Section 5. Targets for Reducing Energy Intensities

This section identifies targets for reducing energy intensities in commercial buildings. These targets are energy end uses that would show large increases if all buildings consumed at the same rate as buildings of the 1980's. In this section, intensities are based upon the entire building stock, not just those buildings using a particular fuel for a given end use. This method of computing intensities reflects both the level of penetration and the efficiency of 1980's technologies in computing hypothetical consumption levels for the total building stock.

Key findings of this section include:

- If all buildings used natural gas for heating with the same intensity as did buildings constructed in the 1980's, the total consumption of natural gas for space heating would fall 201 trillion Btu, or 17 percent (Figure 26).

- If all buildings used electricity for cooling with the same intensity as did buildings constructed in the 1980's, the total consumption of electricity for cooling would drop by 23 trillion Btu. However, the consumption of electricity for ventilation would rise by 14 trillion Btu, for a net reduction of 9 trillion Btu, or 2 percent (Figure 27).

- If all buildings had the same lighting intensity as did buildings constructed in the 1980's, consumption of electricity for lighting would increase by 9 percent (94 trillion Btu) (Figure 28).

- If all buildings used office equipment with the same intensity as did 1980's buildings, consumption of electricity for office equipment would increase by 26 percent (99 trillion Btu) (Figure 29).

Methodology

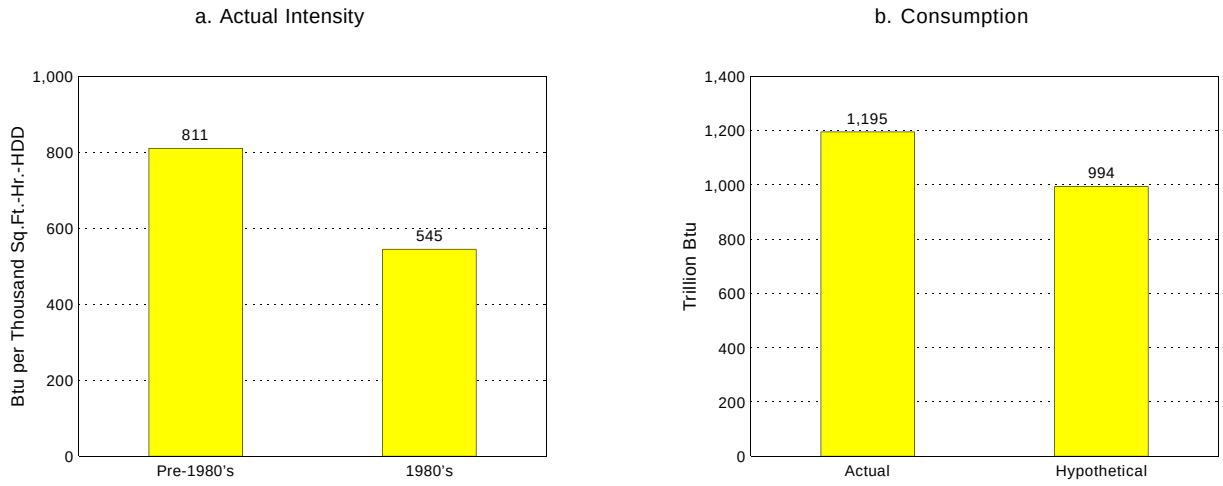
The method used to determine targets for reducing energy intensities was to extrapolate the energy consumption patterns of the 1980's buildings to the entire commercial building stock. The method, performed for five major end uses (natural gas space heating, electric cooling, ventilation, lighting, and office equipment use), had two parts.

- First, the energy intensities of 1980's buildings were calculated by using measures of energy intensities that accounted for differences in building size, operating hours, and weather (for heating and cooling). Energy intensities were calculated by principal building activity categories. For the five most numerous types of buildings in the CBECS sample (education, health care, mercantile, office, and warehouse), the buildings were divided into two groups: (1) small buildings, having 50,000 square feet of floorspace or less, and (2) large buildings, having over 50,000 square feet of floorspace.

- Second, estimates were made of the energy intensities and consumption for the five end uses, assuming that all buildings had the same end-use intensities as those of 1980's buildings.

The results show how the commercial building stock would be different if the entire commercial building stock consumed energy at the rates energy was consumed by the newer buildings, and also resembled the newer buildings in end uses served and in choices of energy sources for end uses. These results are based on the state of technology in commercial buildings in 1989 and do not account for any penetration of more efficient technologies (especially for lighting) which may have occurred since 1989.

