Greenhouse Gas Emissions and Local Government Waste Management

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Overview

- Climate and waste connections
- Inventorying waste-related emissions
- Evaluating waste-related mitigation strategies
- Regional government case studies
- California local government case studies
- Lessons learned
- Next steps

Climate and waste connections

Waste sector sources of greenhouse gas (GHG) emissions and sinks:

Landfilling – largest methane source; also store carbon

Waste combustion – emits carbon dioxide and nitrous oxide

Composting – methane emissions depend on how managed; soil carbon storage

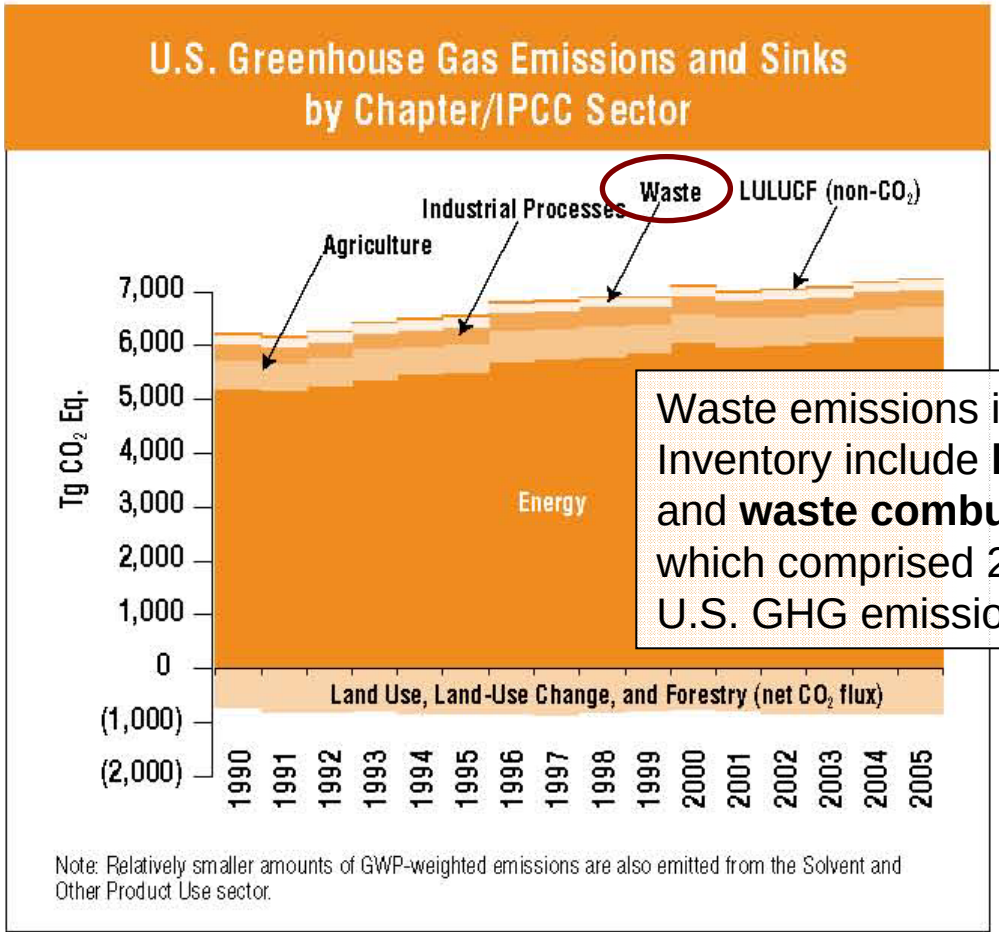
Recycling – impacts manufacturing emissions

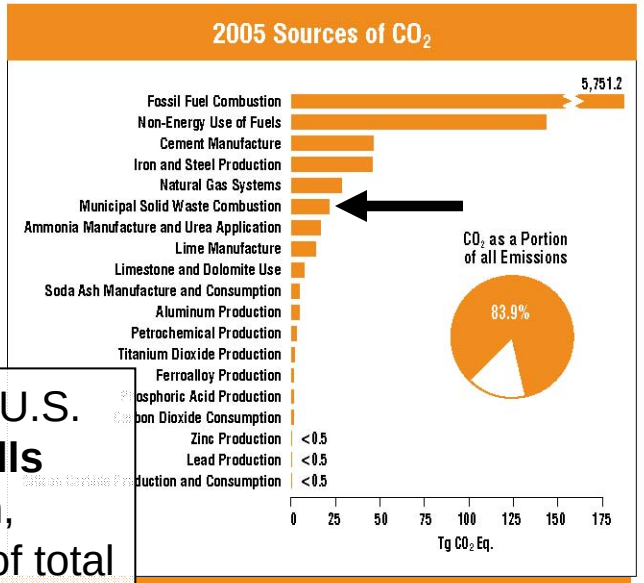
Photo sources: Landfilling: http://www.dcu.ie/chemistry/asg/kiernab/; Composting: http://commons.wikimedia.org/wiki/Image:Compost_Heap.jpg, Combustion: http://www.ec.gc.ca/EnviroZine/english/issues/29/feature1_e.cfm

