

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



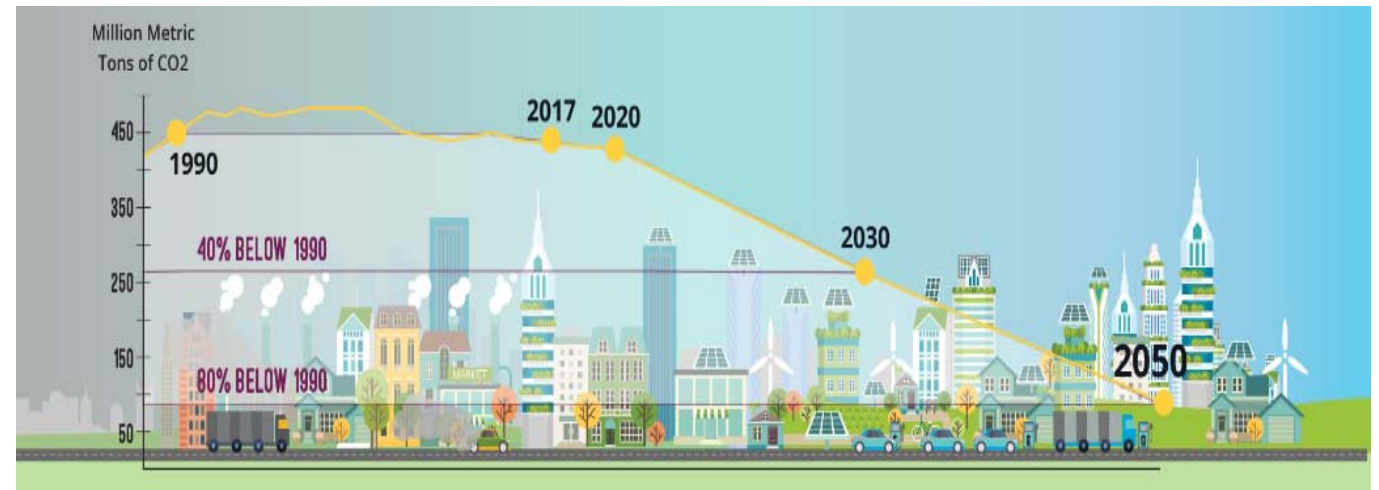
EV Adoption

- Transportation and Building Electrification
- Increasing customer adoption

All-electric Homes

City Reach Codes

- Some cities go beyond minimum code



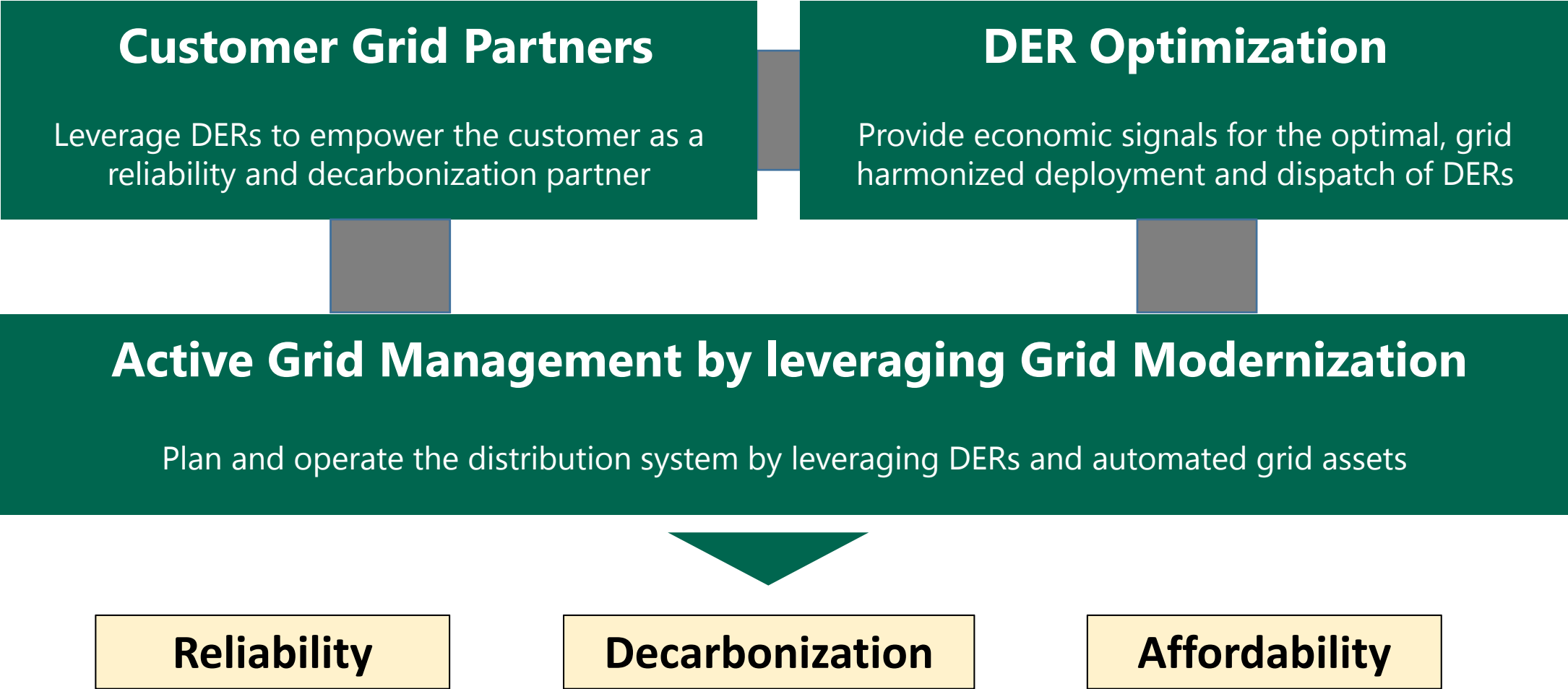
Modern Distribution Business Vision Statement



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



Decarbonization and the Grid

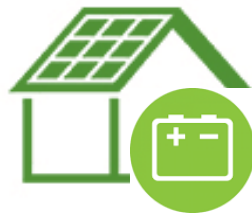
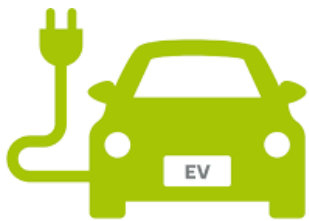
Customer load profiles are changing

- 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?



