LA Metro Sustainability
Committee Meeting

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Los Angeles, CA

First-last mile environmental life-cycle assessment of multimodal transit in Los Angeles

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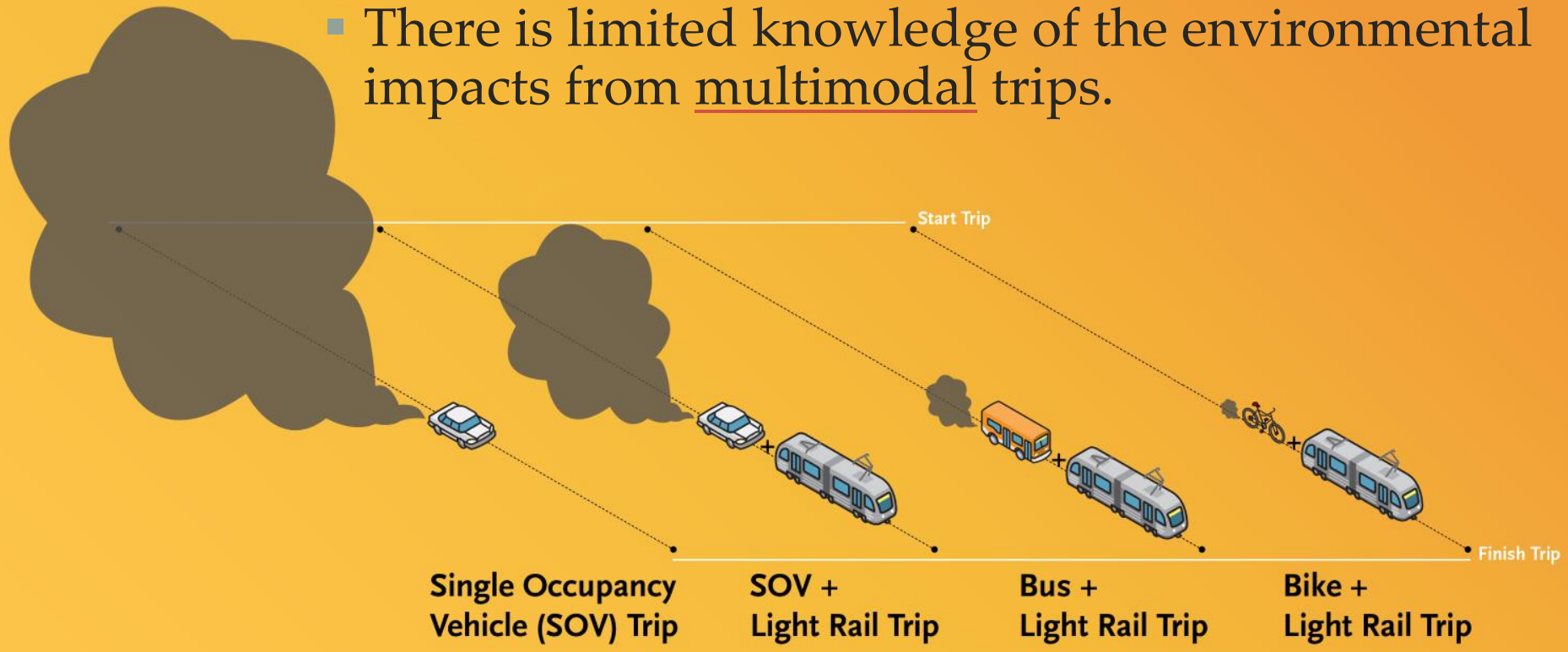
Outline

- Project motivation
- Project overview and scope
- Project methodology & data
- Life cycle impacts (per passenger mile)
- Multimodal impacts (per passenger trip)
- Reducing 10% of system GHG impacts

Motivation in transportation

- There is a strong understanding of the environmental impacts from unimodal trips.
- There is limited knowledge of the environmental impacts from multimodal trips.



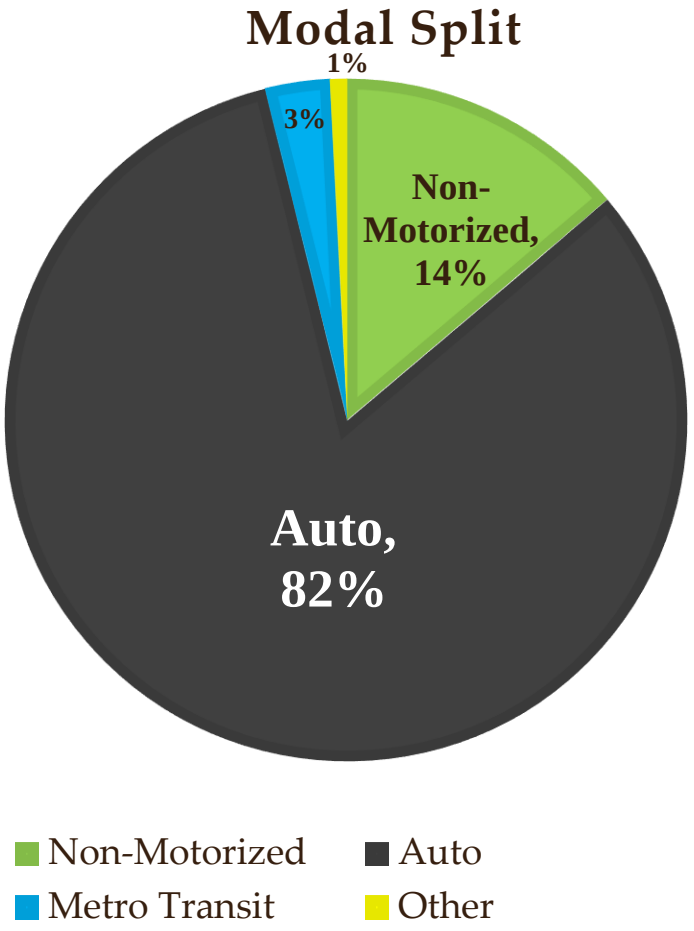
- Very limited knowledge of impacts from automobile access and egress with transit.

