Understanding Integrative Design in LEED v4

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7group

The Integrative Process (IP) ANSI Consensus National Standard Guide

This guide is intended to serve as a common reference that supports the building industry (architects, constructors, designers, engineers, landscape architects, ecologists, facilities managers, clients, manufacturers and others) in the practice of integrative design. It provides a clear framework based upon the following principles:

- It is simple enough to be referenced by busy building professionals and clients seeking to understand why they can benefit from an IP.
- It is specific enough to function as a guideline for practitioners and clients in determining the associated scope and deliverables.
- It is generic enough to be applicable to a wide variety of project types and entry points in the timeline of a project … and it speaks to all the participants in project delivery, so that each team member can comfortably and effectively participate in the process.

This ANSI Standard Guide, derived from *The Integrative Design Guide to Green Buildings: Redefining the Practice of Sustainability* by 7group and Bill Reed, serves as the referenced standard for the new LEED v4 IP credit.

LEED v4 IP Credit

The new IP credit is designed to begin moving LEED project teams beyond a focus on checklists. Although a comprehensive IP (such as that outlined in the *IP ANSI Standard Guide*) engages all building and site systems, **the LEED IP credit is intended to introduce project teams to an integrative approach by focusing primarily on energy- and water-related systems**. Through early analysis of these systems, project teams will ideally discover the following:

- Unique opportunities that lead to innovative designs and translate into more LEED points by providing increased building performance and greater environmental benefits, such as reduced energy, water and resource consumption.
- Unique challenges that can be addressed early in design by capitalizing on synergies between systems, saving projects time and money in both the short and long term.
- Deeper understanding of the interrelationships between systems and their components, enabling optimization of each.
- Reduction in time and cost associated with making design changes during the Construction Document (CD) phase and reduced change orders during construction.

The LEED IP credit is organized into two sets of requirements: Discovery and Implementation. The Discovery requirements identify the analysis that must be performed, while the Implementation requirements clarify how this analysis informs building design and site decisions. Achieving credit compliance requires completion of Discovery and Implementation tasks for energy- and water-related systems:

The Discovery phase is designed to create the opportunity to question assumptions, align team members around goals and foster ongoing engagement in an iterative process. Accordingly, the Discovery component of the credit requires analysis, while the Implementation component requires teams to document how this analysis informed design decisions.

> *"The Discovery phase is the foundation of an integrative process. Every team member should be engaged in discussions and setting performance goals to be considered as early as possible. Rather than imposing solutions, it is important to work to discover solutions through a process of co-learning – asking the right questions – and successfully working together to understand interrelationships between building systems, between the work of the design team members; and between the project and the larger natural systems it inhabits."*[3]
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> [3]Adapted from *The Integrative Design Guide to Green Building* by 7group and Bill Reed

LEED v4 IP Credit Step-By-Step Guidance
We led the effort to create and write the language for this new IP credit in LEED, and we also served as the primary author for the related information in the LEED v4 Reference Guide for Building Design and Construction, including step-by-step guidance to help project teams pursue the LEED IP credit. The following outline summarizes these seven steps:

Discovery Steps

Step 1: Become Familiar with the IP
Although the credit is derived from the *IP ANSI Standard Guide*, steps for achieving LEED compliance represent only a small introductory piece of the much larger IP outlined in the ANSI guide. Accordingly, it would benefit project teams to become familiar with the *IP ANSI Standard Guide*.

Step 2: Conduct Preliminary Energy Research and Analysis (in concert with Step 3)
Without initial research and analysis, potential integrative design opportunities will not be able to be discussed at the Goal-Setting Workshop in Step 4 with a high level of rationale behind them. Therefore, Step 2 includes the following energy-related research and analysis to support effective and informed discussions about potential integrative design opportunities:

1. Understand Site Conditions: Collect information about the local climate, site conditions, energy sources, transportation options and potential building features. This might include gathering annual, hour-by-hour, local climate data for later input into the energy model, including dry-bulb temperature, wet-bulb depression, relative humidity and comfort hours. Although not required, it also is useful to gather the information outlined in the requirements for the new LEED v4 SSc1 Site Assessment, including information about topography, hydrology, climate, vegetation, soils and existing infrastructure.

2. Benchmark Energy Performance for Similar Buildings: Use the U.S. Environmental Protection Agency's Target Finder tool or other data sources to benchmark energy performance for the project's type, scope, occupancy and location.

