We Make Electric Vehicles Greener

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Nuvve Overview

• The world’s only platform enabling profitable deployment of EV fleets globally
• University of Delaware Spin Off
• HQ in San Diego, CA
• Offices in Copenhagen, London, Newark (DE), Paris
• 33 Employees
• Core IP: 15 patents filed or pending
• Projects on 5 continents
• 3+ years of full commercial operation in Denmark on FR markets
• Corporate investors
  o EDF Renewable Energy
  o Toyota Tsusho

Awards: ENERGY STORAGE NORTH AMERICA GLOBAL 100 WINNER

V2G Operations
V2G / VGI

Barcelona, Spain
EVS32 Lyon, France
Culver City, CA
London, UK
UCSD, San Diego CA
Newark, Delaware
Corsica, France
Manila, Philippines
Nagoya, Japan
Torrance, CA
El Cajon, San Diego CA
CDG Airport, Paris
Windhoek, Namibia
White Plains, NY
Nice, France
Frederiksberg, Denmark
V2G Benefits

1. Reduces the cost of Electrification of Transport

2. Defers investment in Grid Infrastructure

3. Contributes to reducing CO2 and pollution from vehicles and power plants

4. Supports additional Renewable Energy sources on the grid
V2G Services Delivered at all Grid Levels

Utility & Distribution Services
- Renewable Energy Time Shifting
- Renewable Energy Capacity Firming
- Demand Response & Curtailment
- Spot Price Optimization
- GHG signal
- Blackout support

Building Energy Optimization
- Building Load time shift
- Charging optimized for solar
- Avoid Demand Charges
- Load Balancing

System Wide Grid Services
- Charging EVs during the night when capacity is available
- Charging EVs during the day with renewable energy
- Diminish ramp rate
- Restituting Energy from V2G during peaks
- Providing Stability Services (Ancillary, DR, Frequency Reg.)
Frequency Regulation, 3.5 years of non-stop operation

- Operational in September 2016 in partnership with TSO
- 43 V2G chargers are operating in east Denmark

Each vehicle generated $2070 of market participation revenue over 2017-18

- High wind generation on grid (55%)
- In the USA, Nuvve is providing FR to PJM in Delaware
Nuvve’s School Bus Deployments

Torrance USD V2G Pilot

Con Edison V2G Pilot

Napa Valley USD V2G Pilot

Cajon Valley USD V1G

San Diego USD V2G project

Central Illinois Bus to Grid Initiative

District selected for $9.75M grant to promote zero-emission vehicles, clean transportation options

San Diego Unified will be receiving a big boost to its environmental leadership efforts, thanks to a new grant from the California Air Resources Board (CARB).

West Coast DC V2G Pilot under development Q4 2020

East Coast DC V2G Pilot under development Q3 2020

Rialto USD 150kW DC-V2G DOE pilot 2021
New school bus economy thanks to V2G

• Dominion Energy in Virginia, announces 1050 School bus to be purchased as GRID ASSETS, because they are V2G enabled.

• Schools no longer need to have large capital expense budget for buses.
• Electric buses become more affordable.
• This accelerates transition from Diesel to Electric.
• Ensures access to clean transportation for all
V2G: AC vs. DC Configuration

AC-V2G (J1772)

- **Description**: Power conversion on-board the vehicle
- **Advantages**: Simple: cheaper, smaller, lighter, and easier to install
- **Disadvantages**: Utility interconnection process is more complicated due inverter on vehicle

DC-V2G (CCS)

- **Description**: Power conversion off-board the vehicle
- **Advantages**: Interconnection process is straightforward as inverter is off-board
- **Disadvantages**: Station and installation is more expensive than AC charging stations

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**Example: Torrance School Unified District**

**Status:** Deployed

**Location:** Torrance Unified School District and Napa Valley Unified School District

**Vehicles:** 2 Blue Bird Type B converted by Transpower with 70kW onboard bidirectional inverter

**EVSE:** Nuvve PowerPort (3-phase bi-directional AC)

**Application:** Demand Charge Management Behind the Meter

**Utility:** Southern California Edison

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**Demand Charge Management**

Typical Weekday vs. Weekday with Discharge

**Savings on site meter**

Charge at night

Discharge at peak

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[Image of school buses and power meter]

[Graph showing power usage and savings]
Nuvve V2G Solutions

• Supports cleaner air
• Reduces TCO for Electrification of Transport
• Provides fleet management tools
Thank You
Nuvve GIVe Platform

HIGH LEVEL OF CONTROL
- Integrates variable sized resources (KWh)
- Independent control of each asset (EV)
- Second-by-second control

VERSATILE INTEGRATION
- Third party integrations with existing systems including EVSEs, OEMs, and utilities
- Secure REST API available
- Support for multiple communication protocols

MOBILE MANAGEMENT
- Set charge levels and enable last-minute charging remotely
- Available as a mobile app and web interface

PERFORMANCE INSIGHTS
- 24/7 dashboard view of EV usage and charging
- Live energy delivery performance reporting
- Custom reports

Drivers can adjust charge needs on the go
Monitor your entire fleet with the Nuvve dashboard
UK Future Energy Scenarios with V2G

Figure 4.24
Electric vehicle charging behaviour at system peak

Community Renewables

An increasing number of vehicle owners participate in V2G once the technology has matured.

In 2030, smart charging could shift 47% of EV demand at peak.

In 2050, V2G could then also offset 85% of the remaining EV demand at peak.

France TSO – EV charge impact

Figure 4: Impact du pilotage sur les appels de puissances – simulations avec un parc de 15 millions de VE à horizon 2035, un jour ouvrable de janvier à température de référence

Source: RTE