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*National Academies*

&

The Three Big Technology Trends

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*Our team here today*



**Reid Wilk**  
**Partner – Detroit**



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**Director – Chicago**

## *Five myths about the future of the automotive industry*

1. There will be significant adoption of electric vehicles within the next few years
2. The fully-autonomous vehicle world is on the near horizon
3. “Uberization” will radically change the industry and facilitate the transition to the fully-autonomous world
4. Traditional automotive OEMs and many suppliers are under enormous threat from new competitors
5. Downstream vertical integration and selling services will help auto OEMs protect/bolster revenues



## *Five predictions about the future of the automotive industry*

1. The electric vs. ICE cross-over point in the U.S. will occur in ~10 years and will then rapidly and radically alter the industry
2. Although the fully autonomous world is much farther away, when it arrives it will be even more revolutionary
3. “Mobility” will only transform when the **relative cost and convenience** of private vehicle ownership decline a lot
4. In the interim, the industry will change substantially, but not the way many think it will
5. We can expect an important downturn sometime in the next several years



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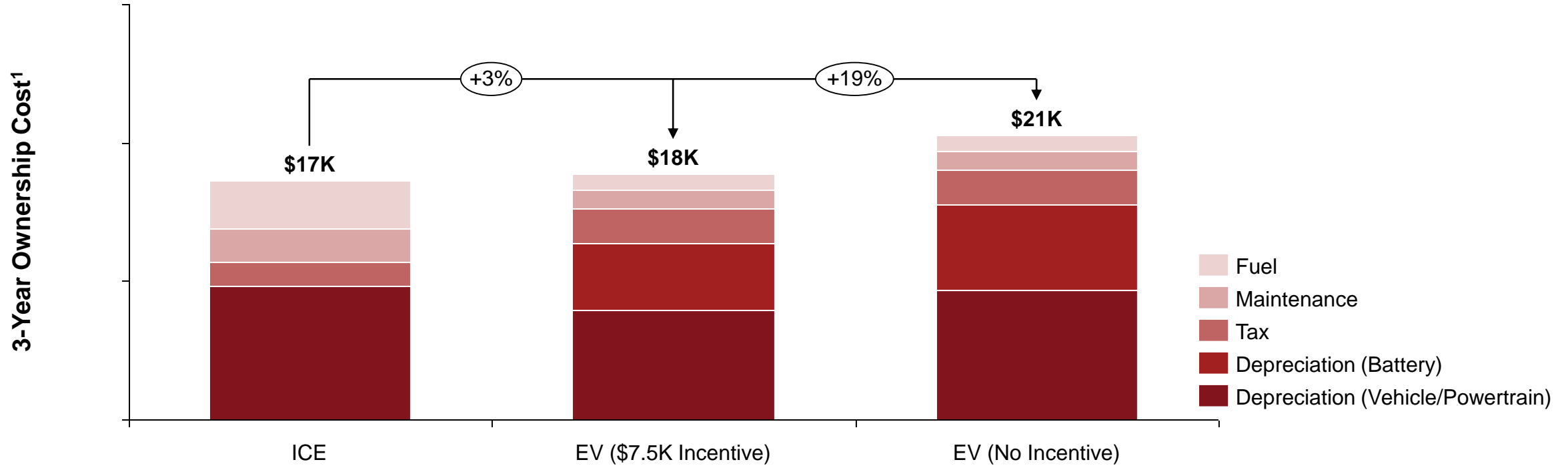
## *Agenda*

- 1. *Electric vehicles***
2. Driverless cars
3. Ride hailing and car sharing
4. Implications for industry participants

# EVs are significantly more expensive than ICE vehicles in US, basically due to battery costs

3-Year Total Cost of Ownership<sup>1</sup>  
Mid-sized Sedan in US, \$2017

USA

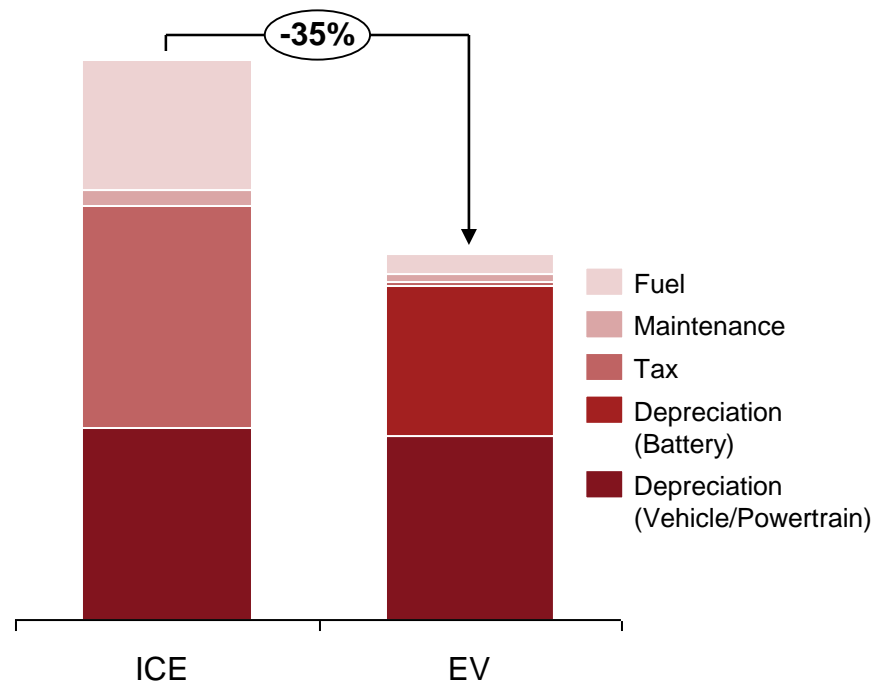


1) Vehicle miles travelled per year = 12,500; Gas price = \$2.4/ gal; Electricity price = \$0.12/ kWh  
Source: Battery expert interviews, Strategy& analysis

