

Categorization of Scope 3 Emissions for Streamlined Enterprise Carbon Footprinting

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Background

- **Carbon footprint**= Greenhouse gas (GHG) emissions resulting from products or activities
- **Initiatives by progressive states and corporations:**
 - Carbon Disclosure Project (CDP):
 - 275 of Global 500 companies report GHG emissions.
 - 206 have reduction target.
 - The Climate Registry (N America): 350 members.
 - States: CA, CO, ID, MA, MD, MN, NC, NV, NY, SC, UT, VT, WA
- **Many organizations, many protocols/standards:**
 - *Examples:* WRI/WBCSD, BSI PAS 2050, ISO 14064, The Climate Registry, ICLEI Local Government for Sustainability

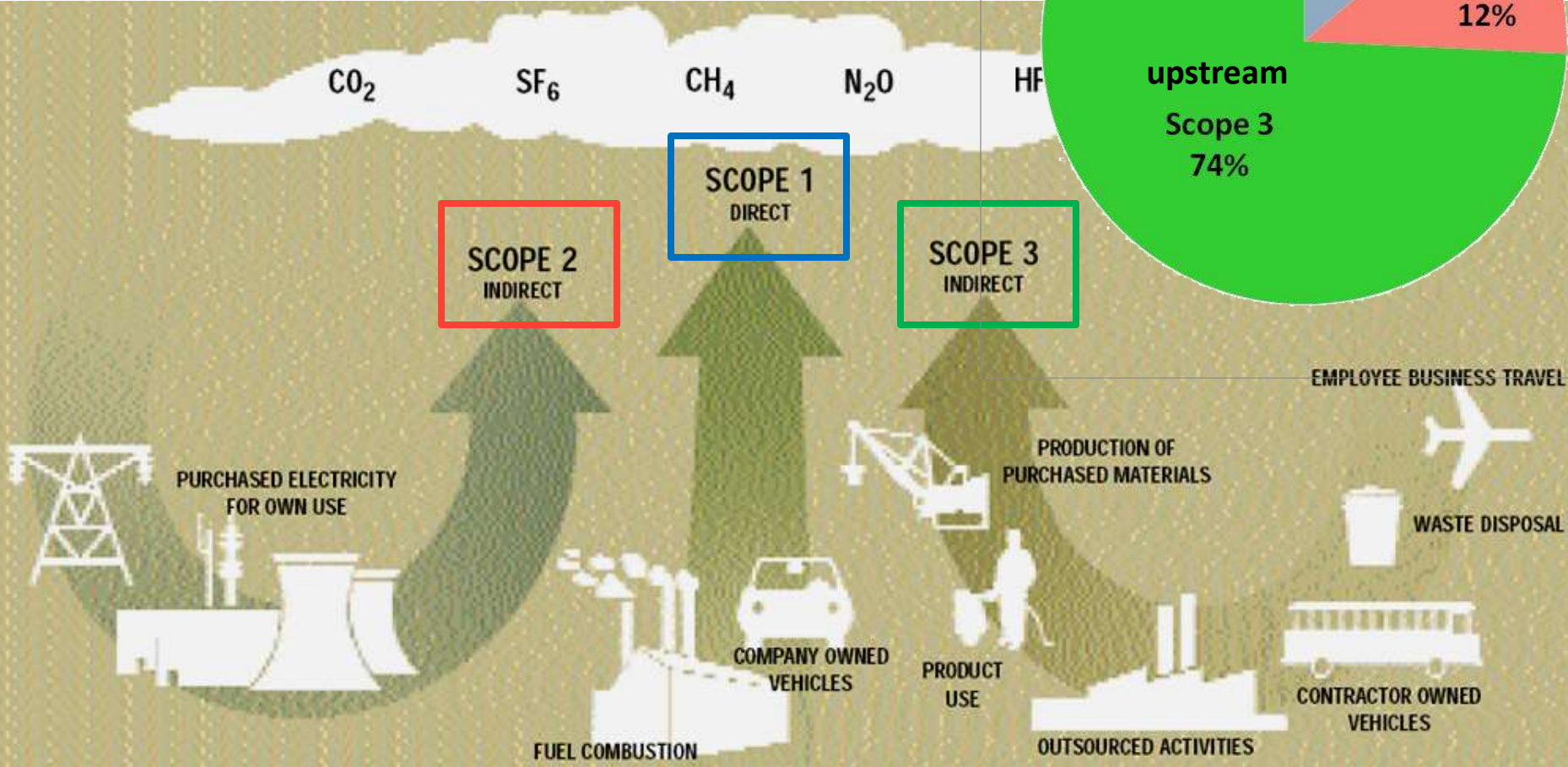
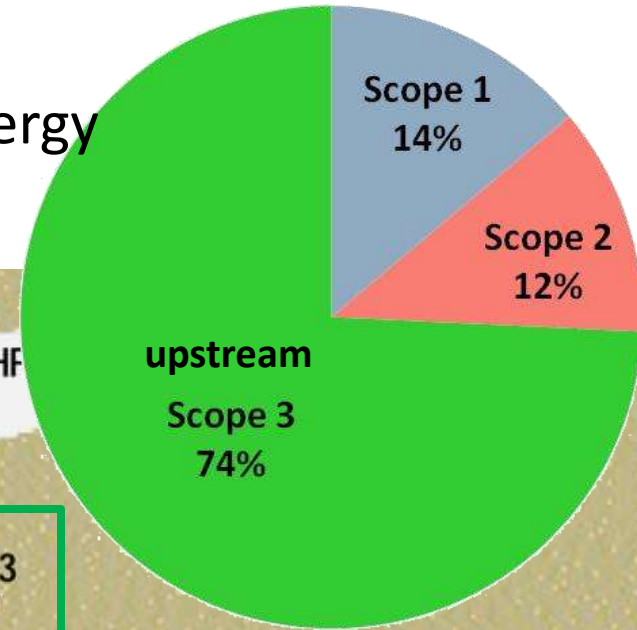
Protocol Scopes

