Sustainable Thinking at Work: New Processes for Building Green

Green Building requires a new way of thinking and approaching the design, construction, operation, and renovation of buildings and communities.

- ❑ How do teams organize as part of an **integrative process**?
- ❑ How do **systems thinking** change the way sites are developed?
- ❑ How does **life-cycle assessment** affect materials selection?

How does this new approach work in real life?

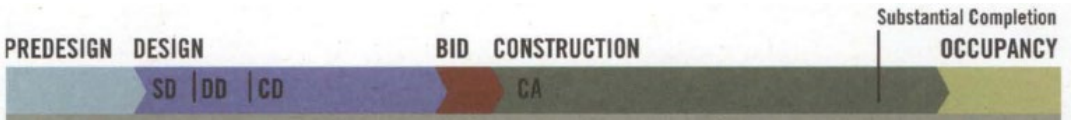
Principles For Successful Practice

Process Matters

A good process is essential to good outcomes.

Principles For Successful Practice

Get in Early



Construction Phases

- **Predesign** entails gathering information, recognizing stakeholder needs, establishing project goals, and selecting the site.
- **Design**
  - **Schematic design (SD)** explores several design options and alternatives, with the intent to establish an agreed-upon project layout and scope of work.
  - **Design development (DD)** begins the process of spatial refinement and usually involves the first design of a project's energy systems.
  - **Construction documents (CD)** carry the design into the detail level for all spaces, systems, and materials so that construction can take place.
- **Bidding** is when costs are established and contracts for construction services are signed.
- **Construction, or construction administration (CA),** involves the actual construction of the project. Commissioning takes place near the end of construction, once the systems have been installed and are operable.
  - **Substantial completion** is a contractual benchmark that usually corresponds to the point at which a client could occupy a nearly completed space.
  - **Final completion**.
  - **Certificate of occupancy** is the official recognition by a local building department that a building conforms to applicable building and safety codes.
- **Occupancy** occurs after the certificate of occupancy has been received and is continued throughout the life of the building. During occupancy, periodic maintenance must occur. Additionally, recommissioning along with occupant surveying (via a post-occupancy evaluation) should take place at regular intervals.

Principles For Successful Practice

Follow Through

- ❑ Ensure that the strategies and technologies are maintained or adapted as necessary to remain effective.
- ❑ Ongoing training ensures knowledgeable operation and maintenance of these strategies and technologies, as well as an opportunity to provide feedback on the challenges faced and lessons learned.

Principles For Successful Practice

Look Beyond First Costs to Long-Term Savings

- ❑ Green Building often shifts cost earlier. Increased efficiency and savings come later.
- ❑ Up-front **goal setting**, analysis, and evaluation of alternatives will assist in making decisions that result in savings over the long term through synergies and integration.
- ❑ **Synergies** are actions that complement each other, creating a whole greater than the sum of its parts.
- ❑ The savings are often reflected in **life-cycle costing**.

Principles For Successful Practice

Include and Collaborate

- ❑ Multidisciplinary team of professionals
- ❑ Members of the community involved or affected by the project
- ❑ Look at the big picture, not just individual elements

ESTABLISHING AN ITERATIVE PROCESS

Integrated Project Delivery (IPD)

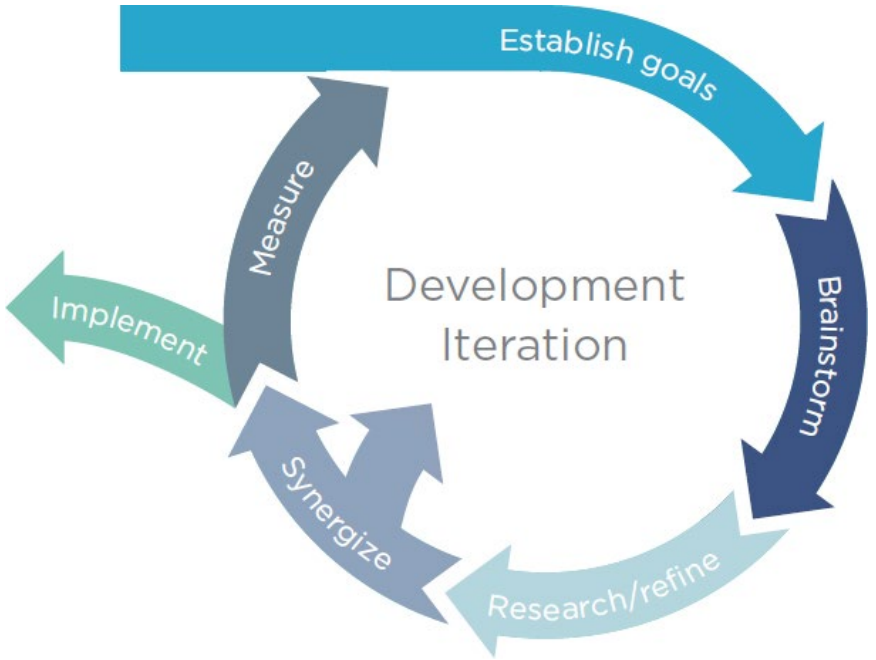
an approach that involves people, systems, and business structures (contractual and legal agreements) and practices. The process harnesses the talents and insights of all participants to improve results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication, and construction. (Adapted from American Institute of Architects)

