



## Greenhouse Gases Workbook

### TAG Reference

TAG Unit A3 - Environmental Impact Appraisal

### Notes

This tool helps valuing the impact arising from the change in CO<sub>2</sub>e emissions, in conjunction with

To use this tool, the following are required:

- 1 Year of appraisal
- 2 Opening year of the analysed scheme/policy
- 3 Annual CO<sub>2</sub>e emissions (tonnes), split by traded and non-traded sector, both for t

Cells requiring user inputs on the 'inputs' sheet are shaded light green. The user inputs required

- 1 Scheme name
- 2 Scheme opening year
- 3 Scheme type (road, rail or road/rail)
- 4 Current year - the year the appraisal is undertaken to ensure the correct profile of
- 5 Without scheme emissions in the non-traded sector
- 6 With scheme emissions in the non-traded sector
- 7 Without scheme emissions in the traded sector
- 8 With scheme emissions in the traded sector

The other standard inputs are taken from the TAG data book / guidance:

- 1 Non-traded carbon values
- 2 Standard 60-year appraisal period
- 3 Standard DfT base year for present values and prices
- 4 HMT profile of discount rates
- 5 GDP deflator series from TAG data book (if results are required for a different base

The 'outputs' sheet produces 'Worksheet 1' as described in TAG Unit A3.

Note: The value of traded emissions should be internalised in the fuel/energy prices use changes in both traded and non-traded emissions for reporting purposes but mon  
Cells highlighted in yellow show the results

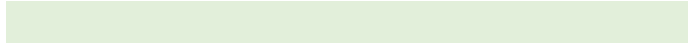
### Version Control

| <u>Date</u> | <u>Description</u>   |
|-------------|--|
| Dec-17      | Updated carbon values and GDP deflator forecasts                               |
| Aug-17      | Updated carbon values and GDP deflator forecasts                               |
| Mar-17      | Updated carbon values and GDP deflator forecasts                               |
| Jul-16      | Updated carbon values and GDP deflator forecasts                               |
| Dec-15      | Updated carbon values and GDP deflator forecasts                               |
| Mar-15      | Revised workbook structure released as forthcoming change                      |
| Nov-14      | Updated non-traded carbon values in line with the 2014 DECC / Supp. Green Book |
| Spring 2014 | Updated non-traded carbon values in line with IAG 2013 guidance                |

Jan-14      Definitive release  
17/10/2013    Release of restructured guidance

## Contact

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h guidance in TAG Unit A3.

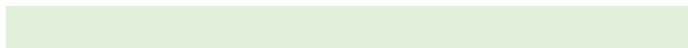
he 'without-scheme' and 'with-scheme' forecasts.

are:

discount rates

se year)

ed in the appraisal. Therefore this spreadsheet calculates  
etary values are only applied to non-traded emissions.



rk guidance on energy and GHGs



# Greenhouse Gases Workbook - Inputs

## Scheme details

|                                |                           |                        |
|--------------------------------|---------------------------|------------------------|
| Scheme name                    | EGD323 - no route changes | <i>Scheme_name</i>     |
| Opening year                   | 2019                      | <i>Opening_year_in</i> |
| Scheme type (select from list) | road/rail                 | <i>Scheme_type</i>     |
| Current year                   | 2018                      | <i>Current_year_in</i> |

## Emissions (tCO2e per year)

|                          | 2010 | 2011 | 2012 | 2013 | 2014 |
|--------------------------|------|------|------|------|------|
| <b>Non-traded sector</b> |      |      |      |      |      |
| Road without scheme      |      |      |      |      |      |
| Road with scheme         |      |      |      |      |      |
| Rail without scheme      |      |      |      |      |      |
| Rail with scheme         |      |      |      |      |      |

## Traded sector

|                     |  |  |  |  |  |
|---------------------|--|--|--|--|--|
| Road without scheme |  |  |  |  |  |
| Road with scheme    |  |  |  |  |  |
| Rail without scheme |  |  |  |  |  |
| Rail with scheme    |  |  |  |  |  |

## Emission values

### Non-traded values (£/tCO2e)

|                 |      |                                 |      |      |      |
|-----------------|------|---------------------------------|------|------|------|
| price base year | 2010 | <i>CO2e_value_price_base_in</i> |      |      |      |
| price base year |      |                                 |      |      |      |
|                 | 2010 | 2011                            | 2012 | 2013 | 2014 |
| Low             | 26.2 | 26.5                            | 26.9 | 27.3 | 27.8 |
| Central         | 52.3 | 53.1                            | 53.9 | 54.7 | 55.5 |
| High            | 78.5 | 79.6                            | 80.8 | 82.0 | 83.3 |

source: TAG data book v1.10 (May 2018). Table A3.4.

### Traded values (£/tCO2e)

|                 |      |                                 |      |      |      |
|-----------------|------|---------------------------------|------|------|------|
| price base year | 2010 | <i>CO2e_value_price_base_in</i> |      |      |      |
| price base year |      |                                 |      |      |      |
|                 | 2010 | 2011                            | 2012 | 2013 | 2014 |
| Low             | 12.3 | 11.1                            | 5.8  | 3.6  | 4.5  |
| Central         | 12.3 | 11.1                            | 5.8  | 3.6  | 4.5  |
| High            | 12.3 | 11.1                            | 5.8  | 3.6  | 4.5  |

source:

TAG data book v1.10 (May 2018). 'GHG' tab.

## Appraisal period and discounting

|                          |      |                                   |
|--------------------------|------|-----------------------------------|
| Appraisal period (years) | 60   | <i>Appraisal_period_length_in</i> |
| PV base year             | 2010 | <i>PV_base_year_in</i>            |
| Outputs price year       | 2010 | <i>Price_base_outputs_in</i>      |
| Discount period 1        | 30   | <i>Discount_period_1_in</i>       |
| Discount period 2        | 75   | <i>Discount_period_2_in</i>       |
| Discount period 3        | 125  | <i>Discount_period_3_in</i>       |
| Discount rate 1          | 3.5% | <i>Discount_rate_1_in</i>         |
| Discount rate 2          | 3.0% | <i>Discount_rate_2_in</i>         |
| Discount rate 3          | 2.5% | <i>Discount_rate_3_in</i>         |

source:

TAG data book v1.10 (May 2018). Table A1.1.1

|                       |      |                                 |
|-----------------------|------|---------------------------------|
| Carbon budget 1 start | 2008 | <i>Carbon_budget_1_start_in</i> |
| Carbon budget 1 end   | 2012 | <i>Carbon_budget_1_end_in</i>   |
| Carbon budget 2 start | 2013 | <i>Carbon_budget_2_start_in</i> |
| Carbon budget 2 end   | 2017 | <i>Carbon_budget_2_end_in</i>   |
| Carbon budget 3 start | 2018 | <i>Carbon_budget_3_start_in</i> |
| Carbon budget 3 end   | 2022 | <i>Carbon_budget_3_end_in</i>   |
| Carbon budget 4 start | 2023 | <i>Carbon_budget_4_start_in</i> |
| Carbon budget 4 end   | 2027 | <i>Carbon_budget_4_end_in</i>   |

|              |       |       |       |       |       |
|--------------|-------|-------|-------|-------|-------|
|              | 2010  | 2011  | 2012  | 2013  | 2014  |
| GDP deflator | 100.0 | 102.0 | 103.6 | 105.6 | 107.4 |

source:

TAG data book v1.10 (May 2018). Annual parameters tab

ime

2015 2016 2017 2018 2019 2020 2021 2022 2023

|  |  |  |  |       |       |       |       |       |
|--|--|--|--|-------|-------|-------|-------|-------|
|  |  |  |  | 0     | 0     | 0     | 0     | 0     |
|  |  |  |  | 19963 | 20237 | 20510 | 20784 | 21058 |
|  |  |  |  |       |       |       |       |       |
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|--|--|--|--|------|------|------|------|------|
|  |  |  |  | 8075 | 8186 | 8296 | 8407 | 8518 |
|  |  |  |  |      |      |      |      |      |
|  |  |  |  |      |      |      |      |      |

2015 2016 2017 2018 2019 2020 2021 2022 2023

|      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|
| 28.2 | 28.6 | 29.0 | 29.5 | 29.9 | 30.3 | 30.9 | 31.4 | 31.9 |
| 56.3 | 57.2 | 58.0 | 58.9 | 59.8 | 60.7 | 61.7 | 62.7 | 63.7 |
| 84.5 | 85.8 | 87.1 | 88.4 | 89.7 | 91.0 | 92.6 | 94.1 | 95.6 |

2015 2016 2017 2018 2019 2020 2021 2022 2023

|     |     |     |     |     |     |      |      |      |
|-----|-----|-----|-----|-----|-----|------|------|------|
| 5.1 | 4.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.5  | 7.1  | 10.5 |
| 5.1 | 4.0 | 3.7 | 3.7 | 3.9 | 4.1 | 10.7 | 17.4 | 24.1 |
| 5.1 | 4.0 | 4.3 | 5.8 | 7.1 | 8.8 | 18.5 | 28.3 | 38.0 |



| 2015  | 2016  | 2017  | 2018  | 2019  | 2020  | 2021  | 2022  | 2023  |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 107.9 | 110.0 | 112.2 | 113.9 | 115.7 | 117.6 | 119.6 | 121.7 | 124.4 |

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2024 2025 2026 2027 2028 2029 2030 2031 2032

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| 0     | 0     | 0     | 0     | 0     | 0        |  |  |  |
| 21332 | 21605 | 21879 | 22153 | 22426 | 22699.98 |  |  |  |
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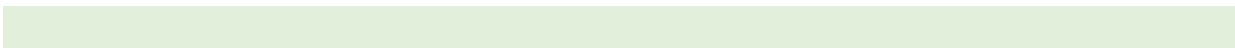


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| 8628 | 8739 | 8850 | 8961 | 9071 | 9182 |  |  |  |
|      |      |      |      |      |      |  |  |  |
|      |      |      |      |      |      |  |  |  |



2024 2025 2026 2027 2028 2029 2030 2031 2032

|      |      |       |       |       |       |       |       |       |
|------|------|-------|-------|-------|-------|-------|-------|-------|
| 32.4 | 32.9 | 33.4  | 33.9  | 34.4  | 34.9  | 35.4  | 38.7  | 42.0  |
| 64.7 | 65.8 | 66.8  | 67.8  | 68.8  | 69.8  | 70.8  | 77.4  | 84.0  |
| 97.1 | 98.6 | 100.2 | 101.7 | 103.2 | 104.7 | 106.2 | 116.1 | 125.9 |



2024 2025 2026 2027 2028 2029 2030 2031 2032

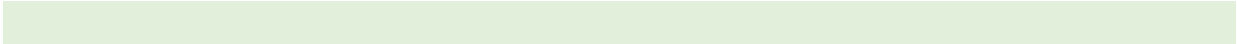
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|------|------|------|------|------|------|-------|-------|-------|
| 14.0 | 17.5 | 20.9 | 24.3 | 27.7 | 31.1 | 35.4  | 38.7  | 42.0  |
| 30.7 | 37.4 | 44.0 | 50.6 | 57.2 | 63.9 | 70.8  | 77.4  | 84.0  |
| 47.7 | 57.5 | 67.2 | 77.0 | 86.7 | 96.5 | 106.2 | 116.1 | 125.9 |



| 2024  | 2025  | 2026  | 2027  | 2028  | 2029  | 2030  | 2031  | 2032  |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 127.2 | 130.0 | 132.8 | 135.7 | 138.7 | 141.8 | 144.9 | 148.1 | 151.3 |



