Cleantech and Electric cars 2018

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Clean-tech

GLOBAL CLIMATE ACTION SUMMIT

GOVERNOR BROWN CLOSES GLOBAL CLIMATE ACTION SUMMIT: "WE'RE LAUNCHING OUR OWN DAMN SATELLITE"

Sep 14, 2018 | Feature, Summit News

Clean-tech

- Planet (founded by ex-NASA scientists in 2010) operates the world's largest constellation of satellites in history
- Planet has launched over 150 Earth-imaging satellites
- State of California + Planet Labs to develop a satellite that will track climate change-causing pollutants
- Climate Data Partnership to serve as a common platform for reporting data from satellite systems studying climate variables

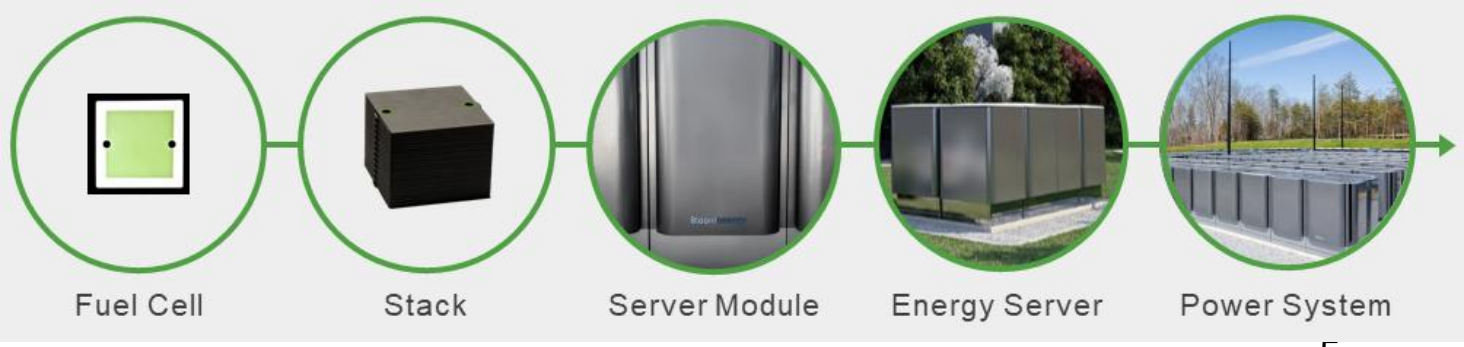
Clean-tech

- Powerhouse (Oakland, 2013): incubator for cleantech startps

Clean-tech

- Bloom (Sunnyvale, 2001): fuel cells that can produce electricity at costs that are competitive with grid power

Bloomenergy



Clean-tech

- Genability (San Francisco, 2010): new-energy use optimization
- Autogrid (Redwood City, 2011): new-energy use optimization
- Advanced Microgrid Solutions (San Francisco, 2012): software to ensuring electricity from generators, renewable energy, batteries and the grid itself will always perfectly match the needs of the buildings

