

Greening Our Future By Educating Tomorrow's Workforce



Module 2: Lean Manufacturing and the Environment

Module 2: Lean Manufacturing and the Environment

What You Will Learn From This Module:

- Definitions of key terms.
- Environmental laws and regulations related to P2.
- Lean and clean manufacturing.
- How traditional Lean wastes relate to environmental Wastes.
- Using value stream mapping to identify environmental wastes.
- EPA's waste management hierarchy and moving beyond the traditional "3R's."



Pollution Prevention

EPA defines *pollution prevention* as:

- Source reduction.
- Use of non-toxic or less-toxic alternatives.
- Implementing conservation techniques.
- Re-using materials rather than putting them into the waste stream.



Pollution Prevention Act of 1990

Established the national policy that pollution should be prevented or reduced at the source whenever feasible.

States that recycling, energy recovery, treatment, and disposal are **NOT** included within the definition of pollution prevention.



Emergency Planning and Community Right to Know Act (EPCRA)

- National environmental legislation for community safety.
- Designed to help local communities protect public health, safety, and the environment from chemical hazards.
- Primary purpose is to inform citizens of toxic chemical releases in their areas through the publicly available Toxic Release Inventory (TRI).



Toxic Release Inventory (TRI)



Provides communities with information about toxic chemical releases and waste management activities to support informed decision making by industry, government, non-governmental organizations, and the public.



Resource Conservation and Recovery Act (RCRA)



Law that established the framework for the proper management of hazardous and nonhazardous solid waste. RCRA gives EPA the authority to control hazardous waste from the "cradle-to-grave."



Clean Water Act

- Establishes the foundation for regulating discharges of pollutants into the waters of the United States and regulating quality for surface waters.



Clean Air Act

- Regulates air emissions from stationary and mobile sources.
- Authorizes EPA to establish National Ambient Air Quality Standards (NAAQS) to protect public health and public welfare and to regulate emissions of hazardous air pollutants.



What Is Waste?

So how does Toyota define *waste*?

“Waste is anything other than the minimum amount of raw materials, parts, space, equipment, and workers’ time that are absolutely necessary to add value to the product.”

—Shoichiro Toyoda, Toyota Motor Company
Chairman and President (1982-1999)



What Is Waste?

EPA defines **waste** as the unnecessary use of resources or a substance released to the air, water, or land that could harm human health or the environment.

- Environmental wastes can occur when companies use resources to provide products or services to customers or when customers use and dispose of products.



What Is Waste?

What is an environmental waste?

- Energy, water, or raw materials consumed in excess of what is needed to meet customer needs.
- Pollutants and material wastes released into the environment, such as air emissions, wastewater discharges, and solid and hazardous wastes.
- Use of hazardous substances in products that adversely affect human health or the environment during.



Why Combine Lean and P2?

Traditional lean manufacturing strives to eliminate **DOWNTIME:**

- Defects
- Overproduction
- Waiting
- Non-utilized resources
- Transportation
- Inventory
- Motion
- Extra-processing



How Lean Relates to Environmental Wastes

Optimize Material Use → Less Scrap = **Reduced Solid Waste**

Reduce Inventory → Less Chemical Spoilage = **Reduced Hazardous Waste**

Reduce Overproduction → Less Runtime = **Energy Savings**

Reduce Defects → Causes Rework and Unusable Products = **Energy Savings and Reduced Solid Waste**

Reduce Transportation → Less Fuel Consumption = **Reduced Air Emissions**



Lean and Clean Manufacturing

Clean manufacturing strives for **NO WASTE**:

- **N**on-toxic substitutes
- **O**ptimized raw material use
- **W**ater and wastewater reductions
- **A**ir emission reductions
- **S**olid and hazardous waste reductions
- **T**ransport packaging optimization
- **E**nergy efficiency



