

The 12 Principles of Green Engineering

- 1. Inherent Rather Than Circumstantial**
Designers need to strive to ensure that all materials and energy inputs and outputs are as inherently nonhazardous as possible.
- 2. Prevention Instead of Treatment**
It is better to prevent waste than to treat or clean up waste after it is formed.
- 3. Design for Separation**
Separation and purification operations should be designed to minimize energy consumption and materials use.
- 4. Maximize Efficiency**
Products, processes, and systems should be designed to maximize mass, energy, space, and time efficiency.
- 5. Output-Pulled Versus Input-Pushed**
Products, processes, and systems should be “output pulled” rather than “input pushed” through the use of energy and materials.
- 6. Conserve Complexity**
Embedded entropy and complexity must be viewed as an investment when making design choices on recycle, reuse, or beneficial disposition.
- 7. Durability Rather Than Immortality**
Targeted durability, not immortality, should be a design goal.
- 8. Meet Need, Minimize Excess**
Design for unnecessary capacity or capability (e.g., “one size fits all”) solutions should be considered a design flaw.
- 9. Minimize Material Diversity**
Material diversity in multicomponent products should be minimized to promote disassembly and value retention.
- 10. Integrate Material and Energy Flows**
Design of products, processes, and systems must include integration and interconnectivity with available energy and materials flows.
- 11. Design for Commercial “Afterlife”**
Products, processes, and systems should be designed for performance in a commercial “afterlife.”
- 12. Renewable Rather Than Depleting**
Material and energy inputs should be renewable rather than depleting.

