Oregon's Consumption-Based Greenhouse Gas Emissions Inventory

Prepared for NEWMOA

May 4, 2018

David Allaway | Oregon Department of Environmental Quality

DEQ
State of Oregon
Department of
Environmental
Quality

Outline of today's presentation

- Oregon's consumption-based emissions inventory (CBEI): Method and data
  - Questions and discussion
- Oregon's CBEI: Results
  - Questions and discussion
- Oregon's CBEI: Uses and applications
  - Questions and discussion

DEQ
State of Oregon
Department of
Environmental
Quality

Common uses of community-scale greenhouse gas (GHG) inventories

- Establish a baseline and measure progress towards climate change goals
- Identify sources of emissions that the community can influence, identify trends in those emissions, and inform related efforts
  - Support climate related projects, programs, planning efforts
  - Provide data and tools to community partners (e.g. cities, community groups, businesses, individuals)
  - Inform development of emissions reduction policy and targets
- Communicate all of the above to policy-makers and the public

Traditional, “in-boundary” inventories

DEQ
State of Oregon
Department of
Environmental
Quality

Limitations of the (modified) “snow globe”

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

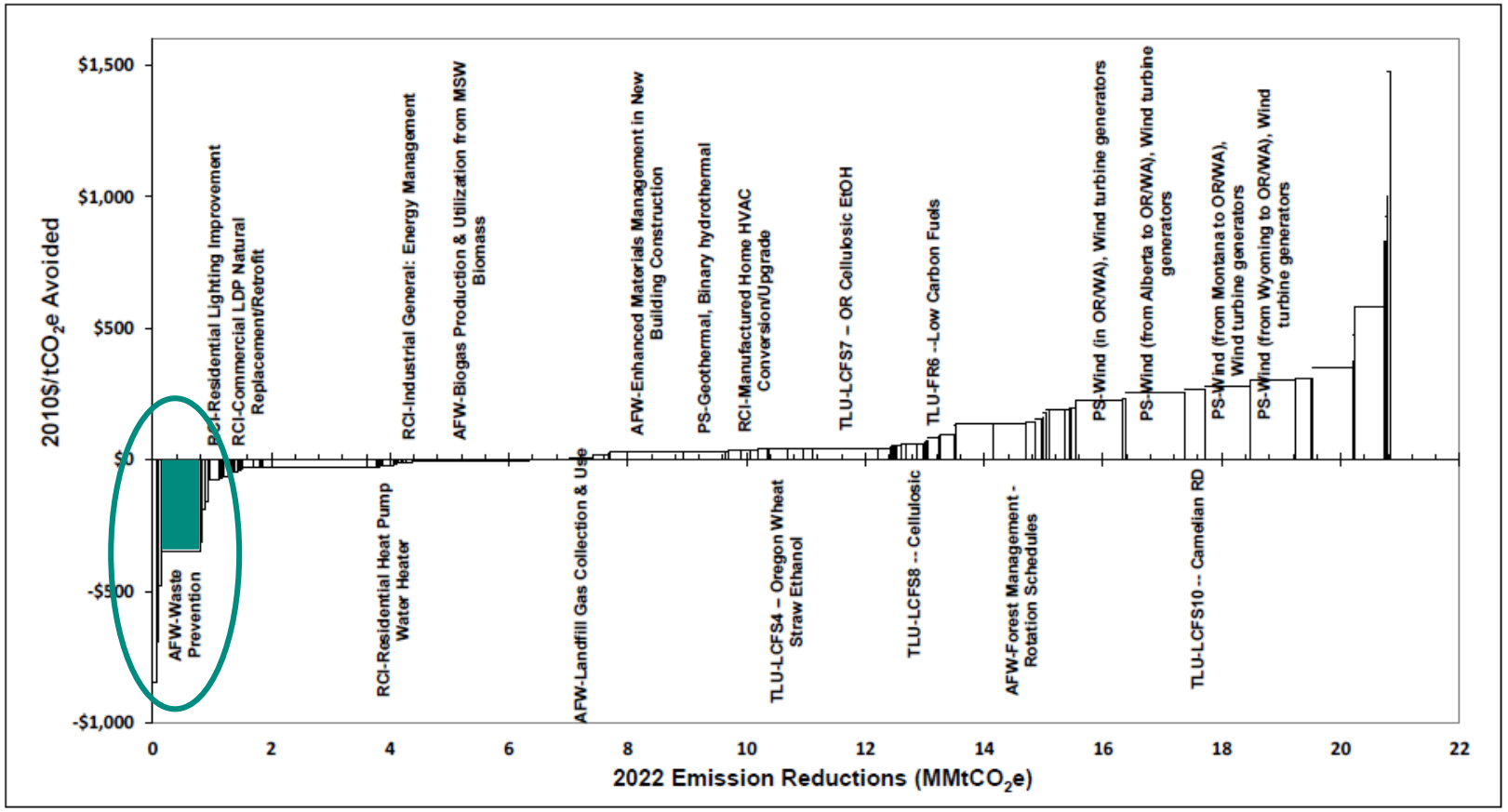
Local consumption, global production

Der Spiegel, The Global Toothbrush, 01/31/2006

http://www.spiegel.de/international/spiegel/0,1518,398229,00.html

Materials: no seat at the table?

