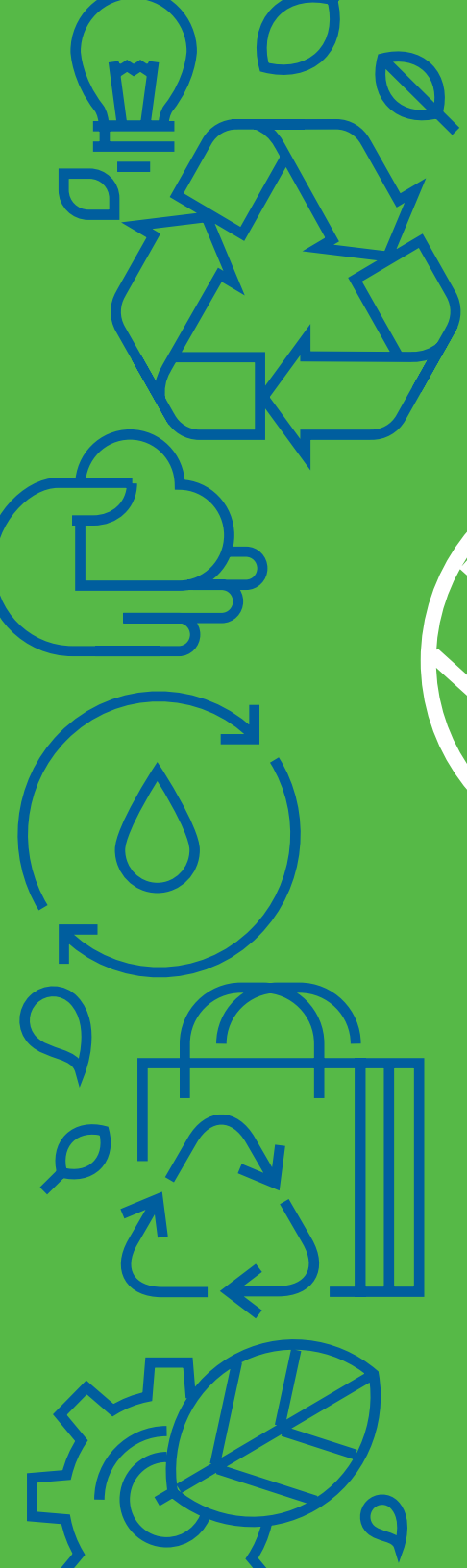

A Beginner's Handbook to **LEED Building Design and Construction Guidelines**

GORDIAN®

INTRODUCTION

My friend and colleague, Bob, is fond of saying, "Sustainability starts and ends with design." Sustainability isn't its own thing. It's not a list of special tasks from a unit price book. It's not simply using recycled raw materials. It's not even using a particular construction technique or a specific contractor. Sustainability boils down to how you design a project. And LEED specifications provide an excellent blueprint for sustainable building design and construction.

We will cover a lot of detail in these 18 pages. However, know this is merely a summary. The complete LEED v4.1 Building Design and Construction Guide is 274 pages, loaded with suggestions and additional detail that you can apply to your specific areas of interest.

Rather than recap all the prerequisites and sustainability credit criteria line-by-line, we'll review the highlights from each and point out where they might prove valuable. Our goal is to bring the main objective of each criteria to the forefront – adding practical recommendations where applicable – so you can more easily apply LEED sustainability principles to your projects.

"GO FORTH AND BE SUSTAINABLE."

John Timmerman, Product Marketing Manager (and Sustainability Nut) at Gordian

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"SUSTAINABILITY STARTS AND ENDS WITH DESIGN."

BOB MEWIS, PRINCIPAL ENGINEER, GORDIAN

INTEGRATIVE PROCESS

Integrative Project Planning and Design is a fitting first guideline for the LEED criteria, as it sets the foundation for everything moving forward with up-front design. This precept is not just about designing the building itself. It starts with planning and designing everything about the building.

As defined, the intent of this guideline is to "maximize opportunities for integrated, cost-effective adoption of green design and construction strategies, emphasizing human health as a fundamental evaluative criterion for building design, construction and operational strategies."

Did you catch that? LEED dictates human health as a foundational tenet for sustainable building design. Not energy efficiency. Not cost control. Not even recycled materials. The benefit to human health should be the primary influence on all our design decisions.