Inventorying waste-related emissions

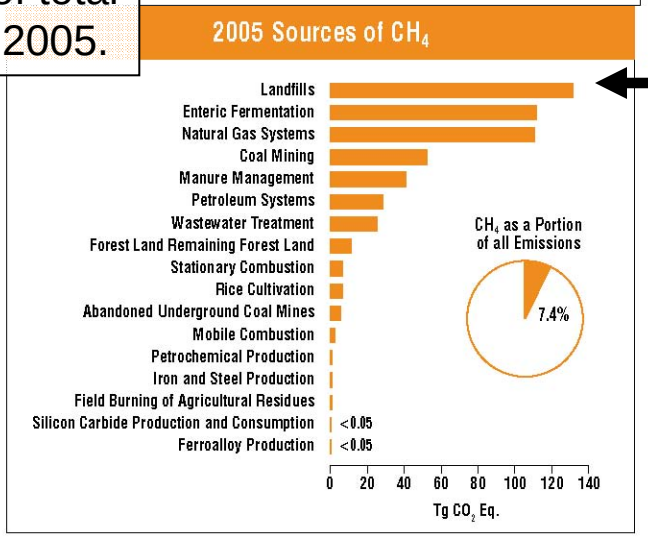
- Emissions sources/gases
  - Landfill methane
  - Landfill carbon storage
  - Nitrous oxide and non-biogenic carbon dioxide from incineration
- Types of emissions
  - Direct: calculated for facilities inside some geographic boundary
  - Indirect: calculated indirectly based on waste disposal practices and assumptions re fates

National waste emissions





Waste emissions in the U.S. Inventory include **landfills** and **waste combustion**, which comprised 2.1% of total U.S. GHG emissions in 2005.



Source: *Inventory of US GHG Emissions and Sinks* available for download at http://www.epa.gov/climatechange/emissions/usginventory.html

But that's not the whole story…

- Emissions from landfills and incinerators are just a piece of the waste puzzle
- End-of-life decisions not only impact GHG emissions and sinks during waste management, but also impact GHGs at other product/material life-stages

Waste management impacts on life-cycle GHG emissions

End-of-life decisions have quantifiable impacts on GHG emissions

- The ratio of virgin raw materials to recycled inputs in new aluminum cans, glass containers, HDPE bottles, etc.
- The amount of virgin wood harvested to make paper products, thereby influencing forest carbon storage
- The fraction of fossil fuels offset by energy from landfills and/or incinerators

Evaluating mitigation strategies for waste

- Scope of control: local/regional gov’ts have control over waste management *practices*, but not necessarily over waste *facilities*
- Geographic scope: Changes in waste practices *inside* a region may lead to emission reductions *outside*
- Accounting: inventory guidance limited to landfill methane, etc.; only life-cycle accounting tracks full suite of benefits (e.g., avoided upstream CO_2)
- Timing: inventories are for a single year; life-cycle benefits accrue up to 30 yrs into the future
- Double counting/credit: potential for double counting/ dueling “credit” when utilizing indirect and/or life-cycle approaches

Evaluating mitigation strategies for waste

- Charge questions:
  - What tools/methods exist to help state, regional, and local governments evaluate waste options
    - Quantify emissions
    - Evaluate emission reduction potential
- Answers depend on:
  - State/regional frameworks/requirements
  - Impetus for initiating/quantifying reductions
  - Importance of “ownership” over reductions

