

# **Ensuring Real MWs from Your C&I Demand Response Participants**

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## **ABSTRACT**

Both utility program managers trying to roll out new demand-response (DR) programs for commercial and industrial (C&I) customers and program managers seeking to increase active participation can speed up the implementation process by identifying the best candidates for DR programs. Enlisting C&I customers in utility DR programs is just the first challenge in running an effective program—it's also necessary to get program participants to take action during a curtailment event. Knowing which sectors to target for these programs can help accelerate the enrollment process, and understanding which DR measures to adopt in specific sectors will facilitate actual demand response. This paper will offer tips for recruiting C&I participants for DR programs and provide suggestions for DR approaches in various C&I sectors.

## **Introduction**

In an effort to rely on the MW from a demand response program, the utility program manager has to do a lot of homework to find the right candidates for a program and then to help their customers shed load when an event is called. The first step is to understand the characteristics of businesses that are likely to participate in demand response programs. Each business type faces a delicate balance of incorporating DR approaches that will provide savings without negatively affecting its businesses. If you can be sympathetic to those challenges and provide suggestions for participation, the customer will appreciate it.

Many commercial, agricultural, industrial, and institutional end users aren't aware of what actions they should take when a utility calls upon them for demand response. Once you have customers enrolled in a program, it will be up to you to explain to them how they can participate in demand response events, what equipment they will need, and help them estimate their bill savings.

These two crucial steps can not only help ensure real MW reductions from your C&I DR program, but also provide excellent service to your customers.

## **Targeting the Right Facilities**

Half of the battle in signing up C&I customers for demand response is spending time only on fruitful efforts and the key is not wasting time on the ones that aren't. Not every customer will be a good candidate for DR. Targeting the right customers for DR programs ensures efficiency in marketing as well as consistent, reliable load relief throughout the life of the programs.

Across different business sectors, E Source research has shown that utilities should look for customers that have one or more of the characteristics below. You can find out these characteristics by

looking through utility records, doing some online research, conducting an interview with a representative from your customer's company, and from walking through the facility.

### **Utility Records and Other Research**

Looking through utility records and seeking some information about specific companies can be a valuable exercise in seeking appropriate candidates. Don't forget to work closely with the key account managers at your utility too! Here are some criteria to seek out.

***Previously participated in energy efficiency.*** A facility manager that understands utility involvement with energy efficiency and knows that there are programs available can be a big ally for getting internal support. This is especially true if they have participated in any type of energy efficiency offering, and specifically other DR-like programs, such as interruptible tariffs, demand bidding, or various dynamic pricing schemes.

***Industry leaders in energy or environmental programs.*** Some large companies have made a public commitment to sustainability and those would be good targets for your programs. There are numerous online sources for finding which companies to add to your list; here are a few for finding companies in your service territory:

- [The Global 100](#)
- [Environmental Leader](#)
- [Newsweek Green Rankings](#)

### **Interview With End-User**

Before you sign customers up for a program, it is a good idea to conduct an interview with a representative of the company. This interview helps the company understand what they should do and helps the utility ensure DR program candidacy. Here are a few items to attempt to discover during the interview process.

***Have an energy manager or individual dedicated to energy management.*** Energy management isn't the top of mind issue for most business owners or employees, but if there is someone that takes is responsible for energy management then they are more likely to have the inclination to participate in a DR program.

***Understand and actively manage the facility.*** If someone at the facility understands the facility's energy use and load profile, then that really sell participation in a demand response program. In addition, that person will be used to implementing various control strategies for energy management.

***Excess production capacity.*** Industrial customers can earn significant incentives to shut down and if they have extra supply on hand then they won't even lose out on revenue. Similarly, if they have product storage capabilities and/or they can shift production to other regions outside of the utility service area.

***Operational flexibility.*** If some facilities have enough advance notification of a DR event they could change the hours of operation during a curtailment day.

***Local ownership or national DR program.*** Many national account facilities don't have the authority to make decisions about matters like enrolling in DR programs. The exceptions would be if they are locally owned and/or managed. Some national accounts do have a national DR presence and the corporation has made a commitment to participating in programs wherever they are offered.

Chain retail stores, in particular, can provide utilities with significant aggregate load reduction if a number of stores in the chain participate in the program. Working with a single corporate-wide facility manager can also simplify DR contracts.

***Need the revenue created from DR programs.*** With their high incentive structures, DR programs can provide businesses with extra cash. This is especially important with industrial customers; in some cases they can make more money by shutting down and getting paid by the utility to curtail than they could producing their standard goods.

