Time Series Analysis: Week 2 - April 8

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"You can observe a lot just by watching"

Berra

Load ffp3 package

- Load the following packages

```
library(tidyverse)
library(fpp3)
library(tswge)
```

Graphs

Plots allow us to identify:

- Patterns
- Unusual observations
- Changes over time
- Relationships between variables.

US GDP

Filter the US data from global_economy

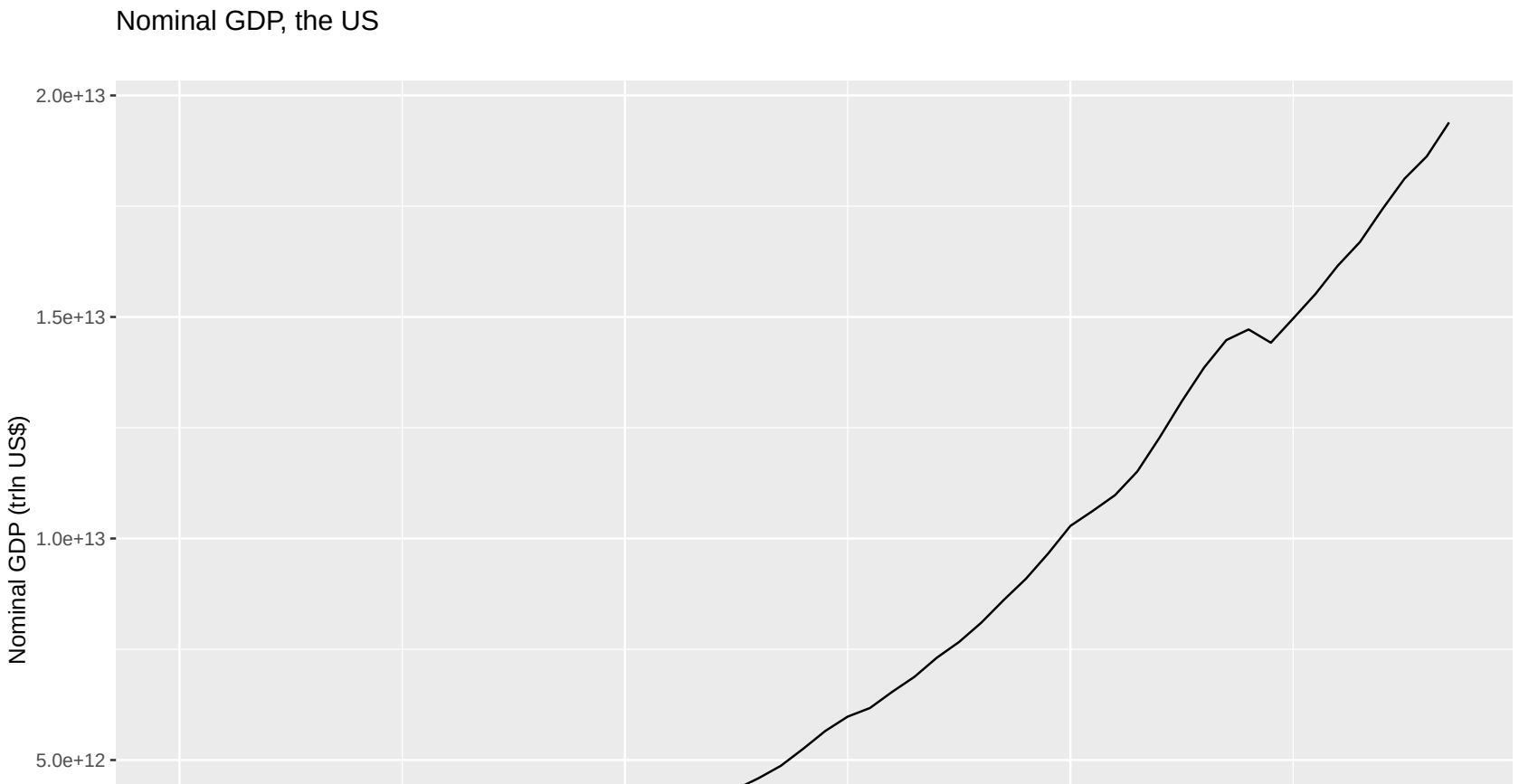
```
us_economy <- global_economy %>%
filter(Country == "United States")

print(us_economy)
```

```
# A tsibble: 58 x 9 [1Y]
# Key:       Country [1]
   Country       Code   Year         GDP Growth   CPI Impor
   <fct>         <fct> <dbl>       <dbl>  <dbl> <dbl>   <db
 1 United States USA    1960     5.43e11  NA      13.6    4.
 2 United States USA    1961     5.63e11   2.30   13.7    4.
 3 United States USA    1962     6.05e11   6.10   13.9    4.
 4 United States USA    1963     6.39e11   4.40   14.0    4.
 5 United States USA    1964     6.86e11   5.80   14.2    4.
 6 United States USA    1965     7.44e11   6.40   14.4    4.
 7 United States USA    1966     8.15e11   6.50   14.9    4.
```

