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GA01 LEED Core Concepts Guide – Section 2. Sustainable Thinking

Green Building and Sustainability

Three major concepts integral to green building and sustainability:

1. Systems thinking
2. Life cycle thinking
3. Integrated processes

Systems Thinking

system an assemblage of parts that interact in a series of relationships to form a complex whole, which serves particular functions of purposes.

Types of Systems

Open System - materials and resources are constantly brought in from the outside, used in some way, and then released outside the system in some form of waste.

Closed System - is one where a quantity or series of quantities cannot enter or leave the system.

More sustainable.

Feedback Loops

The concept of feedback loops helps explain how systems work.

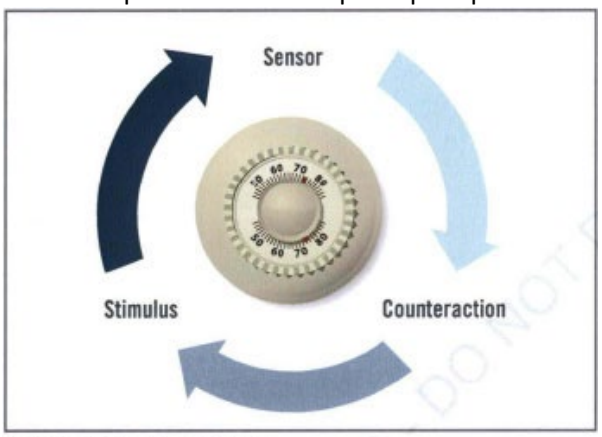


Figure 2.1. Negative feedback loop

This type of feedback loop is called a **negative feedback loop** because embedded in the system's response to a change is a Signal for the system to stop changing when that response is no longer needed. Negative feedback loops enable a system to self correct and stay within a particular range of function or performance. Thus, they keep systems stable.

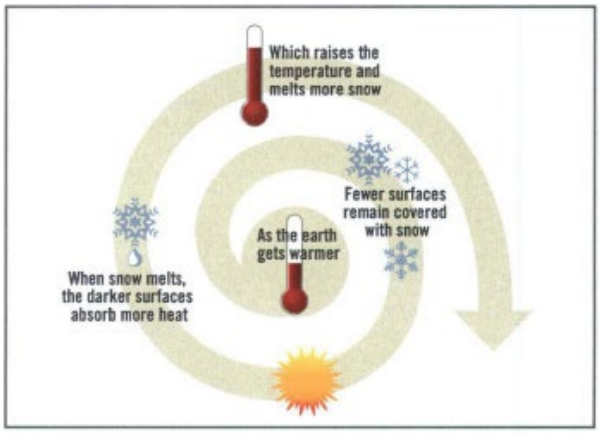
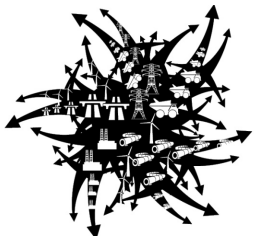


Figure 2.2. Positive feedback loop

Positive feedback loops, on the other hand, are self-reinforcing: the stimulus causes an effect, and the effect produces even more of that same effect. Population growth is a positive feedback loop. The more babies who are born, the more people there will be in the population to have more babies. Therefore, the population can be expected to rise until acted upon by another force, such as an epidemic or shortage of resources.

Unchecked, positive feedback loops can create chaos in a system.



Positive Feedback Loop

heat island effect the absorption of heat by hardscapes, such as dark, non-reflective pavement and buildings, and its radiation to surrounding areas. Particularly in urban areas, other sources may include vehicle exhaust, air-conditioners, and street equipment; reduced airflow from tall buildings and narrow streets exacerbates the effect.

Negative Feedback Loop

THE PRIUS EFFECT

Delivering real-time energy information in a convenient way by installing meters where operators can act on the information and make changes to use energy more efficiently.

Leverage Points

To influence the behavior of a system, it is important to find the leverage points—places where a small intervention can yield large changes.

Providing building occupants with real-time energy information is an example of using a leverage point to alter behavior.

LEVERAGE POINTS

Places to Intervene in a System (in increasing order of effectiveness):

12. Constant, parameters, numbers (such as subsidies, taxes, standards)

11. The sizes of buffers and other stabilizing stocks, relative to their flows

10. The structure of material stocks and flows (such as transport networks, population age structures)

9. The lengths of delays, relative to the rate of system change

8. The strength of negative feedback loops, relative to the impacts they are trying to correct against

7. The gain around driving positive feedback loops

6. The structure of information flows (who does and does not have access to what kinds of information)

5. The rules of the system (such as incentives, punishments, constraints)

4. The power to add, change, evolve, or self-organize system structure

3. The goals of the system

2. The mindset or paradigm out of which the system—its goals, structure, rules, delays, parameters—arises

1. The power to transcend paradigms

QUESTIONS A PROJECT TEAM NEEDS TO EXPLORE AS MEMBERS BEGIN WORKING TOGETHER, INCLUDE:

