

# Free charging for low-income communities -- an idea for discussion

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For

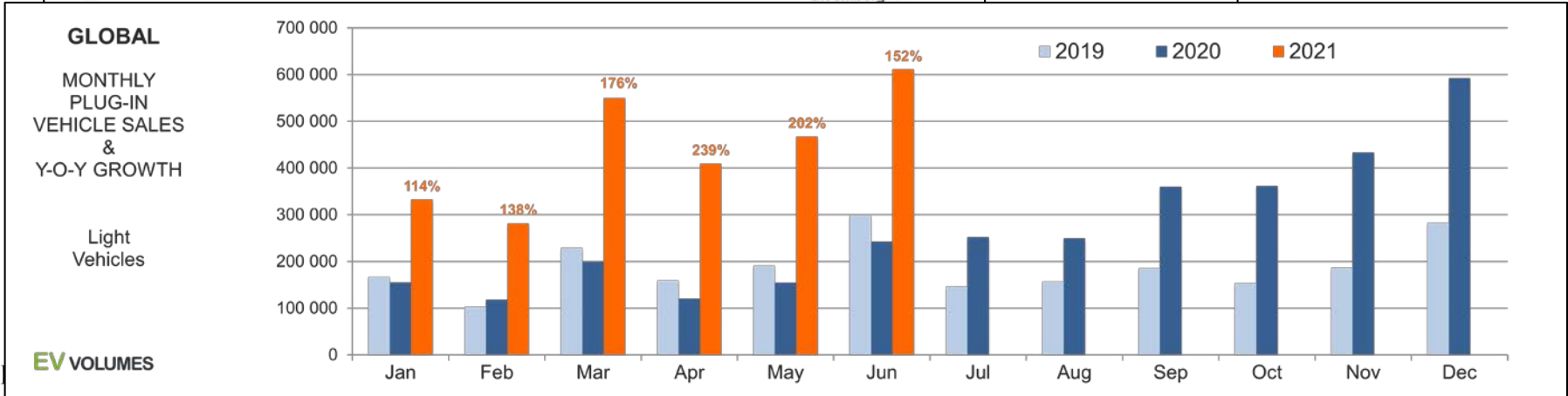