The US GDP

Plot the US GDP

```
us_economy |> autoplot(GDP) +
    labs(title = "Nominal GDP, the US ",
       subtitle = "",
       y = "Nominal GDP (trln US$)")
```



Global Temperature

```
global_temp<- tibble(
  Year = 1850:2009,
  Temperature = hadley
)

global_temp<- global_temp|>
  as_tsibble(index=Year)


global_temp|>
  autoplot(Temperature)
```

Time series patterns

Trend pattern exists when there is a long-term increase or decrease in the data.

Seasonal pattern exists when a series is influenced by seasonal factors (e.g., the quarter of the year, the month, or day of the week).

Cyclic pattern exists when data exhibit rises and falls that are *not of fixed period*

Time series components

Differences between seasonal and cyclic patterns:

- seasonal pattern constant length; cyclic pattern variable length
- average length of cycle longer than length of seasonal pattern
- magnitude of cycle more variable than magnitude of seasonal pattern

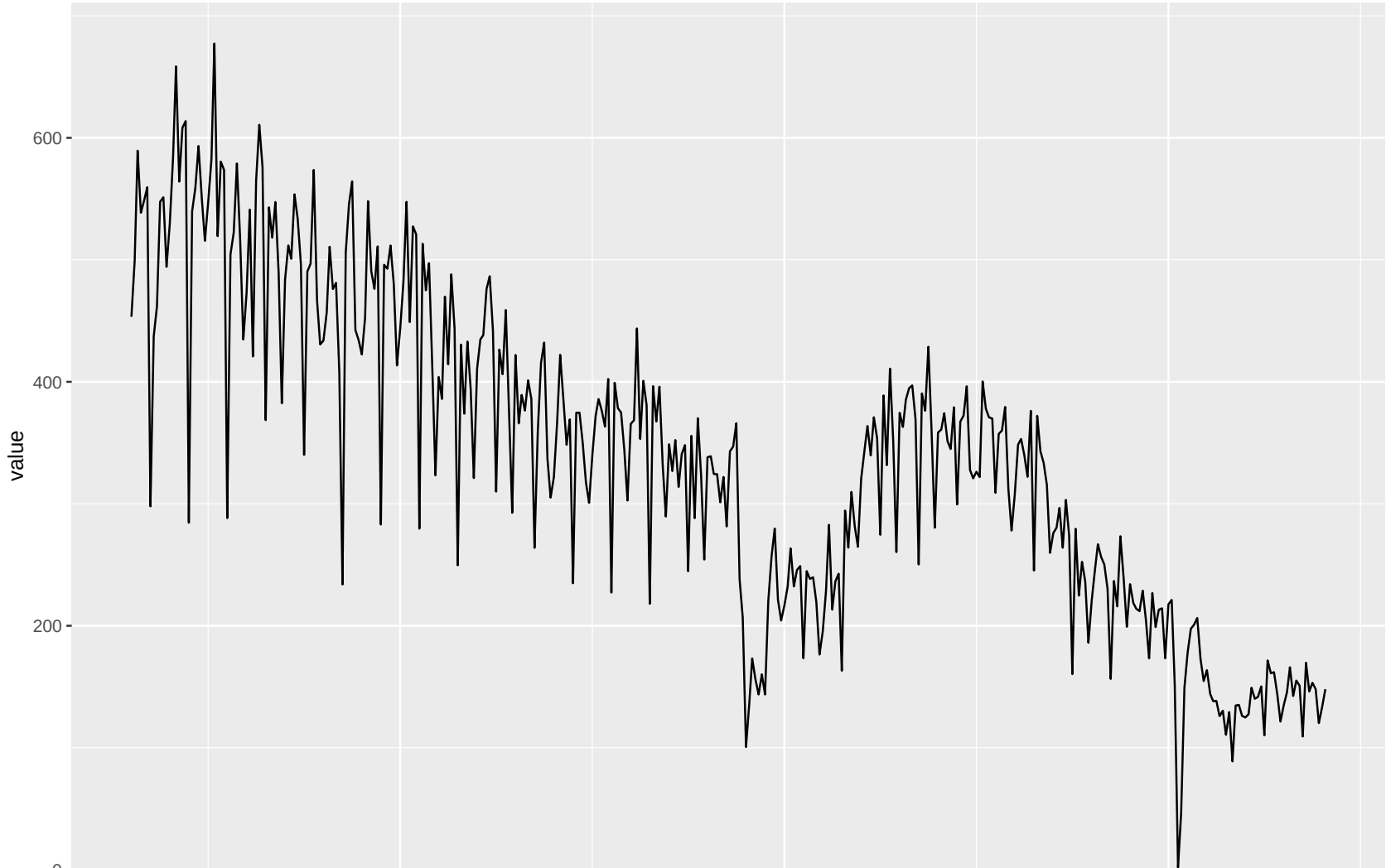
Domestic Car Production

```
library(fredr)

fredr_set_key("33223ed79fd61ea6915872b9a2cc2256")

car_prod <- fredr(
  series_id = "DAUPNSA"
)

car_prod<- car_prod|>
  mutate(date = yearmonth(date)) |>
  as_tsibble(
    index = date
  )
```

