

Greenhouse gas baseline and mitigation options for the commercial sector

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1. Introduction

The United Nations Framework Convention on Climate Change (FCCC) was adopted in 1992, with the objective to “stabilise greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system”. South Africa ratified the Convention in August 1997 and is obliged to develop and submit a National Communication that contains an inventory of greenhouse gas emissions for a base year and a strategy to address climate change. This report provides baseline greenhouse gas emissions and mitigation options in the commercial sector, and serves as an input for a macro-economic analysis of South African greenhouse gas mitigation scenarios and for South Africa’s National Communication.

2. Scope of work

Deliverables required for the commercial sector study are:

- a baseline scenario of greenhouse gas emissions from 1990 to 2030;
- selection and technical description of relevant mitigation options;
- a financial evaluation of mitigation options;
- quantification of evaluation criteria for mitigation options;
- consultation with relevant stakeholders (list given in Appendix A).

Greenhouse gas emissions are to be reported for 1990, 1994, 1998, 2000, 2005, 2010, 2015, 2020, 2025 and 2030.

3. Definition of sectoral activity

The commercial sector is defined under Standard Industrial Classification (SIC) codes 6, 8, and 9. Table 1 shows a breakdown of the commercial SIC sub-sectors together with the corresponding type of building associated with that activity. Note that all public sector activities are included under SIC 9.

Table 1. Commercial sub-sectors by SIC code

<i>SIC</i>	<i>Description</i>	<i>Type of building</i>
6	<i>Trade, catering and accommodation</i>	
61	Wholesale trade	Warehouses
62	Retail trade	Shops
631	Accommodation	Accommodation
632	Catering	Restaurants
8	<i>Finance, property and business services</i>	
81	Financial institutions	Offices
82	Insurance institutions	Offices
83	Auxiliary activities	Offices
84	Real estate	Offices
85	Renting of equipment	Offices
86	Computer activities	Offices
87	Research and development	Offices
88	<i>Other business activities</i>	Offices
9	<i>Community, social and personal services</i>	
91	Public administration	Offices
92	Education	Education facilities
93	Medical and health services	Healthcare facilities
94-99	Other services	Other

4. Baseline methodology and data collection

4.1 Introduction

The following methodology was used to determine greenhouse gas emissions for each year from 1990 to 2030:

1. Project sales output of the commercial sub-sectors (sales output measured in rands).
2. Use commercial sub-sector output projections to project floor-space for different types of buildings (floor-space measured in square metres).
3. Estimate energy intensities for each type of building by type of fuel and type of activity (measured in joules per square metre).
4. Multiply floor-space by energy intensities to get annual energy use by type of fuel (measured in joules).
5. Estimate emission coefficients for each type of fuel for CO₂, CH₄ and NO₂ (measured in grams per joule).
6. Multiply emission coefficients by fuel use to get total greenhouse gas emissions by type of fuel.

All calculations were done on Exel spreadsheets.

4.2 Output of the commercial sector

The output variable used for the commercial sector was annual sales, since the Industrial Development Corporation (1999) provides sales growth projections for the period 1999 to 2015 for the following commercial sub-sectors:

1. Trade, catering and accommodation (SIC 6).
2. Finance, Property and Business Services (SIC 8).
3. Community, Social and Personal Services (SIC 9).

Sales growth for 2015 to 2030 was taken to be the average growth projected for 2010 to 2015. Appendix B shows annual sales growth projections for each sub-sector.

4.3 Floor-space

Energy consumption in the commercial sector is usually related to floor-space. Floor-space for each type of building was estimated for 1990 based on the floor-space of buildings completed in South Africa over the last 45 years (Statistics South Africa, 1946-1990). Floor-space for each building type was projected using annual sales growth in a related commercial sub-sector. Due to increasing efficiencies of floor-space use and an increasing number of people working from home, it was assumed that floor-space will grow at 70% of sales growth. Appendix C shows floor-space projections for each building type. Price (1999) calculated commercial floor space in South Africa to be 80 million square metres in 1996 compared with the 71 million square metres calculated in this study.

4.4 Energy intensities

The commercial sector uses, or is projected to use, the following forms of energy:

1. Electricity
2. Coal
3. Town gas
4. H₂-rich gas
5. CH₄-rich gas
6. Natural gas
7. Diesel
8. Paraffin
9. Residual oil
10. LPG

The commercial sector was divided into the following energy consumption activities:

1. Lighting
2. Space heating
3. Water heating
4. Ventilation and cooling
5. Refrigeration
6. Cooking
7. Other (office equipment, incineration, lifts, standby generators, etc)

Energy intensities (energy consumption per square metre) were estimated by building type, fuel type and activity. Sources of information for energy intensities included Anderssen et al (1995), Energy Information Agency (1994), Spoomaker (1993), and Piani (1995). Appendix D shows estimated energy intensities for 1990. Although this information is old, energy intensities in buildings do not change quickly with time due to the long life of buildings and because energy intensity is strongly related to the design of the building.

One of the most important factors influencing future energy use is the timing of the introduction of natural gas to South Africa. Under the baseline scenario it is assumed that natural gas is introduced in 2010. The following assumptions were made in estimating future energy intensities:

- Total energy intensity declines by 0.5% per year due to efficiency improvements (effect of efficiency improvements counter-acted to some extent by an increasing level of services provided to buildings).
- Coal energy intensity declines by 2% per year.
- Town gas intensity declines by 10% per year to be totally phased out by 2010.
- Hydrogen-rich gas from SASOL increases at 3% per year until 2010 after which it rapidly declines at 10% per year.
- Natural gas is introduced in 2010 and use increases to 25% of fuel energy intensity (excluding electricity). Natural gas will mostly substitute residual oil, coal, and electricity used in boilers.

- Diesel and paraffin intensity declines by 1% per year.
- Residual fuel oil intensity declines by 2% per year.
- LPG intensity increases by 1% per year until 2010 and then declines at 2% per year.

These assumptions were based on a combination of extrapolation of historical and views of the author. Appendix E shows energy intensities for the period 1990 to 2030.

4.5 Energy consumption

Various sources were used to estimate total energy consumption in 1990 in the commercial sector. Total fuel consumption was calculated by multiplying energy intensities and floor-space, and then checked against estimated total fuel consumption by the commercial sector. Estimates of both energy intensities and total fuel consumption were refined until a consistent picture of energy consumption in 1990 emerged. Table 2 shows various estimates of commercial energy consumption, and the values calculated for this study. The bottom-up approach of this study indicates that diesel consumption may be larger than that estimated in previous statistics, perhaps because it is mostly used by smaller establishments and in so many different applications e.g. generators, incinerators and service water boilers. Appendix F shows energy consumption by fuel from 1990 to 2030 for the commercial sector.

Table 2. Energy use in the commercial sector (PJ)

Source	Year	Elec	Coal	Piped gas	LPG	Diesel	Paraffin	Resid. oil
This study	1990	53.1	16.3	0.8	2.0	1.4	0.2	2.8
GHG inventory (Scholes 1997)	1990		126.5	0.6	0.1			0.1
Cooper (1993) ^a	1991	55.1	8.1-35.4	0.8				
DME (1998)	1996	53.5	7.2-35.1	0.8	2.3	-	0.1	-
SSA (1989, 1992) ^b	1990	53.1						
NER (1995)	1996	47.2						
Dutkiewicz et al (1991) ^c	1990		16.3			0.8	0.2	2.8

^a Liquid fuel data was confidential at this time.

^b Interpolated value from Census figures for 1989 and 1992.

^c Calculated for boilers only, assuming 70% of oil is residual oil, 25% diesel and 5% paraffin.

4.6 Greenhouse gas emission coefficients

Greenhouse gas emission coefficients were divided into two categories:

1. Direct emissions – emissions produced at the location of the commercial building. Direct emission factors, shown in Appendix G, were obtained from Howells and de Villiers (1999).
2. Indirect emissions – emissions produced in order to supply a fuel to consumers. Indirect emission coefficients, shown in Appendix H, were obtained from the Energy Sector Baseline Study.

5.5. Greenhouse gas emissions

Direct commercial sector carbon dioxide equivalent emissions in 1990 were calculated to be 1.8 million tons whereas Scholes (1997) calculated them to be 11.5 million tons. Direct carbon dioxide emissions are projected to increase to 3.0 million tons by 2030 in the baseline scenario. Total direct and indirect commercial sector carbon dioxide equivalent emissions were calculated to be 16.9 million tons. Baseline direct greenhouse gas emissions are given in IPCC format in Appendix I and in IDC format in Appendix J. Production value is represented by value of sales.

6.6. Mitigation options

6.1 Introduction

Mitigation options in the commercial sector essentially either involve using energy more efficiently or fuel switching. Because potential financially viable energy savings measures in buildings are so large, and because previous research has only focussed on savings that building owners would consider, only financially viable mitigation options are addressed in this study. This means that the cost of reducing greenhouse gas emissions will actually be a benefit – that is, a win-win situation.

6.2 Energy prices

Energy prices used for the mitigation option calculations are shown in Appendix K.

6.3 Energy efficiency mitigation options

The potential for overall energy efficiency improvement in buildings is indicated by the following:

- Kruger (1990) estimated that 38% too much energy is used in South African buildings.
- Spoomaker (1993) says that the majority of South African buildings consume up to 50% more energy than is necessary.
- The new Standard Bank building headquarters, completed in 1990, was efficiently designed with energy costs being 36% lower than for an equivalent conventional building (Clemitson et al 1993). A subsequent retrofit of another Standard Bank building reduced energy costs by 50% with a payback of five years (Clemitson et al 1993).
- In general, other countries have indicated that building retrofits yield energy savings of 18% to 30% and new building design can reduce energy consumption by up to 70% (Mathews 1996).
- The New South Wales government in Australia introduced the 'Energy Smart Government Programme' in 1995 which aimed to reduce energy consumption by 15% by 2001 and 25% by 2005, using 1995 as a baseline.

Carlin (1979) developed a very illustrative diagram for South African buildings (Figure 1) which shows the enormous difference in energy consumption between an efficient building and an inefficient one, and that the design of the building is the most important factor determining energy consumption.

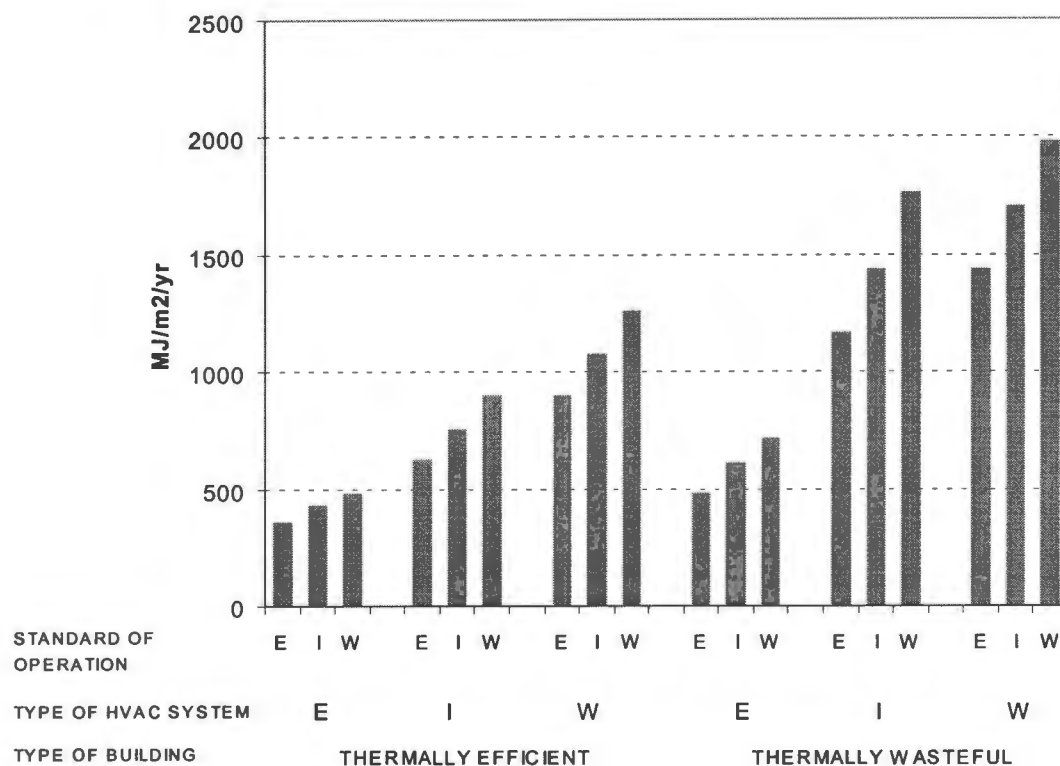


Figure 1. Energy consumption for different types of buildings in South Africa (E= efficient, I=inefficient, W=wasteful) (Carlin, 1979)

Energy efficiency mitigation options considered in this report are:

1. New building envelope design
2. HVAC retrofit
3. Efficient HVAC systems for new buildings
4. Lighting retrofit
5. Efficient lighting systems for new buildings
6. Variable speed drives for fans
7. Heat pumps for water heating
8. Energy star equipment

These mitigation options are not mutually exclusive – that is, each one is evaluated on its own against the baseline, but if new buildings were designed with thermally efficient building envelopes, then the potential savings from HVAC systems would be lower.

6.4 Energy efficiency implementation issues

In order for the energy efficiency mitigation options to be realised, voluntary or mandatory energy standards for new and existing buildings will need to be introduced, combined with awareness and training programmes, availability of effective energy audits and availability of tools for commercial building energy simulation. The adoption of building energy standards has been estimated to reduce building energy consumption by 13-18% in the USA and projected to reduce building energy consumption by 20% in Malaysia, 22% in the Philippines and 24% in Indonesia (Deringer and Levine 1990).

The costs of running such a public programme effectively are not trivial, but highly uncertain. An indication of the order of magnitude of costs is given by the Sustainable Energy Development Authority (SEDA) of New South Wales in Australia. New South Wales has similar total commercial energy consumption, energy prices and climate to South Africa.

SEDA's annual funding for energy efficiency promotion will be about R80 million (excludes co-generation and renewable energy) of which about R20 million can be attributed to the commercial sector (SEDA 1999). Most of the R20 million per annum will fund activities related supporting voluntary building standards. It is assumed that administrative costs will be similar in South Africa, and are apportioned to each energy efficiency mitigation option on the basis of potential energy savings.

6.5 Fuel switching mitigation options

Fuel switching options considered are:

1. Solar water heating.
2. Switching from coal and oil to natural gas for boilers.
3. Switching from electricity to natural gas for heating.

The main driver for gas fuel switching will be the availability of competitively priced piped natural gas. Fuel switching measures are not mutually exclusive of the energy efficiency mitigation options.

6.6 Technical description of mitigation options

6.6.1 New building thermal design

The largest single influence on building energy consumption is the design of the building. New building envelope design will reduce energy consumption through:

- optimisation of thermal mass for local climate;
- optimal insulation;
- glazing;
- correct orientation;
- building shape.

Potential savings depend very much on the payback of the initial investment. Using the discussion on the potential for energy efficiency in buildings as a basis, it is estimated that optimal thermal design of a new building up to 2030 can reduce heating, ventilation and cooling energy requirements by 40% relative to the baseline with an average payback of five years. The reader should note that these estimates are very uncertain.

Barriers to improved thermal design are increased initial cost, split incentives (the developer often does not have to pay for the energy bill), and lack of training of architects and consulting engineers in efficient building practices.

Improved thermal design of buildings will reduce non-greenhouse gas emissions by reducing fuel requirements. Commercial sector emissions are important from a health perspective because they are emitted in high density population areas. South Africa lags behind the developed world in efficient building design and potential measures are all technologically proven.

