Mitigating Climate Change Through Sustainable Materials Management

A&WMA's 111th Annual Conference & Exhibition
Hartford, Connecticut
June 25-28, 2018

Andy Bray, Northeast Waste Management Officials' Association (NEWMOA)

Minal Mistry, Oregon Department of Environmental Quality (OR DEQ)

Submittal Number #411135

Panel Description

Each stage of a product's life cycle - from raw materials extraction to manufacturing, transportation, use, and "end-of-life" management - consumes energy and result in greenhouse gas (GHG) emissions. Many states and local governments have policies that focus on end-of-life, through expanding recycling and waste diversion; however, significant reductions in GHG emissions through sustainable materials management (SMM) are best achieved by focusing on production and consumption. A better shared understanding of the "embodied energy" and associated GHG impacts of categories of products and commodities is needed to inform policies and practices and enable more effective action by state and local governments, as well as businesses and individuals. The panel will review the body of work on climate change mitigation through SMM with emphases on efforts to quantify upstream impacts, policy initiatives at the state and regional level, and specific programs focused on high-impact products and commodities.

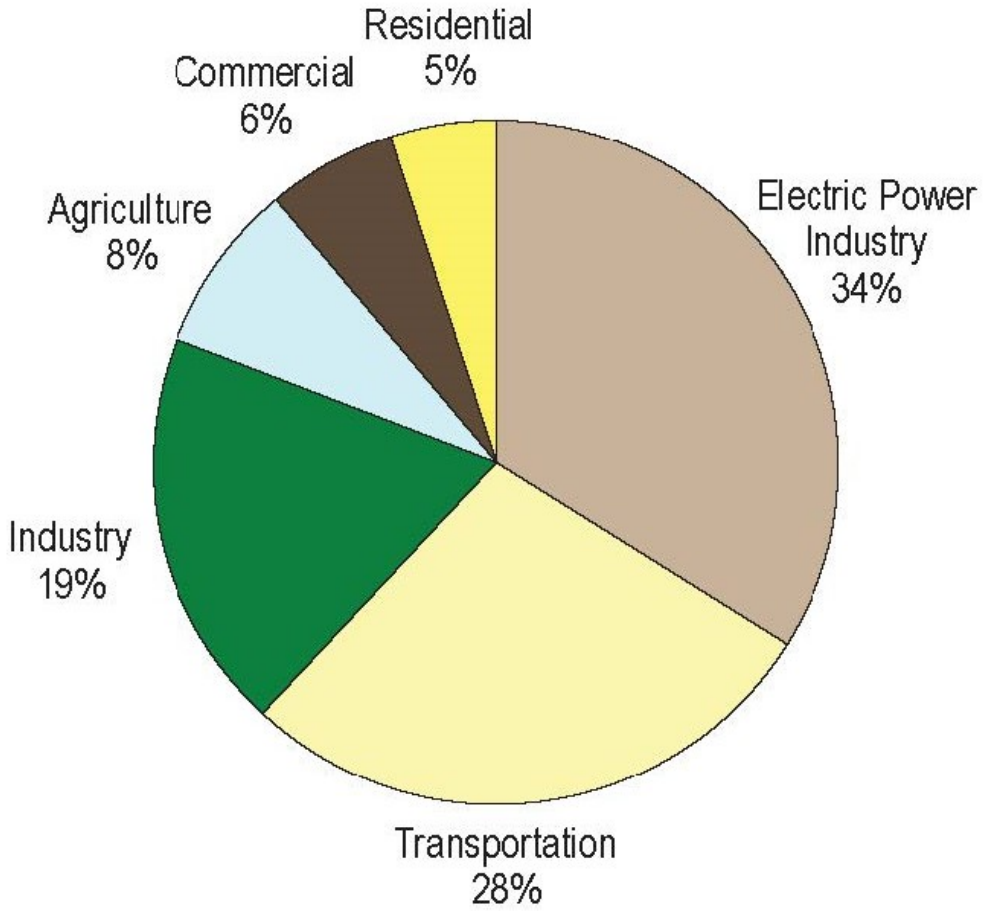
Mitigating Climate Change through Sustainable Materials Management

Andy Bray, NEWMOA

Overview

- Why materials aren't getting enough attention in climate mitigation discussions
  - How are we defining what we measure?
    - Measuring only within local boundaries
    - Focused on the end-of-life, not the full life-cycle
- What we learn when we look through a consumption-based lens
  - Moving from waste management to sustainable materials management
  - Shifting our focus upstream

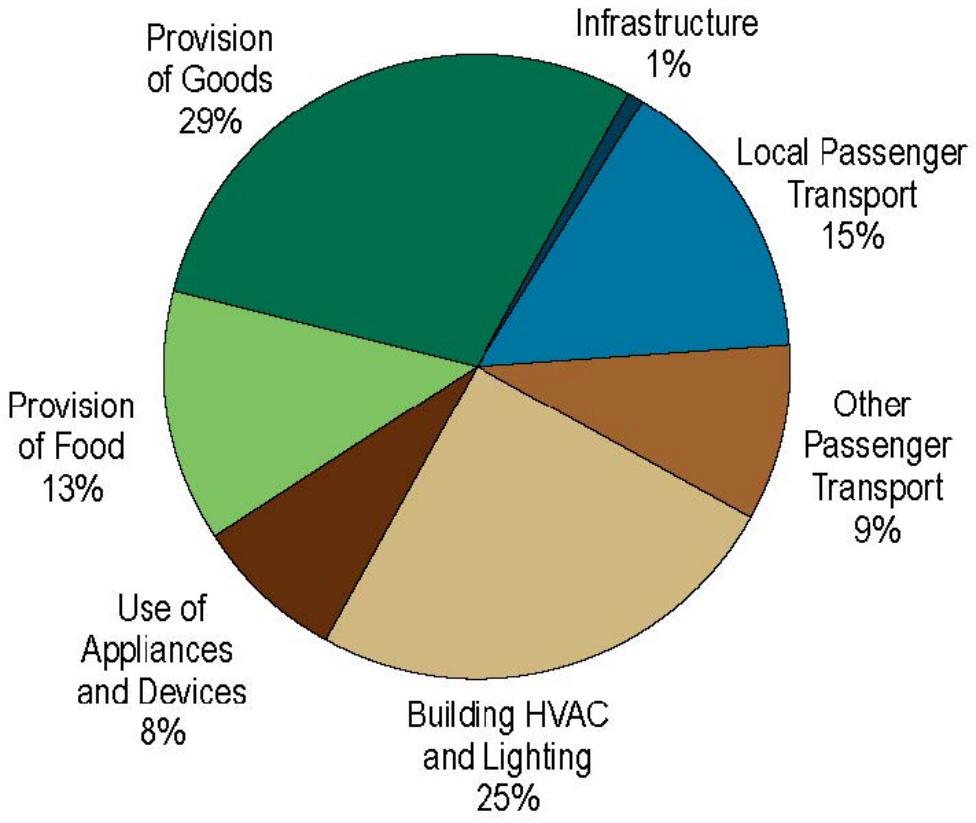
Sector-Based GHG Emission



- Emissions by sector, including electricity, transportation, industry
- Considers the source of emissions
- Only includes emissions from in-boundary sources

Source: “Opportunities to Reduce Greenhouse Gas Emissions through Materials and Land Management Practices”, EPA 2009

System-Based GHG Emission



- Rather than categorizing emissions according to the sector where they are emitted, emissions are categorized according to the need driving those emissions
- Provision of goods and food = 42% of emission

Source: “Opportunities to Reduce Greenhouse Gas Emissions through Materials and Land Management Practices”, EPA 2009

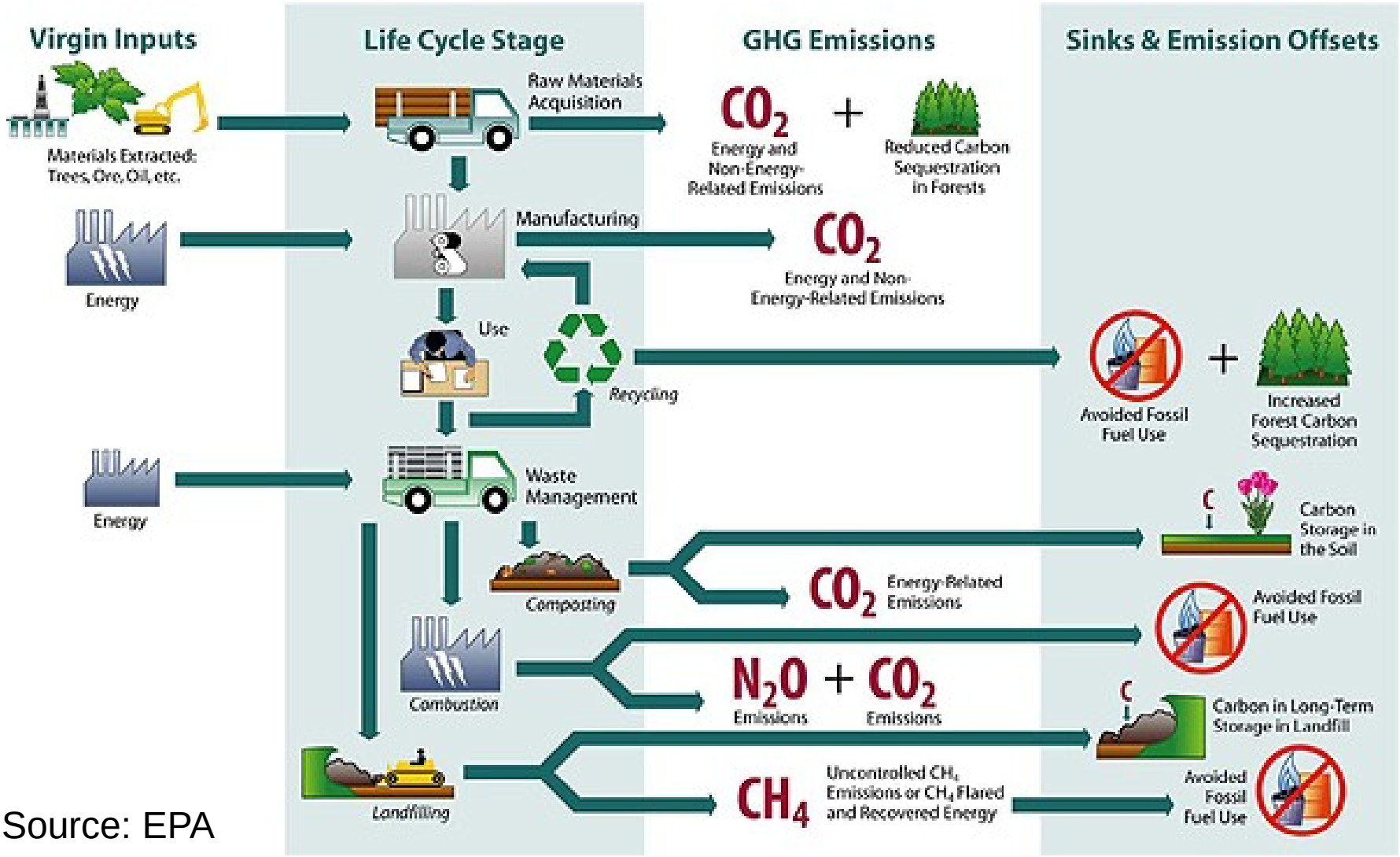
Why Are These Differences Important?