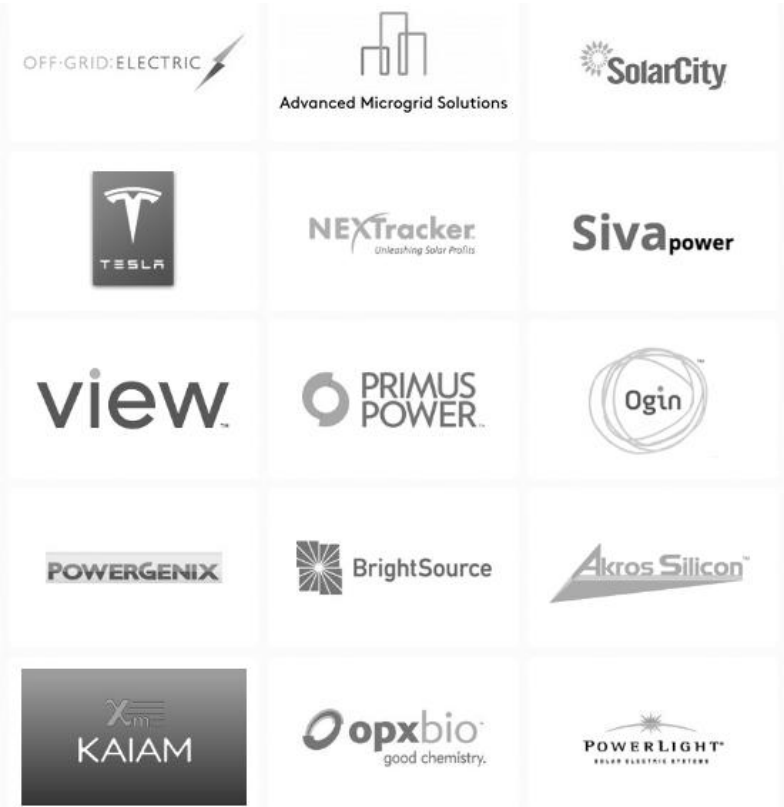
Clean-tech

- Aclima (San Francisco, 2010): air-quality mapping platform - mobile sensing platform on Street View cars in collaboration with Google Earth Outreach (IoT of city-wide network of sensors)

Clean-tech

- DBL Partners - Double Bottom Line Venture Capital (San Francisco, 2016): the first venture capital fund specializing in “impact investment” to achieve significant financial returns to scale

DBL PARTNERS
DOUBLE BOTTOM LINE VENTURE CAPITAL



Clean-tech

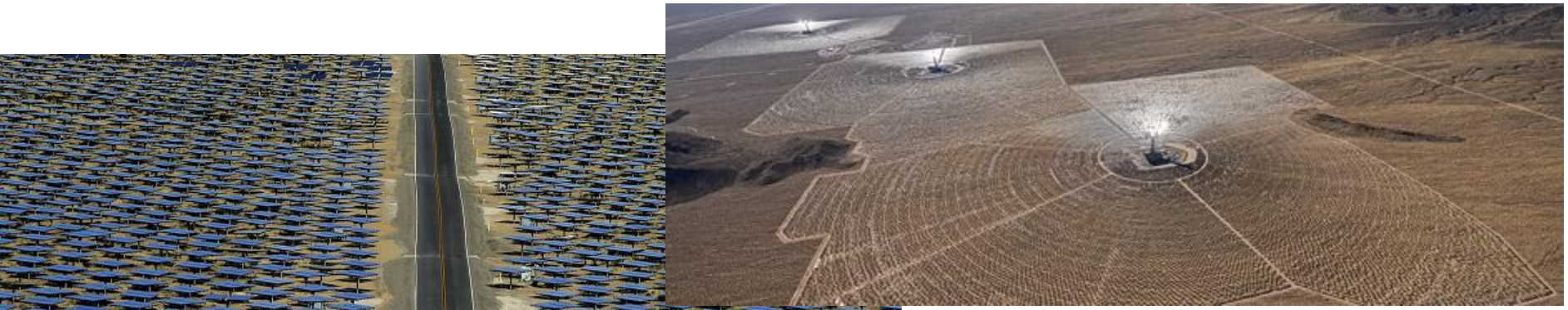
- The garbage industry has traditionally been low-tech
- How to disrupt the $60 billion garbage industry?
- Rubicon Global (Kentucky, 2008): a cloud-based “Uber for trash”
- $1 billion in 2017 (most valued cleantech startup in the US)
- Controversy: *“a trash brokerage business masquerading as a tech company”* (Fortune)

Clean-tech

- Aemetis Company (Cupertino, 2006): renewable fuels
- Alphabet Energy (Berkeley, 2009), spinoff of Lawrence Berkeley National Laboratory: generate power from waste heat

Clean-tech

- Problems: BrightSource leaves California after building the largest solar thermal power plant in the world at Ivanpah (2014)