THE GIST
THE TOP GOAL IN ALL YOUR DESIGN DECISIONS SHOULD BE THE POSITIVE IMPACT ON HUMAN HEALTH.

LOCATION AND TRANSPORTATION

At first glance, the Location and Transportation guideline seems to be about protecting sensitive land, like prime farmland, floodplains, watersheds and habitats for endangered wildlife or plant life, from being leveled for highways and parking lots. However, the stated intention of this criterion is "to avoid development on inappropriate sites, reduce vehicle distance traveled, enhance livability and improve human health by encouraging daily physical activity".

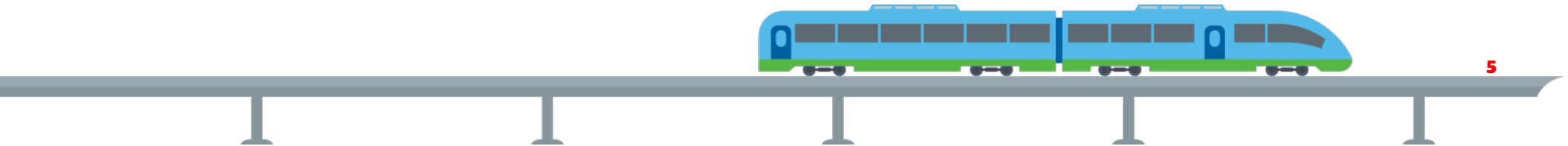
This motivational tenet goes well beyond just encouraging exercise and promoting short commuting times, though. It expounds on the last criterion's push to build with human health in mind, making the point that it is important to be equitable in where we choose to build.

LEED is suggesting we should not put all the new jobs in areas that are already loaded with jobs, forcing those with the fewest nearby employment opportunities to travel the furthest to gain employment. Nor should we expect those without reliable travel options to rely exclusively on spartan public transportation for their work and errand commutes.

Similarly, we should not pave over the only park for miles to create a parking lot for those that will live and work in this new building. As the guidelines dictate, "To build the economic and social vitality of communities, encourage project location in areas with development constraints and promote the ecological and community health of the surrounding area."

Additional LEED certification credits in this category come in the form of bicycle accessibility and storage, reduced parking footprint and improved electric vehicle accommodations. Design with an eye towards the future and multi-modal transportation options.

THE GIST
CHOOSE BUILDING SITES THAT BRING HOMES, EMPLOYMENT AND SERVICES TO COMMUNITIES WITHOUT IMPOSING TRANSPORTATION BURDENS ON THEM.



SUSTAINABLE SITES

While there are provisions under this category for "preventing construction activity pollution," such as soil erosion, waterway sedimentation and airborne dust, the primary concern of the Sustainable Sites guideline is the long-term protection of the building site. This sustainable design guideline prescribes that building sites undergo an Environmental Site Assessment with an eye towards protecting "the health of vulnerable populations by ensuring that the site is assessed for environmental contamination and that any environmental contamination has been remediated."

The intent of the site assessment is to "assess site conditions before design to evaluate sustainable options and inform related decisions about site design." Note that it states, "before design." This point at which we should explore site hydrology and delineate wetlands, lakes, streams and shorelines in accordance with the EPA's Clean Water Act. Or look for rainwater collection and reuse opportunities, like green roofs and bioswales. Or study solar exposure, shading opportunities and heat island effect potential. Or assess primary vegetation types, map significant trees, threatened or endangered species, as well as invasive plants, then create designs that "conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity."

Once we've done our homework to study the site, there are heaps of low-impact design (LID) and green infrastructure (GI) practices that can be applied in the design phase of a sustainable building or construction site. Examples of LID techniques include planting rain gardens with native or adapted plant material, installing a vegetated roof, using permeable paving or installing permanent infiltration and collection features like a cistern than can handle runoff from local rainfall.

LID and GI measures can have long-standing benefits beyond the immediate use of sustainable construction materials or techniques, as well, like capturing and reusing water to reduce the building's demand for potable water or utilizing vegetated green roofs to reduce heat islands. That type of long-term thinking is what the LEED guidelines are all about: How will what we build today benefit our communities for years to come?

