CHAPTER 4
THE COMMERCIAL SECTOR
CO_2 EMISSION REDUCTION STRATEGY

Key Findings

Figure 4

Commercial Sector CO_2 Emission Projections Through 2010

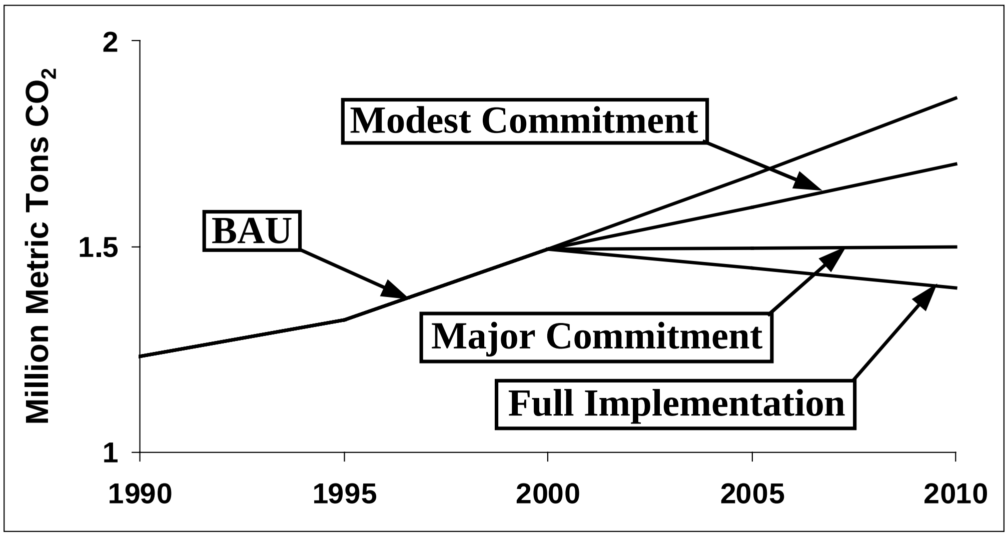

Table 4-1

Summary of Scenario Analyses to Reduce CO_2

in Delaware's Commercial Sector

	Energy Use (trillion Btus)	GHG emissions ($mmtCO_2$)*
1990	16.3	1.2
2010 BAU	28.9	1.9
Implementation Scenarios		
Modest Commitment (35%)	27.0	1.7 (9%)
Major Commitment (65%)	25.3	1.5 (18%)
Full Implementation (100%)	23.4	1.4 (27%)

* Percentage reductions from forecast emission level are indicated in parenthesis

Energy use in the commercial sector has grown rapidly in the recent past and is expected to continue to do so. This sector's energy consumption is forecast to increase by more than 75% between 1990 and 2000 – faster than any other sector in Delaware. Such growth is due to the transition of the Delaware (and U.S.) economy from manufacturing to services. Carbon dioxide emissions grew less quickly (over 50%), due to the reliance of this sector on natural gas – a low-carbon fuel – and technology improvements expected for the sector.

Under the Full Implementation scenario, greenhouse gas emissions in the commercial sector can be reduced significantly, from the 2010 forecast of 1.9 mmtCO_2 to 1.4 mmtCO_2 – a 27% decline (see Table 4-1). However, even the Full Implementation scenario is insufficient to return the sector to the emission levels of 1990. Under the Major Commitment scenario, a decrease from forecast emissions for 2010 of 18% is anticipated; while the Modest Commitment scenario is projected to realize a 9% decrease from the 2010 forecast. Lighting measures are especially attractive in this sector, offering near term net savings. The use of building-integrated photovoltaics (PV) represents a long-term investment in CO_2 mitigation that the DCCC believes is appropriate, given Delaware's leadership in PV research and manufacturing.

Background

The pattern of the sector's energy consumption and CO_2 emissions in Delaware is consistent with national trends. National consumption is about 14 quadrillion Btu of energy (EIA 1997), a modest level in comparison to other sectors. The electricity sector accounts for more than 50% of energy used in the sector and lighting is the largest end use. Delaware's commercial sector reflects these national patterns. The commercial sector contributes the smallest share of the state's CO_2 emissions, and most of the energy consumed is electricity (with natural gas as the second most common source).

