



# Electric Truck & Bus Grid Integration *Opportunities, Challenges & Recommendations*

**June 21, 2016 | Montréal, Québec, Canada**

Jean-Baptiste Gallo  
Senior Project Engineer, CALSTART, Inc.



# CALSTART's 150+ Member Companies and Organizations (Partial Listing)



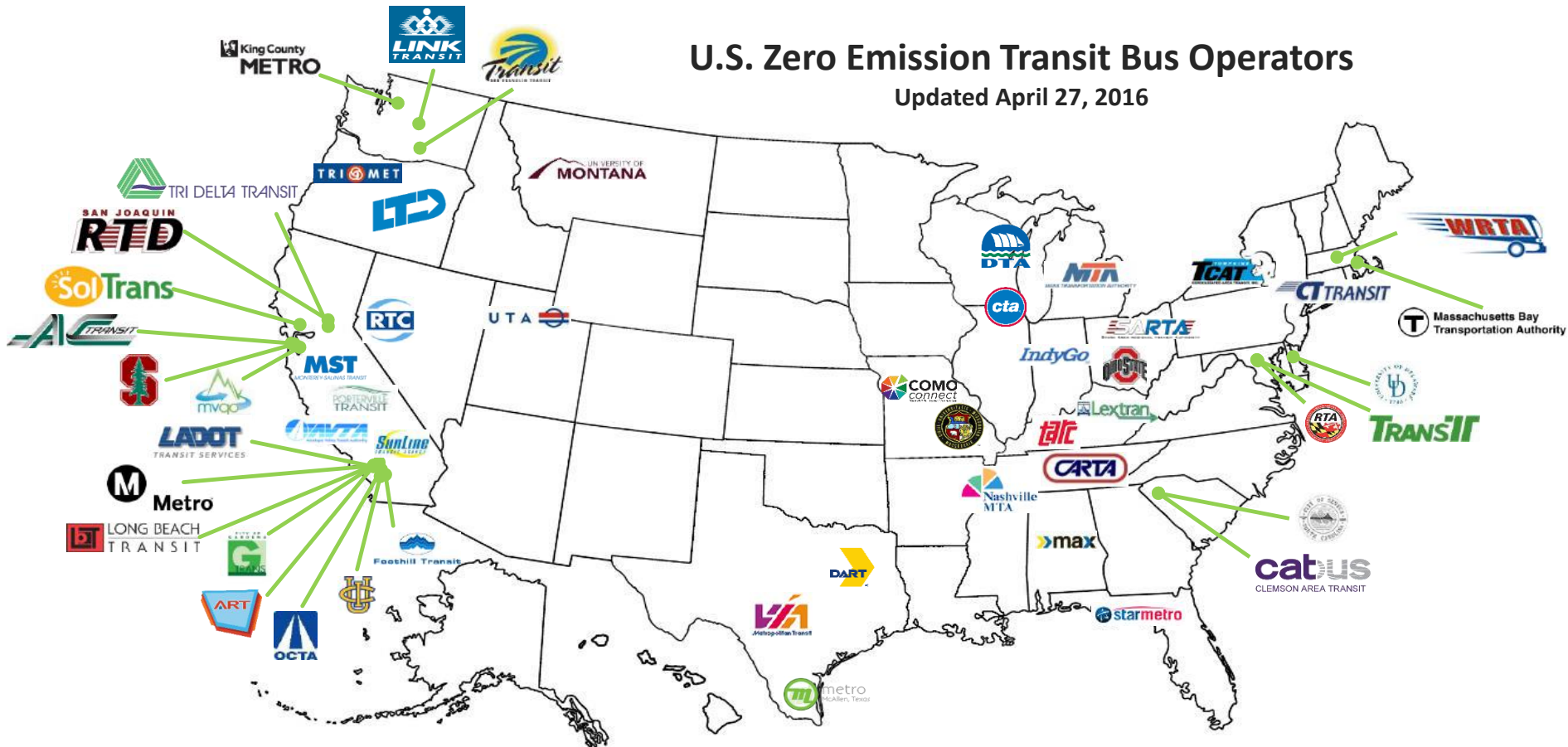
# E-Trucks & Buses are already moving people and goods in California and in North America



