Palo Verde Electric Hub Analysis (2014-2024)

Kendall Beaver

2024-06-21

Overview

The following data was obtained from the Intercontinental Exchange (ICE) via the U.S. Energy Information Administration website (https://www.eia.gov/electricity/wholesale/). Selected

Load Library

2014-2024 Datasets

Import all datasets into their own variables.

```
data_2014 <- read_excel ("./Data/ice_electric-2014final.xls")
# Need to correct "Nepool MH Da LMP Peak" to "Nepool MH DA LMP Peak"
# Need to correct "NP 15 EZ..." to "NP15 EZ Gen..."
# Correct "Palo Verde" to "Palo Verde Peak"
# Change "SP-15 Gen DA LMP Peak" to "SP15 EZ Gen DA LMP Peak"
colnames(data_2014) <- gsub("\n", " ", colnames(data_2014))
colnames(data_2014) <- gsub("  ", " ", colnames(data_2014))
# unique(c(colnames(data_2014)))
# data_2014
data_2014 <- data_2014 %>%
  mutate(`Price hub` =
          ifelse(`Price hub` == "Nepool MH Da LMP Peak", "Nepool MH DA LMP Peak",
          ifelse(`Price hub` == "Indiana Hub RT Peak", "Indiana Rt Peak",
          ifelse(`Price hub` == "PJM-Wh Real Time Peak", "PJM WH Real Time Peak",
          ifelse(`Price hub` == "Mid Columbia Peak", "Mid C Peak",
          ifelse(`Price hub` == "PJM Wh Real Time Peak", "PJM WH Real Time Peak",
          ifelse(`Price hub` == "NP 15 EZ Gen DA LMP Peak", "NP15 EZ Gen DA LMP Peak",
          ifelse(`Price hub` == "Palo Verde", "Palo Verde Peak",
          ifelse(`Price hub` == "SP15 EZ Gen DA LMP Peak", "SP-15 Gen DA LMP Peak", `Price hub`)))))))))
# data_2014 <- select(data_2014, -'Price hub_2')
# unique(data_2014$`Price hub`)
data_2014
```

```
## # A tibble: 1,816 x 11
##    `Price hub`    `Trade date`        `Delivery start date` `Delivery end date`
##    <chr>          <dttm>              <dttm>                <dttm>
##  1 ERCOT North 34~ 2014-04-14 00:00:00 2014-04-15 00:00:00   2014-04-15 00:00:00
##  2 ERCOT North 34~ 2014-04-15 00:00:00 2014-04-16 00:00:00   2014-04-16 00:00:00
```

```
##  3 ERCOT North 34~ 2014-04-16 00:00:00 2014-04-17 00:00:00    2014-04-17 00:00:00
##  4 ERCOT North 34~ 2014-04-17 00:00:00 2014-04-18 00:00:00    2014-04-18 00:00:00
##  5 ERCOT North 34~ 2014-04-21 00:00:00 2014-04-22 00:00:00    2014-04-22 00:00:00
##  6 ERCOT North 34~ 2014-04-22 00:00:00 2014-04-23 00:00:00    2014-04-23 00:00:00
##  7 ERCOT North 34~ 2014-04-23 00:00:00 2014-04-24 00:00:00    2014-04-24 00:00:00
##  8 ERCOT North 34~ 2014-04-24 00:00:00 2014-04-25 00:00:00    2014-04-25 00:00:00
##  9 ERCOT North 34~ 2014-04-25 00:00:00 2014-04-28 00:00:00    2014-04-28 00:00:00
## 10 ERCOT North 34~ 2014-04-28 00:00:00 2014-04-29 00:00:00    2014-04-29 00:00:00
## # i 1,806 more rows
## # i 7 more variables: `High price $/MWh` <dbl>, `Low price $/MWh` <dbl>,
## #   `Wtd avg price $/MWh` <dbl>, Change <dbl>, `Daily volume MWh` <dbl>,
## #   `Number of trades` <dbl>, `Number of counterparties` <dbl>
```

```r
data_2015 <- read_excel ("./Data/ice_electric-2015final.xls")
colnames(data_2015) <- gsub("\n", " ", colnames(data_2015))
colnames(data_2015) <- gsub("  ", " ", colnames(data_2015))
unique(c(colnames(data_2015)))
```

```
##  [1] "Price hub"                "Trade date"
##  [3] "Delivery start date"      "Delivery end date"
##  [5] "High price $/MWh"         "Low price $/MWh"
##  [7] "Wtd avg price $/MWh"      "Change"
##  [9] "Daily volume MWh"         "Number of trades"
## [11] "Number of counterparties"
```

```r
data_2015
```

```
## # A tibble: 1,808 x 11
##    `Price hub`    `Trade date`        `Delivery start date` `Delivery end date`
##    <chr>          <dttm>              <dttm>                <dttm>
##  1 ERCOT North 34~ 2015-01-02 00:00:00 2015-01-05 00:00:00   2015-01-05 00:00:00
##  2 ERCOT North 34~ 2015-01-05 00:00:00 2015-01-06 00:00:00   2015-01-06 00:00:00
##  3 ERCOT North 34~ 2015-01-07 00:00:00 2015-01-08 00:00:00   2015-01-08 00:00:00
##  4 ERCOT North 34~ 2015-01-08 00:00:00 2015-01-09 00:00:00   2015-01-09 00:00:00
##  5 ERCOT North 34~ 2015-01-09 00:00:00 2015-01-12 00:00:00   2015-01-12 00:00:00
##  6 ERCOT North 34~ 2015-01-12 00:00:00 2015-01-13 00:00:00   2015-01-13 00:00:00
##  7 ERCOT North 34~ 2015-01-13 00:00:00 2015-01-14 00:00:00   2015-01-14 00:00:00
##  8 ERCOT North 34~ 2015-01-14 00:00:00 2015-01-15 00:00:00   2015-01-15 00:00:00
##  9 ERCOT North 34~ 2015-01-15 00:00:00 2015-01-16 00:00:00   2015-01-16 00:00:00
## 10 ERCOT North 34~ 2015-01-16 00:00:00 2015-01-19 00:00:00   2015-01-19 00:00:00
## # i 1,798 more rows
## # i 7 more variables: `High price $/MWh` <dbl>, `Low price $/MWh` <dbl>,
## #   `Wtd avg price $/MWh` <dbl>, Change <dbl>, `Daily volume MWh` <dbl>,
## #   `Number of trades` <dbl>, `Number of counterparties` <dbl>
```

```r
data_2016 <- read_excel ("./Data/ice_electric-2016final.xls")
colnames(data_2016) <- gsub("\n", " ", colnames(data_2016))
colnames(data_2016) <- gsub("  ", " ", colnames(data_2016))
unique(c(colnames(data_2016)))
```

```
##  [1] "Price hub"                "Trade date"
##  [3] "Delivery start date"      "Delivery end date"
```

```
##  [5] "High price $/MWh"         "Low price $/MWh"
##  [7] "Wtd avg price $/MWh"       "Change"
##  [9] "Daily volume MWh"          "Number of trades"
## [11] "Number of counterparties"
```