Figure 26. Actual and Hypothetical Consumption of Natural Gas for Main Space Heating



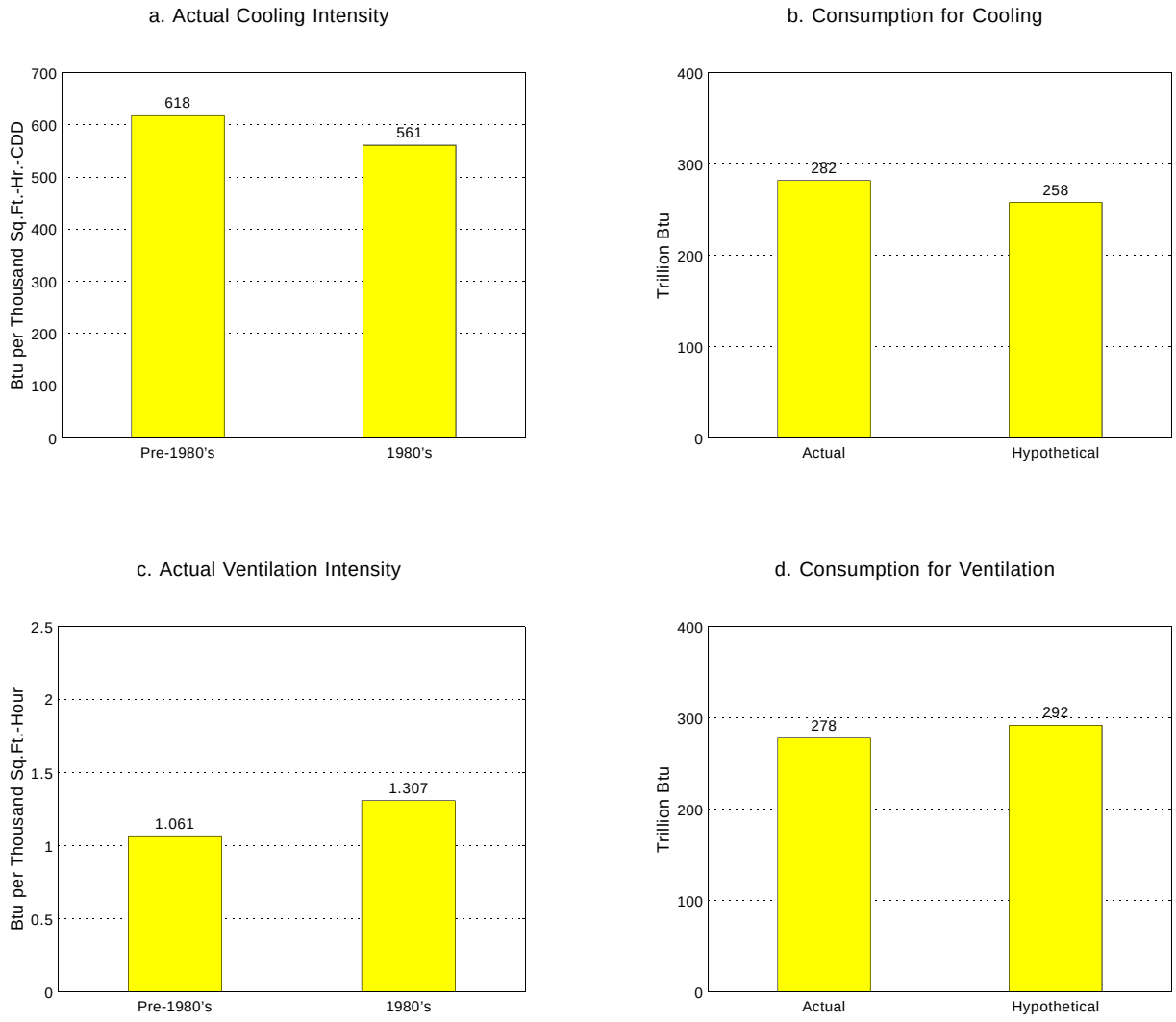
Note: Hypothetical consumption is that which would occur if all buildings consumed energy at the rate of 1980's buildings.
Sources: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-871A through F of the 1989 Commercial Buildings Energy Consumption Survey and statistically adjusted engineering end-use estimates.

- Heating intensity can be expressed as the ratio of energy consumed for heating to the product of the number of square feet of heated floorspace, operating hours, and average daily HDD's. (This formula allows comparison of heating intensities in buildings of different sizes, with different operating hours, and in different climates.)

- Figure 26 shows that buildings constructed during the 1980's consumed natural gas for main space heating about a third less intensively (per heated floorspace-hour-degree-day) than did older buildings.

- If all buildings used natural gas for main space heating with the same intensity as did buildings constructed in the 1980's, the total consumption of natural gas for heating would fall 201 trillion Btu, or 17 percent of the actual total consumption for heating.

Figure 27. Actual and Hypothetical Consumption of Electricity for Cooling and Ventilation



Note: Hypothetical consumption is that which would occur if all buildings consumed energy at the rate of 1980's buildings.
Sources: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-871A through F of the 1989 Commercial Buildings Energy Consumption Survey and statistically adjusted engineering end-use estimates.