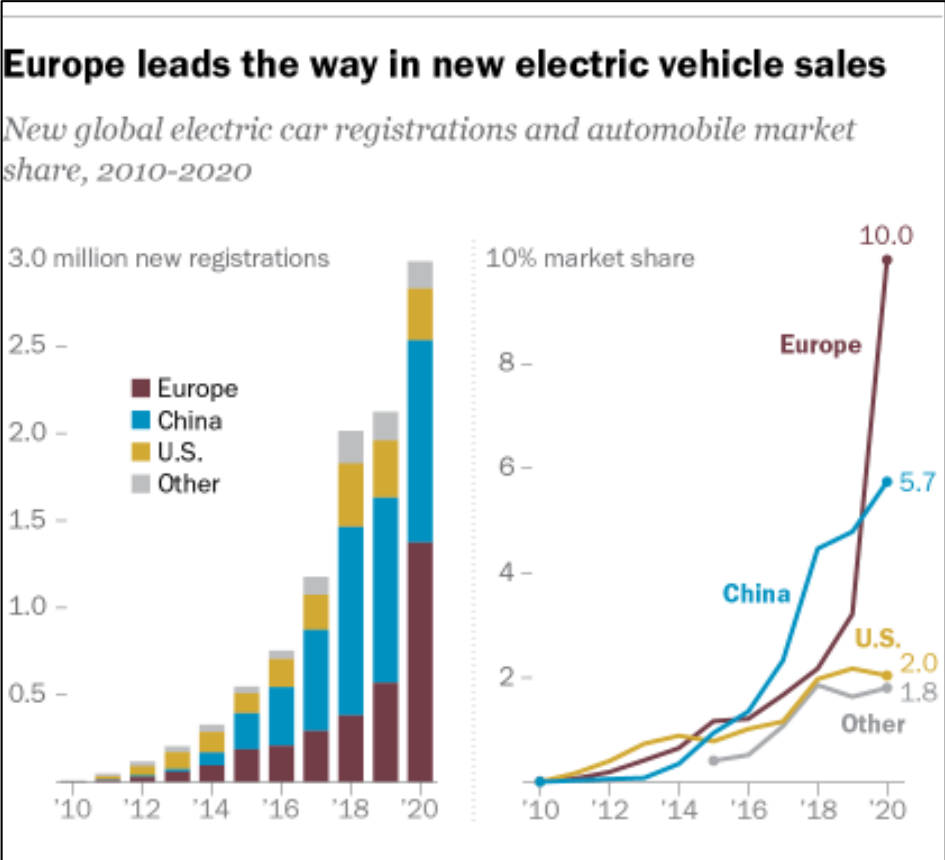
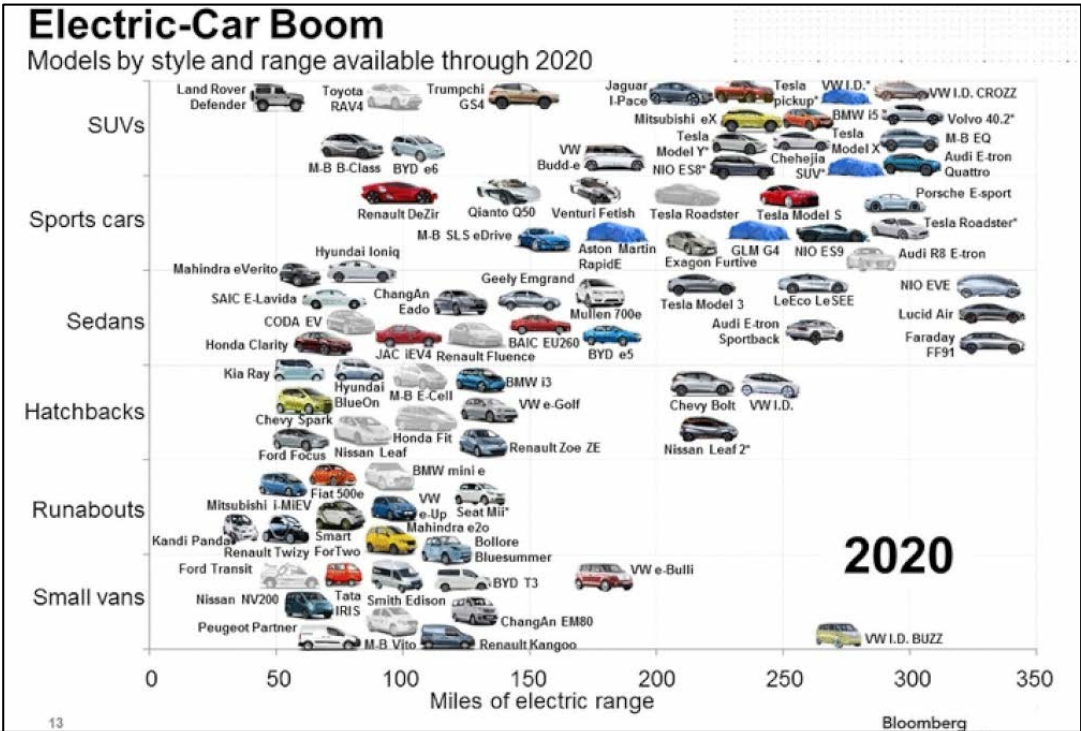
Navigating an Electric Vehicle Future: Virtual Workshop