Clean-tech

- No cleantech unicorn in the top 100

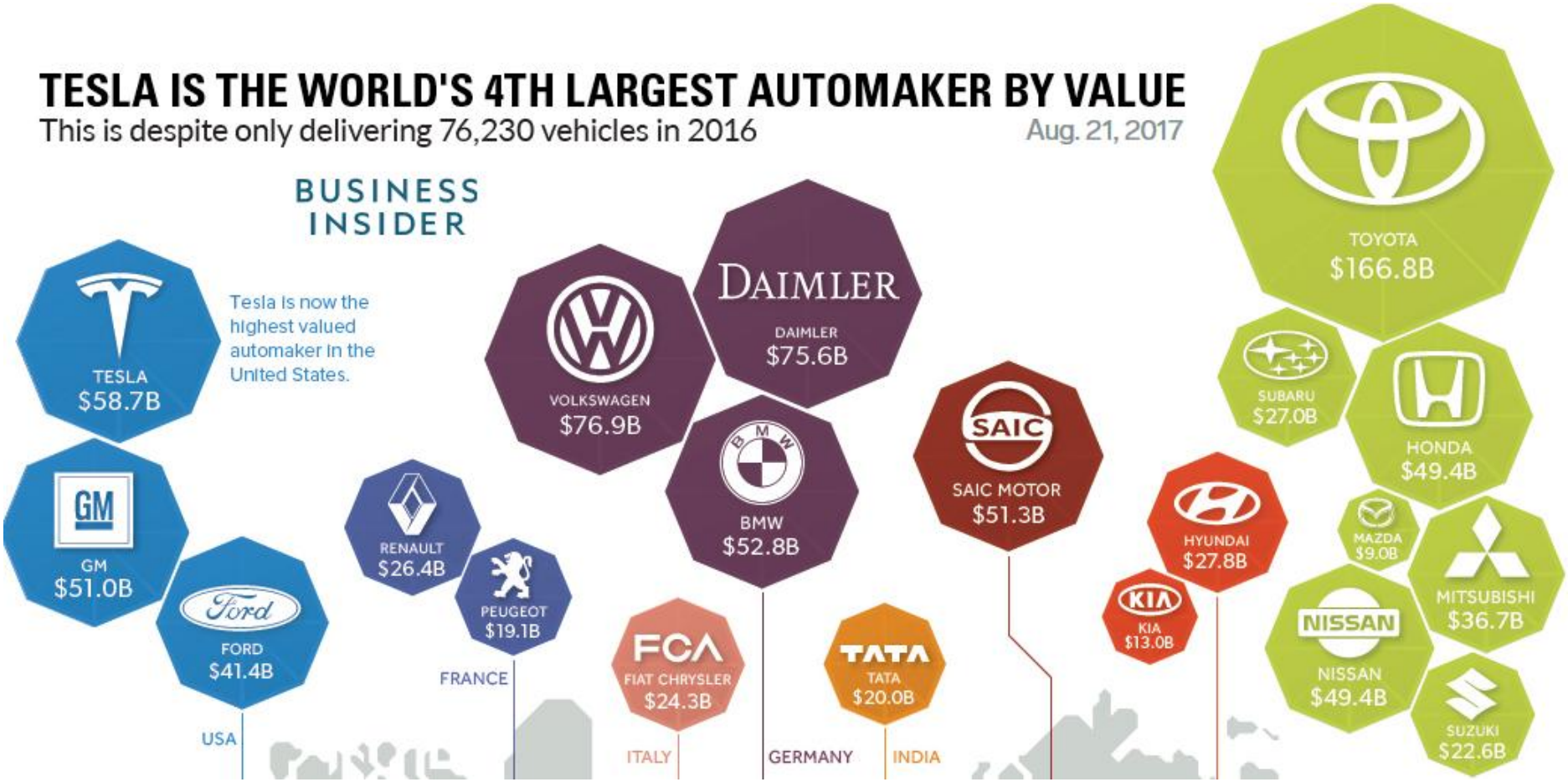
Company	Valuation ($B)	Date Joined	Country
Uber	$72	8/23/2013	United States
Didi Chuxing	$56	12/31/2014	China
Airbnb	$29.3	7/26/2011	United States
SpaceX	$21.5	12/1/2012	United States
Palantir Technologies	$20	5/5/2011	United States
WeWork	$20	2/3/2014	United States
Toutiao (Bytedance)	$20	4/7/2017	China
Stripe	$20	1/23/2014	United States

Cbinsight.com - August 2018

Lu.com	$18.5	12/26/2014	China
JUUL Labs	$15	12/20/2017	United States
Pinterest	$12.3	5/19/2012	United States
Bitmain Technologies	$12	7/6/2018	China
Lyft	$11.5	3/12/2015	United States
GrabTaxi	$11	12/4/2014	Singapore
Global Switch	$11.08	12/22/2016	United Kingdom
Infor	$10	11/16/2016	United States
DJI Innovations	$10	5/6/2015	China