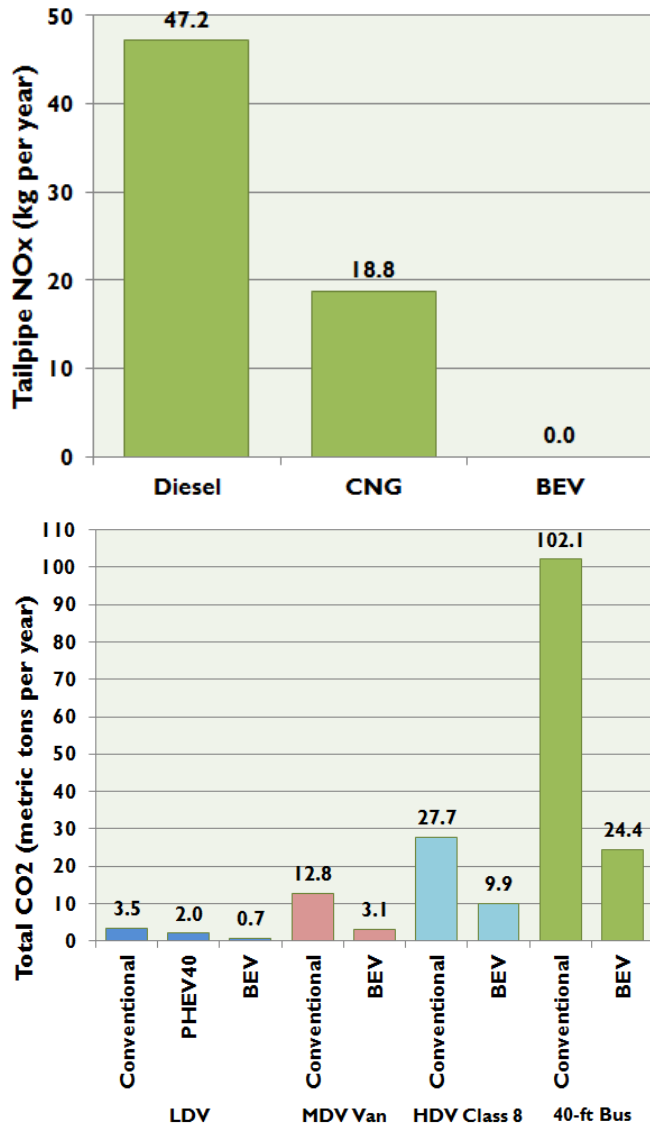
# Transit agencies across the country are deploying a growing number of battery electric buses