Sources: Chester et al. 2013, LA Metro

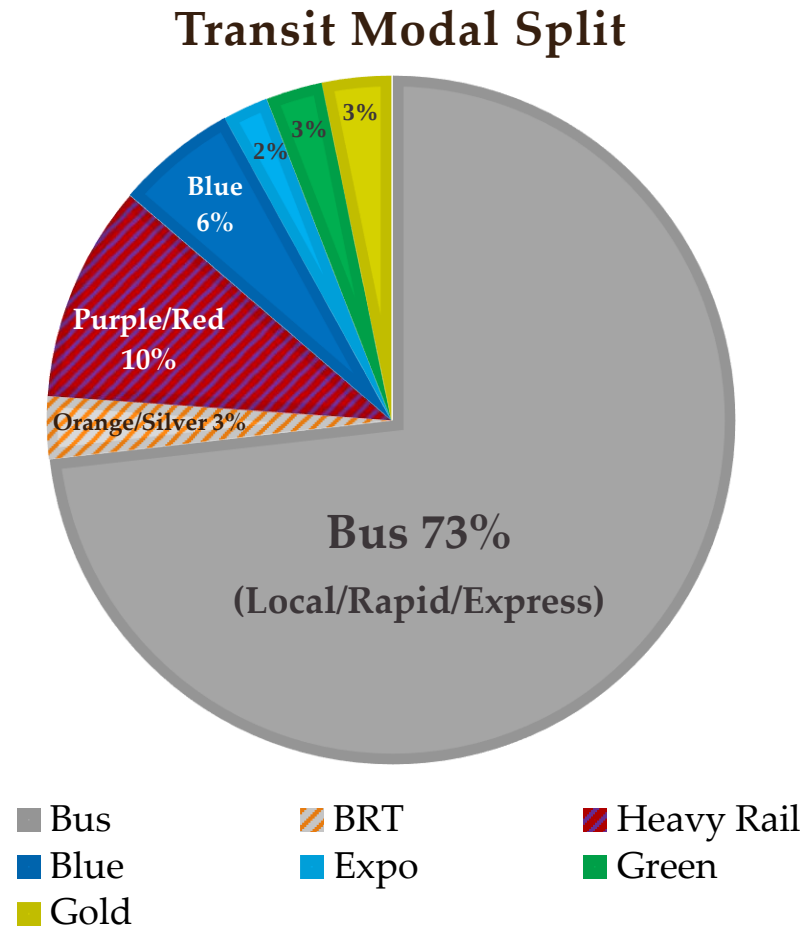
Project Overview

- Assess impacts generated from 10 LA transit systems and LA automobiles.
- Transit systems included:
  - Metro Light Rail Transit (LRT, 4 lines)
  - Metro Heavy Rail Transit (HRT, 1 line)
  - Commuter Rail Transit (CRT, 1 line)
  - Metro Local Bus
  - Metro Rapid Bus
  - Metro Express Bus
  - Bus Rapid Transit (BRT, 1 line)
- LA Auto:
  - 25 MPG sedan

Modal Split in LA



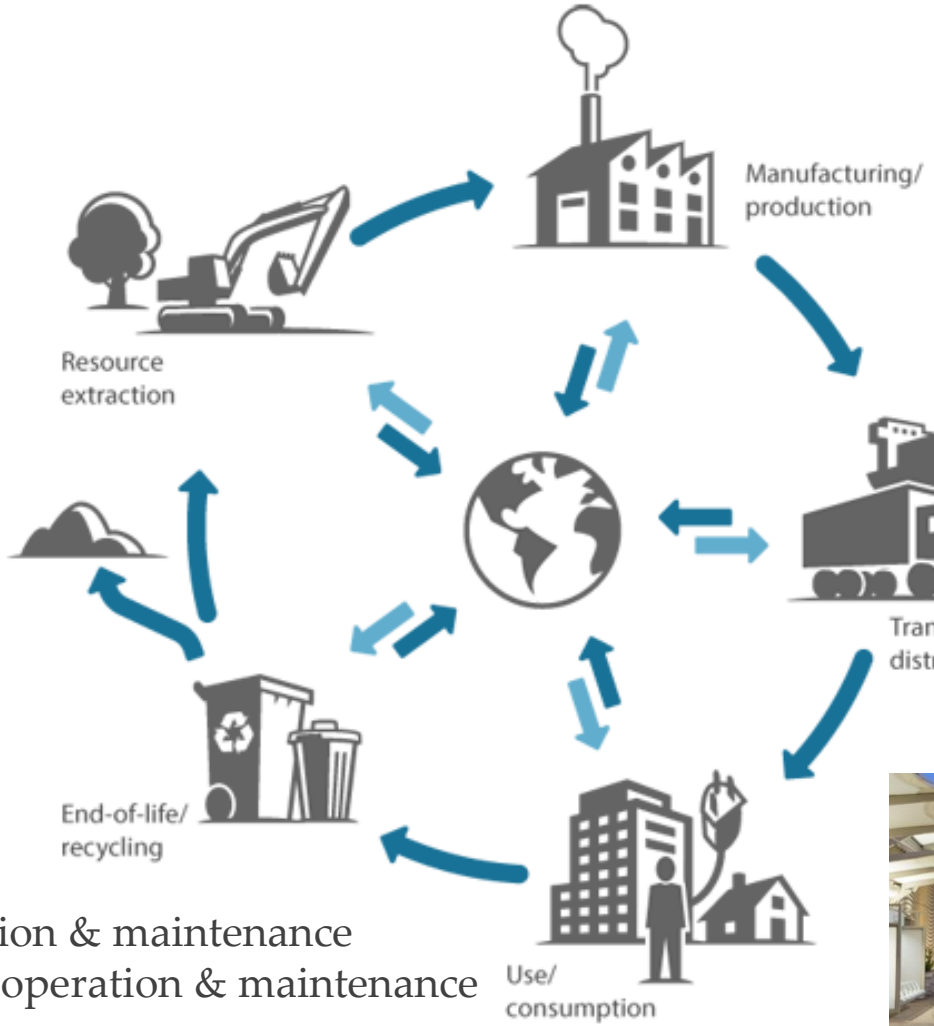
Estimate via California Household Travel Survey (Caltrans, 2013)



Estimate via LA Metro boardings (LA Metro, 2016)

Life-Cycle Assessment Scope

- Material and fuel extraction



- Vehicle manufacturing
- Infrastructure construction
- Electricity production and generation

- Vehicle operation & maintenance
- Infrastructure operation & maintenance

Data & Tools

Trip data:

- California Household Travel Survey (CHTS, 2012-13)
- LA Metro On-board Surveys (2013 – current)

