One of the other benefits of having a LEED AP on the project team is that one credit is awarded for the certification of the project. One drawback of the current system of awarding this credential is that it does not require in-depth knowledge of the building design and construction process, nor does it require professional experience. One challenge for the USGBC has been to create a rigorous accreditation process with requirements either for periodic recertification or for continuing education to maintain currency on green building issues and the LEED system.

In a similar fashion, the GBI offers training and testing designed to produce Green Globes Professionals (GGPs) who have a detailed knowledge of Green Globes, the certification process, and documentation requirements. Like LEED, Green Globes provides credit for having a GGP as a member of the project team. Unlike the LEED AP, the GGP must be a qualified building industry professional prior to taking the accreditation examination to become a GGP. Green Globes also has a higher-level qualification, the Green Globes Assessor (GGA), for the third-party advisor to the GBI regarding certification. The requirements to become a GGA far exceed those to become a GGP. The GGA provides the actual third-party certification for the project, assists the project team through the certification process, and makes the final judgment regarding achievement of certification and the level of certification. Chapter 6 covers the qualifications of GGAs and GGPs in more detail.

Integrated Design Process

Although it is true that excellent teamwork is required for any building project, the level of interaction and communication needed to ensure the success of a green building project is significantly higher. Green buildings are a relatively new concept to the industry, and generally it is necessary to orient all members of the project team to the goals and objectives of the project that are related to issues such as resource efficiency, sustainability, certification, and building health, to name a few. This orientation can serve three purposes. First, it can fulfill its primary purpose of informing the project team about all project requirements. Second, it can familiarize the project team with the owner's priorities for the high-performance green building aspects of the project. Third, it can provide an opportunity to accomplish team building in the form of group exercises for familiarizing the group with the building, the building program, and the building's green building issues.

Integrated building design or integrated design is the name given to the high levels of collaboration and teamwork that help differentiate a green building design from the design process found in a conventional project. According to the US Department of Energy, integrated design is

> [a] process in which multiple disciplines and seemingly unrelated aspects of design are integrated in a manner that permits synergistic benefits to be realized. The goal is to achieve high performance and multiple benefits at a lower cost than the total for all the components combined. This process often includes integrating green design strategies into conventional design criteria for building form, function, performance, and cost. A key to successful integrated building design is the participation of people from different specialties of design: general architecture, HVAC [heating, ventilation, and air conditioning], lighting and electrical, interior design, and landscape design. By working together at key points in the design process, these participants can often identify highly attractive solutions to design needs that would otherwise not be found. In an integrated design approach, the mechanical engineer will calculate energy use and cost very early in the design, informing designers of the energy-use implications of building orientation, configuration, fenestration, mechanical systems, and lighting options.[8]

