The Role of Green Electricity Purchases in Reducing Commercial/Institutional Entity's Carbon Footprint

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Introduction

- For commercial/institutional entities (NAICS 42-81)

  (e.g. office-oriented businesses, universities)

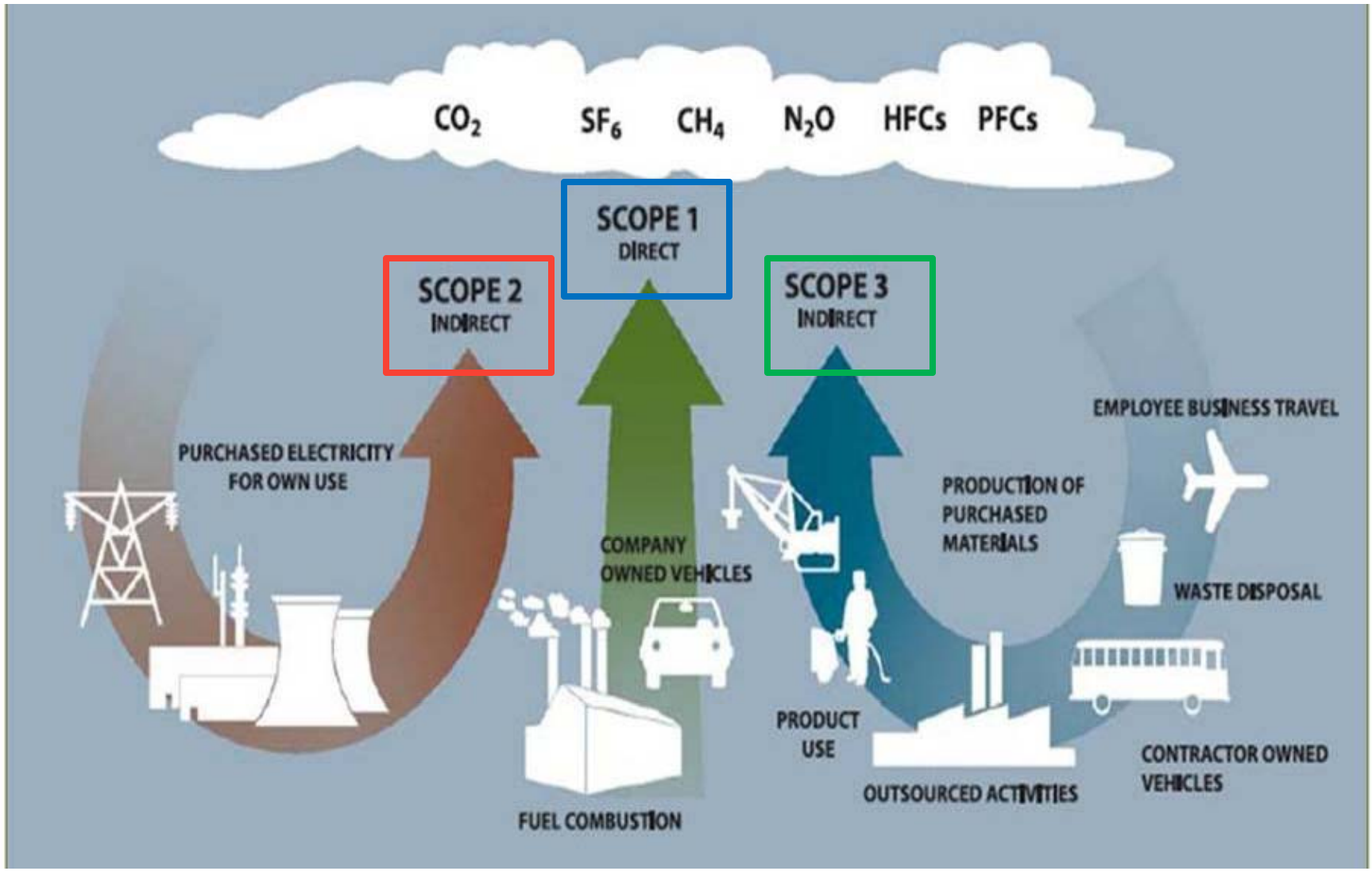
  electricity consumption = major source of carbon footprint
- Reduce energy consumption by:
  - Reduce electricity use or energy conservation measures
  - Purchase green electricity from utility
- What about indirect life cycle electricity?

