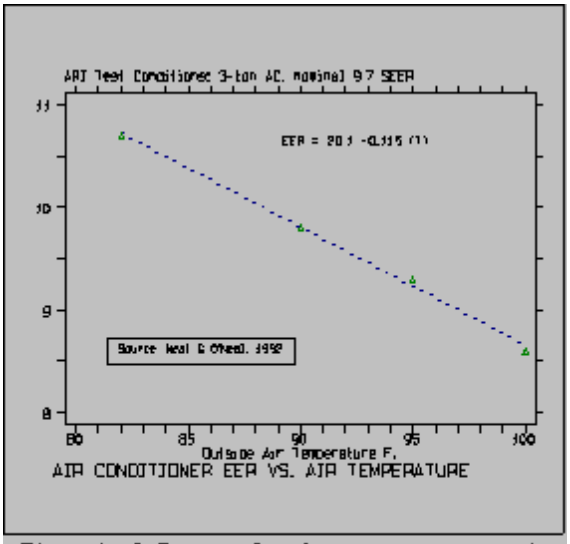

Figure 1. Influence of outdoor temperature on air conditioner EER from 82 - 100°F. The unit is a nominal 3-ton unit with a Seasonal Energy Efficiency Ratio (SEER) of 9.7.

Excerpt from a 1996 Texas A & M study:

In residential air conditioners an evaporator refrigerant temperature of 45oF (280oK) is common. Assuming a peak summer outdoor temperature of 95oF (308oK) and a 25oF temperature difference between the condensing and heat sink temperature, yields a typical condensing temperature of 120oF (322oK). Thus, the theoretical maximum COP for such an air-cooled cycle can be shown to be 8.1.(1) Further manipulation of this equation shows that the machine's COP can be theoretically improved by about 1.4% for each degree F that the outdoor heat sink temperature can be lowered.

The situation is somewhat different for real air conditioners, however, since the simple analysis above assumes a constant compressor efficiency and refrigerant pressure drop, as well as no friction losses or inefficiencies in the compression and expansion process. These factors serve to reduce achievable performance. Air conditioner performance in the U.S. is commonly rated as energy efficiency ratio, or EER, rated in Btu of heat rejection per input watt of power demand; COP = EER/3.413 Btu/W). Generally, the EER of residential air conditioners drops by about 1.2% approximately per each degree F (0.6oC) that the outside air temperature increases over the range between 82 and 100oF (27.8-37.8oC) (Neal and O'Neal, 1992). Figure 1 illustrates this effect from the test results from a standard residential unit.