Consumption Based Emissions – Part 1: Inventories
The West Coast Climate and Materials Management Forum is a collaboration of state, local, and tribal government

- Develop ways to institutionalize sustainable materials management practices.
- Develop tools to help jurisdictions reduce the GHGs associated with materials.
Check out the Forum’s Resources

• Original Report Connecting Materials/Climate
• Research Summaries
• Turn-key Materials Management Presentation
• Climate Action Toolkit
• Food: Too Good to Waste Toolkit
• Climate Friendly Purchasing Toolkit
• Reducing GHGs Through Composting and Recycling

www.westcoastclimateforum.com
This webinar is being provided as part of the West Coast Climate and Materials Management Forum Webinar Series. The Forum is a collaboration of state, local, and tribal governments. We invite guest speakers to share their views on climate change topics to get participants thinking and talking about new strategies for achieving our environmental goals. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Please note the opinions, ideas, or data presented by speakers in this series do not represent West Coast Climate and Materials Management Forum members policy or constitute endorsement by the forum.

[Link to website] www.westcoastclimateforum.com
Consumption-Based Emissions Inventories attribute all global emissions to the ultimate end user, so that, in addition to transportation and housing, the supply chain emissions that occur throughout the lifecycle of goods, food, and services consumed in a jurisdiction are included. When these upstream emissions are made visible, communities can consider policies to reduce these emissions, such as reuse and repair or low-carbon building materials, or educate their residents about steps they can take to reduce their personal carbon footprint. Climate leaders are increasingly considering consumption-based emissions in addition to production or activity-based emissions that have typically formed the basis of climate action planning.
Today's Speakers

**David Allaway** is a Senior Policy Analyst at the Oregon Department of Environmental Quality’s Materials Management Program. He leads projects related to sustainable consumption and production, materials (including waste) management, and greenhouse gases. He led efforts to develop and update Oregon’s consumption-based greenhouse gas emissions inventory and contributed to the ICLEI US greenhouse gas accounting protocols for communities and recycling.

**David Burch** is a Principal Environmental Planner in the Climate Protection Section of the Planning Division at the Bay Area Air Quality Management District. Dave worked with researchers at the UC Berkeley Cool Climate Network to develop a consumption-based greenhouse gas emissions inventory for the San Francisco Bay Area which analyzes the variation in the GHG footprint among communities in the region.
Moderator: Miya Kitahara is a program manager at StopWaste, working on material and energy efficiency. She support Alameda County local government with climate action planning, including helping them incorporate consumption-based emissions.
The emissions we count may be going down, but are we just sending them elsewhere? The only boundary that counts in climate change is planetary.
Examples of consumption-based emissions in local climate action:
San Francisco, 2011
King County, 2015
Portland, 2015
Cities in Europe, North America and Oceana, and other cities that have high consumption-based GHG emissions, are recommended to use consumption-based GHG inventories alongside their sector-based GHG inventories, or incorporate key supply chains into the latter.

This would encourage more holistic GHG emissions assessments; enable decision-makers to consider a wider range of opportunities to reduce global GHG emissions; and provide an additional perspective with which to engage other stakeholders in climate action.
What does it mean for my work?

- **Materials management sector:** Elevates the importance of “reduce/reuse” in the material hierarchy
- **Climate action sector:** Broadens scope of potential local actions to reduce GHG emissions on a global scale
Q&A

Links for more information:

- [oregon.gov/DEQ/mm/Pages/Consumption-based-GHG.aspx](oregon.gov/DEQ/mm/Pages/Consumption-based-GHG.aspx)
- [baaqmd.gov/plans-and-climate/climate-protection](baaqmd.gov/plans-and-climate/climate-protection)
- [coolclimate.berkeley.edu/inventory](coolclimate.berkeley.edu/inventory)
- [stopwaste.org/cbei](stopwaste.org/cbei)
Next Up:
Oregon DEQ's Evaluation of Popular Packaging Attributes
Wednesday, November 28th 10:00-11:30 (PST)

More to come in the Webinar series in 2019:
January 2019: Consumption-based emissions – Part 2: Actions
March 2019: Oregon DEQ’s Sustainability Frameworks White Paper
April 2019: Food and Environment Product Footprint Research
May 2019: Preventing the Wasting of Food
THANK YOU!

Please fill out the survey you receive after the webinar.

