



# Electric Vehicles in Megacities – Shanghai Charges Up



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# Authors



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# We conducted pilots on electric vehicles in three megacities to understand three key questions

City	 Shanghai	 NYC	 Paris
Objective	<b>Consumer &amp; Technology</b> <ul style="list-style-type: none"> <li>Develop deep understanding of <b>consumer preferences and barriers</b> for EV adoption</li> <li>Create integrated total cost of ownership (<b>TCO</b>) model to simulate EV technology, cost optimization and EV penetration</li> </ul>	<b>Consumer &amp; Incentives</b> <ul style="list-style-type: none"> <li>Develop deep understanding of <b>consumer preferences and barriers</b> for EV adoption</li> <li>Derive most efficient <b>incentive schemes</b> to increase private EV adoption</li> </ul>	<b>Infrastructure model</b> <ul style="list-style-type: none"> <li>Create integrated market model with special focus on <b>infrastructure building</b> <ul style="list-style-type: none"> <li>Type and density</li> <li>Investment amount, timing and payment models</li> <li>Role of public authorities</li> </ul> </li> </ul>
Project partner	<ul style="list-style-type: none"> <li>City of Shanghai</li> </ul>	<ul style="list-style-type: none"> <li>City of New York</li> </ul>	<ul style="list-style-type: none"> <li>French government (EV working group)</li> </ul>

## Key questions

- How big is the **EV market potential** and what are the characteristics of **early adopters**?
- What are the **main drivers and barriers** of these early adopters?
- What are **appropriate product offers** and **cost-effective incentives** to stimulate demand?

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# Description of research methodology

## Research stages

## Description

## Objectives



- **12 drive-along interviews** to understand driving needs and “pain points”
- **6 Focus groups** of 6 drivers each to
  - Explore attitudes and consumer reaction to specific electric vehicle concepts
  - Develop early hypotheses on segments
- **“Heat map” survey** (n = 600)
  - Driving diaries of 100 car owners
  - 400 car owners across city rings, plus 100 consumers that intend to buy a car
- **Full-length quantitative survey** (n = 606)
  - Segmented consumers by attitudinal and functional adoption factors
  - Measured potential adoption of electric vehicle concepts given varying business models, and adoption levers
- Define specific features for BEV and PHEV, e.g. range, acceleration, etc.
- Model TCO for different car segments and estimate EV cost reduction in the future
- Based on conjoint data derive consumers’ cost sensitivity curve

- Develop initial insights into customer behaviors, barriers, and pain points as well as into likely early adopters and car concepts to **calibrate quantitative survey**
- Understand **travel patterns** and behaviors
- **EV adoption potential** and **sensitivity** towards important adoption levers
- Better understanding of likely **early adopters**
- Other key insights on incentive policy preference
- Understand BEV, PHEV and ICE **cost base and future reduction**
- Forecast future **EV market penetration**

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# EVs are likely to achieve a substantial market position in all 3 megacities can within the next ten years

