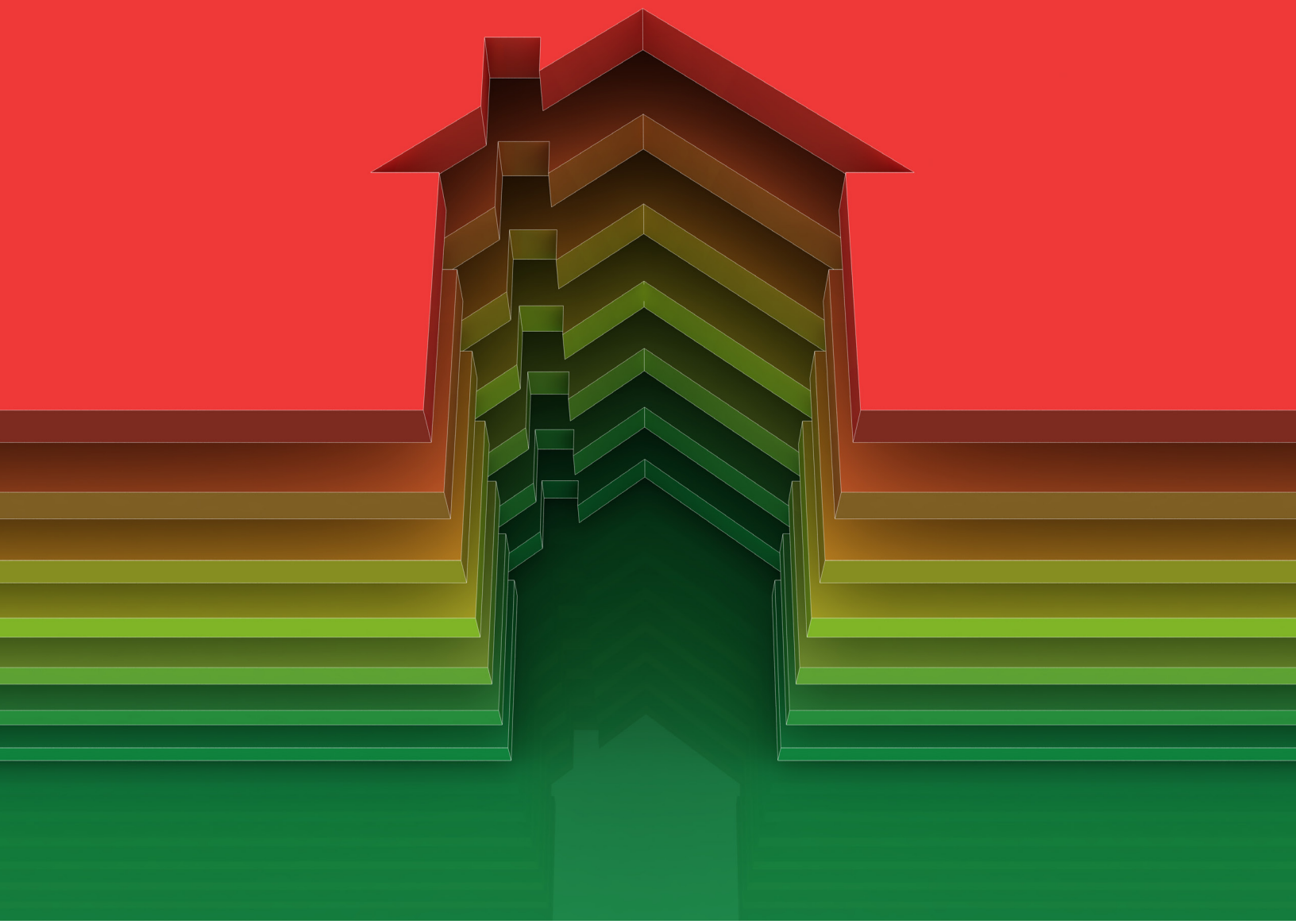

Grid-Interactive Efficient Buildings:

Providing Energy Demand Flexibility for Utilities in the Southwest

August 2019

SWEEP

SOUTHWEST ENERGY EFFICIENCY PROJECT

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About SWEEP

The Southwest Energy Efficiency Project is a public interest organization dedicated to advancing energy efficiency in Arizona, Colorado, Nevada, New Mexico, Utah and Wyoming. For more information, visit: www.swenergy.org

About the Author

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Before joining SWEEP, he worked at The Cadmus Group, a nationwide energy and environmental consulting firm.

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I. INTRODUCTION

The electric utility system is rapidly changing due to retirement of coal generation, low natural gas prices, decreased prices for energy storage and renewable energy resources, and increased investments in energy efficiency. This is leading to flat or decreasing utility sales and changes to most utilities' generation portfolio, away from coal and toward renewable energy and in some places, natural gas-fired generation. At the same time, peak electric demand continues to grow on both the electric system as a whole and on certain portions of the transmission and distribution system. Increasing peak demand leads to the need for investments in both electric generation to serve the new load and the transmission and distribution infrastructure to deliver power to customers. To adapt to the changing industry and modernize the electric grid, electric utilities in the United States plan to invest over $1 trillion in new generation, distribution, and transmission infrastructure over the next 10 years.[1]

