



NextGrid: Utility of the Future Study

Working Group 1: New Technology Deployment and Grid Integration

Meeting No. 4

February 14, 2018

Meeting Summary

[Note: descriptions of presentations and discussion are condensed summaries and paraphrases]

Working Group Leader: Dr. Mohammad Shahidehpour (on the phone). Senior Facilitation Consultant Marty Cohen filling in as meeting facilitator.

Topic: Electrification

Agenda Item I: Opening and Introductions

Working Group Leader Dr. Mohammad Shahidehpour welcomed participants via telephone, reviewed the meeting agenda and informed the group that Senior Facilitation Consultant Marty Cohen would be leading the meeting onsite.

Cohen announced there would be five presentations on the topic of Electrification, each limited to 15 minutes, followed by a 45-minute discussion, question and comment period.

[Subject to permission from presenters, decks and materials to be posted online, encapsulated below.]

Agenda Item II: Presentation by Mark McGranaghan *(Vice President, Distribution & Energy Utilization Electric Power Research Institute (EPRI), Integrated Grid Sector.)*

Grid Modernization R&D Challenges

- Grid modernization is complicated - challenge requiring integration of a wide range of energy systems – electricity, telecommunications, and customer local networks. Not just hardening grid to support automation and resiliency, now also means integrating and supporting DER and providing flexible platform for customer choice, clean energy, smart cities, quick response for enhanced reliability/resilience, fairness for users.
- Electrification supports decarbonization – also is key part of grid modernization goals. See recent EPRI electrification assessment study executive summary. More than EVs -- at Olympics, Zambonis are electric -- it's about technologies to improve productivity and efficiency (infrared paper drying, indoor agriculture, advanced heating and cooling technologies, as examples).

- Local energy systems can incorporate storage, generation, and advanced energy management to optimize energy use while also integrating efficient electrification and providing local resilience. Research underway at EPRI on electrification of transportation, many other technologies, energy efficiency, microwave, induction heating, other industrial processes.
- Natural gas generation projected to continue to grow through 2050 – flexible resource that in combination with electrification makes most economic sense.
- Planning tools are critical to assess hosting capacity, locational DER value, NWAs, voltage management, other advanced tech. Working with industry on development of Distributed Energy Resource Management System (DERMS) – a platform for customer and distributed resource integration.
- Grid modernization will require new policy and regulation approaches and significant capital investment, after which it becomes win-win in meeting societal goals, improving economics, efficiency, competitiveness, job creation. Need to develop methodology for cost benefit analysis.

Agenda Item III: Presentation by Michael Krauthamer (*Senior Advisor, Alliance for Transportation Electrification*)

Overview of the Alliance for Transportation Electrification

- Alliance is coalition advocating for acceleration of transportation electrification across America led by Executive Director Phil Jones, past NARUC president. Members include utilities, EV charging companies, auto makers, trade associations, engineering/construction firms, standard setting organizations.
- Advocates that provision of Level 2 and DC Fast Charging (DCFC) become part of utility portfolio. Reasons include that: local electric company has ubiquity; is a trusted third party to customers; can address challenging economics; is financially stable for long term investment; has lower capital costs; is a regulated reliable partner.
- EV charging infrastructure gap – lack of consistent standards, interoperability, compatible back end data networks. Issues being worked on. Standards are important to any utility investment – must avoid stranded costs and address consumer needs.
- Despite cost, performance, and other advantages, EVs won't be purchased until people see sufficient charging infrastructure. Eventual goal is to make charging EVs as fast as filling up at the gas station.
- EVs not just passenger vehicles, but medium duty trucks, heavy duty trucks, transit vehicles, airports and port equipment.
- Public education and outreach important.
- Need to address charging market failure if EV benefits to be captured. All customers can benefit, see lower energy prices due to new EV loads, under the right approach.