- By considering the practices that contribute to the emissions, not the physical emissions source, we can see where changes in practices upstream have the most potential to reduce emissions downstream
- With systems-based emissions analyses (and consumption-based inventories) we are concerned with the full life-cycle impacts of materials, not just waste management

Are Current GHG Emissions Reduction Efforts Wrongheaded?

- Not at all!
  - Strategies to reduce emissions from in-boundary sources such as power generation and transportation are achieving results towards states' goals
- We can do more!
  - If we know consumption-based emissions are part of global GHG impacts, and those impacts are growing, aren't we compelled to act to mitigate those impacts?

Life-Cycle of Materials



Source: EPA

Strategies to Reduce Life-Cycle Impacts

- Reducing the amount of materials used to make products or perform services
- Influencing product design, use, and reuse capabilities to:
  - minimize raw material inputs
  - extend product life spans
  - maximize the ease and frequency of subsequent product disassembly, recycling, and/or transformation for further use
- Using purchasing power to drive market

Policy Tools

- Enabling legislation to expand authority beyond waste management
- Moving beyond recovery to source reduction goals
- Focusing on materials with high embodied energy and/or GHG reduction potential
- Increasing the emphasis on “reduce” and “reuse”
- Researching full life-cycle approaches

Embodied Energy

*"**Embodied energy** is the sum of all the energy required to produce any goods or services, considered as if that energy was incorporated or 'embodied' in the product itself."*

Research

REMADE Institute

In partnership with industry, academia and national labs, the REMADE Institute will enable early stage applied research and development of technologies that could dramatically reduce the embodied energy and carbon emissions associated with industrial-scale materials production and processing.

www.remadeinstitute.org

REMADE Goals

- Develop technologies capable of reducing energy emissions through a reduction in primary material consumption and an increase in secondary feedstock use in energy-intensive industries
- Develop technologies capable of achieving feedstock “better than cost and energy parity” for key secondary materials
- Promote widespread application of new enabling technologies across multiple industries

Contact

Andy Bray

617.367.8558 ext. 306

abray@newmoa.org

mitigating climate change through sustainable materials management

using a wide angle lens for a whole systems perspective

The Air and Waste Management Association
28 June 2018

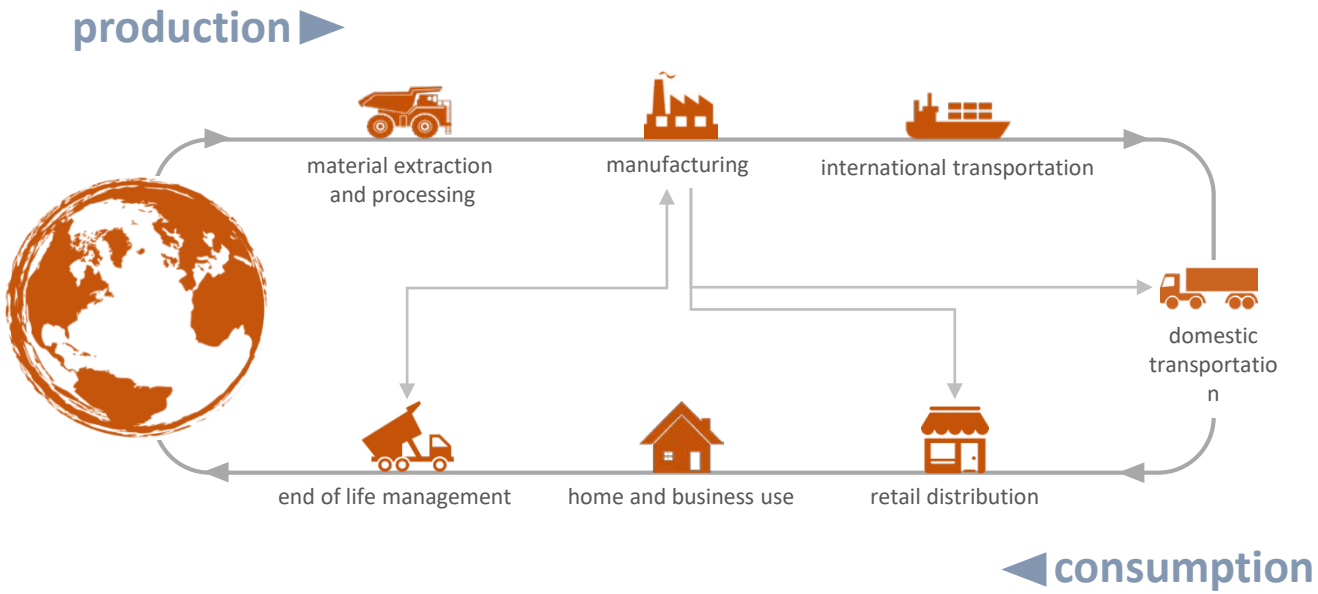
Minal Mistry | Oregon Department of Environmental Quality

Oregon's vision for materials management

By 2050 Oregonians produce and use materials responsibly

- **conserving resources**
- **protecting the environment**
- **living well**

material life cycle

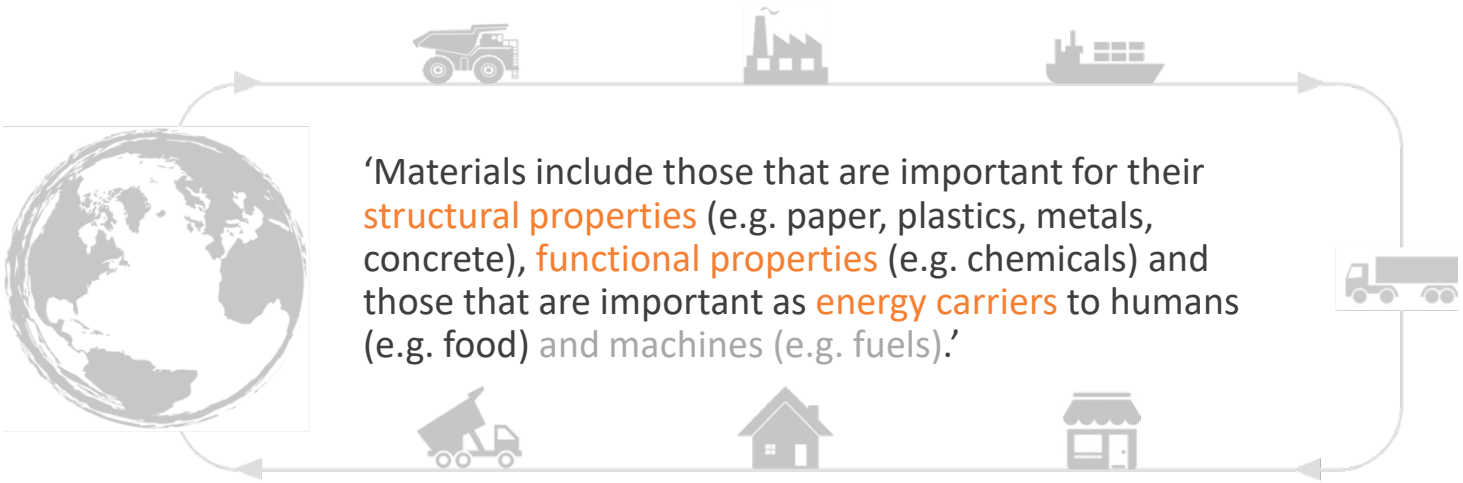


materials management

‘Materials management is an approach to serving human needs by using/reusing resources most productively and sustainably throughout their life cycles, generally minimizing the amount of materials involved and all the associated environmental impacts.’

Source: U.S. EPA

materials writ large



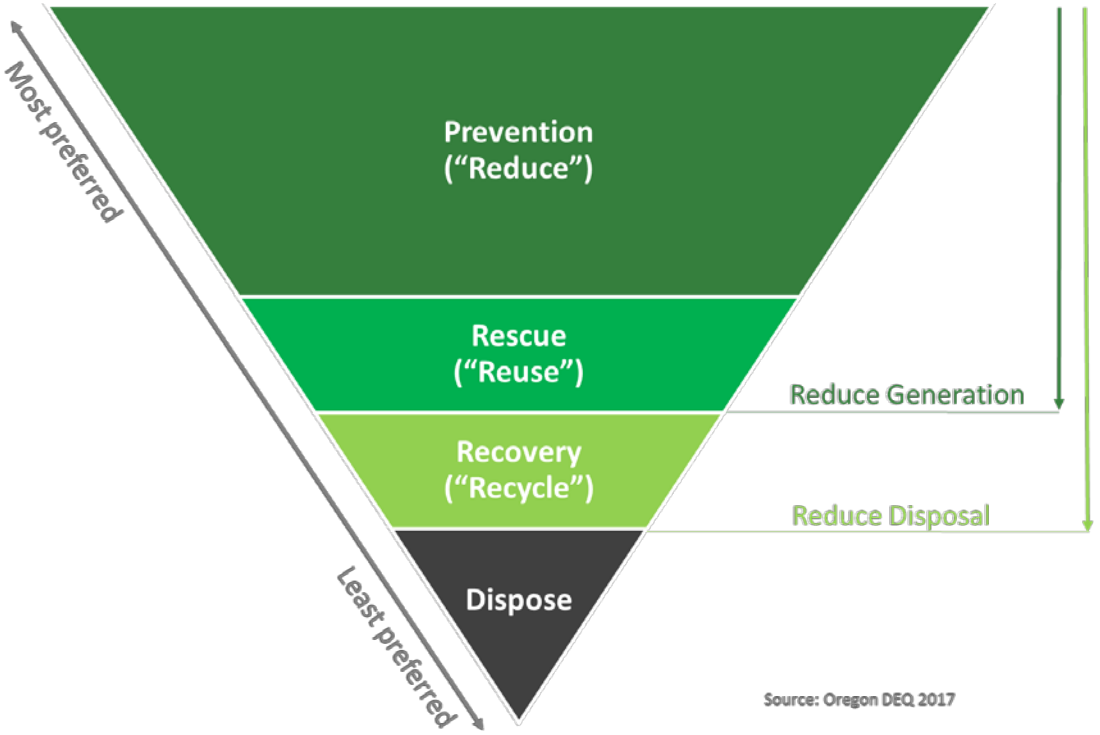
‘Materials include those that are important for their structural properties (e.g. paper, plastics, metals, concrete), functional properties (e.g. chemicals) and those that are important as energy carriers to humans (e.g. food) and machines (e.g. fuels).’

