Life Cycle Assessment Of Organic Diversion Alternatives And Economic Analysis For Greenhouse Gas Reduction Options

Overview

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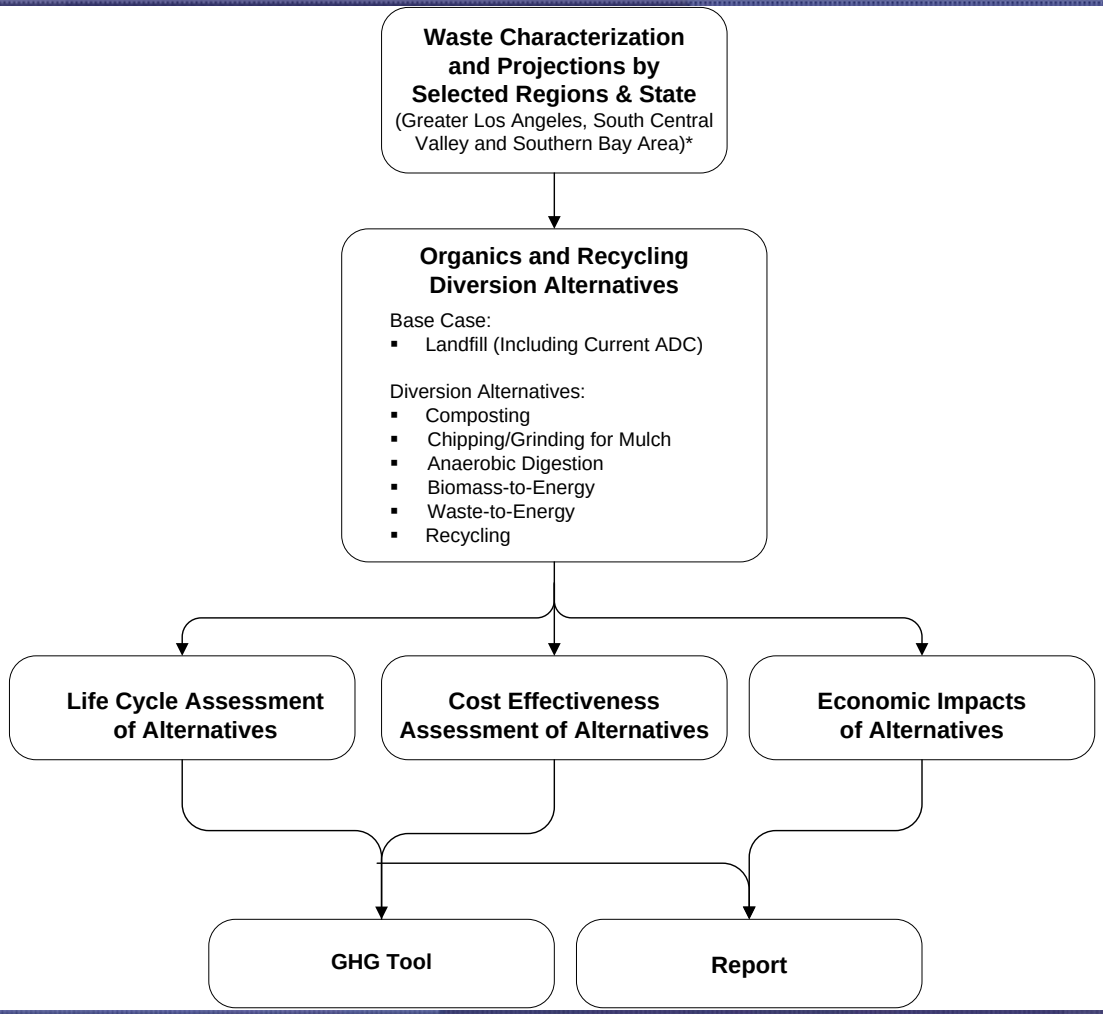
Recap of Project Goals, Tasks, and Outputs

- The goal of the project is to develop data, methods, and tools to analyze the cost and life cycle GHG aspects for organic and recyclables waste management alternatives in California.
- Main Tasks:
  - Conduct LCA focusing on energy and GHG aspects
  - Conduct cost and economic impact analyses
  - Develop CA-specific GHG Tool
- Key Products:
  - Project report detailing State and regional LCA, cost, and economic impact analysis for organic and recyclable waste management alternatives
  - GHG Tool