2033 2034 2035 2036 2037 2038 2039 2040 2041



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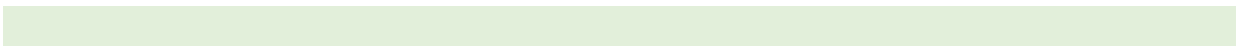


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| 45.3  | 48.6  | 51.8  | 55.1  | 58.4  | 61.7  | 65.0  | 68.3  | 71.6  |
| 90.5  | 97.1  | 103.7 | 110.3 | 116.8 | 123.4 | 130.0 | 136.6 | 143.1 |
| 135.8 | 145.7 | 155.5 | 165.4 | 175.3 | 185.1 | 195.0 | 204.9 | 214.7 |



2033 2034 2035 2036 2037 2038 2039 2040 2041

|       |       |       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 45.3  | 48.6  | 51.8  | 55.1  | 58.4  | 61.7  | 65.0  | 68.3  | 71.6  |
| 90.5  | 97.1  | 103.7 | 110.3 | 116.8 | 123.4 | 130.0 | 136.6 | 143.1 |
| 135.8 | 145.7 | 155.5 | 165.4 | 175.3 | 185.1 | 195.0 | 204.9 | 214.7 |



| 2033  | 2034  | 2035  | 2036  | 2037  | 2038  | 2039  | 2040  | 2041  |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 154.7 | 158.1 | 161.6 | 165.1 | 168.7 | 172.5 | 176.2 | 180.1 | 184.1 |



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|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 74.9  | 78.1  | 81.4  | 84.7  | 88.0  | 91.3  | 94.6  | 97.9  | 101.2 |
| 149.7 | 156.3 | 162.9 | 169.4 | 176.0 | 182.6 | 189.2 | 195.7 | 202.3 |
| 224.6 | 234.4 | 244.3 | 254.2 | 264.0 | 273.9 | 283.8 | 293.6 | 303.5 |



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| 74.9  | 78.1  | 81.4  | 84.7  | 88.0  | 91.3  | 94.6  | 97.9  | 101.2 |
| 149.7 | 156.3 | 162.9 | 169.4 | 176.0 | 182.6 | 189.2 | 195.7 | 202.3 |
| 224.6 | 234.4 | 244.3 | 254.2 | 264.0 | 273.9 | 283.8 | 293.6 | 303.5 |



| 2042  | 2043  | 2044  | 2045  | 2046  | 2047  | 2048  | 2049  | 2050  |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 188.1 | 192.3 | 196.5 | 200.8 | 205.2 | 209.8 | 214.4 | 219.1 | 223.9 |



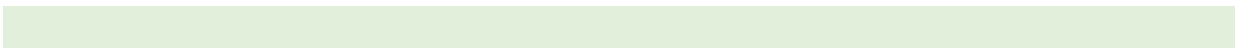
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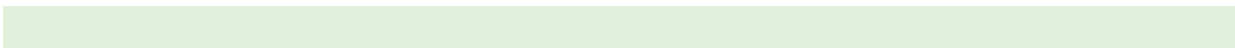


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| 103.7 | 106.0 | 108.3 | 110.6 | 112.6 | 114.6 | 116.4 | 118.1 | 119.7 |
| 209.5 | 216.4 | 223.4 | 230.3 | 237.1 | 243.9 | 250.4 | 256.8 | 263.1 |
| 315.3 | 326.8 | 338.4 | 350.1 | 361.6 | 373.1 | 384.4 | 395.5 | 406.4 |



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| 103.7 | 106.0 | 108.3 | 110.6 | 112.6 | 114.6 | 116.4 | 118.1 | 119.7 |
| 209.5 | 216.4 | 223.4 | 230.3 | 237.1 | 243.9 | 250.4 | 256.8 | 263.1 |
| 315.3 | 326.8 | 338.4 | 350.1 | 361.6 | 373.1 | 384.4 | 395.5 | 406.4 |



| 2051  | 2052  | 2053  | 2054  | 2055  | 2056  | 2057  | 2058  | 2059  |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 228.8 | 233.9 | 239.0 | 244.3 | 249.6 | 255.1 | 260.8 | 266.5 | 272.4 |





2060      2061      2062      2063      2064      2065      2066      2067      2068



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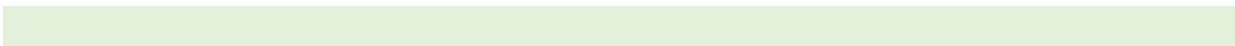


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| 121.1 | 122.0 | 122.7 | 123.2 | 123.5 | 123.6 | 123.7 | 123.4 | 123.1 |
| 269.2 | 274.0 | 278.9 | 283.2 | 287.3 | 290.9 | 294.5 | 297.5 | 300.2 |
| 417.2 | 426.1 | 435.0 | 443.2 | 451.1 | 458.2 | 465.3 | 471.5 | 477.3 |



2060      2061      2062      2063      2064      2065      2066      2067      2068

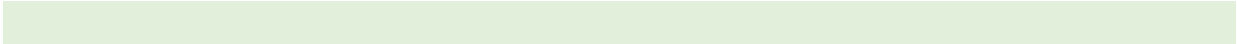
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| 121.1 | 122.0 | 122.7 | 123.2 | 123.5 | 123.6 | 123.7 | 123.4 | 123.1 |
| 269.2 | 274.0 | 278.9 | 283.2 | 287.3 | 290.9 | 294.5 | 297.5 | 300.2 |
| 417.2 | 426.1 | 435.0 | 443.2 | 451.1 | 458.2 | 465.3 | 471.5 | 477.3 |



| 2060  | 2061  | 2062  | 2063  | 2064  | 2065  | 2066  | 2067  | 2068  |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 278.3 | 284.5 | 290.7 | 297.1 | 303.7 | 310.3 | 317.2 | 324.1 | 331.3 |



2069      2070      2071      2072      2073      2074      2075      2076      2077



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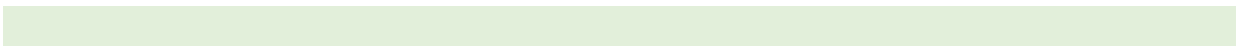


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2069      2070      2071      2072      2073      2074      2075      2076      2077

|       |       |       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 122.5 | 121.8 | 121.0 | 120.2 | 119.1 | 117.9 | 116.7 | 115.2 | 113.6 |
| 302.5 | 304.5 | 306.4 | 308.1 | 309.5 | 310.3 | 311.2 | 311.3 | 311.4 |
| 482.5 | 487.2 | 491.8 | 496.0 | 499.8 | 502.7 | 505.7 | 507.3 | 509.1 |



2069      2070      2071      2072      2073      2074      2075      2076      2077

|       |       |       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 122.5 | 121.8 | 121.0 | 120.2 | 119.1 | 117.9 | 116.7 | 115.2 | 113.6 |
| 302.5 | 304.5 | 306.4 | 308.1 | 309.5 | 310.3 | 311.2 | 311.3 | 311.4 |
| 482.5 | 487.2 | 491.8 | 496.0 | 499.8 | 502.7 | 505.7 | 507.3 | 509.1 |



| 2069  | 2070  | 2071  | 2072  | 2073  | 2074  | 2075  | 2076  | 2077  |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 338.6 | 346.0 | 353.6 | 361.4 | 369.4 | 377.5 | 385.8 | 394.3 | 402.9 |



2078      2079      2080      2081      2082      2083      2084      2085      2086



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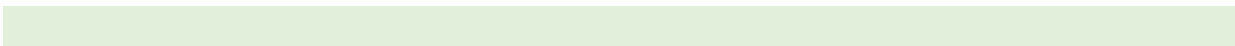


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2078      2079      2080      2081      2082      2083      2084      2085      2086

|       |       |       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 112.0 | 110.2 | 108.2 | 106.6 | 104.9 | 103.0 | 101.1 | 99.2  | 97.2  |
| 311.0 | 310.4 | 309.3 | 309.1 | 308.4 | 307.5 | 306.4 | 305.4 | 303.8 |
| 510.0 | 510.6 | 510.3 | 511.6 | 512.0 | 512.0 | 511.6 | 511.5 | 510.3 |



2078      2079      2080      2081      2082      2083      2084      2085      2086

|       |       |       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 112.0 | 110.2 | 108.2 | 106.6 | 104.9 | 103.0 | 101.1 | 99.2  | 97.2  |
| 311.0 | 310.4 | 309.3 | 309.1 | 308.4 | 307.5 | 306.4 | 305.4 | 303.8 |
| 510.0 | 510.6 | 510.3 | 511.6 | 512.0 | 512.0 | 511.6 | 511.5 | 510.3 |



| 2078  | 2079  | 2080  | 2081  | 2082  | 2083  | 2084  | 2085  | 2086  |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 411.8 | 420.9 | 430.1 | 439.6 | 449.3 | 459.2 | 469.3 | 479.6 | 490.1 |



2087 2088 2089 2090 2091 2092 2093 2094 2095



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2087 2088 2089 2090 2091 2092 2093 2094 2095

|       |       |       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 95.1  | 93.0  | 90.9  | 88.7  | 86.7  | 84.7  | 82.5  | 80.4  | 78.3  |
| 301.9 | 300.1 | 297.9 | 295.7 | 293.9 | 292.0 | 289.6 | 287.2 | 284.7 |
| 508.8 | 507.1 | 505.0 | 502.7 | 501.1 | 499.3 | 496.7 | 494.0 | 491.1 |



2087 2088 2089 2090 2091 2092 2093 2094 2095

|       |       |       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 95.1  | 93.0  | 90.9  | 88.7  | 86.7  | 84.7  | 82.5  | 80.4  | 78.3  |
| 301.9 | 300.1 | 297.9 | 295.7 | 293.9 | 292.0 | 289.6 | 287.2 | 284.7 |
| 508.8 | 507.1 | 505.0 | 502.7 | 501.1 | 499.3 | 496.7 | 494.0 | 491.1 |



| 2087  | 2088  | 2089  | 2090  | 2091  | 2092  | 2093  | 2094  | 2095  |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 500.9 | 511.9 | 523.2 | 534.7 | 546.5 | 558.5 | 570.8 | 583.3 | 596.2 |





2096      2097      2098      2099      2100



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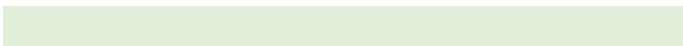


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2096      2097      2098      2099      2100

|       |       |       |       |       |
|-------|-------|-------|-------|-------|
| 76.2  | 74.1  | 71.9  | 69.9  | 67.8  |
| 282.1 | 279.6 | 276.7 | 274.0 | 271.1 |
| 488.0 | 485.1 | 481.4 | 478.2 | 474.4 |



