



Insight into innovation

EVs Will Rule the World, Make Transportation Smart, and Bring World Peace

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Cleantech Group: Insight Into Innovation



SMART GRID

Smart Grid equipment and infrastructure
ABB, Tendril, Enercon, GE
Johnson Controls, Siemens



GREEN TRANSPORTATION

Vehicles design and technology, fuels and logistics
Better Place, Fisker Automotive,
Mission Motors, Tesla Motors



WATER

Filtration, purification, water conservation, irrigation and wastewater treatment
TetraKaDu, Sloan Valve, Veolia



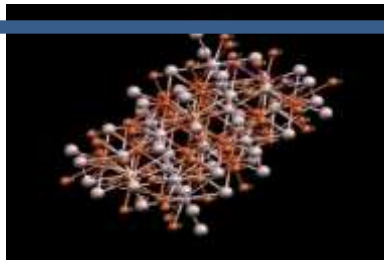
ENERGY EFFICIENCY

Lighting, windows, walls, recycled energy
CB Richard Ellis, Hines Interests,
Johnson Controls, Philips



ENERGY STORAGE

Grid-scale storage, batteries, pumped hydro
A123, Apple, Dell, Coulomb
Technologies, Siemens



MATERIALS

Nanotech, biotech, renewable chemicals
Amyris Biotechnologies,
Applied Materials,
Genomatica