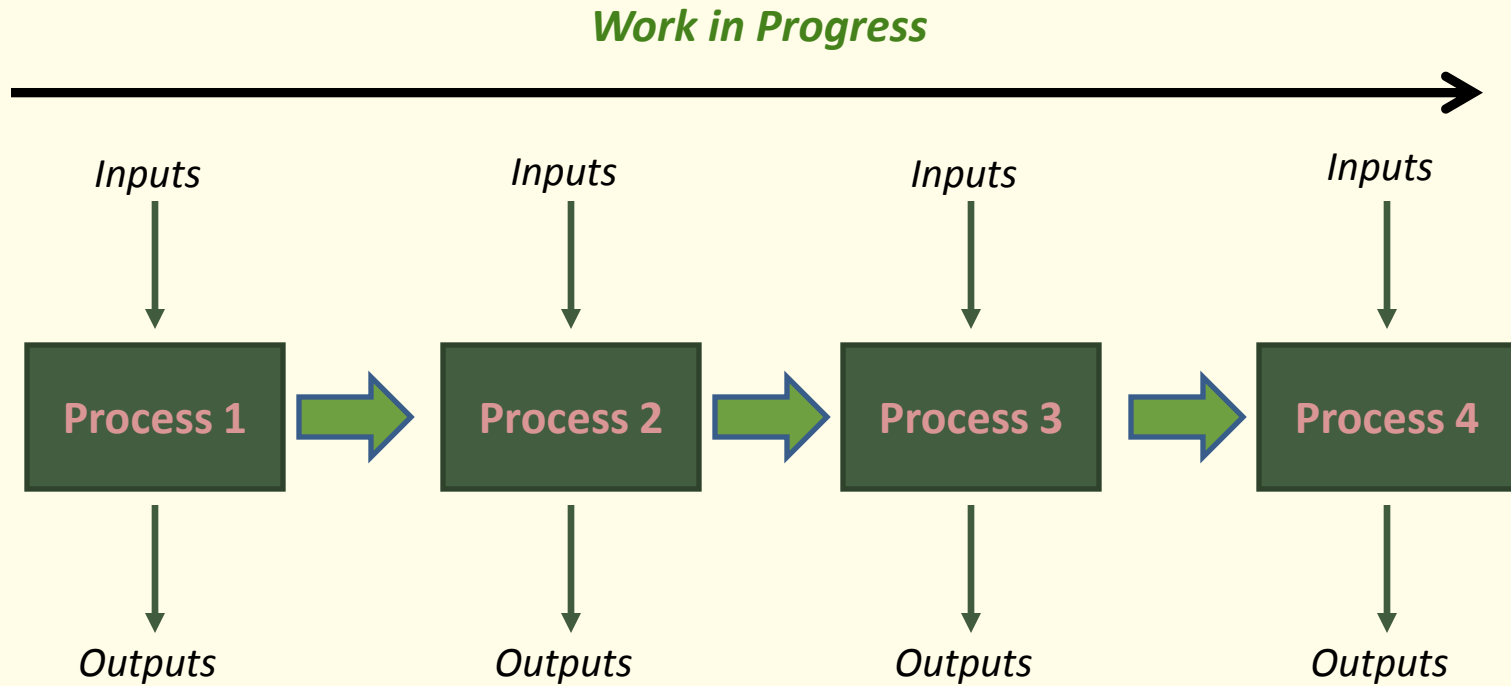
Value Stream Mapping

The purpose of a value stream map is to:

- Identify major sources of *non-value added* time in a value stream.
- Envision a *less wasteful* future state.
- Develop an implementation plan for *improvements*.



Value Stream Mapping



Value Stream Mapping

When used in lean manufacturing, value stream maps traditionally look at:

- Inventory
- Takt Time
- Downtime
- Cycle Time
- Changeovers
- Movement/motion
- Rework
- Information Flow



Value Stream Mapping

Five ways value stream maps can be used to see environmental wastes:

- Use icons to identify environmental impacts in processes.
- Include environmental metrics in value stream maps.
- Use a “materials line” to track resource use versus need.
- Expand focus of value stream map to track energy or water resource flows.
- Find environmental improvements in future state maps.



Timelines and Materials Lines

Traditional lean value stream maps include timelines used to show takt time and cycle time.

Timelines can be modified into materials lines to show you:

- Overall difference between raw material amounts used versus what's actually needed.
- Largest sources of waste for prioritizing improvement efforts.
- Where alternative materials may be an effective option.