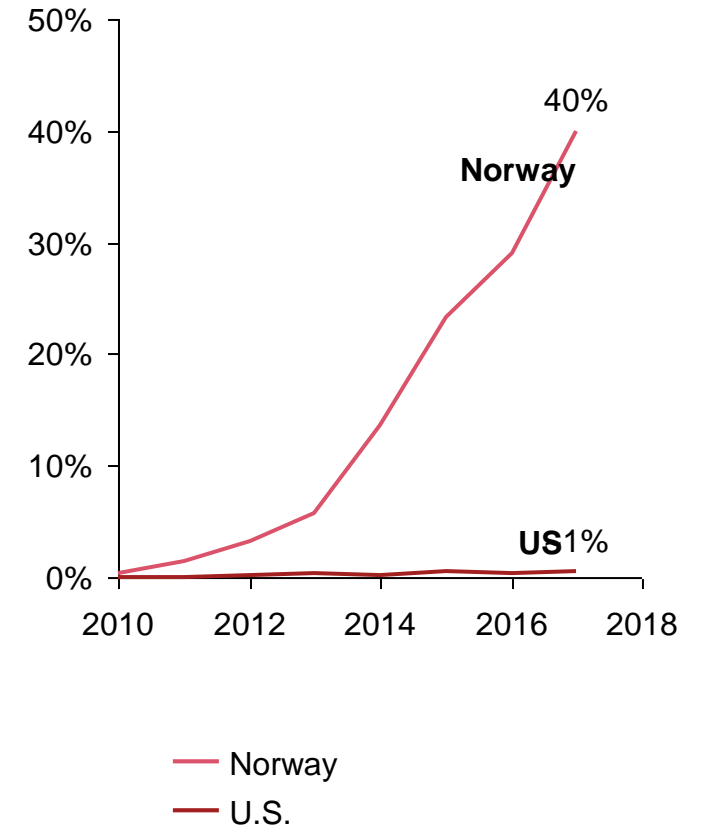
# But, this is not the case everywhere – e.g., Norway

- Strong purchase incentives**  
EVs avoid 50% taxes
- High gas prices**  
~\$7.0 per gallon
- Near free electricity**  
Free public charging points
- Low mileage**  
~8000 miles / yr.  
lowering range anxiety
- Other**  
Toll exemption,  
free parking, pool lanes access

**3-Year Total Cost of Ownership**  
Mid-sized Sedan in Norway, \$2017



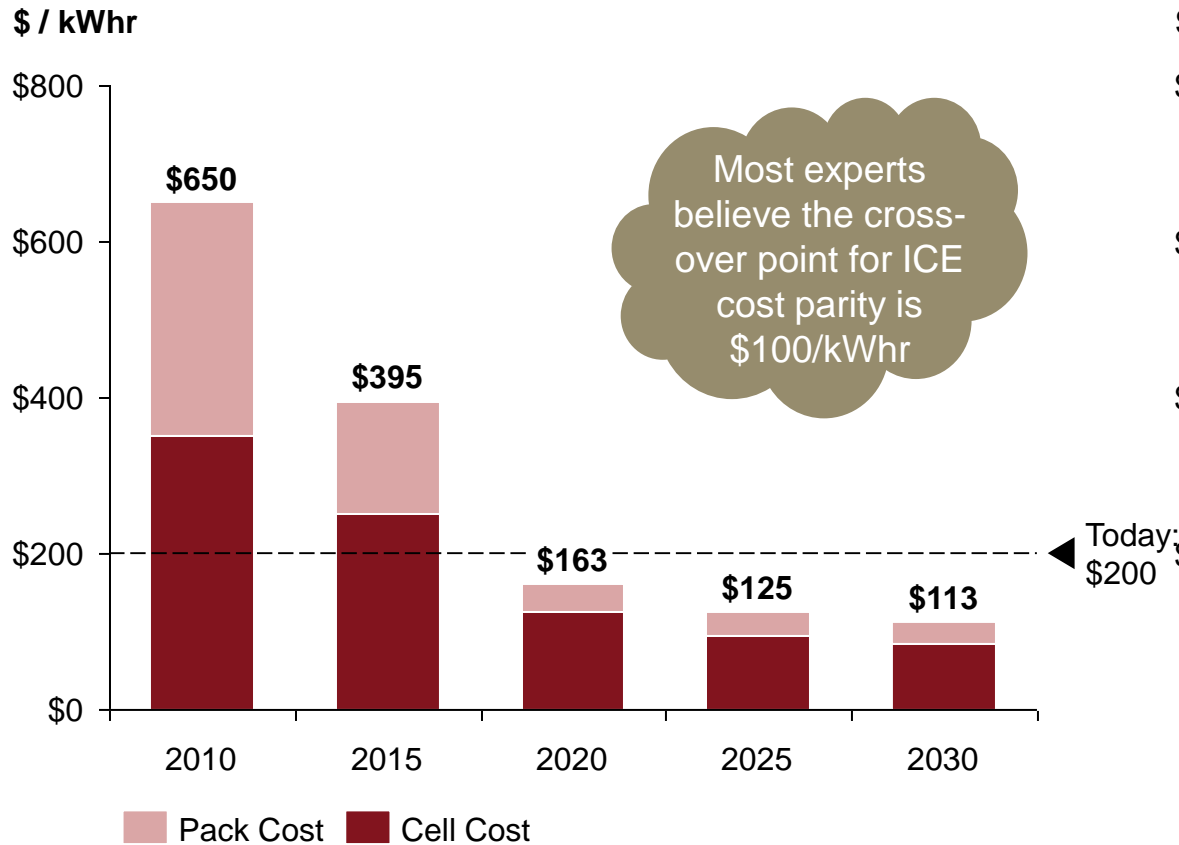
**EV % of New Car Sales – Norway vs. US 2010 – 2017**