6.6.2 HVAC retrofit

Options for a heating, ventilation and cooling (HVAC) retrofit include:

- switching off air-conditioning when there are no occupants;
- eliminating reheat, in which pre-conditioned air is reheated in a heating coil in the duct system;
- prevent mixing of cold and hot air;
- new air-conditioning temperature set-points;
- ventilation with outside air and night cooling;
- use of evaporative cooling;
- use of computerised energy management systems.

The University of Pretoria library retrofitted a HVAC system and reduced energy consumption by 37% with a 2.5 year payback (Grobler et al 1993). It is assumed that similar energy savings

could be realised in 50% of existing buildings over a ten-year period, with an average payback of three years.

Barriers include a lack of awareness by building owners of the benefits of a HVAC retrofit and the mindset that energy services are merely a support service for commercial activity and therefore little attention is given to cost efficiency.

An HVAC retrofit will reduce non-greenhouse gas emissions by reducing fuel and electricity requirements. A small increase in employment would result in the HVAC industry.

6.6.3 Efficient HVAC systems for new buildings

The same measures as in HVAC retrofits apply. In addition, HVAC systems should not be oversized, leading to poor efficiencies. HVAC systems designed for new buildings will be more energy-efficient than those in existing buildings under the baseline scenario. It is estimated that efficiencies for new systems up to 2030 could be reduced by a further 25% with a payback of five years. Once again the reader should note that these estimates are highly uncertain.

The same barriers that apply to the two previous mitigation options apply to new HVAC systems as well.

Efficient new HVAC systems will reduce non-greenhouse gas emissions by reducing fuel requirements. A small increase in employment would result in the HVAC industry.

6.6.4 Lighting retrofit

Efficient lighting includes the following:

- Replace low wattage incandescent lighting with fluorescent lighting.
- Replace high wattage incandescent lighting with high-pressure metal halide or sodium lamps.
- Replace standard fluorescent tubes and magnetic ballasts with more efficient fluorescent tubes and electronic ballasts.
- Replace incandescent lighting with high-pressure metal halide or sodium lighting.
- Replacing existing reflectors with more efficient reflectors.
- Introducing lighting controls including more switches, photo-electric sensors and occupancy sensors.
- Reduce lighting levels where illumination is too high.

Two large lighting retrofits were carried out at Megawatt Park (Grobler 1999). In 1996 automation and integration of the lighting system with the building management system realised energy savings of about 5 543 000 kWh annually (26% of lighting energy). In 1997 standard fluorescent tubes and magnetic ballasts were replaced with more efficient fluorescent tubes and electronic ballasts. The total cost was R 2 313 559 and total savings were 3 216 000 kWh annually (21% of lighting energy). This gives a ratio of R0.72 per annual kWh saved.

Numerous case studies of lighting retrofits in the USA (US DOE 1999) indicate that financially viable building lighting retrofits save between 20% and 40% of lighting energy. It is assumed that 30% of lighting energy can be saved in 70% of South African buildings within the next ten years. It is assumed that the average cost of lighting retrofits is the same as for Megawatt Park (R0.72 per annual kWh saved), and that this represents a once-off incremental cost.

Barriers to a lighting retrofit include lack of awareness by building owners and the mindset that lighting is a service that is used on demand without any thought about cost-effectiveness.

Efficient lighting will reduce non-greenhouse gas emissions by reducing the amount of electricity required. Efficient lighting technologies have existed for some time and technological support is available in South Africa.

6.6.5 Efficient lighting systems for new buildings

There is greater potential for efficient lighting systems in new buildings compared with existing buildings, but the baseline scenario will capture some of these. It is estimated that lighting energy use in new buildings could be reduced by 20% on average with an average payback of three years. As with the lighting retrofit, it is assumed that the cost of replacing lamps does not change significantly in the mitigation scenario.

Barriers to efficient lighting systems for new buildings are increased initial cost, split incentives (the developer often does not have to pay for the energy bill), and lack of training of architects and consulting engineers in efficient building practices.

Efficient lighting will reduce non-greenhouse gas emissions by reducing the amount of electricity required. There are no technological barriers to new efficient lighting systems.

6.6.6 Variable speed drives for fans

Electric motors normally operate at a constant speed (and electricity consumption) no matter what flow is required, and valves or dampers used to control the flow. Variable speed drives allow electric motors to use less electricity by automatically changing the speed (and electricity consumption) of the motor in proportion to the flow required. Variable speed drives were installed at Megawatt Park in 1997 at a cost of R900 000, saving 1 599 000 kWh annually (Grobler 1999) which is 15% of HVAC energy consumption (30% of fan energy consumption). This gives a cost of R0.56/kWh saved. The total amount of electricity used on fans is estimated to be 53% of HVAC electricity consumption (Piani 1997). Only variable volume air handling units can operate with variable speed drives. It is estimated that 25% of air handling fans are eligible for variable speed drives and that these fans could have variable speed drives installed by 2015. The average life of a variable speed drive is 15 years.

Barriers to the installation of variable speed drives for fans are lack of awareness of their benefits, the risk that promised savings will not materialise, and the high investment cost.

Variable speed drives will reduce non-greenhouse gas emissions by reducing the amount of electricity required. Variable speed drives are currently imported, but if sufficient demand was created, local production would be possible. Variable speed drives have been successfully operated for over a decade.

6.6.7 Heat pumps for water heating

Replacing electrical resistance water heaters with heat pumps will reduce energy consumption by 67%. The cost of a 50 kW heat pump is R50 000 and its annual maintenance is R2 500 (Graham (1999)). Assuming a 0.2 load factor, annual electricity consumption is 29 200 kWh. The equivalent electrical resistance heater would cost R12 500, have negligible maintenance costs and consume 87 600 kWh per year.

It is estimated that by 2015 an additional 30% more than the baseline of hot water heating installations could be heat pumps. The average life of a heat pump is assumed to be 15 years.

Barriers to the installation of heat pumps are the high investment cost and possibility of operational problems.

Heat pumps will reduce non-greenhouse gas emissions by reducing the amount of electricity required. Heat pumps systems have imported components so they would have a negative effect on balance of payments. They are a technologically proven technology with technical support available in South Africa.

6.6.8 Energy star equipment

Most computers and other office equipment are shipped to South Africa with the energy saving capability de-activated. Targeting the suppliers will capture most of the savings potential. Suppliers can either be persuaded to activate the energy savings capability through procurement requirements. Bulk computer customers will need to be educated about the potential savings. Costs are administrative and relate to the education of bulk computer customers. Average electricity savings per computer are estimated at 213 kWh per year (40% of consumption), and

in 1998 700 000 computers entered South Africa (Price 1999). Due to uncertainties regarding future computer technologies, it is assumed that savings will only be implemented and realised from 2000 to 2015. It is estimated that computer sales will increase at 5% per year between 1998 and 2015, and it is estimated that 50% of computers bought could benefit from the programme. In addition savings can also be made on other office equipment such as printers, fax machines and photocopiers and it is estimated that these savings will amount to 10% of computer savings. Finally it is assumed that the energy saving capability of office equipment will be activated in the future, but that an energy star programme can speed this process by five years.

Barriers to activated energy star equipment are lack of awareness and the perceived risk that activating energy star capabilities could create computer problems.

Energy star enabled equipment will reduce non-greenhouse gas emissions by reducing the amount of electricity required.

6.6.9 Solar water heating

Solar hot water heating in the commercial sector will usually be considered with a back-up source of heating when solar irradiation is insufficient. In South Africa, on average, about 90% of hot water would be generated by solar energy, and 10% by electricity. Solar collectors are installed on roofs of buildings and connected to a storage tank. At present solar water heating in the South Africa's commercial sector is negligible. Solar water heaters have a life of about 20 years and costs including installation are about R35 000 for a 1000 litre system (Venter 1999) or about R462/GJ of annual water heating. Annual maintenance costs are assumed to be 3% of the investment cost. It is assumed that, by 2015, 25% of commercial hot water heating could be converted to solar water heating. It is estimated that a public programme to promote solar water heaters would cost R2 million per year.

Barriers to solar water heating are the risk of the technology not performing as promised, the risk of operational problems and the high investment cost.

Solar water heating will reduce non-greenhouse gas emissions by reducing fuel and electricity requirements.

6.6.10 Switching from coal and oil boilers to natural gas boilers

Coal and oil fired boilers can be modified to use natural gas. Natural gas is much more convenient to use and maintenance costs will be reduced, and efficiencies of fuel use will improve (assumed by 15%). In the baseline scenario natural gas becomes available in 2010 and, by 2030, 20% of boilers are converted to natural gas. In the mitigation option it is assumed that natural gas becomes available in 2005 and that, by 2030, 50% of boilers are converted to natural gas. Conversion to gas will require an upfront cost, but new gas boilers are cheaper than coal or oil boilers. Maintenance costs on a gas boiler will be lower than those for coal and oil boilers. Since the annualised cost of a boiler investment is considerably less than fuel cost and only incremental costs are of interest, incremental costs are assumed to be zero. Only fuel costs are considered.

The main barrier to the use of natural gas is its availability.

Use of natural gas instead of coal and oil will reduce non-greenhouse gas emissions. Natural gas is likely to be imported and therefore the trade balance would be adversely affected.

6.6.11 Switching from electricity to natural gas for heating

The mitigation option considers replacing centralised electrical heating systems with centralised gas boiler systems. In the baseline scenario it is assumed that natural gas becomes available in 2010 and, by 2030, 10% of electrical heating systems are replaced by natural gas. In the mitigation option it is assumed that natural gas becomes available in 2005 and that, by 2030, 30% of electrical heating systems are converted to natural gas. It is assumed that the efficiency of use of gas is 90% (Wiese 1999). The costs of retrofitting a gas hot water system is R20

000 per 1000 kg/hour system (Wiese 1999), and it is assumed that water heating is carried out 12 hours/day, 6 days per week, and 11 months per year.

The main barrier to the use of natural gas is its availability.

Use of natural gas instead of electricity will reduce non-greenhouse gas emissions. Natural gas is likely to be imported and therefore the trade balance would be adversely affected.

6.7 Financial analysis of mitigation options

A financial analysis was carried out for each mitigation option for one GJ of replaced energy. All monetary values are expressed in 1997 Rands. Key outputs of the financial analysis are:

1. Incremental life cycle costs (LCC) per GJ, calculated by discounting all cash flows (including implementation costs) and subtracting the baseline technology LCC from the mitigation technology LCC.
2. Incremental levelised costs (LC) per GJ, calculated by dividing incremental LCC by a 30-year levelised cost factor (function of discount rate).
3. Cumulative direct and indirect carbon dioxide equivalent reduction per GJ, evaluated over 30 years.
4. Rand per ton of carbon dioxide equivalent, calculated by dividing LCC/GJ by cumulative carbon dioxide equivalent reduction.
5. Kg cumulative carbon dioxide equivalent reduction per rand of incremental investment, calculated by dividing cumulative carbon dioxide equivalent per GJ by incremental investment cost per GJ.
6. Total LCC, calculated by multiplying LCC/GJ by the number of GJ replaced each year and then discounting each year's total LCC back to the first year.
7. Cumulative total carbon dioxide equivalent reduction, calculated by determining the change in energy consumption each year until 2030 and then multiplying each energy type by total (direct and indirect) greenhouse gas emission coefficients.

Appendix L shows the assumed penetration of mitigation option. Appendix M provides calculated values for the financial analysis, for discount rates of 3%, 6%, and 12% (the rest of this report only uses the 6% discount rate).

6.8 Greenhouse gas emissions for mitigation options

Appendix N shows direct greenhouse gas emissions for each mitigation option.

6.9 Evaluation of mitigation options

Table 3 shows an evaluation of mitigation options. Each mitigation option was either quantified or assessed as having a positive, negative, or zero influence on each evaluation criteria. The effect of mitigation options on GDP and inflation is unknown.

Table 3. Evaluation of mitigation options

	Reduction in GHG emissions (mill. tons)	Local environmental impact				Cost-effectiveness (R/ton)	Macro-economic impact					Social impacts		Institutional and admin. capacity	Technological feasibility
		soil conservation & biodiversity	water resources & biodiversity	air quality non GHG emissions	leakage		impact on trade balance	impact on GDP	impact on inflation	return on initial investment (Kg/R)	impact on international competitiveness	social equity & poverty alleviation	job creation		
New building thermal design	80	Zero	Zero	+	Zero	-132	Zero	?	?	33	Zero	Zero	+	-	+
HVAC retrofit	41	Zero	Zero	+	Zero	-153	Zero	?	?	48	Zero	Zero	+	-	+
Efficient new HVAC systems	50	Zero	Zero	+	Zero	-152	Zero	?	?	48	Zero	Zero	Zero	-	+
Lighting retrofit	21	Zero	Zero	+	Zero	-161	Zero	?	?	46	Zero	Zero	+	-	+
New lighting systems	16	Zero	Zero	+	Zero	-160	Zero	?	?	46	Zero	Zero	Zero	-	+
VSDs for fans	16	Zero	Zero	+	Zero	-159	Zero	?	?	44	Zero	Zero	+	-	+
Heat pumps	20	Zero	Zero	+	Zero	-99	-	?	?	33	+	Zero	Zero	-	-
Energy star equipment	9	Zero	Zero	+	Zero	-202	Zero	?	?	Infinite	Zero	Zero	Zero	-	+
Solar water heating	22	Zero	Zero	+	Zero	213	Zero	?	?	13	Zero	Zero	+	-	+
Fuel to natural gas	13	Zero	Zero	+	Zero	124	-	?	?	Infinite	Zero	Zero	+	-	+
Elec to natural gas	18	Zero	Zero	+	Zero	-141	-	?	?	290	Zero	Zero	+	-	+

7. Mitigation marginal cost curve

Figure 2 shows the mitigation marginal cost curve for the commercial sector. It should be noted that mitigation options are not mutually exclusive and therefore the actual maximum cumulative savings is less than 300 million tons indicated in Figure 2.

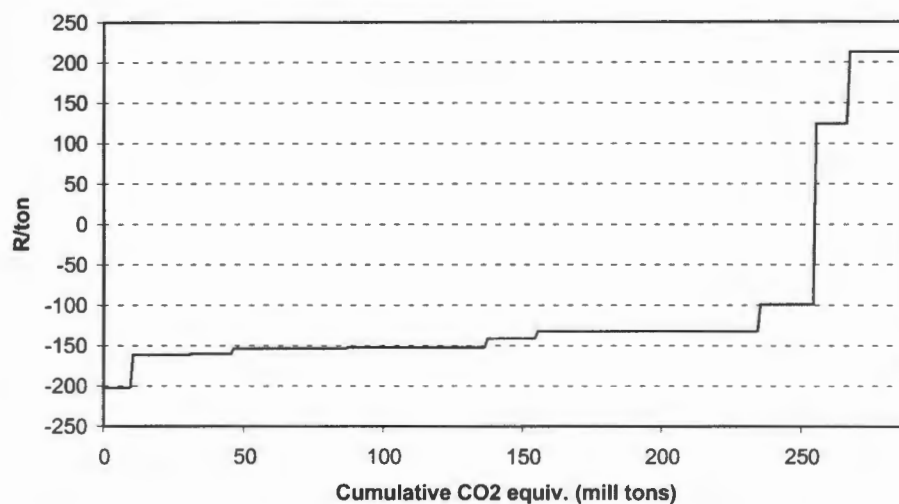


Figure 2. Mitigation marginal cost curve

8. Conclusions

A significant number of financially feasible mitigation options exist in the commercial sector. New building thermal design provides the largest cumulative carbon dioxide equivalent emission reduction, while new lighting systems and lighting retrofits are the most cost-effective mitigation options.

9. Recommendations

Recommendations can only be made for the commercial sector when it is evaluated against other sector results.

