

TESLA

# Energy Storage, EV's and the Grid

**Tesla Motors**

**JB Straubel – CTO, co-founder**

**2015 EIA Conference**

June 15, 2015

Washington, D.C.





# Tesla History & Corporate Overview

- Founded 2003
- IPO in 2010
- Model S sales begin in 2012
- Tesla Energy launched 2015
- HQ in Palo Alto, CA
- 13,000 employees



Headquarters Palo Alto, CA



Tesla Factory Fremont, CA



Design Studio Hawthorne, CA

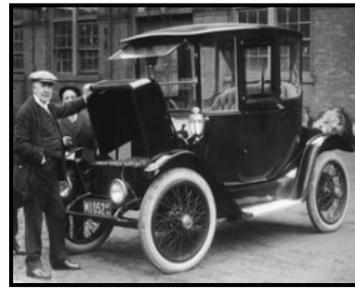


EU Assembly Tilburg, NL



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# Electric Vehicle History – Battery History



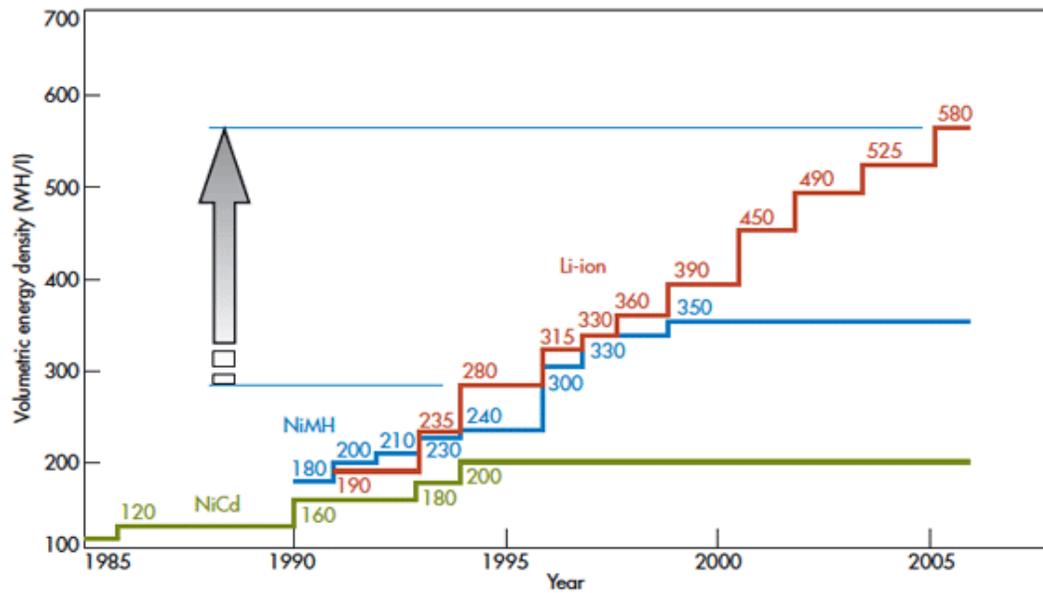
- Lead-acid technology was still status quo in 1995
- Performance had stagnated
  - Short lifespan
  - Very heavy
  - Short range



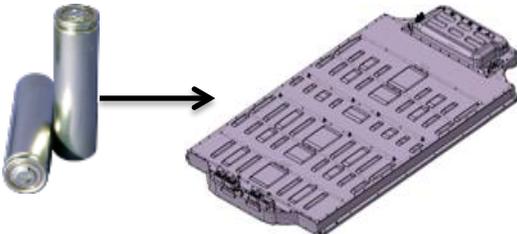
# Lithium-Ion Batteries & Tesla Roadster

**Lithium Ion Technology Enabled**

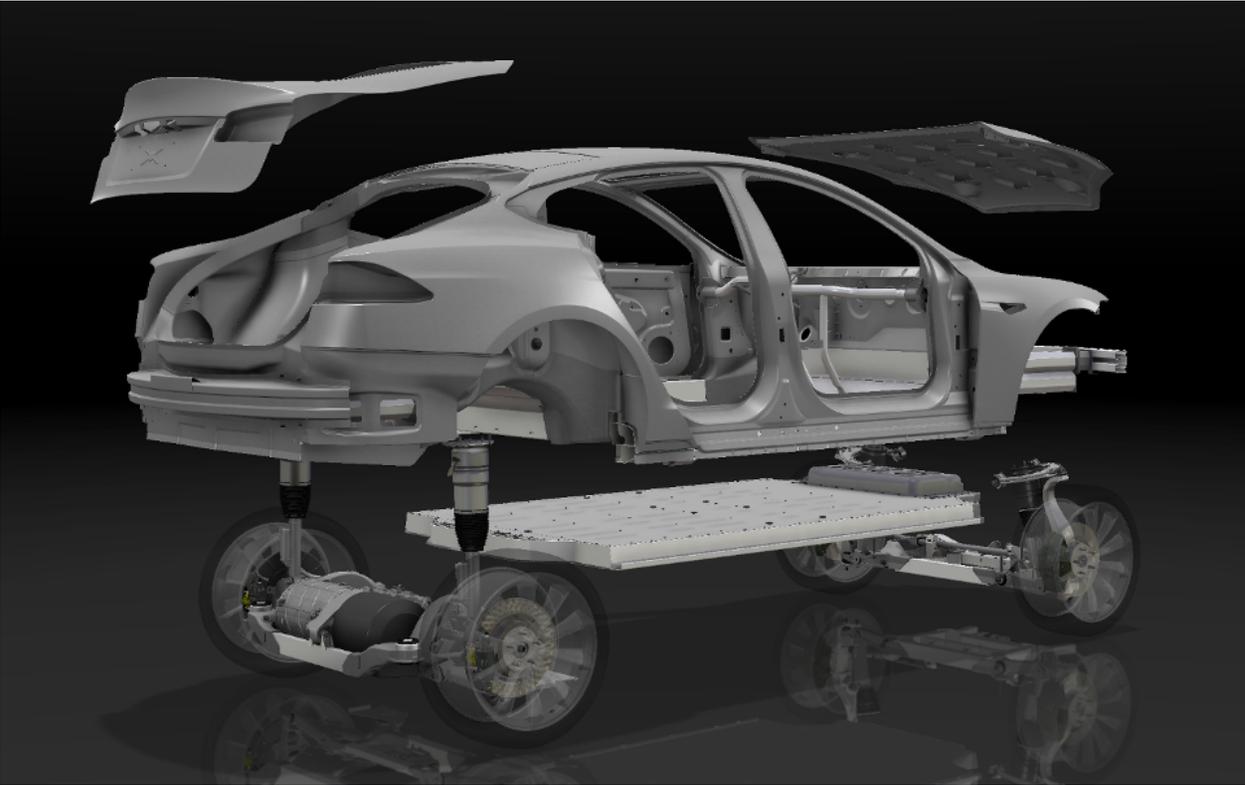
- 4 X gravimetric energy density
- 6 X volumetric energy density



