



MJB & A

# ELECTRIC VEHICLES AND CHARGING INFRASTRUCTURE

TECHNOLOGICAL PATHWAYS TO LOWER CARBON  
TRANSPORTATION: WHEELS IN MOTION: THE NEW  
CHARGE IN ELECTRIC VEHICLES

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M.J. Bradley & Associates LLC  
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# ABOUT US

M.J. Bradley & Associates (“MJB&A”) is a nationally recognized consulting firm with an 18-year track record advising industry, NGOs, and government agencies on environmental and energy policy, technology, and implementation.

- Our staff has professional experience from public, private sector, and non-governmental organizations, and advanced degrees in law, engineering, finance, policy, and environmental science.
  
- We advise our clients on:
  - Air and climate change policy and regulatory analysis
  - Business planning and program development for energy and environmental issues
  - Advanced transportation technologies
  - Political strategy and coalition-building
  - Technical, economic and market assessments for advanced technologies and mitigation projects

## We deliver:

- Tailored engagements through project-based work or open-ended strategic services
- Incisive and timely information: regulatory intelligence, market analysis, and strategic support
- Perspectives informed by our long-term relationships within the energy sector, NGOs, and policymakers



# REPRESENTATIVE CLIENTS

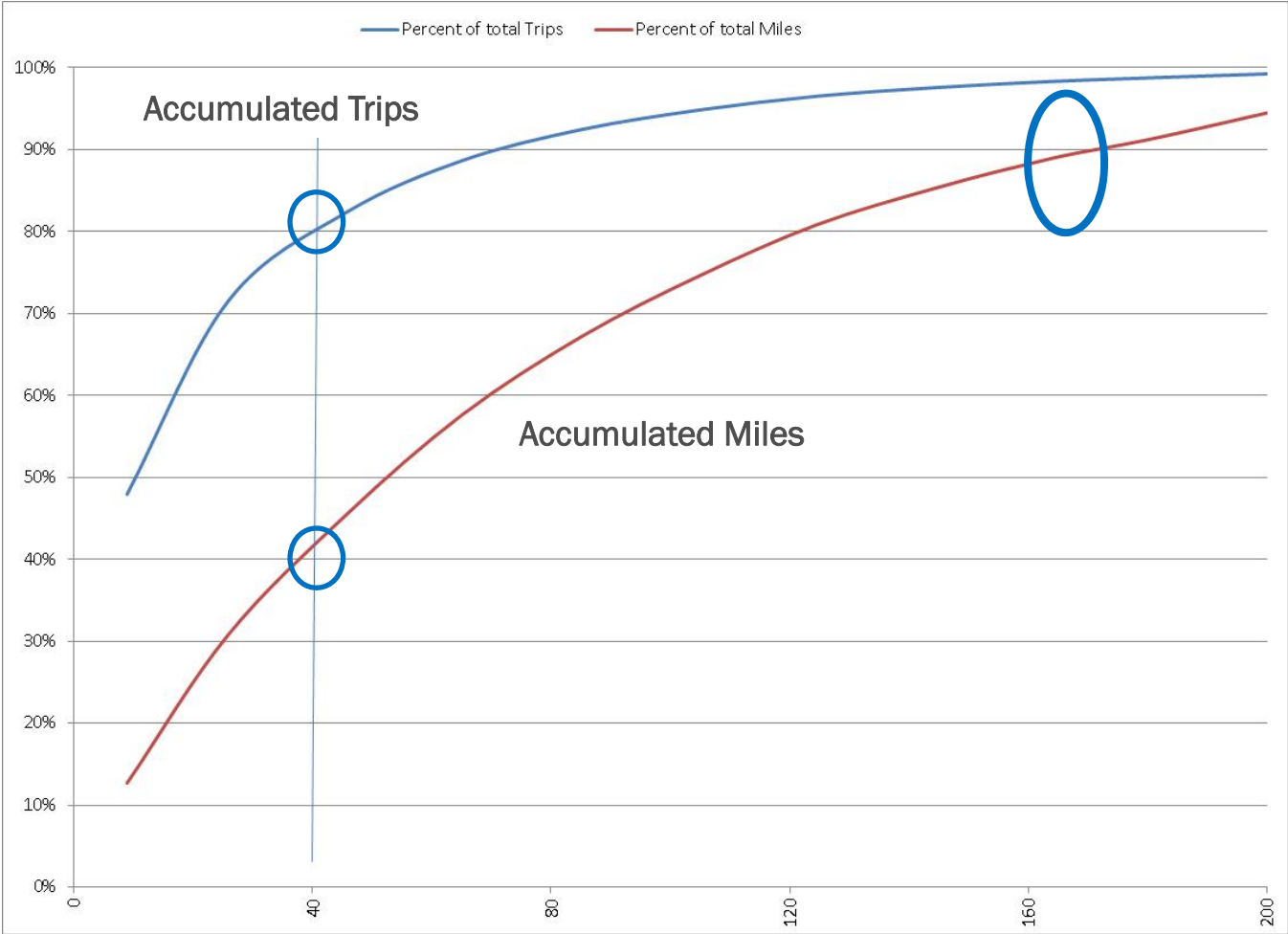
Our clients are multi-national in scope and include energy and clean technology firms, environmental groups, transportation companies and government agencies. Our utility clients generate approximately 25% of the power in the United States.

