How does Peak Demand Occur?

There is a common misunderstanding out there about how Peak Demand occurs and is really measured. Well we're here to set the record straight!

Many times, we hear ***"The instant I turn on my air conditioner, (or other large electric load) that instantaneous start-up spike sets my peak."*** Although that's commonly thought of as the Peak Demand... it's not, and here's why:

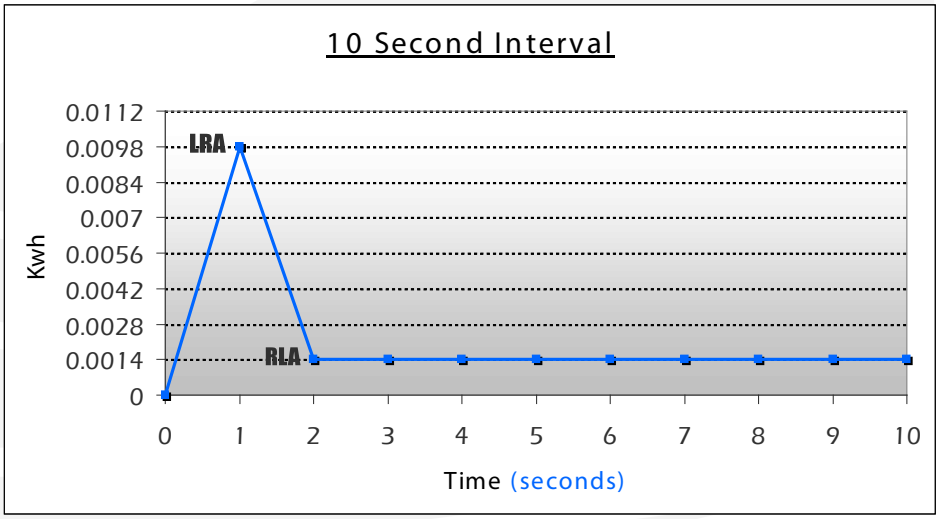
When switched on, inductive machines (machines with motors) will initially use a large amount of energy to begin turning the motor that is used to power the machine. The initial current draw of the motor is called the Locked Rotor Amps (LRA). Once the motor gains momentum it drops down to a steady pace referred to as the Run Load Amps (RLA) or the static load size. The LRA is what is commonly thought of as "setting the peak" as mentioned in the statement above. In actuality, the LRA occurs for such a short period of time it has very little energy content, and thus, very little effect on the Peak Demand.

Air Conditioner Example:

To better understand this concept, let's look at an example of a single-phase 240 Volt 21 AMP Air Conditioner that has a LRA of .0098 kwh/s and a RLA of .0014 kwh/s.

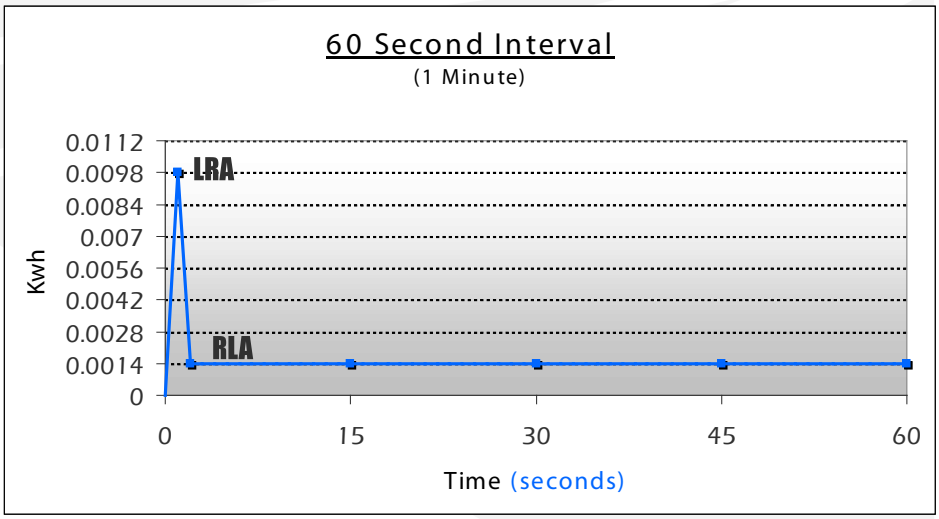
**the LRA is normally 7 times the amount of the RLA*

This graph shows the first 10 seconds of the air conditioner's electric use in Kwhs.