By National Academies committee on the Assessment of Technologies  
for Improving Fuel Economy of Light-Duty Vehicles - Phase 3

Oct 28, 2021

# Vehicle electrification effectiveness

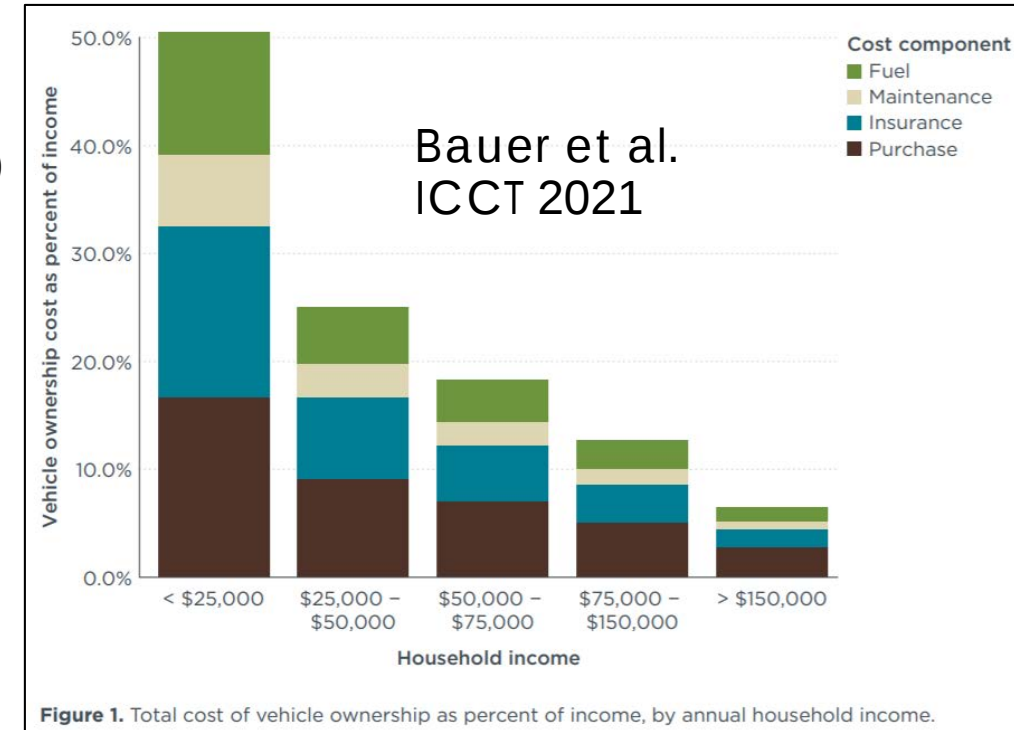
## -- we are doing well



Electric, plug-in hybrid and fuel cell vehicles. In the EU, plus Iceland, Norway, Switzerland and the UK, plus Brazil, Canada, Chile, India, Indonesia, Japan, South Africa, South Korea and Thailand. Policy, "Global EV Outlook 2021."

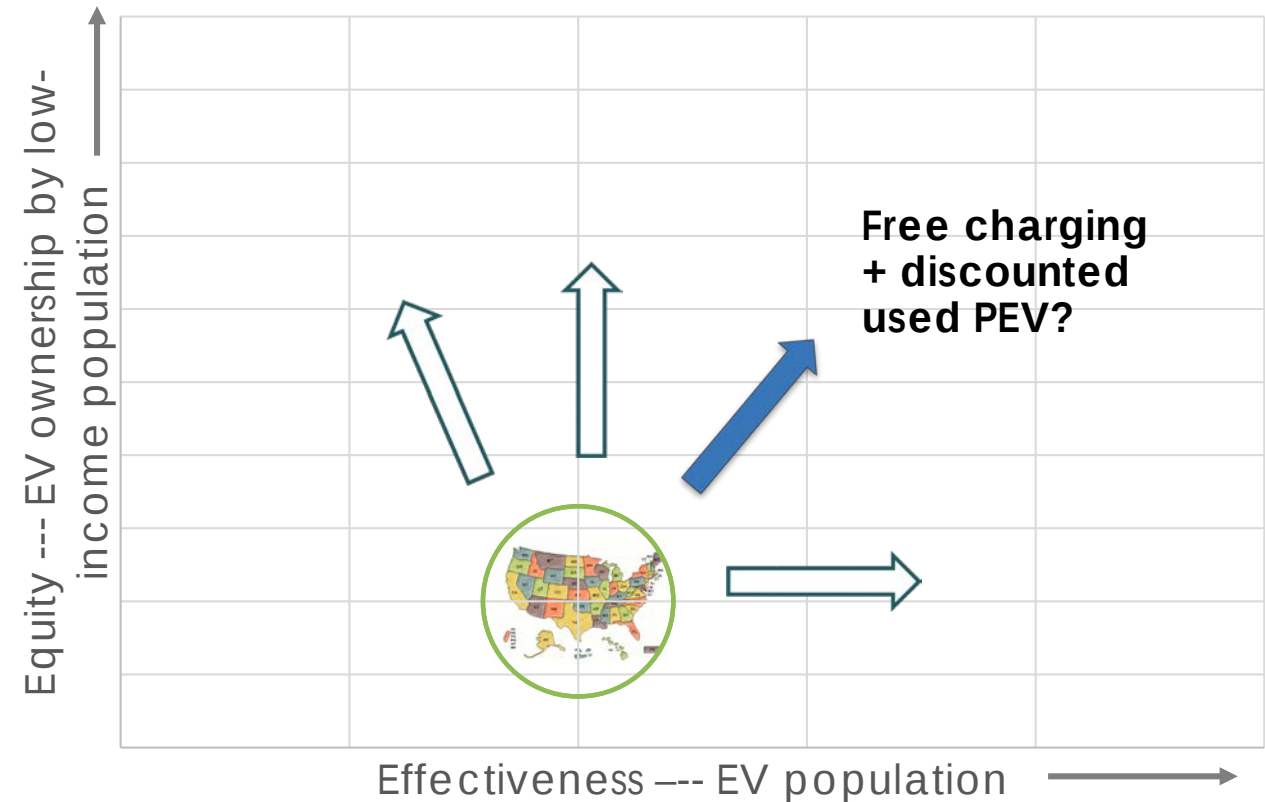
# Vehicle electrification equity --- need improvements

