BUA455FINAL

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```r
# this line specifies options for default options for all R Chunks
knitr::opts_chunk$set(echo=F)

# suppress scientific notation
options(scipen=100,
        getSymbols.warning4.0 = FALSE)

# install helper package (pacman), if needed
if (!require("pacman")) install.packages("pacman", repos = "http://lib.stat.cmu.edu/R/CRAN/")
```

```
## Loading required package: pacman
```

```r
# install and load required packages
# pacman should be first package in parentheses and then list others
pacman::p_load(pacman, tidyverse, ggthemes, magrittr, lubridate, tidyquant, highcharter,
               flexdashboard,knitr, RColorBrewer, dygraphs, gridExtra, maps, usdata,
               mapproj, shadowtext, grid, readxl)

# remove # in front of p_loaded if needed
p_loaded()
```

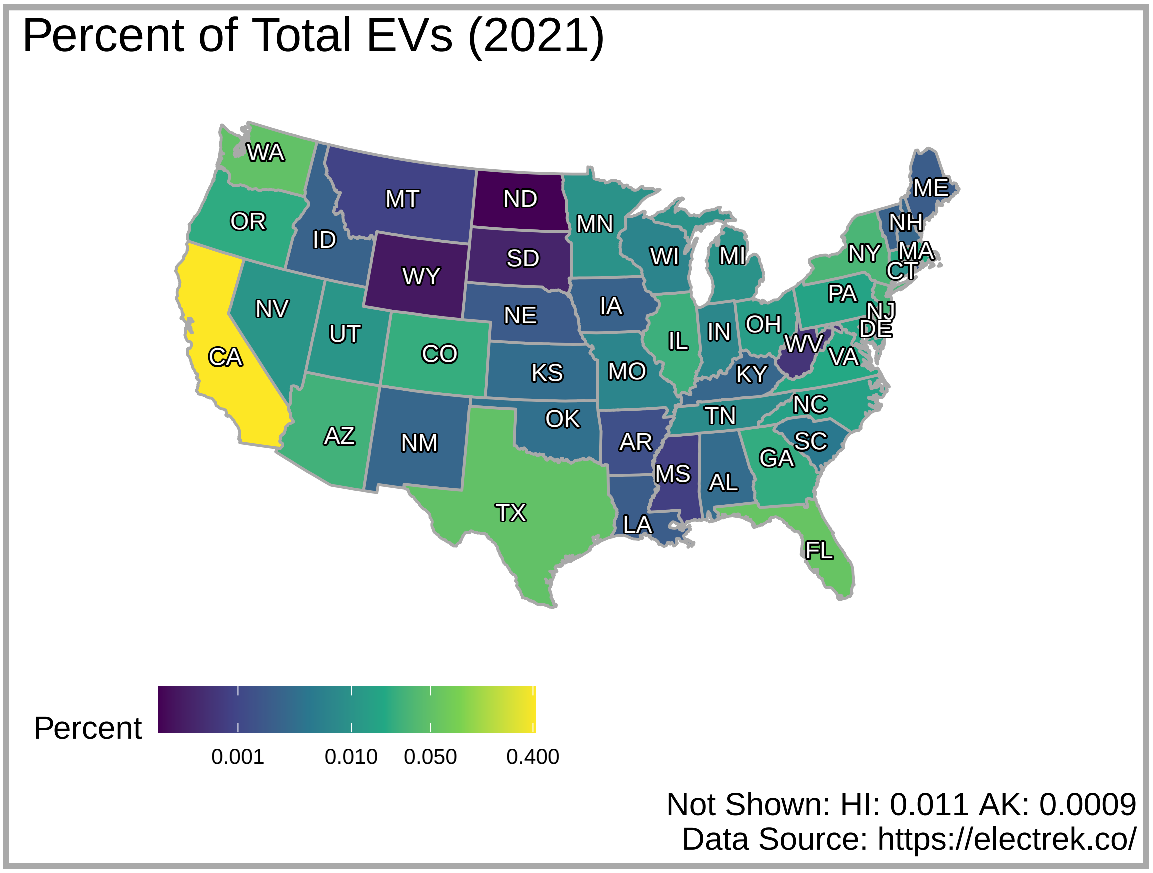
```
##  [1] "readxl"                "shadowtext"            "mapproj"
##  [4] "usdata"                "maps"                  "gridExtra"
##  [7] "dygraphs"              "RColorBrewer"          "knitr"
## [10] "flexdashboard"         "highcharter"           "tidyquant"
## [13] "quantmod"              "TTR"                   "PerformanceAnalytics"
## [16] "xts"                   "zoo"                   "magrittr"
## [19] "ggthemes"              "lubridate"             "forcats"
## [22] "stringr"               "dplyr"                 "purrr"
## [25] "readr"                 "tidyr"                 "tibble"
## [28] "ggplot2"               "tidyverse"             "pacman"
```

How does numbers of EV registered on each state affect numbers of Charging piles build on each state?