data_2016

```
## # A tibble: 1,759 x 11
##    'Price hub'     'Trade date'        'Delivery start date' 'Delivery end date'
##    <chr>           <dttm>              <dttm>                <dttm>
##  1 ERCOT North 34~ 2015-12-31 00:00:00 2016-01-04 00:00:00   2016-01-04 00:00:00
##  2 ERCOT North 34~ 2016-01-04 00:00:00 2016-01-05 00:00:00   2016-01-05 00:00:00
##  3 ERCOT North 34~ 2016-01-05 00:00:00 2016-01-06 00:00:00   2016-01-06 00:00:00
##  4 ERCOT North 34~ 2016-01-06 00:00:00 2016-01-07 00:00:00   2016-01-07 00:00:00
##  5 ERCOT North 34~ 2016-01-07 00:00:00 2016-01-08 00:00:00   2016-01-08 00:00:00
##  6 ERCOT North 34~ 2016-01-08 00:00:00 2016-01-11 00:00:00   2016-01-11 00:00:00
##  7 ERCOT North 34~ 2016-01-11 00:00:00 2016-01-12 00:00:00   2016-01-12 00:00:00
##  8 ERCOT North 34~ 2016-01-12 00:00:00 2016-01-13 00:00:00   2016-01-13 00:00:00
##  9 ERCOT North 34~ 2016-01-13 00:00:00 2016-01-14 00:00:00   2016-01-14 00:00:00
## 10 ERCOT North 34~ 2016-01-15 00:00:00 2016-01-15 00:00:00   2016-01-15 00:00:00
## # i 1,749 more rows
## # i 7 more variables: 'High price $/MWh' <dbl>, 'Low price $/MWh' <dbl>,
## #   'Wtd avg price $/MWh' <dbl>, Change <dbl>, 'Daily volume MWh' <dbl>,
## #   'Number of trades' <dbl>, 'Number of counterparties' <dbl>
```

```
data_2017 <- read_excel ("./Data/ice_electric-2017final.xlsx")
colnames(data_2017) <- gsub("\r\n", " ", colnames(data_2017))
colnames(data_2017) <- gsub("  ", " ", colnames(data_2017))
unique(c(colnames(data_2017)))
```

```
##  [1] "Price hub"               "Trade date"
##  [3] "Delivery start date"     "Delivery end date"
##  [5] "High price $/MWh"        "Low price $/MWh"
##  [7] "Wtd avg price $/MWh"     "Change"
##  [9] "Daily volume MWh"        "Number of trades"
## [11] "Number of counterparties"
```