Regional Case Studies

Regional Inventory Guidance

Delaware Valley Regional Planning Commission

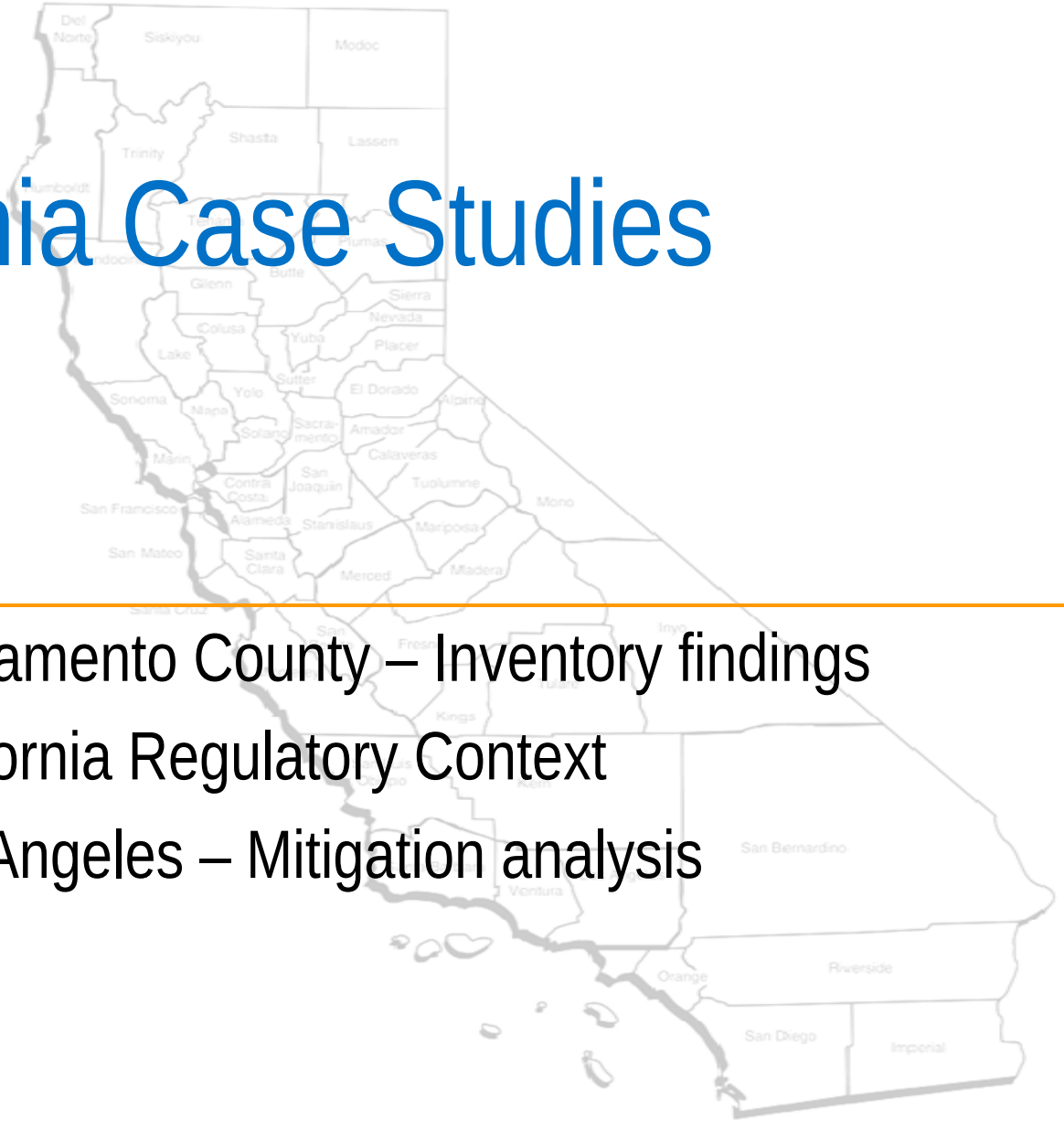
Draft EPA regional inventory guidance

- Methods emphasize application of results
  - Site-based emissions (direct emissions)
    - direct emissions from a specific landfill inside the region regardless of where the waste originated
  - Population-based emissions (indirect emissions)
    - indirect emissions associated with waste generated in the region, regardless of where that waste is disposed
- If both methods are used, must take pains to avoid double counting
- Methodology: First order decay equation is used for both (based on annual disposal)

DVRPC waste emissions

- Population-based emissions
  - First order decay equation; annual disposal based on per capita generation and population
  - Assumed NJ and PA per capita generation rates
  - Assumed NJ and PA statewide incineration rates
- Method chosen for two reasons
  - Inventory intended to support GHG reduction initiatives in the region (it's ok if the scope of the emission inventory includes emissions outside the jurisdiction)
  - Landfills in the region represented little/no opportunity for mitigation onsite (LFGTE sys in place)