THE GIST

TAKE DUE DILIGENCE BEFORE YOU START DESIGNING TO ENSURE YOUR PROJECT WILL IMPACT ITS SURROUNDING ENVIRONMENT MINIMALLY BOTH NOW AND INTO THE FUTURE.

BLOG: SUSTAINABLE TECHNIQUES

Did you know that 30% of materials brought to a construction site end up in a landfill? There's enormous pressure on the construction industry to reduce its impact on the environment. For ideas on how you can help minimize the environmental impact of your project, check out this blog on sustainable construction techniques.

WATER EFFICIENCY

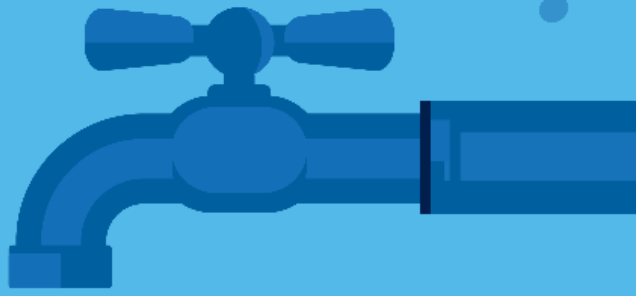
The next guideline discusses reducing water use both inside and outside of buildings in order to slow the consumption of water that's already in our aquifers, watersheds and municipal supplies. There are two main parts to this guideline: the Outdoor Water Use Reduction requirement and Indoor Water Use Reduction requirement.

The intent of the Outdoor Water Use Reduction requirement is to design out the need for a permanent irrigation system. This could be done by utilizing plant life for project landscaping to reduce the need for irrigation water or by installing a more efficient irrigation system that relies on captured rainwater instead of drawing from reserve sources.

There's also a lot to be done towards Indoor Water Use Reduction. You could likely guess the top culprit of inefficient indoor water use. According to the United States Environmental Protection Agency, toilets account for roughly 30% of an average home's water use. In fact, "by replacing old, inefficient toilets...the average family can reduce water used for toilets by 20 to 60 percent every year."

While those statistics are for domestic single-family dwellings, the theory can also apply to commercial construction. Older toilets use in excess of five gallons per flush. Newer, WaterSense labeled units can use as low as 1.28 gallons per flush. High efficiency urinals, faucets and showerheads all represent similar potential indoor water use reductions. Regulating water pressure below LEED baseline supply pressure specifications can further reduce water consumption through flow fixtures and fittings.

THE AVERAGE FAMILY CAN REDUCE WATER USED FOR TOILETS BY 20 TO 60 PERCENT EVERY YEAR.



TOILETS ACCOUNT FOR ROUGHLY 30% OF AN AVERAGE HOME'S WATER USE

Facilities that require clothes washers, dishwashers, spray valves or ice machines should use Energy Star (or performance equivalent) high efficiency appliance options to reduce water consumption. Healthcare centers, schools and hospitality facilities may also require specialized water-consuming and heating/cooling equipment. Each of these have water management process improvements that can be applied to reduce overall usage. As LEED specifications state, "Selecting efficient fixtures, fittings and appliances in the design phase helps ensure that projects will use less water throughout the building life cycle, which may help improve a project's water performance score."

There is an entire prerequisite in the LEED sustainable Building Design and Construction guide around Building-Level Water Metering, which is focused on supporting water management and identifying opportunities for additional water savings by tracking water consumption. The goal is to install permanent water meters that measure the total potable water use for a building and associated grounds so total usage can be compiled and analyzed over time. According to the specification, "Tracking water consumption on a regular basis supports effective water management and provides performance data to help verify that building systems are operating as designed." These measurement steps will help inform your ongoing activities around both Outdoor and Indoor Water Use Reduction.

THE GIST

CREATE INTERIOR AND EXTERIOR DESIGNS THAT MINIMIZE WATER CONSUMPTION, THEN TRACK YOUR BUILDING'S CONSUMPTION TO ENSURE ITS ONGOING SUSTAINABILITY.

CUSTOMER STORY: NYDOE

The New York City Department of Education had a water use issue across it's 1,800 schools. But through innovative design and partnerships with the New York City Department of Environmental Protection and Gordian, the NYC DOE was able to both reduce its water consumption by four million gallons per day and reinforce a natural habitat. Watch this spotlight video to see how they made it happen.