Domestic Car Production

```
car_prod|>autoplot()
```

```
Plot variable not specified, automatically selected `.vars
```

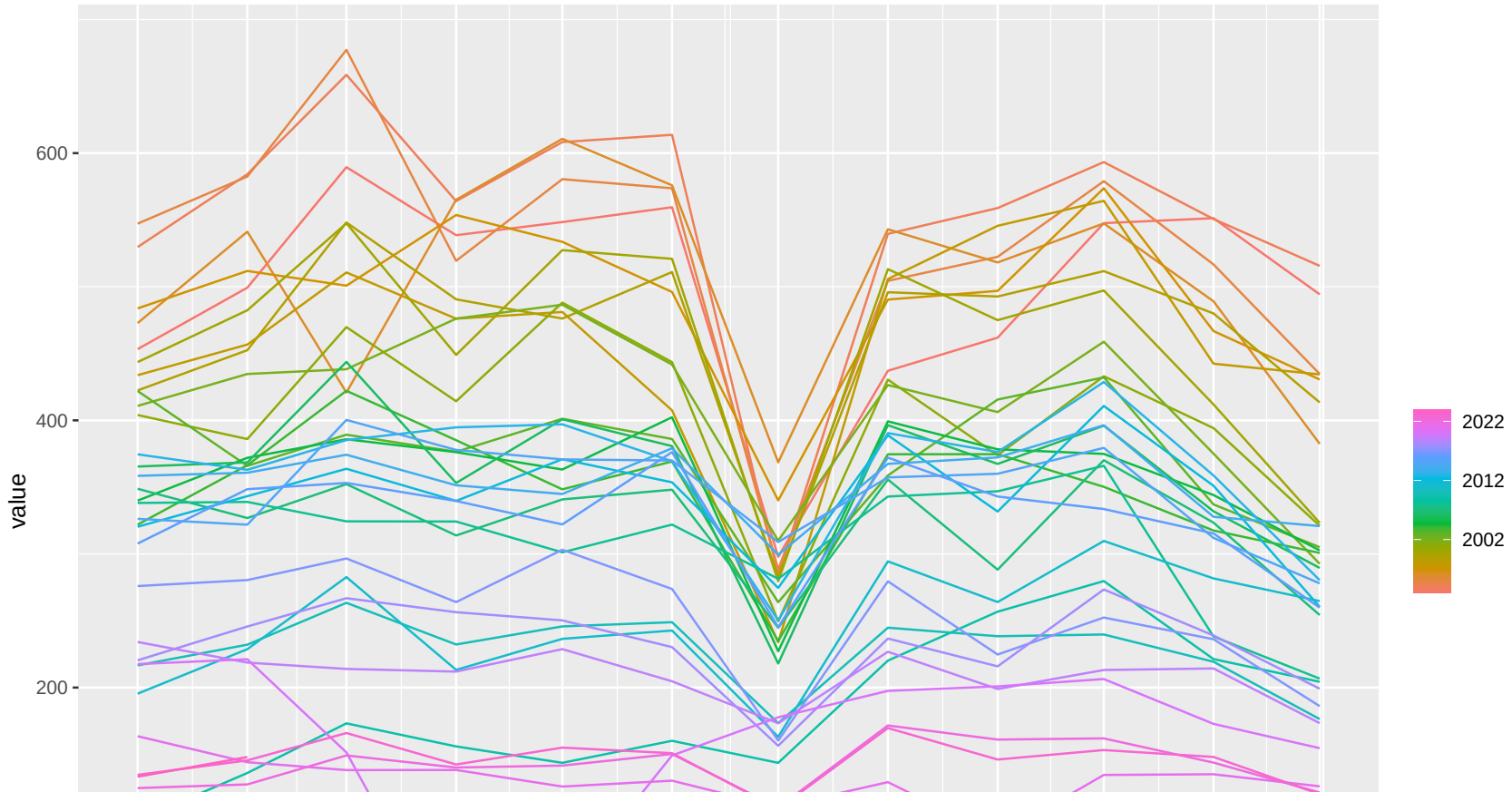


Domestic Car Production

