

THE BUSINESS CASE FOR PEAK DEMAND MANAGEMENT

OVERVIEW

Peak demand management involves managing consumption of electricity at peak times of the day/week/year. This could mean permanently reducing your site peak demand (through energy efficiency and power factor correction), load-shifting the energy consumption to off-peak or shoulder times, or curtailing consumption or running stand-by generation during peak periods.

Electricity network service providers and retailers offer different prices for electricity at different times of day (Time-of-Use pricing), so facilities can save electricity costs by moving consumption to a lower price period. Pricing periods are defined in your bill or on your network service provider's website.

Each network service provider applies its own methodology for calculating demand and/or capacity charges. For example, some network service providers select a number of days during the year (typically during the hottest days of summer) when peak demand is recorded. The average of these maximum demand events recorded at your site during these selected days constitute your maximum capacity level for the next 12 months.

Once you understand the pricing mechanism you can review opportunities for reducing these costs through load shifting or reducing the coincidence of operation of multiple energy intensive equipment. For sites with multiple incoming feeders/electricity accounts, managing demand/capacity charges involves a consistent load allocation between distribution boards to avoid paying a high demand/capacity charge for each of the incoming feeder (as the sum of the maximum demand/capacity recorded at each feeder level can be much higher than the maximum demand of the whole site).

IS IT SUITABLE FOR YOUR MEAT PROCESSING FACILITY?

In order to conduct an initial screening of the opportunities listed above you need to understand your site's tariff structure, your site load characteristics and possible network-driven and market-driven opportunities. Consider the following elements:

- Does your electricity bill include a different price for peak and off-peak electricity consumption (Time of Use pricing)?
- Does your electricity bill include a demand and/or capacity charge?
- If your demand/capacity charge is based on kVA, what is the site's power factor and can this be improved?

- Do you have the ability to temporarily reduce importation of electricity from the grid?
- Is your site in a constrained network area for which the network service provider is seeking network support?

Once these elements are understood you can assess a range of opportunities such as:

- Reduce or reschedule production:
 - Move batch and continuous processes to either before or after an event, or to another day. For example animal processing (smoking, cooking, canning, curing, pickling, flash freezing) or packaging is sometimes done in batches; such processes can often be shut down or delayed to enable demand response participation;
 - Produce extra product a day ahead, and do only packaging on the event day;
 - Stop production during the event i.e. plan maintenance or conduct meetings to minimize equipment use;
 - Adjust employee schedules/shifts so that increased production or energy use occur outside planned events.
- Turn down, cycle or turn off process equipment:
 - Turn off blowers, pump motors, and any other air circulation motors;
 - Cycle/turn off refrigeration system and use thermal inertia/storage of the cold store;
 - Cycle air compressors, air handlers and ventilation systems;
 - Apply ventilation control – temporarily reducing outside air flow can help reduce cooling demand;
 - Adjust variable speed drive controls to reduce load from fans, pumps and chillers;
 - Pre-cool, then float or cycle refrigeration. Certain products can safely float for hours;
 - Alternate cooling methods between cold storage areas to lower simultaneous demand;
 - Pump water into storage tanks prior to an event, and use this water during an event.
- For HVAC: Pre-cool work areas, raise temperature settings, cycle constant air volume HVAC, re-set static pressure for variable air volume HVAC, enable load-cycling for packaged AC units;
- Turn off all non-essential equipment:
 - such as animal-area lighting, other indoor/outdoor lighting, signage, fountains, audio and video displays;
 - kitchen equipment (beverage vending machines, water purifiers, coffee makers, ice makers);
 - office equipment not in use (i.e., printers, copiers, shredders, coffee makers).
- Decrease use of wastewater aerators during an event. If possible, shut off operations completely during an event, then store and collect untreated water for processing after the event;
- Charge battery-operated equipment prior to an event, then use only pre-charged equipment during an event.

As these opportunities are very site dependent, they are best identified with on-site personnel.

