

Implementing Equitable Capacity Management Strategies for All-Electric Multifamily Housing

CCEC, Sierra Ballroom B, 6/25 @ 10:30 am - 11:45 am

Moderator:

- Ilse Villacorta, Prospect Silicon Valley, Sr. Project Manager

Speakers:

- David Kaneda, IDeAs Consulting, Inc., Principal and Thought Leader
- ~~Rongxin Yin, Lawrence Berkeley National Laboratory, Technology Researcher~~
- Doug Black, Lawrence Berkeley National Laboratory, Dr

Notes

David

- CA 2045 Decarbonization Goals - electrify 70% buildings, 75% transport, 100% of retail sales 100% electric
- National Electric Code (NEC) - existing building electrification
 - 1947-1957: 60 Amp services to houses, did not provide guidance for apartments
 - 1962: update 100A to houses, no minimum for apartments
 - 2016: 200A, buildings wired for 100% electrification, still no apartment info
- California multifamily housing:
 - 4 million multi-family households - ½ is low to moderate income
 - 68% are 60A or less per unit
- Controlling demand (not energy) - peak energy times in mid/late morning, decreases at lunch, jumps back up in afternoon/evening, decreases late evening/night - if use same amount of energy all day long - max demand is 90kW, determines transformer, service, panel, an wire size
- Electrical Service Calculations converting gas to electric
 - Study in Redwood Shores, California - condo tenants want to electrify, look at all gas assets to replace e.g. cooktop, ovens, water heaters → heat pumps, electric stove/oven, electric dryer → exceeds 100A rating of electrical services - if had a 60A panel → overload if using all appliances at once
- Typical solutions: new service → 100-200A service, puts more load on the grid. Circuit splitters are used in single family homes - for EV and electric cooktop 240V/60A - about the same size, can set up power sharing devices to only have one on at a time e.g. when cooking stops car charging, resumes charging car when done
- Sacramento Study: All electric home survey - majority below 60A anyway

Ilse

- MFH existing challenges: Existing subpanel capacity is low → constraints new load options, 120V appliances can help with capacity but cost more, service upgrades are \$\$\$, asses like energy storage is increasingly attractive, but not

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tested in MFH units

- What if we could
 - Add capacity w/o service upgrade
 - Manage apartment circuits to prevent overloading/limit costs to renters
 - Automate DR across housing to manage grid
 - Provide backup power to let people stay in home if power goes out - sometimes 48-72 hours

David

- Example existing residence
 - 1) electrify - add heat pump water heater, induction cooktop, dryer on top of fridge, washer, flights, TV, electronic, 120V heat pump - if doesn't work, break will trip and lose power
 - Starting to have some appliances that you can plug into 120V to lower capacity
 - Heat pump 120V water heater - slower to heat up but makes it hotter, so it takes longer
 - 2) Smart panel/low load equipment - "Span" panel - pays attention to peak demand, if numbers start to reach breaker switch off, it will turn off individual circuits, can program to switch off certain ones first
 - 3) Service + battery - it's like an induction cooktop w/ a battery built in but on scale of whole unit e.g. Tesla power wall. If you have an undersized service (60A) and added a new appliances, could set up system where when demand goes up over 60A, switches on battery power (5-20A) to run additional appliances
 - 3a) low battery/load shed - when battery runs out of power, need a smart panel to shut loads off
 - 3b) Utility power outage - battery kicks in when charged to run A/C or fridge, etc
 - 3c) Virtual power plant - utility can ask you for power if there is a grid-scale problem. Utilities did a test where Tesla walls pushed back power back to the grid for 2 hours, generating 435MW → enough power for 130,000 homes

Ilse

- CEC grants - Arcata, Willow Creek + Santa Rosa
- Using Power Management Pilot = smart family at Home Depot, just need qualified electrician to install to do a smart panel, adapting this product + programmable controls, installing in 25 units
 - In Humboldt, allowing for full decarbonization - stovetop, HVAC, electric dryers, some PV - do not need to interface with utility
 - Permitting on multifamily is more extensive than on single-family home - not as long time or expensive as panel upgrades → can avoid costly

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option and get benefits

- If PSPS event is 4 hours, could someone medically vulnerable stay in their home e.g. can refrigerate medication

Doug

- All programs have own controls/apps, created central controlled that takes info from battery, thermostat, smart plugs in test locations to control all together - can do this API, not looking to make a product, showing it is publicly available and there is value in it → industry can take it on. Some aggregators are doing this, trying to promote easy ways to do this that utilities and regulators can get behind
- Capacity management: total device load exceeds 60A - battery will only go on when grid power is off. Set up simple switch between smart panel and existing utility panel to operate different devices on different panels e.g. when reach 60A panel limit, can power some devices from battery
- Virtual power plants adding power to grid is equally as important as decreasing grid load, which is what we are doing during DR events or peak times of day - use battery only to power load to avoid using grid power, control thermostat, can increase it by a couple of degrees which decreases electrical
- Resiliency example: if the grid is out, battery takes over, depending on unit loads, battery will last for hours-days. In test units, there are some PV arrays, will consider demonstrating extended outages with them. When panel detects grid outage, opens main relay, home is islanded, goes into emergency power system load, panel will shed pre-determined non-essential circuits selected by the homeowner e.g. essential/nonessential, critical + essential get powered together until battery is at 50%, then only critical powered
- Real World Example: 66 minute power outage, switched over to battery automatically, powered wifi/critical services and battery went from 87%→83%
- Field demonstration site circuit class distributions: if every load in each apartment was on, this is what they are designing to. Most were 1/3 in actuality
- Field demonstration site expected backup durations per unit - for critical and essential anywhere from 2 hours-5 days, opportunity to work with individual units
- Performance metrics:
 - Power output
 - Battery capacity
 - Expanded capacity
 - Percentage of whole building load
 - Annual bills savings from TOU - ensure that occupants are not paying more
 - Effective capacity
 - Switchover time

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Ilse

- Site installation:
 - Tenant outreach/education - here's the testing, these are the impacts
 - What do tenants consider critical, essential, what could be out for length of PSPS event
 - Switched out appliances e.g. inductive cooktop, new cookware
 - Learning on the fly, some challenges to work out
 - Fabricated own enclosures for the batteries → permitted, reviewed, inspected, and passed. Will have formalized drawings to have details on materials/what they did in this site
 - Battery in one of the enclosures - connector on top of battery to avoid them in actual units. Disconnected the box, ran it outside unit, and connected in enclosure
- Permitting process: Authority Having Jurisdiction (AHJs)
 - AHJ # 1 - City of Arcada
 - Had previous battery project insulations, did not have questions, simple review, 6 week processing time = standard
 - AHJ #2 - Humboldt County
 - More rural, less experience with battery projects, longer process ~3 months to ask questions/comments → in-depth process, had meetings with them, they were proactive in educating themselves on the technology, which made many comments no longer relevant, about to approve permits
 - AHJ takeaways: may not have opportunity to educate themselves
- If a project was coming to your jurisdiction, what resources, guidance, education would people need for decarbonization? e.g. Finance, tech, etc info, vs webinars, pamphlets, etc
 - Staff and safety education
 - Case study
 - Permitting guidelines
 - Cost comparison and data
 - Technical training for AHJs
 - Outreach materials - guides, flyers, postcards, social media, ads
- Great Training Initiative:
 - Problem: emerging technologies, permitting departments have different needs, want to ensure they have info they need about emerging technologies that can change the way we use energy so they feel comfortable reviewing this
 - Have resources, training, support, upcoming webinar and resources
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