Aggregating V2G Resources
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Our Mission

To lower the cost of electric vehicle (EV) ownership while supporting the integration of renewable energy sources including solar and wind.

“We Make Electric Vehicles Greener”
Nuvve Today

- Headquarters in San Diego, CA,
- Offices in Copenhagen, London, Newark (DE), Paris
- 32 Employees
- Projects on 5 continents
- 2 years of commercial operation in Denmark
- Corporate investors
  - EDF Renewable
  - Toyota Tsusho
Aggregation Platform

- Enables second by second control on EV batteries that can match the fluctuation of the grid
- Provides the grid with varying, aggregate energy flows according to the needs of the grid
Priority #1 – Meeting our Customer’s Mobility Needs

Real customers with Real driving needs.

The primary purpose of a vehicle is to drive, providing grid services must always be a secondary opportunity.

Nuvve - World’s first commercial V2G services
Partners Nissan and Enel – Copenhagen – Start of operation September 6, 2016
Rialto Electric School Bus (RESB)

• **Project Scope:**
  • 8 Bluebird electric school buses for the Rialto Unified School District in California in 2020
    • 200 kWh battery
    • 200 kW inverter
  • Charged by Nuvve PowerPort 3-directional charging stations

• **Services:**
  • Ancillary Services (regulation)
  • Vehicle-to-Building (demand management/peak shaving/solar)
E-Flex – Innovate UK

*E-Flex is a scaled demonstration of 200 V2G charging stations in the greater London area by combining variable duty cycles and vehicle types to expand understanding of how whole-system benefits in a larger metropolitan city.*

Key Goals:
- Examine the system value of V2G in a high density city
- Understand whole-system benefits of V2G
- Identify business models that provide end-to-end value for all participants - realizable market with multiple demand/supply participants.

Consortium Partners
- Cisco (Lead)
- Nuvve
- Greater London Authority
- Transport for London
- E-Car Club LTD
- Imperial College London
- Cenex
Grid Motion - PSA

- 50 “smart” future proofed, unidirectional chargers (Nuvve PowerPorts) - Residential customers around France who own a Peugeot or Citroën.
- 15 V2G fleet stations near Paris.

Key Goals:

Vehicles will provide grid balancing both bidirectionally and unidirectionally (combined V1G and V2G).

Charging is to be carried out when there is surplus electricity supply on the grid, while discharging is expected to be carried out when there is surplus electricity demand on the grid. This will be overlapped with Frequency regulation and BtM optimization.

Project Partners:

- Direct Energie
- PSA
- DTU
- Proxiserve
Three hurdles for large scale V2G Adoption

1. Gaps in the Regulatory Frameworks
2. Interconnection to the Grid and Market Qualifications
3. Hardware Infrastructure and vehicle availability
1. Gaps in the Regulatory Framework

No regulatory status for Bi-directional EVs

Storage? Small generator? Demand-side resource? - Currently none for licensing, interconnection, billing and compensation, export capability

Behind the Meter storage/resource regulatory gap:
Under emerging UK regulations, electricity exported from storage resources will be exempt from certain grid tariffs and levies.
- These exemptions only apply to grid-connected storage
- Ofgem: “The licensing framework cannot distinguish between storage for export and storage for self-consumption”
2. Interconnection to the Grid and Market design

Different/Lack of interconnection regulations by Country

- V2G is does not have an interconnection standard so it is open to interpretations from DNOs.
  - Interpretations vary even within the same country and takes months to complete.
  - Complications with DC v. AC charging “mobile inverters”

Original Markets were not designed for highly distributed resources.

- Markets are not designed for highly distributed resources – move towards Hr bids & short lead times
- The current testing procedure does not show full value of V2G
  - DNO shifting to DSO > new markets being developed
  - TSOs unsure how to audit/test distributed resources with varying capacity
3. Hardware Infrastructure and Vehicle Availability

- Limited bi-directional Charging stations available
- Different Energy and EVSE regulations by Country
- Few V2G enabled vehicles currently available
Through key partnerships and the liberalizing of energy markets, Vehicle to Grid will continue to grow and help in the transition to a greener future.
We Make Electric Vehicles Greener
How V2G Works

1. Plug in your car to any charger.
2. Charge battery safely and efficiently in V2G Mode.

3. Make money by providing power capacity and sending energy back and forth to regulate the Grid.
4. Or save costs by using stored energy from EV batteries to reduce building energy peak consumption.

4. You’re ready to drive with the charge you set for the day with advance trip planning using a mobile fleet management app.
**Project Goal:** Demonstrate the real-world benefits of advanced Vehicle-Grid Integration (VGI) applications for that EV owners can share their batteries when not needed (i.e., charged) and as compensation, receive valuable benefits in

- $4 million in funding from the California Energy Commission
- 50 + EVS over three years across the state
- Executing both bi-directional and uni-directional services

**Partners**