California Case Studies

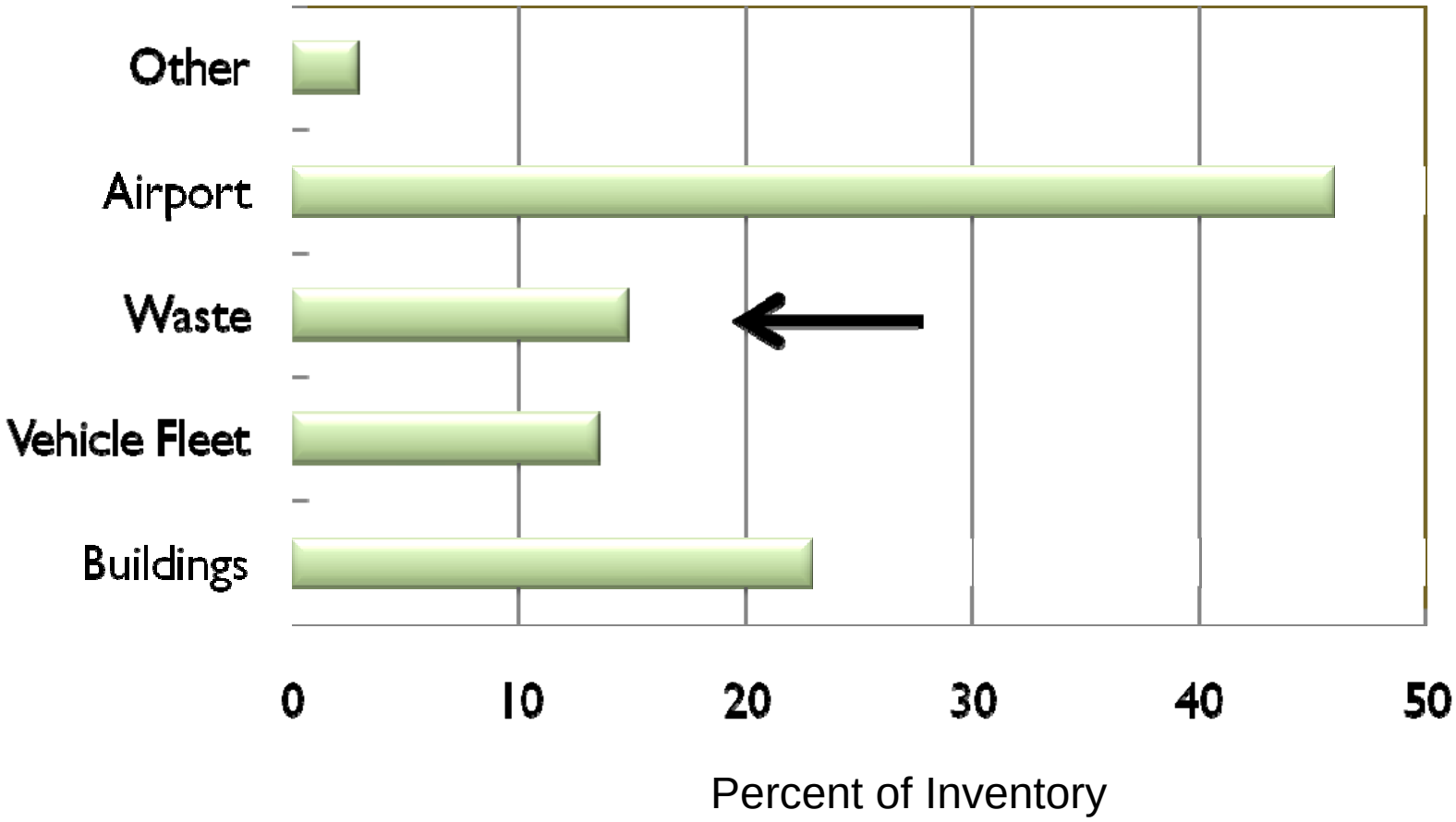


Sacramento County – Inventory findings

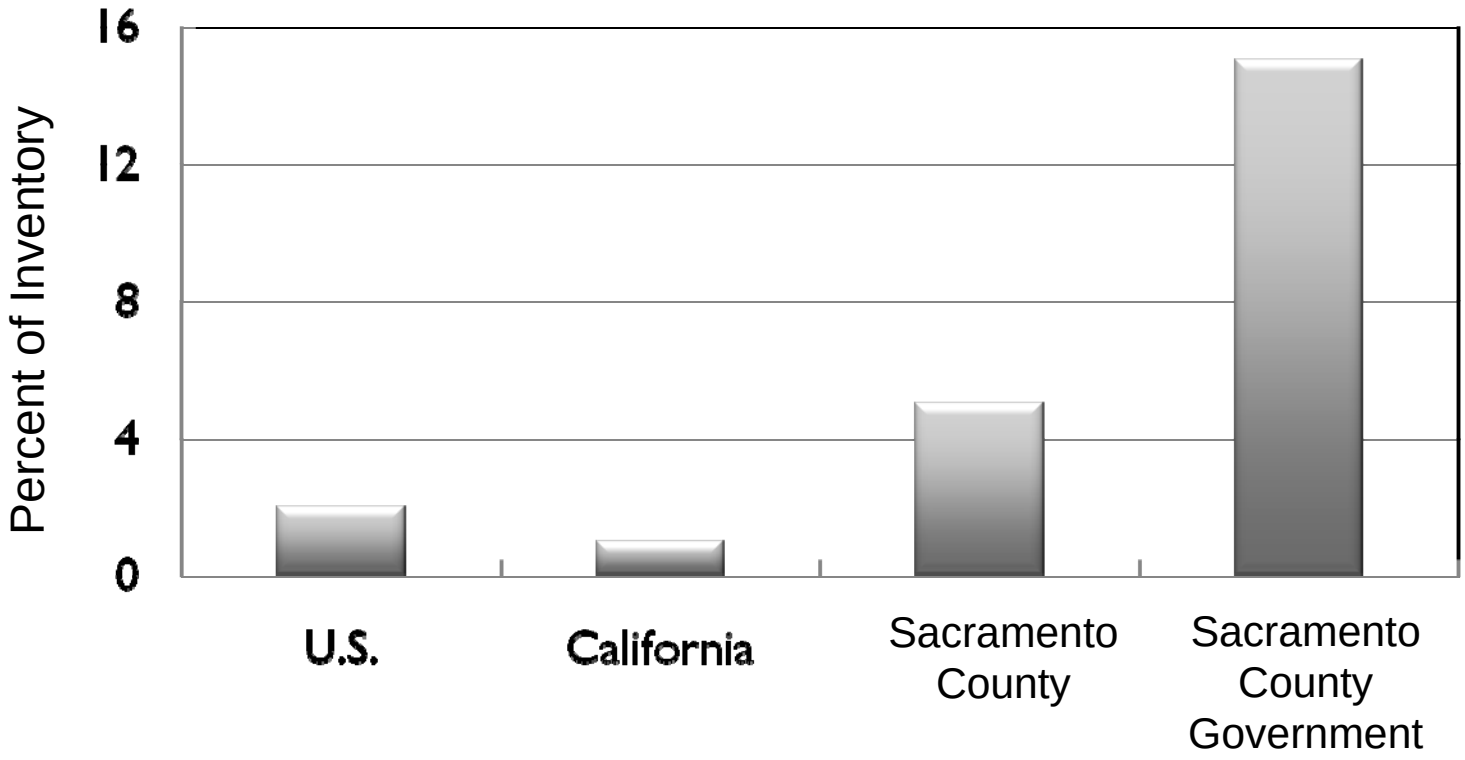
California Regulatory Context

Los Angeles – Mitigation analysis

