Industrial Decarbonization in California

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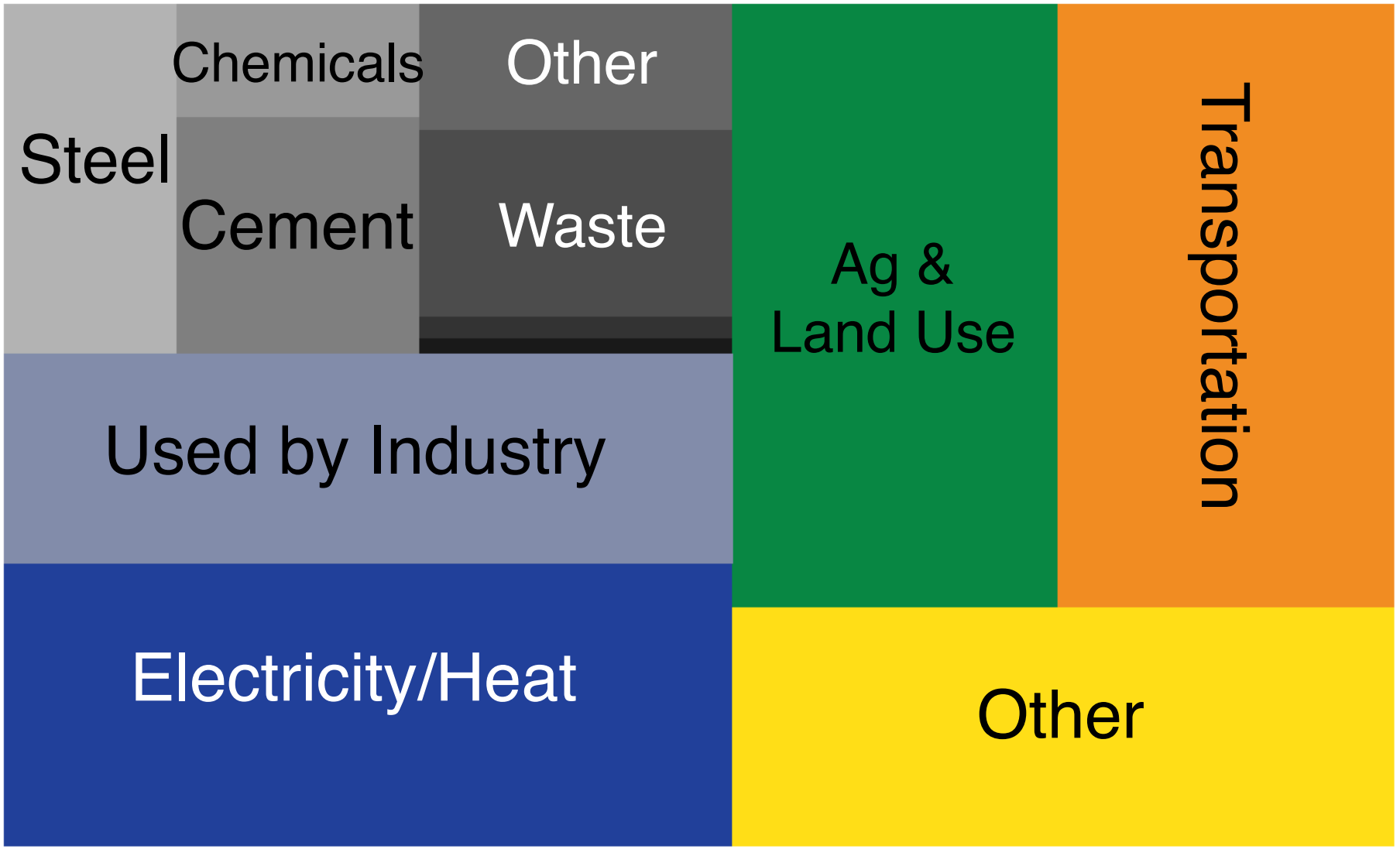
