At Berkeley Lab, the path to a sustainable energy future often runs deep into the basements of its largest facilities, which house the boiler rooms. Whenever possible, large conventional boilers are being replaced by a new generation of highly efficient combustion systems. Known as modulating condensing boilers, they take up a third of the space, and use considerably less energy because they recover almost all the heat available from the burning fuel. The second feature, modulation, allows them to perform more efficiently on those frequent winter days when temperatures are cool, but not cold enough to require the boilers to operate continually at full capacity.

Berkeley Lab has installed four new top-of-the-line modulating condensing boilers, each rated at 2 million BTU, to serve the Advanced Light Source and the complex of building surrounding it. Such boilers can cost $40,000 more than their conventional counterparts, but make up the difference with higher efficiency, longevity, and lower fuel consumption. Berkeley Lab has to date installed 13 of these new boilers in five facilities, and they are projected to save more than $100,000 in fuel costs annually.

The secret of condensing boilers is their ability to extract almost every bit of available heat from the burning fuel. Condensing boilers have much lower flue temperatures; this allows water, a product of combustion, to condense within their flues. This condensate is corrosive. In conventional boilers, flue temperatures are kept high in order to prevent condensation. Condensing boilers employ noncorrosive materials, especially in the flues, to accommodate condensate, which is collected, neutralized and drained safely to the sanitary sewer.

Conventional boilers typically burn their fuel at full throttle, turning on and off according to the demand of room thermostats. Modulating boilers carefully track the temperature of water returning from the heating system, and in warmer weather can dial down the firing level to as low as five percent of maximum, using less energy to reheat it for the new cycle. As a result, the boilers perform at high thermal efficiency not just on the coldest days, but throughout the long heating season.