Design-build and IPD enable team members to participate from the early project stages, including goal setting and initial brainstorming.

ESTABLISHING AN ITERATIVE PROCESS

Iterative Process

- An iterative process is circular and repetitive. It provides opportunities for setting goals and checking each idea against those goals.
- Defining critical milestones, assigning champions, and clarifying goals up front will enable projects of all sizes and types to incorporate sustainability more effectively.



ESTABLISHING AN ITERATIVE PROCESS

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Types of Meetings

- ❑ Charrette
- ❑ Team Meeting
- ❑ Small Task Group
- ❑ Stakeholder Meeting

ESTABLISHING AN ITERATIVE PROCESS

Charrette

an intensive, multiparty workshop that brings people from different disciplines and backgrounds together to explore, generate, and collaboratively produce design options.

ESTABLISHING AN ITERATIVE PROCESS

Charrette

At least one initial strategy meeting or LEED “charrette” generally held at the beginning of the project

- ❑ Charrettes assist in establishing green goals
- ❑ Goal – to develop possible design and strategies for greening a space

<u>Deliverables</u>

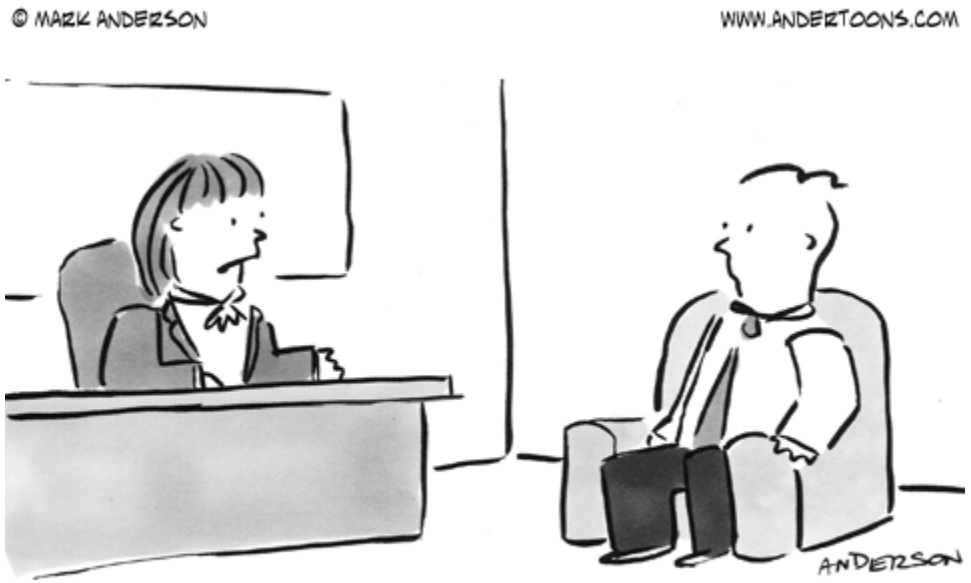
The typical deliverables from the initial strategy meeting are:

1. LEED certification goal (certification level)
2. LEED scorecard that shows the targeted credits for pursuit (LEED checklist)

9+10
21

Team Meeting

Allow the group to work together creatively on new synergies.



"While I appreciate your input, what I really need from you is some output."

Small Task Group

Opportunity to explore particular topics, conduct research, and refine the ideas for presentation at a later team meeting.

