

Proterra's Mission

Advancing electric vehicle technology to deliver the world's best-performing heavy-duty vehicles

- Offices and manufacturing in CA and SC
- 575+ employees, with strong transportation expertise
- >100 customers; >900 vehicles sold
- >10,000,000 service miles
- >50,000,000 pounds of CO2 emissions avoided



Strong Transportation Expertise



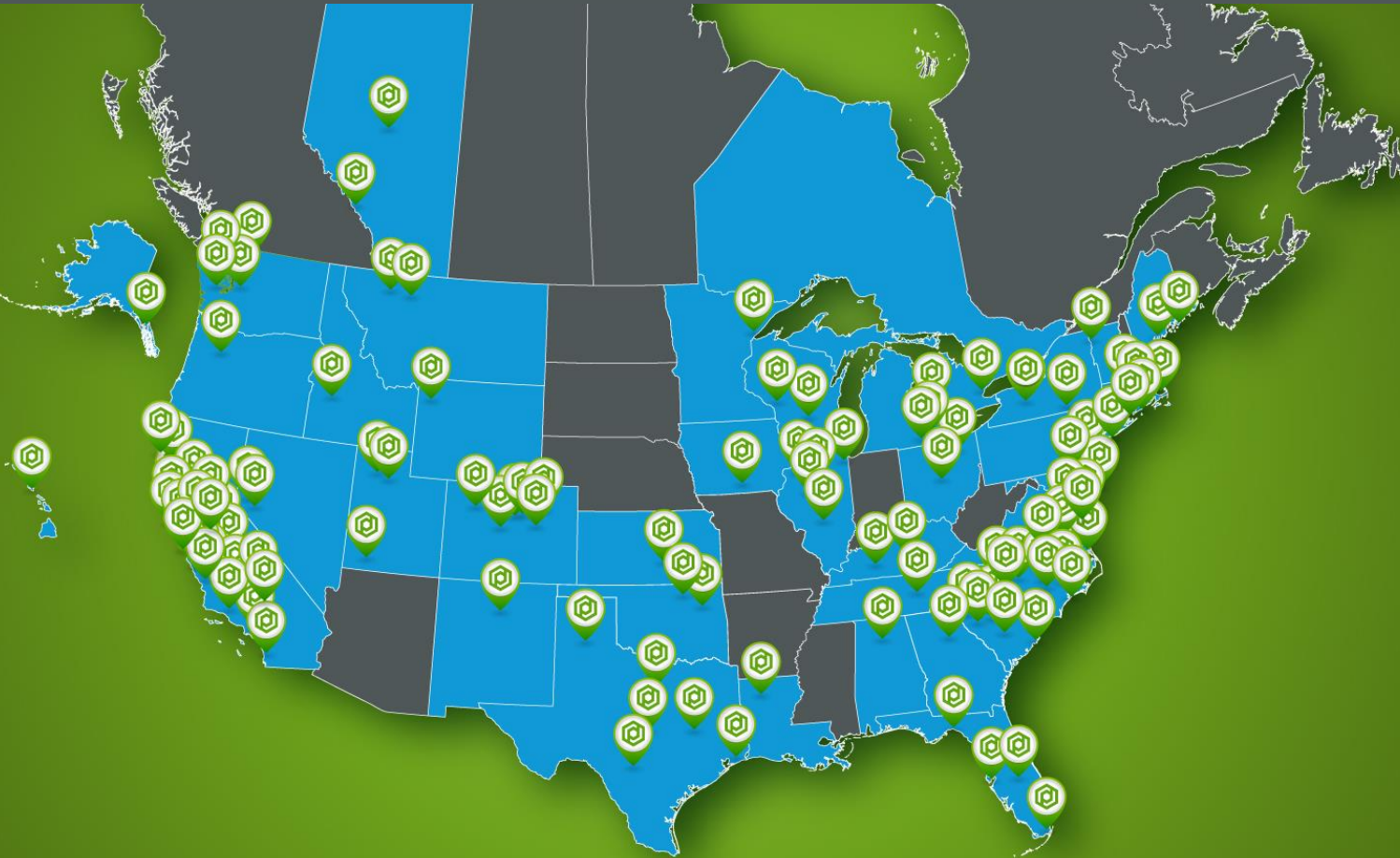
World-Class Financial Partners



OUR CUSTOMERS



PROTERRA



>900 buses sold to >120 customers across 43 states/provinces

AL

ALABAMA A&M UNIVERSITY
NORMAL

AK

CAPITAL TRANSIT JUNEAU

CA

CITY OF ARVIN
CITY OF DUARTE
FAX FRESNO
FCRTA FRESNO
FAST FAIRFIELD
FOOTHILL TRANSIT WEST COVINA
HUMBOLDT TRANSIT AUTHORITY EUREKA
LADOT TRANSIT LOS ANGELES
MAX MODESTO
RABA REDDING
RTD STOCKTON
SACRAMENTO INTERNATIONAL AIRPORT
SACRAMENTO REGIONAL TRANSIT
SAMTRANS SAN CARLOS
SAN FRANCISCO INTERNATIONAL AIRPORT
SAN JOSE INTERNATIONAL AIRPORT
SCMTD SANTA CRUZ
SFMTA SAN FRANCISCO
TRI DELTA TRANSIT ANTIOCH
VTA SAN JOSE
VISALIA TRANSIT VISALIA
YOLO COUNTY REGIONAL TRANSIT WOODLAND
YOSEMITE NATIONAL PARK

CO

TOWN OF BRECKENRIDGE
SUMMIT COUNTY FRISCO
ECO TRANSIT GYPSUM

CT

GBT BRIDGEPORT

DC

DC CIRCULATOR WASHINGTON

DE

DART FIRST STATE DOVER

FL

STAR METRO TALLAHASSEE
LYNX ORLANDO
MIAMI-DADE COUNTY MIAMI

GA

UNIV. OF GEORGIA ATHENS

HI

JTB HAWAII HONOLULU

IA

DART DES MOINES

ID

VALLEY REGIONAL TRANSIT MERIDIAN

IL

QUAD CITIES METROLINK MOLINE
JLL CHICAGO
CHICAGO TRANSIT AUTHORITY
CITYLINK PEORIA

KS

WICHITA TRANSIT WICHITA

KY

TARC LOUISVILLE
LEXTRAN LEXINGTON

LA

SPORTRAN SHREVEPORT

MA

WRTA WORCESTER
PVTA SPRINGFIELD

MD

BGE BALTIMORE
MCDOT ROCKVILLE
THE BUS PRINCE GEORGES COUNTY TRANSIT

ME

SH-ZOOM TRANSIT BIDDEFORD
GREATER PORTLAND METRO PORTLAND

MI

BLUE WATER AREA TRANSIT
PORT HURON
DDOT DETROIT
SMART DETROIT

MN

DTA DULUTH

MT

DASH UNIV. OF MONTANA MISSOULA
MOUNTAIN LINE MISSOULA

NC

RALEIGH-DURHAM INTERNATIONAL AIRPORT
ART ASHEVILLE
GTA GREENSBORO
DUKE UNIVERSITY DURHAM
GO TRIANGLE DURHAM
CHARLOTTE DOUGLAS INTERNATIONAL AIRPORT