2096      2097      2098      2099      2100

|       |       |       |       |       |
|-------|-------|-------|-------|-------|
| 76.2  | 74.1  | 71.9  | 69.9  | 67.8  |
| 282.1 | 279.6 | 276.7 | 274.0 | 271.1 |
| 488.0 | 485.1 | 481.4 | 478.2 | 474.4 |



| 2096  | 2097  | 2098  | 2099  | 2100  |
|-------|-------|-------|-------|-------|
| 609.3 | 622.7 | 636.4 | 650.4 | 664.7 |



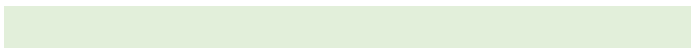
*year\_in*



*Non\_traded\_emissions\_road\_without\_scheme\_in*  
*Non\_traded\_emissions\_road\_with\_scheme\_in*  
*Non\_traded\_emissions\_rail\_without\_scheme\_in*  
*Non\_traded\_emissions\_rail\_with\_scheme\_in*



*Traded\_emissions\_road\_without\_scheme\_in*  
*Traded\_emissions\_road\_with\_scheme\_in*  
*Traded\_emissions\_rail\_without\_scheme\_in*  
*Traded\_emissions\_rail\_with\_scheme\_in*



*CO2e\_values\_low\_in*  
*CO2e\_values\_central\_in*  
*CO2e\_values\_high\_in*



*CO2e\_values\_low\_in\_non\_traded*  
*CO2e\_values\_central\_in\_non\_traded*  
*CO2e\_values\_high\_in\_non\_traded*



*GDP\_deflator\_in*

# Greenhouse Gases Workbook - Calculations

2010                      2011                      2012

## Appraisal period

|                                 |                                   |   |   |   |
|---------------------------------|-----------------------------------|---|---|---|
| Opening year                    | 2019 <i>Opening_year</i>          |   |   |   |
| Opening year                    | 0                                 | 0 | 0 | 0 |
| Appraisal period length (years) | 60 <i>Appraisal_period_length</i> |   |   |   |
| Appraisal period                | 0                                 | 0 | 0 | 0 |
| Check                           | TRUE                              |   |   |   |

## Emissions (tCO2e)

### Non-traded sector

|                                      |          |  |   |   |
|--------------------------------------|----------|--|---|---|
| Road without scheme                  | 0        | 0  | 0 | 0 |
| Road with scheme                     | 0        | 0  | 0 | 0 |
| Road - change in emissions           | 0        | 0  | 0 | 0 |
| Rail without scheme                  | 0        | 0  | 0 | 0 |
| Rail with scheme                     | 0        | 0  | 0 | 0 |
| Rail - change in emissions           | 0        | 0  | 0 | 0 |
| Total change in non-traded emissions | 0        | 0  | 0 | 0 |
| Change over 60 years (tCO2e)         | 234646.7 | <i>Non_traded_emissions_change_60years</i> |   |   |

### Traded sector

|                                  |          |  |   |   |
|----------------------------------|----------|--|---|---|
| Road without scheme              | 0        | 0                                      | 0 | 0 |
| Road with scheme                 | 0        | 0                                      | 0 | 0 |
| Road - change in emissions       | 0        | 0                                      | 0 | 0 |
| Rail without scheme              | 0        | 0                                      | 0 | 0 |
| Rail with scheme                 | 0        | 0                                      | 0 | 0 |
| Rail - change in emissions       | 0        | 0                                      | 0 | 0 |
| Total change in traded emissions | 0        | 0                                      | 0 | 0 |
| Change over 60 years (tCO2e)     | 94913.28 | <i>Traded_emissions_change_60years</i> |   |   |

**Total change in CO2e emissions                      0                      0                      0**

|                                |        |  |  |  |
|--------------------------------|--------|--|--|--|
| Change over 60 years (tCO2e)   | 329560 | <i>TOTAL_emissions_change_60years</i>      |  |  |
| Change in opening year (tCO2e) | 28038  | <i>TOTAL_emissions_change_opening_year</i> |  |  |

## Carbon budget periods

|                       |                                   |
|-----------------------|-----------------------------------|
| Carbon budget 1 start | 2008 <i>Carbon_budget_1_start</i> |
| Carbon budget 1 end   | 2012 <i>Carbon_budget_1_end</i>   |
| Carbon budget 2 start | 2013 <i>Carbon_budget_2_start</i> |
| Carbon budget 2 end   | 2017 <i>Carbon_budget_2_end</i>   |
| Carbon budget 3 start | 2018 <i>Carbon_budget_3_start</i> |
| Carbon budget 3 end   | 2022 <i>Carbon_budget_3_end</i>   |
| Carbon budget 4 start | 2023 <i>Carbon_budget_4_start</i> |
| Carbon budget 4 end   | 2027 <i>Carbon_budget_4_end</i>   |

### Masks

|                 |   |   |   |
|-----------------|---|---|---|
| Carbon Budget 1 | 1 | 1 | 1 |
| Carbon Budget 2 | 0 | 0 | 0 |
| Carbon Budget 3 | 0 | 0 | 0 |
| Carbon Budget 4 | 0 | 0 | 0 |

### Change in traded emissions (tCO<sub>2</sub>e)

|                 |  |
|-----------------|--|
| Carbon Budget 1 | 0 <i>Traded_emissions_change_Budget_1</i>        |
| Carbon Budget 2 | 0 <i>Traded_emissions_change_Budget_2</i>        |
| Carbon Budget 3 | 32964.02 <i>Traded_emissions_change_Budget_3</i> |
| Carbon Budget 4 | 43695.94 <i>Traded_emissions_change_Budget_4</i> |

### Change in non-traded emissions (tCO<sub>2</sub>e)

|                 |  |
|-----------------|--|
| Carbon Budget 1 | 0 <i>Non_traded_emissions_change_Budget_1</i>        |
| Carbon Budget 2 | 0 <i>Non_traded_emissions_change_Budget_2</i>        |
| Carbon Budget 3 | 81494.38 <i>Non_traded_emissions_change_Budget_3</i> |
| Carbon Budget 4 | 108026.1 <i>Non_traded_emissions_change_Budget_4</i> |

## Emission valuations

### Price adjustment

|                                     | 2010                              | 2011  | 2012  |
|-------------------------------------|-----------------------------------|-------|-------|
| GDP deflator                        | 100.0                             | 102.0 | 103.6 |
| CO <sub>2</sub> e values price base | 2010 <i>CO2e_value_price_base</i> |       |       |
| GDP deflator index - base           | 100 <i>GDP_deflator_base</i>      |       |       |
| Price base for outputs              | 2010 <i>Price_base_outputs</i>    |       |       |
| GDP deflator index - for outputs    | 100 <i>GDP_deflator_outputs</i>   |       |       |
| Price base adjustment               | 1.00 <i>Price_adjustment</i>      |       |       |
| Carbon values in 2010 prices        |                                   |       |       |
| low (£/tCO <sub>2</sub> e)          | 26.2                              | 26.5  | 26.9  |
| central (£/tCO <sub>2</sub> e)      | 52.3                              | 53.1  | 53.9  |
| high (£/tCO <sub>2</sub> e)         | 78.5                              | 79.6  | 80.8  |

### Valuing changes in emissions (non-traded) (£)

*positive values represent a benefit - a reduction in GHG emissions*

|             |     |     |     |
|-------------|-----|-----|-----|
| Low (£)     | 0.0 | 0.0 | 0.0 |
| Central (£) | 0.0 | 0.0 | 0.0 |
| High (£)    | 0.0 | 0.0 | 0.0 |

### Discounting and present values

#### Discount period

|                   |      |                          |
|-------------------|------|--------------------------|
| Current year      | 2018 | <i>Current_year</i>      |
| PV base year      | 2010 | <i>PV_base_year</i>      |
| discount period 1 | 30   | <i>Discount_period_1</i> |
| discount period 2 | 75   | <i>Discount_period_2</i> |
| discount period 3 | 125  | <i>Discount_period_3</i> |

#### Masks

|                   |   |   |   |
|-------------------|---|---|---|
| Discount period 1 | 0 | 1 | 1 |
| Discount period 2 | 0 | 0 | 0 |
| Discount period 3 | 0 | 0 | 0 |

#### Discount rates and factors

|                 |      |                        |
|-----------------|------|------------------------|
| discount rate 1 | 3.5% | <i>Discount_rate_1</i> |
| discount rate 2 | 3.0% | <i>Discount_rate_2</i> |
| discount rate 3 | 2.5% | <i>Discount_rate_3</i> |

|                       |      |      |      |
|-----------------------|------|------|------|
| Discount rate profile | 0.0% | 3.5% | 3.5% |
| Discount factor       | 1    | 1.00 | 1.04 |

#### Discounted GHG benefits

|             |   |     |     |
|-------------|---|-----|-----|
| Low (£)     | 0 | 0.0 | 0.0 |
| Central (£) | 0 | 0.0 | 0.0 |
| High (£)    | 0 | 0.0 | 0.0 |

#### Present values

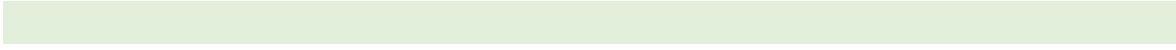
|             |       |                    |
|-------------|-------|--------------------|
| Low (£)     | ##### | <i>NPV_low</i>     |
| Central (£) | ##### | <i>NPV_central</i> |
| High (£)    | ##### | <i>NPV_high</i>    |







|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



- 1
- 2
- 3
- 4



| 2013  | 2014  | 2015  | 2016  | 2017  | 2018  | 2019  |
|-------|-------|-------|-------|-------|-------|-------|
| 105.6 | 107.4 | 107.9 | 110.0 | 112.2 | 113.9 | 115.7 |

|      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|
| 27.3 | 27.8 | 28.2 | 28.6 | 29.0 | 29.5 | 29.9 |
| 54.7 | 55.5 | 56.3 | 57.2 | 58.0 | 58.9 | 59.8 |
| 82.0 | 83.3 | 84.5 | 85.8 | 87.1 | 88.4 | 89.7 |

|     |     |     |     |     |     |            |
|-----|-----|-----|-----|-----|-----|------------|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -596896.9  |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -1193793.9 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -1790690.8 |

|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |

|      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|
| 3.5% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% |
| 1.11 | 1.15 | 1.19 | 1.23 | 1.27 | 1.32 | 1.36 |

|     |     |     |     |     |     |            |
|-----|-----|-----|-----|-----|-----|------------|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -437961.8  |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -875923.5  |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -1313885.3 |



2020                      2021                      2022                      2023                      2024                      2025                      2026



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20236.7488    20510.4416    20784.1344    21057.8272    21331.52    21605.2128    21878.9056

20236.7488    20510.4416    20784.1344    21057.8272    21331.52    21605.2128    21878.9056

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20236.7488    20510.4416    20784.1344    21057.8272    21331.52    21605.2128    21878.9056



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8185.6512    8296.3584    8407.0656    8517.7728    8628.48    8739.1872    8849.8944

8185.6512    8296.3584    8407.0656    8517.7728    8628.48    8739.1872    8849.8944

