



# Greenhouse Gas Emissions Accounting and Product Life-Cycle Management

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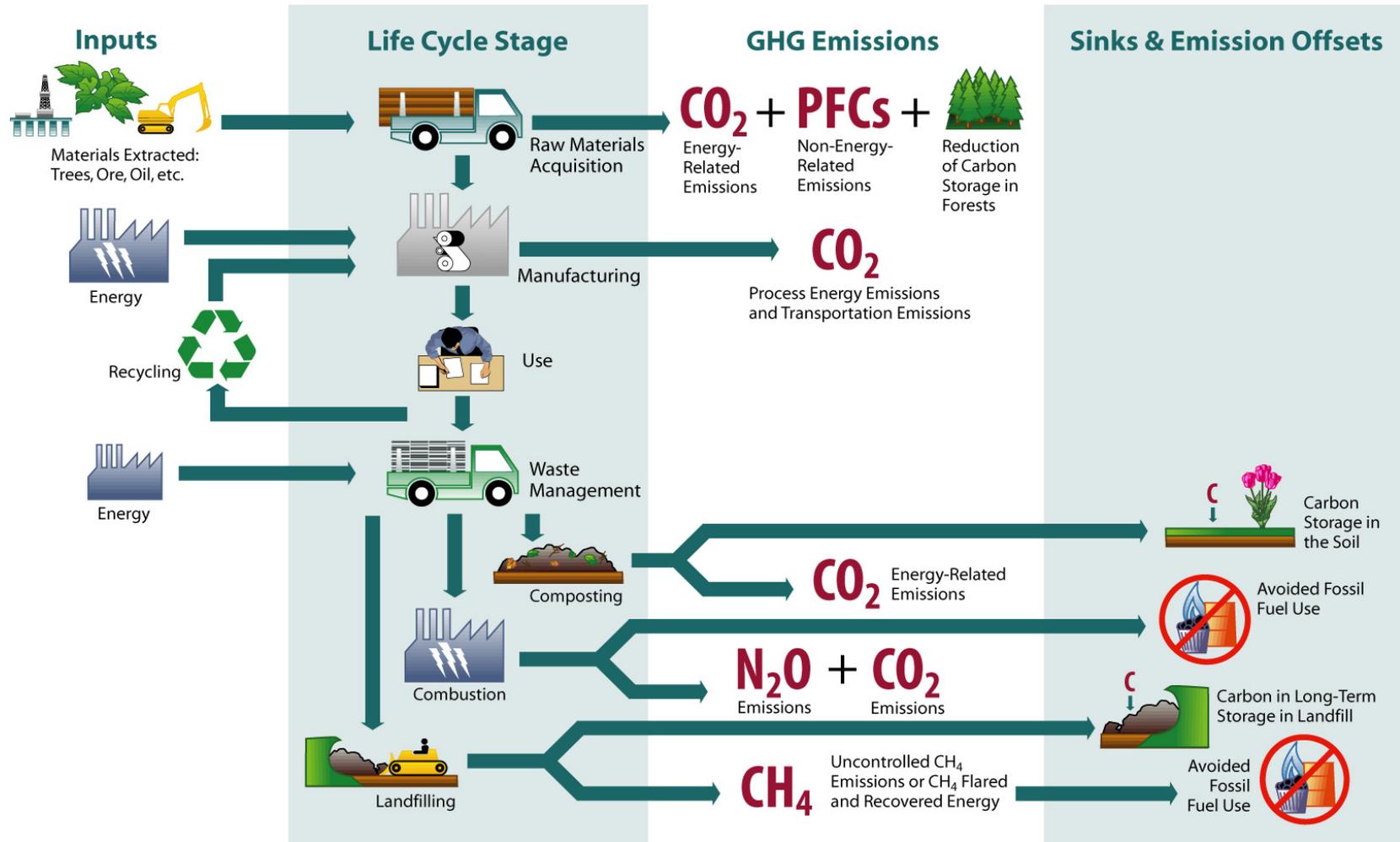
# Primary Objective

*Learn how to apply EPA tools to quantify and understand the life-cycle greenhouse gas emissions (GHG) benefits of the 3 Rs –  
Reducing, Reusing, Recycling.*

# EPA tools to measure life-cycle GHG and energy benefits

- Waste Reduction Model (WARM)
  - calculates the benefits of alternative materials management decisions (focusing on end-of-life perspective)
- Recycled Content Tool (ReCon)
  - calculates the benefits of alternative recycled content purchasing decisions
- individual WARM (iWARM)
  - calculates energy saved by recycling small quantities of common waste materials