- ECC<sup>1</sup>
- BEV<sup>2</sup>
- PHEV<sup>3</sup>

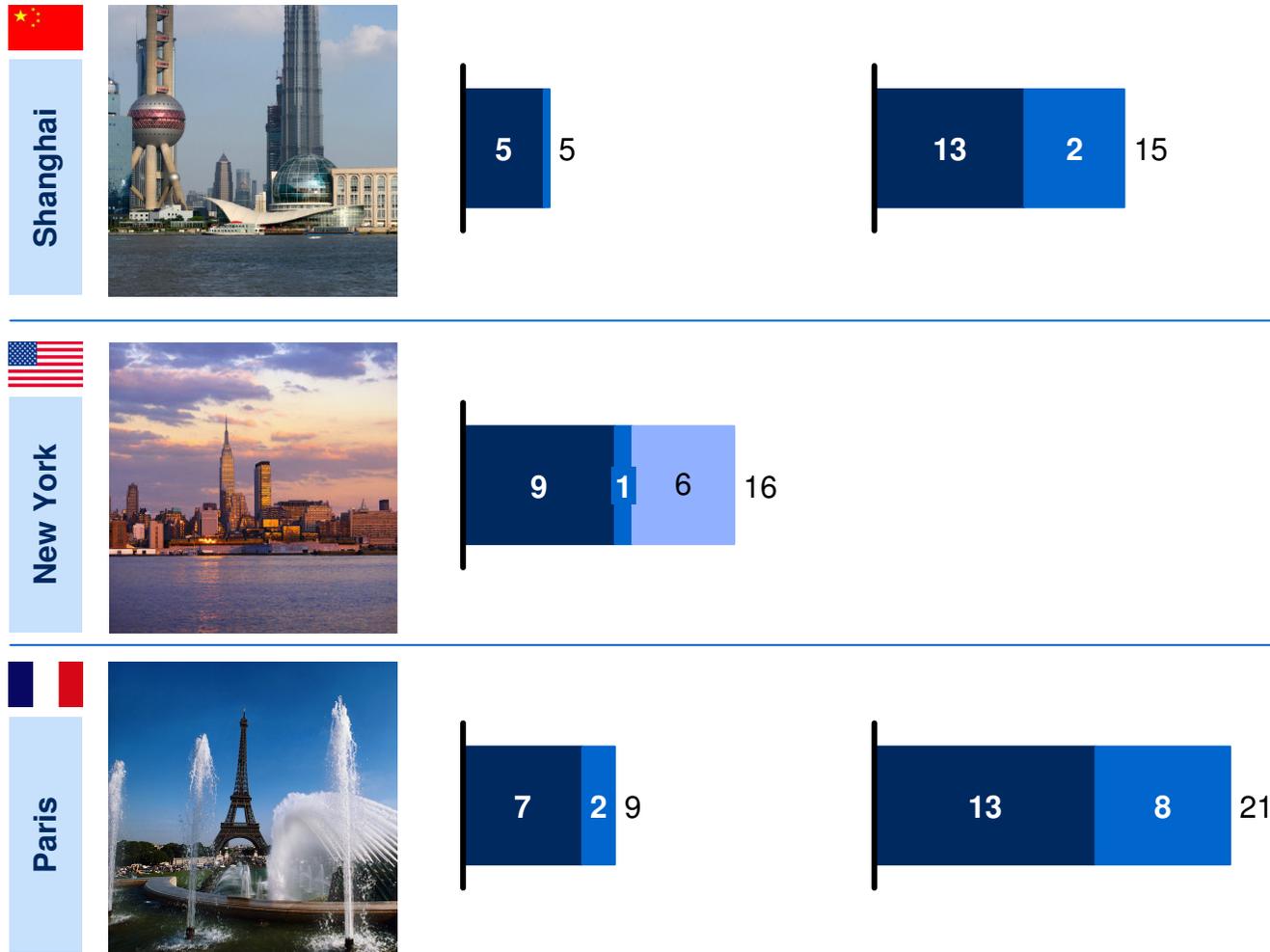
## 2015 demand

Percent of new car sales

## 2020 demand

Percent of new car sales

## Key insights



- Shanghai is expected to triple its EV adoption from 5 percent to 15 percent between 2015 and 2020
- PHEV is generally the preferred drivetrain
- BEV mainly successful as electric city car (ECC) in New York
- In Shanghai, ECC is not likely to take off, since a large share of new car buyers demand family-size cars with full functionality; consumers place high value on exterior size and interior space

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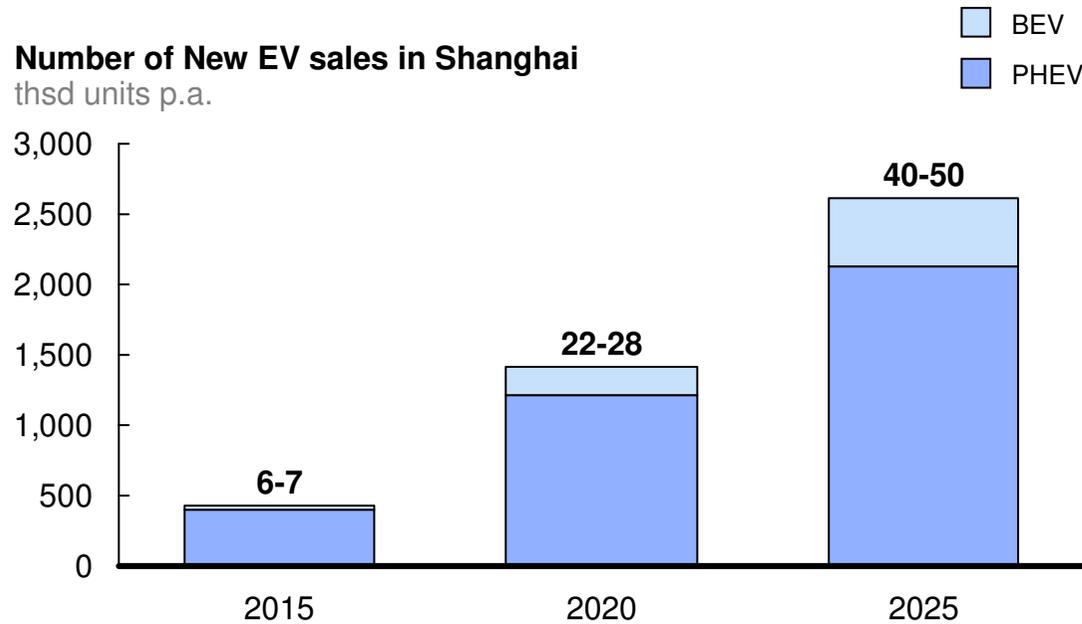
1 Electric city car (small electric vehicle, only tested in Shanghai and New York)