Community vs. Government Emissions in Sacramento County



Waste emissions in context

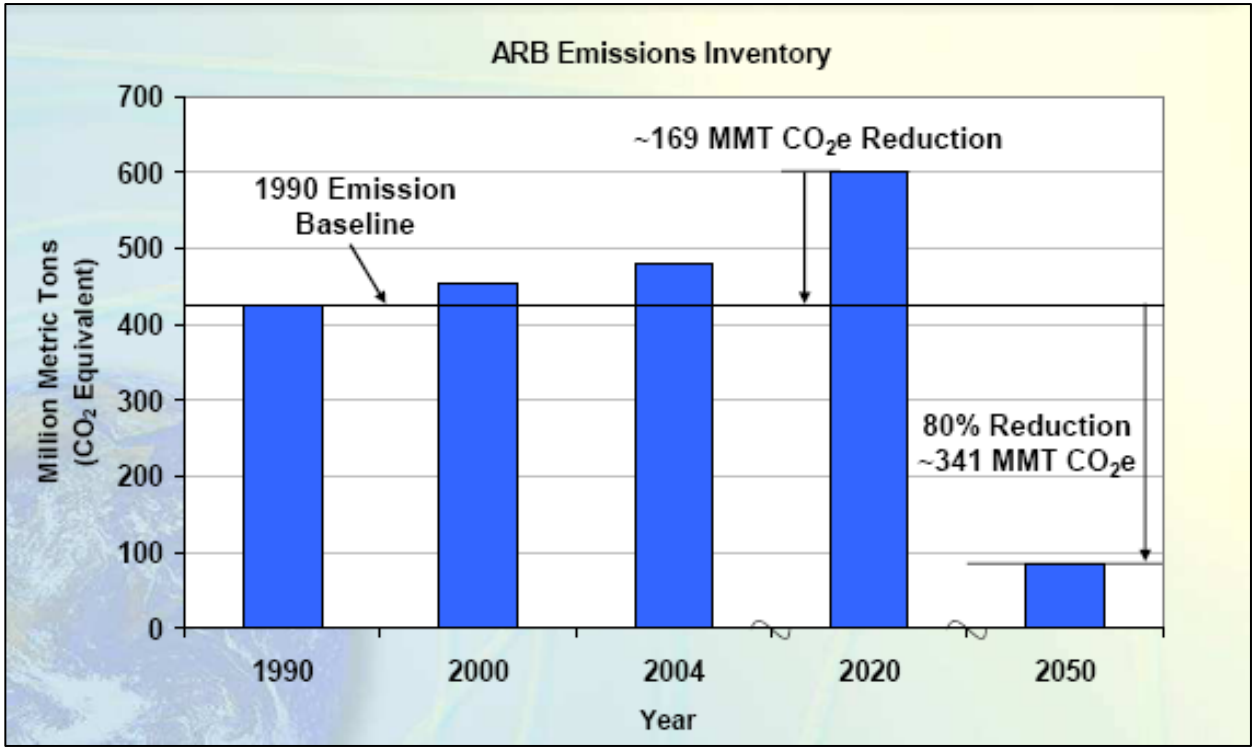


California Assembly Bill 32 CARB Scoping Plan

"Magnitude of the Challenge"/

Scoping Plan Goal:

- Reduce GHGs to1990 levels by 2020



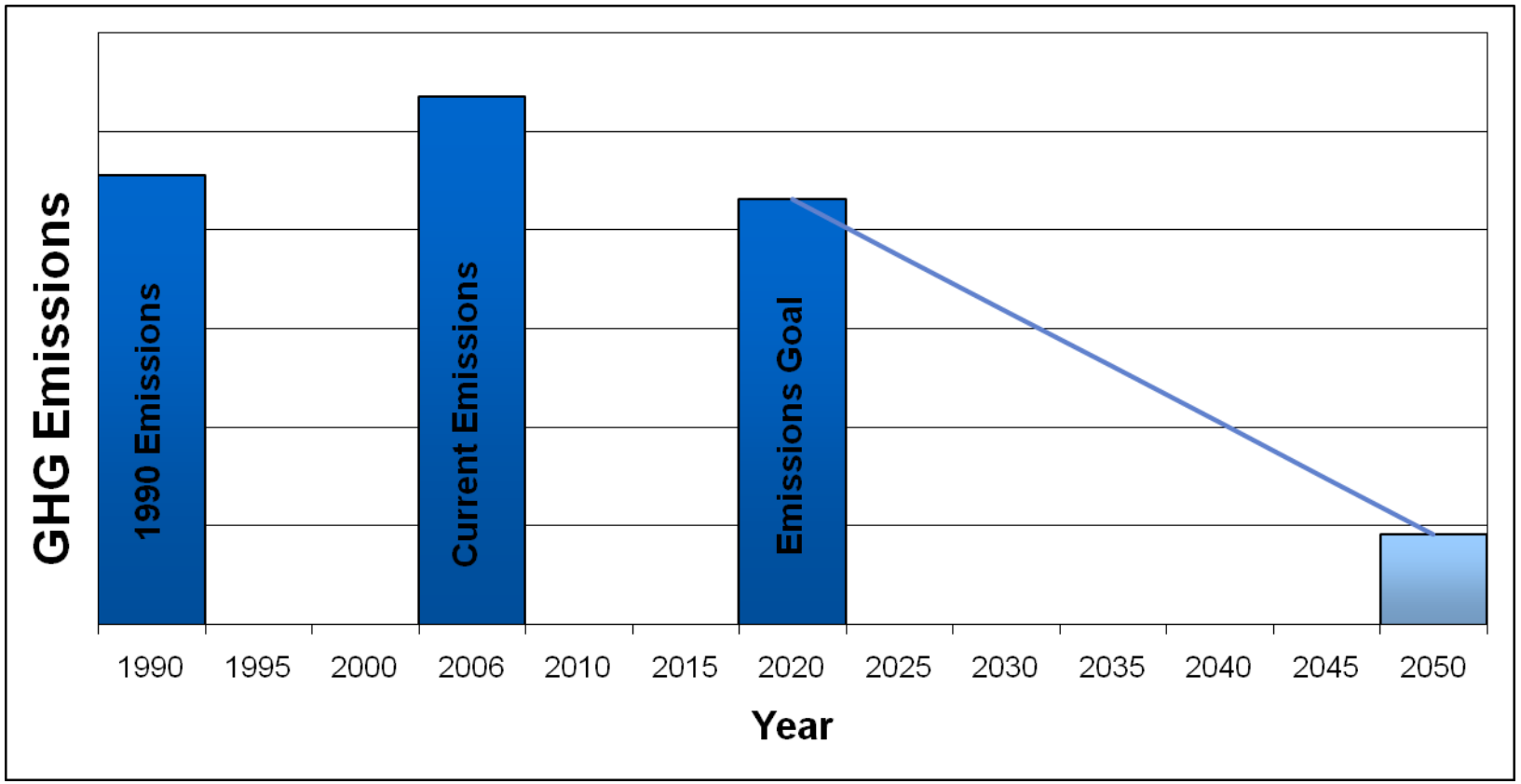
CARB, January 2009

State-wide goals for local governments

"… ARB encourages local governments to adopt a reduction goal for municipal operations emissions and move toward establishing similar goals for community emissions that parallel the State commitment to reduce greenhouse gas emissions by approximately 15 percent from current levels by 2020."