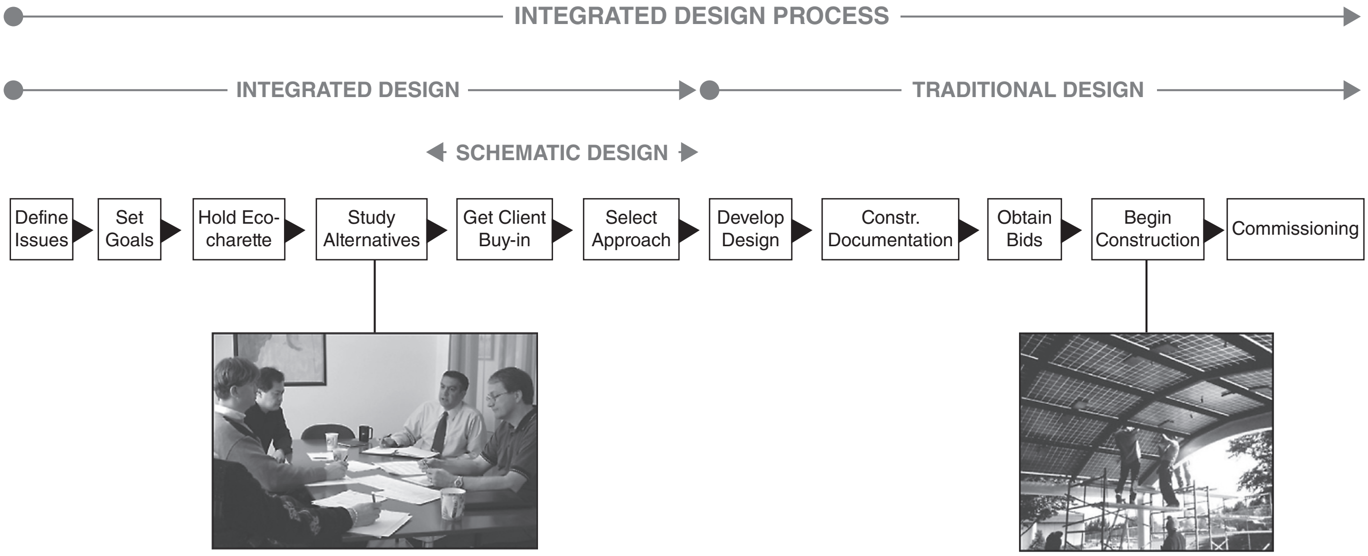

Figure 7.2 In green design, the integrated design starts much earlier in the project development process compared with conventional design, involving interaction with the owner to define issues and to set goals prior to schematic design and continuing through construction and commissioning (Diagram courtesy of Interface Engineering, Inc.)

The IDP is characterized by early significant collaboration in the design process. In conventional design, the team members begin their joint effort at the start of schematic design; in a green building project employing integrated design, the collaboration starts at the very beginning of the project, and all team members have input on design decisions during the entire cycle of design (see Figure 7.2). The earlier integrated design is implemented, the greater the benefits (see Figure 7.3).

There are numerous potential areas for integrated design in any building project: the building envelope, the daylighting scheme, green roofs, minimization of light pollution, indoor environmental quality, and the building hydrologic cycle, to name but a few. The Green Globes building assessment protocol spells out the requirements for integrated design in its project management section, where a team can achieve 20 points for demonstrating that it has indeed implemented integrated design

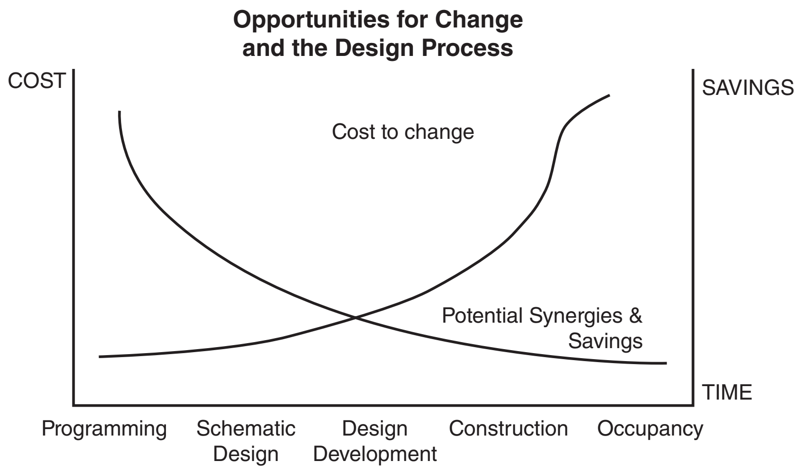

Figure 7.3 The earlier an integrated design is implemented, the greater the potential savings and the lower the cost of changes to the building design.

in the process. In addition to appointing a green design coordinator, the team must demonstrate how it interacted by documenting the results of collaboration in the form of the minutes of goal-setting meetings and lists of items on which team members worked jointly for resolution.[9]

Another term that describes integrated design is *integrated design process*. Some of the foundational work on developing IDP occurred in Canada, and perhaps the most thorough definition was a result of a national workshop on IDP held in Toronto in 2001:

> IDP is a method for realizing high-performance buildings that contribute to sustainable communities. It is a collaborative process that focuses on the design, construction, operation and occupancy of a building over its complete life cycle. The IDP is designed to allow the client and other stakeholders to develop and realize clearly defined and challenging functional, environmental and economic goals and objectives. The IDP requires a multi-disciplinary design team that includes or acquires the skills required to address all design issues flowing from the objectives. The IDP proceeds from whole building system strategies, working through increasing levels of specificity, to realize more optimally integrated solutions.[10]

In addition to this extensive definition of IDP, the main elements of the IDP were identified as:

- Interdisciplinary work between architects, engineers, costing specialists, operations people, and other relevant actors right from the beginning of the design process.
- Discussion of the relative importance of various performance issues and the establishment of a consensus on this matter between client and designers.
- The addition of an energy specialist to test various design assumptions through the use of energy simulations throughout the process and to provide relatively objective information on a key aspect of performance.
- The addition of subject specialists (e.g., for daylighting, thermal storage, etc.) for short consultations with the design team.
- Clear articulation of performance targets and strategies, to be updated throughout the process by the design team.
- In some cases, a design facilitator may be added to the team, to raise performance issues throughout the process and to bring specialized knowledge to the table.