# Battery Technology



- Highest energy density
- Longest range
- Lowest \$/kWh



# Tesla Model S

*"Better than anything we've ever tested"*  
*"99 out of 100 points"*

**Consumer  
Reports**



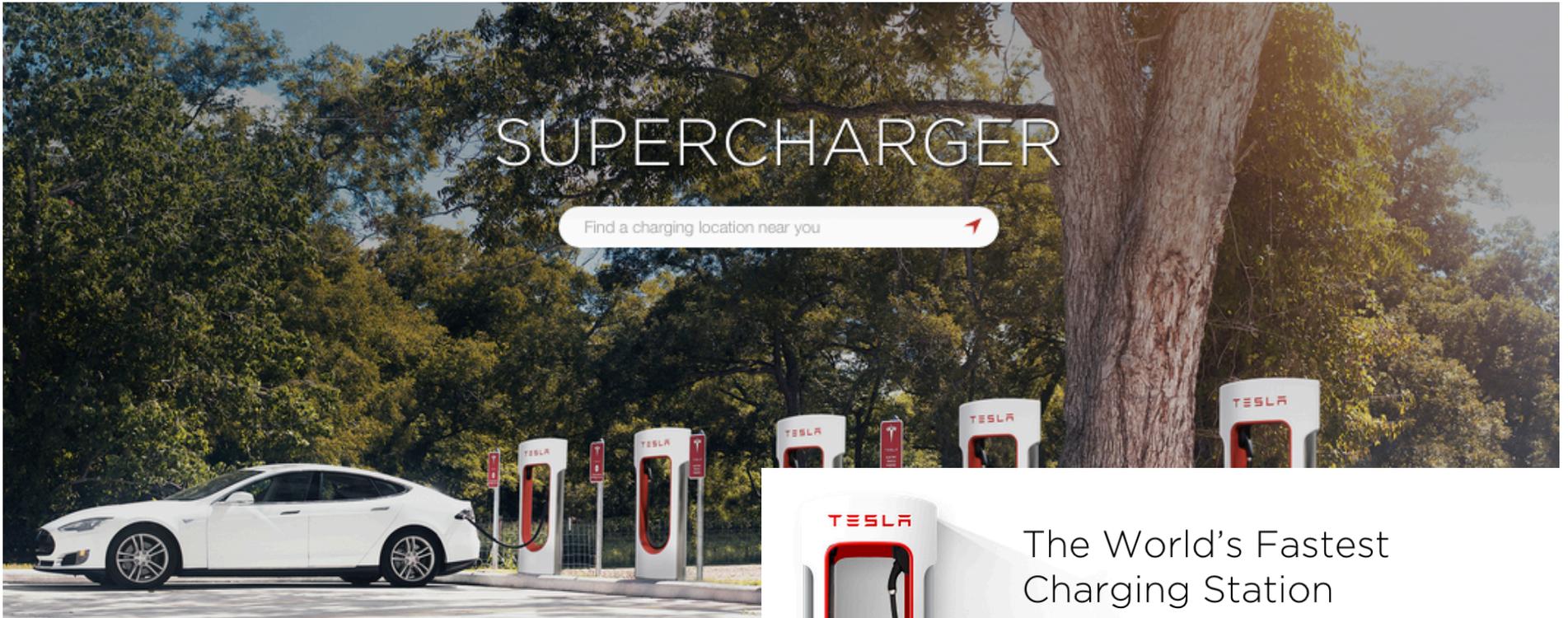
Highest safety rating in America  
Available All-Wheel Drive Dual Motor  
Zero to 60 mph in as little as 3.2 seconds  
Up to 270 miles range (EPA)