For more information, visit www.westcoastclimateforum.com
Oregon’s Consumption-Based Greenhouse Gas Emissions Inventory

West Coast Forum on Climate and Materials Management
2 October 2018
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
  ➢ Inform development of emissions reduction policy and targets
  ➢ Support climate related projects, programs, planning efforts
  ➢ Provide data and tools to community partners (e.g. cities, community groups, businesses, individuals)

• Communicate all of the above to policy-makers and the public
Limitations of conventional “in-boundary” or “sector-based” 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 (“leakage”)

• Alone, may lead to bad decisions (that increase global emissions)

• Alone, may provide misleading signals of change over time
1. Ask sister agencies to acknowledge that the sector-based (“in-boundary”) inventory is incomplete
2. Develop an accounting system that tells a more complete story
3. Encourage other governments to do the same
Oregon consumption-based GHG inventories

• CY 2005 (original) (published 2011)
• CY 2010 (full model update)
• CY 2012 (interim “light update”)
• CY 2014 (interim “light update”)
• CY 2015 (full model update)
  ➢ 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 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
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
Oregon’s 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

- Engine: $20,000
- Parts: $2,500
- Steel: $2,000
- Plastics: $1,200
- Attorneys: $800
- Conferences: $10

Steel: $2,500
- Aluminum: $300
- Attorneys: $200
- Conferences: ...

Iron Ore: $300
- Coal: $45
- Steel: $30
- Conferences: ...

Steel: $45
- Engine: $30
- Attorneys: $20
- Conferences: $2
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).
Oregon’s method: Hybrid life cycle analysis

- Raw Materials Acquisition
- Materials Manufacture
- Product Manufacture
- Product Use or Consumption
- Final Disposition: Landfill, Combustion, Recycle or Reuse

- Energy
- Wastes & Pollution
- Reuse
- Product Recycling

Upstream Manufacturing Phase
Use Phase
Disposal Phase

Based on presentation by:
Jeffrey Morris, Sound Resource Management
H. Scott Matthews, Carnegie Mellon University
Michelle Morris, Sound Resource Management
Frank Ackerman, Tufts University
Some 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)
- Price-quality problem
Oregon 2015 consumption-based GHG emissions, by category of consumption and life cycle stage

<table>
<thead>
<tr>
<th>Category</th>
<th>Pre-purchase</th>
<th>Use</th>
<th>Post-consumer disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>WATER AND WASTEWATER</td>
<td></td>
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<tr>
<td>WHOLESALE</td>
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<tr>
<td>CLOTHING</td>
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<tr>
<td>LIGHTING AND FIXTURES</td>
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<tr>
<td>OTHER</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FURNISHINGS AND SUPPLIES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RETAILERS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ELECTRONICS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRANSPORTATION SERVICES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OTHER MANUFACTURED GOODS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HEALTHCARE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONSTRUCTION</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SERVICES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>APPLIANCES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FOOD AND BEVERAGES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VEHICLES AND PARTS</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

**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%
- Other, 2%
- Electronics, 4%
- Retailers, 4%
- Furnishings and supplies, 3%
- Clothing, 1%
- Wholesale, 1%
- Water and wastewater, 1%
Oregon 2015 consumption-based GHG emissions, by consumer type
Average per-household 2015 consumption-based GHG emissions, by income group

- **Vulnerability**
  - Total 26.5
  - < $30K: 5.9
  - $30K-$50K: 8.1
  - $50K-$100K: 8.8
  - $100K+: 5.2

- **Adaptability**
  - Total 36.1
  - < $30K: 1.5
  - $30K-$50K: 4.3
  - $50K-$100K: 5.4
  - $100K+: 11.2

- **Responsibility**
  - Total 47.9
  - < $30K: 2.9
  - $30K-$50K: 5.5
  - $50K-$100K: 7.3
  - $100K+: 11.6

- **Total 75.0**
  - < $30K: 4.9
  - $30K-$50K: 7.9
  - $50K-$100K: 11.6
  - $100K+: 15.7

Legend:
- Vehicles and parts
- Food and beverages
- Appliances
- Services
- Healthcare
- Transportation services
- All others
2015 Oregon consumption-based GHG emissions, by location of emission

![Bar chart showing GHG emissions by location of emission, with percentages and total CO2e emissions.]