NM

ATOMIC CITY LOS ALAMOS

NV

RTC RENO
TAHOE TRANSPORTATION DISTRICT
STATELINE

NY

MTA NEW YORK CITY
TOMPKINS CONSOLIDATED
AREA TRANSIT ITHACA
PORT AUTHORITY OF NY & NJ

OH

LAKETRAN PAINESVILLE

COLUMBUS AIRPORT Only announced customer names shown. Updated May 2019

OK

THE CHEROKEE NATION

OR

SMART PORTLAND

PA

SEPTA PHILADELPHIA

RI

RIPTA PROVIDENCE

SC

CATBUS CLEMSON
CITY OF SENECA
GREENLINK GREENVILLE
CITY OF ROCK HILL
CARTA CHARLESTON

TN

MTA NASHVILLE

TX

VIA SAN ANTONIO
DART DALLAS
CITIBUS LUBBOCK
PAT PORT ARTHUR
CAPMETRO AUSTIN
BRAZOS TRANSIT DISTRICT BRYAN

UT

PARK CITY TRANSIT PARK CITY
UTA SALT LAKE CITY
ZION NATIONAL PARK

VA

HAMPTON ROADS TRANSIT NORFOLK

VT

GREEN MOUNTAIN TRANSIT BURLINGTON

WA

KING COUNTY METRO SEATTLE
EVERETT TRANSIT EVERETT
KITSAP TRANSIT BREMERTON
PIERCE TRANSIT LAKEWOOD

WI

METRO TRANSIT MADISON
LA CROSSE MTU LA CROSSE

WY

START JACKSON

CANADA

AB

EDMONTON TRANSIT SERVICE
ROAM BANFF

ON

TORONTO TRANSIT COMMISSION

- Battery-electric transit vehicles are moving toward **widespread industry adoption**
- Major cities making commitments to zero-emission transportation
 - Emissions reduction targets
 - Improving air quality
 - Cost savings
- **Purchase barriers eliminated** due to:
 - Improved range
 - Sharp decline in battery costs
 - Service-proven performance
 - Increased funding opportunities



California mandates 100% electric by 2040



Source: National Transit Database; agency websites; 2017 American Public Transportation Association Fact Book

