The Effect of Load Creep
On Determining Energy Savings

According to experts in the energy management industry "load creep" is a concept that relates to all electrical loads but primarily plug loads. Load creep can actually be up or down. The idea is that over time additional appliances (such as TV's, Computers, refrigerators, etc.) are added to a facility causing the overall consumption of energy to go up. In addition to that, compressor motors become less efficient over time. There are several approaches to account for this factor when maintaining an energy consumption baseline that will be used to compare to current year consumption.

One approach, and the most accurate, is to calculate on a case-by-case basis the degree to which additional loads have been added to the facility. You can interview building occupants to determine the number of appliances added. You can check purchasing department records to see what appliances have been purchased over a given year. You can take measurements of the compressor motors to determine the degree of change of efficiency from year to year. There are some good examples of how to do this in the International Performance Measurement and Verification Protocol (IPMVP).

Another approach is to apply a (stipulated) global percentage to the baseline calculation to increase the baseline for load creep. The important question here is, "What is a reasonable percent to use?" Should a globally applied load creep factor even be stipulated?

Load Creep Issues

Here are some significant issues concerning the use of load creep as an across the board baseline adjustment (a stipulated escalation factor).

1. Let's say your total energy consumption for one year is 1,000,000 KWH. This becomes your baseline year.

2. The next year you were able to save 5% on your energy consumption and only used 950,000 KWH (assuming that there were no additional square foot added to your facilities, the cooling and heating degree days were identical, same occupant operations). The amount of savings you achieved was 50,000 KWH.

3. If you use a load creep factor of 1%, then you would adjust your baseline upward by 1% (to account for the additional appliances, and mechanical inefficiencies that gradually "creep" into the facility). In this case you would increase the baseline by 10,000 KWH to 1,010,000 KWH before you subtracted your actual savings achieved from energy conservation measures (ECM's).

4. Subtracting 950,000 KWH from 1,010,000 results in a savings of 60,000 KWH. Even though the baseline was adjusted by only 1%, the impact on the savings reported increases by 20%.

Below is a calculation of the impact of using an across the board load creep factor for baseline adjustments over multiple years (assuming the scenario above).

Year	Original Baseline	Revised Baseline (1% Load Creep)	Total Consumption	Total Savings	%
1	1,000,000 KWH	N/A	1,000,000 KWH	N/A	N/A
2	1,000,000 KWH	1,010,000	950,000 KWH	60,000 KWH	5.9%
3	1,000,000 KWH	1,020,100	950,000 KWH	70,100 KWH	6.8%
4	1,000,000 KWH	1,030,301	950,000 KWH	80,301 KWH	7.8%
5	1,000,000 KWH	1,040,604	950,000 KWH	90,604 KWH	8.7%
6	1,000,000 KWH	1,051,010	950,000 KWH	101,010 KWH	9.6%

If you implemented ECM's in the first year that gained you 50,000 KWH in savings and that's all you did, so that in each succeeding year you did not use more than 950,000 KWH you could show a savings each year from the original baseline of 50,000 KWH or a 5% savings. But if you use a 1% load creep factor to adjust the baseline each year, by the end of the fifth year beyond the baseline year you will show a savings of 9.6% over the revised baseline year.

It's amazing how just a 1% adjustment in the baseline can change what would otherwise be a 5% savings to a 9.6% savings. If the load creep factor is increased to 2%, the savings in year six are 14%. If it is increased to 4%, the savings in year six are 21.9%. And this is just from 5% savings in the first year maintained in the succeeding years. If no load creep factor is applied, the savings in year six is still only 5%.

Year	Original Baseline	Revised Baseline (4% Load Creep)	Total Consumption	Total Savings	%
1	1,000,000 KWH	N/A	1,000,000 KWH	N/A	N/A
2	1,000,000 KWH	1,040,000	950,000 KWH	90,000 KWH	8.7%
3	1,000,000 KWH	1,081,600	950,000 KWH	131,600 KWH	12.2%
4	1,000,000 KWH	1,124,864	950,000 KWH	174,864 KWH	15.5%
5	1,000,000 KWH	1,169,859	950,000 KWH	219,859 KWH	18.8%
6	1,000,000 KWH	1,216,653	950,000 KWH	266,653 KWH	21.9%

This has important implications for baseline management. If load creep is occurring and not accounted for in your savings calculations then savings could be underreported. If it is overstated, then savings will be overstated by an even greater magnitude.

If load creep is applied, then it should probably be applied mainly to the plug load. Other loads that are affected to a small degree include aging of motors (especially compressors and motors connected to belts that can loosen over time. For example, if your school's consumption profile is 50% HVAC, 33% lighting, and 17% other, it might be reasonable to apply a 4% load creep to the "other" category representing 17% of the consumption of the school (primarily plug loads). This calculates to an overall 0.7%. If you add 0.1% (a reasonable range could be from 0.1% to 0.5% per year) for HVAC system increase in inefficiency, then the overall factor you might use is 0.8% per year. However, the more appropriate approach would be to calculate load creep

school by school based on actual data. This is the method presented in IPMVP. You may find that there is actually a “de-creep.” As old systems and appliances are replaced with newer more efficient systems the energy use will actually go down.

Other utilities may also have load creep such as water and natural gas. As water distribution systems age valves may begin to leak. Pipes may rupture underground causing even just a slow seepage. Natural gas boilers may become less efficient over time requiring additional fuel in order to provide the same degree of heating. If you have an active preventative maintenance program, these problems may not be very acute. With some investigation you may find a reasonable factor to be on the order of 0.1% to 0.5% per year. When systems are replaced or repaired you may even see de-creep.