Economy-wide average

Scope 1: direct emissions

Scope 2: emissions from direct purchases of energy

Scope 3: everything else (optional)



Objectives

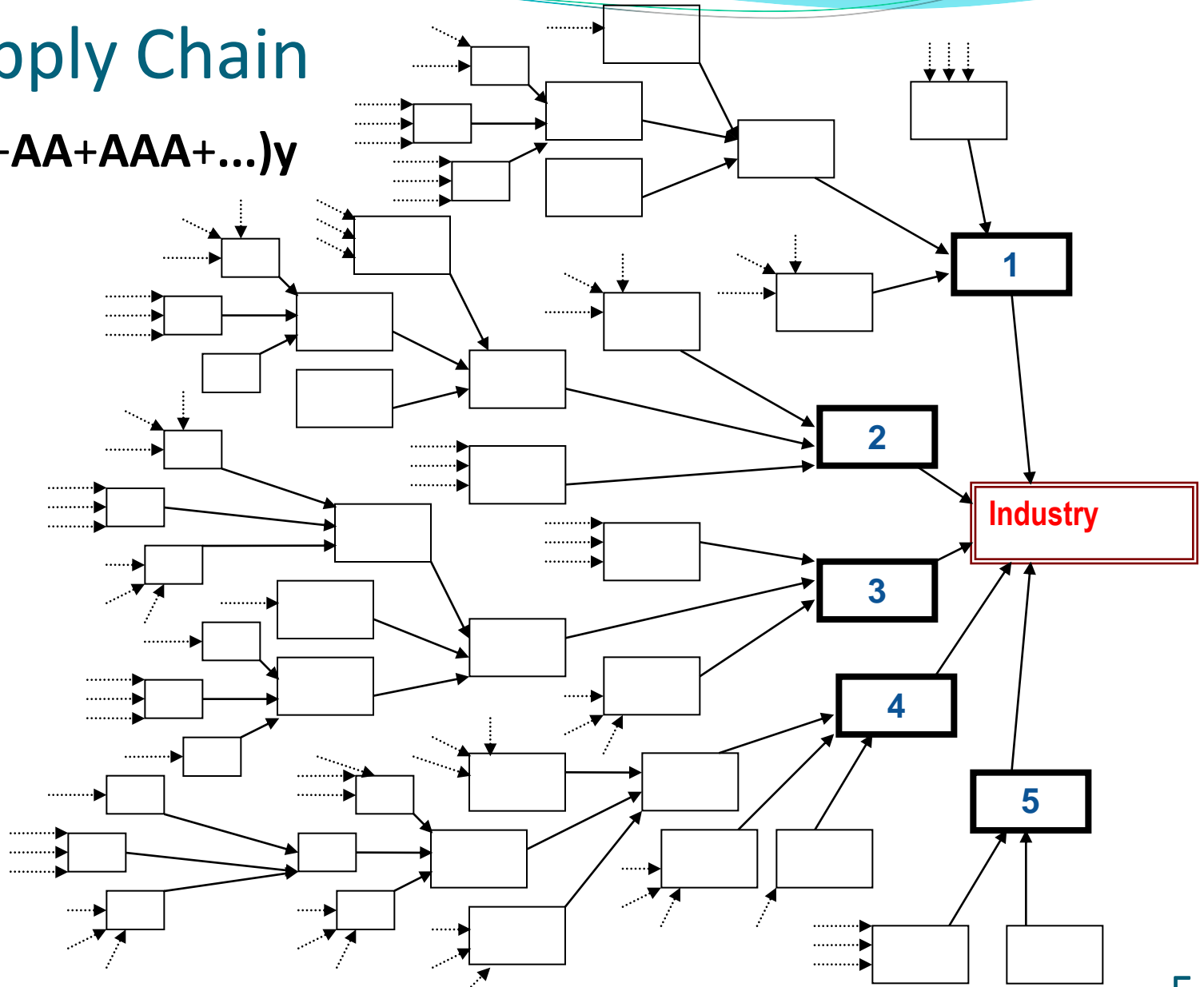
- What Scope 3 sources to include in the footprint?
- How can carbon footprint guidelines help stakeholders prioritize efforts?
- How *sector-specific* should Scope 3 guidelines be?

Approach

- Advanced input-output modeling technique
- Consistent framework for all 426 sectors in the US economy
- High level screening analysis: identify significant sources of upstream emissions in the supply chain

