EV Power - Lab 4 Project Report

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Library Installations

```
library(ggplot2)
library(tibble)
library(dplyr)
library(tidyr)
library(tidytext)
library(stringr)
library(maps)
library(sf)
```

Overview

Research Questions:

- **"Which states contained the most EV registrations in 2023?"**
- **"What is the change in renewable energy usage across each state from 2021 to 2023?"**
- **"What is the share of total energy usage that is renewable energy across each state in 2023, and is this related to how many EV registrations in each state in 2023?"**

Data and Methods

Data Preparation & Cleaning

```
      State    Count
```

```
1      Alabama    13047
2       Alaska     2697
3      Arizona    89798
4     Arkansas     7108
5   California  1256646


Joining with `by = join_by(State, Energy_Source)`
Joining with `by = join_by(State, Energy_Source)`


# A tibble: 5 x 2
  State Renew_Use_2021
  <chr>          <int>
1 AK              9598
2 AL            239816
3 AR             89714
4 AZ             99266
5 CA            810020


# A tibble: 5 x 2
  State Renew_Use_2023
  <chr>          <int>
1 AK             10088
2 AL            222189
3 AR             87277
4 AZ            108445
5 CA           1065179


# A tibble: 5 x 2
  State Total_2021
  <chr>      <int>
1 AK        684975
2 AL       2352656
3 AR       1136025
4 AZ       1681257
5 CA       6142252


# A tibble: 5 x 2
  State Total_2023
  <chr>      <int>
1 AK        746979
2 AL       2265008
```

```
3 AR        1151062
4 AZ        1712667
5 CA        6429818
```