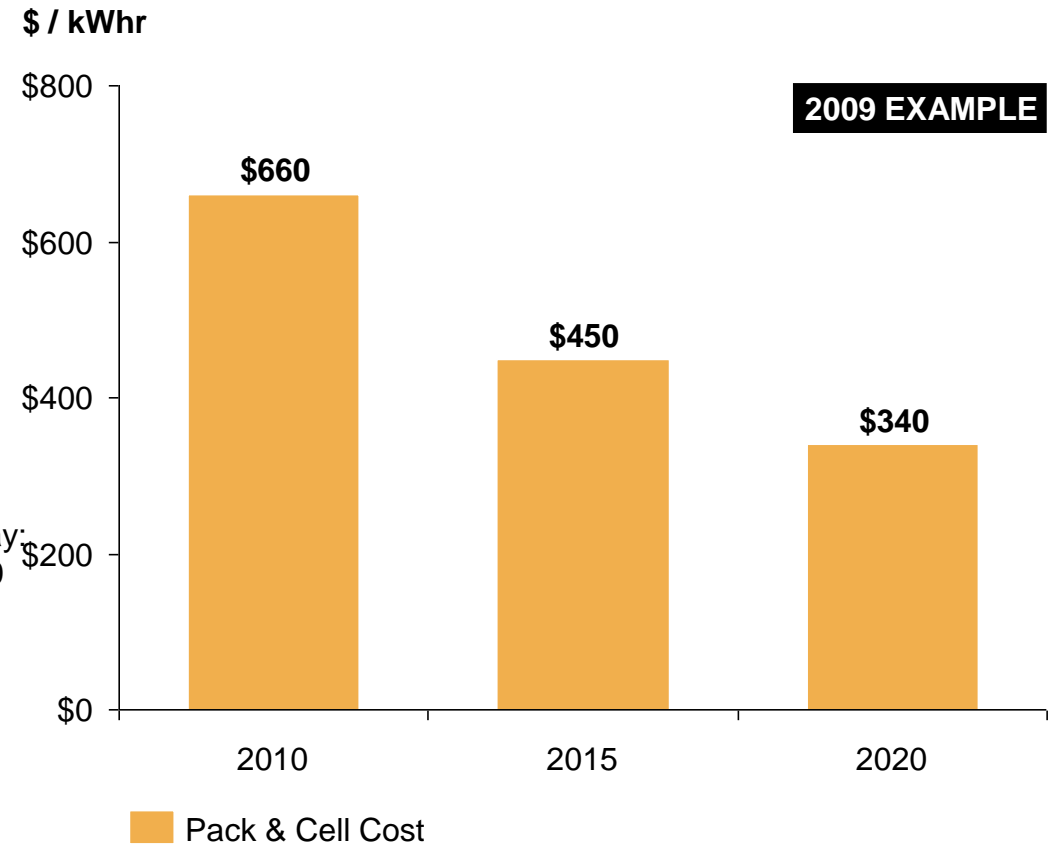
Source: Input from IEA "Global EV Outlook", Strategy& analysis

***Few experts expect pack costs to reach the \$100/kWhr threshold level before 2025 – though they might relatively soon thereafter***

**Battery pack cost estimates (\$/kWh) (U.S.)**



**Battery prices have fallen faster than previously projected (2009 Example)**



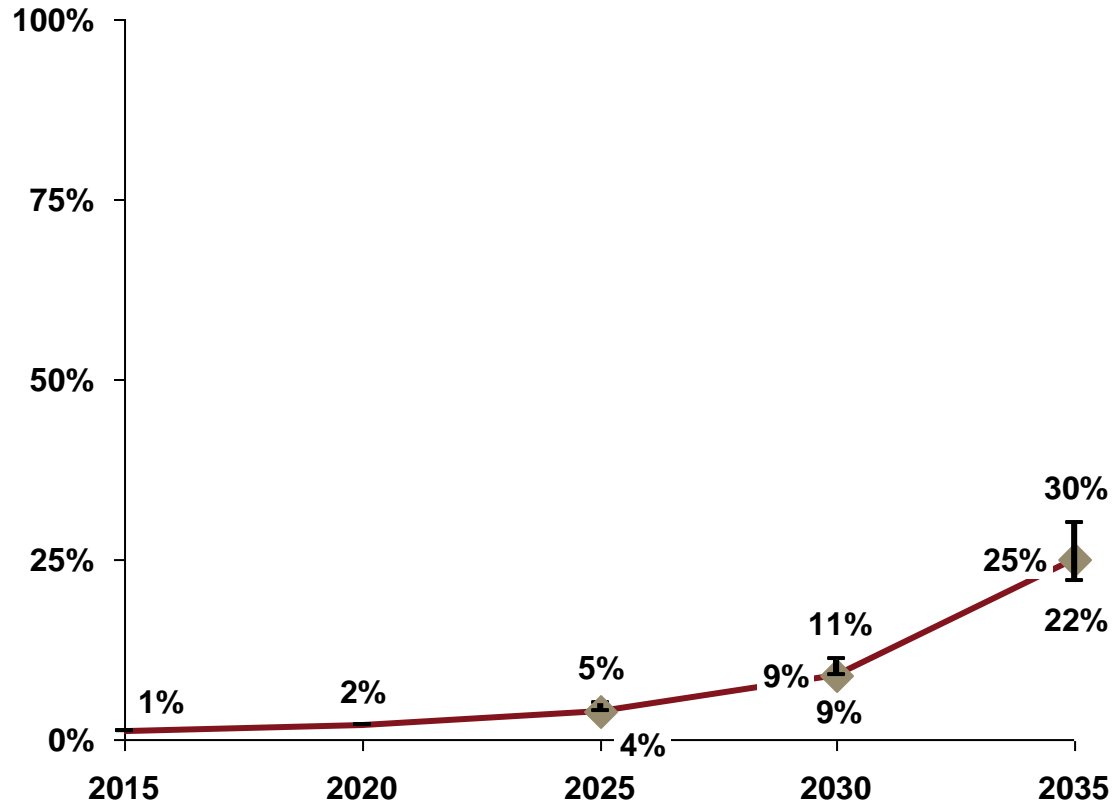
Source: Battery expert interviews, Strategy& analysis