2 Battery electric vehicle

3 Plug-in hybrid electric vehicle

# In a relatively conservative scenario (reference scenario), EV penetration can grow to 10-15% of new car sales in 2020

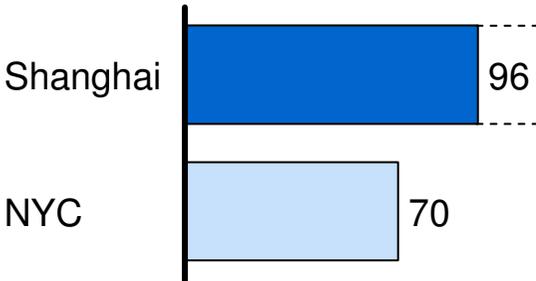
REFERENCE SCENARIO



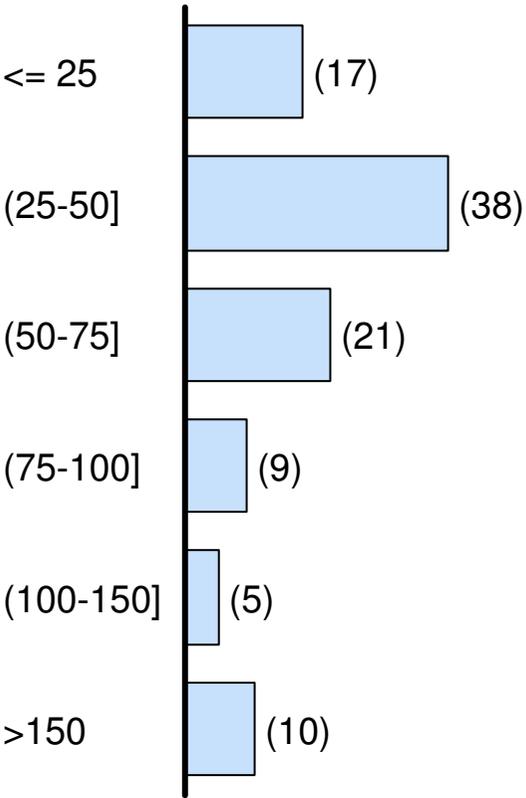
<b>Total EV market share</b>	~5%	10-15%	20-25%
<b>Relative share of EV concepts</b>			
BEV	5%	15%	20%
PHEV	95%	85%	80%

# Large percentage of single car owners in Shanghai say that maximum range is an important consideration for vehicle purchases

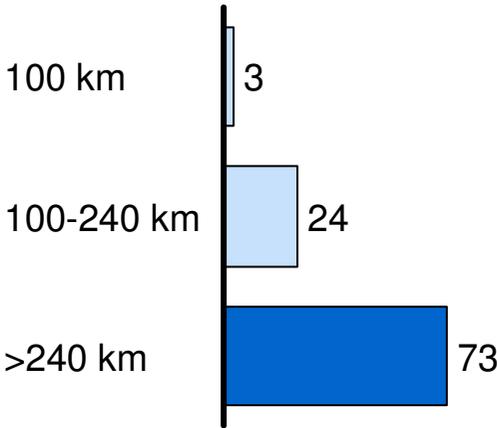
Percent of single vehicle households among all car owners, percent



Average daily range requirement<sup>1</sup>  
Km, (percent)



Maximum range requirement<sup>2</sup>  
Percent

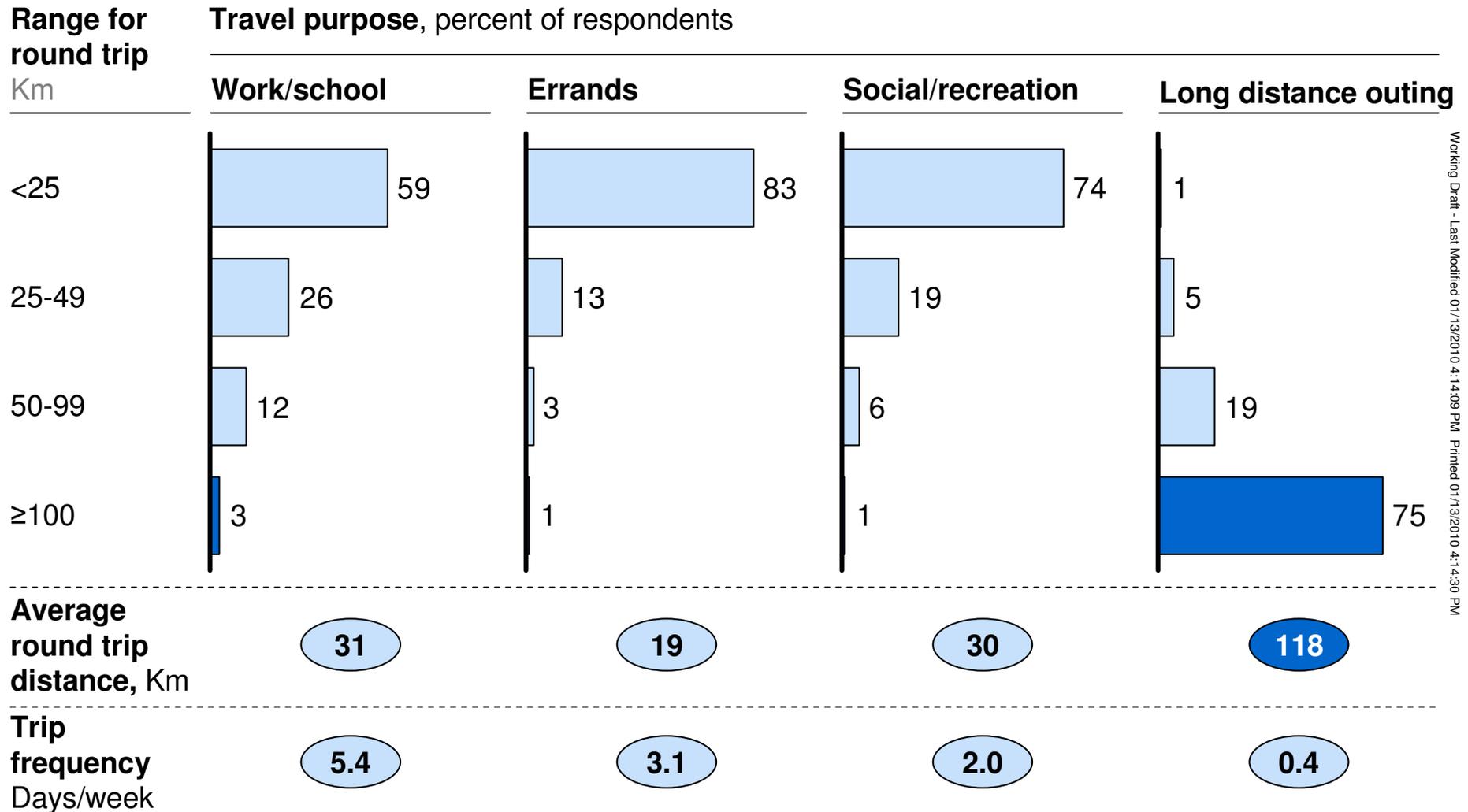


1 Based on the longest daily range requirement during last week  
 2 Based on longest round trip requirement with frequency more than once per year