3. Understand Likely Energy Load Distribution: Develop an extremely simple or "simple box", energy model with an assumed building form to inform the team about the distribution of loads by energy consumption end use. This helps identify where the leverage points are for maximizing impacts. Prepare an initial energy load distribution chart to identify where the dominant energy loads are, thereby identifying priority areas to look for savings that can result from integrative strategies. This initial simple modeling can be accomplished by either an MEP engineer or an energy modeling consultant via a wide array of available software ranging from quite simple to extremely complex. At this stage, simple works well.

Step 3: Conduct Preliminary Water Research and Analysis (in concert with Step 2)
Similar to the preliminary energy analysis in Step 2, the following water-related research and analysis is aimed at supporting effective and informed discussions about potential integrative design opportunities:

1. Understand Site Conditions: Collect information about waste treatment infrastructure, water sources and potential building features. This might include:

    - Annual rain fall (inches or millimeters per year) for the project site.
    - Average monthly rain fall (inches or millimeters per month) for the project site.
    - Identifying the location, capacity, type and level of treatment for sewage treatment serving the site, including any sewage plant facilities (map and distance from site). Include data regarding average water treatment cost (per applicable unit).

- Identifying the location, capacity and type of water sources serving the site, including reservoirs, aquifers, wells, lakes, rivers, non-potable sources, municipal supply, etc. Include data regarding average potable (and/or non-potable) water supply cost (per applicable unit).

2. Assess Expected Water Demand: Conduct preliminary analysis to quantify indoor, outdoor and process water demand using the methodologies for WE Prerequisite Indoor Water Use Reduction, WE Prerequisite Outdoor Water Use Reduction and WE Credit Cooling Tower Water Use.

3. Assess Expected Water Supply: Perform preliminary analysis to quantify the project's potential non-potable supply sources, such as captured rainwater, graywater from flow fixtures, or condensate from HVAC cooling equipment.

4. Prepare a Preliminary Water Budget Analysis: Conduct a preliminary analysis to quantify how fixture and equipment selection and non-potable supply sources may offset potable water use for the water demands.

Step 4: Convene Goal-Setting Workshop (Required)
Actively engage the project owner in the Discovery phase to develop and align the project team around the owner's aspirational goals for the project, including budget, schedule, programmatic requirements, scope, quality and performance expectations, by convening a workshop with all primary project team members. Understanding the nature of the owner's goals and the purpose behind them will aid the team in creative problem-solving and encourage more fruitful interaction. This workshop should:

- Introduce all project team members to the fundamentals of the IP.
- Share initial background research and analysis findings from Discovery Steps 2 and 3 above. For example, share the total annual energy use target derived from EPA's Target Finder (such as 40,000 Btu per square foot), which can then be translated into an annual energy budget, so that everyone immediately sees the operating cost impacts.
- Elicit owner and stakeholder values and aspirations.
- Clarify functional and programmatic goals.
- Establish initial principles, benchmarks, metrics and performance targets (such as 40,000 Btu/sf/year), including LEED credits to be pursued.
- Generate potential integrative strategies for achieving performance targets, such as identifying solar orientation (based on site constraints/opportunities), building envelope characteristics, opportunities for reduced lighting levels, and other load reduction strategies aimed at achieving the targeted annual energy consumption.
- Determine key questions that need to be answered to support project decisions.
- Develop an Integrative Process Road Map that identifies initial responsibilities and deliverables.
- Initiate documentation of the Owner's Project Requirements (OPR).

All key project team members should attend the Goal-Setting Workshop.

Step 5: Assess Possible Energy Strategies (in concert with Step 6)
Evaluate the feasibility of proposed performance targets developed during the Goal-Setting Workshop by identifying and exploring a wide range of opportunities and possible strategies for project energy-related systems. It is recommended that project teams engage this initial early research and analysis by assessing each subsystem described in the *IP ANSI Standard Guide* and evaluating possible strategies against the initial performance targets (and targeted LEED credits) identified at the Goal-Setting Workshop. Use this analysis to discover; for example, what set of related systems/decisions might achieve the targeted 40,000 Btu/sf/year from above (i.e. which

combination of building massing, insulation, window performance and lighting levels will result in the most energy-efficient and cost effective building BEFORE design begins).

This analysis should be conducted with preliminary comparative energy modeling using the “simple box” energy model (Step 2) before completing schematic design to evaluate energy load reduction strategies. Aspects to consider include the following:

- *Site conditions:* landscape solar shading, exterior lighting, feasibility for natural ventilation and adjacent site conditions.
- *Massing and orientation:* number of floors, building footprint, configuration and solar orientation.
- *Building envelope attributes:* wall and roof insulation, thermal mass, window size and orientation, exterior shading devices and window performance (U-values, solar heat gain coefficient, visible light transmittance, etc.).
- *Lighting levels:* lighting power density, lighting needs in workspaces, reflectance values for ceiling and wall surfaces, high-efficiency lighting fixtures and controls, and daylighting.
- *Thermal comfort ranges:* temperature set points and thermal comfort parameters.
- *Plug and process loads:* equipment and purchasing policies, other programmatic solutions, and layout options.
- *Programmatic and operational parameters:* hours of operation, space allotment per person, shared program spaces and teleworking policies.