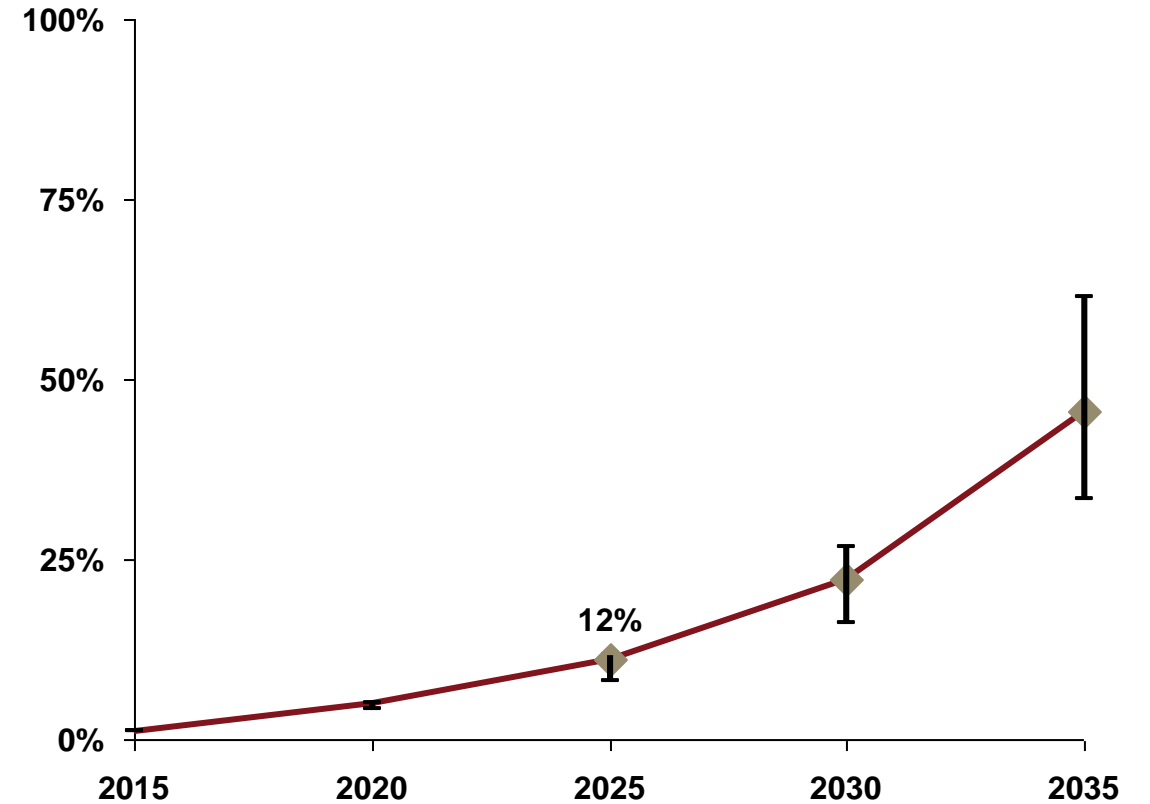
***We anticipate <2% of US new car sales to be EVs by 2020 but a major shift starting in 8 to 10 years – demand forecasts are more aggressive in other geographies***



**US BEV/PHEV penetration**



**Global EV penetration**



1) Global penetration calculated using China EU and U.S. EV penetration 2) 3-year total cost of ownership  
 2) Source: Battery Expert Interviews, Strategy& analysis

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## ***When the shift happens it will be radical and rapid***

- New vehicle sales will see a true tipping point as:
  - Product cost declines snowball
  - Governments have fewer reasons to hold back environmental restrictions
  - OEMs cut investment on old technology
- EVs substantially reduce OEM value added
- EVs shift value-added to different components and suppliers
- Fuelling and aftermarket businesses (including new vehicle dealers) are disrupted

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1. Electric vehicles
- 2. *Driverless cars***
3. Ride hailing and car sharing
4. Implications for industry participants