# EV is compatible with most daily transportation needs except for long distance outings

Consumer travel pattern based on last trip

■ Non-compatible to BEV



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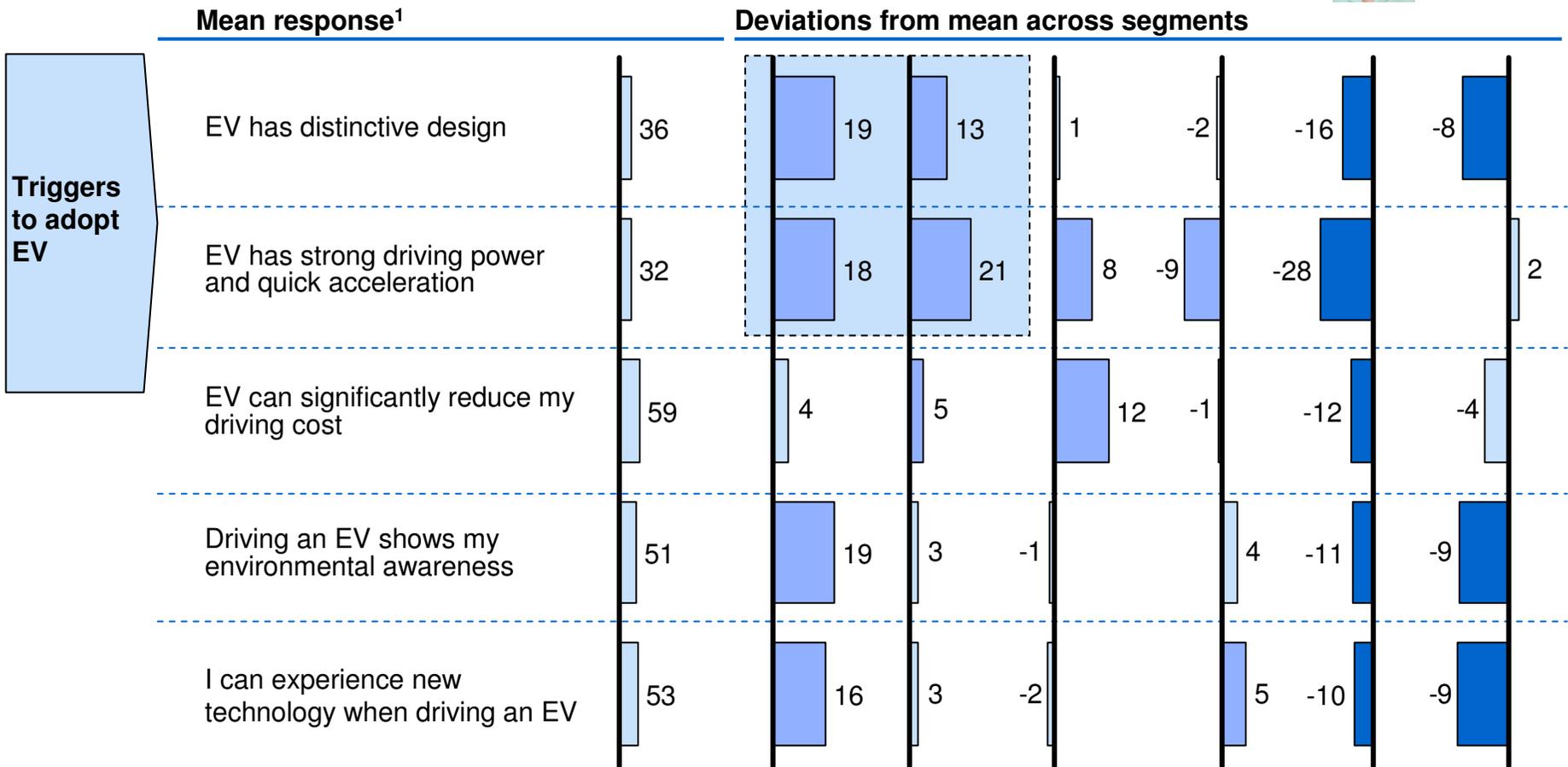
# Of the six consumer segments we identified, 30% are “early adopters”