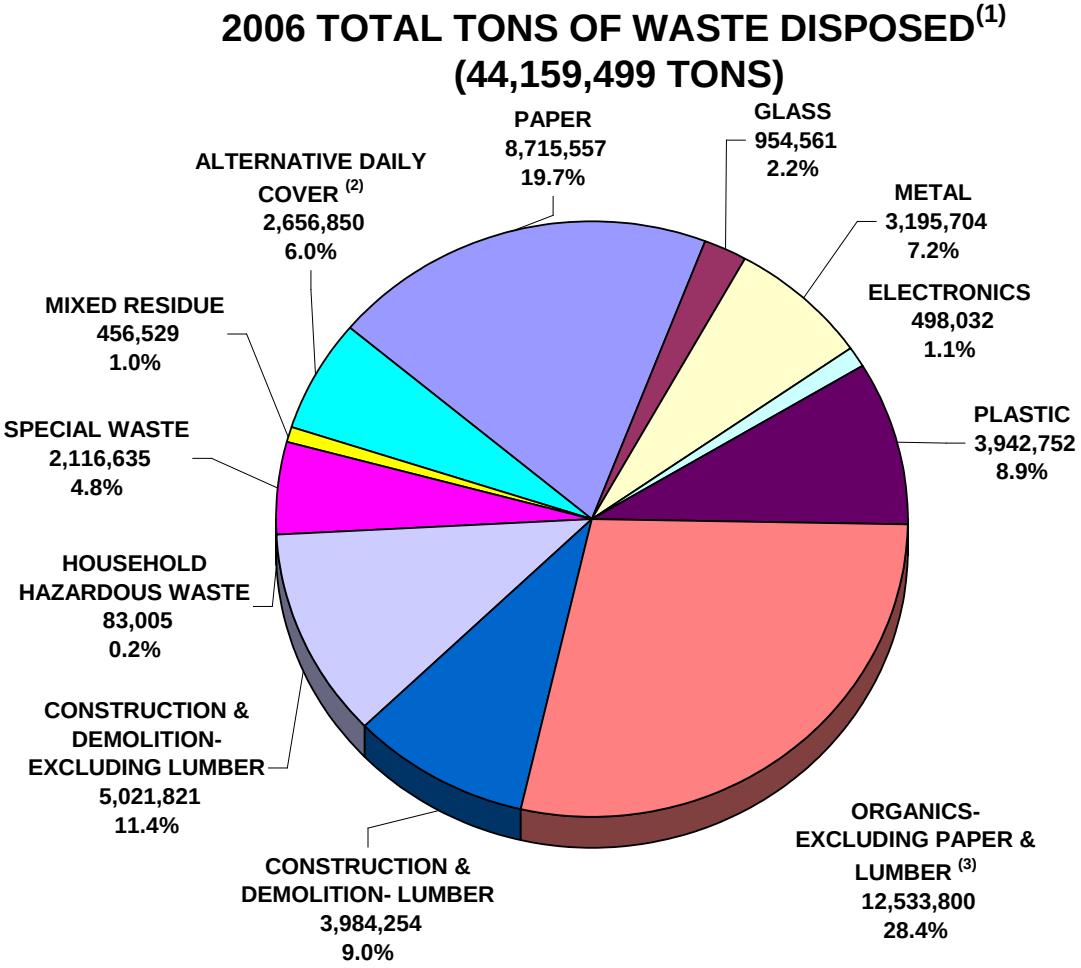
Project Team and Roles

- RTI International (Prime)
  - LCA/GHG analysis
  - GHG Tool lead
- R.W. Beck
  - Cost and Economic Impact analyses
  - GHG Tool support
- Sally Brown
  - Compost research
- Matthew Cotton
  - Facilities information
  - Compost research