<p><b>Energy Sector Clients</b></p>	<p><b>Think Tanks, Policy Institutes and Advocacy Group Clients</b></p>
<p><b>Municipal and Government Clients</b></p>	
<p><b>Transportation Sector Clients</b></p>	

# KEY TAKEAWAYS

- EVs must achieve ~200 mile range to replace a consumer vehicle
  - 200 mile range = less infrastructure
- Battery cost will determine the EV market size
- A major selling point for EVs is that the cost of electricity can be \$1/GALe but it's not being capitalized upon
- Don't count on electric utilities to aggressively promote fast chargers:
  - They don't make electricity cheaper
  - They don't make batteries less expensive
  - They don't make batteries last longer
  - They don't make EVs more efficient
  - They don't alleviate range anxiety

# WHY 200 MILE RANGE?



80% of “day trips” are less than 40 miles, but these trips comprise less than 50% of the annual miles, 90<sup>th</sup> percentile day trip >160 miles



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- National Household Travel Survey, <http://nhts.ornl.gov/>
- Trips over 250 miles eliminated, multiple trips per day combined

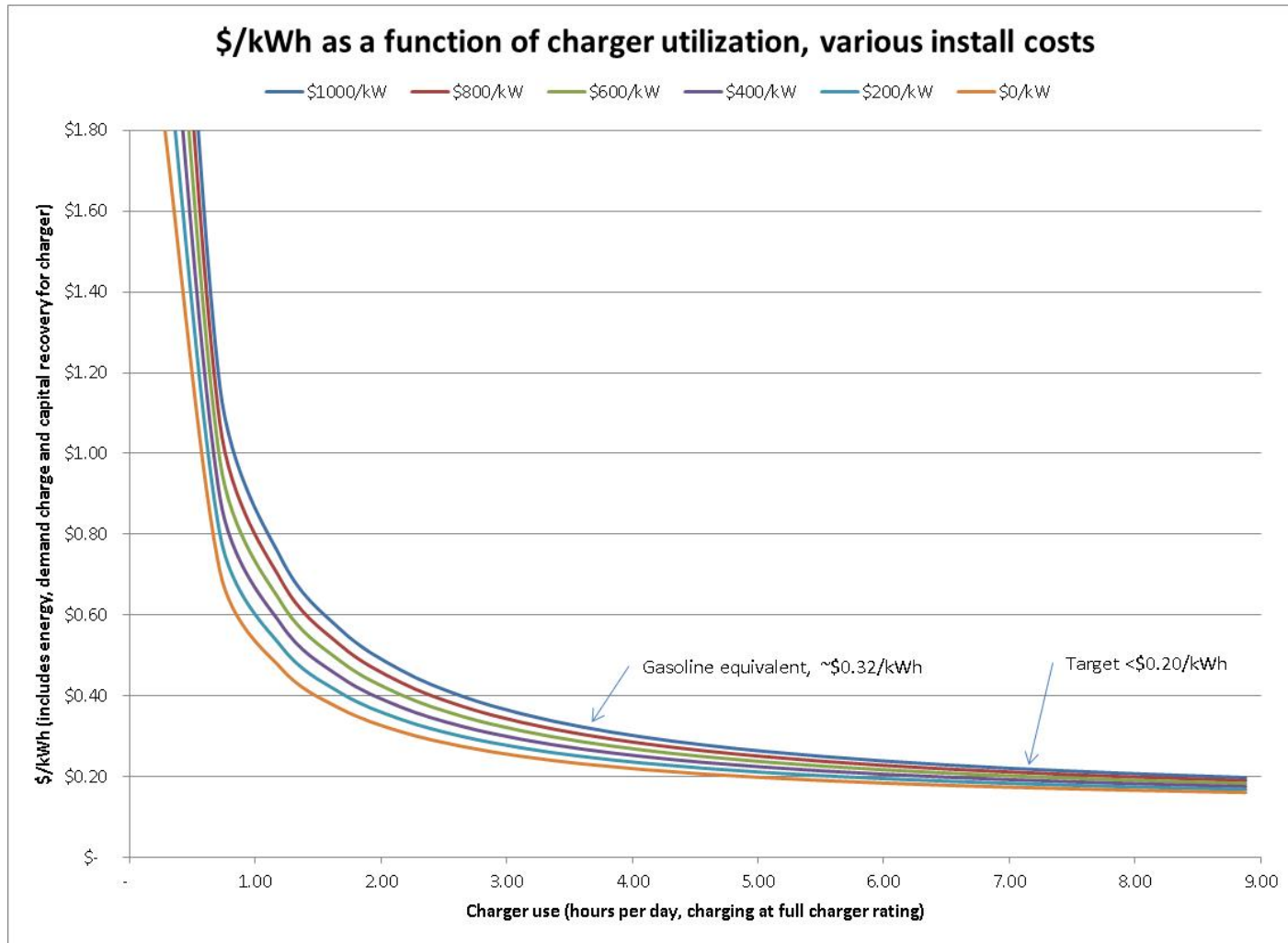
# BATTERY COST IS THE HURDLE TO RANGE

- Electricity **can be** less expensive than gasoline to recover the higher incremental capital cost of the electric vehicle (battery), **~\$1,000/yr savings**
- **200 wh/mi Efficiency:** EVs must get more efficient, current EVs lack optimal efficiency, most >300 wh/mile (~36 mpg).