Electric Cars

Electric Cars



New-Energy Vehicles

- National programs to ban internal combustion engine (ICE) vehicles in favor of electric ones: Norway by 2025, India and China by 2030, Britain and France by 2040, California by 2040

Assemblymember Ting Introduces Clean Cars 2040

Wednesday, January 3, 2018

New-Energy Vehicles

- 2017:
  - Opening of Tesla's largest charger station, halfway between Los Angeles and San Francisco

New-Energy Vehicles

- China rules!
  - 2017: China's electric vehicle production is 50% of global production (EU 21%, USA 17%, Japan 8%, South Korea 3%)
  - 2017: China's battery cell production for electric vehicles is 11 times that of the USA
  - 2017: Largest stock of electric vehicles in the world, with cumulative sales of more than 1.7 million units

New-Energy Vehicles

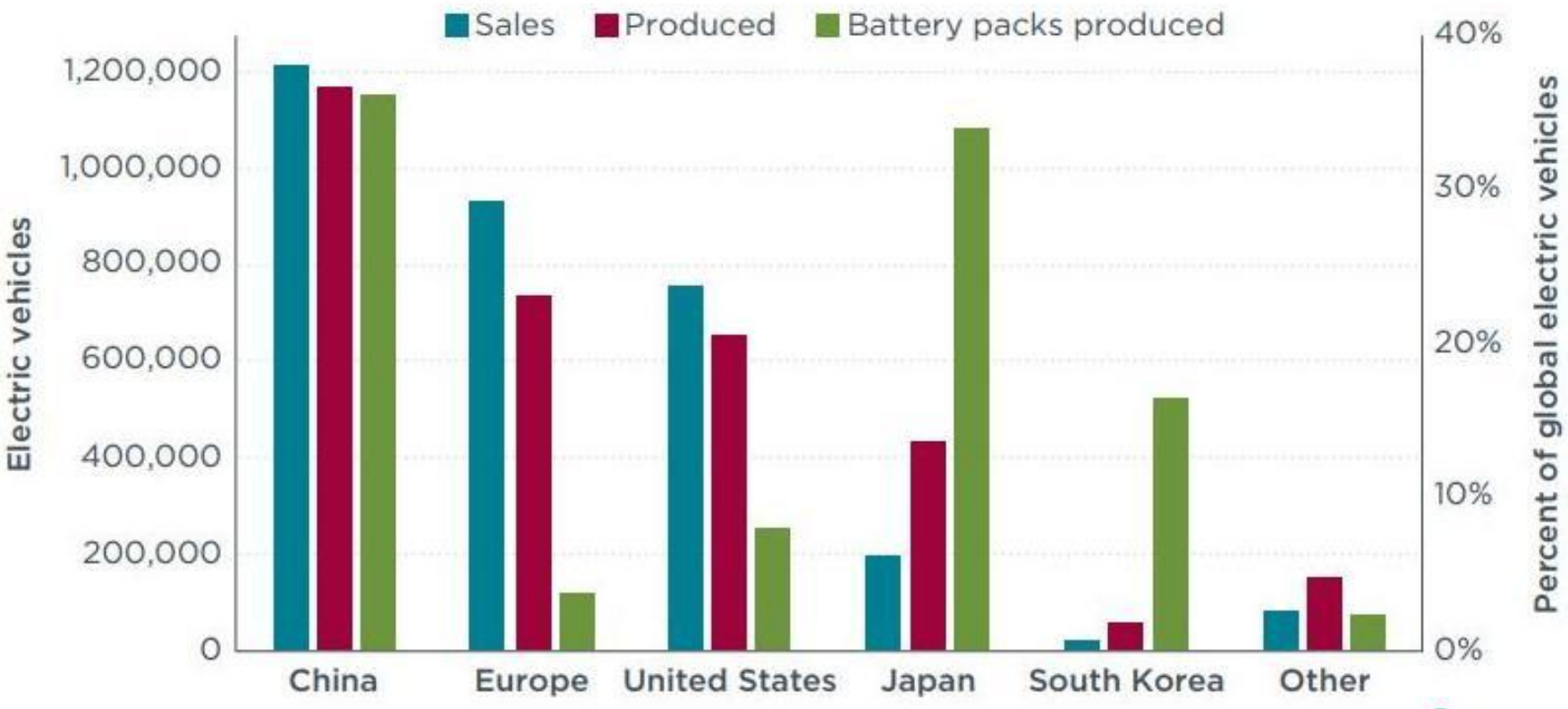


Figure ES-1. Electric vehicle sales, electric vehicle production, and electric vehicle battery production by region through 2017.

