



Dane County Consumptions Based Emissions Accounting

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Outline

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2. Literature Review
3. Interview with Dr. Chris Jones
4. Dane County Production vs Consumption-Based Emissions
5. Discussion
6. Dane County CAP Priorities
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1. Introduction & Background Information



Paris Climate Agreement to limit warming below 1.5°C

Global greenhouse gas emissions and warming scenarios

Our World
in Data

- Each pathway comes with uncertainty, marked by the shading from low to high emissions under each scenario.
- Warming refers to the expected global temperature rise by 2100, relative to pre-industrial temperatures.

Annual global greenhouse gas emissions
in gigatonnes of carbon dioxide-equivalents

150 Gt

100 Gt

50 Gt

Greenhouse gas emissions
up to the present

0

1990 2000 2010 2020 2030 2040 2050 2060 2070 2080 2090 2100

No climate policies

4.1 – 4.8 °C

→ expected emissions in a baseline scenario
if countries had not implemented climate
reduction policies.

Current policies

2.5 – 2.9 °C

→ emissions with current climate policies in
place result in warming of 2.5 to 2.9°C by 2100.

Pledges & targets (2.1 °C)

→ emissions if all countries delivered on reduction
pledges result in warming of 2.1°C by 2100.

2°C pathways

1.5°C pathways



Complementary and overlapping views on carbon emissions

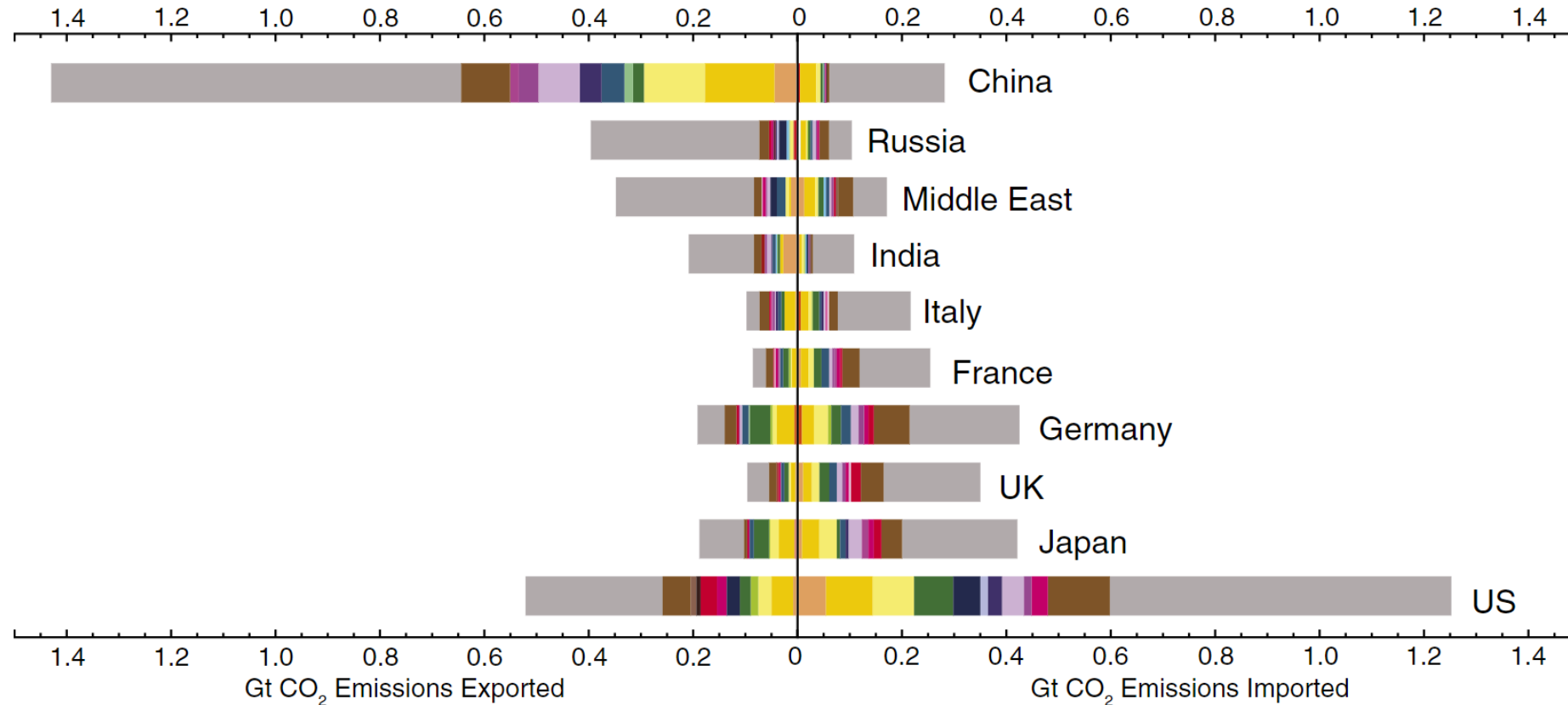
Production

- Boundaries are rigidly defined based on scope
 - State inventory would end at state borders