# Roadmap – EVs for the Mass Market



# SUPERCHARGER

Find a charging location near you



- **Tesla Supercharger Network**

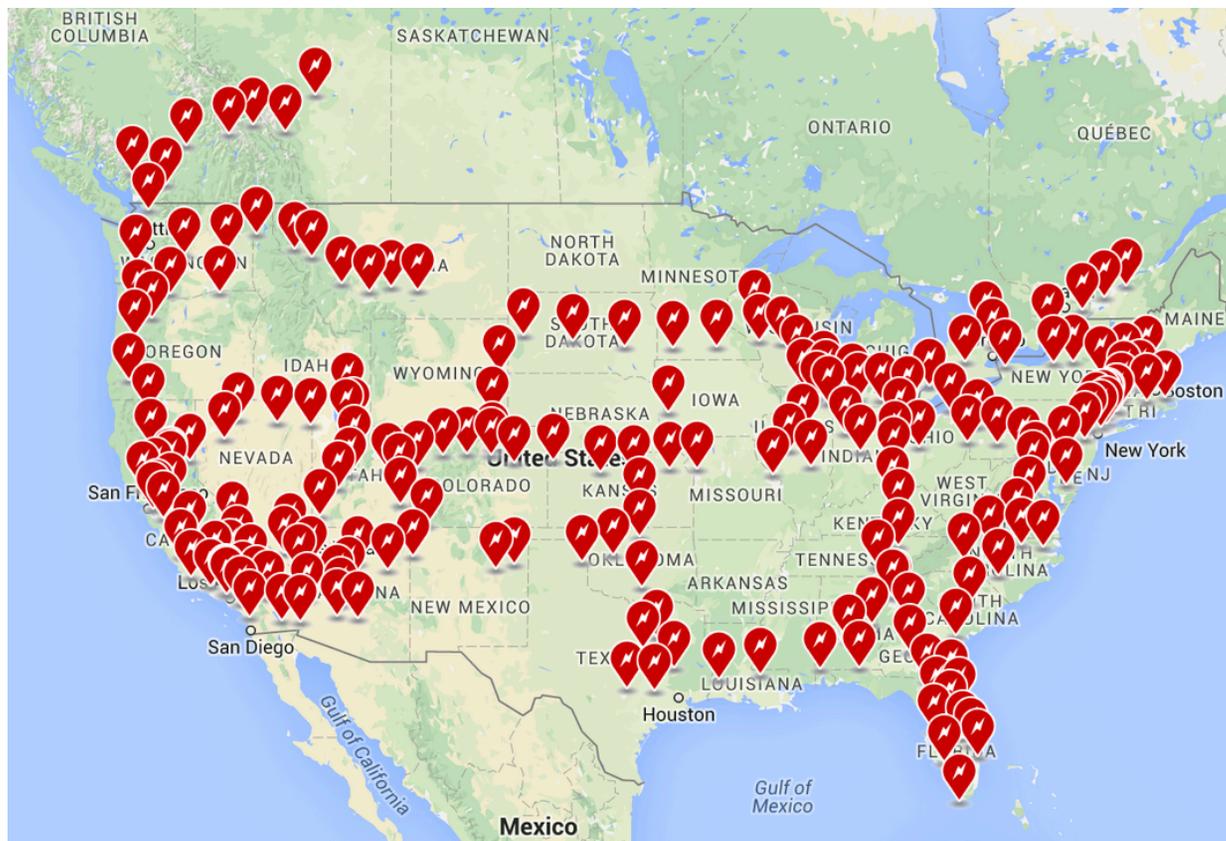
- DC connection to vehicle
- 135 kW power (300-415VDC)
- 400 mph charging (30 minutes)



## The World's Fastest Charging Station

Superchargers are free connectors that charge Model S in minutes instead of hours. Stations are strategically placed to minimize stops during long distance travel and are conveniently located near restaurants, shopping centers, and WiFi hot spots. Each station contains multiple Superchargers to help you get back on the road quickly.

# Superchargers Today



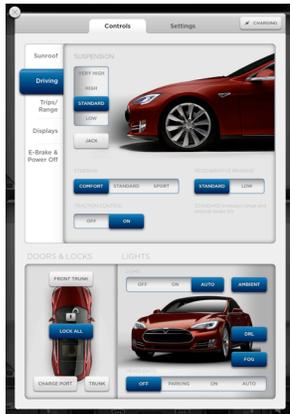


# Superchargers Today





# Connected Vehicle Fleet



- Battery Management
- Motor Control
- Diagnostics
- Touchscreen
- Mobile App
- Traction and Stability Control

Complete Over the Air Updates

2015: 60,000+ cumulative Model S  
**5GWh** of Batteries

2020: 1,000,000+ Tesla Vehicles  
**70GWh** of Batteries  
**10GW** Controllable Charge Load

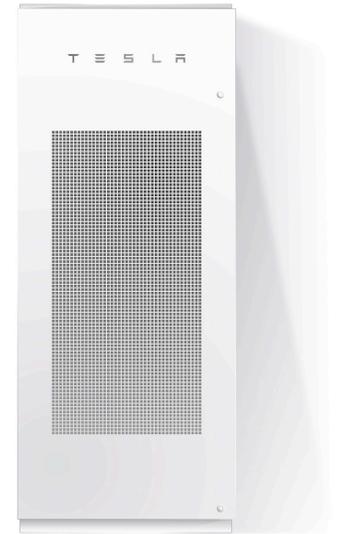




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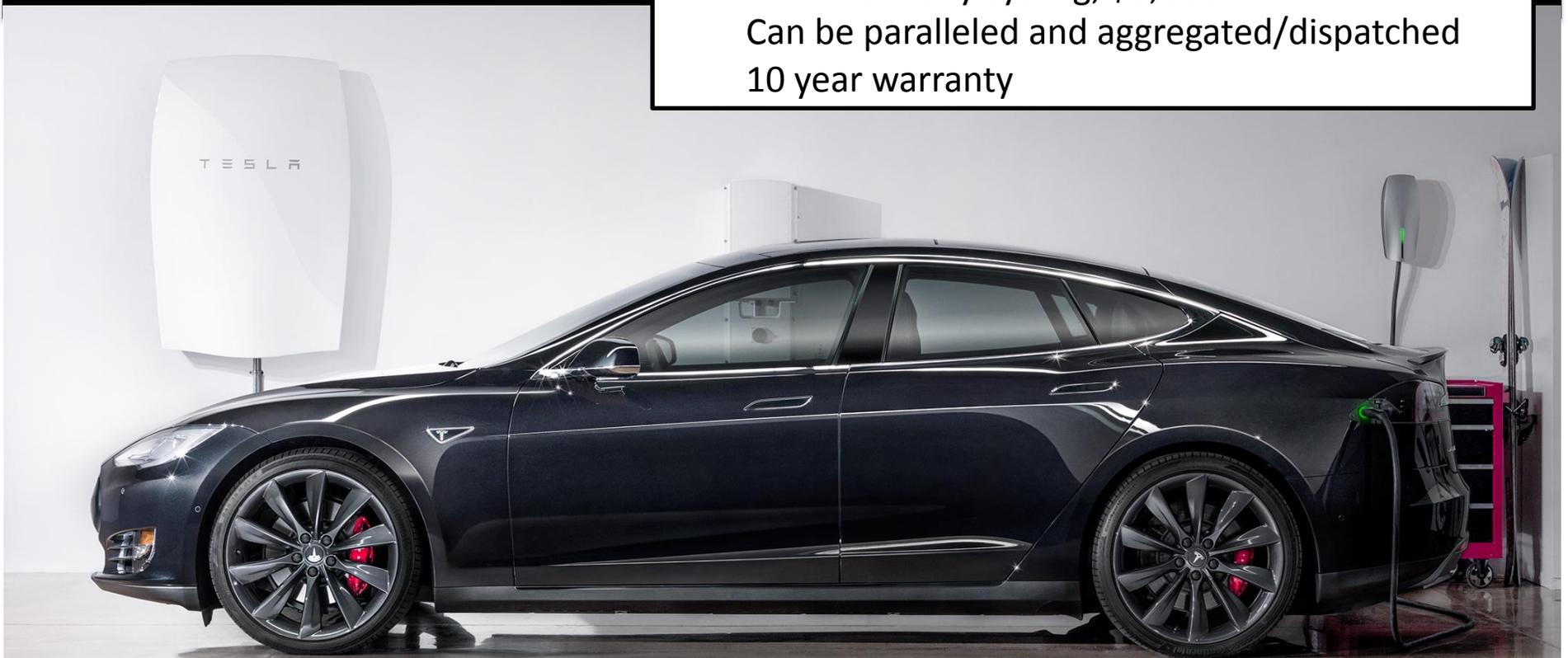
# Tesla Powerwall