icct
THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

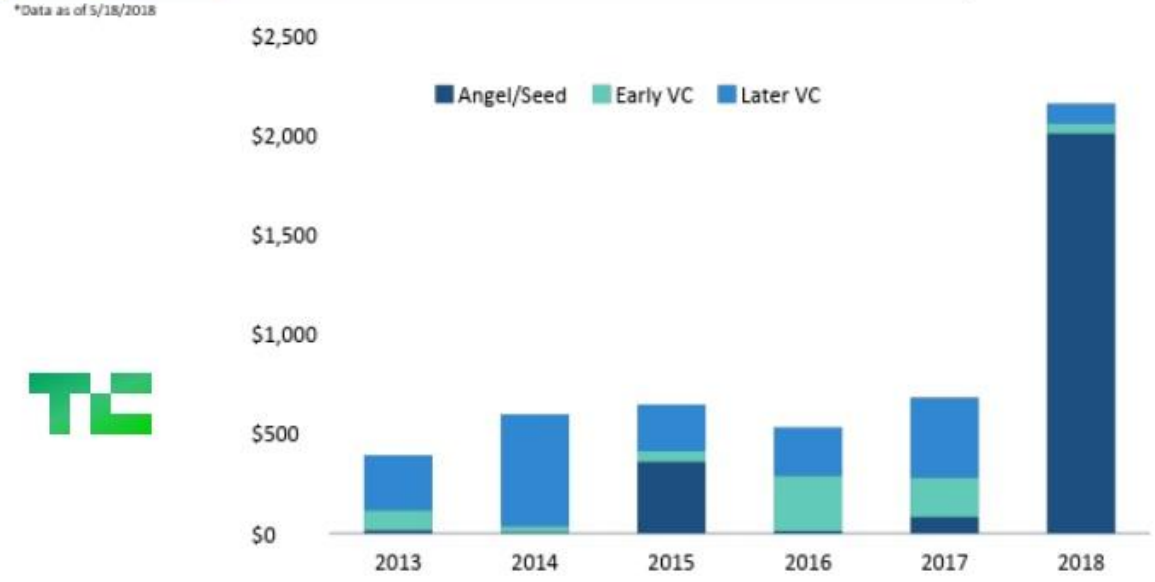
New-Energy Vehicles

- US startups
  - Electric vehicle startups raised more than $2 billion in the U.S. over the first months of 2018 alone, a huge increase over the $650 million raised in 2017

US VC Deal Flow ($M) in Electric Car/Vehicle Companies by Stage

	2013	2014	2015	2016	2017	2018
Angel/Seed	$18.09	$7.65	$362.40	$12.89	$84.39	$2,006.50
Early VC	$101.27	$29.85	$50.17	$275.65	$194.25	$49.10
Later VC	$274.30	$561.63	$234.83	$245.62	$402.36	$100.42

*Data as of 5/18/2018



New-Energy Vehicles

- California startups

Table 1. Electric vehicle and general data for California and the United States.

		U.S.	California	California as percent of U.S.
General	Population	326 million	39.5 million	12%
	Gross domestic product	$19.4 trillion	$2.75 trillion	14%
	Light-duty vehicle sales in 2016	16.2 million	2.0 million	12%
Electric vehicles	New 2017 electric vehicles	193,000	96,000	50%
	Cumulative 2010–2017 electric vehicles	749,000	366,000	49%
Electric vehicle public charging	Level 2 charge points	38,100	12,000	32%
	Fast charge points	6,200	1,600	25%
	Total charge points	44,300	13,600	31%

Population data from U.S. Census; income data from U.S. Bureau of Economic Analysis; vehicle registrations from IHS Automotive; public charging data from Alternative Fuels Data Center.