ENERGY GENERATION

Solar, wind, alternative fuels, biomass
Duke Energy, EDF, First Solar
Solyndra



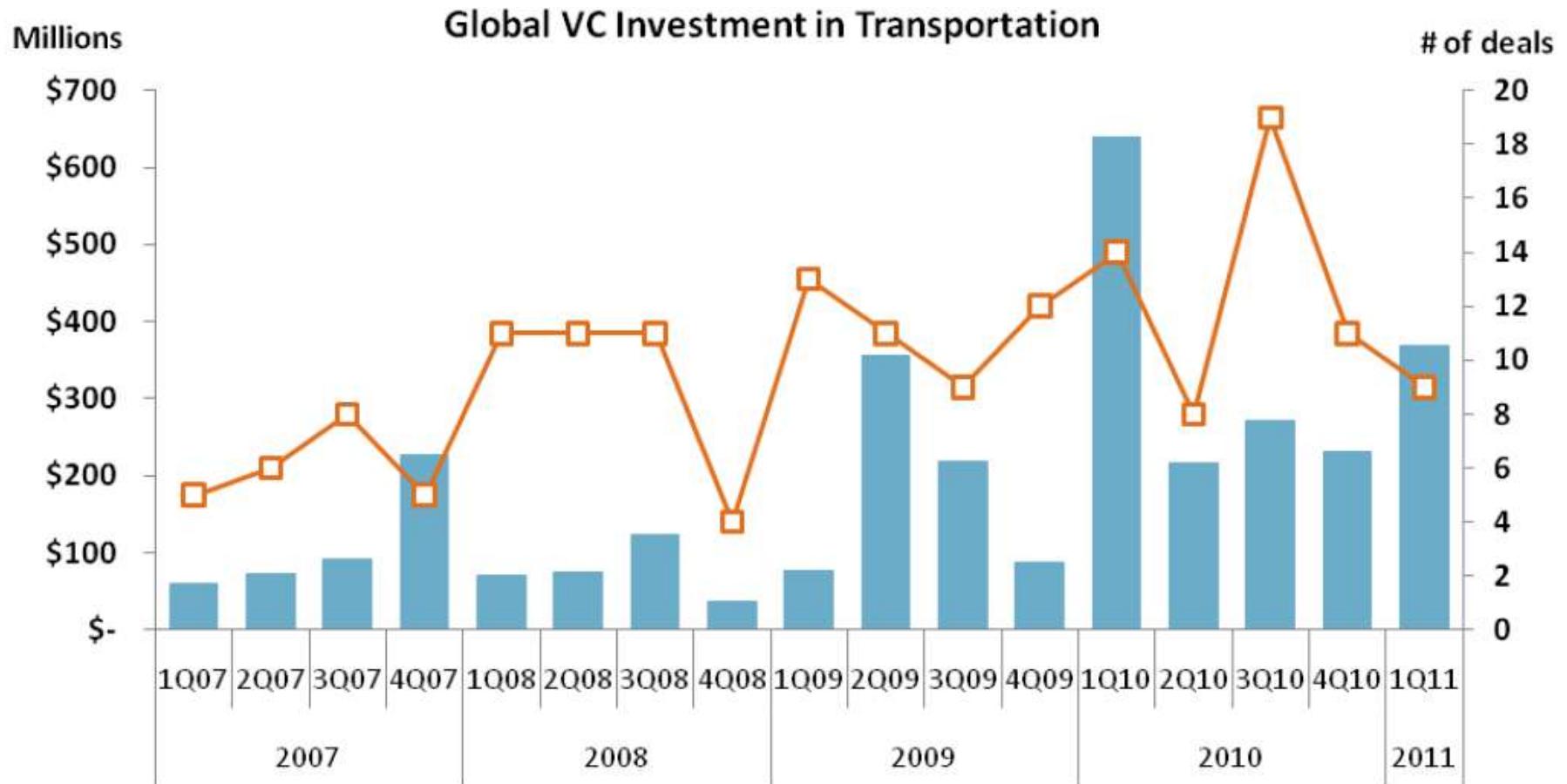
RECYCLING & WASTE

Various recycling services and waste treatment services
Waste Management,





Global VC Investments in Transportation



Source: Cleantech Group

Top VC Investors in Transportation (2011)

Investor	Number of Investments
Kleiner Perkins Caufield & Byers (KPCB)	7
Angeleno Group	6
Virgin Green Fund	5
Element Partners	5
RockPort Capital Partners	5
Balderton Capital	5
Benchmark Capital	5
Khosla Ventures	4
Infield Capital	4
Amadeus Capital Partners	4

Top Corporate Investors (OEMs)



DAIMLER



On-Road Transport

Market segmented by technology, economics, adoption, and distribution infrastructure

ICE-Powered Vehicles

- Run mostly on gasoline and diesel fuels
- Expected to be used in **95% of transport applications** in the next decade

Hybrids and Electrics

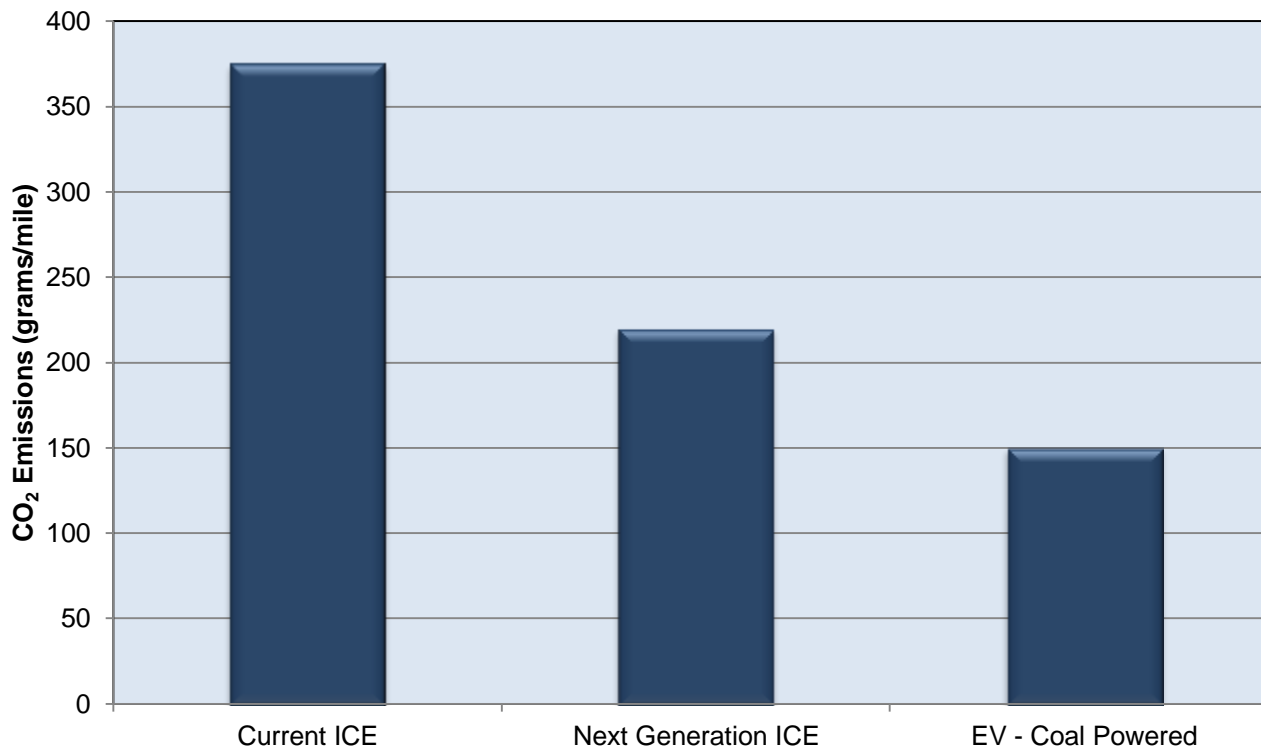
- Non plug in hybrids (ICE + electric motor + battery) = **HEV**
Fill gas tank only
- Plug in hybrids (ICE + electric motor + battery) = **PHEV**
Fill gas tank and charge battery
- Pure electrics (Electric motor + battery) = **BEV**
Charge battery only