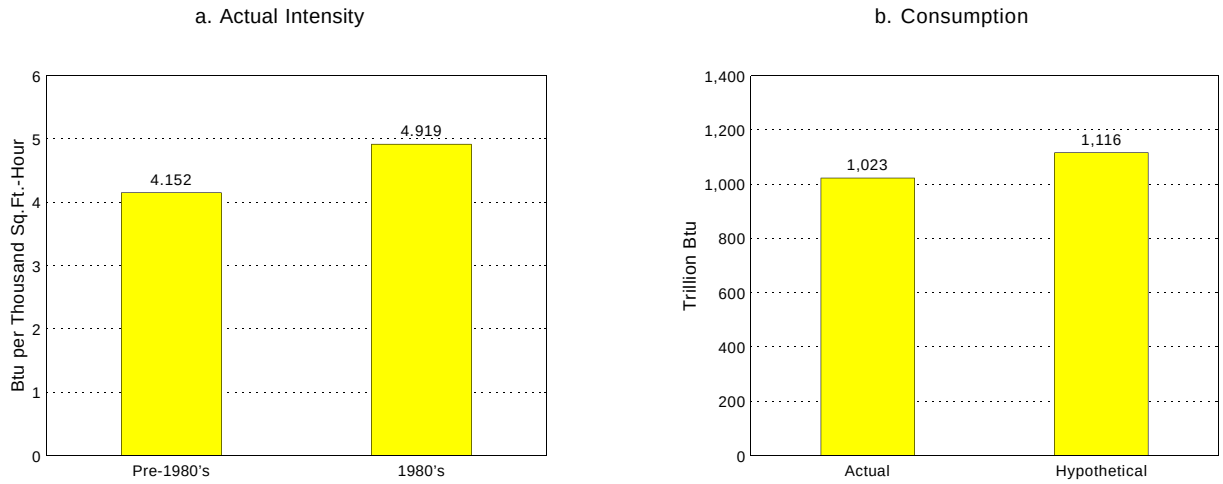
- Cooling intensity can be expressed as the ratio of the energy consumed for cooling to the product of the number of square feet of cooled floorspace, operating hours, and average daily CDD's. (This formula allows comparison of cooling intensities in buildings of different sizes, with different operating hours, and in different climates.)

- Ventilation intensity can be expressed as the product of the number of square feet of ventilated floorspace and operating hours.

- Figure 27 shows that buildings constructed during the 1980's consumed electricity 9 percent less intensively for cooling, but 23 percent more intensively for ventilation, than did older buildings.

- If all buildings used electricity for cooling with the same intensity as buildings constructed in the 1980's, the total consumption of electricity for cooling would drop by 23 trillion Btu. However, the consumption of electricity for ventilation would rise by 14 trillion Btu, for a net reduction of 9 trillion Btu (2 percent).

Figure 28. Actual and Hypothetical Consumption of Electricity for Lighting

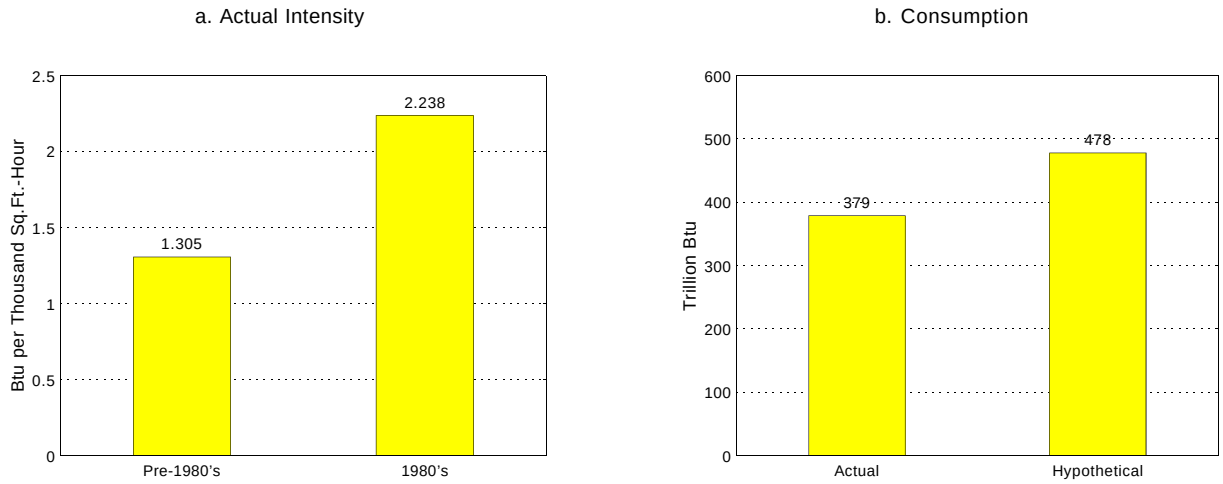


Note: Hypothetical consumption is that which would occur if all buildings consumed energy at the rate of 1980's buildings.
Sources: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-871A through F of the 1989 Commercial Buildings Energy Consumption Survey and statistically adjusted engineering end-use estimates.