	Early adopters		Shapeable groups		Late adopters	
	<b>1 Trendy greens</b> 	<b>2 Running cost sensitive</b> 	<b>3 Bargain hunters</b> 	<b>4 Performance seekers</b> 	<b>5 Trend followers</b> 	<b>6 ICE traditional</b> 
<b>% of households</b>	15%	15%	16%	17%	22%	15%
<b>General attitudes</b>	<ul style="list-style-type: none"> <li>Like to show off</li> <li>Willing to try new technology</li> <li>Less price sensitive</li> <li>Willing to pay premium and sacrifice performance for green</li> <li>Convenience seeker</li> </ul>	<ul style="list-style-type: none"> <li>Sensitive about running costs and willing to pay upfront premium</li> <li>Willing to sacrifice features/ design for better fuel efficiency</li> <li>Care about TCO</li> <li>Willing to change travel habits</li> </ul>	<ul style="list-style-type: none"> <li>Care about both purchase and running costs</li> <li>Shop to find lowest price</li> <li>Willing to sacrifice performance for low cost</li> <li>Concerned about reliability</li> </ul>	<ul style="list-style-type: none"> <li>Like new technology</li> <li>High standards for performance</li> <li>Like to show off</li> <li>Brand conscious</li> <li>Convenience seekers</li> <li>Not price/cost sensitive</li> </ul>	<ul style="list-style-type: none"> <li>Try new products after majority</li> <li>Prefer popular models</li> <li>Concerns about new technology</li> <li>Shop for lowest price and sensitive about operation cost</li> <li>Have clear brand preference</li> </ul>	<ul style="list-style-type: none"> <li>Highly reluctant to change behavior for new products</li> <li>Don't want to sacrifice performance or cost</li> <li>Have strong concerns about stability of EVs</li> <li>Doesn't like to show off</li> <li>Not green conscious</li> </ul>
<b>EV related attitudes</b>	<ul style="list-style-type: none"> <li>Like EV's design, lower running costs</li> <li>Willing to pay for a home charger</li> <li>No concerns toward EV</li> </ul>	<ul style="list-style-type: none"> <li>Appreciate EV's lower running / maintenance cost</li> <li>Not concerned about safety or reliability</li> </ul>	<ul style="list-style-type: none"> <li>Like EV's low running / maintenance cost</li> <li>Concerned about upfront cost and reliability</li> </ul>	<ul style="list-style-type: none"> <li>Attracted by EV's new technology</li> <li>Concern about range / charging / performance</li> </ul>	<ul style="list-style-type: none"> <li>No particular preference for EV</li> <li>Concern about choices, price, and reliability</li> </ul>	<ul style="list-style-type: none"> <li>Strongly rejects EV on almost all attributes</li> </ul>

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# Distinctive design and quick acceleration are the most appealing features for early adopters

Skew higher  
Skew lower



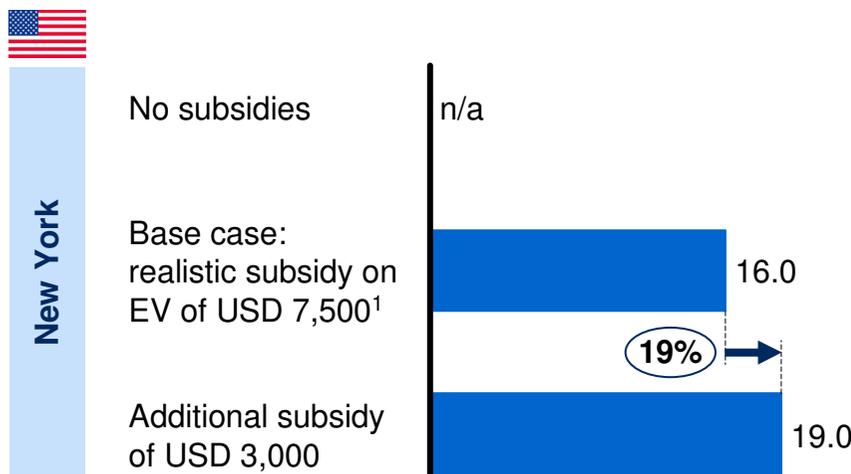
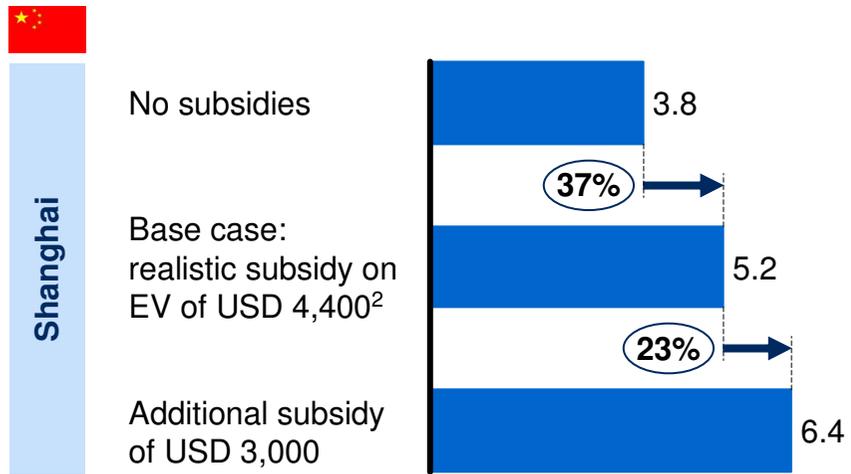
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<sup>1</sup> Percent of respondents who strongly agree or agree with this statement

# Financial subsidies important in kicking off EV penetration, but effectiveness declines at higher levels

(x%) Change to base case

## Effect of retail price/tax reduction on EV adoption (% likelihood of adoption)



## Key insights

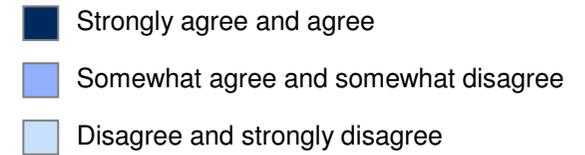
- EV adoption shows some sensitivity to the actual price paid for the vehicle (net of tax credit effects)
- Shanghai numbers especially show that an initial subsidy is important to kick-off EV penetration
- While price changes (e.g., USD 3,000 discount) increase adoption, impact diminishes at higher subsidy levels
- Subsidies need to be reviewed and adjusted regularly