data_2017

```
## # A tibble: 1,535 x 11
##    'Price hub'     'Trade date'        'Delivery start date' 'Delivery end date'
##    <chr>           <dttm>              <dttm>                <dttm>
##  1 ERCOT North 34~ 2017-01-03 00:00:00 2017-01-04 00:00:00   2017-01-04 00:00:00
##  2 ERCOT North 34~ 2017-01-04 00:00:00 2017-01-05 00:00:00   2017-01-05 00:00:00
##  3 ERCOT North 34~ 2017-01-05 00:00:00 2017-01-06 00:00:00   2017-01-06 00:00:00
##  4 ERCOT North 34~ 2017-01-06 00:00:00 2017-01-09 00:00:00   2017-01-09 00:00:00
##  5 ERCOT North 34~ 2017-01-09 00:00:00 2017-01-10 00:00:00   2017-01-10 00:00:00
##  6 ERCOT North 34~ 2017-01-10 00:00:00 2017-01-11 00:00:00   2017-01-11 00:00:00
##  7 ERCOT North 34~ 2017-01-11 00:00:00 2017-01-12 00:00:00   2017-01-12 00:00:00
##  8 ERCOT North 34~ 2017-01-12 00:00:00 2017-01-13 00:00:00   2017-01-13 00:00:00
##  9 ERCOT North 34~ 2017-01-13 00:00:00 2017-01-16 00:00:00   2017-01-16 00:00:00
## 10 ERCOT North 34~ 2017-01-16 00:00:00 2017-01-17 00:00:00   2017-01-17 00:00:00
```

```
## # i 1,525 more rows
## # i 7 more variables: 'High price $/MWh' <dbl>, 'Low price $/MWh' <dbl>,
## #   'Wtd avg price $/MWh' <dbl>, Change <dbl>, 'Daily volume MWh' <dbl>,
## #   'Number of trades' <dbl>, 'Number of counterparties' <dbl>
```

```r
data_2018 <- read_excel ("./Data/ice_electric-2018final.xlsx")
colnames(data_2018) <- gsub("\r\n", " ", colnames(data_2018))
colnames(data_2018) <- gsub("  ", " ", colnames(data_2018))
unique(c(colnames(data_2018)))
```

```
##  [1] "Price hub"              "Trade date"
##  [3] "Delivery start date"    "Delivery end date"
##  [5] "High price $/MWh"       "Low price $/MWh"
##  [7] "Wtd avg price $/MWh"    "Change"
##  [9] "Daily volume MWh"       "Number of trades"
## [11] "Number of counterparties"
```

```r
data_2018
```

```
## # A tibble: 1,359 x 11
##    'Price hub'    'Trade date'        'Delivery start date' 'Delivery end date'
##    <chr>          <dttm>              <dttm>                <dttm>
##  1 ERCOT North 34~ 2018-01-04 00:00:00 2018-01-05 00:00:00  2018-01-05 00:00:00
##  2 ERCOT North 34~ 2018-01-11 00:00:00 2018-01-12 00:00:00  2018-01-12 00:00:00
##  3 ERCOT North 34~ 2018-01-15 00:00:00 2018-01-16 00:00:00  2018-01-16 00:00:00
##  4 ERCOT North 34~ 2018-01-18 00:00:00 2018-01-19 00:00:00  2018-01-19 00:00:00
##  5 ERCOT North 34~ 2018-01-22 00:00:00 2018-01-23 00:00:00  2018-01-23 00:00:00
##  6 ERCOT North 34~ 2018-01-24 00:00:00 2018-01-25 00:00:00  2018-01-25 00:00:00
##  7 ERCOT North 34~ 2018-01-25 00:00:00 2018-01-26 00:00:00  2018-01-26 00:00:00
##  8 ERCOT North 34~ 2018-01-29 00:00:00 2018-01-30 00:00:00  2018-01-30 00:00:00
##  9 ERCOT North 34~ 2018-02-01 00:00:00 2018-02-02 00:00:00  2018-02-02 00:00:00
## 10 ERCOT North 34~ 2018-02-06 00:00:00 2018-02-07 00:00:00  2018-02-07 00:00:00
## # i 1,349 more rows
## # i 7 more variables: 'High price $/MWh' <dbl>, 'Low price $/MWh' <dbl>,
## #   'Wtd avg price $/MWh' <dbl>, Change <dbl>, 'Daily volume MWh' <dbl>,
## #   'Number of trades' <dbl>, 'Number of counterparties' <dbl>
```

```r
data_2019 <- read_excel ("./Data/ice_electric-2019final.xlsx")
colnames(data_2019) <- gsub("\r\n", " ", colnames(data_2019))
colnames(data_2019) <- gsub("  ", " ", colnames(data_2019))
unique(c(colnames(data_2019)))
```

```
##  [1] "Price hub"              "Trade date"
##  [3] "Delivery start date"    "Delivery end date"
##  [5] "High price $/MWh"       "Low price $/MWh"
##  [7] "Wtd avg price $/MWh"    "Change"
##  [9] "Daily volume MWh"       "Number of trades"
## [11] "Number of counterparties"
```

```r
data_2019
```

```
## # A tibble: 1,300 x 11
##    `Price hub`   `Trade date`        `Delivery start date` `Delivery end date`
##    <chr>         <dttm>              <dttm>                <dttm>
##  1 ERCOT North 34~ 2019-01-22 00:00:00 2019-01-23 00:00:00   2019-01-23 00:00:00
##  2 ERCOT North 34~ 2019-01-28 00:00:00 2019-01-29 00:00:00   2019-01-29 00:00:00
##  3 ERCOT North 34~ 2019-03-15 00:00:00 2019-03-18 00:00:00   2019-03-18 00:00:00
##  4 ERCOT North 34~ 2019-04-26 00:00:00 2019-04-29 00:00:00   2019-04-29 00:00:00
##  5 ERCOT North 34~ 2019-05-28 00:00:00 2019-05-29 00:00:00   2019-05-29 00:00:00
##  6 ERCOT North 34~ 2019-07-26 00:00:00 2019-07-29 00:00:00   2019-07-29 00:00:00
##  7 ERCOT North 34~ 2019-11-07 00:00:00 2019-11-08 00:00:00   2019-11-08 00:00:00
##  8 Indiana Hub RT~ 2019-01-03 00:00:00 2019-01-04 00:00:00   2019-01-04 00:00:00
##  9 Indiana Hub RT~ 2019-01-08 00:00:00 2019-01-09 00:00:00   2019-01-09 00:00:00
## 10 Indiana Hub RT~ 2019-01-10 00:00:00 2019-01-11 00:00:00   2019-01-11 00:00:00
## # i 1,290 more rows
## # i 7 more variables: `High price $/MWh` <dbl>, `Low price $/MWh` <dbl>,
## #   `Wtd avg price $/MWh` <dbl>, Change <dbl>, `Daily volume MWh` <dbl>,
## #   `Number of trades` <dbl>, `Number of counterparties` <dbl>
```

```r
data_2020 <- read_excel ("./Data/ice_electric-2020final.xlsx")
colnames(data_2020) <- gsub("\r\n", " ", colnames(data_2020))
colnames(data_2020) <- gsub("  ", " ", colnames(data_2020))
unique(c(colnames(data_2020)))
```

```
##  [1] "Price hub"              "Trade date"
##  [3] "Delivery start date"    "Delivery end date"
##  [5] "High price $/MWh"       "Low price $/MWh"
##  [7] "Wtd avg price $/MWh"    "Change"
##  [9] "Daily volume MWh"       "Number of trades"
## [11] "Number of counterparties"
```

```r
data_2020
```

```
## # A tibble: 1,267 x 11
##    `Price hub`   `Trade date`        `Delivery start date` `Delivery end date`
##    <chr>         <dttm>              <dttm>                <dttm>
##  1 Indiana Hub RT~ 2020-01-17 00:00:00 2020-01-20 00:00:00   2020-01-20 00:00:00
##  2 Indiana Hub RT~ 2020-02-18 00:00:00 2020-02-19 00:00:00   2020-02-19 00:00:00
##  3 Indiana Hub RT~ 2020-03-19 00:00:00 2020-03-20 00:00:00   2020-03-20 00:00:00
##  4 Indiana Hub RT~ 2020-04-15 00:00:00 2020-04-16 00:00:00   2020-04-16 00:00:00
##  5 Indiana Hub RT~ 2020-04-21 00:00:00 2020-04-22 00:00:00   2020-04-22 00:00:00
##  6 Indiana Hub RT~ 2020-04-28 00:00:00 2020-04-29 00:00:00   2020-04-29 00:00:00
##  7 Indiana Hub RT~ 2020-05-07 00:00:00 2020-05-08 00:00:00   2020-05-08 00:00:00
##  8 Indiana Hub RT~ 2020-05-13 00:00:00 2020-05-14 00:00:00   2020-05-14 00:00:00
##  9 Indiana Hub RT~ 2020-05-26 00:00:00 2020-05-27 00:00:00   2020-05-27 00:00:00
## 10 Indiana Hub RT~ 2020-05-29 00:00:00 2020-06-01 00:00:00   2020-06-01 00:00:00
## # i 1,257 more rows
## # i 7 more variables: `High price $/MWh` <dbl>, `Low price $/MWh` <dbl>,
## #   `Wtd avg price $/MWh` <dbl>, Change <dbl>, `Daily volume MWh` <dbl>,
## #   `Number of trades` <dbl>, `Number of counterparties` <dbl>
```

```r
data_2021 <- read_excel ("./Data/ice_electric-2021final.xlsx")
colnames(data_2021) <- gsub("\r\n", " ", colnames(data_2021))
```

```r
colnames(data_2021) <- gsub("  ", " ", colnames(data_2021))
unique(c(colnames(data_2021)))
```

```
## [1] "Price hub"                 "Trade date"
## [3] "Delivery start date"       "Delivery end date"
## [5] "High price $/MWh"          "Low price $/MWh"
## [7] "Wtd avg price $/MWh"       "Change"
## [9] "Daily volume MWh"          "Number of trades"
## [11] "Number of counterparties"
```

```r
data_2021
```

```
## # A tibble: 1,318 x 11
##    `Price hub`     `Trade date`        `Delivery start date` `Delivery end date`
##    <chr>           <dttm>              <dttm>                <dttm>
##  1 Indiana Hub RT~ 2021-01-07 00:00:00 2021-01-08 00:00:00   2021-01-08 00:00:00
##  2 Indiana Hub RT~ 2021-01-12 00:00:00 2021-01-13 00:00:00   2021-01-13 00:00:00
##  3 Indiana Hub RT~ 2021-01-21 00:00:00 2021-01-22 00:00:00   2021-01-22 00:00:00
##  4 Indiana Hub RT~ 2021-01-26 00:00:00 2021-01-27 00:00:00   2021-01-27 00:00:00
##  5 Indiana Hub RT~ 2021-02-04 00:00:00 2021-02-05 00:00:00   2021-02-05 00:00:00
##  6 Indiana Hub RT~ 2021-02-05 00:00:00 2021-02-08 00:00:00   2021-02-08 00:00:00
##  7 Indiana Hub RT~ 2021-02-08 00:00:00 2021-02-09 00:00:00   2021-02-09 00:00:00
##  8 Indiana Hub RT~ 2021-02-09 00:00:00 2021-02-10 00:00:00   2021-02-10 00:00:00
##  9 Indiana Hub RT~ 2021-02-10 00:00:00 2021-02-11 00:00:00   2021-02-11 00:00:00
## 10 Indiana Hub RT~ 2021-02-11 00:00:00 2021-02-12 00:00:00   2021-02-12 00:00:00
## # i 1,308 more rows
## # i 7 more variables: `High price $/MWh` <dbl>, `Low price $/MWh` <dbl>,
## #   `Wtd avg price $/MWh` <dbl>, Change <dbl>, `Daily volume MWh` <dbl>,
## #   `Number of trades` <dbl>, `Number of counterparties` <dbl>
```

```r
data_2022 <- read_excel ("./Data/ice_electric-2022final.xlsx")
data_2022 <- select(data_2022, -'Trade date') # REMOVE COLUMN because it's bad
data_2022$'Trade date' <- data_2022$`Delivery start date` - 86400
data_2022 <- data_2022 %>% select(1, `Trade date`, everything()) # Make 'Trade date' the 2nd column lik
colnames(data_2022) <- gsub("\r\n", " ", colnames(data_2022))
colnames(data_2022) <- gsub("  ", " ", colnames(data_2022))
unique(c(colnames(data_2022)))
```

```
## [1] "Price hub"                 "Trade date"
## [3] "Delivery start date"       "Delivery end date"
## [5] "High price $/MWh"          "Low price $/MWh"
## [7] "Wtd avg price $/MWh"       "Change"
## [9] "Daily volume MWh"          "Number of trades"
## [11] "Number of counterparties"
```

```r
data_2022
```

```
## # A tibble: 1,237 x 11
##    `Price hub`     `Trade date`        `Delivery start date` `Delivery end date`
##    <chr>           <dttm>              <dttm>                <dttm>
##  1 Indiana Hub RT~ 2022-01-04 00:00:00 2022-01-05 00:00:00   2022-01-05 00:00:00
```

```
##  2 Indiana Hub RT~ 2022-01-05 00:00:00 2022-01-06 00:00:00   2022-01-06 00:00:00
##  3 Indiana Hub RT~ 2022-01-06 00:00:00 2022-01-07 00:00:00   2022-01-07 00:00:00
##  4 Indiana Hub RT~ 2022-01-09 00:00:00 2022-01-10 00:00:00   2022-01-10 00:00:00
##  5 Indiana Hub RT~ 2022-01-19 00:00:00 2022-01-20 00:00:00   2022-01-20 00:00:00
##  6 Indiana Hub RT~ 2022-01-20 00:00:00 2022-01-21 00:00:00   2022-01-21 00:00:00
##  7 Indiana Hub RT~ 2022-01-25 00:00:00 2022-01-26 00:00:00   2022-01-26 00:00:00
##  8 Indiana Hub RT~ 2022-01-27 00:00:00 2022-01-28 00:00:00   2022-01-28 00:00:00
##  9 Indiana Hub RT~ 2022-02-02 00:00:00 2022-02-03 00:00:00   2022-02-03 00:00:00
## 10 Indiana Hub RT~ 2022-02-03 00:00:00 2022-02-04 00:00:00   2022-02-04 00:00:00
## # i 1,227 more rows
## # i 7 more variables: `High price $/MWh` <dbl>, `Low price $/MWh` <dbl>,
## #   `Wtd avg price $/MWh` <dbl>, Change <dbl>, `Daily volume MWh` <dbl>,
## #   `Number of trades` <dbl>, `Number of counterparties` <dbl>
```

```r
data_2023 <- read_excel ("./Data/ice_electric-2023final.xlsx")
colnames(data_2023) <- gsub("\r\n", " ", colnames(data_2023))
colnames(data_2023) <- gsub("  ", " ", colnames(data_2023))
unique(c(colnames(data_2023)))
```

```
##  [1] "Price hub"                "Trade date"
##  [3] "Delivery start date"      "Delivery end date"
##  [5] "High price $/MWh"         "Low price $/MWh"
##  [7] "Wtd avg price $/MWh"      "Change"
##  [9] "Daily volume MWh"         "Number of trades"
## [11] "Number of counterparties"
```

```r
data_2023
```

```
## # A tibble: 1,325 x 11
##    `Price hub`     `Trade date`        `Delivery start date` `Delivery end date`
##    <chr>           <dttm>              <dttm>                <dttm>
##  1 Indiana Hub RT~ 2023-03-27 00:00:00 2023-03-28 00:00:00   2023-03-28 00:00:00
##  2 Indiana Hub RT~ 2023-05-12 00:00:00 2023-05-15 00:00:00   2023-05-15 00:00:00
##  3 Indiana Hub RT~ 2023-05-23 00:00:00 2023-05-24 00:00:00   2023-05-24 00:00:00
##  4 Indiana Hub RT~ 2023-06-01 00:00:00 2023-06-02 00:00:00   2023-06-02 00:00:00
##  5 Indiana Hub RT~ 2023-06-06 00:00:00 2023-06-07 00:00:00   2023-06-07 00:00:00
##  6 Indiana Hub RT~ 2023-06-29 00:00:00 2023-06-30 00:00:00   2023-06-30 00:00:00
##  7 Indiana Hub RT~ 2023-07-06 00:00:00 2023-07-07 00:00:00   2023-07-07 00:00:00
##  8 Indiana Hub RT~ 2023-07-10 00:00:00 2023-07-11 00:00:00   2023-07-11 00:00:00
##  9 Indiana Hub RT~ 2023-07-12 00:00:00 2023-07-13 00:00:00   2023-07-13 00:00:00
## 10 Indiana Hub RT~ 2023-07-13 00:00:00 2023-07-14 00:00:00   2023-07-14 00:00:00
## # i 1,315 more rows
## # i 7 more variables: `High price $/MWh` <dbl>, `Low price $/MWh` <dbl>,
## #   `Wtd avg price $/MWh` <dbl>, Change <dbl>, `Daily volume MWh` <dbl>,
## #   `Number of trades` <dbl>, `Number of counterparties` <dbl>
```

```r
data_2024 <- read_excel ("./Data/ice_electric-2024.xlsx")
colnames(data_2024) <- gsub("\r\n", " ", colnames(data_2024))
colnames(data_2024) <- gsub("  ", " ", colnames(data_2024))
unique(c(colnames(data_2024)))
```

```
##  [1] "Price hub"                "Trade date"
```

```
## [3] "Delivery start date"    "Delivery end date"
## [5] "High price $/MWh"       "Low price $/MWh"
## [7] "Wtd avg price $/MWh"     "Change"
## [9] "Daily volume MWh"        "Number of trades"
## [11] "Number of counterparties"
```

