Piquing Interest in Shifting Peaks

Studying the Real-World Impacts of Load Shifting

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THE CHANGING ENERGY LANDSCAPE

Emerging Technologies in Residential Setting
THE SMART HOME STUDY
Using Residential Homes as a Laboratory to Study Load Shifting

» Smart Home Study is a pilot program in SDG&E Territory
» 100 residential homes
» How rate structures and the adoption of BTM DERs impact the utilities and their residential customers
LOAD IMPACTS: GRID PERSPECTIVE
LOAD IMPACTS

DERs: Peaking the Grid

Residential Load Shape: Traditional

- Other
- Cooling
- Pool
LOAD IMPACTS
DERs: Peaking the Grid

Residential Load Shape: PV and EV

- Other
- Cooling
- Pool
- EV
- Solar
LOAD IMPACTS
Costs to the Utility

» SDG&E NEM agreements favorable to customer
  - Buys energy from customer at retail rates

» During high generation hours avoided costs can be $0

» SDG&E benefits from customers storing their excess PV generation
LOAD IMPACTS
DERs: Shifting the Peak—Home Storage

Home Battery Load Profile: Self Generation

- Charge
- Discharge
- Net Load w/ Battery

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LOAD IMPACTS

DERs: Shifting the Peak—Electric Vehicle Charging

» Smart electric vehicle charging to reduce evening peak
RATE IMPACTS: CUSTOMER PERSPECTIVE
SDG&E RATES
Available rates to SHS participants

SDG&E: Summer Weekday Rates

Hour

Dollar per kWh

DR: Tier 1    DR: Tier 2    DR-SES/EV-TOU2    EV-TOU5 **

** Includes flat $16/month charge
CUSTOMER LOAD PROFILE
Storing excess PV generation, reduces evening load

SHS Load Profile: Prior to Battery Install

Net Load-no AES
CUSTOMER LOAD PROFILE
Storing excess PV generation, reducing evening load

Increasing costs by 17%
CUSTOMER LOAD PROFILE
Storing super off-peak energy, reducing evening load

Decreasing costs by 11%

SHS Load Profile- Super Off-Peak Charging

KWh

AES
Net Load-wAES
Net Load-no AES

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BARRIERS TO LOAD SHIFTING
Beyond the customer cost perspective

» EV Charging
  ▪ Do not charge at home often
  ▪ Inflexible charging schedule
  ▪ Multiple EVs

» AES Implementation
  ▪ AES requires energy to operate
    • Larger differential in on-peak and off-peak pricing required to use AES
  ▪ Expensive equipment
CONCLUSION
FINDINGS AND NEXT STEPS
Smart Home Study and beyond

» Can effectively shift customer load to reduce customer bills
» Utility benefits v. customer benefits
  ▪ Can be misaligned under current rate schedules
» Dynamic pricing
  ▪ Smart Home Study to implement two 3-week experiment in optimizing to day-ahead LMP (locational marginal pricing)

Continued research required to understand how BTM DERs will continue to reshape the grid.
Questions?

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