SUSTAINABILITY REFERENCE MATERIALS

RESOURCES TO SUPPORT REGISTRANTS IN INTEGRATING SUSTAINABILITY INTO PROFESSIONAL PRACTICE

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VERSION HISTORY

VERSION NUMBER	PUBLISHED DATE	DESCRIPTION OF CHANGES
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PURPOSE OF THE SUSTAINABILITY REFERENCE MATERIALS

Professional engineers and geoscientists represent an array of disciplines and sectors, with over 250 areas of practice. Employers and jobs differ widely, but the collective responsibility to advance and contribute to sustainability is the same.

Engineers and Geoscientists BC's *Professional Practice Guidelines - Sustainability*, published on April 20, 2023, clarify the expectations and obligations of professional practice for all registrants. The guidelines also recognize the three pillars of sustainability, as follows, which must be integrated into practice in a balanced way:

- Environmental: to stay within the biophysical carrying capacity of our region, country or planet such as minimizing resource use, reducing waste and protecting nature from degradation.
- Social: to maintain and protect social equity, quality of life and the values that we aspire to live by.
- Economic: to ensure long-term access, opportunities and economic participation for all members of society.

These Sustainability Reference Materials are a complement to the *Professional Practice Guidelines* - *Sustainability*. They are a starting point for registrants who want to learn more about key sustainability concepts, and how to integrate them into their practice. The materials are not prescriptive, and do not constitute or replace the *Professional Practice Guidelines* - *Sustainability*. The Sustainability Reference Materials aim to empower registrants to integrate sustainability into their practice, and to contribute to the three pillars of sustainability. Sector- and practice-specific resources may be developed over time to provide more specific and practical support to registrants.

OVERVIEW OF CONCEPT AREAS

The concept areas included in these reference materials were selected through a robust engagement process, which included three focus group sessions that engaged a cross section of registrants. Participants were asked questions concerning sustainability-related expectations, existing guidance and best practices, key sources of information, and gaps in existing materials on sustainability.

The engagement process highlighted that, in practice, sustainability has different meanings among registrants. For many, sustainability means addressing the climate change crisis; for others, it is a broader concept, involving the three pillars, as well as governance and other considerations. Social equity underpins work to advance sustainability, so sustainability solutions must support reconciliation by helping to advance the UN Declaration on the Rights of Indigenous Peoples (UNDRIP) and the Declaration on the Rights of Indigenous Peoples Act (DRIPA), which is a provincial legislation in BC.

The diversity of registrants necessitated highly varied resource requirements; to address this, the areas covered in this document span from conceptual to technical. In addition, varying stages of current knowledge exist among registrants, so these materials contain introductory and advanced sustainability concepts.

For each concept area, there is:

- an overview
- a description of its connection to sustainability

• a curated list of resources for registrants to learn more

These materials are meant to be a living resource, and these concepts may evolve or expand over time to reflect the changing nature of the engineering and geoscience professions and sustainability practices.

ASSET MANAGEMENT

OVERVIEW

Asset management is the combination of practices in planning, management, finance, economics, engineering, operations, and more. When applied to physical and natural assets, asset management can maximize benefits, reduce risks, and provide the required Level of Service (defined as the service quality for a particular activity or service area against which service performance can be measured) in a socially, environmentally, and economically sustainable manner.

CONNECTION TO SUSTAINABILITY

The decisions that public and private asset-owners and service providers make about their assets has implications on long-term environmental, economic, and social sustainability. Integrating sustainability principles and practices into asset management is a significant catalyst that can further sustainability.