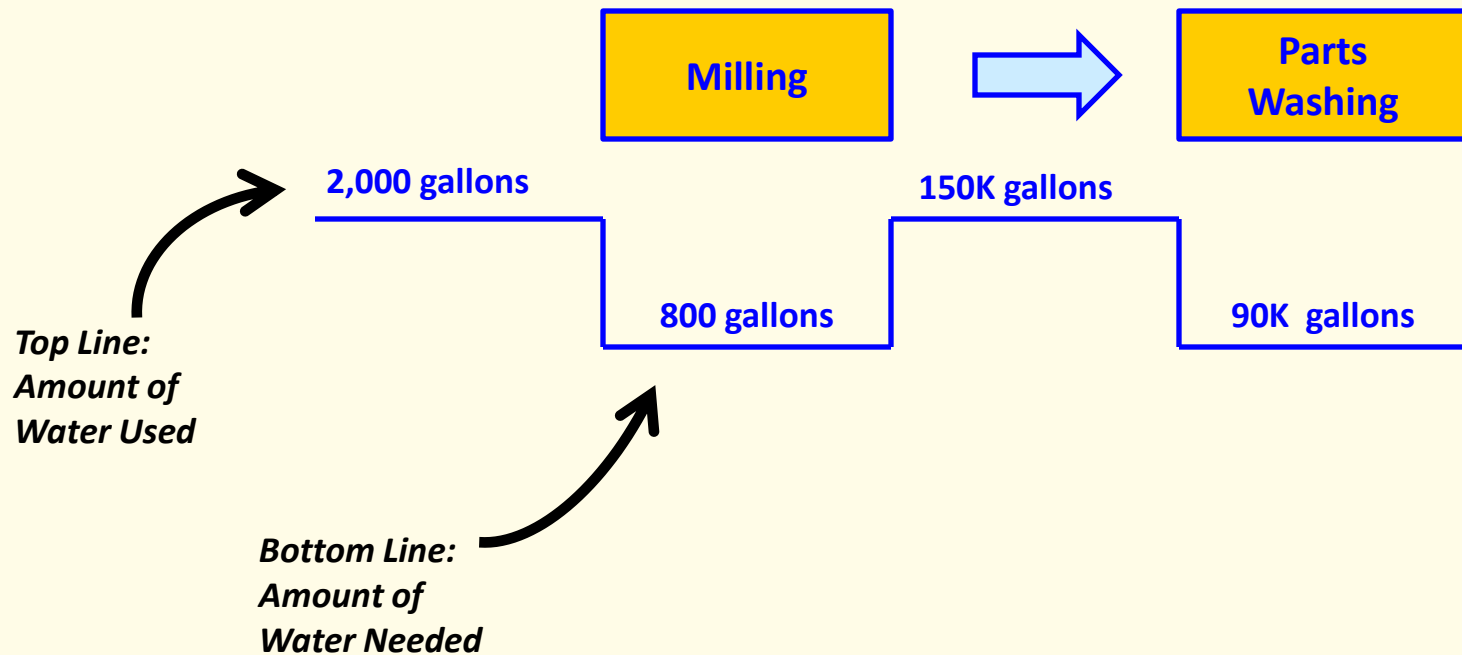
Materials Lines

Materials lines can show you:

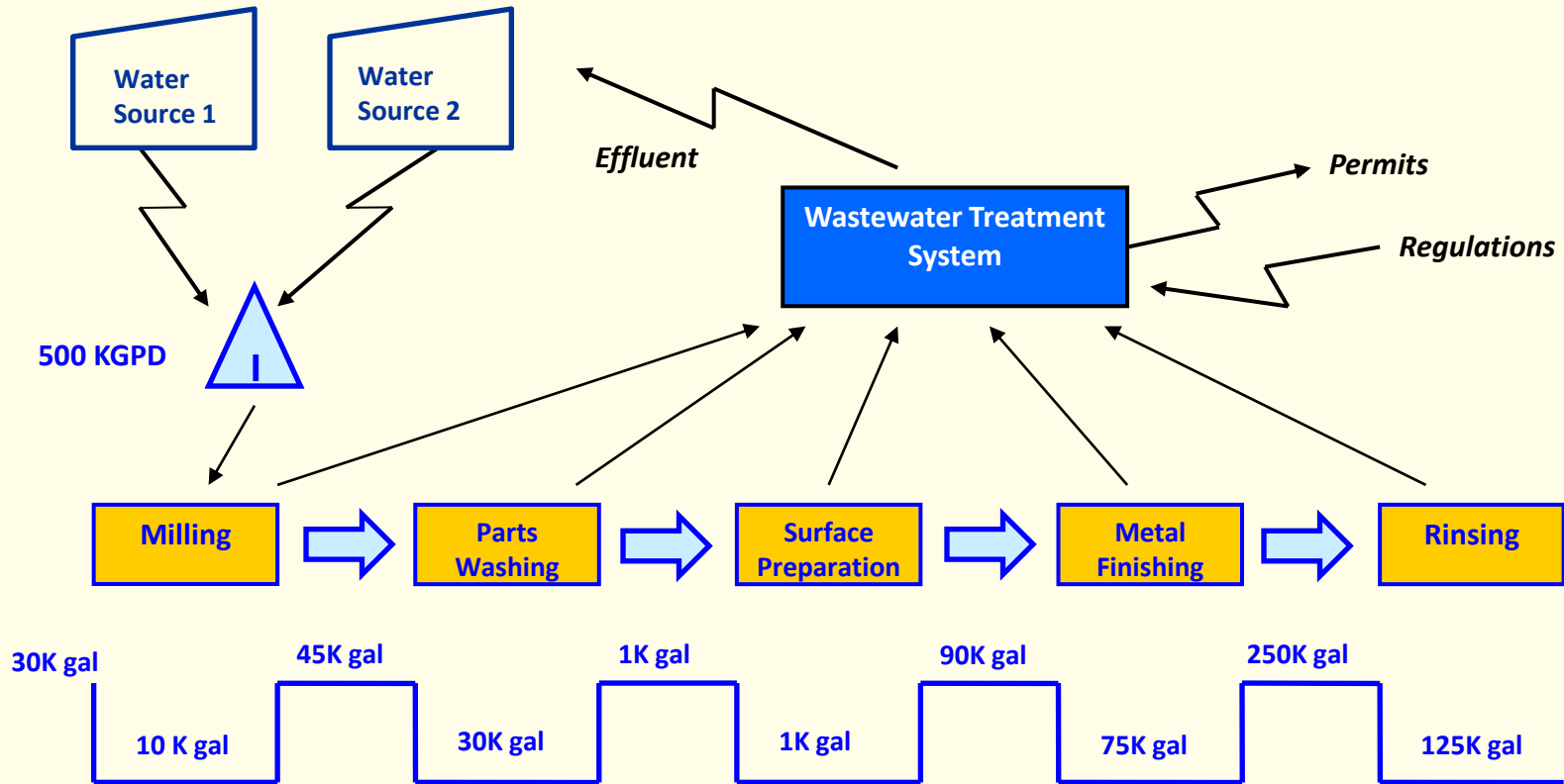
- Overall difference between amounts *used* versus what's actually *needed*.
- Largest sources of waste for *prioritizing improvement* efforts.
- Where *alternative materials* may be an effective option.