Figure 2. Marginal Abatement Cost Curve for Scenario 1, Year 2022



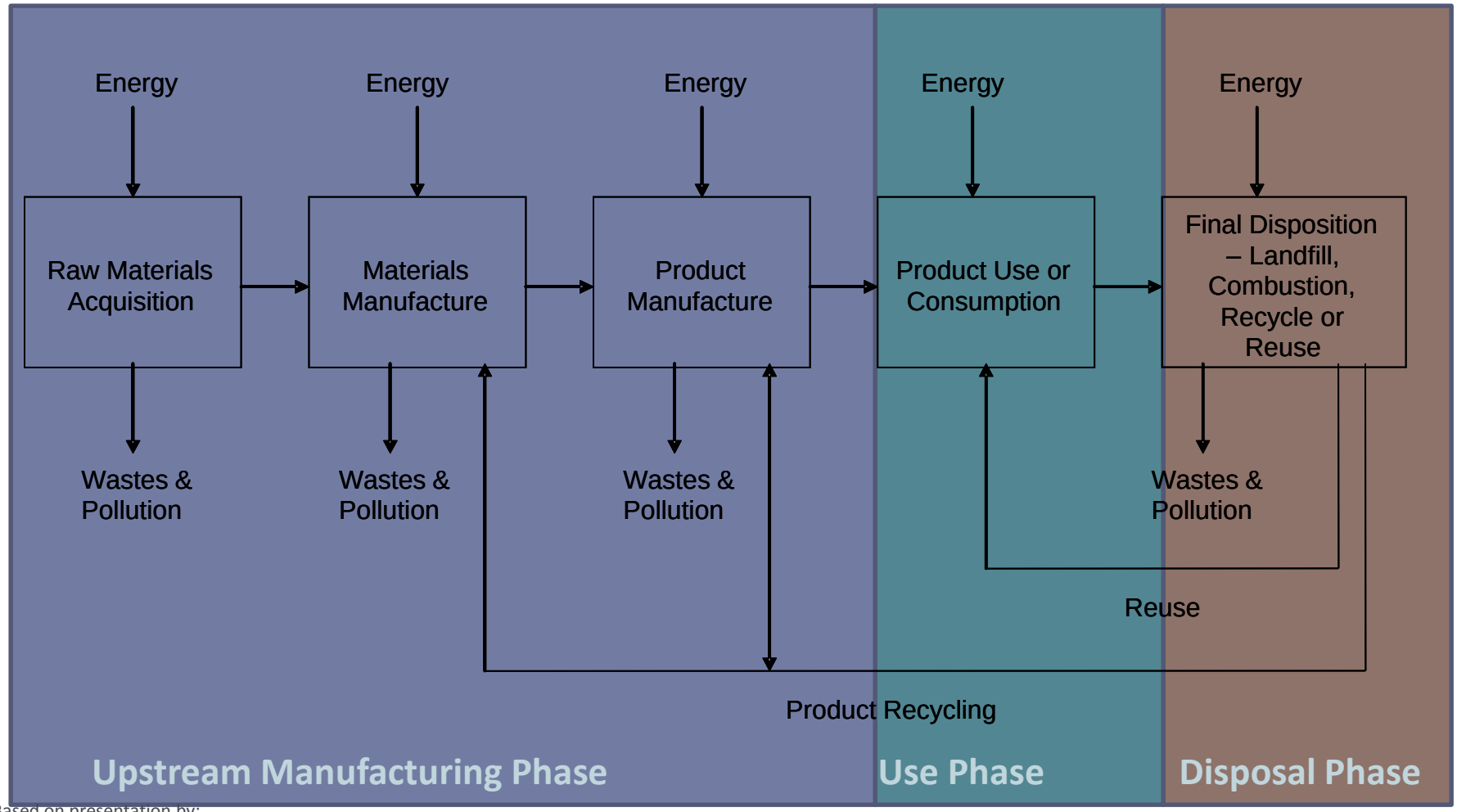
Oregon consumption-based GHG inventories

- CY 2005 (original)
- CY 2010 (full model update)
- CY 2012 (interim “light update”)
- CY 2014 (interim “light update”)
- CY 2015 (publication pending)
  - Includes revision to CY 2005 and CY 2010 estimates
  - Also includes first-order estimate of CY 1990 emissions

Consumption-based emissions inventories

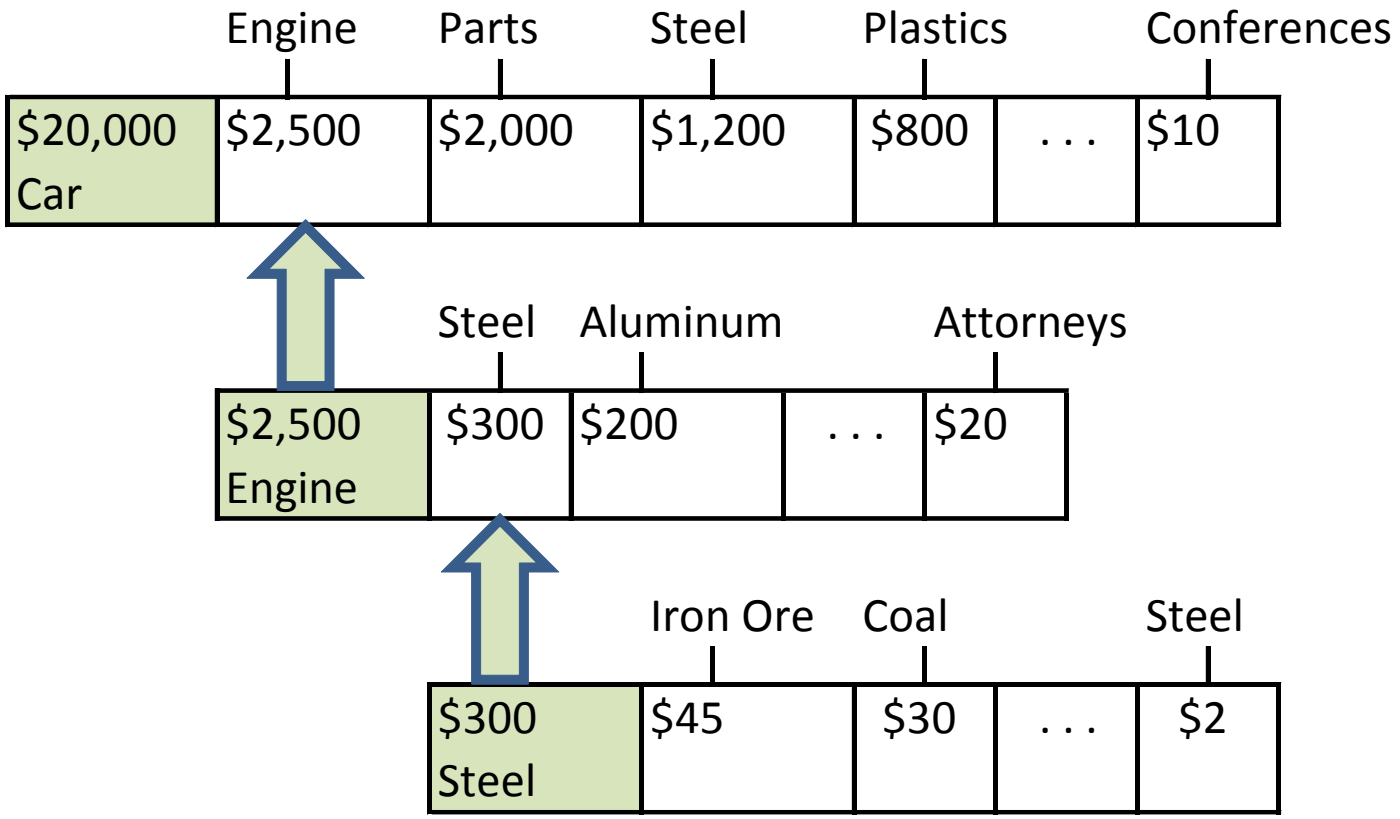
- GHG emissions resulting from *consumption*
  - "Consumption" is typically defined in economic terms (purchases by "consumers" = households, government, business capital formation)
  - Consumption = a "root driver" of emissions
  - Emissions are life-cycle emissions and globally distributed
    - "Life-cycle" = Supply chain/Production + Use + Disposal
  - Includes, but not limited to, materials
    - Includes all fuels, energy, materials and services "consumed" by the community

Method: Hybrid life cycle analysis



Based on presentation by:
Jeffrey Morris, Sound Resource Management
H. Scott Matthews, Carnegie Mellon University
Michelle Morris, Sound Resource Management
Frank Ackerman, Tufts University

