US ZEV Transition Scenarios and Fuel Consumption

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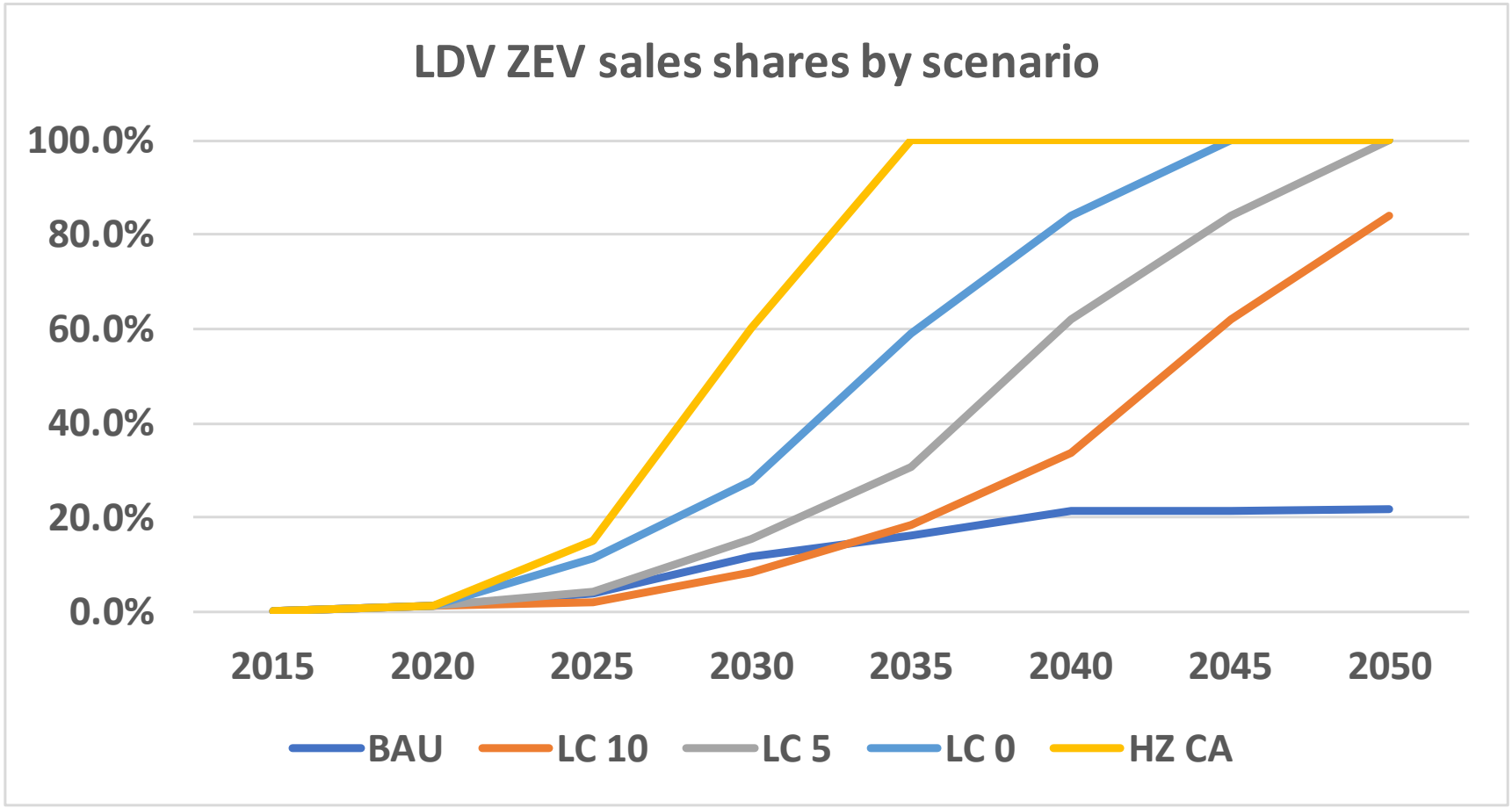
US Transportation Transitions Model