Changes to the electric industry are also creating new challenges for electric grid operators. For example, states with a high penetration of renewable resources, especially solar generation, are beginning to see very low or even negative electricity prices during times of the year when renewable energy generation is high and load is relatively low. At these times, renewable energy generation is reducing load to below the levels of baseload generation resources that are not easily turned off and on, leading to instances where there is more electricity generation than demand, causing negative electricity prices. However, once the sun goes down and solar generation decreases, utilities must have fast response resources that can rapidly fill the generation gap left by renewable resources coming offline. These issues are commonly referred to as the "duck curve".[2]

Buildings in the United States are a major driver of these trends as they consume approximately 75% of electricity.[3] However, buildings can also be a potential solution given that much of the electrical load in buildings is flexible and can be managed to operate at specific times and at different output levels.[4] By adding advanced controls and communications systems to building equipment, building managers and grid operators can adjust power consumption to meet grid needs through controlling existing equipment such as heating, ventilation, and air conditioning ("HVAC") systems, lighting, hot water heaters, and pool pumps. In addition, grid operators can now also utilize customer distributed energy resources such as solar photovoltaics, electric vehicle charging, and energy storage to manage peak loads and provide other value streams back to the grid.

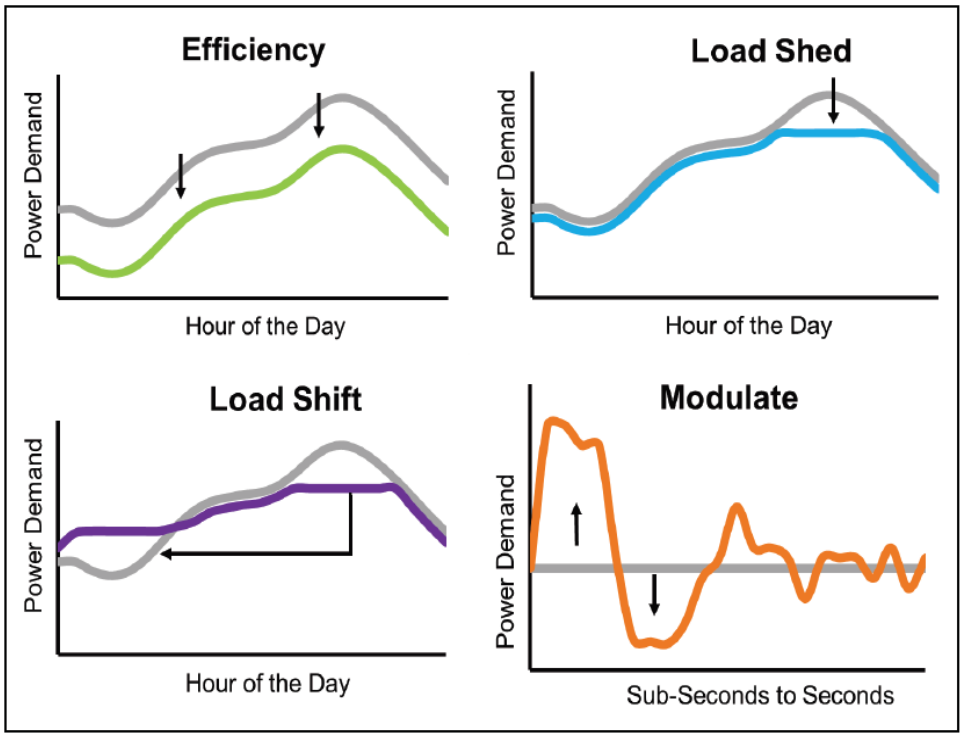
The Rocky Mountain Institute ("RMI") estimates that the demand flexibility available in buildings has the capability to reduce peak energy demand by 8% in the United States, avoiding $9 billion per year in utility capital investments. RMI also estimates that flexible buildings can supply an additional $4 billion per year in value to the electric grid by shifting energy usage to lower cost hours of the day and providing energy services back to the grid.[5]

[1] Dyson, Mark, James Mandel, et al. "The Economics of Demand Flexibility: How "flexiwatts" create quantifiable value for customer and the grid." Rocky Mountain Institute, August 2015.
[2] Lazar, Jim. Teach the "Duck" to Fly, 2nd Edition. Regulatory Assistance Project. February 2016.
[3] Energy Information Administration, Annual Energy Outlook 2018.
[4] Department of Energy, Buildings Technology Office "Grid-Interactive Efficient Buildings Factsheet." April 2019.
[5] Dyson, Mark, James Mandel, et al. "The Economics of Demand Flexibility: How "flexiwatts" create quantifiable value for customer and the grid." Rocky Mountain Institute, August 2015.

Building Demand Flexibility

According to the U.S. Department of Energy, there are four modes with which buildings can provide demand flexibility:[6]

1. **Efficiency:** the ongoing reduction in energy use while providing the same or improved level of building function.
2. **Load Shed:** the ability to reduce electricity use for a short time period and typically on short notice. Shedding is typically dispatched during peak demand periods and during emergencies.
3. **Load Shift:** the ability to change the timing of electricity use to minimize demand during peak periods or take advantage of the cheapest electricity prices. A shift may lead to using more electricity during the cheapest time period and using thermal or battery storage at another time period when electricity prices increase.
4. **Modulate:** the ability to balance power supply/demand or reactive power draw/supply autonomously (within seconds to sub-seconds) in response to a signal from the grid operator during the dispatch period.