Materials Lines



Materials Lines



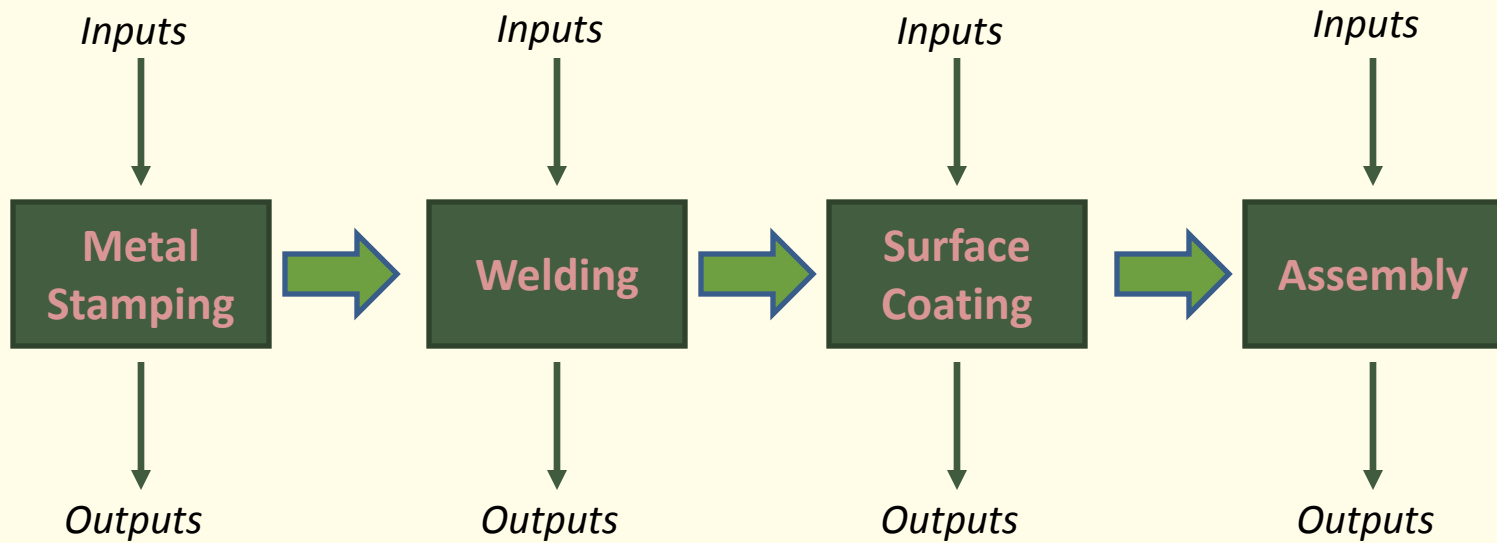
Future State Maps

What does the future state look like?