- Created a US TTM from our CA TTM
- Consider 3 sections of country
  - California, Section 177 states, Remainder of country
- New assumptions for ZEV sales for each scenario:
  - California portion will follow CA TTM scenarios
  - Section 177 states and other states will follow CA TTM scenario but delayed by specified number of years
- Create all US scenarios using a weighted average by population of 3 sections (BAU, LC, High ZEV)
- 4th scenario: US TTM High ZEV CA (HZ CA): identical to CA High ZEV

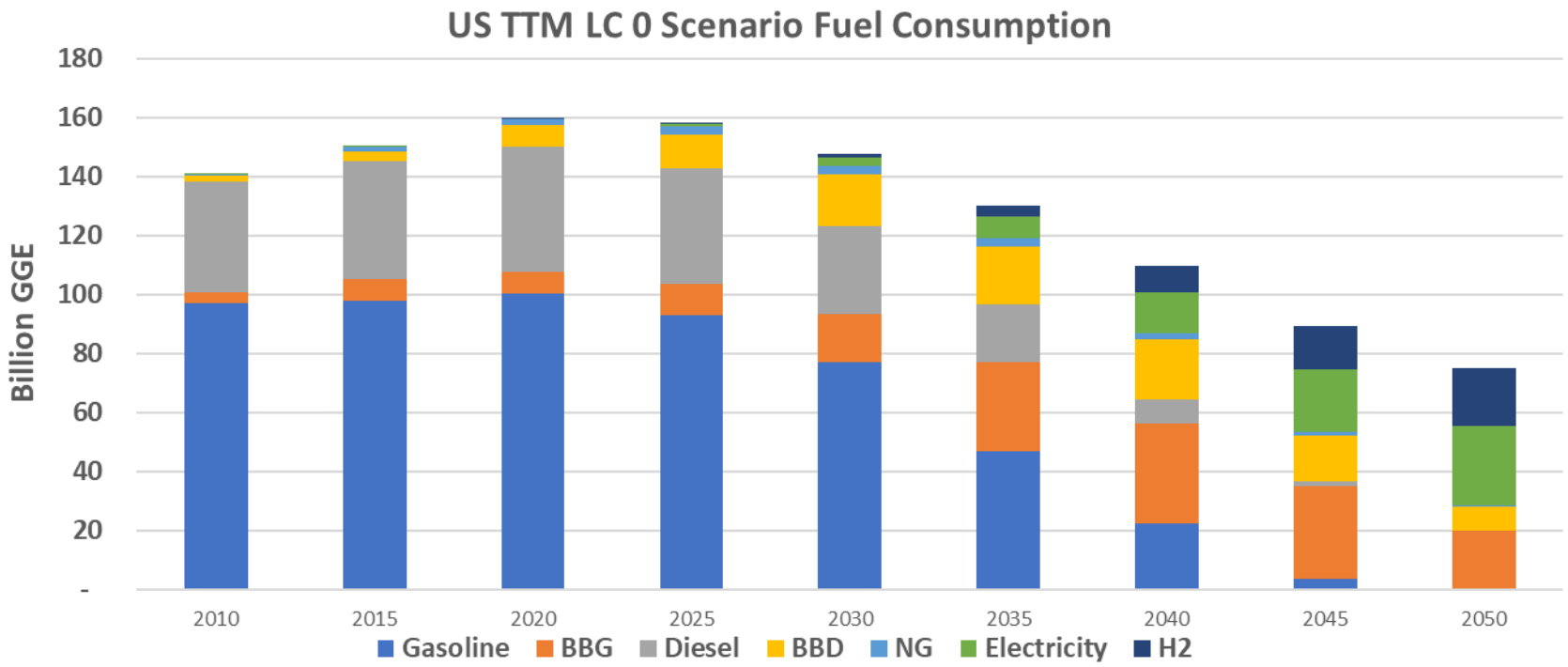
Scenario ZEV Market Penetration

Scenario	ZEV Market Share Reaches 100%	Delay for Section 177 States	Delay for Other States
California			
LC	2040	NA	NA
High ZEV	2035	NA	NA
US			
LC 0	2040	0	5
LC 5	2040	5	10
LC 10	2040	10	15
HZ CA	2035	0	0

Differences in ZEV ramp ups are substantial (LDV example)