ESTABLISHING AN ITERATIVE PROCESS

Stakeholder Meeting

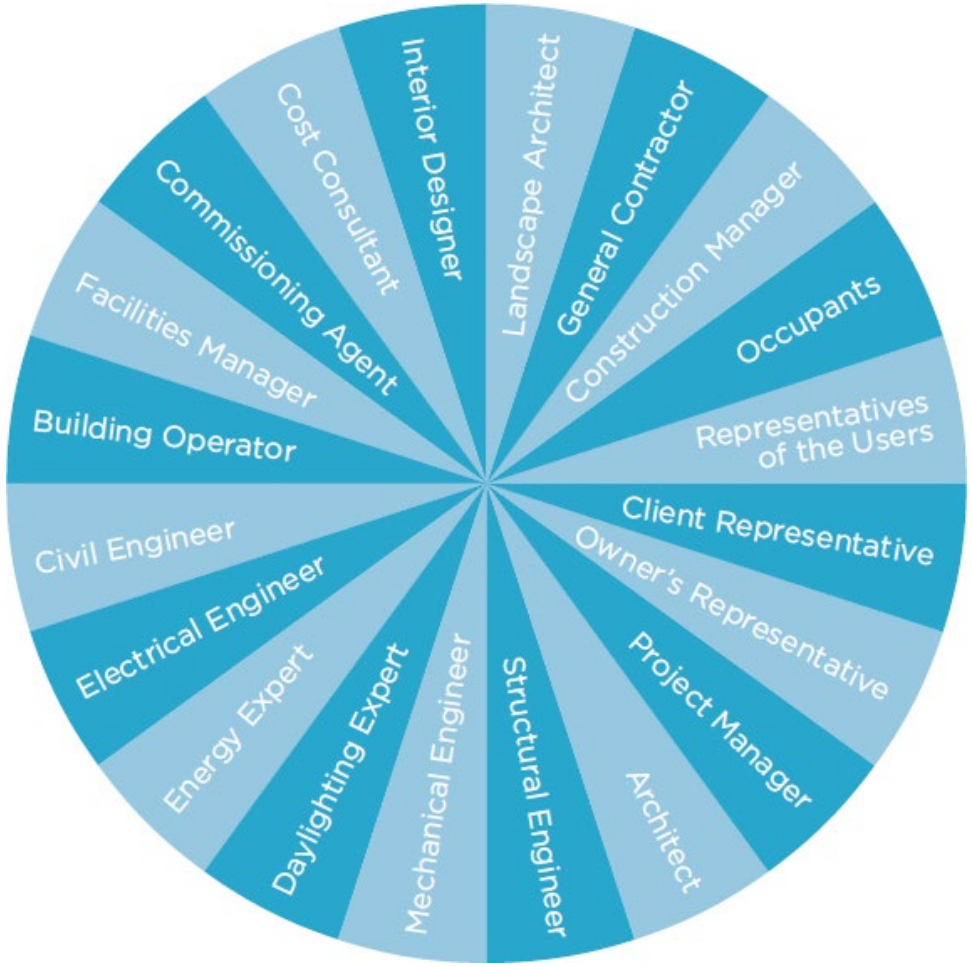
Held with neighbors, community members, and others with a vested interest in the project.

They enhance a project team's interaction with and understanding of community issues, concerns, and ideas.

TEAM SELECTION

Project Team

Broad
Inclusive
Collaborative
Provide Training



GOAL SETTING

Green Building Projects

Must be grounded in strong goals and set a pathway to ensure they are achieved.

GOAL SETTING

Green Building Projects

Clear goals articulate what the project will be designed to accomplish, by:

- ❑ Making sure that the vision is clear
- ❑ Providing a frame of reference for the whole project
- ❑ Defining the sustainability targets and keeping the project on track to meet them

Metrics and Targets

Goals	**Assessments and Measurements**
S = Specific	Metrics
M = Measurable	➔ Qualitative
A = Attainable	➔ Quantitative
R = Realistic	
T = Timely	

GOAL SETTING

Example

Goal - neighborhood project be walkable

Quantitative

Percentage of homes that are within a quarter-mile of destinations such as parks, restaurants, and stores.

Qualitative

Does the project have functional sidewalks?

