# 1-4. Creating Transport Demand for Hydrogen

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# Does hydrogen fit into the transport transition?

- Hydrogen benefits:
  - high energy density compared to batteries.
  - well suited to heavy trucks, intercity buses, aviation, and boats.

- Hydrogen challenges:
  - storage
  - production costs

- *These challenges might slow commercialization*

- But e-fuels are a promising approach…

# Introducing e-fuels

- E-fuels = **carbon + hydrogen**
  - Low-emissions electrolytic hydrogen is 70% of costs
  - CO2 capture is 20% of costs
  - All other steps are already commercialized (e.g. Fischer-Tropsch process)

- Some benefits:
  - A true drop-in alternative for all liquid fuels
  - Removes the need for FCEV's or changes to engines

# E-fuels and… PHEV's?

- The light vehicle BEV transition does have some problems:
  - Minerals supply and vehicle production
  - Scaling up charging infrastructure at the same rate as EV uptake
  - Range requirements.

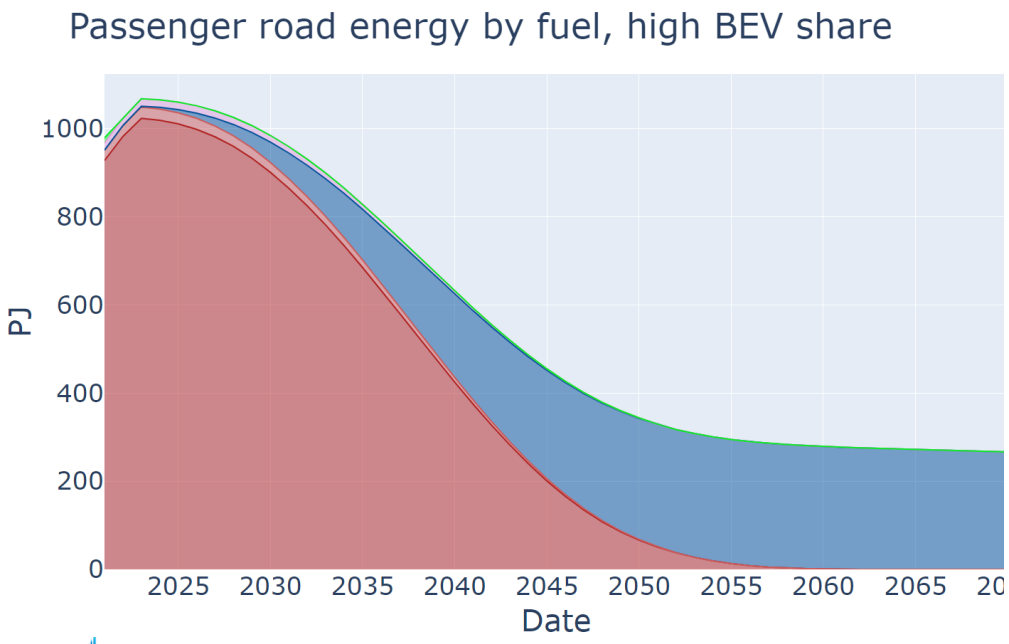
- Replacing half the BEVs with PHEVs with e-fuels would mean:
  - Less mineral requirements
  - Half the chargers
  - No range issues

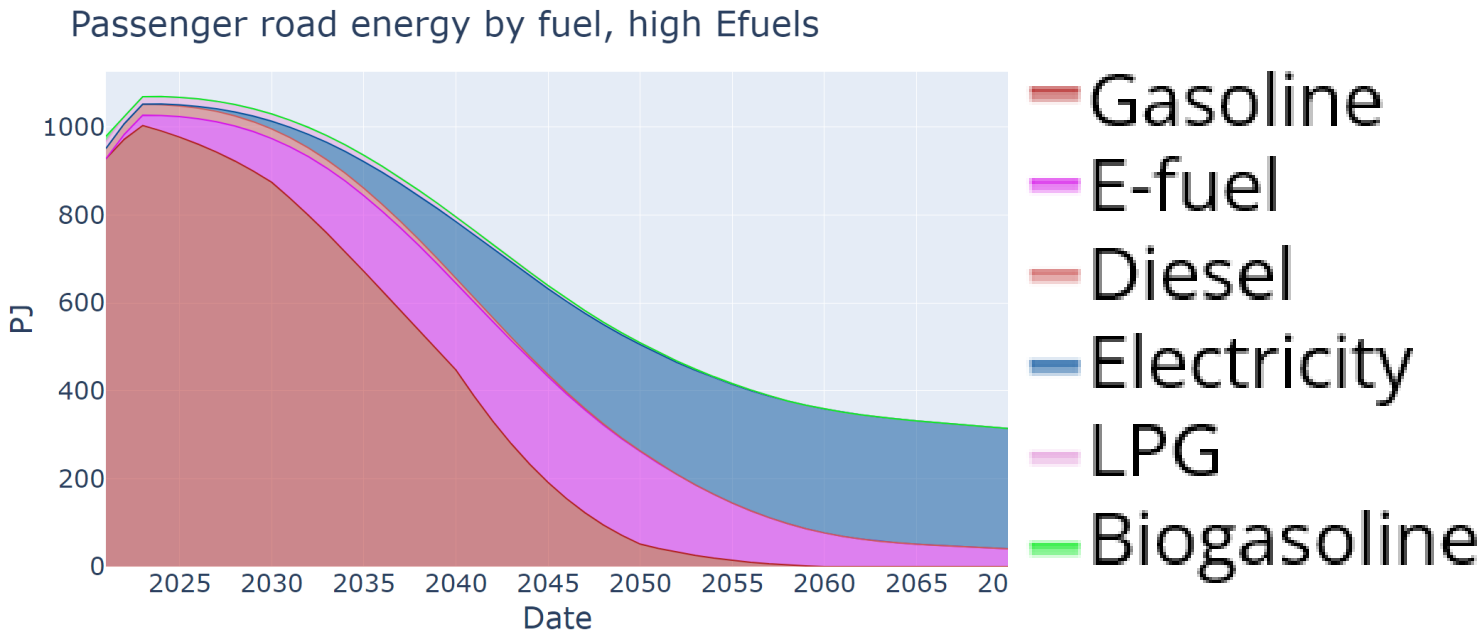
- *Note, we assume the owner has access to a private charger and never uses public chargers.*