### **Facility Walk-Through**

Take a walk around the facility to look for things that can be shut off or turned down. Here are some things to look for.

***Large loads to curtail.*** Knowing which end-uses contribute to the peak, and consume the most amount of energy, in a facility, will help direct which loads should be controlled. This is both at the individual facility level and in aggregate.

***Non-essential loads.*** One easy target for quick demand response reductions is turning off non-essential loads because this won't impact customer or employee comfort. This includes decorative lighting, signage, fountains, etc.

***Fuel switching or energy storage options.*** Some buildings have both electric and gas equipment that the facility manager or plan operator switches between depending on the price of fuel. One example is a gas chiller. This type of equipment can also be used for DR program participation.

***Utilize an energy management system.*** Utilities should target buildings that have an existing energy management system, also known as a building control system or building automation system, that controls most of the HVAC equipment or processes. Having the system makes it much easier to participate in DR events because the system can be programmed to either automatically respond to signals from the utility, or to have a setting for a curtailment event.

***Have backup generators.*** Many end-users want to participate in DR programs by using their backup generation because there will be minimal interruptions to the business day. However in some areas end-users are not allowed to use their generators for DR due to environmental regulations. This is the cases with Austin Energy, for example.

## **Which Sectors Match Those Characteristics?**

Here are some of the characteristics unique to each sector

***Schools.*** Especially if demand is aggregated across a district, schools can contribute substantial load reductions through HVAC, lighting, and plug-load strategies. Students and staff can be included in DR programs to make the most of the educational opportunities these activities provide. Your first reaction might be to think schools aren't good candidates for DR b/c they aren't in session in summer when most utilities need load relief. Or even if it is hot during the school year, there's not much to curtail during peak times. Many schools are used after hours and for summer school and they are back in session when there are still several months of the cooling season left. Schools also make great participants for winter morning

peak reduction. Schools may not provide as much load relief as other sectors—35-55 kW per curtailment per school. As the Auto-DR program in California has experienced, the best idea is to aggregate schools across the district.

**Office Buildings.** Some office building owners and managers participate in DR programs to reduce operating expenses for their tenants. This makes their office space more attractive for leasing and ultimately improves the profitability of all parties involved. Offices are good candidates for DR summer programs because they are guaranteed to have coincident peaks with the utility. However, it is tough to estimate savings from DR for offices because of the size differences of offices.

**Warehouses.** Warehouses are good candidates for DR because you don't have to worry about occupant comfort. In addition, participating in DR really won't impact operations too much. In a warehouse the integrity of the goods is more important. Warehouses are attracted to the utility incentives because they compete for business mostly based on price. Energy can be 10% of revenue for warehouses and that percentage is increasing as more services, such as inventory tracking, are offered. Warehouses can reduce their peak loads from 3 to about 30 percent by using various DR strategies.

**Manufacturing Facilities.** Manufacturing facilities can reap some of the biggest DR benefits of any C&I sector if operational flexibility is an option. Grid reliability is the main motivator for manufacturing facilities to participate. DR helps keep the lights on! Incentive payments are also a big motivator. Sometimes industrial plants can make more money by shutting down—due to the utility incentive—than to produce more goods.

**Retail.** Retail establishments are prime targets for DR because the majority of the occupants—visiting customers—will not be in the store for the entire duration of the event. Typically, customers may only be in the store for up to 30 minutes so they won't be uncomfortable. If the retail establishments is worried about customer comfort—program facilitators recommend providing information to customers to help them understand and support the programs' social and environmental benefits. Stores can inform customers by announcing events over the public address system and posting signs around the store that explain the benefits of the program. Many stores even market their participation as a green initiative, which may boost their image with customers and reduce customer complaints.

**Groceries.** Grocery stores are at a slight disadvantage when participating in DR events compared to other commercial sectors because their largest potential electric peak load available to reduce is refrigeration, and if you alter refrigeration you could risk destroying the products in the store. Grocery stores need to maintain proper temperatures to preserve their product. However, grocery stores have been able to implement some refrigeration methods as well as enough other strategies to make them viable candidates for DR.

**Hotels and Motels.** Hotels and motels make great targets for C&I DR programs because owners often strive for a “green” image to boost their position in the marketplace. The green image can boost profits when hotels advertise their space to event organizers looking for environmentally minded venues to host the event. Additionally, because the hotel industry is highly competitive, owners are always looking for ways to reduce operating costs. Incentive payments for participating in a DR program can offset some of these costs and make a positive difference in hotel operations even when there's no DR event taking place.