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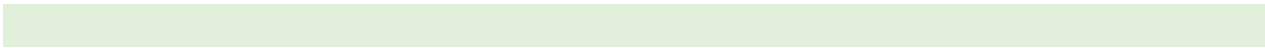
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**28422.4                      28806.8                      29191.2                      29575.6                      29960                      30344.4                      30728.8**



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|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 1 | 1 | 1 |



| 2020  | 2021  | 2022  | 2023  | 2024  | 2025  | 2026  |
|-------|-------|-------|-------|-------|-------|-------|
| 117.6 | 119.6 | 121.7 | 124.4 | 127.2 | 130.0 | 132.8 |

|      |      |      |      |      |      |       |
|------|------|------|------|------|------|-------|
| 30.3 | 30.9 | 31.4 | 31.9 | 32.4 | 32.9 | 33.4  |
| 60.7 | 61.7 | 62.7 | 63.7 | 64.7 | 65.8 | 66.8  |
| 91.0 | 92.6 | 94.1 | 95.6 | 97.1 | 98.6 | 100.2 |

-614156.6 -632837.1 -651794.6 -671028.9 -690540.1 -710328.1 -730393.1  
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-1842469.7 -1898511.4 -1955383.8 -2013086.7 -2071620.3 -2130984.4 -2191179.2

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1.41 1.46 1.51 1.56 1.62 1.68 1.73

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-1306161.5 -1300377.3 -1294040.3 -1287176.0 -1279809.3 -1271964.6 -1263666.0



2027                      2028                      2029                      2030                      2031                      2032                      2033



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22152.5984    22426.2912    22699.984                      0                      0                      0                      0

22152.5984    22426.2912    22699.984                      0                      0                      0                      0

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22152.5984    22426.2912    22699.984                      0                      0                      0                      0



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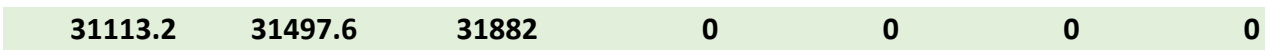
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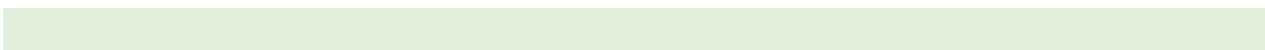
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**31113.2                      31497.6                      31882                      0                      0                      0                      0**



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|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 |



| 2027  | 2028  | 2029  | 2030  | 2031  | 2032  | 2033  |
|-------|-------|-------|-------|-------|-------|-------|
| 135.7 | 138.7 | 141.8 | 144.9 | 148.1 | 151.3 | 154.7 |

|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 33.9  | 34.4  | 34.9  | 35.4  | 38.7  | 42.0  | 45.3  |
| 67.8  | 68.8  | 69.8  | 70.8  | 77.4  | 84.0  | 90.5  |
| 101.7 | 103.2 | 104.7 | 106.2 | 116.1 | 125.9 | 135.8 |

|            |            |            |     |     |     |     |
|------------|------------|------------|-----|-----|-----|-----|
| -750734.9  | -771353.6  | -792249.1  | 0.0 | 0.0 | 0.0 | 0.0 |
| -1501469.8 | -1542707.1 | -1584498.2 | 0.0 | 0.0 | 0.0 | 0.0 |
| -2252204.6 | -2314060.7 | -2376747.3 | 0.0 | 0.0 | 0.0 | 0.0 |

|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |

|      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|
| 3.5% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% |
| 1.79 | 1.86 | 1.92 | 1.99 | 2.06 | 2.13 | 2.21 |

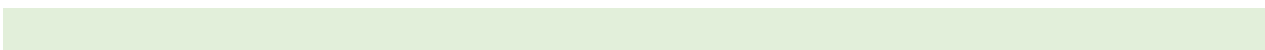
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|------------|------------|------------|-----|-----|-----|-----|
| -418312.3  | -415266.8  | -412092.9  | 0.0 | 0.0 | 0.0 | 0.0 |
| -836624.6  | -830533.6  | -824185.8  | 0.0 | 0.0 | 0.0 | 0.0 |
| -1254936.9 | -1245800.3 | -1236278.6 | 0.0 | 0.0 | 0.0 | 0.0 |







|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



| 2034  | 2035  | 2036  | 2037  | 2038  | 2039  | 2040  |
|-------|-------|-------|-------|-------|-------|-------|
| 158.1 | 161.6 | 165.1 | 168.7 | 172.5 | 176.2 | 180.1 |

|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 48.6  | 51.8  | 55.1  | 58.4  | 61.7  | 65.0  | 68.3  |
| 97.1  | 103.7 | 110.3 | 116.8 | 123.4 | 130.0 | 136.6 |
| 145.7 | 155.5 | 165.4 | 175.3 | 185.1 | 195.0 | 204.9 |



|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |



|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



|      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|
| 3.5% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% |
| 2.28 | 2.36 | 2.45 | 2.53 | 2.62 | 2.71 | 2.81 |



|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |





2041                  2042                  2043                  2044                  2045                  2046                  2047



0                  0                  0                  0                  0                  0                  0

1                  1                  1                  1                  1                  1                  1



0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0



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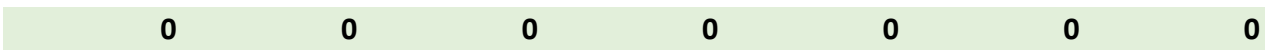
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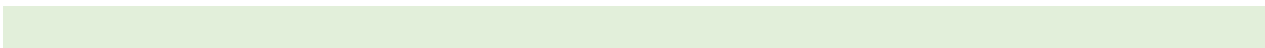
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**0                  0                  0                  0                  0                  0                  0**



|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



| 2041  | 2042  | 2043  | 2044  | 2045  | 2046  | 2047  |
|-------|-------|-------|-------|-------|-------|-------|
| 184.1 | 188.1 | 192.3 | 196.5 | 200.8 | 205.2 | 209.8 |

|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 71.6  | 74.9  | 78.1  | 81.4  | 84.7  | 88.0  | 91.3  |
| 143.1 | 149.7 | 156.3 | 162.9 | 169.4 | 176.0 | 182.6 |
| 214.7 | 224.6 | 234.4 | 244.3 | 254.2 | 264.0 | 273.9 |



|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |



|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



|      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|
| 3.5% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% |
| 2.91 | 3.01 | 3.11 | 3.22 | 3.33 | 3.45 | 3.57 |



|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |





2048                  2049                  2050                  2051                  2052                  2053                  2054



0                  0                  0                  0                  0                  0                  0

1                  1                  1                  1                  1                  1                  1



0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

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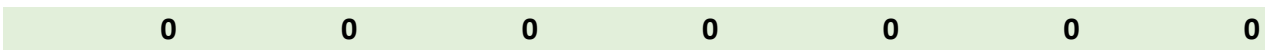
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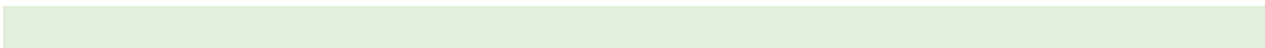
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|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 2048  | 2049  | 2050  | 2051  | 2052  | 2053  | 2054  |
| 214.4 | 219.1 | 223.9 | 228.8 | 233.9 | 239.0 | 244.3 |

|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 94.6  | 97.9  | 101.2 | 103.7 | 106.0 | 108.3 | 110.6 |
| 189.2 | 195.7 | 202.3 | 209.5 | 216.4 | 223.4 | 230.3 |
| 283.8 | 293.6 | 303.5 | 315.3 | 326.8 | 338.4 | 350.1 |



0.0 0.0 0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0 0.0 0.0

1 0 0 0 0 0 0  
0 1 1 1 1 1 1  
0 0 0 0 0 0 0

3.5% 3.0% 3.0% 3.0% 3.0% 3.0% 3.0%  
3.70 3.81 3.92 4.04 4.16 4.28 4.41

0.0 0.0 0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0 0.0 0.0





|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



| 2055  | 2056  | 2057  | 2058  | 2059  | 2060  | 2061  |
|-------|-------|-------|-------|-------|-------|-------|
| 249.6 | 255.1 | 260.8 | 266.5 | 272.4 | 278.3 | 284.5 |

|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 112.6 | 114.6 | 116.4 | 118.1 | 119.7 | 121.1 | 122.0 |
| 237.1 | 243.9 | 250.4 | 256.8 | 263.1 | 269.2 | 274.0 |
| 361.6 | 373.1 | 384.4 | 395.5 | 406.4 | 417.2 | 426.1 |



|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |



|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



|      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|
| 3.0% | 3.0% | 3.0% | 3.0% | 3.0% | 3.0% | 3.0% |
| 4.55 | 4.68 | 4.82 | 4.97 | 5.12 | 5.27 | 5.43 |



|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |





2062                  2063                  2064                  2065                  2066                  2067                  2068



0                  0                  0                  0                  0                  0                  0

1                  1                  1                  1                  1                  1                  1



0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

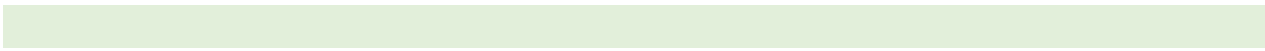
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0                  0                  0                  0                  0                  0                  0



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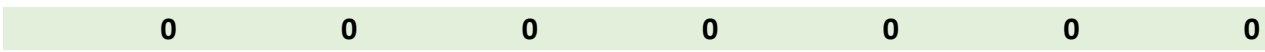
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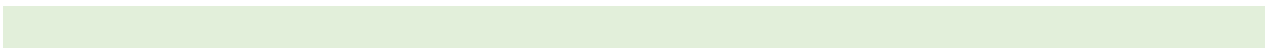
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**0                  0                  0                  0                  0                  0                  0**



|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



| 2062  | 2063  | 2064  | 2065  | 2066  | 2067  | 2068  |
|-------|-------|-------|-------|-------|-------|-------|
| 290.7 | 297.1 | 303.7 | 310.3 | 317.2 | 324.1 | 331.3 |

|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 122.7 | 123.2 | 123.5 | 123.6 | 123.7 | 123.4 | 123.1 |
| 278.9 | 283.2 | 287.3 | 290.9 | 294.5 | 297.5 | 300.2 |
| 435.0 | 443.2 | 451.1 | 458.2 | 465.3 | 471.5 | 477.3 |



|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |



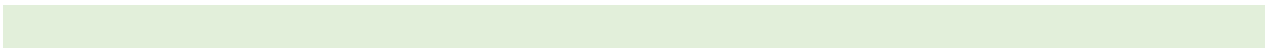
|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



|      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|
| 3.0% | 3.0% | 3.0% | 3.0% | 3.0% | 3.0% | 3.0% |
| 5.59 | 5.76 | 5.93 | 6.11 | 6.29 | 6.48 | 6.68 |



|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

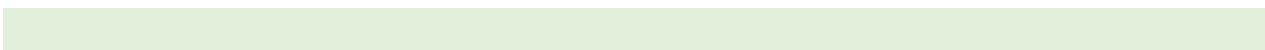








|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 2069  | 2070  | 2071  | 2072  | 2073  | 2074  | 2075  |
| 338.6 | 346.0 | 353.6 | 361.4 | 369.4 | 377.5 | 385.8 |