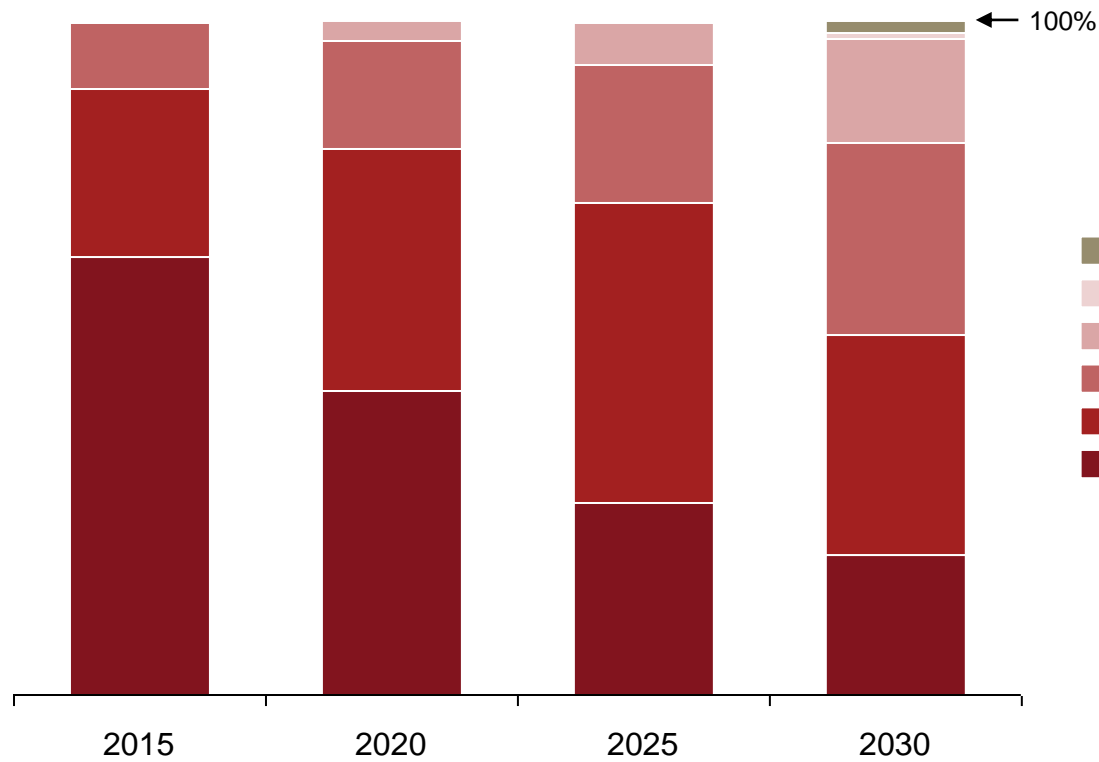
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## ***The fully autonomous world will be radically disruptive ...***

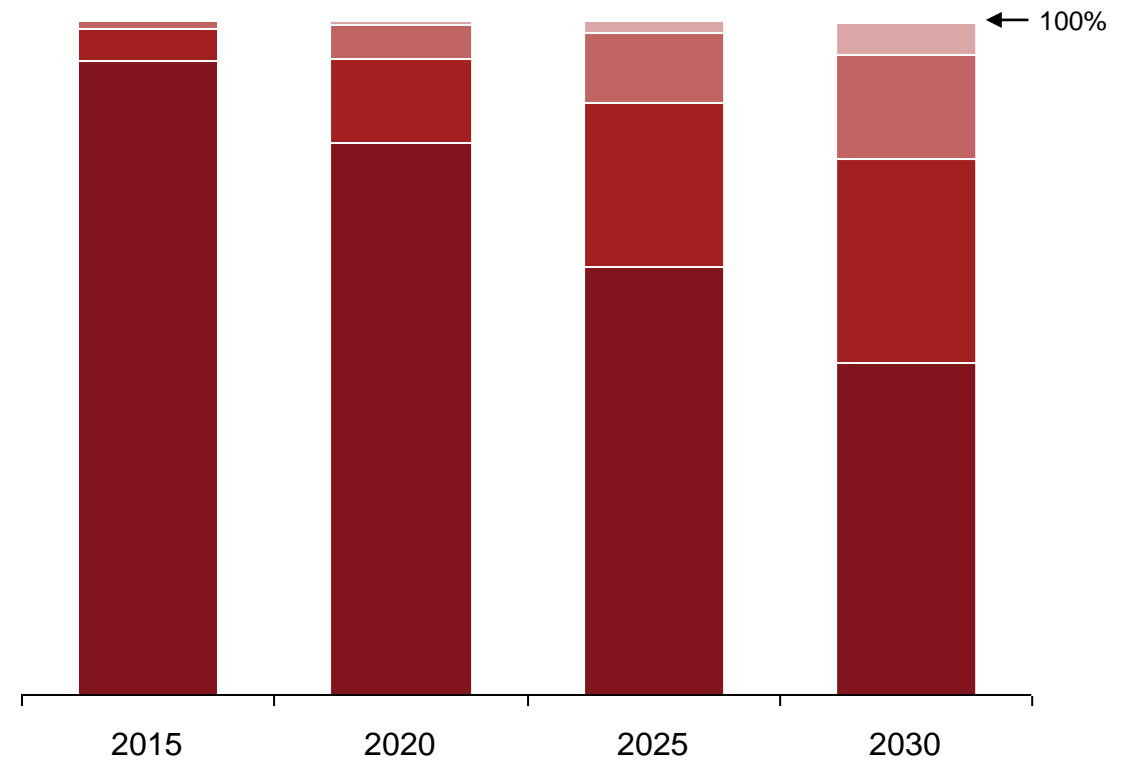
- Customers will not be the same
  - Larger portion of fleet customers with personal vehicles still likely
  - Private or government operators of many vehicles, more akin to taxi fleets and public transportation
- Vehicles will change dramatically
  - For passengers only not drivers, changing the attributes on which consumers make their vehicle choices today (e.g., driving feel and handling)
  - Safety of the car will reduce the on-vehicle crash protection requirements – structural design, airbags, etc.
  - Multiple types of rides and riders plus increase in shared rides
  - Shift towards electric powertrain
- Structure of the industry (and society) will transform
  - Number and role of OEMs
  - Number and scope of suppliers
  - Including the structure of all the supporting industries (e.g., insurance, fuelling, maintenance, parking)

*...but is not expected until long after 2025 – significant investment into L1-3 automation and experimentation in the meantime*

**U.S. New Sales by Autonomy Level**



**U.S. Vehicle Install Base by Autonomy Level**



Source: Strategy& analysis

## Why will it take time?

### **Cost and Technology**

*What happens when the roads aren't great? What data are needed?*

How good does the technology have to be, what technology is required and how much will it cost? What about bad weather, potholes, human drivers? Given design cycles and testing requirements how long will this take?