Source: modified from UNEP

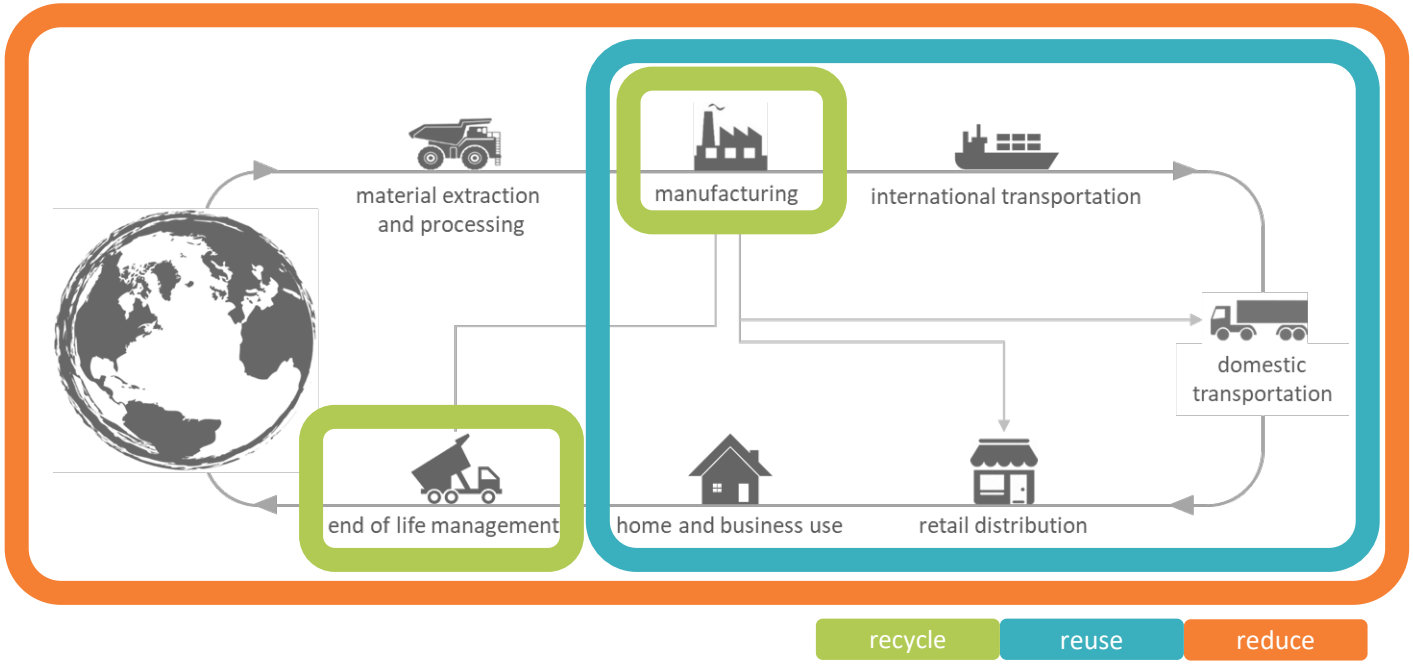
material wastes

seeing more than solid waste

traditional waste hierarchy



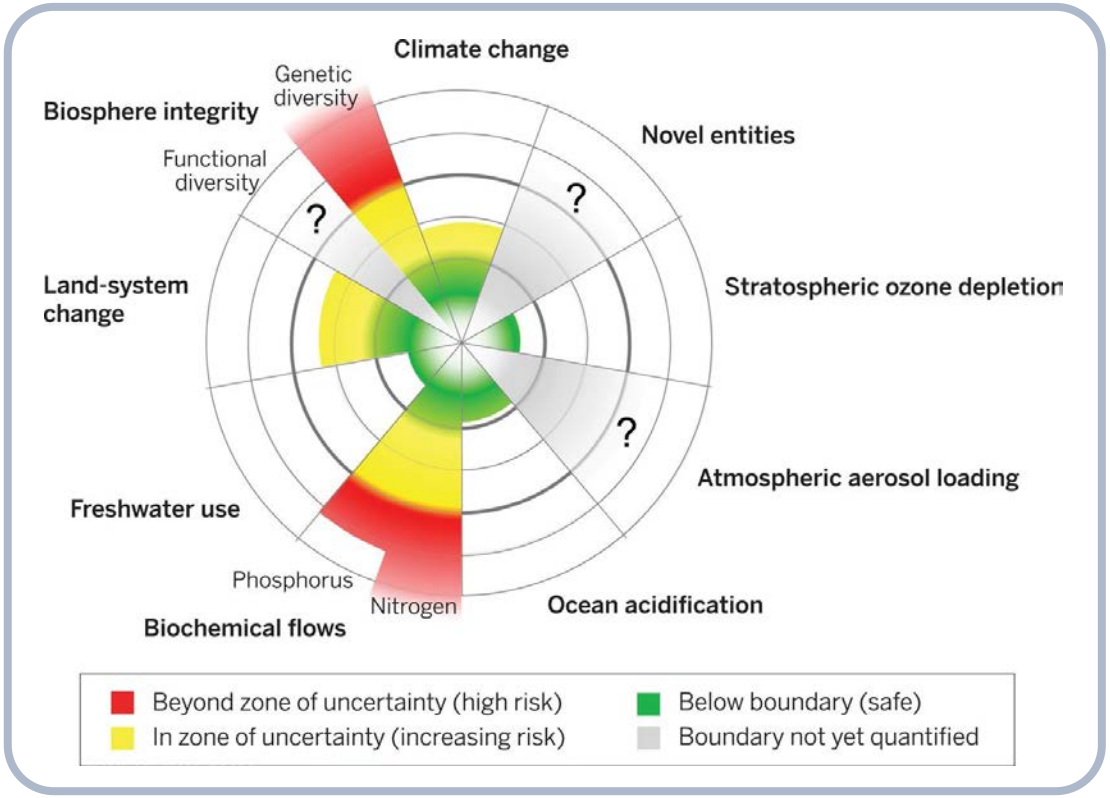
product life cycle and the waste hierarchy



a global problem

consumption-based greenhouse gas emissions

planetary boundaries: “safe operating space” for humanity



Source: Steffen, W., et. al. 2015

local consumption, global production (and emissions)

Der Spiegel, The Global Toothbrush, 01/31/2006 http://www.spiegel.de/international/spiegel/0,1518,398229,00.html

common uses of community-scale GHG inventories

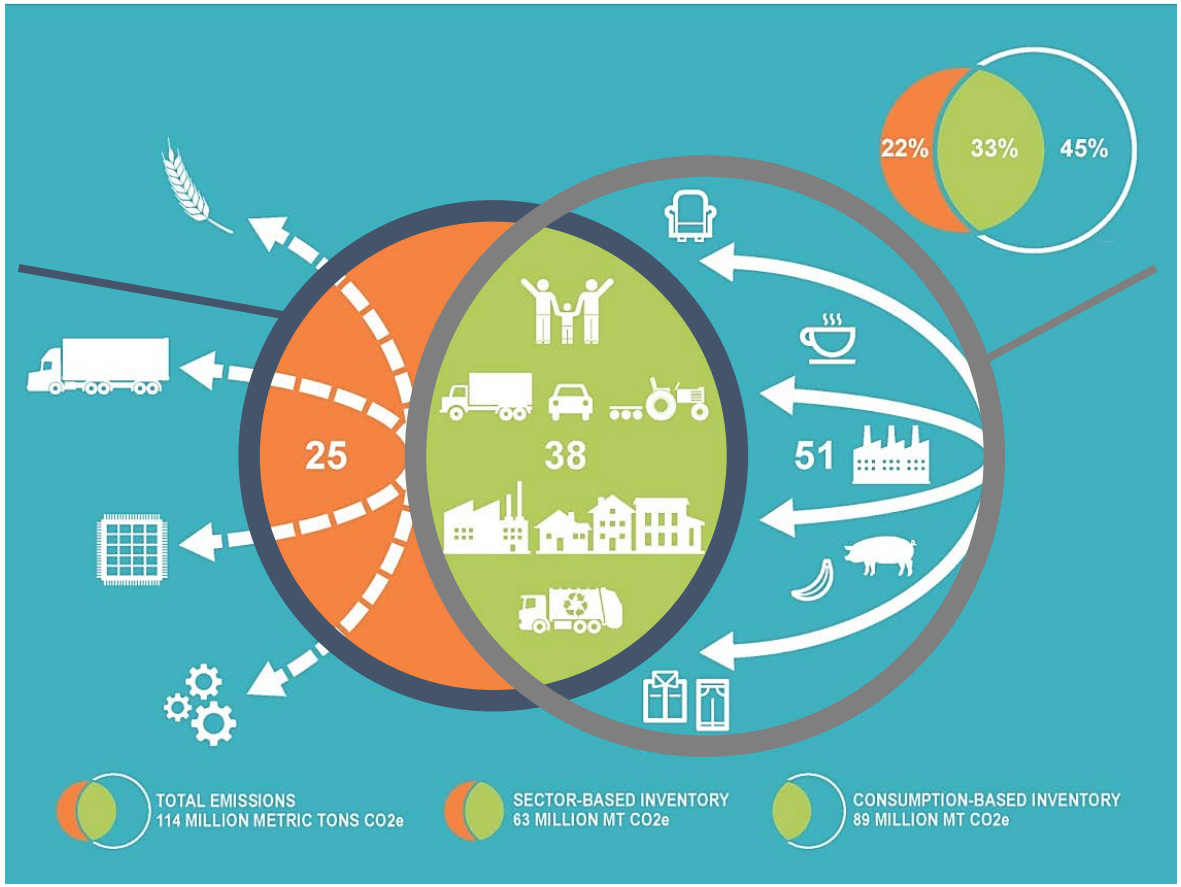
- Establish a baseline and measure progress towards climate change goals
- Identify sources of emissions and trends in those emissions that the community can influence, and inform efforts
  - Support climate related plans, projects, programs
  - Provide data and tools to community partners
  - Inform development of emissions reduction policy and targets
- Communicate all of the above to policy-makers and the public

limitations of traditional “in-boundary” inventories

- Provide an incomplete perspective of how communities contribute to emissions . . .
  - . . . and by extension, opportunities to reduce emissions.
  - Particularly acute for materials!
- Appear to penalize local production, reward outsourcing.
- May lead to sub-optimal decisions (e.g., discontinue recycling)
- Alone, may provide misleading signals of change over time