HOW TO DEVELOP YOUR BUSINESS CASE?

Steps to take when developing a business case to implement peak demand management include:

- 1) Create a breakdown of energy users on-site
- 2) Determine your capacity and peak and off-peak pricing for electricity
- 3) Determine which elements are essential at peak-times
- 4) Develop a site load profile
- 5) Develop a plan to shift energy use to off-peak
- 6) Develop a plan to reduce peak demand charges
- 7) Develop a plan for demand response initiatives

CREATE A BREAKDOWN OF ENERGY USERS ON-SITE

A breakdown of energy uses on-site will help to pinpoint potential for demand management. If you have sub-metering, this can help determine where energy is used. Using major process equipment sizing or circuit sizes can help to create a picture of what uses energy on-site without delving into too much detail. If you have the opportunity, tonging circuits can also give you an idea of energy use around the site. Start at a high level breakdown of consumption and then drill down into the larger. Refer to 'Energy Consumption Guide for Small to Medium Red Meat Processing Facilities' (AM12-5066 Domestic Processors Energy Efficiency Program) for more information on how to breakdown your site's energy consumption.

DETERMINE CAPACITY AND PEAK AND OFF-PEAK PRICING FOR ELECTRICITY

Consult your energy bills or your network service provider's website to determine your peak and off-peak time periods. If you are unsure, contact your energy retailer and ask for a copy of your retail contract and network tariff structure.

To determine your electricity price at peak times per kWh, add together all peak charges listed in \$/kWh and charges that do not indicate peak or off-peak (retail, network and other charges). To determine your electricity price at off-peak per kWh, add together all off-peak charges listed in \$/kWh and charges that do not indicate peak or off-peak. From the electricity bill or your distribution network service provider's website, find the demand / capacity charges that apply, how they are calculated and at which rates.

DETERMINE WHICH ENERGY USES ARE ESSENTIAL AT PEAK TIMES

If you are on a time of use rate, determine where energy is being consumed during peak times then decide on the level of criticality for production; for example, categorise energy consuming plant or processes as "essential", "semi-essential" and "non-essential". Investigate the less essential energy uses to determine your demand response potential.

DEVELOP A SITE LOAD PROFILE

Contact your energy retailer and request 12-months of half-hour interval metering data. If you have a smart meter on-site, interval data should be available from the smart meter's historical data.

Once you have the data, plot a graph showing electricity demand vs. time of day for an operating day during summer and winter. Include a marker to delineate peak, shoulder and off-peak times, as shown in the example provided in Figure 3. As can be seen, there is considerable consumption during peak periods. Also use the daily profiles and identify a typical maximum demand (winter and summer).