10kWh for backup power, \$3,500

7kWh for daily cycling, \$3,000

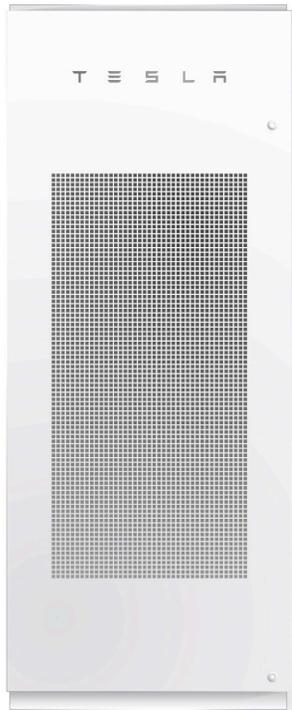
Can be paralleled and aggregated/dispatched

10 year warranty





# Tesla Powerpack

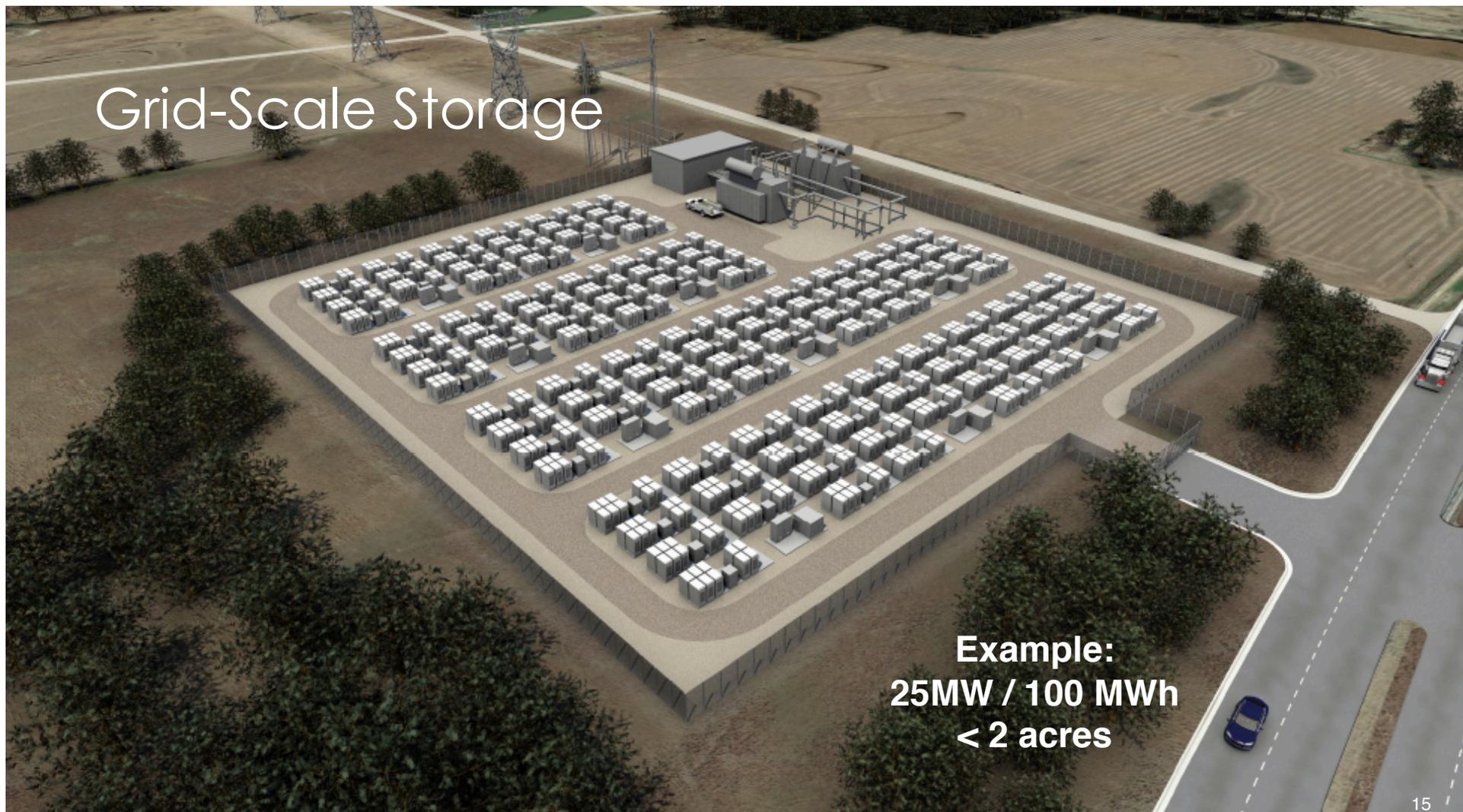


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100kWh building block  
Scales to 100MWh+  
20+ year PPA, capacity guaranteed  
Focus on delivering lowest LCOE,  
flexible transaction structure