-CARB Scoping Plan

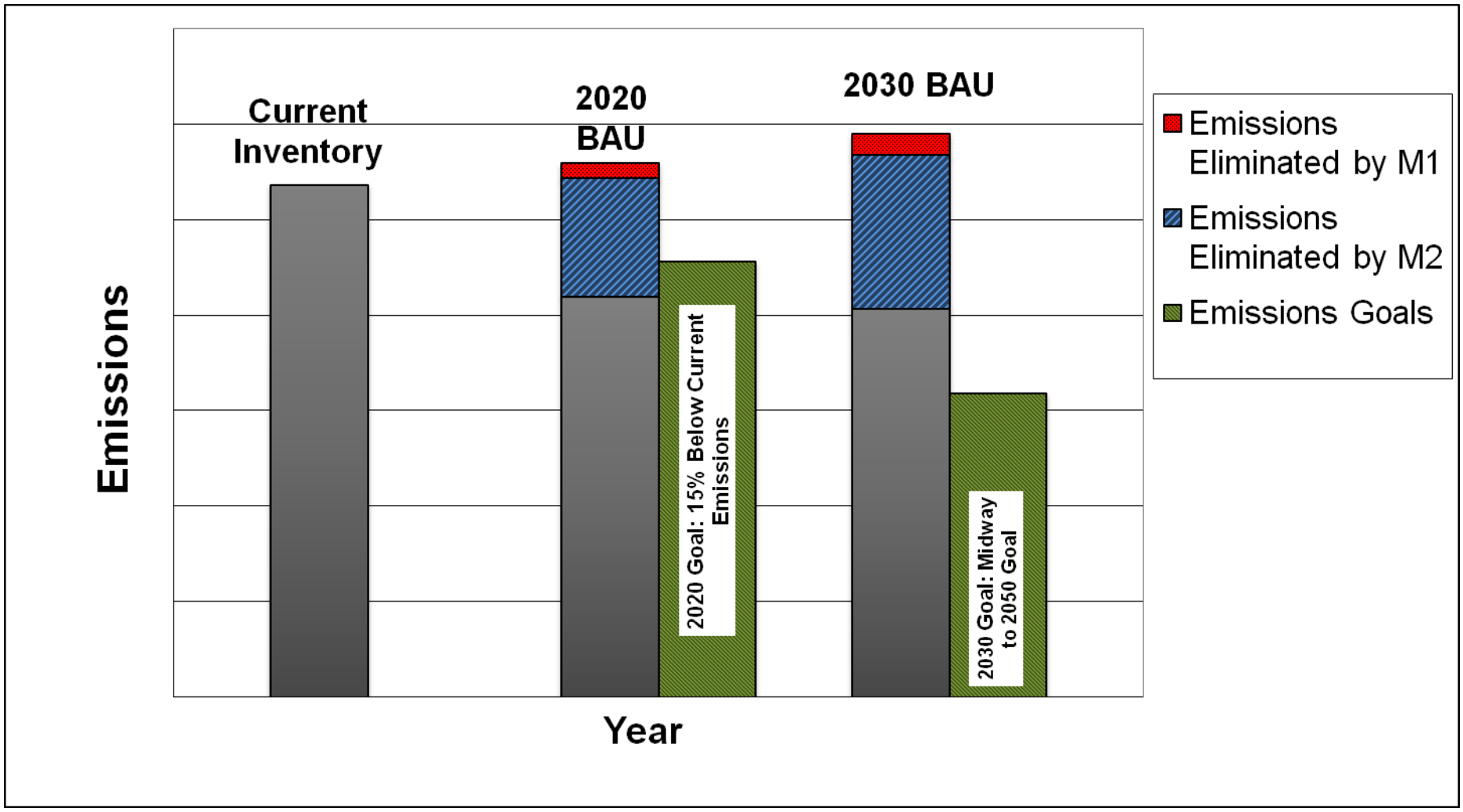
Emission reduction goal setting



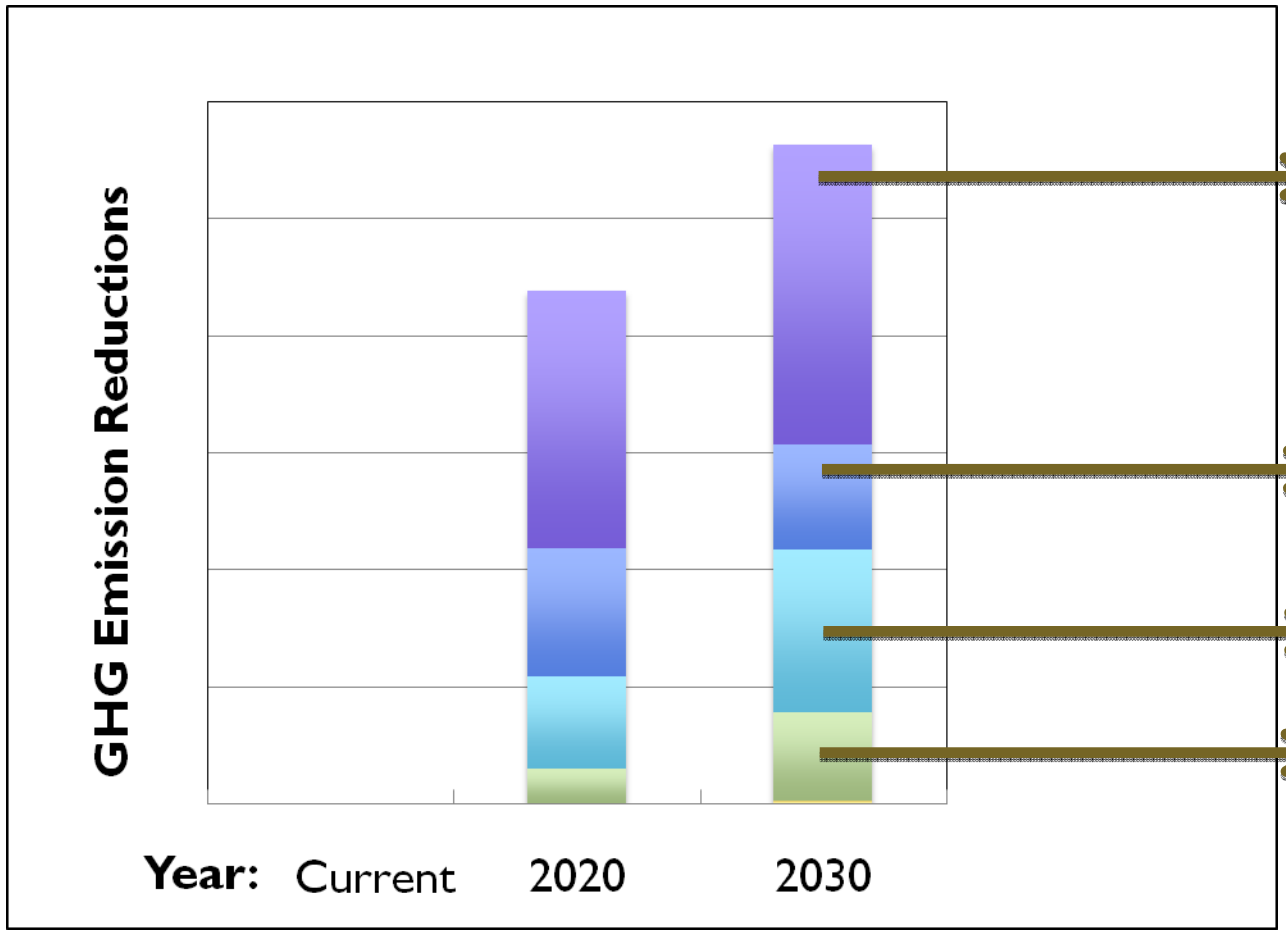
Reduction opportunities

- Quantified Measures
  - M0: Federal
  - M1: State/Regional
  - **M2: Local Government Action**
- Measures not quantified
  - M3: All other mitigation considered
    - Data not available
    - Third-party authority
    - No protocol for quantitative accounting

Theoretical reduction opportunities



Theoretical waste-related mitigation opps



M2: Diversion program (recycling, composting, etc.)

