# Demand Response 101: The Basics of Utility Load Management Programs

Sometimes your utility actually wants you to buy less of what it sells.

What's in it for you? Lower energy bills!

# Why Do Energy Service Providers Care About Electricity Demand?

When utilities plan generation and transmission capacity the physical ability of power plants and wires to make and deliver electricity—they base their decisions on an expected level of energy demand from consumers. In fact, utilities are generally required to build and maintain their systems to serve the highest expected total use that consumers might call for (known as "peak demand"), to ensure that when you turn on the power, it will be there for you.

But long-term plans for generators, transmission lines, and distribution lines are sometimes not accurate enough or flexible enough to meet all power needs under certain conditions. The weather might be unexpectedly hot for days on end, straining the system as an army of air-conditioners and fans run constantly; in winter, a cold snap might result in higherthan-usual electrical heating requirements. Or weather conditions could limit delivery in a given region. That's why utilities are designing programs that give them more options for reducing load in times of extremely high energy consumption. These programs are essentially agreements between the utility and energy users that grant reduced rates or rebates to customers who are willing to cooperate by reducing load at the utility's request.

These agreements, which may be part of demand response, curtailment, load management, or load shedding programs, are designed to benefit the whole utility system. The underlying concept is that when many customers each conserve a little, there will be enough power for everyone. Each type of program offers slightly different policies and terms. Some stipulate mandatory contract terms, some are completely voluntary, and others are intended to be used for frequent, even daily, energy management. In this document, we refer to them collectively as demand response programs.

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## How Customers Benefit from Demand Response Programs

First, participating in a demand response program can help your utility meet the electricity requirements of all homeowners and businesses in its territory, thereby avoiding blackouts. Second, program participants usually pay less for electricity, whether they sign up for mandatory, voluntary, or priceresponsive programs. Rates may include a combination of credits, penalties, or time-of-use charges, but they are generally lower overall for program participants. Finally, the utility may be able to put off or reduce expensive construction of power plants and transmission lines if it can find other ways to meet peak demand—that small part of the day on those few days a year when we're all using more power than usual.

#### **Programs for Large and Small Customers**

For years now, utilities have negotiated voluntary load reduction programs with large consumers. For example, a single industrial plant might agree to shut down certain manufacturing equipment after receiving a call from the utility, thereby making available a significant amount of power that can instead be used to meet the needs of homeowners, hospitals, offices, and retail shops. In return, the utility might give that manufacturer a lower rate for electricity throughout the year, or it might offer the manufacturer rebates or other financial benefits.

Even homeowners can participate in demand response programs. Although one homeowner cannot reduce demand by as much as a factory can, even slight load reductions from many houses can add up to major relief for a utility's system.

#### **Program Elements**

Although curtailment is different from load shedding, all demand response programs share some basic elements.

Advance planning and contracting. A utility tries to prepare ahead for times when it may need to ask customers to reduce demand. The provider typically sets up a demand response program, establishes contracts or agreements with customers, and may also contract with providers of software or hardware to help customers reduce load.

**Building infrastructure and preparing for program management.** To make demand response programs work, the utility must install hardware such as programmable thermostats at customer homes and signals or monitors at businesses. Software must also be installed at the utility control center to manage the program, unless the utility opts to sign a contract with an experienced third-party vendor that can provide program management. The utility may also need to seek special rate approval from the state regulatory commission.

**Notifying participants of demand reductions.** If a utility predicts, based on past usage patterns, that on the day ahead (or even in the hours ahead), it may not be able to deliver power in the amount its customers expect, it will invoke the program agreements by announcing a demand response "event" to participants. Notification may be sent by fax, phone, e-mail, pager, or as an electronic signal.

**Voluntary versus mandatory response.** Customers in voluntary programs can decide on a case-by-case basis whether they will shut off equipment or limit demand in response to the utility notification. Customers in mandatory programs must adjust work schedules or accommodate changes in air conditioning, water heating, or lighting to comply with the utility request for demand reduction.

**Paying for performance.** The utility monitors usage among participating customers, and its billing depart-

ment must account for any credits or rate verifications, according to the terms of the demand response agreement with each customer.

#### Common Terms Used in Demand Response Programs

Utility programs can sound technical and confusing, making it harder for customers to decide whether or not to participate. We offer this glossary of terms to help you understand the vocabulary of demand response.

**Baseline:** To determine whether and how much a customer has reduced energy consumption at the utility's request, the provider has to know how much energy you would normally have used—that is, your baseline consumption. It is calculated using a formula that considers your average electricity usage on similar days. For example, a utility might calculate a baseline for Acme Manufacturing for a demand response event on Tuesday as the average electricity used per quarter-hour over the preceding three Tuesdays.

**Capacity:** The measure of a utility's ability to provide power, capacity is usually expressed in megawatts.

**Demand:** The amount of electricity drawn from a utility system at any given time, demand is usually measured in kilowatts or megawatts. Commercial or industrial customers are often billed for their highest level of demand. Reducing the intensity or number of electrical loads (such as machines or light bulbs) will reduce your demand and lower some of the utility's operating costs.

