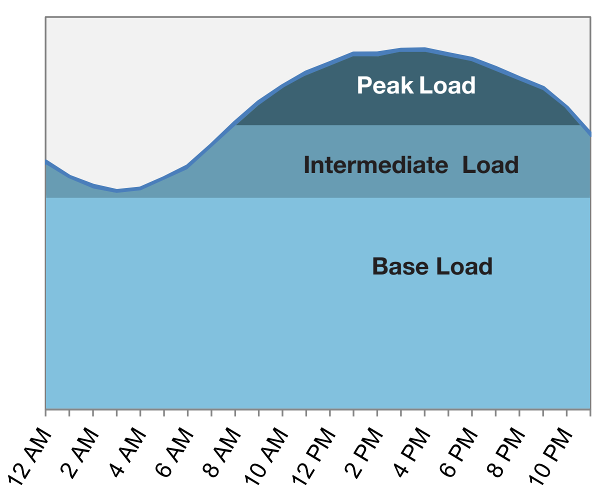
Demand Response: Reducing Peak Electricity Demand

In the Midwest, an often overlooked and under-utilized energy resource has the potential to increase energy efficiency, decrease GHG emissions, and help make the electric grid more stable. Demand response (DR) involves creating incentives for electricity users to reduce their power consumption during high demand periods. Implementing controlled, incremental reductions of electric demand through demand response helps maintain grid reliability, save energy, and integrate wind and solar energy.

The Shape of Electric Demand

The amount of electricity demand in any given region varies not only from day to day but also throughout the course of each day. In general, electric demand follows a pattern of baseload and peak demand according to the activities of society as a whole. Electric demand is generally lower during the late evenings, overnight, and in the early morning, when human activity and energy use has settled to a "baseload" level. Base-load power is the minimum amount of electricity that an RTO or utility must have available at most points of the day. During the daytime, when commercial, industrial and other activities are in full swing, electricity demand ramps up and utilities must draw on more sources of power. The period of each day's highest electric demand is known as the "peak" load.

Electric Demand on a Typical Summer Day



DR Replaces "Peaking" Power Sources

Most power plants are built to operate at constant or gradually changing generation levels, making it challenging to meet rapidly changing peak demand with conventional power plants. Therefore, "peaking" plants and other sources are used during the day to meet peak demand and maintain the stability of the electric grid. Power sources for peak load could be dispatched renewables like hydroelectricity, pumped hydroelectric storage, or, in many cases, natural gas combustion turbines. Combustion turbine power sources are generally less efficient than combined cycle or steam turbine power plants, making them more expensive and greenhouse gas (GHG) intensive than an intermediate-load or base-load plant using the same type of fuel. Therefore, demand reponse provides a great opportunity to save fuel and reduce GHGs while increasing the reliability of the electric grid.

Types of Demand Response

Demand response can be broken into three main categories:

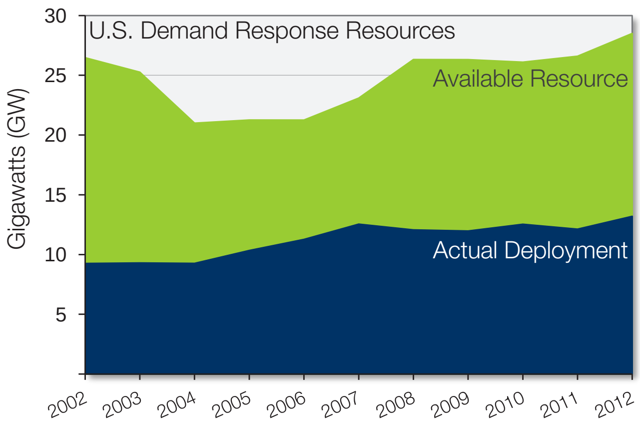
- **Residential programs** typically involve direct control of certain consumer appliances, such as air conditioners, water heaters, pool pumps, or electric heaters. The electric utility will install a remote-controlled switch in exchange for a direct payment or credit on the customer's bill.

- A different method of residential DR involves **dynamic pricing programs** which involve changing the customer's mostly static electric rate structure to one that varies throughout the day. This better reflects the cost to deliver electricity and incents smarter energy use.

- **Large Commercial and Industrial (C&I) Programs** include payments or bill incentives to large electricity consumers in the commercial and industrial sectors. In exchange, the customer agrees to temporarily reduce their power consumption when requested by their power supplier.

Demand Response is Underutilized in the Midwest

Over the past decade, there has been about 25 gigawatts (GW) of total demand response resources available in the United States. In the same period, the U.S. actually only utilized about half those resources, deploying between 9 and 13 GW each year between 2002 and 2012.



Looking at the Midwest, there are roughly 7 thousand megawatts (MW) of demand response resources registered with the Midcontinent System Operator (MISO), the power grid operator for the region. This is equivalent in size to 14 typical gas or coal-fired power plants. However, most demand response in the MISO footprint falls under control of rate-regulated utilities and their state commissions, which makes it hard for the system operator to take advantage of the benefits DR can offer the regional grid. MISO hasn't called on DR since 2006, in part because of regulator restrictions that limit MISO's ability to use it until the grid has reached an emergency state.

MISO estimated that the utilities controlling most of the DR resources called on only 7% of their DR resources during the summer of 2013. In contrast, PJM (MISO's larger peer regional transmission organization to the east) deployed thousands of megawatts of DR during multiple events last summer, fall, and winter, including 6,300 MW (63% of its available DR) during an event in September of 2013. PJM also called on more than 2 thousand MW of DR during the January Polar Vortex in 2014.

Written by: Steve Dahlke Policy Associate
Dane McFarlane Senior Research Analyst

Summer Peak Demand Response in Three Regions

Three Regions, Three Levels of DR Utilization

In 2013, electricity demand reached its summer peak on July 17th and 18th, in the PJM, MISO and NYISO (New York) regions. In this 24 hour period, the RTOs had three unique patterns of demand response utilization. Although PJM and MISO had almost equivalent levels of demand response (DR) available (about 10 GW), PJM deployed about 2.3 GW (23% of what was available) while utilities in the MISO region deployed an estimated 500 MW (5%). Meanwhile, NYISO deployed 1.1 GW, or about 86% of the 1.3 GW it had available.

Despite a similar availability of demand response resources, PJM and MISO deployed very different levels of demand response on the same summer peak day. Due to regulatory and market differences, DR in PJM and NYISO is directly dispatched by the RTO, whereas in the MISO region, individual utilities generally deploy their own DR resources.

In order to work through these regulatory and market hurdles, greater coordination between states and MISO could help increase deployment of demand response resources without overstepping state jurisdictions.

Data Sources

Individual RTO Peak Date, DR Availability and Deployment:
Figures come from market reports and committee minutes from the following RTOs: NYISO, PJM, ISO-NE, MISO, CAISO, ERCOT and SPP. Contact GPI for more information.

U.S. Demand Response Potential and Actual Deployment:
US Department of Energy, Energy Information Administration, *Demand-Side Management Program Annual Effects*. December 2013.