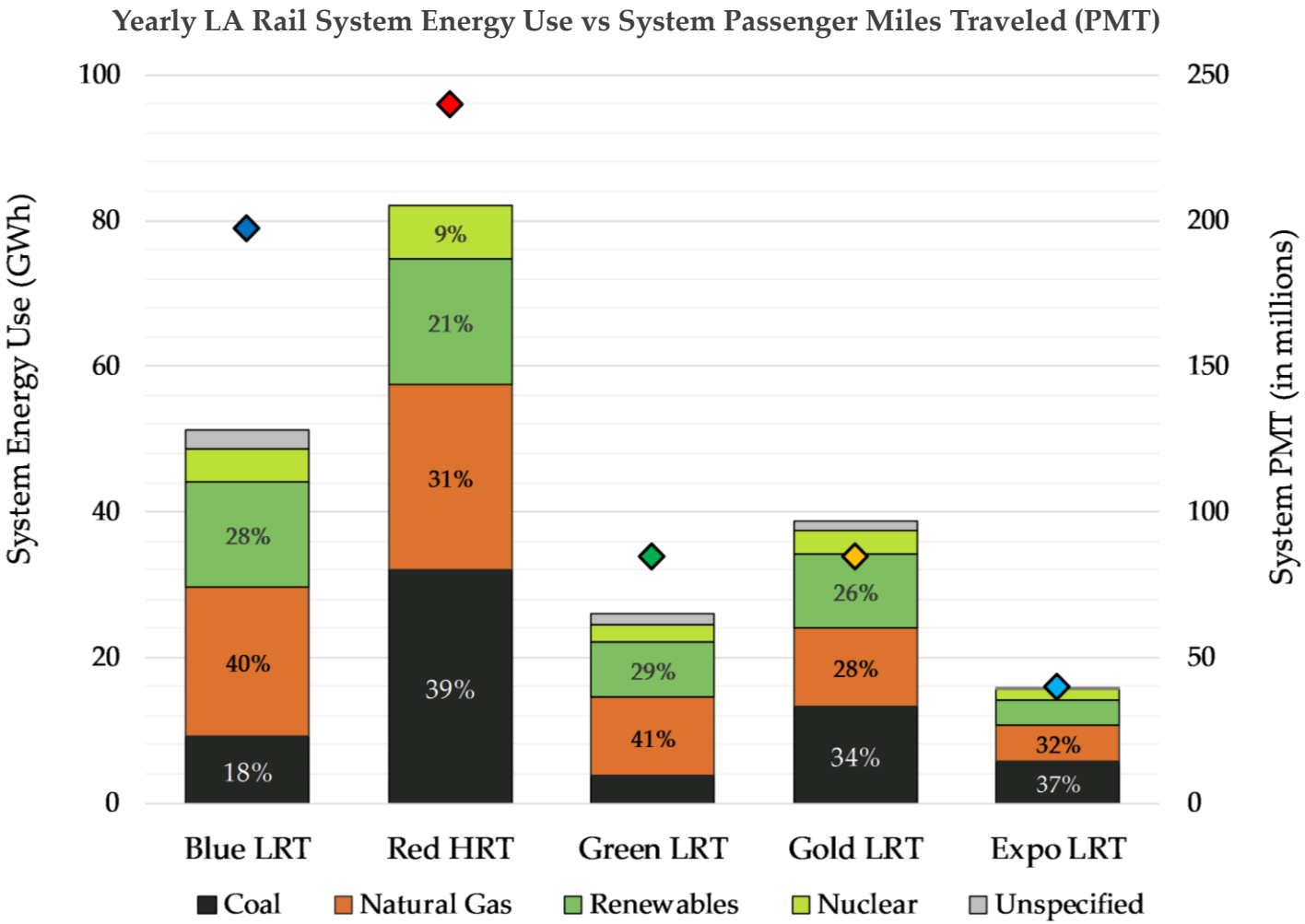
Transit operational data:

- Ridership & Operation Reports (2013 – current)
- Engineering design documents, Google Earth

Life-cycle Modeling:

- Modeling tools including SimaPro, GREET, CiRN-LCA, and other components
- EcoInvent and EIOLCA database and empirical studies