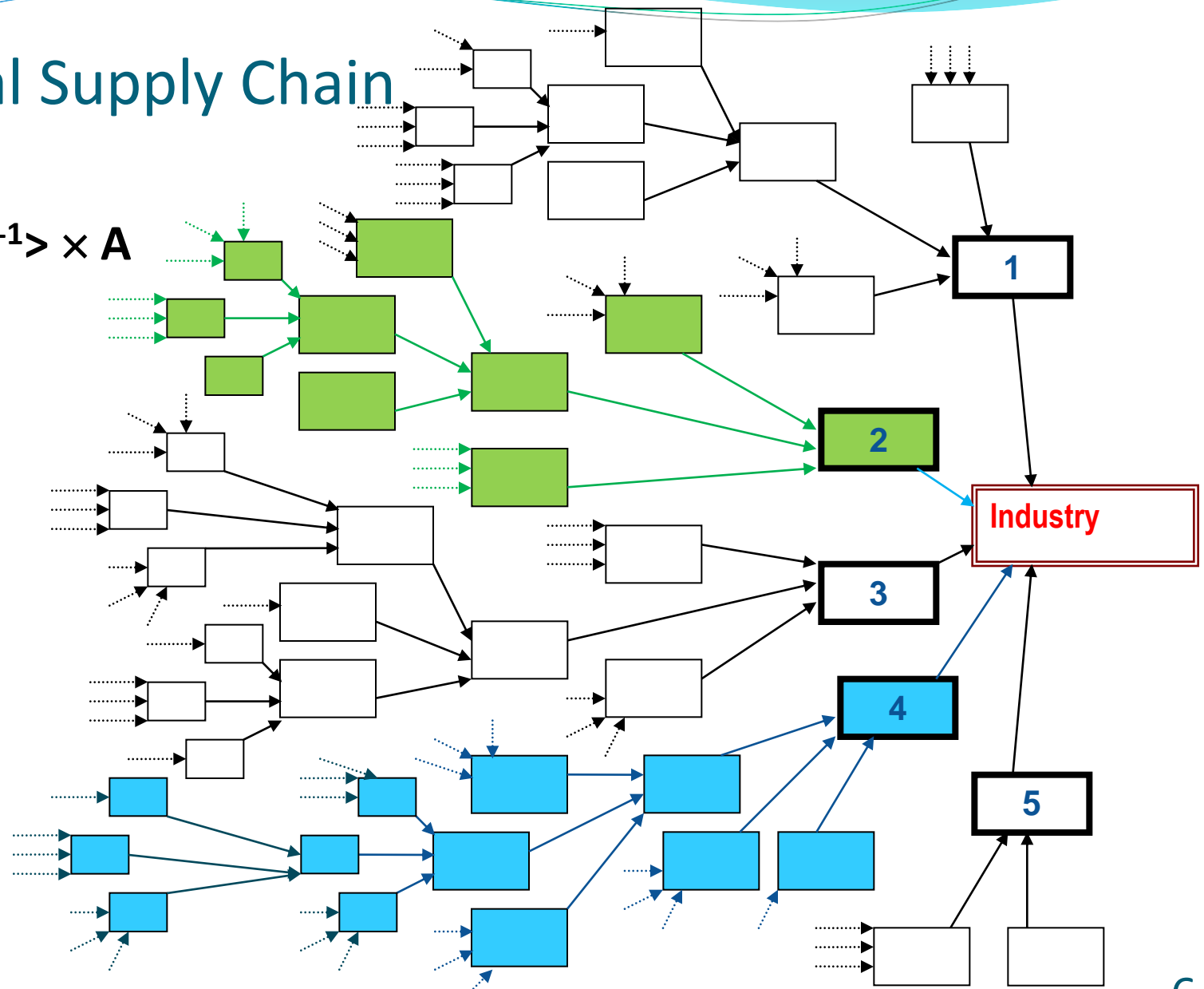
Supply Chain

$$b_i = R_i(I+A+AA+AAA+\dots)y$$
$$= R_i(I-A)^{-1}y$$



Sub-Total Supply Chain (STSC)

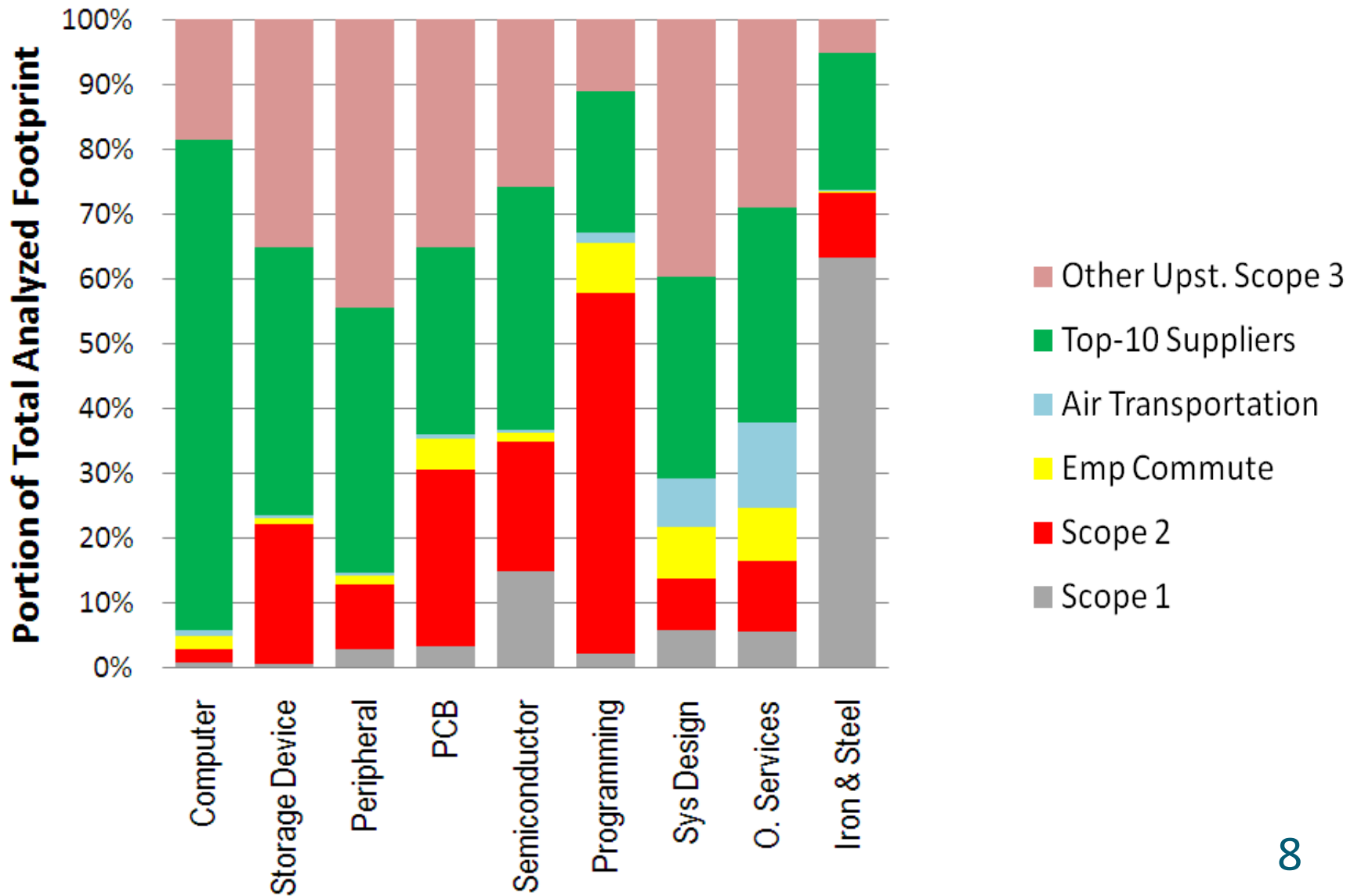
$$B_i = \langle r_i (I-A)^{-1} \rangle \times A$$