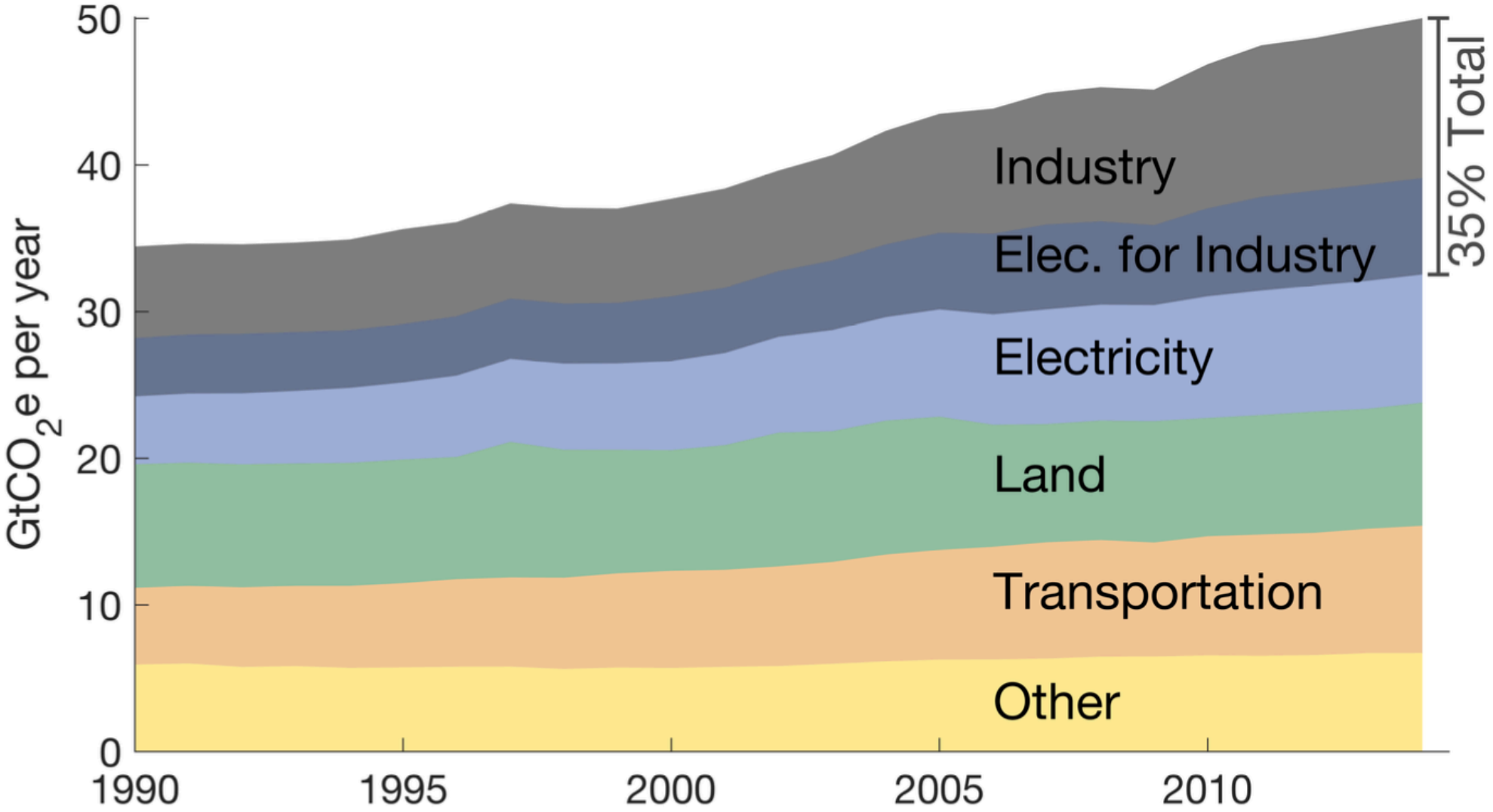
Globally, industrial emissions are a **third** of total emissions.