|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 122.5 | 121.8 | 121.0 | 120.2 | 119.1 | 117.9 | 116.7 |
| 302.5 | 304.5 | 306.4 | 308.1 | 309.5 | 310.3 | 311.2 |
| 482.5 | 487.2 | 491.8 | 496.0 | 499.8 | 502.7 | 505.7 |



|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |



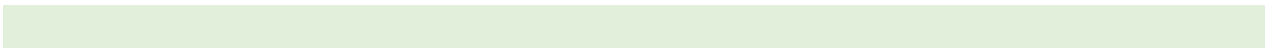
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| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



|      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|
| 3.0% | 3.0% | 3.0% | 3.0% | 3.0% | 3.0% | 3.0% |
| 6.88 | 7.08 | 7.29 | 7.51 | 7.74 | 7.97 | 8.21 |



|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |







|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



| 2076  | 2077  | 2078  | 2079  | 2080  | 2081  | 2082  |
|-------|-------|-------|-------|-------|-------|-------|
| 394.3 | 402.9 | 411.8 | 420.9 | 430.1 | 439.6 | 449.3 |

|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 115.2 | 113.6 | 112.0 | 110.2 | 108.2 | 106.6 | 104.9 |
| 311.3 | 311.4 | 311.0 | 310.4 | 309.3 | 309.1 | 308.4 |
| 507.3 | 509.1 | 510.0 | 510.6 | 510.3 | 511.6 | 512.0 |



|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |



|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



|      |      |      |      |      |      |       |
|------|------|------|------|------|------|-------|
| 3.0% | 3.0% | 3.0% | 3.0% | 3.0% | 3.0% | 3.0%  |
| 8.46 | 8.71 | 8.97 | 9.24 | 9.52 | 9.80 | 10.10 |



|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |





2083                  2084                  2085                  2086                  2087                  2088                  2089



0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0



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0                  0                  0                  0                  0                  0                  0

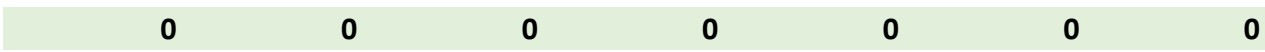
0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0



**0                  0                  0                  0                  0                  0                  0**



|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 2083  | 2084  | 2085  | 2086  | 2087  | 2088  | 2089  |
| 459.2 | 469.3 | 479.6 | 490.1 | 500.9 | 511.9 | 523.2 |

|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 103.0 | 101.1 | 99.2  | 97.2  | 95.1  | 93.0  | 90.9  |
| 307.5 | 306.4 | 305.4 | 303.8 | 301.9 | 300.1 | 297.9 |
| 512.0 | 511.6 | 511.5 | 510.3 | 508.8 | 507.1 | 505.0 |



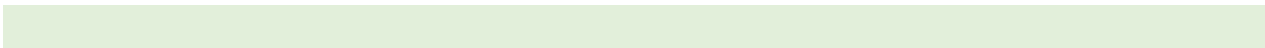
|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |



|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 3.0%  | 3.0%  | 3.0%  | 3.0%  | 3.0%  | 3.0%  | 3.0%  |
| 10.40 | 10.71 | 11.03 | 11.36 | 11.71 | 12.06 | 12.42 |



|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |







2090                  2091                  2092                  2093                  2094                  2095                  2096



0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0



0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0



0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

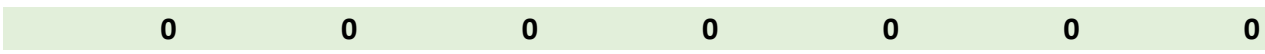
0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0



**0                  0                  0                  0                  0                  0                  0**



|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



| 2090  | 2091  | 2092  | 2093  | 2094  | 2095  | 2096  |
|-------|-------|-------|-------|-------|-------|-------|
| 534.7 | 546.5 | 558.5 | 570.8 | 583.3 | 596.2 | 609.3 |

|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 88.7  | 86.7  | 84.7  | 82.5  | 80.4  | 78.3  | 76.2  |
| 295.7 | 293.9 | 292.0 | 289.6 | 287.2 | 284.7 | 282.1 |
| 502.7 | 501.1 | 499.3 | 496.7 | 494.0 | 491.1 | 488.0 |



|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |



|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 1 | 1 | 1 |



|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 3.0%  | 3.0%  | 3.0%  | 3.0%  | 2.5%  | 2.5%  | 2.5%  |
| 12.79 | 13.17 | 13.57 | 13.98 | 14.33 | 14.68 | 15.05 |



|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |





| 2097 | 2098 | 2099 | 2100 |
|------|------|------|------|
|------|------|------|------|



|   |   |   |   |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
|---|---|---|---|

|   |   |   |   |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
|---|---|---|---|



|   |   |   |   |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
|---|---|---|---|

|   |   |   |   |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
|---|---|---|---|

|   |   |   |   |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
|---|---|---|---|

|   |   |   |   |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
|---|---|---|---|

|   |   |   |   |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
|---|---|---|---|

|   |   |   |   |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
|---|---|---|---|

|   |   |   |   |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
|---|---|---|---|



|   |   |   |   |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
|---|---|---|---|

|   |   |   |   |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
|---|---|---|---|

|   |   |   |   |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
|---|---|---|---|

|   |   |   |   |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
|---|---|---|---|

|   |   |   |   |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
|---|---|---|---|

|   |   |   |   |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
|---|---|---|---|

|   |   |   |   |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
|---|---|---|---|



|          |          |          |          |
|----------|----------|----------|----------|
| <b>0</b> | <b>0</b> | <b>0</b> | <b>0</b> |
|----------|----------|----------|----------|



|   |   |   |   |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 |



| 2097  | 2098  | 2099  | 2100  |
|-------|-------|-------|-------|
| 622.7 | 636.4 | 650.4 | 664.7 |

|       |       |       |       |
|-------|-------|-------|-------|
| 74.1  | 71.9  | 69.9  | 67.8  |
| 279.6 | 276.7 | 274.0 | 271.1 |
| 485.1 | 481.4 | 478.2 | 474.4 |



|     |     |     |     |
|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 |



|   |   |   |   |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 |



|       |       |       |       |
|-------|-------|-------|-------|
| 2.5%  | 2.5%  | 2.5%  | 2.5%  |
| 15.43 | 15.81 | 16.21 | 16.61 |



|     |     |     |     |
|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 |



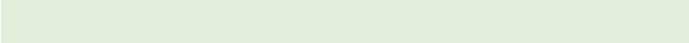



*year*



*Opening\_year\_mask*

*Appraisal\_period*



*Non\_traded\_emissions\_road\_without\_scheme*

*Non\_traded\_emissions\_road\_with\_scheme*


*Non\_traded\_emissions\_road\_change*

*Non\_traded\_emissions\_rail\_without\_scheme*

*Non\_traded\_emissions\_rail\_with\_scheme*

*Non\_traded\_emissions\_rail\_change*

*Non\_traded\_emissions\_TOTAL\_change*



*Traded\_emissions\_road\_without\_scheme*

*Traded\_emissions\_road\_with\_scheme*

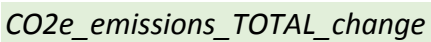
*Traded\_emissions\_road\_change*

*Traded\_emissions\_rail\_without\_scheme*

*Traded\_emissions\_rail\_with\_scheme*

*Traded\_emissions\_rail\_change*

*Traded\_emissions\_TOTAL\_change*



*CO2e\_emissions\_TOTAL\_change*




*Carbon\_budget\_1\_mask*  
*Carbon\_budget\_2\_mask*  
*Carbon\_budget\_3\_mask*  
*Carbon\_budget\_4\_mask*





*CO2e\_values\_low*  
*CO2e\_values\_central*  
*CO2e\_values\_high*







*CO2e\_benefits\_undiscounted\_low*  
*CO2e\_benefits\_undiscounted\_central*  
*CO2e\_benefits\_undiscounted\_high*




*Discount\_period\_1\_mask*  
*Discount\_period\_2\_mask*  
*Discount\_period\_3\_mask*



*Discount\_rate\_profile*  
*Discount\_factor*



*CO2e\_benefits\_discounted\_low*  
*CO2e\_benefits\_discounted\_central*  
*CO2e\_benefits\_discounted\_high*



# Greenhouse Gases Workbook - Calculations

2010                      2011                      2012

## Appraisal period

|                                 |                                   |   |   |   |
|---------------------------------|-----------------------------------|---|---|---|
| Opening year                    | 2019 <i>Opening_year</i>          |   |   |   |
| Opening year                    | 0                                 | 0 | 0 | 0 |
| Appraisal period length (years) | 60 <i>Appraisal_period_length</i> |   |   |   |
| Appraisal period                | 0                                 | 0 | 0 | 0 |
| Check                           | TRUE                              |   |   |   |

## Emissions (tCO2e)

### Non-traded sector

|                                      |          |  |   |   |
|--------------------------------------|----------|--|---|---|
| Road without scheme                  | 0        | 0  | 0 | 0 |
| Road with scheme                     | 0        | 0  | 0 | 0 |
| Road - change in emissions           | 0        | 0  | 0 | 0 |
| Rail without scheme                  | 0        | 0  | 0 | 0 |
| Rail with scheme                     | 0        | 0  | 0 | 0 |
| Rail - change in emissions           | 0        | 0  | 0 | 0 |
| Total change in non-traded emissions | 0        | 0  | 0 | 0 |
| Change over 60 years (tCO2e)         | 234646.7 | <i>Non_traded_emissions_change_60years</i> |   |   |

### Traded sector

|                                  |          |  |   |   |
|----------------------------------|----------|--|---|---|
| Road without scheme              | 0        | 0                                      | 0 | 0 |
| Road with scheme                 | 0        | 0                                      | 0 | 0 |
| Road - change in emissions       | 0        | 0                                      | 0 | 0 |
| Rail without scheme              | 0        | 0                                      | 0 | 0 |
| Rail with scheme                 | 0        | 0                                      | 0 | 0 |
| Rail - change in emissions       | 0        | 0                                      | 0 | 0 |
| Total change in traded emissions | 0        | 0                                      | 0 | 0 |
| Change over 60 years (tCO2e)     | 94913.28 | <i>Traded_emissions_change_60years</i> |   |   |

**Total change in CO2e emissions                      0                      0                      0**

|                                |        |  |  |  |
|--------------------------------|--------|--|--|--|
| Change over 60 years (tCO2e)   | 329560 | <i>TOTAL_emissions_change_60years</i>      |  |  |
| Change in opening year (tCO2e) | 28038  | <i>TOTAL_emissions_change_opening_year</i> |  |  |