ENERGY AND ATMOSPHERE

At its most elemental level, the Energy and Atmosphere guideline is intended to support the design, construction and eventual operation of a building's energy, water, environmental quality and durability components. There's much to be digested here, but its best to start by establishing a baseline level of energy efficiency for your building and all its systems. To do so, answer the following questions:

- **What is the building's occupancy schedule?**
- **What are the equipment run-time schedules?**
- **What are the setpoints for all HVAC equipment?**
- **What are the set lighting levels throughout the building?**
- **What are the minimum outside air requirements?**
- **Are there changes in schedules or setpoints for different seasons, days of the week or times of day?**

From this baseline, you can then determine excess energy that can be saved by achieving a minimum level of energy efficiency for the building and its systems. These savings can come in the form of greenhouse gas emissions or electricity consumption, which can be controlled through elemental devices like lighting occupancy sensors, lighting daylighting controls or automated receptacle controls. Additionally, energy costs and greenhouse gas emissions can potentially be offset by using on-site renewable energy systems such as photovoltaics systems, wind generators or thermal or electric generation from methane capture or qualifying biofuel sourced from the project.

The goal is to "reduce the environmental and economic harms associated with fossil fuel energy and reduce greenhouse gas emissions by increasing the supply of renewable energy" as part of your building design and construction. There are additional credits available for reducing the use of refrigerants in HVAC-R systems that have global-warming potential or only using refrigerants that have no ozone depletion potential.

If you can't reduce your energy needs, consider shifting them to non-peak-demand windows. Simply changing the timing of heavy energy consumption can reap huge dividends. Energy utilities often refer to this as "flattening the curve." Flattening that spike not only reduces the cost of energy, but also reduces the burden on the existing distribution system, helping make energy generation and distribution systems more efficient and reliable. LEED states that you should "coordinate review of building load shape and peak load with review of the regional grid profile to identify the best value load management strategies that the building can provide."

Just like you did with your water use reduction efforts, you've got to measure everything to know what's working. This calls for building and system-level metering and sub-metering. As we've already established: "If you can't measure it, you can't manage it."

THE GIST

LEVERAGE TECHNOLOGY AND DESIGNS THAT REDUCE YOUR BUILDING'S RELIANCE ON NON-RENEWABLE ENERGY SOURCES, OFFSET ITS EMISSIONS AND DECREASE THE BURDEN IT PLACES ON THE LOCAL POWER GRID.

MATERIALS AND RESOURCES

The Materials and Resources guideline begins with a discussion on reducing the amount of waste material that needs to be hauled away from a building and disposed of in landfills. First and foremost, a collection mechanism for recyclable materials needs to be provided in an ongoing fashion for all building occupants. These materials include mixed paper, corrugated cardboard, glass, plastics and metals. Additionally, separate collection should be provided for items requiring special handling, such as batteries, mercury-containing products, fluorescent light bulbs, paints, solvents and electronic waste.

Whereas this section starts with waste management considerations for building occupants of the building, it moves into waste management considerations for the construction and demolition processes of the building project itself. The intent is to "reduce construction and demolition waste disposed of in landfills and incineration facilities through waste prevention and by reusing, recovering and recycling materials."

There are two primary strategies to be deployed at this point: prevention and diversion. What can you do to prevent construction waste through reuse, salvage and recycle renovation? And what can you do to divert construction and demolition materials away from landfills or incinerators, like source-separating materials to be taken to individual types of recyclers or participating in manufacturer take-back programs?

To that end, LEED encourages performing a lifecycle assessment of existing building resources to determine if any can be adaptively reused, reducing the need for new materials. Perhaps portions of existing walls, floors, roofs or exteriors can be repurposed. Or maybe you can salvage non-structural elements, such as interior walls, doors, suspended ceiling systems or floor coverings. Every reused material is one that doesn't need to be created in a factory, transported long-distance to the building site or thrown prematurely into a landfill.

Once you've maximized the reuse of any materials already available, select new building products and materials that have been extracted or sourced in an environmentally, economically and socially responsible manner. Look for manufacturers that participate in an extended producer responsibility programs, who can give you a guarantee that their products were created or sourced in a sustainable manner. Also look to include bio-based materials, like bamboo or hempcrete, or recycled plastics, steel, aluminum or concrete.