Agenda Item IV: Presentation by Katie Bell (*Manager, Energy Policy and Business Development, Tesla*)

Electric Vehicle Charging Infrastructure & DER Integration

- Tesla mission: sustainable energy combining transportation, flexibility, clean energy, storage.
- Illinois 5th most populous state, 6th in EVs. Rapid growth nationwide at compound 32% annual rate; have 455,000 reservations for Model Three and currently beginning to deliver them.
- Rocky Mountain Institute consolidated 11 EV studies, quantified range of individual, social, environmental benefits of EV deployment.
- Essential for charging infrastructure to be available. Tesla made commitment that anyone who owns a Tesla will be able to drive and travel anywhere that you could with a traditional vehicle. Growing Tesla “supercharger” DCFC network – has more than 800 sites.
- Less than 10% of charging occurs at supercharger; 85% of charging occurs at the home; remainder at destinations (hotel, workplace, retail shops). Illinois has a dozen Tesla superchargers installed; continuing to build more (map). Can leverage current utility assets and integrate to improve system. Experience must be seamless for drivers.
- Multi-level approach needed: utility planning for charging integration; infrastructure development (under various charging business models); customer experience, including home charging TOU price signals.
- Study shows 28%-40% of EV owners also invest in solar. Illinois can expect increased PV installation, given coming programs and increasing EV adoption. Combination of EV/solar changes customer load shape [see chart]. Storage also important part of new toolbox, provides dispatch and consumption flexibility to optimize self-consumption and DER applications. Accelerated EV adoption will maximize benefits to all energy customers.

Agenda Item V: Presentation by Kate Tomford *(Senior Analyst, Chicago Transit Authority (CTA))*

Electrification of Mass Transit

- CTA, with 1.54 million riders per day, has long had an electrified 1456-car rail system and is beginning to electrify buses (two of 1,862 presently)
- Spends \$70 million on energy -- 42% diesel fuel for buses, 40% electricity for trains on eight heavy rail lines totaling 224 track miles, another 13% for facilities including 145 rail stations.
- Technology is both AC and DC; modern railcars have regenerative braking, other efficiency technologies, better controls, LED lighting.
- Potential for “wayside” storage under development; could help accelerate trains, support voltage, derive revenue by participating in PJM frequency regulation and other markets; many technical and financial issues being studied
- Two electric buses in service for over 3 years; 100-mile range, operate 80 miles per day; have 300kWh capacity; charged at 100kW (slow) overnight, operate morning, charge mid-day, operate evening rush hour.
- Federal grants will allow purchase of 20 e-buses, two en-route 500kW overhead chargers, five garage fast chargers, in next two years; procurement process underway.

- Issues re en-route charging vs. garage charging [see chart], but no E-bus has sufficient range for all-day route operation
- Opportunities to collaborate with utility ComEd to optimize e-bus en-route charging locations, reduce demand and related charges, address peak issues, ensure resilience, pilot wayside rail storage; potential for microgrid participation

Agenda Item VI: Presentation by Jamie Meyers, (Energy Manager, Cook County, Illinois - Bureau of Asset Management)

Cook County GHG Emission Reduction

- Cook County has 170 public buildings with 16.2 million total square feet, which consume 237.3 million kWh and 12.2 million therms of energy annually [see consumption and reduction charts]; county government is focused on improving their efficiency.
- Department of corrections campus is biggest user of electricity, then hospitals.
- Cook has aggressive emissions goal of 80% reduction from 2010 baseline by 2050; ahead of the 2% annual goal presently, but “low-hanging fruit” have been harvested
- Major capital expenses will be required to reduce emissions further by 30%. Benefits will be cost savings for taxpayers and environmental improvement.
- Potential strategies include EE, space reduction, renewable generation, smart buildings; also possibility of microgrids for campuses.

Agenda Item VII: Topic Discussion (moderated by Andrew Barbeau, President, The Accelerate Group)

- **Topic 1:** Moderator identified common themes and policy issues raised by presenters for discussion: Why is electrification important? Why should policymakers get involved? Should policymakers encourage electrification? If so, what principles should guide that policy? A discussion among participants and panelists ensued, with key points:
 - Panelists responses:
 - Multiple stakeholders involved and affected, so issues must be looked at by policy makers broadly, from different perspectives.
 - Need cost/benefit analyses for support.
 - Private sector cannot do it alone because of market inefficiencies, capital investment too risky for independent EV charging, a long term investment. California tried prohibiting utility chargers but infrastructure didn’t shown up; policy was changed and utility pilots now underway.
 - For public transit, primary driver is the emissions benefit at local level -- significant air quality effects. Electrification spurred by federal government – CTA receiving \$40 million in grants for buses, which cost 850K per bus (plus

charging infrastructure) compared to diesel at 500K. E-buses have lower operating costs and allow participation in EV by public transit riders.