- EV buyers
  - Mostly male, high-income, highly educated, homeowners, +1 cars, charge at home (Hardman et al. 2021)
- EV products
  - Mostly expensive high-end
- EV incentives
  - Lack of equity consideration
  - CA set income eligibility
  - NASEM phase 3 report recommends more equitable design of EV purchase subsidies
- EV charging infrastructure
  - Chargers are not equitably distributed
  - Public charging 2-4 times more expensive than home charging (Electrify America, 2019)
- Low-income consumers
  - More likely exposed to transportation emissions; spent a higher income portion on transportation
  - Benefit more from vehicle efficiency improvement (Greene & Welch, 2017)
  - Missed benefits from vehicle electrification



# Can “free-charged used-PEV for low-income communities” improve vehicle electrification equity AND effectiveness?

- Value of “free” charging
- Affordable used PEVs
- Used-PEV demand reinforces new-PEV demand



# Value of Free

(Shampanier et al. 2007)

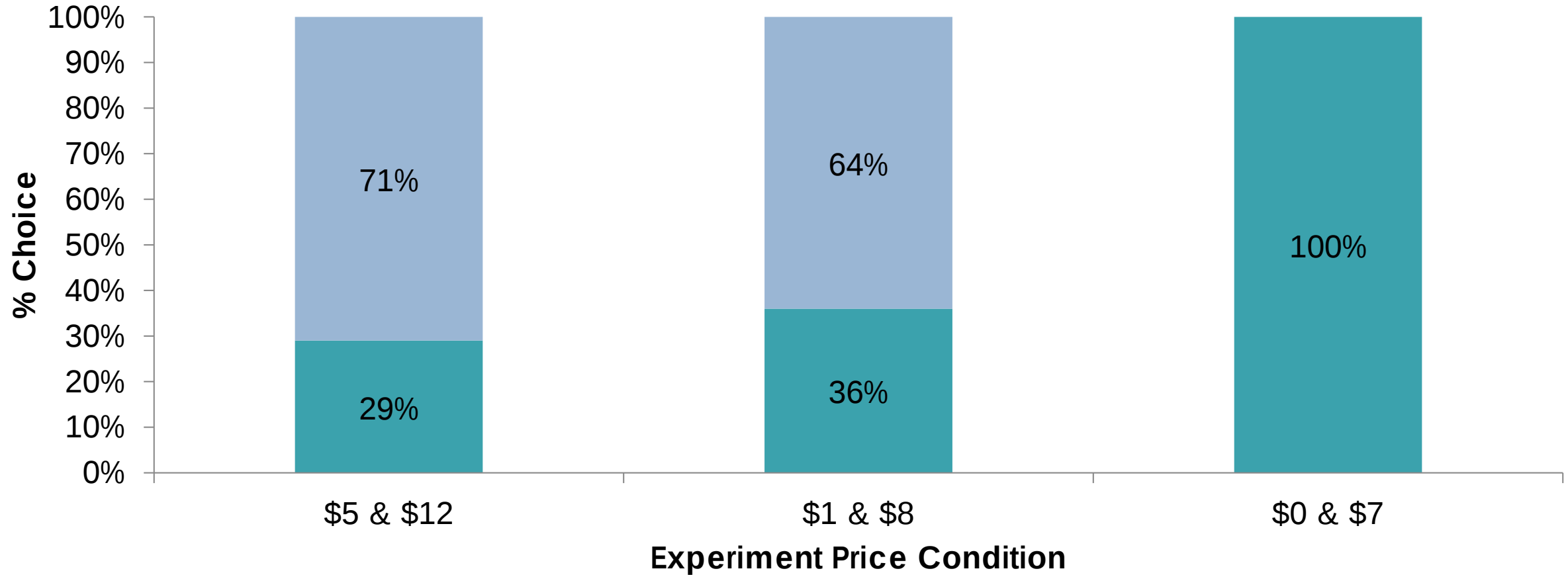
CHOOSE:

GIFT CARD  
\$10

OR

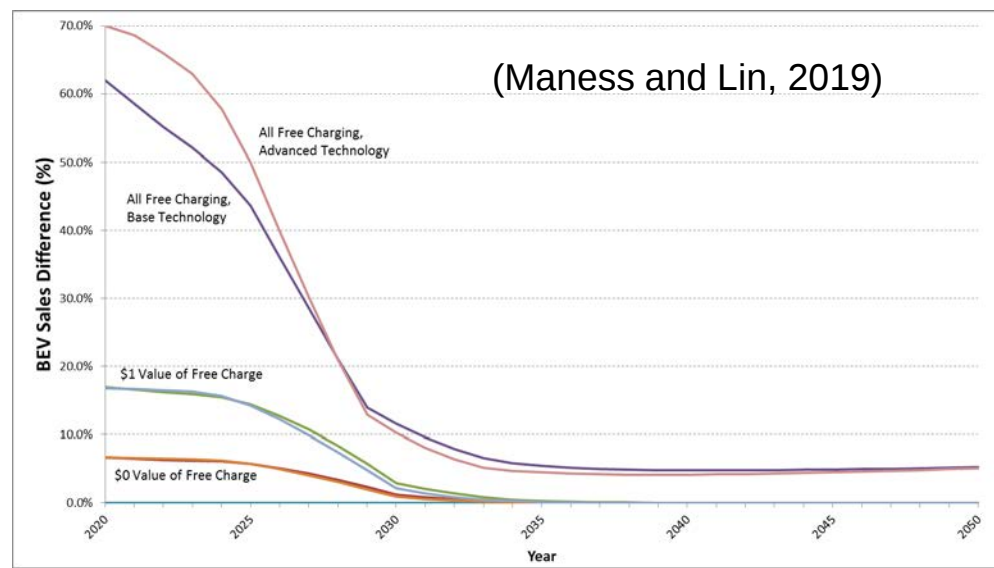
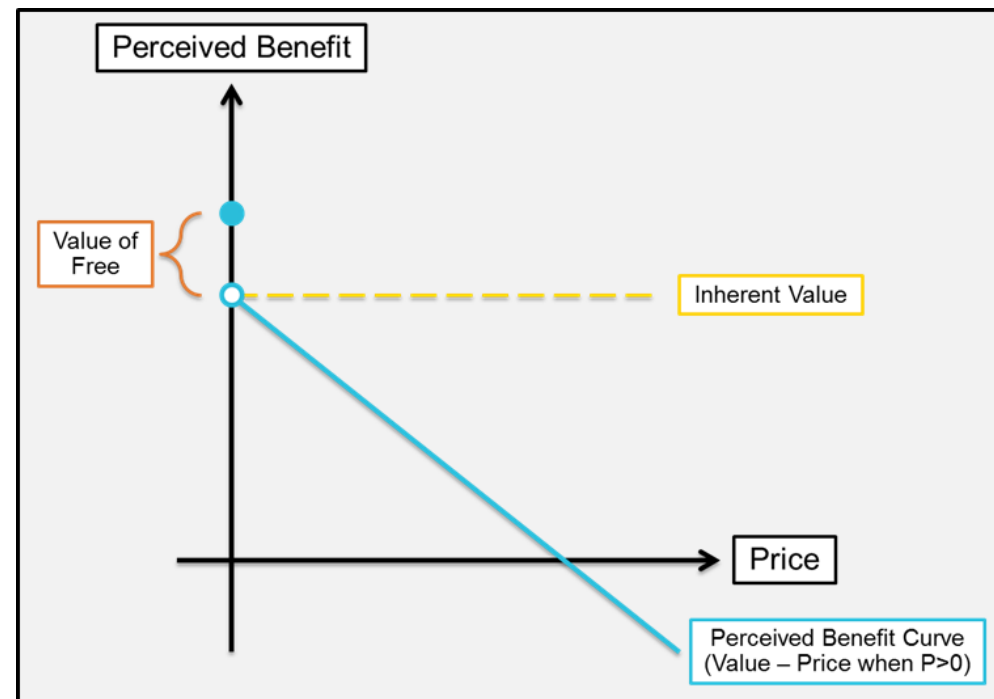
GIFT CARD  
\$20