Total: 88.7 MMT CO2e

- In Oregon: 22%
- Other US: 34%
- Foreign: 44%

- Vehicles and parts: 16.0 MMT CO2e
- Food and beverages: 12.0 MMT CO2e
- Appliances: 10.0 MMT CO2e
- Services: 9.7 MMT CO2e
- Construction: 8.6 MMT CO2e
- Healthcare: 4.5 MMT CO2e
- Other manufactured goods: 4.0 MMT CO2e
- Transportation services: 3.8 MMT CO2e
- Other: 3.5 MMT CO2e
- Furnishings and supplies: 3.4 MMT CO2e
- Retailers: 2.4 MMT CO2e
- Electronics: 1.9 MMT CO2e
- Lighting and fixtures: 1.7 MMT CO2e
- Clothing: 1.6 MMT CO2e
- Wholesale: 1.5 MMT CO2e
- Water and wastewater: 1.0 MMT CO2e
## 2015 emission intensities

<table>
<thead>
<tr>
<th>Final Demand</th>
<th>Average LCA Emissions Intensities (kg CO2e/2015$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials</td>
<td>0.45</td>
</tr>
<tr>
<td>Electricity (direct purchases)</td>
<td>4.37</td>
</tr>
<tr>
<td>Fuel (direct purchases)</td>
<td>6.07</td>
</tr>
<tr>
<td>Services</td>
<td>0.16</td>
</tr>
</tbody>
</table>
# More 2015 emission intensities

<table>
<thead>
<tr>
<th>Categories</th>
<th>LCA Pre-purchase Emissions Intensities (kg CO2e/2015$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation services</td>
<td>1.1</td>
</tr>
<tr>
<td>Clothing</td>
<td>0.8</td>
</tr>
<tr>
<td>Food and beverages</td>
<td>0.7</td>
</tr>
<tr>
<td>Appliances</td>
<td>0.5</td>
</tr>
<tr>
<td>Construction</td>
<td>0.4</td>
</tr>
<tr>
<td>Furnishings and supplies</td>
<td>0.4</td>
</tr>
<tr>
<td>Electronics</td>
<td>0.2</td>
</tr>
<tr>
<td>Services</td>
<td>0.2</td>
</tr>
</tbody>
</table>
2005-2015 Oregon consumption-based GHG emissions
2005-2015 Oregon consumption-based GHG emissions, by meta-category

<table>
<thead>
<tr>
<th>Year</th>
<th>Total</th>
<th>Materials</th>
<th>Services</th>
<th>Fuels (direct purchases)</th>
<th>Electricity (direct purchases)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>79.6</td>
<td>34.5</td>
<td>13.5</td>
<td>19.5</td>
<td>12</td>
</tr>
<tr>
<td>2010</td>
<td>80.2</td>
<td>33.8</td>
<td>17.2</td>
<td>19.3</td>
<td>9.8</td>
</tr>
<tr>
<td>2015</td>
<td>88.7</td>
<td>36.5</td>
<td>23.1</td>
<td>19.6</td>
<td>9.5</td>
</tr>
</tbody>
</table>

Sums of categories may not exactly equal totals due to rounding.
2005 – 2015 Oregon consumption-based GHG emissions, by meta-category

- **2015**
  - Production and supply chain: 49.9 million metric tons CO2e
  - Transportation (pre-purchase & services to consumers)*: 4.4 million metric tons CO2e
  - Wholesale & retail: 4.4 million metric tons CO2e
  - Use: 29.3 million metric tons CO2e
  - Post-consumer disposal: 0.5 million metric tons CO2e

- **2010**
  - Production and supply chain: 42.5 million metric tons CO2e
  - Transportation (pre-purchase & services to consumers)*: 4.0 million metric tons CO2e
  - Wholesale & retail: 2.9 million metric tons CO2e
  - Use: 30.3 million metric tons CO2e
  - Post-consumer disposal: 0.4 million metric tons CO2e

- **2005**
  - Production and supply chain: 40.8 million metric tons CO2e
  - Transportation (pre-purchase & services to consumers)*: 3.5 million metric tons CO2e
  - Wholesale & retail: 2.9 million metric tons CO2e
  - Use: 31.5 million metric tons CO2e
  - Post-consumer disposal: 0.7 million metric tons CO2e
Comparison of Oregon’s 2015 sector-based and consumption-based GHG emissions

TOTAL EMISSIONS 114 MILLION METRIC TONS CO2e
SECTOR-BASED INVENTORY 63 MILLION MT CO2e
CONSUMPTION-BASED INVENTORY 89 MILLION MT CO2e
Are emissions trending upward? Or downward?
Oregon sector-based and consumption-based GHG emissions, 1990 - 2016
Drivers of change in Oregon consumption-based GHG emissions, 2005-2015

- Final demand (real dollars) per capita: -2.4%
- Population: 17.4%
- Final demand (real dollars): 10.7%
- Emissions intensity of consumption: 30.0%
- Total consumption-based emissions: 11.4%

David Allaway  | 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)
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

• Low-carbon purchasing
  ➢ Government purchasing toolkit (West Coast Forum)
  ➢ New purchasing initiative
  ➢ Attributes research (November 28 Forum webinar)
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
  ➢ Under development
Consumption-related programs and policies

