Dual Use of PEV Batteries: V2G Storage and Propulsion

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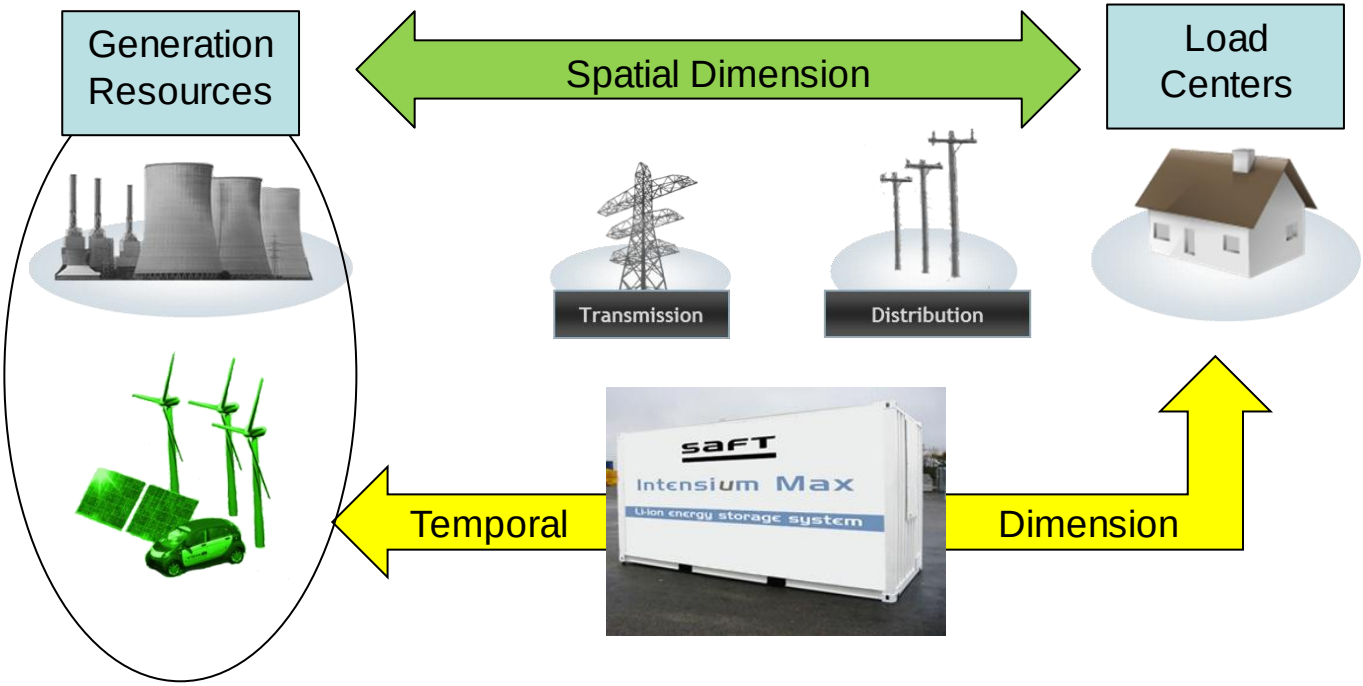
V2G: The Promise

- At projected 1,000,000 plug-in vehicles (<1% of registered passenger vehicles on the US roads), each carrying a ~15kWh store of energy, a sizable 15GWh distributed storage system will become available
- While plugged into the grid, this distributed storage resource can serve grid's diverse storage needs
- Most common grid storage applications
  - > Frequency Regulation
  - > Ramping for renewable resources
  - > µgrids, islanding
  - > Backup power
  - > Network decongestion by time-shifting load or generation, ..

Role of Storage in The Grid: Time & Space Divides

- Two dimensions of separation between generation & load centers



The Challenge

- Batteries are optimally designed to meet specific application needs & requirement (no universal all-purpose battery)
  - A PEV battery is specifically designed to serve PEV loads
- Attempts to serve multiple duties tend to make larger, more expensive systems. Cost & size are major barriers
- Additional duties imposed on the battery by the grid, while plugged-in, will have significant wear & tear on the battery
  - Who pays the initial capital or ownership costs?
  - Who benefits from the grid usage?
  - How stakeholders get compensated for use of battery?
  - How these transactions impact the battery warranty?

Grid Applications

- Grid applications are diverse with very different duty cycles:
  - The backup power (UPS), e.g., keeps the storage at high SOC and only occasionally taps into the battery with deep DOD at near constant rate
  - The frequency regulation (FREG), keeps the battery engaged fully when dispatched with random sharp pulses of a few seconds bi-directionally (charge & discharge). Many shallow cycles superimposed on a usually deep daily DOD cycle
  - Time shifting involves charging and discharging the battery at constant rates intercepted by periods of alternately staying at high & low SOCs
- Different duty cycles & loads, call for very different system engineering especially from thermal management perspective

Regulatory Barriers, Mission Conflicts

- Many ancillary services are purchased as “options to access a resource at call” and require a guaranteed “set-aside capacity”, not a randomly available resource
- As a utility customer, PEV, is interfaced with an LSE (Load Serving Entity) which is within state jurisdiction and regulated by Public Utility Commissions (PUCs)
- The bulk of frequency regulation is in “organized markets” and implemented at the HV transmission at 34kV and 69kV lines. It’s an intrastate transaction under Federal Gov. Jurisdiction typically operated by ISO/RTO’s regulated by FERC
- NERC sets the standards for system reliability for the north American grid (US & Canada)

The Opportunity

- Continental U.S. military bases are ideally suited as a prototype for green community µgrids
- Such µgrids communities can embody multiple synergistic concepts: distributed renewable generation (DRG), stationary distributed storage resources (community type ES, as well as larger scale for backup power & regulation), EV & PEV, and charging stations within the µgrid
- EV & PEV's within that green community prototype can then become an integral part of the grid, and serve as a last resort rather than day to day functions of the grid
- Opportunity for DOD to take a leadership role in addressing nation's looming energy security & dependence on foreign oil

Backup Slides

Saft Group in 2010

*1.40 $/€ conversion rate


Space


Defence


Industrial standby


Telecommunication

Specialty Battery Group

$364MM

44 %

High performance primary and rechargeable lithium and silver batteries for the electronics, defence and space industries.

Industrial Battery Group

$464MM

56 %

Rechargeable nickel and lithium-based batteries for demanding industrial applications.

Joint-Ventures:

- Johnson Controls-Saft HEV and EV batteries
- ASB Group Thermal batteries

Equity accounted


Metering and Professional Electronics


Aviation


Clean Energy Storage


Emergency Lighting


Rail and Mass Transit

International Presence & Character

- Presence in 19 countries
- Saft Jacksonville is its 16th wholly owned mfg. site and the 6th in the U.S.
- 4,000+ employees worldwide
- Saft leads the Li-ion battery market for worldwide observation, scientific and telecom satellites
- 2/3 of the world's civil & military aircraft rely on Saft batteries for starting & backup power
- World leading supplier of advanced battery systems for defense on land, at sea, and in the air