

Greening Our Future By Educating Tomorrow's Workforce



Module 1: Environmental Sustainability

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What You Will Learn From This Module:

- How environmental issues affect communities differently and unequally.
- The four major global environmental revolutions and how each revolution affects our environment.
- The three pillars of environmental sustainability.
- How to track a product's life cycle from cradle to grave and investigate ways to modify its life cycle into a closed loop system.
- How to identify and include the environmental costs in manufacturing decisions.



You and Your Environment

- How does your environment affect you?
- How will your place of employment affect your environment?
- How can you make a difference?

This module will introduce environmental sustainability concepts and issues that apply at work and in your community.



Environmental Issues That Affect Our Lives

Air Pollutants?

Water Pollutants?

Toxics?

Lead?

CFCs?

Emerging Contaminants?



Environmental Issues That Affect Our Lives

Air Pollutants → Asthma, Sick Building Syndrome, Cystic Fibrosis, Emphysema, Cardiopulmonary Disease

Water Pollutants → Infections, Disease, Mercury Exposure, Eutrophication, Fish Kills, Water Scarcity

Toxics → Bioaccumulation, Cancer, Lymphoma, Leukemia, Parkinson's Disease

Lead → Learning Impairments, Infertility, Birth Defects, Premature Birth, Developmental Disabilities

CFCs → Increased Risk of Skin Cancer, Central Nervous System Depression, Cardiac Arrhythmia

Emerging Contaminants → Drug Resistant Disease, Birth Defects, ADD, Infertility, Hormonal Imbalances, Diabetes



Do Environmental Issues Impact Everyone Equally?



Environmental Justice

Q. What causes environmental injustice?

A. A combined lack of environmental awareness, political influence, and economic power makes impoverished and minority communities vulnerable to become a frequent target for environmentally hazardous activities.

Environmental injustice persists because of our society's “*as long as it's not in my back yard*” mentality.



Environmental Justice

“Far too often, and for far too long, low-income, minority and tribal communities have lived in the shadows of some of the worst pollution, holding back progress in the places where they raise their families and grow their businesses.”

—Lisa F. Garcia, senior advisor to the EPA Administrator for Environmental Justice



Environmental Revolutions

Let's briefly look at how three historic revolutions changed the way we interact with our planet.

- *Agricultural Revolution*
- *Industrial Revolution*
- *Technological Revolution*

And why a fourth is inevitable...

- *Sustainable Revolution*



Agricultural Revolution

- Humans transition from hunter-gather nomads into farming communities that settle around fertile soil.
- Populations increase exponentially from agricultural bounty and families “staying put.”
- Population boom and easy living led to the advent of cities which need basic sanitation systems (civilizations had sewer systems as early as 3000-4000 BCE).
- Large scale farming operations lead decreases in biodiversity and the advent of chemical pesticides (DDT).
- America’s environmental movement influenced partly by the popularity of Rachel Carson’s book *Silent Spring*.

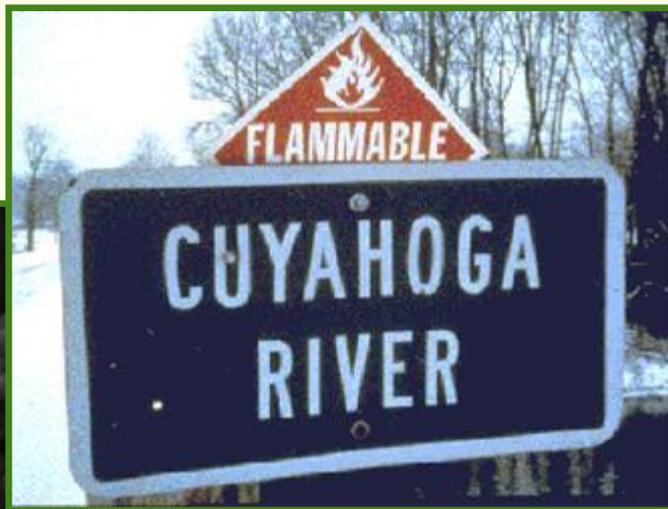


Industrial Revolution

- Age of the urban factory brings influx of jobs, people, and environmental exposures to cities.
- By the mid 19th century, living conditions in major cities are degrading (smog and water pollution).
- Epidemics of typhoid and cholera hit Europe and America in the 1840s to 1860s.
- Deadly smog episodes in Pennsylvania (1948), London (1952, 1956), New York (1953), and Los Angeles (1954) signal an air pollution crisis is underway. The first international air pollution conference is held in 1955.
- Public tipping point of the Cuyahoga River Fire in 1969. Pollution reaches a point where a central federal entity in charge of carrying out environmental regulation is an absolute necessity.
- EPA formed in 1970 as a result of Reorganization Plan 3 and NEPA.