Fuel Consumption LC 0 Scenario



Biofuels Details

- Blend percentage to keep LC 0 near 50 Billion GGE maximum

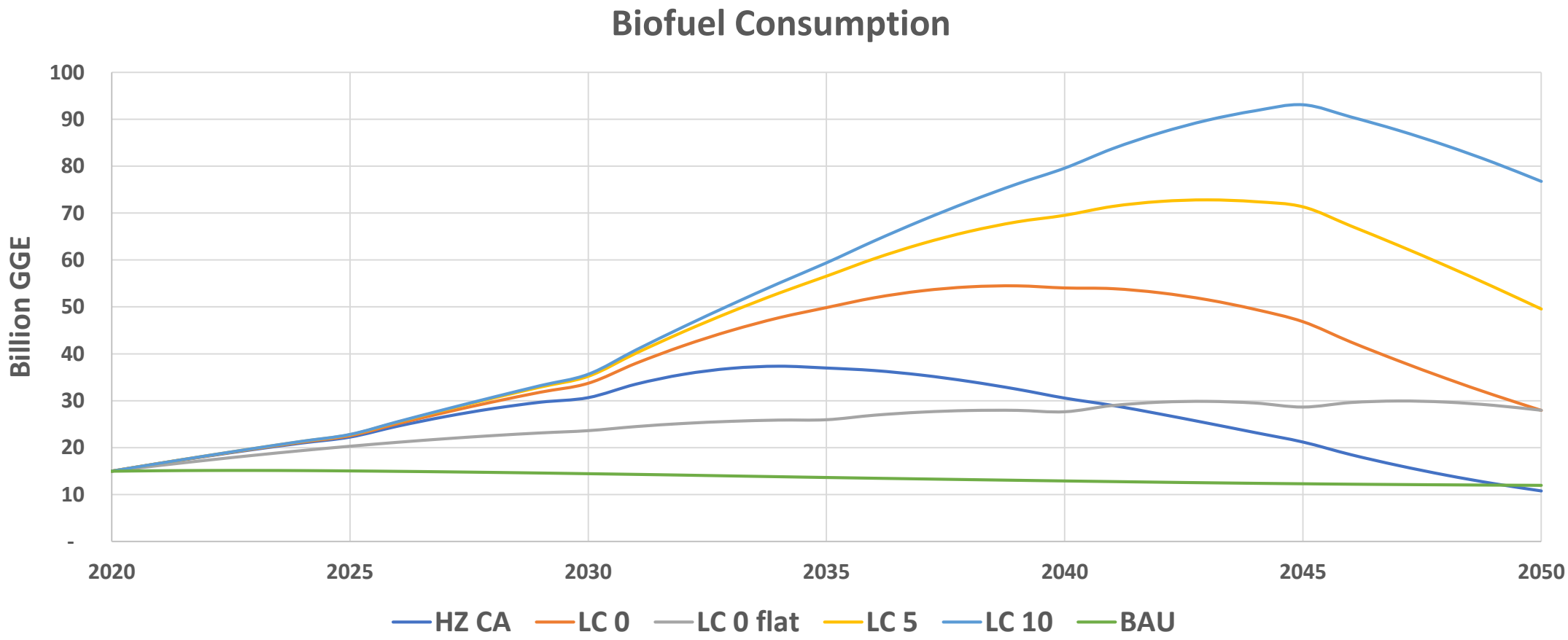
	2020	2025	2030	2035	2040	2045	2050
BBG Blend %	7.0%	10.5%	17.4%	39.2%	60.0%	90.0%	100.0%
BBD Blend %	15.0%	23.0%	37.0%	50.0%	71.1%	90.0%	100.0%

- Carbon Intensity in 2050
  - < 25% of fossil gasoline and fossil diesel

Biomass Based Liquid Fuels Demand

- Vehicle stock increases over time
  - BBD, BBG volume increases
- Blend percentage of BBG and BBD increase over time in order to reduce GHG emissions. Blend percentage reaches 100% in 2050.
  - BBD, BBG volume increases
- ZEV stock increases over time reducing the stock of ICE vehicles
  - BBD, BBG volume decreases