Leading provider of commercial electric vehicles and technology for fleets

Proterra Catalyst®



Proterra Powered™ Vehicles



Thomas school bus

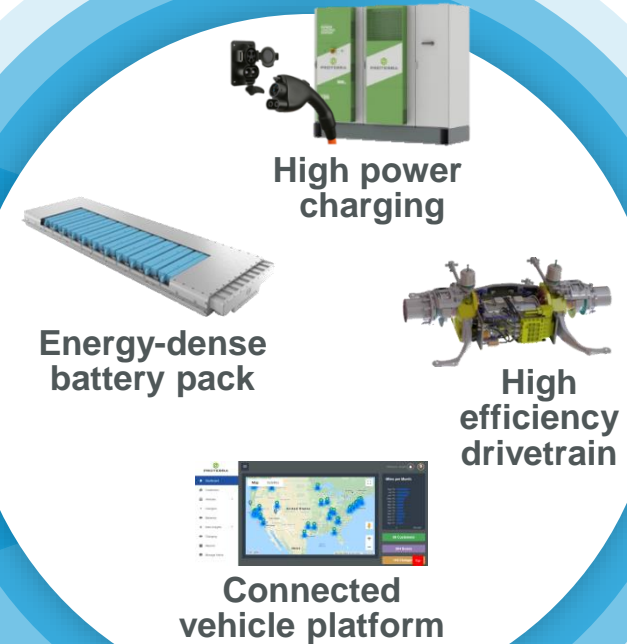


Van Hool coach bus



Freightliner Custom Chassis
Delivery Truck

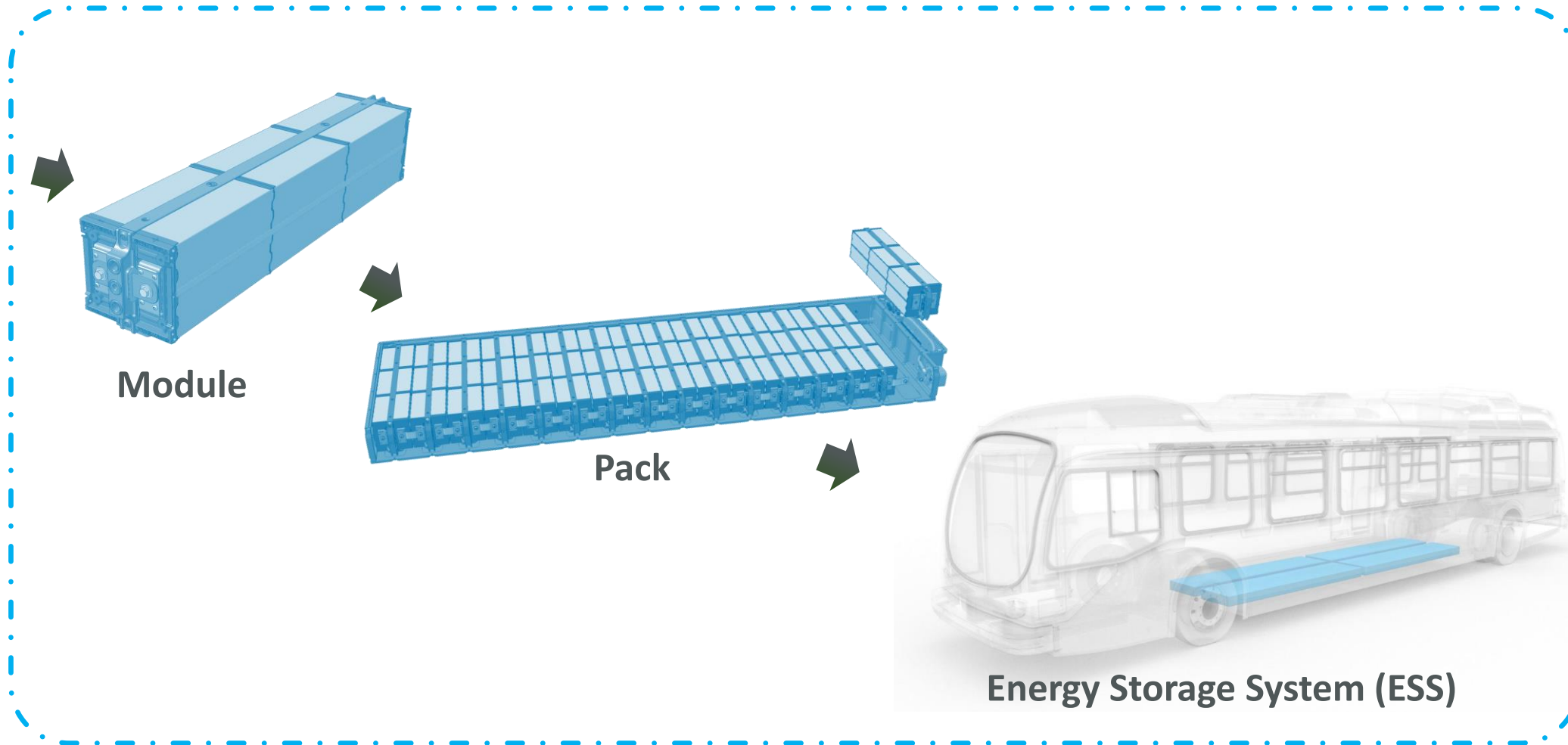
Commercial electric fleet technology





Small Format
Li-Ion Cells
(Cylindrical)

Engineered, Validated, and Manufactured by Proterra in California



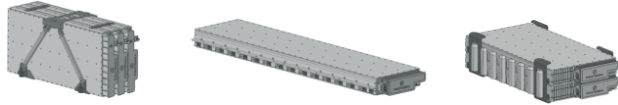
PROTERRA POWERED AS AN ELECTRIFICATION PARTNER

TYPICAL APPROACHES FOR BEV PROJECTS

Tier 1 / 2 Battery Supplier



- Protterra supplies customized **Energy Module** to OEM



- OEM owns integration of overall EV Propulsion system

- Additional related components available:
 - Protterra Battery Junction Box
 - Protterra Telematics Gateway
 - Protterra 15118 / V2G Charge Controller
 - BTMS (3rd party)



Sub-system Integration Partner



- Protterra supplies **Energy Module** to OEM
- Protterra supplies **HV Systems & Controls** to OEM

- Vehicle controller (VCU) w/ proprietary Protterra SW
- Core 3rd Party HV Components (VFDs, DCDC, etc.)



- Protterra can integrate and supply other ancillary hardware such as water pumps, power steering, air compressor, heater, radiator, other customer bracket and hardware
- Protterra provides relevant Functional Safety support in supplier role

End-to-end Powertrain Integration Partner



- Protterra supplies **Energy Module** to OEM
- Protterra supplies **HV Systems & Controls** to OEM
- Protterra supplies **Traction Module** to OEM



Class 4 - 6 E-Axle

Single Motor Direct Drive
*under consideration

Class 6 - 8 Transverse Axle

Single Motor, 4-speed
240kW/200kW

Class 8 E-Axle

Dual Motor, 2-speed
400kW/370kW

- Protterra provides relevant Functional Safety support in supplier role



Partner vehicle

PROTERRA CHARGING SOLUTIONS



60KW
For fleets with longer available charge times.