# Energy use from BEV's vs e-fuels in Japan

- We modelled two scenarios:
  - High BEV share
  - High e-fuels and PHEV's (about a 50/50 sales share of PHEV's to BEV's)

- The energy use graphs below show the energy requirements in passenger transport.

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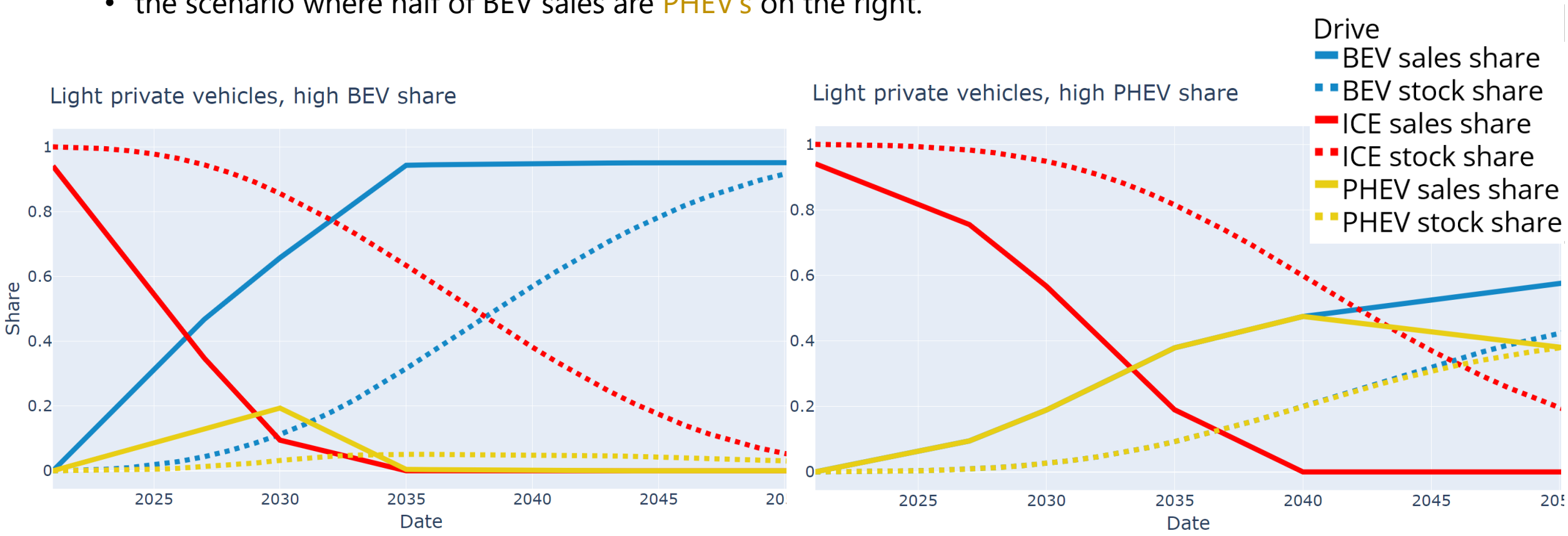
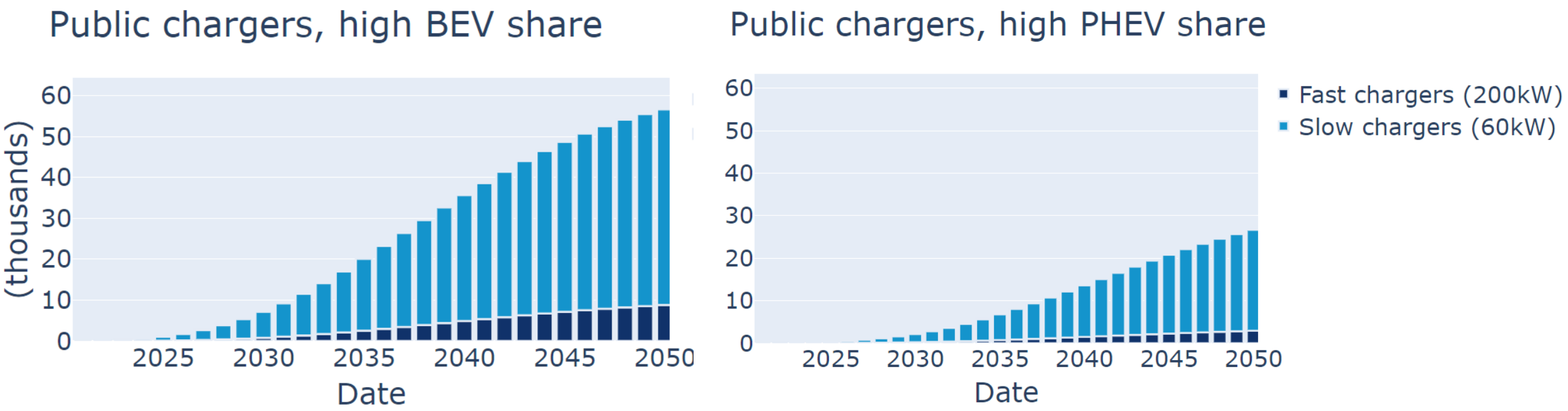
# Sales shares in Japan

