EV Power - Lab 4 Project Report

Example Solution 1

Part 0: libraries

```
library(tidyverse)
```

```
── Attaching core tidyverse packages ───────────────────── tidyverse 2.0.0
──
✔ dplyr     1.1.4     ✔ readr     2.1.5
✔ forcats   1.0.1     ✔ stringr   1.5.2
✔ ggplot2   4.0.0     ✔ tibble    3.3.0
✔ lubridate 1.9.4     ✔ tidyr     1.3.1
✔ purrr     1.1.0
── Conflicts ─────────────────────────────────── tidyverse_conflicts()
──
✖ dplyr::filter() masks stats::filter()
✖ dplyr::lag()    masks stats::lag()
ℹ Use the conflicted package (<http://conflicted.r-lib.org/>) to force all
conflicts to become errors
```

```
library(devtools)
```

```
Loading required package: usethis
```

```
library(dplyr)
library(leaflet)
library(sf)
```

```
Linking to GEOS 3.13.0, GDAL 3.8.5, PROJ 9.5.1; sf_use_s2() is TRUE
```

```
library(rnaturalearth)
```

Part 1: Defining Research Question

Chosen Question: What is the overall renewable energy use in each state?

Part 2: Data Preparation and Cleaning

```
renew_2021 <- read.csv("data/renew-use-2021.csv")
renew_2022 <- read.csv("data/renew-use-2022.csv")
renew_2023 <- read.csv("data/renew-use-2023.csv")
total_2021 <- read.csv("data/total-use-2021.csv")
total_2022 <- read.csv("data/total-use-2022.csv")
total_2023 <- read.csv("data/total-use-2023.csv")
energy_price <- read.csv("data/av-energy-price-2021-2023.csv")
ev_registrations <- read.csv("data/ev-registrations-by-state-2023.csv")

ev_registrations |>
    slice(-1) |>
    slice(-1) |>
    rename('State'='electric.vehicle.registrations_by_state..2023.') |>
    rename('Count_EV'='X')
```

```
                   State   Count_EV
1                Alabama     #13047
2                 Alaska      ~2697
3                Arizona      89798
4               Arkansas   7108 EVs
5             California    1256646
6               Colorado      90083
7         Connecticut EVs      31557
8               Delaware       8435
9   District of Columbia       8066
10               Florida     254878
11               Georgia      92368
12                Hawaii     ~25565
13                 Idaho      #8501
14              Illinois      99573
15               Indiana      26101
16                  Iowa       9031
17                Kansas      11271
18              Kentucky      11617
19             Louisiana       8150
20                 Maine   7377 EVs
21              Maryland      72139
22         Massachusetts      73768
23              Michigan      50284
24             Minnesota      37050
25           Mississippi       3590
26              Missouri      26861
27               Montana       4608
28              Nebraska       6920
29                Nevada      47361
30         New Hampshire       9861
31            New Jersey     134753
```

```
32         New Mexico      10276
33           New York    #131250
34      North Carolina      70164
35        North Dakota        959
36                Ohio 50393 EVs
37            Oklahoma      22843
38              Oregon      64361
39        Pennsylvania      70154
40        Rhode Island       6396
41      South Carolina      20873
42        South Dakota       1675
43       Tennessee EVs 33221
44               Texas     230125
45                Utah      39998
46             Vermont       7816
47            Virginia      84936
48          Washington     152101
49       West Virginia       2758
50           Wisconsin      24943
51             Wyoming       1139
52               Total    3555445
```

```r
renew_2021 <- renew_2021 |>
    mutate(Renewable_Use_2021 = as.numeric(str_extract(Renewable_Use_2021,
"[0-9]+\\.?[0-9]*")))

renew_2022 <- renew_2022 |>
    mutate(Renewable_Use_2022 = as.numeric(str_extract(Renewable_Use_2022,
"[0-9]+\\.?[0-9]*")))

renew_2023 <- renew_2023 |>
    mutate(Renewable_Use_2023 = as.numeric(str_extract(Renewable_Use_2023,
"[0-9]+\\.?[0-9]*")))
```

Part 3: Joining / Pivoting Datasets for Analysis

```r
renew_2021 <- renew_2021 |> mutate(year=2021)
renew_2022 <- renew_2022 |> mutate(year=2022)
renew_2023 <- renew_2023 |> mutate(year=2023)




renew_by_state <- renew_2023 |>
  group_by(State) |>
  summarise(total_renewable = sum(Renewable_Use_2023, na.rm = TRUE))

head(renew_by_state)
```

```
# A tibble: 6 × 2
  State total_renewable
  <chr>           <dbl>
1 AK              10088
2 AL             222189
3 Ar              87277
4 CA            1065179
5 CO             115062
6 DC               2796
```

Part 4: Mapping Visualization

```r
us_states <- ne_states(country = "united states of america", returnclass =
"sf") |>
    select(name, postal, geometry) |>
    left_join(renew_by_state, by= c("postal"="State"))

#Palette
pal <- colorNumeric(palette = "YlGn", domain = us_states$total_renewable)


leaflet_map <- leaflet(us_states) |>
    addTiles() |>
    addPolygons(fillColor = ~pal(total_renewable), fillOpacity=0.7
    ) |>
    addLegend(pal=pal, position = "bottomright", values=~total_renewable,title
= "Renewable Energy Use (2023)", opacity=1) |>
        setView(lng = -98,lat=39, zoom=3)

# leaflet_map (leaflet map doesn't render unfortunately)
```

Analysis: Renewable energy use was concentrated in California, with other states following slowly behind, if at all... the map uses a legend to visualize this finding...