Decarbonization and the Grid: Impacts and Opportunities

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Clean Energy and New Normal

TOU
- System-wide roll-out starting Oct 2020

2020 ZNE Requirements
- 2019 Building Code Effective Jan 1, 2020
- Residential “Electric ZNE”
- Solar PV Requirement
- Compliance options for Battery Storage and DR

EV Adoption
- Transportation and Building Electrification
- Increasing customer adoption

All-electric Homes

City Reach Codes
- Some cities go beyond minimum code
Modern Distribution Business Vision Statement

SCE’s long-term vision is to transform its distribution grid into a flexible, networked platform that optimizes DER value through advanced grid management and empowers customers with options to be reliability partners.
Modern Distribution Business Vision Framework:
Operate a flexible, networked platform enabled by foundational Grid Modernization capabilities

Customer Grid Partners
Leverage DERs to empower the customer as a reliability and decarbonization partner

DER Optimization
Provide economic signals for the optimal, grid harmonized deployment and dispatch of DERs

Active Grid Management by leveraging Grid Modernization
Plan and operate the distribution system by leveraging DERs and automated grid assets

Reliability
Decarbonization
Affordability
Decarbonization and the Grid

Customer load profiles are changing

- One way consumption
- Temperature driven peaks
- Passive
- Bi-directional consumption and production
- Behavior driven peaks
- More controllability and flexibility
- Much higher peaks without control

What is the Impact to the Grid?

- Reliability??
- Affordability??

Energy for What’s Ahead™
Changing Load Profile Examples

Preliminary learning from Default TOU pilot:
The peak usage is slightly reduced but not shift to non-peak hours.

2020 ZNE Requirements

2019 Building Energy Code requires PV installation for all New Residential Construction (NRC)

2019 Building Energy Code provides storage compliance option

* Illustration purpose only to show the directional changes
Changing Load Profile Examples (Cont.)

* Illustration purpose only to show the directional changes

**EV on top of Baseline Load Profile**

- EV profile
- Load profile
- EV is doubling the size of load

**All-electric home**

- Erratic load shape with appliance driven peaks

**Electrification**
Fontana Meritage Home

- First production builder ZNE neighborhood, launched in 2015 - Project location 60 miles east of LA
- CEC Climate Zone 3B (warm and dry)
- Annual peak temperatures ~114.8
Implemented ZNE Measures

- Electric Heating and Water Heating
- All LED lighting
- 3.5 – 4.5 kW PV
- High Performance Envelope

Plus:
- Plug load controllers
- Circuit-level monitoring
Fontana Individual Home Analysis

• Individual home exhibits **higher** peak demand ($\geq 10$ kW).
• EV accentuates the problem, home peak can be as high as 15 kW
Fontana Structure Level Analysis

• The structure level demand peak with “all-electric” is similar to those with mixed-fuel but shows higher winter demand, and hence better utilization of grid assets.

• The structure with battery storage shows lower demand than the one without – Continue to finalize best storage control.

T2: ZNE with electric water and space heating

T3: mixed-fuel

T2: ZNE

T1: ZNE w/Storage

2018 yearly structure profiles
Fontana Structure Level Analysis

Demand Factor Analysis

When is the peak?
What is contributing to the peak?

Coincident Factor Analysis

Coincident factor based on 15-min data
Coincident factor based on 1-min interval data

Typical Assumptions

What is the diversity factor of multiple customers?
Opportunities for Grid Optimization

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Decarbonization and the Grid

Grid and customer win-win

Energy for What’s Ahead™
Storage plays a key role in Grid Harmonization

4 Bed 2 Bath 1430 sf in Garden Grove
3kW PV 2kW 3.4kWh ES

4 Bed 2 Bath 2560 sf in La Crescenta
2.8kW PV 2kW 10kWh ES

7 Bed 8.5 Bath 4247 Sf in Westlake Village
15.4kW PV, 20kW 54kWh ES

5 Bed 5.5 Bath 5400 sf in Palm Spring
25.9kW, 10kW 27kWh ES
Lessons learned from Pilots and Studies

- Load profiles are sensitive to energy storage sizes as well as control.
- Code compliant Energy Storage is not large enough to prevent reverse power flow (and/or reduce the peak). Planning and operation still need to account for peak and reverse power flow.
- (EPRI study) Utilities should promote a TOU tariff that is regional and not utility-wide as ES may turn on simultaneously and cause grid issues.
More “Load” Flexibility Example

Tucson Electric Power Pilot

- Normal Self-Consumption
- Enhanced Self-Consumption

Power (kW)

- Total Net Load
- HVAC
- HPWH
- Solar PV
- BESS

Only BESS used for local self-consumption

Demand response devices are coordinated with BESS to increase self-consumption
Concluding Remarks

• California is fully committed to a clean energy future
• Customer load profiles are changing and their impacts need to be better understood for grid reliability
• Increasing load flexibility presents opportunity to co-optimize grid and customer needs
• Modernize grid planning, program and operations to unlock the customer value
• Collaboration is key to success in this journey