WRI/WBCSD GHG Protocol

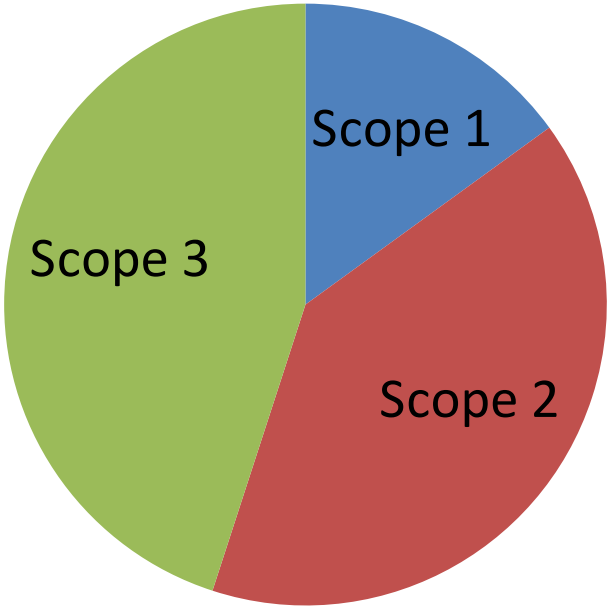
Scope 1: direct emissions

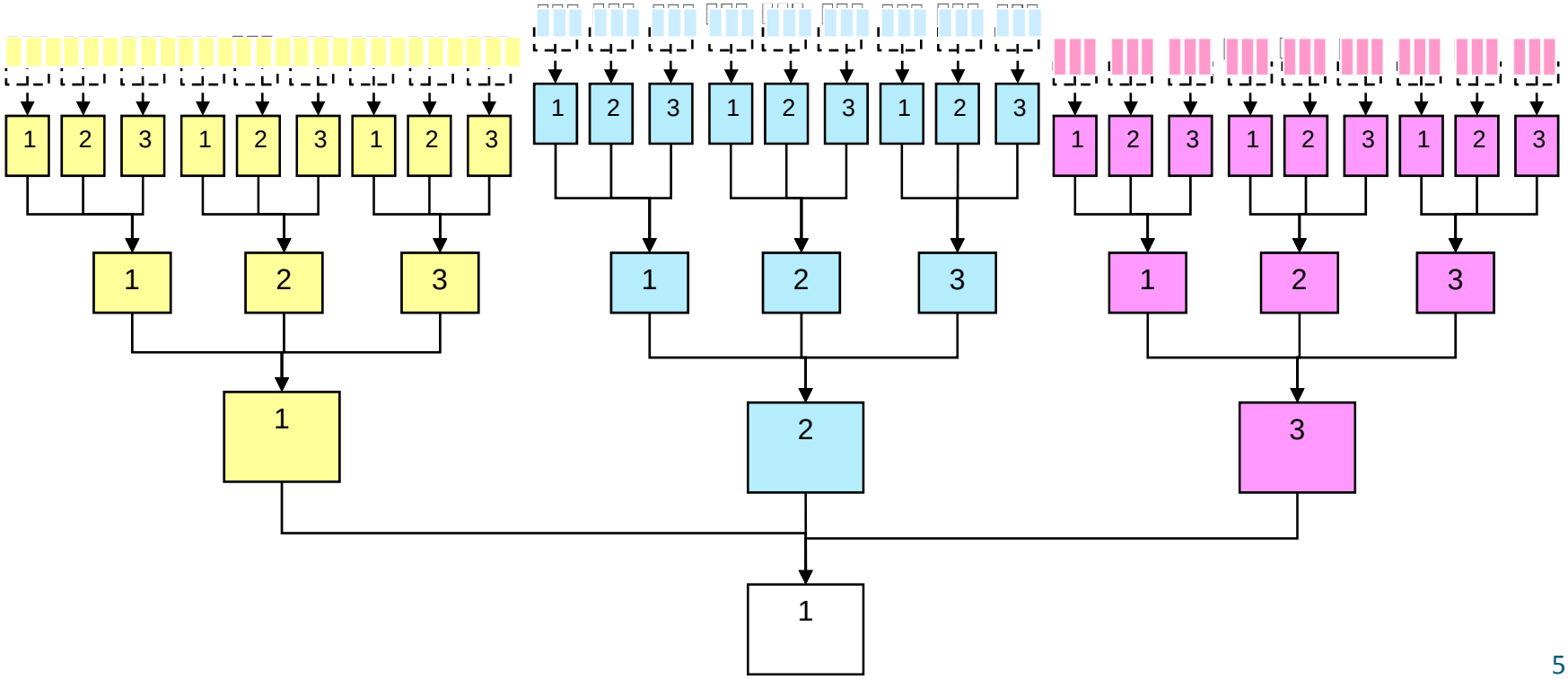
Scope 2: emissions from direct purchases of energy