**Hospitals.** Hospitals can participate in DR programs without adversely affecting their critical loads, which include medical equipment. Hospitals are generally large facilities offering around-the-clock operation and significant load shedding potential, which makes them reliable candidates for DR programs. The large non-critical care areas of hospitals make them great candidates for DR. Because the hospital industry tends to be underfunded, hospitals are primarily motivated by the financial incentives offered through DR program participation. On hot summer afternoons, hospital cooling loads and lighting systems will be operating at full capacity and will coincide with utility peaks. As a result, a hospital will typically be able to reduce loads by 10 to 15 percent during DR events.

## Developing an Action Plan

Once the utility makes the connection and establishes that the facility will be a good candidate, then conducts an interview and does a walk-through, it is important to help that facility manager understand what it is they can do to curtail load during a demand response event. Many end-users don't understand what loads in their facilities actually contribute to demand, let alone know what end-uses to curtail. It may be as simple as the utility representative showing the facility manager their load profile, however E Source recommends going the extra mile to develop a detailed action plan. This will provide an excellent service to the customer, help them secure their full incentive for DR participation, and ensure MW for the utility.

Customers in the C&I sectors we've research employ a unique combination of strategies to participate in demand response events. Some of the most common actions include: turning down or adjusting settings of lighting or HVAC systems; temporarily curtailing or rescheduling manufacturing processes, shutting off decorative fountains or display lights; and shifting loads onto backup generation. A building automation system (BAS) can automate these strategies. This makes it easier for the facility manager because they can rely on the BAS to apply the lower-power building mode instead of having to manually walk around and turn things off or down.

We've tried to provide estimates of the amount of load you could expect from each sector if the customers were to take the actions we've outlined. However, the exact load drops depend on many factors, including climate, building size, equipment type, scheduled production and supply schedules, and the rules of a given DR program—such as whether backup generation can be used.

There is a delicate balance between curtailing significant loads in a facility and making sure demand response isn't negatively affecting these businesses. The actions we outline below are strategies that different sectors have employed successfully in demand response programs across the U.S. We describe those actions as recommendations for what that sector should include in an action plan for DR. We've intentionally left out shifting to backup generation since it is restricted in so many geographic areas.

**Schools.** The biggest energy users in a school are heating, lighting, cooling, and office equipment. Indoor air quality is really important in a school because those environmental conditions can affect students' learning. It is important to remind the facility manager to not affect ventilation as a curtailment strategy.

To participate in DR, schools typically take the following actions:

- Turn off lights in unused areas such as gyms, cafeteria, hallways, and bathrooms. Assign an energy monitor for each grade to make sure the lights are turned off.
- One option for HVAC is to change the thermostat setting for minimal use after school hours. Also, in many cases, schools can raise temperature setpoints on chillers and slow pump and fan systems as much as possible while still providing adequate cooling and ventilation. This strategy must be

used carefully because other equipment within the chilled-water system may begin to work harder to compensate for the chiller's higher setpoint. However, this approach requires more work from a facility manager and isn't feasible for schools that lack such a resource.

- Precooling. Schools with air conditioning can pursue precooling, in which the facility is overcooled in advance of a DR event—during the early morning in most cases. A school's thermal mass then helps store the cooling energy, which is slowly released throughout the day, and temperature settings can be set higher through the afternoon peak. Schools are excellent candidates for this strategy because their thick walls have good thermal mass.

**Office Buildings.** The largest end-uses in offices are HVAC, office equipment, lighting. Strategies to reduce peak load are:

- HVAC—with enough notice, the building operator can warn occupants to dress appropriately. Without advance notice, studies have shown occupants can tolerate a 1-2 degree rise over a 4 hour period.
  - Raise chiller setpoint but leave ventilation on. In this case the occupants might not even realize an event is occurring.
  - Reduce fan speed if the facility has a variable frequency drive.
  - Precool the office early in the morning and then let the temperature drift up over the course of the day.
- Lighting—turn off lights in special-purpose rooms, use only task lamps, which also helps with cooling loads, and dim lights if have dimming ballasts.
- Turn off vending machines, signs, and fountains.
- Program the energy management system to automatically respond to utility curtailment signals and go into low-power mode.

**Warehouses.** The main loads are mostly from lighting and HVAC, and if it is a refrigerated warehouse then that's the biggest end-use. If the warehouse uses gas-powered forklifts then ventilation is also big load. If the forklifts are electric then ventilation isn't a big end-use but charging the electric forklifts is. Depending on the size and type of operations, warehouses can reduce their peak loads by 3 percent using lighting strategies only and up to about 30 percent using comprehensive HVAC, refrigeration, lighting, and plug load strategies during DR events. Strategies for DR include:

- Precooling is great for refrigerated warehouses. Most warehouses will have plenty of insulation to maintain temperatures for a few hours. Beverages can even serve as thermal mass to keep the space cool as the temperature drifts up during a DR event.
- Shift processes off-peak, such as forklift charging.
- Dim or turn some off the HID lights.