## U.S. Zero Emission Transit Bus Operators

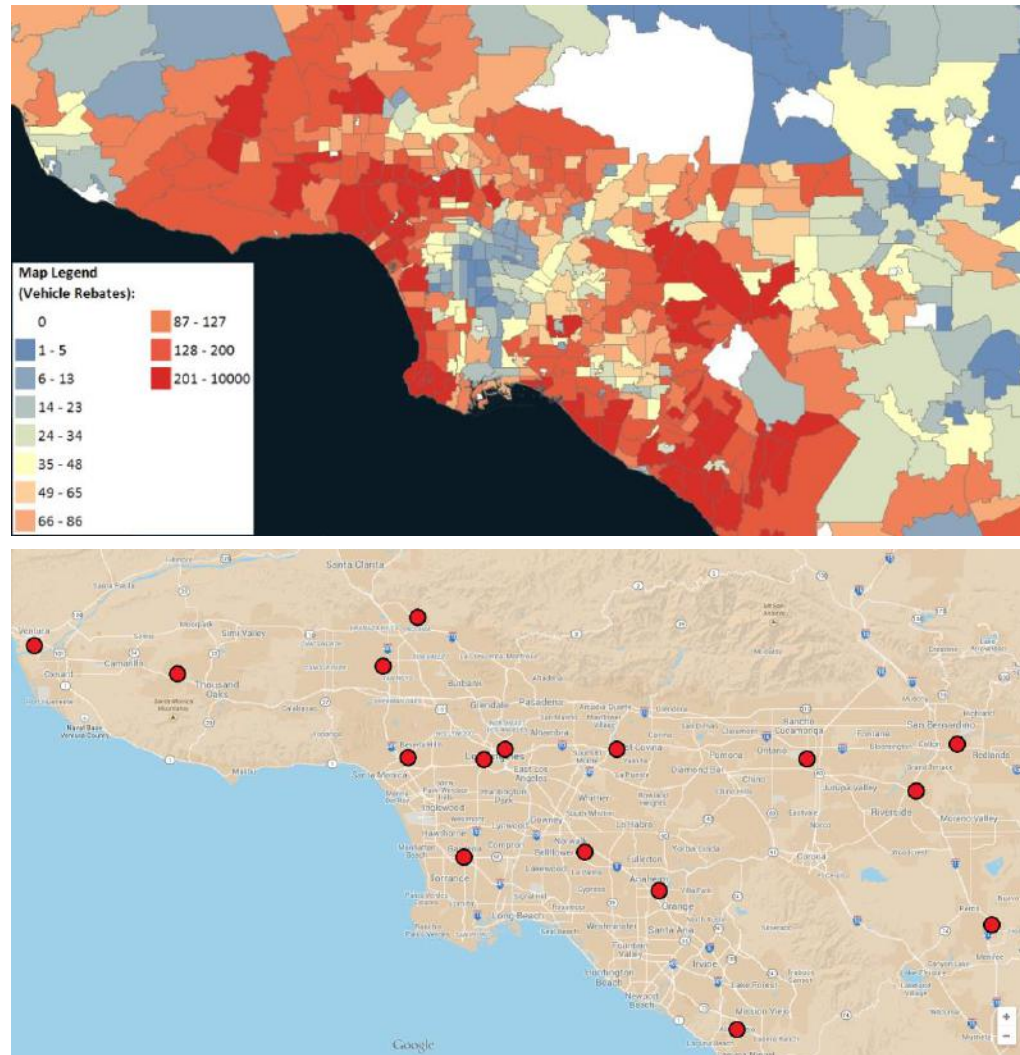
Updated April 27, 2016



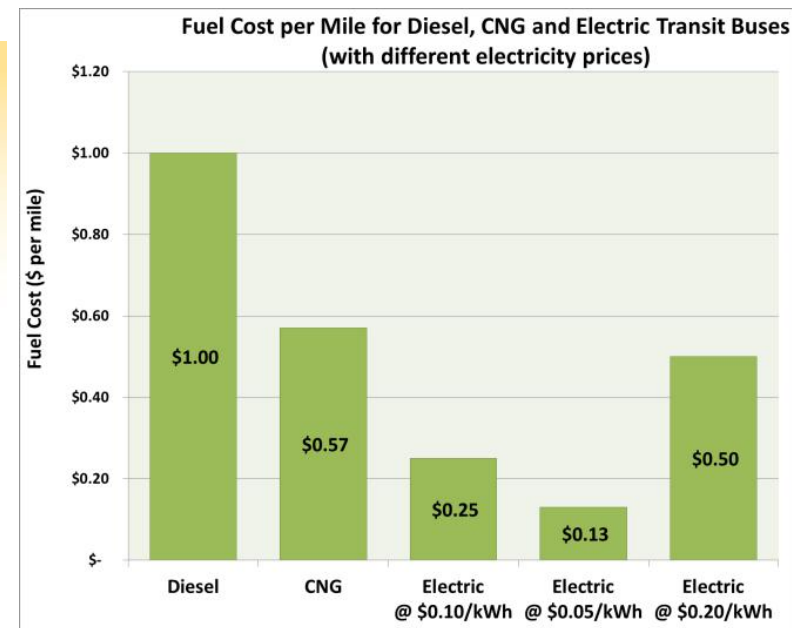