Use `gg_season()` to plot the data against the individual "seasons"

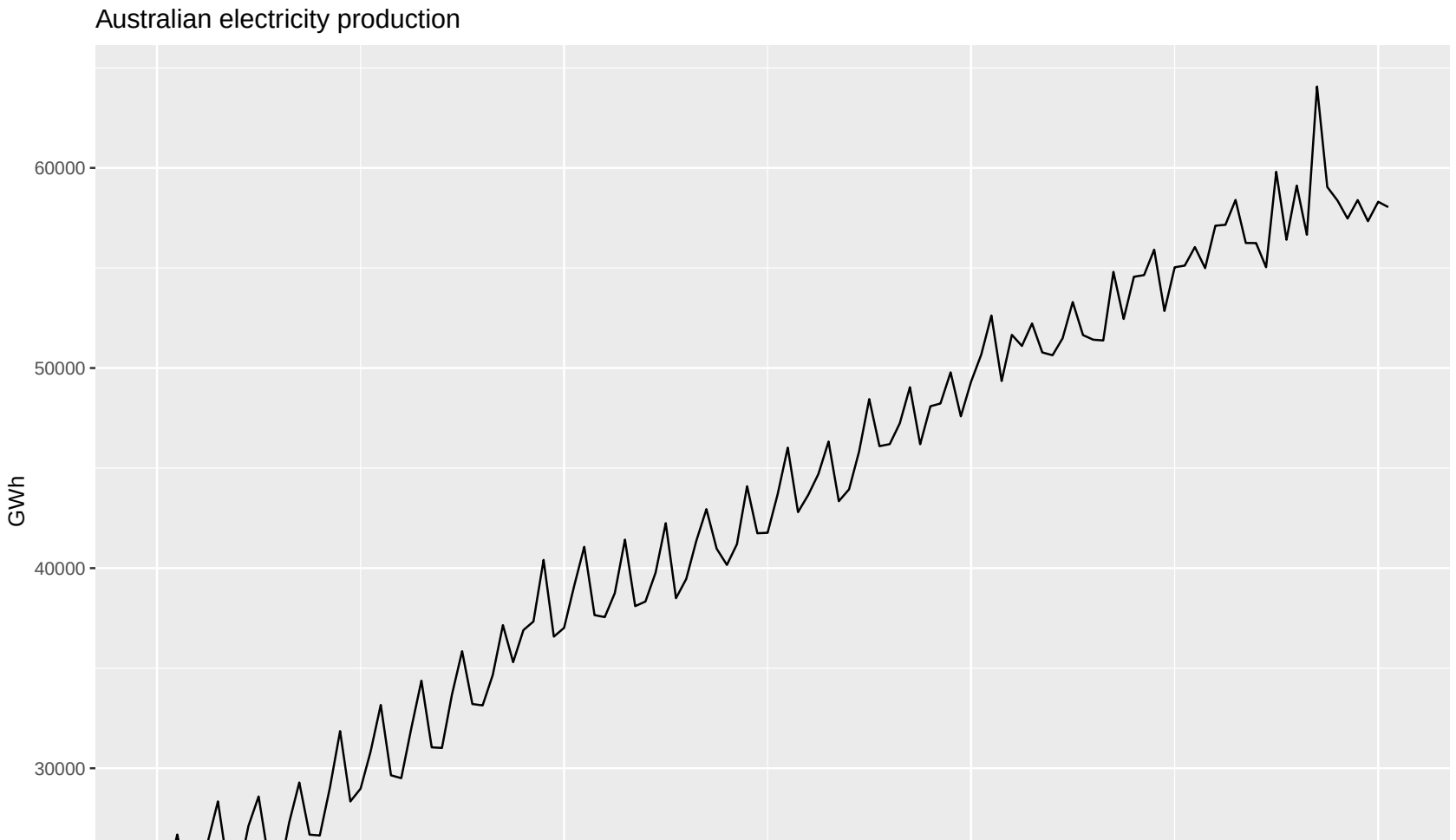
```
car_prod|>
  gg_season()
```

```
Plot variable not specified, automatically selected `y = va
```