• Grants
  ➢ Deconstruction and building material reuse
  ➢ Repair cafes
  ➢ Hot air dryers in schools
  ➢ Reusable food service ware
  ➢ 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, where appropriate (e.g., prevention and reuse)
materials management

conserving resources · protecting the environment · living well

david allaway  |  allaway.david@state.or.us
Bay Area Consumption-Based Greenhouse Gas Emissions Inventory

West Coast Climate & Materials Mgmt Forum
October 2, 2018

David Burch
Principal Environmental Planner
Bay Area Air Quality Mgmt District
San Francisco Bay Area
- 9 counties, 100 + cities
- ~ 8 million residents

Our Mission
- Improve air quality
- Protect public health
- Protect the climate

What we do
- Monitor air pollution levels
- Regulate emissions from factories & refineries
- Support State & local GHG reduction efforts
- Provide grants & incentives
- Collaborate with partners
- Public education
Why We Developed a CBEI

Why would an air quality regulatory agency develop a CBEI?

- Demonstrate leadership on climate
- Acknowledge responsibility for our full GHG contribution
- Identify emissions not shown in production-based GHG inventory
- Inform our 2017 Clean Air Plan
  - identify measures to strengthen our regional climate strategy
- Understand what drives the size & composition of GHG footprint
- Educate Bay Area cities and their residents about actions they can take to reduce consumption-based emissions
Bay Area CBEI

Methodology developed by UC Berkeley *Cool Climate Network*

- Year 2013 emissions of the “Kyoto 6” greenhouse gases
- Full life cycle analysis using best available data for Bay Area
- Attributes all emissions to the final consumer
  - regardless of location where emissions actually occurred
- Business sector is treated as an intermediary, not a final user
- Does not include emissions from government activities
- Highly granular: estimates avg GHG footprint for each of 4,700 Census block groups in Bay Area (~ 500-600 households)
- Provides a CBEI for each Bay Area city and county
Bay Area GHG Inventories by Major Category

Production-Based Inventory: Year 2013
- Transportation: 40%
- Industrial: 25%
- Commercial/Residential: 12%
- Agriculture: 1%
- Electricity/Co-Gen: 15%
- Landfills/Composting: 2%

Consumption-Based Emission Inventory: Year 2013
- Transportation: 32%
- Services: 18%
- Goods: 18%
- Housing: 13%
- Food: 19%
- Electricity/Co-Gen: 15%

Consumption-based inventory ~ 34% larger
US Average Household GHG Footprint

Average **49.8** metric tons CO$_2$e per household

- **Blue** = direct emissions
- **Green** = indirect emissions

### Breakdown of Contributions

- **Transportation**
  - 31%

- **Housing**
  - 26%

- **Food**
  - 18%

- **Goods**
  - 12%

- **Services**
  - 12%

### Breakdown by Category

- **Energy-Indirect**
  - Cereals
  - Fruits/Veggies
  - Other Food

- **Electricity**

- **Natural Gas**

- **Vehicle Fuel Direct**
  - Construction
  - Waste

- **Vehicle Fuel Production**

- **Other Goods**
  - Other Goods
  - Home Furnishings & Large Appliances
  - Clothing
  - Small Appliances & Entertainment Equip.

- **Services**

- **Composting & Recycling**

- **Air Travel**
Average 44.3 metric tons CO$_2$e per household

Blue = direct emissions
Green = indirect emissions

- Transportation: 33%
- Housing: 14%
- Food: 19%
- Goods: 17%
- Services: 17%
GHG Emissions from Food Sector

- Food is GHG-intensive
  - accounts for ~ 10% of total expenditures
  - but 19% of Bay Area GHG emissions

GHG Intensity per Kilo of Food

Red meat & dairy products are GHG-intensive

- Beef
- Lamb
- Cheese
- Pork
- Chicken
- Eggs
- Milk, nuts
- Cereals, fruits, vegetables

Reducing GHG Emissions from Food

Food Production
• Reduce waste
• Improve efficiency
• New technologies
• “Carbon farming”

Food Consumption
• Plant-based diet
• Less processed food
• Reduce waste
• Eat with the season
• Buy local

Tactful messaging on diet is key
Key Factors in GHG Footprint

GHG footprint varies in **size & composition**

Cool Climate Network model includes 30+ factors

But **6 factors account for 93% of variation** in GHG footprint

- household size (# people)
- household income
- size of home (square footage of dwelling unit)
- population density of neighborhood
- carbon intensity of electricity
- vehicle ownership rate
GHG Emissions and Household Income