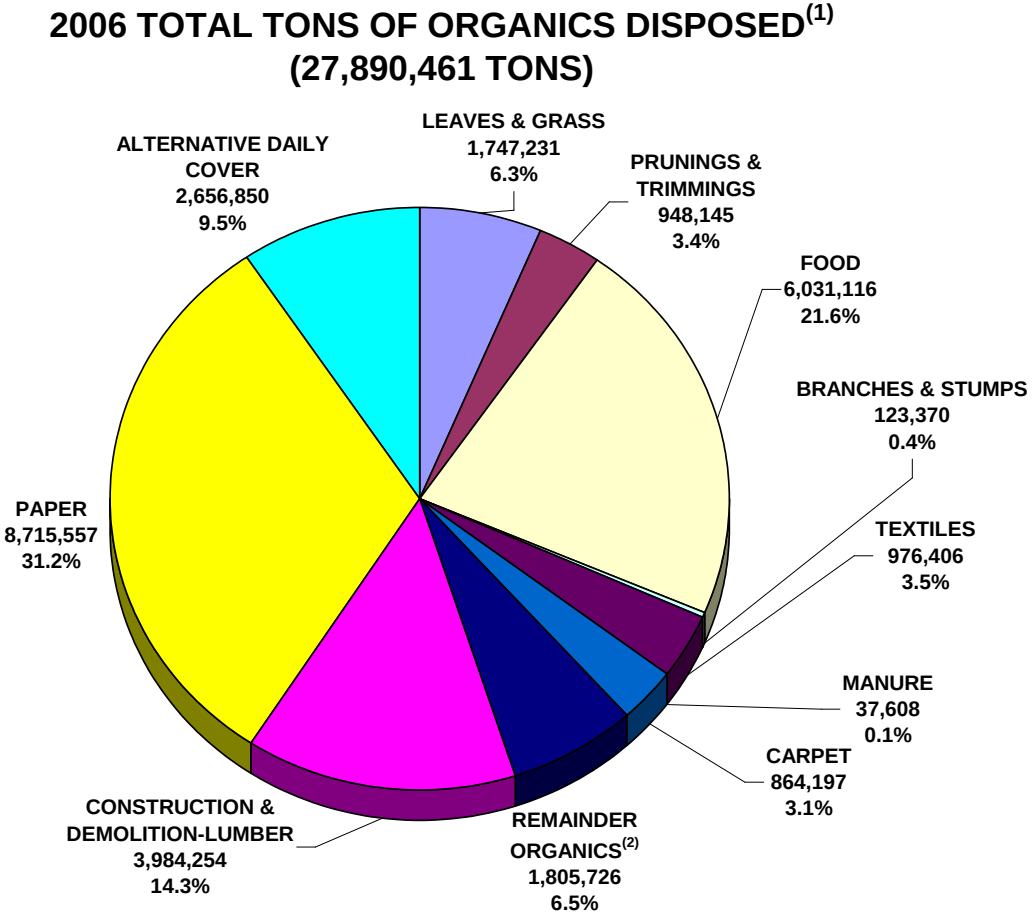
Project Components and Flow



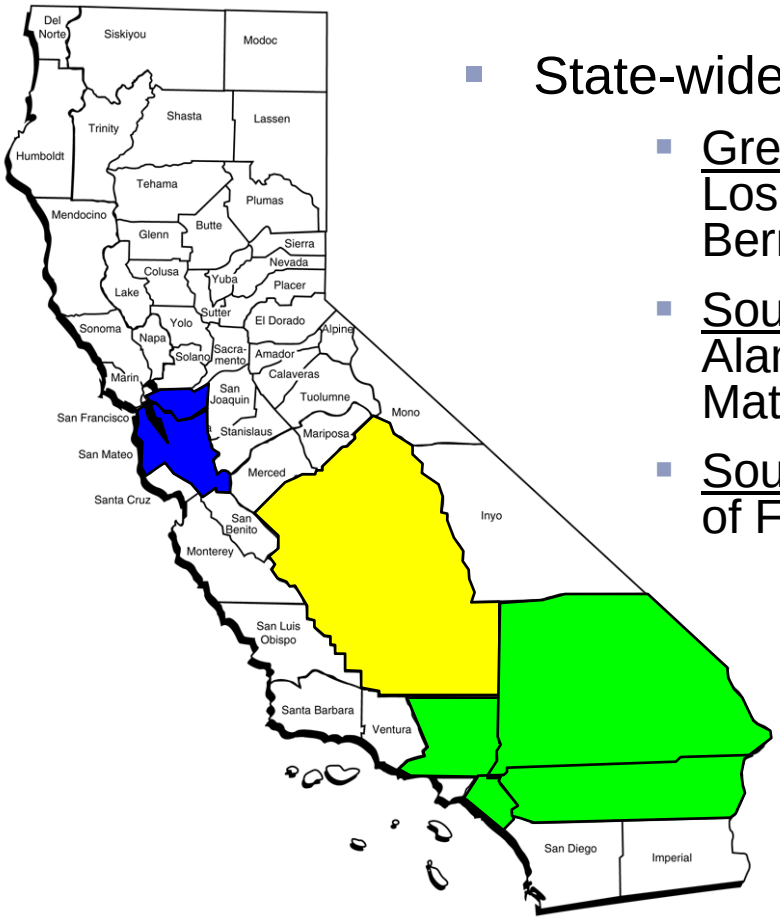
Focus is On Waste Currently and Projected to Be Disposed in Landfills



Details of Organic Fraction



Geographic Scope



- State-wide and regional analyses:
  - Greater Los Angeles: includes the counties of Los Angeles, Orange, Riverside, and San Bernardino.
  - Southern Bay Area: includes the counties of Alameda, Contra Costa, San Francisco, San Mateo, and Santa Clara.
  - Southern Central Valley: includes the counties of Fresno, Kern, Kings, Madera, and Tulare.