■ \$10 Gift Card ■ \$20 Gift Card



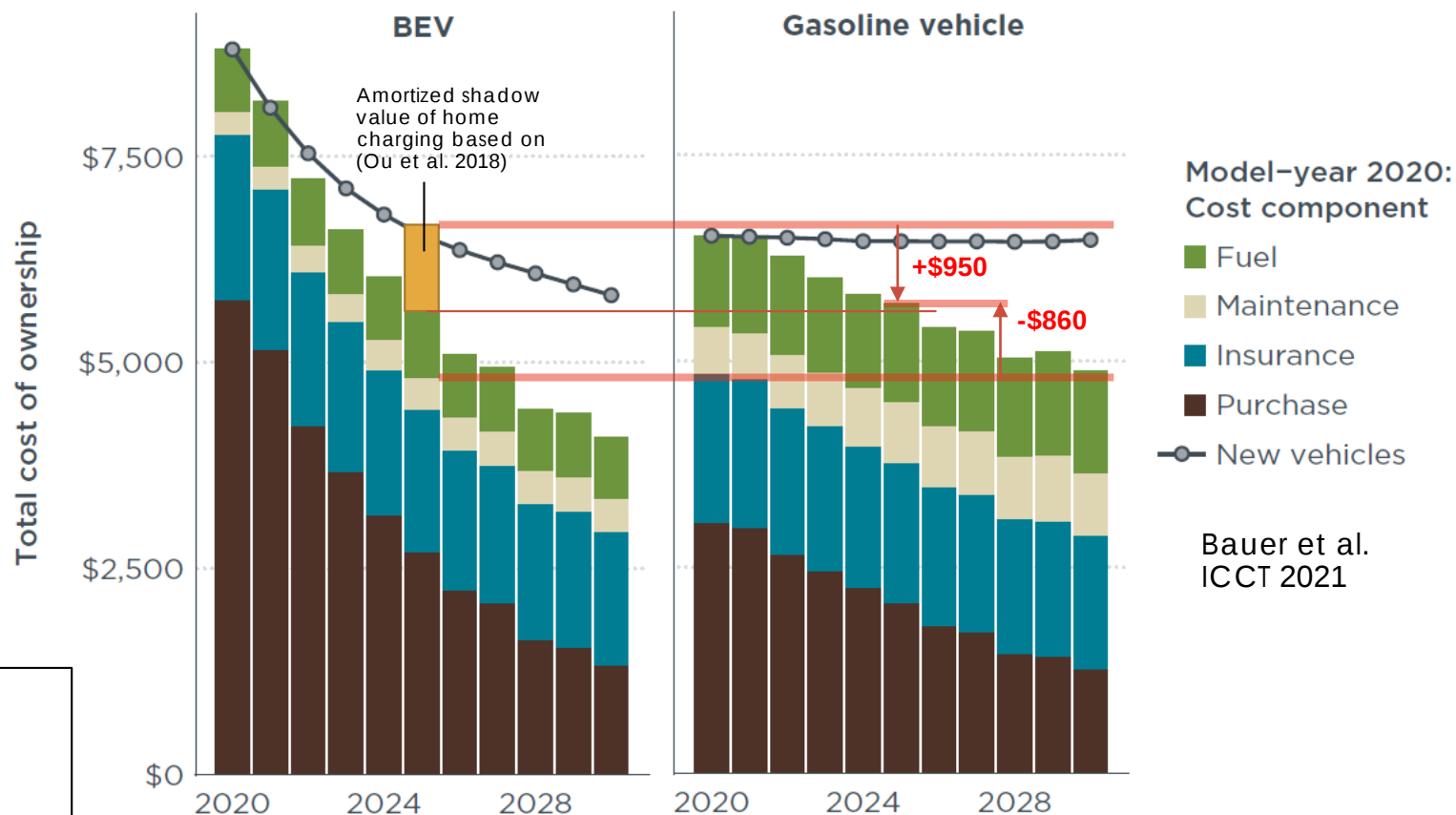
# Value of free charging

- Applications with observed value of free
  - Candy Choice (Shampanier et al. 2007)
  - Supermarket Food (Diamond and Sanyal 1990)
  - Hotels and Free Breakfast (Nicolau & Sellers 2012)
  - Test Preparation (Chandran & Morwitz 2006)
  - Airfare (Nunes and Park 2003)
  - Highway Tolls (Gaker et al. 2011)
  - Free Parking (Wolbertus et al. 2018)
- Marketing and behavioral economics research has found a special valuation at a free price
  - Likely due to emotional affect and not due to transactional cost or mapping difficulties
  - This effect was found for both standalone products and bundles with free additions
- (Maness and Lin, 2019) modeled impact of free charging on EV sales
- On-going survey on perceived value of free charging