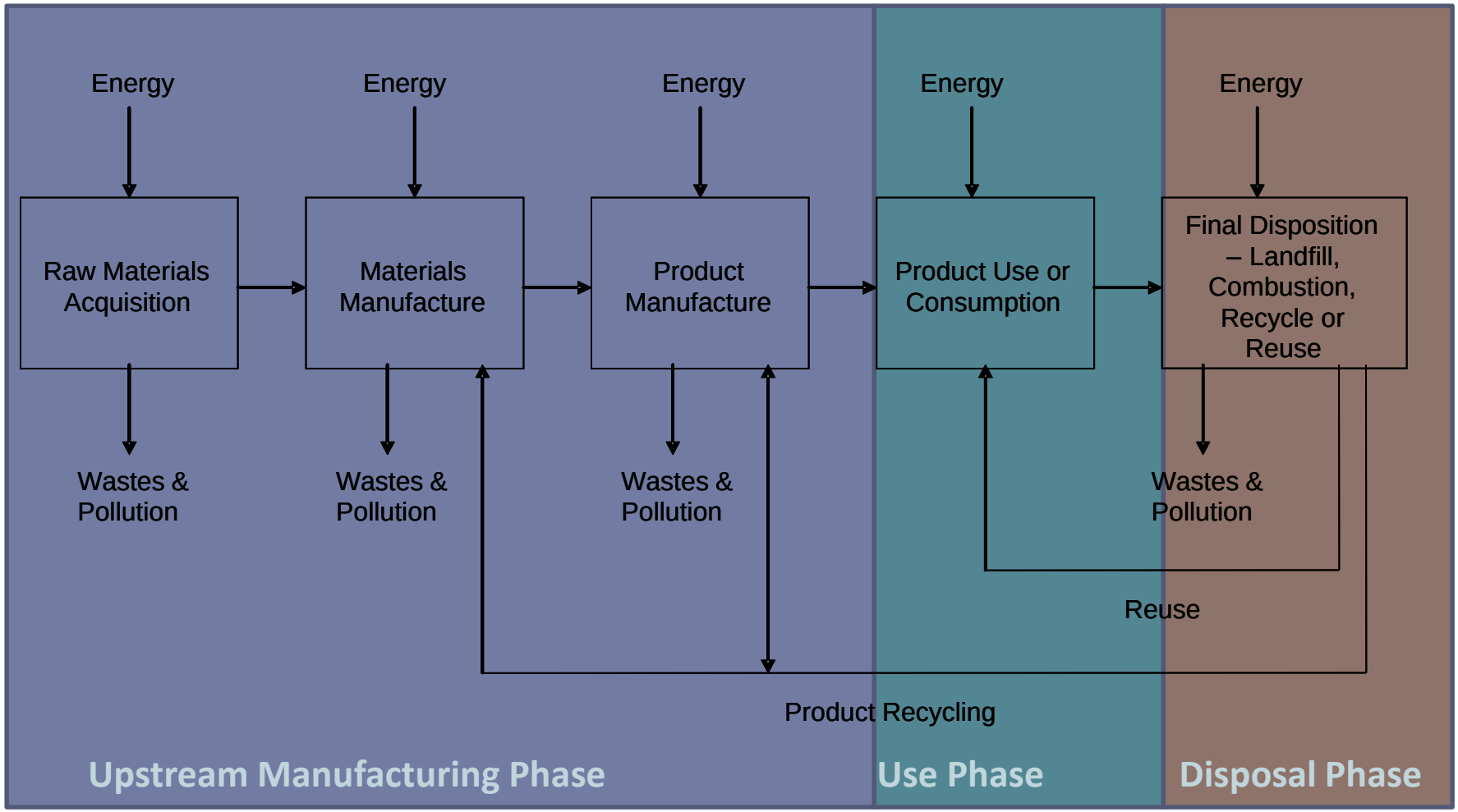
Economic input-output analysis



Economic input-output life-cycle analysis

- Economic input-output analysis estimates financial flows through the supply chain
- Input-output LCA estimates *emissions intensities* (direct emissions/dollar) for different industries
- Upstream emissions = (dollars) x (emissions/dollar)
- Oregon's model uses 440 - 536 commodities and 3 geographic regions
  - Oregon and US economic data (consumption, trade, inter-industry multipliers, imports) from IMPLAN
  - Oregon and US emissions data from in-boundary inventories
  - Foreign emissions intensities from CICERO (with adjustments)

Method: Hybrid life cycle analysis



Based on presentation by:
Jeffrey Morris, Sound Resource Management
H. Scott Matthews, Carnegie Mellon University
Michelle Morris, Sound Resource Management
Frank Ackerman, Tufts University

Key challenges of the consumption-based inventory

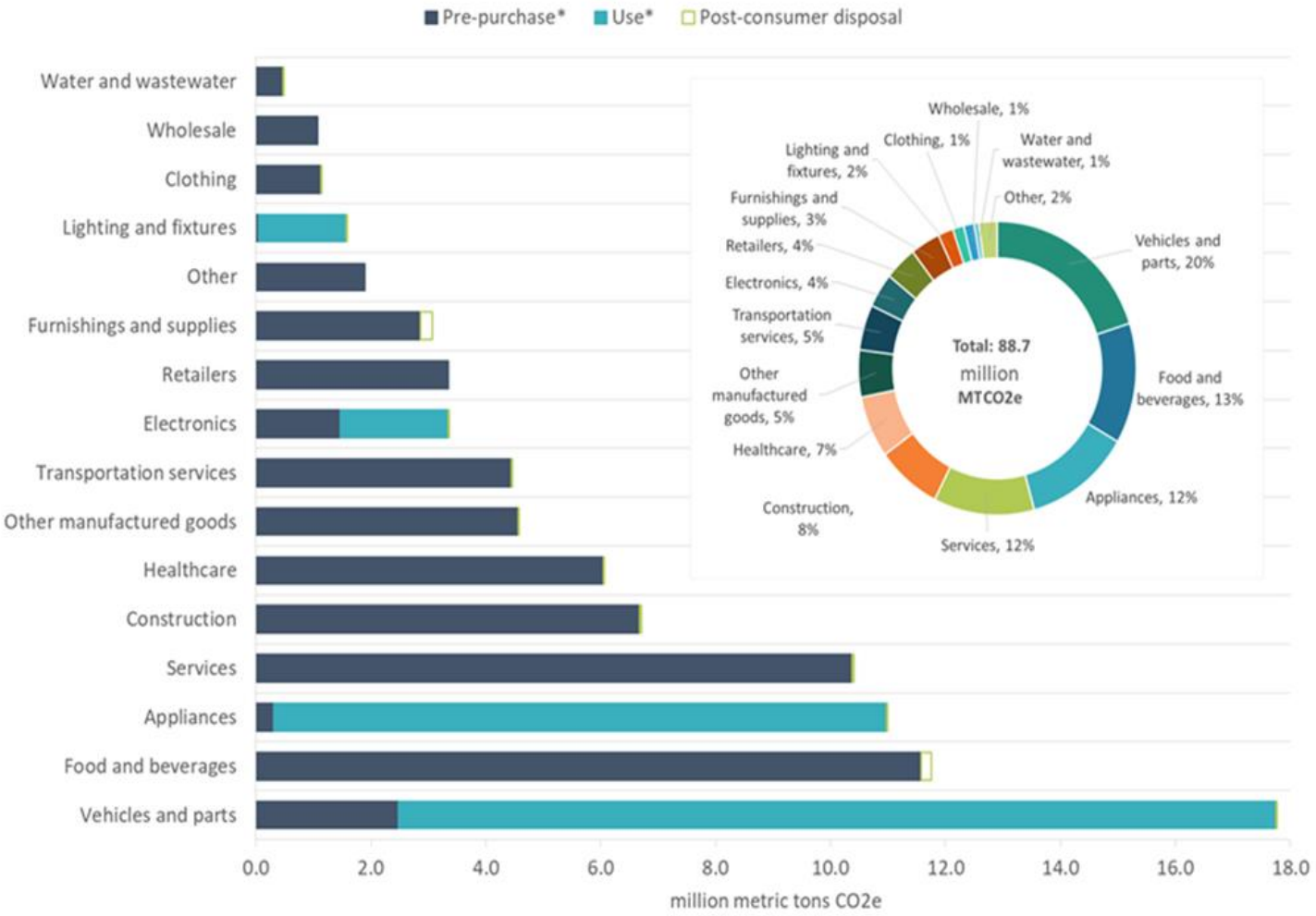
- Complex modeling requirements
- Much of the consumption data is estimated, not actual
  - Oregon demographics (# of households in 9 income strata) x average US/regional per-household consumption baskets for each income strata
- Lack of granularity (536 commodity types)
  - The price-quality problem