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11. Appendices

Appendix A: Stakeholders consulted

Appendix B: Sales growth projections for 1990 to 2030

Appendix C: Floor-space projections for 1990 to 2030

Appendix D: Energy intensities for 1990

Appendix E: Energy intensity baseline projections for South African buildings

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Appendix K: Energy prices for the commercial sector

Appendix L: Financial analysis of mitigation options

Appendix M: Greenhouse gas emissions for mitigation options

Appendix A: Stakeholders consulted

Green Buildings for Africa Program, Vinod Singh, Program Manager

University of Potchefstroom, Prof L J Grobler

South African Property Owner's Association, Brian Kirshmann, CEO

Federation of Hospitality Associations of South Africa, Willem Fick, Chairman

Eskom, ElectroServe, Anton Potgieter, Product Development Manager

Eskom, ElectroServe, Andre Louw, Western Cape ElectroServe Advisor

Department of Public Works, Giovanni Raggiozino

South African Facilities Management Association, Bruce Parker, CEO

International Institute for Energy Conservation, Bob Price

Appendix B: Real sales growth projections (%/annum)

	1990	1994	1998	2000	2005	2010	2015	2020	2025	2030
Trade, catering & accommodation		3.4	-1.4	3.1	2.5	4.6	5.8	3.6	3.6	3.6
Finance, Property & Business Services		7.4	3.4	3.4	4.1	7.1	7.4	6.3	6.3	6.3
Community, Social & Personal Services		1.6	-0.1	1.3	2.9	5.5	5.7	4.1	4.1	4.1

Appendix C: Commercial floor-space projections (square metres)

	1990	1994	1998	2000	2005	2010	2015	2020	2025	2030
Warehouses	7.2	7.6	7.9	8.2	9.4	10.8	12.2	13.8	15.6	17.6
Shops	11.7	12.5	12.9	13.4	15.4	17.6	19.9	22.5	25.5	28.8
Accommodation	2.6	2.8	2.9	3.0	3.4	3.9	4.4	5.0	5.7	6.4
Catering	2.6	2.8	2.9	3.0	3.4	3.9	4.4	5.0	5.7	6.4
Offices	19.5	21.9	24.0	25.1	29.2	35.7	44.3	55.0	68.2	84.6
Education facilities	7.8	7.8	8.1	8.2	9.1	10.5	12.1	14.0	16.2	18.6
Healthcare facilities	4.6	4.5	4.7	4.8	5.3	6.1	7.1	8.2	9.4	10.9
Other	9.1	9.1	9.4	9.5	10.6	12.3	14.2	16.3	18.9	21.8
Total	65.0	68.9	72.8	75.1	85.9	100.9	118.6	139.8	165.0	195.1

Appendix D: Energy intensities for 1990 (MJ/m²)

	Lighting (MJ/m ²)	Space heating (MJ/m ²)	Water heating (MJ/m ²)	Cooling & ventilation (MJ/m ²)	Refrig- eration (MJ/m ²)	Cooking (MJ/m ²)	Other (MJ/m ²)	Total (MJ/m ²)
Electricity								
Warehouses	120	0	0	40	50	0	70	280
Shops	200	50	20	400	150	0	150	970
Accommodation	150	200	150	300	0	0	50	850
Catering	180	50	30	400	150	120	100	1030
Offices	270	100	10	600	0	0	100	1080
Education facilities	190	50	10	100	0	0	80	430
Healthcare facilities	300	50	100	200	30	0	150	830
Other	200	50	30	300	50	0	100	730
Average	215.2	65.5	26.2	352.4	47.6	4.8	104.8	816.5
Coal								
Warehouses	0	0	0	0	0	0	0	0
Shops	0	0	0	0	0	0	0	0
Accommodation	0	0	100	0	0	0	0	100
Catering	0	50	100	0	0	50	0	200
Offices	0	60	60	0	0	0	0	120
Education facilities	0	300	100	0	0	0	0	400
Healthcare facilities	0	400	400	0	0	0	200	1000
Other	0	200	200	0	0	0	200	600
Average	0	112	94	0	0	2	42	250
Town Gas								
Warehouses	0	0	0	0	0	0	0	0
Shops	0	0	0	0	0	0	0	0
Accommodation	0	0	0	0	0	0	0	0
Catering	0	0	0	0	0	0	0	0
Offices	0	0	0	0	0	0	0	0
Education facilities	0	0	10	0	0	0	0	10
Healthcare facilities	0	25	15	0	0	0	0	40
Other	0	0	15	0	0	0	0	15
Average	0	1.75	4.35	0	0	0	0	6.1
H2-rich Gas								
Warehouses	0	0	0	0	0	0	0	0
Shops	0	0	0	0	0	0	0	0
Accommodation	0	0	0	0	0	0	0	0
Catering	0	0	0	0	0	0	0	0
Offices	0	0	0	0	0	0	0	0
Education facilities	0	0	10	0	0	0	0	10
Healthcare facilities	0	25	15	0	0	0	0	40
Other	0	0	15	0	0	0	0	15
Average	0	1.75	4.35	0	0	0	0	6.1
CH4-rich Gas								
Warehouses	0	0	0	0	0	0	0	0
Shops	0	0	0	0	0	0	0	0
Accommodation	0	0	0	0	0	0	0	0
Catering	0	0	0	0	0	0	0	0
Offices	0	0	0	0	0	0	0	0
Education facilities	0	0	0	0	0	0	0	0
Healthcare facilities	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0
Natural Gas								
Warehouses	0	0	0	0	0	0	0	0
Shops	0	0	0	0	0	0	0	0
Accommodation	0	0	0	0	0	0	0	0
Catering	0	0	0	0	0	0	0	0
Offices	0	0	0	0	0	0	0	0
Education facilities	0	0	0	0	0	0	0	0

	Lighting (MJ/m ²)	Space heating (MJ/m ²)	Water heating (MJ/m ²)	Cooling & ventilation (MJ/m ²)	Refrig- eration (MJ/m ²)	Cooking (MJ/m ²)	Other (MJ/m ²)	Total (MJ/m ²)
Healthcare facilities	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0
Diesel								
Warehouses	0	0	0	0	0	0	5	5
Shops	0	0	5	0	0	0	5	10
Accommodation	0	0	10	0	0	0	10	20
Catering	0	0	0	0	0	0	5	5
Offices	0	10	0	0	0	0	10	20
Education facilities	0	10	5	0	0	0	5	20
Healthcare facilities	0	10	20	0	0	0	30	60
Other	0	10	20	0	0	0	10	40
Average	0	6.3	6.1	0	0	0	9.15	21.55
Paraffin								
Warehouses	0	0	0	0	0	0	0	0
Shops	0	0	5	0	0	0	0	5
Accommodation	0	0	10	0	0	0	0	10
Catering	0	0	0	0	0	0	0	0
Offices	0	0	0	0	0	0	0	0
Education facilities	0	0	0	0	0	0	0	0
Healthcare facilities	0	0	5	0	0	0	0	5
Other	0	0	5	0	0	0	0	5
Average	0	0	2.35	0	0	0	0	2.35
Residual Oil								
Warehouses	0	0	0	0	0	0	0	0
Shops	0	0	0	0	0	0	0	0
Accommodation	0	50	50	0	0	0	0	100
Catering	0	0	50	0	0	0	0	50
Offices	0	10	0	0	0	0	0	10
Education facilities	0	30	20	0	0	0	0	50
Healthcare facilities	0	80	120	0	0	0	50	250
Other	0	30	50	0	0	0	0	80
Average	0	18.4	21.8	0	0	0	3.5	43.7
LPG								
Warehouses	0	0	0	0	0	0	0	0
Shops	0	0	0	0	0	0	0	0
Accommodation	0	0	30	0	0	0	0	30
Catering	0	0	10	0	0	80	0	90
Offices	0	0	40	0	0	0	0	40
Education facilities	0	0	20	0	0	25	0	45
Healthcare facilities	0	0	40	0	0	25	0	65
Other	0	0	20	0	0	10	0	30
Average	0	0	21.6	0	0	9.35	0	30.95
Total								
Warehouses	120	0	0	40	50	0	70	280
Shops	200	50	20	400	150	0	150	970
Accommodation	150	250	330	300	0	0	50	1080
Catering	180	100	190	400	150	250	100	1370
Offices	270	170	110	600	0	0	100	1250
Education facilities	190	380	160	100	0	25	80	935
Healthcare facilities	300	555	675	200	30	25	400	2185
Other	200	280	315	300	50	10	300	1455
Average	215.2	197.65	167.95	352.4	47.6	16.15	150.3	1147.25

Appendix E: Energy intensity baseline projections (MJ/m²)

	1990	1994	1998	2000	2005	2010	2015	2020	2025	2030
Electricity	817	788	786	785	780	770	759	745	728	709
Coal	250	231	213	204	185	167	151	136	123	111
Town gas	6	4	3	2	1	1	0	0	0	0
H ₂ -rich gas	6	7	8	8	10	11	7	4	2	1
CH ₄ -rich gas	0	0	0	0	0	0	0	0	0	0
Natural gas	0	0	0	0	0	3	16	30	43	57
Diesel	22	21	20	19	19	18	17	16	15	14
Paraffin	2	2	2	2	2	2	2	2	2	2
Residual oil	44	40	37	36	32	29	26	24	22	19
LPG	31	32	34	34	36	38	34	31	28	25
Total	1147	1124	1102	1091	1064	1038	1012	987	963	939

Appendix F: Energy consumption baseline projections (PJ)

	1990	1994	1998	2000	2005	2010	2015	2020	2025	2030
Electricity	53.1	54.2	57.3	58.9	67.0	77.7	90.1	104.1	120.1	138.3
Coal	16.3	15.9	15.5	15.3	15.9	16.8	17.9	19.1	20.3	21.7
Town gas	0.4	0.3	0.2	0.2	0.1	0.1	0.1	0.0	0.0	0.0
H ₂ -rich gas	0.4	0.5	0.6	0.6	0.8	1.1	0.8	0.5	0.4	0.3
CH ₄ -rich gas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Natural gas	0.0	0.0	0.0	0.0	0.0	0.3	1.9	4.2	7.1	11.1
Diesel	1.4	1.4	1.4	1.5	1.6	1.8	2.0	2.2	2.5	2.8
Paraffin	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3
Residual oil	2.8	2.8	2.7	2.7	2.8	2.9	3.1	3.3	3.6	3.8
LPG	2.0	2.2	2.4	2.6	3.1	3.8	4.1	4.3	4.6	4.9
Total	74.6	77.4	80.3	81.9	91.4	104.7	120.1	138.0	158.9	183.2

Appendix G. Direct emission coefficient projections (g/MJ)

	1990	1994	1998	2000	2005	2010	2015	2020	2025	2030
Carbon dioxide										
Electricity	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Coal	8.15E+01	8.15E+01	8.15E+01	8.15E+01	8.15E+01	8.15E+01	8.15E+01	8.15E+01	8.15E+01	8.15E+01
Town gas	3.44E+01	3.44E+01	3.44E+01	3.44E+01	3.44E+01	3.44E+01	3.44E+01	3.44E+01	3.44E+01	3.44E+01
H ₂ -rich gas	3.61E+01	3.61E+01	3.61E+01	3.61E+01	3.61E+01	3.61E+01	3.61E+01	3.61E+01	3.61E+01	3.61E+01
CH ₄ -rich gas	3.45E+01	3.45E+01	3.45E+01	3.45E+01	3.45E+01	3.45E+01	3.45E+01	3.45E+01	3.45E+01	3.45E+01
Natural gas	3.20E+01	3.20E+01	3.20E+01	3.20E+01	3.20E+01	3.20E+01	3.20E+01	3.20E+01	3.20E+01	3.20E+01
Diesel	7.33E+01	7.33E+01	7.33E+01	7.33E+01	7.33E+01	7.33E+01	7.33E+01	7.33E+01	7.33E+01	7.33E+01
Paraffin	7.09E+01	7.09E+01	7.09E+01	7.09E+01	7.09E+01	7.09E+01	7.09E+01	7.09E+01	7.09E+01	7.09E+01
Residual oil	7.73E+01	7.73E+01	7.73E+01	7.73E+01	7.73E+01	7.73E+01	7.73E+01	7.73E+01	7.73E+01	7.73E+01
LPG	6.05E+01	6.05E+01	6.05E+01	6.05E+01	6.05E+01	6.05E+01	6.05E+01	6.05E+01	6.05E+01	6.05E+01
Methane										
Electricity	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Coal	1.07E-02	1.07E-02	1.07E-02	1.07E-02	1.07E-02	1.07E-02	1.07E-02	1.07E-02	1.07E-02	1.07E-02
Town gas	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
H ₂ -rich gas	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CH ₄ -rich gas	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Natural gas	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Diesel	5.75E-05	5.75E-05	5.75E-05	5.75E-05	5.75E-05	5.75E-05	5.75E-05	5.75E-05	5.75E-05	5.75E-05
Paraffin	1.97E-04	1.97E-04	1.97E-04	1.97E-04	1.97E-04	1.97E-04	1.97E-04	1.97E-04	1.97E-04	1.97E-04
Residual oil	3.00E-03	3.00E-03	3.00E-03	3.00E-03	3.00E-03	3.00E-03	3.00E-03	3.00E-03	3.00E-03	3.00E-03
LPG	9.19E-04	9.19E-04	9.19E-04	9.19E-04	9.19E-04	9.19E-04	9.19E-04	9.19E-04	9.19E-04	9.19E-04
Nitrous oxide										
Electricity	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Coal	1.72E-03	1.72E-03	1.72E-03	1.72E-03	1.72E-03	1.72E-03	1.72E-03	1.72E-03	1.72E-03	1.72E-03
Town gas	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
H ₂ -rich gas	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CH ₄ -rich gas	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Natural gas	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Diesel	1.41E-03	1.41E-03	1.41E-03	1.41E-03	1.41E-03	1.41E-03	1.41E-03	1.41E-03	1.41E-03	1.41E-03
Paraffin	3.93E-04	3.93E-04	3.93E-04	3.93E-04	3.93E-04	3.93E-04	3.93E-04	3.93E-04	3.93E-04	3.93E-04
Residual oil	3.00E-04	3.00E-04	3.00E-04	3.00E-04	3.00E-04	3.00E-04	3.00E-04	3.00E-04	3.00E-04	3.00E-04
LPG	1.82E-03	1.82E-03	1.82E-03	1.82E-03	1.82E-03	1.82E-03	1.82E-03	1.82E-03	1.82E-03	1.82E-03

Appendix H. Indirect emission coefficient projections (g/MJ)