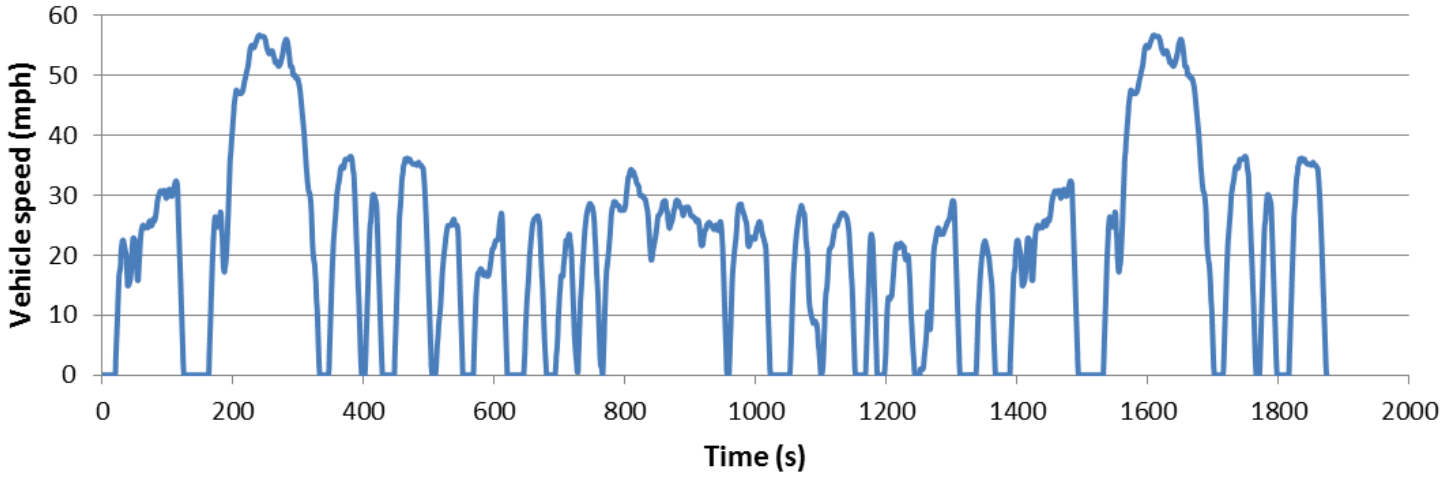
LA Metro Rail Energy Use



* Reflects 2013-2014 data

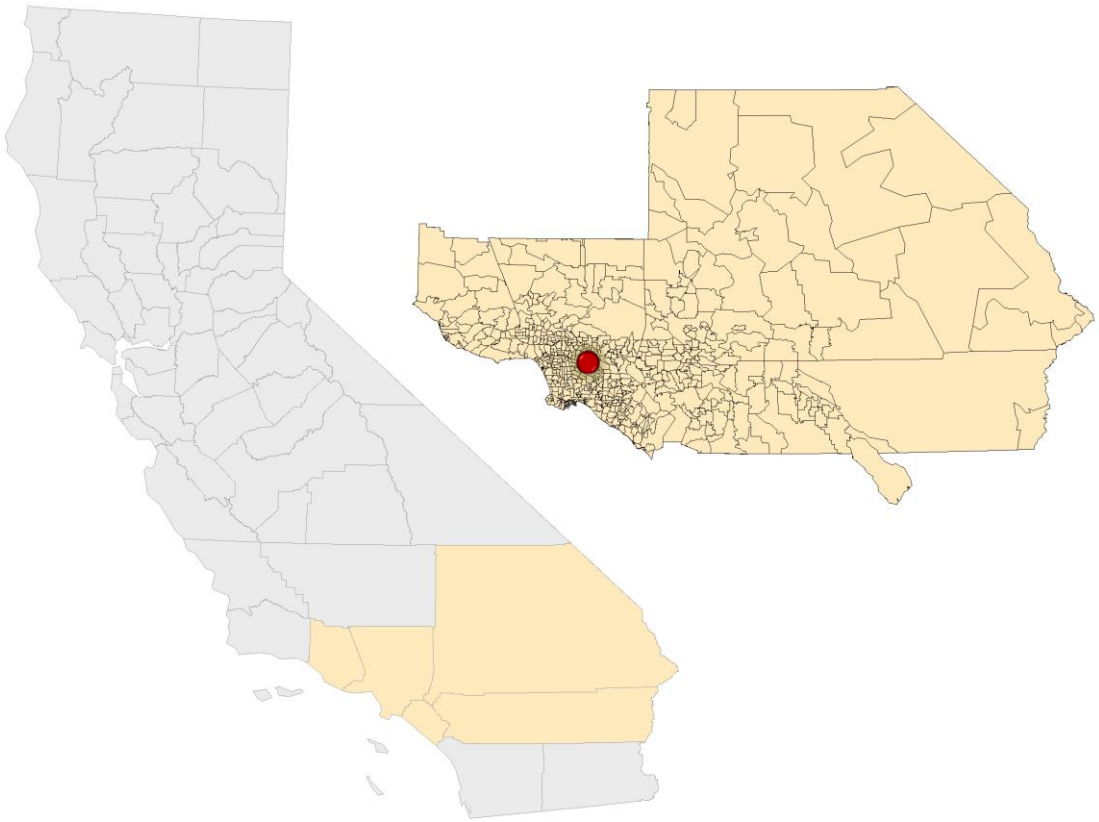
Bus & Metrolink Drive Cycles

- Local, Express, and Rapid Bus drive cycles were estimated by matching similar empirically tested cycles in similar buses (excluding Orange BRT).
- Estimated system fuel consumption (based on mileage) was 4% lower for buses, and 7% lower than locomotives.
- Metrolink drive cycles developed from similar locomotive operation impacts from Fritz (1994).



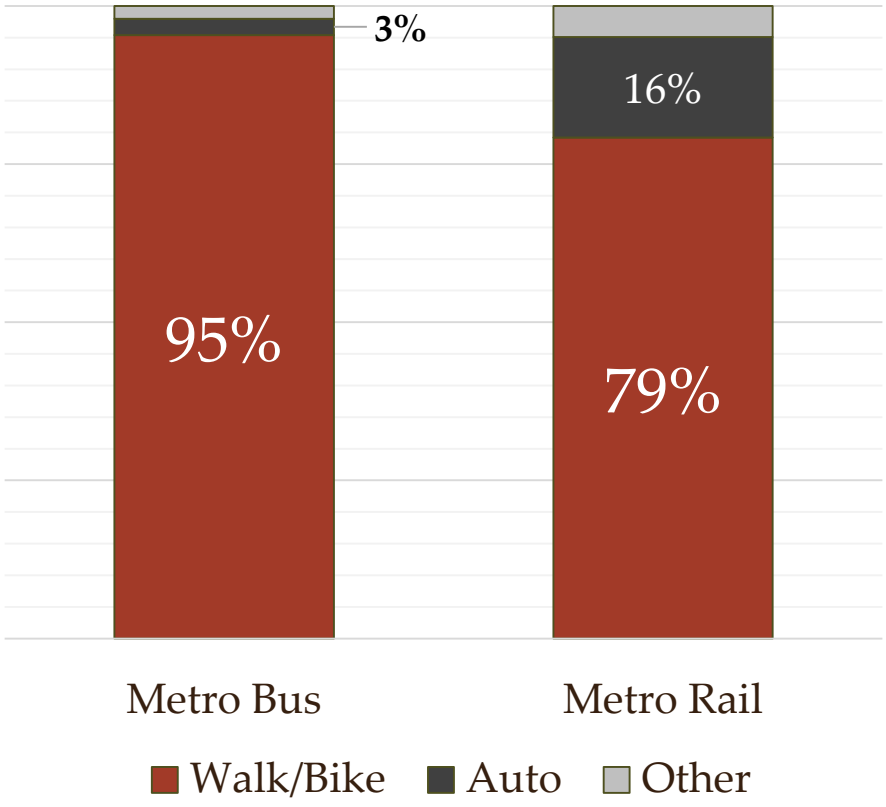
Trip Characteristics (CHTS)

- Trip characteristics determined for each region/transit system.
- Aggregation at the zip code level, over 900 sub-regions.
- Auto trips are shorter distance than transit for same ODs.

