Conversions

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Background

Load libraries

```
# Delete everything in environment
rm(list = ls())

# Load libraries
library(tidyverse)
library(readxl)
library(readr)
```

Load data

```
# Load EIA Total CO2 Emission, 1970-2022 (in million metric tons)
co2_million_tons <- read_excel("CO2.xlsx")

# Load EPA Total PM2.5 Emission, 1990-2024 (in kilotons)
pm2.5_kilotons <- read.csv("national_tier1_caps_21feb2025.xlsx - PM25Primary.csv")
```

Data wrangling

Wrangle CO2 data

```
# Delete (unnecessary) last four columns
co2_million_tons <- subset(co2_million_tons, select = -c(...55 : ...58))

# Rename columns of data set
years <- seq(1970, 2022)
cols <- append(years, "variable", 0)
names(co2_million_tons) <- cols

# Convert data to be in long/tidy format with correct values
co2_million_tons <- co2_million_tons %>%
  filter(variable == "Total of states") %>%
  pivot_longer(cols = -variable,
```

```
                names_to = "Year",
                values_to = "CO2") %>%
  mutate(Year = as.integer(Year),
         CO2 = as.numeric(gsub(",", "", CO2))) %>%
  select(Year, CO2)
```

Wrangle PM2.5 data

```
# Rename columns of data set
years <- seq(1990, 2024)
cols <- append(years, "variable", 0)
names(pm2.5_kilotons) <- cols

# Convert data to be in long/tidy format with correct values
pm2.5_kilotons <- pm2.5_kilotons %>%
  filter(variable == "Total") %>%
  pivot_longer(cols = -variable,
               names_to = "Year",
               values_to = "PM2.5") %>%
  mutate(Year = as.integer(Year),
         PM2.5 = as.numeric(gsub(",", "", PM2.5))) %>%
  select(Year, PM2.5)
```

Conversions

Convert PM2.5 data to million metric tons[1]

```
pm2.5_million_tons <- pm2.5_kilotons %>%
  mutate(PM2.5 = 0.001 * PM2.5)

head(co2_million_tons)
```

```
## # A tibble: 6 x 2
##    Year   CO2
##   <int> <dbl>
## 1  1970 4256.
## 2  1971 4301.
## 3  1972 4520.
## 4  1973 4717.
## 5  1974 4546.
## 6  1975 4420.
```

```
head(pm2.5_million_tons)
```

```
## # A tibble: 6 x 2
##    Year PM2.5
```

[1] 1 kiloton = 0.001 million metric tons (since 1 kiloton = 1,000 metric tons)

```
##   <int> <dbl>
## 1  1990  7.56
## 2  1991  7.32
## 3  1992  7.20
## 4  1993  7.15
## 5  1994  7.54
## 6  1995  6.93
```

Convert CO2 data to kilotons[2]

```
co2_kilotons <- co2_million_tons %>%
  mutate(CO2 = 1000 * CO2)

head(co2_kilotons)
```

```
## # A tibble: 6 x 2
##    Year      CO2
##   <int>    <dbl>
## 1  1970 4255764.
## 2  1971 4301051.
## 3  1972 4520369.
## 4  1973 4717128.
## 5  1974 4545548.
## 6  1975 4420379.
```

```
head(pm2.5_kilotons)
```

```
## # A tibble: 6 x 2
##    Year PM2.5
##   <int> <dbl>
## 1  1990  7560
## 2  1991  7320
## 3  1992  7198
## 4  1993  7149
## 5  1994  7542
## 6  1995  6929
```

[2] 1 million metric ton = 1,000 kilotons (since 1 million metric tons = 1,000,000 metric tons)