Grid-integrated efficient buildings ("GEBs") can provide one or all of these services to the grid without affecting the comfort of building occupants or the functioning of the building. Energy efficiency is a key component of GEBs, as efficient buildings reduce the electricity consumed by the building during all hours of the year. In addition, efficient buildings may be more able to provide additional value to the grid by changing the timing of electricity usage. For example, many GEBs provide services to the grid through changing the timing and temperature set point of building cooling. A well-insulated, efficient building will maintain its temperature for a longer period during hot weather, providing a larger ability to shift the timing of energy usage relative to a poorly insulated building, without affecting the comfort

[6] U.S. Department of Energy, "Grid-Interactive Efficient Buildings Overview." April 2019.

of occupants.[7] Thus, efficient buildings have the ability to participate in longer-duration demand response (DR) events, creating more value to both the building owner and the electric grid.

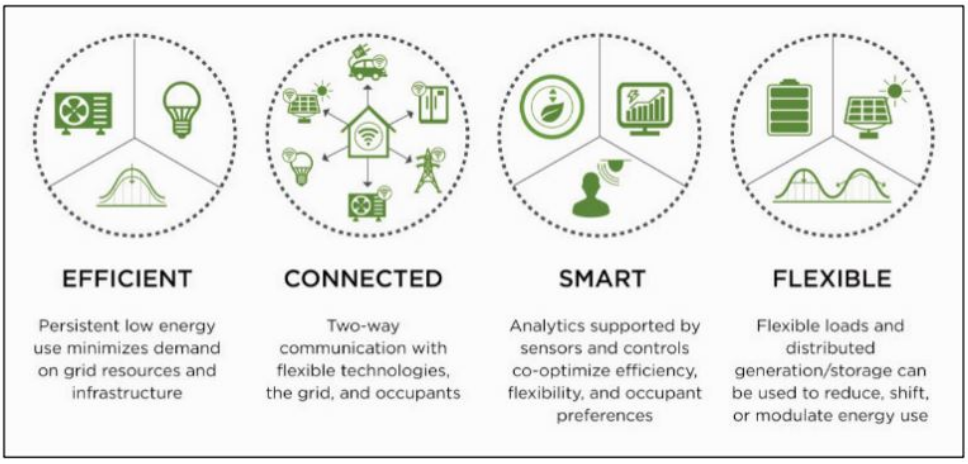
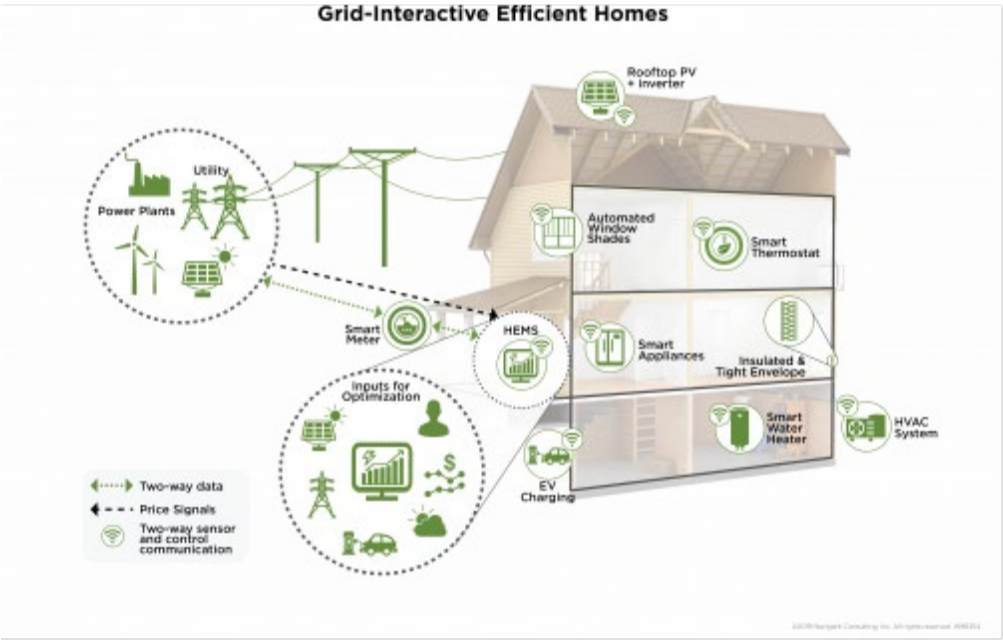


Figure 1. Characteristics of Grid-Interactive Efficient Buildings. Graphic: U.S. DOE

Buildings can provide additional value by changing the timing of load in response to grid signals by shedding, shifting, or modulating the load of the building. With its high and growing penetration of variable renewable generation, the Southwest states are at the forefront of efforts to utilize GEBs to help better control power demand and integrate high levels of renewable generation into the electric system at a reasonable cost.



This report provides a summary of the residential and small commercial grid-interactive building demand-side management (DSM) programs at the major utilities in the Southwest, highlighting existing programs in the region that are using grid-interactive buildings as a resource to help with the integration of variable renewable generation and to provide other grid services that create value for customers. [8] While not meant to be exhaustive, this report attempts to highlight programs that are at the forefront of utilizing GEBs to provide value to the grid.

