Vehicle-to-Grid: Using Electric Vehicles as a “Microgrid-in-a-Box”

CERAWeek Innovation Agora Pod
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The Problem: Utility Grid Stability

- Significantly increased demand for electric power
  - Population growth
  - More electric devices in homes and businesses - increased power demand
  - Number of electric vehicles needing recharging will continue to increase

- Peak demand window has fundamentally changed
  - Used to be during daytime (10am-4pm)
  - Now is 5pm-9pm in metro areas

- Renewables (PV solar, wind, etc.) provide new energy resources to supplement the grid
  - But their energy contribution isn’t always predictable
  - Almost never available during peak demand
Ways to Address Today’s Grid Stability Issues

- Increase Power Generation and Distribution
  - Decades to approve new power plant, long-range distribution lines
  - Years to install metro distribution lines >1MW
  - These options are highly capital-intensive; bad business for utilities

- Utilize Energy Storage Resources at the Points of Demand (“micro-grid”)
  - Eliminates/significantly reduces need for new distribution lines
  - Potentially easy to deploy/redeploy as needed
Two (Complementary) Options to Implement Energy Storage

- Deploy containerized energy storage resources ("box of batteries")
  - Typically in the MWh range
  - Easy to set up – drive in; connect to the grid, loads
  - Easy to move to as demand changes – unplug, load on the truck, and drive away
  - Great for industrial and commercial deployments

- Utilize vehicle to grid (V2G) – enables electric vehicles (EVs) to act as storage devices
  - Great way to augment containerized energy storage
  - Very granular storage option (tens/hundreds of kWh each)
  - Especially useful for commercial/public EV fleets that operate during day, can charge during off-peak hours
Requirements to Successfully Implement V2G for an EV Fleet

- **Bi-Directional EV Charging Infrastructure**
  - Must meet UL-1741SA ("smart inverter"/"grid support") in US
- **High-Capacity EVs (>60kWh each)**
  - Put end-of-day remaining power back onto the grid during peak hours
- **Optional energy storage resources ("box of batteries")**
  - Store enough energy during the day to ensure that EVs can recharge during super off-peak hours
- **Energy Management System (EMS) software**
  - Interfaces with charging infrastructure
  - Controls movement of power from EVs to grid, from grid to EVs, from batteries to EVs
Why V2G is Critical to EV Fleet Operators

- V2G can reduce energy costs for EV fleet operators
  - Most commercial EVs complete their shift with a significant amount of unused power
  - Unused EV power is returned to the grid during peak hours
  - Vehicles can then charge during super off-peak hours

- On-peak prices can be 1.5X-2X off-peak prices, and up to 3X super-off peak prices
  - In municipalities with net metering, the power returned to the grid is credited to fleet EV operator at the premium price

- Result: significantly reduced energy costs
Rhombus is dedicated to providing the building blocks to enable V2G solutions:

- High-Power Electric Vehicle (EV) Charging Infrastructure
- Energy Storage Solutions for High-Power EV Charging
- Containerized Microgrids for Commercial and Off-Grid Buildings (Batteries and Inverters)
- Rhombus VectorStat® EMS hardware/software

We have the right technologies, power ranges

- Chargers from 60kW to 500kW with UL-1741SA certification (V2G compatibility)
- Decades of experience on EVs, microgrids, and renewable (PV solar) deployments