- Where is the project located, and who are its neighbors—locally, regionally, and beyond? What is the local watershed? The bioregion? What are the characteristics of these systems?
- How do resources, such as energy, water, and materials, flow into the project? Where do they come from, and from how far away? What other purposes or projects do those flows serve?
- What natural processes are at work on the site? How do resources, such as rainwater, wastewater, and solid waste, flow out of the system? Where do they go? Are there places on site where these flows can be captured, stored, or reused?
- What are the goals of the owner? What is the function or purpose of the project? How will the project meet those goals?
- What is the community within the project? Who are the people who come here, and where do they come from? Where do they go? What brings them together, and what might keep them apart? How will the project change their interactions?
- How does the project community interact with other, overlapping communities? What are the interrelationships? Are there sources of conflicts? What is the economic system within the project? How does it fit into larger or overlapping economic systems?
- What are the leverage points within the system? Are there places where small changes can produce big results?

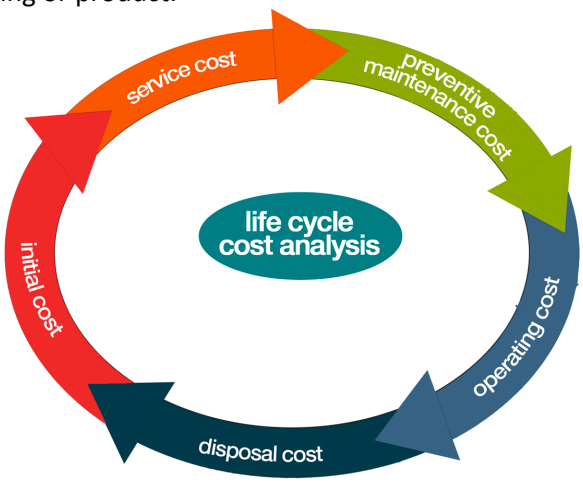
Life-Cycle Approach

What is LCA?

Life Cycle Assessment (LCA) is a tool used to evaluate the potential **environmental** impact of a product, process or activity throughout its entire life cycle by quantifying the use of resources ("inputs" such as energy, raw materials, water) and environmental emissions ("outputs" to air, water and soil) associated with the system that is being evaluated.

Fig 1: Structure of the Life Cycle Assessment (LCA)

What is LCC?
Life Cycle Costing (LCC) a process of costing that looks at both purchase and operating costs as well as relative savings over the life of the building or product.



Life-Cycle Costing
LCC can be used in comparing alternatives with different initial and operating costs.
For a building this usually includes the following costs:

- ❑ Initial purchase, acquisition, or construction
- ❑ Fuel
- ❑ Operation, maintenance, and repair
- ❑ Replacement
- ❑ Disposal (or residual value for resale or salvage)
- ❑ Finance charges
- ❑ Other intangible benefits or costs, such as increased employee productivity

The Key to Sustainability

- ❑ Establish goals and targets early in the process
- ❑ Understand the systems that are in play
- ❑ Anticipate how those systems are likely to change and evolve

Assembling the right team, establishing goals, and understanding the systems and metrics for success will help ensure that we move closer to a sustainable built environment.

Integrative process

Phases of the Integrative Process

discovery—is also the most important and can be seen as an expansion of what is conventionally called predesign. Actions taken during discovery are essential to achieving a project's environmental goals cost-effectively.

design and construction — begins with what is conventionally called schematic design. Unlike its conventional counterpart, however, in the integrative process, design will incorporate all of the collective understandings of system interactions that were found during discovery.

occupancy, operations, and performance feedback — Here, the integrative process measures performance and sets up feedback mechanisms. Feedback is critical to determining success in achieving performance targets, informing building operations, and taking corrective action when targets are missed.

Design Synergies

FOR EXAMPLE:

- Locating homes near jobs and shops and designing safe, pedestrian-friendly streets can encourage people to walk, both reducing vehicle emissions and improving their health
- Designing landscapes that use native species can both reduce water consumption and provide habitat for local fauna
- Orienting buildings appropriately on a site and designing them to catch sunlight for heating and illumination and natural breezes for cooling and ventilation can save energy, improve indoor air quality, and even increase workers' productivity
- Composting improves the quality of the soil and reduces greenhouse gas emissions related to trash hauling

Practitioners of an Integrative Process

Must develop new skills that might not have been required in their past professional work:

- ❑ Critical thinking and questioning
- ❑ Collaboration
- ❑ Teamwork and communication
- ❑ Deep understanding of natural processes

An integrative process is a different way of thinking and working, and it creates a team from professionals who have traditionally worked as separate entities.

The Integrative Process

- ❑ Requires more time and collaboration during the early conceptual and design phases than conventional practices.
- ❑ Time must be spent building the team, setting goals, and doing analysis before any decisions are made or implemented.
- ❑ This upfront investment of time, however, reduces the time it takes to produce construction documents.