[7] Comments of the Alliance to Save Energy. Request for Information DE-FOA-0002070: Efficient and Flexible Building Loads. March 1, 2019.
[8] Our analysis examines utilities in Colorado, Utah, New Mexico, Arizona, and Nevada.

II. LOAD SHEDDING PROGRAMS

Load shedding programs are rare in residential and small commercial DR programs, as the traditional HVAC program events that last for multiple hours end up with increased usage in the times outside of the demand response event. Some residential HVAC programs are also now pre-cooling homes prior to DR events. The result is that most HVAC programs are shifting usage to either before or after times of peak demand instead of shedding load.

However, Rocky Mountain Power in Utah has recently begun using its air conditioning load control program, called Cool Keeper, to provide load shedding as a contingency reserve resource. Contingency reserves provide support to the whole electric grid during emergencies or other unexpected events on the bulk power system. Most utilities currently use fossil fuel generating resources to provide contingency reserves.

Rocky Mountain Power's contingency events are usually short-lived, lasting less than 5 minutes. With its Cool Keeper program, the company has approximately 200 MW of air conditioning load under control in approximately 108,000 residential, multifamily, small commercial, and low-income premises.[9] The HVAC systems are controlled by switches, which cycle the units at the company's signal. The company's switches can be activated in less than one minute, with the ability to create a near instantaneous drop in load throughout its system with full activation. In addition, with short events of 5-10 minutes customers do not notice a difference during events, as the air conditioner's coils will remain cool and the fan will continue to run, circulating cool air throughout the building. The use of shorter DR events has enabled Rocky Mountain Power to significantly increase the amount of demand it curtails, compared to what it achieved with long event periods during which AC units were shut off for only a portion of each hour, while also calling more events per year than it has in the past. As shown in table 1, Rocky Mountain Power was able to reduce 201 MW of the 239 MW enrolled in the Cool Keeper program during one demand response event in 2018.[10] In previous years the company usually saw maximum reductions of half of the enrolled demand as it cycled units off and on during load control events.

Table 1. 2018 Rocky Mountain Power Cool Keeper Load Events. Source: Utah Energy Efficiency and Peak Reduction Annual Report. January 1, 2018 - December 31, 2018

Date	Event	Event Times	Estimated Load Reduction - Utah at Gen (MW)
June 4, 2018	1	5:33PM-5:45PM	144
June 6, 2018	2	2:24PM-2:29PM	71
June 27, 2018	3	3:58PM-4:28PM	142
June 27, 2018	4	4:47PM-4:53PM	66
June 28, 2018	5	2:53PM- 3:29PM	159
July 18, 2018	6	5:09PM-5:14PM	192
July 18, 2018	7	6:30PM-6:35PM	201

[9] Interview with Shawn Grant, Rocky Mountain Power. May 2, 2019. shawn.grant@pacificorp.com
[10] Rocky Mountain Power. Utah Energy Efficiency and Peak Reduction Annual Report: January 1, 2018-December 31, 2018.

In addition, by shifting to this new model of load control in 2018 Rocky Mountain has substantially increased the benefits to customers. Figure 2 shows net benefits from demand response programs in the Rocky Mountain Power service territory over the past four years.[11] In 2018, net benefits from load control programs increased substantially to almost $120 million due to the increase in demand reductions available from curtailment of the whole demand response fleet and value from providing new services. In evaluating new technologies, such as smart thermostats, to incorporate into its Cool Keeper program, Rocky Mountain Power found that other technologies could not provide the fast-acting resource enabled by utility-controlled switches. The fast-acting nature of this resource is essential to allow the resource to provide contingency reserves. Thus, the company continues to exclusively operate its Cool Keep Program using utility-controlled switches and chose not to add smart thermostats to its program at this time.

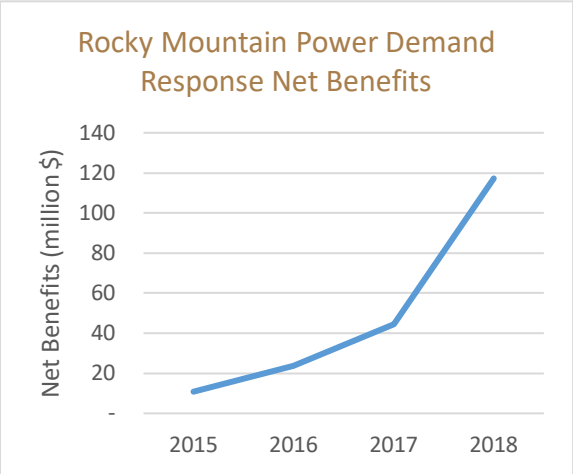


Figure 2. Net Benefits from Rocky Mountain Power load control programs

Fort Collins Utilities, a municipal utility in northern Colorado, has also recently begun utilizing a load shedding program to assist with the integration of variable renewable resources, in addition to a capacity focused DSM program described in more detail in Section III, below. Over the past few months there have been several events in the Fort Collins service territory where renewable energy has quickly dropped off the system, such as when cloud cover comes through limiting solar generation. During these events, the company can call 2.5-3 MW of load reductions for 10-15 minutes until the renewable resource comes back online. Fort Collins Utilities manually called a few such events in 2018 to test the response of the resource. Based on an analysis of historical data, the company estimates that it would have called 60 such events in 2018.[12] Fort Collins Utilities plans to automate this functionality in the future with the expectation that the automated system will use demand response for load shedding more often.