Everything Else

- Fuel cells – hydrogen, methanol
- LNG – liquefied natural gas
- CNG – compressed natural gas
- LPG – liquefied petroleum gas (propane, butane)

EVs Relative to Incumbent Technology

Emissions comparison:



Energy density matters:

ICE: 30% efficiency powerplant with fuel energy density of 13,000 W-hr/kg

EV: 90% efficient powerplant with battery energy density of 300 W-hr/kg

15X factor

Takeaway: EVs are fundamentally **range-limited** with current battery technologies

Current State of EVs and Charging – US Example

- <2,000 commercial charging stations today (gas stations: 150,000)
- Today only a few thousand grid-dependent vehicles sold annually; 500,000 on road by 2015
- Several well-known vehicles already or imminently available, in production quantities of fewer than 10,000 per year through 2012

Vehicle Model	Battery	Range	Retail Price
Tesla Roadster	53 kW-hr Li-ion	240 miles	\$109,000
Nissan Leaf	24 kW-hr Li-ion (NEC)	100 miles	\$34,000
Chevrolet Volt PHEV	16 kW-hr Li-ion (LG)	40 miles electric	\$41,000

- Major order: GE planning to purchase 25,000 EVs for fleet purposes in next few years
 - Includes roughly 10,000 Chevrolet Volt PHEVs