- Effectively omits emissions due to trade
 - All emissions required to import a product (transportation, services, etc)

Consumption

- Boundaries are undefined so long as directly or indirectly related
 - Emission contributions could be located outside of borders
- Omits emissions from most direct production
 - Emissions produced from local businesses
 - Vehicle emissions included, typically

Observed discrepancies between reporting methods



Dane County Climate Action Plan, p. 64



- *It is important to recognize that our actions here in Dane County result in GHG emissions elsewhere. An example of this is that the petroleum-powered vehicles we drive here result in GHG emissions where the petroleum oil is extracted, where the oil is refined and shipped here to our gas stations, and where the vehicles are manufactured and shipped here. All those steps result in GHG emissions outside of Dane County. Shipping vegetables and fruit grown in California would be another example. The modeling discussed below does account for most of the energy related emissions we cause outside, or upstream, of Dane County, such as oil drilling, refining, and transport. **The model does not have enough information to include the GHG emissions caused by most of the non-energy products we purchase and consume here, such as veggies and fruit grown in California.***



Impact on Dane County's Climate Action Plan six priorities

- Equity
- Economic Benefits
- Health Benefits
- Resilience
- Rural-urban cooperation
- Ecosystem Benefits



2. Literature Review



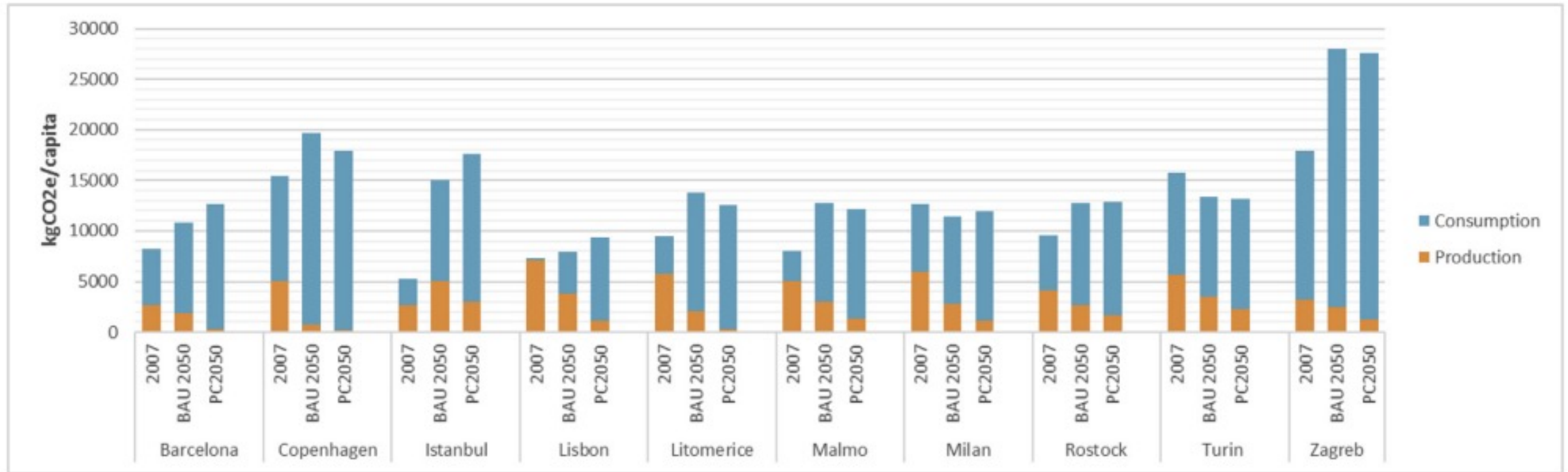


Literature review included:

- Peer-reviewed papers, white papers, conference proceedings, government documents, and non-governmental organization (NGO) documents, and newspaper articles
- Local Governments for Sustainability (ICLEI, an NGO)
- (2) CoolClimate Network/EcoDataLab reports
- NYT article re: CoolClimate Network
- Dane County Climate Action Plan (2020)
- Dane County emissions data

City-Level:

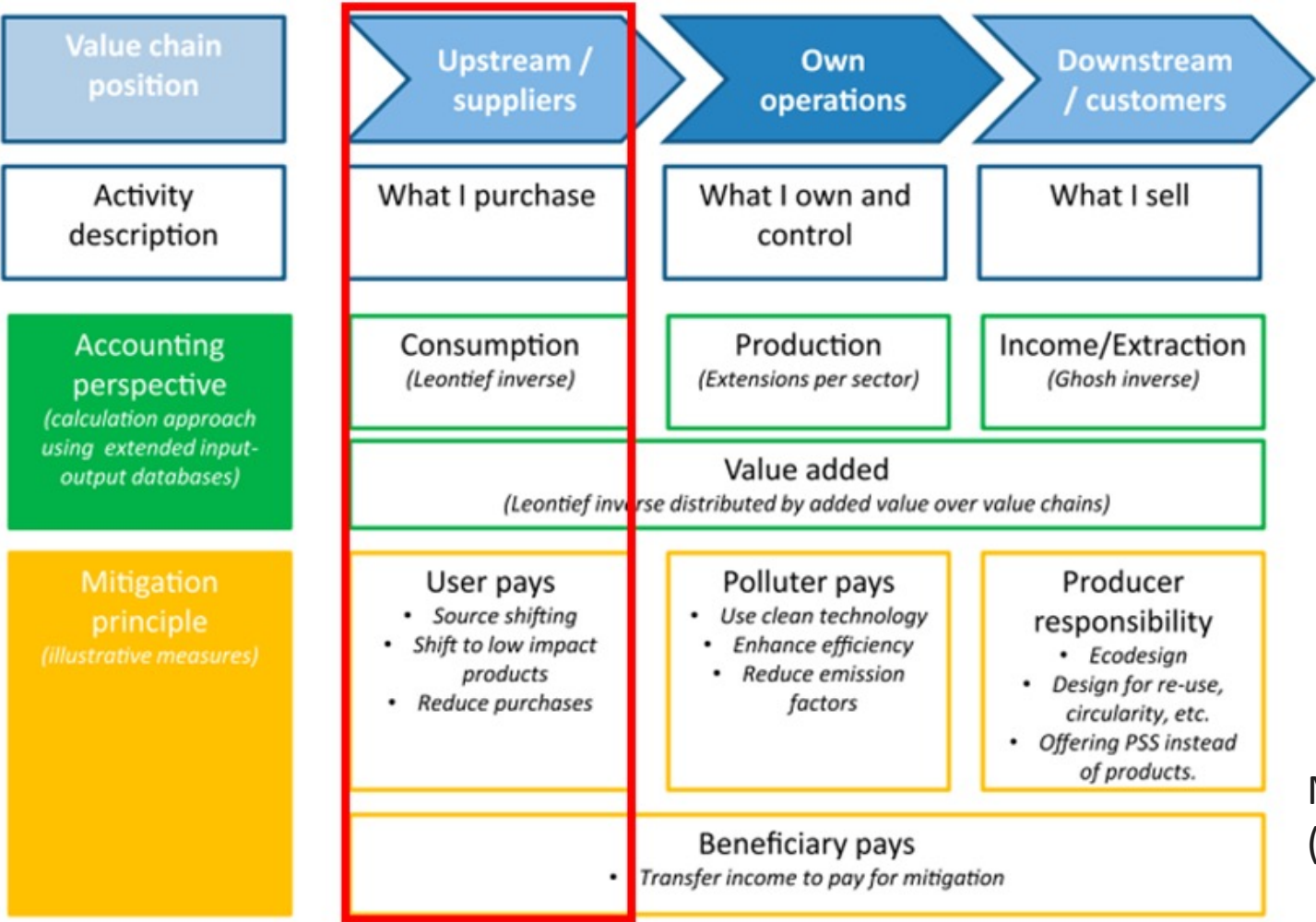
Comparison of Consumption vs Production Emissions per capita