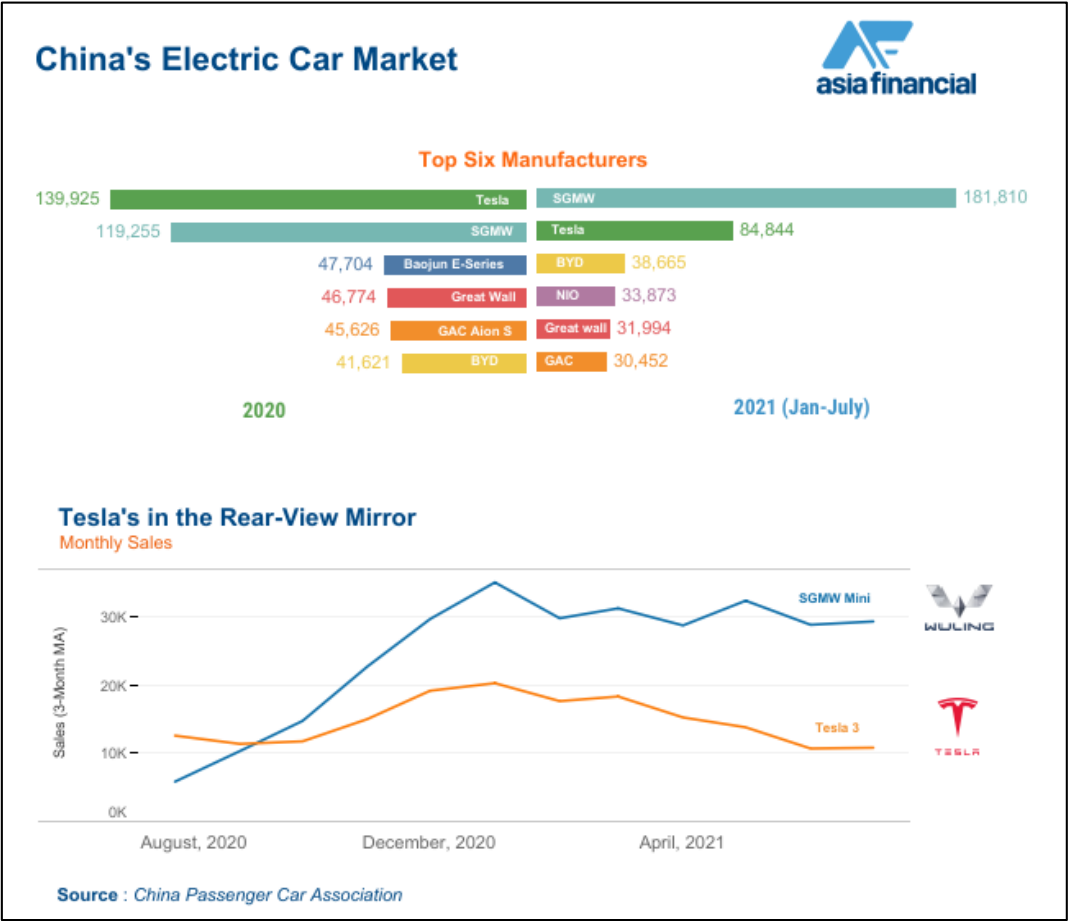


# Free charging implies significant incentive value to used PEV buyers

- Lack of residential charging, \$7382 barrier if public charging available(Ou et al. 2018); even higher if not
- It causes \$950/yr higher to own a 5yo BEV than a 5yo GV
- With free charging close to home (how?), 5yo BEV becomes \$860/yr cheaper to own than a 5yo GV
- Greater impact if value of “free” is considered



# Low-end BEV available in the US?



~\$36,500, NEDC range 468 km

## Model 3

预计交付日期: 4至6周

468公里    225公里/时    5.6秒

续航里程  
NEDC综合工况

最高时速

百公里加速

后轮驱动

标准续航升级版

¥ 235,900\*

双电机全轮驱动

Performance 高性能版

¥ 339,900

\*此为补贴后起售价, 由补贴前起售价 ¥251,740 扣除现行新能源汽车补贴金额得出 (目前私人购买补贴金额为 ¥15,840, 非私人购买或用于营运的新能源乘用车补贴金额为 ¥11,088)。如果选配后的车辆价格高于 ¥300,000, 则不享受上述新能源汽车补贴。详见政府政策。



~\$4,500, NEDC range 120 km

## 宏光MINIEV

订金 ¥ 9.90

价格: 2.88万

车款

宏光MINIEV 轻松款

宏光MINIEV 自在款

宏光MINIEV 悦享款

宏光MINIEV 轻松款 (后排5/5分座椅)

宏光MINIEV 悦享款 (后排5/5分座椅)

宏光MINIEV 自在款 (后排5/5分座椅)