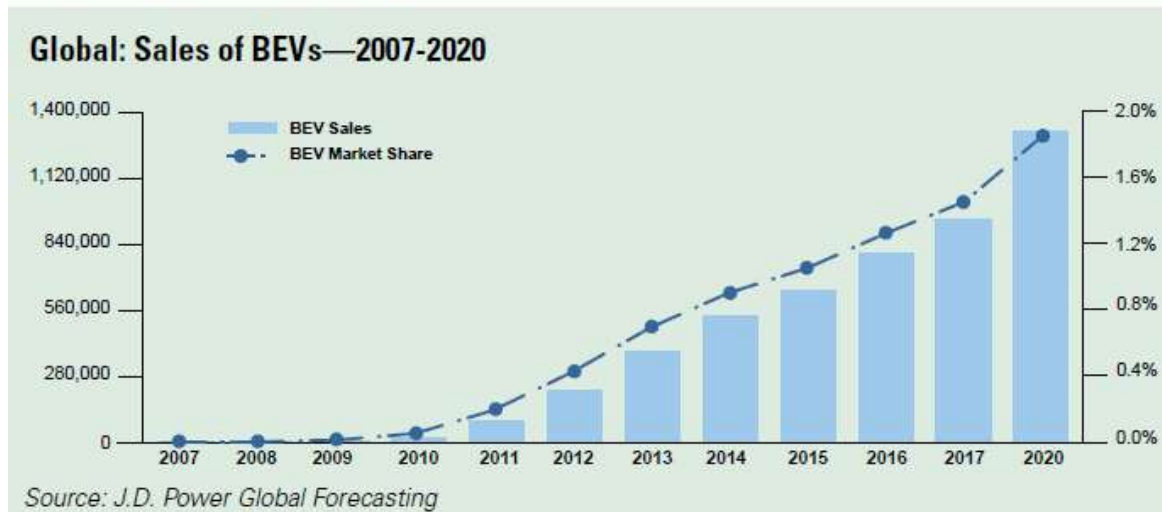
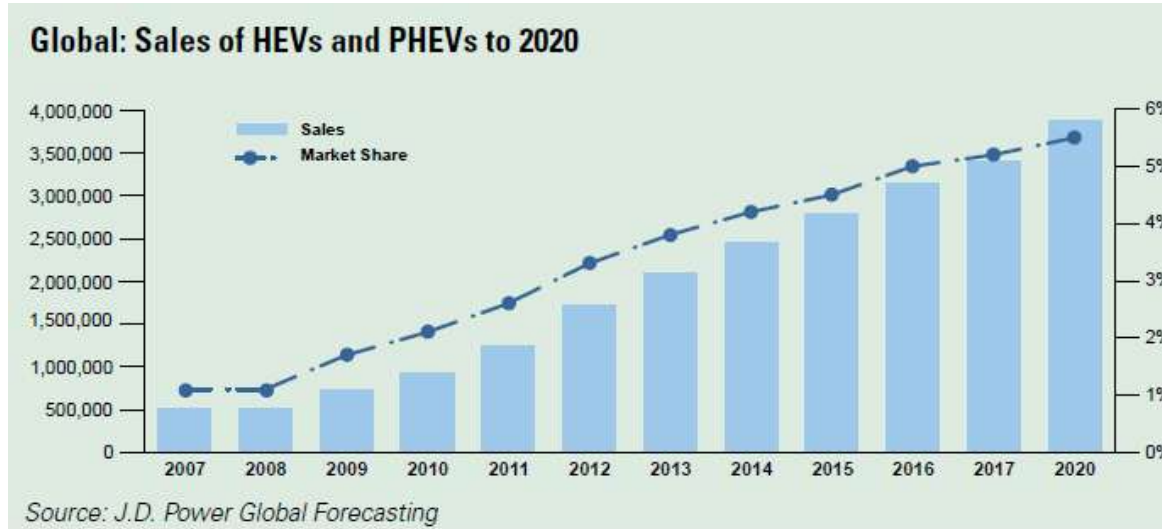
Current State of EVs and Charging – US Example

- Average passenger vehicle battery size = approx. 40 kW-hr
 - At \$0.10/kWhr, this is equivalent to only \$4 for a full charge
 - If desired charge time is less than 4 hrs, need minimum 10 kW steady power input
 - Average power consumed in a CA household: 5 kW