### **Installed Base**

*How will existing vehicles be affected? How long will it take?*

How long will it take to replace 250 million vehicles on the road with an average age of over 11 years? How will robotic vehicles interact with human-driven vehicles?

### **Liability and Ethics**

*Who is liable? How do computers make life and death decisions?*

Who is responsible for an accident? How will machines make "life and death" choices? Who will be responsible for decisions programmed in or made by machines?

### **Standards & Infrastructure**

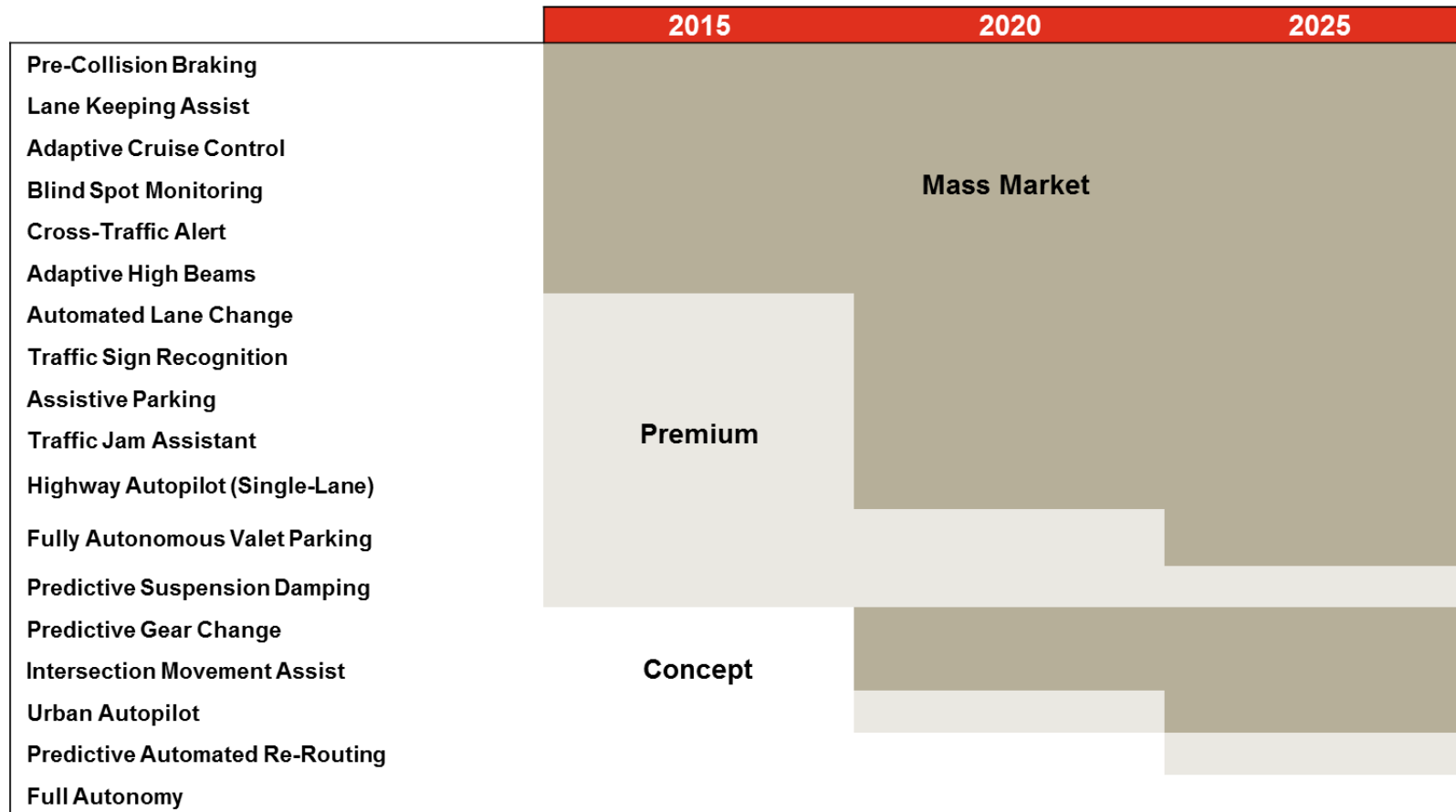
*What standards are needed? Who will pay for any infrastructure costs?*

How will the standards be established? How will they change over time? What infrastructure is actually required and who will pay for it?