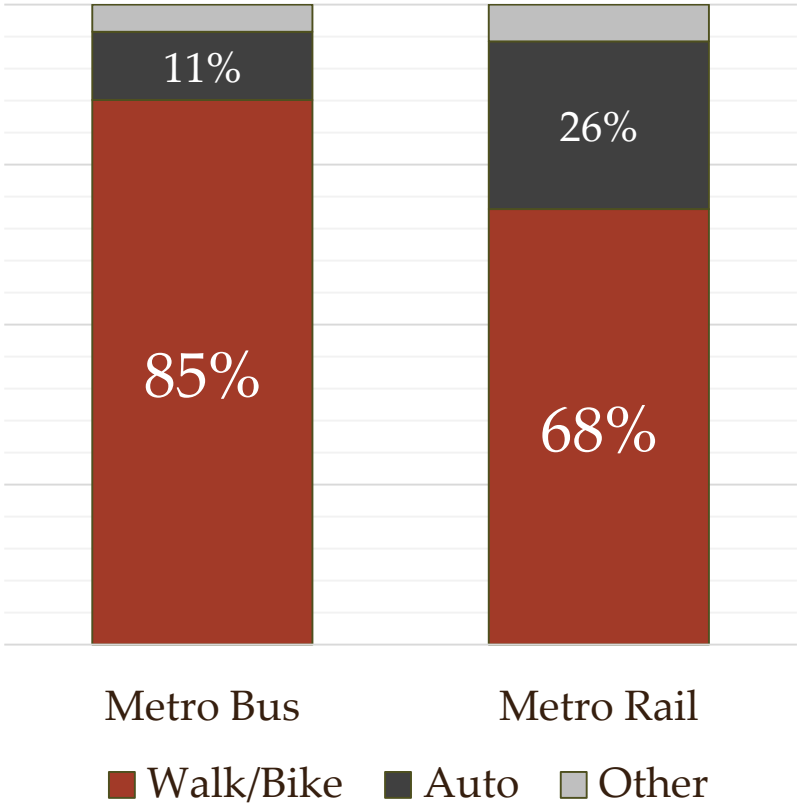


Transit Access & Egress in LA

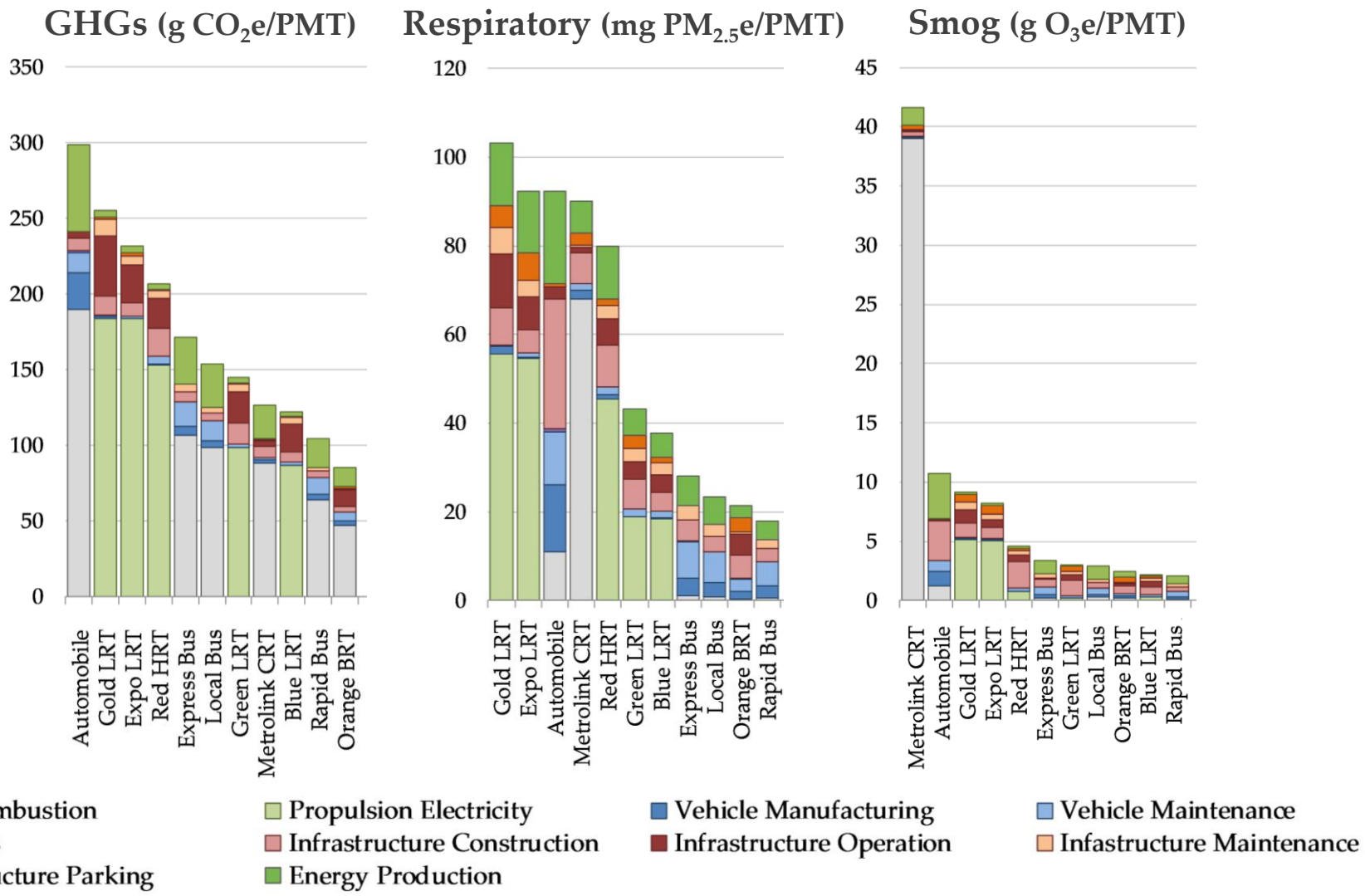
Access & Egress Modes (2012-13 CHTS)



Access Mode (2012-13 Metro Surveys)

