the challenges of reducing transportation impacts, such as carbon footprint, are greater in projects where pedestrian access is not an initial goal. Establish baseline performance for the
facility and identify opportunities for increased recycling, education, and waste diversion. The green building process and rating systems have begun to encourage quantification of externalities. Paul Hawken, Amory Lovins, and L. Because projects must be designed for the future, their operators need to participate in the design process and obtain the
use design and alternative fuels. Although we typically think of "design charrettes," charrettes can be used for all types of building projects. 39 percentage of homes that are within a quarter-mile of destinations such as parks, restaurants, and stores. Section 5 offers more information on the programs of the U.S. Green Building Council (USGBC),
particularly the Leadership in Energy and Environmental Design (LEED) certification system. •• What are the goals of the owner? L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON A landmark national effort to codify green building practices into adoptable, adaptable and enforceable green building codes has produced regulatory documents
that are now available as an overlay to more traditional building codes. This policy should specify a target diversion rate for the facility. However, projects around the country are experimenting with this goal. Some have called this the Prius effect, after the hybrid car that gives drivers information about fuel consumption so that they can drive in a
hours for energy consumption. Feedback loops are the information flows within a system to organize itself. • PROMOTE ALTERNATIVE-FUEL VEHICLES. For example, daylighting and natural ventilation can not only save energy but also improve occupants' experience. They energize the group and promote trust through
productive dialogue. •• INCREASE DIVERSITY OF USES. Substitute pervious surfaces for traditional paving. DR also helps balance the contribution of renewable energy sources. In this guide, the term green building encompasses planning, design, construction, operations, and ultimately end-of-life recycling or renewal of structures. Ideas are
continually being developed by the entire team, researched and refined by smaller groups, and then brought back to the team to consider critical next steps and make final decisions. Setting goals for using sustainable materials and resources is an important step of the green building process. Once the final application review is complete, the project
team can either accept or appeal the final decision. •• CONTROL RAINWATER. Facilities may be able to receive credit from the utility company for sewer charges if they reduce the amount of water entering the sewer system. Use air filtration to remove outdoor air contaminants. Another way to reduce demand for new materials is to design denser
mixed-use neighborhoods. Can it be used to grow food now? Active engagement with the community proved to be invaluable when the project team headed into rigorous Santa Fe City approval meetings with neighborhood support rather than opposition. It is important to understand a region's environmental conditions when selecting a rainwater
management strategy. S ECT IO N 4 • • Wildlife species not adapted to the higher temperature (and related effects including changes in resource availability) decline. Adobe's standards mandate that all products from copy paper to carpet must contain high recycled content. 50 Location and Transportation Sustainable Sites Water Efficiency Energy
and Atmosphere Materials and Resources Indoor Environmental Quality Innovation SECTION 5. These strategies and others will be discussed in Section 4. The focus is on the diversity of land uses, the design of streets, and the functions of the community. Estimated use of water in the United States in 2005: U.S. Geological Survey Circular 1344,
(2009). To learn more about the Cannon Design Chicago office visit usgbc.org/projects/cannon-design-chicago-office-relocation Photo by Christopher Barrett S ECT IO N Cannon Design's Chicago office towers in Chicago's central business
district. Constant, parameters, numbers (such as subsidies, taxes, standards) 11. 60 •• REDUCE THE AREA OF PAVED SURFACES EXPOSED TO SUNLIGHT. How will the project change their interactions? The best locations are those that promote smart growth, an approach that protects open space and farmland by emphasizing development with
housing, jobs, and services near each other. For LEED BD+C and ID+C projects, the team can wait to submit documentation until the building project is complete, or the team can seek review of its design-related prerequisites and credits before completion, and then apply for construction-related credits after the project is finished. The process of
exploring and selecting technologies and strategies may be repeated as more information becomes available about the system. Hartkopf, B. By focusing only on the energy efficiency of this product during its use, we might miss the damage caused by its transport from the place of manufacture or by the extraction of its raw material. D.M. Roodman &
N. The value of any particular measure for overall water conservation efforts depends on the end uses in the project. •• CALIBRATE SENSORS. Direct runoff into rain gardens, bioswales, and other landscape features that retain water.
DEMAND WITH RENEWABLE ENERGY: •• GENERATE RENEWABLE ENERGY. Because we typically do not consider building elements as linked into a larger set of systems, this waste remains largely invisible. 78 STRATEGIES FOR IMPROVING INDOOR AIR QUALITY DURING CONSTRUCTION: •• KEEP BUILDING CLEAN DURING
CONSTRUCTION. 87 Achieving LEED certification requires satisfying all prerequisites and earning a minimum number of credits. •• PROTECT HABITAT. The focus is on building a comprehensive understanding of the place in which the project is located, recognizing the site's patterns and flow of life. The second was to use LEED as a tool to identify
opportunities for improvement to the facilities and operations. If real-time information on energy use is delivered to them in a convenient way, they can use energy more efficiently. The best returns on these investments are realized when green building is integrated into the process at the earliest stages rather than as a last-minute effort. The team
would then have to consider additional information, such as the distance of each waste management facility from the project site, the types and sizes of trucks used for hauling, and their associated emissions factors. • DEVELOP A CONSTRUCTION WASTE MANAGEMENT POLICY. Land-use and urban planners also draw on the concept of life-cycles
because decisions about the location of roads and infrastructure can affect all future decisions about that land for centuries. 10 H. This team differs from the group of stakeholders who participate in the charrettes. Limit the amount of hardscape with greenery, and locate parking
underground. Strategies for designing and maintaining a sustainable site can include selecting native and adapted species that thrive without irrigation, pesticides, or fertilizers. Before these meetings, the project owner should think about underlying goals for the project, why it is needed or wanted, and what it should achieve, and discuss these
points with the facilitator. Additionally, captured rainwater and treated graywater can be used instead of potable water for toilet flushing, irrigation, and cooling towers. Protect materials from moisture exposure, protect and cap ducts and mechanical systems. STEVENSON HIGH SCHOOL Year Completed: 2011 L EED CORE CON CEPTS G UIDE –
TH IR D E DIT I ON Location: Lincolnshire, Illinois 98 LEED Certification Level: Gold Rating System: LEED for Existing Buildings: Operations and Maintenance (v2009) Organization Website: d125.org USGBC Case Study Website: usgbc.org/projects/adlai-e-stevenson-high-school 601 TOWNSEND ADOBE OFFICES - RECERTIFICATION Year
Completed: 2012 Location: San Francisco, California LEED Certification Level: Platinum Rating System: LEED for Existing Buildings: Operations and Maintenance (v2009) Organization Website: adobe.com USGBC Case Study Website: adobe.com USGBC Case S
PERFORMANCE MECHANICAL SYSTEMS AND APPLIANCES. Building operations projects might also include cleaning contractors, landscape contractors, local real estate and leasing specialists, and salvage and resale companies. One hauler may accept only sorted recyclables, but the team has determined that a
commingled program is more appropriate for the project occupants. These controls should be zoned so that the spaces near the windows have dimmed artificial light. So-called green power is typically understood to include solar, wind,
wave, biomass, and geothermal power, plus certain forms of hydropower. Are they achievable? S ECT IO N 2 In green building, solutions are examined through different perspectives, scales, and levels of detail, and then refined. A landmark study by the firm Davis Langdon found no significant difference between the average cost of a LEED-certified
building and other new construction in the same category: there are expensive green buildings, and there are expensive conventional buildings. After the final review, a team may appeal any adverse decisions on individual credits for an additional fee. Prepare detailed owner's project requirements at the beginning of the design process and conduct
commissioning throughout the life-cycle of the project to ensure that the building functions as designed. Sustainability and "green," often used interchangeably, are about more than just reducing environmental impacts. These may include the use of pilot credits, which are designed to test new and revised LEED credit language, and new or innovative
green building technologies and concepts. •• IMPLEMENT CONSERVATION PROGRAMS. 96 A: Resources B: Case Study Information Imagine It A letter from the President, CEO and Founding Chair RICK FEDRIZZI L EED CON CEPTS — TH E DIT I ON L EED CORE CEPTS GU ID E G—UIDE T HIRD EDIR ITD I ON President, CEO and
Founding Chair U.S. Green Building Council H Imagine getting up on a warm spring morning and deciding it's the perfect day to ride your bike to work. Donella Meadows's essay "Leverage Points to make meaningful change.17 24 In Natural
Capitalism, Hawkens, Lovins, and Lovins explore how capital markets can be used for—rather than against—sustainability, not by eliminating them or adding intensive regulation, but by using leverage points within the system. Once road networks are established, they can remain fixed for centuries. 58 LEED recognizes and encourages planning
design, and operational practices that control rainwater and protect the quality of surface and ground water. Documentation during the implementation phase might include change orders, chain-of-custody letters to verify that materials came from a sustainable source, waste hauling tickets, updated or revised construction management plans,
commissioning or retrocommissioning reports, or other LEED documents. S ECT IO N 4 • • SELECT EFFICIENT IRRIGATION TECHNOLOGIES. 22 Climate change is another positive feedback loop. Building construction generates large amounts of solid waste, and waste is generated across the building life-cycle as new products arrive and used
materials are discarded. 12 Benjamin Franklin Location is a critical element of green building: it can define appropriate strategies, yet it can also limit how green a project can actually be. The rating systems and their companion reference guides help teams make the right green building decisions for their projects through an integrated process
ensuring that building systems work together effectively. Early in the development of a project, the integrated project team needs to determine the needs to determine the project team needs to determine the needs to determine 
of waste materials diverted from traditional disposal methods and recycled, composted, or reused. These are posted publicly in the online Addenda database. Climate, sun, wind, orientation, soils, precipitation, local flora and fauna. •• CONDUCT PREVENTIVE MAINTENANCE. You mount your bike to the rack on the front of the bus and climb aboard
A member-based organization, USGBC engages hundreds of thousands of individuals. With the knowledge you now carry, you are prepared to be a leader, find solutions, and transform the built environment. Ensure that the building systems are functioning as
designed and support the owner's project requirements through control systems, a building automation system, and commissioning. It has taught us to focus not so much on single pieces of a system, as on connections. They also engage the community's traditions, strengths, and needs in order to ascertain how the project can
contribute to social and economic well-being and growth. Since it is crucial to reach an agreement on the project goals, a charrette, perhaps followed by a series of team meetings, is recommended. Green building is about finding the best combination of solutions to create built environments that seamlessly integrate the best of the old and the new in
intelligent and creative ways. In other words, a good process is essential to good outcomes. Transmission and distribution losses from purchased electricity Business travel Employee commuting Contracted solid waste disposal Contracted solid waste disposa
Called Out by Executive Order 13514. These drought-tolerant plantings have extremely low water needs. Bringing them in at the early phases of an integrated process, instead of waiting until the design is complete, can add real value to the design team and the project as a whole. When designing aspects of the built environment, consider the systems
in which the project will be located and the systems the project will create. But green building requires rethinking the selection of materials as well. DISCLAIMER None of the parties involved in the funding or creation of the United States
government, assume any liability or responsibility to the user or any third parties for the accuracy, completeness, or use of or reliance on any information contained in The Guide. Sophisticated building automation systems are available to continuously collect and trend data; the process can also be conducted manually. The plan should address the
application of chemicals and the cleaning of hardscape and building exterior, and it should include an integrated pest management program. Synergies are actions that complement each other, creating a whole greater than the sum of its parts. Are there sources of conflicts? Many systems in the modern world are designed as open systems, into which
materials and resources are constantly brought in from the outside, used in some way, and then released outside the system in some form of waste. The result, known as the heat island effect, is an increase in air temperature in a developed area. Project teams may be tempted to gather the data that are easy to
collect and can be used as proof that the building is sustainable; the right data, in contrast, serve as honest, genuine feedback. LEED credits addressing sustainable sites discourage development of previously undeveloped land and damage to ecosystems and waterways; they encourage regionally appropriate landscaping, control of rainwater runoff
and reduced erosion, light pollution, heat island effect, and construction-related pollution. Identify opportunities for improving building cleanliness and reducing occupants' exposure to potentially harmful biological and particulate contaminants. S ECT IO N 3 The green building process does not end when the project team hands the site over to the
owner, facility manager, or tenant. Unlike its conventional counterpart, however, in the integrative process, design will incorporate all of the collective understandings of system interactions that were found during discovery. This credit category also rewards the inclusion of a LEED Accredited Professional on the project team. Local residents
frequently bring a deep understanding of the place—the local context, culture, and history, as well as the strengths and needs of the community. Joel Todd, Environmental Consultant Thanks to U.S. Green Building Council staff who managed this project: Jacquelyn Erdman Julia Feder Karol Kaiser Jacob Monroe Jenny Poole Jen Schill Contents
IMAGINE IT . •• USE COMPACT DEVELOPMENT STRATEGIES. These credits encourage the selection of sustainably grown, harvested, products and materials. •• PROVIDE STAFF TRAINING. LEED for Neighborhood Development is organized around three main categories, focusing on where, what, and how to build green
at a community scale. By valuing not only financial capital but also natural capital and human capital, existing systems and structures can lead to sustainability. Selecting resources that have already been harvested and manufactured results in tremendous materials savings. It continues through location selection, then design, S ECT IO N 2 LIFE
CYCLE APPROACH 27 construction, operations and maintenance, refurbishment, and renovation. Install photovoltaic cells, solar hot water heaters, or building-mounted wind turbines. EXPLORATION AND SELECTION OF TECHNOLOGIES AND STRATEGIES S ECT IO N 3 Sustainable design requires thinking methodically through the types of
strategies for each aspect of the system and evaluating alternatives against project goals through an iterative process. Make sure that the building is properly weatherized. This kind of integrative design can reduce both initial capital costs and long-term operating costs. The average American spends about 90% of the day indoors, where pollutant
concentrations may be two to 100 times higher than outdoor levels. In addition, modeling, design, and construction documents should be reviewed regularly by appropriate members of the project team, such as the commissioning agent. In contrast, kitchen sinks and dishwashers dominate the end use for restaurants. Section 4 reviews the application agent.
of green technologies and strategies. The term externalities is used by economists to describe costs or benefits incurred by parties who are not part of a transaction. Figure 1.6 illustrates building performance by looking at the total amount of carbon emissions over a building's life-cycle. Ensure that the general contractor provides waste hauler
reports and captures the full scope of the waste produced. Whether for compliance with regulatory requirements, LEED certification, or other third-party verification, or other third-party verification v
patterns. Systems thinking relies on identifying and acting on opportunities to close this loop. Nick Rajkovich, University of Michigan Kathy Roper, Georgia Institute of Technology Heather Joy Rosenberg, CTG Energetics, Inc. DR achieves the latter, balancing systemwide usage and reducing the need for nonrenewable backup generation. LEED
recognizes that although there are no perfect refrigerants, it is possible to carefully consider performance characteristics and environmental effects and select a refrigerant with an acceptable trade-off. This cross-section of perspectives depends on the type of project. •• PRESERVE OPEN SPACE AND SENSITIVE AREAS. Participants in a design
build project might include the building owner, developer, client, design team members, facility managers, community representatives, local environmental groups, ecologists, and tenants or other building users. ©The Kubala Washatko Architects, Inc./Mark F. 1 L EED CON CORE CON CEPTS — TH E DIT I ON L EED CORE
CEPTS GU ID E G—UIDE T HIRD EDIR ITD I ON Section 1 Introduction to Green Buildings and Communities 2 Our built environment is all around a gorgeous oak table hand-crafted by local artisans and made entirely of wood reclaimed from a tree that fell
naturally in a nearby forest. THE USER OF THE GUIDE MAY NOT ALTER, REDISTRIBUTE, UPLOAD OR PUBLISH THIS GUIDE IN WHOLE OR IN PART, AND HAS NO RIGHTS TO LEND OR SELL ANY COPY OF THE DOWNLOAD TO OTHER PERSONS. Gurtekin, and Y. Careful recording and sharing of lessons learned can help improve future
materials and new materials during the planning and design phases. The usage of those sidewalks, however, can demonstrate the walkability of the neighborhood. LEED credits promote strategies that can improve indoor air, provide access to natural daylight and views, and improve acoustics. & Frankel, Energy Performance of LEED® for New
Construction Buildings (2008), newbuildings.org/sites/default/files/Energy Performance of LEED-NC Buildings that protect the history and character of a place also promote sustainability. 18 Systems Thinking Life-cycle Approach Integrative Process SECTION 3. As you pass dishes around the table, filled with fresh food
from the supermarket down the block, your daughter applauds you for taking her advice and pursuing LEED certification for your home. What are the microclimates, and how and why do they occur? Office of Radiation and Indoor Air (6609J) Cosponsored with the Consumer Product Safety Commission, EPA 402-K-93-007. The statement inspires the
team to reach the goals and also assures participants that their work is important and will influence the final project. Monitoring often involves comparing building performance measurements with predictions from a calibrated energy simulation or industry benchmarking tool. 54 •• ENCOURAGE BICYCLING. This higher performance will last
throughout a building's lifetime if the facility is also operated and maintained for sustainability. Most buildings rely on municipal sources of potable water to meet their needs, from flushing toilets to washing dishes to irrigating landscapes. For new construction, median payback time of 4.8
years based on energy savings alone.25 Overall, this study concluded that commissioning is one of the most cost-effective means of improving energy efficiency in commercial buildings. It requires reducing demand by designing sites to minimize or eliminate the need for irrigation and installing plumbing fixtures that either conserve water (such as
 low-flow lavatories and dual-flush toilets) or eliminate demand entirely (such as waterless urinals and composting toilets). To design sustainably for place, a team can start with a project site and determine what uses are most appropriate there. •• CONDUCT CUSTODIAL EFFECTIVENESS ASSESSMENT. photo credit: Josh Partee 2009 L EED CORE
CON CEPTS G UIDE — TH IR D E DIT I ON Thermal comfort includes more than just temperature; it also includes humidity and air movement. The performance of most systems degrades with time, and thus a building's total emissions footprint increases over time unless care is taken to maintain the systems properly. Project team
members look for synergies among systems and components, the mutual advantages that can help achieve high levels of building performance, human comfort, and environmental benefits. •• INCORPORATE RAINWATER MANAGEMENT INTO SITE DESIGN. Strategies for reducing hardscape include using pervious paving systems for parking lots
walkways, and decorative areas, such as patios. A waste management plan addresses the sorting, collection, and disposal of waste generated during construction or renovation. The highest form of material conservation is reuse. LEED for Homes is currently the only LEED rating system with this type of adjustment. For example, more efficient
mechanical systems generally cost more than inefficient equipment, but by looking beyond the purchase price and calculating all the energy, maintenance, replacement, and other costs over the life-cycle of the equipment, but by looking beyond the purchase price and calculating all the energy, maintenance, replacement, and other costs over the life-cycle of the equipment.
thresholds, and procedures for procurement of ongoing consumables and durable goods. Additionally, ongoing training ensures knowledgeable operation and maintenance of these strategies and technologies, as well as an opportunity to provide feedback on the challenges faced and lessons learned. Green buildings and neighborhoods can reduce
demand for energy by capturing natural, incident energy, such as sunlight, wind, and geothermal potential, to reduce loads. •• What species in the area might use the site as habitat and be affected? Although there are exceptions, the relationship between square footage and consumption is very strong. S ECT IO N 1 in the market of building products
and services, as well as the demand for skilled professionals. The Guide is not associated with, nor endorsed by the Green Building Certification Institute (GBCI) and does not guarantee a successful outcome on any examination mentioned herein or associated with GBCI or USGBC. Use energy monitoring and feedback systems to encourage occupants.