Ref: Harris et al., (2020)

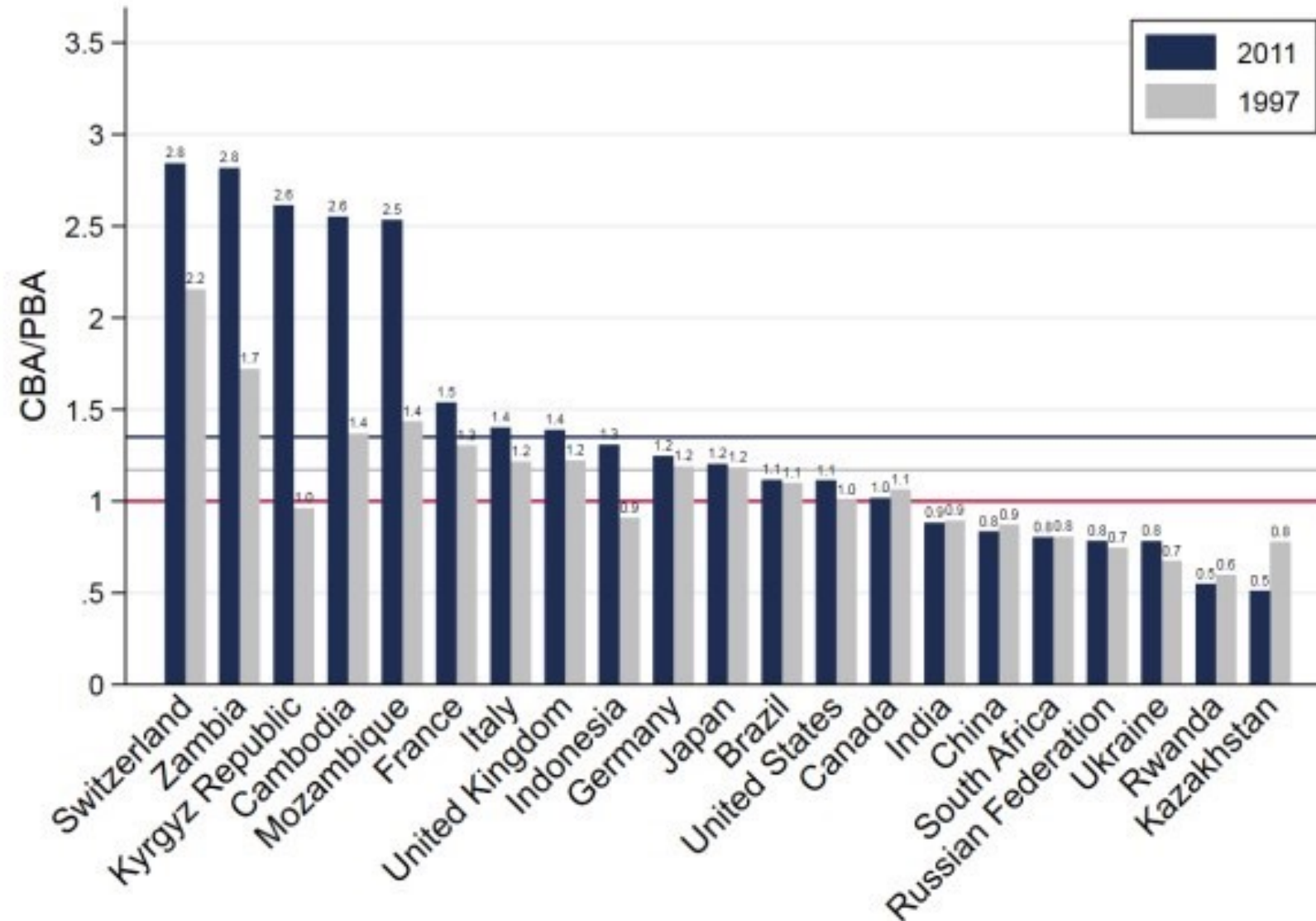
Different Accounting Perspectives and Related Mitigation Measures