```r
# import data and rename vars
EV_data <- read_excel("EV data.xlsx")
names(EV_data) <- c("state", "num_reg_20", "pct_tot_20", "num_reg_21", "pct_tot_21", "yoy_growth")
```

```r
# filter out HI, AK and total
ev_data <- EV_data |>
  mutate(state = tolower(state)) |>
  filter(state != "alaska" & state != "hawaii" & state != "total")

# save map dataset of us polygons to global environment
us_states <- map_data("state") |>           # state polygons (from R)
  select(long:region) |>
  rename("state" = "region")

state_abbr <- state_stats |>                # many useful variables in this dataset
  select(state, abbr) |>
  mutate(state = tolower(state)) |>
  filter(state != "alaska" & state != "hawaii")

us_states <- full_join(us_states, state_abbr)

# join ev data to map dataset
ev_map <- full_join(us_states, ev_data)


# import dataset of state centroids and add centroid for DC
state_coords <- read_csv("state_coords.csv", show_col_types = F,
                         col_names = c("state", "m_lat", "m_long")) |>
  mutate(state = gsub(", USA", "", state, fixed=T),
         state = gsub(", the USA", "", state, fixed=T),
         state = gsub(", the US", "", state, fixed=T),
         state = tolower(state))

state <- "district of columbia"        # save values for dc
m_lat <- 38.9072
m_long <- -77.0369
dc <- tibble(state, m_lat, m_long)     # create dataset of dc data ( 1 obs)
state_coords <- bind_rows(state_coords, dc) |>  # add dc to state_coords
  filter(state != "alaska" & state != "hawaii")

# add state centroids to ev_map data so that states can be labeled with state abbreviation
ev_map <- full_join(ev_map, state_coords)

# code from For US MAP
(state_ev_plot <- ev_map |>
    ggplot(aes(x=long, y=lat, group=group, fill=pct_tot_20)) +
    geom_polygon(color="darkgrey") +
    theme_map() +
    coord_map("albers", lat0 = 39, lat1 = 45) +
    scale_fill_continuous(type = "viridis",  trans="log",
                          breaks=c(0.001, 0.01, 0.05, 0.4)) +
    geom_shadowtext(aes(x=m_long, y=m_lat, label=abbr),
                    color="white", check_overlap = T,
                    show.legend = F, size=3) +
    labs(fill= "Percent", title="Percent of Total EVs (2021)",
         caption= "Not Shown: HI: 0.011 AK: 0.0009
         Data Source: https://electrek.co/") +
```