Case Study: Cuyahoga River



*“We burned this river down.
This where they walked, swam,
hunted, danced and sang.
Take a picture. Take a souvenir.
Cuyahoga is gone.”*

—REM



Technological Revolution

- Technological advances begin to solve environmental problems caused by the industrial revolution. For example, the invention of the catalytic converter.
- Developed countries transition their economies from the post Industrial Revolution era based upon the ideals of free trade.
- Industrial labor is available globally, service industries replace manufacturing, and the “knowledge industry” takes shape.
- Computers become obsolete quickly, resulting in substantial amounts of electronics waste (eWaste). In 2009, discarded TVs, computers, printers, scanners, fax machines, mice, keyboards, and cell phones totaled more than 2 million metric tons.
- Internet and social networking heightens sense of community and awareness.
- Today’s high tech products require rare earth metals. Demand for rare earth metals is straining supply, and there is growing concern that the world could soon face a shortage.



The Next Environmental Revolution

Why is the Sustainable Revolution inevitable?

- Resource scarcity
- Rising energy costs
- Increasing global environmental awareness
- More countries transitioning from developing to developed nations
- Global population and standard of living both increasing
- Being sustainable provides a competitive advantage in the marketplace



Sustainable Manufacturing

“Sustainability is not only central to business strategy, but will increasingly become a critical driver of business growth. How well and how quickly businesses respond to this agenda will determine which companies succeed and which will fail.”

—Patrick Cescau, CEO of Unilever

“Sustainability will help us be a trusted partner in expanding in markets around the world. Our emphasis on resource efficiency positions us well to weather rapidly rising costs for energy and materials.”

—Alan Mullaly, CEO of Ford Motor Company



Sustainable Manufacturing

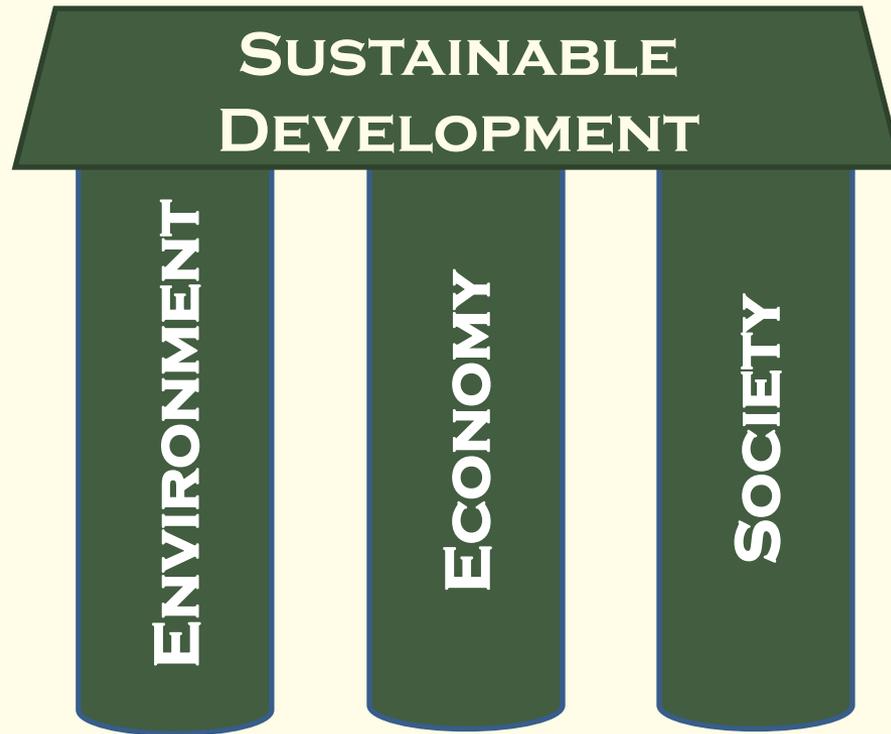
So what is sustainability?