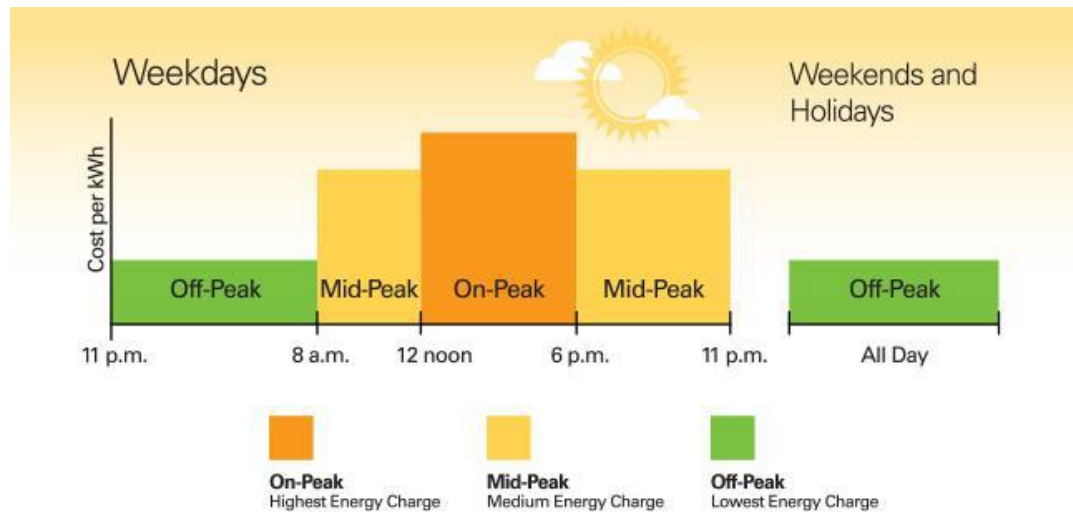
# One E-Truck or E-Bus provides substantial environmental benefits compared to one light-duty EV