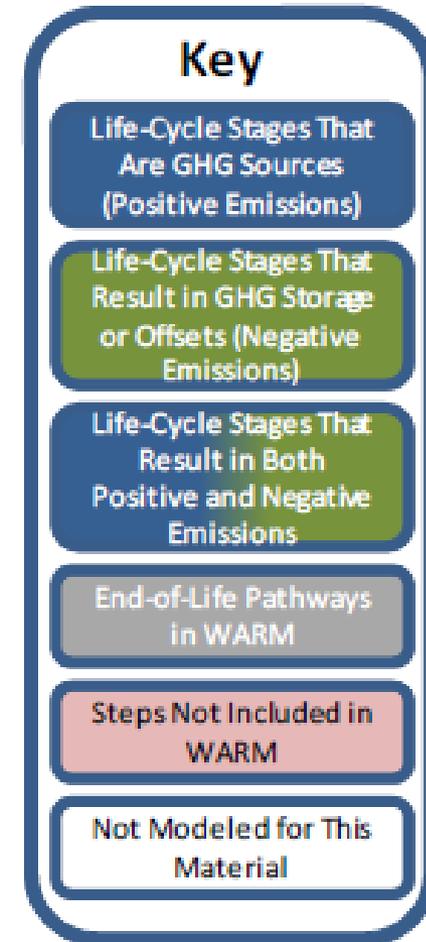
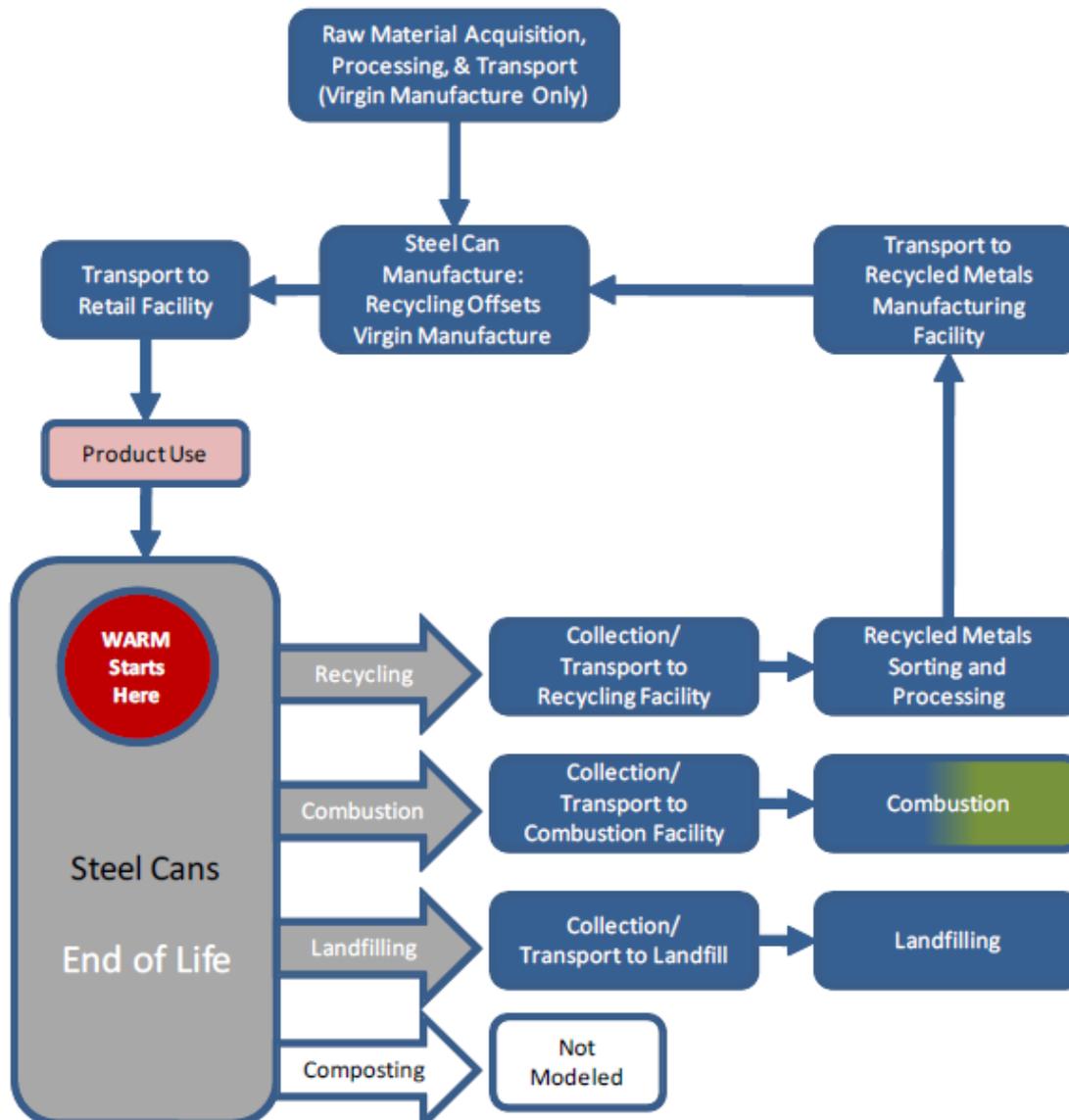
# GHG Sources & Sinks Associated with the Material Life Cycle