## Carbon budget periods

|                       |                                   |
|-----------------------|-----------------------------------|
| Carbon budget 1 start | 2008 <i>Carbon_budget_1_start</i> |
| Carbon budget 1 end   | 2012 <i>Carbon_budget_1_end</i>   |
| Carbon budget 2 start | 2013 <i>Carbon_budget_2_start</i> |
| Carbon budget 2 end   | 2017 <i>Carbon_budget_2_end</i>   |
| Carbon budget 3 start | 2018 <i>Carbon_budget_3_start</i> |
| Carbon budget 3 end   | 2022 <i>Carbon_budget_3_end</i>   |
| Carbon budget 4 start | 2023 <i>Carbon_budget_4_start</i> |
| Carbon budget 4 end   | 2027 <i>Carbon_budget_4_end</i>   |

### Masks

|                 |   |   |   |
|-----------------|---|---|---|
| Carbon Budget 1 | 1 | 1 | 1 |
| Carbon Budget 2 | 0 | 0 | 0 |
| Carbon Budget 3 | 0 | 0 | 0 |
| Carbon Budget 4 | 0 | 0 | 0 |

### Change in traded emissions (tCO<sub>2</sub>e)

|                 |  |
|-----------------|--|
| Carbon Budget 1 | 0 <i>Traded_emissions_change_Budget_1</i>        |
| Carbon Budget 2 | 0 <i>Traded_emissions_change_Budget_2</i>        |
| Carbon Budget 3 | 32964.02 <i>Traded_emissions_change_Budget_3</i> |
| Carbon Budget 4 | 43695.94 <i>Traded_emissions_change_Budget_4</i> |

### Change in non-traded emissions (tCO<sub>2</sub>e)

|                 |  |
|-----------------|--|
| Carbon Budget 1 | 0 <i>Non_traded_emissions_change_Budget_1</i>        |
| Carbon Budget 2 | 0 <i>Non_traded_emissions_change_Budget_2</i>        |
| Carbon Budget 3 | 81494.38 <i>Non_traded_emissions_change_Budget_3</i> |
| Carbon Budget 4 | 108026.1 <i>Non_traded_emissions_change_Budget_4</i> |

## Emission valuations

### Price adjustment

|                                     | 2010                              | 2011  | 2012  |
|-------------------------------------|-----------------------------------|-------|-------|
| GDP deflator                        | 100.0                             | 102.0 | 103.6 |
| CO <sub>2</sub> e values price base | 2010 <i>CO2e_value_price_base</i> |       |       |
| GDP deflator index - base           | 100 <i>GDP_deflator_base</i>      |       |       |
| Price base for outputs              | 2010 <i>Price_base_outputs</i>    |       |       |
| GDP deflator index - for outputs    | 100 <i>GDP_deflator_outputs</i>   |       |       |
| Price base adjustment               | 1.00 <i>Price_adjustment</i>      |       |       |
| Carbon values in 2010 prices        |                                   |       |       |
| low (£/tCO <sub>2</sub> e)          | 12.3                              | 11.1  | 5.8   |
| central (£/tCO <sub>2</sub> e)      | 12.3                              | 11.1  | 5.8   |
| high (£/tCO <sub>2</sub> e)         | 12.3                              | 11.1  | 5.8   |

### Valuing changes in emissions (traded) (£)

*positive values represent a benefit - a reduction in GHG emissions*

|             |     |     |     |
|-------------|-----|-----|-----|
| Low (£)     | 0.0 | 0.0 | 0.0 |
| Central (£) | 0.0 | 0.0 | 0.0 |
| High (£)    | 0.0 | 0.0 | 0.0 |

### Discounting and present values

#### Discount period

|                   |      |                          |
|-------------------|------|--------------------------|
| Current year      | 2018 | <i>Current_year</i>      |
| PV base year      | 2010 | <i>PV_base_year</i>      |
| discount period 1 | 30   | <i>Discount_period_1</i> |
| discount period 2 | 75   | <i>Discount_period_2</i> |
| discount period 3 | 125  | <i>Discount_period_3</i> |

#### Masks

|                   |   |   |   |
|-------------------|---|---|---|
| Discount period 1 | 0 | 1 | 1 |
| Discount period 2 | 0 | 0 | 0 |
| Discount period 3 | 0 | 0 | 0 |

#### Discount rates and factors

|                 |      |                        |
|-----------------|------|------------------------|
| discount rate 1 | 3.5% | <i>Discount_rate_1</i> |
| discount rate 2 | 3.0% | <i>Discount_rate_2</i> |
| discount rate 3 | 2.5% | <i>Discount_rate_3</i> |

|                       |      |      |      |
|-----------------------|------|------|------|
| Discount rate profile | 0.0% | 3.5% | 3.5% |
| Discount factor       | 1    | 1.00 | 1.04 |

#### Discounted GHG benefits

|             |   |     |     |
|-------------|---|-----|-----|
| Low (£)     | 0 | 0.0 | 0.0 |
| Central (£) | 0 | 0.0 | 0.0 |
| High (£)    | 0 | 0.0 | 0.0 |

#### Present values

|             |          |                    |
|-------------|----------|--------------------|
| Low (£)     | -795,150 | <i>NPV_low</i>     |
| Central (£) | #####    | <i>NPV_central</i> |
| High (£)    | #####    | <i>NPV_high</i>    |





|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



- 1
- 2
- 3
- 4



| 2013  | 2014  | 2015  | 2016  | 2017  | 2018  | 2019  |
|-------|-------|-------|-------|-------|-------|-------|
| 105.6 | 107.4 | 107.9 | 110.0 | 112.2 | 113.9 | 115.7 |

|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 3.6 | 4.5 | 5.1 | 4.0 | 0.0 | 0.0 | 0.0 |
| 3.6 | 4.5 | 5.1 | 4.0 | 3.7 | 3.7 | 3.9 |
| 3.6 | 4.5 | 5.1 | 4.0 | 4.3 | 5.8 | 7.1 |

|     |     |     |     |     |     |          |
|-----|-----|-----|-----|-----|-----|----------|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0      |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -31468.9 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -57011.0 |

|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |

|      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|
| 3.5% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% |
| 1.11 | 1.15 | 1.19 | 1.23 | 1.27 | 1.32 | 1.36 |

|     |     |     |     |     |     |          |
|-----|-----|-----|-----|-----|-----|----------|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0      |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -23089.7 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -41830.8 |



| 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 |
|------|------|------|------|------|------|------|
|------|------|------|------|------|------|------|



|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|

|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|---|---|---|---|---|---|---|



|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|

|            |            |            |            |          |            |            |
|------------|------------|------------|------------|----------|------------|------------|
| 20236.7488 | 20510.4416 | 20784.1344 | 21057.8272 | 21331.52 | 21605.2128 | 21878.9056 |
|------------|------------|------------|------------|----------|------------|------------|

|            |            |            |            |          |            |            |
|------------|------------|------------|------------|----------|------------|------------|
| 20236.7488 | 20510.4416 | 20784.1344 | 21057.8272 | 21331.52 | 21605.2128 | 21878.9056 |
|------------|------------|------------|------------|----------|------------|------------|

|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|

|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|

|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|

|            |            |            |            |          |            |            |
|------------|------------|------------|------------|----------|------------|------------|
| 20236.7488 | 20510.4416 | 20784.1344 | 21057.8272 | 21331.52 | 21605.2128 | 21878.9056 |
|------------|------------|------------|------------|----------|------------|------------|



|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|

|           |           |           |           |         |           |           |
|-----------|-----------|-----------|-----------|---------|-----------|-----------|
| 8185.6512 | 8296.3584 | 8407.0656 | 8517.7728 | 8628.48 | 8739.1872 | 8849.8944 |
|-----------|-----------|-----------|-----------|---------|-----------|-----------|

|           |           |           |           |         |           |           |
|-----------|-----------|-----------|-----------|---------|-----------|-----------|
| 8185.6512 | 8296.3584 | 8407.0656 | 8517.7728 | 8628.48 | 8739.1872 | 8849.8944 |
|-----------|-----------|-----------|-----------|---------|-----------|-----------|

|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|

|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|

|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|

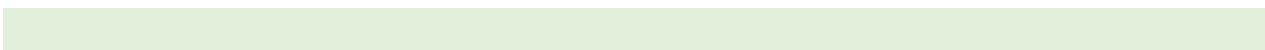
|           |           |           |           |         |           |           |
|-----------|-----------|-----------|-----------|---------|-----------|-----------|
| 8185.6512 | 8296.3584 | 8407.0656 | 8517.7728 | 8628.48 | 8739.1872 | 8849.8944 |
|-----------|-----------|-----------|-----------|---------|-----------|-----------|

|                |                |                |                |              |                |                |
|----------------|----------------|----------------|----------------|--------------|----------------|----------------|
| <b>28422.4</b> | <b>28806.8</b> | <b>29191.2</b> | <b>29575.6</b> | <b>29960</b> | <b>30344.4</b> | <b>30728.8</b> |
|----------------|----------------|----------------|----------------|--------------|----------------|----------------|





|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 1 | 1 | 1 |



| 2020  | 2021  | 2022  | 2023  | 2024  | 2025  | 2026  |
|-------|-------|-------|-------|-------|-------|-------|
| 117.6 | 119.6 | 121.7 | 124.4 | 127.2 | 130.0 | 132.8 |

|     |      |      |      |      |      |      |
|-----|------|------|------|------|------|------|
| 0.0 | 3.5  | 7.1  | 10.5 | 14.0 | 17.5 | 20.9 |
| 4.1 | 10.7 | 17.4 | 24.1 | 30.7 | 37.4 | 44.0 |
| 8.8 | 18.5 | 28.3 | 38.0 | 47.7 | 57.5 | 67.2 |

0.0 -29374.6 -59320.6 -89851.1 -120978.1 -152712.8 -185065.3  
-33302.7 -89127.1 -146346.1 -204964.9 -264988.2 -326420.3 -389265.3  
-71742.3 -153565.3 -237546.0 -323684.6 -411981.0 -502435.2 -595047.2

1 1 1 1 1 1 1  
0 0 0 0 0 0 0  
0 0 0 0 0 0 0

3.5% 3.5% 3.5% 3.5% 3.5% 3.5% 3.5%  
1.41 1.46 1.51 1.56 1.62 1.68 1.73

0.0 -20120.0 -39257.4 -57451.2 -74738.1 -91152.8 -106728.3  
-23608.9 -61047.2 -96849.4 -131055.4 -163704.9 -194837.2 -224491.6  
-50859.5 -105183.9 -157204.0 -206965.3 -254514.4 -299898.9 -343167.2



2027                  2028                  2029                  2030                  2031                  2032                  2033



0                      0                      0                      0                      0                      0                      0

1                      1                      1                      1                      1                      1                      1



0                      0                      0                      0                      0                      0                      0

22152.5984    22426.2912    22699.984                  0                      0                      0                      0

22152.5984    22426.2912    22699.984                  0                      0                      0                      0

0                      0                      0                      0                      0                      0                      0

0                      0                      0                      0                      0                      0                      0

0                      0                      0                      0                      0                      0                      0

22152.5984    22426.2912    22699.984                  0                      0                      0                      0



0                      0                      0                      0                      0                      0                      0

8960.6016    9071.3088    9182.016                  0                      0                      0                      0

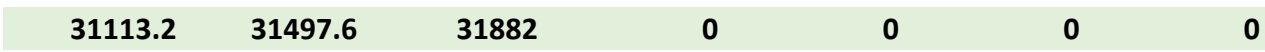
8960.6016    9071.3088    9182.016                  0                      0                      0                      0

