Data Article

Data on greenhouse gases emission of fuels in power plants in Malaysia during the year of 1990–2017

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ABSTRACT

Energy has a significant influence on Malaysia’s industry. It is used in electricity generation, refineries, gas processing plants and end-user applications such as transportation, residential, agriculture and fishing. These burning fossil fuel activities produce greenhouse gases (GHG) emissions. This article presents the emissions data of fuel used in power plants in Malaysia during the year of 1990 until 2017. The fuel used in power plants is coal and coke, natural gas, diesel oil and residual fuel oil. The energy data used in power plants were gathered from the Malaysia Energy Information Hub, published by the Malaysian Energy Commission. The GHG emissions data were calculated using the emission factors method. The climate impact of different GHGs in terms of CO₂-equivalent (CO₂-e) was also calculated using global
warming potentials. The article also presents population data in Malaysia during the year. A correlation between the fuels, GHG emission and the population is also investigated using statistical analysis. The data presented here may facilitate the Malaysian government to identify the source of the pollutants and undertake a climate change mitigation plan.

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Specifications Table

| Subject                      | Environmental Engineering |
|------------------------------|----------------------------|
| Specific subject area        | Air Pollution              |
| Type of data                 | Table                      |
|                              | Figure                     |
|                              | Graph                      |
| How data were acquired       | Raw data was gathered from the Malaysia Energy Commission and the Department of Statistics, Malaysia. |
| Data format                  | Processed, raw             |
| Parameters for data collection | Data of fuel input to power stations and Malaysia's population during the year of 1990 until 2017 were considered. |
| Description of data collection | The data was processed and analysed using the emission factor method by the 2006 IPCC Guidelines for National Greenhouse Inventories. The global warming potential values from the 2014 IPCC Fifth Assessment Report was used in global warming potential calculation. The data was analysed statistically using Microsoft Excel 2013. |
| Data source location         | Malaysia, 4.2105° N, 101.9758° E |
| Data accessibility           | Processed data is available with the article. Direct URL to raw data: https://meih.st.gov.my/publications, http://www.dosm.gov.my and http://www.data.gov.my |

Value of the Data

- These data are useful for climate change mitigation measures in reducing GHG emissions from fossil-fuel-fired power plants.
- Malaysia’s government is committed to reducing its greenhouse gas emission under the 2015 Paris Climate agreement by 2030. The government can estimate how much the reduction when switching to renewable energy plants using these data. The data is also beneficial for those who are interested with Malaysia’s greenhouse gas emissions trend during the year of 1990 until 2017.
- The data presents the opportunity for greenhouse gas emission reduction in Malaysia from the power plants sector.
- The data shows the trend of Malaysia’s populations from 1990 until 2017 and their correlation with the GHG emission from the power plant sector. The data is beneficial for those who are interested in learning the relationship between Malaysia’s energy vs. population, either performing the time series or forecasting future trends.

1. Data description

Data for populations, GHG emissions specifically CO₂, CH₄, N₂O and total emissions in CO₂-e from fuel power plants in Malaysia during the year of 1990 until 2017 are shown. The total of
Table 1
Emission factor and global warming potential value.

| GHG      | Emission Factor (kg/TJ) [4] | GWP values for 100-year time horizon [2] | Fifth assessment report (AR5) |
|----------|-----------------------------|------------------------------------------|-------------------------------|
|          | Natural gas    | Diesel oil   | Fuel Oil (as Residual Fuel oil) | Coal and Coke (as coking coal) |                          |                             |                             |
| CO₂      | 56,100         | 74,100       | 77,400                        | 94,600                        | 1                          |                             |                             |
| CH₄       | 5              | 10           | 10                            | 10                            | 28                         |                             |                             |
| N₂O      | 0.1            | 0.6          | 0.6                           | 1.5                           | 265                        |                             |                             |

Fig. 1. Power plants located in Peninsular Malaysia.

four figures and seven tables showing each data are presented in this investigation. Fig. 1 and Fig. 2 show active power plants in Malaysia using coal, natural gas, diesel and fuel oil in 2018. Table 1 shows the emission factor and global warming potential values for a 100-year limit relative to CO₂. Table 2 presents the data of Malaysia’s populations during the year 1990 until 2017. Table 3 depicts the data of GHG and its total emissions in tons and CO₂-e, respectively, from natural gas power plants. Table 4, Table 5 and Table 6 present the GHG emissions data in tons and CO₂-e from diesel, fuel oil and coal and coke power plants, respectively. Fig. 3. illus-
Fig. 2. Power plants located in West Malaysia.
Table 2  
Malaysia’s population 1990 – 2017.