- Dictionary definition: 1. Able to maintain or endure.
2. Benefiting from natural resources without destroying the ecological balance.
- EPA's definition: Sustainability is the basic principle that everything we need for our survival and well-being depends, either directly or indirectly, on our natural environment.

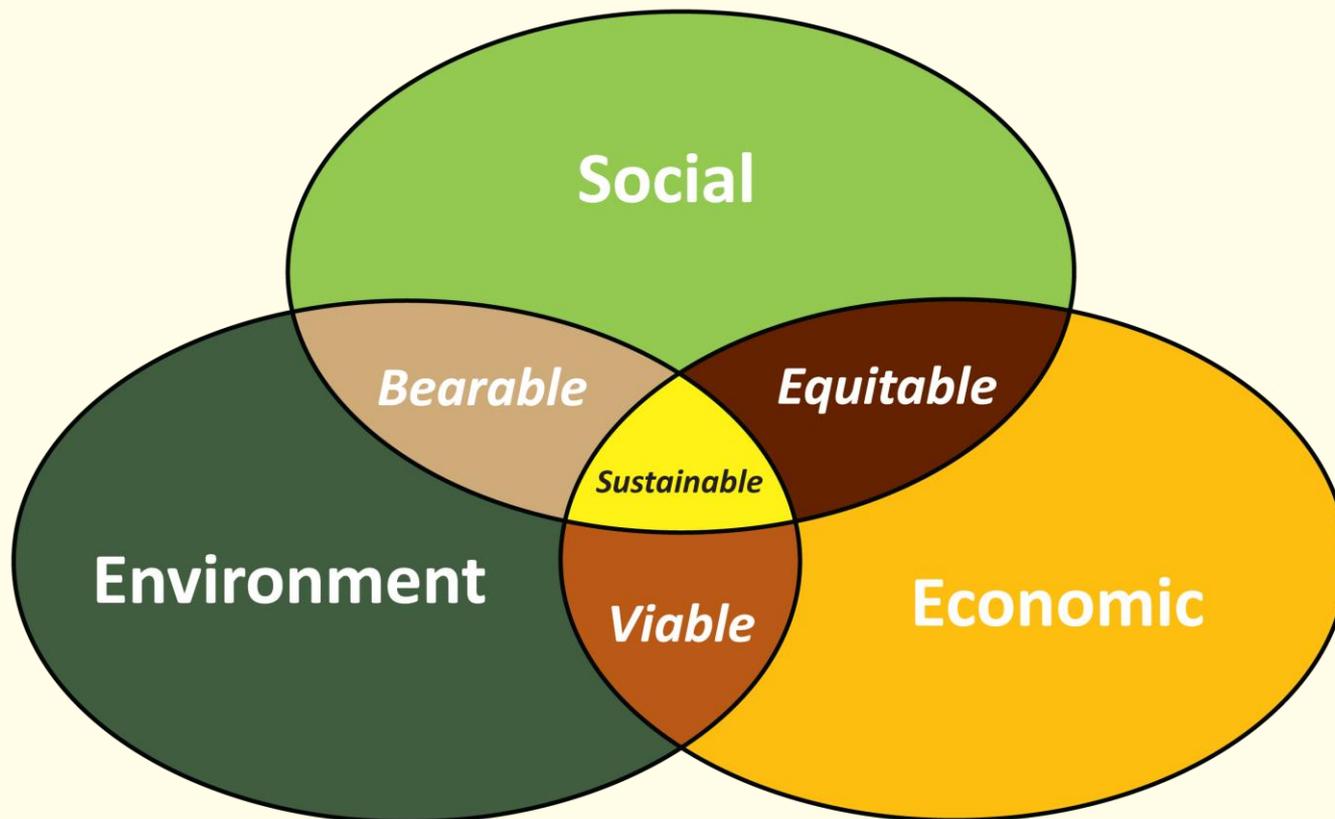


Sustainable Manufacturing

Three Pillars Model of Sustainability



Three Pillars of Sustainability Model



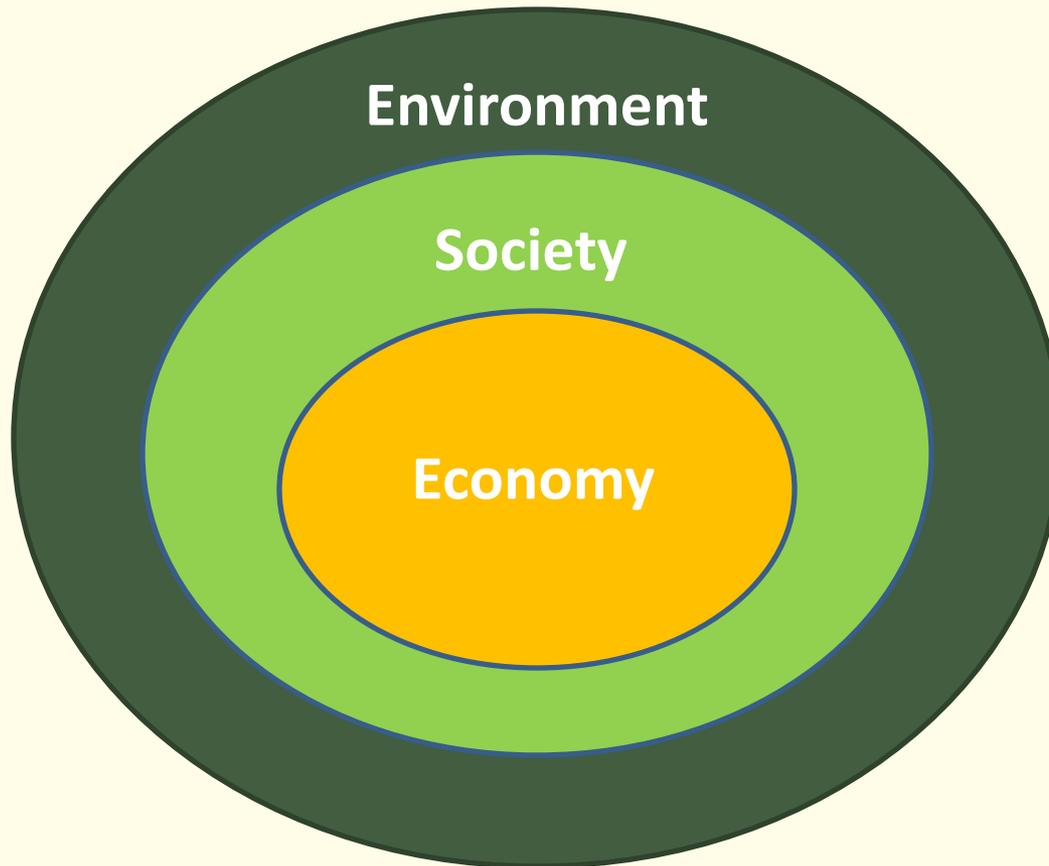
Sustainable Manufacturing

Are there flaws in the three pillars model?

- Should environment, economy, and society all carry equal weight?
- How does the environment relate to society? Should they be separate?
- If we are able to find an equal balance between our economic needs, our social well-being, and the environment, will this lead to an attitude of “business-as-usual” rather than continued progress?
- If the environment is considered separate, is it more or less significant than either the economy or our social well-being?



Nested Sustainability Model



Making Socially Responsible Decisions

The Story of Stuff Project

with

Free Range Studios with Corporate Accountability International, Polaris Institute, Environmental Working Group, Food and Water Watch, and the Pacific Institute

Presents

“The Story of Bottled Water”



Making Socially Responsible Decisions

Q. What can you do to be more socially and environmentally responsible?

Visit EPA's Pick 5 campaign to find out.

www.epa.gov/pick5



Greening The Supply Chain

Companies across all industry sectors agree that transitioning toward sustainability is essential to staying competitive.

70% of companies state their investments in sustainability increased in 2011.

75% of companies will reward suppliers with sound sustainability practices and will de-select suppliers based on failure to meet environmental criteria.

70% of manufacturers state that sustainability is permanently on their agenda.

50% of manufacturers state that sustainability will lead to reduced costs and increased profitability.



