

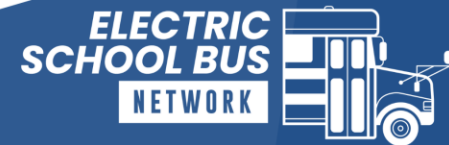
ELECTRIC
SCHOOL BUS
NETWORK



Working with a Private Contractor to Electrify Your Fleet

Northeast / Mid-Atlantic Electric School Bus
Working Group

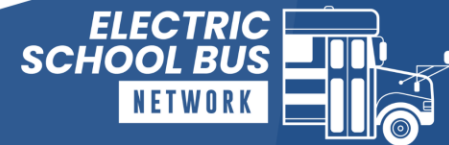
May 24, 2023 | 1:00 PM ET



MAY 24, 2023

WORKING GROUP AGENDA

- Intro to Electric School Bus Network
- Guest Speaker Introduction: Zūm
 - Pallav Prakash
- Guest School District Representative:
 - Kimberly Raney from Oakland Unified School District
- Questions
- Summary + Closing



MEET THE TEAM



Rachel Chard
National Program
Manager



Katelyn Tomaszewski
Project Manager



Juan Espinoza
Project Manager



Liza Walsh
Associate Project Manager



Ian Fried
Lead Project Manager





ESB NETWORK

The Electric School Bus Network accelerates nationwide school bus fleet electrification through peer-to-peer networking and dialogue-driven working group meetings for school districts, advocacy organizations, government organizations, and industry representatives. The ESB Network provides access to educational tools, resources, and subject matter experts to help support the electric school bus fleet transition.

In Partnership With:



Questions for speaker?

Please raise your hand or type your questions for our panelists in the chat!



Zum Net Zero Electrifying OUSD



Zum's partnership with OUSD to electrify school bus transportation system

Dr. Pallav Prakash
Program Manager
May 2023
Zūm Services Inc.



Why OUSD and Zum Partnered

- OUSD in 2019 RFP was looking for an innovative solution that challenges status quo
 - 5-10 year commitment, wanted a partner that was innovative and future proof
 - Zum mission to “Modernize Student Transportation” aligned
 - We had projected 100% EV conversion by 2025, right now running 1 year ahead of schedule
- District provides school bus transportation to Special Ed students - desire to do the best for these kids
- Air Resources Board (CARB) designates Oakland USD in ‘disadvantaged community’
 - Pollution burden 87th percentile
 - Diesel exposure 92nd percentile
 - Asthma rate 93rd percentile

What made electrification appealing

- School bus - best commercial vehicle use case to electrify given predictable routes, fewer miles and predictable timings
- Can provide children and community with benefits (In OUSD, will remove 2000 tons GHG emissions = 80,000 trees)
 - Reduced exposure to harmful emissions - healthier communities
 - No engine noise and reduced vibration levels - arrive, ready to learn
- Potential of being an even stronger part of Oakland community by building a backup to the grid (V2G / VPP)

Considerations

Zum and OUSD looked through the following prism

- 100% EV conversion
- Economically viable way
- Achieve net zero operations
- Achieve maximum potential of EVs: Transportation + VPP



Grants for EV Bus - Stacking

- Grants for EV school buses & charging infrastructure
- OUSD and Zum worked together for grants and funding
- Zum did the heavy lifting and OUSD supported at every step



Behind the Meter - Utility Work / Interconnect



The most crucial piece for EV deployment is the utility work or interconnect

In our case this was a partnership with PG&E

Learnings:

- If have choice, select yard location based on feeder capacity study
- Utilities have dedicated EV programs & teams - extremely knowledgeable & helpful
- Design approval and permitting takes time - frontload the work
- Switchgear design is crucial and supply is critical
- We used Innovative circuit design to bring down overall load. Helps in faster deployment
- Use phased approach to make it easy for utilities to meet demand

Selecting right charging equipment

Criteria

- Right capacity for your buses - 11, 20, 30, 40, 60, 120, 200 KW?
- AC or DC or fast charger?
- Uni or Bi-directional?
- Protocols and communication?
- Right contracts - uptime, maintenance...