| Year | Populations      | Reference |
|------|------------------|-----------|
| 1990 | 18,102,400       | [5]       |
| 1991 | 18,547,200       | [5]       |
| 1992 | 19,067,500       | [5]       |
| 1993 | 19,601,500       | [5]       |
| 1994 | 20,141,700       | [5]       |
| 1995 | 20,681,800       | [5]       |
| 1996 | 21,222,600       | [5]       |
| 1997 | 21,769,300       | [5]       |
| 1998 | 22,333,500       | [5]       |
| 1999 | 22,909,500       | [5]       |
| 2000 | 23,494,900       | [5]       |
| 2001 | 24,030,500       | [5]       |
| 2002 | 24,542,500       | [5]       |
| 2003 | 25,038,100       | [5]       |
| 2004 | 25,541,500       | [5]       |
| 2005 | 26,045,500       | [5]       |
| 2006 | 26,549,900       | [5]       |
| 2007 | 27,058,400       | [5]       |
| 2008 | 27,567,600       | [5]       |
| 2009 | 28,081,500       | [5]       |
| 2010 | 28,588,600       | [5]       |
| 2011 | 29,062,000       | [5]       |
| 2012 | 29,510,000       | [5]       |
| 2013 | 30,213,700       | [5]       |
| 2014 | 30,708,500       | [6]       |
| 2015 | 31,186,100       | [6]       |
| 2016 | 31,633,500       | [6]       |
| 2017 | 32,022,600       | [6]       |

Fig. 3. Time-series plot for GHG emissions and population trends.

Figures 3 and 4 illustrate the trend of GHG emissions and populations over time. Fig. 4 represents the total GHG emissions in CO₂-e from power plants and populations in Malaysia. Table 7 shows the correlation analysis between the total GHG emissions in CO₂-e from fuels used in power plants and populations.
Table 3
GHG emissions in tons from natural gas power plants in Malaysia, 1990–2017.

| Year | GHG emissions (tons) | Annual growth/Reduction |
|------|----------------------|--------------------------|
|      | CO₂ | CH₄ | N₂O | All GHGs (tons CO₂-e) |                          |
| 1990 | 3196,709.72 | 56.98 | 5.70 | 3,199,815.26 | – |
| 1991 | 5949,497.23 | 106.05 | 10.61 | 5,955,277.04 | 86.1% |
| 1992 | 7384,610.85 | 131.63 | 13.16 | 7,391,784.85 | 24.1% |
| 1993 | 10,273,628.46 | 183.13 | 18.31 | 10,283,609.07 | 39.1% |
| 1994 | 12,023,480.58 | 214.32 | 21.43 | 12,035,161.15 | 17.0% |
| 1995 | 15,065,169.85 | 268.54 | 26.85 | 15,079,805.35 | 25.3% |
| 1996 | 17,590,124.26 | 313.55 | 31.35 | 17,607,212.70 | 16.8% |
| 1997 | 17,688,773.64 | 315.31 | 31.53 | 17,705,957.92 | 0.6% |
| 1998 | 20,871,390.59 | 372.04 | 37.20 | 20,891,666.72 | 18.0% |
| 1999 | 23,868,452.76 | 425.46 | 42.55 | 23,891,640.47 | 14.4% |
| 2000 | 27,199,043.78 | 484.83 | 48.48 | 27,225,467.10 | 14.0% |
| 2001 | 28,002,331.61 | 499.15 | 49.92 | 28,029,535.30 | 14.0% |
| 2002 | 24,768,041.17 | 441.50 | 44.15 | 24,792,102.81 | 3.0% |
| 2003 | 25,585,421.76 | 456.07 | 45.61 | 25,610,775.75 | 4.2% |
| 2004 | 24,768,041.17 | 441.50 | 44.15 | 24,792,102.81 | –12.3% |
| 2005 | 23,822,060.99 | 513.76 | 51.38 | 23,850,061.03 | –3.2% |
| 2006 | 29,416,306.08 | 524.35 | 52.44 | 29,444,883.41 | 16.4% |
| 2007 | 29,475,025.95 | 525.40 | 52.54 | 29,503,660.33 | 2.1% |
| 2008 | 32,063,397.81 | 571.54 | 57.15 | 32,094,546.75 | 8.8% |
| 2009 | 31,450,362.37 | 560.61 | 56.06 | 31,480,915.75 | –1.3% |
| 2010 | 29,660,580.73 | 528.71 | 52.87 | 29,689,395.38 | –5.7% |
| 2011 | 25,782,720.52 | 459.59 | 45.96 | 25,807,767.90 | –13.1% |
| 2012 | 27,088,650.43 | 482.86 | 48.29 | 27,114,966.50 | 5.1% |
| 2013 | 31,755,705.70 | 566.06 | 56.61 | 31,786,555.71 | 17.2% |
| 2014 | 32,554,259.93 | 580.29 | 58.03 | 32,583,921.76 | 2.5% |
| 2015 | 31,422,176.83 | 560.11 | 56.01 | 31,452,702.84 | –3.5% |
| 2016 | 31,145,019.05 | 555.17 | 55.52 | 31,175,275.80 | –0.9% |
| 2017 | 27,927,999.30 | 497.83 | 49.78 | 27,955,130.78 | –10.3% |