New-Energy Vehicles

- California startups

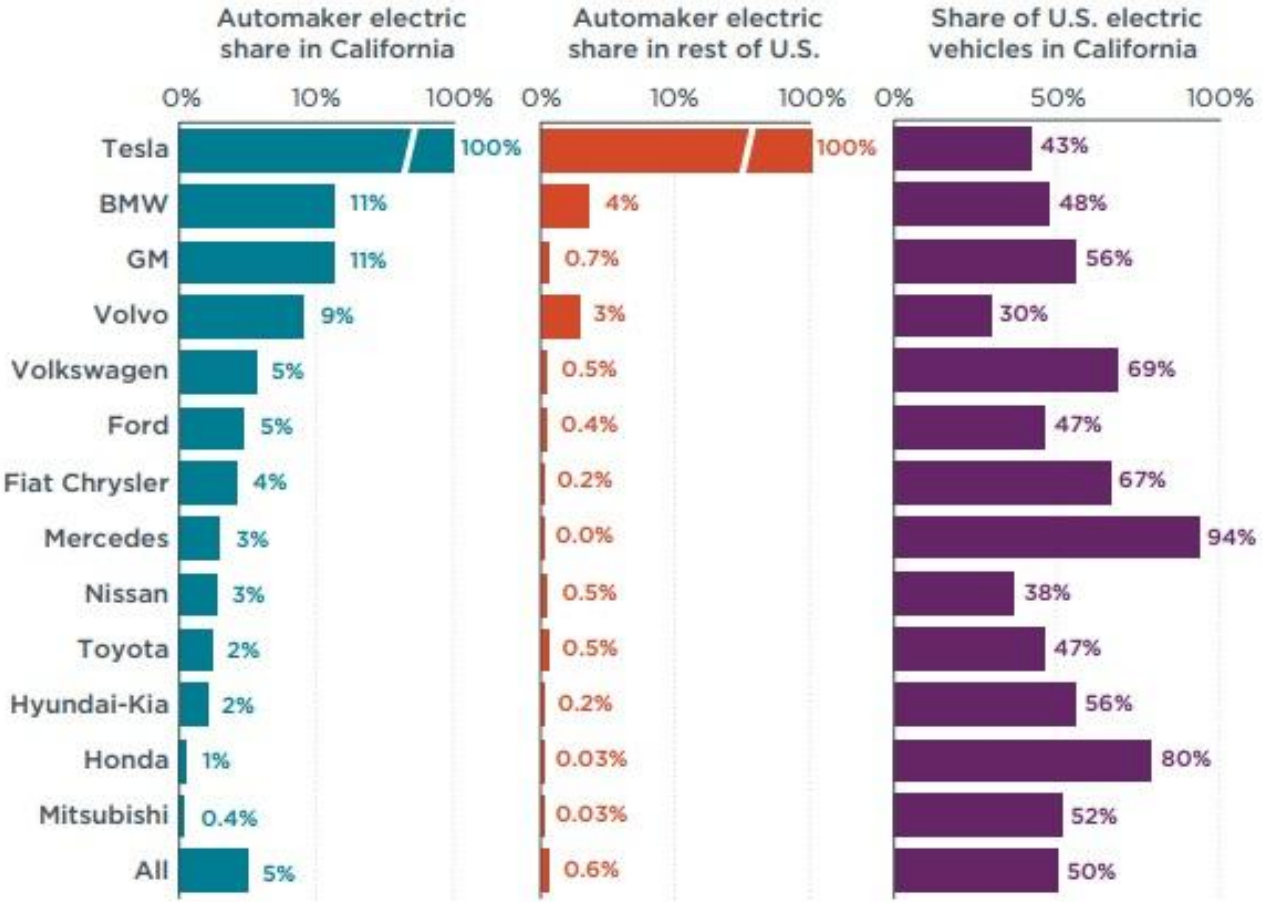
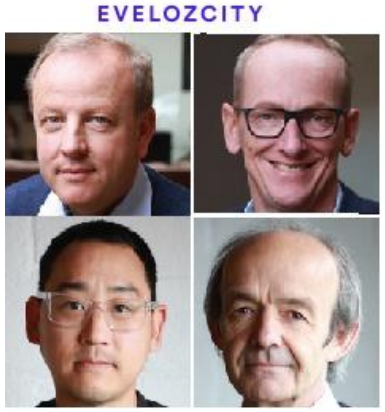