Avoid materials that have a risk of releasing persistent, bio-accumulative and toxic chemical ingredients, such as mercury (fluorescent lighting systems), lead (paints, plumbing fixtures, roofing, flashing and electrical systems), copper (pipes and wiring) or cadmium (in batteries, paints, pigments and electroplate coatings). And look for these warning signs beyond the building itself: Many types free-standing furniture or equipment can contain unhealthy levels of chemicals and unsustainable textiles, finishes and dyes.

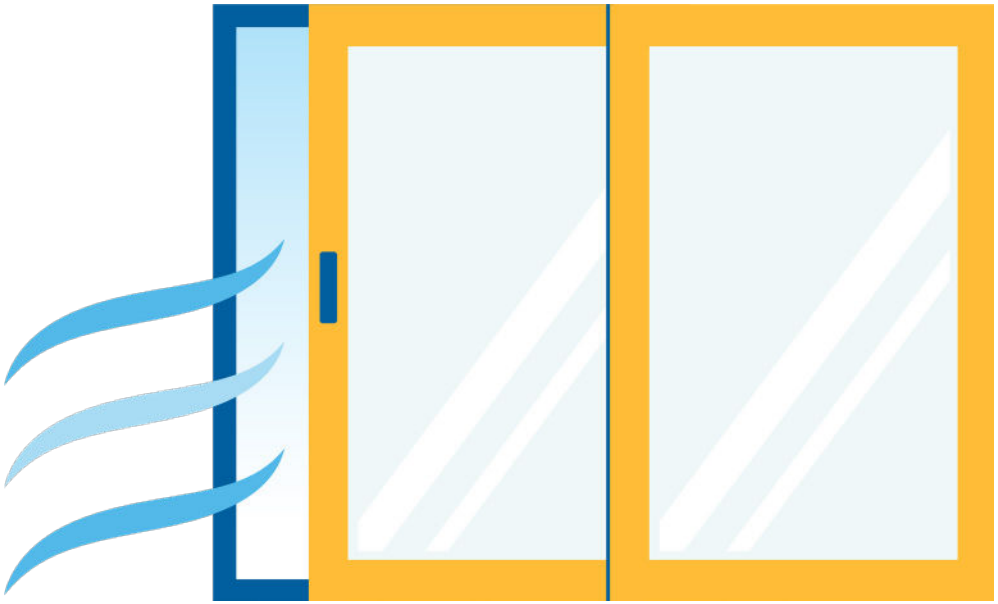
THE GIST

WHETHER DURING CONSTRUCTION OR OPERATION, LOOK FOR WAYS TO RECYCLE AND REUSE MATERIALS IN ORDER TO PREVENT ENVIRONMENTAL WASTE.

BLOG: SUSTAINABLE MATERIALS

Selecting the right green construction materials can be difficult. It's hard to know which ones truly follow sustainable practices from their raw state to the supply shelf. As you consider materials, examine the process required to get to that end-state material along these five parameters.

INDOOR ENVIRONMENTAL QUALITY



LEED's Indoor Environmental Quality guideline removes all questions associated with defining minimum indoor air quality. Their top concern is evaluating the outdoor air quality and designing the requisite systems to ensure it is converted into or maintained at an acceptable quality level as it is consumed by the building.

One of the contributing factors to sub-par indoor air quality is the exposure of building occupants, indoor surfaces and ventilation systems to environmental smoke. That makes the easiest step to fulfilling this guideline simply prohibiting smoking inside and limiting smoking outside to designated smoking areas that are at least 25 feet from all entries, air intakes and operable windows.

Designing entryway systems that are at least 10 feet long and fitted with grates, grilles or floor mats can provide catchment for dirt, dust and other outdoor particulates that might negatively impact air quality. If an especially clean environment is required in your building, you may also consider pressurized vestibules and particle filters to minimize the inflow of contaminants.