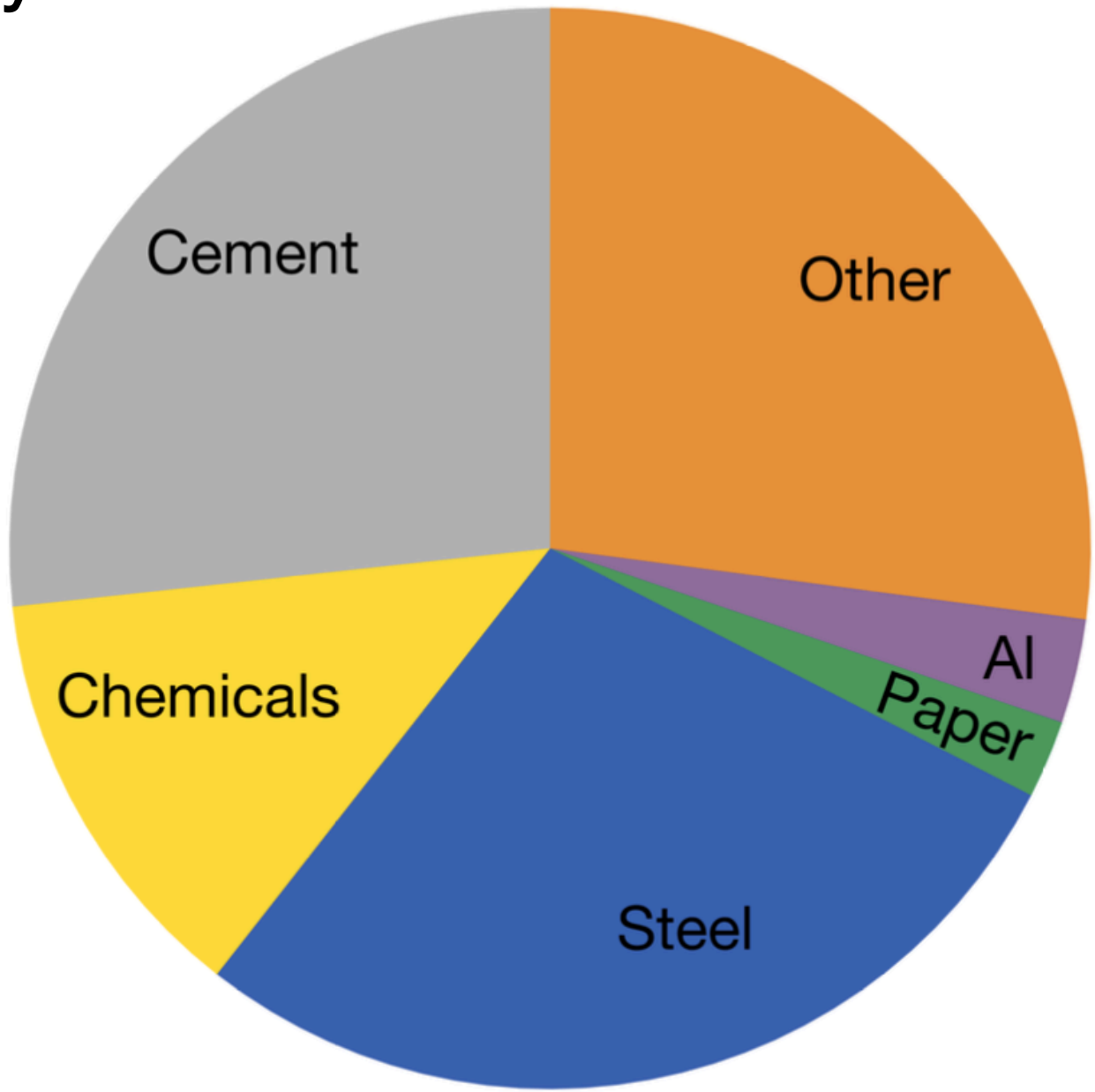
Source: CAIT (2017), with IEA *ETP 2017* used to impute industrial sector portion of power sector emissions.