Greening the Supply Chain

Q. Where do environmental costs occur in the supply chain?



Greening the Supply Chain

Q. Where do environmental costs occur in the supply chain?

- Energy use
- Water use
- Solid waste disposal
- Transportation
- Transport and product packaging
- Meeting customer specifications



Transport Packaging

Q. Does transport packaging add value to the final product?

A. It depends.

Is packaging required to prevent damage that would otherwise render the product unusable?



Transport Packaging

Q. Can packaging increase costs incurred by the customer without increasing the product's value?

Q. Can packaging's environmental impacts outweigh its benefit?

Q. Does anyone remember McDonald's McDLT?



Designing Products for Sustainability

Traditional Product Design = Take, Make, Waste

Sustainable Product Design

- Looks closely at all of a product's environmental impacts from *cradle to grave*.



Designing Products for Sustainability

Manufacturers perform *life cycle analyses* to broaden their views on environmental impacts by:

- Compiling an inventory of relevant energy and material inputs and environmental releases.
- Evaluating the potential impacts associated with identified inputs and releases.
- Interpreting the results to help you make a more informed decision.



Life Cycle Analysis

What is Life Cycle Analysis?

- The term *life cycle* refers to the major activities in the course of the product's life-span from gathering the raw materials that make up the product, manufacture, use, and maintenance, to its final disposal.