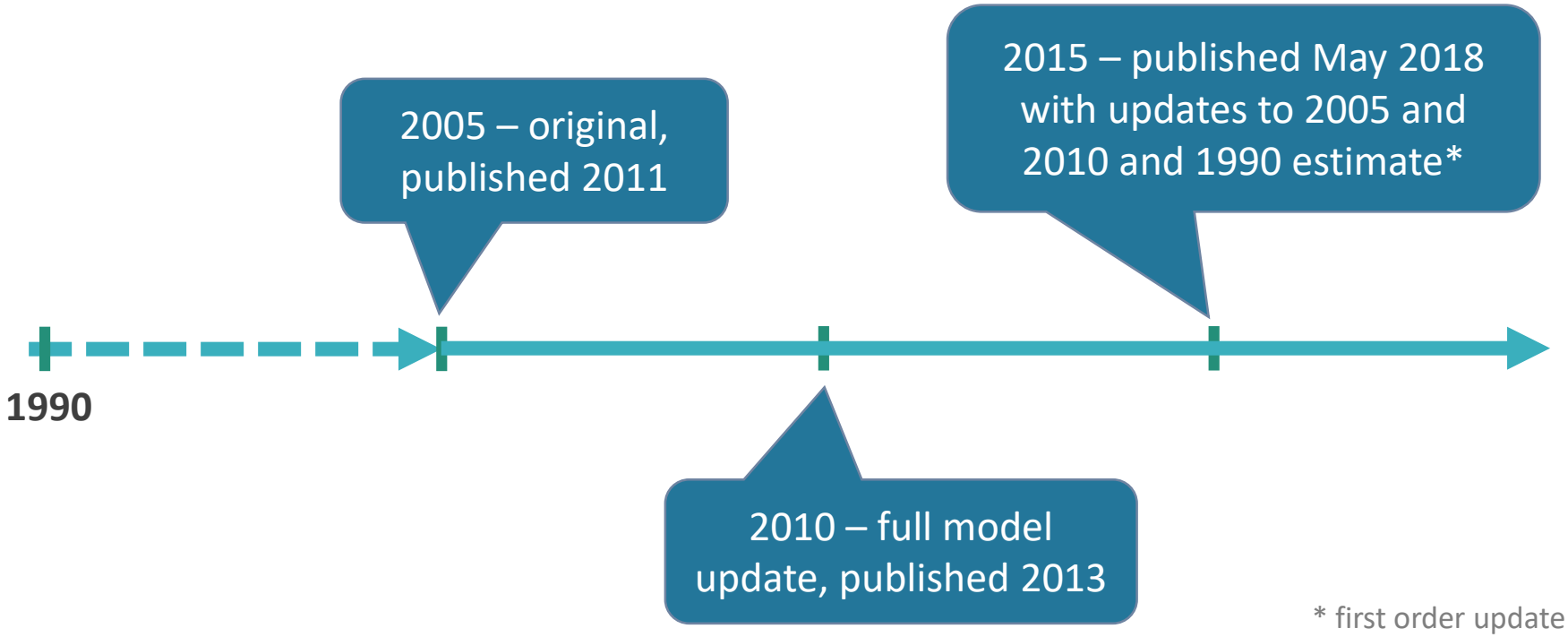
comparison of sector-based and consumption-based inventories

Oregon Economy (63 MMT CO2e)



Oregon Consumption (89 MMT CO2e)

timeline of Oregon consumption-based GHG inventories

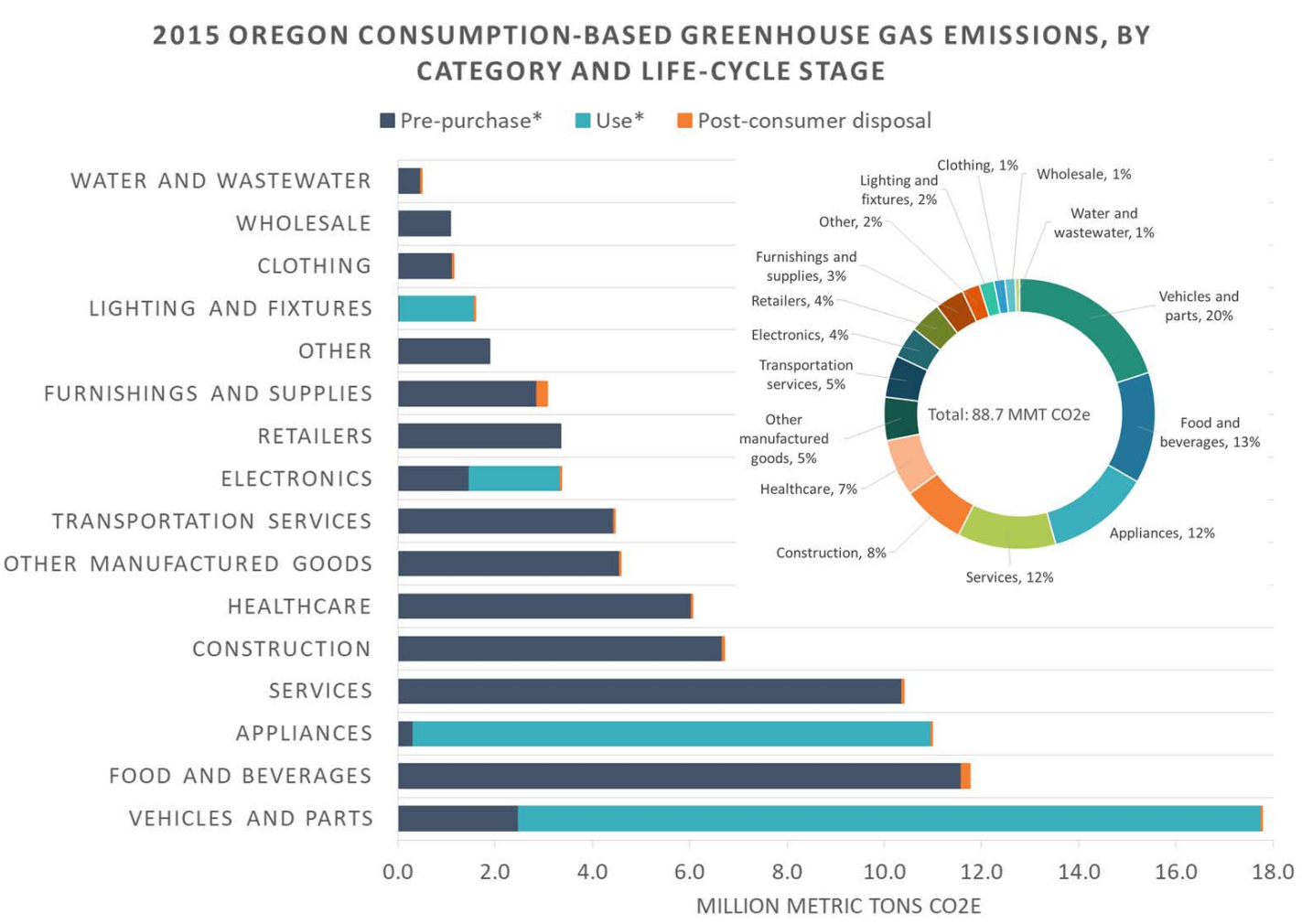


* first order update

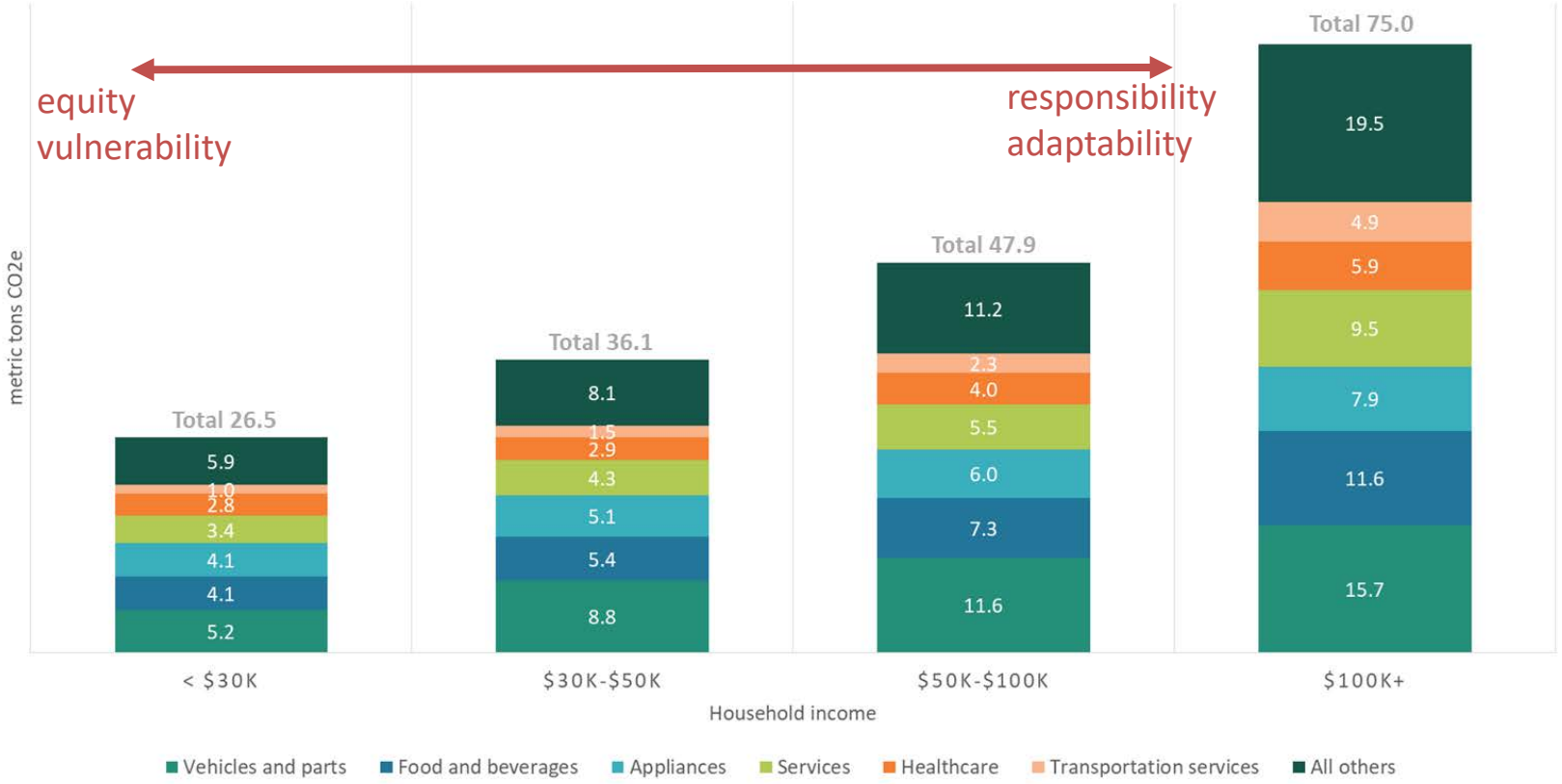
GHG emissions resulting from consumption