Globally, industrial emissions are rising at twice the rate of overall emissions.



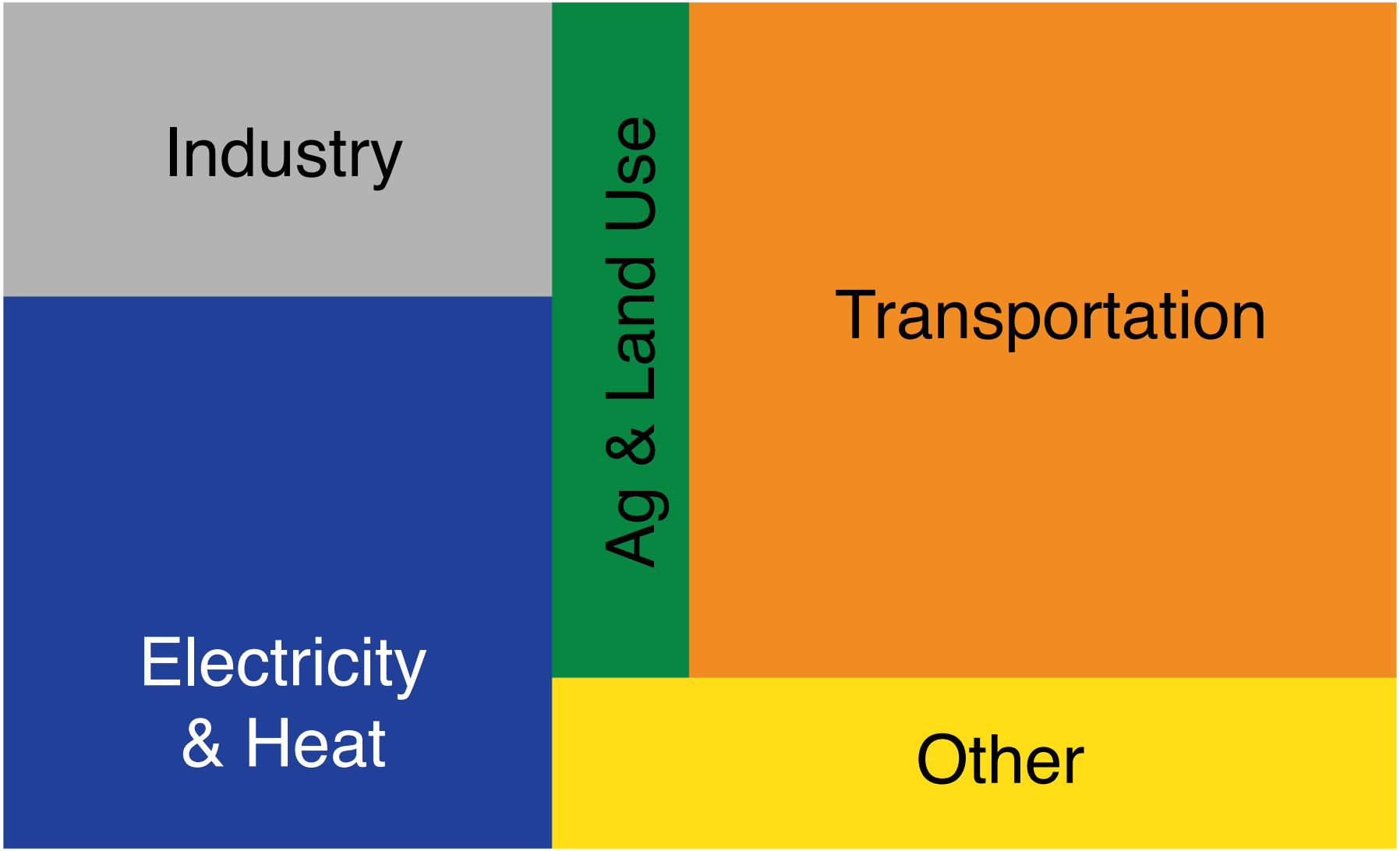
Source: CAIT (2017), with IEA *ETP 2017* used to impute industrial sector portion of power sector emissions.