Source: Strategy& analysis

***In the meantime, ADAS capabilities will evolve and adoption will migrate down market***

**Projected Timeline of ADAS Adoption by Market Segment**



Source: Strategy& analysis, Industry interviews

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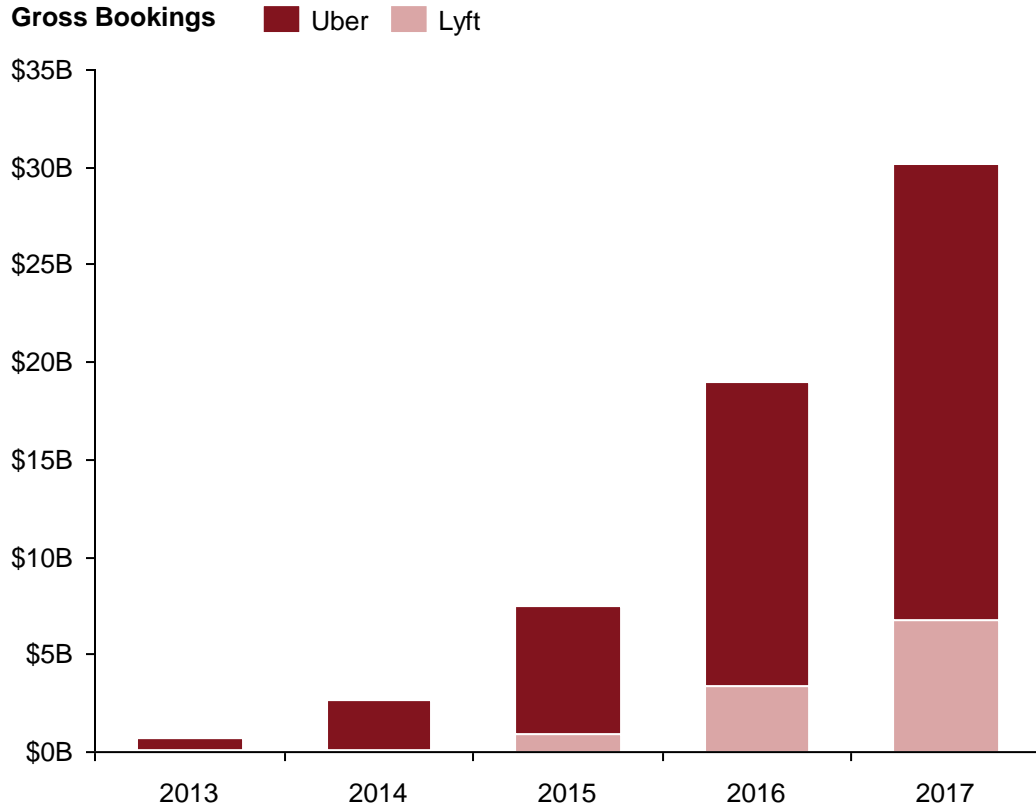
## *Agenda*

1. Electric vehicles
2. Driverless cars
- 3. *Ride hailing and car sharing***
4. Implications for industry participants

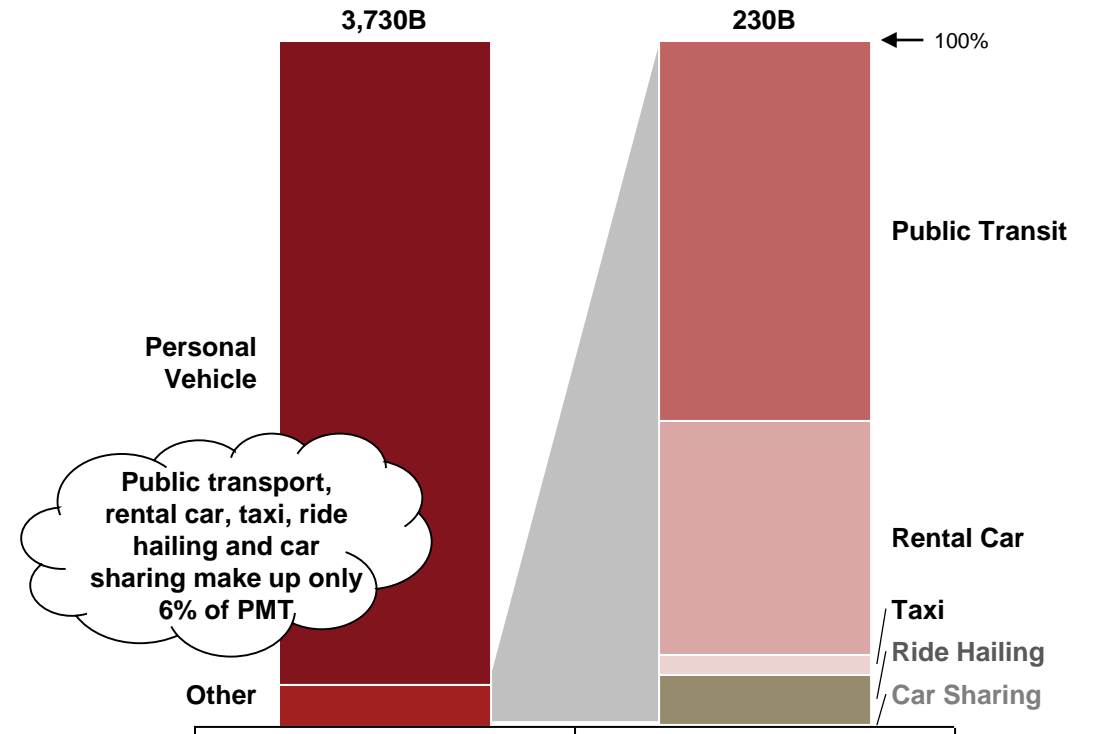


# Despite tremendous growth – and frothy valuations – ride hailing is still a minute proportion of total passenger miles

U.S. Ride-hailing estimated gross bookings (\$)