- A “root driver” of global emissions
- Typically defined in economic terms:
  - Purchases by “consumers” = households, government, business capital formation
- Emissions are life-cycle emissions and globally distributed
  - “Life cycle” = Supply chain/production + Use + Disposal
- Includes, but not limited to materials
  - Fuels, energy, materials, and services “consumed” by the community

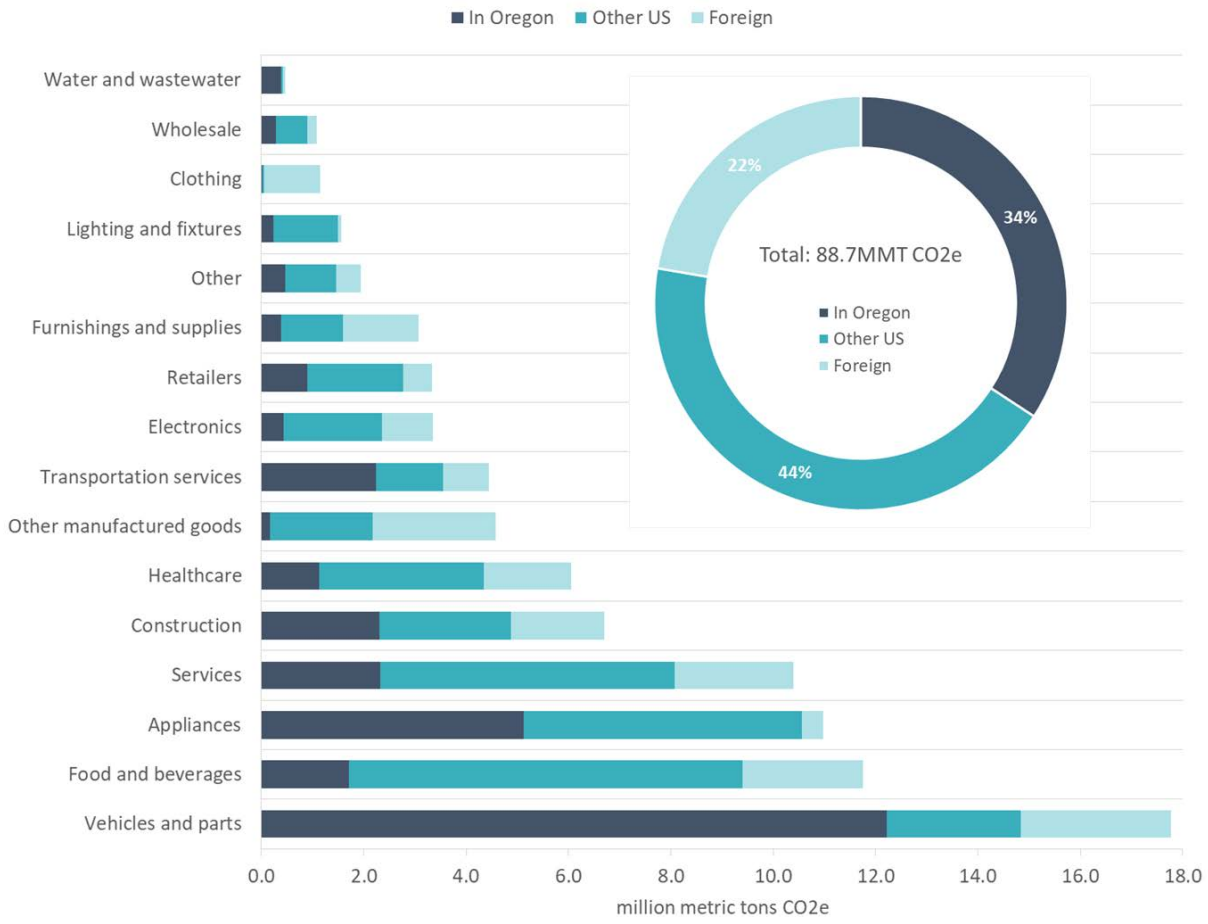
con·sump·tion [kənˈsəm(p)SH(ə)n]
the using up of a resource


2015 OREGON CONSUMPTION-BASED GREENHOUSE GAS EMISSIONS, BY CATEGORY AND LIFE-CYCLE STAGE
Pre-purchase*
Use*
Post-consumer disposal
WATER AND WASTEWATER
WHOLESALE
CLOTHING
LIGHTING AND FIXTURES
OTHER
FURNISHINGS AND SUPPLIES
RETAILERS
ELECTRONICS
TRANSPORTATION SERVICES
OTHER MANUFACTURED GOODS
HEALTHCARE
CONSTRUCTION
SERVICES
APPLIANCES
FOOD AND BEVERAGES
VEHICLES AND PARTS
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
MILLION METRIC TONS CO2E
Total: 88.7 MMT CO2e
Vehicles and parts, 20%
Food and beverages, 13%
Appliances, 12%
Services, 12%
Construction, 8%
Healthcare, 7%
Other manufactured goods, 5%
Transportation services, 5%
Electronics, 4%
Retailers, 4%
Furnishings and supplies, 3%
Other, 2%
Lighting and fixtures, 2%
Clothing, 1%
Wholesale, 1%
Water and wastewater, 1%

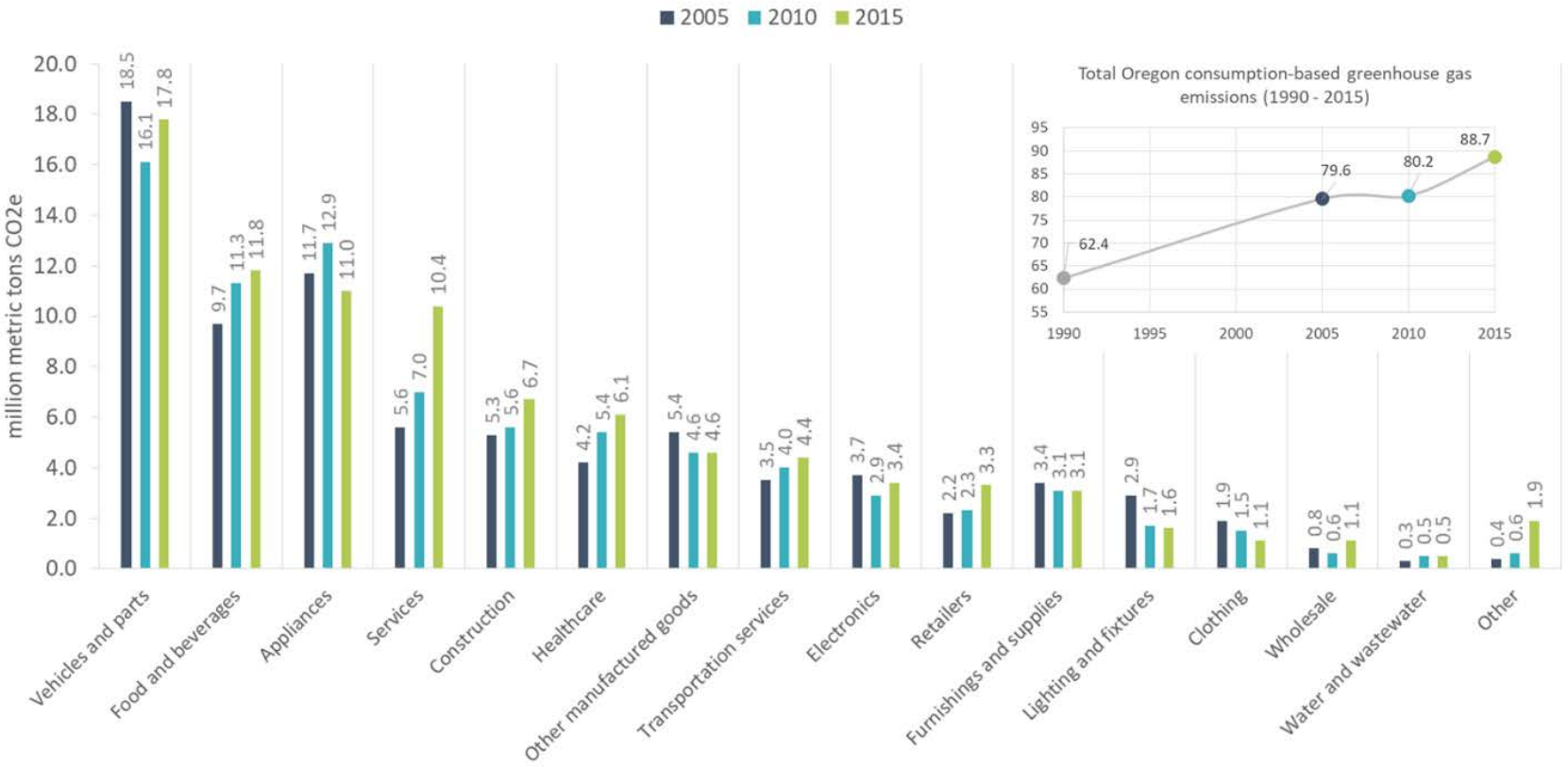
average per-household 2015 consumption-based GHG emissions, by income group