Consumption-based accounting



Millward-Hopkins et al.,
(2017)

CBA:PBA ratios for OECD and non-OECD countries



Franzen and
Mader (2017)

Local Governments for Sustainability



- Global organization for advancing sustainable urban development, particularly through influencing policies that work towards low emissions
- 2500+ local and regional governments—including Dane County, and spans 125+ countries
- Reports that 45% of global emissions relate to consumption habits, with a focus on land management, production of buildings, vehicles, food, and consumer goods and services.
- A Consumption-Based Emissions Inventory Cohort was launched through ICLEI to provide technical assistance to up to 15 ICLEI-member cities or counties to create a **“consumption-based greenhouse gas inventory as a baseline to support local policies and programs to operationalize the transition to a circular economy from infrastructure, business and community perspectives.**

ICLEI: Consumption-Based Emissions Inventory Cohort

7 Sessions (April 2021 – Oct. 2021)

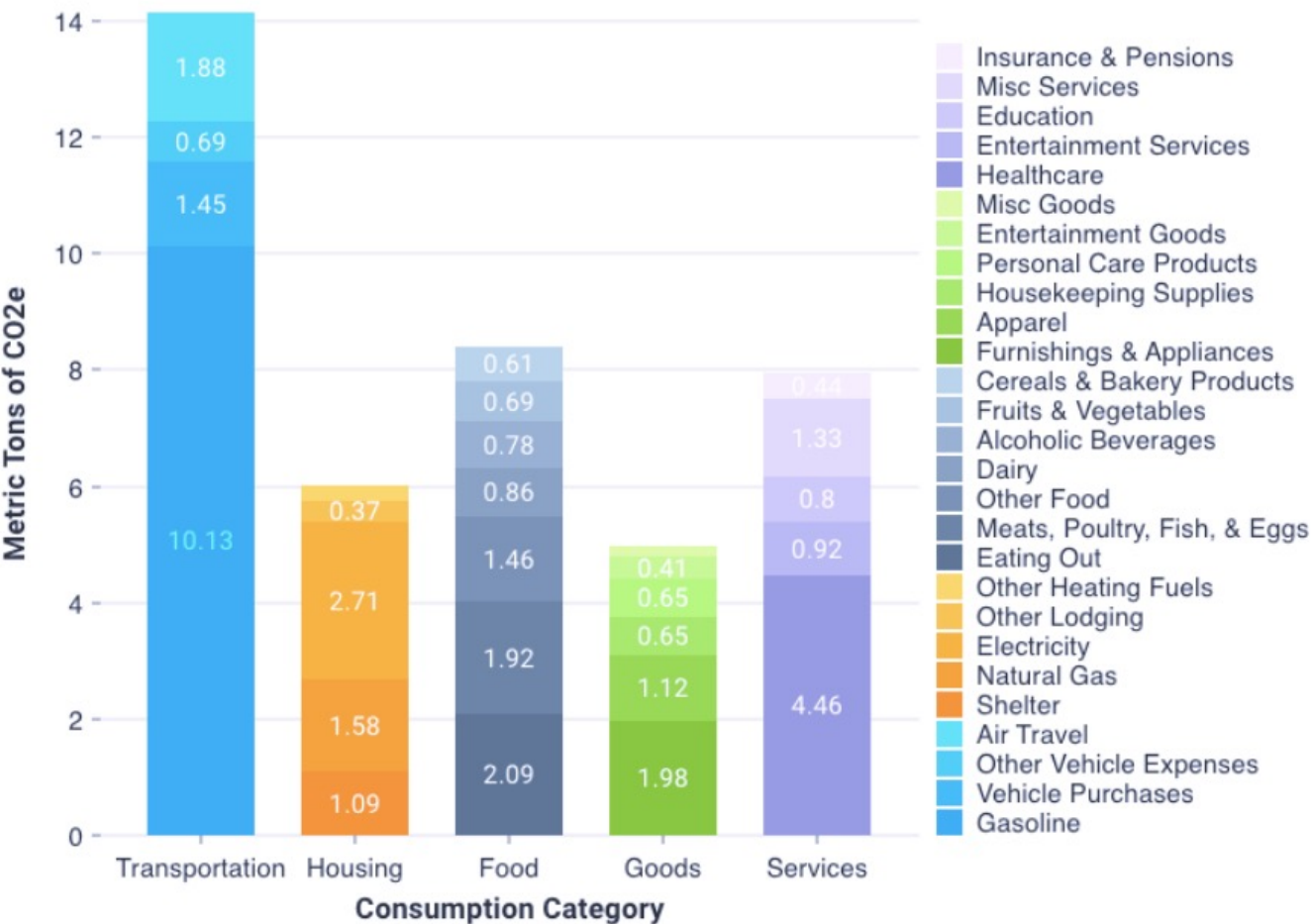


- *Session 1: Intro to consumption-based inventories*
- *Session 2: Survey design and dissemination*
- *Session 3: Downscaling and adjusting data*
- *Session 4: Understanding life cycle emissions factors*
- *Session 5: Round robin comparison of results*
- *Session 6: Policies, communicating results*
- *Session 7: Takeaways and next steps*



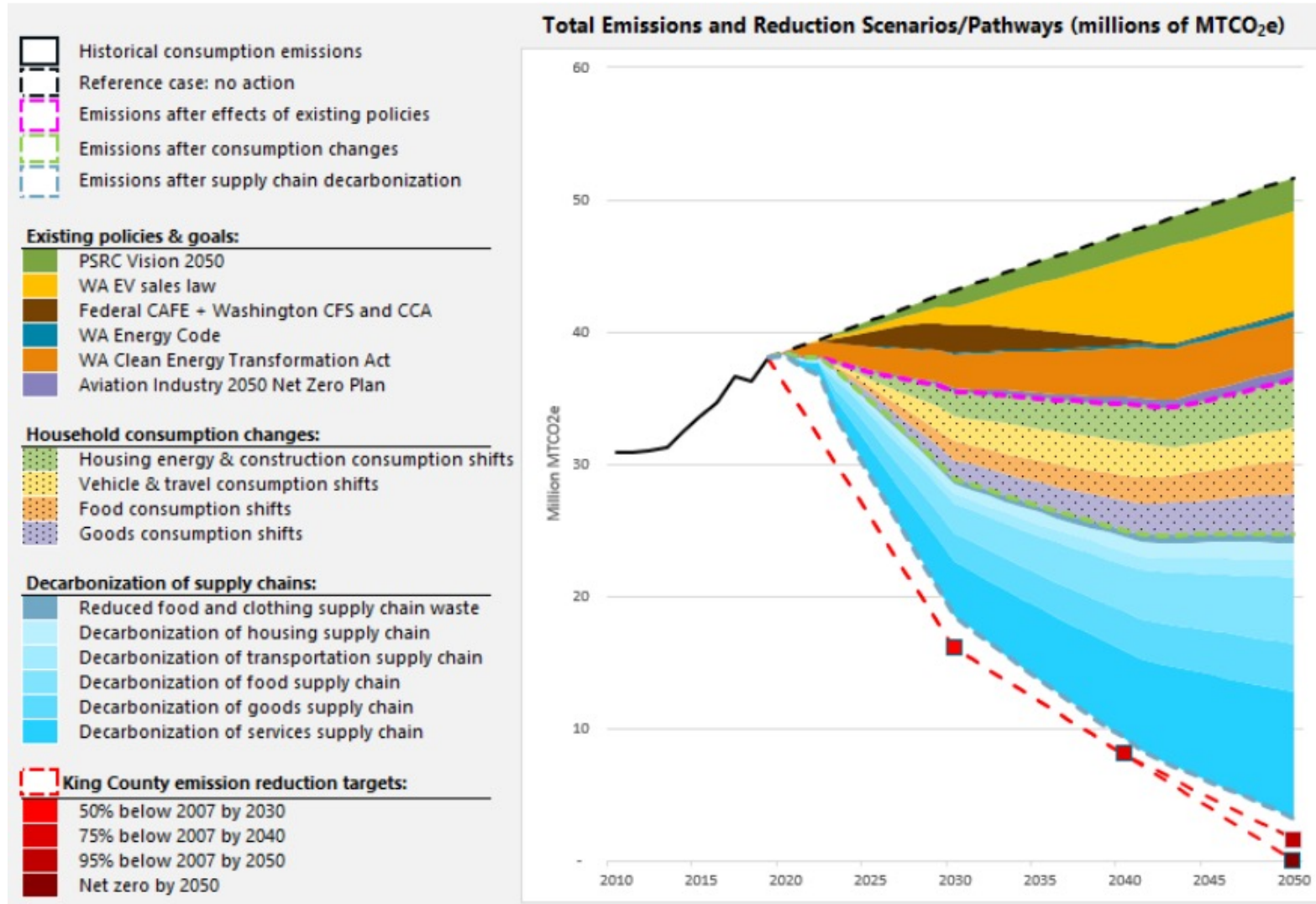
CoolClimate Network/EcoDataLab: local CBEIs