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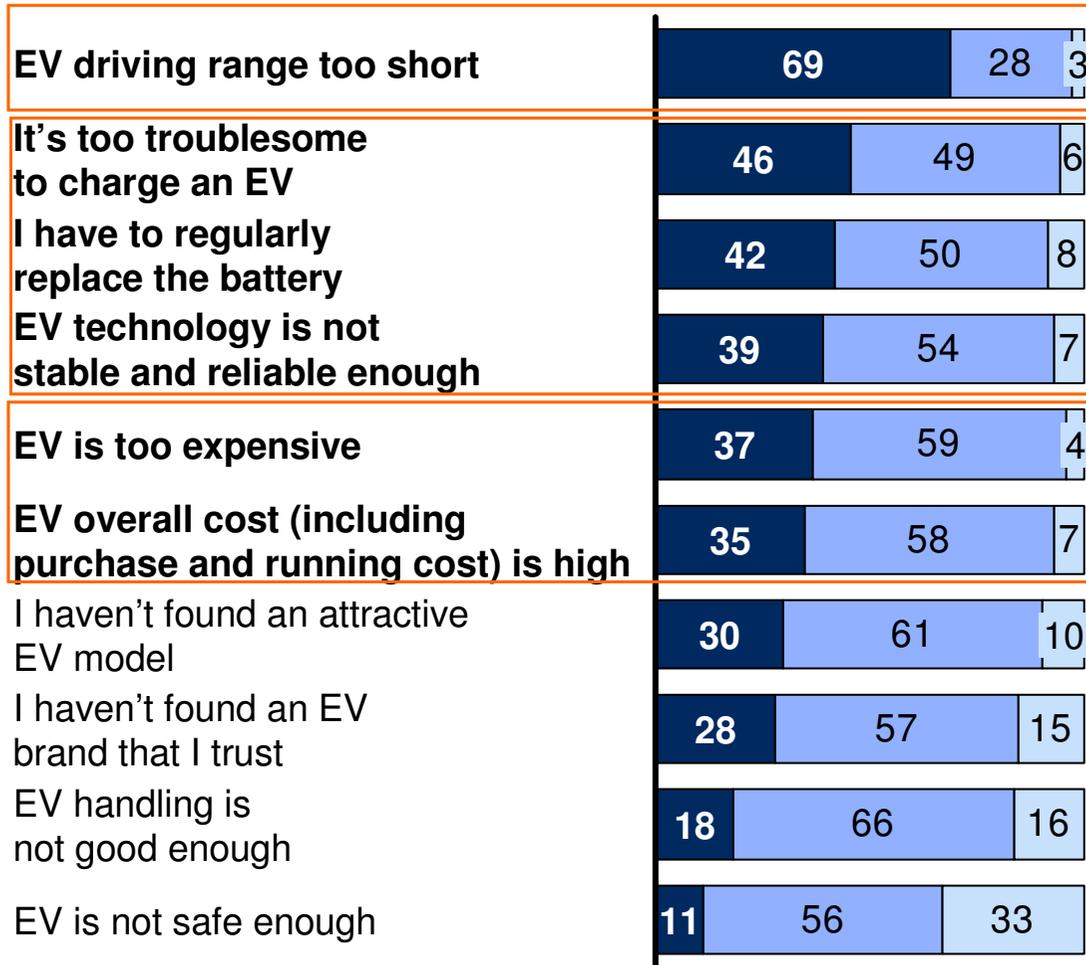
<sup>1</sup> Federal incentive (agreed)

<sup>2</sup> Waiving of license plate fee (in discussion)