RESOURCES

RESOURCE	DESCRIPTION
<u>BC Framework for Sustainable</u> <u>Service Delivery</u>	A starting point for registrants who want to learn more about local government Asset Management. The Framework establishes a high level, systematic approach to help local governments implement best practices to deliver services sustainably.
Guide for Integrating Climate Change Considerations into Municipal Asset Management	A guide focusing on integrating climate change considerations into local government asset management. It provides general context, rationale, and a framework with four identified entry points, depending on existing processes.
Integrating Natural Assets into Asset Management	Asset management processes have traditionally been applied to engineered infrastructure; this guide provides foundational concepts, rationale, and starting points for integrating natural assets into asset management processes and practices to deliver services sustainably.
<u>Climate Change and Asset</u> <u>Management</u>	This guide introduces an approach to integrating climate change considerations throughout the asset management process; this can help local governments deliver services sustainably.
Land Use Planning and Asset Management	This primer introduces how asset management can be integrated into land use planning to help local governments deliver services sustainably.
<u>Asset Management Resources</u> <u>Library</u>	A collection of reports, toolkits, recommendations, and other resources published by the Federation of Canadian Municipalities (FCM) that are designed to help address community challenges through asset management.
<u>Asset Management in Industrial</u> <u>Environments</u>	A white paper focusing on the applications of asset management for industrial companies in several fields, including chemical, oil & gas, power generation, manufacturing, metal, food and pharmaceuticals, and others.
Energy Sector Asset Management: For Electric Utilities, Oil & Gas Industry	Provides guidance on how to enhance asset management practices in an energy organization's operating environment using pre-existing and new capabilities.

<u>Global Mining Guidelines Group –</u> Asset Management Working Group	A page showcasing the publications of the Asset Management Working Group, which focuses on developing asset management guidelines for improved environment, social, and governance (ESG), safety, and operating performance for the mining industry.
	performance for the mining industry.

BEST AVAILABLE TECHNOLOGY

OVERVIEW

Best Available Technology Economically Achievable (commonly referred to as Best Available Technology, or BAT) is a technology used to carry out a specific activity. It is selected from several options after considering factors such as technology, economics, public policy, and other relevant parameters (US Department of Energy, 2011). The BAT is a moving target as technology evolves; because of this, it is generally expressed as the outcome of an assessment process, rather than as a specific technology.

CONNECTION TO SUSTAINABILITY

The BAT concept is often applied to support protecting the environment and human health from harmful industrial emissions. Its application has been expanded to cover energy efficiency, waste reduction, and environmental conservation. BAT is a powerful concept that enables organizations to maximize their business' sustainability across the three pillars of sustainability.

RESOURCE	DESCRIPTION
<u> 1992 - OSPAR Convention</u>	The first prominent agreement to include the BAT standard; Appendix 1 of the document includes a comprehensive definition of the concept that successive agreements and regulations draw upon.
Best Available Technologies in Federally Regulated Pipelines	A report from the Canadian National Energy Board outlining BAT, with a focus on pipeline materials, construction, emergency management, emerging technology, and environmental considerations. The introduction outlines the report's definition of BAT and its applications to pipeline design.
Sustainable Production: Best Available Techniques	An overview of the parameters, process, and rationale for developing BAT reference documents. For resources from European Union countries, see next box.
BAT Reference Documents	A comprehensive collection of documents published by the European Commission covering BAT in specific manufacturing sectors, and widely applicable topics such as energy efficiency, industrial cooling systems, and storage emissions.
Best Available Techniques Assessment to Inform Waste Discharge Standards	Published by the BC Ministry of Environment and Climate Change Strategy, this handout informs the steps needed to perform a BAT assessment in support of the permitting process for industrial waste.
Best Available Techniques for Controlling Industrial Pollution	Published by the Organization for Economic Cooperation and Development (OECD), this series is intended to support governments in implementing policies and practices applying the BAT concept. Over a series of five documents, it covers existing policies, approaches, measurement, implementation, and value chain approaches to determining the best available techniques for industrial processes.

CIRCULARITY

OVERVIEW

Circularity (or the circular economy) is a concept that aims to eliminate waste from our traditional and linear economic system of extraction, consumption, and disposal. In a circular economy, there is no waste; the system retains and recovers as much value as possible from all resources throughout the process. This is achieved by recirculating products/materials at their highest value or returning them to the earth to regenerate nature.

CONNECTION TO SUSTAINABILITY

The circular economy and sustainability are highly related, but not interchangeable. Sustainability requires balanced consideration of the three pillars to inform how productive processes can be managed in the face of increasing consumption. The circular economy is more specific; it aims to make productive process more efficient by decoupling economic activity from the consumption of finite resources and transitioning to renewable energy and materials (Ellen Macarthur Foundation, 2022). Circular economy concepts provide a pathway to achieving all three pillars of sustainability for individuals, businesses, and governments.

