

CPET 581 Smart Grid & Energy Management
Friday 6:00-8:45PM
2013/10/18

Lecture 11

Topics of Discussion

- EV Charging Stations Project – team discussion
- SmartGrid Plug-In Vehicle Project
- EV & SmartGrid Integration
- Smart Grid Technology Roadmap
- Smart Grid Technology Areas: Generation, Transmission, Distribution, Industrial, Service, Residential
- Smart Grid Deployment
 - Demonstration & Deployment Efforts
- Smart Grid Interoperability Standards

Energy Management Related News

- **Aluminum Glut Claims Major Smelter in Ohio** (Ormet Corp), by John W. Miller and Stephanie Gleason, WSJ, Oct. 18, 2013, page B3
 - Ormet Corp, a 57 years company located in Hannibal, OH, was the 4th largest U.S. aluminum maker,
 - Was operating under bankruptcy court protection since it files Chapter 11 protection in February 2013, more than 750 employee out of 1,188 has being lay off
 - Shut the 272,000 ton-a-year smelter this month after failing to persuade Ohio regulators to increase subsidies on its electricity purchase.
 - Aluminum prices slipping to under \$1,800 a ton, from over \$2,600 two years ago
 - Cost Mitigation
 - Power from AEP typically accounts for between ¼ to 1/3 of a smelter's operating cost (Negotiated for a lower rate?)
 - Regulators said they had already provided \$346 million in discounts over the last 4 years
 - Failed the plan to switch the plant to use natural-gas produced electricity
 - Hope to sell the smelter to Wayzata Investment Partners LLC, for more than \$200 million dollar; failed due to the fact that Ormet couldn't negotiate a steeper electricity discount
 - Found another potential buyer for a refinery in Burnside LA
- Portable Solar System Cut the Need for Dangerous Fuel Conveys in Afghanistan, by Ehren Goosens, Bloomberg Businessweek, pp. 35-36
- The Army Goes Green, But Not to Save the Earth, by Ehren Goosens, Oct. 14-20, 2013, Bloomberg Businessweek, <http://www.businessweek.com/articles/2013-10-10/the-u-dot-s-dot-army-adopts-renewable-energy-as-a-way-to-improve-troop-safety>

- Cheap Solar Irrigation, Oct. 14-20, 2013, by Nick Leiber, Bloomberg Businessweek,, <http://www.businessweek.com/articles/2013-10-10/innovation-sunwaters-cheap-solar-powered-irrigation>

California ISO/EPRI Smart Grid Roadmap & Architecture

- Key Smart Grid Drivers:
 - Energy supply from renewables
 - CO2 emission level rolled back to 1990 level by 2020
 - One million roof-top solar panels
 - Large investment in energy conservation & delivery
 - New Once-Through Cooling regulation affecting coastal plants 2012-2024
 - Large investments in smart grid (smart meters, storage, etc)
- Smart Grid Objectives (research, pilot, implement, integrate smart grid technologies)
 - Increase grid visibility, efficiency, and reliability
 - Enable diverse generation including utility-scale renewable resources, demand response, storage and smaller-scale solar PV technologies to fully participate in the wholesale market
 - Provide enhanced physical and cyber security
- The Expected Benefits
 - Ability to recognize grid problems sooner and resolve them
 - Efficiently use the transmission system to defer or displace costly transmission investments
 - Enable customers to react to grid conditions making them active participants in their energy use
 - Leverage conventional generation and emerging technologies when possible including distributed energy resources, demand response and energy storage, to address the challenges introduced by variable renewable resources

References: EV & Hybrid EV Charging Stations & SmartGrid Plug-In Vehicles Projects

- GE's New EV Charging Station Projects, Jan. 2012, <http://www.gereports.com/ges-new-ev-charging-station-project-aims-to-reduce-installation-costs/>
- EVlink Charging Solutions, Schneider Electric, <http://www.schneider-electric.us/sites/us/en/solutions/energy-efficiency/electric-vehicles/electric-vehicles.page>
- Find your Charge on the Go, <http://carstations.com/>
 - a. Charger types: J1772 (AVCON), Large Paddle Inductive, Small Paddle Inductive, NEMA 5, NEMA 14-50, SAE J1772-2010, CHAdeMO
- EV and Charging Stations, City of Boulder, Colorado, <https://bouldercolorado.gov/pages/electric-vehicles-and-charging-stations>
 - a. EV & Charging Stations, <http://user.govoutreach.com/boulder/faq.php?cid=23683>
- EV Integration into SmartGrid of the Future with UCLA WINSmartGrid Technology, Energy Research Center, <http://smartgrid.ucla.edu/EV/>

- ChargingPoint, National Grid, and NYSERDA Launch EV Charging Station Project in Upstate New York, 2013/5/31, <http://smartgrid.testing-blog.com/2013/05/31/chargepoint-national-grid-and-nyserda-launch-electric-vehicle-charging-station-project-in-upstate-new-york/>
- Plug-In EV, Kansas City, http://www.kcplsave.com/residential/programs_and_services/plug_in_vehicles/how_it_works.html