# Consumer interest in EVs held back by concerns around range, battery charging, and reliability



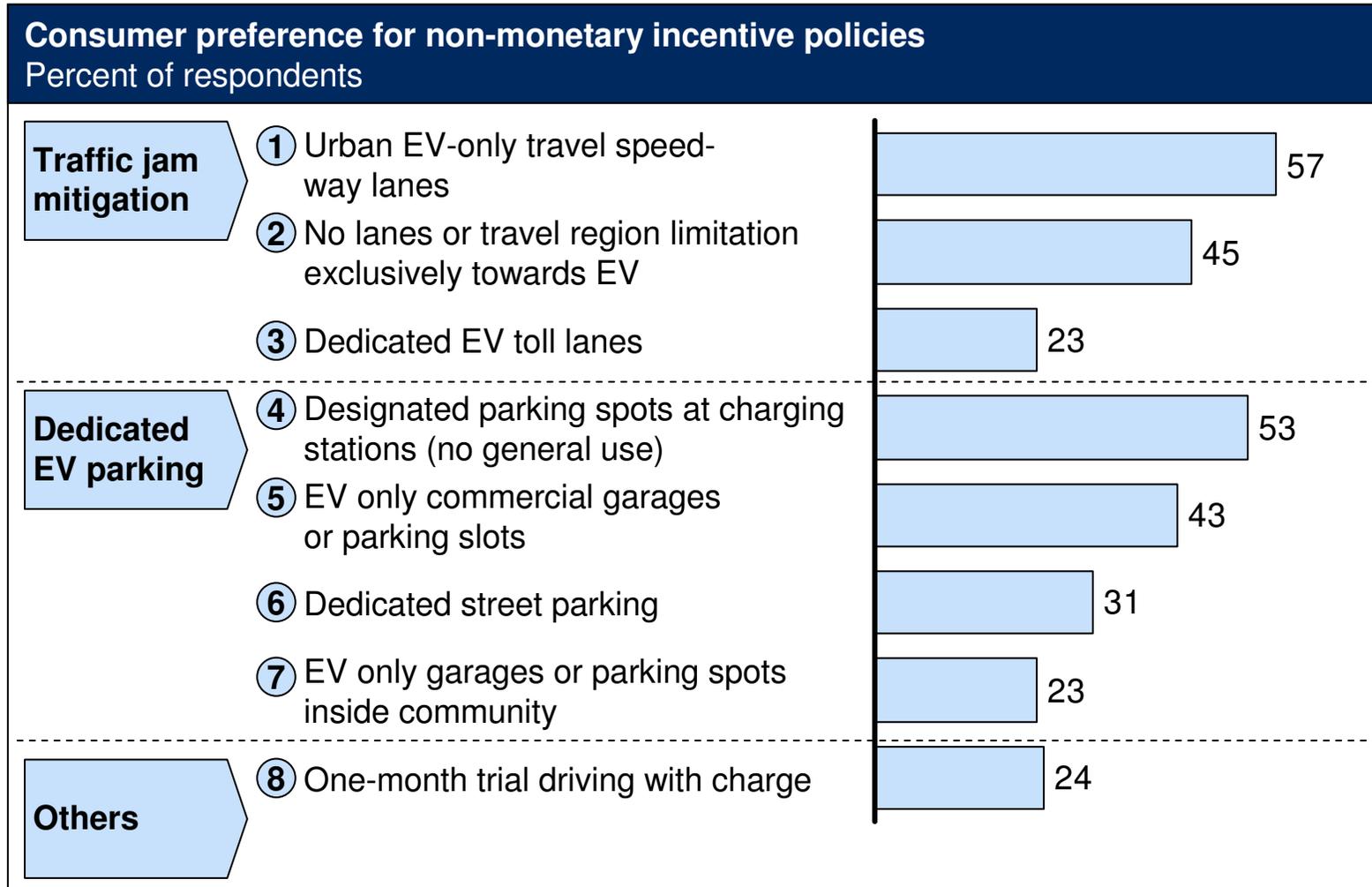
## Reasons for rejecting EVs



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# Shanghai consumers attracted by non-monetary incentives that address traffic and parking problems

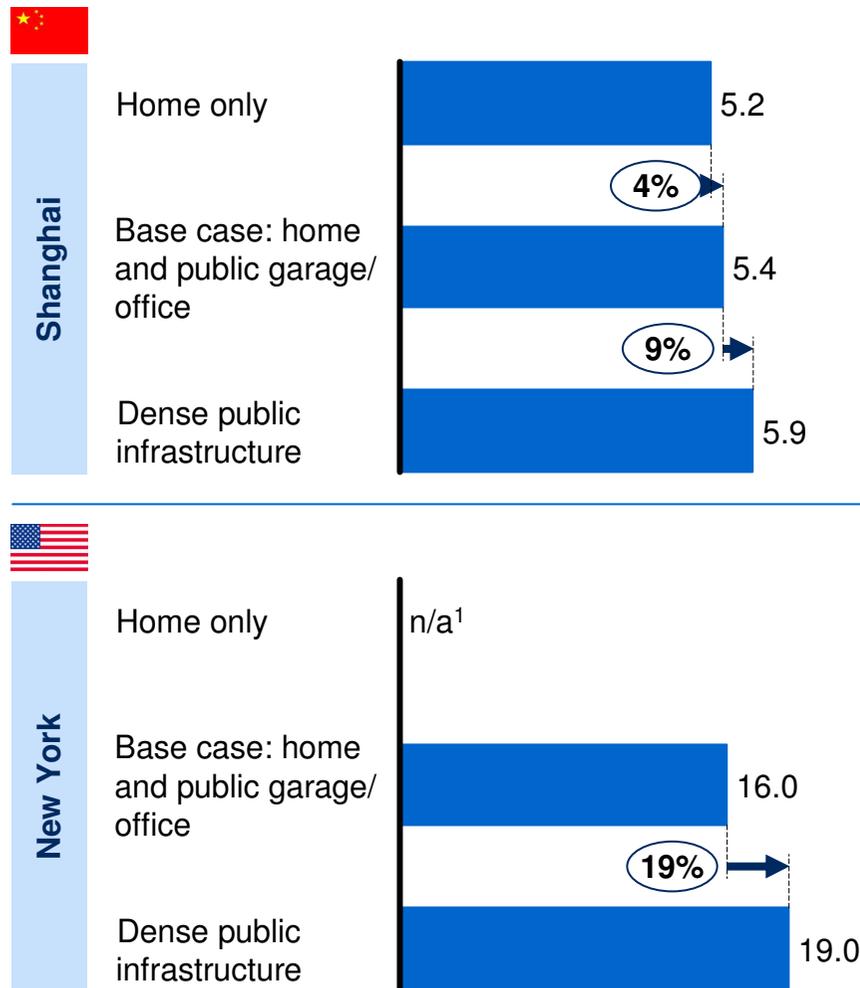
Question: Which of the following incentives will be most likely to increase your interest in buying an EV? [select the 3 most influential]