OBSERVATION OF THE SYSTEM

Data Gathering and Interpretation

Often requires expertise of technical specialists:

Hydrologists

Ecologists

Engineers

Economists

Anthropologists

OBSERVATION OF THE SYSTEM

Data Gathering and Interpretation Tools

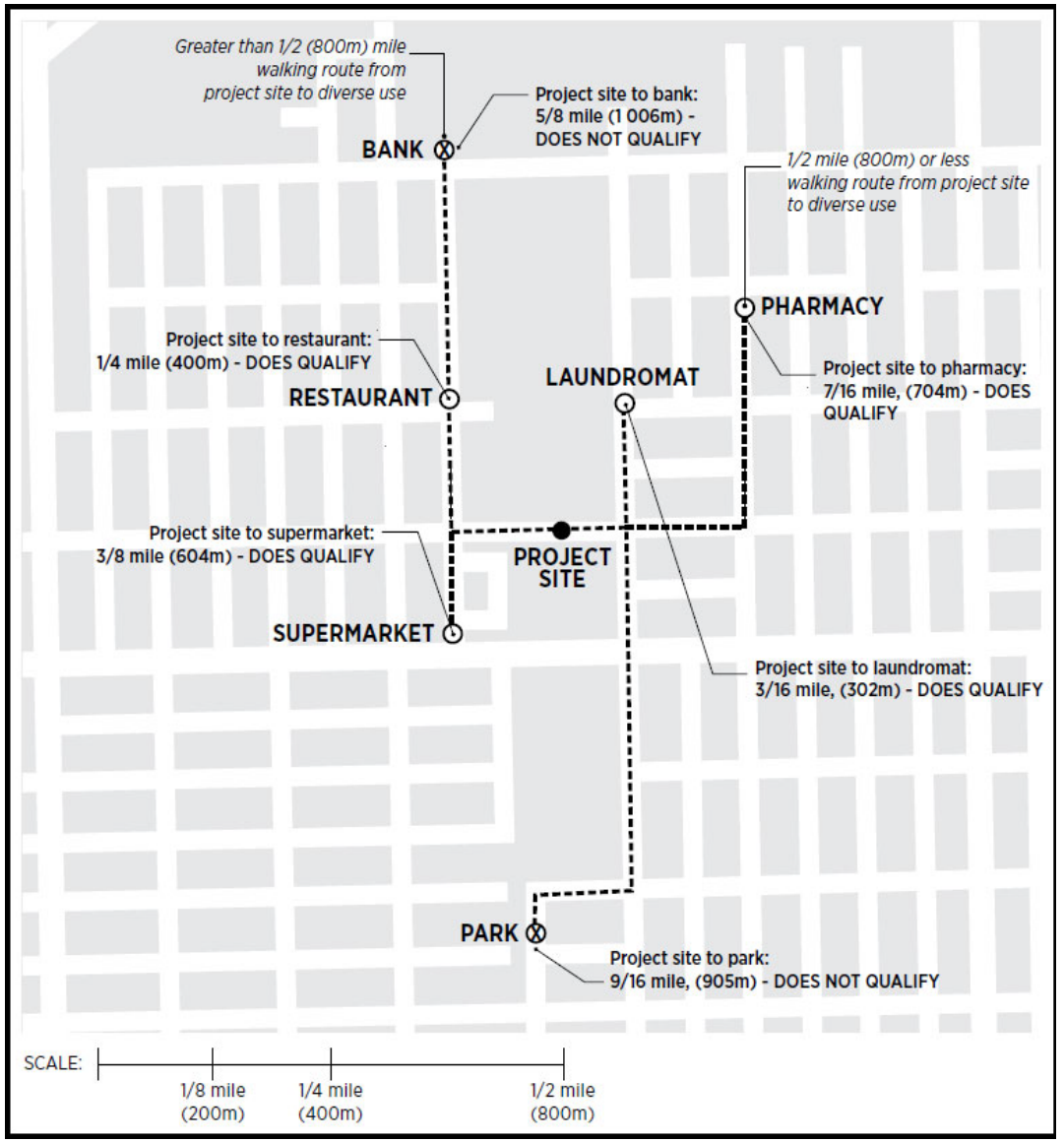
Systematic data collection and analysis

Mapping

Occupant surveys

Building walkthroughs

Audits



OBSERVATION OF THE SYSTEM

Data Gathering and Interpretation

Geographical information systems (GIS) can help illustrate how different elements intersect and overlap.

Map layers might show soils, infrastructure, shade, wind patterns, species distribution, land uses, demographics, roads and transit routes, traffic patterns, walkways and barriers, material flows, and solid waste pathways.

Maps can also display growth projections, targeted development areas, and other indicators of how the site is likely to change over time.

