Dual-credit policy: Impact on PEV sales and industry profits in China

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PEV sales in China exploding until recent months

Electrified Light-duty Vehicle Sales

- HEV in China
- PEV in China
- HEV in US
- PEV in US

Monthly PEV (Passenger vehicle) Sales in China


Data source: https://www.d1ev.com/news/shuju

(Ou et al., 2019)
Dual-credit combines CAFE and ZEV rules and is replacing purchase subsidies as policy stimulator for PEV sales.

September 2017: “Passenger Cars Corporate Average Fuel Consumption and New Energy Vehicle Credit Regulation” (Dual-credit Policy)

**Corporate Average Fuel Consumption (CAFC Credit)**

- **Meet CAFC Target?**
  - Yes: Positive CAFC credits → Carry forward to next years
  - No: Negative CAFC credits →
    - Offset by own PEV Credits in current year
    - Offset by CAFC credits transferred from related companies
    - Offset by purchasing PEV Credits

**New Energy Vehicle Quota (NEV Credit)**

- **Meet NEV Production Target?**
  - Yes: Positive NEV credits →
    - Sell PEV Credits
  - No: Negative NEV credits →
    - Offset negative CAFC credits
    - Offset by purchasing PEV Credits

1 CAFC Credit = 1 NEV Credit

Note: NEV = new energy vehicles, including plug-in electric vehicles and fuel cell vehicles
Approach: New Energy and Oil Consumption Credits Model (NEOCC)

- **Features**
  - A consumer choice model with industry profit optimization constrained by the Dual-credit policy
  - Calibrated with 2017 Chinese vehicle market (and later to 2018 market data)
  - Market share projection from 2018 to 2050
  - Policy compliance as constraints, powertrain cross-subsidy as decision variables, gross profit maximization as the objective function
  - Key dynamics: battery cost, ICEV efficiency cost curve, subsidy phase-out, PEV multiplier, PEV credit by range, charging infrastructure

- **Algorithm**

  - Objective function: profit maximization
    \[ d\text{Profit}(Sales_{\text{vehicles}}) = 0. \]
    Or, marginal revenue = marginal cost
NEOCC results: strong PEV sales growth in China

Several institutions projected 1.6 million PEV sales (LDV and commercial) at the beginning of 2019, but have now down-adjusted their projections to about 1.4 million PEVs and 1.1 million passenger PEVs.
NEOCC results: PEV multiplier and credit conversion lead to efficiency leakage

Fewer efficient ICEVs (ICE-Low) if PEV CAFC multiplier and conversion from NEV credits to CAFC credits are allowed.
With same subsidy, consumers prefer shorter ranges

Amount per vehicle, based on 2017 policies

Subsidies: 20K CNY
Subsidies: 36K CNY, 71%
Subsidies: 44K CNY, 29%

Electric range (km)

Amount per vehicle, based on 2017 policies

Subsidies: 20K CNY
Subsidies: 36K CNY, 71%
Subsidies: 44K CNY, 29%
Strong PEV sales growth will likely continue, especially BEVs

• Driving factors
  – technology improvement
  – policies
  – consumer familiarity
  – expansion of license restriction to 2\textsuperscript{nd} and 3\textsuperscript{rd} tier cities
  – BYD and Tesla effects
  – investments of foreign major OEMs
  – charging infrastructure

• Potential uncertainties
  – overall vehicle market
  – battery safety
  – range reduction and disappointment
  – Relaxation of license restriction

• Soon-to-be-finalized Dual-credit policy 2021-2023
  – Slightly de-emphasize long e-ranges
  – More credits for efficient ICEVs
Questions for more discussions

• Can de-emphasis of long e-ranges accelerate PEV penetration?
• How will OEMs play differently in the China EV market and what is the implication?
• Are fuel cells a distraction to vehicle electrification in China?
• How to address policy leakage on emissions and efficiency?
• Is the China EV industry technologically progressing (truly and substantially) or still policy dependent?
Thank you!

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For model downloads and publications, please visit
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Adjustment of vehicle market policy

Dual-credit policy Phase 2 (2021-2023): released on Sept 2019

- Adjust calculation methods of credits on every vehicle, weaken the impacts of electric range on vehicle credits
- Increase incentives for more fuel economy conventional vehicles.

Source: GAST Strategy Consulting
Major Assumptions – Reference Case

- Analyzing technology market penetration under various cost of ownership and policy scenarios
Vehicle policy impacts on China’s market – simulated by NEOCC model

Sensitivity analysis – Battery costs (Market in 2020 and battery pack cost is assumed to be $146 /kWh)

- Sales changes compared to current level
- Industry profit impacted by policy ($/vehicle)

Benchmark: 2020 market level.
Vehicle policy impacts on China’s market – simulated by NEOCC model

What is the role of public charging infrastructure in market?

1. Battery costs are much more important on increasing the growth of PEV sales than the public charging infrastructure;
2. However, the public charging infrastructure is an effective role to contribute the PEV sales growth in the emerging market.

**PEV sales growth (benchmark: 2020 market level)**

Battery costs are much more important on increasing the growth of PEV sales than the public charging infrastructure. However, the public charging infrastructure is an effective role to contribute the PEV sales growth in the emerging market.