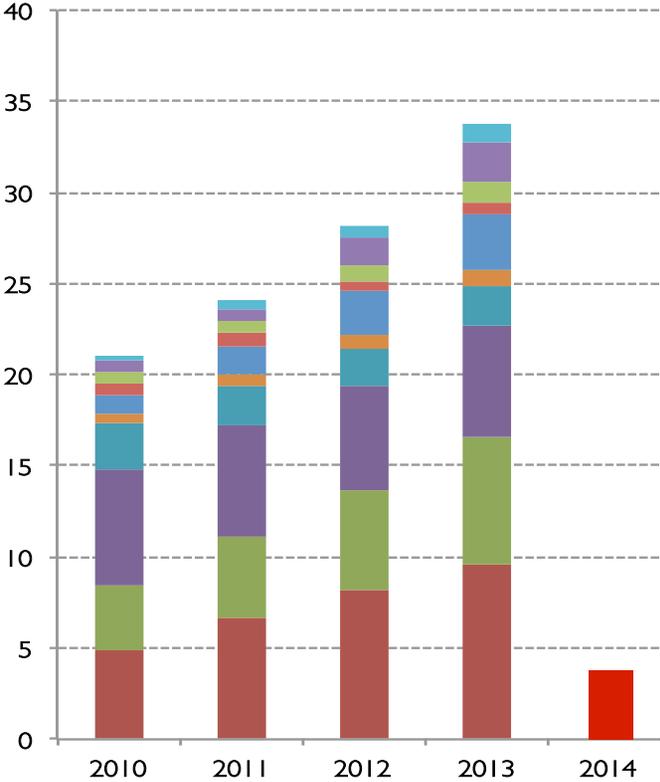
# Grid-Scale Storage



**Example:  
25MW / 100 MWh  
< 2 acres**



# Global Battery Manufacturing



500,000 vehicles/year



- Gigafactory
- Others
- Lishen
- BYD
- BAK
- ATL
- Maxell
- Sony
- Panasonic
- LGC
- SDI

# Gigafactory 1.0



- \$4-5 Billion investment
- Under construction in Reno, NV
- 6,500 full-time jobs
- First battery packs mid-2016