Waste Management Alternatives Included in the Analysis

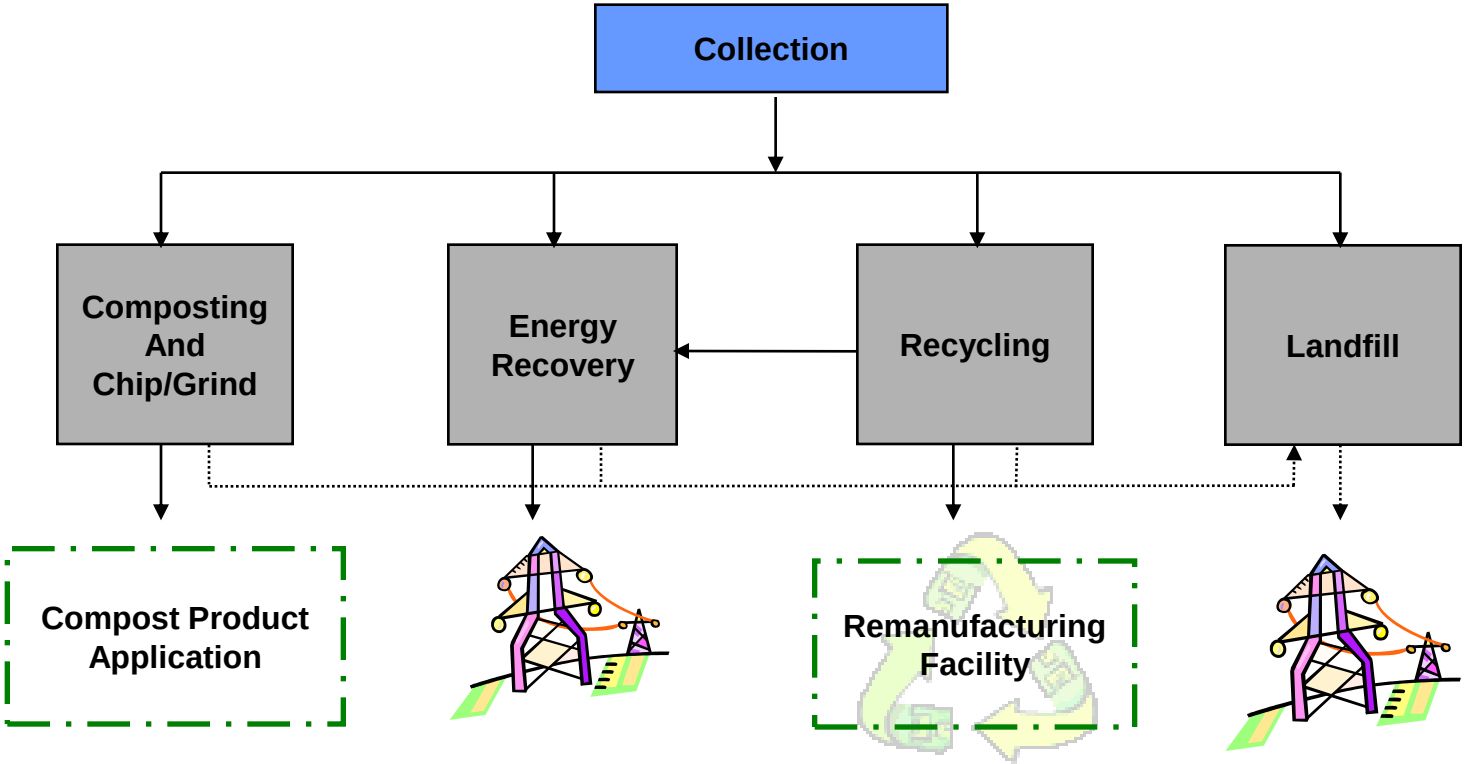
Baseline:

- Landfill

Alternatives:

- Anaerobic Digestion
- Biomass to Energy
- Chipping/Grinding
- Composting
- Recycling (recyclables only)
- Waste to Energy

Life Cycle for Waste Management Systems



Project Focuses on Conducting an LCA for GHG Emissions

- Includes activities and processes upstream and downstream from waste management facilities.
- Includes energy consumption and emissions associated with material inputs and energy production.
- Includes energy consumption and emissions offsets/savings by virtue of materials and/or energy recovery.
- Includes carbon storage and sequestration:
  - Landfill carbon storage for the undegraded biogenic fraction
  - Forest carbon sequestration associated with paper recycling
  - Soil carbon sequestration associated with compost application

LCA versus GHG Inventory

- In short, an LCA provides a standard approach for conducting an extended “systems” analysis:
  - Upstream
  - Downstream
- Both LCA and GHG Inventories provides a “snapshot” view with fixed data, assumptions, and methods.
  - Results are only as specific as the data, assumptions, methods used.
  - Can contain significant uncertainties.
- LCA is not the same as a GHG inventory. Take landfills for example:
  - LCA = net total GHGs produced during a 100 year time period per defined tonnage of waste disposed including collection, transportation, and landfill activities less any energy recovery-related GHG offsets and carbon storage.
  - GHG inventory = annual net GHG emissions per waste-in-place in a landfill(s).