Biofuel Consumption by Scenario

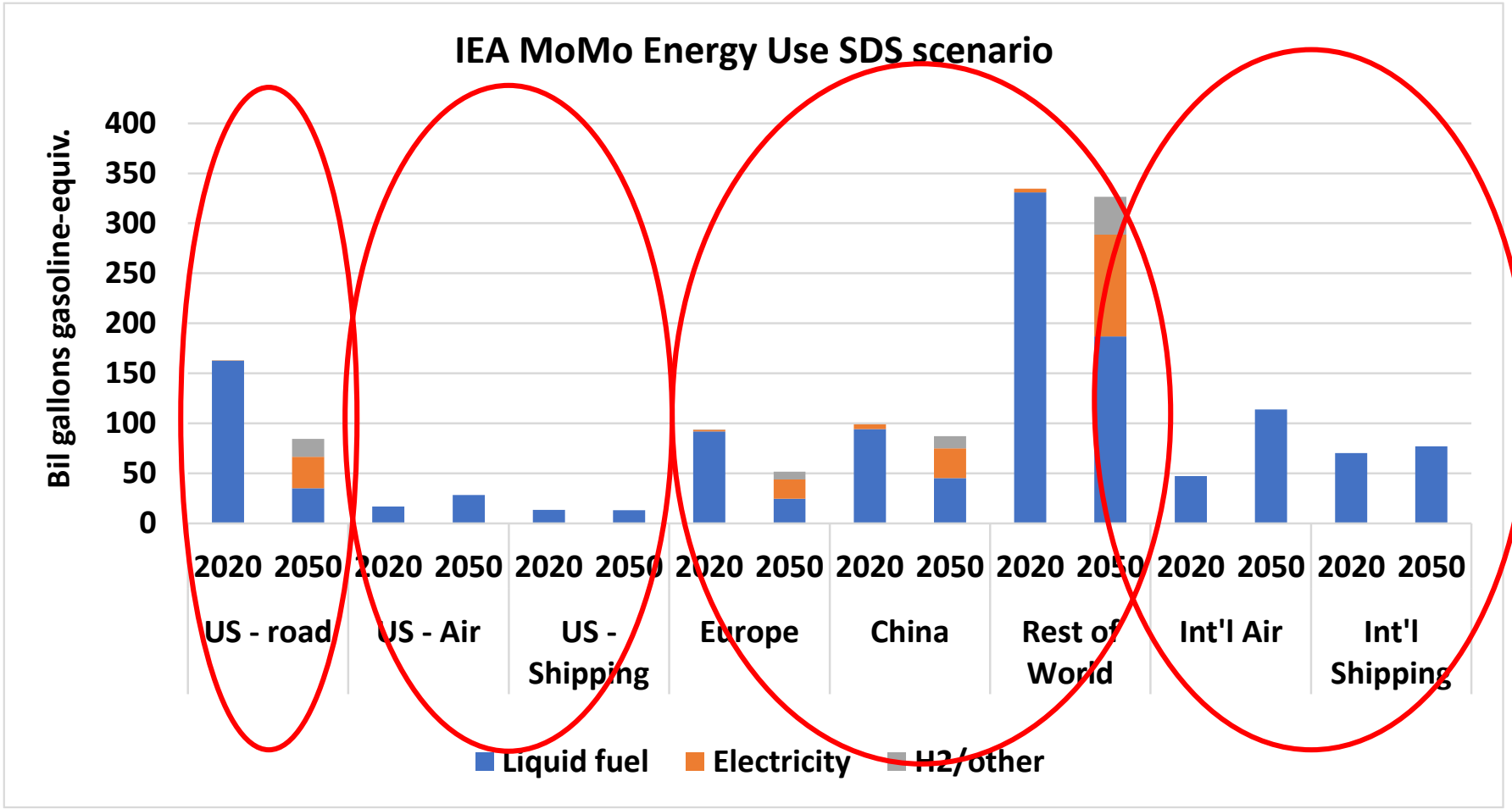


Scenario GHG Emissions

Scenario	GHG Reduction 2015 to 2050 (%)	Cumulative emissions (Gt CO2e)
BAU	24	
LC 0	96	21.5
LC 0 flat	96	23.5
LC 5	93	
LC 10	89	
High ZEV	98	