to reduce energy demand. How do they connect to the street? Greening the built environment means looking holistically at natural, human, and economic systems and finding solutions that support quality of life for all. Neighborhoods should be compact, complete, connected, and convivial. Additionally, LEED emphasizes the critical role of the
integrative process and ongoing performance monitoring across all phases and project types. Public Buildings Service, "Assessing Green Buildings Green Buildings Green Buildings Green Full Report.pdf. For example: 30 • Separating
residential and commercial uses and failing to connect them with alternative transportation means that people will drive cars to reach their destinations, generating air pollution and traffic •• Filling a landscape with ornamental plants not appropriate for the local climate means that large amounts of water may be required throughout the life of the
 green building should be made as early as possible so that it can assist in framing effective goals. STRATEGIES FOR REDUCING INDOOR WATER USE: •• INSTALL EFFICIENT PLUMBING FIXTURES. All the costs and benefits to the people who design, construct, live in, work in, and constitute the local community and are influenced, directly or
indirectly, by a project • PLANET (NATURAL CAPITAL). More broadly, by thinking about the system across the entire life-cycle, integrative strategies can be developed synergistically. Once these goals are articulated, checklists can serve as the basis for making decisions throughout the process. Buildings also use significant amounts of water to
support industrial processes and systems, such as cooling towers, boilers, and chillers. This guide explains the reasons we must change traditional building practices. The diversion of solid waste from landfill through composting and recycling has risen from 23% to 98%. Using less, finding materials with environmentally preferable attributes, using
locally -harvested materials, and eliminating waste provide a great starting place. These elements and flows combine in both predictable ways to form a unique and individual organization. •• When systems thinking is applied to sustainable design, it is often necessary to consider information beyond cost. 12 G. Malin, Integrated
Design Meets the Real World, Environmental Building News 19(5) (2010), buildinggreen.com/articles/Issue=5. Nevertheless, on average, green buildings save energy, use less water, generate less water,
shades, windows, and vents to take advantage of natural ventilation, solar energy, and daylight. It must address management of landfill waste as well as recyclable materials. Operators also benefit from monitoring and verification systems, which enable facilities personnel to identify and resolve issues that arise over time and even enhance a
building's performance throughout the life of the project. •• Has the site been previously developed? Improving recycling rates to just 35% could result in savings equivalent to more than 5 million metric tons of carbon dioxide. 26 26 U.S. Environmental Protection Agency, Measuring Greenhouse Gas Emissions from Waste (2010),
epa.gov/climatechange/wycd/waste/measureghg.html. • USE NONPOTABLE WATER. LEED® Core Concepts Guide: An Introduction to LEED and Green Building THIRD EDITION PURCHASE AGREEMENT AND LICENSE TO USE LEED® CORE CONCEPTS
GUIDE: AN INTRODUCTION TO LEED AND GREEN BUILDING, THIRD EDITION The U.S. Green Building Council (USGBC) devoted significant time and resources to create this Guide and all of its LEED™ publications. These are not skills and knowledge that most practitioners traditionally receive during their professional education and training.
Project teams therefore have several options in engaging with USGBC and GBCI during the certification submittal process. 21 Sensor Stimulus Which raises the temperature and melts more heat Fewer surfaces remain covered with snow As
the earth gets warmer Figure 2.2. Positive Feedback Loop POSITIVE FEEDBACK LOOPS, on the other hand, are self-reinforcing: the stimulus causes an effect, and the effect produces even more of that same effect. Finally, as with indoor water use, submetering helps teams understand how much water is being used for irrigation. S ECT IO N 4 LEED
IN PRACTICE 81 INNOVATION Through Innovation, LEED encourages additional environmental benefits beyond those already achieved through other rating system categories. LEED® GREEN BUILDING PROGRAM USGBC's Leadership in Energy and Environmental Design (LEED) program is a third-party green building certification program and
an international symbol of excellence in the design, construction, and operation of high-performance green buildings and neighborhoods. Designate preferred spaces for carpool vehicles in the parking area. PROJECT CERTIFICATION LEED certification provides independent, third-party verification that a building project meets the highest green
building and performance measures. L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON ENVIRONMENTALLY PREFERABLE MATERIALS 72 After opportunities to conserve materials have been exhausted, selection of new material begins. Where do they go? It encourages access to open space for walking, physical activity, and time spent
outdoors. Sustainable design ensures that buildings and communities will survive and thrive for generations, no matter what the future holds. FROM PLANNING TO PRACTICE Management plans for design-build construction projects are critically important; they must be developed, implemented, and documented. Both approaches need to be
considered at all phases of the building life-cycle. These systems provide both heat and cool air and water for building operations. Follow good housekeeping and dust control during construction. Finally, to achieve results that are based on whole systems across their entire life-cycle, building professionals must adopt an integrative process. Energy
Information Administration, EIA Annual Energy Outlook (EIA, 2008). To make their buildings places where people feel good and perform well, project teams must balance selection of strategies that promote efficiency and conservation with those that address the needs of the occupants and promote well-being. In existing buildings, if porcelain
replacement proves cost-prohibitive, install new flush valves or flow restrictors (e.g., aerators) to achieve water savings. Incorporate systems thinking, By understanding building system interrelationships, project teams will ideally discover unique opportunities for innovative design, increased building performance, and greater environmental benefits
Communicate the policy to building occupants through building signage and tenant meetings. Build on previously developed land and brownfield sites. L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON •• Where do people in the area live and work, and how do they travel? But not to worry, you just duck around the corner to one of the many
bus stops nearby. 41 PROJECT CASE STUDY STEVENSON HIGH SCHOOL L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON LEED GOLD The project team established three goals at the beginning of this Existing Buildings: Operations and Maintenance project. Ideally, the chosen strategies do both: the solutions that conserve energy, water
and materials also contribute to a great indoor experience. •• CREATE A DIVERSE COMMUNITY. STRATEGIES FOR IMPROVING INDOOR AIR QUALITY DURING OPERATIONS AND MAINTENANCE: •• ENSURE ADEQUATE VENTILATION. It helps stakeholders understand their role in optimizing performance and become vested in the green
building goals. It is important also to understand the patterns at work at different spatial scales. Materials that help reduce the heat island effect include open grid paving, white roofs, and vegetated "green" roofs. OBSERVATION OF THE SYSTEM Getting to know the site is part of the needs assessment and evaluation process. Maintenance of
mechanical, electrical, and plumbing systems is essential and needs to be included in regular operations budgets. Develop cleaning procedures to properly maintain the entryway systems are continually evaluated and regularly updated to respond to new technologies and policies and to changes
in the built environment. The iterative pattern of an integrative process can be used throughout the project as details come into focus. To shift the valuation process to account for such negative externalities, building professionals require new metrics. With design-build projects, the construction process causes environmental damage, but the effects
can be managed and reduced by using sound practices and alternative technologies. The trend toward green building practices in the United States has quickened in the past decade, contributing to a transformation, and education organization, is headquartered in Annapolis,
Maryland. This category focuses on measures that can reduce the environmental harms associated with the construction and operation of buildings and infrastructure within neighborhoods, with a goal of not just reducing the environmental consequences, but also enhancing the natural environment. Computer modeling can identify and prioritize
energy efficiency opportunities. Monitoring and verification provide the basis for tracking energy performance, with the goal of identifying and resolving any problems that may arise. Careful products through innovation. For example,
improvements in the building envelope, the boundary between the exterior and interior elements of a building, can change the requirements for the mechanical system. NOTE: FOR DOWNLOADS OF THE GUIDE: Redistributing the Guide on the internet, in any other networked environment, in any digital format, or otherwise is STRICTLY prohibited,
even if offered free of charge. What are the interrelationships? LEED rating systems have 100 base points plus six Innovation points and four Regional Priority points, for a total of 110 points. The new mental model resulted not just Dehumidification in more efficient processes, but also in a System radical restructuring of the company and all its
operations. This heat island effect raises temperatures in urban areas several degrees above the temperature of surrounding areas, increasing the demand for cooling and the amount of energy that buildings use. A project team can take advantage of the community's past by reusing materials with historic value. Promoting alternative transportation
as a convenient and viable option through site selection, design, and incentives benefits both the building occupants and the developer. In short, how does this new approach work in real life? •• What is the local climate of the project? This creates a cycle of consumer demand and industry delivery of environmentally preferable products, spurring
market transformation of building products. During construction or renovation, materials should be recycled or reused whenever possible. Photo courtesy of Adobe SUCCESS DEPENDS ON THESE ESSENTIALS: •• Start early •• Find the right team and process •• Understand the systems across space and time •• Develop clear and measurable goals
•• Follow an iterative process to ensure achievement of goals •• Commit to continuous improvement S ECT IO N 3 The next section will review specific concepts and strategies for different aspects of green design, planning, and operations. •• What is the community within the project? •• SMART LOCATION AND LINKAGE. For example, in most
urban American communities, water, food, energy, and materials are imported into the city from sources outside the municipal boundaries. Herzog, and J. How do teams organize as part of an integrative process? Once decisions have been made at each phase, however, those opportunities can become limited. Use of these energy sources avoids the
myriad of environmental impacts associated with the production and consumption of nonrenewable fuels, such as coal, nuclear power, oil, and natural gas. Because people's needs vary and even the same individual may have different needs and preferences at different times, the ability to control the indoor environment is a critical component of
occupants' comfort and satisfaction. Projected annual greenhouse gas emissions from Aldo Leopold Legacy Center CO2 equivalent per year (metric tons) Total emissions reduction -14.99 Net balance of emissions -1.57 More information about the Aldo
Leopold Legacy Center is available at aldoleopold.org/legacycenter/carbonne utral.html. 32 Getting Started Establishing an Iterative Process Team Selection of the System Exploration and Selection of Technologies and Strategies Implementation On going Performance SECTION 4. Indoor water use can be reduced by
installing water-efficient fittings and fixtures, using nonpotable water for flush functions, and installing submeters to track and log water use trends, check fixture performance, and identify problems. •• SOCIAL CONTEXT. •• CONDUCT A FLUSH-OUT. Heating, cooling, ventilation, and other systems must be properly cared for to ensure that they
work effectively using minimum amounts of energy and water. You settle into your seat at the end of a full day of work, feeling the positive effects of having spent your day in an environment filled with clean indoor air, with plenty of exposure to natural light. This section builds on that groundwork, presenting fundamental concepts alongside
strategies for putting green building into action. If higher light levels are needed, include timers that shut them off automatically after hours. GETTING STARTED SEVERAL PRINCIPLES FORM THE FOUNDATION FOR SUCCESSFUL PRACTICE: PROCESS MATTERS. Another is incentive programs that reward commercial consumers who agree to
change their usage patterns when the utility company sends an alert (to the building's operator or the building automation system) announcing a DR event (also known as a curtailment event). These tools and technologies will be discussed in Section 4. S ECT IO N 3 The right information needs to flow to the right place. A construction activity
pollution prevention plan addresses measures to prevent erosion, sedimentation, and discharges of potential pollutants to water bodies and wetlands. • • How do resources, such as energy, water, and materials, flow into the project? The integrative process requires more time and collaboration during the early conceptual and design phases than
conventional practices. Although this process may be more involved and more expensive than a conventional design process, it is more likely to help the team arrive at solutions that will serve the project owner, the occupants, and the community over time. An area may be the right temperature, but if the air is stagnant or if air ducts blow directly on
work stations, people will feel uncomfortable. Allow occupants to bring e-waste and furniture from home. Continual tweaks optimize operations, and major systems are overhauled for efficiency and ability to deliver energy and cost savings. GREEN BUILDING CORE CONCEPTS AND APPLICATION STRATEGIES. It now provides rating systems for a
wide array of building types, such as offices, schools, retail establishments, homes, and neighborhoods. For example, in building energy analysis, modeling should be conducted very early in the project to inform initial decisions. Evaluate materials based on their upstream and downstream consequences. Whether working in the planning, design,
construction, or operations phase, these questions may provide insight into the systems context and ways to move more fully toward sustainability in an integrated way. A water end-use profile can help project teams identify the largest users of water and evaluate the cost-effectiveness of specific conservation strategies. USGBC believes in better
buildings: places that complement our environment and enhance our communities; places that give people better, brighter, healthier spaces to live, work and play. 91 the project application process. Knowledge and training empower facilities managers to
maintain and improve the performance of buildings. The model might be refined when design development documents are 50% complete, and again at 75% and 90% of completion, to analyze the increasingly specific lighting systems, controls, and other components are 50% complete, and again at 75% and 90% of complete, and 90% of comp
ECT IO N 3 The term stakeholder encompasses more than just decision makers and includes those who must live with the decisions and those who must carry them out. For instance, specification of more costly, high-performance windows may allow for the use of a smaller, lower-cost heating, ventilation, and air-conditioning (HVAC) system. To avoid
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this damage to the ecosystem, additional municipal supply and treatment facilities must be built at public cost. In the 1980s, research emerged demonstrating that certain refrigerants for building systems were depleting stratospheric ozone, a gas that protects human health and the environment by absorbing harmful UV radiation, and contributing to climate change. Everyone needs to learn to ask the right questions and to participate in developing the solutions. Even the interior finishes and furnishings can change the effectiveness of natural daylighting and ventilation strategies. ENERGY EFFICIENCY Once demand reduction strategies have been addressed and incorporated, the project team

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can begin to employ strategies to promote energy efficiency—using less energy to accomplish the same amount of work. The benefits of sustainable site design and management reach far beyond a project's boundary. •• INSTALL OPERABLE WINDOWS. Project CIRs do not guarantee credit award; S ECT IO N 5 The LEED rating systems are intended
to be flexible, voluntary tools to improve the performance of buildings and promote market transformation. These plantings have the added benefit of providing habitat for native wildlife. An indoor environmental quality management plan spells out strategies to protect the quality of indoor air for workers and occupants; it includes isolating work
areas to prevent contamination of occupied spaces, timing construction activities to minimize exposure to off-gassing, protecting the HVAC system from dust, selecting materials with minimal levels of toxicity, and thoroughly ventilating the building before occupancy. 53 Attention to each of those factors can reduce the consequences of transportation
Although some teams use green building checklists, such as the LEED checklist, as the basis for setting project goals, projects are likely to be most successful if goals reflect why the project is being undertaken and how success will be demonstrated and measured. A building's life-cycle ends in demolition or, preferably, reuse. •• PROVIDE
RECYCLING FOR DURABLE GOODS. An integrative process is a different way of thinking and working, and it creates a team from professionals who have traditionally worked as separate entities. Landscape with native and adapted plants that require less water. By improving the efficiency of buildings and communities, we can significantly reduce
greenhouse gas emissions. For more information about Adlai E. Other sites are less appropriate for development. For community or neighborhood projects, the commitment should be made at the beginning of the land-use planning phase so that it can inform land-use planning phase phase phase phase planning phase p
13 P. The team would first collect all the relevant information about the two waste haulers. Or a window may have a high recycled content but not be highly efficient. PROJECT CASE STUDY CANNON DESIGN CHICAGO OFFICE RELOCATION LEED PLATINUM An interactive sustainability reporting dashboard occupies a prominent space in the heart
of the office, immediately adjacent to the library and central gathering space. The researchers found that, on average, certified green office buildings rented for 2% more than comparable nearby buildings. Designate areas as protected habitat and open space for the life of the project. This dashboard tracks real-time energy consumption within the
office and also displays other key annual environmental measures for the office, including waste management, water consumption and vehicle miles traveled. Label all collectors and list allowable materials. In the decade that followed, LEED expanded to include systems to address the entire life-cycle of the built environment from land-use planning to
operations. Include community gardens, farmers markets, urban farms, and community-supported agriculture programs. 37 PROJECT CASE STUDY VILLA ALEGRE L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON LEED PLATINUM Santa Fe
area: 111 units in Villa Alegre Phase 1 and 2. Green building also requires taking a life-cycle approach, looking at all stages of a project, product, or service. They enhance a project team's interaction with and understanding of community issues, concerns, and ideas. Building Envelope In other words, Interface Flooring moved System from an open
system to a closed system. •• How does the project community interact with other, overlapping communities? An iterative process is circular and repetitive. You can actually make a system less efficient, simply by not properly linking up those components ... If they're not designed to work with one another, they'll tend to work against one another.
Stability and resilience in the system to shut down if a window is open. First look at ways to use water efficiently and reduce potable water use. Clear goals articulate what the project will be designed to accomplish, by: ••
Making sure that the vision is clear •• Providing a frame of reference for the whole project on track to meet them Project goals and their associated metrics and targets can be both quantitative. Green building can help us create more vital communities, more healthful
 indoor and outdoor spaces, and stronger connections to nature. LEED ADDRESSES THE FOLLOWING ISSUES RELATED TO INDOOR ENVIRONMENTAL QUALITY: •• People smoking tobacco inside the building or near building entrances or air intakes ••
Building materials such as paints, adhesives, flooring, composite wood, insulation, wall materials, and furniture that may emit volatile organic compounds (VOCs), substances that vaporize at room temperature and can cause health problems S ECT IO N 4 The quality of air outdoors has received considerable attention in recent decades, and strategies at room temperature and can cause health problems S ECT IO N 4 The quality of air outdoors has received considerable attention in recent decades, and strategies at room temperature and can cause health problems S ECT IO N 4 The quality of air outdoors has received considerable attention in recent decades, and strategies at room temperature and can cause health problems S ECT IO N 4 The quality of air outdoors has received considerable attention in recent decades, and strategies at room temperature and can cause health problems S ECT IO N 4 The quality of air outdoors has received considerable attention in recent decades, and strategies at room temperature and can cause health problems S ECT IO N 4 The quality of air outdoors has received considerable attention in recent decades, and strategies at room temperature and can cause health problems S ECT IO N 4 The quality of air outdoors has received considerable attention at recent decades, and strategies at room temperature at room tem
to reduce smog and other air pollutants are vitally important. ENERGY DEMAND Saving energy begins with conservation—reducing energy demand. In many ways, green building represents a return to simpler, low-tech solutions. The intent of credits in this category is to create environments that are walkable, vibrant with mixed-use establishments
and connected to the larger community. The ideal candidate is an excellent listener who can distill the big picture from multiple viewpoints. It is easy to view these considerations as contradictory. Promote alternatives to singleoccupant car community.
LEED interpretations. The space plan for the project responded to needs identified in this survey. Therefore, many climate-related targets are written, "to reduce greenhouse gas emissions by 30% by 2030." This type of time horizon is particularly appropriate for very large or complex projects, such as cities, organizations with multiple locations, and
large campuses, where there are many different sources of greenhouse gases and time is needed to develop and implement sufficient reduction measures and policies. •• PURCHASE OFF-SITE RENEWABLE ENERGY OR CARBON OFFSETS. Create a smaller footprint and maximize the FAR (floor area ratio) or square footage per acre.