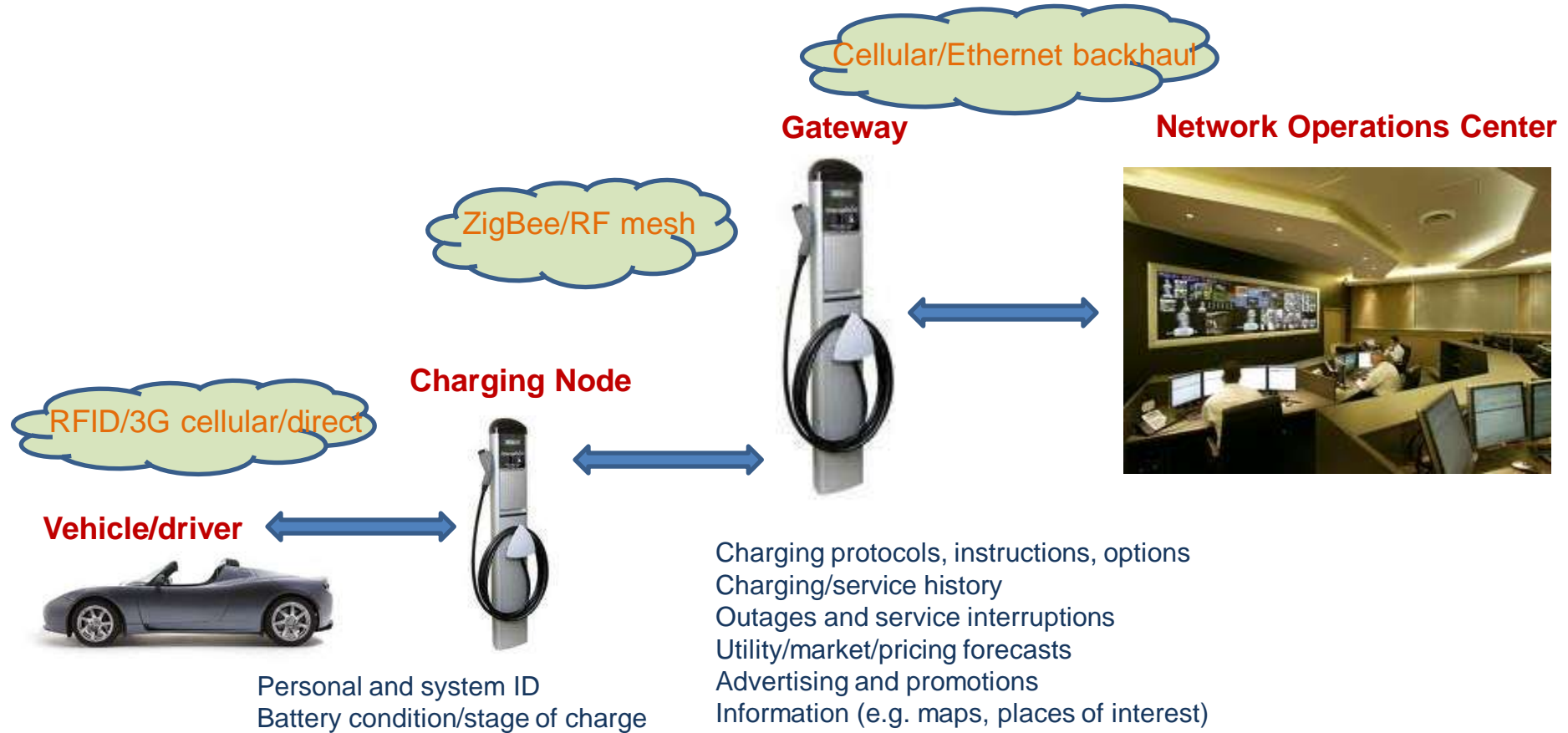
Charge Level	Voltage	Power	Comments
Level 1	120 V AC	2 kW	Uses NEMA 5 standard outlet –no elec. upgrades needed.
Level 2	240 V AC	7-10 kW	Most common proposed system.
Level 3	480 V DC	> 50 kW	Can reduce battery life. Rectifier in charger vs. on-board.

- Technology approaches: direct (conductive), wireless (inductive), battery switching
- Charger form factors: pedestal, wall-mounted, pole-mounted