- **40 kWh Capacity:** Battery technology (power, weight, volume) has improved dramatically but batteries are still costly so manufacturers use least allowable kWh
- Need **~\$4,000 incremental cost:** Current EVs are too expensive with limited range because of **>\$100/kWh battery cost** limiting market size to 2%

# UTILITY PUBLIC FAST CHARGING

- Public Fast Charging, (20 kW=1 mi/min)
  - Consumers dislike gasoline stations, why copy?
  - ~2 hours/day for public fast charging, not much time
- Progressive Utilities, Low Flat Tariffs, Trying to Help
  - Low charger utilization will result in high actual \$/GALe
  - The 98% socializing the 2% is not sustainable

# WHAT CHARGING RATE = ~\$1/GAL ELECTRICITY?



\*Energy @ \$0.11265, Demand Charge @ \$13.07/kW, Various \$/kW Capex

For electricity \$ < gasoline \$, need >6 hour per day utilization



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\*DOT road taxes not included



# UTILITY INFRASTRUCTURE ONE-ONE (WIN-WIN)

- Prioritize **inexpensive home and work charging while parked**
  - Inexpensive = 12 gauge conductor, 20 amp circuits
  - Greater EV range will vastly reduce need for Public infrastructure
- **One at Home (<4 kW=12 mi/hr, parked for ~14 hrs/day)**
  - Inexpensive **Charging at Night**, even 40 kWh pack
  - Vehicle preconditioning for consumers w/o garage
- **One at Work (<2 kW=6 mi/hr, parked for ~8 hrs/day)**
  - Parking Garage Level 1 Charging (~\$1.50/day max, Free?) **Low and Slow during the day**

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