In the first second of use, there is an initial spike where the current energizes the motor windings and tries to begin turning the motor in the air conditioner (LRA). As the motor gains momentum, energy needed decreases and drops down to the RLA.

If we were to look at the first 60 seconds of use it would look like the graph below.



The amount of energy use is staying constant at the static load size (RLA). At this point the air conditioner will remain at the RLA of .0014 kwh/s unless it is turned off.

If you haven't yet, check out our "What is Demand" and "How are you Billed for Demand" downloadable documents in the Resources section of our website. These documents will go into more detail on information refrenced below.

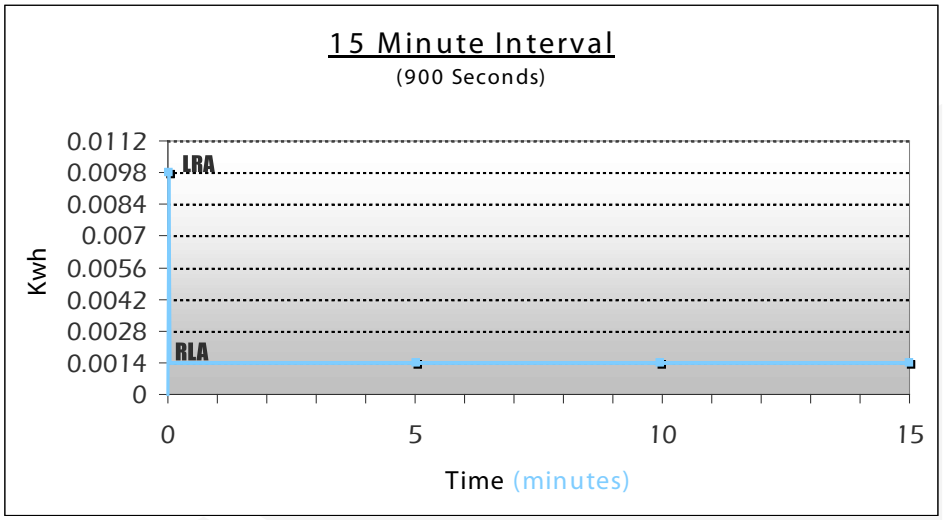
Refresher on Peak Demand:

To recap, most commercial customers and some residential customers (depending on the utility) are billed something called a "Demand Charge". The Demand Charge is the amount you pay, per KW, during the billing month for the "Peak Demand." The Peak Demand is the highest Kwh usage in any demand interval (usually 15 minutes) during the billing month. It determines not only your Demand Charge, but may also determine what rate you're placed on by the utility. The utility's meter records and averages your Kwh use for each of those 15-minute intervals, and the interval with the highest 15-minute usage (in that billing period) sets your peak demand for that month.

The 15-Minute Interval:

To reiterate, the Peak Demand is not the highest instantaneous KW spike that occurs during the billing month, it is the highest **averaged** 15-minute period that occurs within the billing month.