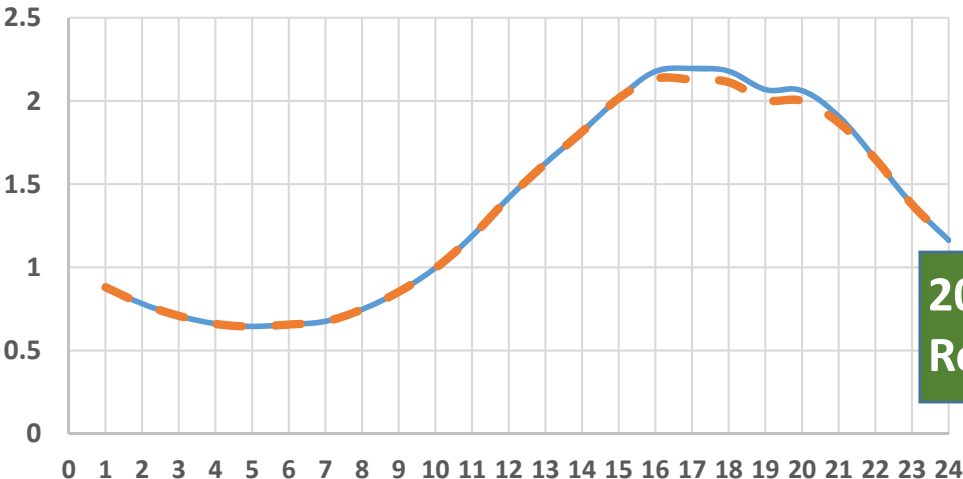
Reliability??
Affordability??