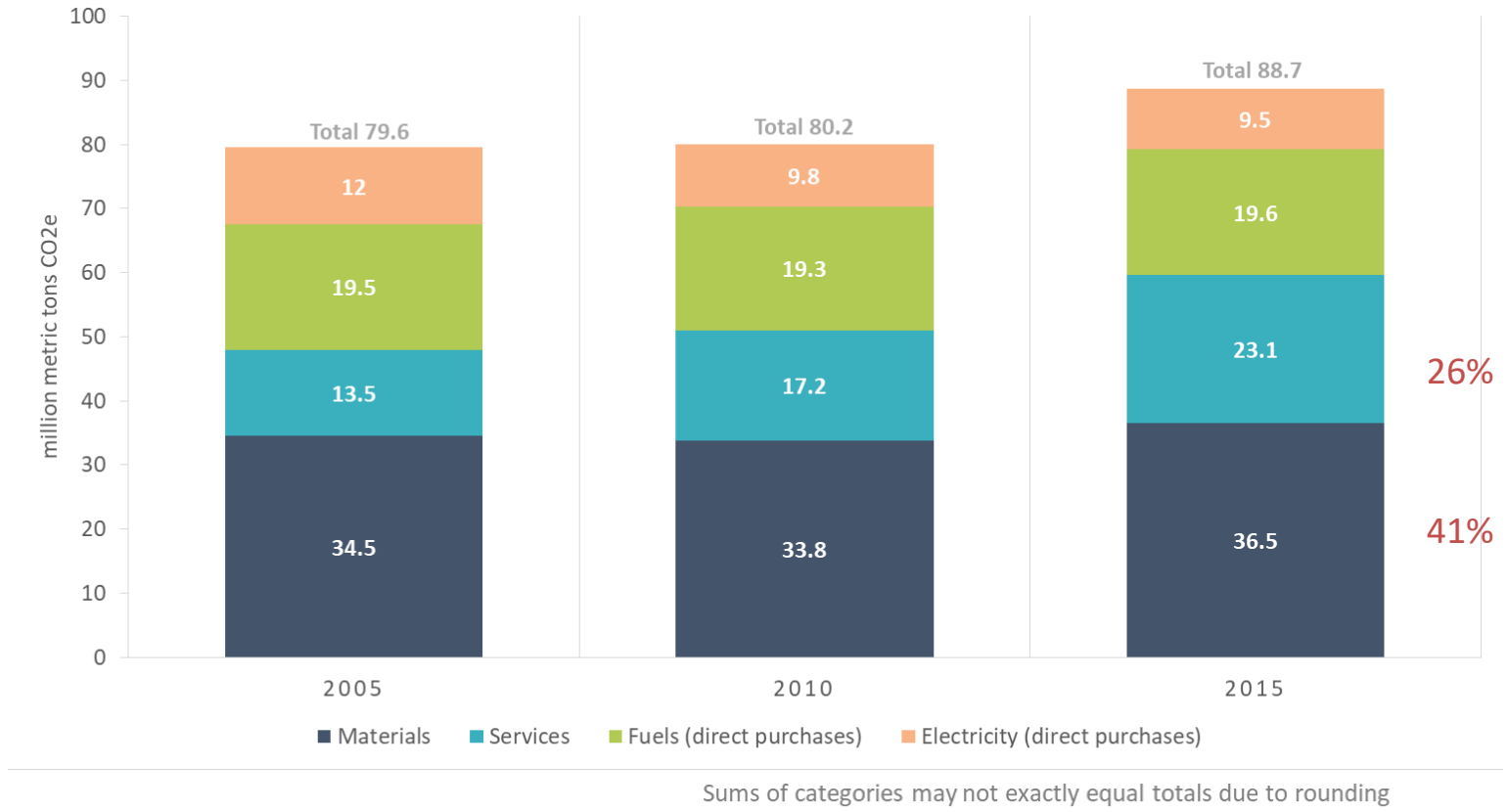
2015 Oregon consumption-based GHG emissions, by location of emission