Industrial emissions are concentrated in a few commodity industries.



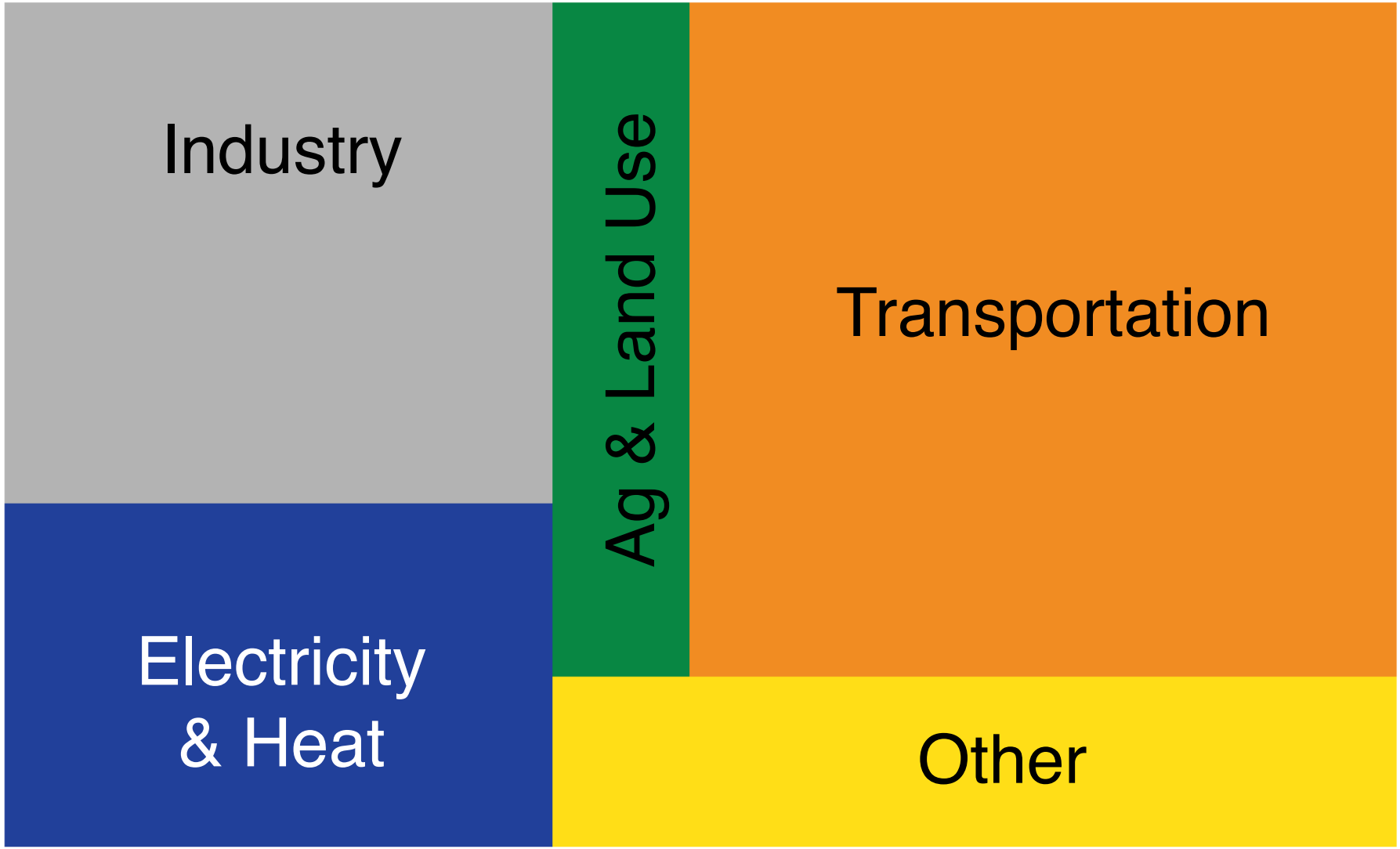
Source: IEA (2017).