• Household income has strong influence on both size & composition of GHG footprint
• Especially in relation to transportation, goods, services
  - income & air travel are highly correlated
• Lower income households spend larger portion of income on basic food & shelter
• As income increases, people spend more on discretionary goods & services
• Quality vs quantity
Local Variation in GHG Footprint

- Large variation in **size** and **composition** of GHG footprint
- GHG footprint is generally lower in urban core areas
  - smaller homes, lower vehicle ownership rate, better transit
- Variation between Census block groups: ratio of 7 to 1
- Variation within (large cities): ratio of 4 or 5 to 1
- Variation between cities: ratio of 3 to 1
- Should we consider this variation in crafting emissions reduction efforts?
CBEI Products

- Inventory tables & graphs at regional, county, and city scale
- Maps showing GHG footprint at fine-grained local scale

Total Emissions

Marin County

Total Emissions (CO2e) Per Household

- 0 - 30.1
- 30.2 - 34.7
- 34.8 - 37.7
- 37.8 - 40.5
- 40.6 - 43.3
- 43.4 - 46.5
- 46.6 - 49.9
- 50.0 - 54.2
- 54.3 - 61.3
- 61.4 - 103.7
The pie chart below shows a breakdown of the key sectors contributing to the total CO2e emissions. Hover over the pie chart for additional information.
GHG Emissions from Transportation by Block Group
Food Emissions
Opportunities

Reduce GHG emissions from both production & consumption sides

Embrace circular economy
• Improve efficiency
• Promote re-use
• Reduce waste

Use market signals
• Carbon tax
• Labeling of GHG emissions (disclosure & transparency)

Consumer education
• Promote low-carbon diet: Plant-based foods / less processed food
• Avoid high-GHG goods; consume low-GHG services
Establish embodied GHG emission standards for key products

California’s “Buy Clean Act” (AB 262, 2017):

- Requires State to establish “global warming potential standards by 1/1/2019: steel, glass
- Contractors for State-funded projects must submit an Environment Product Declaration to demonstrate compliance
How Bay Area AQMD is Using CBEI

• Included a section on “conscientious consumption” as part of long-range vision in our 2017 Clean Air Plan

• Encouraging climate planners in Bay Area cities to consider local variation in emissions footprint

• Working to educate Bay Area residents about most effective ways to reduce their GHG footprint

• Reducing emissions from food:
  - Building partnerships w food service providers
  - Climate-Friendly Cuisine conference on Sept 11
  - Webinar for local climate planners on Oct 22
Key Insights

• Consumption-based emissions exceed production-based emissions in developed economies
• Need to consider this “carbon loophole” or “leakage”
• Large variation in size & composition within Bay Area cities
• Food is major GHG source – should not be ignored
• Government agencies cannot do it alone
• CBEI provides valuable info for public education
For Additional Information

www.baaqmd.gov/plans-and-climate/climate-protection

http://coolclimate.berkeley.edu/inventory

• Final Report for Bay Area CBEI
• Tables & graphs showing data for each city and county
• Interactive maps re: GHG footprint by Census block group
• Dave Burch: Dburch@BAAQMD.gov
• Dr. Chris Jones: cmjones@berkeley.edu
• The Carbon Loophole (Aug 2018)
Basic Approach

Estimate GHG footprint of average household:
- **Transportation, Housing, Food, Goods, Services**

Highly granular: each of 4,700 Census block groups in Bay Area

• **Step 1:** Develop a consumption profile for each Census block group
• **Step 2:** Multiply consumption inputs x life-cycle emissions factors
• **Step 3:** Add emissions for each product or service to calculate total GHG footprint
Data Sources

- **Household demographics**: household size, income, etc.
  - US Census, American Community Survey & other sources

- **Transportation**: vehicle travel, air travel, etc.
  - National Household Travel Survey

- **Housing**: home size, energy & water consumption, recycling rate
  - electric, natural gas & water use data from utilities

- **Food**: Diet info from USDA & BLS Consumer Expenditures Survey

- **Goods & Services**:
  - Bureau of Labor Statistics Consumer Expenditures Survey
  - *Input-Output Life Cycle Assessment Model*
Life Cycle Emissions for Automobile

**Upstream**
- **Individual Parts**: Production, including upstream emissions for each part
- **Vehicle Assembly**
- **Shipping to Dealer**

**In-Use**
- **Fuel Consumption**
  - Fuel economy
  - Fuel type
  - Driving conditions

**Downstream**
- **Landfill**
- **Recycling / re-use (credit)**

- Upstream emissions from refining gasoline
- Vehicle Maintenance