data_2024

```
## # A tibble: 591 x 11
##    `Price hub`    `Trade date`        `Delivery start date` `Delivery end date`
##    <chr>          <dttm>              <dttm>                <dttm>
##  1 Indiana Hub RT~ 2023-12-29 00:00:00 2024-01-02 00:00:00   2024-01-02 00:00:00
##  2 Indiana Hub RT~ 2024-01-02 00:00:00 2024-01-03 00:00:00   2024-01-03 00:00:00
##  3 Indiana Hub RT~ 2024-01-09 00:00:00 2024-01-10 00:00:00   2024-01-10 00:00:00
##  4 Indiana Hub RT~ 2024-01-15 00:00:00 2024-01-16 00:00:00   2024-01-16 00:00:00
##  5 Indiana Hub RT~ 2024-01-16 00:00:00 2024-01-17 00:00:00   2024-01-17 00:00:00
##  6 Indiana Hub RT~ 2024-01-18 00:00:00 2024-01-19 00:00:00   2024-01-19 00:00:00
##  7 Indiana Hub RT~ 2024-01-22 00:00:00 2024-01-23 00:00:00   2024-01-23 00:00:00
##  8 Indiana Hub RT~ 2024-01-23 00:00:00 2024-01-24 00:00:00   2024-01-24 00:00:00
##  9 Indiana Hub RT~ 2024-01-24 00:00:00 2024-01-25 00:00:00   2024-01-25 00:00:00
## 10 Indiana Hub RT~ 2024-02-02 00:00:00 2024-02-05 00:00:00   2024-02-05 00:00:00
## # i 581 more rows
## # i 7 more variables: `High price $/MWh` <dbl>, `Low price $/MWh` <dbl>,
## #   `Wtd avg price $/MWh` <dbl>, Change <dbl>, `Daily volume MWh` <dbl>,
## #   `Number of trades` <dbl>, `Number of counterparties` <dbl>
```

Head 2014-2024

Use the following to make mass changes:

1. One quick suggestion on how to more effectively use grepl is that you can separate things out with |. So for example, ifelse(grepl("tequi|agave", Alcohol_Type1, ignore.case = TRUE), "TEQUILA", That should help shorten up some of your code. Similarly, use the %in% function for longer lists, e.g. ifelse(Item.Description %in% c("MAKER'S MARK CO-PACK", "HA ORPHAN BARREL BARTERHOUSE"), "BOURBON",

```r
# 8 Peaks (2014-2019):
#
# "ERCOT North 345KV Peak"
# "Indiana Rt Peak"
# "Mid C Peak"
# "Nepool MH DA LMP Peak"
# "NP15 EZ Gen DA LMP Peak"
# "Palo Verde Peak"
# "PJM WH Real Time Peak"
# "SP-15 Gen DA LMP Peak"

unique(data_2014$`Price hub`)
```

```
## [1] "ERCOT North 345KV Peak"  "Indiana Rt Peak"
## [3] "Mid C Peak"              "Nepool MH DA LMP Peak"
## [5] "NP15 EZ Gen DA LMP Peak" "Palo Verde Peak"
## [7] "PJM WH Real Time Peak"   "SP-15 Gen DA LMP Peak"
```

```r
unique(data_2015$`Price hub`)
```

```
## [1] "ERCOT North 345KV Peak"  "Indiana Hub RT Peak"
## [3] "Mid C Peak"              "Nepool MH DA LMP Peak"
## [5] "NP15 EZ Gen DA LMP Peak" "Palo Verde Peak"
## [7] "PJM WH Real Time Peak"   "SP15 EZ Gen DA LMP Peak"
```

```r
unique(data_2016$`Price hub`)
```

```
## [1] "ERCOT North 345KV Peak"  "Indiana Hub RT Peak"
## [3] "Mid C Peak"              "Nepool MH DA LMP Peak"
## [5] "NP15 EZ Gen DA LMP Peak" "Palo Verde Peak"
## [7] "PJM WH Real Time Peak"   "SP15 EZ Gen DA LMP Peak"
```

```r
unique(data_2017$`Price hub`)
```

```
## [1] "ERCOT North 345KV Peak"  "Indiana Hub RT Peak"
## [3] "Mid C Peak"              "Nepool MH DA LMP Peak"
## [5] "NP15 EZ Gen DA LMP Peak" "Palo Verde Peak"
## [7] "PJM WH Real Time Peak"   "SP15 EZ Gen DA LMP Peak"
```

```r
unique(data_2018$`Price hub`)
```

```
## [1] "ERCOT North 345KV Peak"  "Indiana Hub RT Peak"
## [3] "Mid C Peak"              "Nepool MH DA LMP Peak"
## [5] "NP15 EZ Gen DA LMP Peak" "Palo Verde Peak"
## [7] "PJM WH Real Time Peak"   "SP15 EZ Gen DA LMP Peak"
```

```r
unique(data_2019$`Price hub`)
```

```
## [1] "ERCOT North 345KV Peak"  "Indiana Hub RT Peak"
## [3] "Mid C Peak"              "Nepool MH DA LMP Peak"
## [5] "NP15 EZ Gen DA LMP Peak" "Palo Verde Peak"
## [7] "PJM WH Real Time Peak"   "SP15 EZ Gen DA LMP Peak"
```

```r
# 7 Peaks (2020-2024):

# Indiana Hub RT Peak
# Mid C Peak
# Nepool MH DA LMP Peak
# NP15 EZ Gen DA LMP Peak
# Palo Verde Peak
# PJM WH Real Time Peak
# SP15 EZ Gen DA LMP Peak
#
# Missing is "ERCOT North 345KV Peak"

unique(data_2020$`Price hub`) # 7 Peaks
```

```
## [1] "Indiana Hub RT Peak"      "Mid C Peak"
## [3] "Nepool MH DA LMP Peak"    "NP15 EZ Gen DA LMP Peak"
## [5] "Palo Verde Peak"          "PJM WH Real Time Peak"
## [7] "SP15 EZ Gen DA LMP Peak"
```

```r
unique(data_2021$`Price hub`) # 7 Peaks
```

```
## [1] "Indiana Hub RT Peak"      "Mid C Peak"
## [3] "Nepool MH DA LMP Peak"    "NP15 EZ Gen DA LMP Peak"
## [5] "Palo Verde Peak"          "PJM WH Real Time Peak"
## [7] "SP15 EZ Gen DA LMP Peak"
```

```r
unique(data_2022$`Price hub`) # 7 Peaks
```

```
## [1] "Indiana Hub RT Peak"      "Mid C Peak"
## [3] "Nepool MH DA LMP Peak"    "NP15 EZ Gen DA LMP Peak"
## [5] "Palo Verde Peak"          "PJM WH Real Time Peak"
## [7] "SP15 EZ Gen DA LMP Peak"
```

```r
unique(data_2023$`Price hub`) # 7 Peaks
```

```
## [1] "Indiana Hub RT Peak"      "Mid C Peak"
## [3] "Nepool MH DA LMP Peak"    "NP15 EZ Gen DA LMP Peak"
## [5] "Palo Verde Peak"          "PJM WH Real Time Peak"
## [7] "SP15 EZ Gen DA LMP Peak"
```

```r
unique(data_2024$`Price hub`) # 7 Peaks
```

```
## [1] "Indiana Hub RT Peak"      "Mid C Peak"
## [3] "Nepool MH DA LMP Peak"    "NP15 EZ Gen DA LMP Peak"
## [5] "Palo Verde Peak"          "PJM WH Real Time Peak"
## [7] "SP15 EZ Gen DA LMP Peak"
```