	1990	1994	1998	2000	2005	2010	2015	2020	2025	2030
Carbon dioxide										
Electricity	2.66E+02	2.66E+02	2.66E+02	2.66E+02	2.66E+02	2.66E+02	2.66E+02	2.66E+02	2.66E+02	2.66E+02
Coal	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Town gas	8.49E+01	8.49E+01	8.49E+01	8.49E+01	8.49E+01	8.49E+01	8.49E+01	8.49E+01	8.49E+01	8.49E+01
H ₂ -rich gas	8.49E+01	8.49E+01	8.49E+01	8.49E+01	8.49E+01	8.49E+01	8.49E+01	8.49E+01	8.49E+01	8.49E+01
CH ₄ -rich gas	8.49E+01	8.49E+01	8.49E+01	8.49E+01	8.49E+01	8.49E+01	8.49E+01	8.49E+01	8.49E+01	8.49E+01
Natural gas	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Diesel	1.70E+01	1.70E+01	1.70E+01	1.70E+01	1.70E+01	1.70E+01	1.70E+01	1.70E+01	1.70E+01	1.70E+01
Paraffin	2.26E+01	2.26E+01	2.26E+01	2.26E+01	2.26E+01	2.26E+01	2.26E+01	2.26E+01	2.26E+01	2.26E+01
Residual oil	1.08E+01	1.08E+01	1.08E+01	1.08E+01	1.08E+01	1.08E+01	1.08E+01	1.08E+01	1.08E+01	1.08E+01
LPG	3.00E+01	3.00E+01	3.00E+01	3.00E+01	3.00E+01	3.00E+01	3.00E+01	3.00E+01	3.00E+01	3.00E+01
Methane										
Electricity	2.94E-01	2.94E-01	2.94E-01	2.94E-01	2.94E-01	2.94E-01	2.94E-01	2.94E-01	2.94E-01	2.94E-01
Coal	7.96E-02	7.96E-02	7.96E-02	7.96E-02	7.96E-02	7.96E-02	7.96E-02	7.96E-02	7.96E-02	7.96E-02
Town gas	1.41E-01	1.41E-01	1.41E-01	1.41E-01	1.41E-01	1.41E-01	1.41E-01	1.41E-01	1.41E-01	1.41E-01
H ₂ -rich gas	1.41E-01	1.41E-01	1.41E-01	1.41E-01	1.41E-01	1.41E-01	1.41E-01	1.41E-01	1.41E-01	1.41E-01
CH ₄ -rich gas	1.41E-01	1.41E-01	1.41E-01	1.41E-01	1.41E-01	1.41E-01	1.41E-01	1.41E-01	1.41E-01	1.41E-01
Natural gas	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Diesel	2.97E+00	2.97E+00	2.97E+00	2.97E+00	2.97E+00	2.97E+00	2.97E+00	2.97E+00	2.97E+00	2.97E+00
Paraffin	2.73E+00	2.73E+00	2.73E+00	2.73E+00	2.73E+00	2.73E+00	2.73E+00	2.73E+00	2.73E+00	2.73E+00
Residual oil	3.46E+00	3.46E+00	3.46E+00	3.46E+00	3.46E+00	3.46E+00	3.46E+00	3.46E+00	3.46E+00	3.46E+00
LPG	2.49E+00	2.49E+00	2.49E+00	2.49E+00	2.49E+00	2.49E+00	2.49E+00	2.49E+00	2.49E+00	2.49E+00
Nitrous oxide										
Electricity	3.39E-03	3.39E-03	3.39E-03	3.39E-03	3.39E-03	3.39E-03	3.39E-03	3.39E-03	3.39E-03	3.39E-03
Coal	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Town gas	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
H ₂ -rich gas	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CH ₄ -rich gas	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Natural gas	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Diesel	3.20E-05	3.20E-05	3.20E-05	3.20E-05	3.20E-05	3.20E-05	3.20E-05	3.20E-05	3.20E-05	3.20E-05
Paraffin	2.93E-05	2.93E-05	2.93E-05	2.93E-05	2.93E-05	2.93E-05	2.93E-05	2.93E-05	2.93E-05	2.93E-05
Residual oil	3.75E-05	3.75E-05	3.75E-05	3.75E-05	3.75E-05	3.75E-05	3.75E-05	3.75E-05	3.75E-05	3.75E-05
LPG	2.66E-05	2.66E-05	2.66E-05	2.66E-05	2.66E-05	2.66E-05	2.66E-05	2.66E-05	2.66E-05	2.66E-05

Appendix I: Greenhouse gas baseline emissions - IPCC format

YEAR: 1990

IPCC Category	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufactur	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
	Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
	Commercial	1.81E+03	0.00E+00	1.84E-01	0.00E+00	3.44E-02					

YEAR: 1994

IPCC Category	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufactur	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
	Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
	Commercial	1.78E+03	0.00E+00	1.80E-01	0.00E+00	3.42E-02					

YEAR: 1998

IPCC Category	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufactur	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
	Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
	Commercial	1.76E+03	0.00E+00	1.76E-01	0.00E+00	3.39E-02					

YEAR: 2000

IPCC Category	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufactur	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
	Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
	Commercial	1.76E+03	0.00E+00	1.75E-01	0.00E+00	3.39E-02					

YEAR: 2005

IPCC Category	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufactur	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
	Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
	Commercial	1.86E+03	0.00E+00	1.81E-01	0.00E+00	3.60E-02					

YEAR: 2010

IPCC Category	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufactur	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
	Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
	Commercial	2.03E+03	0.00E+00	1.93E-01	0.00E+00	3.93E-02					

YEAR: 2015

IPCC Category	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufactur	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
	Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
	Commercial	2.20E+03	0.00E+00	2.05E-01	0.00E+00	4.19E-02					

YEAR: 2020

IPCC Category	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufactur	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
	Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
	Commercial	2.41E+03	0.00E+00	2.18E-01	0.00E+00	4.48E-02					

YEAR: 2025

IPCC Category	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufactur	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
	Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
	Commercial	2.66E+03	0.00E+00	2.33E-01	0.00E+00	4.80E-02					

YEAR: 2030

IPCC Category	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufactur	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
	Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
	Commercial	2.95E+03	0.00E+00	2.49E-01	0.00E+00	5.15E-02					

Appendix J: Greenhouse gas baseline emissions - IDC format

YEAR: 1990

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg)	CO2 equiv (Gg) Manufactur	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.28E+02	0.00E+00	1.86E-02	0.00E+00	4.38E-03	0.00E+00	2.30E+02	0.00E+00		1.33E+11	1.73E-09
Finance, Property & Business Services	8	9.38E+01	0.00E+00	8.79E-03	0.00E+00	2.01E-03	0.00E+00	9.47E+01	0.00E+00		9.13E+10	1.04E-09
Community, Social & Personal Services	9	1.48E+03	0.00E+00	1.57E-01	0.00E+00	2.80E-02	0.00E+00	1.50E+03	0.00E+00		4.74E+10	3.16E-08

YEAR: 1994

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg)	CO2 equiv (Gg) Manufactur	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.29E+02	0.00E+00	1.83E-02	0.00E+00	4.43E-03	0.00E+00	2.31E+02	0.00E+00		1.46E+11	1.58E-09
Finance, Property & Business Services	8	9.41E+01	0.00E+00	8.62E-03	0.00E+00	2.03E-03	0.00E+00	9.49E+01	0.00E+00		1.08E+11	8.82E-10
Community, Social & Personal Services	9	1.46E+03	0.00E+00	1.54E-01	0.00E+00	2.77E-02	0.00E+00	1.47E+03	0.00E+00		4.71E+10	3.13E-08

YEAR: 1998

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg)	CO2 equiv (Gg) Manufactur	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.29E+02	0.00E+00	1.79E-02	0.00E+00	4.49E-03	0.00E+00	2.31E+02	0.00E+00		1.53E+11	1.51E-09
Finance, Property & Business Services	8	9.43E+01	0.00E+00	8.44E-03	0.00E+00	2.06E-03	0.00E+00	9.51E+01	0.00E+00		1.23E+11	7.75E-10
Community, Social & Personal Services	9	1.44E+03	0.00E+00	1.50E-01	0.00E+00	2.74E-02	0.00E+00	1.45E+03	0.00E+00		5.00E+10	2.90E-08

YEAR: 2000

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg)	CO2 equiv (Gg) Manufactur	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.30E+02	0.00E+00	1.77E-02	0.00E+00	4.53E-03	0.00E+00	2.32E+02	0.00E+00		1.61E+11	1.44E-09
Finance, Property & Business Services	8	9.47E+01	0.00E+00	8.37E-03	0.00E+00	2.08E-03	0.00E+00	9.55E+01	0.00E+00		1.31E+11	7.32E-10
Community, Social & Personal Services	9	1.43E+03	0.00E+00	1.48E-01	0.00E+00	2.73E-02	0.00E+00	1.44E+03	0.00E+00		5.07E+10	2.85E-08

YEAR: 2005

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg)	CO2 equiv (Gg) Manufactur	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.47E+02	0.00E+00	1.85E-02	0.00E+00	4.94E-03	0.00E+00	2.49E+02	0.00E+00		1.98E+11	1.26E-09
Finance, Property & Business Services	8	1.02E+02	0.00E+00	8.71E-03	0.00E+00	2.26E-03	0.00E+00	1.03E+02	0.00E+00		1.62E+11	6.35E-10
Community, Social & Personal Services	9	1.51E+03	0.00E+00	1.54E-01	0.00E+00	2.88E-02	0.00E+00	1.52E+03	0.00E+00		5.89E+10	2.58E-08

YEAR: 2010

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg)	CO2 equiv (Gg) Manufactur	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.75E+02	0.00E+00	1.98E-02	0.00E+00	5.55E-03	0.00E+00	2.77E+02	0.00E+00		2.38E+11	1.16E-09
Finance, Property & Business Services	8	1.13E+02	0.00E+00	9.31E-03	0.00E+00	2.53E-03	0.00E+00	1.14E+02	0.00E+00		2.15E+11	5.31E-10
Community, Social & Personal Services	9	1.64E+03	0.00E+00	1.64E-01	0.00E+00	3.12E-02	0.00E+00	1.65E+03	0.00E+00		7.27E+10	2.27E-08

YEAR: 2015

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg)	CO2 equiv (Gg) Manufactur	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	3.02E+02	0.00E+00	2.10E-02	0.00E+00	5.94E-03	0.00E+00	3.05E+02	0.00E+00		2.84E+11	1.07E-09
Finance, Property & Business Services	8	1.24E+02	0.00E+00	9.90E-03	0.00E+00	2.71E-03	0.00E+00	1.25E+02	0.00E+00		2.92E+11	4.28E-10
Community, Social & Personal Services	9	1.77E+03	0.00E+00	1.74E-01	0.00E+00	3.33E-02	0.00E+00	1.79E+03	0.00E+00		8.90E+10	2.01E-08

YEAR: 2020

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg)	CO2 equiv (Gg) Manufactur	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	3.35E+02	0.00E+00	2.24E-02	0.00E+00	6.36E-03	0.00E+00	3.37E+02	0.00E+00		3.38E+11	9.98E-10
Finance, Property & Business Services	8	1.38E+02	0.00E+00	1.05E-02	0.00E+00	2.90E-03	0.00E+00	1.37E+02	0.00E+00		3.96E+11	3.46E-10
Community, Social & Personal Services	9	1.94E+03	0.00E+00	1.85E-01	0.00E+00	3.55E-02	0.00E+00	1.95E+03	0.00E+00		1.09E+11	1.79E-08

YEAR: 2025

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg)	CO2 equiv (Gg) Manufactur	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	3.73E+02	0.00E+00	2.39E-02	0.00E+00	6.84E-03	0.00E+00	3.75E+02	0.00E+00		4.02E+11	9.33E-10
Finance, Property & Business Services	8	1.50E+02	0.00E+00	1.13E-02	0.00E+00	3.11E-03	0.00E+00	1.51E+02	0.00E+00		5.38E+11	2.81E-10
Community, Social & Personal Services	9	2.13E+03	0.00E+00	1.98E-01	0.00E+00	3.80E-02	0.00E+00	2.15E+03	0.00E+00		1.33E+11	1.61E-08

YEAR: 2030

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg)	CO2 equiv (Gg) Manufactur	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	4.18E+02	0.00E+00	2.55E-02	0.00E+00	7.36E-03	0.00E+00	4.21E+02	0.00E+00		4.79E+11	8.78E-10
Finance, Property & Business Services	8	1.67E+02	0.00E+00	1.20E-02	0.00E+00	3.34E-03	0.00E+00	1.68E+02	0.00E+00		7.30E+11	2.31E-10
Community, Social & Personal Services	9	2.37E+03	0.00E+00	2.11E-01	0.00E+00	4.08E-02	0.00E+00	2.39E+03	0.00E+00		1.63E+11	1.46E-08

Appendix K: Projections of energy prices (R/GJ)

	1990	1994	1998	2000	2005	2010	2015	2020	2025	2030
Electricity	82.90	71.75	63.16	60.62	60.02	60.02	60.02	60.02	60.02	60.02
Coal	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Town gas	34.20	34.20	34.20	34.20	34.20	34.20	34.20	34.20	34.20	34.20
H ₂ -rich gas	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
CH ₄ -rich gas	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
Natural gas	22.11	22.11	22.11	22.11	22.11	22.11	22.11	22.11	22.11	22.11
Diesel	31.25	22.31	25.22	25.64	26.70	27.75	28.80	29.86	30.91	31.96
Paraffin	34.70	26.81	27.75	28.22	29.38	30.53	31.69	32.85	34.01	35.17
Residual oil	25.49	15.95	20.13	20.47	21.31	22.15	22.99	23.83	24.67	25.51
LPG	59.50	40.90	48.07	48.87	50.88	52.88	54.89	56.90	58.90	60.91

Appendix L: GJ of baseline scenario energy replaced by mitigation option

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016-2030	Total
New building thermal design	1.35	1.48	1.64	1.79	1.31	1.41	1.61	1.76	2.02	2.17	1.48	1.37	1.98	2.27	2.58	35.84	62.1
HVAC retrofit	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	0.00	0.00	0.00	0.00	0.00	0.00	37.2
Efficient new HVAC systems	1.35	1.48	1.64	1.79	1.31	1.41	1.61	1.76	2.02	2.17	1.48	1.37	1.98	2.27	2.58	35.84	62.1
Lighting retrofit	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	0.00	0.00	0.00	0.00	0.00	0.00	14.3
New lighting systems	0.48	0.53	0.59	0.64	0.46	0.49	0.56	0.61	0.70	0.76	0.49	0.45	0.67	0.77	0.88	11.05	20.1
VSDs for fans	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.00	8.4
Heat pumps	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.00	4.6
Energy star equipment	0.74	0.78	0.81	0.86	0.90	0.94	0.99	1.04	1.09	1.15	1.20	1.26	1.33	1.39	1.46	0.00	15.9
Solar water heating	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.00	3.9
Fuel to natural gas	0.00	0.00	0.00	0.00	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	7.50	13.0
Elec to natural gas	0.05	0.05	0.05	0.05	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	3.00	5.4

Appendix M: Financial analysis of mitigation options

Discount rate: 6%

	New building thermal design	HVAC retrofit	Efficient new HVAC systems	Lighting retrofit	New lighting systems	VSDs for fans	Heat pumps	Energy star equipment	Solar water heating	Fuel to natural gas	Elec to natural gas
Incremental LCC (R/GJ)	-179.44	-95.69	-128.67	-134.63	-127.57	-189.73	-264.79	-98.58	764.41	131.02	-496.79
Incremental LC (R/GJ/year)	-12.30	-6.56	-8.82	-9.23	-8.74	-13.00	-18.15	-22.08	52.39	8.98	-34.05
CO2 equivalent reduction (kg/GJ)	2,786	1,288	1,741	1,721	1,639	2,459	5,492	546	7,377	2,165	7,238
R per ton CO2 equiv.	-132	-153	-152	-161	-160	-159	-99	-202	213	124	-141
Kg CO2 equiv./ incr. Investment (kg/R)	33	48	48	46	46	44	33	#DIV/0!	13	#DIV/0!	290
Total incremental LCC (Rm)	-4,640	-2,620	-3,327	-1,418	-1,104	-1,032	-797	-965	1,918	675	-1,105
CO2 equiv. reduction (mill. tons)	80	41	50	21	16	16	20	9	22	13	18

Discount rate: 3%

	New building thermal design	HVAC retrofit	Efficient new HVAC systems	Lighting retrofit	New lighting systems	VSDs for fans	Heat pumps	Energy star equipment	Solar water heating	Fuel to natural gas	Elec to natural gas
Incremental LCC (R/GJ)	-303.38	-148.03	-199.41	-208.18	-197.62	-285.91	-428.36	-107.40	896.22	185.27	-718.00
Incremental LC (R/GJ/year)	-15.03	-7.33	-9.88	-10.31	-9.79	-14.16	-21.22	-22.77	44.39	9.18	-35.56
CO2 equivalent reduction (kg/GJ)	2,786	1,288	1,741	1,721	1,639	2,459	5,492	546	7,377	2,165	7,238
R per ton CO2 equiv.	-162	-171	-170	-180	-179	-173	-116	-208	181	127	-147
Kg CO2 equiv./ incr. Investment (kg/R)	38	48	48	46	46	38	28	#DIV/0!	12	#DIV/0!	290
Total incremental LCC (Rm)	-11,706	-4,698	-7,694	-2,542	-2,513	-1,912	-1,585	-1,327	2,764	1,471	-2,408
CO2 equiv. reduction (mill. tons)	80	41	50	21	16	16	20	9	22	13	18