```r
    theme(legend.position = "bottom",
          legend.key.width = unit(1, "cm"),
          plot.background = element_rect(color = "darkgrey", fill=NA, size=2),
          plot.title = element_text(size = 18),
          plot.subtitle = element_text(size = 13),
          plot.caption = element_text(size = 12),
          legend.text = element_text(size = 8),
          legend.title = element_text(size = 12)))
```



This graph Shows the total percentage of Electronic vesicles registration in 2021.Each state's situation is marked on the graph, Based on the graph, we can find out that CA has the most EV registration in the 2021 which is almost 40 percent. For the rest state, their EV registration is between 0.1% to 5%, The Hawaii and Alaska are not show on the graph but listed on the right corner

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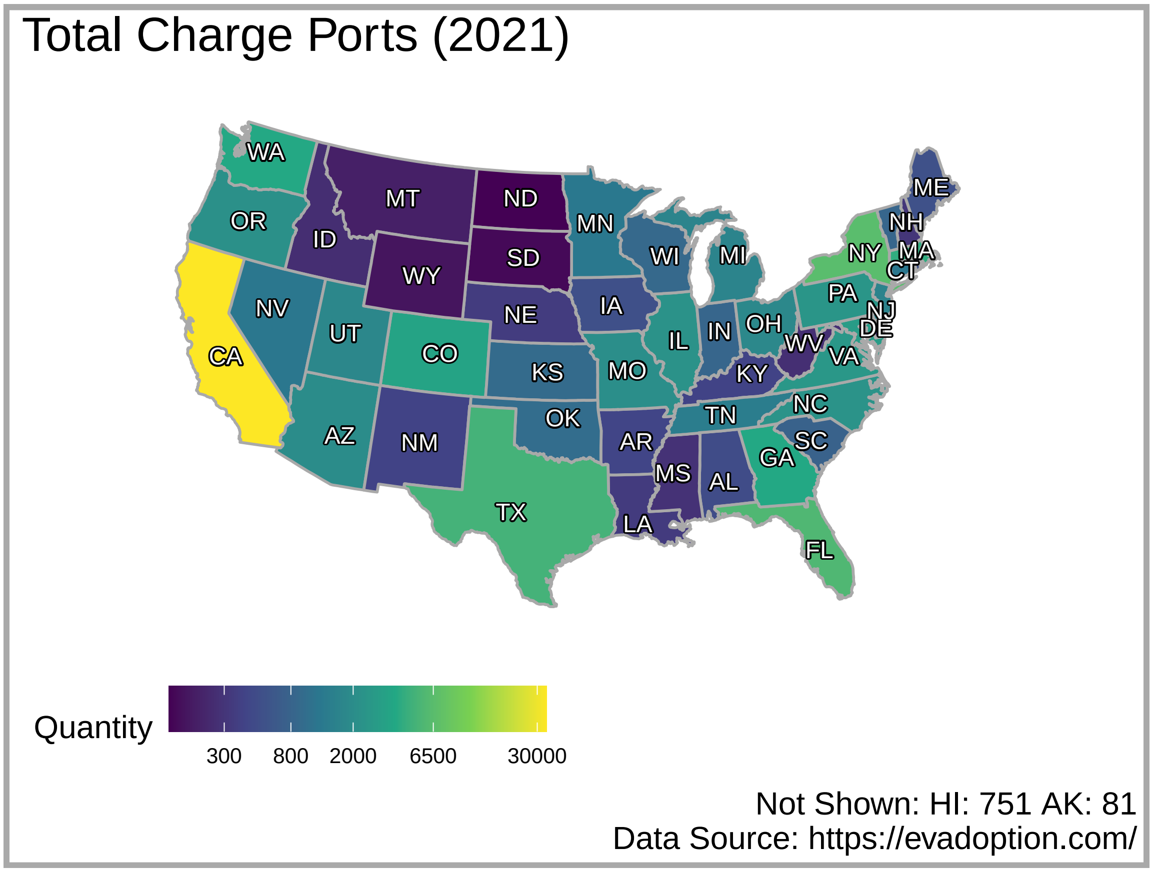
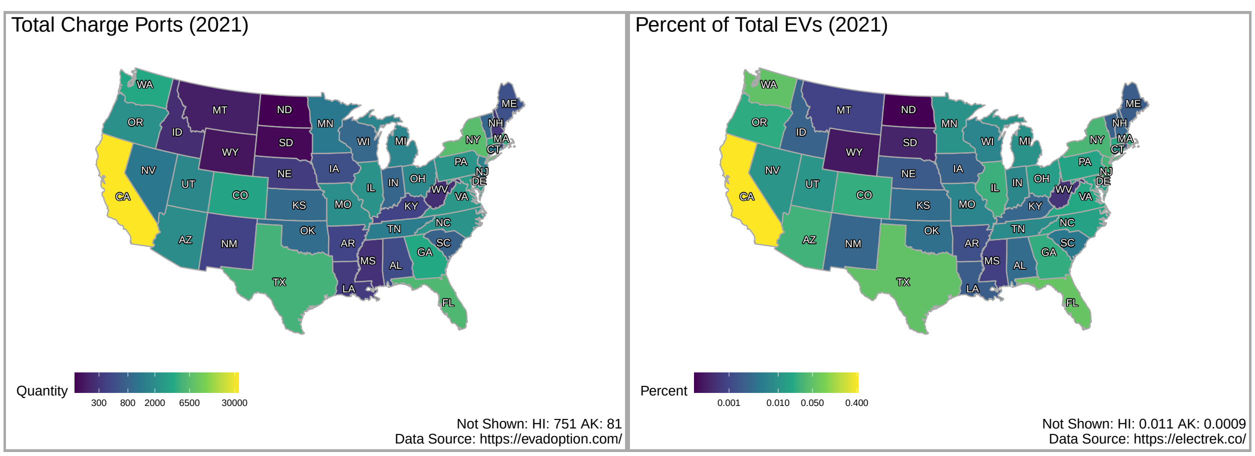
How many Chargepile in Each State in United States

```r
CP_data <- read_excel("Charge_Pile.xlsx")
```

```r
names(CP_data) <- c("state","Total_EV","Level_1_Ports","Level_2_Ports", "DCFC_Ports","Total_Ports",
"Ratio_Evs_to_Charger_Ports")

cp_data <- CP_data |>
           mutate(state = tolower(state)) |>
           filter(state != "alaska" & state != "hawaii" & state != "total")

cp_map <- full_join(us_states,cp_data)

cp_map <- full_join(cp_map,state_coords)

(state_cp_plot <- cp_map |>
                 ggplot(aes(x=long, y=lat, group=group, fill= Total_Ports)) +
                 geom_polygon(color="darkgrey") +
                 theme_map() +
                 coord_map("albers", lat0 = 39, lat1 = 45) +
                 scale_fill_continuous(type = "viridis",  trans="log",
                                       breaks=c(300, 800, 2000, 6500,30000))+
                 geom_shadowtext(aes(x=m_long, y=m_lat, label=abbr),
                    color="white", check_overlap = T,
                    show.legend = F, size=3) +
                  labs(fill= "Quantity", title="Total Charge Ports (2021)",
                       caption= "Not Shown: HI: 751 AK: 81
                        Data Source: https://evadoption.com/") +
                        theme(legend.position = "bottom",
                        legend.key.width = unit(1, "cm"),
                         plot.background = element_rect(color = "darkgrey", fill=NA, size=2),
                         plot.title = element_text(size = 18),
                         plot.subtitle = element_text(size = 13),
                         plot.caption = element_text(size = 12),
                         legend.text = element_text(size = 8),
                        legend.title = element_text(size = 12)))
```



Combined graph of total ports and total EVs in each state



Based on those two graphs, We can find out the the content and situation of each state are basically coincide, Which means their situation are consistent to each other. In general, it means more electronically vehicles will need more charge piles to assist.