Catalyst charge time:
~6 hours



125KW
For fleets with high uptime requirements

Catalyst charge time:
~3 hours



INTELLIGENT

Automated and rules-based vehicle charging

UNIVERSAL

Standards-based, OCPP 1.6 open communications protocol-compatible

REMOTE

Can be located up to 500 feet from dispenser

SCALABLE

Can be installed side-to-side and back-to-back for high-density charger banks



Open source communications protocol



Bi-directional V2G capability



Smart grid ready



Telematics-enabled

PROTERRA CHARGING INFRASTRUCTURE OVER 75 PROJECTS COMPLETED ACROSS 23 STATES



San Jose Airport, CA



Modesto, CA



Wilsonville, OR



Reno, NV



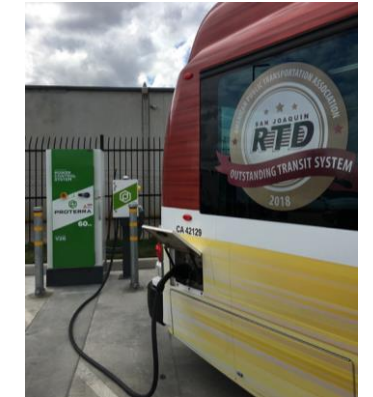
City of Industry, CA



Everett, WA



Stockton, CA

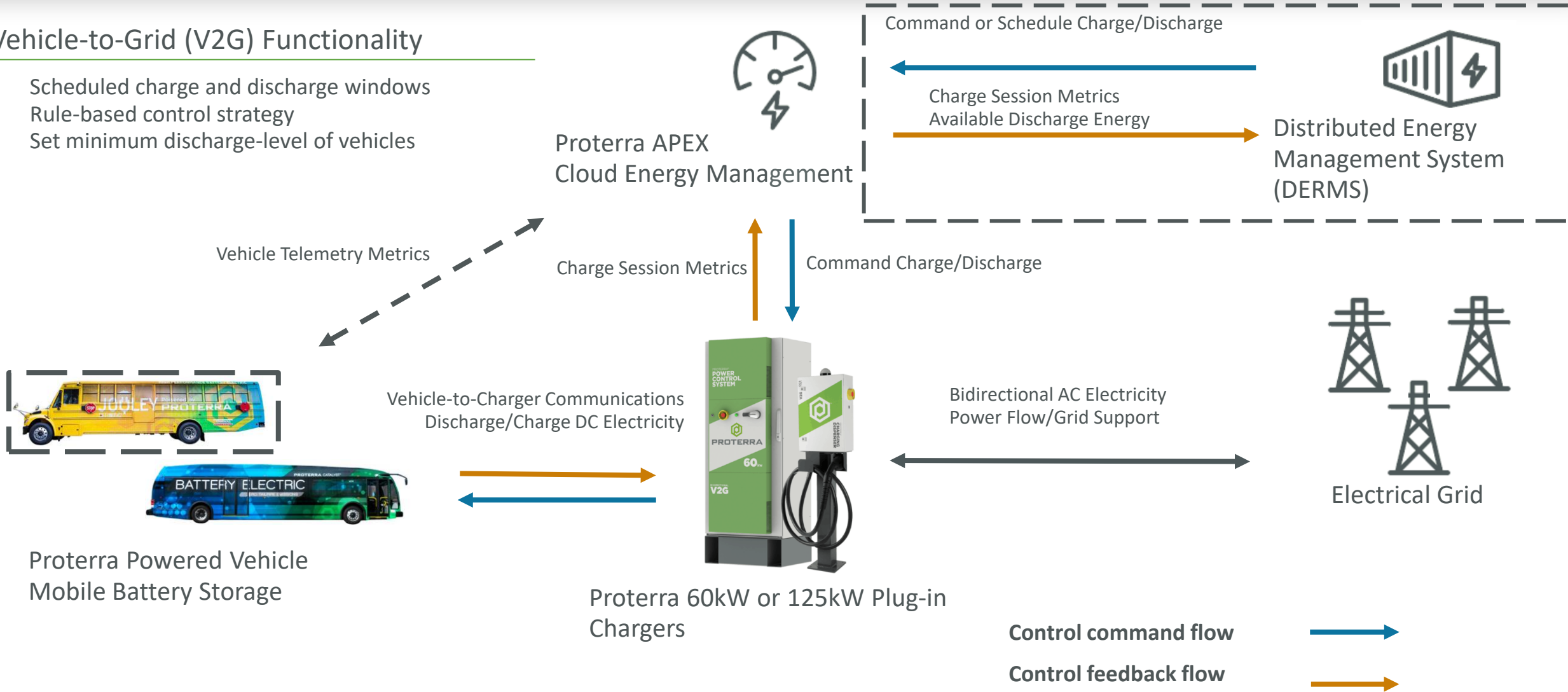


- Low daily utilization
- Often unused in summer months
- Predictable routes and energy consumption
- Centrally operated and planned fleets
- Already need coordination with utilities for charging

SYSTEM OVERVIEW AND INITIAL FOCUS

Vehicle-to-Grid (V2G) Functionality

- Scheduled charge and discharge windows
- Rule-based control strategy
- Set minimum discharge-level of vehicles