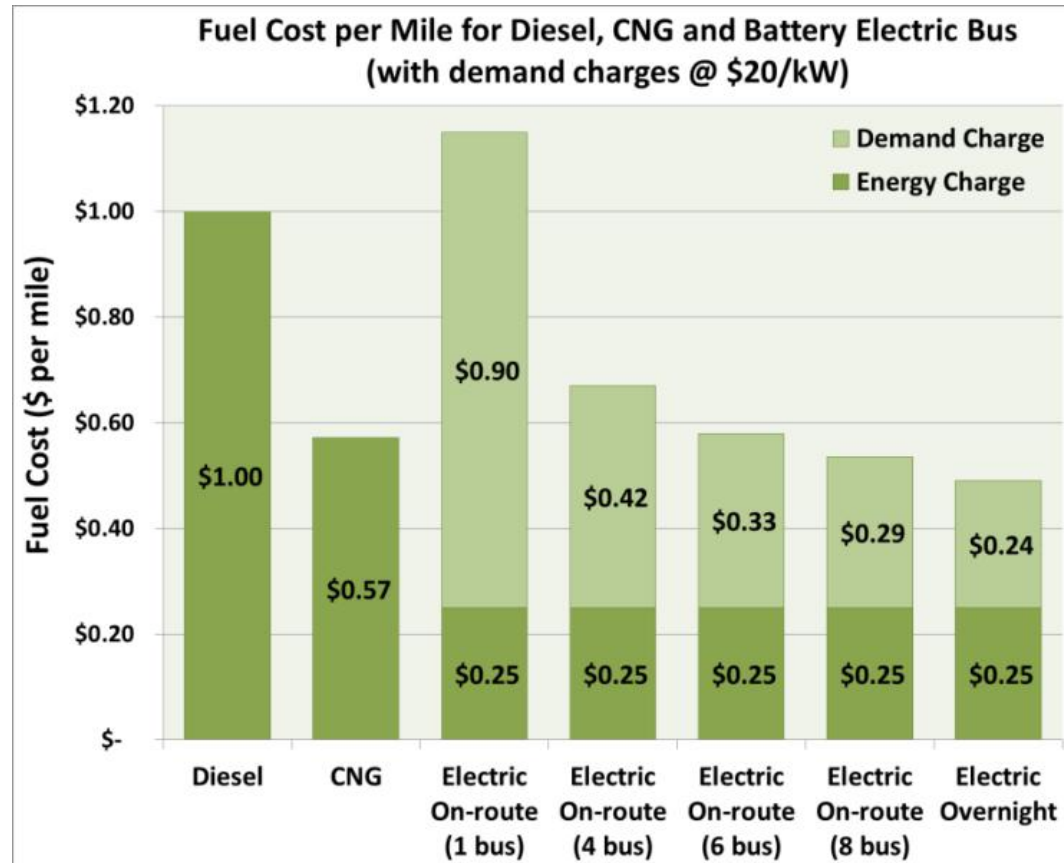
# Utility load planning will be easier for E-Trucks & Buses as they will be concentrated in fewer areas



