Electric Fleets: Moving Beyond Pilots for Real Benefits

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About Black & Veatch

Transformative Technologies
Mission Critical Facilities
Renewable / Clean Energy

11,000+ Professionals
110+ offices
Six continents
7,000 active projects worldwide

$3.4 Billion in revenue in 2017

Safety Performance
0.37 Recordable Incident Rate
0.06 Lost Time Incident Rate
Transformative Technologies

Over 1,000 250KW+ High-Power Sites
Scalable Distributed
Clean Resilient Energy Infrastructure

Electric Vehicle Infrastructure
Hydrogen Infrastructure
Energy Storage Networks
Hub and Depots for Fleets & Transit
Emerging Distributed Technology
Autonomous, Connected Vehicle Infrastructure

We build complex networks faster
Step Change in Charging Infrastructure Requirements

- Larger Batteries
- Higher Power Charging
- Higher Utilization Vehicles
- Higher Voltages, Conductive, Inductive
- New Applications and Venues
  - Larger Capital Requirements
  - Power Delivery Requirements
  - Schedule Risk Management
  - Least Regret Investments

> Energy Procurement, Power Delivery, Infrastructure Deployment Strategy

High-Power Corridors
Urban Charging Hubs & Depots
Freight Movement Facilities
Autonomous Aviation
The Financial Benefits

Electric Fleets Roll Towards Cost-Parity

Several eFleet use cases in the United States have already reached cost-parity with diesel. Falling battery prices, substantially lower maintenance and fuel costs, and increased battery performance help lower the total cost of ownership across applications.

- **Light-duty truck** (Classes 1-2, 6-10,000 lbs)
  - Urban last-mile distribution with central hub and many stops
  - Regional grocery delivery for shops and restaurants

- **Medium-duty truck** (Classes 3-6, 10-26,000 lbs)
  - Grocery store chain with logistics center for several branches

- **Heavy-duty truck** (Classes 7-8, >26,000 lbs)
  - International or continental freight logistics

- **City bus** (Classes 3-6, 10-26,000 lbs)
  - Typical city bus or school bus with dozens of stops

**MarCom:** Add vehicle types to each category:

- **Light Duty-Truck:** Utility van
- **Medium-Duty Truck:** Mini-bus, school bus, transit bus, box truck, delivery truck
- **Heavy-Duty Truck:** garbage truck, small semi-truck, drayage truck, long-haul transportation truck

![Graph showing cost-parity over time for different vehicle types](image)

Stakeholder Alignment & Program Goals

- Existing Project History
- Concurrent, Future Projects
- Building Load Integration
- Cost of Energy, Renewable Content
- Resilience
- Future Proofing Infrastructure
- Project Timeline
- Project Budget
- Total Cost of Operation

> Fleets, Agencies, Utilities, Cities, Vehicle OEMs, Clean Energy, Community Interests, Project Execution Team, Funding & ROI
Example Schedules – Power delivery scenarios are specific to a location, feeder access, existing, in queue projects and utility operating / power provisioning standards.
Pilot While Planning for Scale

“Businesses (& Fleets) that do not electrify will be at a competitive disadvantage...”
—Black & Veatch – EVS30 “Priming the U.S. Grid for High-Power Charging”

> Modular, least regret infrastructure investment program (Fleets & Facilities)
BUILDING A WORLD OF DIFFERENCE

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United Kingdom
United States
Uruguay
Uzbekistan
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Understanding Power Delivery

**Customer Property**
- **Service Transformer**: Convert primary medium voltage to secondary, can range from ~75 kVA to 2 MVA
- **Service Entrance Conductor**: Cable to meter, Customer installs conduit
- **Supply Conductor**: A switch on the main circuit with conductor to site via overhead or underground
- **Main Switchboard**: Customer-owned, contains utility meter and main circuit breaker

**Distribution Circuit**
- **Radial or Network Distribution Circuit**: Distribute electricity to load. Various voltages. 12 kV circuits support ~10 - 12 MW of load
- **Distribution Conductor**: overhead via poles and insulators or underground in conduit or directly buried
- **Line Equipment**: Fuses, sectionalizers, regulators, capacitor banks used to control the operation and power quality

**Distribution Substation**
- **Distribution Substations**: Convert high voltage to medium voltage, connects to numerous distribution feeders
- **Medium Voltage Bus**: Many circuits/feeder connect to a common node via breakers with feeder level metering and protection. Typically 4 kV, 12 kV, 36 kV
- **High Voltage Bus**: Connection to subtransmission system 40 kV or greater including substation metering and high voltage line protection
- **Substation Transformer Bank**: Converts high voltage to medium voltage, can range 20 to 40 MVA

For illustrative purposes only, Icons for the distribution towers and transformers made by Freepik from www.flaticon.com.