NATIONAL GRID PEAK SHIFTING PROGRAM USING AN ENERGY STORAGE SYSTEM ON A BUS

Connected Solutions Program:
Receive incentives for decreasing energy use or contributing power back to the grid at the right times.

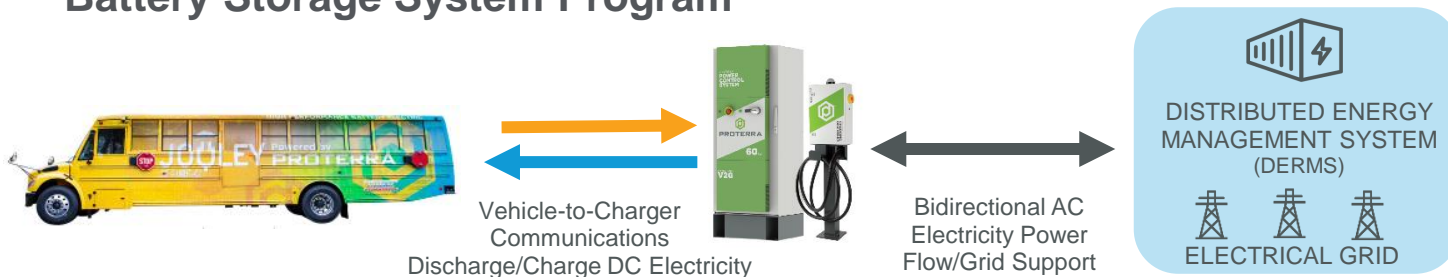
Demand Response and Peak Shaving helps reduce peak-day generator emissions, delay installation of costly utility equipment, and can help reduce the purchase of expensive peak-day energy.

Contribute power back to the grid for a few hours during about **50** periods of high energy demand each **summer**.

Connected Solutions Summer Program 2021 Beverly, MA electric school bus

Incentives	\$200 per kW per summer
Frequency	30-60 events per season
Season	June-September (primarily in July/August)
Duration	2-3 hours per event
Event Notifications	Notifications are sent 1 day prior to event
Revenue	\$12,000 for 60kW of capacity (assumes 100% participation)

Battery Storage System Program



**HIGHLAND ELECTRIC
TRANSPORTATION**



nationalgrid

VEHICLE TO GRID THE NEXUS OF TRANSPORTATION AND ENERGY



Vehicle-to-Charger Communications
Discharge/Charge DC Electricity



Bidirectional AC
Electricity Power
Flow/Grid Support



DISTRIBUTED ENERGY
MANAGEMENT SYSTEM
(DERMS)