We also have to be concerned about things that are already in the building that could damage air quality, human health, productivity or the environment. Avoid especially pungent or potentially poisonous chemical compounds and contaminants in your building design. Look for low volatile organic compound content and emission ratings for paints, coatings, adhesives, sealants, flooring coverings, wall panels ceiling tiles and insulation. Just because we've eliminated asbestos doesn't mean our work here is done.

This guideline extends beyond air quality, too. Depending upon the nature or location of your project, there may be acoustic standards to be considered for indoor environment quality. This means designing your space to reduce noise pollution. There are design provisions in place for minimizing HVAC background noise, cross-over noise from adjacent spaces or exterior noise mitigation from planes, trains and automobiles. Fortunately, there are a number of acoustic treatments such as wall panels, ceiling finishes and sound-absorbent materials that can be applied to help limit the impact of loud external noises on the quality of the indoor environment.

Effective sustainable design must also promote occupants' productivity, comfort and well-being by providing quality thermal control. Here, the LEED specification defers to Thermal Comfort Conditions for Human Occupancy as defined by the ASHRAE Standard 55-2017. In addition to optimizing overall energy efficiency, there is a requirement for thermal comfort controls to allow occupants to adjust either the temperature, air speed or humidity in their local environment.

Occupant productivity, comfort and well-being can also be affected by the type and amount of lighting in their local environment. Glare control, color rendering, lighting control and surface reflectivity should all be accounted for in your sustainable design strategy. Working with the owner up front to understand the occupants' lighting needs and desires is an excellent first step prior to planning your lighting designs.

Sustainable design also seeks to connect building occupants with the outdoors wherever possible. This reinforces circadian rhythms and reduces the use of electrical lighting by introducing daylight into the occupied space. Effective use of skylights, blinds or shades, and building orientation can maximize the availability of natural lighting for your project. Another way to provide building occupants with a connection to the natural outdoor environment is through the utilization of quality views. Everybody likes a good view from their workspace or office common area. In fact, the LEED specification requires a view of either nature, an urban landmark, or art to get full credit for this sustainability requirement. Even if you can't see outside, being in view of a picture of nature is better than nothing.

Lastly, sustainable design isn't only concerned with the resulting air quality and comfort of building occupants. It should also take into consideration the well-being of construction workers who build the facility by minimizing air quality problems associated with construction or renovation processes. You may need temporary air-handling systems with higher filtration capabilities and mandated particulate masks beyond what you might already be using for workplace infection control. Post-construction, you may need to perform a general "flush out" to ensure that all construction detritus has been removed and minimum indoor air quality standards have been reestablished before building occupancy ensues.

THE GIST

DESIGN YOUR BUILDING TO KEEP OCCUPANTS COMFORTABLE THROUGH IMPROVED AIR QUALITY, NOISE REDUCTION, TEMPERATURE, LIGHTING AND SIGHTLINES TO THE WORLD OUTSIDE THE BUILDING.

INNOVATION

As much as LEED has prescribed the previous guidelines and credits, they don't want to discourage new initiatives or thinking outside of the box. Here, they actually encourage and award credit for achieving a significant, measurable environmental performance using a design strategy that is not addressed in the LEED green building rating system. If you can discover a new method or innovative solution, you'll be awarded.

You can also receive credit for simply having a LEED Accredited Professional (AP) on your design team. LEED has found that the application and certification process is streamlined by having someone that "knows how LEED works" on a design team. They are therefore willing to provide an additional point of project credit for this simple inclusion. It's an easy win, and you should always take a freebie where it's offered.