- Lighting intensity can be expressed as the ratio of the energy consumed for lighting to the product of the number of square feet of floorspace lighted and operating hours.

- Figure 28 shows that if all buildings had the same lighting intensity as did buildings constructed in the 1980's, consumption of electricity for lighting would increase by 9 percent (94 trillion Btu).

Figure 29. Actual and Hypothetical Consumption of Electricity for Office Equipment



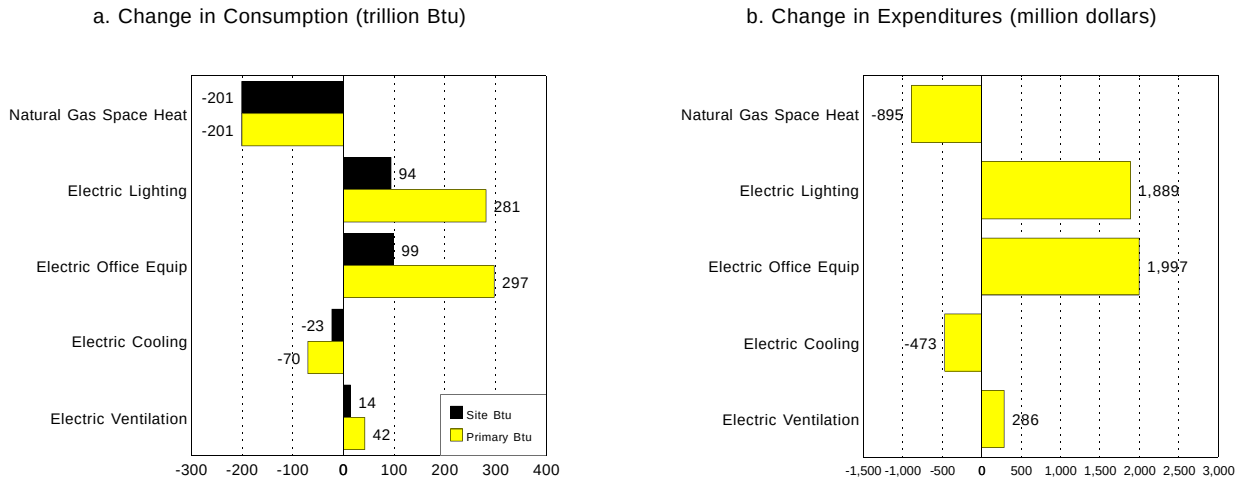
Note: Hypothetical consumption is that which would occur if all buildings consumed energy at the rate of 1980's buildings.
Sources: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-871A through F of the 1989 Commercial Buildings Energy Consumption Survey and statistically adjusted engineering end-use estimates.

- Energy intensity for office equipment can be expressed as the product of the square feet of floorspace and operating hours.

- Figure 29 shows that buildings constructed during the 1980's consumed electricity for office equipment much more intensively (71 percent more per floorspace-hour) than did older buildings.

- Applying the 1980's intensities to all buildings, consumption of electricity for office equipment would increase by 26 percent (99 trillion Btu).

Figure 30. Summary of Changes for Selected End-Use Energy Consumption and Expenditures that Would Occur If All Buildings Consumed at the Rate of 1980's Buildings



Sources: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-871A through F of the 1989 Commercial Buildings Energy Consumption Survey and statistically adjusted engineering end-use estimates.

- Figure 30 shows that, as the 1980's buildings have shown, the demand for services is increasing, particularly in end uses served by electricity. It is important, for consumption in the 1990's and beyond, that these increasing demands be served by efficient technology.

- For the five selected end-uses, the changes in site energy consumption that would occur if all buildings consumed energy at the rate of the 1980's buildings would cancel each other out.

- The large decrease in natural gas consumption for space heating (201 trillion Btu) would be counterbalanced by increases in electricity consumption for lighting (94 trillion Btu) and office equipment (99 trillion Btu).

- Primary energy consumption would increase, driven by increases in intensity of electric lighting and office equipment use, despite gains in the efficiency of these technologies during the 1980's. Electricity end-use consumption would increase, offsetting decreases in fossil fuel end-use consumption.

- The increases in electricity consumption would have been greater if there had not been gains in the efficiency of technology during the 1980's. In particular, commercial lighting has been a prime target of commercial sector demand-side management programs sponsored by electric utilities, which were newly launched in 1989.