Scope 3: everything else (optional)



Life Cycle Assessment “Tree”



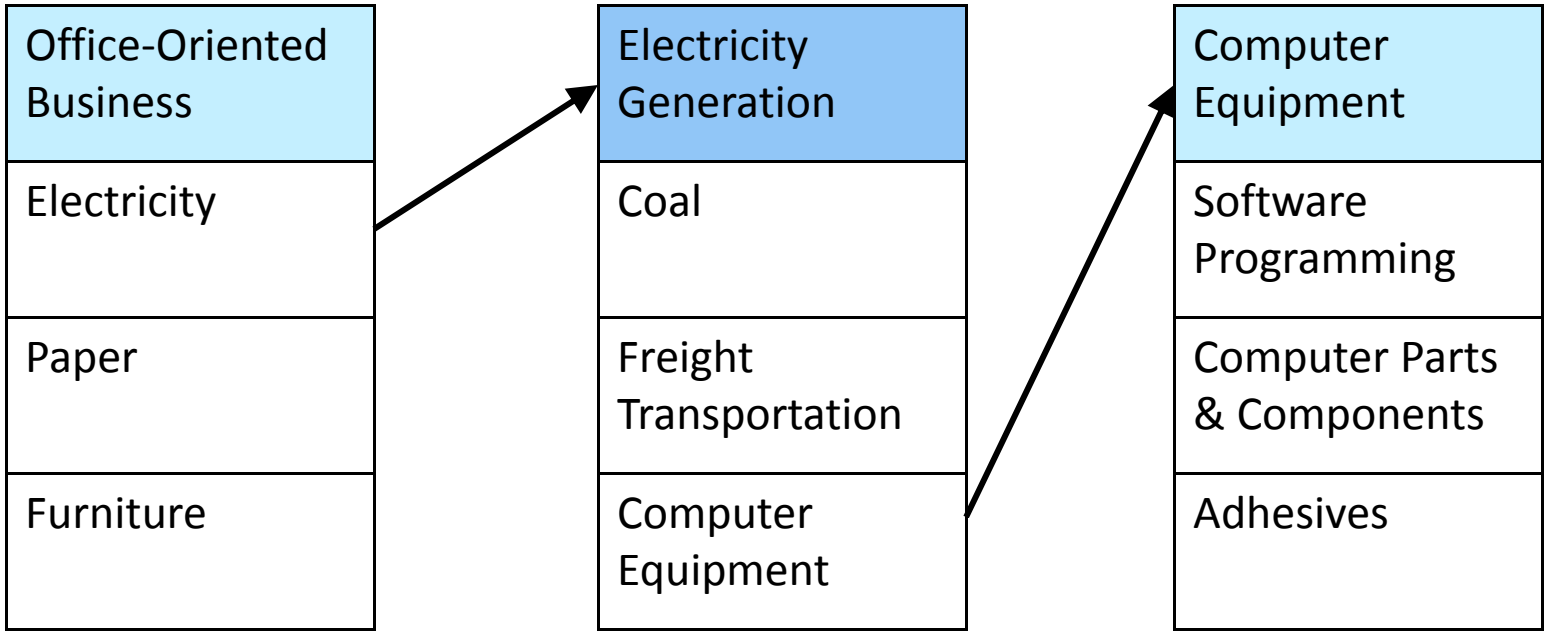


Questions

- What portion of a commercial/institutional entity's total carbon footprint can be reduced by direct energy conservation or renewable electricity purchases?
- Besides direct electricity use, what portion of an entity's indirect carbon footprint can be potentially reduced by a RPS implemented at the state and federal levels?
- How much carbon footprint reduction can an entity see if it chooses upstream supply chain located in a state with lower electricity carbon intensity?