THE GIST

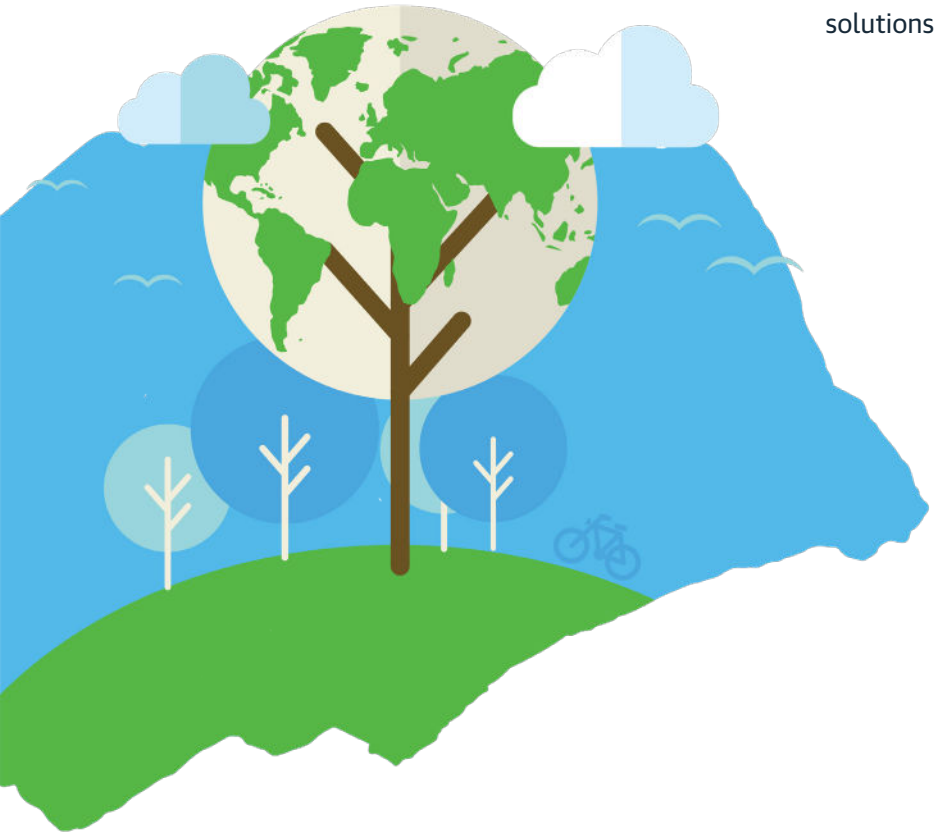
THE GREEN BUILDING MOVEMENT MOVES FORWARD THROUGH INNOVATIONS, SO LOOK FOR NEW WAYS TO REDUCE THE ENVIRONMENTAL, ECONOMIC AND SOCIAL BURDEN OF YOUR FACILITY.

REGIONAL PRIORITY

While regional priority may sound vague, LEED wants to encourage projects that address geographically specific environmental, social equity or public health priorities. They are six regional priority credits listed by geographic region (city, state, zipcode) and you can earn additional points for up to four of the six. You can easily query for regional priority credit opportunities near you at the USGBC website.

THE GIST

CONSIDER WAYS YOUR BUILDING OR PROJECT CAN BRING REAL, POSITIVE IMPACT TO YOUR COMMUNITY'S SPECIFIC NEEDS.



ACHIEVING YOUR GRAND, GREEN GOALS

Whether you're designing a green facility, constructing a new piece of infrastructure or interested in operating an existing building more sustainably, Gordian has the solutions you need to achieve your sustainability goals.

RSMeans data from Gordian:

Gordian's proprietary RSMeans data is the industry's leading source of cost data for construction, renovation and maintenance projects. With over 85,000 line items in the database, RSMeans data will give you an accurate estimate for any project, no matter the size.

For sustainable-minded projects, Gordian's Green Construction Costs RSMeans dataset offers the most extensive selection of green material, equipment and task construction costs anywhere.

Job Order Contracting:

Invented by Gordian's founder, Job Order Contracting (JOC) is a uniquely innovative construction procurement method. Through JOC, facility owners can procure a high volume of construction, renovation and maintenance projects from contractors via a single, long-standing contract.

JOC uses preset pricing for construction tasks to ensure a fair price for both owners and contractors, making it an excellent way to invest in local contracting businesses.

Facilities Management Solutions:

Before you can optimize your facility's energy efficiency, you need data on its current performance. Gordian's Facilities Management Solutions help you see beyond the surface of your facility to unbiased data on its condition, needs and future outlook.

Once you have a project in mind, Gordian's Strategic Capital Planning framework can help you make data-driven, actionable plan for making it a reality.

ABOUT GORDIAN

Gordian is the leading provider of Building Intelligence™ Solutions, delivering unrivaled insights, robust technology and expert services to fuel customers' success through all phases of the building lifecycle. Gordian created Job Order Contracting (JOC) and the industry-standard RSMeans Data. We empower organizations to optimize capital investments, improve project performance and minimize long-term operating expenses.

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