III. LOAD SHIFTING PROGRAMS

Many utilities in the Southwest run load shifting DR programs. Often these programs utilize smart thermostats or air conditioning switches to allow the company to change the set point on thermostats or cycle air conditioning units for a certain period. In these programs, the utilities are often shifting usage from times of peak demand on the hottest summer days; however utilities in the region have been exploring using load shifting to provide other services to the electric grid. The new services utilities are exploring include smoothing the ramp associated with the loss of renewable energy generation when the sun goes down and helping to stabilize the electric grid during times when generating resources are down for maintenance.

For example, Public Service of New Mexico runs both a residential and small commercial air conditioning switch program, as well as a smart thermostat program. In each of these programs, the company either cycles the customer's air conditioner using a switch or changes the thermostat

[11] Source: Tables 1, 2, and 14 from the 2016-2018 Rocky Mountain Power Annual DSM Reports.
[12] Interview with Pablo Bauleo, Fort Collins Utilities, July 16, 2019. pbauleo@fcgov.com

temperature setting. Events last four hours, usually from 4-8 p.m. on weekday afternoons when load is highest.

Similarly, Xcel Energy Colorado also runs both an air conditioner switch program and a bring-your-own smart thermostat DR program. For the switch program, the company runs events for four hours on weekday evenings, cycling a customer's air conditioner on and off in 15-minute intervals. With the smart thermostats, the company changes the customer set point during peak load events. The company has been experimenting with the timing and length of smart thermostat events to better understand the number of customers opting out of specific events. The company is also experimenting with pre-cooling prior to events in certain homes during the summer of 2019.[13] With pre-cooling, the company would automatically pre-cool the home prior to the DR event with the expectation that homes would remain more comfortable and fewer customers would manually override the temperature setback during longer events.

NV Energy Residential Powershift 2018 Program Highlights

Number of Connected devices: 125,188
Verified capacity reduction (kw): 183,377
Verified Energy savings (kwh): 22,193,325
Number of DR Events: 43

NV Energy also runs a large and successful residential and small commercial smart thermostat program. Under the PowerShift label, NV Energy will install a smart thermostat in a customer's home at no cost. In 2018, the program included over 114,000 devices in over 78,000 homes in the Nevada Power Company service territory in southern Nevada and an additional 11,000 devices in the company's Sierra Pacific territory in northern Nevada.[14] Combined, the residential devices provided over 184 MW in demand reductions in 2018.[15] During the summer months participants give NV Energy permission to change the thermostat set-point by four degrees over a two hour period. Homes are pre-cooled prior to events and thermostats are cycled sequentially to avoid a large spike in usage once the event ends.

In 2018, the company called 43 residential DR events in southern Nevada, with events beginning at either at 3:30 or 4:00 p.m. Customers receive a rebate based on the verified demand reduction during each event and the incremental cost of generation during the event. For small commercial customers, NV Energy uses smart thermostats, as well as demand limiting devices that can coordinate energy usage among a number of roof-top units to reduce coincident facility demand, with an additional 10,000 commercial devices enrolled in the program. The commercial devices provided an additional 21 MW of demand reductions in 2018.[16]

In addition to demand reductions, NV Energy also takes credit for the energy savings from its smart thermostats and other DR devices. Energy savings include those during demand response events as well as savings throughout the year from energy optimization provided by the smart thermostats. In 2018, NV Energy's customers saved over 22,000 MWh of electricity consumption from the smart thermostats and other DR devices. NV Energy currently uses two brands of smart thermostats that are installed by the company. The company has piloted an additional bring-your-own-thermostat program and plans to roll it out as a program offering with additional vendors in the next few years.

[13] Interview with Patrik Ronnings, Xcel Energy, May 17, 2019. Patrik.ronnings@xcelenergy.com
[14] The majority of devices are smart thermostats with some legacy A/C switches still on the system.
[15] ADM, Commercial Demand Response NV Energy, Measurement & Verification Report – Program Year 2018.
[16] ADM, Commercial Demand Response NV Energy, Measurement & Verification Report – Program Year 2018.

Fort Collins Utilities, a municipal utility serving approximately 165,000 customers in Colorado, has run a successful electric hot water heater and thermostat DR program for many years. Fort Collins currently has approximately 1,500 thermostats and 2,000 controllable water heaters in homes.[17] The thermostat program shifts demand outside of peak times during the hottest days of the year by cycling customers' air conditioners or heat pumps for between 2-4 hours. Fort Collins has installed thermostats in customers' homes, though it recently added a bring-your-own thermostat program option as well.

The water heater program works to shift usage out of peak times every day. Customers can choose from three participation levels where the utility completely shuts off the water heater for either the last hour of peak prices, the last 2.5 hours of peak, or the full five hours of peak. Given the storage capacity of water heaters, most customers do not notice a difference in the availability of hot water and save money by switching usage out of the peak demand pricing period in conjunction with the utilities' time-of-use pricing which is now the default residential rate.

Other utilities in the region are beginning to pilot newer load shifting technologies as part of their DR programs. Xcel Energy Colorado is beginning a residential managed electric vehicle charging pilot and residential battery demand response pilot in 2019.[18] While the details of the pilots are still being finalized, Xcel Energy Colorado plans to use these load shifting technologies to provide a number of different services and value to the electric grid.