Comined Dataset

```r
combined_data <- rbind(data_2014, data_2015, data_2016, data_2017, data_2018, data_2019, data_2020, data
combined_data
```

```
## # A tibble: 15,315 x 11
##    `Price hub`    `Trade date`        `Delivery start date` `Delivery end date`
##    <chr>          <dttm>              <dttm>                <dttm>
##  1 ERCOT North 34~ 2014-04-14 00:00:00 2014-04-15 00:00:00   2014-04-15 00:00:00
##  2 ERCOT North 34~ 2014-04-15 00:00:00 2014-04-16 00:00:00   2014-04-16 00:00:00
##  3 ERCOT North 34~ 2014-04-16 00:00:00 2014-04-17 00:00:00   2014-04-17 00:00:00
##  4 ERCOT North 34~ 2014-04-17 00:00:00 2014-04-18 00:00:00   2014-04-18 00:00:00
##  5 ERCOT North 34~ 2014-04-21 00:00:00 2014-04-22 00:00:00   2014-04-22 00:00:00
##  6 ERCOT North 34~ 2014-04-22 00:00:00 2014-04-23 00:00:00   2014-04-23 00:00:00
##  7 ERCOT North 34~ 2014-04-23 00:00:00 2014-04-24 00:00:00   2014-04-24 00:00:00
```

```
##  8 ERCOT North 34~ 2014-04-24 00:00:00 2014-04-25 00:00:00    2014-04-25 00:00:00
##  9 ERCOT North 34~ 2014-04-25 00:00:00 2014-04-28 00:00:00    2014-04-28 00:00:00
## 10 ERCOT North 34~ 2014-04-28 00:00:00 2014-04-29 00:00:00    2014-04-29 00:00:00
## # i 15,305 more rows
## # i 7 more variables: `High price $/MWh` <dbl>, `Low price $/MWh` <dbl>,
## #   `Wtd avg price $/MWh` <dbl>, Change <dbl>, `Daily volume MWh` <dbl>,
## #   `Number of trades` <dbl>, `Number of counterparties` <dbl>
```

```r
# Plot the data

# Make sure the dates are in the correct format
combined_data$`Trade date` <- as.Date(combined_data$`Trade date`)

# Filter dataset for "Palo Verde Peak"
palo_verde_peak <- combined_data %>% filter(`Price hub` == 'Palo Verde Peak')

# Rearrange "Change" column from largest to smallest
palo_verde_peak %>% arrange(desc(Change))
```

```
## # A tibble: 2,578 x 11
##    `Price hub`     `Trade date` `Delivery start date` `Delivery end date`
##    <chr>           <date>       <dttm>                <dttm>
##  1 Palo Verde Peak 2021-06-16   2021-06-17 00:00:00   2021-06-17 00:00:00
##  2 Palo Verde Peak 2020-08-17   2020-08-18 00:00:00   2020-08-18 00:00:00
##  3 Palo Verde Peak 2023-08-15   2023-08-16 00:00:00   2023-08-16 00:00:00
##  4 Palo Verde Peak 2022-09-05   2022-09-06 00:00:00   2022-09-06 00:00:00
##  5 Palo Verde Peak 2022-08-31   2022-09-01 00:00:00   2022-09-02 00:00:00
##  6 Palo Verde Peak 2020-09-03   2020-09-05 00:00:00   2020-09-05 00:00:00
##  7 Palo Verde Peak 2020-08-14   2020-08-17 00:00:00   2020-08-17 00:00:00
##  8 Palo Verde Peak 2020-08-18   2020-08-19 00:00:00   2020-08-19 00:00:00
##  9 Palo Verde Peak 2023-08-14   2023-08-15 00:00:00   2023-08-15 00:00:00
## 10 Palo Verde Peak 2021-06-14   2021-06-15 00:00:00   2021-06-15 00:00:00
## # i 2,568 more rows
## # i 7 more variables: `High price $/MWh` <dbl>, `Low price $/MWh` <dbl>,
## #   `Wtd avg price $/MWh` <dbl>, Change <dbl>, `Daily volume MWh` <dbl>,
## #   `Number of trades` <dbl>, `Number of counterparties` <dbl>
```

```r
# Look at top results
head(palo_verde_peak)
```

```
## # A tibble: 6 x 11
##   `Price hub`     `Trade date` `Delivery start date` `Delivery end date`
##   <chr>           <date>       <dttm>                <dttm>
## 1 Palo Verde Peak 2014-01-02   2014-01-03 00:00:00   2014-01-04 00:00:00
## 2 Palo Verde Peak 2014-01-03   2014-01-06 00:00:00   2014-01-06 00:00:00
## 3 Palo Verde Peak 2014-01-06   2014-01-07 00:00:00   2014-01-07 00:00:00
## 4 Palo Verde Peak 2014-01-07   2014-01-08 00:00:00   2014-01-08 00:00:00
## 5 Palo Verde Peak 2014-01-08   2014-01-09 00:00:00   2014-01-09 00:00:00
## 6 Palo Verde Peak 2014-01-09   2014-01-10 00:00:00   2014-01-11 00:00:00
## # i 7 more variables: `High price $/MWh` <dbl>, `Low price $/MWh` <dbl>,
## #   `Wtd avg price $/MWh` <dbl>, Change <dbl>, `Daily volume MWh` <dbl>,
## #   `Number of trades` <dbl>, `Number of counterparties` <dbl>
```

```
# Top 6 trade dates are:
# 2021-06-16
# 2020-08-17
# 2023-08-15
# 2022-09-05
# 2022-08-31
# 2020-09-03

# Let's look at June 2021:
pvp_june_2021 <- palo_verde_peak %>%
  filter(`Trade date` > as.Date('2021-06-01') & `Trade date` < as.Date('2021-06-30'))
pvp_june_2021
```
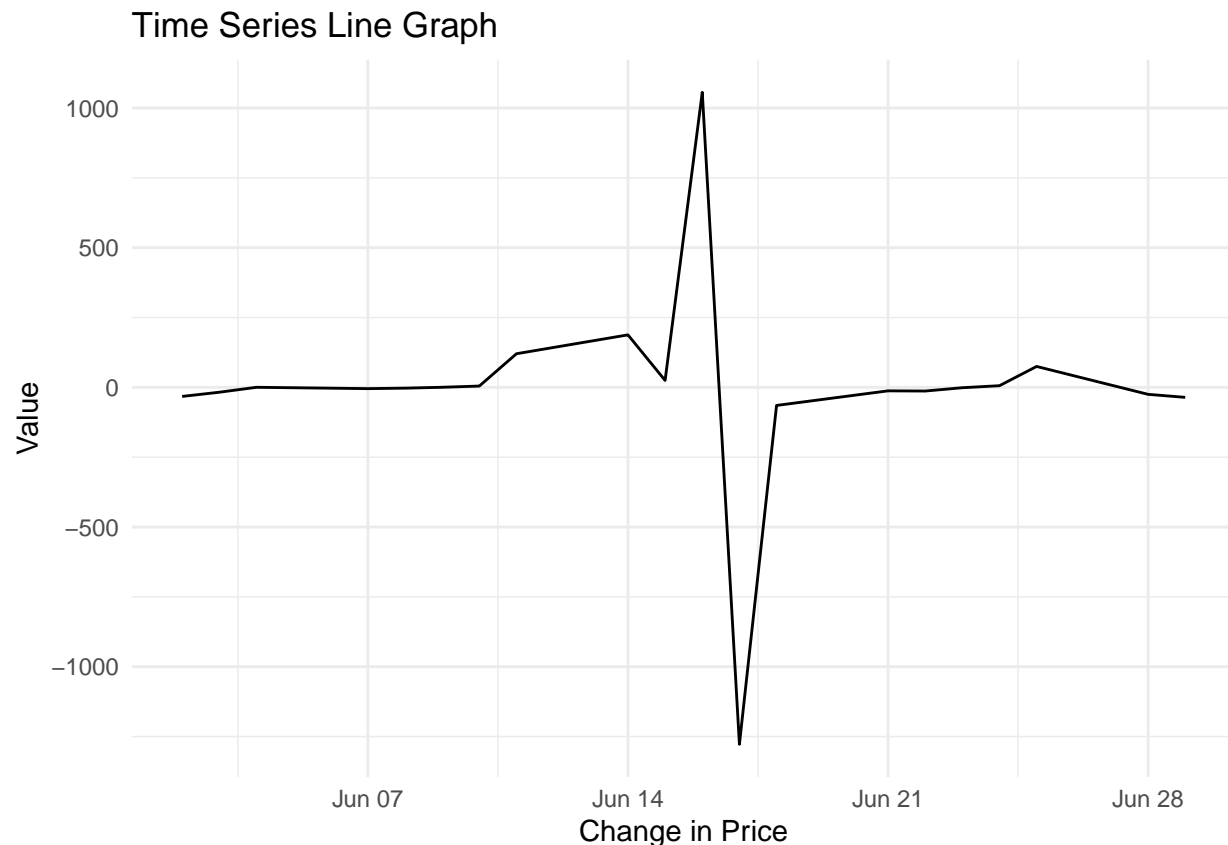
```
## # A tibble: 20 x 11
##    `Price hub`     `Trade date` `Delivery start date` `Delivery end date`
##    <chr>           <date>       <dttm>                <dttm>
##  1 Palo Verde Peak 2021-06-02   2021-06-03 00:00:00   2021-06-03 00:00:00
##  2 Palo Verde Peak 2021-06-03   2021-06-04 00:00:00   2021-06-05 00:00:00
##  3 Palo Verde Peak 2021-06-04   2021-06-07 00:00:00   2021-06-07 00:00:00
##  4 Palo Verde Peak 2021-06-07   2021-06-08 00:00:00   2021-06-08 00:00:00
##  5 Palo Verde Peak 2021-06-08   2021-06-09 00:00:00   2021-06-09 00:00:00
##  6 Palo Verde Peak 2021-06-09   2021-06-10 00:00:00   2021-06-10 00:00:00
##  7 Palo Verde Peak 2021-06-10   2021-06-11 00:00:00   2021-06-12 00:00:00
##  8 Palo Verde Peak 2021-06-11   2021-06-14 00:00:00   2021-06-14 00:00:00
##  9 Palo Verde Peak 2021-06-14   2021-06-15 00:00:00   2021-06-15 00:00:00
## 10 Palo Verde Peak 2021-06-15   2021-06-16 00:00:00   2021-06-16 00:00:00
## 11 Palo Verde Peak 2021-06-16   2021-06-17 00:00:00   2021-06-17 00:00:00
## 12 Palo Verde Peak 2021-06-17   2021-06-18 00:00:00   2021-06-19 00:00:00
## 13 Palo Verde Peak 2021-06-18   2021-06-21 00:00:00   2021-06-21 00:00:00
## 14 Palo Verde Peak 2021-06-21   2021-06-22 00:00:00   2021-06-22 00:00:00
## 15 Palo Verde Peak 2021-06-22   2021-06-23 00:00:00   2021-06-23 00:00:00
## 16 Palo Verde Peak 2021-06-23   2021-06-24 00:00:00   2021-06-24 00:00:00
## 17 Palo Verde Peak 2021-06-24   2021-06-25 00:00:00   2021-06-26 00:00:00
## 18 Palo Verde Peak 2021-06-25   2021-06-28 00:00:00   2021-06-28 00:00:00
## 19 Palo Verde Peak 2021-06-28   2021-06-29 00:00:00   2021-06-29 00:00:00
## 20 Palo Verde Peak 2021-06-29   2021-06-30 00:00:00   2021-06-30 00:00:00
## # i 7 more variables: `High price $/MWh` <dbl>, `Low price $/MWh` <dbl>,
## #   `Wtd avg price $/MWh` <dbl>, Change <dbl>, `Daily volume MWh` <dbl>,
## #   `Number of trades` <dbl>, `Number of counterparties` <dbl>
```

```
ggplot(pvp_june_2021, aes(x = `Trade date`, y = Change)) +
  geom_line() +
  labs(title = "Time Series Line Graph",
       x = "Change in Price",
       y = "Value") +
  theme_minimal()
```