Fig. 4. Total GHG emissions in CO₂-e from power plants and populations in Malaysia.
Table 4
GHG emissions in tons from diesel power plants in Malaysia, 1990–2017.

| Year | CO₂      | CH₄      | N₂O      | All GHGs CO₂-e | Annual growth/Reduction |
|------|----------|----------|----------|----------------|--------------------------|
| 1990 | 359,880.58 | 14.57    | 2.91     | 361,060.76     | –                        |
| 1991 | 508,796.68 | 20.60    | 4.12     | 510,465.21     | 41.4%                    |
| 1992 | 496,387.01 | 20.10    | 4.02     | 498,014.84     | −2.4%                    |
| 1993 | 269,910.44 | 10.93    | 2.19     | 270,795.57     | −45.6%                   |
| 1994 | 772,502.28 | 31.28    | 6.26     | 775,035.59     | 186.2%                   |
| 1995 | 822,140.98 | 33.29    | 6.66     | 824,837.07     | 6.4%                     |
| 1996 | 881,086.94 | 35.67    | 7.13     | 883,976.33     | 7.2%                     |
| 1997 | 573,947.48 | 23.24    | 4.65     | 575,829.65     | −34.9%                   |
| 1998 | 853,165.17 | 34.54    | 6.91     | 855,963.00     | 48.6%                    |
| 1999 | 533,616.03 | 21.60    | 4.32     | 535,365.95     | −37.5%                   |
| 2000 | 592,561.99 | 23.99    | 4.80     | 594,505.21     | 11.0%                    |
| 2001 | 862,472.43 | 34.92    | 6.98     | 865,300.78     | 45.5%                    |
| 2002 | 1476,751.35 | 59.79   | 11.96    | 1,481,594.14   | 71.2%                    |
| 2003 | 1054,822.39 | 42.71   | 8.54     | 1,058,281.53   | −28.6%                   |
| 2004 | 843,857.91 | 34.16    | 6.83     | 846,625.22     | −20.0%                   |
| 2005 | 924,520.80 | 37.43    | 7.49     | 927,552.63     | 9.6%                     |
| 2006 | 1914,192.40 | 77.50   | 15.50    | 1,920,469.71   | 107.0%                   |
| 2007 | 974,159.50 | 39.44    | 7.89     | 977,354.12     | −49.1%                   |
| 2008 | 927,623.22 | 37.56    | 7.51     | 930,665.22     | −4.8%                    |
| 2009 | 1191,328.82 | 48.23    | 9.65     | 1,195,235.61   | 28.4%                    |
| 2010 | 1287,503.80 | 52.13    | 10.43    | 1,291,725.98   | 8.1%                     |
| 2011 | 3043,472.84 | 123.22  | 24.64    | 3,053,453.46   | 136.4%                   |
| 2012 | 2516,061.65 | 101.86  | 20.37    | 2,524,312.70   | −17.3%                   |
| 2013 | 1932,806.91 | 78.25    | 15.65    | 1,939,145.27   | −23.2%                   |
| 2014 | 1929,704.49 | 78.13    | 15.63    | 1,936,032.67   | −0.2%                    |
| 2015 | 865,574.85 | 35.04    | 7.01     | 868,413.37     | −55.1%                   |
| 2016 | 511,899.10 | 20.72    | 4.14     | 513,577.80     | −40.9%                   |
| 2017 | 465,474.51 | 18.85    | 3.77     | 467,000.96     | −9.1%                    |