Discount rate: 12%

	New building thermal design	HVAC retrofit	Efficient new HVAC systems	Lighting retrofit	New lighting systems	VSDs for fans	Heat pumps	Energy star equipment	Solar water heating	Fuel to natural gas	Elec to natural gas
Incremental LCC (R/GJ)	-59.43	-44.50	-59.50	-62.67	-59.04	-96.22	-107.24	-84.00	631.01	77.50	-280.35
Incremental LC (R/GJ/year)	-6.59	-4.93	-6.60	-6.95	-6.54	-10.67	-11.89	-20.81	69.94	8.59	-31.08
CO2 equivalent reduction (kg/GJ)	2,786	1,288	1,741	1,721	1,639	2,459	5,492	546	7,377	2,165	7,238
R per ton CO2 equiv.	-71	-115	-114	-121	-120	-130	-65	-190	284	119	-129
Kg CO2 equiv./ incr. Investment (kg/R)	30	48	48	46	46	52	39	#DIV/0!	15	#DIV/0!	290
Total incremental LCC (Rm)	-833	-936	-834	-507	-283	-367	-226	-550	1,110	194	-322
CO2 equiv. reduction (mill. tons)	80	41	50	21	16	16	20	9	22	13	18

Appendix N: Direct greenhouse gas emissions for mitigation options

Appendix N: Direct greenhouse gas emissions for mitigation options

New building thermal design

YEAR: 1990

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.28E+02	0.00E+00	1.86E-02	0.00E+00					
Finance, Property & Business Services	8	9.38E+01	0.00E+00	8.79E-03	0.00E+00	2.01E-03	0.00E+00	9.47E+01	0.00E+00		9.13E+10	1.04E-09
Community, Social & Personal Services	9	1.48E+03	0.00E+00	1.57E-01	0.00E+00	2.80E-02	0.00E+00	1.50E+03	0.00E+00		4.74E+10	3.16E-08

YEAR: 1994

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.29E+02	0.00E+00	1.83E-02	0.00E+00					
Finance, Property & Business Services	8	9.41E+01	0.00E+00	8.82E-03	0.00E+00	2.03E-03	0.00E+00	9.49E+01	0.00E+00		1.08E+11	8.82E-10
Community, Social & Personal Services	9	1.46E+03	0.00E+00	1.54E-01	0.00E+00	2.77E-02	0.00E+00	1.47E+03	0.00E+00		4.71E+10	3.13E-08

YEAR: 1998

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.29E+02	0.00E+00	1.79E-02	0.00E+00					
Finance, Property & Business Services	8	9.43E+01	0.00E+00	8.44E-03	0.00E+00	2.06E-03	0.00E+00	9.51E+01	0.00E+00		1.23E+11	7.75E-10
Community, Social & Personal Services	9	1.44E+03	0.00E+00	1.50E-01	0.00E+00	2.74E-02	0.00E+00	1.45E+03	0.00E+00		5.00E+10	2.90E-08

YEAR: 2000

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.30E+02	0.00E+00	1.77E-02	0.00E+00					
Finance, Property & Business Services	8	9.47E+01	0.00E+00	8.37E-03	0.00E+00	2.08E-03	0.00E+00	9.55E+01	0.00E+00		1.31E+11	7.32E-10
Community, Social & Personal Services	9	1.43E+03	0.00E+00	1.48E-01	0.00E+00	2.73E-02	0.00E+00	1.44E+03	0.00E+00		5.07E+10	2.85E-08

YEAR: 2005

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.41E+02	0.00E+00	1.78E-02	0.00E+00					
Finance, Property & Business Services	8	9.91E+01	0.00E+00	8.42E-03	0.00E+00	2.20E-03	0.00E+00	1.00E+02	0.00E+00		1.82E+11	6.18E-10
Community, Social & Personal Services	9	1.46E+03	0.00E+00	1.49E-01	0.00E+00	2.79E-02	0.00E+00	1.47E+03	0.00E+00		5.89E+10	2.50E-08

YEAR: 2010

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.60E+02	0.00E+00	1.84E-02	0.00E+00					
Finance, Property & Business Services	8	1.07E+02	0.00E+00	8.67E-03	0.00E+00	2.41E-03	0.00E+00	1.08E+02	0.00E+00		2.15E+11	5.03E-10
Community, Social & Personal Services	9	1.53E+03	0.00E+00	1.52E-01	0.00E+00	2.93E-02	0.00E+00	1.54E+03	0.00E+00		7.27E+10	2.13E-08

YEAR: 2015

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.79E+02	0.00E+00	1.88E-02	0.00E+00					
Finance, Property & Business Services	6	1.14E+02	0.00E+00	8.89E-03	0.00E+00	2.51E-03	0.00E+00	1.15E+02	0.00E+00		2.92E+11	3.94E-10
Community, Social & Personal Services	9	1.60E+03	0.00E+00	1.58E-01	0.00E+00	3.02E-02	0.00E+00	1.62E+03	0.00E+00		8.90E+10	1.82E-08

YEAR: 2020

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	3.01E+02	0.00E+00	1.93E-02	0.00E+00					
Finance, Property & Business Services	8	1.22E+02	0.00E+00	9.12E-03	0.00E+00	2.62E-03	0.00E+00	1.23E+02	0.00E+00		3.96E+11	3.11E-10
Community, Social & Personal Services	9	1.70E+03	0.00E+00	1.59E-01	0.00E+00	3.12E-02	0.00E+00	1.71E+03	0.00E+00		1.09E+11	1.57E-08

YEAR: 2025

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	3.29E+02	0.00E+00	1.98E-02	0.00E+00					
Finance, Property & Business Services	8	1.32E+02	0.00E+00	9.37E-03	0.00E+00	2.74E-03	0.00E+00	1.33E+02	0.00E+00		5.38E+11	2.48E-10
Community, Social & Personal Services	9	1.82E+03	0.00E+00	1.63E-01	0.00E+00	3.23E-02	0.00E+00	1.84E+03	0.00E+00		1.33E+11	1.38E-08

YEAR: 2030

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	3.62E+02	0.00E+00	2.04E-02	0.00E+00					
Finance, Property & Business Services	8	1.44E+02	0.00E+00	9.63E-03	0.00E+00	2.88E-03	0.00E+00	1.45E+02	0.00E+00		7.30E+11	1.99E-10
Community, Social & Personal Services	9	1.97E+03	0.00E+00	1.68E-01	0.00E+00	3.35E-02	0.00E+00	1.99E+03	0.00E+00		1.63E+11	1.22E-08

HVAC retrofit

YEAR: 1990

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.28E+02	0.00E+00	1.86E-02	0.00E+00					
Finance, Property & Business Services	8	9.38E+01	0.00E+00	8.79E-03	0.00E+00	2.01E-03	0.00E+00	9.47E+01	0.00E+00		9.13E+10	1.04E-09
Community, Social & Personal Services	9	1.48E+03	0.00E+00	1.57E-01	0.00E+00	2.80E-02	0.00E+00	1.50E+03	0.00E+00		4.74E+10	3.16E-08

YEAR: 1994

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.29E+02	0.00E+00	1.83E-02	0.00E+00					
Finance, Property & Business Services	8	9.41E+01	0.00E+00	8.62E-03	0.00E+00	2.03E-03	0.00E+00	9.49E+01	0.00E+00		1.08E+11	8.82E-10
Community, Social & Personal Services	9	1.46E+03	0.00E+00	1.54E-01	0.00E+00	2.77E-02	0.00E+00	1.47E+03	0.00E+00		4.71E+10	3.13E-08

YEAR: 1998

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.29E+02	0.00E+00	1.79E-02	0.00E+00					
Finance, Property & Business Services	8	9.43E+01	0.00E+00	8.44E-03	0.00E+00	2.06E-03	0.00E+00	9.55E+01	0.00E+00		1.23E+11	7.75E-10
Community, Social & Personal Services	9	1.44E+03	0.00E+00	1.50E-01	0.00E+00	2.74E-02	0.00E+00	1.45E+03	0.00E+00		5.00E+10	2.90E-08

YEAR: 2000

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.30E+02	0.00E+00	1.77E-02	0.00E+00					
Finance, Property & Business Services	8	9.47E+01	0.00E+00	8.37E-03	0.00E+00	2.08E-03	0.00E+00	9.55E+01	0.00E+00		1.31E+11	7.32E-10
Community, Social & Personal Services	9	1.43E+03	0.00E+00	1.48E-01	0.00E+00	2.73E-02	0.00E+00	1.44E+03	0.00E+00		5.07E+10	2.85E-08

YEAR: 2005

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.40E+02	0.00E+00	1.78E-02	0.00E+00					
Finance, Property & Business Services	8	9.88E+01	0.00E+00	8.38E-03	0.00E+00	2.19E-03	0.00E+00	9.96E+01	0.00E+00		1.82E+11	6.15E-10
Community, Social & Personal Services	9	1.45E+03	0.00E+00	1.48E-01	0.00E+00	2.76E-02	0.00E+00	1.46E+03	0.00E+00		5.89E+10	2.49E-08

YEAR: 2010

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.59E+02	0.00E+00	1.83E-02	0.00E+00					
Finance, Property & Business Services	8	1.07E+02	0.00E+00	8.65E-03	0.00E+00	2.41E-03	0.00E+00	1.08E+02	0.00E+00		2.15E+11	5.02E-10
Community, Social & Personal Services	9	1.53E+03	0.00E+00	1.51E-01	0.00E+00	2.92E-02	0.00E+00	1.54E+03	0.00E+00		7.27E+10	2.12E-08

YEAR: 2015

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.87E+02	0.00E+00	1.96E-02	0.00E+00					
Finance, Property & Business Services	8	1.17E+02	0.00E+00	9.23E-03	0.00E+00	2.58E-03	0.00E+00	1.18E+02	0.00E+00		2.92E+11	4.06E-10
Community, Social & Personal Services	9	1.66E+03	0.00E+00	1.62E-01	0.00E+00	3.12E-02	0.00E+00	1.68E+03	0.00E+00		8.90E+10	1.88E-08

YEAR: 2020

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	3.19E+02	0.00E+00	2.09E-02	0.00E+00					
Finance, Property & Business Services	8	1.30E+02	0.00E+00	9.88E-03	0.00E+00	2.77E-03	0.00E+00	1.31E+02	0.00E+00		3.98E+11	3.30E-10
Community, Social & Personal Services	9	1.83E+03	0.00E+00	1.73E-01	0.00E+00	3.35E-02	0.00E+00	1.84E+03	0.00E+00		1.09E+11	1.69E-08

YEAR: 2025

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	3.57E+02	0.00E+00	2.24E-02	0.00E+00					
Finance, Property & Business Services	8	1.44E+02	0.00E+00	1.06E-02	0.00E+00	2.98E-03	0.00E+00	1.45E+02	0.00E+00		5.38E+11	2.70E-10
Community, Social & Personal Services	9	2.02E+03	0.00E+00	1.86E-01	0.00E+00	3.60E-02	0.00E+00	2.04E+03	0.00E+00		1.33E+11	1.53E-08

YEAR: 2030

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	4.03E+02	0.00E+00	2.41E-02	0.00E+00					
Finance, Property & Business Services	8	1.61E+02	0.00E+00	1.14E-02	0.00E+00	3.21E-03	0.00E+00	1.62E+02	0.00E+00		7.30E+11	2.22E-10
Community, Social & Personal Services	9	2.26E+03	0.00E+00	1.99E-01	0.00E+00	3.88E-02	0.00E+00	2.28E+03	0.00E+00		1.63E+11	1.39E-08

Efficient new HVAC systems

YEAR: 1990

SIC Category	SIC Code	CO2						CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		CO2		CH4		N2O						
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.28E+02	0.00E+00	1.86E-02	0.00E+00	4.38E-03	0.00E+00	2.30E+02	0.00E+00		1.33E+11	1.73E-09
Finance, Property & Business Services	8	9.38E+01	0.00E+00	8.79E-03	0.00E+00	2.01E-03	0.00E+00	9.47E+01	0.00E+00		9.13E+10	1.04E-09
Community, Social & Personal Services	9	1.48E+03	0.00E+00	1.57E-01	0.00E+00	2.80E-02	0.00E+00	1.50E+03	0.00E+00		4.74E+10	3.16E-08

YEAR: 1994

SIC Category	SIC Code	CO2						CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		CO2		CH4		N2O						
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.29E+02	0.00E+00	1.83E-02	0.00E+00	4.43E-03	0.00E+00	2.31E+02	0.00E+00		1.46E+11	1.58E-09
Finance, Property & Business Services	8	9.41E+01	0.00E+00	8.62E-03	0.00E+00	2.03E-03	0.00E+00	9.49E+01	0.00E+00		1.08E+11	8.82E-10
Community, Social & Personal Services	9	1.46E+03	0.00E+00	1.54E-01	0.00E+00	2.77E-02	0.00E+00	1.47E+03	0.00E+00		4.71E+10	3.13E-08

YEAR: 1998

SIC Category	SIC Code	CO2						CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		CO2		CH4		N2O						
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.29E+02	0.00E+00	1.79E-02	0.00E+00	4.49E-03	0.00E+00	2.31E+02	0.00E+00		1.53E+11	1.51E-09
Finance, Property & Business Services	8	9.43E+01	0.00E+00	8.44E-03	0.00E+00	2.06E-03	0.00E+00	9.55E+01	0.00E+00		1.23E+11	7.75E-10
Community, Social & Personal Services	9	1.44E+03	0.00E+00	1.50E-01	0.00E+00	2.74E-02	0.00E+00	1.45E+03	0.00E+00		5.00E+10	2.90E-08

YEAR: 2000

SIC Category	SIC Code	CO2						CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		CO2		CH4		N2O						
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.30E+02	0.00E+00	1.77E-02	0.00E+00	4.53E-03	0.00E+00	2.32E+02	0.00E+00		1.61E+11	1.44E-09
Finance, Property & Business Services	8	9.47E+01	0.00E+00	8.37E-03	0.00E+00	2.08E-03	0.00E+00	9.55E+01	0.00E+00		1.31E+11	7.32E-10
Community, Social & Personal Services	9	1.43E+03	0.00E+00	1.48E-01	0.00E+00	2.73E-02	0.00E+00	1.44E+03	0.00E+00		5.07E+10	2.85E-08

YEAR: 2005

SIC Category	SIC Code	CO2						CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		CO2		CH4		N2O						
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.43E+02	0.00E+00	1.81E-02	0.00E+00	4.86E-03	0.00E+00	2.45E+02	0.00E+00		1.98E+11	1.24E-09
Finance, Property & Business Services	8	1.00E+02	0.00E+00	8.53E-03	0.00E+00	2.22E-03	0.00E+00	1.01E+02	0.00E+00		1.62E+11	6.24E-10
Community, Social & Personal Services	9	1.48E+03	0.00E+00	1.51E-01	0.00E+00	2.82E-02	0.00E+00	1.49E+03	0.00E+00		5.89E+10	2.53E-08

YEAR: 2010

SIC Category	SIC Code	CO2						CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		CO2		CH4		N2O						
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.66E+02	0.00E+00	1.89E-02	0.00E+00	5.38E-03	0.00E+00	2.68E+02	0.00E+00		2.38E+11	1.12E-09
Finance, Property & Business Services	8	1.10E+02	0.00E+00	8.91E-03	0.00E+00	2.46E-03	0.00E+00	1.11E+02	0.00E+00		2.15E+11	5.13E-10
Community, Social & Personal Services	9	1.57E+03	0.00E+00	1.56E-01	0.00E+00	3.00E-02	0.00E+00	1.58E+03	0.00E+00		7.27E+10	2.18E-08