Time Series Line Graph


```r
# Let's look at August & September 2020:
pvp_aug_2020 <- palo_verde_peak %>%
  filter(`Trade date` > as.Date('2020-08-01') & `Trade date` < as.Date('2020-08-31'))
pvp_aug_2020
```

```
## # A tibble: 20 x 11
##    `Price hub`     `Trade date` `Delivery start date` `Delivery end date`
##    <chr>           <date>       <dttm>                <dttm>
##  1 Palo Verde Peak 2020-08-03   2020-08-04 00:00:00   2020-08-04 00:00:00
##  2 Palo Verde Peak 2020-08-04   2020-08-05 00:00:00   2020-08-05 00:00:00
##  3 Palo Verde Peak 2020-08-05   2020-08-06 00:00:00   2020-08-06 00:00:00
##  4 Palo Verde Peak 2020-08-06   2020-08-07 00:00:00   2020-08-08 00:00:00
##  5 Palo Verde Peak 2020-08-07   2020-08-10 00:00:00   2020-08-10 00:00:00
##  6 Palo Verde Peak 2020-08-10   2020-08-11 00:00:00   2020-08-11 00:00:00
##  7 Palo Verde Peak 2020-08-11   2020-08-12 00:00:00   2020-08-12 00:00:00
##  8 Palo Verde Peak 2020-08-12   2020-08-13 00:00:00   2020-08-13 00:00:00
##  9 Palo Verde Peak 2020-08-13   2020-08-14 00:00:00   2020-08-15 00:00:00
## 10 Palo Verde Peak 2020-08-14   2020-08-17 00:00:00   2020-08-17 00:00:00
## 11 Palo Verde Peak 2020-08-17   2020-08-18 00:00:00   2020-08-18 00:00:00
## 12 Palo Verde Peak 2020-08-18   2020-08-19 00:00:00   2020-08-19 00:00:00
## 13 Palo Verde Peak 2020-08-19   2020-08-20 00:00:00   2020-08-20 00:00:00
## 14 Palo Verde Peak 2020-08-20   2020-08-21 00:00:00   2020-08-22 00:00:00
## 15 Palo Verde Peak 2020-08-21   2020-08-24 00:00:00   2020-08-24 00:00:00
## 16 Palo Verde Peak 2020-08-24   2020-08-25 00:00:00   2020-08-25 00:00:00
## 17 Palo Verde Peak 2020-08-25   2020-08-26 00:00:00   2020-08-26 00:00:00
```

```
## 18 Palo Verde Peak 2020-08-26    2020-08-27 00:00:00    2020-08-27 00:00:00
## 19 Palo Verde Peak 2020-08-27    2020-08-28 00:00:00    2020-08-29 00:00:00
## 20 Palo Verde Peak 2020-08-28    2020-08-31 00:00:00    2020-08-31 00:00:00
## # i 7 more variables: 'High price $/MWh' <dbl>, 'Low price $/MWh' <dbl>,
## #   'Wtd avg price $/MWh' <dbl>, Change <dbl>, 'Daily volume MWh' <dbl>,
## #   'Number of trades' <dbl>, 'Number of counterparties' <dbl>
```

```
pvp_sept_2020 <- palo_verde_peak %>%
  filter(`Trade date` > as.Date('2020-09-01') & `Trade date` < as.Date('2020-09-30'))
pvp_sept_2020
```

```
## # A tibble: 19 x 11
##    'Price hub'     'Trade date' 'Delivery start date' 'Delivery end date'
##    <chr>           <date>       <dttm>                <dttm>
##  1 Palo Verde Peak 2020-09-02   2020-09-03 00:00:00   2020-09-04 00:00:00
##  2 Palo Verde Peak 2020-09-03   2020-09-05 00:00:00   2020-09-05 00:00:00
##  3 Palo Verde Peak 2020-09-04   2020-09-08 00:00:00   2020-09-08 00:00:00
##  4 Palo Verde Peak 2020-09-08   2020-09-09 00:00:00   2020-09-09 00:00:00
##  5 Palo Verde Peak 2020-09-09   2020-09-10 00:00:00   2020-09-10 00:00:00
##  6 Palo Verde Peak 2020-09-10   2020-09-11 00:00:00   2020-09-12 00:00:00
##  7 Palo Verde Peak 2020-09-11   2020-09-14 00:00:00   2020-09-14 00:00:00
##  8 Palo Verde Peak 2020-09-14   2020-09-15 00:00:00   2020-09-15 00:00:00
##  9 Palo Verde Peak 2020-09-15   2020-09-16 00:00:00   2020-09-16 00:00:00
## 10 Palo Verde Peak 2020-09-16   2020-09-17 00:00:00   2020-09-17 00:00:00
## 11 Palo Verde Peak 2020-09-17   2020-09-18 00:00:00   2020-09-19 00:00:00
## 12 Palo Verde Peak 2020-09-18   2020-09-21 00:00:00   2020-09-21 00:00:00
## 13 Palo Verde Peak 2020-09-21   2020-09-22 00:00:00   2020-09-22 00:00:00
## 14 Palo Verde Peak 2020-09-22   2020-09-23 00:00:00   2020-09-23 00:00:00
## 15 Palo Verde Peak 2020-09-23   2020-09-24 00:00:00   2020-09-24 00:00:00
## 16 Palo Verde Peak 2020-09-24   2020-09-25 00:00:00   2020-09-26 00:00:00
## 17 Palo Verde Peak 2020-09-25   2020-09-28 00:00:00   2020-09-28 00:00:00
## 18 Palo Verde Peak 2020-09-28   2020-09-29 00:00:00   2020-09-29 00:00:00
## 19 Palo Verde Peak 2020-09-29   2020-09-30 00:00:00   2020-09-30 00:00:00
## # i 7 more variables: 'High price $/MWh' <dbl>, 'Low price $/MWh' <dbl>,
## #   'Wtd avg price $/MWh' <dbl>, Change <dbl>, 'Daily volume MWh' <dbl>,
## #   'Number of trades' <dbl>, 'Number of counterparties' <dbl>
```

