Demand response

An important component of electricity conservation

By Peter Love

Conserving energy has many advantages to both the users of energy as well as more broadly as a society. To end users, these include financial ("save your money"), environmental (doing your part) and reputational. For society more broadly, they include economic advantages (companies reduce their operating costs so they are more successful domestically and internationally) and employment benefits (designing/manufacturing/selling/installing energy conservation products/services are very labour intensive, with most of the labour being local).

For our electricity system, conservation can also make the entire system more reliable and affordable as it can postpone or avoid expensive upgrades to the generation, transmission and distribution system.

There are five different components of electricity conservation with some more obvious and better understood than others.

Probably the best known is energy efficiency which involves replacing older, inefficient technology with newer, more energy efficient – from LED lights and EnergyStar appliances to LEED buildings. Even simpler is good old-fashioned behavioural conservation which uses existing technology more intelligently – turning off lights/computers when not in use and using a programmable thermostat.

Two others are fuel substitution (switching from one fuel source to another) and self-generation (solar, wind). The fifth is demand response which although perhaps the least obvious has major benefits to both electricity users and energy system planners/operators. That is the focus of this article.

Unlike most other forms of energy like oil, gasoline or natural gas, electricity is not easily stored. Because end users expect it to be available when they need it, electricity systems are designed to ensure there is enough generation and transmission capacity to meet the peak demand. One answer to this problem is to generate electricity when there is less demand (nights/weekends) and then use it during times of peak demand (hot summer afternoons).

The most common form of storage is to store water in a reservoir but there are a limited number of locations where this can be done. New electricity storage technologies are rapidly being developed and will play an important role in the future. Peaker plants (typically low-efficiency using natural gas) are designed to only generate electricity during these peaks but face local opposition. One of the most cost-effective and readily available ways to overcome this problem is to shift electricity demand from peak periods to off peak periods – demand response.

With such a difference in prices for electricity, charging electricity users the same amount, regardless of when they used it, makes no sense. Large users, such a major manufactures, have typically been charged different rates depending on when they used it, promoting them to alter their electricity consumption patterns to use more when it is less expensive.

Over the last five years, Ontario has emerged as the North American leader in replacing older electricity meters that just measured the amount of electricity

used in total with smart "Time-of-Use" meters and introduced time-of-use electricity rates so all electricity consumers have a financial incentive to adjust their consumption patterns.

The advantages of encouraging electricity consumers to adjust when they use electricity are so large that many jurisdictions have introduced a range of demand response incentive programs. Again, Ontario is a leader in this area and has launched a range of voluntary incentive programs. For homeowners and small businesses, the Peaksaver program uses utility-controlled thermostats or switches to cycle down central air conditioning units during peak times in the summer that have negligible impacts on indoor comfort.

To date, about 190,000 units have been installed and have the ability to reduce peak demand by about 100 MW. For larger companies, the Ontario Power Authority has offered a range of Demand Response programs that provide financial incentives to participants; the most recent is capable of reducing demand by more than 250 MW.

Among the features of this program is the ability of approved "aggregators" to sign up smaller electricity customers to receive incentives to change their consumption patterns. And for the largest users (over 5 MW), the new five Coincident Peaks program provides them an incentive to reduce their demand on the five highest peak hours of the year.

As they can never be sure when these hours will occur, they typically reduce their demand by as much as 50 hours/year. Last summer, this program resulted in a peak demand reduction on the hottest day by 560 MW. Large consumers also participated in Ontario's Operating Reserve market which contributed 259 MW.

Ontario companies such as Embala and Rodan are also leading the way in the development of innovative products and services that help consumers take advantage of lower costs of electricity during off-peak times automatically.

More can and needs to be done to further enhance these programs. The price differential between on-peak and off-peak electricity, currently less than 2:1, should be increased; increasing it to 4:1 is estimated to triple the drop in peak demand. More of the fixed costs of electricity (now more than half the average bill) should be converted into variable costs to provide even stronger motivation to use more off-peak power. OPA's demand response program rules can be improved and the important role played by aggregators can be better supported.

But most important, it is up to you. Find out more about these programs by contacting your electricity provider. Once informed, find the best way to participate so you can begin saving money while doing your part for the environment. If your province does not yet have demand response programs and time-of-use rates, ask them to investigate the advantages. **BS&S**

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