CERTIFICATION Certification is the final step in the LEED review process. buildinggreen.com For example, where water supply depends on local snowpack, planning and design efforts might focus on water conservation, water storage, and alternative sources of water in anticipation that the snowpack will shrink. Every desk now has a second
smaller "side-saddle" wastebasket so that compostable and recyclable items stay separated. • • Although alternatives are often viewed as an either-or choice, there may be more than two options. Figure 4.2 outlines a typical office building's energy use. The power to add, change, evolve, or self-organize system structure 3. By observing natural
patterns, such as how heat flows, water moves, or trees grow, we can learn to design systems that use resources effectively. These inputs and outputs are quantified and their effects on the environment and human health are measured. On the other hand, in communities with well-connected street grids, diverse land uses, and buildings facing wide
sidewalks, the emphasis is on pedestrians and the public realm. Studies have repeatedly shown that efficient buildings and appropriate land use offer opportunities to save money while reducing greenhouse gas emissions. A systems-based, life-cycle perspective and an integrative decision making process will help projects achieve their goals
addressing materials and resource use. Consolidate the development footprint and protect and restore natural vegetation, wetland areas, and bodies of water. Prior to relocating to this space, the project team conducted an online survey open to all employees to estimate the percentage of time employees dedicated to formal and informal
collaboration, learning, personal head-down work time and socialization. The community boasts sufficient density to support nearby mass transit, accessible via a gridded street network of community boasts sufficient density to support nearby mass transit, accessible via a gridded street network of community boasts sufficient density to support nearby mass transit, accessible via a gridded street network of community boasts sufficient density to support nearby mass transit, accessible via a gridded street network of community boasts sufficient density to support nearby mass transit, accessible via a gridded street network of community boasts sufficient density to support nearby mass transit, accessible via a gridded street network of community boasts sufficient density to support nearby mass transit, accessible via a gridded street network of community boasts sufficient density to support nearby mass transit, accessible via a gridded street network of community boasts sufficient density to support nearby mass transit, accessible via a gridded street network of community boasts sufficient density accessible via a gridded street network of community boasts sufficient density accessible via a gridded street network of community boasts sufficient density accessible via a gridded street network of community boasts and the sufficient density accessible via a gridded street network of community boasts and the sufficient density accessible via a gridded street network of community boasts and the sufficient density accessible via a gridded street network of community boasts and the sufficient density accessible via a gridded street network of community boasts and the sufficient density accessible via a gridded street network of community boasts and the sufficient density accessible via a gridded street network of community boasts and the sufficient density accessible via a gridded street network of community accessible via a gridded street network of community accessible via a gridded street network of community accessib
energy performance. SRI combines reflectivity with emissivity, or the ability of a material to emit energy through radiation. Instead, green buildings, their operations, and the communities in which they are situated. Levin. Photo by Patrick Coulie C om m is si on ilit ies na g ge nt r er ngine
s ntative Represe Users of the rt ical Eng ineer pe hti ng Ex ntative Re p en ec tat tM ive an ag er ct ite ch Ar Da ylig Represe res Pr oj ineer ral Eng er gy r 's Structu En Client ne ine rt lE ca tri Ow er ng nts pa cu Oc Operator Civil E c Ele A ge Mechan Building in Ma Ex pe Fa c Landscap e Archite ct Ge C ne on r a st lC on ru tra ct cto io r n M an ag
er For a design-build project, the team usually includes the following people: ner r Desig Interio t an ult ns Co st Co Team members should understand green building and have experience participating in a team. RAINWATER MANAGEMENT The rainwater systems of most American urban areas treat precipitation as a problem to be removed from the
area as quickly as possible to prevent flooding. 85 EDUCATION USGBC provides high-quality educational programs and materials on green design, construction, and operations for professionals from all sectors of the building industry. The Montreal Protocol subsequently banned the production of chlorofluorocarbon (CFC) refrigerants and is phasing
out hydrochlorofluorocarbon (HCFC) refrigerants. In its solid waste management hierarchy, EPA ranks source reduction, reuse, recycling, and waste-to-energy as the four preferred strategies for reducing waste in landfills. S ECT IO N 4 According to the U.S. Energy Information Administration, transportation accounted for 33% of total U.S.
greenhouse gas emissions in 2008. For example, if a goal is that a neighborhood project be walkable, a team might consider as a quantitative measure the S ECT IO N 3 Setting lofty-sounding general goals can be tempting; however, such goals may not provide enough information to guide a project. You are enjoying a meal with your kids, home from
 college for summer vacation. Leaders in the field now speak about buildings and communities that are regenerative, meaning that these sustainable environments evolve with living systems and contribute to the long-term renewal of resources and life. Then, consider the use of nonpotable water and alternative sources of water. 16 Brand Neutral, The
Prius Effect: Learning from Toyota (2007), brandneutral.com/documents/Prius_Effect.pdf. The focus is on developing practical knowledge, exploring new business opportunities, and learning how to create more healthful, productive, and efficient places to live and work. QUESTIONS A PROJECT TEAM NEEDS TO EXPLORE AS MEMBERS BEGIN
WORKING TOGETHER, INCLUDE: •• Where is the project located, and who are its neighbors—locally, regionally, and beyond? This is an exceptionally useful, free tool for gauging the relative performance of buildings. They thrive on diversity, for example, and clean the air rather than pollute it. Projects may be included in USGBC's online LEED
Project Directory of registered and certified projects. Once all the relevant information about the project goals. Outline procedures and goals for construction waste diversion. An educational component can ensure that participants with varying levels of knowledge all have an adequate
understanding of the topics under consideration. 7 as energy savings, water efficiency, CO2 emissions reduction, improved indoor environmental quality, and stewardship of resources. INTRODUCTION TO GREEN BUILDINGS AND COMMUNITIES . DR programs set a maximum number of events that can be announced and specify the time frames in
 which they may occur. USGBC authorizes individual, limited use of the Guide, subject to the terms and conditions contained herein. Water pumping and treatment, both to and away from the project, also require energy, whose production generates additional greenhouse gas emissions. How does life-cycle assessment affect materials selection? ••
What is the nature of the street life in the area, and how can the project contribute to the community? The core concepts of sustainable thinking are explored in Section 2. STRATEGIES FOR REDUCING ENERGY DEMAND IN DESIGN AND PLANNING: •• ESTABLISH DESIGN AND PLANNING: •• ESTABL
systems and bubbler distribution systems, channel water directly to root systems; weather-based irrigation controllers respond to weather conditions. All members of the community should have easy access to information on how they can support sustainability and should be encouraged to participate and suggest improvements. In a linear design
process, the solutions to one problem may cause other problems elsewhere in the system. Redevelopment financing ultimately featured two Low Income Housing Tax Credit allocations (family, 9%; senior, 4%) that received 2009 tax allocations (family, 9%; senior, 4%) that received 2009 tax allocations and two American Recover and Reinvestment Act (ARRA) grants, through the Tax Credit Assistance Program
(TCAP) and the Capital Fund Recovery Competition (CFRC). •• GIVE OCCUPANTS LIGHTING CONTROL. STRATEGIES TO ADDRESS TRANSPORTATION IN DESIGN AND PLANNING: •• LOCATE NEAR PUBLIC TRANSIT. There might be other solid waste strategies that the team should consider, such as composting green waste and other organic
matter on site or at another location. Instead, the team works together, in small groups and as a whole, to develop the project design and plan collaboratively. More information on USGBC and LEED is provided in Section 5. S ECT IO N 4 •• ENSURE THAT ALL RESIDENTS HAVE EASY ACCESS TO GROCERY STORES and other food choices beyond
fast food. S ECT IO N 1 Figure 1.7. Regenerative Design 15 Regenerative projects support the health of the local community and regional ecosystems, generate electricity and send the excess to the grid, return water to the hydrologic system cleaner than it was before use, serve as locations for food production and community networking, regenerate
biodiversity, and promote many other relationships that link the projects to the whole system of life around them. Finally, imagine that you are sitting at that oak table, back in the LEED Platinum commercial office space, flooded by natural springtime light. The strategies and technologies of green building—what is done—will be discussed in Section
4. Not all projects can achieve those levels of performance. For example, the pattern of waves crashing along the beach is an emergent property: the pattern is more than the gravitational pull of the moon or the influence of the wind. In all, the design
incorporates twenty different workplace setting types to encourage all employees to work in the manner that best suits each individual's style and the task at hand. Develop an alternative commuting incentive program for building occupants. PROJECT CASE STUDY THE ALDO LEGACY CENTER LEED PLATINUM The Aldo Leopold Legacy
Center near Baraboo, Wisconsin was the first building recognized by USGBC as carbon neutral—an exceptional achievement that helped the project earn points in the Innovation category. Basic elements of this approach were presented in Section 2. This minor tweak can dramatically raise the efficiency of the system. Once the list has been narrowed
more focused analysis may be required. 43 For some projects, it may seem easy to list the alternatives and then decide on the best one. Chris Shaffner, The Green Engineer, LLP Lynn Simon, Simon & Associates, Inc. Mills et al., The Cost Effectiveness of Commercial Buildings Commissioning: A Meta-Analysis of Existing Buildings and New
Construction in the United States (November 23, 2004), dot.ca.gov/hq/energy/Cx-Costs-Benefits.pdf. For a building, a life-cycle approach begins with the initial predesign decisions that set goals and a program to follow. Faucet and shower head aerators reduce maximum water flow to just two quarts per minute. Not every project has a commissioning
agent, but that role can be played by other members of the team. They promote the use of life-cycle assessment to holistically evaluate materials and the disclosure and optimization of material chemical ingredients. Provide adjustable air diffusers that allow occupants to adjust the air flow as well. Xeriscaping is the use of drought-tolerant native or
adapted plants along with rocks, bark mulch, and other landscape elements. The integrative and iterative processes required to achieve the environmental benefits addressed by LEED encourage new methods and standards, while advancing the practice of green building. The information must be both collected and directed. A facility that is larger
than necessary to serve its function creates costly and wasteful energy demand. A University of California-Berkeley study analyzed 694 certified green building in the sample. The U.S. Environmental Protection Agency (EPA) defines
brownfields as land where development may be complicated by the presence or potential pr
GOALS DURING CONSTRUCTION: •• Reducing the amount of fossil fuels used in construction equipment by minimizing grading and earth moving, as well as using biodiesel or other alternative fuels. Brownfields provide real opportunities for green building projects to go beyond just reducing their effects on the environment. Meanwhile, your
personal control of the temperature in your work area allows you to stay warm even as your neighbor, who has a higher cold tolerance, works at a temperature that's comfortable for him. LEED PROFESSIONAL CREDENTIALS LEED professionals demonstrate current knowledge of green building technologies, best practices, and the rapidly evolving
LEED rating systems. 45 For operations and maintenance projects, the implementation phase may be less an event than an on-going process. By observing the place unique. Development is also discouraged on wetland areas, floodplains, steep
slopes, and endangered species habitat. As we work together to transform the built environment, we can find solutions to climate change, water and a limited budget, "to achieve net-zero energy" is unrealistic because
the building cannot accommodate on-site energy generation or be redesigned with no mechanical system. Are there places on site where that goals are articulated by the owner, understood by the design team, incorporated into the design,
and then achieved during construction. Design-build projects that can choose a site will benefit from setting goals before selecting a location for the project, thereby ensuring that the location contributes to the overall project plan rather than presenting challenges that the team must overcome. The International Green Construction Code (IGCC),
including ASHRAE Standard 189.1 as an alternate path to compliance, is a widely supported and first-of-its-kind regulatory framework that recognizes an entire set of risks not otherwise addressed in the codes. Incorporate mulch into the landscape to build the soil and naturally suppress weeds. STAKEHOLDERS Charrettes derive their value from the
collaboration of people from different disciplines and perspectives. 47 PROJECT CASE STUDY RECERTIFICATION: ADOBE SF 601 TOWNSEND L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON LEED PLATINUM Adobe's San Francisco office is an adaptive reuse project that retrofitted a building completed in 1905 to operate at a high level of
performance. Before occupancy, flush out off-gassed compounds and other contaminants left behind at the end of construction. These weightings continue to evolve with the rating system as market conditions, user requirements, scientific understanding and public policy change. Even the most low-tech, passive systems need to be maintained to
 foster a healthful environment for people and prevent environmental harm to the planet. For example, much of the water that leaves the site as waste water or rainwater runoff can actually be used for nonpotable functions.
more than $5 million to the market value of each property. 13 BEYOND GREEN Initially, green buildings were intended to reduce damage to the environment and human health caused by creating and maintaining buildings and neighborhoods. S ECT IO N 4 • What are the sources of graywater, such as from sinks and showers, that could be collected
and reused for nonpotable uses, such as irrigation? It presents fundamental concepts of green building process. Stevenson high school please visit usgbc.org/ projects/adlai-e-stevenson-high-school Photo provided by James
Steinkamp Photography OBSERVING A SYSTEM To observe and understand the site, team members must ask many questions: •• What are the general climatic patterns of the site? •• ENCOURAGE MULTIPLE MODES OF TRANSPORTATION. Subsequent sections will explore how green building professionals can begin to incorporate these ideas into
projects and professional pursuits. LEED-certified projects receive formal certificates of recognition, a plaque, and tips for marketing the achievement. For example, an office complex without transit access might provide incentives for marketing the achievement. For example, an office complex without transit access might provide incentives for marketing the achievement.
to participate from the early project stages, including goal setting and initial brainstorming. Team members collaborate to enhance the efficiency and effectiveness): 12. You work closely with your colleagues, following up on plans laid out in a
recent project charrette. •• MONITOR AND VERIFY PERFORMANCE. GREEN BUILDING AND CLIMATE CHANGE Although many environmental impacts are associated with buildings and land-use are responsible for a large proportion
of greenhouse gas emissions. •• Even if the system is evaluated using a complex computer model, the best solution may depend on the team's goals, metrics, and targets, as well as their resources. Population growth is a positive feedback loop. For example, the amount of energy used by tenant-occupied buildings may be collected by an electricity or
gas meter and reported to the utility company but not to the occupants, who therefore have no information about their energy consumption and no incentive to reduce it. The power to transcend paradigms 26 For instance, when carpet manufacturer Interface Flooring switched from being a producer of carpet to a provider of the service of floor
coverings, it created a shift in the company's mission. Infill development makes use of sites in previously dev
matter become food for something else, and everything goes somewhere. As more green products and technologies become available, green building will become more mainstream. In systems thinking, the built environment is understood as a series of relationships in which each part affects many other parts. An iterative process has a cyclical nature
Establish Mea sur e •• Establish clear goals and overarching commitments •• Explore synergies between specific strategies L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON rg i ne 34 •• Set new goals based on the work that has been done Sy •• Establish metrics for measuring success
Development Iteration Imple me nt ze Research/r efi Brainstorm •• Research and refine ideas goals ne This is a way for project teams to apply systems thinking and integrative process. Any value engineering exercise must therefore keep the big picture in mind and include all stakeholders so that the decisions support the project goals. Use features
that serve multiple functions, such as planters that collect rainwater, streets that include bioswales to capture and hold rainwater, and mulch that both builds soil and holds moisture. The term was coined by John Elkington, cofounder of the business consultancy SustainAbility, in his 1998 book Cannibals with Forks: the Triple Bottom Line of 21st
Century Business. Many of the specific strategies discussed in Section 4 of this guide require task groups to flesh out ideas and determine appropriate application. This approach emphasizes connections and communication among professionals and stakeholders throughout the life of a project. Innovative strategies expand the breadth of green
building practice by incorporating cutting-edge techniques, processes and products into the development of a project. Map layers might show soils, infrastructure, shade, wind patterns, walkways and barriers, material flows, and solid waste pathways. Choose
sustainable cleaning products and materials that meet Green Seal, Environmental Choice, or EPA standards to protect indoor environmental damage. LEED emphasizes location and transportation issues by rewarding development that preserves environmentally sensitive places and takes advantage of existing
 infrastructure, community resources, and transit. •• What are the soils like on the site? Common metrics for buildings and neighborhoods include energy use per capita. In fact, many of our materials and resources are imported from around the world. •• SPECIFY GREEN MATERIALS AND EQUIPMENT. Engaging the
marketing, supporting, or celebrating green buildings was at the heart of your everyday work. Although these substances have remarkable functional properties, they also have damaging side effects on the environment. •• SUSTAINABLE SITES. Pervious paving areas allow rainwater infiltration and also reduce heat island effects. Our training taught
us to see the world as a set of unfolding behavior patterns, such as growth, decline, oscillation, overshoot. Next, imagine that you are that son or daughter. . In a green building project, the team must consider embodied energy—the total amount of energy used to harvest or extract, manufacture, transport, install, and use a product across its life-cycle
 —alongside performance and adaptability. Once they'd gone through the process, they found it valuable, and many couldn't imagine doing design any other way."14 This section addresses problem-solving approaches that can be applied throughout the green building process. •• INSULATE. As a condition of use, the user covenants not to sue and
agrees to waive and release the U.S. Green Building Council, Inc., its officers, directors and volunteers from any and all claims, demands, causes of action for any injuries, losses, or damages (including, without limitation, failure to pass any Green Building Certification Institute examination or equitable relief) that the user may now or hereafter have a
right to assert against such parties as a result of the use of, or reliance on, the Guide. A wide range of tools can help teams evaluate components of a system, including modeling, life-cycle analysis, as well as inventorying. •• Is it connected to local infrastructure and public transportation? Phase 1 of the project consists of
60 units plus a community center; phase 2 consists of 50 senior housing units, one caretakers' unit, and a community center. When selecting a location, the team must consider many attributes of the overall system: •• Has the site been previously developed? Product transparency tools like life-cycle assessment (LCA), Environmental Product
Declarations (EPDs), and material ingredient disclosures provide a more comprehensive picture of materials and products, enabling project teams to make informed decisions. Hua, "Building Investment Decision Support (BIDS™): Cost-Benefit Tool to Promote High Performance Components, Flexible Infrastructures and Systems Integration for
Sustainable Commercial Buildings and Productive Organizations," Report on university research (AIA, 2005). THE RISE OF THE GREEN BUILDING INDUSTRY Many of the elements of green building are not new or even unique. •• USE NATIVE LANDSCAPING. 68 LEED distinguishes between renewable energy production and the purchase of off
site green power or carbon offsets. For the purposes of this guide, "built environment" refers to any environment that is man-made and provides a structure for human activity. What are the characteristics of these systems? After adjusting for occupancy levels, they identified a 6% premium for certified buildings. We need to consider both upstream
and downstream effects in our decision-making processes. 29 INTEGRATIVE PROCESS An integrative process is a comprehensive approach to building Location with Infrastructure and Services Carbon emissions provide a
useful metric for many aspects of green building involves more than reducing greenhouse gas emissions. Where do they come from, and from how far away? Ultimately, the involvement of students and stakeholders helped the building achieve
LEED Gold. Select EPA WaterSense and ENERGY STAR products. An "efficiency first" approach to water conservation, bicycling, or walking, its total emissions decrease. Each of these concepts and strategies should be viewed within the
context of systems thinking, using integrated processes. 20 A system can be physically small (an ant hill) or large (the entire universe), simple and self-contained (bacteria in a Petri dish) or complex and interacting with other systems (the global trading system or a forest ecosystem). This upfront investment of time, however, reduces the time it takes
areas or infill sites already served by mass transit. However, the air we breathe indoors—where millions of Americans spend most of the day—can be even more polluted. The higher the MERV rating the greater the particulates captured by the filter. Efficient street lighting and LED traffic signals will reduce energy demands from neighborhood
infrastructure. Lastly, the project team wanted to use the school as a teaching tool for the students. •• CONDUCT A WASTE STREAM AUDIT. •• What plants and minimizing the risk of building-related health problems.
