EV Power - Lab 4 Project Report

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Part 0: libraries

```
library(tidyverse)
library(janitor)
```

Part 1: Overview

This report analyzes renewable electricity use across U.S. states between 2021 and 2023.
The two research questions explored are:

1. How has the share of renewable energy changed from 2021–2023 across U.S. states?
2. What is the share of electricity that comes from clean sources by state in 2023?

Understanding these patterns helps assess how states are transitioning toward cleaner energy systems.

Part 2: Data and Methods

The datasets include renewable and total energy use by state for 2021–2023.
Data were cleaned using the `tidyverse` and `janitor` packages to standardize column names, ensure consistent state naming, and remove non-numeric characters.

(1) Data Preparation & Cleaning

```
# A tibble: 6 × 4
  state energy_source renewable_use  year
  <chr> <chr>                <dbl> <dbl>
1 AK    Biomass               3153  2021
2 AK    Geothermal             186  2021
3 AK    Hydropower            5763  2021
4 AK    Solar Energy            45  2021
5 AK    Wind Energy            451  2021
6 AL    Biomass             198543  2021
```

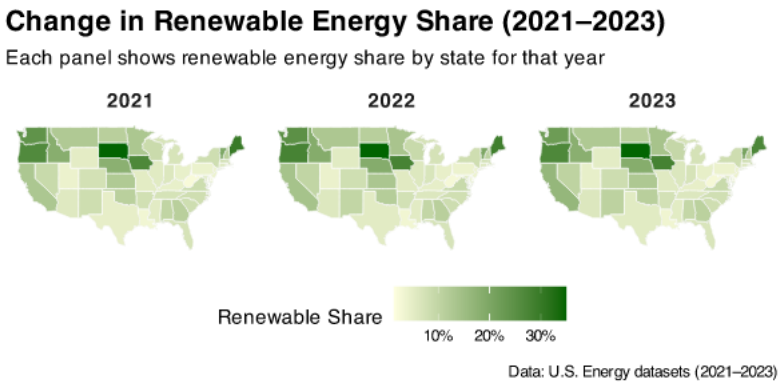
```
# A tibble: 6 × 4
  energy_source state total_use  year
  <chr>         <chr>     <dbl> <dbl>
1 Coal          AK        18694  2021
2 Coal          AL       309791  2021
```

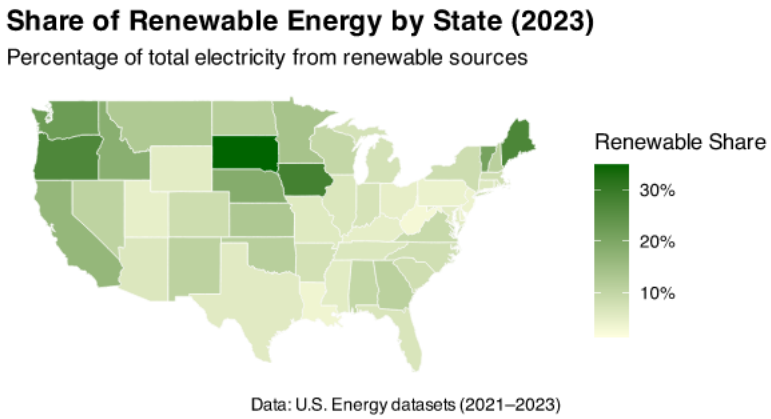
```
3 Coal          AR       216123  2021
4 Coal          AZ       160299  2021
5 Coal          CA        28244  2021
6 Coal          CO       252442  2021
```

(2) Joining / Pivoting Datasets for Analysis

```
# A tibble: 6 × 5
  state  year total_renew total_energy renewable_share
  <chr> <dbl>       <dbl>        <dbl>           <dbl>
1 AK     2021        9598       684975          0.0140
2 AK     2022       10410       730276          0.0143
3 AK     2023       10088       746979          0.0135
4 AL     2021      239816      2352656          0.102
5 AL     2022      232035      2337513          0.0993
6 AL     2023      222189      2265008          0.0981
```

Part 3: Map Visualization





Part 4: Analysis

The maps reveal clear spatial and temporal trends in renewable electricity use: 1. Overall increase: Between 2021 and 2023, most states show gradual growth in renewable energy shares, with noticeable gains in the Pacific Northwest and New England.

2. Regional differences: Western and northeastern states, including Washington, Oregon, and Vermont, maintain the highest renewable shares, while Southeastern states like Alabama and Louisiana remain heavily fossil-fuel-dependent.
3. 2023 snapshot: States such as Vermont, Maine, and Washington generate over 30% of their electricity from renewables, while several southern states remain below 10%.

These findings suggest that while renewable capacity is rising nationwide, the transition remains uneven. The geographic maps effectively highlight where progress is concentrated and where policy or investment gaps may persist.