OBSERVATION OF THE SYSTEM

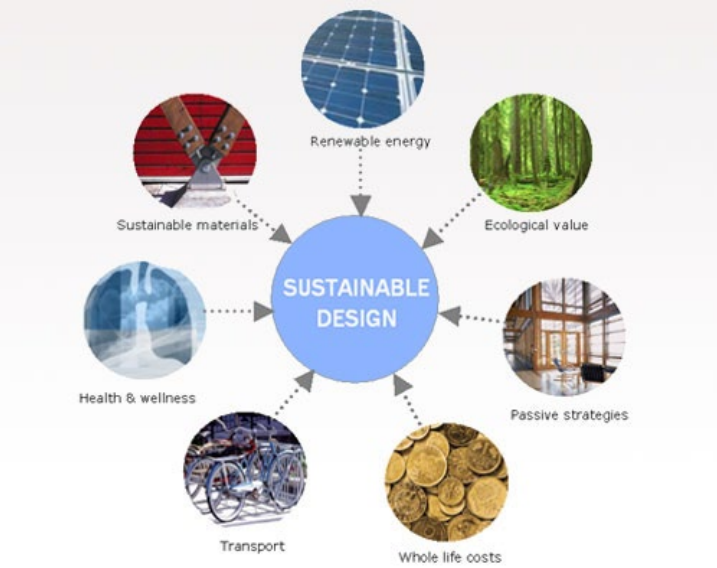
OBSERVING A SYSTEM

To observe and understand the site, team members must ask many questions:

- What are the general climatic patterns of the site? What are the microclimates, and how and why do they occur? How does water fall on and run off the site? How does the sun affect these conditions?
- What are the soils like on the site? Are they rich loam or hard clay? Has the site ever been used for agriculture? Can it be used to grow food now?
- What plants and animals exist on the site? How did they get there? Are they healthy or stressed?
- How does energy get to the site? Is the site remote or connected to a utility grid?
- Are there roads? What type? Where do they go? Do they have sidewalks? How do the current occupants use this infrastructure?
- What kind of buildings are on the site? How tall are they? How do they connect to the street? Are they new or old? Occupied or vacant? What are they used for?

Sustainable Design

Requires thinking methodically through the types of strategies for each aspect of the system and evaluating alternatives against project goals through an iterative process.



Example - Designing a new waste management plan

Waste Hauler #1	Waster Hauler #2
Cost less	Higher recycling diversion rate
Accepts only sorted recyclables	Accepts commingled recyclables

Team values both recycling and cost savings. Now what?

What if another project goal is to reduce GHG emissions associated with solid waste?

The team would then have to consider additional information, such as the distance of each waste management facility from the project site, the types and sizes of trucks used for hauling, and their associated emissions factors.

That example illustrates four important points.

- When systems thinking is applied to sustainable design, it is often necessary to consider information beyond cost. A wide range of tools can help teams evaluate components of a system, including modeling, life-cycle analysis, and life-cycle cost analysis, as well as inventorying.

- Even if the system is evaluated using a complex computer model, the best solution may depend on the team's goals, metrics, and targets, as well as their resources. The alternatives must be analyzed and evaluated against the goals.

- Although alternatives are often viewed as an either-or choice, there may be more than two options. In the waste hauler example, the question is about more than which hauler to select. When deciding between two alternatives, the project team must ask whether there is a third option (or a fourth or a fifth …). The question can spark the creativity needed to find new solutions that lead to sustainability.

- Sometimes other variables, besides goals, targets, and costs, may make certain solutions inappropriate for the site. Sustainable design means finding not only the measures that perform best in a model but also the solutions that will perform best over the life of the project.

EXPLORATION AND SELECTION OF TECHNOLOGIES AND STRATEGIES

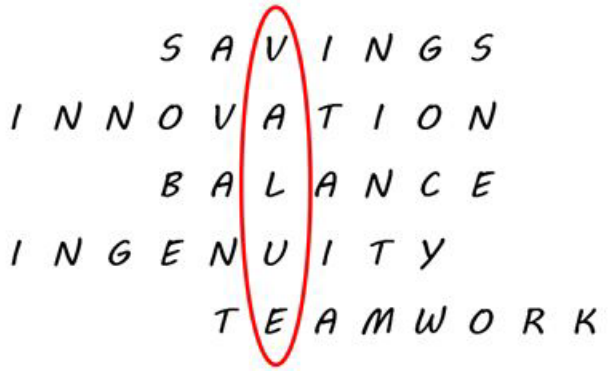
EVALUATING STRATEGIES

For existing building projects, the evaluation process should take the following steps:

- Set goals
- Benchmark performance
- Identify improvement opportunities
- Prioritize and align improvement opportunities with the project goals
- Implement the program
- Measure performance and undergo third-party verification
- Set revised or new goals

Value Engineering

a formal review based on the project's intended function and conducted to identify alternatives that reduce costs and improve performance, is a critical part of the sustainable design process.