So if we go back to our example of the air conditioner, and look at its use in a 15-minute period it would look like the graph below:



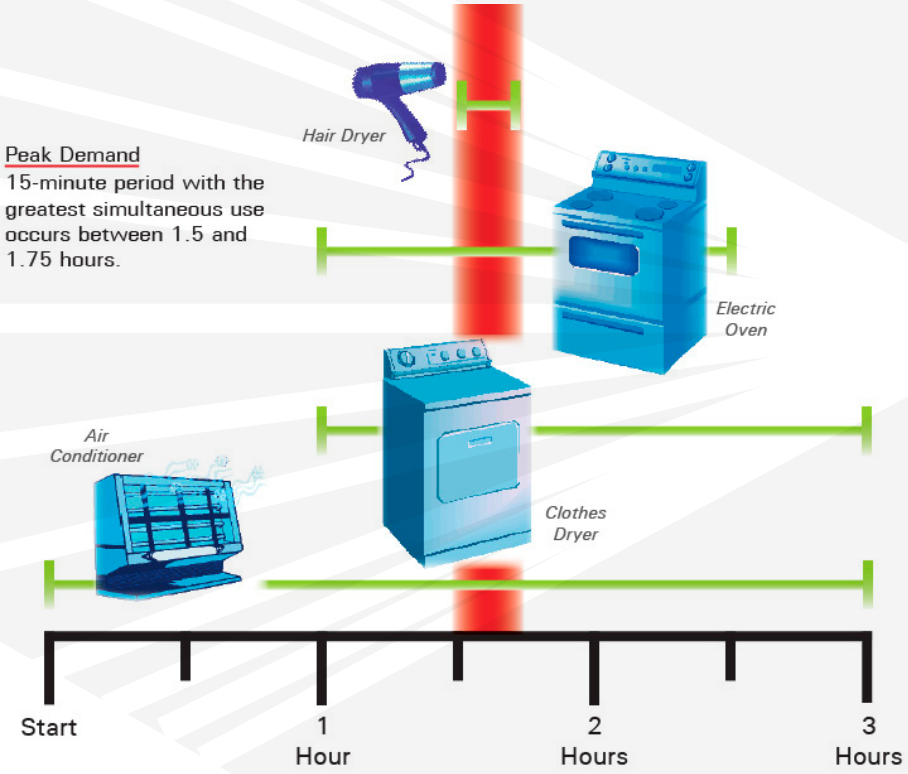
The one second energy spike of .0098 Kwh, has very little effect on the 15-minute interval average when the remaining 899 seconds are at .0014 Kwh.

It is very unlikely that one air conditioner will be the only electric load in operation. However, the concept of how little the turn-on spike effects the Peak Demand is shown. Basically, that spike is averaged out as somewhat of a "glitch" because it happens for such a brief period of time. If you were to calculate demand in a 15-minute interval at a constant rate of .0014 it would average out at 5.04KW. When adding the brief one second spike, the demand only increases to about 5.07KW. This is a very minuscule difference when you consider most situations have several electric loads impacting the demand at much larger scales.

Spotting the Peak:

When studying Peak Demand it is essential to take into consideration all the electric loads in operation and when they are operating. The example below displays a 3-hour timeline of three larger electric loads and one smaller load in use at various times. As mentioned above, Peak Demand occurs in the highest averaged 15-minute period. In this case it would most likely occur between 1.5 and 1.75 hours when all the loads are being used as the same time.

**Take note that this is not when the larger loads are being turned on (when turn-on spikes occur)*



Take-Away:

- The initial spike in energy use caused by turning on a machine (LRA) lasts for a very brief period, typically a few seconds. Energy use then drops to the static load size (RLA).
- The turn-on spike has very little effect on the total amount of energy use calculated in the 15-minute interval because it occurs for such a brief period of time.
- Peak Demand is determined by the highest Kwh usage in any 15-minute demand interval within a billing month.
- The real "Peak Demand" is a result of having a 15-minute interval where there were coincidental maximum number of loads operating simultaneously. ("Too many loads on together for too long")
- There are approximately 3,000 15-minute intervals in a typical billing period, in other words 3,000 opportunities to set your Peak Demand. (Most utilities use 15-minute intervals, some use 30 or 60-minute intervals.)
- When studying Peak Demand it is essential to take into consideration all the electric loads in operation and when they are operating.

Hopefully, we have set the record straight about turn-on spikes and how little they affect Demand. If you would like to know more about how demand is calculated or how to lower your Peak Demand, contact the experts at Brayden Automation Corp.