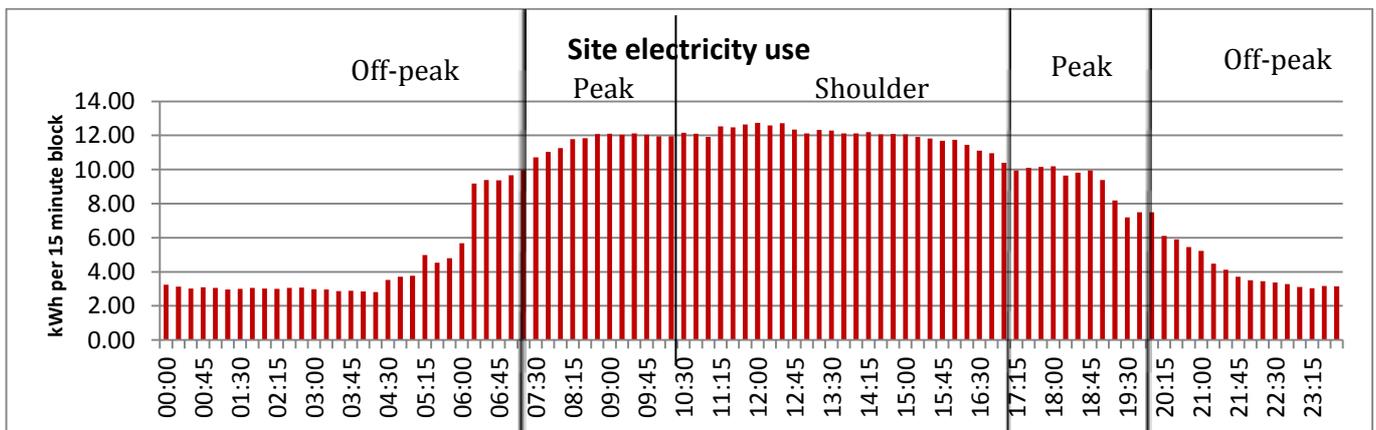


Figure 1 - Daily load profile

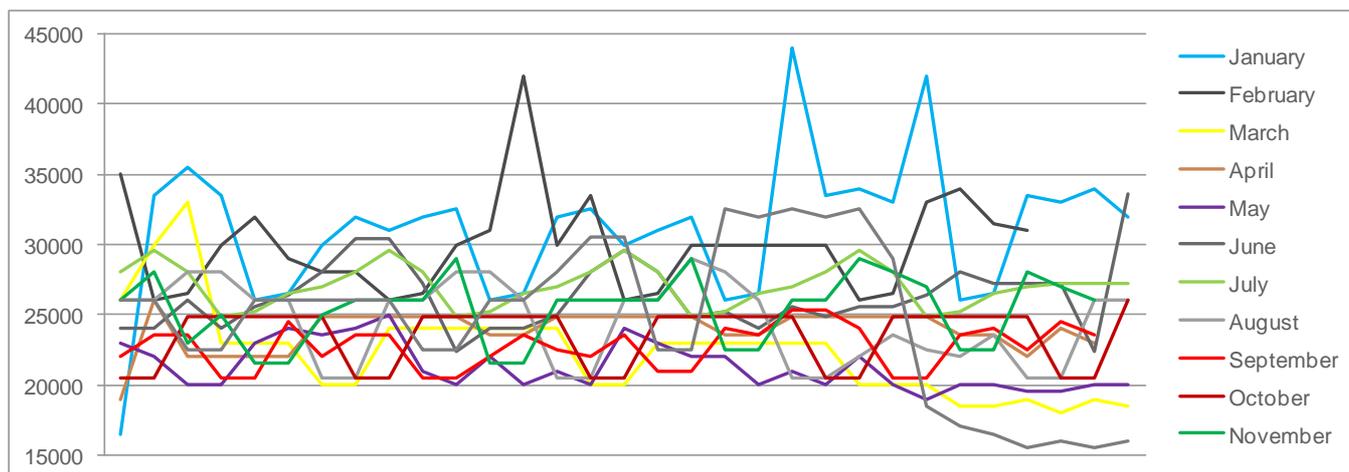


Figure 2 - Example yearly demand profile

Also graph the daily peaks for the year, as shown in the example in Figure 4. From the yearly demand profile or the data, identify the top 5 events and note the day and time of the events. Compare these maximum demand events to the typical maximum demand from the daily profiles to see if the single peaks are significantly higher (indicating an atypical event).

DEVELOP A PLAN TO SHIFT ENERGY USE TO OFF-PEAK

Using the list of non-essential energy users and your peak period schedule, develop a plan to shift energy consumption outside of the peak period. Estimate the costs and savings of implementing permanent solutions to keep consumption outside peak periods. Note that although many of the load-shifting projects are zero capital cost, some costs may be incurred to increase automation of equipment or to program control systems. Other costs may include re-wiring to increase control over sections of non-essential vs. time-critical equipment. Also on-going maintenance of savings include re-assessing and re-programming controls as the peak periods and pricing change.