For the battery demand response pilot, the company plans to test three use cases. The first is peak load reduction, where batteries are charged during off-peak hours and discharged to reduce system peak load. The second is controlled charging, which attempts to minimize total utility costs by charging during times of low energy costs and discharging at higher cost times, such as during large ramping events and at system peak. Finally, Xcel Energy Colorado plans to test using batteries to relieve distribution system constraints in areas with high penetration of residential solar generation. On feeders with a lot of solar generation, batteries would be charged mid-day when solar generation is high and discharged during the evening ramp. This use case could be especially valuable during the spring and fall, when solar generation is relatively high and load is lower as it may allow additional solar generation on feeders and reduce problems on the distribution system caused by solar production exceeding electricity usage on a feeder.

For the smart electric vehicle charging pilot, Xcel Energy Colorado is primarily planning to shift vehicle charging to the lowest cost hours in the middle of the night. For this use case, charging would begin at 1-2 am, instead of when a vehicle arrives home, often during peak times. The company also plans to test the ability of electric vehicles to avoid curtailing utility-scale wind generation. Currently, the company has up to 30 events per year when it must curtail wind generation as load is below that of baseload generation plants that cannot be easily turned off and on. During these events, the company may change the time of vehicle charging to correspond to renewable curtailment events in an effort to minimize the level of curtailment.

Arizona Public Service ("APS") is also piloting residential battery demand response and residential water heater demand response programs, in addition to its smart thermostat AC control program. For the residential battery pilot, the company is installing up to 40 batteries behind-the-meter in residential premises that will be owned and operated by APS. The company is targeting batteries to certain areas that will provide the most value to the electric grid, such as feeders with high solar

[17] Phone Interview, Pablo Bauleo, Fort Collins Utilities, July 16, 2019. pbauleo@fcgov.com
[18] Xcel Energy Colorado, 2019/2020 Demand-Side Management Plan. April 18, 2019.

penetration or that are nearing capacity of transformers or other equipment. APS plans to charge batteries at times of low-cost energy, usually during the middle of the day when solar generation is high. Batteries would then be discharged during the evening ramp or at peak times. To participate in this program, customers must be on a rate with a demand charge, with much of the customer savings coming through reduced usage during the peak hour that drives customer bills under such a rate plan.

APS is also beginning a residential heat pump water heater pilot. In this program, the company plans to install up to 200 heat pump water heaters with utility control capability in homes at no cost to the customer. Once installed the customer will own the water heater. Again, eligible customers must be in certain areas where the heat pumps can provide the maximum value to the electric grid. The company plans to use the thermal energy storage in the water heaters by heating water mid-day when solar generation is high and not allowing the heat pump to operate during the evening ramp or at peak times. Similar to the battery program, customers must be on either time-of-use rates or residential demand charge-based rates to qualify for the pilot. Along with the energy savings from having an efficient water heater, the value to the customer will be enhanced by optimizing energy usage to reduce bills under such a rate plan.

IV. LOAD MODULATING PROGRAMS

Load modulating programs are also in their infancy, especially in the residential and small commercial sectors. Load modulation involves using load dynamically to adjust demand on the electric system. To provide modulating services, such as frequency response and regulation, a resource must be able to respond within seconds to minutes and be able to shift load both up and down.

Frequency response is primarily used to help return the electric grid to normal operations following a major outage or other contingency event. According to NERC requirements, frequency response resources must immediately respond when called and be fully active within 50 seconds of event detection.

Beginning in 2018, Rocky Mountain Power began using its Cool Keeper program to provide frequency response services.[19] As discussed above, the utility-controlled air conditioning switches respond immediately, and the company has demonstrated that the resource can respond to very detailed utility requirements. Similar to the load shedding program described above, the frequency regulation events generally last for a short duration and have no impact on the comfort of customers. Using the Cool Keeper program to provide this grid service means the company does not need to utilize existing fossil fuel resources to provide the service. This may be especially important in the future, when the grid is powered by higher levels of renewable resources that are less able to offer frequency response.

Other utilities in the region are considering the ability of residential and small commercial batteries to provide load modulating services, such as frequency regulation. However, the Cool Keeper program is currently the only such program operating in the Southwest, and one of the few, if not the only residential DR program provide frequency regulation services in the entire United States.

V. GEO-TARGETING

Another way in which utilities in the Southwest are deriving value from residential and small commercial GEBs is through geo-targeting of DR programs. Under geo-targeting, a utility seeks to avoid

[19] Interview with Shawn Grant, Rocky Mountain Power, May 2, 2019. shawn.grant@pacificorp.com

or delay investments on localized areas of its distribution or transmission system through the deployment of distributed energy resources, including energy efficiency and demand response.