Industrial emissions are a **seventh** of California emissions (according to IEA).



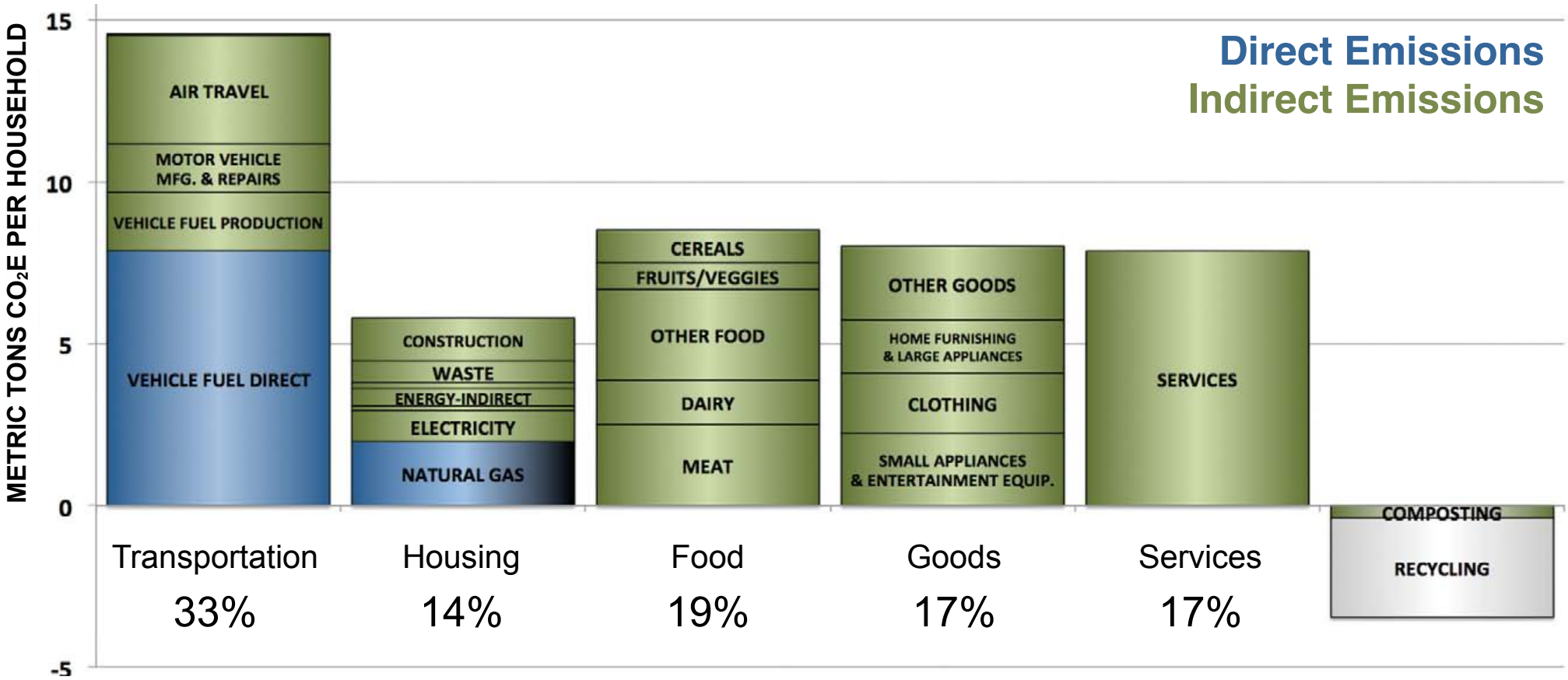
Source: CARB (2018).