Outline of today's presentation

- Oregon's consumption-based emissions inventory (CBEI): Method and data
  - Questions and discussion
- Oregon's CBEI: Results
  - Questions and discussion
- Oregon's CBEI: Uses and applications
  - Questions and discussion

DEQ
State of Oregon
Department of
Environmental
Quality

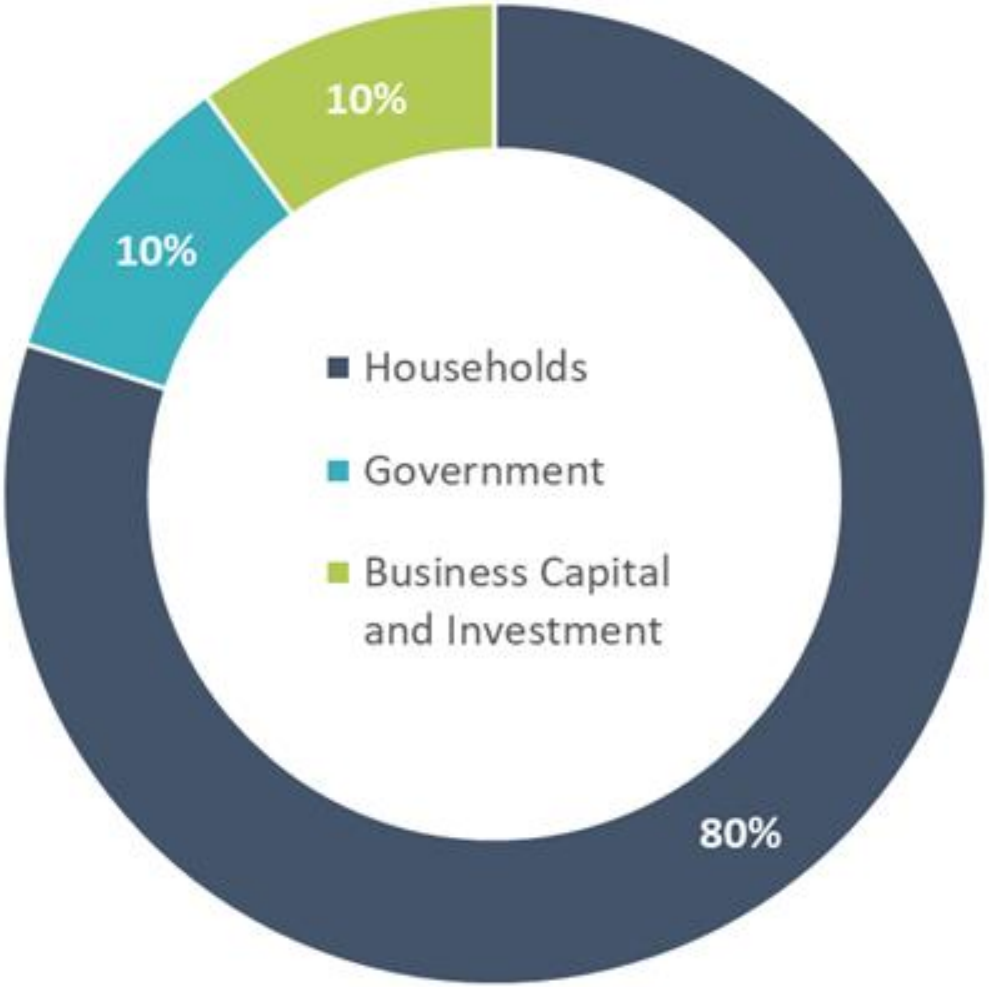
Oregon (2015) Consumption-Based Greenhouse Gas Emissions, by Category of Consumption and Life Cycle Stage (Preliminary)



* "Pre-purchase" are all emissions that occur prior to final purchase, including production, supply chain, transport, retail and wholesale. "Use" refers to emissions resulting from the use of vehicles, appliances, electronics and lighting. Other categories (e.g., food and clothing) have use phase emissions that are accounted for elsewhere. For example, emissions from cooking and laundering are both assigned to the category of "appliances", which include ranges and clothes dryers.

DEQ
State of Oregon Department of Environmental Quality

Oregon (2015) Consumption-Based Greenhouse Gas Emissions, by Consumer Type (Preliminary)