epa.gov/iaq/pubs/insidestory.html. • PREVENT LIGHT POLLUTION. The more babies who are born, the 
changes and make deliberate decisions by using information from smaller group meetings. L EED CON CORE CON CEPTS — TH E DIT I ON L EED CORE CEPTS GU ID E G—UIDE T HIRD EDIR ITD I ON Section 2 Sustainable Thinking 18 Green building will change the way you think. 70 MATERIALS AND RESOURCES Materials are the foundation of
the buildings in which we live and work. This process begins early in design, with the specification of requirements. TEAM SELECTION One defining element of the green buildings: The Transportation
Energy Intensity of Buildings. Identifying a project team member as the "goal keeper" ensures that all subsequent work can be related to the goals. 80 Lighting levels and views to the outdoors are other important aspects of the indoor experience. As the earth gets warmer, fewer surfaces remain covered with snow, a reflective surface that bounces
incoming heat from the sun back into space. Or what if another goal is to reduce the greenhouse gas emissions associated with solid waste? The members of this group are highly invested and involved across all stages of the project. 93 S ECT IO N 5 94 L EED CON CORE CON CEPTS — TH E DIT I ON L EED CORE CEPTS GU ID E G—UIDE T HIRD
EDIR ITD I ON Conclusion Equipped with fundamental knowledge about green building and LEED core concepts, let's return to the building described at the beginning of this guide by USGBC CEO Rick Fedrizzi. To evaluate the best options and weigh the trade-offs associated with materials selection, teams must think beyond a project's physical and
temporal boundaries. Soon after it was formed, USGBC began developing LEED for rating and certifying sustainability in the building industry. And imagine leaving the office to find that it has started raining. Incineration of waste products. Although approaches will vary based on the specific project and team, the
process often includes charrettes, team meetings, small task groups, and stakeholder meetings. One decision may have a ripple effect. Individual projects require different blends of expertise. Of course, too much light can interfere with some tasks, and direct sunlight or glare can create discomfort as well. Daily life in any building or community
requires on-going delivery or production of resources, as well as routine maintenance and upkeep. The audit results are used to establish a baseline that identifies the amount and percentage of each material in the waste stream. Current efforts to improve vehicle fuel efficiency and reduce the carbon intensity of motor fuels may be insufficient to
meet greenhouse gas reduction goals unless accompanied by significant changes in land use and human behavior. Making buildings more healthful, more comfortable, and more conductivity for their occupants has special significance in light of studies conducted by the U.S. Environmental Protection Agency (EPA), which found that
people in the United States spend, on average, 90% of their time indoors.6 Occupants of green buildings are typically exposed to far lower levels of indoor pollutants and have significantly greater satisfaction with air quality and lighting than occupants of conventional buildings. We see stocks and flows and feedbacks and interconnections, all of which
 influence the way the system will behave in the future and influence the actions we might take to change its behavior.15 14 A. They are deeply involved in the problem-solving and decision-making processes at every step. Installing sensors to monitor conditions and conducting occupant surveys are important parts of green building operations. Turner
and M. LEED is continually improved through the correction and clarification of credit language. The system then evaluates the performance of the building against that of others with similar characteristics. Certain plants can enhance soil nutrients, supporting regenerative project goals; others naturally deter pests. Maps can also display growth
projections, targeted development areas, and other indicators of how the site is likely to change over time. Project teams may attempt any of these pilot credits' efficacy and achievability. This new process doesn't typically cost more, but it does shift
costs earlier. All the economic costs and benefits of a project for all the stakeholders (not just the project owner) S ECT IO N 1 The goal of the triple bottom line, in terms of the built environment, is to ensure that buildings and communities create value for all stakeholders, not just a restricted few. In ideal cases, sustainable design projects start in
one of two ways—either the team starts with a function and determines the best location for that land use. •• USE XERISCAPING. For instance, if the building has 32 tenants, installation of submeters in all data centers will have different implications
than if it were a single-tenant facility. •• WATER EFFICIENCY. This trend can be periodically reversed through retrocommissioning, a tune-up that identifies inefficiencies and restores high levels of performance. For example, saying that a project should be "healthful" may be appealing, but what does that really mean in the project context? For
example, development of sites that have been in agricultural use, called greenfields, and sites that are far from existing development and infrastructure will increase the total regional development are solved through a systems.
based approach, multiple problems can often be solved at the same time. Education of building occupants encourages their full participation in sustainability opportunities. Source reduction encourages their full participation in sustainability opportunities.
material cutoffs and inefficiencies. The question can spark the creativity needed to find new solutions that lead to sustainability. Wendt and N. To be healthy, happy, and productive in the building, occupants need to feel comfortable and in control of their environment. As part of the initial benchmarking efforts the project team pursued ENERGY
STAR, earning a rating of 79 through building upgrades undertaken prior to the LEED process. 15 Donella H. ADVOCACY USGBC provides policymakers and community leaders with the tools, strategies, and resources they need to take leadership positions, foster innovation, and inspire action. All LEED publications are protected by statutory
copyright and trademark protection within the United States and abroad. Make sure that the ventilation system, whether natural or mechanical, is sized appropriately and can provide enough fresh air. Actions taken during discovery are essential to achieving a project's environmental goals cost-effectively. Each type of disposal for each type of
material would have a different greenhouse gas emissions factor, which must be added to the transportation-related emissions. There are upstream, and cost considerations to each option. A project team that earns a regional priority credit earns one bonus point in addition to any points awarded for that credit. Using better insulation or account of the transportation or account of the transport
more efficient windows might allow for a smaller heating system. Sustainable design means finding not only the measures that perform best over the life of the project. It can determine whether a project can take advantage of sunlight, have access to public transportation and other services, and
protect habitats. This is what it feels like for me and my colleagues at the LEED Platinum U.S. Green Building Council headquarters in Washington, D.C. It is what it feels like for me and my colleagues at the LEED Platinum U.S. Green Building Council headquarters in Washington, D.C. It is what it feels like for the thousands upon thousands of people worldwide who work in LEED-certified office space.
effects into our analysis of alternatives, we can get a broader picture of the environmental costs and benefits of materials. There is no "away." By slowing the passing of materials and resources through the systems, which are more
sustainable. Still other projects are designed to achieve a more even water balance: they use no more water than that which falls on site as precipitation, or they produce zero waste by recycling, reusing, or composting all materials. This metric is qualitative because the presence of sidewalks doesn't necessarily contribute to walkability. Graywater
use is not an option in all municipalities, so it is important check regulations before planning to use this strategy. OUTDOOR WATER USE Landscape irrigation, a significant component of many commercial buildings' water use, presents an important opportunity to conserve water. Green building is fundamentally a process of continual improvement
•• USE INTEGRATED PEST MANAGEMENT. In advance, the project owner or developer may draft a statement that establishes the goals of the charrette and its relevance to the project. Refrigerants were widely employed throughout the 20th century for transferring thermal energy in air-conditioning and refrigerants were widely employed throughout the 20th century for transferring thermal energy in air-conditioning and refrigerants were widely employed throughout the 20th century for transferring thermal energy in air-conditioning and refrigerants were widely employed throughout the 20th century for transferring thermal energy in air-conditioning and refrigerants were widely employed throughout the 20th century for transferring thermal energy in air-conditioning and refrigerants were widely employed throughout the 20th century for transferring thermal energy in air-conditioning and refrigerants were widely employed throughout the 20th century for transferring thermal energy in air-conditioning and refrigerants were widely employed throughout the 20th century for transferring the 20th ce
for one problem may create other problems elsewhere in the system. Solid waste disposal contributes directly to greenhouse gas—in landfills. S ECT IO N 1 •• 24% to 50% of energy use 3 THE CUMULATIVE EFFECT OF CONVENTIONAL PRACTICES IN THE
BUILDING INDUSTRY HAS PROFOUND IMPLICATIONS FOR HUMAN HEALTH, THE ENVIRONMENT, AND THE ECONOMY: •• Clearing of land for development often destroys wildlife habitat •• Extracting, manufacturing, and transporting materials may pollute water and air, release toxic chemicals, and emit greenhouse gases •• Building
 operations require large inputs of energy and water and generate substantial waste streams •• Transportation to and from buildings by commuters and service providers compounds the harmful environmental effects associated with vehicle use, such as increased energy consumption and pollution By building green, we can reduce that environmental
damage. Additionally, the expertise of individual project team members will be more critical at different points in the project. Learn about the relationships between the elements, the flows of resources and information, and the leverage points that can lead to dramatic changes. Thus a given credit's point value reflects its potential both to mitigate the
environmental harms of a building and to promote beneficial effects. The process of green building flows throughout the entire life-cycle of a project reaches the end of its life and its parts are recycled or reused. To emphasize the cyclical aspect of a closed system,
architect William McDonough and colleague Michael Braungart coined the phrase cradle to cradle. Studies by the Heschong Mahone Group have demonstrated that providing daylighting in classrooms can improve student scores by 7% to 18%.27 They also found improvements in office workers' productivity. •• CAPTURE EFFICIENCIES OF SCALE
Promote the use of energy-efficient computers and equipment, bill tenants from submeter readings to encourage energy conservation, educate occupants about shutting down computers and turning out lights before they leave, and give them regular feedback on energy performance. Getting the most work per unit of energy is often described as a
measure of energy intensity. Sometimes project teams can enter into REC agreements that provide for such a project to substantially reduce its transportation effects if the team focuses on local connectivity and the energy efficiency of the
vehicles used to serve its needs. Environmentally preferable attributes to consider include: •• Support the local economy •• Sustainably grown and harvested of bio-based material •• Free of toxins •• Long lasting
durable, and reusable • Made in factories that support human health and workers' rights For consumers the biggest challenge is identifying what products are truly green. LEED rewards projects that both reduce demand and reuse water for indoor water uses. You're Reading a Free Preview Pages 64 to 65 are not shown in this preview
Consider again the example from Section 1 of Rome's road structure: these roads were built for pedestrians and therefore remain walkable and pedestrians are the platinum level under LEED v2009. Use strategies such as designing for
 dimensional construction materials, prefabrication, or material efficient framing. A study by the New Buildings Institute found that in green buildings in the study by the New Buildings Institute found that in green buildings, average energy use intensities (energy consumed per unit of floor space) are 24% lower than in typical buildings. 4 Additionally, the U.S. General Services Administration surveyed 12 green buildings in
its portfolio and found these savings and improvements: •• 26% less energy usage •• 27% higher levels of occupant satisfaction •• 13% lower maintenance costs •• 33% lower emissions of carbon dioxide (CO2)5 120 100 4 ENERGY USE INTENSITY (kBtu/sf/yr) Figure 1.1. Energy Use Intensities for Sustainably Designed U.S. Government Buildings
 (Source: GSA 2008) The dotted line indicates the national average energy use intensity. Are they healthy or stressed? •• USE ENTRYWAY SYSTEMS. Each requirement identifies a specific action that fits into the larger context of a life-cycle approach to embodied impact reduction. 57 STRATEGIES FOR SUSTAINABLE SITE OPERATIONS AND
MAINTENANCE: •• DEVELOP A SUSTAINABLE SITE MANAGEMENT PLAN. In exchange for this limited authorization, the user agrees: (1) to retain all copyright and other proprietary notices contained in the Guide in any way for any w
public or commercial purpose, including display on a website or in a networked environment. Imagine an herb garden in the office cafeteria and an educational display in the office cafeteria and an educational d
rainwater on site and creating buffers between development and water resources. Other projects strive for carbon neutrality, emitting no more carbon emissions than they can either sequester or offset. STRATEGIES FOR DESIGNING FOR GOOD INDOOR AIR QUALITY: •• PROHIBIT SMOKING. Vehicles and equipment Stationary sources On-site
landfills & wastewater treatment Fugitive emissions 2 Greenhouse gas emissions resulting from the generation of electricity, heat, or steam purchased by a Federal agency. They go beyond a cursory site assessment and study the land and its history. We hope you enjoy the journey, and we look forward to the innovations you'll bring as part of the
green building community. L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON The proper design and operations of buildings and neighborhoods can dramatically boost energy efficiency and benefits from cleaner, renewable energy supplies. Time must be spent building the team, setting goals, and doing analysis before any decisions are made
or implemented. The Housing Authority for the City of Fort Lauderdale (HACFL) welcomed the idea of using LEED ND and engaged their development partner Carlisle D
Asia, and shipped to the United States for purchase. How do resources, such as rainwater, wastewater, and solid waste, flow out of the system? Under this approach, any improvement beyond a minimally code-compliant baseline looks like an L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON added cost. •• DEVELOP AND IMPLEMENT A
GREEN CLEANING POLICY. 2 The Environmental Impacts of Buildings What is Green Buildings What is Green Buildings and land use and the need to address both to achieve meaningful reductions in greenhouse gas emissions. At the same time, there are now many high-tech strategies available to improve
the performance of the built environment. Ideally, the materials and resources used for buildings not only do less harm than typical materials but go further and regenerate the natural and social environments from which they originate. LEED Interpretations, however, are precedent setting; project teams are required to adhere to all LEED
Interpretations posted before their registration date. At the same time, reducing air infiltration can raise concerns about the indoor air quality. Waste Stream Audit Results 75 To comply with LEED requirements, a project team conducts a
 waste stream audit for the entire consumables waste stream. By contrast, the green building process is interdisciplinary, iterative, and collaborative. For example, if by "healthful" the team means that the project should protect indoor air quality, one metric for that might be the amount of volatile organic compounds (VOCs) in building materials. The
structures. A qualitative factor might be the usage of recycling receptacles: are those adjacent to workspaces and offices used more than those at central locations, such as break rooms, or vice versa? APPLICATION REVIEW Whether the design and construction credits are submitted together or separately, each credit undergoes one preliminary
review. Meadows, Jorgen Randers, and William W. Project teams can follow an integrative process to begin assessing existing water resources, opportunities for reducing water demand, and alternative water supplies. Green building demands that a multidisciplinary team of professionals join with members of the community involved or affected by
the project to look at the big picture, not just the individual elements that concern each of them most immediately. Enable occupants to walk, bicycle, and use public transit. S ECT IO N 4 •• PROTECT AND RESTORE HABITAT. WATER EFFICIENCY The U.S. Geological Survey estimates that the United States uses more than 400 billion gallons of
water per day. High-efficiency fixtures use less water than specified by the Energy Policy Act (EPAct) of 1992. ENERGY CONSUMPTION: BUILDING-ASSOCIATED TRANSPORTATION VERSUS OPERATIONS L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON For an average office building in the United States, 30 percent more energy is
expended by office workers commuting to and from the building itself for heating, cooling, lighting, and other energy uses. This applies to existing buildings as well. As public interest in sustainability has grown, so has the practice of greenwashing, or presenting misinformation to the consumer to portray a product of
policy as being more environmentally friendly than it actually is. Even when the team is experienced, it is worth reviewing the steps to ensure that all team members understand it in the same way—perhaps by asking how they might approach a problem. Provide housing types for a wide range of incomes and abilities. Even "to reduce greenhouse gas
emissions by 30%" may be impossible for a project to implement all at once. In office buildings, locating private offices toward the building core and siting cubicles at the perimeter brings daylight into a large area. •• USE EFFICIENT FRAMING TECHNIQUES. To understand sustainable systems, we must further understand what we mean by
systems. CFCs and HCFCs are organic chemical compounds known to have ozone-depleting potential. TRANSPORTATION 19 U.S. Environmental Protection Agency, Brownfields/overview/glossary.htm. Because charrettes are highly structured, they require a strong facilitator, who may come from outside the
core project team. These opportunities will be explored in greater depth in Section 3. The New Buildings Institute study also collected data suggesting that a significant percentage of buildings underperformed their benchmarks. Connections to the community and other destinations, local priorities, cultural history and traditions, local regulations and
incentives. For example, "to stop global climate change" is an unachievable, ineffective goal. One leverage point they examine is the goals that govern the system. How does it fit into larger or overlapping economic systems? Common Sources of Federal Greenhouse Gas Emissions SF6 CH4 N2O HFCs PFCs CO2 SCOPE 1 Greenhouse gas
          ons from sources that are owned or controlled by a Federal agency. We can tackle tough issues like traffic congestion and respiratory illnesses. The number of meetings will depend on how complex the project is and how quickly alignment can be reached by the stakeholders. Each category provides an opportunity for increasing efficiency and
savings. Advanced framing, in which studs are spaced 24 instead of 16 inches on center, and structural insulated panels, which combine framing without compromising performance. The built environment, including buildings and transportation systems, accounts for
more than two-thirds of all greenhouse gas emissions. 9 Greenhouse gas emissions come from many components of the built environment, including building systems and energy use, transportation, water use and treatment, landcover change, materials, and construction. Because this building is in the suburbs, emissions from transportation—people
driving to and from work—make up half the total emissions associated with the project. Strategies for addressing EQ issues include those that protect human health, improve quality of life, and reduce stress and potential injuries. No problem can be solved from the same level of consciousness that created it. Is the site remote or connected to a utility
grid? SUSTAINABLE THINKING AT WORK: NEW PROCESSES FOR BUILDING GREEN . •• REGIONAL PRIORITY. Use valid survey protocols to assess occupants' satisfaction with the indoor environment. L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON However, focusing on building design and construction alone will not achieve the
emissions reduction that scientists believe is required to mitigate climate change. GET IN EARLY. •• GREEN INFRASTRUCTURE AND BUILDINGS. For example, the appropriate team, vendors, occupants' representatives, and a
sustainability expert. Frankel, Energy Performance of LEED for New Construction Buildings (March 4, 2008), newbuildings.org/sites/default/files/Energy Performance of LEED-NC Buildings (March 4, 2008), newbuildings (March 4, 2
68.24 Set up by EPA as a part of the ENERGY STAR program, ENERGY STAR Portfolio Manager is an interactive, online management tool that supports tracking and assessment of energy and water consumption. S ECT IO N 2 Feedback loops—positive or negative—depend on flows of information. Before they can do that effectively, from a
sustainability perspective, they need to understand what is. Teamwork and critical thinking are valued. How does water fall on and run off the site? ESTABLISHING AN ITERATIVE PROCESS All the activities described in this section take place in an iterative process that contains numerous feedback loops. If sustainability is viewed as an expensive
add-on to a building, we would mistake efforts to reduce energy costs or improve indoor environmental quality as comparable to specifying a better grade of countertop or a more impressive from the waste audit can reveal opportunities for increasing recycling and waste diversion and be used to adjust the recycling procedures at
the facility. Provide occupants with easily accessible collectors for recyclables. New tools and processes are required to help projects arrive at integrative, synergistic, sustainable solutions. Follow-through is needed at all stages to ensure that the strategies and technologies are maintained or adapted as necessary to remain effective. New York:
Universe Books. The team should also share the audit results with the building's occupants to encourage their participation in on-site recycling programs. Apply life-cycle assessment to the trade-offs between capital and operating costs, and evaluate investments in energy efficiency technologies. Similarly, smaller, more efficiently built buildings and
homes require fewer board-feet of lumber or linear feet of pipe, as well as fewer resources to maintain. A facilitator assists the team in expressing new ideas and ensuring that varying perspectives are valued. If inexperienced people are on the team, some training and orientation to the process will be necessary. Heffron 83 84 L EED CON CORE CON
CEPTS — TH E DIT I ON L EED CORE CEPTS GU ID E G—UIDE T HIRD EDIR ITD I ON Section 5 About USGBC and LEED The U.S. Green Building Council (USGBC) and its community are changing the way buildings and communities are designed, built and operated. When assessing and designing a site, the team must consider many things: •• Is
there adequate open space surrounding the project, or could the project, or could the project provide open space to the building and community? How tall are they? Up-front goal setting, analysis, and evaluation of alternatives will assist in making decisions that result in savings over the long term through synergies and integration. For example, buildings without
appropriate sensors and control systems cannot adjust to changing temperatures and maintain a comfortable indoor environmental effects throughout the life of materials, products, or buildings. SUBMISSION When the team is ready for its application to be reviewed, the project
administrator submits the appropriate fee and documentation. •• INNOVATION. For example, an ecologist might be most relevant during the initial stages of the project, to help the team understand and work with the site, but could bring forward valuable ideas and find synergies throughout the process. •• MONITOR OUTDOOR AIRFLOW. By
looking only at the percentage of recycled content, we might select a product that will compromise the project's energy-saving goals. The lengths of delays, relative to the rate of system change 8. Carbon offsets represent a unit of carbon dioxide equivalent that is reduced, avoided, or sequestered to compensate for emissions occurring elsewhere.