# E-Truck & Bus charging has to support vehicle operation and unlike light-duty EVs cannot easily be shifted



# Demand charges can be prohibitively costly for early E-Truck & Bus deployments



## Assumptions:

Each bus drives 40,000 miles per year. The diesel bus has a fuel economy of 4 MPG and diesel is priced at \$4.00 per gallon. The CNG bus has a fuel economy of 3.5 MPDGE and CNG is priced at \$2.00 per DGE. The electric transit buses have an efficiency of 2.5 AC kWh/mile and electricity is priced at \$0.10/kWh. One electric bus charging on-route draws 150 kW from the grid, 4 draw 280 kW, 6 draw 330 kW and 8 draw 380 kW. The electric bus charging overnight draws 40 kW from the grid.

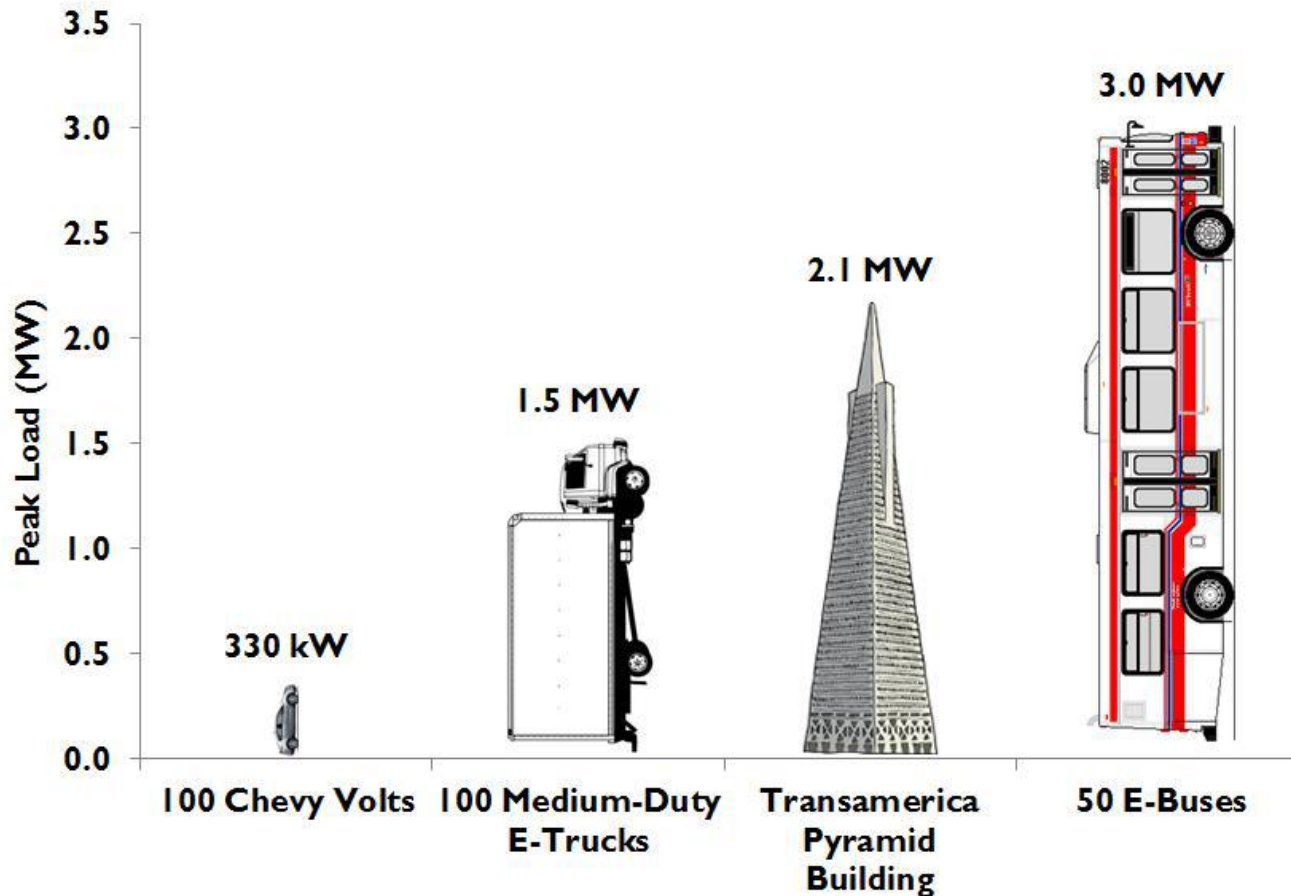
# E-Truck & Bus charging infrastructure is a limiting factor for further vehicle adoption