Xcel Energy Colorado will implement a geo-targeting pilot as part of its 2019-2020 DSM Plan. In this pilot, the company plans to defer the need for investment in a new distribution transformer and associated feeder upgrades through targeted deployment of energy efficiency and demand response.[20] On the feeder in question, the company projects the need for both a new transformer and feeder in 2023, at a cost of $10.1 million, due to load growth in this localized area. The company estimates it will need 3 MW of load reduction by 2026 to avoid the need for the transformer. To defer this investment, energy efficiency and DR will be used to keep feeder peak load below the current thermal limit of the distribution system. In addition to targeted energy efficiency in this area, the company plans to use its existing air conditioning switches to provide peak load reduction at times of feeder peak, dispatching resources only within the area in question instead of throughout its service territory. The company currently has about 1 MW of demand response capacity installed in this area through air conditioning switches. Xcel will test calling those resources based on local conditions during the summer of 2019 in order to gather data on performance.[21]

Similarly, NV Energy is proposing to use geo-targeted energy efficiency, demand response, and utility-scale battery storage to defer installing a second transformer at one of its substations. The second transformer would cost $2.3 million to install.[22] Under projected load growth, the company projects that the existing transformer will exceed its thermal limits in 2021. As part of the project, the company plans to utilize the 1.2 MW of residential HVAC DR capabilities already installed on the feeder. The company plans to test its ability to use its localized DR resource during the summer of 2019. This resource is large enough that it should allow the company to defer both the need for the transformer and any battery storage until at least 2023, giving the company additional time to update its load forecast and test procurement of targeted energy efficiency and additional DR measures in this area.

VI. CONCLUSIONS

Electric utilities in the Southwest have a long history of utility-sponsored DSM programs, including those that include residential and small commercial GEBs. However, over the past few years these programs have evolved beyond air conditioner load control programs that aim to reduce system peak load at times of very high demand. Utilities are using load shifting programs that target new technologies, such as battery storage and hot water heaters. In addition, the load shifting programs are evolving to not only target peak demand reduction, but also help integrate renewable energy by increasing load at times when renewable generation is high and reducing load when solar production comes offline in the evenings. Utilities are also starting to target programs to localized areas on its system with capacity constraints or high penetration of renewable generation.

In addition, Rocky Mountain Power has begun to use its residential Cool Keeper program to shed load during contingency events and provide frequency response services to the grid, based on load control events that typically last 10 minutes or less. The fast-acting Rocky Mountain Power resource is providing value to the grid for services that are traditionally provided by fossil fuel generating resources. This helps to reduce greenhouse gas emissions, while also helping the company maximize the value it can create for all customers from investments it has already made in DR resources. This

[20] Xcel Colorado, 2019-2020 Demand-Side Management Plan, pg. 290-291.
[21] Interview with Eric Maurer, Xcel Energy, May 14, 2019. eric.l.maurer@xcelenergy.com
[22] PUCN Docket Number 19-04003. Distributed Resource Plan, Attachment D, pg. 31.

new approach to peak demand reduction is providing much greater value to the utility and its customers, compared to the traditional way in which AC load control switches were used.

As generation from variable renewable resources increases, the challenges facing grid operators will only increase. The innovative programs highlighted in this report show how utilities in the Southwest are beginning to utilize grid-integrated appliances and other devices to facilitate grid modernization and minimize costs, as well as reduce greenhouse gas emissions. While many of these initiatives are just getting off the ground, they show much promise and should be carefully monitored and analyzed.

VII. APPENDIX: DETAILED UTILITY PROGRAM INFORMATION

Utility Name	Xcel Energy Colorado
Program Summary	Xcel Energy Colorado launched its residential air conditioning switch program, known as the Saver Switch, in 2000. The company now estimates it has switches installed in approximately 50% of the single-family homes in its service territory. The Saver Switches operate via the paging network. When the company calls events, the switches cycling each air conditioner on and off in 15-minute intervals. The AC Rewards program is a bring-your-own thermostat program available to owners of Ecobee and Honeywell thermostats with central air conditioners that began in 2017. The program works by adjusting the temperature set point of the thermostat during peak events. The company is also planning to pilot residential battery storage and managed electric vehicle charging, but the details of both programs are still under development
Sectors Covered	Single-family residential
Number of Devices	200,000 switches and 4,000 smart thermostats
Event Details	Events are traditionally four hours in length from 2-6 or 4-7 on weekday afternoons. The company is experimenting with shorter duration events in its AC Rewards program.
Incentive Level	Saver Switch: $40 per year of participation AC Rewards: $75 at enrollment, $25 per year of participation
Planned Program Enhancements	Xcel is planning to expand the AC Rewards program to additional thermostat manufacturers and models over next 1-2 years. The company is also looking to update the Saver Switches to work via the smart meter communications network once it is installed in its service territory. The company is also testing precooling in employee homes with AC Rewards during summer of 2019.
Additional Resources	https://www.xcelenergy.com/programs_and_rebates/residential_programs_and_rebates/heating_and_cooling

Utility Name	Rocky Mountain Power
Program Summary	Rocky Mountain Power's Cool Keeper program is available to all residential and small commercial customers with central air conditioning in the Wasatch front. The program is not available in rural parts of the company's service territory due to the lack of communications infrastructure. The switches cycle air conditioners on and off in approximately 15 minute intervals. In addition to capacity resources, Rocky Mountain Power has begun to use the Cool Keeper program to provide contingency reserves and frequency regulation.
Sectors Covered	Residential and small commercial customers
Number of Devices	108,000
Event Details	Events can last up to four hours each between 2-9 p.m. on weekdays between May 1 and September 30. In 2018, no event lasted for more than 36 minutes
Incentive Level	$30 per year
Planned Program Enhancements	Rocky Mountain Power recently updated the tariff for the program to provide the opportunity to add additional technologies. The company is assessing the ability of lighting and commercial refrigeration to participate, but it has no current plans to expand the program.
Additional Resources	https://www.rockymountainpower.net/coolkeeper