Method: EIO-LCA Model

- Economic Input-Output Life Cycle Assessment Model
- Developed by Carnegie Mellon University
- Based on Wassily Leontief's Nobel Prize-winning input-output analysis (1936)



Method: EIO-LCA Model

- U.S. Bureau of Economic Analysis
- National-level input-output data (in $1 Million) by industry sectors = 426 x 426 matrix

		1111A0	1111B0	111200	111335	1113A0	111400	111910	111920	1119A0	1119B0	112120	1121A0	112300	112A00	113300
		Oilseed farming	Grain farming	Vegetable and melon farming	Tree nut farming	Fruit farming	Greenhouse and nursery production	Tobacco farming	Cotton farming	Sugarcane and sugar beet	All other crop farming	Milk Production	Cattle ranching and farming	Poultry and egg production	Animal production, except	Logging
1111A0	Oilseed farming	0.0713	0.0022	0.0021	0.0029	0.0029	0.0009	0.0061	0.002	0.0014	0.002	0.0005	0.0003	0.0003	0.0005	0.0003
1111B0	Grain farming	0.0241	0.0728	0.0043	0.0061	0.0062	0.0019	0.0421	0.0084	0.0028	0.0469	0.0317	0.0462	0.09	0.0293	0.0007
111200	Vegetable and melon	0.0003	0.0004	0.0309	0.0007	0.0023	0.0002	0.0004	0.0005	0.0003	0.0005	0.0001	0.0001	0.0001	0.0001	0.0001
111335	Tree nut farming	0.0001	0.0001	0.0002	0.0134	0.0002	0.0001	0.0001	0.0002	0.0001	0.0002	0	0	0	0	0
1113A0	Fruit farming	0.0004	0.0007	0.0008	0.0011	0.0101	0.0004	0.0007	0.0008	0.0006	0.0008	0.0002	0.0001	0.0001	0.0002	0.0001
111400	Greenhouse and nurse	0.0001	0.0002	0.0003	0.0004	0.0004	0.0972	0.0002	0.0003	0.0002	0.0003	0.0001	0	0	0.0001	0
111910	Tobacco farming	0.0001	0.0002	0.0003	0.0004	0.0004	0.0001	0.049	0.0003	0.0002	0.0003	0.0001	0	0	0.0001	0
111920	Cotton farming	0.0143	0.0005	0.0006	0.0008	0.0008	0.0003	0.0005	0.0873	0.0004	0.0006	0.0001	0.0001	0.0001	0.0001	0.0001
1119A0	Sugarcane and sugar b	0.0002	0.0003	0.0003	0.0005	0.0005	0.0001	0.0003	0.0003	0.0678	0.0003	0.0001	0	0	0.0001	0.0001
1119B0	All other crop farming	0.0007	0.0122	0.0014	0.0007	0.0007	0.0003	0.0012	0.001	0.0027	0.0162	0.1044	0.162	0.0001	0.062	0.0623
112120	Milk Production	0.0004	0.0006	0.0007	0.001	0.001	0.0003	0.0006	0.0007	0.0005	0.0007	0.0021	0.002	0.0001	0.001	0.0001