YEAR: 2015

SIC Category	SIC Code	CO2						CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		CO2		CH4		N2O						
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.88E+02	0.00E+00	1.96E-02	0.00E+00	5.67E-03	0.00E+00	2.90E+02	0.00E+00		2.84E+11	1.02E-09
Finance, Property & Business Services	8	1.18E+02	0.00E+00	9.27E-03	0.00E+00	2.58E-03	0.00E+00	1.19E+02	0.00E+00		2.92E+11	4.07E-10
Community, Social & Personal Services	9	1.67E+03	0.00E+00	1.62E-01	0.00E+00	3.13E-02	0.00E+00	1.68E+03	0.00E+00		8.90E+10	1.89E-08

YEAR: 2020

SIC Category	SIC Code	CO2						CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		CO2		CH4		N2O						
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	3.14E+02	0.00E+00	2.05E-02	0.00E+00	5.99E-03	0.00E+00	3.16E+02	0.00E+00		3.38E+11	9.36E-10
Finance, Property & Business Services	8	1.28E+02	0.00E+00	9.66E-03	0.00E+00	2.73E-03	0.00E+00	1.29E+02	0.00E+00		3.96E+11	3.24E-10
Community, Social & Personal Services	9	1.79E+03	0.00E+00	1.69E-01	0.00E+00	3.28E-02	0.00E+00	1.80E+03	0.00E+00		1.09E+11	1.65E-08

YEAR: 2025

SIC Category	SIC Code	CO2						CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		CO2		CH4		N2O						
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	3.45E+02	0.00E+00	2.14E-02	0.00E+00	6.35E-03	0.00E+00	3.48E+02	0.00E+00		4.02E+11	8.64E-10
Finance, Property & Business Services	8	1.39E+02	0.00E+00	1.01E-02	0.00E+00	2.88E-03	0.00E+00	1.40E+02	0.00E+00		5.38E+11	2.60E-10
Community, Social & Personal Services	9	1.94E+03	0.00E+00	1.76E-01	0.00E+00	3.45E-02	0.00E+00	1.95E+03	0.00E+00		1.33E+11	1.46E-08

YEAR: 2030

SIC Category	SIC Code	CO2						CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		CO2		CH4		N2O						
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	3.83E+02	0.00E+00	2.23E-02	0.00E+00	6.74E-03	0.00E+00	3.86E+02	0.00E+00		4.79E+11	8.04E-10
Finance, Property & Business Services	8	1.53E+02	0.00E+00	1.05E-02	0.00E+00	3.05E-03	0.00E+00	1.54E+02	0.00E+00		7.30E+11	2.11E-10
Community, Social & Personal Services	9	2.12E+03	0.00E+00	1.84E-01	0.00E+00	3.62E-02	0.00E+00	2.14E+03	0.00E+00		1.63E+11	1.31E-08

Lighting retrofit

YEAR: 1990

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg)	CO2 equiv (Gg)	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.28E+02	0.00E+00	1.86E-02	0.00E+00	4.38E-03	0.00E+00	2.30E+02	0.00E+00		1.33E+11	1.73E-09
Finance, Property & Business Services	8	9.38E+01	0.00E+00	8.79E-03	0.00E+00	2.01E-03	0.00E+00	9.47E+01	0.00E+00		9.13E+10	1.04E-09
Community, Social & Personal Services	9	1.48E+03	0.00E+00	1.57E-01	0.00E+00	2.80E-02	0.00E+00	1.50E+03	0.00E+00		4.74E+10	3.16E-08

YEAR: 1994

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg)	CO2 equiv (Gg)	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.29E+02	0.00E+00	1.79E-02	0.00E+00	4.49E-03	0.00E+00	2.31E+02	0.00E+00		1.46E+11	1.58E-09
Finance, Property & Business Services	8	9.41E+01	0.00E+00	8.62E-03	0.00E+00	2.08E-03	0.00E+00	9.49E+01	0.00E+00		1.08E+11	8.82E-10
Community, Social & Personal Services	9	1.46E+03	0.00E+00	1.54E-01	0.00E+00	2.77E-02	0.00E+00	1.47E+03	0.00E+00		4.71E+10	3.13E-08

YEAR: 1998

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg)	CO2 equiv (Gg)	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.29E+02	0.00E+00	1.79E-02	0.00E+00	4.49E-03	0.00E+00	2.31E+02	0.00E+00		1.53E+11	1.51E-09
Finance, Property & Business Services	8	9.43E+01	0.00E+00	8.44E-03	0.00E+00	2.06E-03	0.00E+00	9.51E+01	0.00E+00		1.23E+11	7.75E-10
Community, Social & Personal Services	9	1.44E+03	0.00E+00	1.50E-01	0.00E+00	2.74E-02	0.00E+00	1.45E+03	0.00E+00		5.00E+10	2.90E-08

YEAR: 2000

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg)	CO2 equiv (Gg)	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.30E+02	0.00E+00	1.77E-02	0.00E+00	4.53E-03	0.00E+00	2.32E+02	0.00E+00		1.81E+11	1.44E-09
Finance, Property & Business Services	8	9.47E+01	0.00E+00	8.37E-03	0.00E+00	2.08E-03	0.00E+00	9.55E+01	0.00E+00		1.31E+11	7.32E-10
Community, Social & Personal Services	9	1.43E+03	0.00E+00	1.48E-01	0.00E+00	2.73E-02	0.00E+00	1.44E+03	0.00E+00		5.07E+10	2.85E-08

YEAR: 2005

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg)	CO2 equiv (Gg)	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.47E+02	0.00E+00	1.85E-02	0.00E+00	4.94E-03	0.00E+00	2.49E+02	0.00E+00		1.98E+11	1.28E-09
Finance, Property & Business Services	8	1.02E+02	0.00E+00	8.71E-03	0.00E+00	2.28E-03	0.00E+00	1.03E+02	0.00E+00		1.62E+11	6.35E-10
Community, Social & Personal Services	9	1.51E+03	0.00E+00	1.54E-01	0.00E+00	2.88E-02	0.00E+00	1.52E+03	0.00E+00		5.89E+10	2.58E-08

YEAR: 2010

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg)	CO2 equiv (Gg)	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.75E+02	0.00E+00	1.98E-02	0.00E+00	5.55E-03	0.00E+00	2.77E+02	0.00E+00		2.38E+11	1.16E-09
Finance, Property & Business Services	8	1.13E+02	0.00E+00	9.31E-03	0.00E+00	2.53E-03	0.00E+00	1.14E+02	0.00E+00		2.15E+11	5.31E-10
Community, Social & Personal Services	9	1.64E+03	0.00E+00	1.64E-01	0.00E+00	3.12E-02	0.00E+00	1.65E+03	0.00E+00		7.27E+10	2.27E-08

YEAR: 2015

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg)	CO2 equiv (Gg)	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	3.02E+02	0.00E+00	2.10E-02	0.00E+00	5.94E-03	0.00E+00	3.05E+02	0.00E+00		2.84E+11	1.07E-09
Finance, Property & Business Services	8	1.24E+02	0.00E+00	9.90E-03	0.00E+00	2.71E-03	0.00E+00	1.25E+02	0.00E+00		2.92E+11	4.28E-10
Community, Social & Personal Services	9	1.77E+03	0.00E+00	1.74E-01	0.00E+00	3.33E-02	0.00E+00	1.79E+03	0.00E+00		8.90E+10	2.01E-08

YEAR: 2020

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg)	CO2 equiv (Gg)	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	3.35E+02	0.00E+00	2.24E-02	0.00E+00	6.36E-03	0.00E+00	3.37E+02	0.00E+00		3.38E+11	9.98E-10
Finance, Property & Business Services	8	1.38E+02	0.00E+00	1.05E-02	0.00E+00	2.90E-03	0.00E+00	1.37E+02	0.00E+00		3.96E+11	3.46E-10
Community, Social & Personal Services	9	1.94E+03	0.00E+00	1.85E-01	0.00E+00	3.55E-02	0.00E+00	1.95E+03	0.00E+00		1.09E+11	1.79E-08

YEAR: 2025

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg)	CO2 equiv (Gg)	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	3.73E+02	0.00E+00	2.39E-02	0.00E+00	8.84E-03	0.00E+00	3.75E+02	0.00E+00		4.02E+11	9.33E-10
Finance, Property & Business Services	8	1.50E+02	0.00E+00	1.13E-02	0.00E+00	3.11E-03	0.00E+00	1.51E+02	0.00E+00		5.38E+11	2.81E-10
Community, Social & Personal Services	9	2.13E+03	0.00E+00	1.98E-01	0.00E+00	3.80E-02	0.00E+00	2.15E+03	0.00E+00		1.33E+11	1.61E-08

YEAR: 2030

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg)	CO2 equiv (Gg)	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	4.18E+02	0.00E+00	2.55E-02	0.00E+00	7.36E-03	0.00E+00	4.21E+02	0.00E+00		4.79E+11	8.78E-10
Finance, Property & Business Services	8	1.67E+02	0.00E+00	1.20E-02	0.00E+00	3.34E-03	0.00E+00	1.68E+02	0.00E+00		7.30E+11	2.31E-10
Community, Social & Personal Services	9	2.37E+03	0.00E+00	2.11E-01	0.00E+00	4.08E-02	0.00E+00	2.39E+03	0.00E+00		1.63E+11	1.48E-08

New lighting systems

YEAR: 1990

SIC Category	SIC Code	CO2						CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		CO2		CH4		N2O						
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.28E+02	0.00E+00	1.86E-02	0.00E+00	4.38E-03	0.00E+00	2.30E+02	0.00E+00		1.33E+11	1.73E-09
Finance, Property & Business Services	8	9.38E+01	0.00E+00	8.79E-03	0.00E+00	2.01E-03	0.00E+00	9.47E+01	0.00E+00		9.13E+10	1.04E-09
Community, Social & Personal Services	9	1.48E+03	0.00E+00	1.57E-01	0.00E+00	2.80E-02	0.00E+00	1.50E+03	0.00E+00		4.74E+10	3.16E-08

YEAR: 1994

SIC Category	SIC Code	CO2						CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		CO2		CH4		N2O						
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.29E+02	0.00E+00	1.83E-02	0.00E+00	4.49E-03	0.00E+00	2.31E+02	0.00E+00		1.46E+11	1.58E-09
Finance, Property & Business Services	8	9.41E+01	0.00E+00	8.62E-03	0.00E+00	2.03E-03	0.00E+00	9.49E+01	0.00E+00		1.08E+11	8.82E-10
Community, Social & Personal Services	9	1.46E+03	0.00E+00	1.54E-01	0.00E+00	2.77E-02	0.00E+00	1.47E+03	0.00E+00		4.71E+10	3.13E-08

YEAR: 1998

SIC Category	SIC Code	CO2						CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		CO2		CH4		N2O						
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.29E+02	0.00E+00	1.79E-02	0.00E+00	4.49E-03	0.00E+00	2.31E+02	0.00E+00		1.53E+11	1.51E-09
Finance, Property & Business Services	8	9.43E+01	0.00E+00	8.44E-03	0.00E+00	2.06E-03	0.00E+00	9.51E+01	0.00E+00		1.23E+11	7.75E-10
Community, Social & Personal Services	9	1.44E+03	0.00E+00	1.50E-01	0.00E+00	2.74E-02	0.00E+00	1.45E+03	0.00E+00		5.00E+10	2.90E-08

YEAR: 2000

SIC Category	SIC Code	CO2						CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		CO2		CH4		N2O						
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.30E+02	0.00E+00	1.77E-02	0.00E+00	4.53E-03	0.00E+00	2.32E+02	0.00E+00		1.61E+11	1.44E-09
Finance, Property & Business Services	8	9.47E+01	0.00E+00	8.37E-03	0.00E+00	2.08E-03	0.00E+00	9.55E+01	0.00E+00		1.31E+11	7.32E-10
Community, Social & Personal Services	9	1.43E+03	0.00E+00	1.48E-01	0.00E+00	2.73E-02	0.00E+00	1.44E+03	0.00E+00		5.07E+10	2.85E-08

YEAR: 2005

SIC Category	SIC Code	CO2						CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		CO2		CH4		N2O						
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.47E+02	0.00E+00	1.85E-02	0.00E+00	4.94E-03	0.00E+00	2.49E+02	0.00E+00		1.99E+11	1.29E-09
Finance, Property & Business Services	8	1.02E+02	0.00E+00	8.71E-03	0.00E+00	2.26E-03	0.00E+00	1.03E+02	0.00E+00		1.62E+11	6.35E-10
Community, Social & Personal Services	9	1.51E+03	0.00E+00	1.54E-01	0.00E+00	2.88E-02	0.00E+00	1.52E+03	0.00E+00		5.89E+10	2.58E-08

YEAR: 2010

SIC Category	SIC Code	CO2						CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		CO2		CH4		N2O						
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.75E+02	0.00E+00	1.98E-02	0.00E+00	5.55E-03	0.00E+00	2.77E+02	0.00E+00		2.38E+11	1.16E-09
Finance, Property & Business Services	8	1.13E+02	0.00E+00	9.31E-03	0.00E+00	2.53E-03	0.00E+00	1.14E+02	0.00E+00		2.15E+11	5.31E-10
Community, Social & Personal Services	9	1.64E+03	0.00E+00	1.64E-01	0.00E+00	3.12E-02	0.00E+00	1.65E+03	0.00E+00		7.27E+10	2.27E-08

YEAR: 2015

SIC Category	SIC Code	CO2						CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		CO2		CH4		N2O						
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	3.02E+02	0.00E+00	2.10E-02	0.00E+00	5.94E-03	0.00E+00	3.05E+02	0.00E+00		2.84E+11	1.07E-09
Finance, Property & Business Services	8	1.24E+02	0.00E+00	9.90E-03	0.00E+00	2.71E-03	0.00E+00	1.25E+02	0.00E+00		2.92E+11	4.28E-10
Community, Social & Personal Services	9	1.77E+03	0.00E+00	1.74E-01	0.00E+00	3.33E-02	0.00E+00	1.79E+03	0.00E+00		8.90E+10	2.01E-08

YEAR: 2020

SIC Category	SIC Code	CO2						CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		CO2		CH4		N2O						
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	3.35E+02	0.00E+00	2.24E-02	0.00E+00	6.36E-03	0.00E+00	3.37E+02	0.00E+00		3.38E+11	9.98E-10
Finance, Property & Business Services	8	1.38E+02	0.00E+00	1.05E-02	0.00E+00	2.90E-03	0.00E+00	1.37E+02	0.00E+00		3.96E+11	3.48E-10
Community, Social & Personal Services	9	1.94E+03	0.00E+00	1.85E-01	0.00E+00	3.55E-02	0.00E+00	1.95E+03	0.00E+00		1.09E+11	1.79E-08

YEAR: 2025

SIC Category	SIC Code	CO2						CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		CO2		CH4		N2O						
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	3.73E+02	0.00E+00	2.39E-02	0.00E+00	6.84E-03	0.00E+00	3.75E+02	0.00E+00		4.02E+11	9.33E-10
Finance, Property & Business Services	8	1.50E+02	0.00E+00	1.13E-02	0.00E+00	3.11E-03	0.00E+00	1.51E+02	0.00E+00		5.38E+11	2.81E-10
Community, Social & Personal Services	9	2.13E+03	0.00E+00	1.98E-01	0.00E+00	3.80E-02	0.00E+00	2.15E+03	0.00E+00		1.33E+11	1.61E-08

YEAR: 2030

SIC Category	SIC Code	CO2						CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		CO2		CH4		N2O						
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	4.18E+02	0.00E+00	2.55E-02	0.00E+00	7.36E-03	0.00E+00	4.21E+02	0.00E+00		4.79E+11	8.78E-10
Finance, Property & Business Services	8	1.67E+02	0.00E+00	1.20E-02	0.00E+00	3.34E-03	0.00E+00	1.68E+02	0.00E+00		7.30E+11	2.31E-10
Community, Social & Personal Services	9	2.37E+03	0.00E+00	2.11E-01	0.00E+00	4.08E-02	0.00E+00	2.39E+03	0.00E+00		1.63E+11	1.46E-08