*Fleet cost estimates  
per one charger installation*

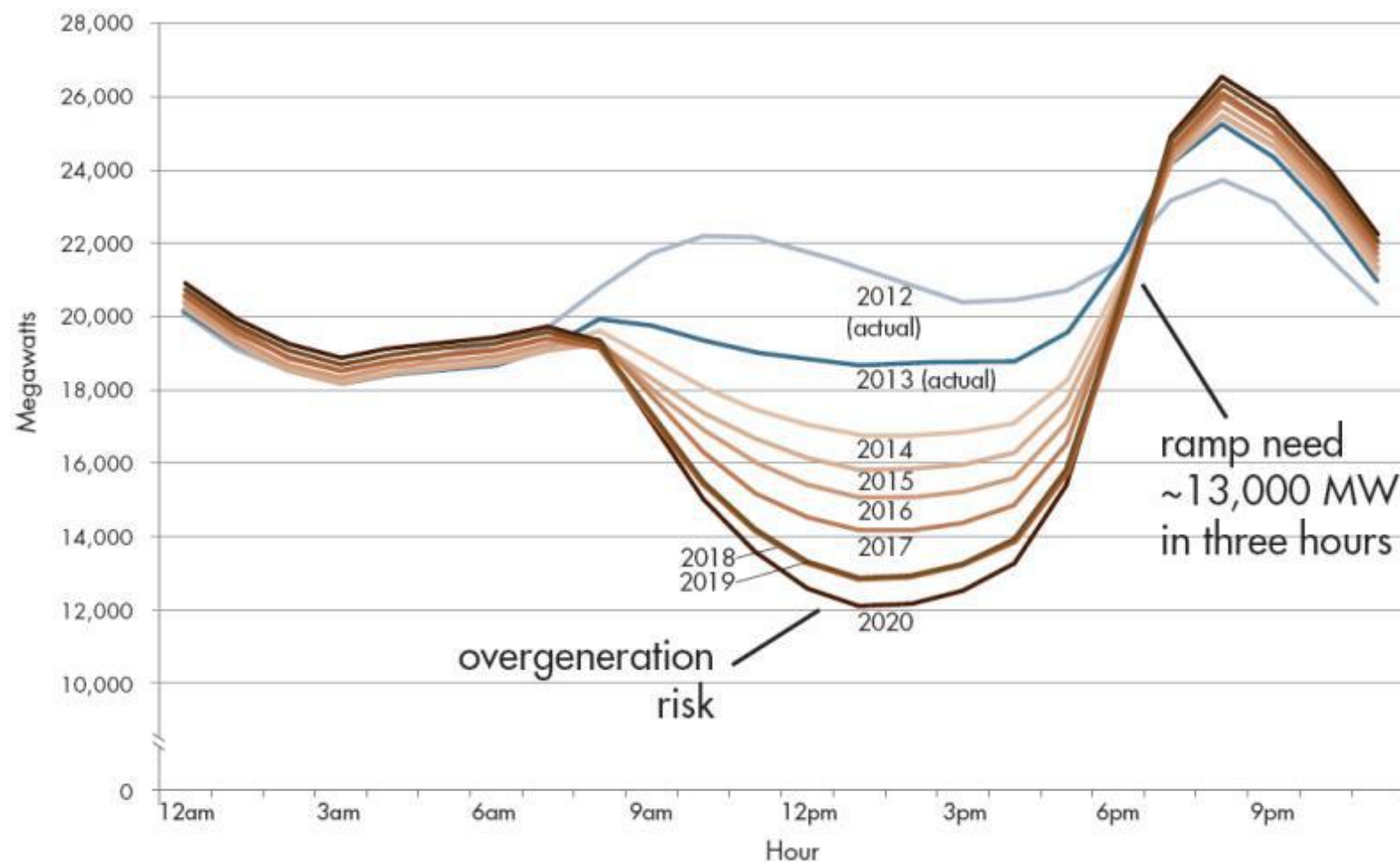
|                          | EVSE               | EVSE Installation |           |
|--------------------------|--------------------|-------------------|-----------|
|                          |                    | Low               | High      |
| 16.5kW (220V / 75A)      | \$1,000 - \$3,000  | \$17,000          | \$32,000  |
| 70kW (208VAC 3Ø / 200A)  | \$5,000 - \$10,000 | \$20,000          | \$75,000  |
| 450kW (480VAC 3Ø / 640A) | \$350,000          | \$150,000         | \$200,000 |

# E-Truck & Bus charging, if unmanaged, can have significant impacts on the grid



*Assumptions: the Chevy Volt charging rate is 3.3 kW, the medium-duty E-Truck charging rate is 15 kW and the E-Bus charging rate is 60 kW. The peak load for the Transamerica Pyramid building is from [26].*

# E-Trucks & Buses could provide additional benefits to the electric grid



# The need to electrify the truck & bus market requires innovative utility rates



| Utility        | SCE                                                                                                              |                                    |                                    |
|----------------|------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------------------------|
| Rate Schedule  | TOU-EV-3                                                                                                         | TOU-EV-4                           | TOU-EV-6*                          |
| Maximum Demand | <20kW                                                                                                            | >20kW<br><500kW                    | >500kW                             |
| EV Submetering | Required                                                                                                         |                                    |                                    |
| Energy Charge  | Max. \$0.36/kWh<br>Min. \$0.06/kWh                                                                               | Max. \$0.29/kWh<br>Min. \$0.06/kWh | Max. \$0.39/kWh<br>Min. \$0.07/kWh |
| Demand Charge  | A - \$0.00/kW<br>B - \$7.23/kW                                                                                   | \$13.20/kW                         | \$10.93/kW                         |
| Notes          | No EV demand charges if EV account demand does not exceed General Service account demand of associated facility. |                                    |                                    |

# Next Steps

---

## Commercial Electric Vehicle Working Group

*Improving the Business Case for Electric Trucks and Buses*



**For more information, feedback and comments, please contact:**

Jean-Baptiste Gallo, Senior Project Engineer

T: 626.744.5605 | [jgallo@calstart.org](mailto:jgallo@calstart.org)