2. Experimental design, materials, and methods

The energy data used in the research were gathered from the Malaysia Energy Commission [1]. The amount of GHG emitted from power plants was calculated using Eq. (1). For the estimation of the global warming potential from the power generation technologies, the Eq. (2) was used.

\[ E(\text{tons}) = A(\text{ktoe}) \times EF(\text{kg/TJ}) \]  \hspace{2cm} (1)

\[ \text{Total GHG(tons CO₂ - e)} = E(\text{tons}) \times \text{GWP( CO₂ - e)} \]  \hspace{2cm} (2)

where \( E \) is the amount of GHG mass in tons, \( A \) is the activity data in ktoe and EF is the emission factor in kg/TJ, which is the coefficient established by the Intergovernmental Panel on Climate Change (IPCC) as shown in Table 1 [2]. The total GHG emissions data were converted to CO₂-e by multiplying the \( E \) with the global warming potential, GWP values as shown in Table 1. The CO₂-e reports the equivalent global warming impact from any quantity and type of GHG emissions. The data were processed using an Excel spreadsheet. For the next step in the analysis of the data, the Spearman correlation analysis was applied. The statistical analysis is rated to have a confidence level of 95% [3].
Table 5
GHG emissions in tons from fuel oil power plants in Malaysia, 1990–2017.

| Year | GHG emissions (tons) | CH₄ | N₂O | All GHGs (tons CO₂-e) | Annual growth/Reduction |
|------|----------------------|-----|-----|-----------------------|-------------------------|
|      | CO₂                  |     |     |                       |                         |
| 1990 | 9310,195.53          | 360.86 | 72.17 | 9,339,425.22         | –                       |
| 1991 | 8707,447.06          | 337.50 | 67.50 | 8,734,784.39         | –6.5%                   |
| 1992 | 7621,851.69          | 295.42 | 59.08 | 7,645,780.76         | –12.5%                  |
| 1993 | 7738,512.85          | 299.94 | 59.99 | 7,762,808.01         | 1.5%                    |
| 1994 | 6341,821.32          | 245.81 | 49.16 | 6,361,731.69         | –18.0%                  |
| 1995 | 6717,728.97          | 295.67 | 59.13 | 6,738,819.52         | 5.9%                    |
| 1996 | 7628,332.85          | 299.94 | 59.99 | 7,652,282.27         | 13.6%                   |
| 1997 | 8043,127.50          | 311.75 | 62.35 | 8,068,379.18         | 5.4%                    |
| 1998 | 6902,442.22          | 267.54 | 53.51 | 6,924,112.67         | –14.2%                  |
| 1999 | 3078,554.04          | 119.32 | 23.86 | 3,088,219.27         | –55.4%                  |
| 2000 | 1918,425.25          | 74.36  | 14.87 | 1,924,448.22         | –37.7%                  |
| 2001 | 2365,625.74          | 91.69  | 18.34 | 2,373,052.70         | 23.3%                   |
| 2002 | 4416,914.90          | 171.20 | 34.24 | 4,430,781.96         | 86.7%                   |
| 2003 | 936,528.54           | 36.30  | 7.26  | 939,468.81           | –78.8%                  |
| 2004 | 887,919.80           | 34.42  | 6.88  | 890,707.45           | –5.2%                   |
| 2005 | 891,160.38           | 34.54  | 6.91  | 893,958.21           | 0.4%                    |
| 2006 | 554,139.73           | 21.48  | 4.30  | 555,879.47           | –37.8%                  |
| 2007 | 644,876.06           | 25.00  | 5.00  | 646,900.67           | 16.4%                   |
| 2008 | 586,545.56           | 22.73  | 4.55  | 588,387.04           | –9.0%                   |
| 2009 | 664,319.56           | 25.75  | 5.15  | 666,405.21           | 13.3%                   |
| 2010 | 405,072.90           | 15.70  | 3.14  | 406,344.64           | –39.0%                  |
| 2011 | 3574,363.27          | 138.54 | 27.71 | 3,585,585.11         | 782.4%                  |
| 2012 | 1782,320.76          | 69.08  | 13.82 | 1,787,916.42         | –50.1%                  |
| 2013 | 1270,308.61          | 49.24  | 9.85  | 1,274,296.79         | –28.7%                  |
| 2014 | 871,716.88           | 33.79  | 6.76  | 874,453.67           | –31.4%                  |
| 2015 | 327,298.90           | 12.69  | 2.54  | 328,326.47           | –62.5%                  |
| 2016 | 502,290.40           | 19.47  | 3.89  | 503,867.35           | 53.5%                   |
| 2017 | 364,653.11           | 14.13  | 2.83  | 365,797.95           | –27.4%                  |