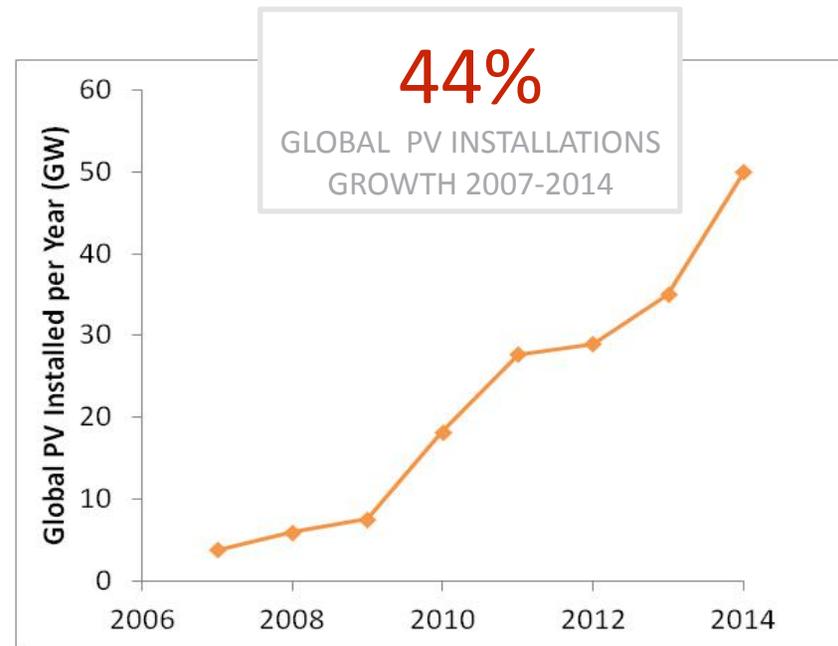
# Solar Photovoltaics

- The cost of solar PV has dropped precipitously



# Solar Photovoltaics

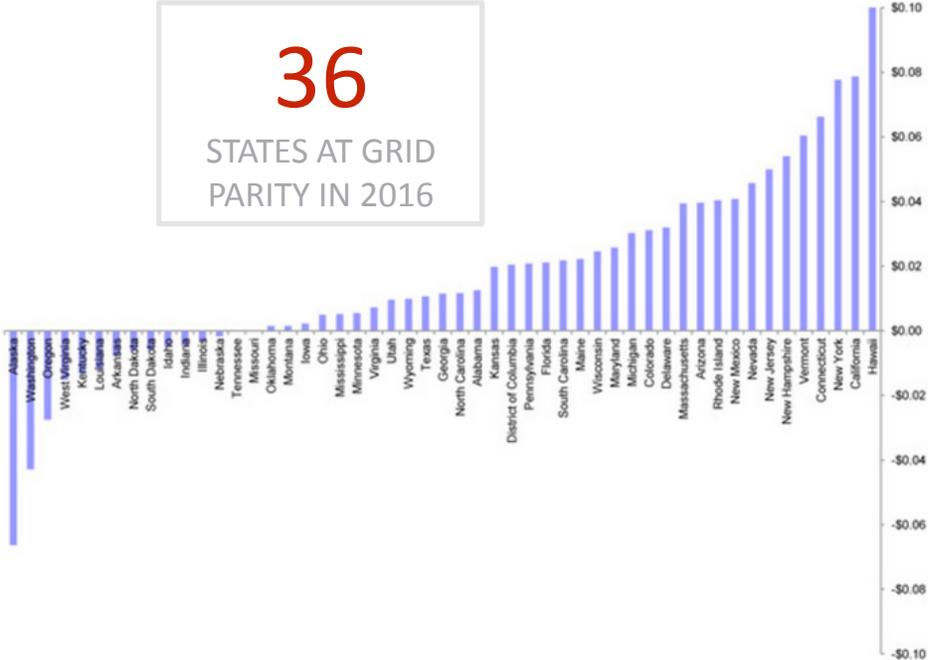
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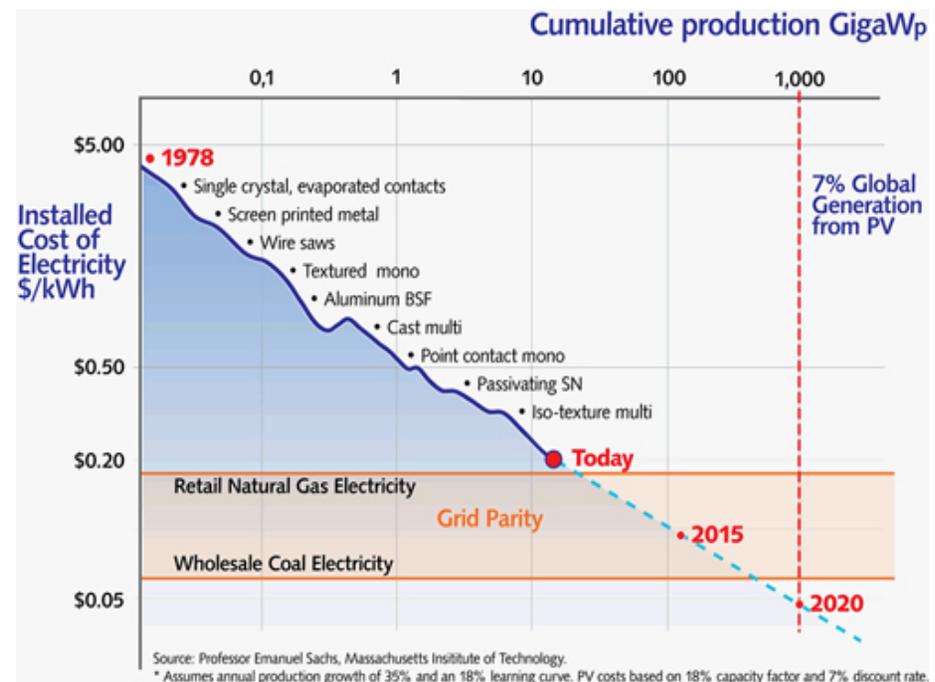
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- **Current prices are at or near retail grid parity and rapidly approaching wholesale in many markets.**





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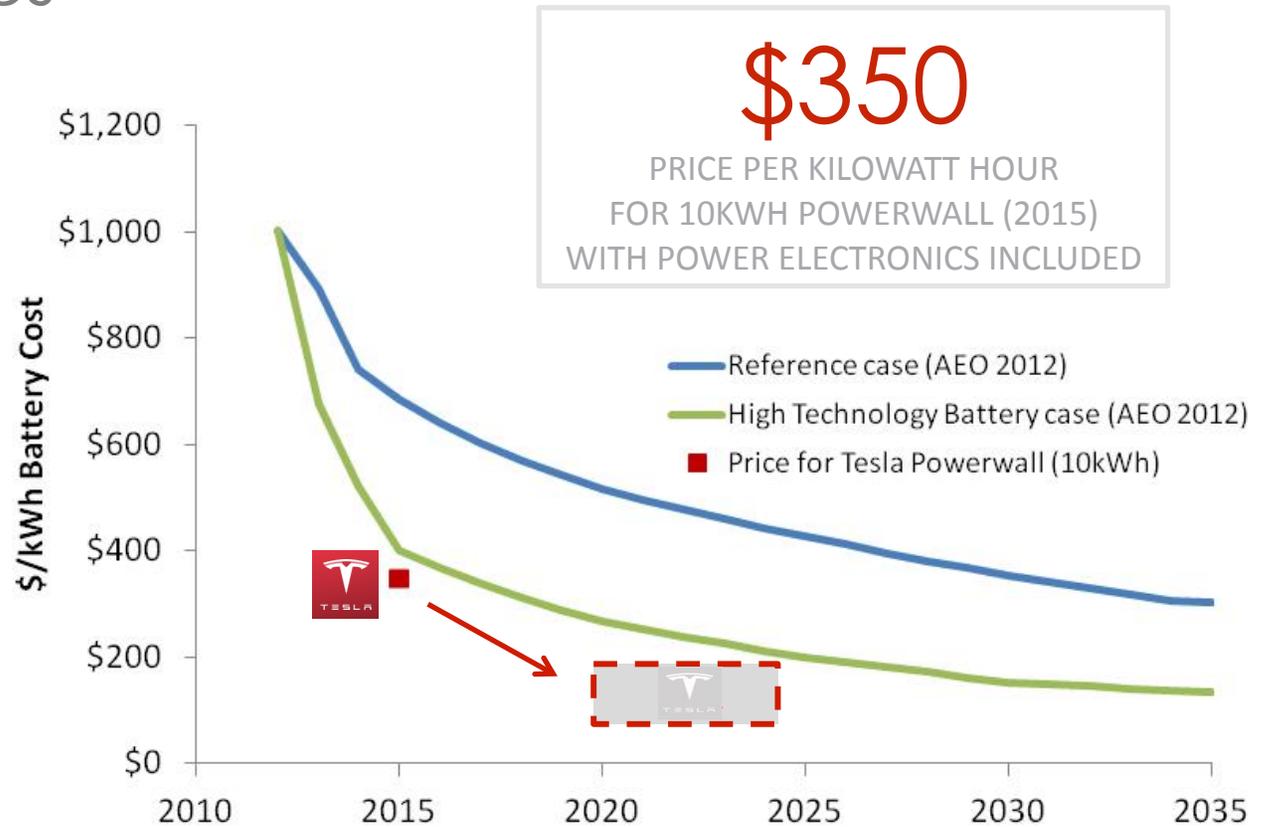
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# Electric Vehicles