LCA versus REC and VER

- There are two parallel and related, but distinct, environmental markets related to climate change:
  - Renewable energy certificates (RECs)
  - Voluntary [carbon] emission reductions (VERs)
- RECs deal with energy only:
  - Represent energy generated from a clean and renewable source, such as wind, solar, hydro, or certain types of renewable biomass.
  - Since these renewable energy resources generate little to no carbon as they produce energy, they represent an indirect emission reduction,
  - For example, wind power “offsets” the demand for fossil-fueled power.
- VERs; also called carbon offsets:
  - Represent the reduction, avoidance, destruction, or sequestering carbon in one place to “offset” an emission taking place somewhere else.
  - Offsets generally represent direct emission reductions or sequestration.
  - For example, the destruction of methane emitted from a landfill.

LCA vs REC and VER (cont.)

- Three different “scopes” of emissions are currently recognized in the VER process as contributing to a companies c-footprint:
  - *Scope I* emissions associated with on-site, direct sources such as a boiler or a generator at a facility.
  - *Scope II* emissions are indirect, energy-based emissions, such as those from the electricity to run equipment and office space.
  - *Scope III* emissions are all other types of indirect emissions sources, including those associated with travel, paper use, etc.
- Where do LCA-type results for energy and GHG emissions fit in?

Scenario Analysis

- Predefined waste management scenarios were analyzed to evaluate relative costs and life-cycle environmental aspects of alternatives for managing waste currently landfilled.
  - Goal was to develop a better understanding of the potential cost and life cycle environmental (particularly GHG emission) tradeoffs among the alternatives.
  - Goal was *not* to make absolute judgments about the preference of one waste management alternative or another.
- Different approaches can be taken for defining scenarios.
  - Originally, we design the scenarios around regional waste plans but data and planning typically occurs at city/county levels and not necessarily coordinated within regions.
  - Instead, we developed an “objectives” approach for designing the scenarios.

Scenario Objectives Analyzed

- Baseline Landfill (status quo): this scenario is used as the basis for comparing the other scenarios against.
- Minimum Cost: the goal of this scenario is to identify the set of diversion alternatives that achieves diversion targets at the lowest cost, regardless of GHG emissions or other environmental burdens.
- Minimum GHG Emissions: the goal of this scenario is to identify the set of waste management alternatives that minimizes GHG emissions, regardless of cost or other environmental burdens.
- Minimum Cost while Achieving GHG Emission Reduction Targets: the goal of this scenario is to identify the set of diversion alternatives that provides the lowest cost means of achieving GHG emission reduction targets, regardless of cost or other environmental burdens.
- Minimum Energy Consumption: the goal of this scenario is to identify the set of diversion alternatives that minimizes energy consumption, regardless of GHG emissions and other environmental burdens or cost.

Process for Conducting Scenario Analysis

- Utilized generally accepted methods and current thinking rather than creating new methods.
  - State and regional specific data collected was used to develop assumptions to tailor the coefficients/analysis.
  - Incorporated key state and regional policies and future legislation.
- Developed cost, energy, and GHG emission coefficients per the management of a unit (e.g., ton) of waste per each process.
- Identified material/process combinations that best met each of the scenario objectives.
- Developed mass flows per the “solution” and used this mass flow as the basis for developing all results.

Constraints Placed on Scenarios

- Waste generated within each region is assumed to be managed in each region; waste exporting not addressed.
- Projected and applied diversion constraints to meet State and regional targets.
  - Example: 75% waste diversion from landfills by year 2020.
  - Always assume a percent of waste is disposed of in landfills.
- Implementation of new facilities at assumed average facility sizes for different alternatives in each study region over time.
  - Straight-line percent increase
  - Phased increase

Consideration of Key State Policies

Table 1-7. Established and Proposed California Policies and How They Are Being Incorporated into This Study

Policy Description	How Incorporated
Energy	
Renewable Portfolio Standard – Established in 2002 under Senate Bill 1078 and accelerated in 2006 under Senate Bill 107, California's RPS program requires electric corporations to increase procurement from eligible renewable energy resources by at least 1% of their retail sales annually, until they reach 20% by 2010.	See below for the accelerated RPS.
Accelerated RPS – 33% by 2020 (the following Renewable Portfolio Standard target is hereby established for California: All retail sellers of electricity shall serve 33 percent of their load with renewable energy by 2020.). http://gov.ca.gov/executive-order/11072/	The percent of eligible renewable electrical energy sources was increased during the study period to reach the 33% target by 2020. See Section 3.1.
Low Carbon Fuel Standard: Executive Order S-1-07, the Low Carbon Fuel Standard (LCFS) issued on January 18, 2007, calls for a reduction of at least 10% in the carbon intensity of California's transportation fuels by 2020. http://www.arb.ca.gov/fuels/lcfs/lcfs.htm	We reduced the transportation carbon emission factor by 1% per year out to 2020 and then hold constant to 2025. One issue is how the LCFS will be met and how costs and fuel production environmental burdens might change.