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Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi: 10.1016/j.dib.2020.105440.
Table 6
GHG emissions in tons from coal and coke power plants in Malaysia, 1990–2017.

| Year | CO₂ emissions (tons) | CH₄  | N₂O  | All GHGs (tons CO₂-e) | Annual growth/Reduction |
|------|----------------------|------|------|-----------------------|-------------------------|
| 1990 | 3220,059.51          | 34.04| 51.06| 3,234,542.97          | –                       |
| 1991 | 3814,166.43          | 40.32| 60.48| 3,831,322.11          | 18.5%                   |
| 1992 | 3833,969.99          | 40.53| 60.79| 3,851,214.75          | 0.5%                    |
| 1993 | 3501,270.12          | 37.01| 55.52| 3,517,018.43          | –8.7%                   |
| 1994 | 3663,659.34          | 38.73| 58.09| 3,680,138.06          | 4.6%                    |
| 1995 | 3790,402.15          | 40.07| 60.10| 3,807,450.95          | 3.5%                    |
| 1996 | 3762,677.16          | 39.77| 59.66| 3,779,601.25          | –0.7%                   |
| 1997 | 3493,348.69          | 36.93| 55.39| 3,509,061.37          | –7.2%                   |
| 1998 | 3818,127.14          | 40.36| 60.54| 3,835,300.64          | 9.3%                    |
| 1999 | 5275,669.45          | 55.77| 83.65| 5,299,398.81          | 38.2%                   |
| 2000 | 5921,265.64          | 62.59| 93.89| 5,947,898.81          | 12.2%                   |
| 2001 | 7897,661.32          | 83.48| 125.23| 7,933,184.10          | 33.4%                   |
| 2002 | 10,123,581.92        | 107.01| 160.52| 10,169,116.63        | 28.2%                   |
| 2003 | 16,254,765.33        | 171.83| 257.74| 16,327,877.41        | 60.6%                   |
| 2004 | 21,098,717.09        | 223.03| 334.55| 21,193,616.71        | 29.8%                   |
| 2005 | 21,946,309.62        | 231.99| 347.99| 22,045,021.62        | 4.0%                    |
| 2006 | 23,621,691.14        | 249.70| 374.55| 23,727,938.81        | 7.6%                    |
| 2007 | 29,649,896.02        | 313.42| 470.14| 29,783,257.87        | 25.5%                   |
| 2008 | 31,958,991.58        | 337.83| 506.75| 32,102,739.48        | 7.8%                    |
| 2009 | 35,686,022.33        | 377.23| 565.85| 35,846,533.98        | 11.7%                   |
| 2010 | 51,295,191.47        | 542.23| 813.35| 51,525,911.39        | 43.7%                   |
| 2011 | 51,540,755.67        | 544.83| 817.24| 51,772,580.10        | 0.5%                    |
| 2012 | 55,996,557.57        | 591.93| 887.89| 56,248,423.69        | 8.6%                    |
| 2013 | 53,576,562.05        | 566.35| 849.52| 53,817,543.31        | –4.3%                   |
| 2014 | 54,055,808.29        | 571.41| 857.12| 54,298,945.15        | 0.9%                    |
| 2015 | 61,894,058.93        | 654.27| 981.41| 62,172,451.34        | 14.5%                   |
| 2016 | 67,732,149.59        | 715.98| 1073.98| 68,036,801.07        | 9.4%                    |
| 2017 | 75,170,368.23        | 794.61| 1191.92| 75,508,475.97        | 11.0%                   |

Table 7
Spearman correlation analysis between GHG emissions from fuels and populations.

| Fuel type       | Natural gas | Diesel | Fuel oil | Coal & Coke |
|-----------------|-------------|--------|----------|-------------|
| Population      | 0.876<sup>a</sup> | 0.515<sup>b</sup> | –0.867<sup>a</sup> | 0.936<sup>a</sup> |

<sup>a</sup> Correlation is significant at the 0.05 level (2-tailed).

<sup>b</sup> Correlation is significant at the 0.01 level (2-tailed).

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