Changing Load Profile Examples

2020 Baseline
load profile

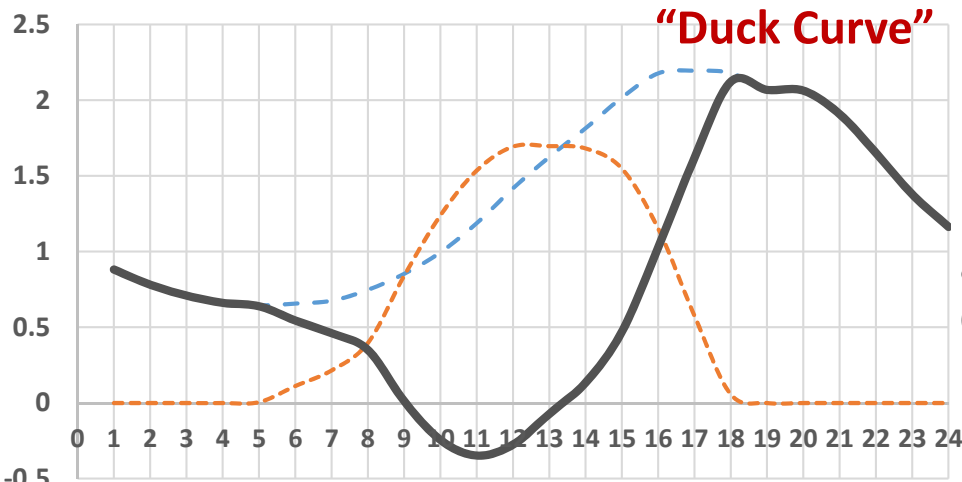
Reference Baseline

Typical Residential Daily Profile



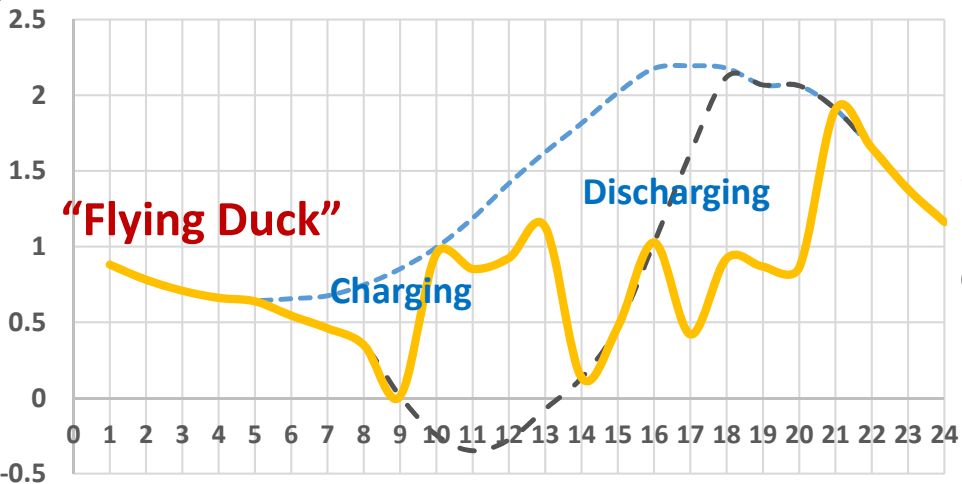
2020 ZNE
Requirements

Residential with PV



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

Residential with PV paired Storage



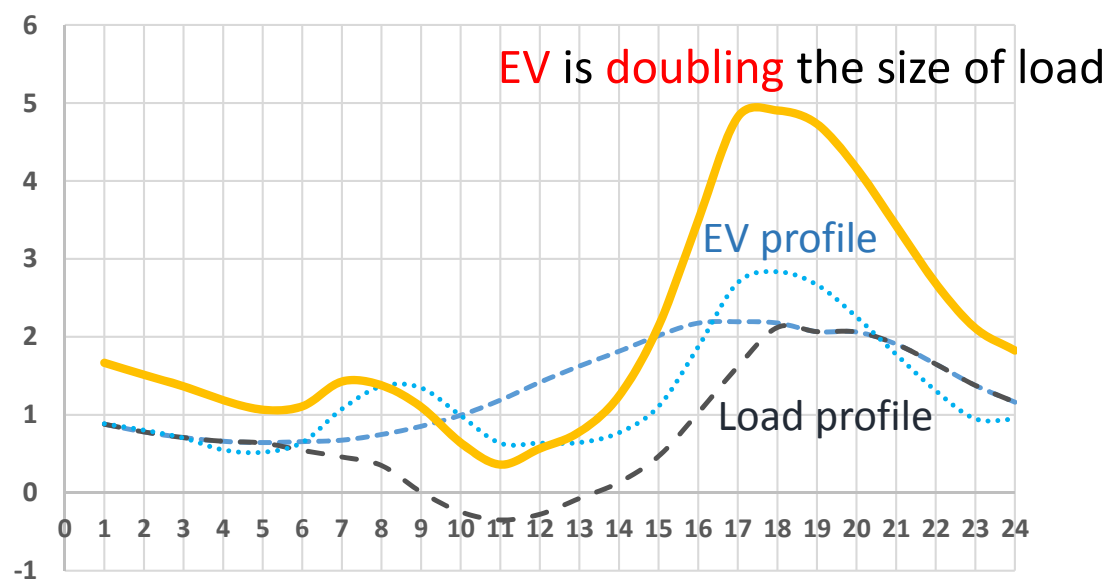
2019 Building Energy Code
provides storage
compliance option

* Illustration purpose only to show the directional changes

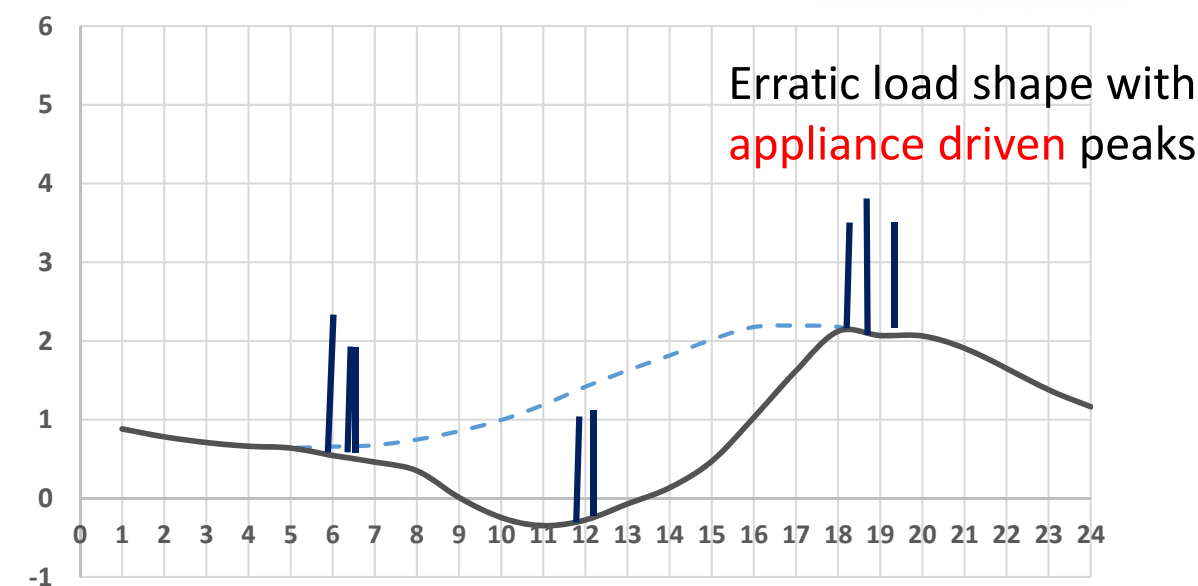
Changing Load Profile Examples (Cont.)