Continued in the report

Summary Cost Results by Scenario—State

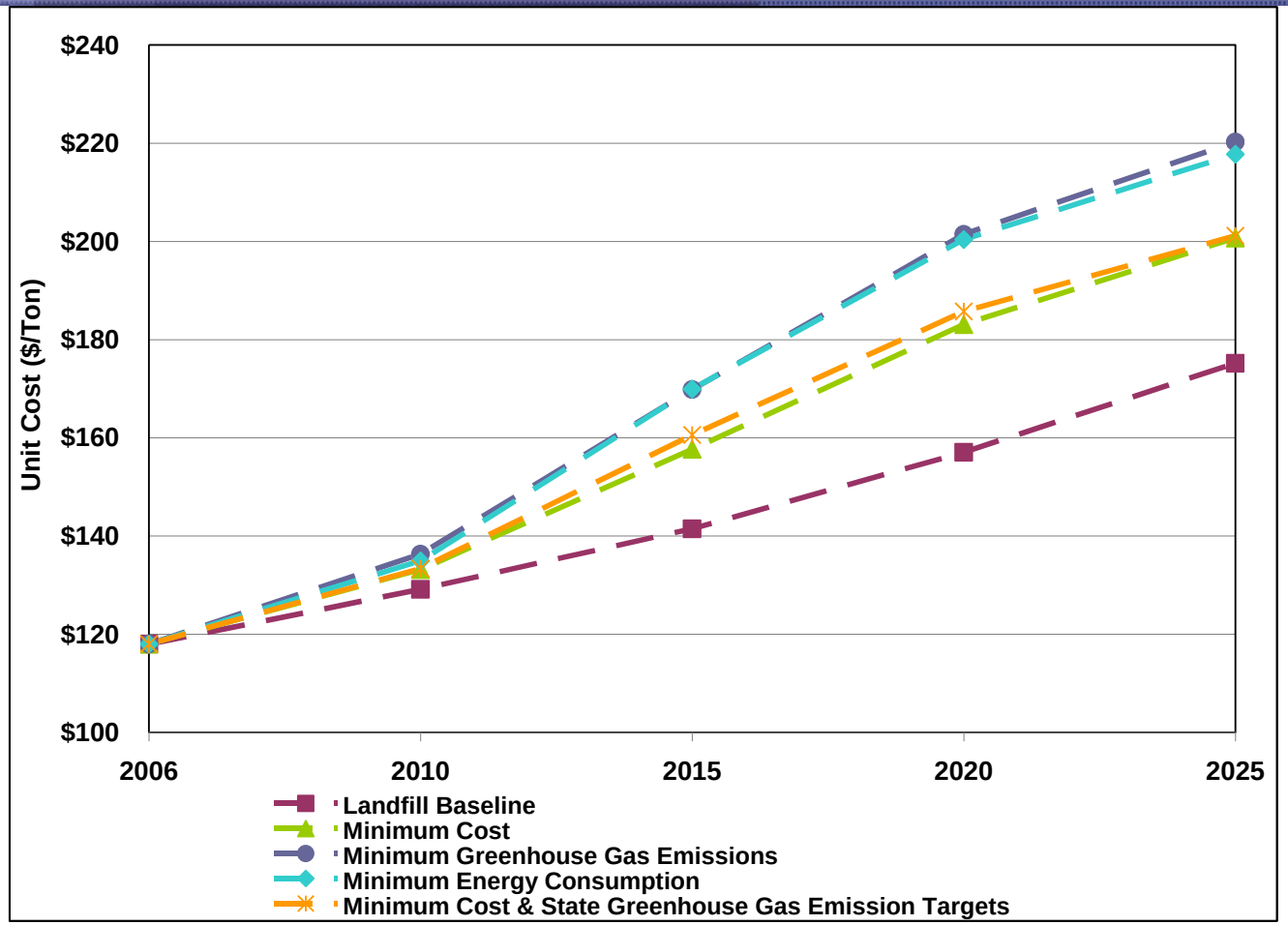


Figure 6.1 Summary of Cost by Scenario Results—State