2005-2015 Oregon consumption-based GHG emissions

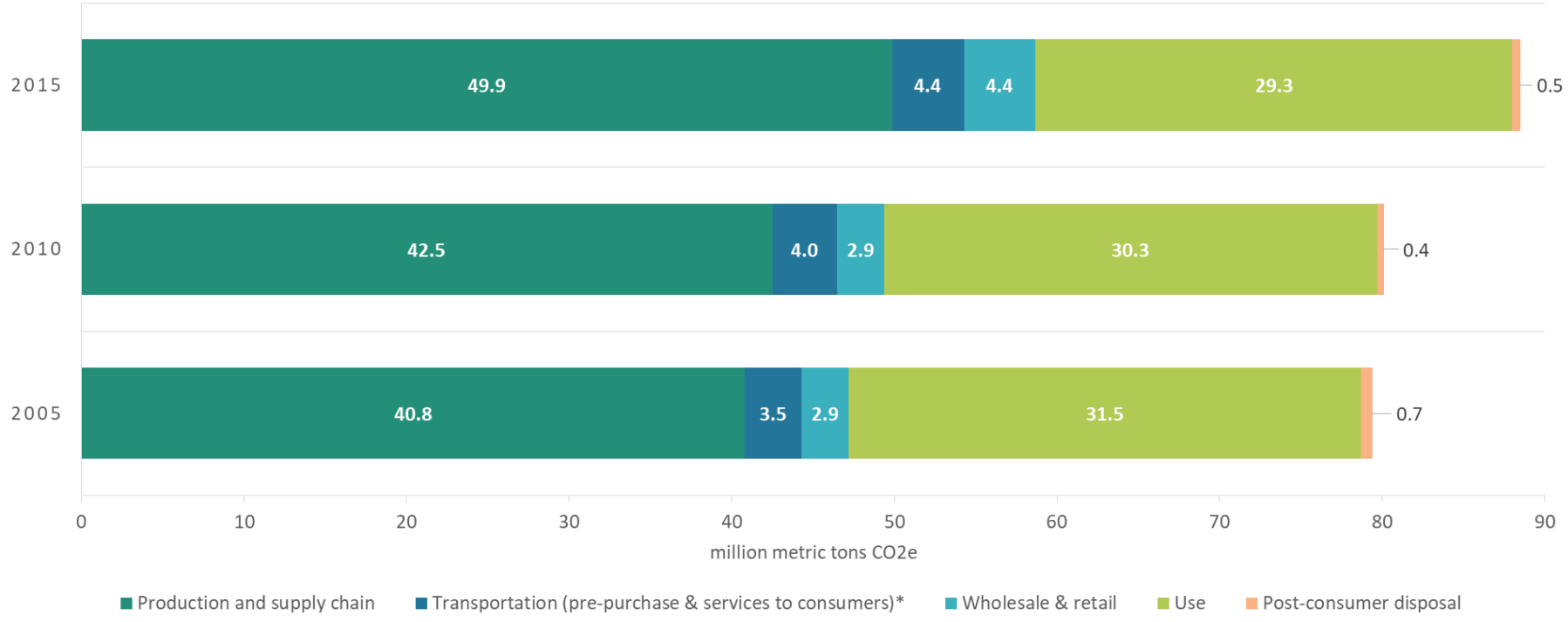


2005-2015 Oregon consumption-based GHG emissions, by meta-category

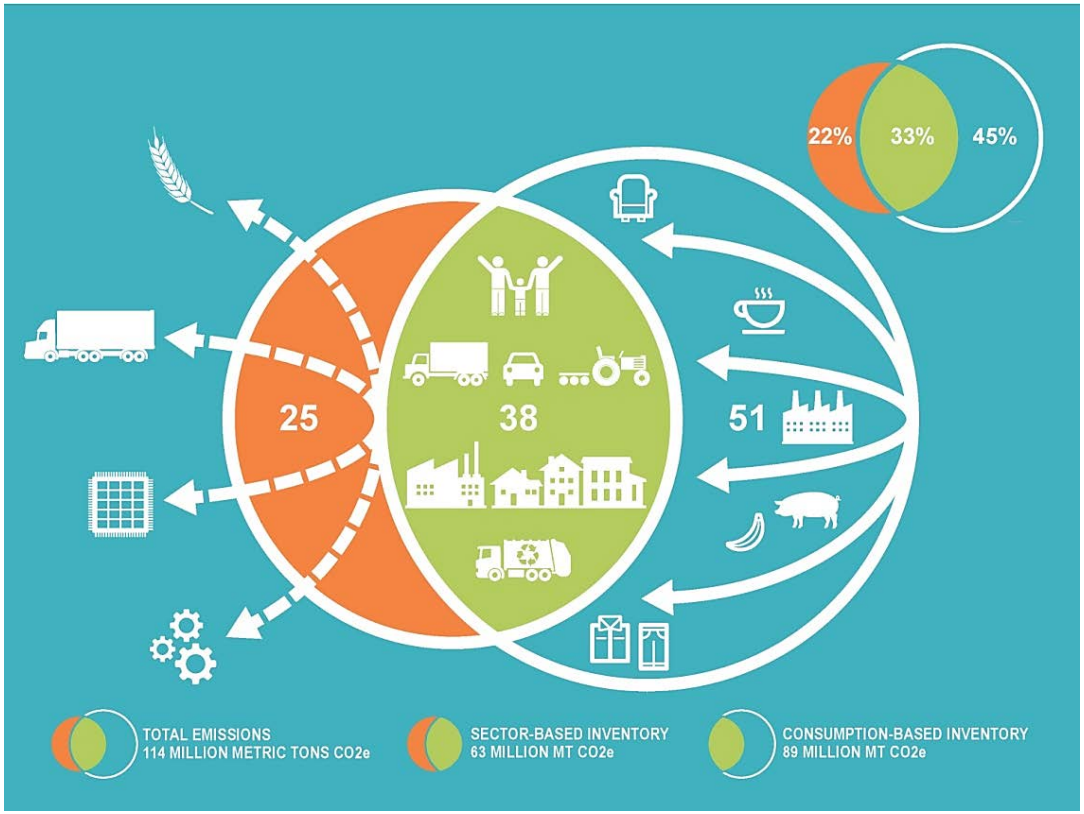


Sums of categories may not exactly equal totals due to rounding

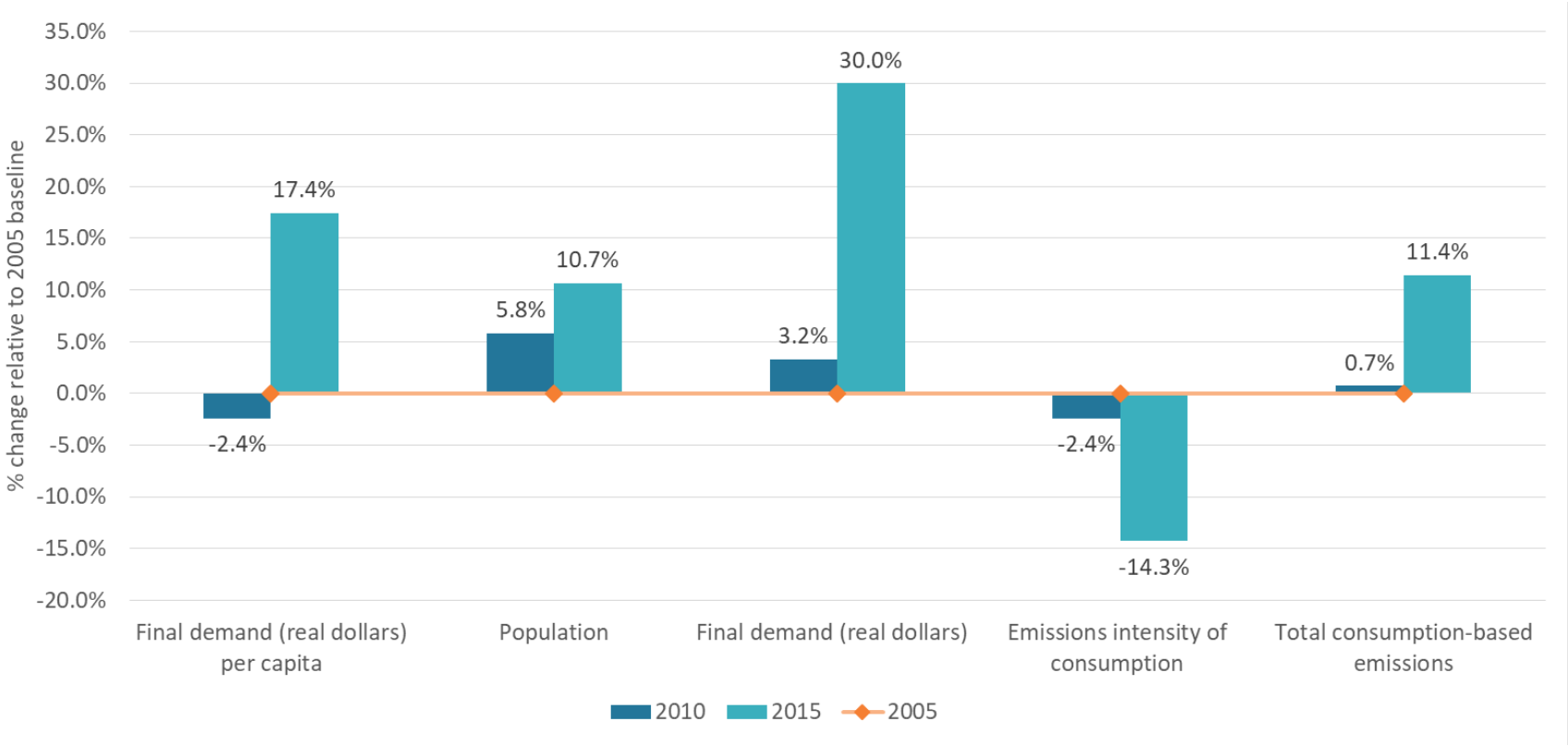
2005 – 2015 Oregon consumption-based GHG emissions, by meta-category



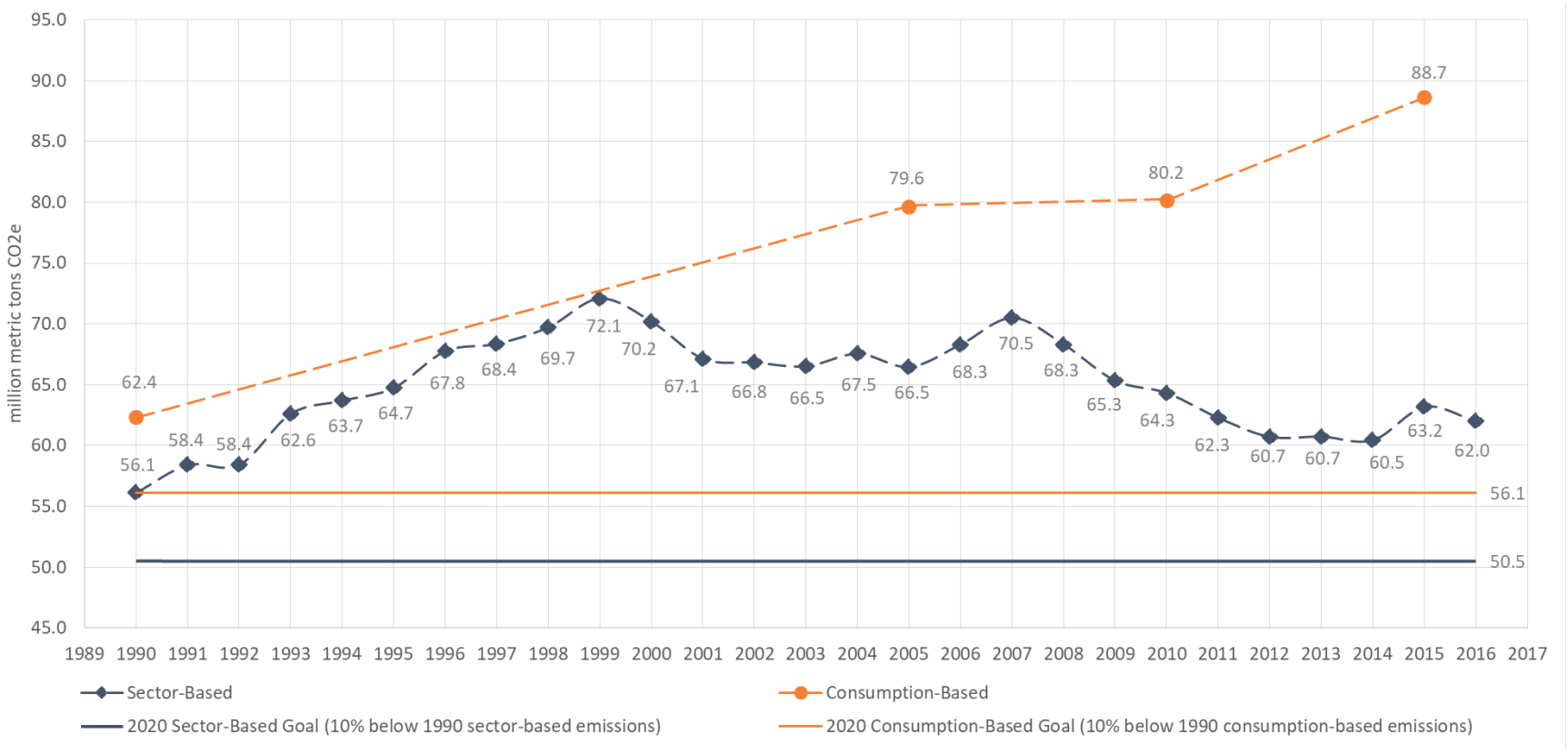
comparison of Oregon's 2015 sector-based and consumption-based GHG emissions



drivers of change in Oregon consumption-based GHG emissions, 2005-2015



Oregon sector-based and consumption-based GHG emissions, 1990-2016



re-cap of high-level findings (focusing on materials)

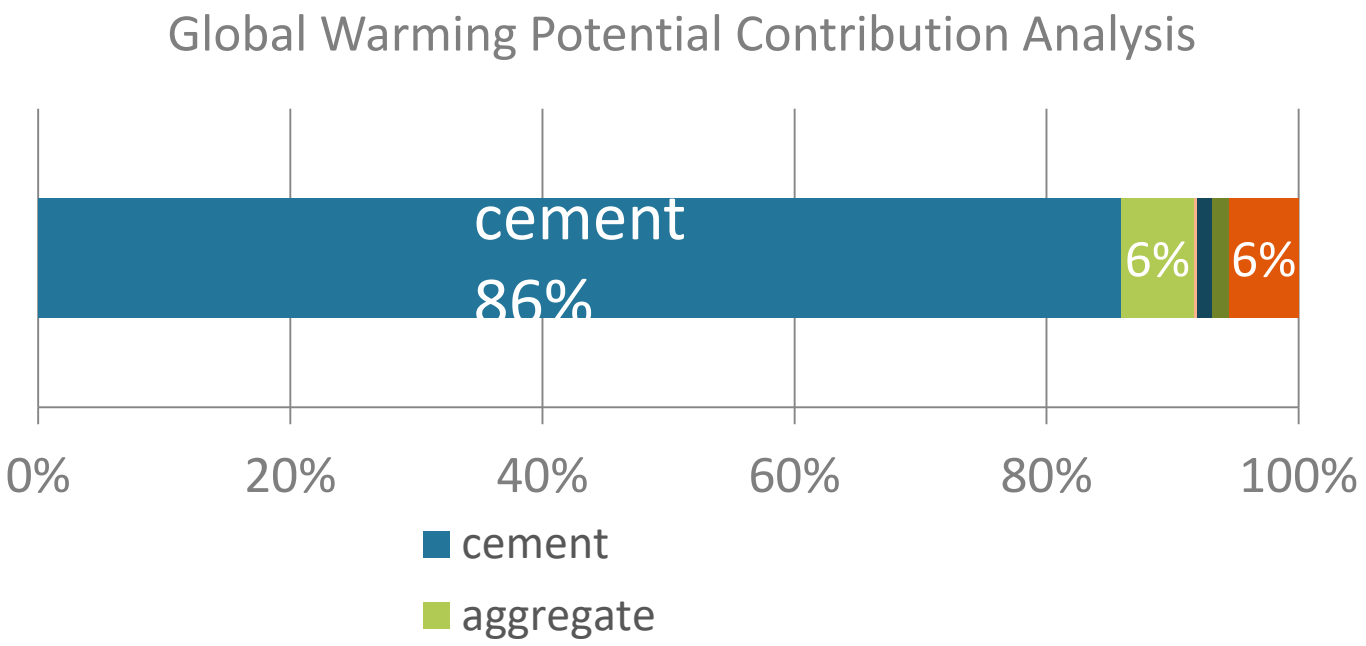
- Materials matter: disposal less so, upstream much more so!
- Some materials are more impactful than others
- Different materials have different emissions intensities (relevant for waste prevention)
- Income considerations (equity) are important
- Consumption-based emissions are real, large and growing.
- Important for everyone to reduce emissions:
  - We need action by national and global partners . . .
  - . . . but Oregon also needs to act