Sources and Trends of Emissions

CO_2 emissions in the commercial sector are produced primarily by the consumption of electricity, which accounted for 58% of the total from this sector in 1996, and natural gas, which accounted for 23%. The remaining emissions derive from distillate, residual fuels, and coal. The CO_2 contributions by fuel type are presented in Appendix G. According to the Action Plan's projections, the fuel mix is expected to change slightly through the year 2010, with electricity contributing 57% of total CO_2 emissions in that year, and natural gas increasing its share to 27% (see Appendix G).

Projections

Total CO_2 emissions from the commercial sector in 1990 were 1.2 mmtCO_2, rising to 1.4 mmt in 1996. The 1990 emissions accounted for 3% of total State CO_2 emissions for that year (CEEP 1995), 2% less than the national average for the commercial sector. By 2010, commercial sector emissions are forecast to reach 1.9 mmtCO_2 under the BAU, over a 50% increase from 1990 levels. Improvements in energy efficiency are broadly available and inexpensive to implement. Generally, strategies identified in the Action Plan produce near-term financial benefits to commercial enterprises in the form of lower energy bills.

Methodology

Modeling of cost-effective CO_2 mitigation is quite similar for the residential and commercial sectors, since energy use in both is largely concerned with buildings-related technologies and management strategies. Just as the residential sector strategy used the IWG study (1997) to model residential energy efficiency improvement, analysis for this sector applied commercial measures researched by the IWG to Delaware. A cost-effectiveness screen of 4.0¢/kWh and payback period of less than 5 years was used. National data were used, with regional adjustment for climate, due to the absence of detailed state-level data on energy use by activity (heating, lighting, etc.).

Analysis of Options

The emission reduction measures selected for analysis include: high efficiency lighting, space conditioning, refrigeration, building-integrated PV,[1] and fuel switching. The estimated CO_2 emissions-reduction potential from these measures under three implementation scenarios is illustrated in Figure 4-1.

In this sector, space conditioning (including heating, ventilation and air conditioning) uses both gas and electricity. Space conditioning is influenced by many factors, but principally by building characteristics, climate, type of heating and cooling equipment, and thermal gains from equipment.

Action Plan projections show that, under the BAU scenario, emissions from electric space conditioning and ventilation will increase from 179,468 $mtCO_2$ in 1996 to 203,349 $mtCO_2$ in 2010, a gain of 13%. Emissions from gas-powered space conditioning will rise from 241,630 $mtCO_2$ in 1996 to 315,780 $mtCO_2$ in 2010, an increase of 31%. An even greater increase in the use of natural gas – a low-carbon fuel – with a decrease in the use of electricity could lead to an overall reduction in CO_2 emissions in 2010. As shown in Appendix I, with fuel switch beginning in the year 2000, CO_2 emissions could decrease to 127,359 $mtCO_2$ for electricity and to 250,525 $mtCO_2$ for natural gas in 2010, a savings of 37% and 21% of emissions, respectively. Fuel switching would involve high initial cost, but can return economic benefits to commercial users relatively quickly. Due to its high capital cost, only a modest level of fuel switching is anticipated in the Action Plan.

At present, lighting in the commercial sector accounts for 245,509 $mtCO_2$ of emissions. If the technological status quo is maintained, it is projected that in 2010

[1] This measure did not meet the cost-effectiveness criteria set by DCCC for other measures. However, special benefits accrue to Delaware since it is home to a leading PV manufacturer and the University of Delaware has been designated by the U.S. Department of Energy as one of only two "Centers of Excellence" in the country for development of advanced PV technology and market and policy requirements for its diffusion. DCCC expects rapid technical and economic improvements in this technology and believes that Delaware can be a leader in its market development.

emissions will rise to 285,273 mtCO_2, an increase of 16%. At present, fluorescent lighting accounts for 70% of the energy used for lighting in the sector, with incandescents accounting for 18% (IWG 1997).