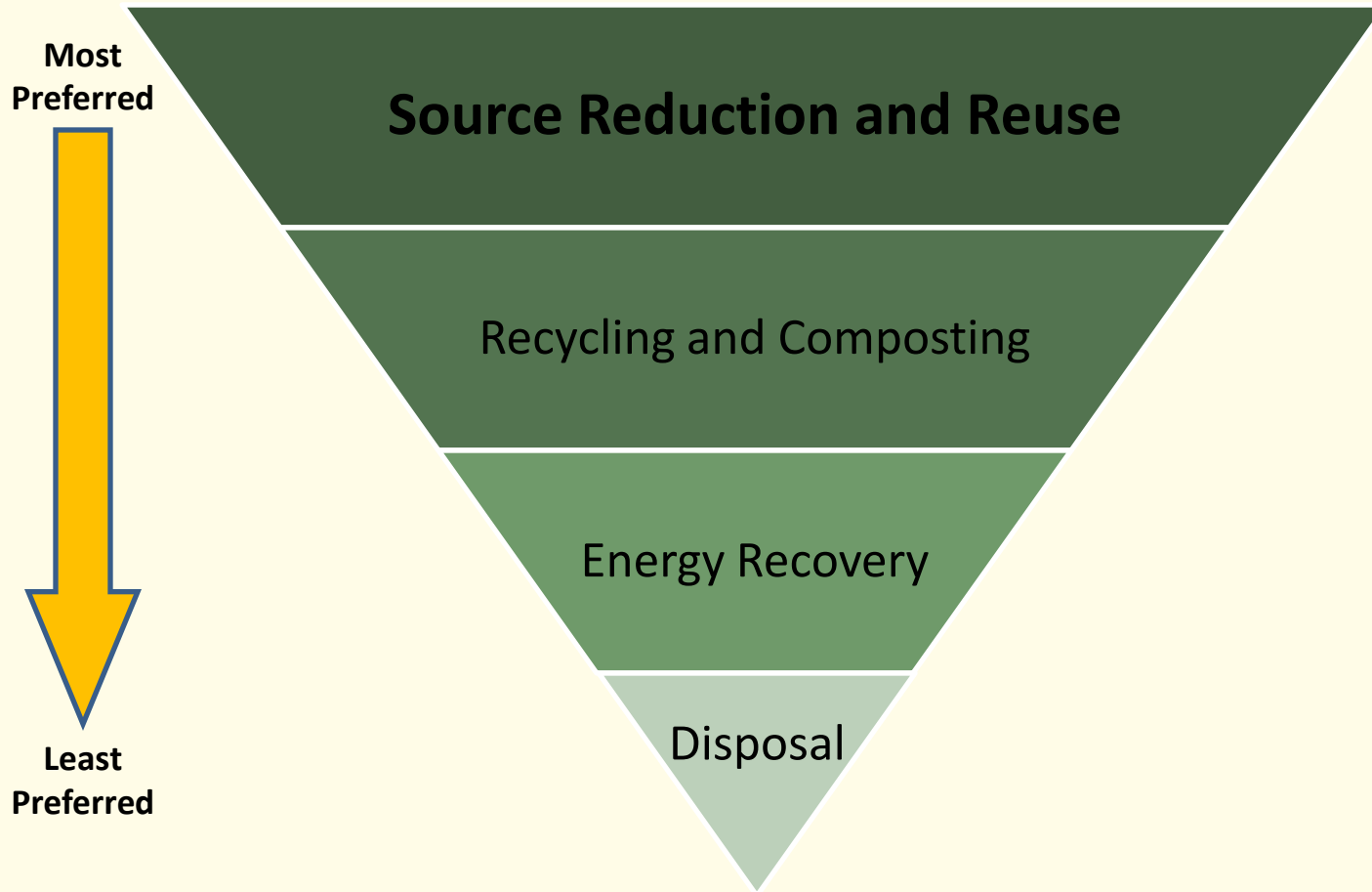
- A future state map does not need to be a mirror image of the current state.
- Can remove cost capital limitation and assume no investment is too large to make.
- It's a chance to redesign the operation to what it would look like in a perfect scenario—fully optimized and efficient.



Using Value Stream Maps to Identify Waste



Waste Management Hierarchy



Waste Management Hierarchy

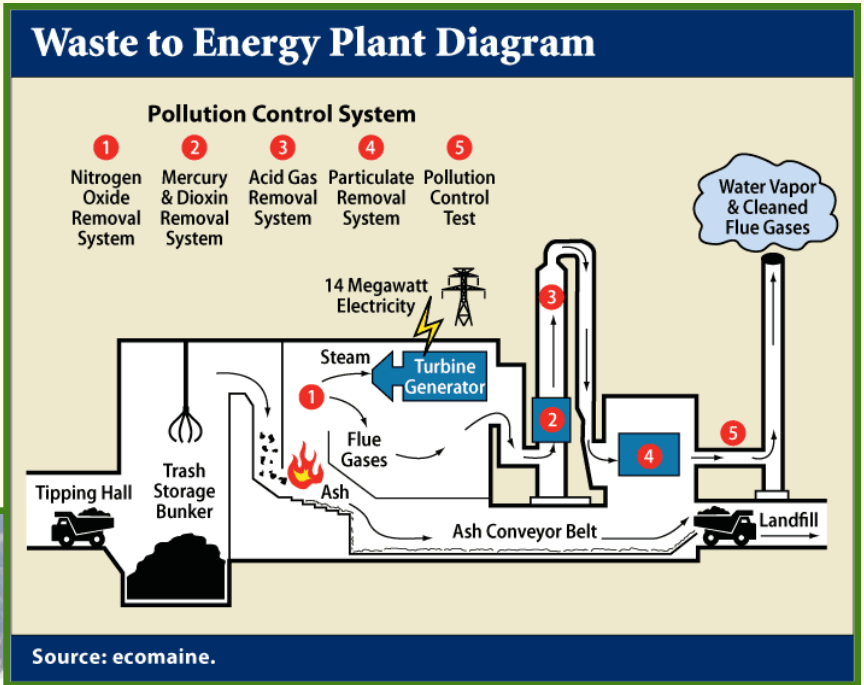
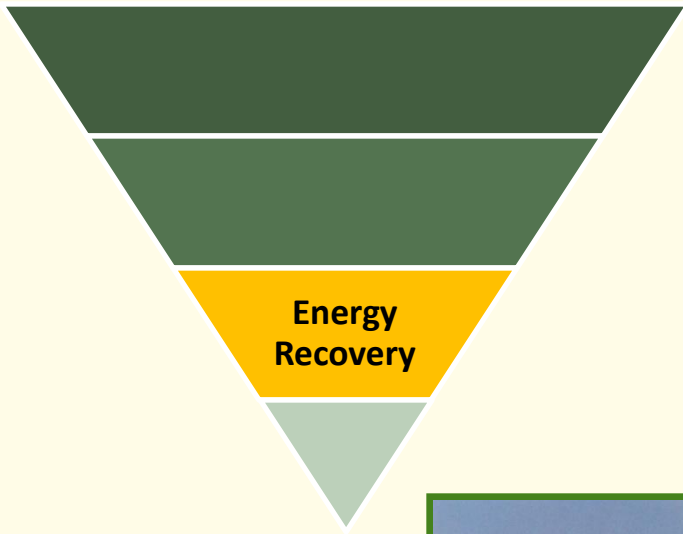
Source Reduction and Reuse