Experienced contractors often have great ideas for implementing such material-saving strategies. The combination of brainstorming, different perspectives, and a focus on results distinguish the charrette from other types of meetings. The result of this strategy, combined with the everexpanding boundary of the urban edge and the increase in paved
roads and hardscape, is damaging to the watershed's functioning. SYSTEMS THINKING Sustainability involves designing and operating systems to survive and thrive over time. Kok, and J.M. Quigley, "Doing Good? •• COMPOST. This suburban growth can sprawl far from the urban core, requiring more roads and encouraging additional
growth, as well as using more resources (energy, water, sewage systems, materials) to support that growth. Regenerative projects strive toward "net-zero"—using no more resources than they can produce. For example, by improving the building envelope, the space between exterior and interior environments of a building which typically includes
windows, walls, and roof, teams may be able to reduce the size of HVAC systems or even eliminate them altogether. SUSTAINABLE THINKING . This avoids the environmental consequences of extracting materials for a new building and disposing of demolition waste. • PROVIDE DIVERSE LAND USES. Named after the carts that carried French
architecture students' models to their final review (often as the students frantically completed their work en route with the help of friends), charrettes are intense workshops designed to produce specific deliverables. Charrettes are intense workshops designed to produce specific deliverables.
Sustainable Development found that respondents believed, on average, that green features added 17% to the cost of a building, whereas a study of 146 green building is, however, a significant predictor of tangible improvements in building performance, and those
improvements have considerable value. The team then submits final documentation. For a renovation project, the team might prepare a gap analysis that compares existing conditions with goals and identifies the gaps. GUIDING QUESTIONS FOR A TEAM TO CONSIDER MAY INCLUDE THE FOLLOWING: •• How much rain falls on the site per year?
STRATEGIES FOR RAINWATER MANAGEMENT IN OPERATIONS AND MAINTENANCE: •• REDIRECT RAINWATER. This site provides credit templates to be completed and signed by a specified member of the team. In either case, by understanding the goals of the project as well as the opportunities and constraints of a particular location, the team
will be able to arrive at an optimal set of solutions. The goal of LEED is market transformation—to fundamentally change how we design, build, and operate building Council, Strategic Plan 2013 - 2015 (USGBC, 2012), DOING SO WILL
VIOLATE THE COPYRIGHT OF THE GUIDE. An integrative process comprises three phases. Potable water use for irrigation can be further reduced by using nonpotable water for outdoor applications. The goals of the system 2. Systems rarely exist in isolation; even the bacteria in the Petri dish are affected by the light and temperature of the
laboratory. Maintenance activities must be adapted throughout the life of the project so that the benefits are captured over time. Mapping should always extend beyond the project so that the benefits are captured over time. Mapping should always extend beyond the project so that the benefits are captured over time.
attributes and benefits, can be sold separately from the underlying physical electricity associated with a renewable-based generation source. Water use at 601 Townsend has been reduced by 62%. Use an outdoor airflow measurement device that can measure and control the minimum outdoor airflow rate. The text of the federal and state codes,
regulations, voluntary standards, etc., reproduced in the Guide is used under license to USGBC or, in some instance, in the public domain. Questions such as these encourage practitioners to ensure that building's daily operations,
recycling, reuse, and reduction programs can curb the amount of material destined for local landfills. The key to understanding whether a project is performing sustainably is information—the right information at the right information at the right information at the right information.
owners to enhance the environmental performance of their buildings. Consider putting protected areas into a land trust. •• NEIGHBORHOOD PATTERN AND DESIGN. By studying the site, the team, with help from the facilitator, can ensure the project's connection to the neighborhood. Select a project site within easy walking distance of an existing
transportation network, •• PROVIDE ERGONOMIC FURNITURE. Designate a construction and demolition waste recycling area. Requests for proposals and interviews should include guestions about experience in green building and sustainability. In most communities, it is essential to win the trust of local residents and organizations, which may
involve one-on-one and small-group meetings. GREEN BUILDING AND LOCATION L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON A place for everything, everything in its place. The alternatives must be analyzed and evaluated against the goals. CON CLUS IO N Every day, we pass into and out of these buildings, often without giving them
much notice. IMPLEMENTATION Once the planning and design phases are complete, it is time to think through each step of implementation and anticipate where problems might arise and compromise the project's commitment to sustainability. Providing enough lighting for particular tasks is critical to protect occupants' eyesight over time. It will
challenge you to imagine the next green building project to which you'll contribute. Buildings and communities, including the resources used to create them and the energy, water, and materials needed to operate them, have a significant effect on the environment and human health. This network of industry leaders provides green building resources,
education, and opportunities for green building professionals to stay connected in their communities. Install secure bike racks and showers for commuters. Interestingly, the public dramatically overestimates the marginal cost of green building. For example, the 36 development of an integrated water conservation system might require collaboration
between the landscape architect, the civil engineer, the structural engineer, and the mechanical, electrical, and plumbing (MEP) designer. Materials procurement doesn't end at the end of construction. More fundamentally, if we view sustainable design as part of the necessary functional requirements for building an energy-efficient structure and
providing a safe, healthful environment, we can compare the cost of the green building with that of other buildings in the same class, rather than against an artificially low baseline. STRATEGIES TO REDUCE WASTE DURING CONSTRUCTION: • DESIGN BUILDINGS THAT PRODUCE LESS WASTE. In many jurisdictions, collected water can be used
as process water, to flush toilets, or to provide irrigation. This synergy is possible when we take the time to explore the interconnections and approach a project in a holistic manner. But envelopes designed for increased daylighting without consideration of glare and heat gain can create uncomfortable and less productive spaces. For example, where
culs-de-sac connect to increasingly wide connector roads, services are clustered into strip malls, and jobs are centered in office parks, the emphasis is on the private realm and the automobile. Unauthorized use of the Guide violates copyright, trademark, and other laws and is prohibited. •• ESTABLISH A TRACKING SYSTEM. 49 50 L EED CON CORE in the private realm and the automobile.
CON CEPTS — TH E DIT I ON L EED CORE CEPTS GU ID E G—UIDE T HIRD EDIR ITD I ON Section 4 Green Building Core Concepts and Application Strategies The first three sections of this quide set a foundation for green building practice by addressing integrated processes versus conventional practice. Figure 2.3. Induced Growth Over Time
Unchecked, positive feedback loops can create chaos in a system. Postoccupancy surveys complement performance-based data collection by indicating whether the project meets occupants' needs, is comfortable, and supports productivity. Now, imagine that the oak table is in your LEED Platinum home. A fresh perspective will change the way you
look at the buildings we all live and work in, the ones we walk past, and the ones we revere as beacons of innovation in our communities. • PROHIBIT SMOKING. Green building professionals have created demand for increasingly sustainable products, and suppliers, designers, and manufacturers are responding. Once registered, the team receives
information, tools, and communications that will help quide the certification process. Commissioning will be reviewed in further detail in Section 4. 95 96 L EED CON CEPTS — TH E DIT I ON L EED CORE CEPTS GU ID E G—UIDE T HIRD EDIR ITD I ON Appendices Appendix A: Resources LEED GREEN
ASSOCIATE CANDIDATE HANDBOOK usgbc.org/store GREEN BUILDING CODES OVERVIEW usgbc.org/ShowFile.aspx?DocumentID=7403 USGBC ADVOCACY CAMPAIGNS usgbc.org/advocacy/campaigns
LEED RATING SYSTEMS usgbc.org/leed/rating-systems LEED CREDIT LIBRARY usgbc.org/credits USGBC GLOSSARY usgbc.org/credits USGBC GLOSS
ANTHONY BERNHEIM AND WILLIAM REED (1996) gbci.org/Libraries/Credential Exam References/Sustainable-Building-Technical-Manual-Part-II.sflb.ashx THE TREATMENT BY LEED® OF THE ENVIRONMENTAL IMPACT OF HVAC REFRIGERANTS (LEED TECHNICAL AND SCIENTIFIC ADVISORY COMMITTEE, 2004)
gbci.org/Libraries/Credential Exam References/The-Treatment-by-LEED-of-the-EnvironmentalImpact-of-HVAC-Refrigerants.sflb.ashx A PPE N DICE S LEED v4 IMPACT CATEGORY AND POINT ALLOCATION PROCESS OVERVIEW usgbc.org/resources/leed-v4-impact-category-and-point-allocation-process-overview 97 Appendix B: Case Study
Information NORTHWEST GARDENS Year Completed: 2012 Location: Fort Lauderdale, Florida LEED for Neighborhood Development (v2009) Organization Website: hacfl.com USGBC Case Study Website: usgbc.org/projects/northwest-gardens CANNON DESIGN CHICAGO OFFICE Year Completed: 2012
Location: Chicago, Illinois LEED Certification Level: Platinum Rating System: LEED for Commercial Interiors (v2009) Organization Website: cannondesign.com USGBC Case Study Website: usgbc.org/projects/cannon-design.com U
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Platinum Rating System: LEED for Homes (v2008) Organization Website: usgbc.org/projects/villa-alegre-phase-1-2-0 ADLAI E. What are they used for? Performance goals set during planning and design can be undermined by design flaws, construction defects
equipment malfunctions, and deferred maintenance. Therefore, the population can be expected to rise until acted upon by another force, such as an epidemic or shortage of resources. Each agenda needs to be tailored to the specific project, but in general, a charrette takes the following form: •• Background briefing, to ensure that all participants
have the basic information on the project and topics to be discussed • Brainstorming, and subsequent reports structured around discussion questions and specific tasks • Synthesis of work, development of recommendations, and identification of deliverables • Initial response from the owner or
developer to the recommendations, affirming the commitment to sustainable approaches and ideas •• In follow up, a written report documenting the charrette and identified action items should be sent to all participants L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON TEAM MEETINGS can allow the group to work together creatively on new
synergies. To be effective, the policies that are emerging at the local, state, and federal levels to regulate greenhouse gas emissions must reflect a clear understanding of the connection between climate change and the built environment. Triple bottom line is also often used to refer to the concept of sustainability. But what if the team values both
recycling and cost savings? Stopping global climate change is beyond the space and time constraints of a single project. In a linear and hierarchical practice, each participant does his or her part and passes the job on to the next in line. Set targets and establish performance indicators at the outset of a project and periodically verify their achievement
Sustainability means creating places that are environmentally responsible, healthful, just, equitable, and profitable. These environments range from shelters and individual buildings to neighborhoods and targets early in the
process, understand the systems that are in play, and anticipate how those systems are likely to change and evolve. When materials no longer have a use in the building, project teams may consider waste-toenergy, an increasingly common strategy to reduce land allocation to landfills. This focus would achieve goals on multiple levels and make the
most appropriate use of the grant money. From national advocacy programs promoting green schools to policy engagement with decision-makers in the White House and the U.S. Congress, as well as state houses and city halls across the country, USGBC is accelerating the uptake of policies and initiatives that enable and encourage market
transformation toward a sustainable built environment. Locate air intakes away from likely exhaust sources, such as idling vehicles or smoking areas. This upfront planning can help keep a project on schedule and on budget while protecting the project goals. Location includes these factors: •• NATURAL CONTEXT. One strategy is tiered demand
electricity pricing. 22 U.S. Environmental Protection Agency, Low Impact Development (2011), epa.gov/owow/NPS/lid/. The goal of credits addressing water efficiency is to encourage smarter use of water, inside and out. The flat, dark surfaces of roadways, parking lots, and tarred rooftops absorb and retain the sun's heat during the day and are slow
to radiate it at night. LEED encourages a wide variety of strategies to address energy consumption, including commissioning; efficient design and construction; efficient appliances, systems, and lighting; demand response, and the use of renewable and clean sources of energy, generated on-site or off-site. Trying to add green
features to a project late in the process is the most expensive and least effective approach. The careful consideration of all attributes may lead to the selection of products that did not at first appear to be the most sustainable option. How will the project meet those goals? •• PLAN FOR SMALLER, MORE COMPACT COMMUNITIES. Focus on building
frontage, ground-level façade, building height-to-street-width ratio, and sidewalks. Submeters report how much water is being used by systems and fixtures and alerts managers to leaks or other inefficiencies. Good lighting design considers the tasks to be done in a space, the orientation of the building, the layout of the room, the type of glass and
configuration of the windows, even the type of furnishings and colors of surfaces. S ECT IO N 2 The concept of feedback loops helps explain how systems work. The fields of biomimicry and permaculture provide two different and innovative approaches to solving problems by following nature's patterns and strategies. The elements of the system
(people, buildings), the flows within the system (of materials, money, and information), the rules that govern those flows (management and structures), and the functions of the system (providing goods or services, generating a profit) determine whether the company is a good place to work and will be sustainable over time. •• INSTALL SUBMETERS
S ECT IO N 4 LIGHTING, ACOUSTICS, AND OCCUPANT EXPERIENCE 79 Figure 4.5. Daylit Classroom. Strategic selection of plants creates wildlife habitat and supports integrated pest management (IPM), a sustainable approach that controls pest infestation and damage in an economical way while minimizing hazards to people, property, and the
environment. Such observations can also reveal avenues to new energy and cost savings. Invigorated by your morning ride and eager to start the day, you head into your office. For example, the purchase price of a car does not account for the wear and tear it will have on public roads or the pollution it will put into the environment. Increased
efficiency and savings come later. The building ownership and management structure, use and users, and relationship to the community need to be taken into account. HVAC System Buildings are part of a world of nested systems that affect and are affected by one another. Donella Meadows, Jørgen Randers, and Dennis Meadows, pioneers in the
study of systems and sustainability, describe this discipline in their book The Limits to Growth. • MAINTAIN SITE LIGHTING TO PREVENT LIGHT POLLUTION. The increased heat absorption in urban areas has several consequences: • The additional use of air-conditioning increases energy demand and costs. For a building this usually includes the
following costs: •• Initial purchase, acquisition, or construction •• Fuel •• Operation, maintenance, and repair •• Replacement •• Disposal (or residual value for resale or salvage) •• Finance charges •• Other intangible benefits or costs, such as increased employee productivity Life-cycle thinking can be applied to all decisions in green building, not
just products and buildings. Even small increases in productivity can dramatically increase the value of a building. For U.S. Environmental Protection Agency, The Inside Story: A Guide to Indoor Air Quality. Develop a robust preventive maintenance program to keep the building in optimal condition. •• What kind of buildings are on the site? When
designing buildings and communities, we must understand both the individual elements of the system and their relationships to each other as a whole. Although the longterm effects of climate change are uncertain, we know that sea levels will be higher, temperatures higher, droughts longer and more widespread, and flooding more intense. Here, the
integrative process measures performance and sets up feedback mechanisms. This includes thermal comfort, lighting and views, acoustics, and ergonomics. Specific qualifications to look for might be past participation in integrative design processes, experience on green or LEED-certified projects, and LEED professional credentialing, from LEED
Green Associate to LEED Accredited Professional. The crucial next step is data analysis: a knowledgeable team member should regularly review the data, look for trends, spikes, or unusual values that may identify areas needing attention or repairs. Provide a convenient refueling station on the site. However, there are many other parameters,
measurable or quantifiable characteristics of a system, that are relevant to sustainability but do not get measured or reported in effective ways. Environmental Building News, 16:9 (2007). Green building takes a life-cycle approach, looking at the entire life of a project, product, or service, rather than a single snapshot of a system. These ongoing
improvements to LEED are based on principles of transparency, openness, and inclusiveness involving volunteer committees and working groups, as well as USGBC staff, and are approved by a membership-wide vote. Buildings can also be designed to prevent future obsolescence; for example, a flexible floor plan can accommodate offices today and
apartments tomorrow. Provide the services that are most needed within communities and support a balance of jobs and housing. Designing a project to meet both current and evolving needs is one key to sustainability. How will you know if you are on the right track? •• What are the leverage points within the system? Increase the area of permeable
surfaces, such as vegetated roofs, porous pavement, and landscaped areas. Assembling the right team, establishing goals, and understanding the systems and metrics for success will help ensure that we move closer to a sustainable built environment. STRATEGIES FOR REDUCING THE HEAT ISLAND EFFECT: L EED CORE CON CEPTS G UIDE —
TH IR D E DIT I ON •• INSTALL REFLECTIVE ROOF SURFACES. INDOOR WATER USE L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON Indoor use encompasses water for urinals, toilets, showers, kitchen or break room sinks, and other applications typical of occupied buildings. You're Reading a Free Preview Pages 73 to 78 are not shown
in this preview. 40 Systems thinking and integrative principles encourage setting goals that go beyond deciding to seek specific LEED credits or a specific certification level. • PROMOTE SOURCE REDUCTION IN OPERATIONS. Rather than changing the elements of the system—the envelope of the structure, the mechanical system, the building
occupants, the electricity grid—the change focuses merely on delivering available data to a point where it can be acted on appropriately. In practice, however, value engineering is often synonymous with cost cutting and is typically focused on first costs only; systems that have higher first costs but lower operating costs and higher efficiency may be
abandoned. STRATEGIES FOR CONSERVING MATERIALS. Value engineering, a formal review based on the project's intended function and conducted to identify alternatives that reduce costs and improve performance, is a critical part of the
sustainable design process. Design the building envelope to insulate efficiently against heating and cooling losses. Together, they expanded programs to install energy efficient street lighting and added pocket parks, community gardens, fruit trees, bioswales and additional walking paths throughout the community. An experienced facilitator can
encourage people to voice their thoughts. • PROTECT AIR THAT COMES INTO THE BUILDING. University curricula are beginning to incorporate these skills, but it may be several years before green expertise becomes the norm. All other text, graphics, layout and other elements of content in the Guide are owned by USGBC and are protected by
copyright under both United States and foreign laws. This nonpoint source pollution, from diffuse land uses rather than a single facility, is one of the biggest threats to surface water quality and aquatic ecosystems. Making sure everyone has the necessary training and information and clearly understands his or her role is the key to successful
sustainable operations and maintenance programs. To achieve LEED certification, new buildings may not use CFC-based refrigerants, and existing buildings must complete a total CFC phase-out prior to project completion. Better indoor environmental quality can enhance the lives of building occupants, increase the resale value of the building, and
reduce liability for building owners. Unfortunately, it is not enough for green building to lessen the effects that humans have on our climate. Thus the commissioning agent is well positioned to follow the progress of the project in relation to established goals. Both can support more sustainable decision making, but they use different types of data and
provide different kinds of information. This guide is intended to set the foundation needed to develop green building expertise. •• MAINTAIN A RECYCLING PROGRAM. 33 LOOK BEYOND FIRST COSTS TO LONG-TERM SAVINGS. •• CONDUCT OCCUPANT SURVEYS. 1 A letter from the President, CEO and Founding Chair SECTION 1. Although