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# Dense public charging infrastructure not a necessary requirement to drive early EV adoption in Shanghai

## Effect of charging infrastructure on EV adoption (% likelihood of adoption)



## Key insights

- The effect of dense public charging infrastructure availability on early EV adoption is modest
- In Shanghai, consumers expressed concern about the long waiting hours at the public charging stations
- Significant adoption rates could be reached in infrastructure settings that rely on home charging and include minor public elements
- In the long term, public charging will be needed to make EVs attractive for customers that do not have private parking (i.e., charging facilities)

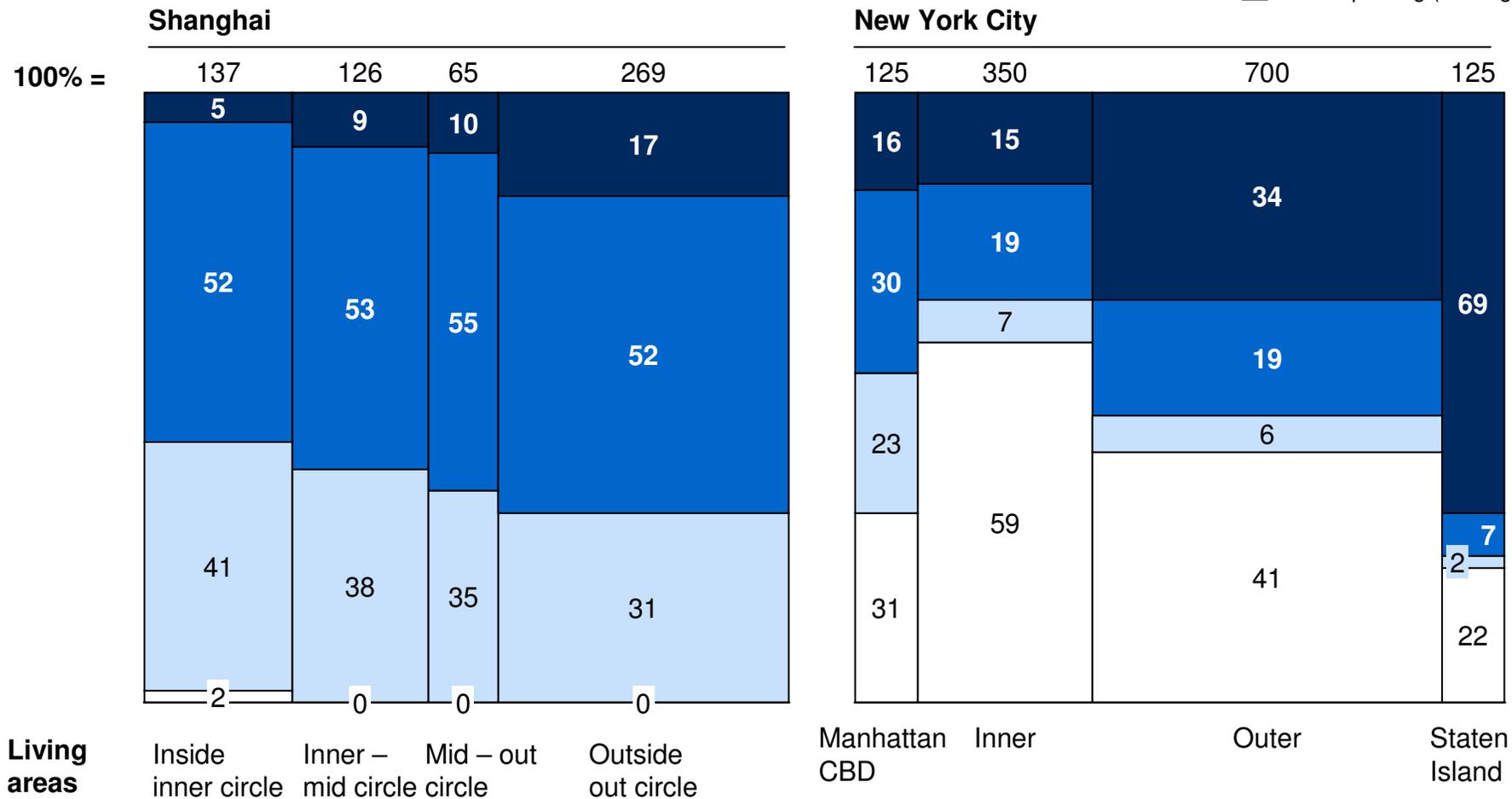
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<sup>1</sup> Not tested in New York

# More assigned parking slots at home make it easier to use overnight charging facilities in Shanghai

Placement of cars for overnight parking by ring and parking type, '000 thousand, percentage of households with vehicles

- Private garage (assigned)
- Garage/lot (assigned)
- Garage/lot (floating)
- Street parking (floating)



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## IN SUMMARY...

- **Electric vehicle penetration will likely reach 100,000 in Shanghai by 2020**
- **Early adopters (up to 30% of respondents) are ‘trendy greens’ and ‘running cost sensitive’ buyers, rather than entry level ‘bargain hunters’**
- **To accelerate early adoption, policy incentives need to address not only the price gap, but also concerns around range limit, safety and charging convenience**
- **Charging infrastructure will primarily be over-night charging in residential communities, supplemented by medium-speed charging in public garages and fast charging stations**

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