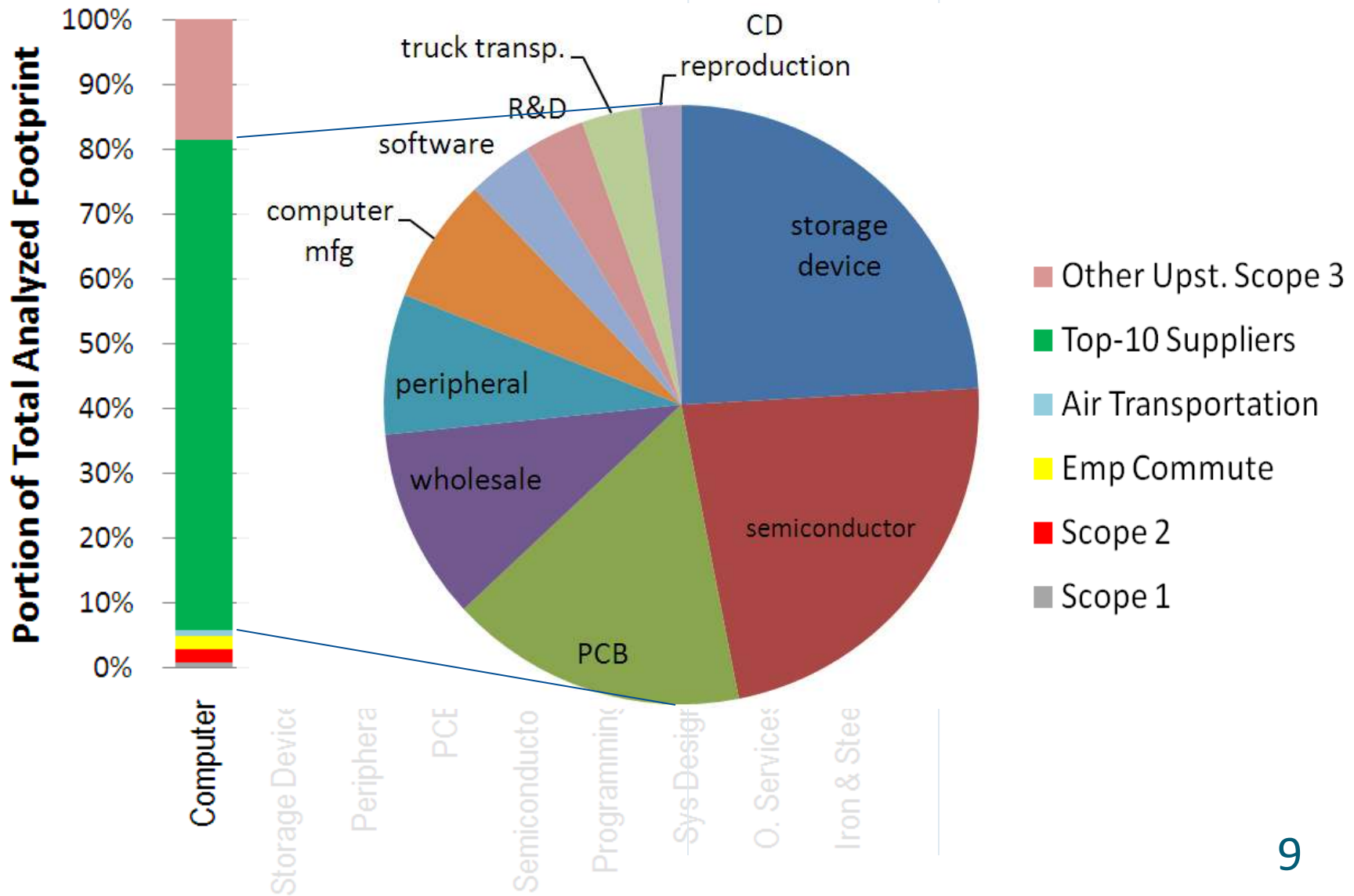
Employee Travel

- in Scope 3 (WRI/WBCSD GHG Protocol)
- Relatively easy to quantify: local data sources, no significant data collection from suppliers
- Companies can influence directly
- **Business travel:** already accounted for in basic IO tables, but need special transportation table to separate passenger vs. freight transport
- **Commute:**
 - BTS Census Transportation Planning Package: commute modes for employees in 14 aggregated industries
 - DOE Transportation Energy Data Book: energy, fuels use, and CO₂ intensity for public transit and commute data
 - EPA: average fuel efficiency for cars