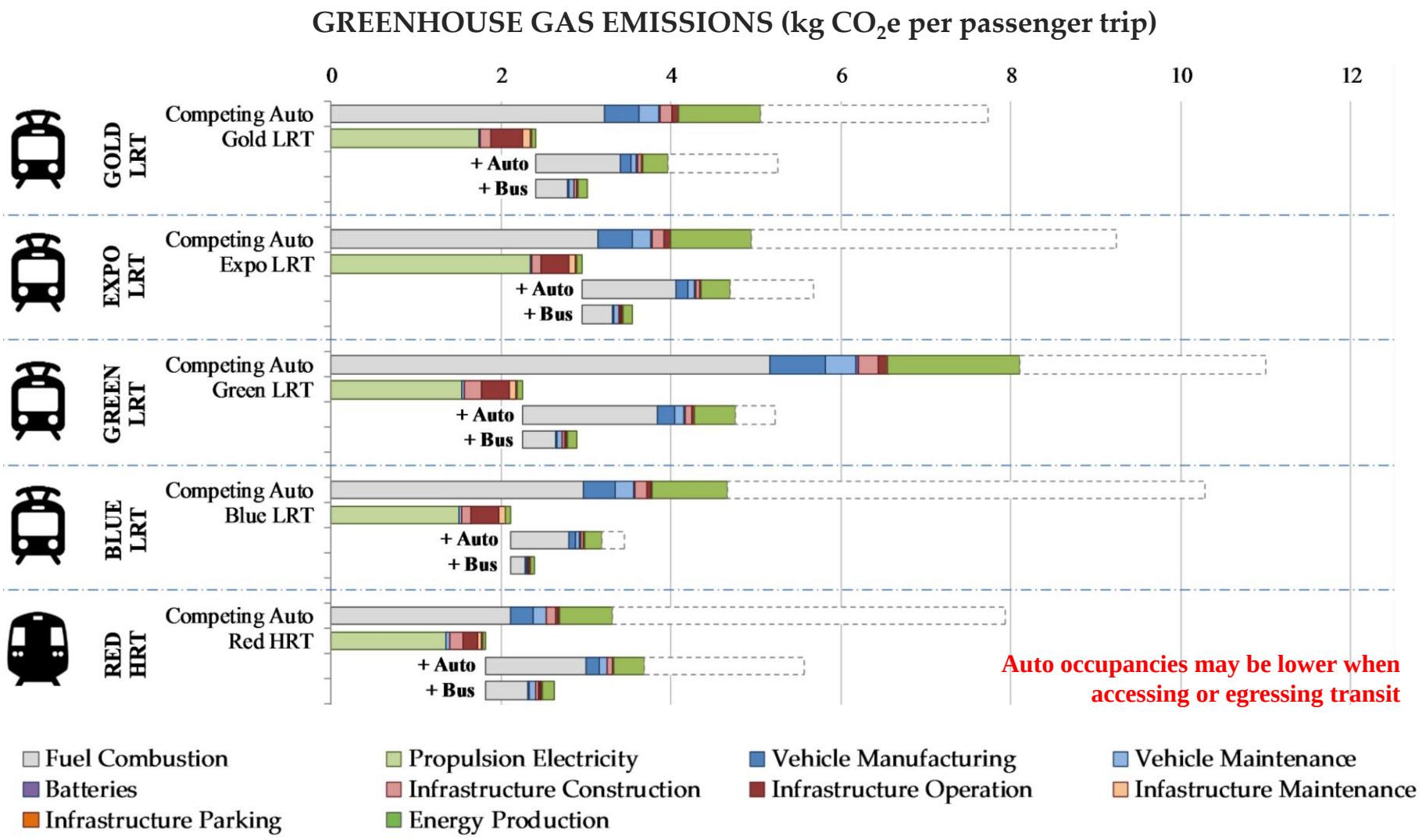


Per Passenger-mile Impacts

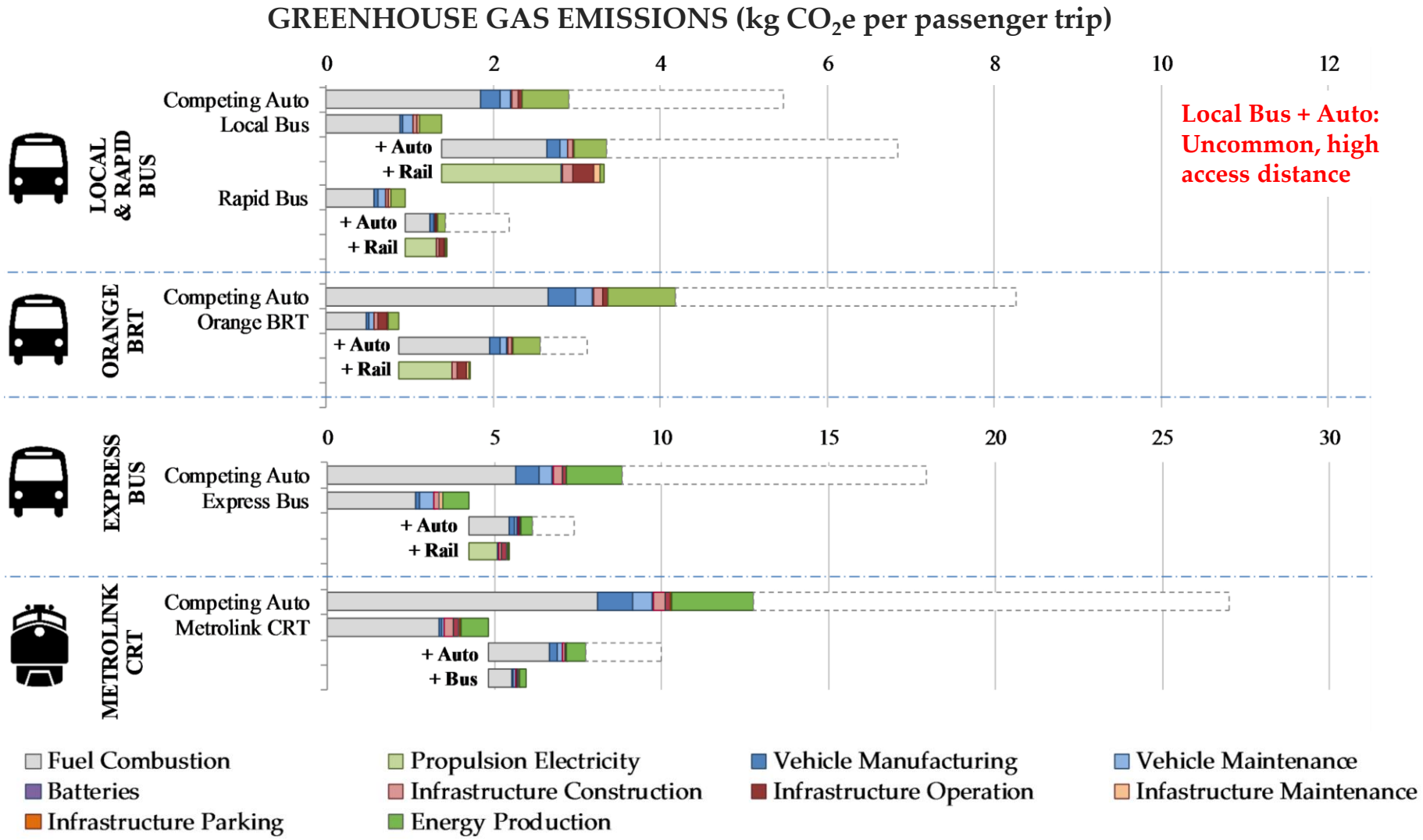


Note that auto trips in LA are ~2 pax per trip

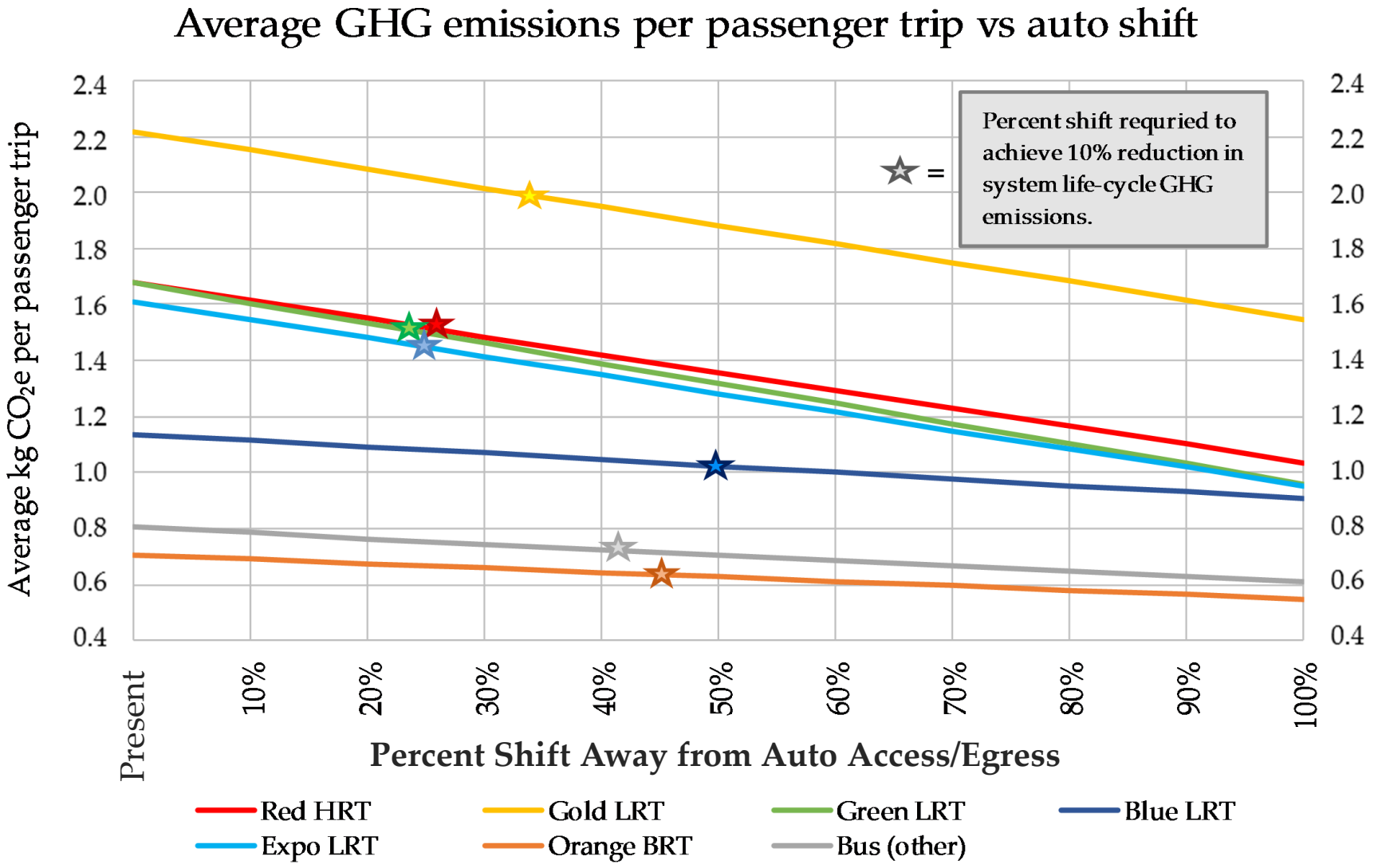
GHGs per Passenger-Trip



GHGs per Passenger-Trip



Reducing 10% of GHG Impacts



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REPORT and DATA

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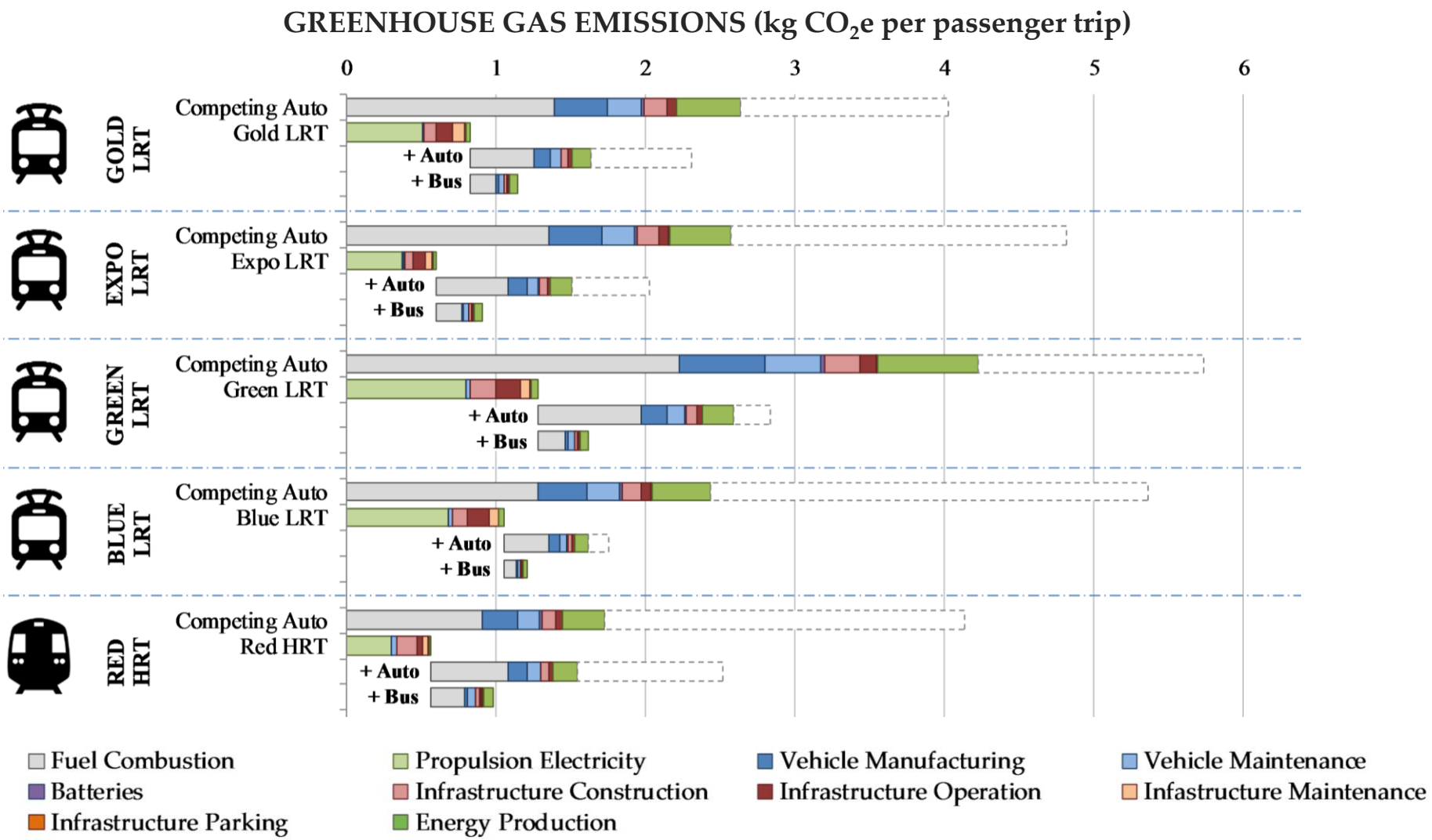
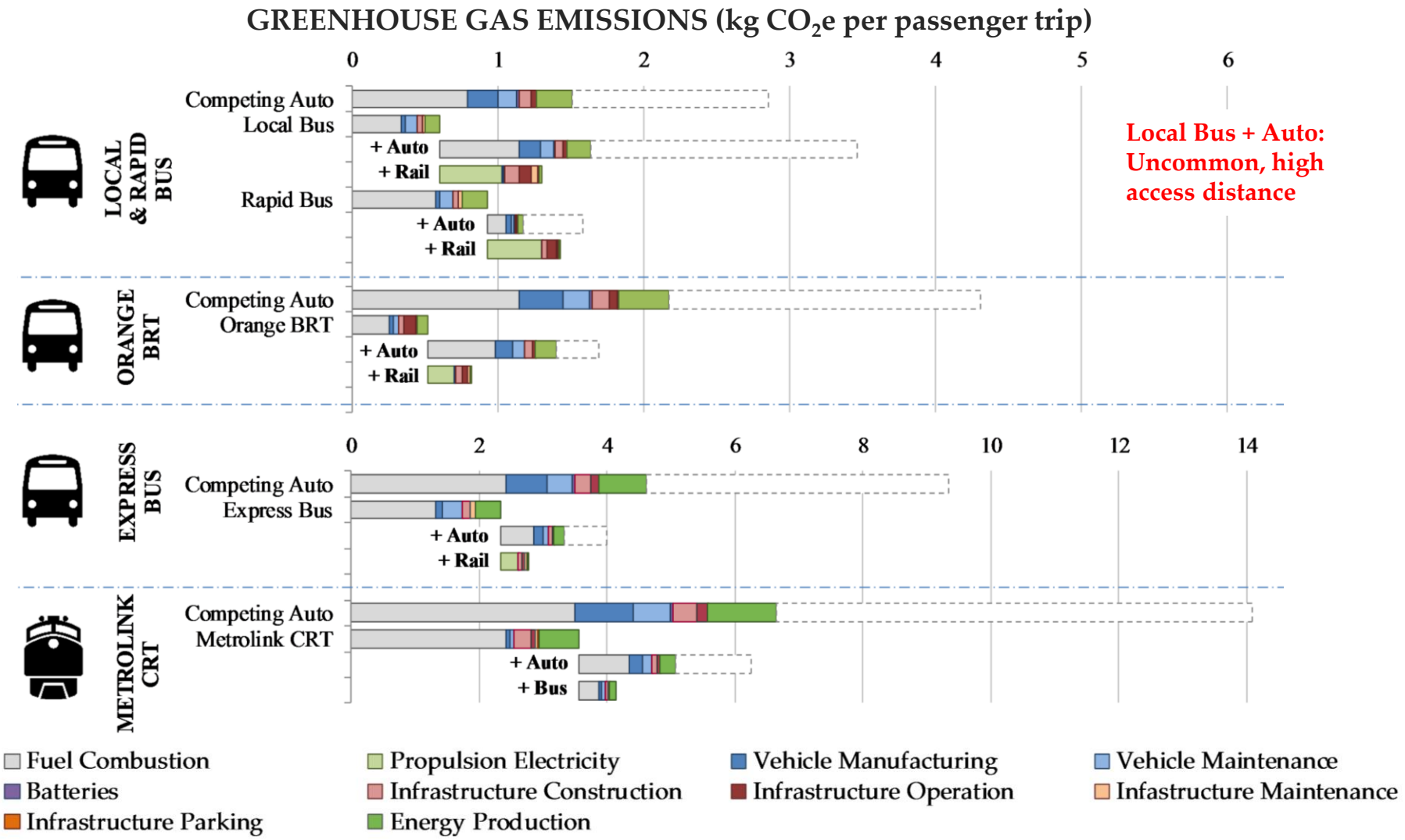
System Boundary