Joining / Pivoting Datasets for Analysis

```
Joining with `by = join_by(State)`
Joining with `by = join_by(State)`

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Joining with `by = join_by(State)`
```

```
# A tibble: 5 x 4
  State      Renew_Use_2021 Renew_Use_2022 Renew_Use_2023
  <chr>               <int>          <int>          <int>
1 alaska               9598          10410          10088
2 alabama            239816         232035         222189
3 arkansas            89714          90824          87277
4 arizona             99266         101214         108445
5 california         810020         880995        1065179
```

```
# A tibble: 5 x 4
  State      Total_2021 Total_2022 Total_2023
  <chr>           <int>      <int>      <int>
1 alaska         684975     730276     746979
2 alabama       2352656    2337513    2265008
3 arkansas      1136025    1178115    1151062
4 arizona       1681257    1651857    1712667
5 california    6142252    6244174    6429818
```

```
# A tibble: 5 x 2
  State      Renew_Difference
  <chr>                 <int>
1 alaska                  490
2 alabama              -17627
3 arkansas              -2437
4 arizona                9179
5 california           255159
```
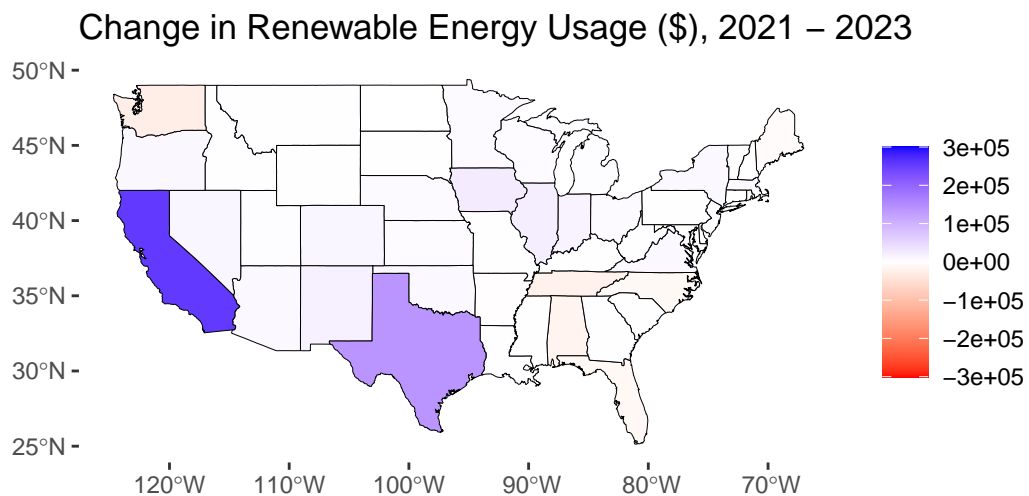
```
# A tibble: 5 x 2
  State      Total_Difference
  <chr>                 <int>
1 alaska                62004
2 alabama              -87648
3 arkansas              15037
4 arizona               31410
5 california           287566


# A tibble: 5 x 2
  State      Renew_Share
  <chr>            <dbl>
1 alaska          0.0135
2 alabama         0.0981
3 arkansas        0.0758
4 arizona         0.0633
5 california      0.166
```
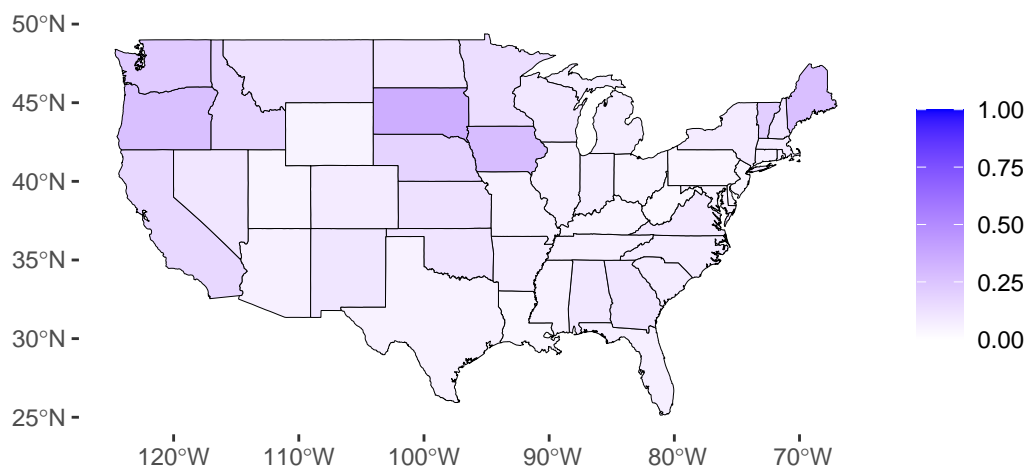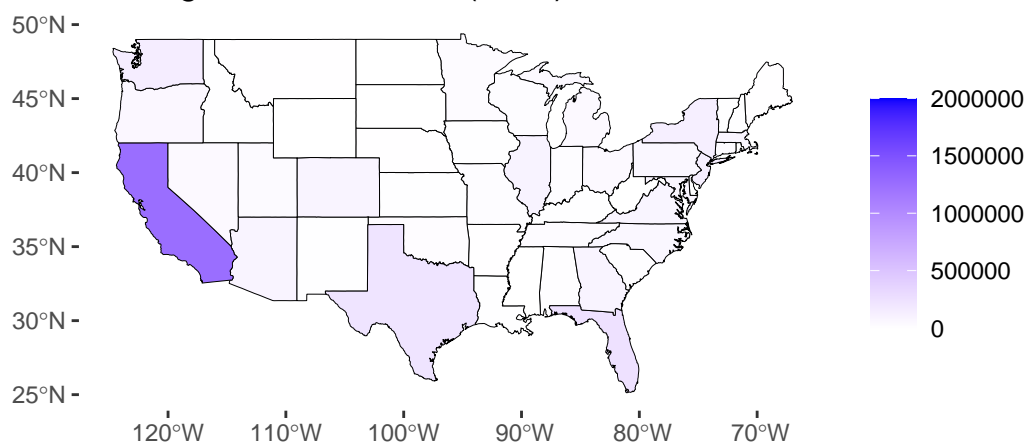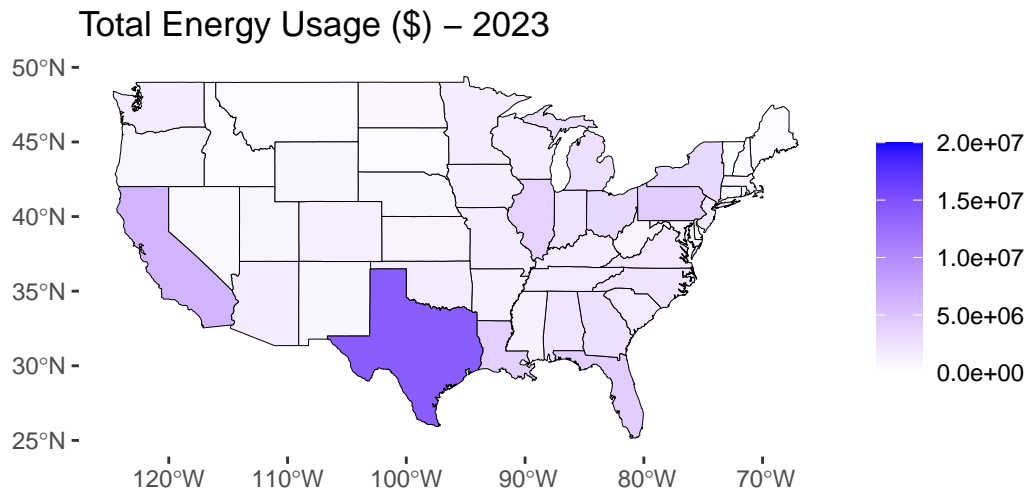
Mapping Visualization

Change in Renewable Energy Usage ($), 2021 – 2023

Renewable Proportion of Total Energy Use (2023)

EV Registrations Counts (2023)

Total Energy Usage ($) – 2023

Analysis

I created four maps, one that shows the change in renewable energy usage from 2021 to 2023 across each state, one that shows the share of total energy usage that is renewable in 2023 across each state, one that shows the number of EV registrations in 2023 across each state, and one that shows the total energy usage in 2023 across each state.

I notice that in certain states, such as California and Texas, the largest increases in renewable energy usage from 2021 to 2023 are linked with large numbers of EV registrations in 2023. However, these states are not represented in the states that have the largest shares of renewable energy usage. I perceive this to be the case, because when looking at the total energy usage map, California and Texas are the states with the most energy used in total for the year 2023, so it's possible that the renewable energy share seems "watered down" due to the larger amount of total energy used, compared to other states.

That being said, South Dakota and Iowa seem to be some of the states with the largest shares of renewable energy in 2023, however in that same year, the seemingly have very low counts of EV registrations. My interpretation of this finding is that the demographic may be different in those states compared to California or Texas (i.e. more farmland and rural area), where it's a possibility that those states would utilize larger proportions of renewable energy, also given that their total energy usage is likely lower due to a smaller population.

So to conclude, it's not enough to just look at purely the count of EV registrations, the share of renewable energy usage, or the change in renewable energy usage across certain years to answer these kinds of research questions, because things such as population, demographic differences, and state laws are important factors that have effects on this data.