Utility Name	Public Service of New Mexico
Program Summary	The PNM Power Saver program runs using either a utility-controlled air conditioning switch or a utility-installed smart thermostat. The program is available to all residential and small commercial customers with central air conditioning or a central heat pump. During events, the switches run air conditioning units at 50% of the prior hours' operating time. The thermostats change the temperature setting on the customer's thermostat. The program is generally used to provide peak load reduction; however, the company has begun to utilize the resource to help minimize the ramp associated reduced solar generation or to help during emergency events when a transmission line or generator come offline.
Sectors Covered	Residential and small commercial customers with demand less than 50kW
Number of Devices	39,000 switches and 100 thermostats
Event Details	Events can last up to four hours each between 1-8 p.m. on weekdays between June 1 and September 30. In 2018 all events ran for four hours from 3-7 or 4-8 p.m.
Incentive Level	$25 at signup and $25 per year
Planned Program Enhancements	Plan to offer a bring-your-own thermostat program beginning in the fall of 2019.
Additional Resources	https://www.pnmpowersaver.com/overview/

Utility Name	Arizona Public Service
Program Summary	The Cool Rewards program began in 2018. It is a bring-your-own smart thermostat program. The program works by changing the thermostat temperature by 2-3 degrees and includes precooling prior to the event. The Storage Rewards programs is looking to install up to 40 behind-the-meter batteries at residences in targeted areas of the company's service territory that have high solar production or on feeders that are facing capacity constraints. The company would own and operate the batteries. Customers must be on a rate with a demand charge to qualify. The batteries are charged mid-day when solar production is high and discharged during peak demand or the evening ramp. The Reserve Rewards program is looking to install up to 200 heat pump water heaters in residences that already have electric water heating in targeted areas of the company's service territory that have high solar production or on feeders that are facing capacity constraints. Customers must be on a time-of-use rate or a rate with a demand charge to qualify. The company will control water heating to use energy in the afternoons when solar production is high, while reducing energy usage during the evening ramp or at times of peak demand.
Sectors Covered	Residential
Number of Devices	6,000 thermostats
Event Details	Cool Rewards events can last up to two hours each on weekdays between June 1 and September 30. The average event time is 2 hours.
Incentive Level	Cool Rewards: $25 at signup and $25 per year of participation Storage Rewards: $500 at signup Reserve Rewards: Heat Pump Water Heater at no cost to customer (up to $6,000 value)
Planned Program Enhancements	The company is exploring expanding to other technologies such as smart invertors and managed electric vehicle charging. In addition, the Storage Rewards and Reserve Rewards program could expand depending on the results of the pilot program.
Additional Resources	https://www.aps.com/en/residential/renewableenergy/typesofsolar/Pages/coolrewards.aspx https://www.aps.com/en/residential/savemoneyandenergy/your-options/Pages/storage-rewards.aspx https://www.aps.com/en/residential/savemoneyandenergy/your-options/Pages/reserve-rewards.aspx

Utility Name	NV Energy
Program Summary	NV Energy has been running residential and small commercial demand response programs since 2001. The current PowerShift offering began in 2016. The company installs smart thermostats in customers' home and businesses. On event days, 2 hour demand response events are phased across the fleet of thermostats, so events last approximately 3 hours and 10 minutes. Immediately before an event each home is pre-cooled by a few degrees. During an event the company increases the set point by four degrees. In the summer of 2019 NV Energy also began using its PowerShift program to alleviate local distribution constraints. NV Energy has also begun piloting company control of behind-the-meter battery storage devices.
Sectors Covered	Residential and Small Commercial
Number of Devices	125,000 residential thermostats 8,700 small commercial thermostats and Demand Limiting Control
Event Details	Community events can last up to six hours each on weekdays between June 1 and September 30. The average event time is 2 hours.
Incentive Level	Free installation of a smart thermostat and an event specific incentive based on verified energy reductions and the marginal cost of electricity avoided.
Planned Program Enhancements	The company is expanding its geo-targeting program and battery storage pilot
Additional Resources	https://www.nvenergy.com/save-with-powershift/smart-thermostat

Utility Name	Fort Collins Utilities (Colorado)
Program Summary	Fort Collins Utilities runs the Peak Partner program where the utility will either install a smart web-programmable thermostat or water heater control switch in a customer's home at no cost to the customer. For the thermostat program the utility cycles the customer's HVAC system at 50% of its maximum output during conservation events. The company also began a bring-your-own-thermostat program with Honeywell and Nest in 2019. For the water heater program customers can choose between three levels of participation where the company turns the water heater off at peak times every day. Given the size and storage potential, most customers should not see an impact on water availability. Participation includes cycling water heater for either one hour, 2.5 hours, or 5 hours.
Sectors Covered	Residential
Number of Devices	1,500 thermostats 2,000 connected water heaters
Event Details	Community events can last up to 4 hours each on weekdays between May 1 and September 30. The average event time is 2-4 hours.
Incentive Level	Free installation of a smart thermostat or hot water heater switch.
Planned Program Enhancements	The company is working to begin a battery storage pilot and add electric vehicle charging infrastructure to its demand response portfolio.
Additional Resources	https://www.peakpartnersfortcollins.com/overview