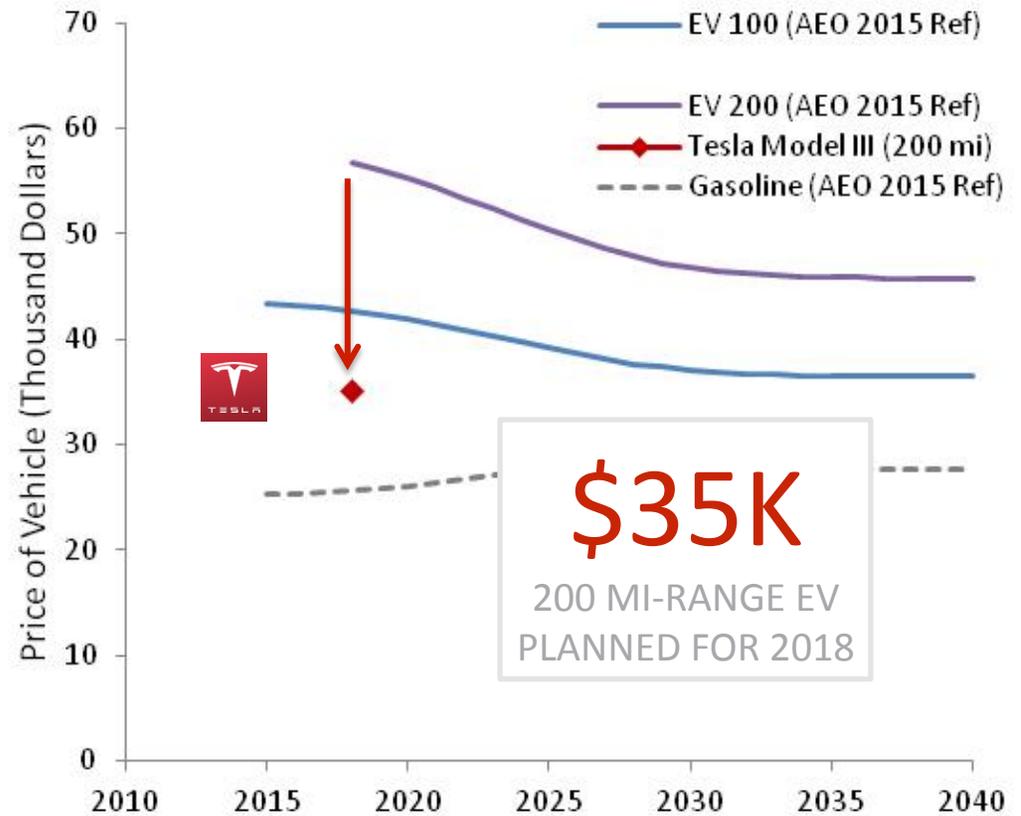
- Battery costs will improve much more rapidly





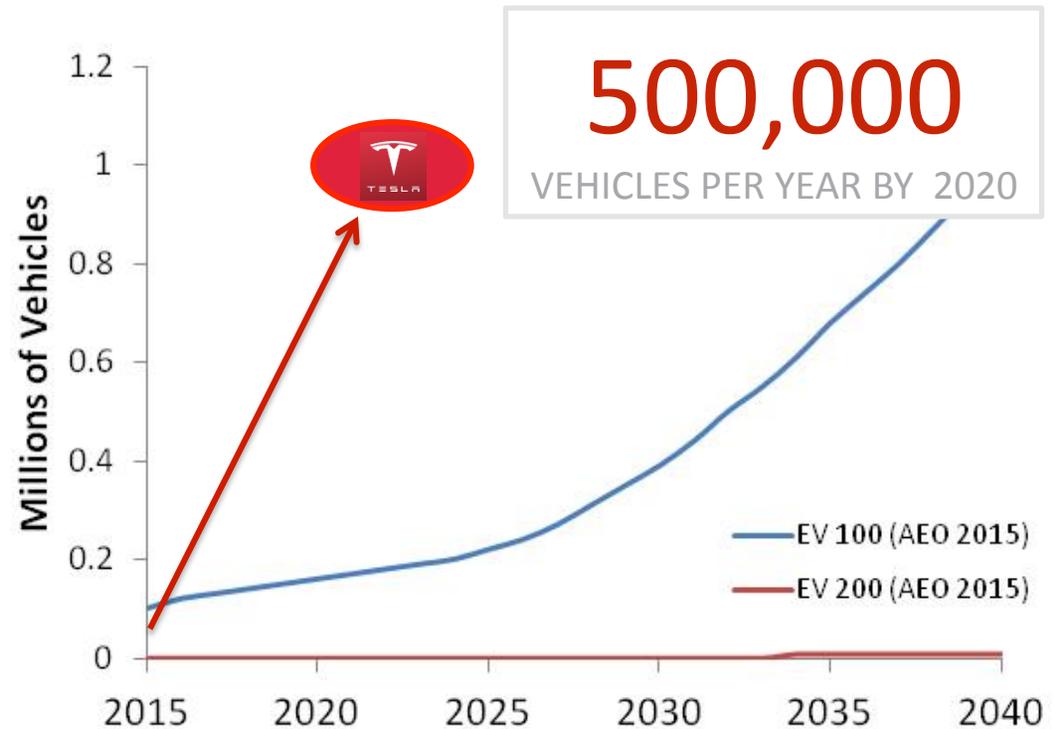
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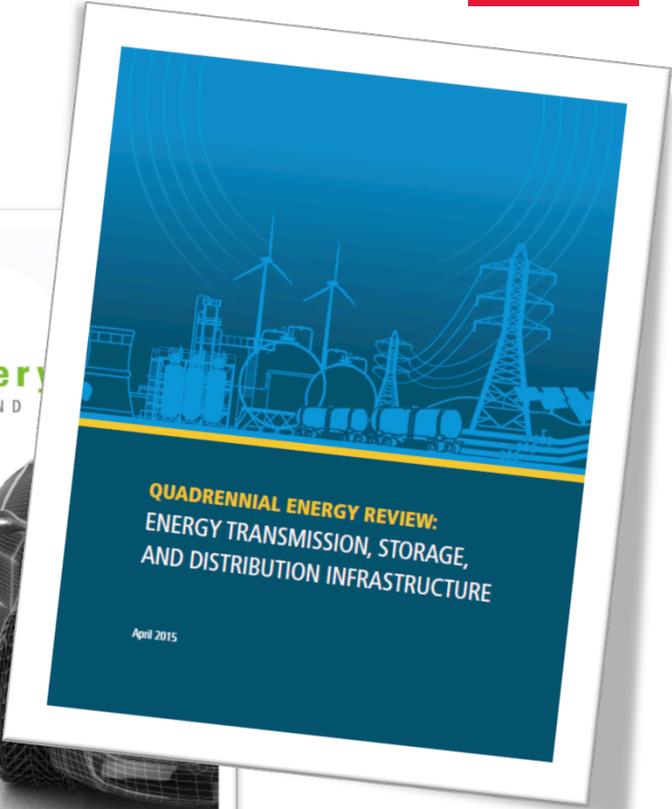
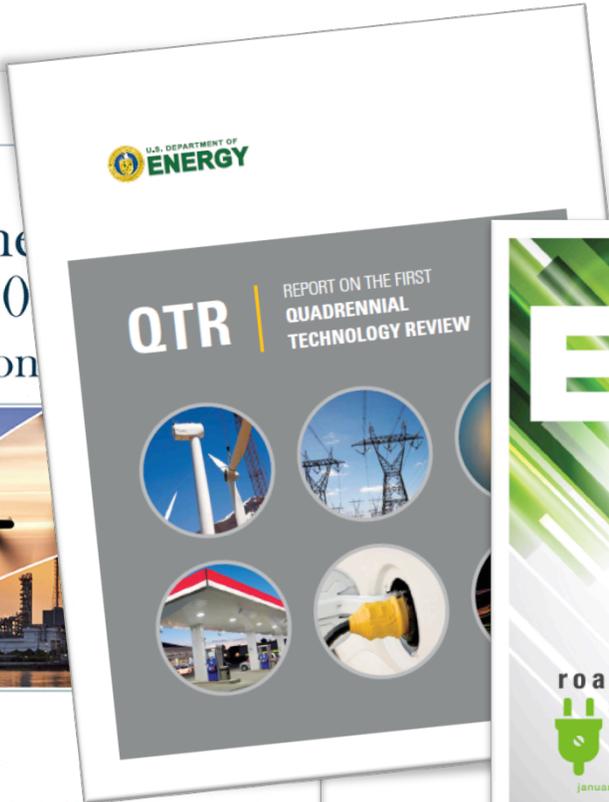
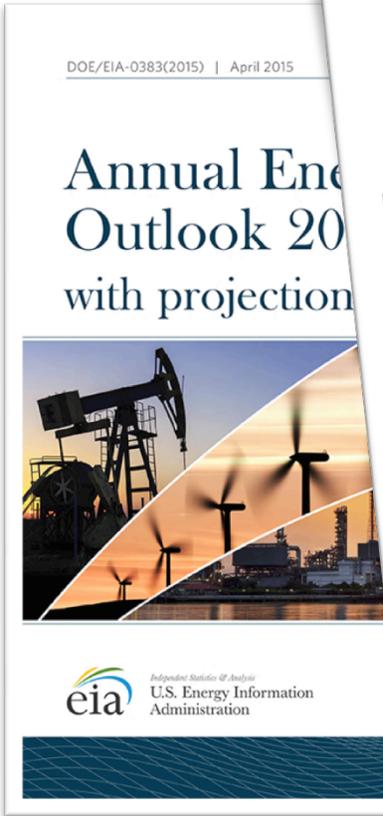
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# Electric Vehicles