Carbon Footprint Profile by STSC- Examples

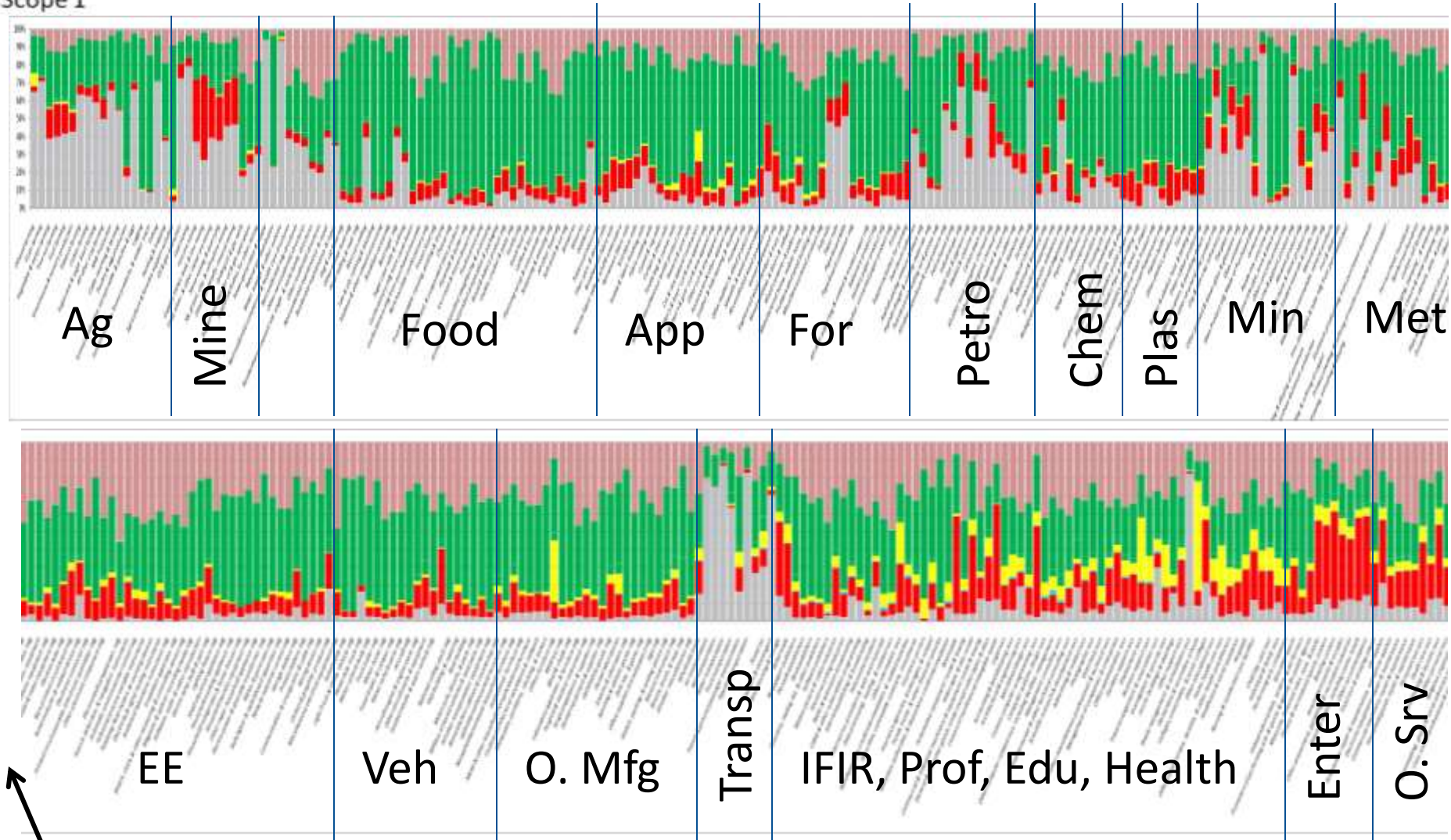


Carbon Footprint Profile by STSC- Examples



- Other Upstream Scope 3
- Scope 3: Top-10 Suppliers STSC
- Scope 3: Commute
- Scope 2
- Scope 1