Planning and Design Phase

Up-front Planning

- ❑ Helps keep a project on schedule and on budget
- ❑ Protects achieving the projects goals

IMPLEMENTATION

FROM PLANNING TO PRACTICE

Management plans for design-build construction projects are critically important; they must be developed, implemented, and documented.

A **construction activity pollution prevention plan** addresses measures to prevent erosion, sedimentation, and discharges of potential pollutants to water bodies and wetlands.

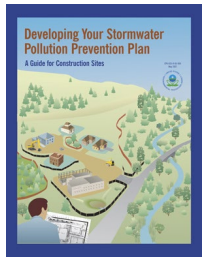
An **indoor environmental quality management plan** spells out strategies to protect the quality of indoor air for workers and occupants; it includes isolating work areas to prevent contamination of occupied spaces, timing construction activities to minimize exposure to off-gassing, protecting the HVAC system from dust, selecting materials with minimal levels of toxicity, and thoroughly ventilating the building before occupancy.

A **waste management plan** addresses the sorting, collection, and disposal of waste generated during construction or renovation. It must address management of landfill waste as well as recyclable materials.

IMPLEMENTATION

THE FOLLOWING STRATEGIES CAN HELP PROJECTS MEET SUSTAINABILITY GOALS DURING CONSTRUCTION:

- Reducing the amount of fossil fuels used in construction equipment by minimizing grading and earth moving, as well as using biodiesel or other alternative fuels.
- Preventing air and water pollution by addressing dust and implementing a construction activity pollution prevention plan.
- Ensuring indoor air quality by following an indoor environmental quality management plan for protecting ductwork and pervious materials, preventing dust, and protecting any occupied spaces from pollutants.
- Minimizing landfill waste by reducing construction debris and following a waste management plan that addresses waste separation and hauling, also saving costs.



SMACNA SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION

IMPLEMENTATION

Documentation

Essential for verifying achievement of sustainability goals

Maintain clear and organized documentation throughout implementation will help to ensure success.

Examples:

- Change orders
- Chain-of-custody letters
- Waste hauling tickets
- Updated/revised construction management plans
- Commissioning or retrocommissioning reports
- LEED documents

ON-GOING PERFORMANCE

Green Buildings and Neighborhoods

The construction and operations of green building and neighborhood projects are never really complete.

- ❑ Requires on-going delivery or production of resources
- ❑ Routine maintenance and upkeep
- ❑ Data collection and feedback
- ❑ Training – occupants and personnel

ON-GOING PERFORMANCE

Building System Performance

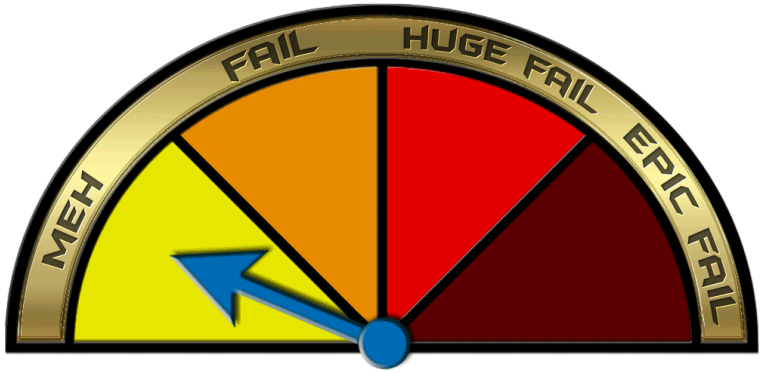
Regular inspections and maintenance to reveal problems or opportunities for improvement:

- ❑ Retrocommissioning
- ❑ Energy and water audits
- ❑ Solid waste audits
- ❑ Occupant surveys, including thermal comfort and transportation analysis
- ❑ Green purchasing and green housekeeping program assessments

ON-GOING PERFORMANCE

Measurement and Verification

- ❑ Essential to identifying opportunities for improvement.
- ❑ The right information needs to flow to the right place.
- ❑ The flow of information can be used as a feedback loop within the built environment to promote continuous improvements and support the commitment to sustainability.



ON-GOING PERFORMANCE

SUCCESS DEPENDS ON THESE ESSENTIALS:

- Start early
- Find the right team and process
- Understand the systems across space and time
- Develop clear and measurable goals
- Follow an iterative process to ensure achievement of goals
- Commit to continuous improvement