RESOURCE	DESCRIPTION
Circular Economy Introduction	An overview of the circular economy, published by the Ellen MacArthur Foundation. It features examples, frameworks, learning pathways, and a glossary of key terminology.
Circular Economy Examples	A collection of case studies that describe circular economy success stories for governments, businesses, and cities.
<u>Funding Opportunities for</u> <u>Individuals and Businesses –</u> <u>Government of Canada</u>	A page covering strategies for individuals, communities, and businesses to integrate circular economy concepts into planning and decision-making. It also lists funding opportunities and other key resources.
Explore Circular Economy Initiatives – Government of Canada	Coverage of key efforts underway by the federal and provincial/territorial governments to support the circular economy, international initiatives supported by the Government of Canada, and Canadian success stories.
<u>Circular Economy – A Brief</u> <u>Literature Review</u>	An open access research paper that examines different perspectives and concepts of the circular economy, from its emergence in the 1970s through to the present day.
<u>Theoretical Research on Circular</u> <u>Economy and Sustainability</u> <u>Tradeoffs and Synergies</u>	An open access research paper that examines the links between sustainability and the circular economy, including what makes them similar, what makes them different, and how they can contribute to one other.
<u>The Circular Economy – A New</u> Sustainability Paradigm?	An open access research paper providing conceptual clarity on the difference between sustainability and the circular economy.

CLIMATE RISK, RESILIENCE, ADAPTATION AND MITIGATION

OVERVIEW

The Earth's climate is changing after over 10,000 years of relative stability. As global temperatures rise, extreme events are projected to increase in frequency and intensity beyond natural climate variability (Intergovernmental Panel on Climate Change [IPCC] 2022). For individuals, companies, and governments, this increasing climate risk will shape decision-making, now and into the future. Climate change mitigation (mitigation) refers to activities to reduce human-produced greenhouse gas emissions and remove them from the atmosphere. Mitigation activities must be implemented alongside climate change adaptation (adaptation) which are actions to reduce the impacts of climate change on existing social, ecological, and technological systems. Resilience is the ability of these systems to absorb impacts, recover to original function, and transform themselves when necessary, in the face of increasing climate risks.

CONNECTION TO SUSTAINABILITY

Climate change is a threat to current and future sustainability; climate risks exacerbate existing challenges such as poverty, food and water security, and healthcare. The most effective climate adaptation and mitigation measures are designed through the lens of the three pillars of sustainability, and are informed by the development goals of the jurisdiction they're implemented in. This is brought together in the concept of Climate Resilient Pathways. These are development trajectories that combine adaptation and mitigation to achieve sustainable development. (IPCC, 2022).

RESOURCE	DESCRIPTION
<u>Climate Risk and Response:</u> <u>Physical Hazards and</u> <u>Socioeconomic Impacts</u>	An overview from McKinsey Consulting of climate risk's physical characteristics, and the projected areas (worldwide) of greatest impact by 2050.
Preliminary Strategic Climate Risk Assessment – BC	An overview of the greatest areas of climate risk in BC. The assessment was completed in 2019, with a forecast period ending in the 2050s.
<u>Climate Change 2022 – Impacts,</u> <u>Adaptation and Vulnerability</u>	A comprehensive report from the Intergovernmental Panel on Climate Change (IPCC) that assesses the climate change impacts and looks at ecosystems, biodiversity, and human communities at global and regional levels. Chapter 18 includes further information on Climate Resilient Pathways.
What do adaptation and climate resilience mean?	A brief overview from the UN Framework Convention on Climate Change (UNFCCC) on adaptation and climate resilience.
What is climate resilience, and why does it matter?	A publication from the Center for Climate and Energy Solutions (C2ES) that delves into the meanings and applications of resilience.
Climate Change Information Portal	Resources collected by Engineers and Geoscientists BC to support registrants in incorporating climate change considerations into their practice.

CO-BENEFITS, TRADE-OFFS, AND MULTIPLE OBJECTIVE DECISION-MAKING

OVERVIEW

Many real-world problems have multiple–and often competing–objectives that must be considered and simultaneously optimized to inform decisions and achieve the best result. Formalized approaches to navigating these challenges are known as Multiple Objective Decision-making (MODM). Examining the trade-offs between achieving different objectives to varying extents is key to these processes; achieving one objective to a greater extent may require achieving another objective to a lesser extent. Conversely, another critical input to MODM is an awareness of co-benefits. These are areas where multiple objectives can be achieved through a single action pathway.