**Manufacturing Facilities.** Each type of manufacturing facility is so different, but across the board, process loads drive peak facility demand. Rescheduling production time will be the primary way to achieve load reduction. When you are talking with manufacturers, here is what you can recommend they do during a DR event:

- Shut down production
- Schedule production for off-peak, especially with advanced notice
- Switch to backup generation if allowed
- Shut off or dim lighting
- Program the building automation system for curtailment events

**Retail.** The largest electricity users in retail stores are, in order of decreasing size: space cooling, lighting, office equipment, and refrigeration—making HVAC and lighting the best targets for DR. Here are some specific actions:

- Turn off lights. Although retailers are very concerned about lighting their products, they can still turn off a portion of its lights or turn off every other row of lights. Finally, during DR events, store staff can turn lights off in special-purpose areas, such as window displays, stockrooms, offices, and other peripheral rooms. Turning off lights can reduce overall building demand by 5 to 15 percent.
- Reduce HVAC loads. To reduce air-conditioning loads, facility operators can increase the store's thermostat setpoint by a couple of degrees.
- Manually turn off nonessential equipment and plug loads.
- Program the building automation system to respond to DR signals.
- Precool the facility.

**Groceries.** Refrigeration is the largest electric load in grocery stores. While the store needs to maintain proper temperatures for the products, there are a few things grocery stores can do to reduce refrigeration loads.

In addition to the strategies for retail establishments, grocery stores can:

- Reducing the number of compressor cycles that are run on refrigeration units.
- Turn off antisweat heaters. Antisweat heaters are found in glass display doors and refrigerated cases to prevent condensation on the glass and ice buildup on door gaskets. Condensation on the glass obstructs product viewing. The latest antisweat heater controls can sense humidity in the store's ambient air and reduce operation of antisweat heaters in low-humidity conditions. Turning off the antisweat heaters for short periods during a DR event may not cause display cases to fog. Demand savings can range from 5 to 10 kW for a grocery store that has 30,000 to 50,000 square feet of floor space. Note that if antisweat heaters are controlled with humidistats, this strategy will not be applicable in low-humidity climates or in grocery stores with dehumidification systems because the antisweat heaters will likely already be turned off.
- Shut off refrigerated cases. Store owners are likely to resist this strategy initially. However, in some situations, facility operators can completely shut down refrigeration fans, pumps, and compressors for several hours without damaging products. Thermal insulation in the walls of the refrigeration unit can prevent thawing and temperature creep. Facility operators need to monitor refrigeration equipment to ensure that temperatures remain below regulation levels and grocery store staff must be prepared to end curtailment if temperatures rise too rapidly. Additionally, staff can shift inventory to empty some of the refrigeration storage units in the back of the store—allowing the store to shut down those empty units.

**Hotels and Motels.** The largest electricity users in hotels and motels are, in decreasing order: space cooling, lighting, space heating, office equipment, refrigeration, and water heating. As a result, facility operators typically reduce HVAC and lighting loads during curtailment events. Hotels and motels may also shut down kitchen and laundry facilities to reduce water-heating loads. In some larger hotels, swimming pool heaters and pool pumps have large demands and can also be curtailed.

Here are some of the most common strategies for this sector:

- Lower lighting levels. Hotels and motels typically have discretionary lighting loads or decorative lighting in the atrium, conference rooms, and meeting rooms that hotel staff can turn off during a

DR event. Staff can also turn off lighting in special-purpose rooms like restaurants, conference rooms, and exercise facilities. On the morning of a DR event, facility managers can also remind staff to turn off lights in unoccupied areas and guest rooms. On DR event days, the staff can reiterate that policy to the housekeeping staff.