examples

life cycle thinking

Concrete environmental product declaration (EPD) program

Global warming potential of a cubic yard of concrete

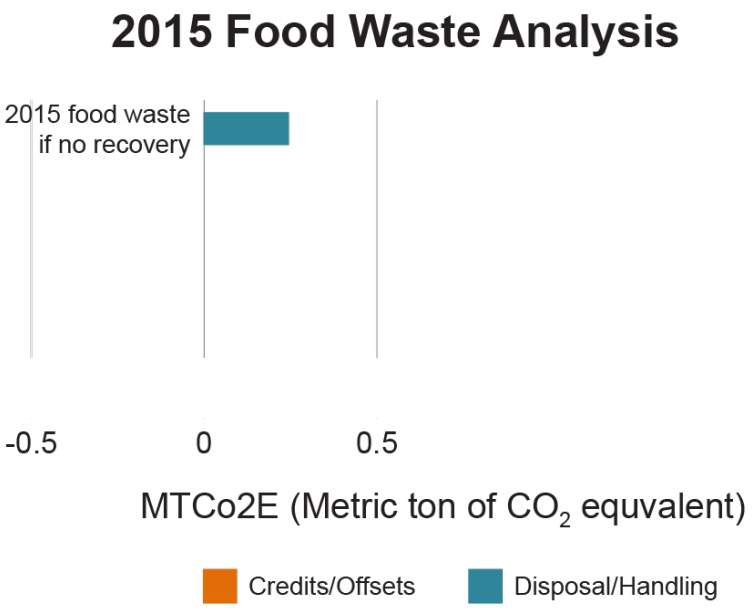


Source: per yd^3, 4000 psi mix, CSI tool

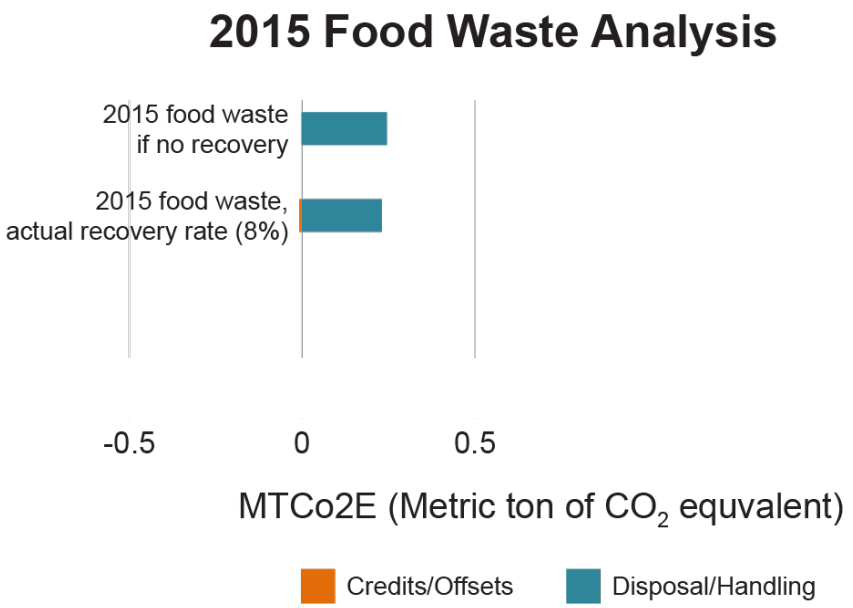
Multnomah County Courthouse, Portland, OR

“wasted food” or “food waste”?

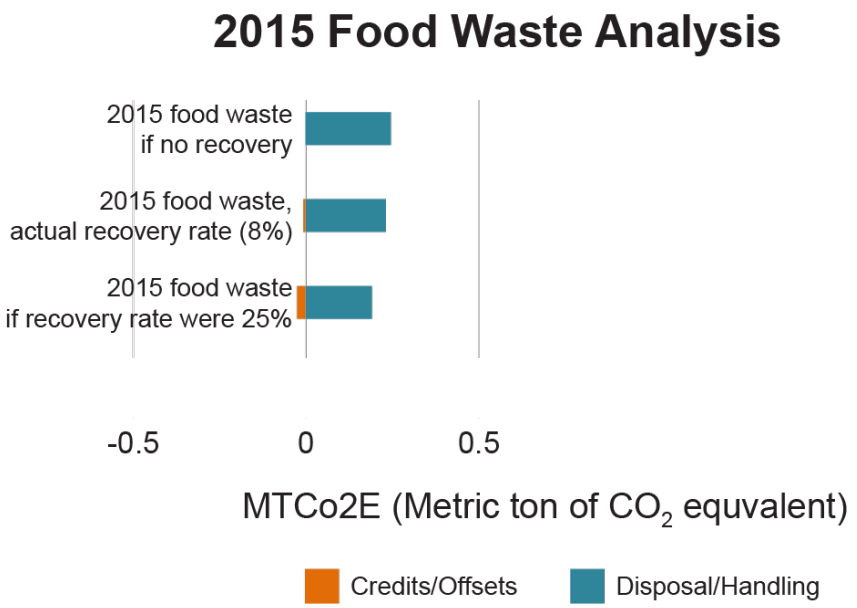
relative GHG impacts – an Oregon case study



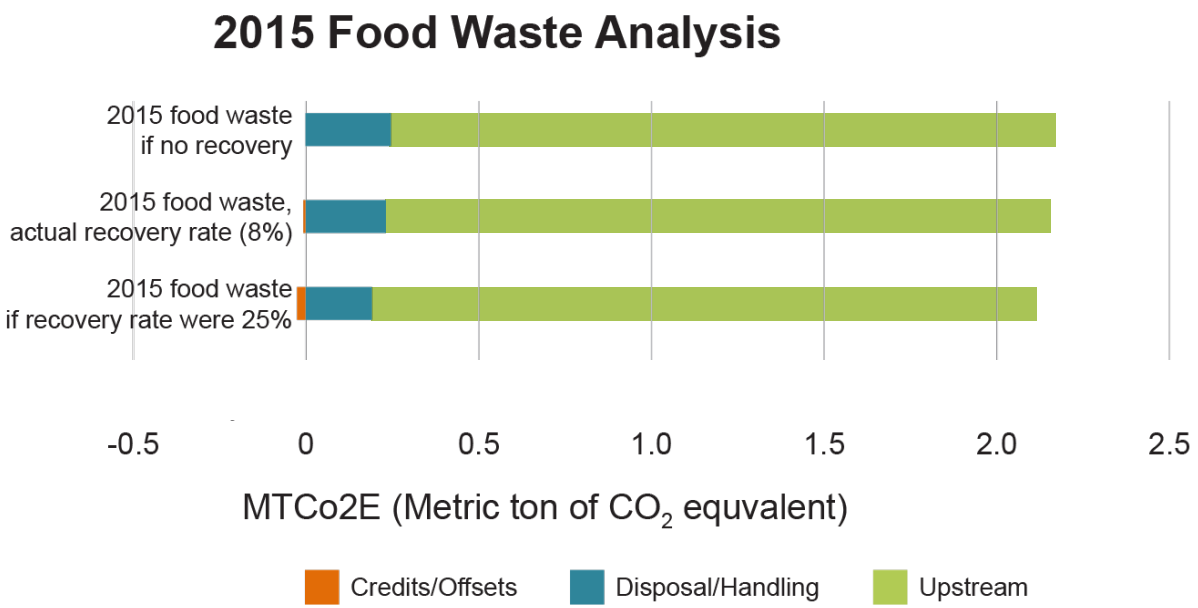
relative GHG impacts – an Oregon case study



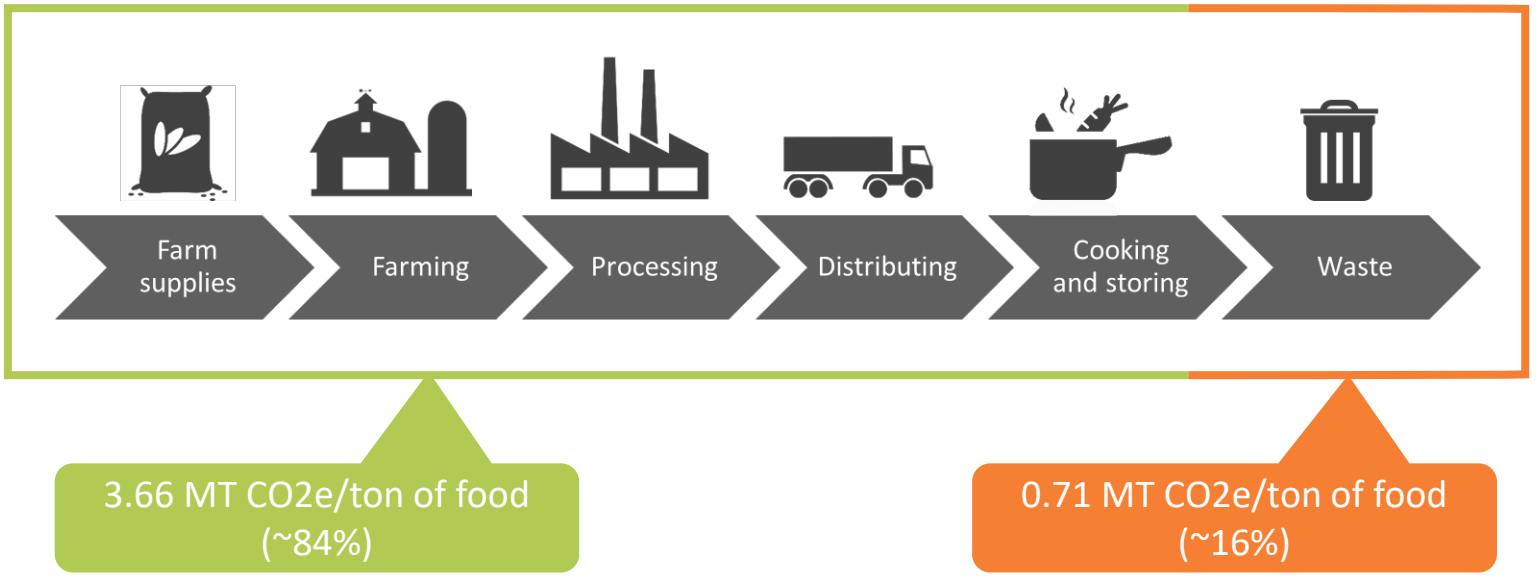
relative GHG impacts – an Oregon case study



the importance of generation goals – an Oregon case study



relative GHG impacts across the food life cycle



Sources: EPA WARM (2016), http://www.lifecyclelogic.com.au/2013/11/lca-perspective-of-food/

wasted food wasted money campaign

materials management

conserving resources · protecting the environment · living well

minal mistry | minal.mistry@state.or.us