**Event:** When announcing a demand response or curtailment event, the utility asks (or requires, for mandatory programs) participating customers to reduce their demand for a certain time period. Events may be called due to high system demand (as on very hot days), due to low system capacity (as when a power plant is shut down), or due to a problem with delivery capacity (as when storms or fires interrupt the flow of electricity on transmission lines).



**Interval meter:** These meters record how much energy is used during short time periods or intervals, typically 15 minutes in North America and 30 minutes in the United Kingdom. Interval meters measure not only how much energy customers use during a month, but also *when* they used it. An interval meter also registers peak demand for each time period.

**Kilowatt, megawatt:** These units are used to measure power: 1 kilowatt is equal to 1,000 watts; a megawatt is equal to 1 million watts. When turned on, a single 100-watt bulb represents a load of 0.10 kilowatts.

**Kilowatt-hour, megawatt-hour:** These units are used to measure energy consumption. When turned on for one hour, a single 100-watt bulb has consumed 0.10 kilowatt-hours. Utilities bill customers in kilowatt-hours or megawatt-hours equivalent to the total amount of electricity they have consumed.

**Load:** At any given moment, the actual amount of power a customer is using is that customer's load. Peak load is the highest amount of electricity drawn from the utility during a given increment of time—for example, per month, per day, or per hour. Each utility must plan to have the capacity needed to satisfy the anticipated peak load on its system at any time.

**Mandatory program:** In mandatory programs, which are sometimes called interruptible load programs, the customer and utility agree in advance that when the utility calls a demand response event, the customer must reduce its electricity consumption. The customer may have to pay penalties if it does not comply with the signed agreement.

**Price-responsive program:** Whether they specify time-ofuse (TOU) rates or critical peak pricing (CPP), some demand response programs are built on a rate structure in which the participating consumer pays less than the standard rate most of the year, but pays significantly higher rates during hours when the utility system is stressed. Both consumers and the utility share in the risk associated with the time-varying cost of generating and delivering energy. **Settlement:** In demand response programs, the agreement between the customer and the utility may include monetary payments, credits, or penalties, depending on how much load the customer is able to shed. Settlement is the accounting exercise through which credits or payments due are calculated based on the difference between the customer's energy consumption baseline and its actual consumption during the event. Program participants must usually have a TOU or interval meter to provide the necessary data.

**TOU meter:** Some electricity meters record the total number of kilowatt-hours of electricity a customer uses per time-block per day. (A time block might be some-thing like the peak hours of 10:00 a.m. to 2:00 p.m.) Usage in each time-block accumulates until the end of the month, when the meter is read. The meter may, for example, sum up on-peak and off-peak usage, providing several totals per meter read.

**Voluntary program:** In a voluntary program, the customer may choose to reduce demand, but is not *required* to do so. In most of these programs, customers are encouraged to shed load in response to price signals—that is, in response to very high rates enforced during the event period and/or credits offered for reducing load during the event. Again, it's necessary to install a TOU or interval meter to record how much energy the customer consumes during the event period.

#### **Examples of Load-Control Hardware**

For most demand response programs to work properly, customers will need to let the utility install metering or communication equipment at their homes or businesses. For example, in one common residential program, the utility is able to send signals to turn off home air conditioners during periods of peak demand and then turn them on again about two hours later or when demand has lessened. To make this possible, a radio signal receiver is installed at the air-conditioner control panel to convert the radio signal sent from the utility into a control signal



that will turn the unit on or off. **Figure 1** shows a typical utility signal receiver.

More-sophisticated programs and hardware can give homeowners some measure of control. For example, a utility program might send signals to and from a smart thermostat to temporarily change the thermostat setpoint.

Figure 1: Air-conditioner control at a residence Xcel Energy has installed a Cannon Technologies signal receiver (right) at this home to turn the home's central air conditioner off and on under peak demand conditions. The homeowner receives an annual rebate from the utility for allowing Xcel to control the air conditioner a few days out of the year.



These settings could be posted at a secure Web site. The consumer can be allowed to change the settings at the thermostat or online, overriding the utility's signal, or the homeowner might choose to let the utility's control program run uninterrupted.

Large energy consumers, such as manufacturing facilities, may install extra meters that will allow an energy manager to monitor consumption in real time from his or her desk, or even from a different building. If, for example, the utility asks the manufacturer to use 3 megawatts less than usual for a two-hour period, the energy manager needs to be able to see that the facility is or is not meeting that requirement. Failure to meet demand response agreements can be very expensive resulting in financial penalties or even cancellation of the rate agreement, meaning that the manufacturer would have to pay higher energy charges every month for up to a year.

## **For More Information**

Call the following organizations or visit their Web sites to obtain more information on demand response programs.

Demand Response and Advanced Metering Coalition, Washington, D.C., tel 202-441-1420, web www. dramcoalition.org.

Peak Load Management Alliance, Jupiter, Florida, tel 561-575-1788, web www.peaklma.com.

California Energy Commission, Sacramento, California, tel 916-654-4287, web www.energy.ca.gov.

GoodCents Solutions, Gulf Power, Pensacola, Florida, tel 877-892-4962, web www.goodcents.com.