The Full Implementation scenario would include the widespread use of halogen and compact fluorescent technologies. With these technologies, CO_2 emissions in 2010 are projected to be 225,841 mt. This would translate to 21% lower emissions in 2010 than the BAU forecast (see Appendix I). There is a net saving for investing in high-efficiency lighting in this sector. The IWG report (1997) indicates that this benefit includes savings in maintenance costs because halogen and compact fluorescent lighting have longer lifetimes and need to be replaced less frequently.

Refrigeration constitutes a modest component of the energy consumed in the commercial sector. But analyses conducted for the Action Plan show that the potential exists to cost-effectively reduce the level of CO_2 emissions by introducing higher efficiency models of this technology. Commercial refrigeration covers a wide array of devices, such as ice-makers, walk-in centralized systems, vending machines, and reach-in freezers. The largest energy savings derive from supermarket upgrades. The cost of conserved energy is low across the wide array of refrigeration units examined, ranging from \$0.003 kWh (for centralized systems in small groceries) to \$0.022 kWh (for vending machines).

As shown in Appendix H, under the BAU scenario, CO_2 emissions from refrigeration will increase by 23% from 29,888 mtCO_2 in 1996 to 36,809 mtCO_2 in 2010. With the use of more efficient technologies (especially technologies with an energy use index (EIU) of 2.0 kBtu/sf), emissions from refrigeration could fall to 29,202 mtCO_2, 21% below the BAU (see Appendix I).

Recently enacted state policies to deregulate electricity markets in the mid-Atlantic region anticipate from 3% (Pennsylvania) to 6.5% (New Jersey) of electricity to be provided by renewable energy by 2010-2012. One important opportunity for reducing energy use and greenhouse gas emissions in this regard is the application of photovoltaic (PV) technology to buildings to reduce electricity demand. The National Renewable Energy Laboratory has sponsored research on the CO_2 effects of a national strategy to provide 2% of national buildings-related electricity consumption from photovoltaic systems (Byrne et al 1999). PV systems can be installed on rooftops or other suitable locations and incorporated into commercial building energy systems, and thereafter operated as a peak management technology. This application has proved to be cost-effective at current technology prices (e.g. Byrne et al, 1997 and 1998). The Action Plan's analysis is based on existing PV systems that are commercially available and in operation around the country. It identifies emission reductions of 75,650 mtCO_2 by 2010 through a PV measure that anticipates the use of the technology for peak-shaving and emergency power purposes (see Appendix I).

Results

The Full Implementation Strategy would realize a 27% reduction in emissions by the year 2010; the Major Commitment Strategy (65% of full implementation) would result in an 18% reduction, and the Modest Commitment Strategy (35% of full implementation) would realize a 9% reduction below forecast levels. Results for all measures are presented in Appendix I.

Conclusions

Under the BAU scenario, emissions from the sector will increase by more than 50%, from 1.2 mmtCO_2 in 1990 to 1.9 mmtCO_2 in 2010. Reductions under the Modest Commitment scenario result in emissions of 1.7 mmtCO_2, while the Major Commitment scenario results in 1.5 mmtCO_2 by 2010. Forecast emissions under the Full Implementation scenario are 1.4 mmtCO_2 by the target year. Using the Major Commitment scenario as the benchmark for action, emissions in the commercial sector can be reduced by 18% from the forecast level for 2010. Still, this is equivalent to 24% above the 1990 level for this sector. The increase in emissions above 1990 levels, even after an aggressive savings program is implemented can be explained by the rapid economic growth forecast for the sector as part of a state and national trend toward a service-based economy.

Many opportunities are available to arrest the forecast trend of increasing energy use in the commercial sector. Implementation can be achieved with reasonable cost-effectiveness. Improving energy efficiency will benefit commercial activities by lowering the expenditure on energy; in the case of improved lighting, the financial and greenhouse benefits are immediate. For the sector to achieve an emissions reduction of Strategy. Policy actions to support the adoption of the analyzed measures for CO_2 emission reduction in the sector are identified in Chapter 9.

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