San Francisco (California), 2020



CoolClimate Network/EcoDataLab: local CBEIs

King County Report (Washington), 2022





3. Interview with Dr. Chris Jones





EcoDataLab model is a large, profitable and growing work

- CoolClimate Network rotates 20-40 students annually to aid in emissions modelling
- Students usually have data science background along with environmental studies education
- Model results projected at city-block resolution
- Ultimate goal is to develop metabolic analysis of emissions across geographies
- Issues with Austin, Texas inventory due to limited staffing

EcoDataLab's CBEI algorithm

- Selection of a nation-wide survey to establish estimates travel behavior, consumer expenditures and energy consumption
- Key household characteristics, like household size, income, vehicle ownership etc. are identified and data is gathered from sources like census and ACS
- The survey results and household characteristics are run through a multiple linear regression, to identify how strongly these variables correlate with each other. The program is built to seek household and geographic characteristics and learn to predict survey results.

$$y = m_1x_1 + m_2x_2 + m_3x_3 + \dots + b$$

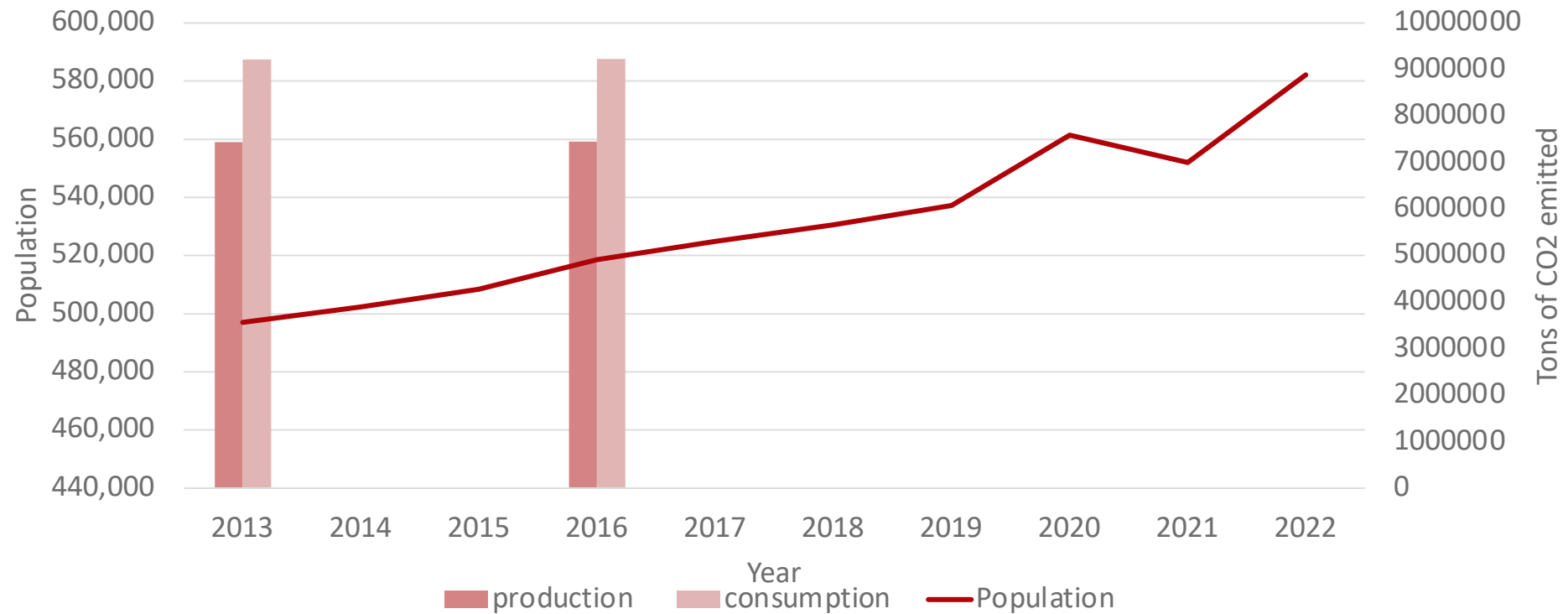
x_n is a different household or geographic characteristic,