0                      0                      0                      0                      0                      0                      0

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0                      0                      0                      0                      0                      0                      0

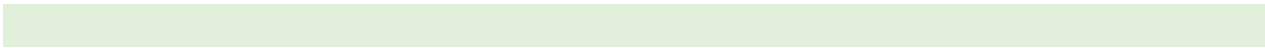
8960.6016    9071.3088    9182.016                  0                      0                      0                      0



**31113.2          31497.6          31882                  0                      0                      0                      0**



|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 |



| 2027  | 2028  | 2029  | 2030  | 2031  | 2032  | 2033  |
|-------|-------|-------|-------|-------|-------|-------|
| 135.7 | 138.7 | 141.8 | 144.9 | 148.1 | 151.3 | 154.7 |

|      |      |      |       |       |       |       |
|------|------|------|-------|-------|-------|-------|
| 24.3 | 27.7 | 31.1 | 35.4  | 38.7  | 42.0  | 45.3  |
| 50.6 | 57.2 | 63.9 | 70.8  | 77.4  | 84.0  | 90.5  |
| 77.0 | 86.7 | 96.5 | 106.2 | 116.1 | 125.9 | 135.8 |

|           |           |           |     |     |     |     |
|-----------|-----------|-----------|-----|-----|-----|-----|
| -218045.1 | -251660.6 | -285919.8 | 0.0 | 0.0 | 0.0 | 0.0 |
| -453526.7 | -519208.0 | -586312.2 | 0.0 | 0.0 | 0.0 | 0.0 |
| -689817.0 | -786744.7 | -885830.1 | 0.0 | 0.0 | 0.0 | 0.0 |

|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |

|      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|
| 3.5% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% |
| 1.79 | 1.86 | 1.92 | 1.99 | 2.06 | 2.13 | 2.21 |

|           |           |           |     |     |     |     |
|-----------|-----------|-----------|-----|-----|-----|-----|
| -121495.5 | -135484.3 | -148722.8 | 0.0 | 0.0 | 0.0 | 0.0 |
| -252706.8 | -279521.4 | -304973.6 | 0.0 | 0.0 | 0.0 | 0.0 |
| -384368.7 | -423552.7 | -460769.6 | 0.0 | 0.0 | 0.0 | 0.0 |



2034                  2035                  2036                  2037                  2038                  2039                  2040



0                  0                  0                  0                  0                  0                  0

1                  1                  1                  1                  1                  1                  1



0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0



0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

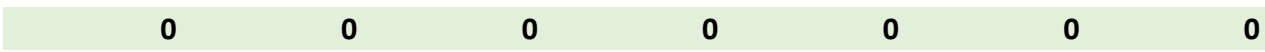
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0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

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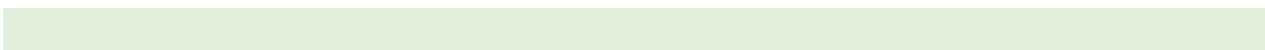
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**0                  0                  0                  0                  0                  0                  0**



|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



| 2034  | 2035  | 2036  | 2037  | 2038  | 2039  | 2040  |
|-------|-------|-------|-------|-------|-------|-------|
| 158.1 | 161.6 | 165.1 | 168.7 | 172.5 | 176.2 | 180.1 |

|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 48.6  | 51.8  | 55.1  | 58.4  | 61.7  | 65.0  | 68.3  |
| 97.1  | 103.7 | 110.3 | 116.8 | 123.4 | 130.0 | 136.6 |
| 145.7 | 155.5 | 165.4 | 175.3 | 185.1 | 195.0 | 204.9 |



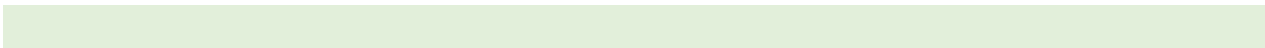
|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |



|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



|      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|
| 3.5% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% |
| 2.28 | 2.36 | 2.45 | 2.53 | 2.62 | 2.71 | 2.81 |



|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |







2041                  2042                  2043                  2044                  2045                  2046                  2047



0                  0                  0                  0                  0                  0                  0

1                  1                  1                  1                  1                  1                  1



0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

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0                  0                  0                  0                  0                  0                  0



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0                  0                  0                  0                  0                  0                  0

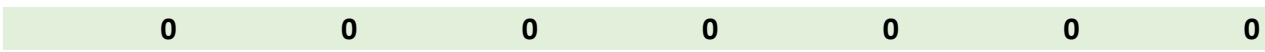
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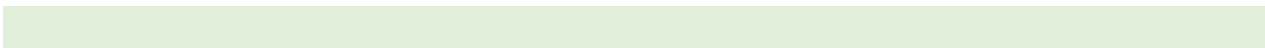
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|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



| 2041  | 2042  | 2043  | 2044  | 2045  | 2046  | 2047  |
|-------|-------|-------|-------|-------|-------|-------|
| 184.1 | 188.1 | 192.3 | 196.5 | 200.8 | 205.2 | 209.8 |

|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 71.6  | 74.9  | 78.1  | 81.4  | 84.7  | 88.0  | 91.3  |
| 143.1 | 149.7 | 156.3 | 162.9 | 169.4 | 176.0 | 182.6 |
| 214.7 | 224.6 | 234.4 | 244.3 | 254.2 | 264.0 | 273.9 |



|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |



|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



|      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|
| 3.5% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% |
| 2.91 | 3.01 | 3.11 | 3.22 | 3.33 | 3.45 | 3.57 |



|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |





2048                  2049                  2050                  2051                  2052                  2053                  2054



0                  0                  0                  0                  0                  0                  0

1                  1                  1                  1                  1                  1                  1



0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

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0                  0                  0                  0                  0                  0                  0



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0                  0                  0                  0                  0                  0                  0

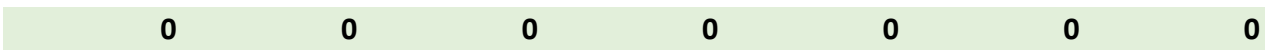
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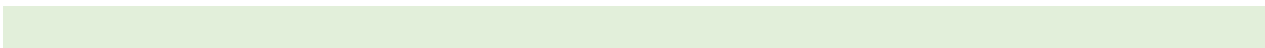
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**0                  0                  0                  0                  0                  0                  0**



|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 2048  | 2049  | 2050  | 2051  | 2052  | 2053  | 2054  |
| 214.4 | 219.1 | 223.9 | 228.8 | 233.9 | 239.0 | 244.3 |

|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 94.6  | 97.9  | 101.2 | 103.7 | 106.0 | 108.3 | 110.6 |
| 189.2 | 195.7 | 202.3 | 209.5 | 216.4 | 223.4 | 230.3 |
| 283.8 | 293.6 | 303.5 | 315.3 | 326.8 | 338.4 | 350.1 |

0.0 0.0 0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0 0.0 0.0

1 0 0 0 0 0 0  
0 1 1 1 1 1 1  
0 0 0 0 0 0 0

3.5% 3.0% 3.0% 3.0% 3.0% 3.0% 3.0%  
3.70 3.81 3.92 4.04 4.16 4.28 4.41

0.0 0.0 0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0 0.0 0.0  
0.0 0.0 0.0 0.0 0.0 0.0 0.0



2055                  2056                  2057                  2058                  2059                  2060                  2061



0                  0                  0                  0                  0                  0                  0

1                  1                  1                  1                  1                  1                  1



0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

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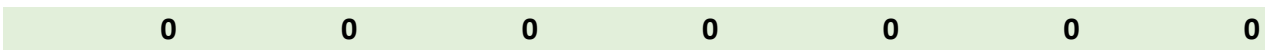
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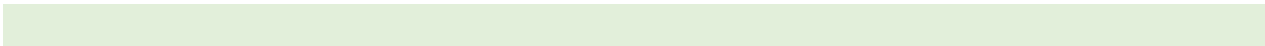
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**0                  0                  0                  0                  0                  0                  0**



|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



| 2055  | 2056  | 2057  | 2058  | 2059  | 2060  | 2061  |
|-------|-------|-------|-------|-------|-------|-------|
| 249.6 | 255.1 | 260.8 | 266.5 | 272.4 | 278.3 | 284.5 |

|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 112.6 | 114.6 | 116.4 | 118.1 | 119.7 | 121.1 | 122.0 |
| 237.1 | 243.9 | 250.4 | 256.8 | 263.1 | 269.2 | 274.0 |
| 361.6 | 373.1 | 384.4 | 395.5 | 406.4 | 417.2 | 426.1 |





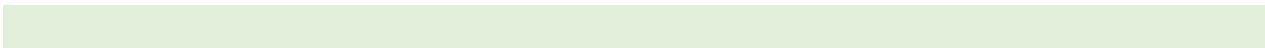
|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |



|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



|      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|
| 3.0% | 3.0% | 3.0% | 3.0% | 3.0% | 3.0% | 3.0% |
| 4.55 | 4.68 | 4.82 | 4.97 | 5.12 | 5.27 | 5.43 |



|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |





2062                  2063                  2064                  2065                  2066                  2067                  2068



0                  0                  0                  0                  0                  0                  0

1                  1                  1                  1                  1                  1                  1



0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

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0                  0                  0                  0                  0                  0                  0



0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

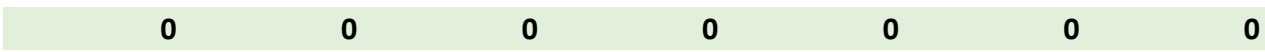
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0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0



**0                  0                  0                  0                  0                  0                  0**



|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



| 2062  | 2063  | 2064  | 2065  | 2066  | 2067  | 2068  |
|-------|-------|-------|-------|-------|-------|-------|
| 290.7 | 297.1 | 303.7 | 310.3 | 317.2 | 324.1 | 331.3 |

|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 122.7 | 123.2 | 123.5 | 123.6 | 123.7 | 123.4 | 123.1 |
| 278.9 | 283.2 | 287.3 | 290.9 | 294.5 | 297.5 | 300.2 |
| 435.0 | 443.2 | 451.1 | 458.2 | 465.3 | 471.5 | 477.3 |



|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |



|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



|      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|
| 3.0% | 3.0% | 3.0% | 3.0% | 3.0% | 3.0% | 3.0% |
| 5.59 | 5.76 | 5.93 | 6.11 | 6.29 | 6.48 | 6.68 |



|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |







|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 2069  | 2070  | 2071  | 2072  | 2073  | 2074  | 2075  |
| 338.6 | 346.0 | 353.6 | 361.4 | 369.4 | 377.5 | 385.8 |

|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 122.5 | 121.8 | 121.0 | 120.2 | 119.1 | 117.9 | 116.7 |
| 302.5 | 304.5 | 306.4 | 308.1 | 309.5 | 310.3 | 311.2 |
| 482.5 | 487.2 | 491.8 | 496.0 | 499.8 | 502.7 | 505.7 |



|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |



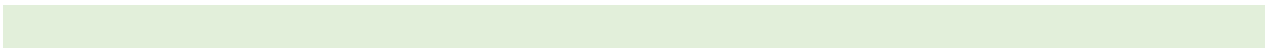
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|---|---|---|---|---|---|---|
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| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



|      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|
| 3.0% | 3.0% | 3.0% | 3.0% | 3.0% | 3.0% | 3.0% |
| 6.88 | 7.08 | 7.29 | 7.51 | 7.74 | 7.97 | 8.21 |



|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |





2076                  2077                  2078                  2079                  2080                  2081                  2082