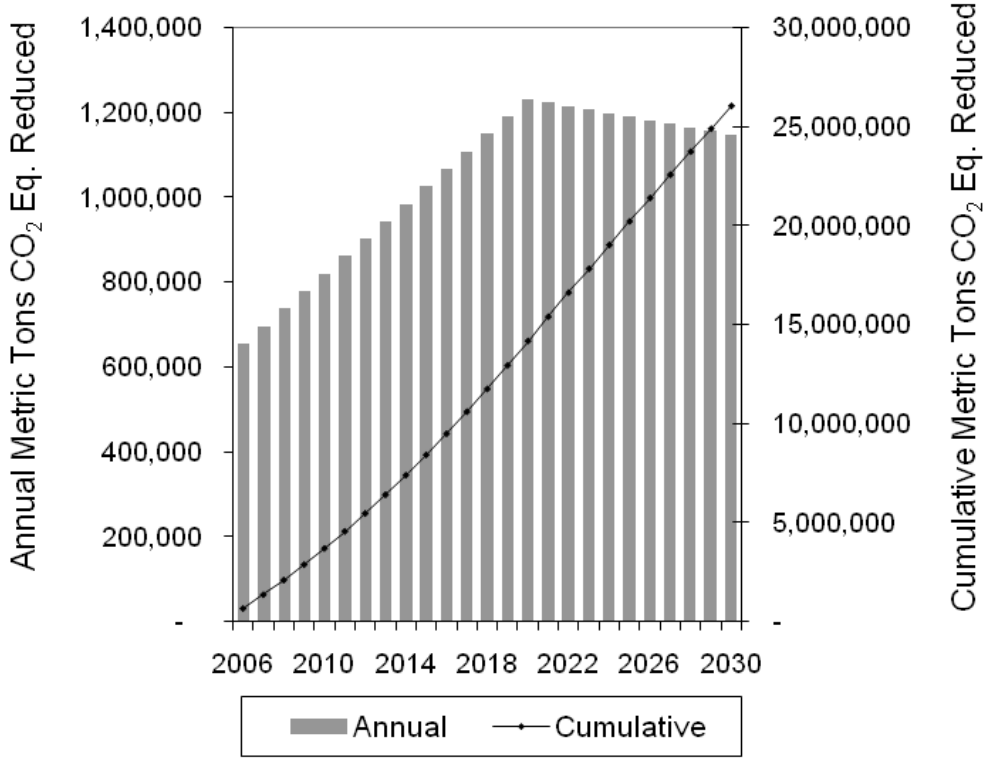
M2: Methane capture at landfill (exempt from proposed State req.)

M2: Landfill gas to energy

M1: ARB proposed regulation

City of Los Angeles waste reduction analysis

GOAL: Analyze GHG *lifecycle* reductions from increase in waste diversion goal from 62% to 70%



EPA WARM results

Lessons learned

- Waste emissions, as estimated for inventories, don't tell the full story
- With decreasing geography and increasing population, the more important "exported" waste becomes
- Emission estimation methods must be flexible, transparent, and provide a basis for tracking progress, particularly when including indirect emissions from waste
- Full benefit of waste reduction measures requires a life-cycle perspective, BUT life-cycle analysis makes accounting "messy"
- When viewed from a life-cycle perspective, GHG reductions through alternative waste management offer significant reductions
- Waste mitigation efforts may contribute to a local government's achievement of AB 32 (or other regulatory) reduction goals

Next steps

- Pilot test the regional inventory methods
- Refine per capita waste generation estimates: national per capita assumption will not support tracking against future waste reduction measures
- Resolve “rules” for waste-related reductions under AB 32
  - Indirect emission reductions (waste reduction efforts that reduce per capita generation and presumably GHG emissions at waste disposal sites elsewhere)
  - Life-cycle GHG benefits, including avoided upstream energy-related CO_2 emissions and carbon sequestration benefits of recycling, etc.
- Expand existing tools to address costs and feasibility of alternative waste management practices for local governments

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Appendix: WAste Reduction Model (WARM)

- Effort to expand the portfolio of reasons for alternative waste management practices (1993-present)
- Streamlined, peer-reviewed life-cycle approach
- Purpose:
  - **Understand** the link between waste management practices and climate change
  - **Incorporate** GHG impacts into decision-making processes
  - **Communicate** GHG emission reductions to the public
  - **Improve** materials management through incorporation into climate action plans at the municipal and state level