Industrial emissions are a **quarter** of California emissions (according to CARB).



Source: CARB (2018).

Consumption-based accounting increases California emissions significantly.



Source: BAAQMD (2018), CARB (2018).

Consumption-based accounting increases California emissions significantly.

Consumption-based accounting (Bay Area): 16 tCO2e per person
Production-based accounting (CA): 11.6 tCO2e per person

Source: BAAQMD (2018), CARB (2018).

Emissions reductions come in three basic categories.

$$GHG = S \times \frac{P}{S} \times \frac{M}{P} \times \frac{GHG}{M}$$

S: Services
P: Products
M: Materials

Product-Service Intensity
Precision application
Increased product lifetimes
Reuse
Increased utilization

Materials Intensity
Substituting low-C materials
Light-weighting
Process waste reduction
Recycling

Emissions Intensity
CCS
Fuel switching
Bio-energy
Energy efficiency
Innovative processes

Opportunity Areas in California

Work on the demand side to create protected markets for low carbon materials.

- Public procurement
  - *Expand Buy Clean* (AB 262)
- Increase information and salience around embodied carbon
  - *Mandatory accounting:* 20% of global emissions from the built environment are in materials; it could be as high as 50% in CA.
  - *Building codes* to discourage overbuilding
- Encourage then require material substitution
  - *Clinker substitution:* Typical CA concretes have 80-85% clinker in their cement; 60% is sufficient.
  - *Timber substitution* for high-carbon structural materials, including in large buildings.

Improve the quality and quantity of secondary materials.

- *Regulate packaging* to reduce variety of plastics and additives, and increase quality of recycled material.
- *Facilitate reuse* of structural material.

Research, develop, and commercialize low carbon processes and materials.

- *CCS pilots* in the cement, chemicals, and refinery sectors would draw on CA expertise and geology. The 45q tax credit will provide up to $55/tCO2.
- *Alternative cements* with clinker as low as 50% or different chemistries should be tested and deployed.

Emissions reductions are affordable in the context of the wider economy.

Material	Current Cost ($ per ton)	tCO2 (per ton)	New Cost	% increase
Steel	$600	3	$900	50%
Cement	$100	1	$200	100%
Ethylene	$1,000	2	$1,100	20%

Product	Current Cost	Material Amount	New Cost	% increase
Car (steel)	$30,000	1 ton	$30,300	1%
Bridge (cement)	$ 6.5 billion	100,000 ton	$ 6.51 billion	1%
Soft drink (plastic)	$2	10 gram	$2.005	1%

The challenge is less how to pay for decarbonization generally than how to ensure that the costs are efficiently passed through to the final consumers without leakage.

Civil society can play important roles in reducing industrial emissions.

Information, Awareness, Communications

- Raise awareness among citizens and stakeholders of the GHG implications of the material economy and building support for material efficiency.
- Train the workforce for a more material efficient economy.

Knowledge Development

- Convene researchers, citizens, businesses, and other stakeholders around key research areas and projects.
- Develop tools for assessing and reducing embodied emissions.

Policy Advocacy

- Ensure California's industry has a high level of environmental performance.
- Ensure California's industry is rewarded when it achieves a high level of environmental performance.
- Foster coalitions to support policies that can simultaneously reduce GHG emissions, improve air quality, and provide good jobs.
- Continue to advocate for energy efficiency.

California can be a world leader in decarbonizing the industrial sector.

We will need a comprehensive approach that includes both reducing direct emissions from our facilities and embodied emissions from our consumption.

Success will require all stakeholders, including civil society, researchers, businesses, government, and citizens.