Some additional factors to look at:

- $84 million in higher wholesale short-term sales primarily due to: (i) an increase in price and sales volume; and (ii) an increase in capacity sales to affiliates for a tolling PPA (Power Purchase Agreement) entered into in June 2021; (https://www.sec.gov/ix?doc=/Archives/edgar/data/100122/000010012222000020/tep-20211231.htm)

Fixing Hidden Characters in Columns

```
# This showed me that there were hidden columns

unique(c(colnames(data_2014))) # "Delivery \nend date"
```

14

```
## [1] "Price hub"              "Trade date"
## [3] "Delivery start date"    "Delivery end date"
## [5] "High price $/MWh"       "Low price $/MWh"
## [7] "Wtd avg price $/MWh"     "Change"
## [9] "Daily volume MWh"        "Number of trades"
## [11] "Number of counterparties"
```

```r
unique(c(colnames(data_2015))) # "Delivery \nend date"
```

```
## [1] "Price hub"              "Trade date"
## [3] "Delivery start date"    "Delivery end date"
## [5] "High price $/MWh"       "Low price $/MWh"
## [7] "Wtd avg price $/MWh"     "Change"
## [9] "Daily volume MWh"        "Number of trades"
## [11] "Number of counterparties"
```

```r
unique(c(colnames(data_2016))) # "Delivery \nend date"
```

```
## [1] "Price hub"              "Trade date"
## [3] "Delivery start date"    "Delivery end date"
## [5] "High price $/MWh"       "Low price $/MWh"
## [7] "Wtd avg price $/MWh"     "Change"
## [9] "Daily volume MWh"        "Number of trades"
## [11] "Number of counterparties"
```

```r
unique(c(colnames(data_2017))) # "Delivery \r\nend date"
```

```
## [1] "Price hub"              "Trade date"
## [3] "Delivery start date"    "Delivery end date"
## [5] "High price $/MWh"       "Low price $/MWh"
## [7] "Wtd avg price $/MWh"     "Change"
## [9] "Daily volume MWh"        "Number of trades"
## [11] "Number of counterparties"
```

```r
unique(c(colnames(data_2018))) # "Delivery \r\nend date"
```

```
## [1] "Price hub"              "Trade date"
## [3] "Delivery start date"    "Delivery end date"
## [5] "High price $/MWh"       "Low price $/MWh"
## [7] "Wtd avg price $/MWh"     "Change"
## [9] "Daily volume MWh"        "Number of trades"
## [11] "Number of counterparties"
```

```r
unique(c(colnames(data_2019))) # "Delivery \r\nend date"
```

```
## [1] "Price hub"              "Trade date"
## [3] "Delivery start date"    "Delivery end date"
## [5] "High price $/MWh"       "Low price $/MWh"
## [7] "Wtd avg price $/MWh"     "Change"
## [9] "Daily volume MWh"        "Number of trades"
## [11] "Number of counterparties"
```

```r
unique(c(colnames(data_2020))) # "Delivery \r\nend date"
```

```
##  [1] "Price hub"              "Trade date"
##  [3] "Delivery start date"    "Delivery end date"
##  [5] "High price $/MWh"       "Low price $/MWh"
##  [7] "Wtd avg price $/MWh"     "Change"
##  [9] "Daily volume MWh"       "Number of trades"
## [11] "Number of counterparties"
```

```r
unique(c(colnames(data_2021))) # "Delivery \r\nend date"
```

```
##  [1] "Price hub"              "Trade date"
##  [3] "Delivery start date"    "Delivery end date"
##  [5] "High price $/MWh"       "Low price $/MWh"
##  [7] "Wtd avg price $/MWh"     "Change"
##  [9] "Daily volume MWh"       "Number of trades"
## [11] "Number of counterparties"
```

```r
unique(c(colnames(data_2022))) # "Delivery \r\nend date"
```

```
##  [1] "Price hub"              "Trade date"
##  [3] "Delivery start date"    "Delivery end date"
##  [5] "High price $/MWh"       "Low price $/MWh"
##  [7] "Wtd avg price $/MWh"     "Change"
##  [9] "Daily volume MWh"       "Number of trades"
## [11] "Number of counterparties"
```

```r
unique(c(colnames(data_2023))) # "Delivery \r\nend date"
```

```
##  [1] "Price hub"              "Trade date"
##  [3] "Delivery start date"    "Delivery end date"
##  [5] "High price $/MWh"       "Low price $/MWh"
##  [7] "Wtd avg price $/MWh"     "Change"
##  [9] "Daily volume MWh"       "Number of trades"
## [11] "Number of counterparties"
```

```r
unique(c(colnames(data_2024))) # "Delivery \r\nend date"
```

```
##  [1] "Price hub"              "Trade date"
##  [3] "Delivery start date"    "Delivery end date"
##  [5] "High price $/MWh"       "Low price $/MWh"
##  [7] "Wtd avg price $/MWh"     "Change"
##  [9] "Daily volume MWh"       "Number of trades"
## [11] "Number of counterparties"
```

Including Plots

You can also embed plots, for example:
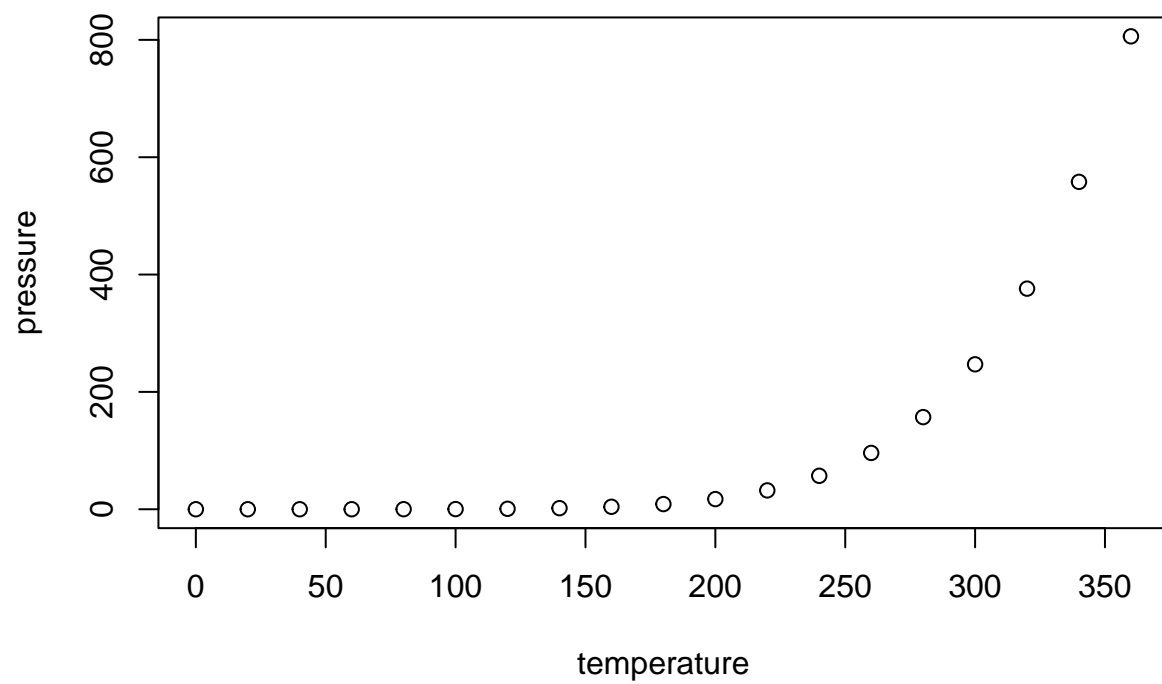
Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.