# Chapter 9

# Technology and Industrial Ecology

## Chapter Overview

People have a lot of unique ideas for creating a better system of using resources that are a part of a sustainable future. Remember that sustainable living is about living in harmony with nature, which means living within ecological limits, which includes the ecosystem services that can manage people’s (non-toxic) wastes. As long as future sustainable technologies exist well within these limits, which includes a lower human population within its carrying capacity, all people on earth can live a comfortable lifestyle and an improved quality of life overall. But remember, green technology is but one part of what constitutes sustainable living.

This chapter discusses the need to use the fossil fuel system to jumpstart the renewable energy system. As society moves into the transition people must embrace science, but mindfully. Meeting all the needs of a technological society that is built on a sustainable premise may require utilizing many of today’s more controversial technologies to help build the sustainable society of tomorrow. The future will have technology that is clean, sustainable, and good for people and natural systems providing that it is planned well. People will have a good standard of living *and* a higher quality of life, but may have to make short-term compromises to reach such a noble goal as sustainability that encompasses ecological and human equity. It is time to plan the future now with mindful, long-range goals—not simply let it happen.

## Vocabulary Terms

applied ecology

biomimicry

biopharming

buckyball

cradle–cradle manufacturing

cradle–grave manufacturing

drag

empathic listening

Fibonacci sequence

golden ratio

green energy

green washing

hybrid

industrial ecology

life cycle analysis (life cycle design)

logarithmic spirals

lotus effect

mechanoceptors

Rayleigh waves

renewable energy

renewable energy systems

smart growth

smart transportation

superhydrophobicity

traffic calming

whitewashing

Wright brothers

## Terms With Definitions

**applied ecology—**Integrated treatment of the ecological, social, and biotechnological aspects of natural resource management.

**biomimicry—**Emulating naturally engineered systems to solve many human engineering problems.

**biopharming—**Denotes searching for natural plant solutions for new drugs. The term has also been

used to include genetically modified crops and biogenetically engineered plants.

**buckyball—**Named after Buckminster Fuller, who popularized the geodesic dome. The buckyball is a 60-sided geodesic molecule.

**cradle–cradle manufacturing—**Redesigning how to make things to take into account the full life cycle of a product from its creation to becoming materials for new products when its life is done; full recycle manufacturing.

**cradle–grave manufacturing—**A linear system of manufacturing that uses virgin materials where everything eventually becomes waste.

**drag—**Refers to forces that oppose the relative motion of an object through a medium such as liquid or gas; often called *air resistance.*

**empathic listening—**A way of listening that emphasizes sensitivity by responding to another person, thus improving mutual understanding and increasing trust.

**Fibonacci sequence—**The occurrence of a sequence of numbers that have a definitive relationship to each other. For instance, the numbers 0, 1, 1, 2, 3, 5, 8, 13, and so on are all built on the relationship that the next number is simply a sum of the two previous numbers in the sequence.

**golden ratio—**A spiral shape formula that causes a spiral to become wider from its origins with a specific factor for every full turn it makes. Many shell creatures have spiral shells that exhibit this mathematical formula.

**green energy—**The use of renewable energy sources.

**greenwashing—**A marketing effort to brand a product or process as environmentally sound when the product, process, or company are not making any real efforts to be environmentally conscious.

**hybrid—**Vehicles that use both an electric and a gasoline engine to improve fuel efficiency by using the electric engine.

**industrial ecology—**Designing the industrial system to mimic the natural ecological system.

**life cycle analysis (life cycle design)—**Analyzing the full effects and consequences of a product.

**logarithmic spirals—**Similar to the golden spiral, these spirals are constructed around equally spaced radial lines from a central focus. Each spiral line is connected to the previous line but perpendicular to the radial line.

**lotus effect—**The very high water repellency shown on the leaves of the lotus flower.

**mechanoceptors—**A body nerve sensor that responds to mechanical pressure or distortion.

**Rayleigh waves—**A surface acoustic wave, often related to earthquakes. Many mechanoceptors are sensitive to these specific waves.

**renewable energy—**Use of energy sources that are derived directly or indirectly from the sun and therefore are infinite. Examples include all forms of solar, wind, wave, and geothermal energy.

**renewable energy systems—**Engineered systems that work specifically from renewable energy.

**smart growth—**A newer and different way to build and maintain a way of living. It is based on communities with housing and transportation choices near jobs, shops, and schools, and that support local economies while protecting the environment.

**smart transportation—**Development of mass transit transportation systems that maximize efficiency.

**superhydrophobicity—**The property of repelling water very efficiently.

**traffic calming—**A system to slow vehicle traffic in specific areas to maximize safety for pedestrians, cyclists, and other road users.

**whitewashing—**Glossing over, covering up, or blaming another for something negative.

## Extended Learning Activities

1. Analyze your energy consumption over a one-month period of time. Consider the following in your analysis:

* How many miles did you drive and how many miles per gallon of gas did your vehicle get?
* How many gallons of water did you use (refer to water bill)?
* How many things did you buy that were not necessarily for your survival (wants vs. needs)?
* How much energy did you use to heat and cool your home (refer to electric bill)?
* How many bags of trash (a standard 10 gallon trash can) did you accumulate?
* What percentage of your food that was purchased was grown locally?
* What can you do to lower your energy consumption?

Compare your results with those of your classmates and brainstorm as a class how you could implement ways to reduce energy use on your campus or community.

1. Design a product that uses biomimicry or explain how biomimicry is being used that is not discussed in the text. Discuss how this product would classify as being one that uses this innovative idea.
2. You just returned from visiting City X, which is known for being a green city. Describe how this city looked and felt compared to City Z, which does not claim to be a green city. Discuss some reasons why you think City Z is not embracing green technology or some challenges they might face should they want to emulate City X. Look up cities in the United States that claim to be green or sustainable. What makes them different? Do they justify their claim?

## Research and Response Questions

1. Research a product that was designed to replicate nature. What organism (or organisms) was used as a model for the design of this product and what aspects of it were replicated?
2. Research a product that can exhibit cradle-to-cradle technologies. Describe how the product qualifies as a cradle-to-cradle product.

## Web Links

[Apollo Alliance](http://apolloalliance.org/about/mission/)

[Bicycle Museum of America](http://www.bicyclemuseum.com/)

[Biomimicry Institute](http://biomimicry.net/)

[*Journal of Applied Ecology*](http://www.journalofappliedecology.org/view/0/index.html)

[Reconciliation ecology](http://www.winwinecology.com/)

[Smart Growth America](http://www.smartgrowthamerica.org/issues/transportation/)

[Solar Roadways](http://www.solarroadways.com/main.html)

[Transportation for America](http://www.transportationforamerica.org/)

[U.S. Environmental Protection Agency](http://www.epa.gov/)