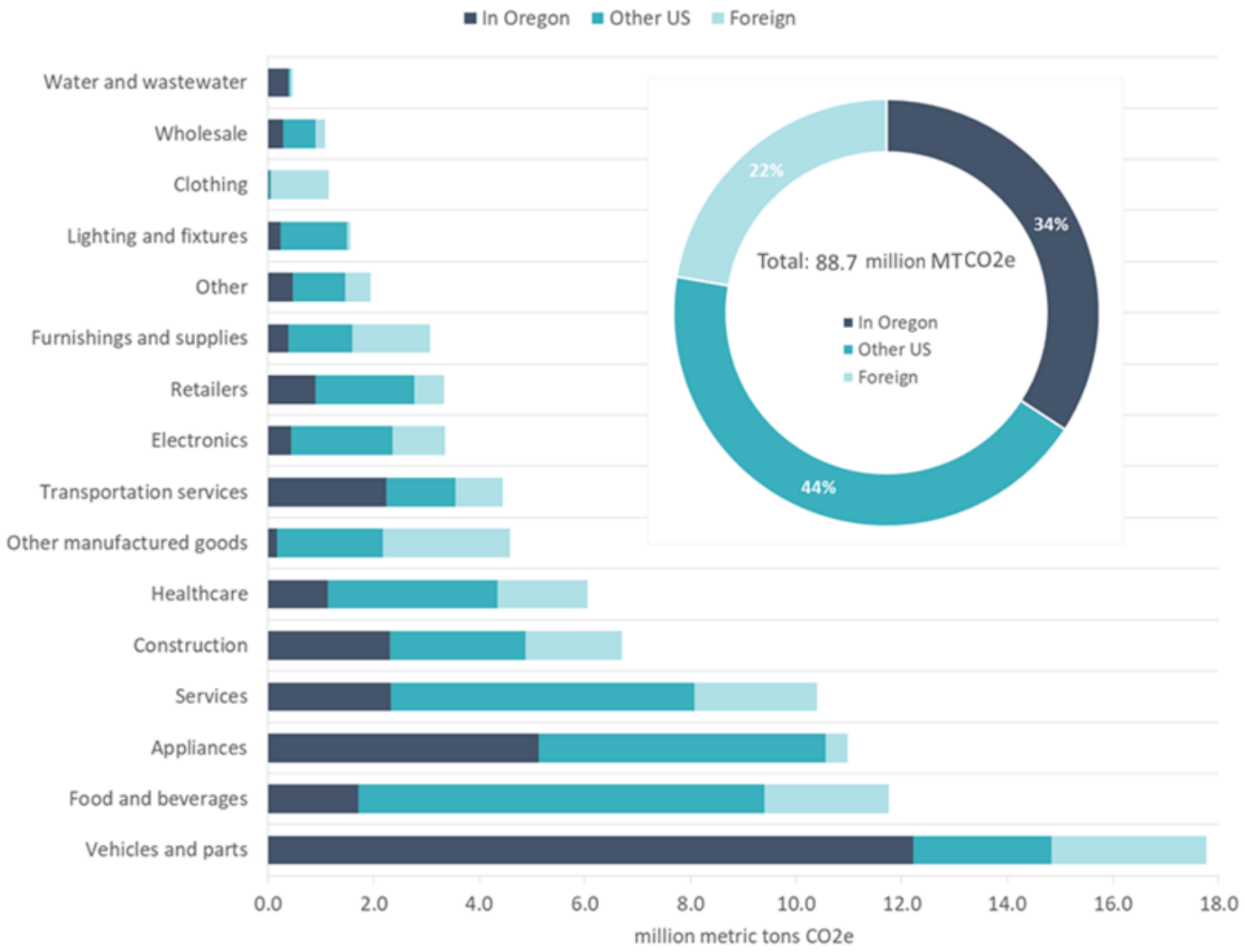


DEQ
State of Oregon Department of Environmental Quality

Average Oregon 2015 per-household consumption-based GHG emissions (MTCO2e/household), by income group (Preliminary)

DEQ
State of Oregon
Department of
Environmental
Quality

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



DEQ
State of Oregon
Department of
Environmental
Quality

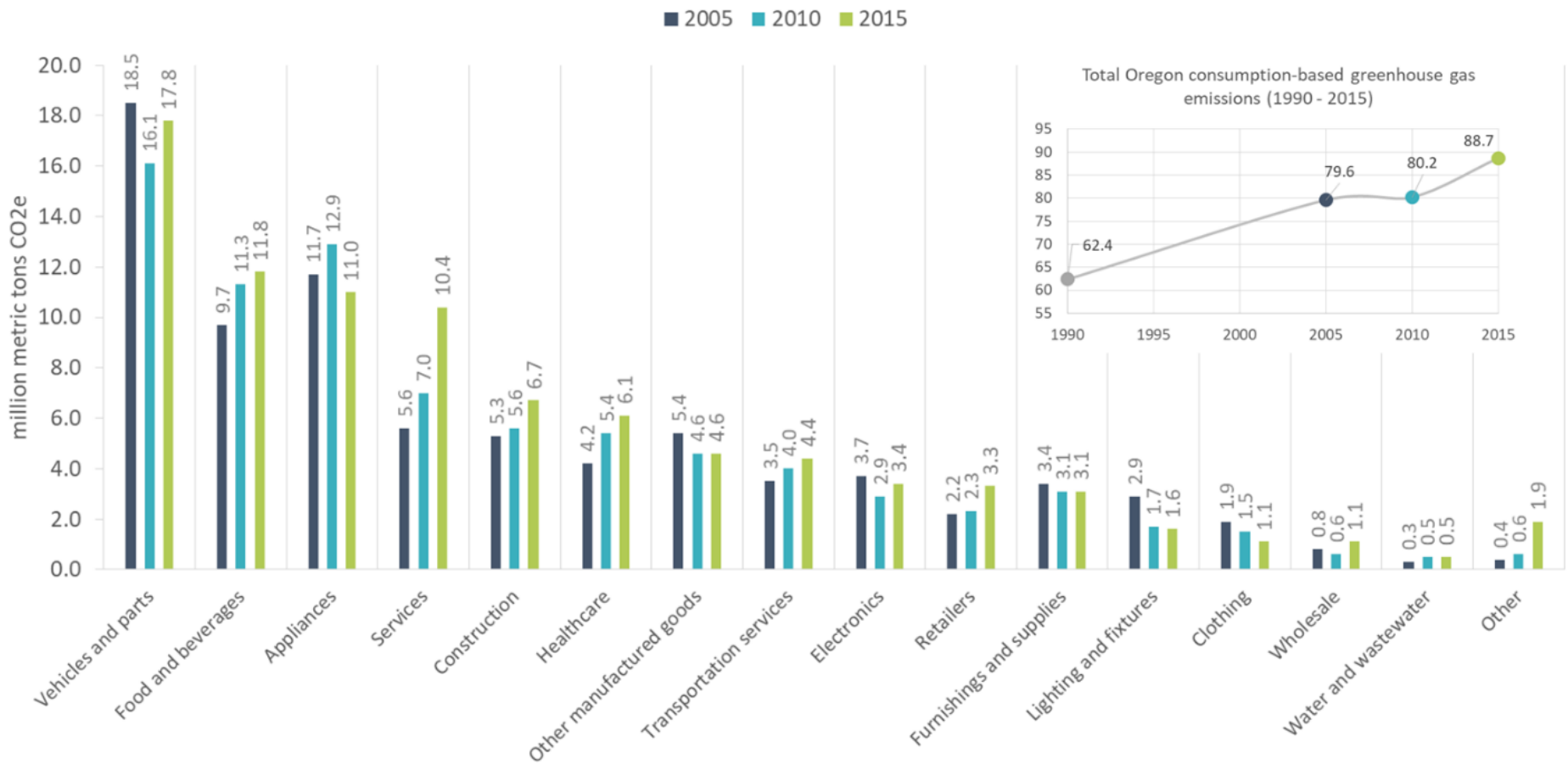
Emissions intensities

Final Demand	Average LCA Emissions Intensities (kg CO2e/2015$)
Materials	0.45
Electricity (direct purchases)	4.37
Fuel (direct purchases)	6.07
Services	0.16