Life Cycle Analysis

Inputs

Raw
Materials →

Energy →

Materials Acquisition

Manufacturing

Use/Reuse/ Maintenance

Recycle/Disposal

Outputs

→ Wastes

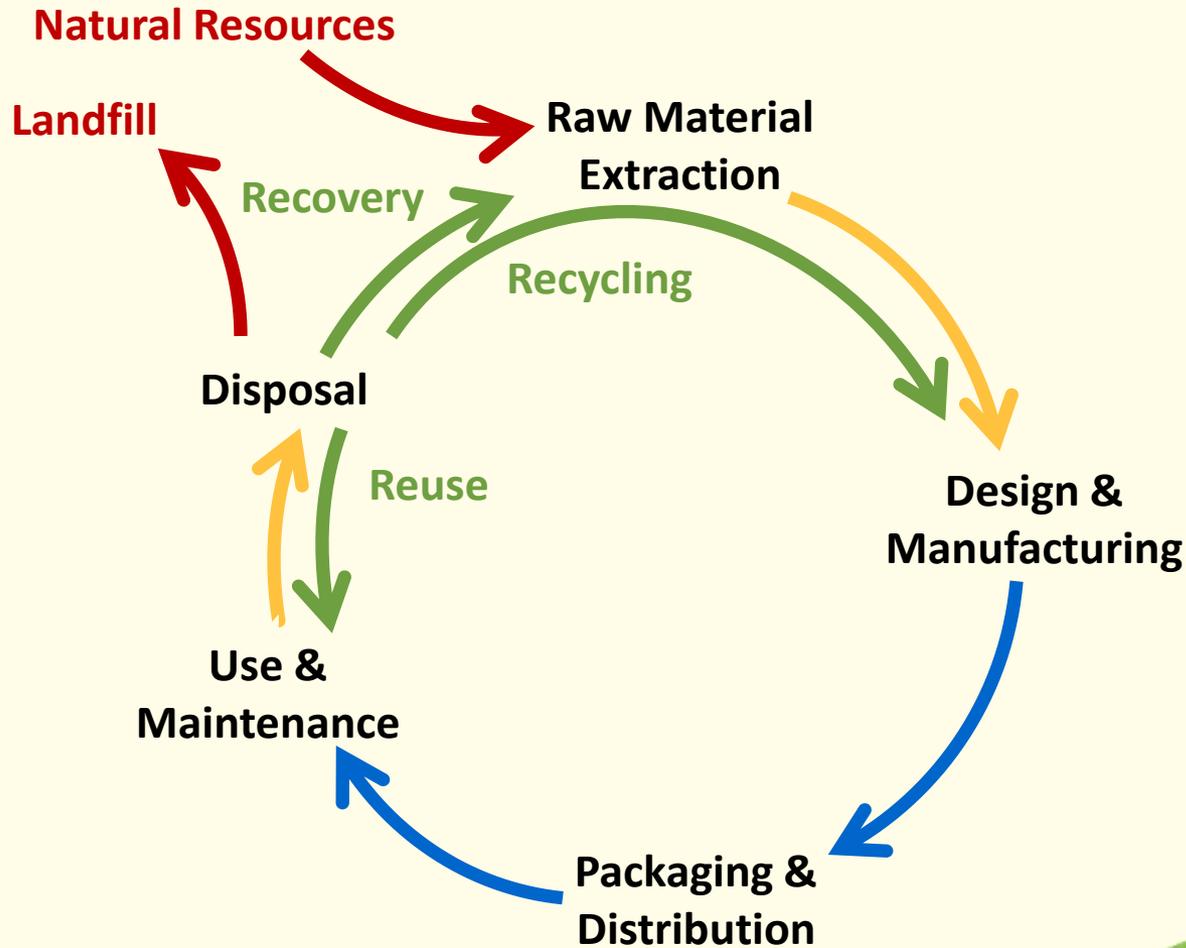
→ Emissions

→ Releases

→ Byproducts

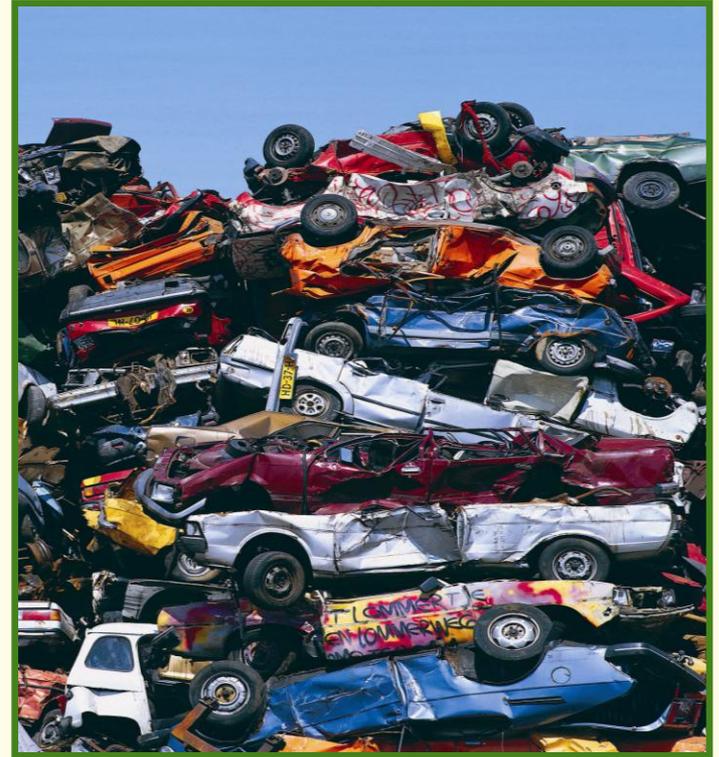


Life Cycle Analysis



4 Steps of Life Cycle Analysis

1. Goal Definition and Scoping
2. Inventory Analysis
3. Impact Assessment
4. Interpretation



Life Cycle Analysis

Step 1: Goal Definition and Scoping

- Defines and describes the product, process, or activity that is being assessed.
- Determines what information is vital to decision makers.
- Defines the scope and boundaries of the assessment (cradle to grave).
- Identifies the environmental metrics to be included.
- Identifies potential data gaps.
- Determines how results should be organized and presented.



Life Cycle Analysis

Step 2: Inventory Analysis

- Uses process mapping to identify inputs and outputs.
- Gather data for inputs and outputs.
- Uses estimates where data is not available.
- Quantifies energy and raw material inputs, air emissions, wastewater, solid wastes, and other releases for the entire life cycle.



Life Cycle Analysis

Step 3: Impact Analysis

- Evaluate potential human health and environmental impacts of the environmental resources and releases identified during inventory analysis.
- Categorize different types of impacts (i.e., water pollutants, air emissions).
- Identify environmental releases associated with the life cycle that act as stressors or potentially cause environmental impacts.
- Weigh all identified impacts to emphasize priority environmental releases.



Life Cycle Analysis

Step 4: Interpreting the Findings

- Evaluate significant issues identified.
- Ensure completeness.
- Ensure consistent boundaries, data collection methods, assumptions, and allocation of data.
- Provide conclusions and recommendations based on findings.