VSDs for fans

YEAR: 1990

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.28E+02	0.00E+00	1.86E-02	0.00E+00					
Finance, Property & Business Services	8	9.38E+01	0.00E+00	8.79E-03	0.00E+00	2.01E-03	0.00E+00	9.47E+01	0.00E+00		9.13E+10	1.04E-09
Community, Social & Personal Services	9	1.48E+03	0.00E+00	1.57E-01	0.00E+00	2.80E-02	0.00E+00	1.50E+03	0.00E+00		4.74E+10	3.16E-08

YEAR: 1994

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.29E+02	0.00E+00	1.83E-02	0.00E+00					
Finance, Property & Business Services	8	9.41E+01	0.00E+00	8.82E-03	0.00E+00	2.03E-03	0.00E+00	9.49E+01	0.00E+00		1.08E+11	8.82E-10
Community, Social & Personal Services	9	1.46E+03	0.00E+00	1.54E-01	0.00E+00	2.77E-02	0.00E+00	1.47E+03	0.00E+00		4.71E+10	3.13E-08

YEAR: 1998

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.29E+02	0.00E+00	1.79E-02	0.00E+00					
Finance, Property & Business Services	8	9.43E+01	0.00E+00	8.44E-03	0.00E+00	2.06E-03	0.00E+00	9.51E+01	0.00E+00		1.23E+11	7.75E-10
Community, Social & Personal Services	9	1.44E+03	0.00E+00	1.50E-01	0.00E+00	2.74E-02	0.00E+00	1.45E+03	0.00E+00		5.00E+10	2.90E-08

YEAR: 2000

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.30E+02	0.00E+00	1.77E-02	0.00E+00					
Finance, Property & Business Services	8	9.47E+01	0.00E+00	8.37E-03	0.00E+00	2.08E-03	0.00E+00	9.55E+01	0.00E+00		1.31E+11	7.32E-10
Community, Social & Personal Services	9	1.43E+03	0.00E+00	1.48E-01	0.00E+00	2.73E-02	0.00E+00	1.44E+03	0.00E+00		5.07E+10	2.85E-08

YEAR: 2005

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.47E+02	0.00E+00	1.85E-02	0.00E+00					
Finance, Property & Business Services	8	1.02E+02	0.00E+00	8.71E-03	0.00E+00	2.26E-03	0.00E+00	1.03E+02	0.00E+00		1.82E+11	6.35E-10
Community, Social & Personal Services	9	1.51E+03	0.00E+00	1.54E-01	0.00E+00	2.88E-02	0.00E+00	1.52E+03	0.00E+00		5.89E+10	2.58E-08

YEAR: 2010

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.75E+02	0.00E+00	1.98E-02	0.00E+00					
Finance, Property & Business Services	8	1.13E+02	0.00E+00	9.31E-03	0.00E+00	2.53E-03	0.00E+00	1.14E+02	0.00E+00		2.15E+11	5.31E-10
Community, Social & Personal Services	9	1.64E+03	0.00E+00	1.64E-01	0.00E+00	3.12E-02	0.00E+00	1.65E+03	0.00E+00		7.27E+10	2.27E-08

YEAR: 2015

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	3.02E+02	0.00E+00	2.10E-02	0.00E+00					
Finance, Property & Business Services	8	1.24E+02	0.00E+00	9.90E-03	0.00E+00	2.71E-03	0.00E+00	1.25E+02	0.00E+00		2.92E+11	4.28E-10
Community, Social & Personal Services	9	1.77E+03	0.00E+00	1.74E-01	0.00E+00	3.33E-02	0.00E+00	1.79E+03	0.00E+00		8.90E+10	2.01E-08

YEAR: 2020

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	3.35E+02	0.00E+00	2.24E-02	0.00E+00					
Finance, Property & Business Services	8	1.36E+02	0.00E+00	1.05E-02	0.00E+00	2.90E-03	0.00E+00	1.37E+02	0.00E+00		3.98E+11	3.48E-10
Community, Social & Personal Services	9	1.94E+03	0.00E+00	1.85E-01	0.00E+00	3.55E-02	0.00E+00	1.95E+03	0.00E+00		1.09E+11	1.79E-08

YEAR: 2025

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	3.73E+02	0.00E+00	2.39E-02	0.00E+00					
Finance, Property & Business Services	8	1.50E+02	0.00E+00	1.13E-02	0.00E+00	3.11E-03	0.00E+00	1.51E+02	0.00E+00		5.38E+11	2.81E-10
Community, Social & Personal Services	9	2.13E+03	0.00E+00	1.98E-01	0.00E+00	3.80E-02	0.00E+00	2.15E+03	0.00E+00		1.33E+11	1.61E-08

YEAR: 2030

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	4.18E+02	0.00E+00	2.55E-02	0.00E+00					
Finance, Property & Business Services	8	1.67E+02	0.00E+00	1.20E-02	0.00E+00	3.34E-03	0.00E+00	1.68E+02	0.00E+00		7.30E+11	2.31E-10
Community, Social & Personal Services	9	2.37E+03	0.00E+00	2.11E-01	0.00E+00	4.08E-02	0.00E+00	2.39E+03	0.00E+00		1.63E+11	1.46E-08

Heat pumps

YEAR: 1990

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.28E+02	0.00E+00	1.86E-02	0.00E+00					
Finance, Property & Business Services	8	9.38E+01	0.00E+00	8.79E-03	0.00E+00	2.01E-03	0.00E+00	9.47E+01	0.00E+00	9.13E+10	1.04E-08	
Community, Social & Personal Services	9	1.48E+03	0.00E+00	1.57E-01	0.00E+00	2.80E-02	0.00E+00	1.50E+03	0.00E+00	4.74E+10	3.16E-08	

YEAR: 1994

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.29E+02	0.00E+00	1.83E-02	0.00E+00					
Finance, Property & Business Services	8	9.41E+01	0.00E+00	8.62E-03	0.00E+00	2.03E-03	0.00E+00	9.49E+01	0.00E+00	1.08E+11	8.82E-10	
Community, Social & Personal Services	9	1.46E+03	0.00E+00	1.54E-01	0.00E+00	2.77E-02	0.00E+00	1.47E+03	0.00E+00	4.71E+10	3.13E-08	

YEAR: 1998

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.29E+02	0.00E+00	1.79E-02	0.00E+00					
Finance, Property & Business Services	8	9.43E+01	0.00E+00	8.44E-03	0.00E+00	2.06E-03	0.00E+00	9.51E+01	0.00E+00	1.23E+11	7.75E-10	
Community, Social & Personal Services	9	1.44E+03	0.00E+00	1.50E-01	0.00E+00	2.74E-02	0.00E+00	1.45E+03	0.00E+00	5.00E+10	2.90E-08	

YEAR: 2000

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.30E+02	0.00E+00	1.77E-02	0.00E+00					
Finance, Property & Business Services	8	9.47E+01	0.00E+00	8.37E-03	0.00E+00	2.08E-03	0.00E+00	9.55E+01	0.00E+00	1.31E+11	7.32E-10	
Community, Social & Personal Services	9	1.43E+03	0.00E+00	1.48E-01	0.00E+00	2.73E-02	0.00E+00	1.44E+03	0.00E+00	5.07E+10	2.85E-08	

YEAR: 2005

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.47E+02	0.00E+00	1.85E-02	0.00E+00					
Finance, Property & Business Services	8	1.02E+02	0.00E+00	8.71E-03	0.00E+00	2.26E-03	0.00E+00	1.03E+02	0.00E+00	1.62E+11	7.32E-10	
Community, Social & Personal Services	9	1.51E+03	0.00E+00	1.54E-01	0.00E+00	2.88E-02	0.00E+00	1.52E+03	0.00E+00	5.89E+10	2.58E-08	

YEAR: 2010

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.75E+02	0.00E+00	1.98E-02	0.00E+00					
Finance, Property & Business Services	8	1.13E+02	0.00E+00	9.31E-03	0.00E+00	2.53E-03	0.00E+00	1.14E+02	0.00E+00	2.15E+11	5.31E-10	
Community, Social & Personal Services	9	1.64E+03	0.00E+00	1.64E-01	0.00E+00	3.12E-02	0.00E+00	1.65E+03	0.00E+00	7.27E+10	2.27E-08	

YEAR: 2015

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	3.02E+02	0.00E+00	2.10E-02	0.00E+00					
Finance, Property & Business Services	8	1.24E+02	0.00E+00	9.90E-03	0.00E+00	2.71E-03	0.00E+00	1.25E+02	0.00E+00	2.92E+11	4.28E-10	
Community, Social & Personal Services	9	1.77E+03	0.00E+00	1.74E-01	0.00E+00	3.33E-02	0.00E+00	1.79E+03	0.00E+00	6.90E+10	2.01E-08	

YEAR: 2020

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	3.35E+02	0.00E+00	2.24E-02	0.00E+00					
Finance, Property & Business Services	8	1.38E+02	0.00E+00	1.05E-02	0.00E+00	2.90E-03	0.00E+00	1.37E+02	0.00E+00	3.96E+11	3.46E-10	
Community, Social & Personal Services	9	1.94E+03	0.00E+00	1.85E-01	0.00E+00	3.55E-02	0.00E+00	1.95E+03	0.00E+00	1.09E+11	1.79E-08	

YEAR: 2025

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	3.73E+02	0.00E+00	2.39E-02	0.00E+00					
Finance, Property & Business Services	8	1.50E+02	0.00E+00	1.13E-02	0.00E+00	3.11E-03	0.00E+00	1.51E+02	0.00E+00	5.38E+11	2.81E-10	
Community, Social & Personal Services	9	2.13E+03	0.00E+00	1.98E-01	0.00E+00	3.80E-02	0.00E+00	2.15E+03	0.00E+00	1.33E+11	1.61E-08	

YEAR: 2030

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	4.18E+02	0.00E+00	2.55E-02	0.00E+00					
Finance, Property & Business Services	8	1.87E+02	0.00E+00	1.20E-02	0.00E+00	3.34E-03	0.00E+00	1.88E+02	0.00E+00	7.30E+11	2.31E-10	
Community, Social & Personal Services	9	2.37E+03	0.00E+00	2.11E-01	0.00E+00	4.08E-02	0.00E+00	2.39E+03	0.00E+00	1.63E+11	1.46E-08	

Energy star equipment

YEAR: 1990

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.28E+02	0.00E+00	1.86E-02	0.00E+00	4.38E-03	0.00E+00	2.30E+02	0.00E+00		1.33E+11	1.73E-09
Finance, Property & Business Services	8	9.38E+01	0.00E+00	8.79E-03	0.00E+00	2.01E-03	0.00E+00	9.47E+01	0.00E+00		9.13E+10	1.04E-09
Community, Social & Personal Services	9	1.48E+03	0.00E+00	1.57E-01	0.00E+00	2.80E-02	0.00E+00	1.50E+03	0.00E+00		4.74E+10	3.16E-08

YEAR: 1994

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.29E+02	0.00E+00	1.79E-02	0.00E+00	4.49E-03	0.00E+00	2.31E+02	0.00E+00		1.46E+11	1.58E-09
Finance, Property & Business Services	8	9.41E+01	0.00E+00	8.62E-03	0.00E+00	2.03E-03	0.00E+00	9.49E+01	0.00E+00		1.08E+11	8.82E-10
Community, Social & Personal Services	9	1.46E+03	0.00E+00	1.54E-01	0.00E+00	2.77E-02	0.00E+00	1.47E+03	0.00E+00		4.71E+10	3.13E-08

YEAR: 1998

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.29E+02	0.00E+00	1.79E-02	0.00E+00	4.49E-03	0.00E+00	2.31E+02	0.00E+00		1.53E+11	1.51E-09
Finance, Property & Business Services	8	9.43E+01	0.00E+00	8.44E-03	0.00E+00	2.06E-03	0.00E+00	9.51E+01	0.00E+00		1.23E+11	7.75E-10
Community, Social & Personal Services	9	1.44E+03	0.00E+00	1.50E-01	0.00E+00	2.74E-02	0.00E+00	1.45E+03	0.00E+00		5.00E+10	2.90E-08

YEAR: 2000

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.30E+02	0.00E+00	1.77E-02	0.00E+00	4.53E-03	0.00E+00	2.32E+02	0.00E+00		1.61E+11	1.44E-09
Finance, Property & Business Services	8	9.47E+01	0.00E+00	8.37E-03	0.00E+00	2.08E-03	0.00E+00	9.55E+01	0.00E+00		1.31E+11	7.32E-10
Community, Social & Personal Services	9	1.43E+03	0.00E+00	1.48E-01	0.00E+00	2.73E-02	0.00E+00	1.44E+03	0.00E+00		5.07E+10	2.85E-08

YEAR: 2005

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.47E+02	0.00E+00	1.85E-02	0.00E+00	4.94E-03	0.00E+00	2.49E+02	0.00E+00		1.98E+11	1.26E-09
Finance, Property & Business Services	8	1.02E+02	0.00E+00	8.71E-03	0.00E+00	2.28E-03	0.00E+00	1.03E+02	0.00E+00		1.62E+11	6.35E-10
Community, Social & Personal Services	9	1.51E+03	0.00E+00	1.54E-01	0.00E+00	2.88E-02	0.00E+00	1.52E+03	0.00E+00		5.89E+10	2.58E-08

YEAR: 2010

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	2.75E+02	0.00E+00	1.98E-02	0.00E+00	5.55E-03	0.00E+00	2.77E+02	0.00E+00		2.38E+11	1.16E-09
Finance, Property & Business Services	8	1.13E+02	0.00E+00	9.31E-03	0.00E+00	2.53E-03	0.00E+00	1.14E+02	0.00E+00		2.15E+11	5.31E-10
Community, Social & Personal Services	9	1.64E+03	0.00E+00	1.64E-01	0.00E+00	3.12E-02	0.00E+00	1.65E+03	0.00E+00		7.27E+10	2.27E-08

YEAR: 2015

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	3.02E+02	0.00E+00	2.10E-02	0.00E+00	5.94E-03	0.00E+00	3.05E+02	0.00E+00		2.84E+11	1.07E-09
Finance, Property & Business Services	8	1.24E+02	0.00E+00	9.90E-03	0.00E+00	2.71E-03	0.00E+00	1.25E+02	0.00E+00		2.92E+11	4.28E-10
Community, Social & Personal Services	9	1.77E+03	0.00E+00	1.74E-01	0.00E+00	3.33E-02	0.00E+00	1.79E+03	0.00E+00		8.90E+10	2.01E-08

YEAR: 2020

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	3.35E+02	0.00E+00	2.24E-02	0.00E+00	6.36E-03	0.00E+00	3.37E+02	0.00E+00		3.38E+11	9.98E-10
Finance, Property & Business Services	8	1.36E+02	0.00E+00	1.05E-02	0.00E+00	2.90E-03	0.00E+00	1.37E+02	0.00E+00		3.96E+11	3.46E-10
Community, Social & Personal Services	9	1.94E+03	0.00E+00	1.85E-01	0.00E+00	3.55E-02	0.00E+00	1.95E+03	0.00E+00		1.09E+11	1.79E-08

YEAR: 2025

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	3.73E+02	0.00E+00	2.39E-02	0.00E+00	6.84E-03	0.00E+00	3.75E+02	0.00E+00		4.02E+11	9.33E-10
Finance, Property & Business Services	8	1.50E+02	0.00E+00	1.13E-02	0.00E+00	3.11E-03	0.00E+00	1.51E+02	0.00E+00		5.36E+11	2.81E-10
Community, Social & Personal Services	9	2.13E+03	0.00E+00	1.98E-01	0.00E+00	3.80E-02	0.00E+00	2.15E+03	0.00E+00		1.33E+11	1.61E-08