More emissions intensities

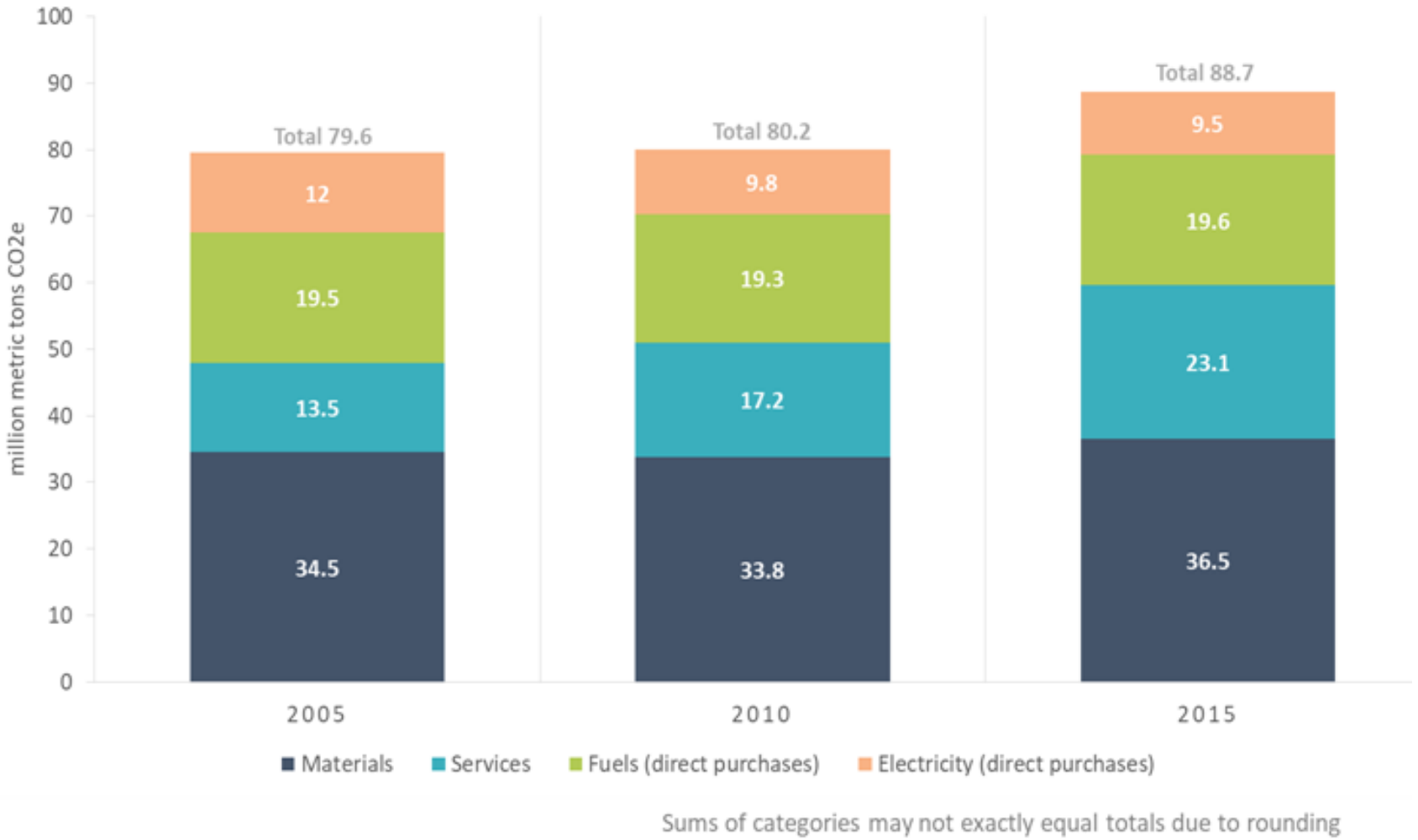
Categories	LCA Pre-purchase Emissions Intensities (kg CO2e/2015$)
Transportation services	1.1
Clothing	0.8
Food and beverages	0.7
Appliances	0.5
Construction	0.4
Furnishings and supplies	0.4
Electronics	0.2
Services	0.2

2005 - 2015 Oregon consumption-based GHG emissions, by category (Preliminary)



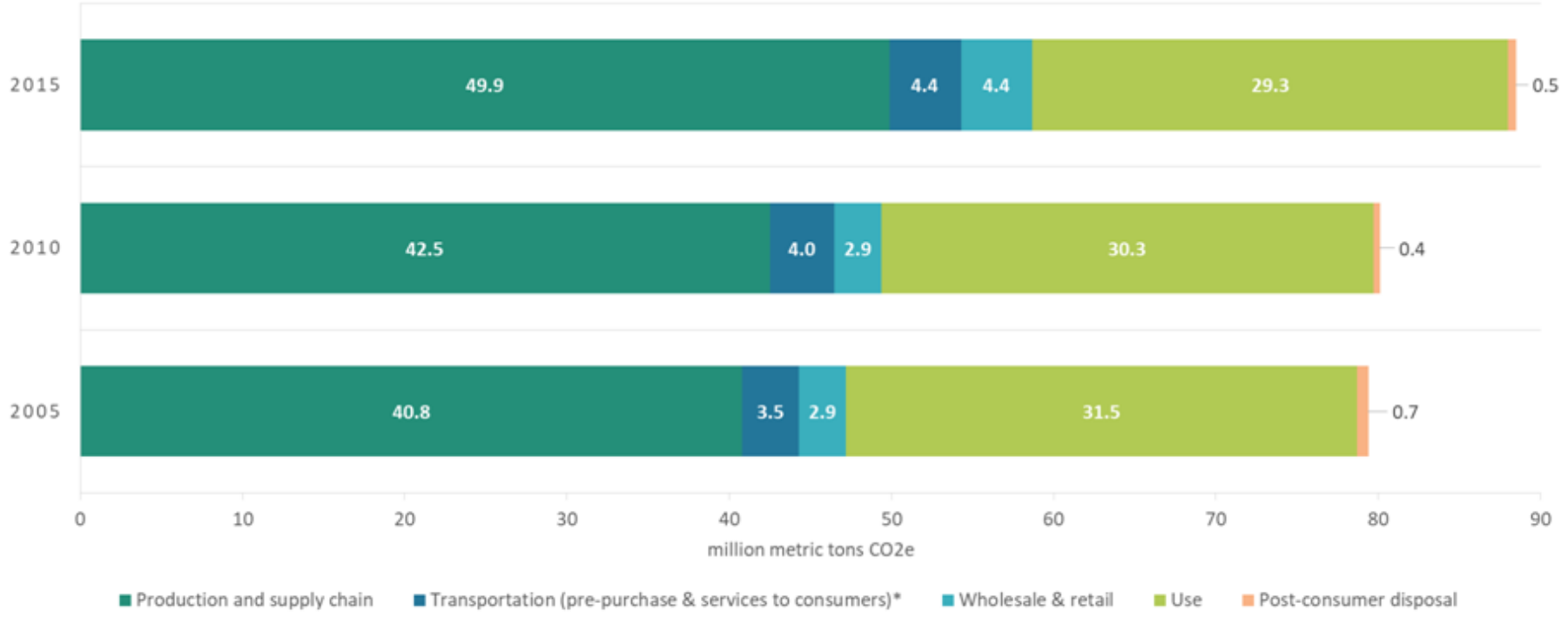
DEQ
State of Oregon
Department of Environmental Quality