- Battery costs will improve much more rapidly
- Price gap with ICE vehicles will shrink then disappear
- **Electric vehicles sales will grow quickly**







# Our View

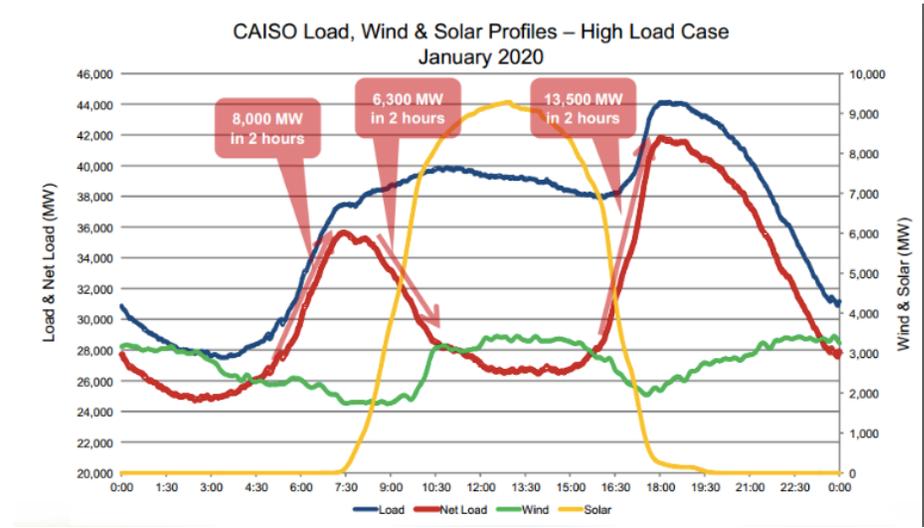
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  - BEVs better than ICE-based cars





# Our View

- Electricity will replace petroleum as primary fuel for LDV transportation
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- **The utility business model becomes very different than what it used to be**
  - EVs provide source of electricity demand growth
  - Storage breaks instantaneous market balance requirement



## Our View

- Electricity will replace petroleum as primary fuel for LDV transportation
  - BEVs better than ICE-based cars
- The utility business model becomes very different than what it used to be
  - EVs provide source of electricity demand growth
  - Storage breaks instantaneous market balance requirement
- **Solar + Storage becomes low-cost solution for developing countries where grid is nonexistent, expensive, or unreliable**



1.2 B

PEOPLE WITHOUT  
ELECTRICITY

“The stone age came to an end not for lack of stones  
And the oil age will come to an end not for lack of oil”

— *Sheikh Yamani, former Saudi Oil Minister*