m_n is a unique correlation coefficient

- Once a predictive model is built, it is run using local data, gathered from a variety of sources, and based on client request. Using US EPA's USEEIO Model and EIA's eGrid emission factors, final emissions are calculated.



4. Dane County Production vs Consumption-Based Emissions



Agency	Method	Publishing Year	Total Emissions (tons of CO2 per year)
Dane County	Production based	2017	7,439,781.397
CoolClimate Network	Consumption based	2014	9,215,735



5. Discussion





Double Counting & Discrepancies

- Prolific issue when cities or counties utilize production-based emissions inventories
- Consumption inventories by themselves don't solve the issue of double-counting; different components are just doubly counted
- Most governments solve double-counting by comparing consumption and production inventories along with locally filed inventories from firms
 - Manual revisions of double-counting is tedious but has been documented to be successful, this is also partially outsourced



Feasibility For Dane County

- Not currently feasible for Dane County due to its present human capacity.
- Collaboration between Dane County and UW Madison for robust emission data creation.
- Data privacy concerns the present information.



6. Dane County CAP Priorities

Dane County CAP Priorities



Six Additional CAP Priorities for Dane County	Potential Actions	Potential Outcomes
1. Equity	a. Zoning requirements and building codes. b. Access to low-cost clean energy programs.	a. An increase in housing density with access to public transportation will improve equitable access to jobs and affordable housing. b. Lower utility bills for those that need it most.
2. Economic benefits	a. Circular economy and local supply chain support. b. Workforce training for new “green energy” jobs	a. More local industry/supply chain may lead to local business/economic development. b. Job creation for potentially higher wage jobs.
3. Health benefits	a. Renewable energy access (and discontinued coal use) b. Zoning requirements	a. The phase out of coal will result in less air pollution, which has disproportionate negative healthy consequences for low-income, minority communities. b. More walkable, bike-friendly cities will lead to a healthier population from increased walking/biking.

Dane County CAP Priorities



Six Additional CAP Priorities for Dane County	Potential Actions	Potential Outcomes
4. Resilience	a. Decentralization of the electric grid (make clean energy microgrids available)	a. Creating microgrids that use clean energy and have backup energy sources available will lead to a resilient grid when needed.
5. Rural-urban cooperation	a. Electric vehicle (EV) charging stations to promote EV transition, particularly in more rural areas b. Clean energy development in rural areas (wind and solar)	a. EV usage in lieu of combustion engine vehicles will require joint rural-urban coordination and planning to ensure transportation reliability across geographies. b. Clean energy advancements will lead to new revenue streams in rural areas and clean energy access for both rural and urban populations.
6. Ecosystem benefits	a. Thoughtful zoning and natural habitat protection when considering new developments/construction b. Agrivoltaics development	a. Preserving natural resources that enhance carbon sequestration (i.e. forests and bogs) will help mitigate the effects of climate change b. Pollinator-friendly native plants and soil rehabilitation

7. Recommendations

- CBEI should be used with PBEI as a complement for carbon emission accounting due to political dimension for policy administration.
- More focus on CBEI methodology to provide consistency between consumption and environmental impacts.



Specific Recommendations

1. Dane County should pursue consumption *and* production-based inventories – useful for informing policy decisions
2. ICLEI consumption-based emissions cohort schedule to be used as a template for assisting to facilitate collaboration amongst several localities within Wisconsin – community driven effort
3. Should Dane County pursue consumption inventories we *strongly* advocate for transparency in methodology and reproducibility of results
4. Development of open-source local-level consumption-based emission inventory model through UW-Madison – promotes transparency in methodology and reproducibility
5. Reliable consumption-based results to be used to prioritize actions and inform policy – can be used to understand efficacy of current policies, programs and incentives along with their projected emissions reductions