- Compare:
  - the rapid uptake of BEV's on the left
  - the scenario where half of BEV sales are PHEV's on the right.



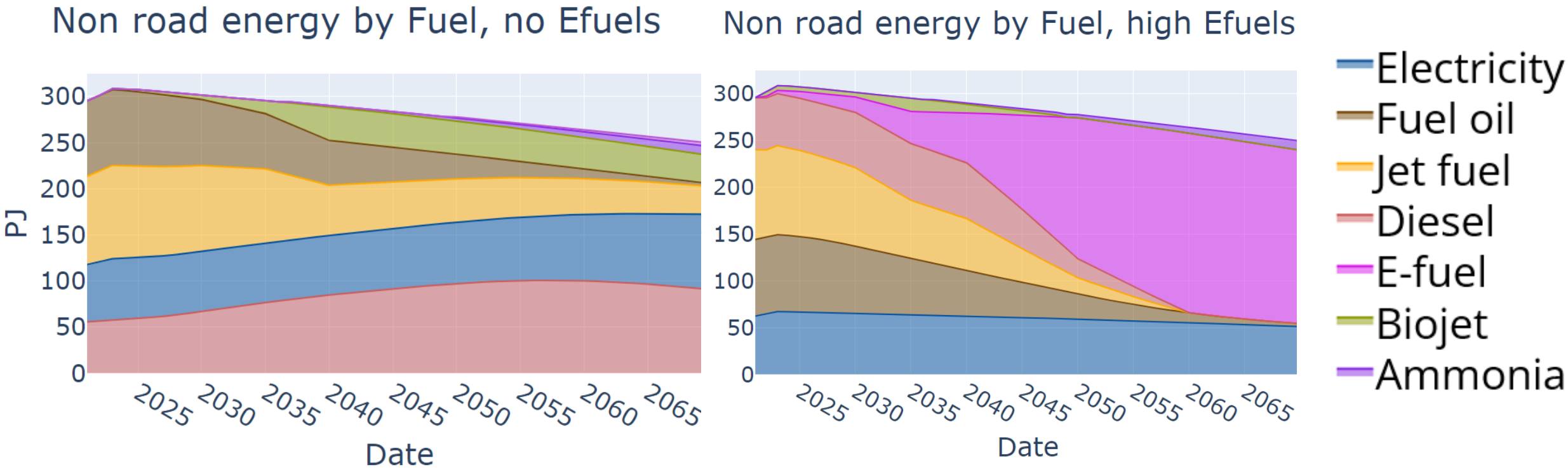
# No exponential growth required

- Slower BEV growth means slower charging station growth.
- By 2050 there are half as many charging stations



# Side effects for heavy vehicles, aviation and marine sectors

- E-fuels in passenger transport provides more certainty for e-fuels where there are few alternatives
- E-fuels could be fully transitioned to use in these mediums from 2040 onwards:

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# Challenges with e-fuels

- **How to lower hydrogen and carbon capture costs?**
- E-fuels may cost more than other fuels
- PHEV utilization rate probably needs to be increased using policy or nudging
  - it is currently at 50%, we assumed it would rise to 70% by 2040
- PHEVs are not being produced at the same scale as BEVs
- PHEVs cost as much as BEVs

# Conclusions

- Using more PHEVs in the early stages of the transition means the growth of EVs does not have to be exponential.
- The same CO2 reductions can be achieved.
- Support the e-fuels industry for harder to decarbonize heavy transport types.
- A 100% BEV passenger fleet can still be achieved in the long term.
- E-fuels mostly rely on the success of green hydrogen and carbon capture technologies.
- This is not a guaranteed solution, but it is a valuable option to keep open.

# Thank you.

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