Summary Energy Results by Scenario—State

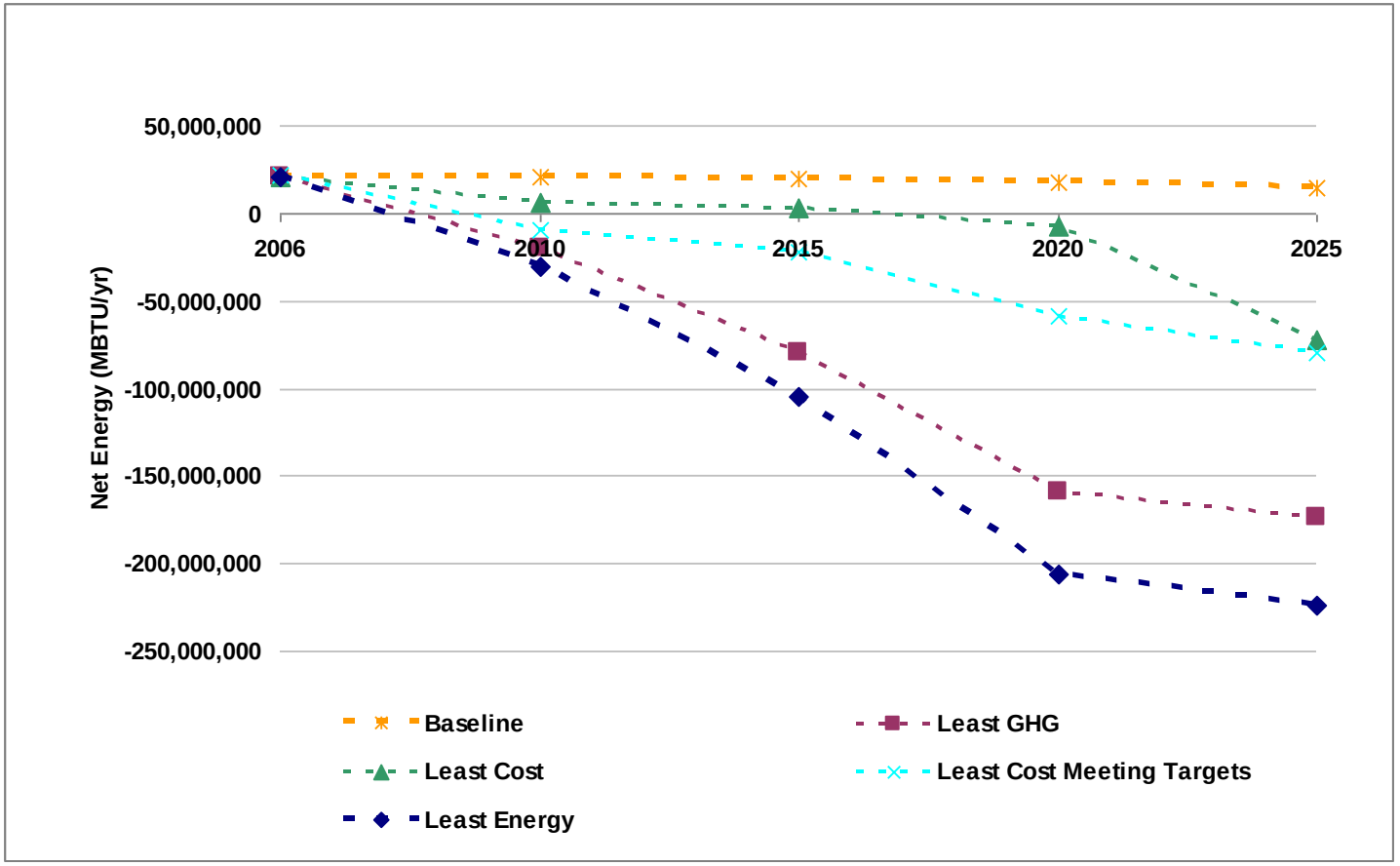


Figure 6.2. Net Energy Consumption for Different Scenarios—State.