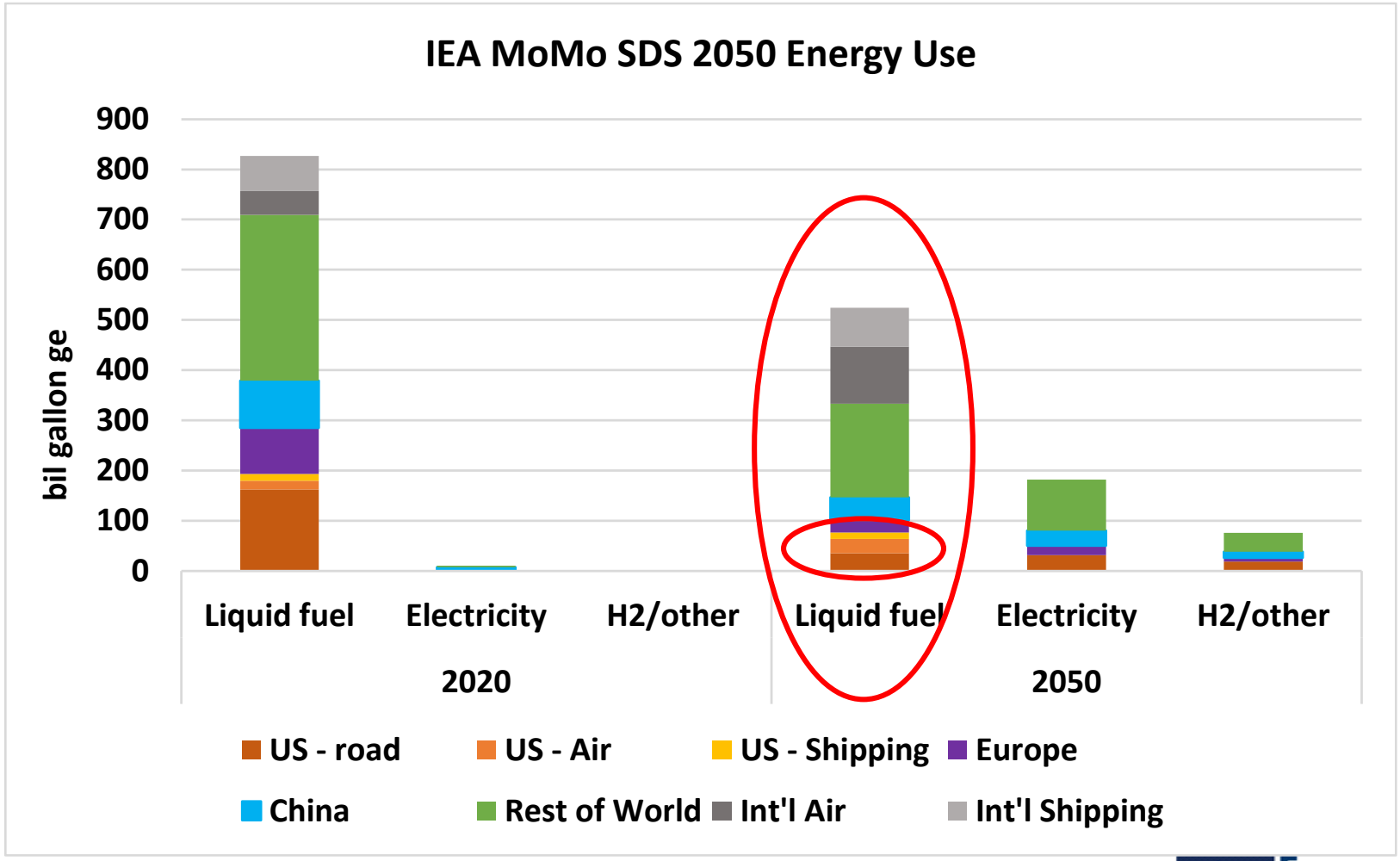
IEA MoMo projections from ETP 2020

Global transportation energy use, Sustainable Development Scenario (below 2 degrees)



Projections by fuel type

US represents about 15% of the global liquid fuels demand in 2050 in this scenario



Questions for Biofuels (2022 work)

- What is maximum US production for low CI biofuels?
- What are the feedstocks for that production?
- If US consumption drops well below supply 5 to 10 years after peak demand, what can we do with excess production?
  - Sell to international markets?
  - Use for other sectors (aviation, shipping)?
  - Will there be stranded assets?

Thank You

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