Full Cost Accounting

Q. What is *Full Cost Accounting*?

A. Systematic approach for estimating the actual costs of a product or decision.

It takes into account past and future outlays, overhead costs, and *maintenance and operating costs* through the life cycle of the product and *disposal costs*.



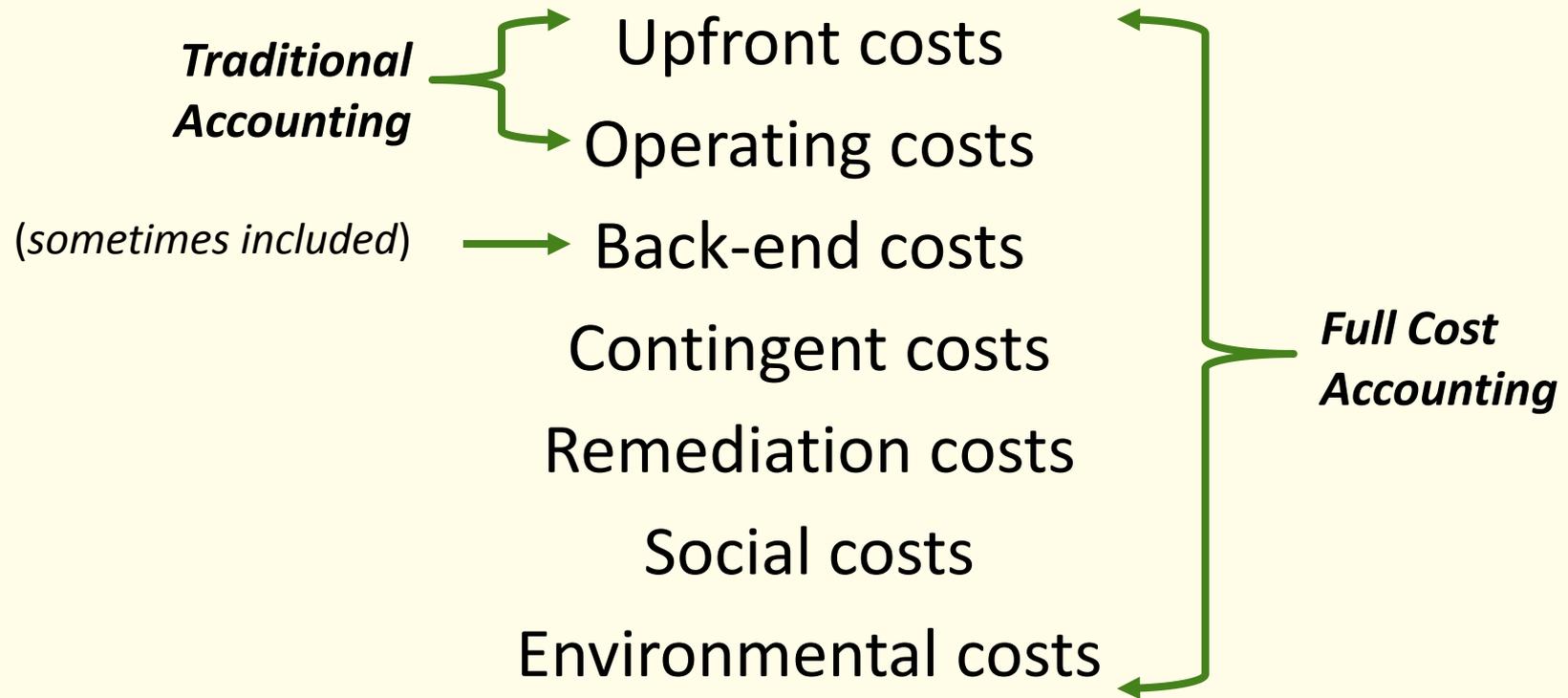
Full Cost Accounting

Q. What is the difference between an outlay and a cost?

Q. What is the difference between the outlay and the cost of a vehicle?



Full Cost Accounting



Life Cycle and Full Cost Activity

Auto Lifetime Activity

*Dust 2 Dust: Energy Cost of New Vehicles
From Concept to Disposal Report*