1121A0	Cattle ranching and fa	0.0026	0.0048	0.0048	0.0053	0.0052	0.0019	0.002	0.0042	0.004	0.0027	0.0243	0.3355	0.0003	0.0172	0.0004
112300	Poultry and egg produ	0.0003	0.0004	0.0005	0.0007	0.0007	0.0002	0.0004	0.0005	0.0003	0.0007	0.0001	0.0001	0.1409	0.0001	0.0001
112A00	Animal production, ex	0.0014	0.003	0.0017	0.0021	0.002	0.0007	0.0314	0.0012	0.0007	0.0023	0.0033	0.0002	0.0002	0.0909	0.0023
113300	Logging	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2524
113A00	Forest nurseries, fores	0	0	0	0	0	0.0001	0	0	0	0	0	0	0	0	0.1799
114100	Fishing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
114200	Hunting and trapping	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
115000	Agriculture and forest	0.0447	0.0721	0.0826	0.1197	0.12	0.0379	0.0718	0.0845	0.058	0.0824	0.0194	0.0104	0.0121	0.0194	0.0141
211000	Oil and gas extraction	0.0024	0.0044	0.002	0.0016	0.0015	0.0029	0.0045	0.0041	0.0033	0.0049	0.0016	0.0014	0.0009	0.0013	0.0004
212100	Coal mining	0	0	0	0	0	0	0	0	0	0	0	0	0.0056	0	0
212210	Iron ore mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
212230	Copper, nickel, lead, a	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2122A0	Gold, silver, and other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
212310	Stone mining and qua	0.0015	0.004	0.0013	0.0006	0.0007	0.0005	0.0021	0.0013	0.0014	0.0034	0.0013	0.0003	0.0003	0.0008	0
212320	Sand, gravel, clay, and	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
212390	Other nonmetallic mir	0.0004	0.0021	0.0002	0.0005	0.0002	0	0.0002	0.0005	0.0003	0.0064	0.0003	0	0	0.0001	0
213111	Drilling oil and gas we	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
213112	Support activities for c	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21311A	Support activities for c	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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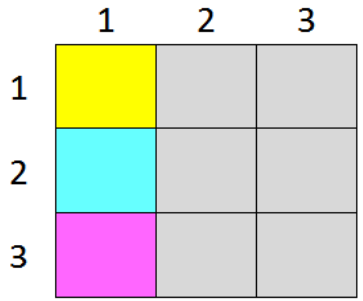
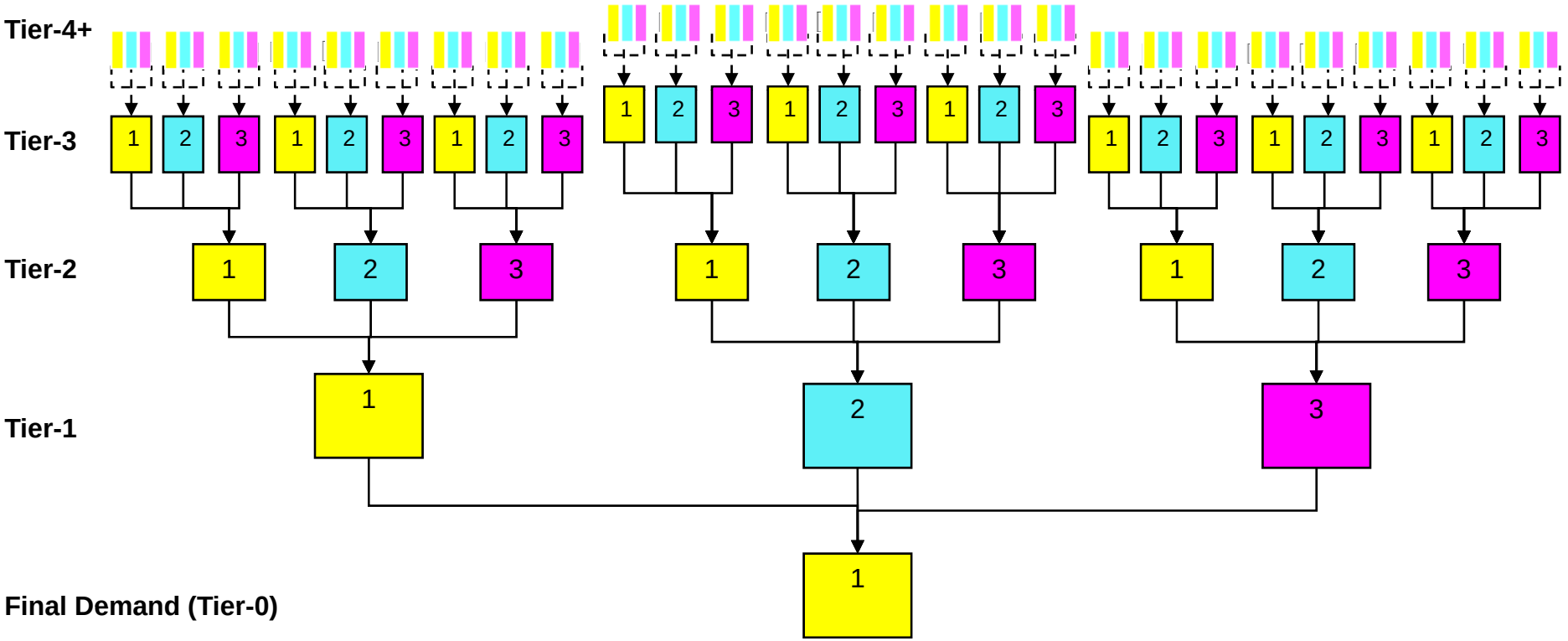
The basic Leontief inverse gives the sectoral sum of sector i at all tiers