- Reduce air conditioning. During a DR event, facility managers can raise thermostat setpoints to decrease cooling demand in common areas. Staff can also be reminded to draw the blinds in guest rooms to reduce cooling loads and turn off room air conditioners in unoccupied rooms. Curtailing air-conditioning loads can typically reduce a hotel's total peak load by 8 to 10 percent.
- Manually reduce or eliminate key equipment loads. There are a couple of key equipment loads that can be shut down in the mid-afternoon when most guests are not in the hotel. First, hotels can turn settings in the swimming pool, kitchen facilities, and laundry facilities down or off if these systems aren't in use. Kitchen and laundry activities can also be shifted to off-peak times. This strategy requires that management effectively communicate these activities to hotel staff because these loads must be turned off by hand.
- Turn off fountain pumps. Interior fountains in some hotels provide aesthetic appeal as well as evaporative cooling. However, shutting down fountains during DR events will not cause much discomfort to the occupants. Potential demand savings vary from 3 to 10 kilowatts (kW) for most fountain pumps.
- Shut down elevators and escalators. If a hotel has multiple elevators and escalators, facility managers can shut down a portion of these loads if there is low demand from guests. Generally speaking, shutting down an elevator can reduce demand by 30 kW, while turning off an escalator can reduce demand by 7 kW.

**Hospitals.** The largest electricity loads in hospitals are, in decreasing order: lighting, ventilation, and cooling—making lighting and HVAC the best targets for DR. Hospitals often have special-purpose rooms such as cafeterias and lounges, in which facility operators can curtail lighting and plug loads without interrupting routine operations. About one-quarter of all hospitals in the U.S. also have a building automation system (BAS) that monitors and controls HVAC and lighting systems. Lastly, all hospitals are required to have backup generation, which facility operators could dispatch during events.

Hospitals can successfully contribute to load reductions using a number of proven strategies. These focus on lighting, cooling, load shifting, BASs, and backup generation.

- Reduce lighting levels. Facility operators can curtail lighting in special-purpose rooms, such as cafeterias and lounges, when they are unoccupied. Operators can also reduce lighting in corridors. Rooms and corridors can use natural lighting if available. On average, reducing lighting loads in common areas, such as cafeterias and lounges, can reduce a building's peak load by up to 5 percent.
- Set back chillers. Setting the thermostat back can significantly decrease demand for cooling. In many cases, facility operators can raise temperature setpoints on chillers and slow pump systems while still providing adequate cooling. This strategy must be used carefully because other equipment within the chilled-water system may begin to work harder to compensate for the chiller's higher setpoint. Increasing setpoints by 3° Celsius in hospitals can typically reduce overall peak load by 10 to 15 percent.
- Shift loads off peak. Hospitals can shift certain processes to before or after a DR event. For example, facility operators can schedule food preparation, dishwashing, and laundry around a DR event. This strategy requires that hospital management effectively communicate scheduling requirements to staff so that they don't mistakenly turn on these loads during a DR event.
- Use a building automation system. Many modern healthcare facilities have complex BASs that use sensors and controllers to monitor and optimize lighting, temperature, humidity, and indoor air

quality while minimizing lighting and HVAC energy use. If the BAS can communicate directly with the DR facilitator, the BAS can automatically adjust thermostat setpoints and reduce discretionary lighting loads upon DR notification—eliminating the need to manually adjust equipment. If a hospital doesn't have an automatic DR system, the staff or a facility manager would need to manually switch the BAS into DR mode to reduce HVAC and lighting loads through the BAS.

## Conclusions

Ensuring real peak savings from your demand response programs is a multi-step process. First, utility program managers should identify the best candidates for DR programs. That includes knowing the characteristics of different businesses likely to participate as well as having an understanding on which business types are more likely to enroll. Second, utilities should help their program participants take action during a curtailment event. This entails comprehending which DR measures to adopt in specific sectors to facilitate actual demand response. Armed with that knowledge, your DR program is much more likely to achieve its peak reduction goals.

## References

Strategies for C&I Demand Response: Overview plus 8 Sectors, E Source reports (2008-2009). Available online at [http://www.esource.com/members/TAS-RB-1/Research\\_Brief/DR\\_Strategy\\_Overview](http://www.esource.com/members/TAS-RB-1/Research_Brief/DR_Strategy_Overview).

Demand Response Resource Guide, CEATI (forthcoming 2010), contracted to E Source.

Demand-Response Opportunities for Commercial and Industrial Sectors, E Source web conference (June 10, 2008). Archive available online at <http://www.esource.com/node/24573>.

Demand-Response Measures for Commercial Buildings, E Source Forum (2007). Presentations available online at <http://www.esource.com/node/23372#wednesday>.

Market Segment Auto-DR Brochures, Global Energy Partners. Available online at <http://www.auto-dr.com/>.

Demand Response Case Studies, PG&E (2007), contracted to E Source. Available online at <http://www.pge.com/mybusiness/energysavingsrebates/demandresponse/cs/index.shtml>.

Demand Response Training for Integrated Audits, PG&E (2007), contract to E Source.