ELECTRICAL GRID

UTILITY OWNED

VIRGINIA

50 buses 35 chargers 16 schools

funded by Dominion Energy + Schools



MICHIGAN

6 buses 2 chargers 2 schools

funded by VW+ Schools + DTE Energy

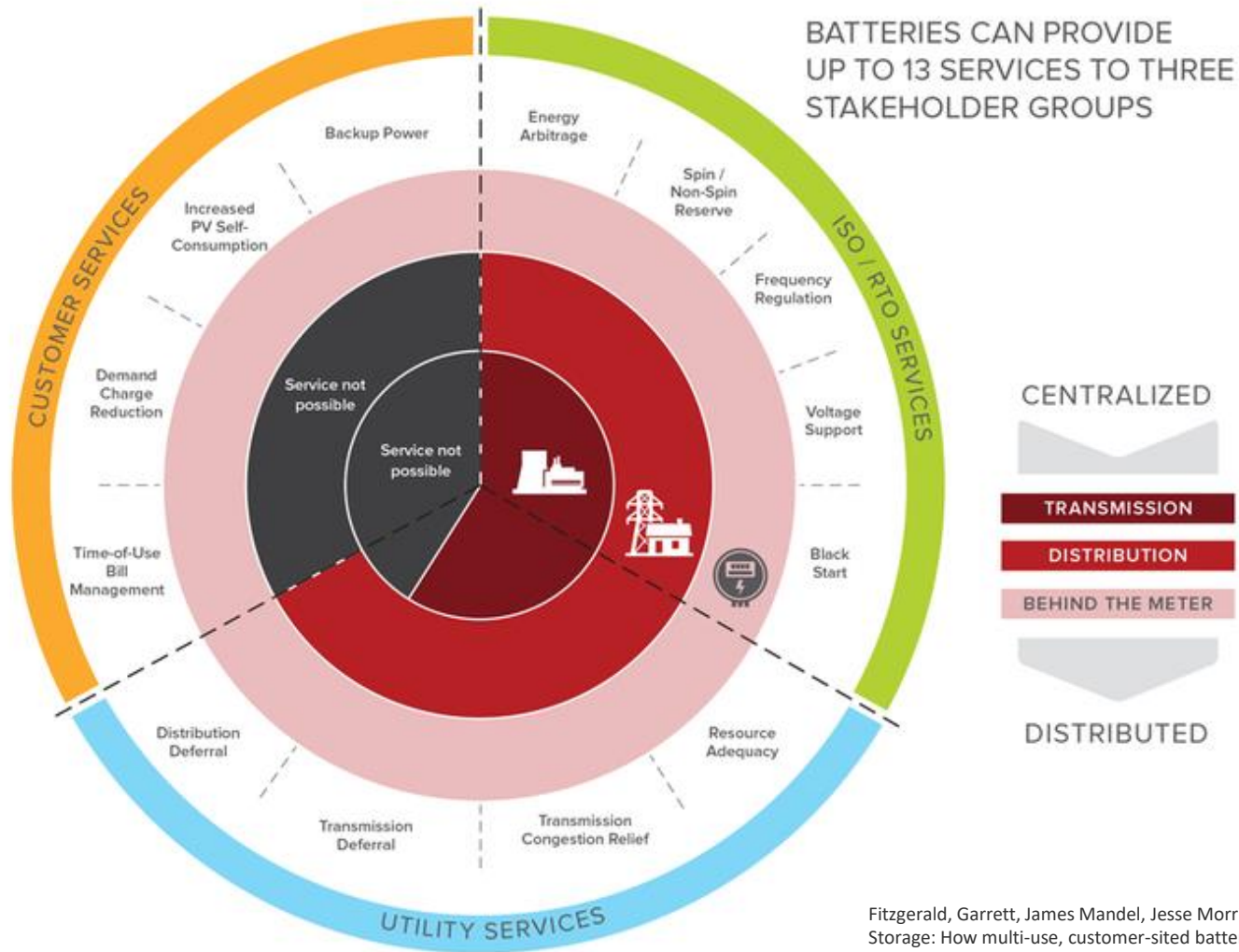


MASSACHUSETTS

2 buses 2 chargers 1 school

funded by HET + VW+ School + National Grid





- Additional uses cases
- Greater utility integration
- More sophisticated integration to fleet operations

Fitzgerald, Garrett, James Mandel, Jesse Morris, and Hervé Touati. The Economics of Battery Energy Storage: How multi-use, customer-sited batteries deliver the most services and value to customers and the grid. Rocky Mountain Institute, September 2015. <<http://www.rmi.org/electricity_battery_value>>

- Technical solutions to allow prioritization of use cases/value stacking (i.e. running vehicle operations, delivering grid services)
- Close collaboration between entities who haven't worked in that way before
- Bidirectional energy charging standard development and lack of standardization
- Monetization/compensation for energy storage services