YEAR: 2030

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Trade, catering & accommodation	6	4.18E+02	0.00E+00	2.55E-02	0.00E+00	7.36E-03	0.00E+00	4.21E+02	0.00E+00		4.79E+11	8.78E-10
Finance, Property & Business Services	8	1.67E+02	0.00E+00	1.20E-02	0.00E+00	3.34E-03	0.00E+00	1.68E+02	0.00E+00		7.30E+11	2.31E-10
Community, Social & Personal Services	9	2.37E+03	0.00E+00	2.11E-01	0.00E+00	4.08E-02	0.00E+00	2.39E+03	0.00E+00		1.63E+11	1.46E-08

Solar water heating

YEAR: 1990

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.28E+02	0.00E+00	1.86E-02	0.00E+00					
Finance, Property & Business Services	8	9.38E+01	0.00E+00	8.79E-03	0.00E+00	2.01E-03	0.00E+00	9.47E+01	0.00E+00		9.13E+10	1.04E-09
Community, Social & Personal Services	9	1.48E+03	0.00E+00	1.57E-01	0.00E+00	2.80E-02	0.00E+00	1.50E+03	0.00E+00		4.74E+10	3.16E-08

YEAR: 1994

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.29E+02	0.00E+00	1.83E-02	0.00E+00					
Finance, Property & Business Services	8	9.41E+01	0.00E+00	8.62E-03	0.00E+00	2.03E-03	0.00E+00	9.49E+01	0.00E+00		1.08E+11	8.82E-10
Community, Social & Personal Services	9	1.46E+03	0.00E+00	1.54E-01	0.00E+00	2.77E-02	0.00E+00	1.47E+03	0.00E+00		4.71E+10	3.13E-08

YEAR: 1998

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.29E+02	0.00E+00	1.79E-02	0.00E+00					
Finance, Property & Business Services	8	9.43E+01	0.00E+00	8.44E-03	0.00E+00	2.06E-03	0.00E+00	9.51E+01	0.00E+00		1.23E+11	7.75E-10
Community, Social & Personal Services	9	1.44E+03	0.00E+00	1.50E-01	0.00E+00	2.74E-02	0.00E+00	1.45E+03	0.00E+00		5.00E+10	2.90E-08

YEAR: 2000

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.30E+02	0.00E+00	1.77E-02	0.00E+00					
Finance, Property & Business Services	8	9.47E+01	0.00E+00	8.37E-03	0.00E+00	2.08E-03	0.00E+00	9.55E+01	0.00E+00		1.31E+11	7.32E-10
Community, Social & Personal Services	9	1.43E+03	0.00E+00	1.48E-01	0.00E+00	2.73E-02	0.00E+00	1.44E+03	0.00E+00		5.07E+10	2.85E-08

YEAR: 2005

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.47E+02	0.00E+00	1.85E-02	0.00E+00					
Finance, Property & Business Services	8	1.02E+02	0.00E+00	8.71E-03	0.00E+00	2.26E-03	0.00E+00	1.03E+02	0.00E+00		1.62E+11	6.35E-10
Community, Social & Personal Services	9	1.51E+03	0.00E+00	1.54E-01	0.00E+00	2.88E-02	0.00E+00	1.52E+03	0.00E+00		5.89E+10	2.58E-08

YEAR: 2010

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.75E+02	0.00E+00	1.98E-02	0.00E+00					
Finance, Property & Business Services	8	1.13E+02	0.00E+00	9.31E-03	0.00E+00	2.53E-03	0.00E+00	1.14E+02	0.00E+00		2.15E+11	5.31E-10
Community, Social & Personal Services	9	1.64E+03	0.00E+00	1.64E-01	0.00E+00	3.12E-02	0.00E+00	1.65E+03	0.00E+00		7.27E+10	2.27E-08

YEAR: 2015

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	3.02E+02	0.00E+00	2.10E-02	0.00E+00					
Finance, Property & Business Services	8	1.24E+02	0.00E+00	9.90E-03	0.00E+00	2.71E-03	0.00E+00	1.25E+02	0.00E+00		2.92E+11	4.28E-10
Community, Social & Personal Services	9	1.77E+03	0.00E+00	1.74E-01	0.00E+00	3.33E-02	0.00E+00	1.79E+03	0.00E+00		8.90E+10	2.01E-08

YEAR: 2020

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	3.35E+02	0.00E+00	2.24E-02	0.00E+00					
Finance, Property & Business Services	8	1.36E+02	0.00E+00	1.05E-02	0.00E+00	2.90E-03	0.00E+00	1.37E+02	0.00E+00		3.96E+11	3.46E-10
Community, Social & Personal Services	9	1.94E+03	0.00E+00	1.85E-01	0.00E+00	3.55E-02	0.00E+00	1.95E+03	0.00E+00		1.09E+11	1.79E-08

YEAR: 2025

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	3.73E+02	0.00E+00	2.39E-02	0.00E+00					
Finance, Property & Business Services	8	1.50E+02	0.00E+00	1.13E-02	0.00E+00	3.11E-03	0.00E+00	1.51E+02	0.00E+00		5.38E+11	2.81E-10
Community, Social & Personal Services	9	2.13E+03	0.00E+00	1.98E-01	0.00E+00	3.80E-02	0.00E+00	2.15E+03	0.00E+00		1.33E+11	1.61E-08

YEAR: 2030

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	4.18E+02	0.00E+00	2.55E-02	0.00E+00					
Finance, Property & Business Services	8	1.67E+02	0.00E+00	1.20E-02	0.00E+00	3.34E-03	0.00E+00	1.68E+02	0.00E+00		7.30E+11	2.31E-10
Community, Social & Personal Services	9	2.37E+03	0.00E+00	2.11E-01	0.00E+00	4.08E-02	0.00E+00	2.39E+03	0.00E+00		1.63E+11	1.46E-08

Fuel to natural gas

YEAR: 1990

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Finance, Property & Business Services	8	9.38E+01	0.00E+00	8.79E-03	0.00E+00	2.01E-03	0.00E+00	9.47E+01	0.00E+00	9.13E+10	1.04E-09	
Community, Social & Personal Services	9	1.48E+03	0.00E+00	1.57E-01	0.00E+00	2.80E-02	0.00E+00	1.50E+03	0.00E+00	4.74E+10	3.16E-08	

YEAR: 1994

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Finance, Property & Business Services	8	9.41E+01	0.00E+00	8.62E-03	0.00E+00	2.03E-03	0.00E+00	9.49E+01	0.00E+00	1.08E+11	8.82E-10	
Community, Social & Personal Services	9	1.46E+03	0.00E+00	1.54E-01	0.00E+00	2.77E-02	0.00E+00	1.47E+03	0.00E+00	4.71E+10	3.13E-08	

YEAR: 1998

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Finance, Property & Business Services	8	9.43E+01	0.00E+00	8.44E-03	0.00E+00	2.06E-03	0.00E+00	9.51E+01	0.00E+00	1.23E+11	7.75E-10	
Community, Social & Personal Services	9	1.44E+03	0.00E+00	1.50E-01	0.00E+00	2.74E-02	0.00E+00	1.45E+03	0.00E+00	5.00E+10	2.90E-08	

YEAR: 2000

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Finance, Property & Business Services	8	9.47E+01	0.00E+00	8.37E-03	0.00E+00	2.08E-03	0.00E+00	9.55E+01	0.00E+00	1.31E+11	7.32E-10	
Community, Social & Personal Services	9	1.43E+03	0.00E+00	1.48E-01	0.00E+00	2.73E-02	0.00E+00	1.44E+03	0.00E+00	5.07E+10	2.85E-08	

YEAR: 2005

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Finance, Property & Business Services	8	1.01E+02	0.00E+00	8.50E-03	0.00E+00	2.23E-03	0.00E+00	1.02E+02	0.00E+00	1.62E+11	6.28E-10	
Community, Social & Personal Services	9	1.48E+03	0.00E+00	1.50E-01	0.00E+00	2.82E-02	0.00E+00	1.50E+03	0.00E+00	5.89E+10	2.54E-08	

YEAR: 2010

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Finance, Property & Business Services	8	1.07E+02	0.00E+00	8.04E-03	0.00E+00	2.33E-03	0.00E+00	1.08E+02	0.00E+00	2.15E+11	5.01E-10	
Community, Social & Personal Services	9	1.50E+03	0.00E+00	1.40E-01	0.00E+00	2.75E-02	0.00E+00	1.51E+03	0.00E+00	7.27E+10	2.08E-08	

YEAR: 2015

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Finance, Property & Business Services	8	1.12E+02	0.00E+00	7.56E-03	0.00E+00	2.34E-03	0.00E+00	1.13E+02	0.00E+00	2.92E+11	3.87E-10	
Community, Social & Personal Services	9	1.51E+03	0.00E+00	1.31E-01	0.00E+00	2.65E-02	0.00E+00	1.53E+03	0.00E+00	8.90E+10	1.72E-08	

YEAR: 2020

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Finance, Property & Business Services	8	1.19E+02	0.00E+00	7.15E-03	0.00E+00	2.36E-03	0.00E+00	1.20E+02	0.00E+00	3.96E+11	3.02E-10	
Community, Social & Personal Services	9	1.58E+03	0.00E+00	1.23E-01	0.00E+00	2.57E-02	0.00E+00	1.57E+03	0.00E+00	1.09E+11	1.44E-08	

YEAR: 2025

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Finance, Property & Business Services	8	1.28E+02	0.00E+00	6.79E-03	0.00E+00	2.40E-03	0.00E+00	1.29E+02	0.00E+00	5.38E+11	2.39E-10	
Community, Social & Personal Services	9	1.64E+03	0.00E+00	1.16E-01	0.00E+00	2.52E-02	0.00E+00	1.65E+03	0.00E+00	1.33E+11	1.24E-08	

YEAR: 2030

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
Finance, Property & Business Services	8	1.39E+02	0.00E+00	8.51E-03	0.00E+00	2.47E-03	0.00E+00	1.40E+02	0.00E+00	7.30E+11	1.92E-10	
Community, Social & Personal Services	9	1.76E+03	0.00E+00	1.10E-01	0.00E+00	2.49E-02	0.00E+00	1.77E+03	0.00E+00	1.63E+11	1.08E-08	

Elec to natural gas

YEAR: 1990

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	8	2.28E+02	0.00E+00	1.86E-02	0.00E+00					
Finance, Property & Business Services	8	9.38E+01	0.00E+00	8.79E-03	0.00E+00	2.01E-03	0.00E+00	9.47E+01	0.00E+00		9.13E+10	1.04E-09
Community, Social & Personal Services	9	1.48E+03	0.00E+00	1.57E-01	0.00E+00	2.80E-02	0.00E+00	1.50E+03	0.00E+00		4.74E+10	3.16E-08

YEAR: 1994

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.29E+02	0.00E+00	1.83E-02	0.00E+00					
Finance, Property & Business Services	8	9.41E+01	0.00E+00	8.62E-03	0.00E+00	2.03E-03	0.00E+00	9.49E+01	0.00E+00		1.08E+11	8.82E-10
Community, Social & Personal Services	9	1.46E+03	0.00E+00	1.54E-01	0.00E+00	2.77E-02	0.00E+00	1.47E+03	0.00E+00		4.71E+10	3.13E-08

YEAR: 1998

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.29E+02	0.00E+00	1.79E-02	0.00E+00					
Finance, Property & Business Services	8	9.43E+01	0.00E+00	8.44E-03	0.00E+00	2.06E-03	0.00E+00	9.55E+01	0.00E+00		1.23E+11	7.75E-10
Community, Social & Personal Services	9	1.44E+03	0.00E+00	1.50E-01	0.00E+00	2.74E-02	0.00E+00	1.45E+03	0.00E+00		5.00E+10	2.90E-08

YEAR: 2000

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.30E+02	0.00E+00	1.77E-02	0.00E+00					
Finance, Property & Business Services	8	9.47E+01	0.00E+00	8.37E-03	0.00E+00	2.08E-03	0.00E+00	9.55E+01	0.00E+00		1.31E+11	7.32E-10
Community, Social & Personal Services	9	1.43E+03	0.00E+00	1.48E-01	0.00E+00	2.73E-02	0.00E+00	1.44E+03	0.00E+00		5.07E+10	2.85E-08

YEAR: 2005

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.49E+02	0.00E+00	1.85E-02	0.00E+00					
Finance, Property & Business Services	8	1.03E+02	0.00E+00	6.71E-03	0.00E+00	2.26E-03	0.00E+00	1.03E+02	0.00E+00		1.62E+11	6.39E-10
Community, Social & Personal Services	9	1.52E+03	0.00E+00	1.54E-01	0.00E+00	2.88E-02	0.00E+00	1.53E+03	0.00E+00		5.89E+10	2.60E-08

YEAR: 2010

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	2.82E+02	0.00E+00	1.98E-02	0.00E+00					
Finance, Property & Business Services	8	1.16E+02	0.00E+00	9.31E-03	0.00E+00	2.53E-03	0.00E+00	1.17E+02	0.00E+00		2.15E+11	5.42E-10
Community, Social & Personal Services	9	1.67E+03	0.00E+00	1.64E-01	0.00E+00	3.12E-02	0.00E+00	1.69E+03	0.00E+00		7.27E+10	2.32E-08

YEAR: 2015

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	3.14E+02	0.00E+00	2.10E-02	0.00E+00					
Finance, Property & Business Services	8	1.28E+02	0.00E+00	9.90E-03	0.00E+00	2.71E-03	0.00E+00	1.29E+02	0.00E+00		2.92E+11	4.41E-10
Community, Social & Personal Services	9	1.83E+03	0.00E+00	1.74E-01	0.00E+00	3.33E-02	0.00E+00	1.85E+03	0.00E+00		8.90E+10	2.08E-08

YEAR: 2020


SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	3.51E+02	0.00E+00	2.24E-02	0.00E+00					
Finance, Property & Business Services	8	1.41E+02	0.00E+00	1.05E-02	0.00E+00	2.90E-03	0.00E+00	1.43E+02	0.00E+00		3.98E+11	3.60E-10
Community, Social & Personal Services	9	2.02E+03	0.00E+00	1.85E-01	0.00E+00	3.55E-02	0.00E+00	2.04E+03	0.00E+00		1.09E+11	1.87E-08

YEAR: 2025

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	3.94E+02	0.00E+00	2.39E-02	0.00E+00					
Finance, Property & Business Services	8	1.57E+02	0.00E+00	1.13E-02	0.00E+00	3.11E-03	0.00E+00	1.58E+02	0.00E+00		5.38E+11	2.95E-10
Community, Social & Personal Services	9	2.25E+03	0.00E+00	1.98E-01	0.00E+00	3.80E-02	0.00E+00	2.26E+03	0.00E+00		1.33E+11	1.69E-08

YEAR: 2030

SIC Category	SIC Code	CO2		CH4		N2O		CO2 equiv (Gg) Energy	CO2 equiv (Gg) Manufacturer	Production Volume (units/a)	Production Value (R/a)	Emission factor (Gg CO2 equiv / R output)
		Energy	Manufacture	Energy	Manufacture	Energy	Manufacture					
		Trade, catering & accommodation	6	4.44E+02	0.00E+00	2.55E-02	0.00E+00					
Finance, Property & Business Services	8	1.76E+02	0.00E+00	1.20E-02	0.00E+00	3.34E-03	0.00E+00	1.77E+02	0.00E+00		7.30E+11	2.42E-10
Community, Social & Personal Services	9	2.51E+03	0.00E+00	2.11E-01	0.00E+00	4.08E-02	0.00E+00	2.52E+03	0.00E+00		1.63E+11	1.54E-08



**Greenhouse gas baseline
and mitigation options
for the commercial sector**

MARK DE VILLIERS