Project teams must conduct preliminary modeling to assess at least two optional strategies for each of the above seven aspects.

Step 6: Evaluate Possible Water Strategies (in concert with Step 5)
Similar to the preliminary energy analysis in Step 3 (and based on the goals developed during the Goal-Setting Workshop), assess the feasibility of proposed performance targets by identifying and exploring opportunities and possible strategies for project water-related systems. Conduct a preliminary water budget analysis using research on potential water-use reduction strategies (Step 3). Aspects to consider include the following:

- *Indoor water use demand:* preliminary baseline and design case water consumption inside the building based on the building occupants’ use of assumed plumbing fixture flow and flush rates (using the methodology for WE Prerequisite Indoor Water Use).
- *Outdoor water use demand:* preliminary baseline and design case water consumption for landscape irrigation based on assumed landscape strategies and irrigation systems (using the methodology for WE Prerequisite Outdoor Water Use).

Gather data (in addition to that collected in Step 3) to assess and quantify the project’s potential non-potable supply sources, such as captured rainwater, graywater from flow fixtures and condensate produced by initially assumed HVAC cooling equipment.

Assess and quantify how potential non-potable supply sources can be used to offset potable water use for the water demands calculated above. Identify at least one on-site, non-potable water source that could supply a portion of at least two demand components.

Implementation Step

Step 7. Document How Analysis Informed Design and Building Form
LEED Credit form worksheets, which are a series of spreadsheet questionnaires, are provided in LEED Online to document the results in which project teams must enter narrative information. These forms/worksheets are designed to keep the documentation process simple as they request summary information about the following:

1. Energy-related systems: Document energy-related research and analysis from the Discovery phase by demonstrating how the above energy-related analysis informed design and building form decisions in the project's OPR and basis of design (BOD), including the following, as applicable:

    - Building and site program
    - Building form and geometry
    - Building envelope and façade treatments on different orientations
    - Elimination or significant downsizing of building systems (e.g., HVAC, lighting, controls, exterior materials, interior finishes and functional program elements)
    - Other systems

    Provide narrative explanations of the energy evaluation in the energy analysis section of the IP worksheet (provided by USGBC) and identify at least two options for each of the seven aspects listed in Step 5.

2. Water-related systems: Document water-related research and analysis from the Discovery phase by demonstrating how the above water-related analysis informed building and site design decisions in the project's OPR and BOD, including the following, as applicable:

    - Plumbing systems
    - Sewage conveyance and/or on-site treatment systems
    - Rainwater quantity and quality management systems
    - Landscaping, irrigation and site elements
    - Roofing systems and/or building form and geometry
    - Other systems

    Provide narrative explanations of the water evaluation in the water analysis section of the IP worksheet, and identify how at least one on-site, non-potable water source was used to supply a portion of at least two demand components.

Conclusion

A successful sustainable project is a solution that is greater than the sum of its parts. By intentionally exploring opportunities between the engineered, cultural and natural systems present in all building projects, significant efficiencies, cost savings and even regeneration of living systems, can be achieved. Simply adding or overlaying individual "environmental" systems in isolation will not allow projects to benefit from the synergies that can be identified through an integrative, or whole system, design approach. This is the fundamental challenge of sustainable design and building cost-effective LEED projects.

The core concept of integrative design is simple: almost everything in a building project affects everything else. Consequently, the IP examines, in advance, an understanding of how different systems impact each other, and how to consciously make choices that improve the efficiency of a project. The goal is to integrate site parameters, solar orientation, water, stormwater systems, thermal envelope, lighting, window performance, heating and cooling supply systems, ventilation and air distribution in such a way that all of these systems are working together, much like those within an organism.

To accomplish this, a robust integrative design methodology constantly examines the tradeoffs between up-front costs for pursuing project goals and the benefits that are derived from achieving them. Design decisions are based upon analyzing, quantifying and evaluating the interrelationships between building systems. This methodology engages everyone with every issue early in the project, and allows project teams to design and construct high performance (and LEED) buildings that cost no more (and often less) to construct than conventional buildings, cost much less to operate and benefit the environment.