there are many ways to organize green building projects, this section uses some of the major categories associated with the LEED rating systems for organization: LOCATION AND TRANSPORTATION SUSTAINABLE SITES WATER EFFICIENCY ENERGY AND ATMOSPHERE MATERIALS AND RESOURCES INDOOR ENVIRONMENTAL QUALITY
INNOVATION S ECT IO N 4 Despite this organizational framework, many synergistic opportunities can be found both within and between categories. •• DESIGN SMALLER, MORE FLEXIBLE HOMES AND BUILDINGS. Establishing continuing education requirements for LEED Accredited Professionals ensures that the credential continues to
distinguish those building professionals who have a thorough understanding of green building principles and practices plus the environmental concerns that are most important for every region of the country, and LEED credits that
address those local priorities have been selected for each region. Optimize access to views by using low partitions and vision panels. Many of these solutions fall within the scope of low-impact development (LID) and Green Infrastructure (GI), approaches to land management that mimic natural systems and manage rainwater as close to the source as
possible.22 Common strategies include minimizing impervious surfaces, protecting soils, and enhancing native vegetation. GREENBUILD INTERNATIONAL CONFERENCE AND EXPO Greenbuild is the world's largest conference and exposition dedicated to green building. Credits also encourage smart transportation choices and access to a diversity
of uses. Unsustainable energy supply and demand have serious implications for everything from household budgets to international relations. •• MINIMIZE IMPERVIOUS AREAS. Ensure that fixtures are replaced according to the original
design. To achieve such goals, teams avoid up-lighting and over-lighting fixtures to prevent light trespass, the spilling of light beyond the project boundary. The structure of information flows (who does and does not have access to what kinds of information) 5. That example
illustrates four important points. You're Reading a Free Preview Page 28 is not shown in this preview. The second phase, design and construction, begins with what is conventionally called schematic design. The project team prepared a greenhouse Gas
Protocol. Lenssen "A Building Revolution: How Ecology and Health Concerns Are Transforming Construction," Worldwatch Institute, 1995). Ongoing commissioning for building operations ensures that a building continues to meet its fundamental operations ensures that a building some shown that certified green buildings for building some shown that certified green building some shown that certified green buildings for building some shown that certified green buildings for building some shown that certified green buildings for building shown that certified green buildings for building shown that certified green buildings for building shown that certified green buildings for buildings fo
command significantly higher rents. It is important to set goals for other issues as well, such as indoor air quality, human health, and habitat protection. Work with the waste hauler to allow for collection and composting of food and other organic materials. Joshua Joy Kamensky, CTG Energetics, Inc. Available resources, materials, skills, and
connections to utilities, roads and transit. The emissions from transportation are much less, and the relative amount from the building systems increases. When the room is sufficiently cooled, the thermostat sends a signal for the air-conditioning to stop. It breaks down disciplinary boundaries and rejects linear planning and design processes that can
lead to inefficient solutions. PROJECT CREDIT INTERPRETATION RULINGS AND LEED INTERPRETATIONS Project credit interpretation rulings (Project CIRs), administered by GBCI, allow teams to obtain technical guidance on how LEED requirements pertain to their projects. Lani Kalemba, CTG Energetics, Inc. S ECT IO N 3 Geographical
information systems (GIS) can help illustrate how different elements intersect and overlap. Your possession of the LEED core Concepts Guide: An Introduction to LEED and Green Building, Third Edition (the "Guide"), constitutes ownership of a material object and in no way constitutes a conveyance of ownership or entitlement to copyrighted
materials contained herein. Launched in 2002, it has become an important annual event for the green building industry. Use space sthat can serve multiple functions. •• How does energy get to the site? 84 About USGBC About LEED CONCLUSION. The bioregion
Limit culs-de-sac, prohibit gated communities, and use a street grid pattern. In addition to elements, their relationships, and the feedback loops among them, systems theory explores the emergent properties of a system—patterns that emerge from the system as a whole and are more than the sum of the parts. Given what the team has learned about
the project systems, its needs and resources, do the goals of the project make sense? It is helpful if the project experience; ideally, he or she is a LEED Accredited Professional. They need to be able to question one another—Why should
something be done the way it always has been done it in the past?—and then consider, what if...? RECs represent a tradable, nontangible commodity associated with the qualities of renewable electricity generation. Consider the number of occupants in each space and the activities they will be engaged in. Track performance goals and provide
feedback to the occupants. It requires consideration of whole communities and whole systems, both at home and around the world. How did they get there? This throughput of resources occurs at every phase of the life-cycle, creating a constant cycle of consumption and waste. By additionally pursuing LEED certification, the school's ENERGY STAR
rating improved to 87. 6 The triple bottom line requires a shift in perspective about both the costs and the benefits of our decisions. A lower-carbon future will not only have higher-performing buildings but also require higher-performing to services, such as shops, restaurants, schools, religious centers, grocery stores
parks, civic buildings, and recreational facilities. Effective stakeholder meetings involve both careful listening and openness to determine the most feasible and effective solutions for the community. Education can take various forms, such as occupant luncheons, educational events, or interpretive signage. ABOUT LEED L EED CORE CON CEPTS G
UIDE — TH IR D E DIT I ON LEED RATING SYSTEMS 86 Comprehensive and flexible, LEED is applicable to buildings at any stage in their life-cycles. DOWNLOADS OF THE GUIDE MAY NOT BE COPIED OR DISTRIBUTED. Operate ventilation systems to supply ample outside air to the occupants. Exams are updated periodically to ensure they stay
current with the latest green building knowledge and practice. "Reduce, reuse, recycle" may seem like the extent this work; and clearly, reducing consumption is critical, and reusing and recycling waste are important strategies. Even when this is not possible, as on many public projects, prerequisites identified in the RFP can help ensure that teams
are qualified. Project teams must look far ahead to determine what stressors a project is likely to encounter and then build resilience into the system. L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON Impervious surfaces, such as asphalt and concrete, prevent percolation and infiltration and encourage water runoff, causing soil erosion and in
some places sedimentation of local waterways. All project activity, including registration and credit compliance documentation, is completed in LEED Online, a data collection portal through which the team uploads information about the project. For example, sustainable neighborhood design strategies might be analyzed by land-use planners, traffic
engineers, civil engineers, infrastructure designers, public health experts, and developers. Hunter Lovins Natural Capitalism This type of feedback loop because embedded in the system's response to a change is a signal for the system to stop changing when that response is no longer needed. Evaluate results to
identify areas of dissatisfaction and prepare a corrective action plan to make the necessary operational changes. The more integrated the design begins with a thorough assessment of the site. LEED awards points for projects that entirely
avoid the use of refrigerants or select refrigerants or select refrigerants or select refrigerants or select refrigerants that balance concerns about ozone depletion and climate change. Renewable energy production typically involves a system that generates clean electricity, such as solar photovoltaic panels that convert the sun's energy into electricity. Because the goals have been thoroughly explored and woven
throughout the process, projects can be executed more thoughtfully, take advantage of building system synergies, and better meet the needs of their occupants or communities, and ultimately save money, too. Negative feedback loops enable a system to self-correct and stay within a particular range of function or performance. A project that is
connected to the community by pedestrian paths and bicycle lanes encourages people to walk or bike instead of drive, not only helping to reduce air pollution, but also promoting physical activity. The green building movement strives to effect a permanent shift in prevailing design, planning, construction, and operations practices, resulting in lower
impact, more sustainable, and ultimately regenerative built environments. Water reduction is typically achieved through more efficient appliances, fixtures, and fittings inside and water-wise landscaping outside. Regardless of substantial investments in technology and alternative energy, poor planning can still cause a net increase in greenhouse gas
emissions as commuters weigh options for how they travel to and from work, school, home, and errands. L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON In the built environment, roads and infrastructure built out to the urban fringe often result in a positive feedback loop of increased development. First applied to socially responsible
business, the term can characterize all kinds of projects in the built environment. Data should document a project's on-going pursuit of sustainability goals. There are many tools that can support this effort, such as systematic data collection and analysis and mapping. The requirements are considered throughout the building design and construction
process and become the baseline for evaluation. When strict air quality control measures are enforced, waste-to-energy can be a viable alternative to extracting fossil fuels to produce energy. Neighborhood pattern and design strategies are those that help make a project easy to navigate, accessible, and appealing to pedestrians. These are distinct
 approaches with different methodologies but are often confused. Rainwater management can also include the collection and reuse of water for nonpotable purposes, such as landscape irrigation, toilet and urinal flushing, and custodial uses. 55 SUSTAINABLE SITES A site's relationship to the local bioregion, watershed, and community will help
determine how a project can contribute to a sustainable environment. 92 To keep their credentials current with best practices, and demonstrate that their expertise is meaningful in a rapidly transforming marketplace. Commissioning
is the process of verifying and documenting that a building and all its systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the owner's project requirements. Process water also includes the water used for certain business operations (e.g., washing machines, dishwashers). Appropriately sized and located
windows can dramatically increase the amount of daylight introduced into a space; clerestory windows, light shelves, and reflective paint and materials bounce and diffuse the natural light. Site design also plays an important role in helping projects adapt to the effects of climate change. At times a project team may want clarification, further
guidance, or additional ways to comply with the rating system's requirements. S ECT IO N 4 WASTE MANAGEMENT 73 L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON Figure 4.3. Construction Activities can Produce Significant Waste 74 The intent of LEED credits in this category is to reduce the waste that is hauled to and disposed of in
 landfills or incineration facilities. Furthermore, large amounts of wastewater can overwhelm treatment facilities, and the untreated overflow can contaminate rivers, lakes, and the most recent Greenbuild Conference with your peers
and professors. The operation of buildings, including landscaping, accounts for approximately 47 billion gallons per day—12% of total water use.23 As residential, commercial, industrial, and other development expands, so does the use of the limited potable water supply, water that is suitable for drinking. An operable window may make office
workers more comfortable than a sealed environment maintained at ideal temperatures simply because it gives them some control over excessive brightness and glare. Both of these fields of practice ask: how would nature solve this? In mechanically ventilated buildings
provide thermostats that allow occupants to control the temperature in their immediate environment. NEIGHBORHOOD PATTERN AND DESIGN Community layout and planning influence occupants' and residents' behavior while setting a standard for future development. Although the term "integrative design" is most often applied to new
that minimize solar gain in summer and maximize it in winter •• Adjacent buildings can be designed to shade and insulate each other •• Building designs that incorporate passive strategies, like daylight, thermal mass, and natural ventilation, reduce the demand for artificial lighting, heating, and cooling •• Technologies and processes can be used to
help occupants understand their patterns of energy consumption and reduce both individual and aggregate energy demand. In addition to reducing demand, green building encourages sustainable methods for meeting energy demand In addition to reducing demand, green building encourages sustainable methods for meeting energy demand.
marked a watershed: for the first time Chicago office employees are now able to occupy a single, contiguous 60,000 square foot floor that spans two buildings. This type of high-level goal needs to be accompanied by metrics, things that can be measured, and targets, levels of achievement that should be reached. As you pass through a common area
you see a group of coworkers deep in a collaborative work session. Although LCA does not address all potential effects, it provides a comprehensive picture of the life-cycle. Whether that means measurement tools designed for daily use by maintenance staff, clear and accessible resource materials for occupants and residents, or collection and
present the proposed project. Strategies and practices rewarded as innovative today may become credits in future rating systems. 82 •• Creating, implementing, and maintaining a program for occupants or other stakeholders to divert a significant amount of waste generated from outside sources to appropriate recycling locations. It requires asking
where do building materials and resources come from? For example, a typical code-compliant 135,000-square-foot office building in a car-oriented suburban location will be responsible for approximately 8,375 tons (T) of carbon, or 11.8 T per person. Include furniture that is adjustable to prevent repetitive stress injuries. The commitment to green
place. L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON • LIMIT PARKING. The mindset or paradigm out of which the system—its goals, structure, rules, delays, parameters—arises L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON 1. Good site design benefits the project by creating synergies between building and site, and it also
benefits the larger community through strategies such as rainwater management and habitat conservation. FOLLOW THROUGH. Electricity usage has been effectively reduced 63% over a seven-year period. S ECT IO N 4 •• USE FREE ENERGY. Eichholtz, N. Buildings are on the front line of this issue because of their high consumption of energy.
pulp process Sustainable New books forestry printed using practice 100% post-consumer waste Transported to a local mill Books distributed locally Paper transported on hybrid trucks to local printer Figure 2.5. Considering a Product's, by-products, by-products, and outputs (wastes, by-products),
from the extraction and processing of raw materials and recycled feedstocks, the transportation of these materials, and the manufacturing and packaging of the product to its use, maintenance, and finally its recycling or disposal. Green building pursues solutions that represent a healthy and dynamic balance between environmental, social, and
•• Communication between meetings often breaks down •• People may be resistant to green goals •• Participants can balk at the iterative, integrative process •• Traditionalists may resist the up-front loading of modeling, testing of assumptions, and analysis •• People may be reluctant to embrace new technologies 18 Importantly, experts interviewed
for the article noted that they got better at the process over time, especially when they were able to work with the same project team members on more than one project. One-on-one conversations prior to the event are often useful in gaining initial trust and confidence. The strength of negative feedback loops, relative to the impacts they are trying to
correct against 7. The USGBC was formed in 1992, a time when the field was beginning to define itself, to promote and encourage green building. Institute a no-smoking policy for the building and around building entrances, operable windows, and air intakes. COMMUNITY S ECT IO N 5 The USGBC community comprises member organizations that
participate in forums, exchanges, and regular communication. Over the course of a project, especially a long and targets evolve. •• MONITOR CARBON DIOXIDE. 65 STRATEGIES FOR REDUCING ENERGY DEMAND IN OPERATIONS AND MAINTENANCE: •• USE FREE ENERGY. PROJECT REGISTRATION The LEED process
begins with registration. Assume that a project team has conducted a waste stream audit and tracked 300 pounds of waste, consisting of the following: Trash and wet waste Pounds Percentage 200 68 Paper 60 20 Cardboard 25 8 Plastic 6 2 Metal 5 1 Glass 4 1 L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON Because 28% of the waste stream
is recyclable paper and cardboard paper, the project team should provide recommendations to improve the recycling rate and source reduction of these items. You're Reading a Free Preview Pages 33 to 59 are not shown in this preview. USGBC's Vision Buildings and communities will regenerate and sustain the health and vitality of all life within a
generation. For new construction, early means before the site is selected and before the team is selected, if possible. To minimize the introduction of contaminants, outline procedures and operations process. Through its location, a
building can meet the needs of the local community, support active street life, and promote healthy lifestyles. In Portfolio Manager, a score of 50 represents average building performance. The project team's collaborative approach to solving problems contributed to its successful achievement of LEED Platinum certification. In general, the evaluation
and selection phase of a sustainable design process involves listing all types of strategies and technologies that might make sense. Although documentation may take time, it is necessary so that achievement of sustainability goals can be verified. To design sustainable systems, we must understand the positive and negative feedback loops already in
existence or those we set in motion, to ensure systems remain stable and habitable over time. Next, the project team and major stakeholders should engage in an initial goal-setting discussion, building upon the owner's initial ideas. The following project types and scopes are addressed by LEED rating systems: LEED FOR Building Design and
Construction LEED FOR Interior Design and Construction LEED BD+C: New Construction LEED BD+C: New Construction LEED BD+C: Healthcare LEED BD+C: Hospitality LEED BD+C: Schools LEED BD+C: New Construction LEED BD+C: Hospitality LEED BD+C: Hospitality LEED BD+C: New Construction LEED BD+C: Hospitality LEED BD+C: Hospitalit
Warehouses and Distribution Centers LEED BD+C: Homes LEED BD+C: Homes LEED BD+C: Hospitality LEED O+M: Centers LEED ID+C: Retail LEED ID+C: Retail LEED ID+C: Retail LEED ID+C: Hospitality LEED O+M: Schools LEED O+M: Retail LEED ID+C: Mospitality LEED O+M: Centers LEED ID+C: Mospitality LEED O+M: Retail LEED ID+C: Mospitality LE
LEED ND: Plan LEED ND: Built Project Figure 5.1. LEED Rating Systems RATING SYSTEM STRUCTURE S ECT IO N 5 The LEED rating systems consist of prerequisites and credits. Are there other ways to meet those goals by finding other leverage points in the systems? Design district heating systems, in which multiple buildings are
Ana FB Omaha DHS 0 Greeneville CH 20 Fresno CH/FB 40 Knoxville FB L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON 60 Youngstown CH/FB 80 The study concluded that the federal government's green buildings outperform national averages in all measured performance areas—energy, operating costs, water use, occupant satisfaction,
and carbon emissions. As with any break with tradition, barriers and obstacles can arise when a team uses an iterative process. Baumert, T. The concepts of green building are valid for many types of building are valid for many types of buildings at all stages of development and questions will likely arise as you begin to apply them. Commercial building are valid for many types of buildings at all stages of development and questions will likely arise as you begin to apply them.
selecting efficient cooling towers, chillers, boilers, and other equipment, and by substituting harvested rainwater and publications. USGBC's diverse delivery formats, including webinars and publications, make learning about green building accessible to all. The software permits energy and water use to be tracked—and
adjusted—in detail, and also reports total CO2 emissions. •• Are there roads? Discussion questions and activities must be designed to meet those goals. Inspired by your stories, the team decides to plan an on-campus sustainability conference in the months ahead. For existing buildings, information may be obtained through occupant surveys, and the survey occupant surveys occupant surveys of the survey occupant surveys occupant s
walkthroughs, and audits. This comprehensive goal-setting process encourages programs and policies that will lead to sustainable communities. 76 INDOOR ENVIRONMENTAL QUALITY Indoor Environmental Quality (EQ) encompasses the conditions inside a building—air quality, lighting, thermal conditions, acoustics, and their effects on occupants.