Life Cycle Grouping	Automobiles/Buses	Rail
Vehicle		
Manufacturing	▪ Vehicle Manufacturing ▪ Battery Manufacturing ▪ Transport to Point of Sale	▪ Train ▪ Transport to Point of Sale
Operation	▪ Propulsion ▪ Idling	▪ Propulsion ▪ Idling
Maintenance	▪ Typical Maintenance ▪ Tire Replacement ▪ Battery Replacement	▪ Typical Train Maintenance ▪ Train Cleaning ▪ Flooring Replacement
Infrastructure		
Construction	▪ Roadway	▪ Track ▪ Station
Operation	▪ Roadway Lighting ▪ Herbicide Use	▪ Track, Station, and Parking Lighting ▪ Herbicide Use ▪ Train Control ▪ Miscellaneous (Escalators, Equipment)
Maintenance	▪ Roadway Maintenance	▪ Track and Station Maintenance
Parking	▪ Curbside Parking	▪ Dedicated Parking
Energy Production		
Extraction, Processing, & Distribution	▪ Gasoline/Diesel/Natural Gas Extraction, Processing, & Distribution	▪ Raw Fuel Extraction and Processing, Electricity Generation, Transmission & Distribution

GHGs per Passenger-Trip (LT)



GHGs per Passenger-Trip (LT)



Local vs Remote Impacts Per Passenger Trip