426 Sectors View; 24 Industry Groups

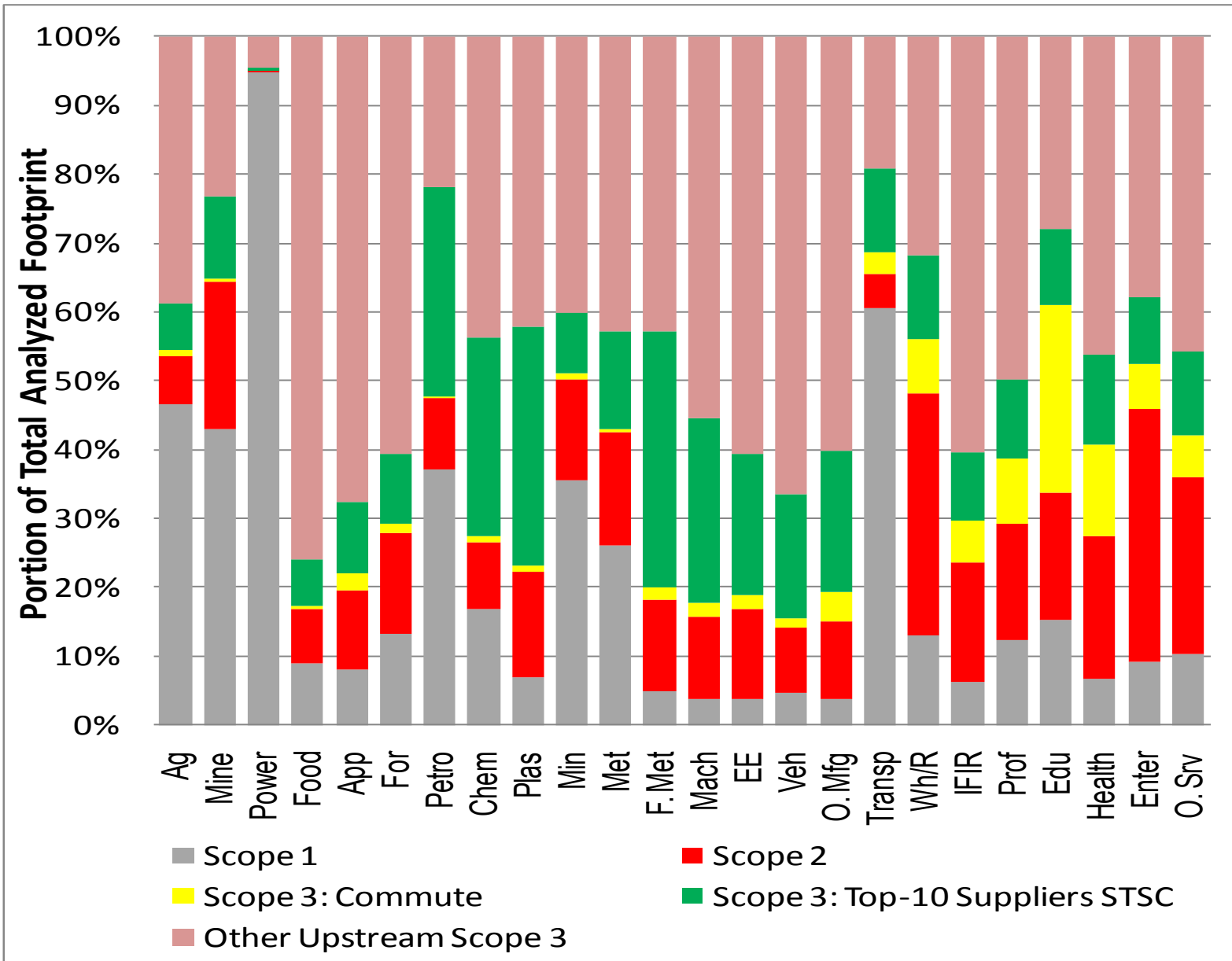


Not shown: F. Met, Mech

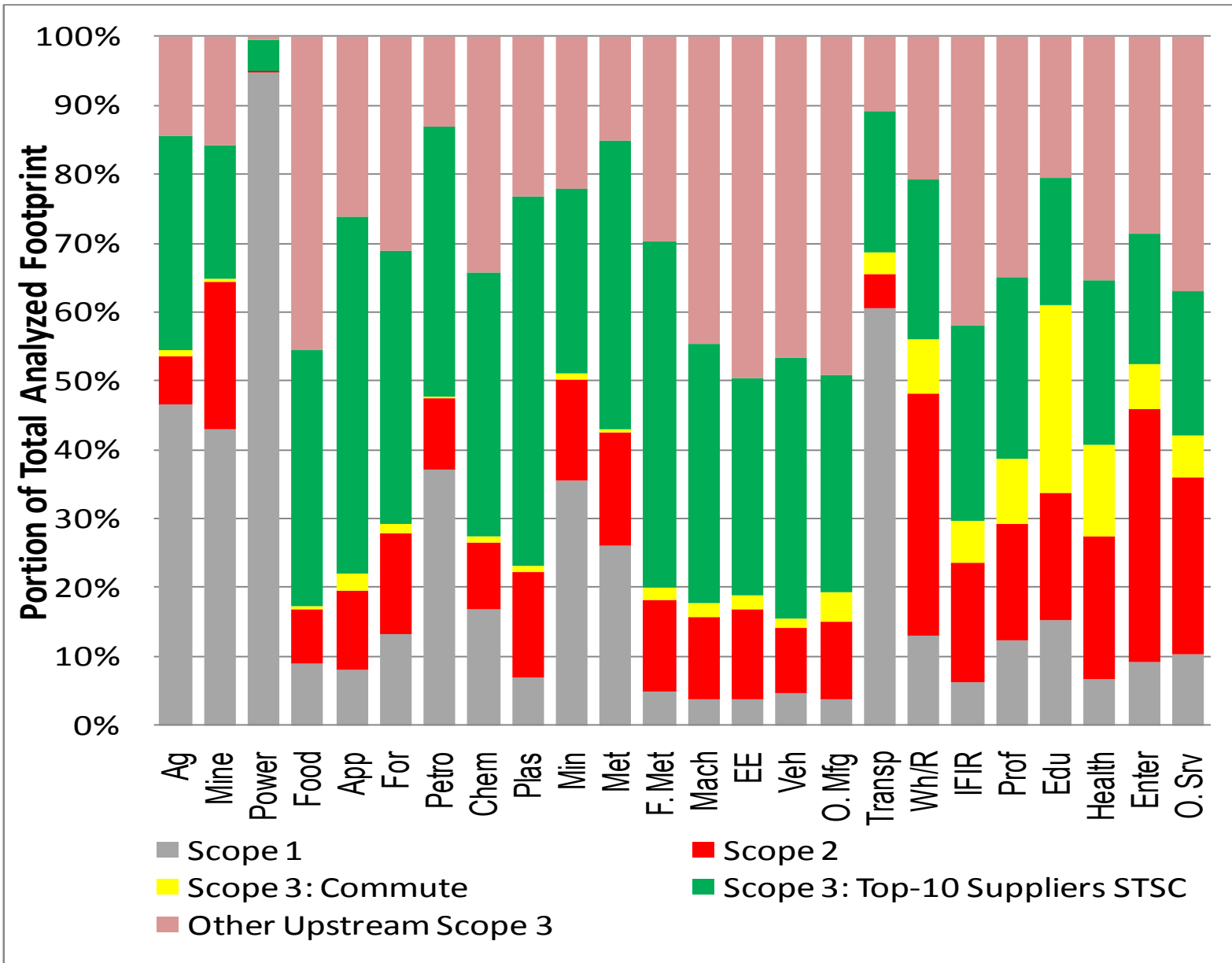
General Economy-Wide Top Suppliers List

Top Supplier Sectors by STSC	% Portion of TAF Captured		Number of Appearances in Top-10 Lists	
	Rank ¹	% mean (range ²)	% Appearances ³	Rank
Iron and steel mills	1	5.2 (0 , 19.4)	27%	3
Truck transportation	2	2.1 (0.6 , 3.7)	60%	2
Petroleum refineries	3	1.9 (0.1 , 3.8)	25%	4
Plastics material and resin manufacturing	4	1.6 (0 , 4.3)	17%	9
Other basic organic chemical manufacturing	5	1.4 (0 , 2.9)	18%	8
Wholesale trade	6	1.2 (0.2 , 2.3)	20%	6
Real estate	7	1.1 (0 , 3.6)	22%	5
Motor vehicle parts manufacturing	8	1 (0 , 1.2)	8%	23
Other plastics product manufacturing	9	0.9 (0 , 2.7)	16%	11
Grain farming	10	0.9 (0 , 0)	7%	27
Alumina refining and primary aluminum production	11	0.9 (0 , 2.1)	10%	18
Paperboard container manufacturing	12	0.9 (0 , 2.5)	16%	10
Air transportation	13	0.9 (0.1 , 2.2)	13%	13
Scope 3 portion of of tier-1 power generation & supply	14	0.8 (0.2 , 1.5)	15%	12
Plastics packaging materials, film and sheet	15	0.8 (0 , 2.2)	12%	16
Natural gas distribution	17	0.8 (0.2 , 1.7)	19%	7
Paperboard Mills	19	0.7 (0 , 0.8)	6%	29
Animal (except poultry) slaughtering and processing	20	0.7 (0 , 0.6)	7%	25