EV on top of Baseline Load Profile



All-electric home

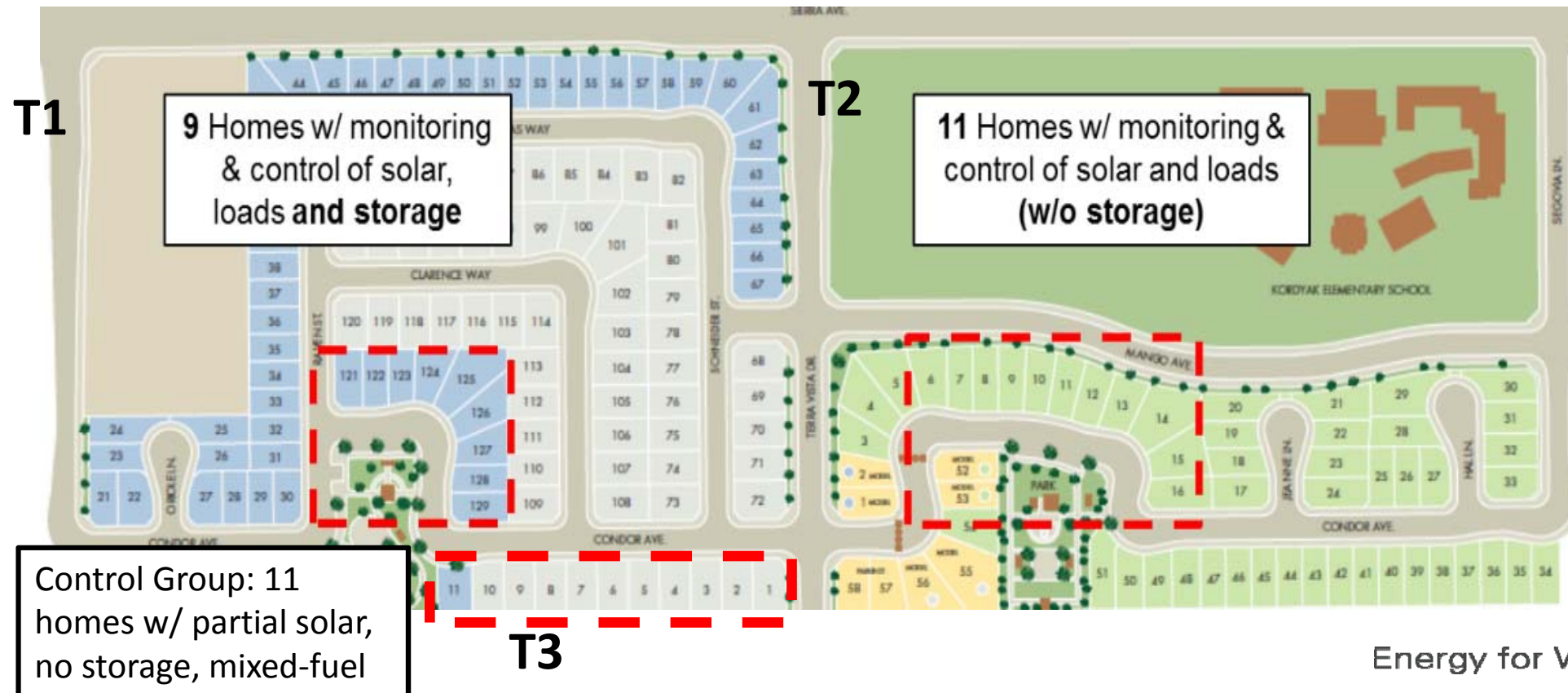


Electrification

* Illustration purpose only to show the directional changes

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

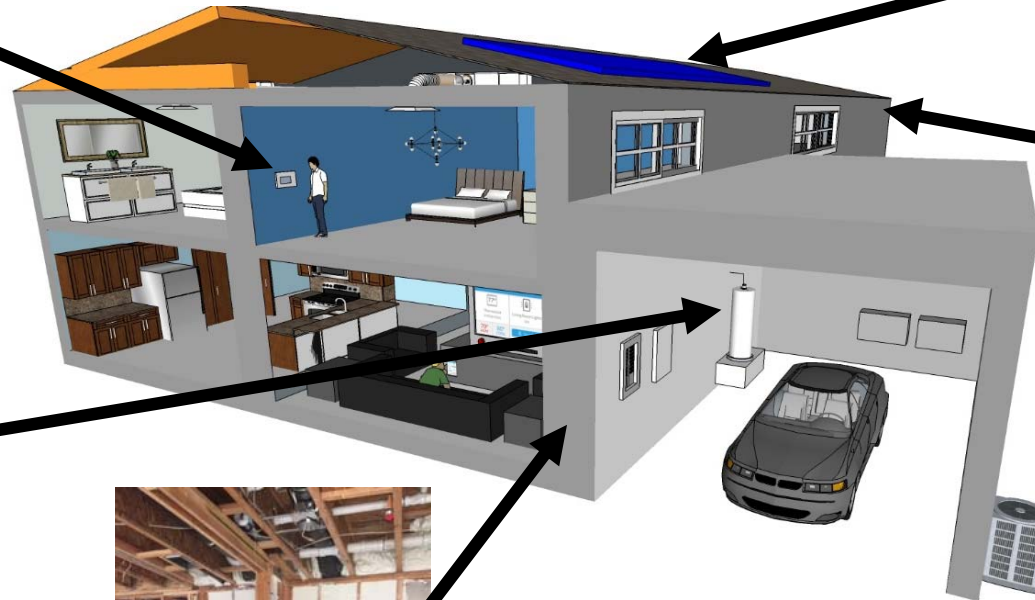


Nexia Thermostats/HEMS

All LED lighting



3.5 – 4.5 kW PV



High Performance Envelope



Electric Heating and Water Heating



Foam Insulation



Plus:

- Plug load controllers
- Circuit-level monitoring

Fontana Individual Home Analysis

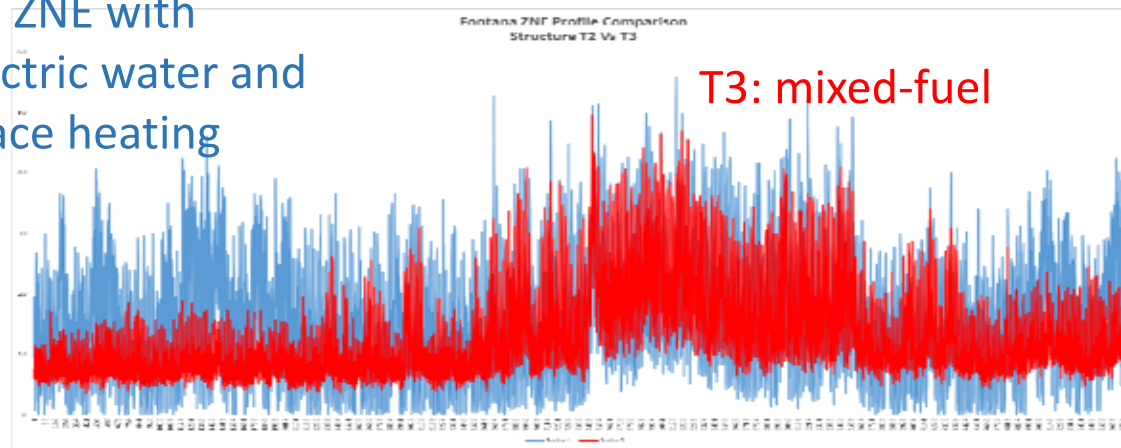
- Individual home exhibits **higher** peak demand (≥ 10 kW).
- EV accentuates the problem, home peak can be as high as 15 kW



Fontana Structure Level Analysis

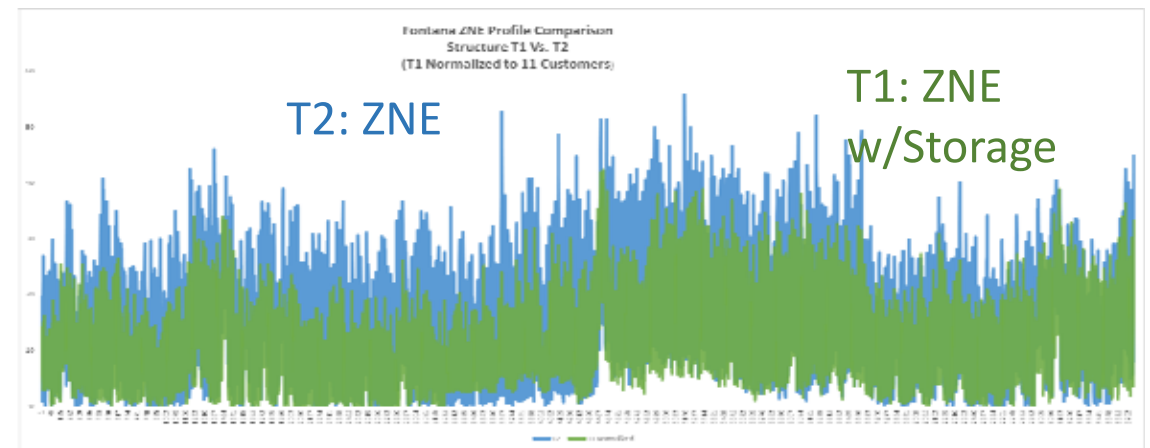
- The structure level demand peak with “all-electric” is **similar** to those with mixed-fuel but shows higher winter demand, and hence better utilization of grid assets.
- The structure with battery storage shows **lower** demand than the one without – Continue to finalize best storage control