Figure 4. Automaker group electric vehicle share in California and the United States, and share of U.S. electric vehicles deployed in California. (*Vehicle registrations from IHS Automotive*)

New-Energy Vehicles

- Karma Automotive (2015, ex Fisker, owned by Wanxiang Group)
- Evelozcity (2017)
- Independent Electric Vehicles (2017, Steve Osorio)

KARMA



Independent Electric Vehicles

New-Energy Vehicles

- SF Motors (2016, John Zhang) – with Tesla's founder Martin Eberhard
- Lucid Motors (2017, Peter Rawlinson)

New-Energy Vehicles

- Zoox (2014, Tim Kentley-Klay) - unicorn worth $1.5 billion
- Nuro.ai (2016, former Google engineers)

ZOOX

We are building an advanced mobility experience that will support the future needs of urban mobility for both people and the environment.

Our first step is a self-driving vehicle for local goods transportation

New-Energy Vehicles

- The problem: the range
  - Chevy Bolt EV (238 miles)
  - Tesla Model 3 (220 miles)
  - Nissan Leaf (150 miles)
- Three solutions
  - New kind of batteries
  - Wireless charging
  - Lighter materials

2018 Nissan LEAF

New-Energy Vehicles

- Volta Charging (San Francisco, 2010): network of free charging stations
- FreeWire (San Leandro, 2014): portable electric vehicle charging stations

New-Energy Vehicles

- New-energy vehicles use… OLD energy!
- The lithium-ion battery was introduced in 1991

New-Energy Vehicles

Energy@Stanford & SLAC 2018

Energy Research for the 21st Century

Monday - Thursday, September 10 -13
Friday, September 14 (optional half-day)

Stanford | Precourt Institute for Energy SIMES SLAC NATIONAL ACCELERATOR LABORATORY

SLAC NATIONAL ACCELERATOR LABORATORY

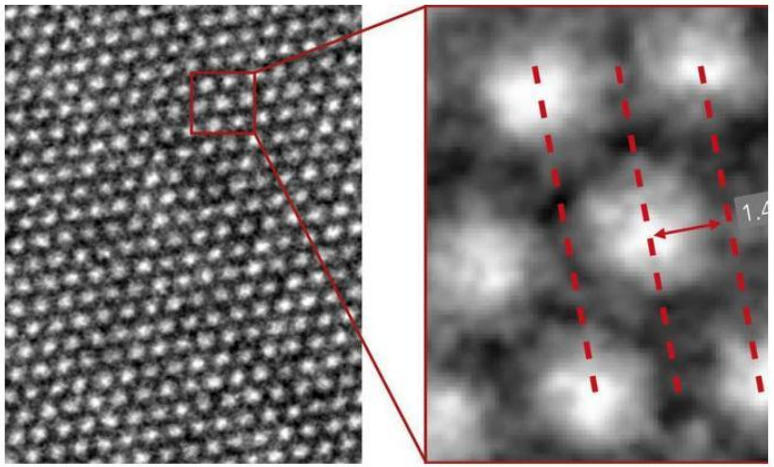
August 30, 2018

Chuntian Cao wins 2018 Klein Award for lithium-ion battery research

Using SLAC's X-ray synchrotron SSRL, Cao improves fundamental knowledge about how a new lithium-ion battery material works

New-Energy Vehicles

- Cryo-electron microscopy (Cryo-EM) to study battery materials
  - 2016: Yi Cui at Stanford uses Cryo-EM for research on battery material: the first time ever that scientists can see atomic-level microscopic images of lithium metal



New-Energy Vehicles

- Cryo-electron microscopy (Cryo-EM)
  - 2017 Nobel prize in chemistry

The Nobel Prize in Chemistry 2017

The Royal Swedish Academy of Sciences has decided to award the Nobel Prize in Chemistry 2017 to

Jacques Dubochet
University of Lausanne, Switzerland

Joachim Frank
Columbia University, New York, USA

Richard Henderson
MRC Laboratory of Molecular Biology, Cambridge, UK

"for developing cryo-electron microscopy for the high-resolution structure determination of biomolecules in solution"

The End (for now)

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