CONNECTION TO SUSTAINABILITY

The three pillars of sustainability serve as a framework for MODM in any situation where sustainability is the desired outcome, or a consideration in the decision being made. Considering the trade-offs and cobenefits between sustainability-related objectives and other objectives of an organization can help ensure that decisions are holistically informed.

RESOURCE	DESCRIPTION
<u>Guidance for Navigating Trade-offs</u> <u>to Support Sustainability Related</u> <u>Decision-making</u>	Overview, process, and Excel-based workbook to support product designers and decision-makers in incorporating sustainability into the design and decision process.
<u>Trade-offs in Corporate</u> <u>Sustainability</u>	An examination of the multi-faceted and complex nature of sustainable development, which proposes a framework for analysis of trade-offs in corporate sustainability.
The Co-Benefits of Climate Action	A report that defines co-benefits in a climate context and summarizes reporting by cities on their climate actions and co-benefits.
What You Need to Know about Climate Co-benefits	A briefing on co-benefits, published by the World Bank.
<u>Even Swaps – A Rational Method</u> for Making Trade-offs	A proposed method for examining trade-offs in a general context, published by Harvard Business Review.
Multi-Objective and Multi-Attribute Optimization for Sustainable Development Decision Aiding	A collection of papers that elaborate on approaches in state-of-the-art case studies in sustainable development decision-making. This includes construction, transportation, infrastructure development, production, and organization management.

DEMONSTRATING THE BUSINESS CASE FOR SUSTAINABILITY

OVERVIEW

Gaining the support of decisionmakers is necessary to advance sustainability. To gain support from stakeholders, it can be helpful to demonstrate the value of sustainable activities and sustainable decision-making by developing and communicating the business case for sustainability.

CONNECTION TO SUSTAINABILITY

In the past, public and private organizations were primarily oriented toward economic viability, with a focus on sustaining profitability to benefit shareholders or using public funds efficiently. By viewing decisions and operations through the lens of sustainability, opportunities for other forms of value creation may be identified and implemented, thereby improving organizational performance. Integrating sustainability into an organization can present opportunities to innovate, build brand reputation, and secure more projects while reducing risks doing business.

RESOURCE	DESCRIPTION
<u>The Comprehensive Business</u> <u>Case for Sustainability</u>	An article published by Harvard Business Review that states companies who build sustainability into their business strategy will drive innovation and encourage enthusiasm and loyalty from employees, customers, suppliers, communities, and investors.
<u>The Business Case for</u> <u>Sustainability</u>	A paper from the International Finance Corporation that outlines how the private sector can manage downside risk (i.e., financial risk associated with losses), create business value by incorporating sustainable solutions, or identify innovative ways to finance sustainability.
Business Cases with Sustainability for Consulting Engineers (1)	This article describes the rationale—from an engineering perspectivefor engaging in corporate sustainability, for the mutual benefit of shareholders and stakeholders alike.
Business Cases with Sustainability for Consulting Engineers (2)	This article explores the underlying drivers of change that make a business successful in incorporating sustainability. The sustainability actions linking internal and external dynamics within a company are represented in a Causal Loop Diagram.
Business Cases for Sustainability and the Role of Business Model Innovation: Developing a Conceptual Framework	This paper presents a framework for business model innovation that involves strategically and regularly creating business cases as an inherent, deeply integrated element of business activities.

ENGAGEMENT, CONSULTATION, AND MUTUAL BENEFITS

OVERVIEW

Engagement involves relevant individuals, organizations, and communities in decision-making processes while building trust and meaningful relationships. In Canada, nearly every infrastructure and resource-development project happens on Indigenous territories. Governments have a legal obligation to consult affected Indigenous peoples when their interests may be impacted by a government decision. Registrants must be aware of these obligations and consider how these might translate into responsibilities in professional practice. Effective engagement and consultation can lead to mutual benefits for the involved parties because the various perspectives, values, and desired outcomes have been considered in the decision-making process.

CONNECTION TO SUSTAINABILITY

Meaningful engagement and consultation can support sustainable outcomes because the three pillars of sustainability are often represented in stakeholders' various perspectives, values, and desired outcomes. A greater range of perspectives help ensure that decisions are made through a holistic lens. Meaningful engagement and consultation can result in adjustments to proposed policies, projects, and plans to minimize or eliminate undesired effects to a community. This ultimately shows greater respect for Indigenous rights and can act as a step towards reconciliation.