It was also noted that it may be useful to launch the IDP with a charrette, which is described in more detail in the next section of the chapter.

Traditional design could be said to have three steps:

1. The client and architect agree to a design concept that includes the general massing of the building, its orientation, its fenestration, and probably its general appearance and basic materials.
2. The mechanical and electrical engineers are engaged to design systems based on the building design concept agreed to in step 1. The civil engineer and landscape architect develop a concept for landscaping, parking, paving, and infrastructure based on the building design concept and the owner's wishes.
3. Each phase of design (schematic, design development, and construction documents) is carried out employing the same pattern, with minimal interaction between disciplines, little or no interdisciplinary collaboration, and great attention to the speed and efficiency of executing each discipline's design.

The result of traditional design is a linear, noncollaborative process with little attempt to set goals beyond meeting the owner's basic needs. The building meets the building code but is not optimized. Each discipline functions in isolation, with interdisciplinary communications kept to a minimum. As is the case with every other system, optimizing each subsystem of the project results in a suboptimal building. The most likely outcome is not only a suboptimal project but also a range of other potential problems caused by a lack of strong coordination among disciplines.

In contrast to traditional design, the point of the IDP is to optimize the entire building project. The requirements for communication are intense, nonstop, and at all stages of the project, from design through construction, commissioning, handover to the owner, and postoccupancy analysis. Integrated design starts prior to the actual design process, with the project team articulating goals for the project and determining the opportunities for synergies in which design solutions have multiple benefits for the project. A typical sequence of events that is indicative of integrated design is listed next.

- The project team establishes performance targets and preliminary strategies to achieve the targets for a broad range of parameters, to include energy, water, wastewater, landscape performance, heat island issues, indoor environmental quality, and construction and demolition waste generation, to name a few. The IDP should bring engineering skills and perspectives to bear at the concept design stage, thereby helping the owner and architect avoid becoming committed to a suboptimal design solution. It also should involve all members of the team bringing their skills to bear on designing the optimal building. Mechanical engineers are better placed in terms of their background in thermodynamics and heat transfer than the architect, and it makes sense to engage them in the design of the building envelope.
- The team minimizes heating and cooling loads and maximizes daylighting potential through orientation; building configuration; an efficient building envelope; and careful consideration of the amount, type, and location of fenestration. A wide variety of plug loads should be addressed due to the effects of large numbers of computers, printers, fax machines, sound systems, and other equipment on building performance. Minimizing these loads and selecting equipment with the lowest possible energy consumption is needed so that the intent of the high-performance building is not compromised by neglecting to account for this consumption. The broad range of indoor environmental quality issues should be addressed, to include air quality, noise, lighting quality and daylighting, temperature and humidity, and odors. The team also should collaborate on site issues to maximize the use of natural systems; minimize hardscape; use trees to assist heating and cooling of the building; and integrate rainwater harvesting, graywater systems, and reclaimed water into the design of the building's hydrologic cycle.
- The team maximizes the use of solar and other renewable forms of energy, and use efficient HVAC systems while maintaining performance targets for indoor air quality, thermal comfort, illumination levels and quality, and noise control.
- The results of the process are several concept design alternatives, employing energy, daylighting, and other simulations to try out the alternatives, and then the selection of the most promising of these for further development.

The earlier IDP is instituted, the greater its effect on the design process. The maximum benefit occurs when the decision to employ the IDP is made prior to the start of the design process and the project team has the opportunity to set goals for the project that guide the design process.

The result of the IDP should be a full understanding of the potential design synergies and the connection of the project goals to the resulting building design. A truly collaborative process will use these project goals as the basis for wide-ranging, dynamic interaction among the project team members to capitalize on the potential for reducing resource consumption, limiting environmental impacts, and restoring the site to its maximum ecological potential. Figure 7.4 is a schematic that demonstrates how project goals can be used in conjunction with IDP to produce a wide range of benefits, both for the project and for the environment.