T2: ZNE with
electric water and
space heating



2018 yearly structure profiles

T2: ZNE

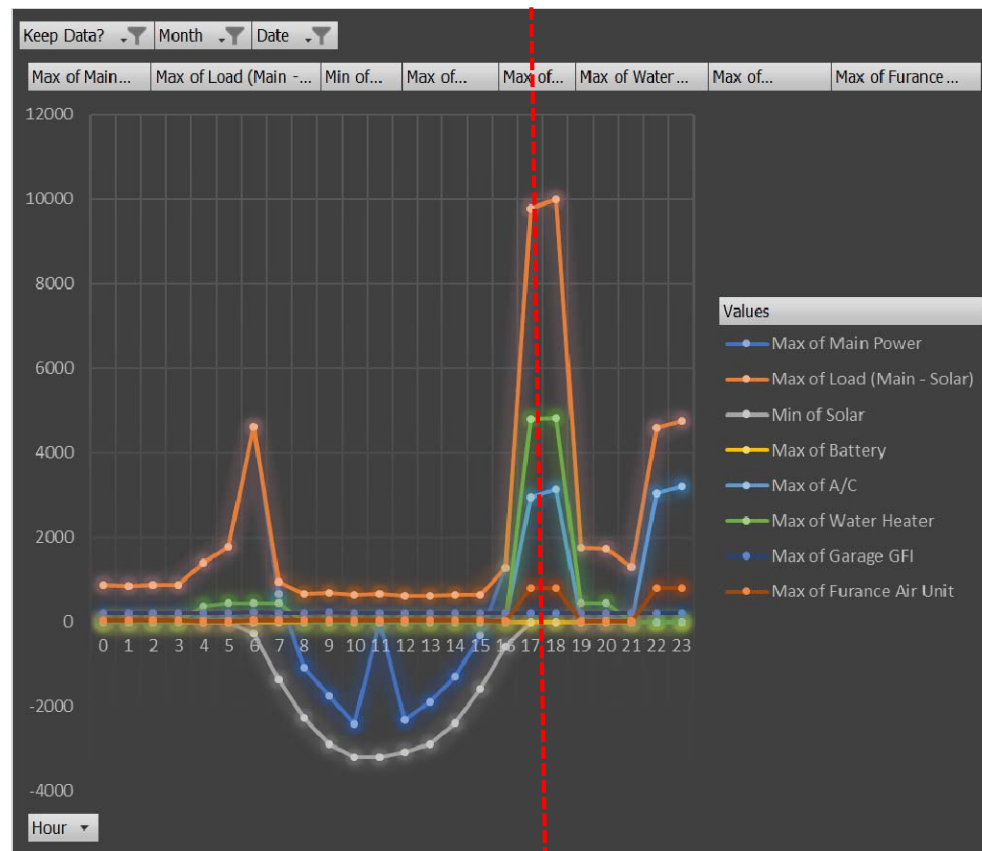


T1: ZNE
w/Storage

2018 yearly structure profiles

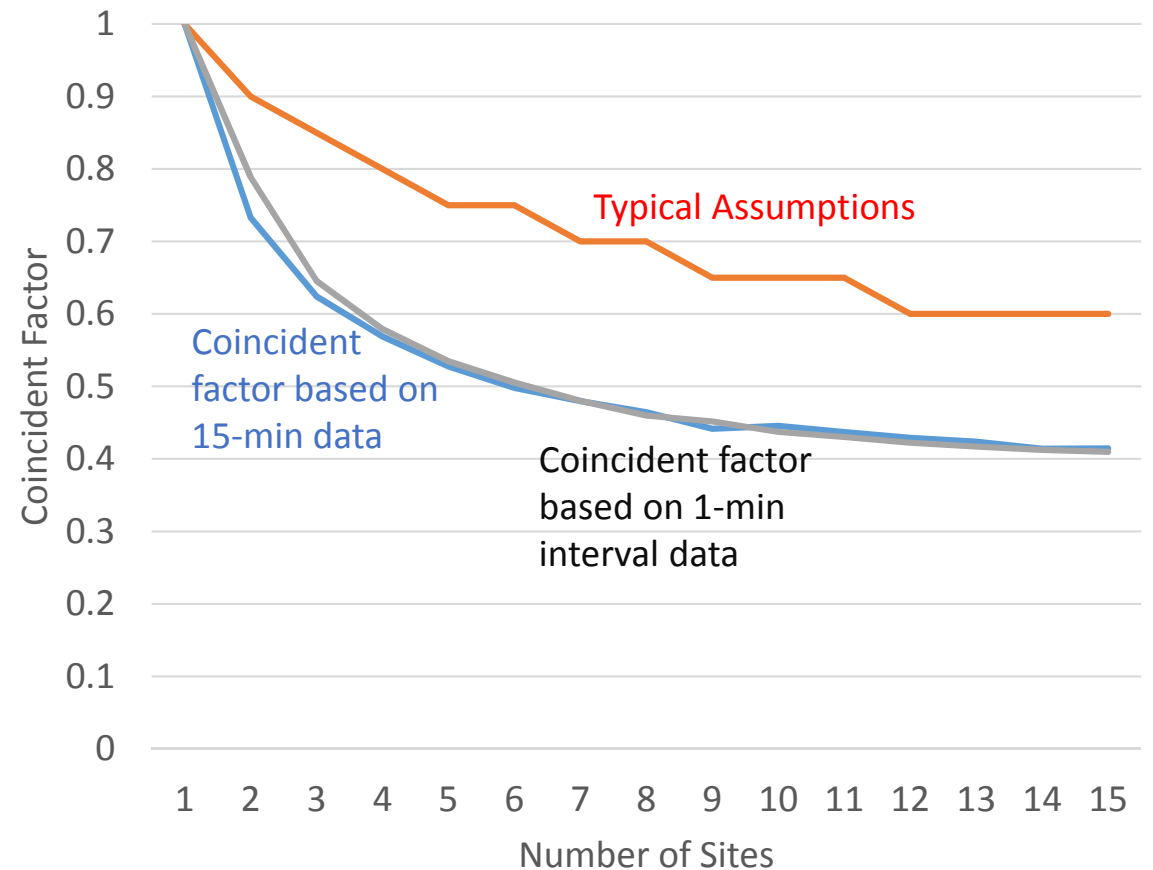
Fontana Structure Level Analysis

Demand Factor Analysis



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

Coincident Factor Analysis



What is the diversity factor of multiple customers?

Decarbonization and the Grid

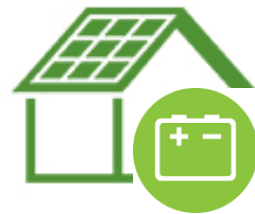
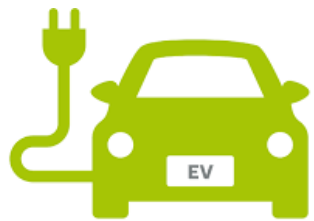
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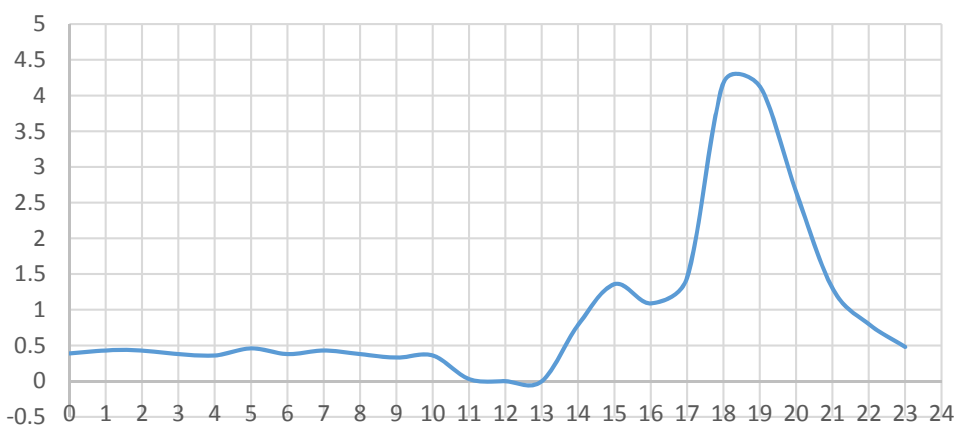
Opportunities for Grid Optimization