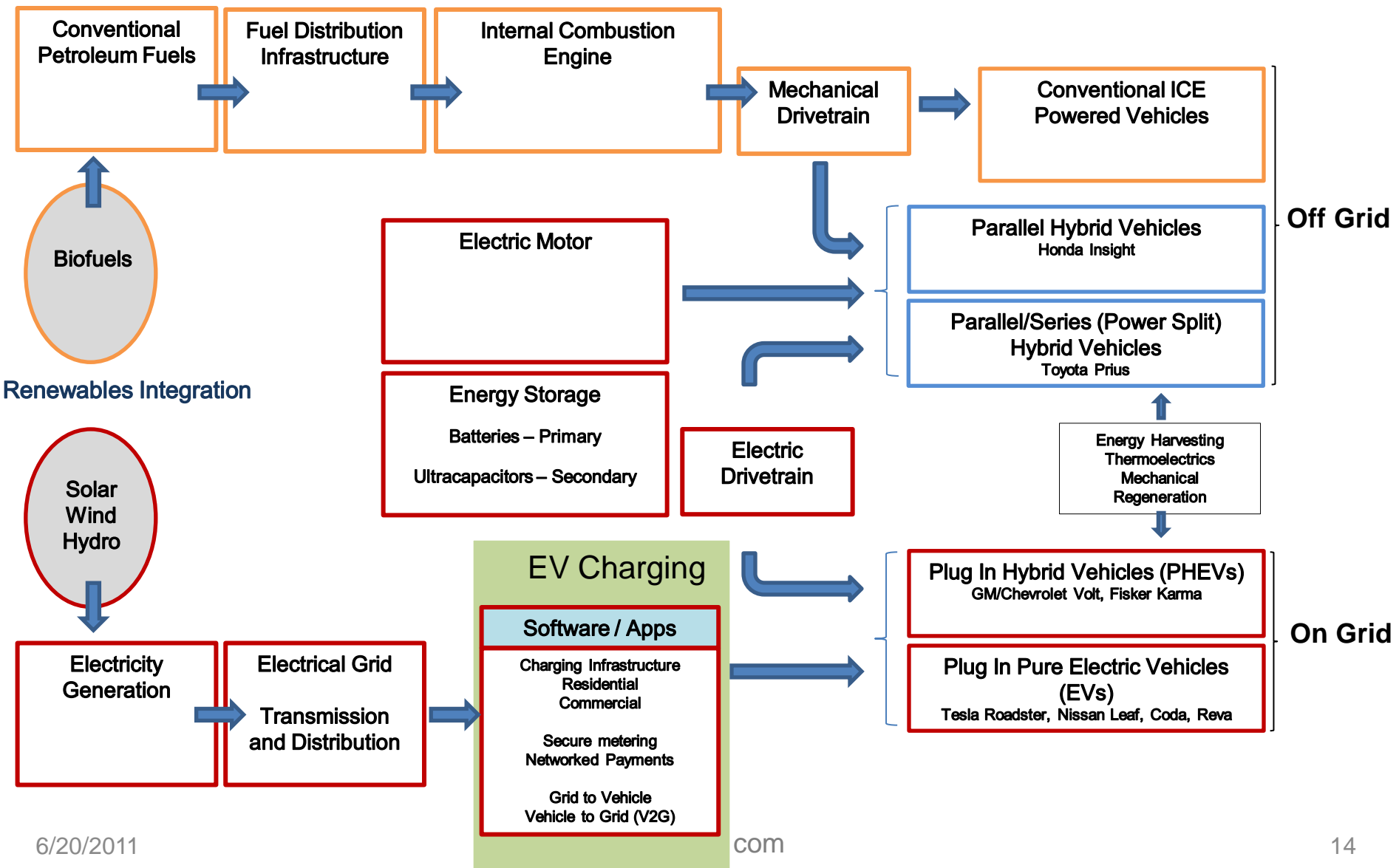
HEV and PHEV/BEV Forecasts



Communications Architecture and Data Exchange



Lots of Innovation Spots in Value chain



The Smart Transportation Landscape



Airplane



HGV/Bus



Light-duty truck



4 Wheel



2 Wheel



What's Next for Transportation?




RelayRides

Borrow cars from car owners in your neighborhood, by the hour or by the day. It's safe, easy & convenient.

CURRENTLY AVAILABLE IN BOSTON AND SAN FRANCISCO.

- Click Here to Join Today!
- Bring RelayRides to Your City.



Lot's of Innovation in France



Thank You (and Our Clients)

Utilities & Energy



DTE Energy



ICT

Autodesk



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Diversified Industrial



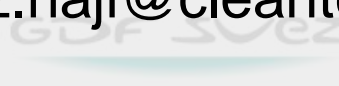
PHILIPS

Mitsubishi

ABB

SIEMENS

Water, Waste & Transport



Business Services



McKinsey & Company

Investors



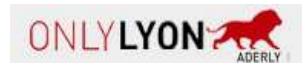
ROCKPORT
CAPITAL

Blackstone

khosla ventures
venture assistance, strategic advice, venture capital



Governments & Education



ONTARIO
CANADA