References: Charging Stations & Standards

- Clean Cities, Dept. of Energy, <http://www1.eere.energy.gov/cleancities/>
- Plug-In EV Handbook for Public Charging Stations (20 pages), U.S. Dept of Energy, <http://www.afdc.energy.gov/pdfs/51227.pdf>
- Charging Station, http://en.wikipedia.org/wiki/Charging_station
 - a. Telsa Roadster Sport (Shizuoka, Japan)
 - b. Nissan Leaf (NRG Energy eVgo station)
 - c. Public Charging Station (2009), San Francisco
 - d. Brammo Empulse electric motorcycle at an AeroVironment charging station
- EV Charging Station – Standards, http://en.wikipedia.org/wiki/Charging_station
 - a. SAE
 - 240 V AC charging – Level 2 charging
 - 500 V DC – DC Fast Charging
 - b. IEC Modes definitions (International Electrotechnical Commission)
 - Mode 1 – Slow charging from a regular electric socket (1 or 3 –phase)
 - Mode 2 – Slow charging from a regular socket but which equipped with some EV specific protection arrangement (e.g., the Park & Charge or the PARVE systems)
 - Mode 3 – Slow or fast charging using a specific EV multi-pin socket with control and functions (e.g., SAE J1772 and IEC 62196)
 - Mode 4 – Fast charging using some special charge technology such as CHAdeMO
 - c. Four Plug-Types
 - Type 1 – Single phase vehicle coupler – reflecting the SAE J1772/2009 automotive plug specification
 - Type 2 – Single and three phase vehicle coupler – reflecting the VDE-AR-E-2623-2-2 plug specification
 - Type 3 – Single and three phase vehicle coupler equipped with safety shutters – reflecting the EV Plug Alliance proposal
 - Type 4 – Fast charge coupler – for special systems such as CHAdeMO
- EV & Plug-in EV Charging Station <-> Smart grid communication, http://en.wikipedia.org/wiki/Charging_station
 - a. SAE International: SAE J28471/1: “Communication between Plug-in Vehicles and the Utility Grid
 - b. ISO/IEC 15118: Road vehicles – Vehicle to grid communication interface
- Charging Station Manufacturers
- Charging Network Operators
 - a. ChargePoint
 - b. ECOtality: Blink Network
 - c. Better Place
 - d. Fullcharger International
- Battery Swapping

- Renewable electricity and RE charging stations
 - SPARC station (Solar Powered Automotive ReCharging station)
 - Wind-Powered charging station: Urban Green Energy (4 kW vertical-axis wind turbine paired with GE Wattstation)

References

- [1] Smart Grid Road Map, 2011, IEA Free Publication, http://www.iea.org/publications/freepublications/publication/smartgrids_roadmap.pdf
- [2] Free Publications, International Energy Agency, <http://www.iea.org/publications/>
- [3] Smart Grid Roadmap and Architecture, California ISO/EPRI, December 2010, http://www.smartgrid.epri.com/doc/cal%20iso%20roadmap_public.pdf
- [4] NIST Framework and Roadmap for Smart Grid Interoperability Standards Release 2.0, 227 pages, http://www.nist.gov/smartgrid/upload/NIST_Framework_Release_2-0_corr.pdf
- [5] NIST Smart Grid Interoperability Standards Update, July 25, 2011, http://www.smartgrid.gov/sites/default/files/doc/files/National_Institute_Standards_Technology_NIST_Smart_Grid_Inte_201103.pdf
- [6] NIST Smart Grid Advisory Committee (SGAC) Report, 2011, 70 pages, http://www.smartgrid.gov/sites/default/files/doc/files/NIST_Smart_Grid_Advisory_Committee_SGAC_Report.pdf

Smart Grid Demos

- [1] EPRI (Electric Power Research Institute) Smart Grid Demo Projects (Youtube), <http://www.youtube.com/playlist?list=PLphKrncF69X0MxPf4aHDu1UJHn8wGuq>
 - a. EDF Smart Grid Demo, 2012
 - b. PNM/EPRI Smart Grid Demo
 - c. KCP&L/EPRI Smart Grid Demo
 - d. Smart Grid Application – Southern Company’s Approach
- [2] Smart Grid Demos – Integration of Distributed Energy Resources, EPRI Smart Grid Resource Center, <http://smartgrid.epri.com/Demo.aspx>
 - a. Smart Grid Demonstration Five-Year Update, 28 pages, 08/10/2013
 - b. Smart Grid Demonstration Four-Year Update, 07/26/2012
 - c. Smart Grid Demonstration Three-Year Update, 07/21/2011
 - d. Smart Grid Demonstration Two-Year Update, 08/20/2010
- [3] Pacific Northwest Smart Grid Demo Project, <http://www.pnwsmartgrid.org/>
 - a. Transactive Control
 - b. Integrating Renewable Energy
 - c. Improving Reliability
 - d. Keeping the Cost Down
 - e. Empowering Consumers
- [4] The Pecan Street Project, Texas, <http://www.pecanstreet.org/projects/smart-grid-demonstration/>
- [5] Lower Valley Energy, <http://www.lvenergy.com/smart-grid-demo-project-moves-forward/>
- [6] Residential Smart Grid Solutions – Lutron, <http://www.lutron.com/en-US/Residential-Commercial-Solutions/Pages/Residential-Solutions/ResidentialSmartGridSolutions.aspx>

References - Smart Grid Projects

- Sacramento Municipal Utility District,
http://www.smartgrid.gov/project/sacramento_municipal_utility_district_smartsacramento