Another term related to integrated design is *whole-building design*, a concept advocated by the National Institute of Building Sciences and described as consisting of two components: an integrated design approach and an integrated team process.[11] Whole-building design has been adopted by a group of federal agencies as the core concept of high-performance green buildings, and the emphasis is on collaboration and life-cycle performance. The concept of collaboration is extended outside the project team to include all stakeholders in the building process. In the integrated team process, the design team and all affected stakeholders work together throughout the project phases to evaluate the design for cost, quality of life, future flexibility, and efficiency; overall environmental impact; productivity and creativity; and the effect on the building's occupants. Whole-building design, as described by the National Institute of Building Sciences, draws from the knowledge pool of all the stakeholders across the project's life cycle, from defining the need for a building through planning, design, construction, building occupancy, and operations. The process does not conclude at the end of construction and handover to the owner. During operation, the building should be evaluated to ensure that it has met its high-performance design objectives. Furthermore, the building should be recommissioned periodically to maintain its high-performance character throughout its life cycle.

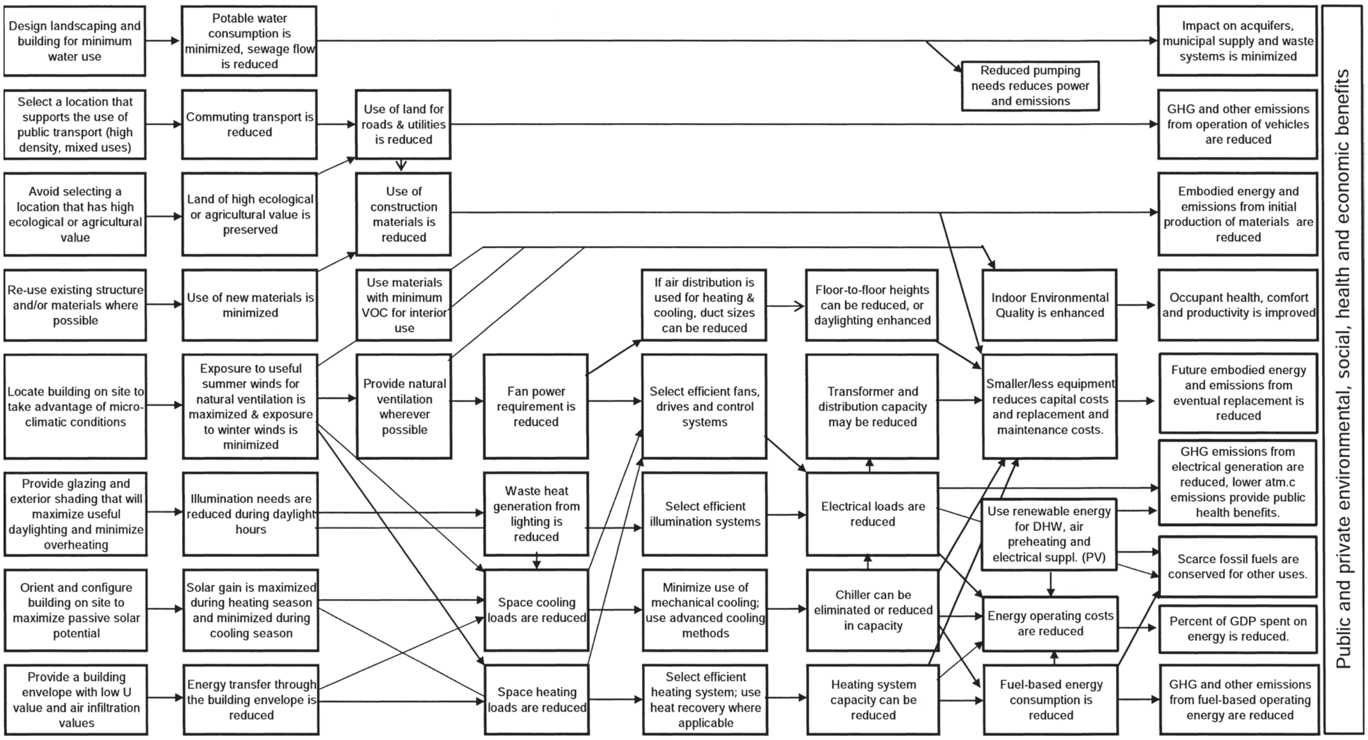

Figure 7.4 An IDP can assist in achieving design synergies by stimulating interdisciplinary collaboration. The result can be green strategies, such as those listed in the leftmost column of this example project, being translated into benefits for the building owner and occupants as well as for the global environment. (Illustration courtesy of Nils Larsson, Natural Resources Canada, and the United Nations Environmental Program)