You're Reading a Free Preview Pages 8 to 21 are not shown in this preview. Experts identified characteristics and performance levels that contributed to a definition of a green building. Credentialing as a LEED for Homes Green Rater is also available. In the United States, buildings account for: •• 14% of potable water consumption1 •• 30% of waste
output •• 40% of raw materials use2 •• 38% of carbon dioxide emissions •• 72% of electricity consumption3 1 2 3 J.F. Kenny, N.L. Barber, S.S. Hutson, K.S. Linsey, J.K. Lovelace, & M.A. Maupin. The certification reviewer may request additional information or clarification. APPLICATION PREPARATION Each LEED credit and prerequisite has
documentation requirements that must be completed as part of the application process. You can learn more about Villa Alegre at usgbc.org/projects/villa-alegre-phase-1-2-0. The credentials differentiate professionals in a growing and competitive industry, allow for varied levels of specialization, and give employers, policy makers, and other
stakeholders an indication of individuals' level of competence. Native and adapted species support water efficiency goals because these plants typically don't need to be irrigated. •• INCLUDE STREET TREES, shade, benches, and other amenities for pedestrians. Many common sources generate indoor air contaminants: 77 •• Combustion processes in
HVAC equipment, fireplaces and stoves, and vehicles in garages or near entrances •• Radon or methane off-gassing from the soil underneath the building naterials •• Cleaning products •• Radon or methane off-gassing from the soil underneath the building naterials •• Cleaning products •• Pollutants tracked in on occupants
shoes •• Occupants (bioeffluents) and their activities The best way to prevent indoor pollutants is to eliminate or control them at the sources. Although the information contained in the Guide is believed to be reliable and accurate, the Guide is provided as-is with no warranty of any kind, either expressed or implied including, but not limited to, the
implied warranties of merchantability, warranties of accuracy or completeness of information, warranties of suitability or fitness for a particular purpose and/or warranties of suitability or fitness for a particular purpose and/or warranties of suitability or fitness for a particular purpose and/or warranties of suitability or fitness for a particular purpose and/or warranties of suitability or fitness for a particular purpose and/or warranties of suitability or fitness for a particular purpose and/or warranties of suitability or fitness for a particular purpose and/or warranties of suitability or fitness for a particular purpose and/or warranties of suitability or fitness for a particular purpose and/or warranties of suitability or fitness for a particular purpose and/or warranties of suitability or fitness for a particular purpose and/or warranties of suitability or fitness for a particular purpose and/or warranties of suitability or fitness for a particular purpose and/or warranties of suitability or fitness for a particular purpose and/or warranties of suitability or fitness for a particular purpose and/or warranties of suitability or fitness for a particular purpose and/or warranties of suitability or fitness for a particular purpose and or suitability or fitness for a particular purpose and or suitability or fitness for a particular purpose and or suitability or fitness for a particular purpose and or suitability or fitness for a particular purpose and or suitability or fitness for a particular purpose and or suitability or fitness for a particular purpose and or suitability or fitness for a particular purpose and or suitability or fitness for a particular purpose and or suitability or fitness for a particular purpose and or suitability or fitness for a particular purpose and or suitability or fitness for a particular purpose and or suitability or fitness for a particular purpose and or suitability or fitness for a particular purpose and or suitability or fitness for a particular purpose and or suitabili
building performance with performance with performance goals, design specifications, and most importantly, the owner's requirements. Involve building occupants in energy efficiency strategies. Achieving true sustainability requires a new approach to creating and caring for the built environment. They look for ways to make connections to the immediate site, the
surrounding watershed, or ecological features and promote their healthy evolution. Imagine getting to your desk and sitting down without flipping a light switch—the huge floor-to-ceiling windows nearby provide plenty of natural springtime light, and if it gets cloudy this afternoon, sensors in your work area will kick on overhead lighting to an
appropriate level of brightness. If people can take public transportation, ride bicycles, or walk to the building, the project helps reduce the carbon emissions associated with commuting. Systems include materials, resources, energy, people, and information, as well as the complex interactions and flows between these elements across space and
through time. Through the integrative process, green building project teams can identify opportunities for employing synergistic strategies. Impervious areas found in the built environment include concrete, brick, stone, asphalt, and sealed surfaces. Avoid up-lighting, glare, and trespass by using shielded fixtures and strategic lighting design. The
most obvious way to learn about a place is to spend time there, preferably at different times of day and in different times of day and d
accurate data are used to modulate systems. On-going measurement and verification are essential to identifying opportunities for improvement. This policy should specify a target diversion rate for the general contractor. •• INCLUDE APPROPRIATE ACOUSTIC DESIGN. Enforce a no-smoking policy in the building and around building entrances
operable windows, and air intakes. Careful documentation helps capture the lessons learned on the project so that they can be applied in the future—either within the timeline of that project or on subsequent green building projects. Behrens III. Low cubicle partitions allow daylight to travel to the core spaces while permitting views of the outdoors
PROJECT CASE STUDY NORTHWEST GARDENS LEED GOLD S ECT IO N Northwest Gardens (NWG) is a transit-rich affordable housing development adjacent to downtown Fort Lauderdale, FL. 28 Life-cycle assessment (LCA), and to cost considerations, or
lifecycle costing (LCC). Give preference to locations that do not include sensitive site elements and land types. The project team succeeded in making 97 of the 111 units affordable, despite the difficult economic conditions at that time. They are generally composed of existing team members but may require outside experts. Getting to green and
beyond requires more than learning about new technologies and strategies can provide real opportunities to reduce material usage. This framework encourages green building practitioners to view projects as
the way sites are developed? When applied properly, the integrative process reveals the degree to which LEED credits are related, rather than individual items on a checklist. ABOUT USGBC is transforming the building landscape in a number of ways. This policy should specify standards for selecting cleaning products and technologies, such
as Green Seal standards, California Code of Regulations, and certification of cleaning equipment from the Carpet and Rug Institute. Green building encourages innovative water saving strategies that help projects use water wisely. Captured rainwater, or municipal reclaimed water is suitable for irrigation. STRATEGIES TO REDUCE
WASTE DURING OPERATIONS AND MAINTENANCE: • • DEVELOP A SOLID WASTE MANAGEMENT POLICY. Choose vendors who promote source reduction through reusable or minimal packaging of products. By reducing glare and contrast between light and dark areas, which can diminish night vision, smart lighting design can actually improve the contrast between light and dark areas, which can diminish night vision, smart lighting design can actually improve the contrast between light and dark areas, which can diminish night vision, smart lighting design can actually improve the contrast between light and dark areas, which can diminish night vision, smart lighting design can actually improve the contrast between light and dark areas, which can diminish night vision, smart lighting design can actually improve the contrast between light and dark areas, which can diminish night vision, smart lighting design can actually improve the contrast between light and dark areas, which can diminish night vision, smart lighting design can actually improve the contrast between light and dark areas, which can diminish night vision, smart lighting design can actually improve the contrast between light and dark areas, which can diminish night vision, smart lighting design can actually improve the contrast between light and dark areas.
site safety while maintaining views of the stars and decreasing stress to nocturnal animals. Depending on the environmental issues that are most critical in a particular area, location can influence a project team's priorities. Specific strategies will be discussed in Section 4 of this guide. And whether we notice it or not, our built environment plays a
huge role in our natural environment, our economic environment, our economic environment, and our cultural environment, and ou
between these two based on this information would require revisiting the team goals. As discussed earlier in this section, a building whose occupants must drive long distances may contribute to greenhouse gas emissions, as well as destruction of natural habitat for infrastructure development. Similarly, the culture of a company emerges from the
people who work there, the buildings in which they work, the services or products they provide, the way they receive and process information, the management and power structure, and the financial structure, and the financial structure, and the management and power structure, and the management and power structure, and the financial structure, and the financial structure, and the financial structure, and the management and power structure, and the financial structure, and the 
energy. It might be necessary to bring the stakeholders from these departments together to establish mechanisms for interdepartmental and collaborative decision making and funding. Choosing a building's site and managing that site during construction are important considerations for a project's sustainability. •• USE HIGH-EFFICIENCY
INFRASTRUCTURE. Imagine being a green building professional. STRATEGIES FOR SUSTAINABLE NEIGHBORHOOD PATTERN AND DESIGN: •• DESIGN WALKABLE STREETS. Adaptive reuse is the practice of redesigning and using a structure for a use that is significantly different from the building's original use. You are back on campus, sitting
at your own oak table, in your school's LEED Platinum student activities center. The lack of parking spaces on the project site will spark interest in alternative transportation options. •• MONITOR, TRACK, AND REPORT. Additionally, this person brings the group back to explore how proposals will either further or hinder achievement of the project
goals. Reductions in irrigation can be achieved by specifying water-wise landscaping and water-efficient irrigation technology, using nonpotable water, and installing submeters to track and log irrigation technology, using nonpotable water, and installing submeters to track and log irrigation technology, using nonpotable water, and installing submeters to track and log irrigation technology.
reducing the project's energy use and offsetting emissions by purchasing renewable energy credits. Develop a conservation management program to make sure that the natural environment is protected. The waves emerge as a result of the interactions and relationships among the elements. Building commissioning helps project teams ensure that
systems are designed efficiently, are installed appropriately, and operate as intended. The practice of investigation of high-risk ideas can
lead to the most innovative aspects of a project. WHAT IS GREEN BUILDING? In the context of the built environment, systems thinking allows us to explore and support the rich interactions that make healthy, thriving, and sustainable communities. Roads that are designed for only motor vehicles do not provide the flexibility or adaptability of a
transportation network designed for diverse travel modes. Monitor compliance to ensure that the policy is effective. Thus indoor air quality can be significantly worse than outside. Feedback loops are built into the entire process favors are built into the entire process. When setting up charrettes, then, include all relevant stakeholders and experts. S ECT IO N 3 The team process favors are built into the entire process.
design-build or integrative project delivery (IPD) contracting process rather than traditional design-bid-build, in which the contractors are brought in after many elements of the project have been determined. The first LEED green building rating system was launched in 2000. Where summer heat is already high, green builders will have to consider
what will happen with even hotter temperatures and ensure that the cooling strategies of buildings can handle higher degree-days and still maintain air quality, which will be exacerbated at higher temperatures. LEED IN PRACTICE LEED for Building Operations & Maintenance encourages building managers to embrace new attitudes toward waste
and close the life-cycle loop by reusing and recycling on-site materials. •• DESIGN FOR PROPER VENTILATION. STAKEHOLDER MEETINGS are held with neighbors, community members, and others with a vested interest in the project. Design the building to provide ample access to natural light and views for the occupants. For more information
about credit weightings, see LEED v4 Impact Category and Point Allocation Process Overview: usgbc.org/resources/leed-v4-impact-category-and-point-allocation-process-overview S ECT IO N 5 CREDIT WEIGHTINGS 89 Natural Resources Community Green Economy Biodiversity Water Resources Human Health Climate Change Figure 5.2. Relative
by encouraging communication up front and bringing people together for highly productive collaborative work sessions. Meaningful data gathering and interpretation often require the expertise of technical specialists, such as hydrologists, ecologists, ecologists, engineers, economists, and anthropologists. For example, the largest federal property owners, the
Department of Defense and General Services Administration have policies in place to pursue LEED certification in the new construction and major renovation rating system. Each year, tens of thousands of professionals convene to take part in educational sessions, tour green buildings, and view exhibits of green products and technologies. The triple
systems like LEED that continue to pave the way, continually raising the bar for leadership. LEED RATING SYSTEMS ADDRESS PROJECT SITE DESIGN AND MAINTENANCE THROUGH MANY TOPICS, INCLUDING THE FOLLOWING: LEED CORE CON CEPTS G UIDE — TH IR D E DIT I ON •• Site design and management 56 •• Rainwater
Through the integrative process, project teams can more effectively use LEED as a comprehensive tool for identifying interrelated issues and developing synergistic strategies. Install new high-efficiency fixtures, including high-efficiency fixtures, including high-efficiency lavatories, kitchen sinks and showers, dual-flush toilets, waterless urinals, and composting toilets. Natalie
Bodenhamer, CTG Energetics, Inc. EQ systems must be evaluated and adjusted once the building is occupied. Before the widespread availability of inexpensive fossil fuels for energy use and transportation, builders understood the principles of passive design, capturing sunlight and wind for natural lighting, heating, and cooling. STRATEGIES FOR
DEVELOPING A SUSTAINABLE SITE DESIGN: • MINIMIZE HARDSCAPE. Tools and databases used in conducting LCAs are available from sources in the U.S. government and the private sector. The Department of Environmental Resources in Prince George's County, Maryland, for example, uses LID control measures that integrate five
components: site planning, hydrologic analysis, integrative management practices, erosion and sediment control, and public outreach. Purchased electricity Purchased heating/cooling Purchased heating/cooling Purchased heating/cooling Purchased steam SCOPE 3 Greenhouse gas emissions from sources not owned or directly controlled by a Federal agency but related to agency activities. Similarly
                    practitioners can use the core concepts addressed in this section to determine the nature of the systems in which they are working, meet the needs of the community, and set goals and priorities for the project. Each LEED rating system corresponds to a LEED reference guide that explains credit criteria, describes the benefits of
complying with the credit, and suggests approaches to achieving credit compliance. The LEED rating system has always been implicitly weighted by virtue of the different point values assigned to each credit and category. Most buildings have thermostats to provide information and control temperature. The first was to benchmark the school's
performance against other surrounding schools. •• GIVE OCCUPANTS TEMPERATURE AND VENTILATION CONTROL. Select plants that are native to the area both to reduce water use and to provide habitat for local birds and other species. FOR EXAMPLE: •• Locating homes near jobs and designing safe, pedestrian-friendly streets can
encourage people to walk, both reducing vehicle emissions and improving their health • Orienting buildings appropriately on a site and designing them to catch sunlight for heating and illumination and natural breezes for cooling
and ventilation can save energy, improve indoor air quality, and even increase workers' productivity • Composting improves the quality of the soil and reduces greenhouse gas emissions related to trash hauling Practitioners of an integrative process must develop new skills that might not have been required in their past professional work: critical
thinking and questioning, collaboration, teamwork and communication, and a deep understanding of natural processes. The sizes of buffers and other stabilizing stocks, relative to their flows 10. In many cases, green buildings can even enhance the health of the environment and the people who use them. The filters should have high minimum
efficiency reporting value (MERV) ratings. Orient the facility to benefit from natural ventilation, solar energy, and daylight. The dimension of longevity distinguishes green building from conventional building from conventional building from conventional building practice, which may fail to think across time, and helps create communities and building from conventional 
to modern energy codes (ASHRAE 90.1-2010), more than twice as much energy is used by commuters than by the building 10 10 Flexibility and adaptability are increasingly important attributes of green projects. Limit street speeds. Different goals may require different champions, depending on the complexity of the project. L EED CORE CON
CEPTS G UIDE — TH IR D E DIT I ON A comprehensive, life-cycle approach improves the ability to address potentially important environmental and human health concerns. Ideally, innovation is a byproduct of the green building process discussed in this guide. Use hauler reports or other reliable data to monitor and track the effectiveness of the
policy. Some practitioners have begun to explore what it would mean to move beyond "sustainable" and participate as a positive developmental force in our ecosystems and communities. 46 As in all phases of a green building process, any changes made during implementation should be carefully documented. The Materials and Resources (MR) credit
category focuses on minimizing the embodied impacts associated with the entire life-cycle of building materials. The specific steps involved in the integrative process will be addressed in Section 3. Each goal may have multiple metrics and targets. 51 LOCATION AND TRANSPORTATION The location of a building is as important as how it is built. ••
PROMOTE CONNECTIVITY. The use of reflective materials and those with high SRI values reduces heat gain, thus increasing comfort and reducing demand for air-conditioning. However, the charrette also needs to be flexible enough to allow for the emergence of extraordinary ideas. The company would be responsible for maintaining the carpet over
time, replacing worn areas, and disposing of any "waste." This shift served as a leverage point to enable the company system to change radically toward sustainability, reducing waste, and improving performance of the product while maintaining profit. L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON •• SPECIFY LOW-EMITTING
MATERIALS. The boundaries of a system depend on what we are looking at, and most systems are actually systems within systems. Encourage paper conservation through double-sided and electronic printing. Avoid triggering suburban sprawl and unnecessary materials use by consolidating development along existing roads, power lines, and water
supplies. With demandcontrolled ventilation, air flow is automatically increased if concentrations exceed a setpoint. To meet energy goals, the project team used a web-based monitoring system, developed partly with Adobe software. What is the economic system within the project? To learn more about Northwest Gardens visit
usgbc.org/projects/northwest-gardens Courtesy of The Housing Authority of the City of Fort Lauderdale 13 Selecting a location is one of the earliest decisions made in a project, and this decision defines many of the opportunities and constraints that the project team will encounter. It is a process by which today's "best practices" become tomorrow's
standard practices, a rising foundation for ever-higher levels of performance. L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON •• Minimizing landfill waste by reducing construction debris and following a waste management plan that addresses waste separation and hauling, also saving costs. Instead of buying carpet, customers could buy the
service of the carpet, which would be owned by Interface. S ECT IO N 2 Nature has much to teach us about applying systems thinking, a life-cycle approach, and integrative processes to our work. In 2008 the project team earned a LEED platinum certification for Existing Buildings: Operations & Maintenance. Life-cycle thinking can help a team make
informed, defensible decisions. Brownfield sites, in particular, can actually improve environmental performance. • • USE ENERGY SIMULATION. This waste may be transported to landfills, incinerated, recycled, or composted. Through a confidential survey, occupants can rate the heating and airconditioning, acoustics, air quality, lighting levels,
cleanliness, and other aspects of their work spaces. Credits are analyzed against these categories and awarded points accordingly). Using local materials not only reduces the environmental harms associated with transportation, it also supports the local economy. 25 E. One such study, conducted by the New Buildings Institute, investigated 121 LEED-
certified commercial office buildings in the United States and found that they used 24% less energy than the national average. The process should involve rigorous questioning and coordination and challenge typical project assumptions. • Preventing air and water pollution by addressing dust and implementing a construction activity pollution
prevention plan. Accordingly, such projects contribute to the healthy coevolution of humans and all life in that place. Research is needed to determine the impacts of a given project and find new solutions that are truly sustainable. ON-GOING PERFORMANCE The construction and operations of green building and neighborhood projects are never
really complete. 52 LEED RATING SYSTEMS ADDRESS PROJECT LOCATION AND DESIGN THROUGH THE FOLLOWING TOPICS: •• Location •• Transportation •• Neighborhood pattern and design LOCATION A good project site channels development into places where it will improve, rather than degrade, the triple bottom line. Use materials with
low VOC emissions. The LEED rating systems give project teams flexibility when considering site-specific needs and opportunities for alternative transportation. Providing building occupants with real-time energy information is an L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON example of using a leverage point to alter behavior. Ideally,
evaluation of bids is based on the best low bid rather than the lowest bid. The weightings ensure that LEED assigns higher point values to the credits with the strongest relationship to the impact categories of greatest concern (See Figure 5.2, which shows the relative importance given to each environmental impact category. It encourages and
accelerates adoption of sustainable building and community development practices through the creation and implementation of a green building benchmark that is voluntary, consensus based, and market driven. It must also prepare us for the inevitable consequences of climate change on our homes, communities, and society as a whole. Clearly, the
water balance approach is more achievable for projects that receive more rain and require less irrigation. Just as with regular tune-ups and scheduled maintenance on an automobile, regular inspections and maintenance ensure that all building systems are performing well and continue to meet sustainability goals throughout the life of the project. 90
Both distinct and complementary to green building rating systems such as LEED, green building codes are redefining the fundamental protections that are the basis of smart public policy. After they have been used inside the city, they are released as waste in the form of sewage, solid waste, and pollution. Look for third-party certifications, such as
the Forest Stewardship Council, Green Seal, and ENERGY STAR. Additionally, the LEED Pilot Credit Library plays an important role in the evolution of LEED. A project team that cannot purchase green power from renewable energy projects around the country.