2017 U.S. passenger miles by mode of transport<sup>1</sup>

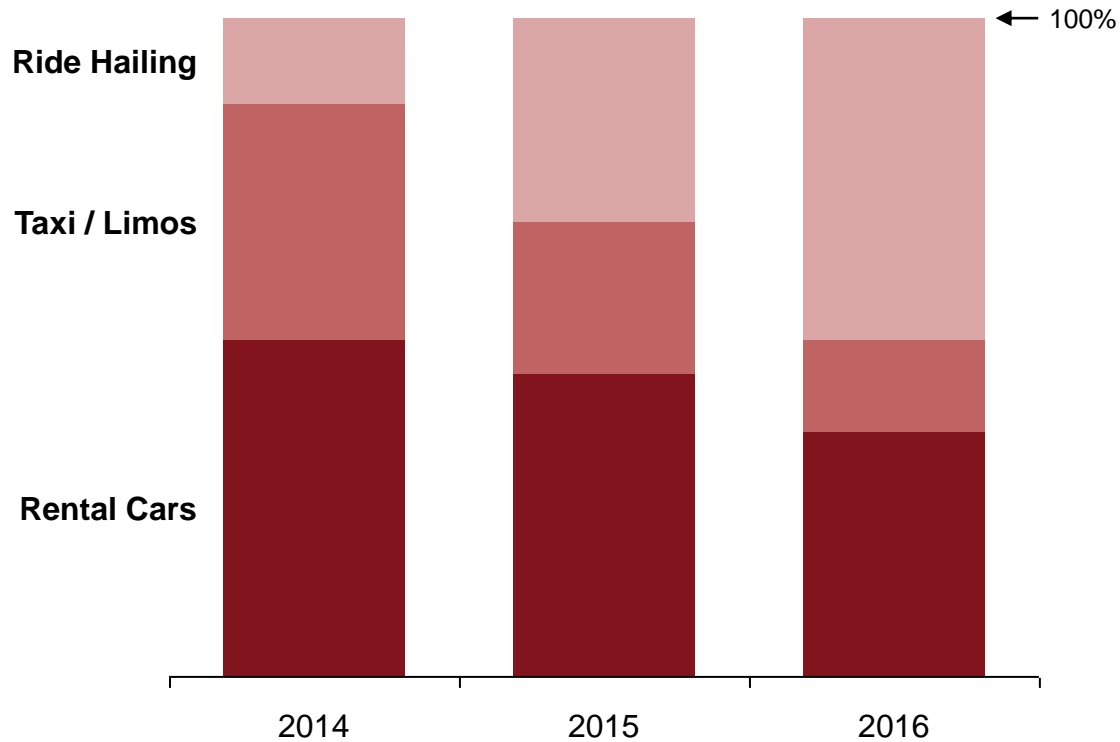


1) Commercial vehicles and goods transportation not included.  
Source: IBIS, DoT, Strategy& analysis

# *Manned ride hailing services are having a major impact on taxis/limos...*

## **Business traveler choice for commute**

2014 - 2016, % of business travelers



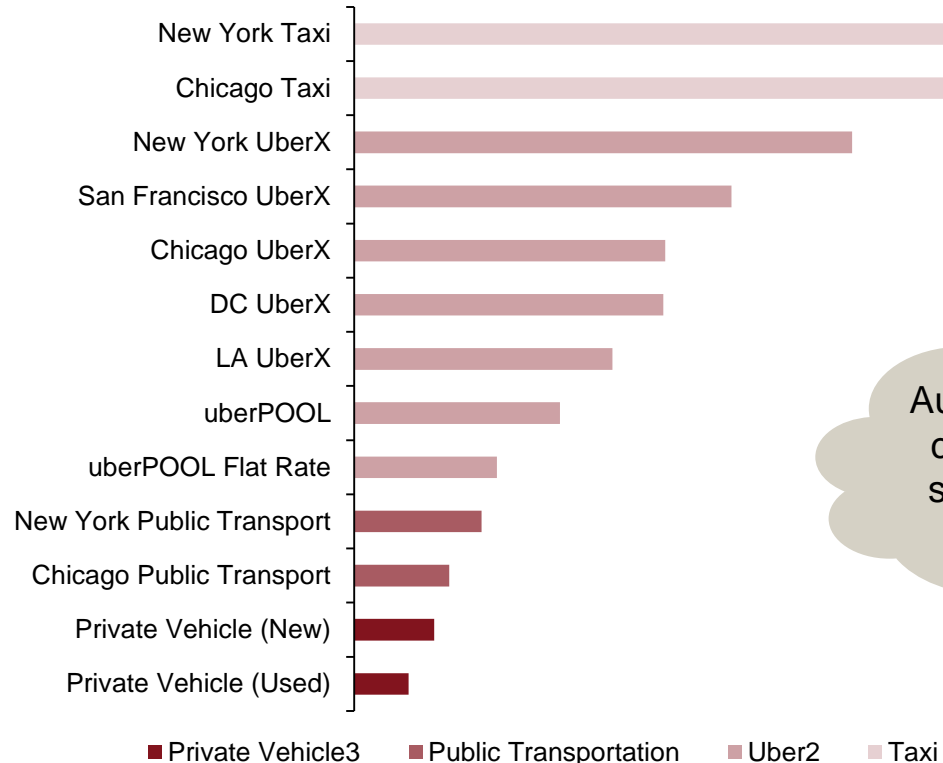
### **Discussion**

- The average taxi rides per month in San Francisco has fallen from 1424 in 2012 to 504 in 2014
- Yellow Cab, LA's largest cab service, has witnessed a 15% reduction in cab requests in 2014

Source: Certify; Strategy& analysis

***...But are unlikely to capture substantial share from private vehicle travel due to the cost – it's all about the economics!***

**2017 cost/mile of vehicle transportation**



Autonomous vehicles will change the economics significantly, but not for quite a while

A consumer with a 10 yr. old vehicle, traveling 12k miles/yr. would have to spend an extra \$18k/yr. to switch to ride hailing.

1) Based off of average distance travelled and average mph of travel by city, 6.4 mile trip  
 2) uberPOOL is 20%-50% the average fare of uberX  
 3) Private vehicle ownership is based on AAA estimates and an average of 15,000 miles  
 Note: 2015 US median family income before tax was \$52,500 (U.S. Census Bureau)  
 Source: Strategy& analysis

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## *So, how will these changes affect the industry*

### **Interim Period**

- **More innovation – fuel efficiency, safety, intelligent/connected vehicles**
- **In particular, more digital technology – sensors, electronics, software**
- **New technology suppliers**
- **More frequent software and in-cycle product updates**
- **Much greater focus on security**

### **Longer Term**

- **Even more connectivity, data and intelligence**
- **Electric powertrain transformation**
- **More reliance on suppliers in some areas**
- **Fewer new vehicles sold and fewer OEMs**
- **Completely different vehicle design with increased reliability and redundancy**
- **Safer, more secure vehicles**

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***Thank you!***

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