# Streamlined Life-Cycle Methodology

- Life-cycle assessment limited to GHG and energy impacts
- Focus on GHGs emitted, carbon stored, or utility energy displaced at following stages:
  - Raw material acquisition
  - Manufacturing
  - Waste management
  - Transportation of raw material and waste

# Life Cycle of Steel Cans in WARM



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# Using WARM to Quantify Source Reduction Benefits

**WARM** Waste  
Reduction  
Model  
*Encouraging Life-Cycle Thinking*

# Source Reduction

- Refers to any change in the design, manufacture, purchase, or use of materials or products (including packaging) that reduces the amount of material entering the waste collection and disposal system.
- Conserves resources and reduces pollution, including GHG emissions that contribute to global warming.



# Source Reduction Scenario in WARM

## → Demo

- WARM available at [www.epa.gov/warm](http://www.epa.gov/warm)
- Example of source reducing 500 tons of office paper in an alternative scenario vs. recycling vs. landfilling
  - Relative to landfilling in baseline, life-cycle GHG emissions reduction of about 4,600 metric tons of carbon dioxide equivalent (MTCO<sub>2</sub>E)
  - Relative to recycling in baseline, life-cycle GHG emissions reduction of about 2,600 MTCO<sub>2</sub>E

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# Using WARM to Quantify Reuse Benefits

# Reuse

- Form of source reduction
- Number of times a material or product is reused → increased benefits
- Reuse examples:
  - Reusing a plastic crate twenty times before recycling it
  - Donating a personal computer to a school program or non-profit organization for continued use
  - Reusing a cardboard box one time before recycling it



# Reuse Modeling with WARM →

Demo at [www.epa.gov/warm](http://www.epa.gov/warm)

- Run WARM with a non-source reduction baseline and an alternative of source reduction
- Multiply the result by the times the material is reused
- Example of using HDPE plastic crates (weighing 500 tons) 20 times before recycling
  - Life-cycle GHG benefit of source reducing vs. recycling for 1 use based on current mix of inputs: approx. 300 MTCO<sub>2</sub>E
  - Life-cycle GHG emissions benefit = 300 MTCO<sub>2</sub>E x 19 (20 total uses – 1 original use) = approx. 5,700 MTCO<sub>2</sub>E

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# Using EPA's ReCon Tool to Quantify Recycled Content Benefits

# Using ReCon → Demo

- For online or Excel tool, go to:  
[http://epa.gov/epawaste/conserves/tools/warm/ReCon\\_home.html](http://epa.gov/epawaste/conserves/tools/warm/ReCon_home.html)
- Enter the amount of each material purchased or manufactured
- Enter the baseline (or current) and alternate post-consumer recycled content of each material; could tailor to specific purchasing specifications
- Select to view GHG and energy outputs

# Preview of Upcoming Updates to Food Factors in WARM

- WARM includes a general “food scraps” waste type that does not address upstream impacts from food production (i.e., no source reduction pathway)
- A range of energy and GHG impacts can result from production and disposal of different food types
- Currently developing food type-specific factors, including upstream GHGs for 5 food types and an aggregated national average food waste factor



# Summary

- Significant reductions in GHG emissions and energy use can be realized through source reduction, reuse, increasing the recycled content in manufacture or purchasing practices, and recycling
- Benefits accrue across the life cycle
- EPA tools are freely available and allow for measurement of reductions from alternative materials management practices

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# Questions?

# For More Information...

- **WARM:** [www.epa.gov/warm](http://www.epa.gov/warm)
- **ReCon:**  
[www.epa.gov/epawaste/consERVE/tools/warm/ReCon\\_home.html](http://www.epa.gov/epawaste/consERVE/tools/warm/ReCon_home.html)
- **Model Documentation:**  
<http://epa.gov/epawaste/consERVE/tools/warm/SWMSGHGreport.html>

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