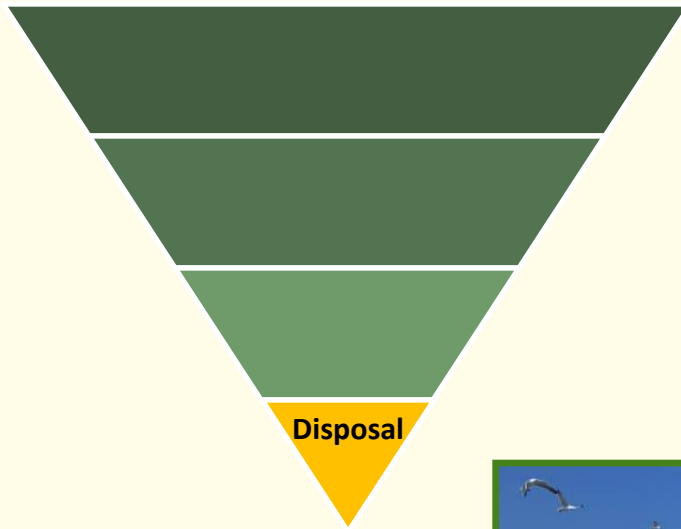
Waste Management Hierarchy



Waste Management Hierarchy

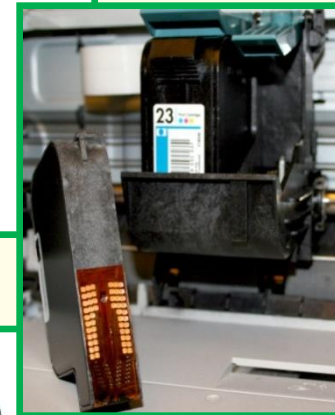


Waste Management Hierarchy



The Traditional 3 R's

*Reduce, Reuse,
Recycle*



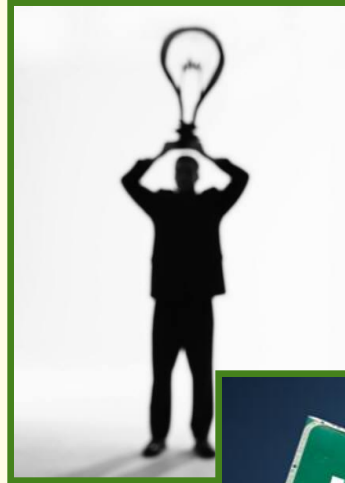
Moving Beyond the Traditional 3R's

Three new "R's"

Rethink

Reject

Recover



EPA's Recycle City



Appendix A

**Notes View Only/
Hide this slide for presenting**

Appendix B

**Notes View Only/
Hide this slide for presenting**

Appendix C

**Notes View Only/
Hide this slide for presenting**