RESOURCE	DESCRIPTION
Consultation & Engagement	An overview of BC Oil & Gas Commission's approach to engagement and consultation with Indigenous communities.
First Nation Consultation Framework	This framework provides background information and lists effective consultation practices with Indigenous peoples in Canada and internationally.
<u>Consultation and engagement at</u> <u>Crown-Indigenous Relations and</u> <u>Northern Affairs Canada and</u> <u>Indigenous Services Canada</u>	An overview of engagement and consultation practices within the federal government. It presents ongoing and past consultation activities and initiatives.
<u>Citizen Engagement Handbook for</u> <u>BC Government Employees</u>	This document provides direction to BC Government public servants who are planning a citizen engagement project. This document references many internal processes, but contains general information and frameworks that may be useful to other governments and public engagement professionals.
Guidelines on Public Engagement	A guideline from Health Canada that contains detailed information on how to execute public engagement activities. This document references many internal processes, but contains general information and frameworks that may be useful to other governments and public engagement professionals

Promoting Sustainable Development with Community Engagement	An article published by Citizen Lab that outlines how local governments can mobilize communities to achieve sustainable development goals.
Community Engagement Guide for Sustainable Communities	An overview from Policy Link of the Sustainable Communities Initiative that provides useful generalist information on the benefits of, and guidelines for, community engagement.
IAP2 Resources	A webpage with links to resources curated by the International Association for Public Participation. This includes training opportunities, conferences and events, articles from the Journal of Deliberative Democracy, and other information about public participation.

LEAN CONSTRUCTION / INTEGRATED PROJECT DELIVERY

OVERVIEW

Integrated Project Delivery (IPD) is a project delivery model grounded in **Lean Construction** principles. It integrates people, systems, business structures, and practices into a process that collaboratively harnesses the talents and insights of all participants to optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication, and construction (American Institute of Architects).

CONNECTION TO SUSTAINABILITY

How engineers and geoscientists work together and with stakeholders has implications for the extent that sustainability is considered in the process. When the IPD model is applied effectively, the effective application of an IPD model, the project scope, costs, and schedule are established early in the process, allowing time to consider how to effectively add value, control costs, and reduce waste. Economic and environmental sustainability are inherently supported when the value delivered is maximized. Sustainability also reduces the waste from labour, energy, water, and materials.

RESOURCE	DESCRIPTION
Getting Started with Lean	A collection of introductory reference materials, compiled by the Lean Construction Institute (LCI).
Lean Practitioner's Resources	A collection of implementation-focused materials compiled by LCI to support practitioners engaging with their company and project teams.
Documents – Lean Construction Institute of Canada	A list of article and white papers on Lean Construction practices, as well as a glossary of terms provided by the Lean Construction Institute of Canada via the Canadian Construction Association.
Integrated Project Delivery Model in Canada: What you need to know	An overview of what IPD is, and the business case for it, published by Osler, Hoskins and Harcourt LLP.
Integrated Project Delivery: A Guide	A guide that focuses on using IPD methodologies in designing and constructing projects, published by the American Institute of Architects.
Integrated Project Delivery – An Action Guide for Leaders	A resource published by LCI covering IPD-geared goals, problem solving, project processes and tools, legality, team strategies, and best practices.
Investigating Factors Leading to IPD Success in Canada	The research—published by the Integrated Project Delivery Alliance— presented in this report aimed to document three cases of IPD implementation in Canada to understand how and why IPD was implemented, and the reasons that led to this success or lack thereof for this approach.

LIFE CYCLE ANALYSIS

OVERVIEW

Life Cycle Analysis or Assessment (LCA) is a commonly used cradle-to-grave method to assess and quantify the impact of a product, service, process, or company across its entire life cycle. Impacts can be viewed through the three pillars of sustainability. There are four steps an LCA must include: goal and scoping; life-cycle inventory analysis; life-cycle impact assessment; and life-cycle interpretation. Varying scopes exist, but every product stage can be accounted for through this analysis if intended, from embodied carbon and raw material extraction to manufacturing, distribution, use, and disposal.