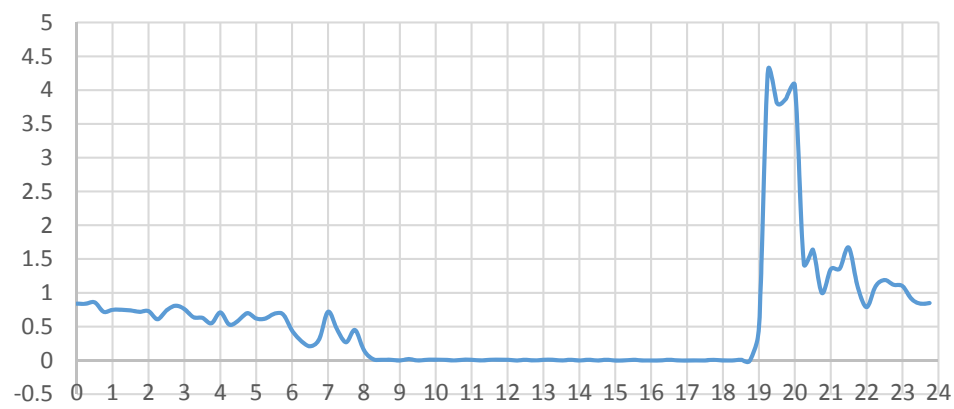
Grid and customer win-win

Storage plays a key role in Grid Harmonization

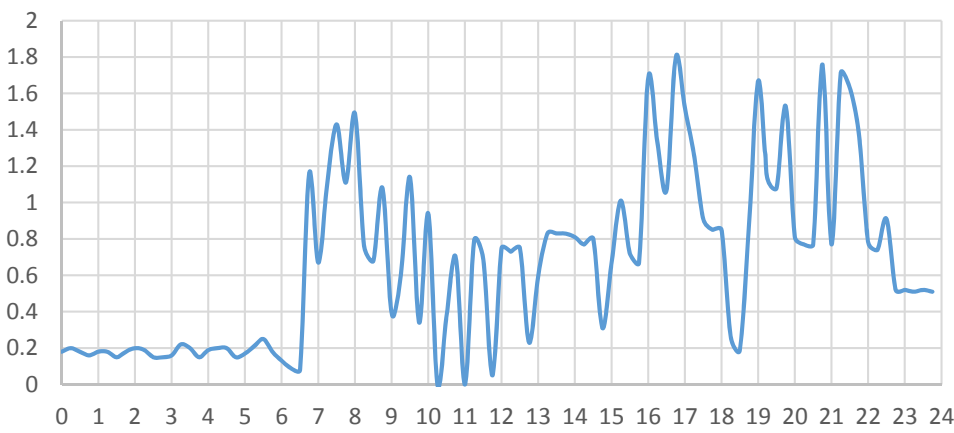
4 Bed 2 Bath 1430 sf in Garden Grove
3kW PV 2kW 3.4kWh ES



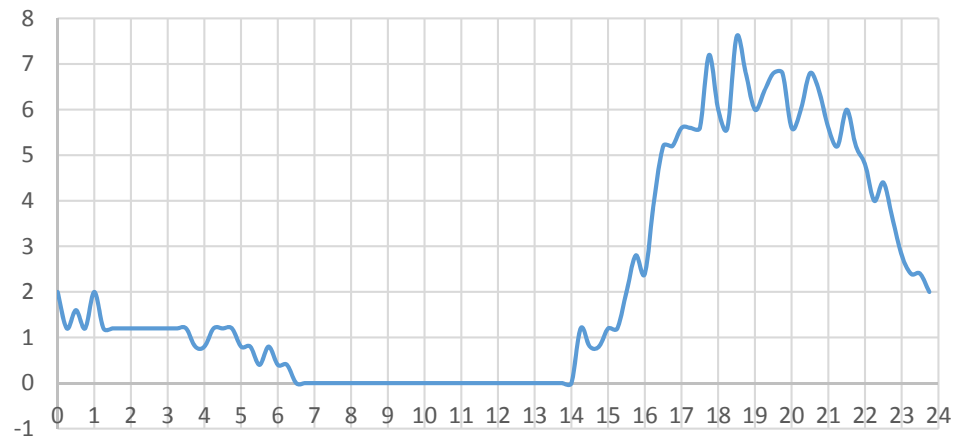
7 Bed 8.5 Bath 4247 Sf in Westlake Village
15.4kW PV, 20kW 54kWh ES



