

Appendix 1-A

Scenarios of Future Energy Use

The scenarios of future energy use in the residential and commercial sectors presented in this chapter are based on two factors: changes in the energy intensity of the buildings and growth in the number and size of buildings.

For the residential sector, changes in household energy intensity (energy use per household) and changes in the number of people per household (which when combined with population growth yields the number of households) are analyzed. For household energy intensity, three levels are considered:

- There is no further improvement in intensity—energy use per household stays at its current level.
- Intensity drops at half the rate it has dropped in the past. As noted in figure 1-5 intensity has actually increased in recent years; it is not clear if this trend will continue. It appears unlikely, however, that intensity will continue to drop as it has over the last two decades; therefore this level is, in OTA's view, the most likely future path for intensity.
- Intensity continues to drop at the rate it has dropped in the past two decades (-0.9 percent per year).

Population growth is assumed to be 0.61 percent per year.¹ In order to reflect uncertainty in future changes in household size, three different assumptions of future trends in household size are considered:

- Low: Household size (number of people per household) stays at its current level (2.68 people per household).
- Middle: Household size shrinks at half the rate it has shrunk in the past (-0.45 percent per year, half of 0.9 percent per year), leading to more (but smaller) households. As the historical shrinkage in household size has slowed in recent years, this is in OTA's view the most likely trend.
- High: Household size continues to shrink at the historical rate observed from 1970 to 1989 (-0.9 percent per year), leading to many more households.

The results are summarized in table 1-A-1. For each intensity scenario, three levels of 2010 consumption are shown corresponding to the three different assumptions as to household size.

A similar analysis is shown below in table 1-A-2 for the commercial sector. The two variables analyzed are changes in intensity and growth in square footage. Intensity scenarios are as in the residential sector:

- There is no future improvement in intensity (energy use per square foot). As shown in figure 1-10 this is consistent with trends since 1970, and is therefore, in OTA's view, the most likely future path for intensity.
- Future improvements in intensity are slow.
- Future improvements in intensity are moderate.²

Table 1-A-1—Energy Intensity and Household Density: Effects on Residential Building Energy Use

Actual consumption, 1989 (quads): 16.8	Consumption in 2010 (quads)		
	Low	Middle	High
If there are no further drops in intensity:	18.9	20.7	22.7
At half historical rates:	17.2	18.9	20.7
If historical intensity drops continue:	15.6	17.2	18.9

SOURCE: Office of Technology Assessment, 1992. See app. 1-A.

Table 1-A-2—Energy Intensity and Square Footage: Effects on Commercial Building Energy Use

Actual consumption, 1989 (quads): 12.6	Consumption in 2010 (quads)		
	Low	Middle	High
If there are no further drops in intensity:	16.2	19.9	24.4
At half historical rates:	14.8	18.2	22.3
With moderate future intensity drops:	13.4	16.5	20.3

SOURCE: Office of Technology Assessment, 1992. See app. 1-A.

¹ This is a weighted average of population projections as reported in U.S. Department of Commerce, Bureau of the Census, *Projections of the Population of States by Age, Sex, and Race: 1989 to 2010*, Series P-25, No. 1053 (Washington, DC: January 1990), p. 2.

² As shown in figure 1-10, energy intensity in commercial buildings has been relatively flat in the last 20 years. Therefore as a proxy for slow and moderate future improvements in intensity, the observed historical intensity change from the residential sector (-0.9 percent/year) is applied to the commercial sector as well. As in the residential sector, "slow" is set at half the historical rate and "moderate" set at the historical rate.

Uncertainty in future growth of the building stock (the total square footage of commercial buildings) is incorporated via three different assumptions of growth rates in the building stock:

- Low: Annual growth of 1.1 percent per year in total commercial building square footage.
- Middle: Annual growth is 2.1 percent per year.³ This is, in OTA's view, the most reasonable assumption.
- High: Annual growth is 3.1 percent per year.

As in the residential sector, for each intensity scenario three levels of 2010 consumption are shown corresponding to the three different assumptions as to commercial building square footage (table I-A-2).⁴

³ This is the value used in the National Energy Strategy; see *National Energy Strategy Technical Annex 2, draft* (Washington, DC: May 1991), p. A-5.

⁴ It is interesting to note that, for both sectors, the lower the intensity the lower the uncertainty in final consumption due to different assumptions as to the size of the building stock. In other words, lower intensity means both lower energy use and lower uncertainty. Uncertainty in energy demand has a cost, difficult to determine but surely nonzero; therefore decreased uncertainty can be seen as a benefit of lower intensity.