Our learnings

- Contrary to popular belief, school buses really do not need heavy duty fast chargers
- We built Oakland system with 90% 30KWH DC bi-directional chargers and 10% 60 KWH DC bi-directional chargers (V2G capable)
- Significantly reduce load profile on the grid - makes deployment faster
- Led to a significant lowering of infrastructure costs and easier maintenance and replacements later on
- Perform extensive protocol testing between chargers, buses and CMS

Selecting EV school buses

- The most capital-intensive cost item
- Choose based on the use case climatic conditions, terrain and mileage
- Pay special attention to
 - Battery (covered next slide)
 - Motor power and gradeability
 - Braking and Regen
 - Torque and motor cooling system
 - Body noise, ground clearance and vehicle uptime
 - V2G protocols
- Perform rigorous trials to understand what works and what doesn't
- Bus manufacturers are really helpful - engage with their technical teams not just sales team
- Principles of ICE buses do not apply - focus on warranty, how manufacturer/dealer will support (network)



EV batteries

Heart of EV School Bus. Also, **most costly part** of the bus.

Focus on

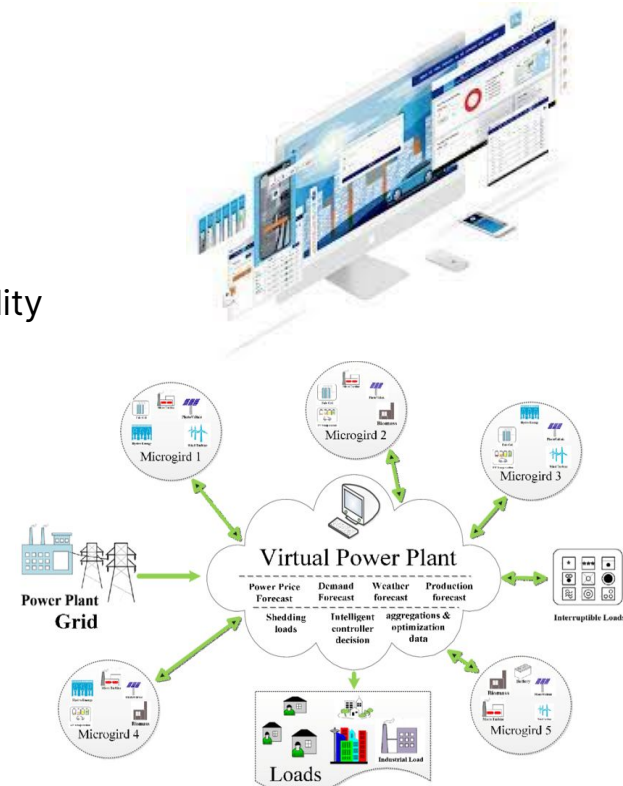
- Cell Type and design (NMC vs LFP)
- Battery thermal management system (cooling)
- Capacity and consumption
- Duty cycle regime and battery life cycle
- Battery performance and degradation
- How does it tie to warranty and replacement issue?
(8 years of battery life vs 12 years of school bus life)



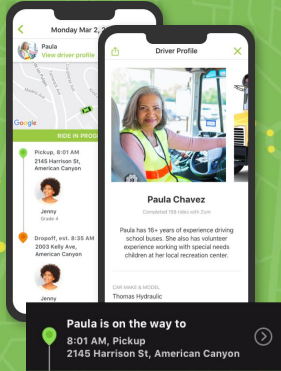
Identifying right software

Controlling and managing software provide solutions

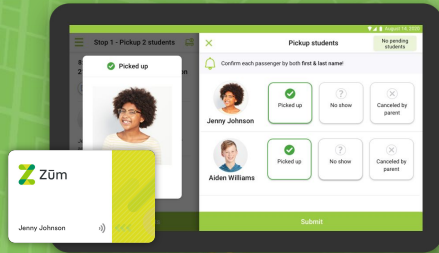
- Charging Station Management System (CSMS)
 - Needs an enterprise level solution
 - Seamless Bi-directional communication management capability
 - Check how many commercial vehicles in one deployment do they support? How long? Do reference checks.
- Virtual power plant (VPP) provider
 - Ability to identify right quantum of power available to sell
 - Ability to learn and forecast (Smart/AI) while working at enterprise level with multiple vehicles
 - Knowledge and experience with utility tariffs and programs