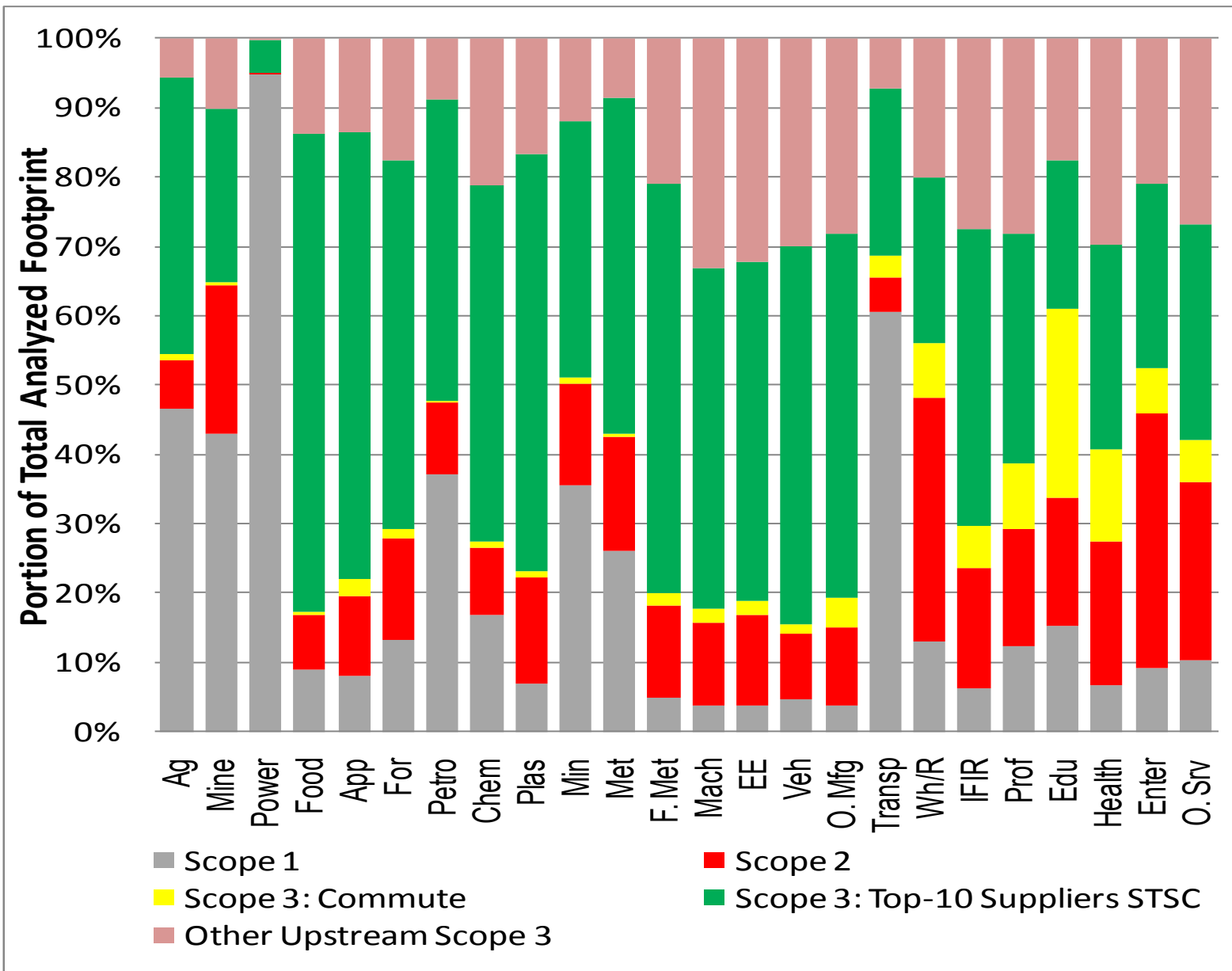
General Economy-Wide Top-10 Suppliers



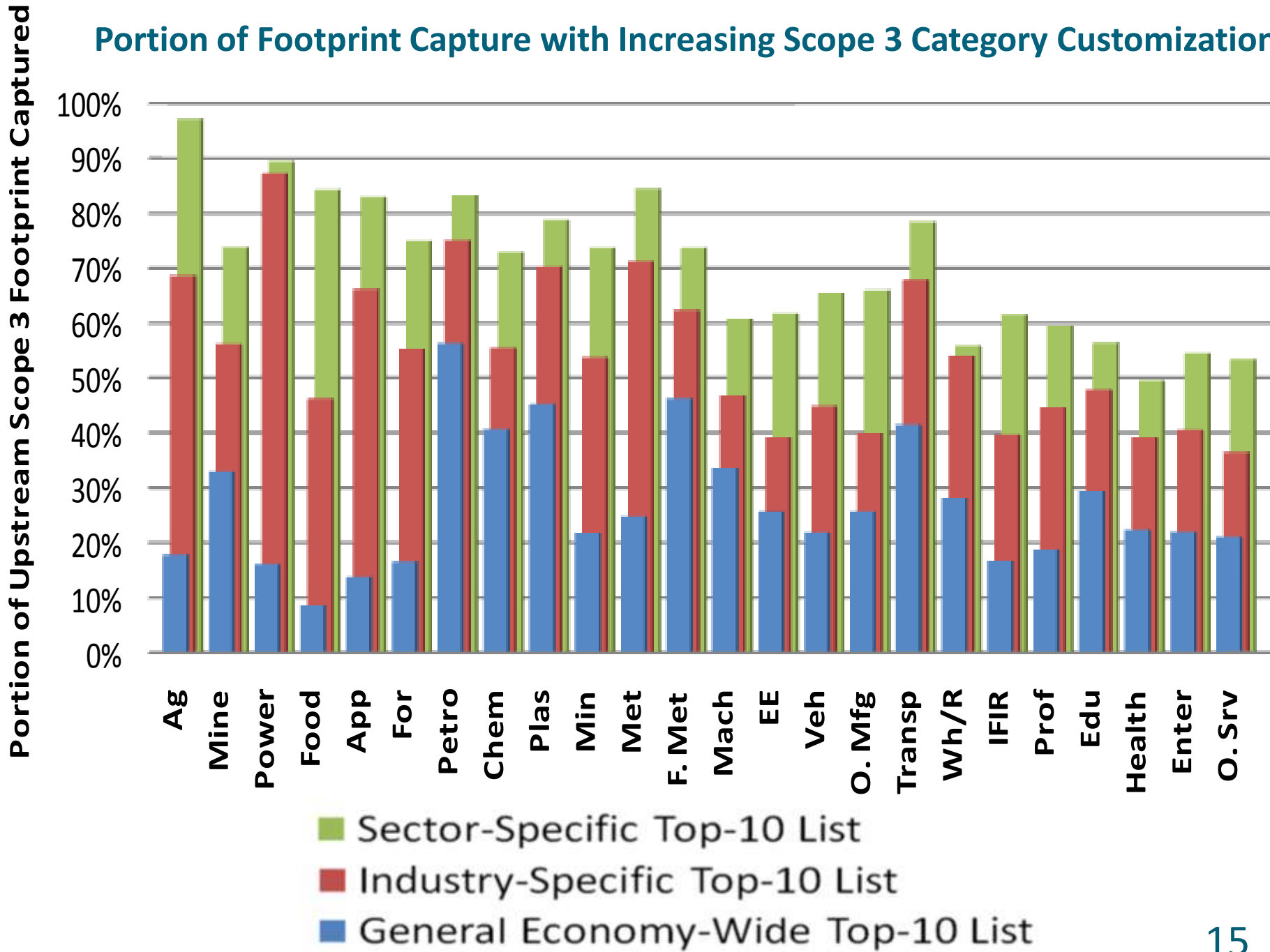
Industry-Specific Top-10 Suppliers



Sector-Specific Top-10 Suppliers



Portion of Footprint Capture with Increasing Scope 3 Category Customization



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- ***Manuscript in-progress:***

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