Summary Carbon Results by Scenario—State

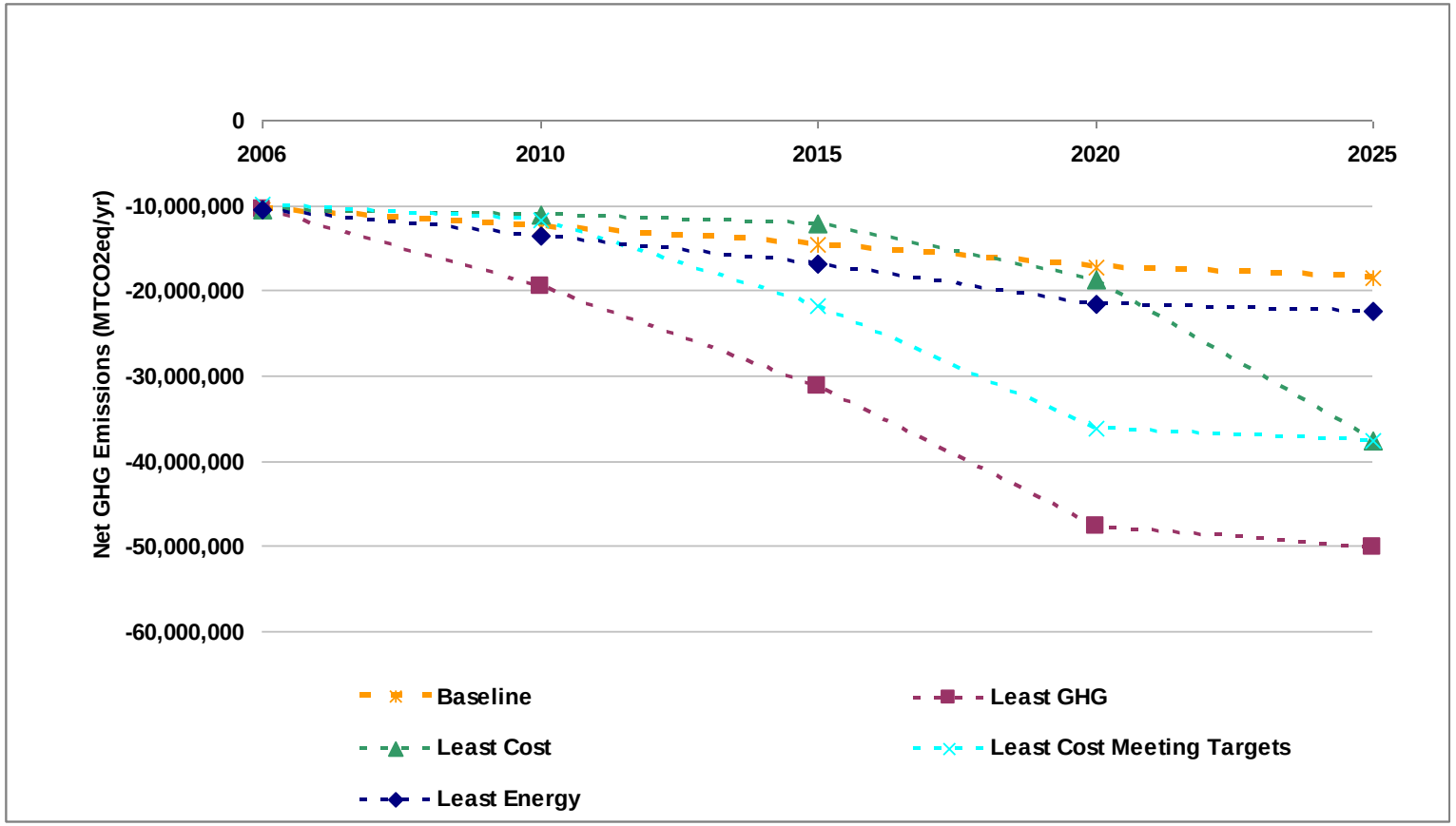


Figure 6.3. Net GHG Emissions for Different Scenarios—State.

Number of New Facilities Needed by Scenario: State Example

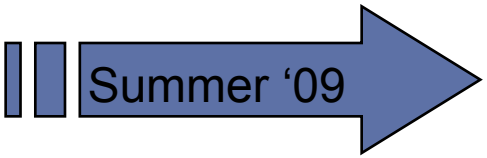
Table 6.1 Number of Facilities required under Scenarios

	Landfill	Anaerobic Digestion	Biomass-to-Energy	Chipping/ Grinding	Composting	Multi MRF Recycling	C&D Recycling	Self Haul/ Baling	Waste-to-Energy	Total
Landfill Baseline	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**
Minimum Cost	n/a	0.0	0.0	211.4	150.7	83.7	0.0	0.0	5.5	**451.4**
Minimum Greenhouse Gas Emissions	n/a	73.9	0.0	0.0	0.0	46.9	36.9	80.8	32.4	**270.9**
Minimum Energy Consumption	n/a	0.0	0.0	0.0	0.0	19.1	0.0	30.8	56.5	**106.4**
Minimum Cost & State Greenhouse Gas Emission Targets	n/a	0.0	0.0	211.4	64.1	163.8	0.0	0.0	5.5	**444.9**

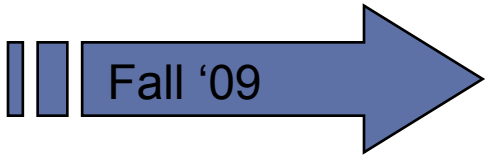
Differences Between Scenario Analysis and GHG Tool

- Analysis will have fixed data and assumptions whereas GHG tool will allow for more flexibility in data and assumptions.
- Scenarios are objective based (compared to baseline LF):
  - Minimum cost
  - Minimum GHG emissions
  - Minimum cost while achieving GHG emission reduction targets
  - Minimum energy consumption
- GHG Tool is mass flow (simulation) based:
  - Users define flow of material to alternatives

Remaining Schedule



- Finalize compost sampling and analysis report
- Draft project report out to stakeholders for review and comment
- Prototype GHG tool out to stakeholders for review and comment
- Stakeholders workshop



- Review and prioritize comments for implementation
- Finalize Project report
- Finalize GHG tool

Agenda for Today

- Recap our approaches for conducting:
  - Cost and economic impact analyses
  - LCA for energy and GHG emissions
- Review findings from the scenario analyses.
- Present key issues for discussion.
- Roll out conceptual design of the GHG tool prior to release for review.
- Q&A after each presentation and again at end of day.