Think of One Integrated Platform



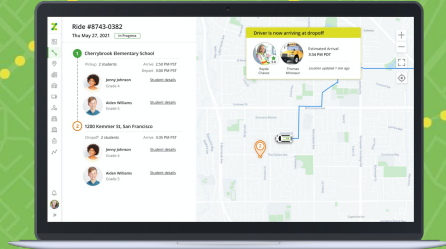
Parent & Student Apps



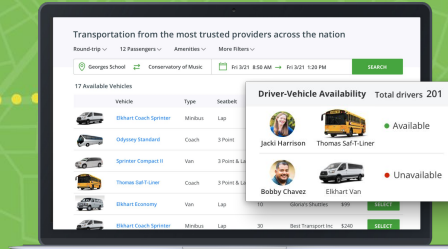
Driver Apps



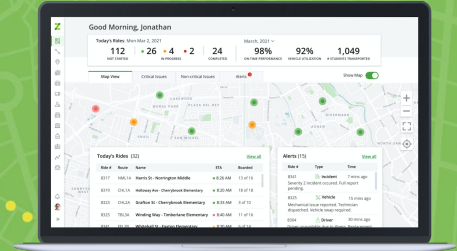
Routing & Analytics



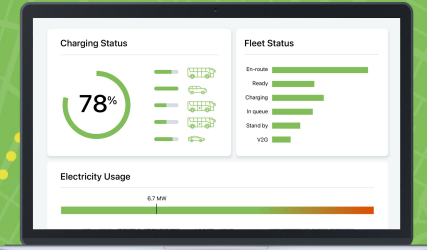
District dashboard



Athletics & Field Trips



Dispatcher Dashboard



Intelligent Charging

Last but not the least...

- **Change management**
 - Buy in from drivers and mechanics
 - Training and development of talent in high technology
 - Stakeholder and change management
- **Integration trials**
 - Interoperability testing
 - Synchronization of charge and discharge function



Always Happy to Help!



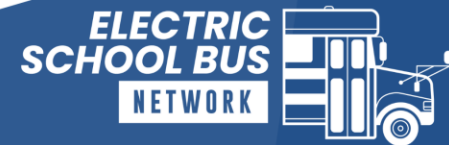
Let us together
create the future
we want our
children to live,
learn and travel in.

Contact:

Dr. Pallav Prakash
Program Manager, Zum Services Inc.
Email: pprakash@ridezum.com
netzero@ridezum.com
Cell: (667) 802-0910

2023 EPA CLEAN SCHOOL BUS GRANT PROGRAM

- EPA anticipates awarding approximately \$400 million in Clean School Bus funding
- Application opened on April 24, 2023 and will close on August 22, 2023 at 11:59 p.m. Eastern Time
- Eligible applicants include state and local governmental entities that provide a bus service, public school districts, eligible contractors, nonprofit school transportation associations, Indian tribes, tribal organizations, or tribally controlled schools
- <https://www.epa.gov/cleanschoolbus/clean-school-bus-program-grants>



Wrap Up

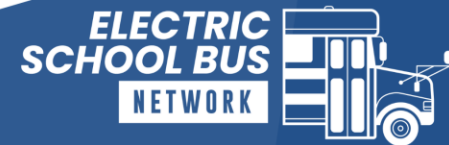
A follow-up email will be sent on Friday 5/26 with the following:

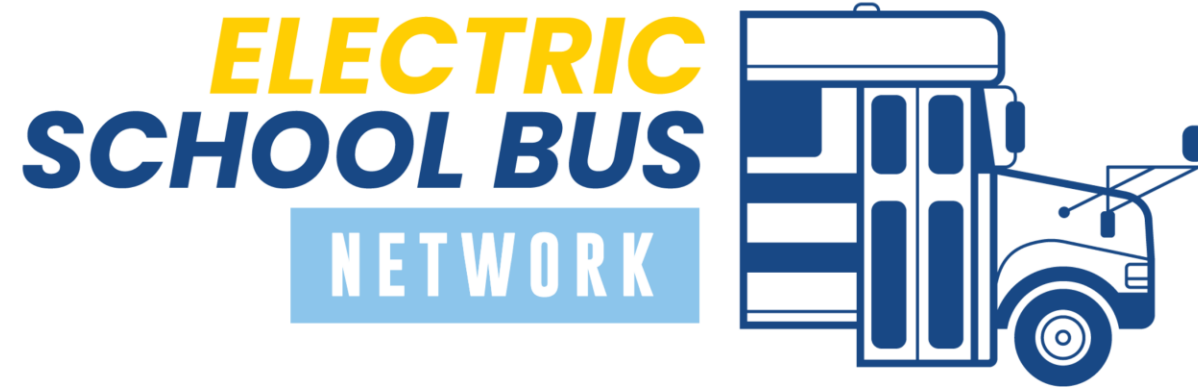
- Recording of the meeting
- Copy of slides

Stay in touch this summer through our monthly ESB Network Newsletter!

Questions?

- Email: SchoolBusTeam@calstart.org





THANK YOU FOR PARTICIPATING