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



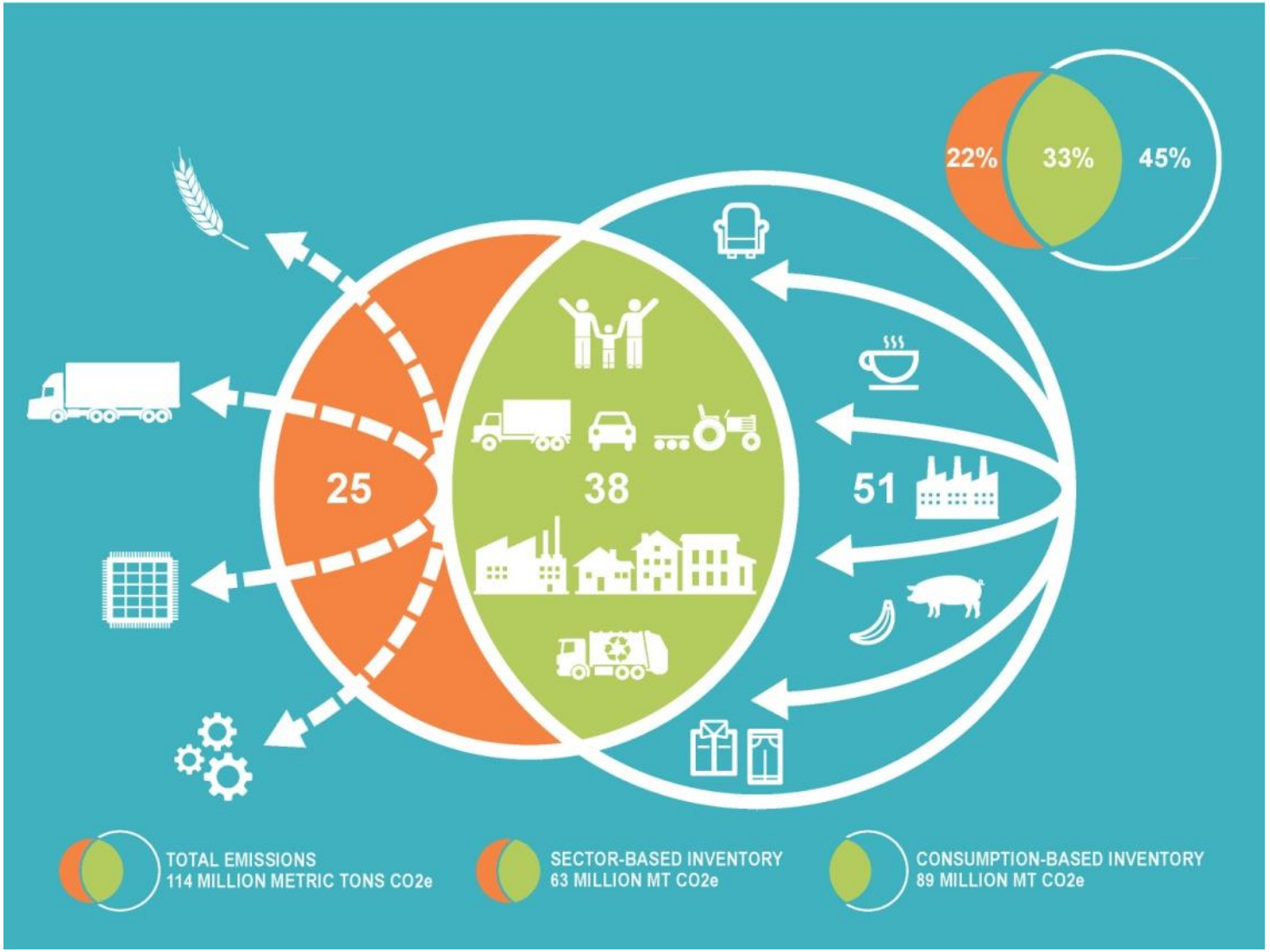
DEQ
State of Oregon
Department of
Environmental
Quality

2005 - 2015 Oregon consumption-based GHG emissions, by life-cycle stage (Preliminary)



DEQ
State of Oregon
Department of
Environmental
Quality

Comparison of Oregon's 2015 sector-based and consumption-based GHG emissions (Preliminary)

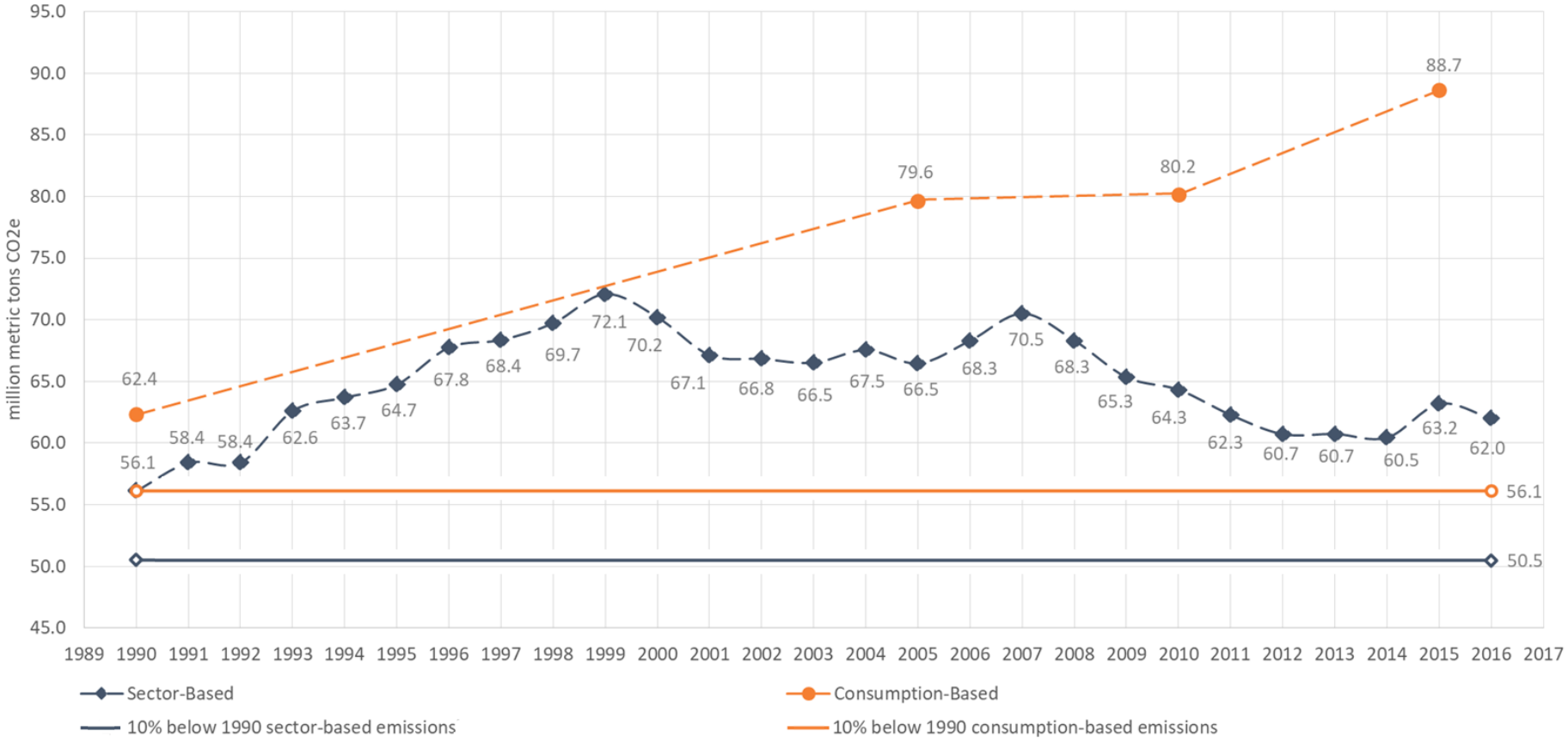


DEQ
State of Oregon
Department of
Environmental
Quality

Are emissions trending upward? Or downward?