0                  0                  0                  0                  0                  0                  0

1                  1                  1                  0                  0                  0                  0



0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0



0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

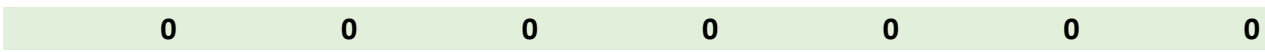
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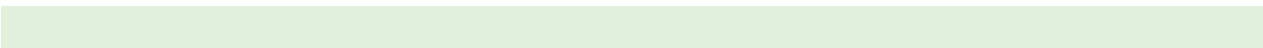


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|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



| 2076  | 2077  | 2078  | 2079  | 2080  | 2081  | 2082  |
|-------|-------|-------|-------|-------|-------|-------|
| 394.3 | 402.9 | 411.8 | 420.9 | 430.1 | 439.6 | 449.3 |

|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 115.2 | 113.6 | 112.0 | 110.2 | 108.2 | 106.6 | 104.9 |
| 311.3 | 311.4 | 311.0 | 310.4 | 309.3 | 309.1 | 308.4 |
| 507.3 | 509.1 | 510.0 | 510.6 | 510.3 | 511.6 | 512.0 |



|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |



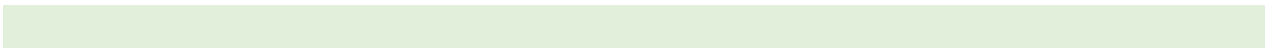
|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



|      |      |      |      |      |      |       |
|------|------|------|------|------|------|-------|
| 3.0% | 3.0% | 3.0% | 3.0% | 3.0% | 3.0% | 3.0%  |
| 8.46 | 8.71 | 8.97 | 9.24 | 9.52 | 9.80 | 10.10 |



|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |





2083                  2084                  2085                  2086                  2087                  2088                  2089



0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0



0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

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0                  0                  0                  0                  0                  0                  0

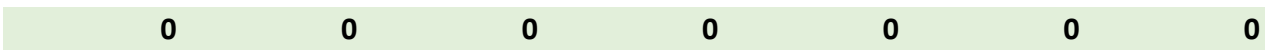
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0                  0                  0                  0                  0                  0                  0

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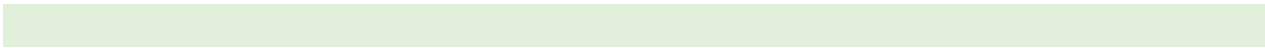
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**0                  0                  0                  0                  0                  0                  0**



|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 2083  | 2084  | 2085  | 2086  | 2087  | 2088  | 2089  |
| 459.2 | 469.3 | 479.6 | 490.1 | 500.9 | 511.9 | 523.2 |

|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 103.0 | 101.1 | 99.2  | 97.2  | 95.1  | 93.0  | 90.9  |
| 307.5 | 306.4 | 305.4 | 303.8 | 301.9 | 300.1 | 297.9 |
| 512.0 | 511.6 | 511.5 | 510.3 | 508.8 | 507.1 | 505.0 |



|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |



|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 3.0%  | 3.0%  | 3.0%  | 3.0%  | 3.0%  | 3.0%  | 3.0%  |
| 10.40 | 10.71 | 11.03 | 11.36 | 11.71 | 12.06 | 12.42 |



|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |





2090                  2091                  2092                  2093                  2094                  2095                  2096



0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0



0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

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0                  0                  0                  0                  0                  0                  0



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0                  0                  0                  0                  0                  0                  0

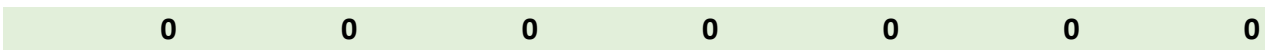
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0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0

0                  0                  0                  0                  0                  0                  0



**0                  0                  0                  0                  0                  0                  0**



|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |



| 2090  | 2091  | 2092  | 2093  | 2094  | 2095  | 2096  |
|-------|-------|-------|-------|-------|-------|-------|
| 534.7 | 546.5 | 558.5 | 570.8 | 583.3 | 596.2 | 609.3 |

|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 88.7  | 86.7  | 84.7  | 82.5  | 80.4  | 78.3  | 76.2  |
| 295.7 | 293.9 | 292.0 | 289.6 | 287.2 | 284.7 | 282.1 |
| 502.7 | 501.1 | 499.3 | 496.7 | 494.0 | 491.1 | 488.0 |



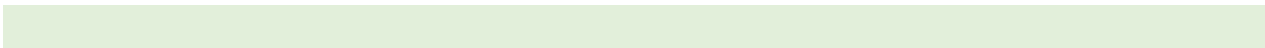
|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |



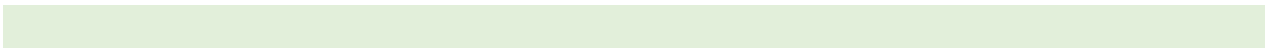
|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 1 | 1 | 1 |



|       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|
| 3.0%  | 3.0%  | 3.0%  | 3.0%  | 2.5%  | 2.5%  | 2.5%  |
| 12.79 | 13.17 | 13.57 | 13.98 | 14.33 | 14.68 | 15.05 |



|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |





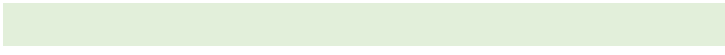


2097                  2098                  2099                  2100



0                      0                      0                      0

0                      0                      0                      0



0                      0                      0                      0

0                      0                      0                      0

0                      0                      0                      0

0                      0                      0                      0

0                      0                      0                      0

0                      0                      0                      0

0                      0                      0                      0



0                      0                      0                      0

0                      0                      0                      0

0                      0                      0                      0

0                      0                      0                      0

0                      0                      0                      0

0                      0                      0                      0

0                      0                      0                      0



**0                      0                      0                      0**



|   |   |   |   |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 |



|       |       |       |       |
|-------|-------|-------|-------|
| 2097  | 2098  | 2099  | 2100  |
| 622.7 | 636.4 | 650.4 | 664.7 |

|       |       |       |       |
|-------|-------|-------|-------|
| 74.1  | 71.9  | 69.9  | 67.8  |
| 279.6 | 276.7 | 274.0 | 271.1 |
| 485.1 | 481.4 | 478.2 | 474.4 |



|     |     |     |     |
|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 |



|   |   |   |   |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 |



|       |       |       |       |
|-------|-------|-------|-------|
| 2.5%  | 2.5%  | 2.5%  | 2.5%  |
| 15.43 | 15.81 | 16.21 | 16.61 |



|     |     |     |     |
|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 |



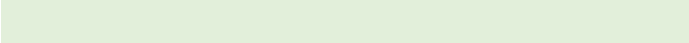



*year*



*Opening\_year\_mask*

*Appraisal\_period*



*Non\_traded\_emissions\_road\_without\_scheme*

*Non\_traded\_emissions\_road\_with\_scheme*


*Non\_traded\_emissions\_road\_change*

*Non\_traded\_emissions\_rail\_without\_scheme*

*Non\_traded\_emissions\_rail\_with\_scheme*

*Non\_traded\_emissions\_rail\_change*

*Non\_traded\_emissions\_TOTAL\_change*



*Traded\_emissions\_road\_without\_scheme*

*Traded\_emissions\_road\_with\_scheme*

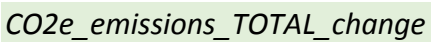
*Traded\_emissions\_road\_change*

*Traded\_emissions\_rail\_without\_scheme*

*Traded\_emissions\_rail\_with\_scheme*

*Traded\_emissions\_rail\_change*

*Traded\_emissions\_TOTAL\_change*




*CO2e\_emissions\_TOTAL\_change*





*Carbon\_budget\_1\_mask*  
*Carbon\_budget\_2\_mask*  
*Carbon\_budget\_3\_mask*  
*Carbon\_budget\_4\_mask*




*CO2e\_values\_low*  
*CO2e\_values\_central*  
*CO2e\_values\_high*




*CO2e\_benefits\_undiscounted\_low*  
*CO2e\_benefits\_undiscounted\_central*  
*CO2e\_benefits\_undiscounted\_high*




*Discount\_period\_1\_mask*  
*Discount\_period\_2\_mask*  
*Discount\_period\_3\_mask*



*Discount\_rate\_profile*  
*Discount\_factor*



*CO2e\_benefits\_discounted\_low*  
*CO2e\_benefits\_discounted\_central*  
*CO2e\_benefits\_discounted\_high*



# Greenhouse Gases Workbook - Worksheet 1

Scheme Name: EGD323 - no route changes

Present Value Base Year

Current Year

Proposal Opening year:

Project (Road/Rail or Road and Rail):

**Overall Assessment Score:**

Net Present Value of carbon dioxide equivalent emissions of proposal (£):

\*positive value reflects a net benefit (i.e. CO2E emissions reduction)

**Quantitative Assessment:**

Change in carbon dioxide equivalent emissions over 10 year appraisal period (tonnes):  
 (between 'with scheme' and 'without scheme' scenarios)

Of which Traded

Change in carbon dioxide equivalent emissions in opening year (tonnes):  
 (between 'with scheme' and 'without scheme' scenarios)

Net Present Value of traded sector carbon dioxide equivalent emissions of proposal (£):

(N.B. this is not additional to the appraisal value in cell I17, as the cost of traded sector emissions is assumed to be internalised into market prices. See TAG Unit A3 for further details)

\*positive value reflects a net benefit (i.e. CO2E emissions reduction)

**Change in carbon dioxide equivalent emissions by carbon budget period:**

|                   | Carbon Budget 1 | Carbon Budget 2 | Carbon Budget 3 | Carbon Budget 4 |
|-------------------|-----------------|-----------------|-----------------|-----------------|
| Traded sector     | 0               | 0               | 32964.0192      | 43695.936       |
| Non-traded sector | 0               | 0               | 81494.3808      | 108026.064      |

**Qualitative Comments:**

This scheme does not include any new routes to mitigate the impact of the enlarged danger area

The proportion of traded vs non-traded has been calculated according to the following:

The proportion of Intra-EU flights is 71.2% (classed as traded)

Flights starting or finishing outside of the EU make up 28.8% for all flights (classed as non-traded)

**Sensitivity Analysis:**

Upper Estimate Net Present Value of Carbon dioxide Emissions of Proposal (£):

Lower Estimate Net Present Value of Carbon dioxide Emissions of Proposal (£):

**Data Sources:**

Computer simulation using AirTOP modelling tool, with BADA performance data.

Traffic data extracted using Eurocontrol's Network Strategic Tool (NEST).  
Traffic growth rates as per NATS base case traffic forecasting

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