颜色

星空蓝

星云白

星韵粉

星辉金

提车4S

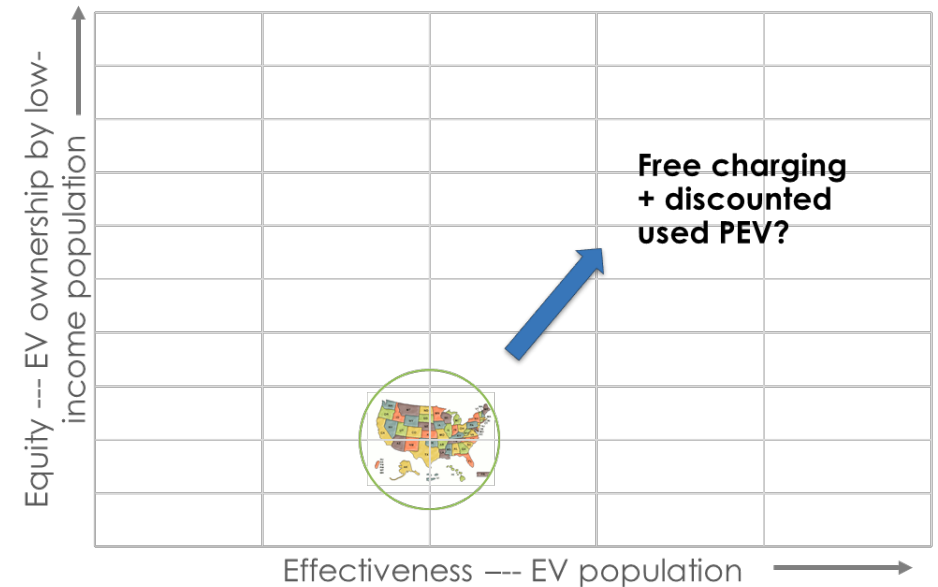
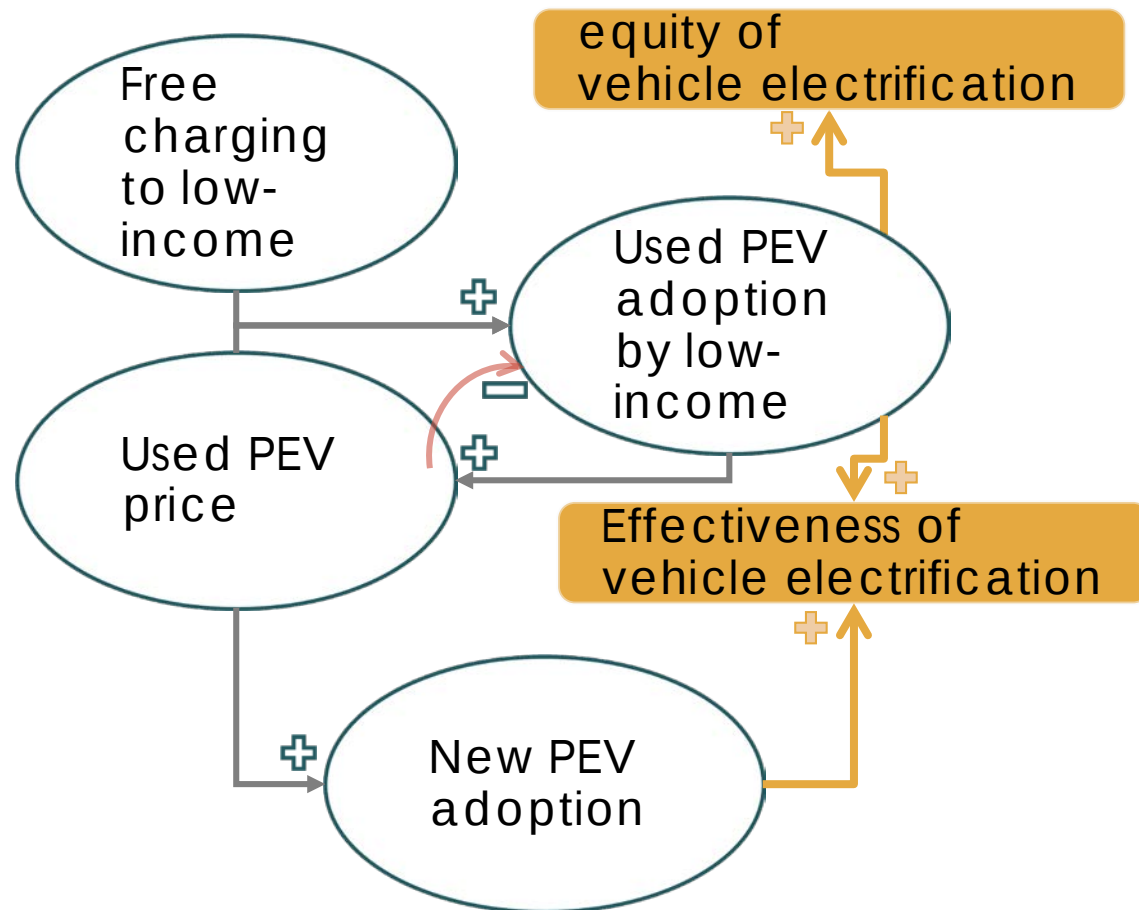
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立即下单

# free-charged used-PEV for low-income communities to improve vehicle electrification equity AND effectiveness



# Some research questions

- Which low-income communities to start?
  - No equity benefit without effective adoption
- Scale and cost of such "free charging" programs?
- How should it be funded?
- Will abuse/overuse occur? How to manage?
- How to quantify the benefits?
  - Air quality in low-income communities; transportation cost savings; positive externality to new PEV market; overall GHG reduction

# Conclusions

- Free-charged used-PEV for low-income communities to improve vehicle electrification equity and effectiveness
  - As an idea for further analysis and discussion