$$I+A+AA+AAA+AAAA\ldots = (I- A)^{-1}$$



Method: EIO-LCA Model

- Input-output model augmented with environmental data from U.S. EPA and DOE:

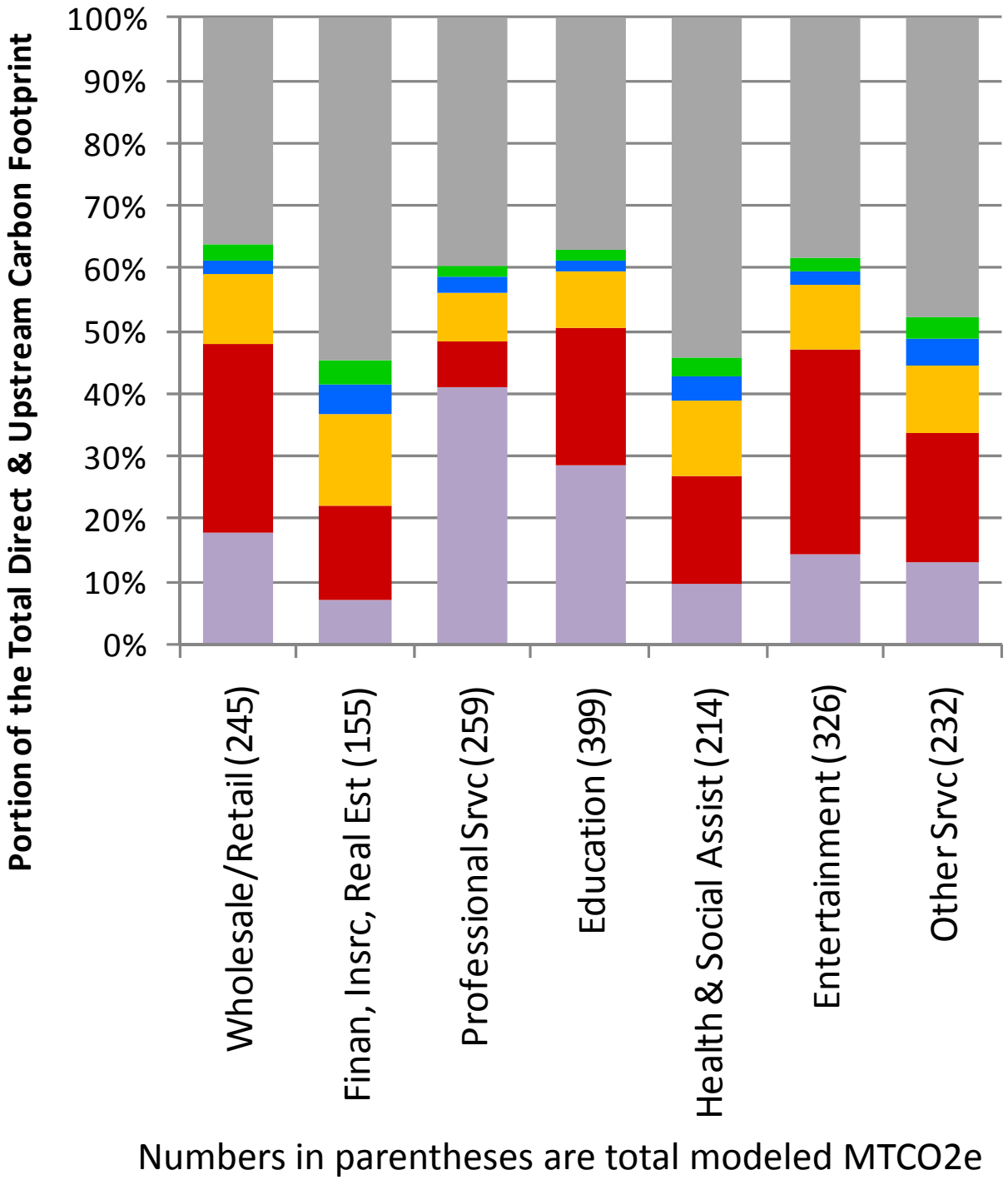
Environmental Impact ($MTCO_2e$)	=	Industry Output ($1M)	X	Environmental Intensity ($MTCO_2e$/$1M)

Multi-Regional IO Model

- Separate domestic and import potions with U.S. Bureau of Economic Analysis data
- Separate California production and consumption data from rest of the U.S. (RUS) with proxy data
- Allocate CA and RUS supplies used to meet California demands
- Allocate CA and RUS supplies used to meet RUS industry demands
- Multi-Regional matrix (1278 x 1278)

Model Results: Carbon Footprint Profile

(by aggregated industry groups, NAICS 42-81)



Numbers in parentheses are total modeled MTCO2e

Discussions

- Reduce the impacts of direct (Scope 2) electricity consumption
- State and National RPS: get life cycle reduction without entities taking actions
- California's electricity intensity is 40% lower than rest of the U.S.
- Move supply chain into California
- "Average" entity and "average" industry results may not be representative of unique individual entities

Thank you

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