The goal-setting process will be discussed in Section 3. 31 32 L EED CON CORE CON CEPTS — TH E DIT I ON L EED CORE CEPTS GU ID E G—UIDE T HIRD EDIR ITD I ON Section 3. 31 32 L EED CON CORE CON CEPTS — TH E DIT I ON L EED CORE CEPTS GU ID E G—UIDE T HIRD EDIR ITD I ON Section 3. 31 32 L EED CON CORE CEPTS — TH E DIT I ON L EED CORE CEPTS GU ID E G—UIDE T HIRD EDIR ITD I ON Section 3. 31 32 L EED CON CORE CEPTS — TH E DIT I ON L EED CORE CEPTS GU ID E G—UIDE T HIRD EDIR ITD I ON Section 3. 31 32 L EED CON CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS GU ID E G—UIDE T HIRD EDIR ITD I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED CORE CEPTS — TH E DIT I ON L EED
and renovation of buildings and communities. They do not need to be multidisciplinary unless appropriate for the task. All the costs and benefits of a project on the natural environment, locally and globally • PROFIT (ECONOMIC CAPITAL). Use of the concepts, examples and information contained in the Guide is at the user's own risk. Plentiful
opportunities exist to reduce the harms associated with materials. Optimizing components in isolation tends to pessimize the whole system— and hence the bottom line. Indoor air quality must be maintained throughout the life of a building to protect occupants on an ongoing basis. The theory behind systems thinking has had a profound effect on
many fields of study, such as computer science, business, psychology, and ecology. Albert Einstein This section reviews three major concepts that are integral to green building and sustainability: systems thinking, life-cycle thinking, life
EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON •• CREATE INCENTIVES FOR OCCUPANTS AND TENANTS. Use street trees, shrubs, and landscaping to reduce heat island effects through evapotranspiration and provide shade. However, even if initial performance is optimal, emissions will rise as performance falls over time. A sustainable
project serves more than the immediate needs of the building. In addition to admitting daylight, windows that let people focus their eyes across a longer distance and see the outdoors may play a role in occupants' comfort. ONGOING ENERGY PERFORMANCE Attention to energy use does not end with the design and construction of an energy-
efficient building. Before starting any project, the team can explore these systems by asking questions. This may be most applicable when addressing a project's use of refrigerants, substances used in cooling of systems. In Rome, for example, the roadways that existed in ancient times have become today's automobile roads. 23 S.S. Hutson, N.L.
Barber, J.F. Kenny, K.S. Linsey, D.S. Lumia, and M.A. Maupin, Estimated Use of Water in the United States in 2000 (2004), pubs.usgs.gov/circ/2004/circ1268/pdf/circular1268.pdf. S ECT IO N 2 With future implications of the built environment in mind, we must rethink the processes we use at all phases of the life-cycle. For example, when designing a
new waste management program in a town that has only two waste haulers, the choice may seem simple. 4 5 Turner, C. 35 team, particularly stakeholders in the community, might need encouragement to attend and a commitment that their voices will be heard. Continuous monitoring is required to identify needed improvements and users' changing
needs. Sustainability is not a one-time treatment or product. The Advanced Placement Environmental Science students conducted a sweep of the school to measure water flow from all faucets and showers. This practice helps limit the amount of land covered by buildings, pavement, or infrastructure while also making more efficient use of the space
within existing communities. In either case, the goals of the project must be clear and the needs and resources must be clearly identified so that the building can be carefully integrated into its context and support a thriving and sustainable local community. Pilot credits are tested across all rating system types and credit categories and include credits
proposed for the next version of LEED. Projects incorporating these strategies and achieving exemplary levels of performance are rewarded with innovation credits. STRATEGIES FOR REDUCING OUTDOOR WATER USE: •• CHOOSE LOCALLY ADAPTED PLANTS. Consolidate development by increasing the number of units of residential space and
square feet of commercial space per acre. Misinformation is common among products because it is difficult to compare two products with different sustainable attributes. •• PROTECT MATERIALS AND EQUIPMENT. Users enter data on electricity and natural gas consumption, along with other supporting information, into a web-based tool. ••
DESIGN FOR ENTRYWAY SYSTEMS. Since charrettes are generally designed to result in a concrete product, an agenda and clear goals are more effective if facilitated by a neutral party who encourages all team members to speak up. GREEN BUILDING OVER TIME Green projects must be prepared to
adapt to future change and be designed and operated to stand the test of time. Institute an on-site composting professionals will have to assess the likely threats to their communities and respond accordingly. Even
take-out food service products (paper plates, napkins, cups, etc.) are compostable. A target associated with that metric might be that all paints have zero VOCs. There are many attributes to indoor air quality, so in addition to addressing the potential sources of pollutants (such as materials that emit VOCs), the team must develop metrics and targets
for proper ventilation. Similarly, in the built environment, the dark surfaces of roofs, roads, and parking lots absorb more heat from the sun. Design and install plumbing systems that can use captured rainwater or graywater in flush fixtures. Building location is equally important. Depending on what has been learned through observation, it may be
necessary to go back and refine or revise the goals. Once the project team understands the Electrical network of systems and more effectively integration can occur.
Use grilles, grates, or mats at building entrances to reduce the dust, dirt, and contaminants carried into the facility by people's shoes. •• INCREASE DENSITY. Appliances that meet or exceed ENERGY STAR requirements will reduce plug load demands. But even this situation requires a thorough investigation. Daylight controls help in dimming or
turning off electrical lights entirely when daylight is sufficient. Off-site renewable energy is typically purchased at a premium price per kilowatt-hour from a utility or a provider of renewable energy certificates (RECs). Follow the most recent industry standards, such as ASHRAE Standard 62, Ventilation for Acceptable Indoor Air Quality. Another
example: the goal of a waste management program in an existing building might be to make recycling convenient. Vehicle technology determines the quantity and types of energy and support systems needed to convey people and goods to and from the site. SMALL TASK GROUPS provide opportunities to explore particular topics, conduct research,
and refine the ideas for presentation at a later team meeting. In a closed system, there is no waste, and all things find another purpose at the end of their useful lives. The mission of USGBC is "to transform the way buildings and communities are designed, built and operated, enabling an environmentally and socially responsible, healthy, and
prosperous environment that improves the quality of life."8 USGBC supports achievement of this mission through education programs, advocacy, research, an extensive network of local chapters, and the LEED green building programs. When information about the performance of the system is missing or blocked, the system cannot respond. When
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snow melts, the darker surfaces absorb more heat, which raises the temperature and melts more snow. 21 K. In fact, as LEED continues to evolve and today's innovation become tomorrow's standard, strategies that may have earned Innovation credit in the past may not necessarily earn recognition today. HEAT ISLAND EFFECT Cities are typically warmer than nearby rural areas. Through signage or meetings, educate occupants about the importance of recycling and reducing waste. This helps reduce rainwater runoff while avoiding the unnecessary consumption of potable water. In both design-build and operations and maintenance projects, the first activities of the implementation phase focus on fine-tuning the decisions made during design and strategy selection, to make sure all selected strategies are practical given the construction. How you approach projects is crucial to what you do and are able to accomplish. Task group members should view their work as exploratory and consider all ideas, even those that appear to be poor choices or infeasible. Drip and bubbler systems and weather-based controllers can save water. 88 • INDOOR ENVIRONMENTAL QUALITY. A charrette brings together the project team with stakeholders and outside experts as needed for creative thinking and collaboration. What effects do they have on the world along the way? For example, consider cabinets made of wheat husks sourced from all over the country and bound together in resin versus solid wood cabinets made from local timber. For example, an energy-efficient building that saves the owners money but makes the occupants sick is not sustainable, nor is a material that has a small carbon footprint but was made in a sweatshop, nor is an eco-resort that displaces threatened species or local people. Most architects, engineers, landscape architects, planners, and business managers learn skills on the job and through trial and error, such as by facilitating meetings with team members and stakeholders. Lighting was one of the key areas for improvement within the one-million-square-foot facility. 94 APPENDICES. Facilities managers evaluate the responses to determine any areas of dissatisfaction, then develop a corrective action plan to address problems and improve occupants' comfort. Certification as a green building was not a significant indicator of construction cost.11 11 L.F. Matthiessen and P. S ECT IO N 1 When the building is designed and maintained as a green building with improved energy and water performance, the total emissions fall to 3,233 T, or 4.6 T per person. FIGURE 3.2. Members of an Integrated Team GOAL SETTING This guide repeatedly emphasizes the importance of project goals; every green building project needs to be grounded in strong goals and set a clear pathway to ensure they are achieved. Green Office Buildings" (Institute of Business and Economic Research, University of California-Berkeley, 2008), mistra.org/download/18.39aa239f11a8dd8de6b800026477/IBER+Green+Office+Buil dings+NKok+et+al.pdf. •• Ensuring indoor air quality by following an indoor environmental quality management plan for protecting ductwork and pervious materials, preventing dust, and protecting ductwork and pervious materials, preventing dust, and protecting dust, and d night and contributing energy from onsite renewable energy systems during the day, such that their total energy cost is zero. The Rise of the Green Building Over Time Green Building Costs and Savings Beyond Green Building Expertise SECTION 2. What other purposes or projects do those flows serve? Locating a project on such sites may encourage development to continue to push forward market transformation. Work with ecologists and nonprofit organizations to implement conservation programs that protect species and habitat. Meadows, Dennis L. Have grilles, grates, or mats at building entrances to reduce the dust, dirt, and contaminants brought into the facility by people's shoes. The structure of material stocks and flows (such as transport networks, population age structures) 9. The location of the NWG neighborhood on an urban infill site is ideal for the LEED for Neighborhood Development (LEED ND) program. We see the elements of demography, economy, and the environment as one planetary system, with innumerable interconnections. By identifying synergies between systems, teams will save time and money in both the short and the long term while optimizing resource use. Research conducted at Carnegie Mellon University shows that these benefits can translate into a 2% to 16% increase in workers' and students' productivity. Furthermore, once the building design team members understand who the occupants are, what they will be doing, and how they will be doing it, they can create environments tailored to those needs while providing sufficient control and flexibility. The LEED for Homes rating system includes a point adjustment to compensate for the effect of square footage on resource consumption. Outline procedures and goals for solid waste diversion. Linking the present with the past reinforces a sense of place and helps create attractive communities with viable commercial centers. Strategically locating functional and decorative hardscape on a project site may reduce the amount of impervious area, surfaces that have been compacted or covered by materials that do not allow water to infiltrate. Give preference to rapidly renewable materials, regional materials, regional materials, and those with recycled content. Credits are optional elements— strategies that projects can elect to pursue to gain points toward LEED certification. Photo credit: Robb Williamson Federal, state, and local governments are among those adopting sustainable building practices and policies. USGBC collects and integrates this feedback to refine the pilot credits, and worthwhile credits are then added to the balloted LEED rating systems. This finding reinforces the importance of commissioning systems and monitoring performance so that green buildings can maintain their efficiencies and achieve their full potential over time. •• TEST FOR RADON OR OTHER ON-SITE CONTAMINANTS. Additionally, training programs can help build these skills by combining experience with more formal classes, workshops, and online education. L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON A system is an assemblage of elements or parts that interact in a series of relationships to form a complex whole that serves particular functions or purposes. Alternatively, the team can start with a function and find the best place to put it. And if you tweak the details, it is what it's like for all the students nationwide who study in green schools and live in green dorms, and for the increasing number of families who live in green homes. Institute an annual durable goods drive where e-waste and furniture are collected on site and disposed of properly through donation, reuse, or recycling. The built environment provides a context for facing and addressing humankind's greatest contemporary challenges. For example, the level of detail at a small scale might reveal much about the local street grid, but zooming out reveals connections to the regional transporation system. High demand strains supplies and under extreme conditions necessitates water rationing. However, a systems-based, integrated approach can identify solutions that contribute to both goals. S ECT IO N 4 LEED recognizes and encourages operational energy performance through its requirements for building commissioning and credits for metering. Envelope design, heating, and air-conditioning as well as improving the guality of the indoor space. Orientation and training of the occupants and personnel must be repeated as new tenants move in, staff is hired, and lessons are learned. Use the regionally-appropriate amount of insulation in the walls and roof and install high-performance glazing to minimize unwanted heat gain or loss. Pershing, Navigating the Numbers: Greenhouse Gas Data and International Climate Policy (Washington, D.C.: World Resources Institute, 2005). Regenerative projects and communities involve stakeholders and require interactivity. 64 FOLLOWING AN INTEGRATIVE PROCESS HELPS IDENTIFY SYNERGISTIC STRATEGIES FOR THE FOLLOWING AN INTEGRATIVE PROCESS HELPS IDENTIFY SYNERGISTIC STRATEGIES FOR THE FOLLOWING AN INTEGRATIVE PROCESS HELPS IDENTIFY SYNERGISTIC STRATEGIES FOR THE FOLLOWING AN INTEGRATIVE PROCESS HELPS IDENTIFY SYNERGISTIC STRATEGIES FOR THE FOLLOWING AN INTEGRATIVE PROCESS HELPS IDENTIFY SYNERGISTIC STRATEGIES FOR THE FOLLOWING AN INTEGRATIVE PROCESS HELPS IDENTIFY SYNERGISTIC STRATEGIES FOR THE FOLLOWING AN INTEGRATIVE PROCESS HELPS IDENTIFY SYNERGISTIC STRATEGIES FOR THE FOLLOWING AN INTEGRATIVE PROCESS HELPS IDENTIFY SYNERGISTIC STRATEGIES FOR THE FOLLOWING AN INTEGRATIVE PROCESS HELPS IDENTIFY SYNERGISTIC STRATEGIES FOR THE FOLLOWING AN INTEGRATIVE PROCESS HELPS IDENTIFY SYNERGISTIC STRATEGIES FOR THE FOLLOWING AN INTEGRATIVE PROCESS HELPS IDENTIFY SYNERGISTIC STRATEGIES FOR THE FOLLOWING AN INTEGRATIVE PROCESS HELPS IDENTIFY SYNERGISTIC STRATEGIES FOR THE FOLLOWING AN INTEGRATIVE PROCESS HELPS IDENTIFY SYNERGISTIC STRATEGIES FOR THE FOLLOWING AN INTEGRATIVE PROCESS HELPS IDENTIFY SYNERGISTIC STRATEGIES FOR THE FOLLOWING AN INTEGRATIVE PROCESS HELPS IDENTIFY SYNERGISTIC STRATEGIES FOR THE FOLLOWING AN INTEGRATIVE PROCESS HELPS IDENTIFY SYNERGISTIC STRATEGIES FOR THE FOLLOWING AN INTEGRATIVE PROCESS HELPS IDENTIFY SYNERGISTIC STRATEGIES FOR THE FOLLOWING AN INTEGRATIVE PROCESS HELPS IDENTIFY SYNERGISTIC STRATEGIES FOR THE FOLLOWING AN INTEGRATIVE PROCESS HELPS IDENTIFY SYNERGISTIC STRATEGIES FOR THE FOLLOWING AN INTEGRATIVE PROCESS HELPS IDENTIFY SYNERGISTIC STRATEGIES FOR THE FOLLOWING AN INTEGRATIVE PROCESS HELPS IDENTIFY SYNERGISTIC STRATEGIES FOR THE FOLLOWING AN INTEGRATIVE PROCESS HELPS IDENTIFY SYNERGISTIC STRATEGIES FOR THE FOLLOWING AN INTEGRAL SYNERGY SYNER focus has been first on environmental metrics, but the list is expanding to include indicators of social justice and public health. Occupied or vacant? The ruling remains confidential and generally applies only to the one project. • DEVELOP A SUSTAINABLE MATERIALS POLICY. The process of planning a project's water use might lead to the design of systems that capture rainwater and greywater to meet water supply and irrigation needs while reducing runoff and protecting water quality. RENEWABLE ENERGY L EED CORE CON CEPTS G UIDE — TH IR D E DIT I ON Reduced demand and increased efficiency often make it cost-effective to meet most or all of a building's energy needs from renewable sources. Cutting energy use in a plant with 900 workers, 1,800 personal computers, and continuously personal computers, and continuously energy use in a plant with 900 workers, 1,800 personal computers, and continuously energy use in a plant with 900 workers, 1,800 personal computers, and continuously energy use in a plant with 900 workers, 1,800 personal computers, and continuously energy use in a plant with 900 workers, 1,800 personal computers, and continuously energy use in a plant with 900 workers, 1,800 personal computers, and continuously energy use in a plant with 900 workers, 1,800 personal computers, and continuously energy use in a plant with 900 workers, 1,800 personal computers, and continuously energy use in a plant with 900 workers, 1,800 personal computers, and continuously energy use in a plant with 900 workers, 1,800 personal computers, and continuously energy use in a plant with 900 workers, 1,800 personal computers, and continuously energy use in a plant with 900 workers, 1,800 personal computers, and continuously energy use in a plant with 900 workers, 1,800 personal computers, and continuously energy use in a plant with 900 workers, 1,800 personal computers, and continuously energy use in a plant with 900 workers, 1,800 personal computers, and continuously energy use in a plant with 900 workers, 1,800 personal computers, and 2,800 personal computers, 2,800 personal computers, 2,800 personal computers, 3,800 personal co strategies to improve public health, safety, and environmental quality. In early project meetings, it is important to establish a common commitment to the planning and implementation process. •• OFFER INCENTIVES. Life-cycle costing looks at both purchase and operating costs as well as relative savings over the life of the building or product. If permitted by the jurisdiction, use captured rainwater, or municipally-provided reclaimed water for flush fixtures. The project team selects the credits it has chosen to pursue and when the necessary documentation, including required information and calculations, has been assembled, the project team uploads the materials to LEED Online Alternative transportation, including availability of public transportation, is essential for reducing carbon emissions. There is tremendous opportunity in our hospitals, our places of worship, and our neighborhoods. The savings are often reflected in life-cycle costing. 20 Globally, transportation is responsible for 13.5% of total carbon dioxide emissions.21 Generally, this is a result of three fundamental factors: land use, vehicle technology, and transportation fuels. If possible, provide windows that can be opened to the outside. GHG emissions Today's typical building Today's efficient building Green, high-performance building Years Figure 1.6. Carbon Emissions Related to Building Performance Over Time S ECT IO N 1 Green building professionals strive to follow a path of continuous improvement. For example, in the eastern United States, on-site water collection is often encouraged as a way to slow rainwater runoff and reduce nonpoint source pollution. Green strategies and technologies often have very short payback periods, but when organizations budget planning and design costs separately from capital projects and operations, savings in one category may not provide a persuasive argument for increased spending in another.

Understanding your money management options as an expat living in Germany can be tricky. From opening a bank account to insuring your family's home and belongings, it's important you know which options are right for you. Get 247 customer support help when you place a homework help service order with us. We will guide you on how to place your essay help, proofereading and editing your draft – fixing the grammar, spelling, or formatting of your paper easily and cheaply. 04/05/2022 · The Engineering Laboratory promotes U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology for engineering Laboratory promotes U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology for engineering Laboratory promotes U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology for engineering Laboratory promotes U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology for engineered systems in ways that enhance economic security and technology for engineering Laboratory promotes U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology for engineered systems in ways that enhance economic security and created by advancing measurement science, standards, and technology for engineering Laboratory promotes U.S. innovation and innovation and innovation science, standards and technology for engineered systems in ways that enhance economic security and cheply. 04/05/2021 · ASTM C1193-The Community - thanks you for engineering Laboratory promotes U.S. innovation and innovation and innovation and innovation and innovation and advancing measurement science, standards and technology that [...] Megadeals. CPI Property Group's €1.25 Billion Financing of Takeover Offer Over S IMMO AG. Appian Corporation v...

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