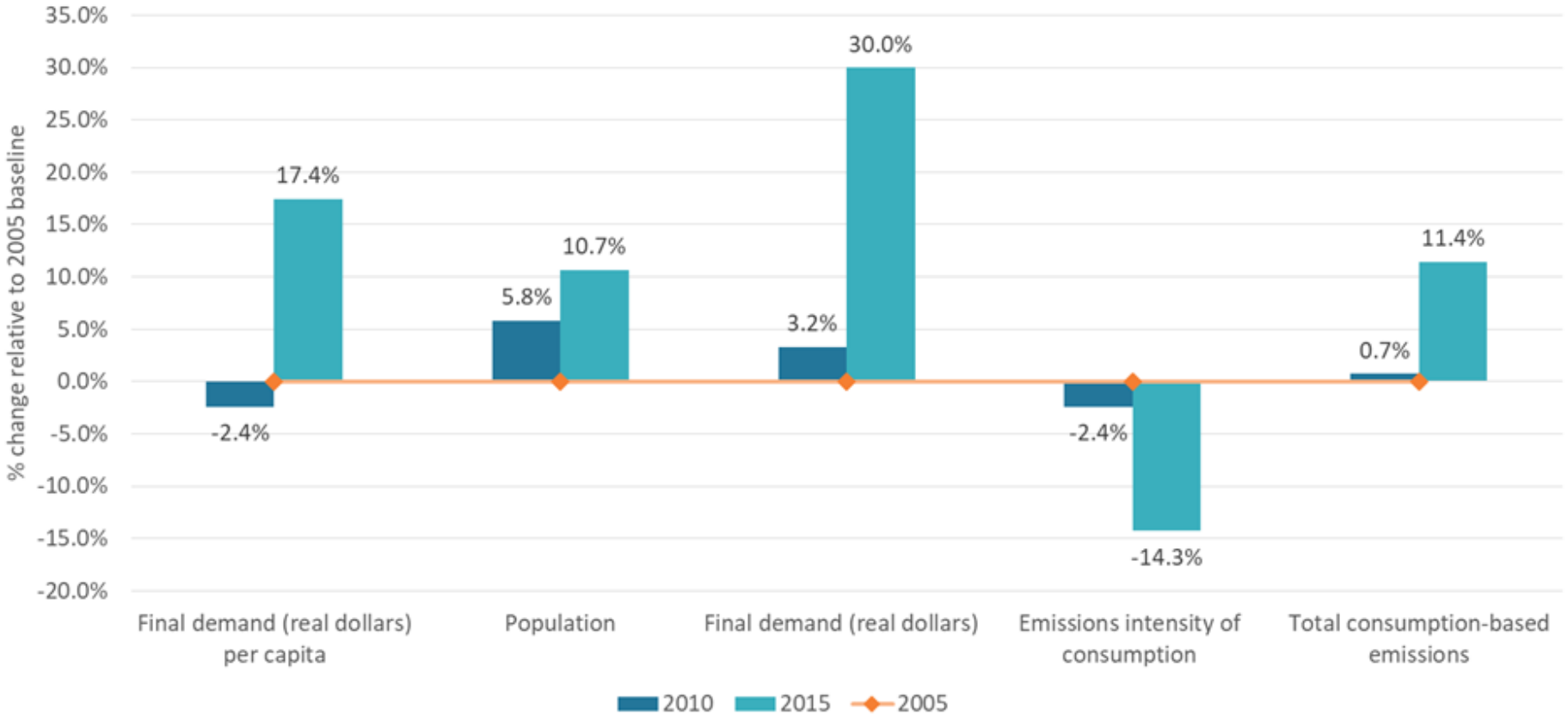
DEQ
State of Oregon
Department of
Environmental
Quality

Trends in Oregon sector-based and consumption-based GHG emissions, 1990 - 2015 (Preliminary)



DEQ
State of Oregon
Department of
Environmental
Quality

Drivers of change in Oregon consumption-based GHG emissions, 2005 – 2015 (Preliminary)



DEQ
State of Oregon Department of Environmental Quality

Outline of today's presentation

- Oregon's consumption-based emissions inventory (CBEI): Method and data
  - Questions and discussion
- Oregon's CBEI: Results
  - Questions and discussion
- Oregon's CBEI: Uses and applications
  - Questions and discussion

DEQ
State of Oregon
Department of
Environmental
Quality

Summary uses of Oregon's consumption-based inventory

- ID "hot spots" (high emissions, high intensities)
  - Hot spots → potential focus areas (e.g., food, concrete, built environment)
- Communication to consumers
  - DEQ's on-line carbon footprint calculator (but not from Oregon CBEI)
- Inform design of plans and programs
  - e.g., waste prevention focus on clothing and food (higher emissions intensities)
- Empower and justify "whole life cycle" approaches (→ Sustainable Materials Management, Oregon's *2050 Vision*)

Summary uses of Oregon's consumption-based inventory (continued)

- Oregon Sustainable Consumption Strategy (in process)
- Evaluating specific materials
  - e.g., "nutrition density" of beverages
- Local government CBEIs (derived from Oregon's)
- Government purchasing tool (Scope 3 emissions)

Consumption-related programs and policies

- *Materials Management in Oregon: 2050 Vision and Framework for Action*
  - Full life-cycle approach
  - Includes but not limited to waste and recovery
  - Major program reorientation for DEQ
- Increasing supply and demand of “space efficient housing”
  - Green building standards
  - Support for local policy changes
  - State code (green code)
  - Foundational research (e.g., appraisals, survey)
  - Promotion (tours, conferences)
  - Funding

Consumption-related programs and policies

- Preventing the wasting of food
  - Strategy finalized last year
  - Measurement
  - Messaging
  - Industry engagement
  - Outreach, pilot projects
- Product Environmental Footprinting
  - Phase One: Foundational research
  - Phase Two: Concrete EPDs, food research, business case studies
  - Phase Three: Asphalt, others?
- Low-carbon purchasing
  - Government purchasing toolkit (West Coast Forum)
  - New purchasing initiative
  - Attributes research

Consumption-related programs and policies

- Carbon Leadership Forum
- Strategic Plan for Reuse, Repair and Product Lifespan Extension
  - Workforce development
  - Building material reuse; whole building reuse
  - Remanufacturing
  - Textiles
- Sustainable Consumption Strategy
  - Definition of sustainable consumption
  - “Making the case” document
  - Under development

Consumption-related programs and policies

- Grants
  - Deconstruction and building material reuse
  - Repair cafes
  - Hot air dryers in schools
  - Reusable trays for Meals on Wheels
  - Furniture salvage and reuse
  - Wasted food prevention
  - Etc.
- Senate Bill 263: waste prevention and reuse requirements for cities, counties

Consumption-related programs and policies

- "Outcome based recovery rates" or "life cycle assessment of materials in waste generated"
  - Necessitates quantifying energy savings (+GHG reductions) from waste recovery
  - Put in context: energy (+GHG) impacts of waste generation
  - Goals:
    - Prioritize recovery efforts
    - Refocus action upstream (prevention and reuse)

Thank you

David Allaway
Oregon Department of Environmental Quality
allaway.david@deq.state.or.us