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

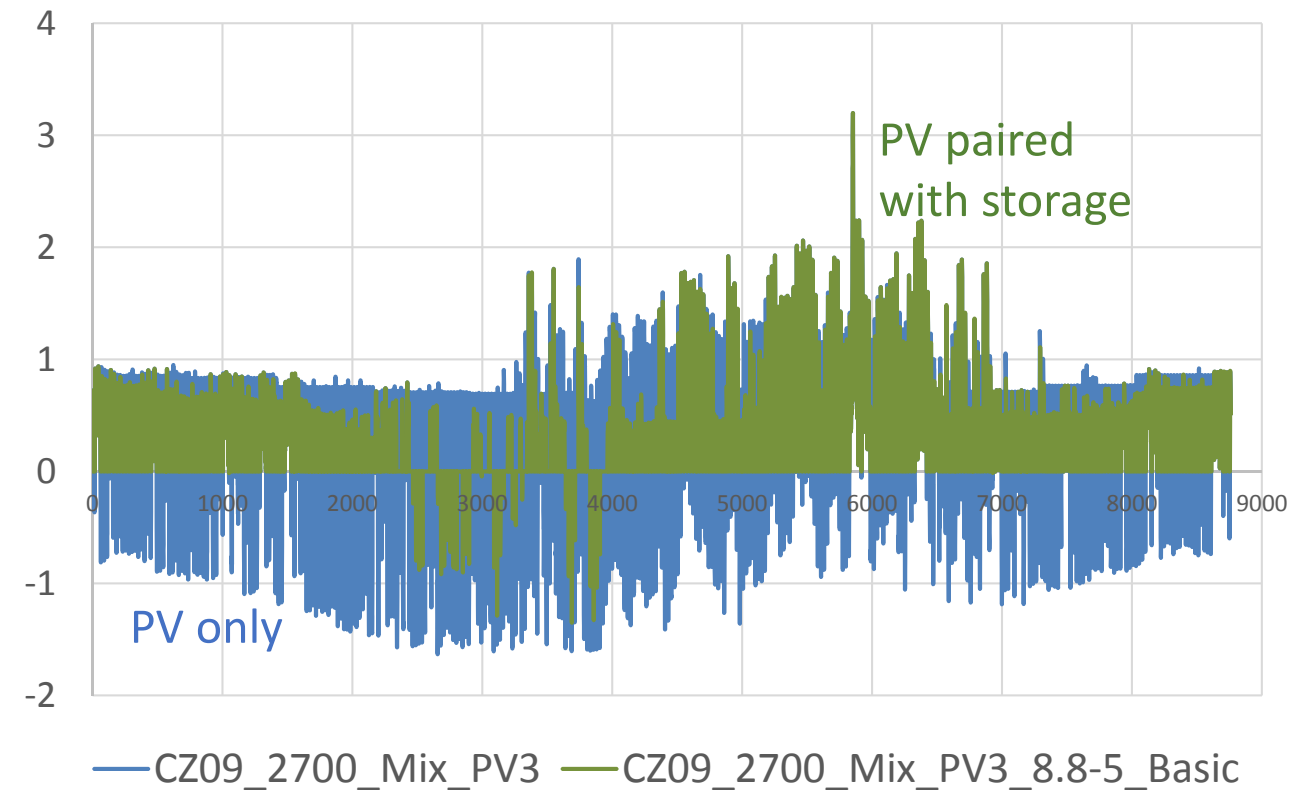


5 Bed 5.5 Bath 5400 sf in Palm Spring
25.9kW, 10kW 27kWh ES

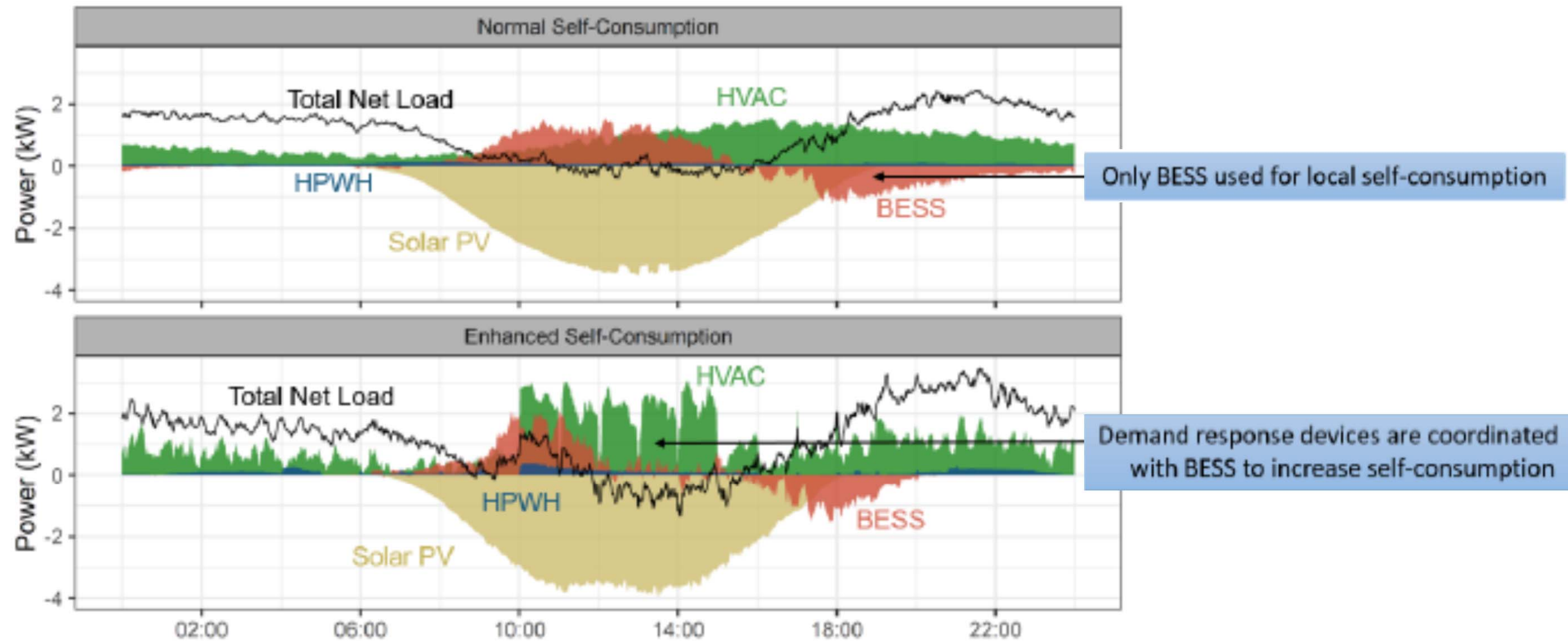


Lessons learned from Pilots and Studies

- 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

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