- Public policy provides pathway to set goals and have accountability and measurement of outcomes.
- **Topic 2:** Questions and discussion among the panel and participants about quantification of GHG benefits, with key points:
 - Federal grants require quantification of benefits (and costs).
 - California Air Resources Board (CARB) has market to quantify and monetize emission reductions, specific to vehicle. For example, typical medium duty truck calculated to have 10 cents per kwh value over diesel.
- **Topic 3:** Questions and discussion among the panel and participants about how to bring benefits of electrification to low income communities, renters, those without garages, rural communities and others. Key points made:
 - Non-EV drivers benefit from EVs from more efficient electricity grid, cleaner air, less carbon, potentially lower electricity costs over time.
 - Downward pressure on electric rates if EV charging fills gaps in load shape; however, if charging adds to peak demand can have opposite effect; smart rate design and smart charging needed.
 - Integration of individual customers and their distributed resources can address grid flexibility and capacity requirements; key challenge is to create regulatory constructs to share value streams.
 - Access in low income communities is policy, not technology, challenge – beginning to be addressed in California through programs, financing, rules, other support.
 - TOU rate designs under study across country; consumer education is a challenge.
 - Another view is that there may be little role for public policy in promoting EV expansion in Illinois, due to competitive wholesale and retail energy markets and competitive vehicle markets. Why design rates to be market proxy when we already have a market? CTA has multiple private company bidders who make buses; market for EVs is developing without policy intervention.
 - Policy makers have role in establishing markets; different time horizons for state policy, public utilities, private sector; market failures should be addressed; some difficult use cases: apartment buildings, multifamily units, on-street parking, low-income, renters.
- **Topic 4:** Questions and discussion among the panel and participants about EV charging profiles (in reference to Bell slide 12), with these key points:
 - Ramping occurs (due to Level 2 charging) when drivers arrive home from work or whenever rates reduced; TOU by itself does not address this.

- SDGE in California studying advanced EV charging rates taking into account circuit conditions, renewables output, cost of energy, other factors.
 - At high EV penetration, need smart charging programs to improve load shape; will also be both utility and non-utility DR.
 - Need to be clear on goals and design approaches to fit
- **Topic 5:** Questions and discussion among the panel and participants about policy goals of electrification, with these key points:
 - 10 states have decarbonization mandates; Illinois not yet among them. Can public subsidies be justified if emissions eliminated from cost benefit analysis?
 - Not a subsidy, but investment. Can involve third party aggregators, customer choice, competition, market mechanisms.
 - Value to the grid beyond environmental benefits; load shape; locational; reserve market; can all be calculated and monetized.
 - Illinois uniquely already has hourly market-based variable energy pricing available to all customers of ComEd and Ameren; also has AMI almost fully deployed.
 - Rates paid for charging do not have to be the same as for other household usage.
 - Other costs, fees, taxes may be increased or reconsidered to recover lost gas taxes.
 - Sustainability of mass transit is new issue; need to continue to provide low-cost urban transportation option, particularly for those without EV opportunity.
 - EV charging infrastructure installation provides well-paying jobs and economic benefits.
 - All electricity consumers, including low income, can have lower rates if higher utility revenue from charging exceeds new costs; economies of scale can reduce costs.
 - Non-electric technologies expected to compete with electrification; natural gas and hydrogen vehicles; dual fuel using existing infrastructure
- **Topic 6:** Moderator Barbeau said that any questions of phone participants that had not been addressed will be sent out for comment. He proposed four questions to be circulated to the working group for follow-up comments:
 - How do you create a cost-benefit framework that helps determine the value of avoiding creation of new peaks and need for new distribution infrastructure? (That there is a cost of doing nothing).
 - How do you bring the electrification economy to ALL customers? Low-income communities and communities that don't choose car ownership? What models can work, and what is unique to Illinois?
 - How do you implement electrification – through markets, rates, incentives, and programs – to achieve a least-cost and high-benefit future?

- What benefits can be achieved from electrification beyond the transportation sector?

Administrative Matters

- Cohen announced that the next working group meeting will feature presentations on Distributed Energy Resources (DER) issues.
- He further announced that a draft outline of the contents of the Working Group 1 report will be circulated to the members by the next meeting, at which the drafting process will be discussed.
- Dr. Gross suggested that presentations be circulated in advance and limited to ten minutes in order to have additional time for group discussion.
- Dr. Shahidehpour thanked everyone for their participation and adjourned the meeting.