CONNECTION TO SUSTAINABILITY

Life Cycle Analysis is a tool for measuring sustainability. It is possible for every pillar of sustainability to be accounted for through the process, ensuring a complete sustainability picture emerges for a product or service. This enables improvements to be made, and can result in resource efficiency, cost savings, reduced environmental liabilities, and product differentiation.

RESOURCE	DESCRIPTION
Life Cycle Analysis: Past, Present, and Future	A paper outlining the development of LCA from the 1970s to 2011.
Life Cycle Assessment Explained	This article provides an overview of how life cycle assessment works, and how it can help inform decisions and lead to more sustainable outcomes.
<u>Sustainability – Environmental Life</u> <u>Cycle Assessment</u>	An open-source collection of research papers that utilize environmental life cycle assessment (LCA) methods to understand the environmental impacts of products and services.
ISO14044:2006 – Environmental Management – Life Cycle Assessment – Requirements and Guidelines	[Paid Resource] ISO 14044:2006 specifies requirements and provides guidelines for life cycle assessment (LCA).
LCA Resources Archive	A collection of resources including tools to calculate carbon footprints, inventory databases, policy information, and globally recognized methodologies.
<u>Open LCA</u>	An open source, free software for LCA use cases, including in the industry, consulting, education, research, and public sectors.
<u>One Click LCA</u>	One Click LCA (and other similar software services) offer automated LCA software that enables users to calculate and reduce environmental impacts of buildings, infrastructure projects, products, and portfolios.

SUSTAINABILITY REPORTING

OVERVIEW

Frameworks and standards for sustainability reporting have been developed in response to mounting pressure for organizations to disclose their environment, social, and governance (ESG) information and impact. Many reporting frameworks exist, from non-prescriptive guides like the UN Sustainable Development Goals (SDGs) to rigorous accounting standards like the Global Reporting Initiative (GRI).

Sustainability reporting is highly dependent on organizational context. Publicly traded corporations generally follow the rigorous disclosure standards of one of the major reporting standards. Many companies embrace the concept of stakeholder capitalism, which is an idea that businesses have a responsibility that extends beyond their shareholders. At a more granular level, various ratings systems exist for the climate impact of buildings, including the BC Energy Step Code and LEED rating system.

CONNECTION TO SUSTAINABILITY

Sustainability reporting fosters an understanding of an organization's performance in terms of sustainability, gaps in performance, and opportunities for improvement. Sustainability reporting enables targeted interventions to lead to better outcomes.

RESOURCE	DESCRIPTION
<u>Sustainability Reporting Updates:</u> <u>Canada</u>	Chartered Professional Accountants (CPA) Canada regularly curates a summary of the latest Canadian and global sustainability reporting developments.
<u>Sustainability Reporting</u> <u>Frameworks – Guide for CIOs</u>	This report focuses on four common ESG reporting frameworks: the Climate Disclosure Project (CDP), the Global Reporting Initiative (GRI), the Sustainability Accounting Standards Board (SASB) and the Task Force on Climate-related Financial Disclosures (TCFD). While aimed at Chief Investment Officers, the report provides general information on the differences between these frameworks.
<u>UN Sustainable Development</u> <u>Goals</u>	The SDGs are calls to action for all countries to act in global partnership to address the most pressing issues of our time. Many organizations, both public and private, align reporting and strategies with one or more of the SDGs.
Principles for Responsible Investment	The six Principles for Responsible Investment offer a menu of possible actions for incorporating ESG issues into investment practice. While targeted towards investment professionals, the PRI is a useful example of a voluntary and aspirational framework.
Don't Confuse Sustainability with CSR	An article outlining the key differences between sustainability and corporate social responsibility (CSR).

<u>The Big eBook of Sustainability</u> <u>Reporting Frameworks</u>	This eBook catalogues some of the major voluntary and mandatory environmental frameworks. For each, a high-level analysis is included for the framework's requirements, as well as a summary of its distinct criteria and unique benefits as a tool for environmental reporting.
BC Energy Step Code	An overview of the BC Energy Step Code, an optional compliance path in the BC Building Code that local governments may use to incentivize energy efficiency in new construction.
LEED Rating System	An overview of the LEED green building rating system, the most widely used building rating system for energy efficiency.

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