Estimate the savings of each item being load shifted. To determine this, use the energy consumption shifted to outside peak multiplied by difference in the price per kWh. If production is affected, estimate the negative financial impact and determine viability of permanent load-shifting.

DEVELOP A PLAN TO REDUCE PEAK DEMAND CHARGES

If demand/capacity charges are based on kVA (or kW with application of a further adjustment factor based on kVA performance), assess benefit and cost of power factor correction to reduce peak demand permanently. If power factor correction has not been assessed at your site, check your overall power factor at peak demand (from 30-min interval data that typically comprises kW, kVA and kVAr information). Complete a study as to the necessary/optimal sizing of capacitors to increase your power factor (below a certain size you may not get enough benefits to justify the equipment and installation costs; above a certain size, the marginal demand savings is not sufficient to justify the capacitors' incremental cost).

Take the monthly interval data yearly load profile and correlate the peak demand events (top 5) with activities on-site. If a correlation is clear, assess the ability to reduce the consumption at future similar events. This process should be redone periodically to identify new causes for peak demand events on-site. Also if your contract has demand charges, monitor site demand peaks monthly or each billing period to keep facility peak to a minimum. If you have a control system, electricity demand can be added to monitor parameters with alarms like other process parameters. (See smart metering fact sheet).

Estimate the savings of eliminating the peaks by subtracting the typical daily maximum demand from the peak event and multiply by the capacity/demand tariff structure and rates.

DEVELOP A PLAN FOR DEMAND RESPONSE & DYNAMIC PRICING INITIATIVES

Determine if your facility can temporarily reduce production, significantly curtail load, or has a standby generator. The critical peak events with demand response dispatch are typically 4 hours long on hot afternoons in summer. An assessment of processes on-site that can be delayed for 4 hours can identify the viability of participation. When negotiating a network-driven or wholesale market driven demand response/peak load reduction agreement get a full understanding of the implication(s) of you not being able to dispatch when notified (e.g. not being paid the demand response incentive payment vs. having to pay a penalty) and review possible clauses on liabilities and consequential losses.

Savings are based on the price you can get for demand reduction and the amount of demand reduced. Different pricing arrangements exist (e.g. availability payment/dispatch payment) and different measurement options are available (typically relying on a comparison between your demand during the event and baseline demand based on recent historical records).

If production is impacted, estimate the savings of implementation by subtracting the cost of loss of production from the income/saving from the demand response mechanism. If you are going to use a generator as part of your load curtailment, add the cost of running the generator to net cost/savings estimate.

There are many opportunities to proactively benefit from dynamic pricing mechanisms. These include:

- The reserve capacity mechanism in the South West Interconnected System (SWIS) in Western Australia;
- Critical Peak Pricing/Peak Time Rebate options in the National Electricity Market (NEM);
- Network-driven demand response offered by network service providers in specific local network areas;
- Wholesale market price driven demand response triggered by retailers or aggregators.

Through the reserve capacity mechanism in the SWIS allows, a site can sell their demand reduction at times of high demand. Sale can either be done on the demand response market at the market price or to an aggregator for a set-price.

Businesses can register for critical peak demand/peak time rebates. They receive notifications of critical peak demand events up to one week prior to the event and can then reduced demand during the typical 4 hour event duration. When capacity charges are reevaluated for the year, the facility's peak demand will be set at the demand during the notified critical peak demand periods.

Some network service providers pay for demand reduction at times of peak demand to defer network investment. Such programs are very time sensitive (lasting a few years only) and geographically specific (your site needs to be in the target network area). You can register as an interested party on your network service provider's website. You will be informed of such opportunities, can lodge an expression of interest and engage in negotiations on the terms of a network agreement.

Finally some retailers are looking for demand response capacity to hedge the wholesale market price volatility risk (e.g. it's cheaper to pay you to curtail load than pay an expensive peaking plant). You need to engage with your electricity retailer or/and a demand response aggregator to identify possible attractive opportunities in this area.