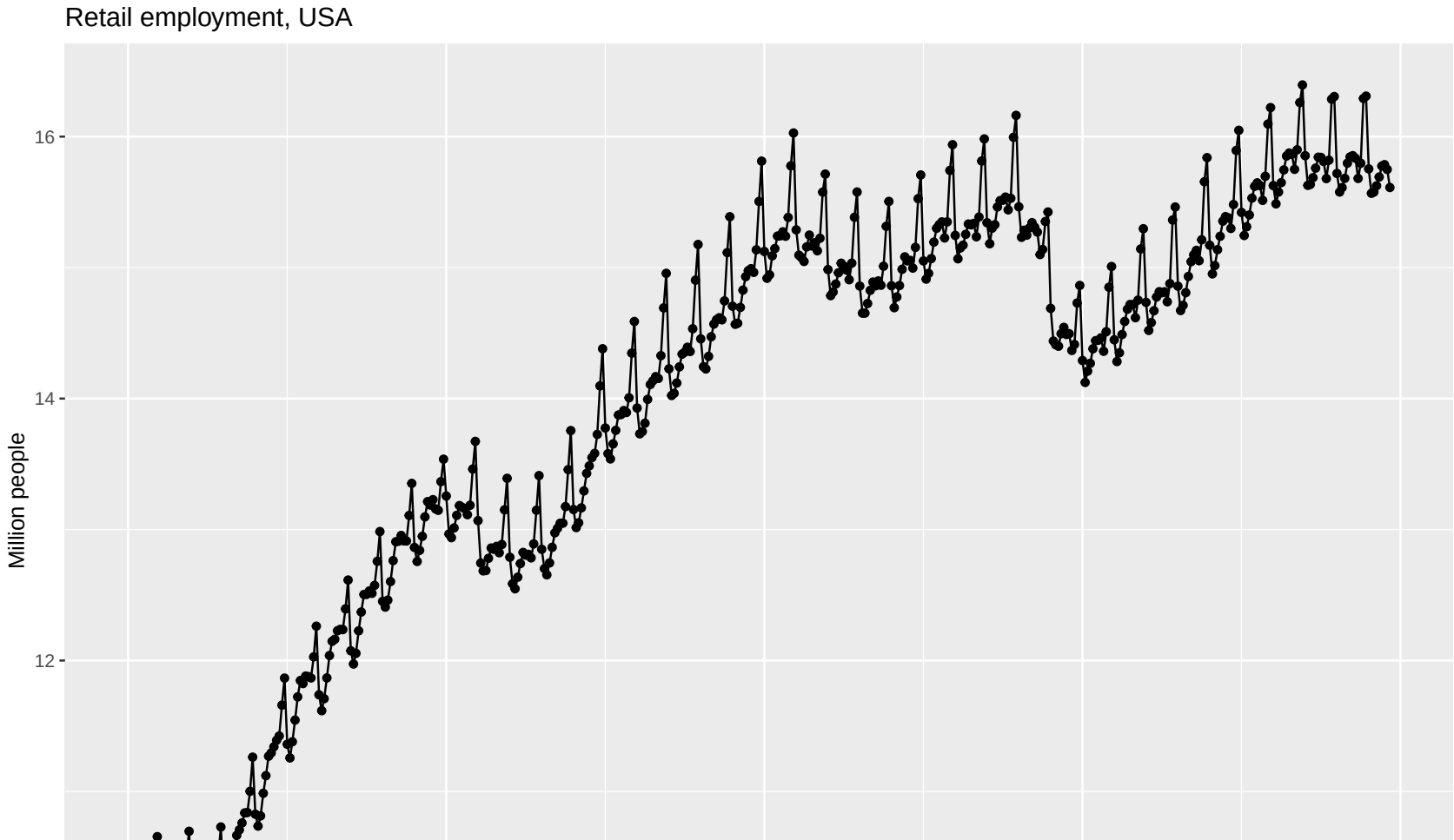
Australian Electricity Production

```
aus_production |>
  filter(year(Quarter) >= 1980) |>
  autoplot(Electricity) +
  labs(y = "GWh", title = "Australian electricity productio
```



The US Retail Employment

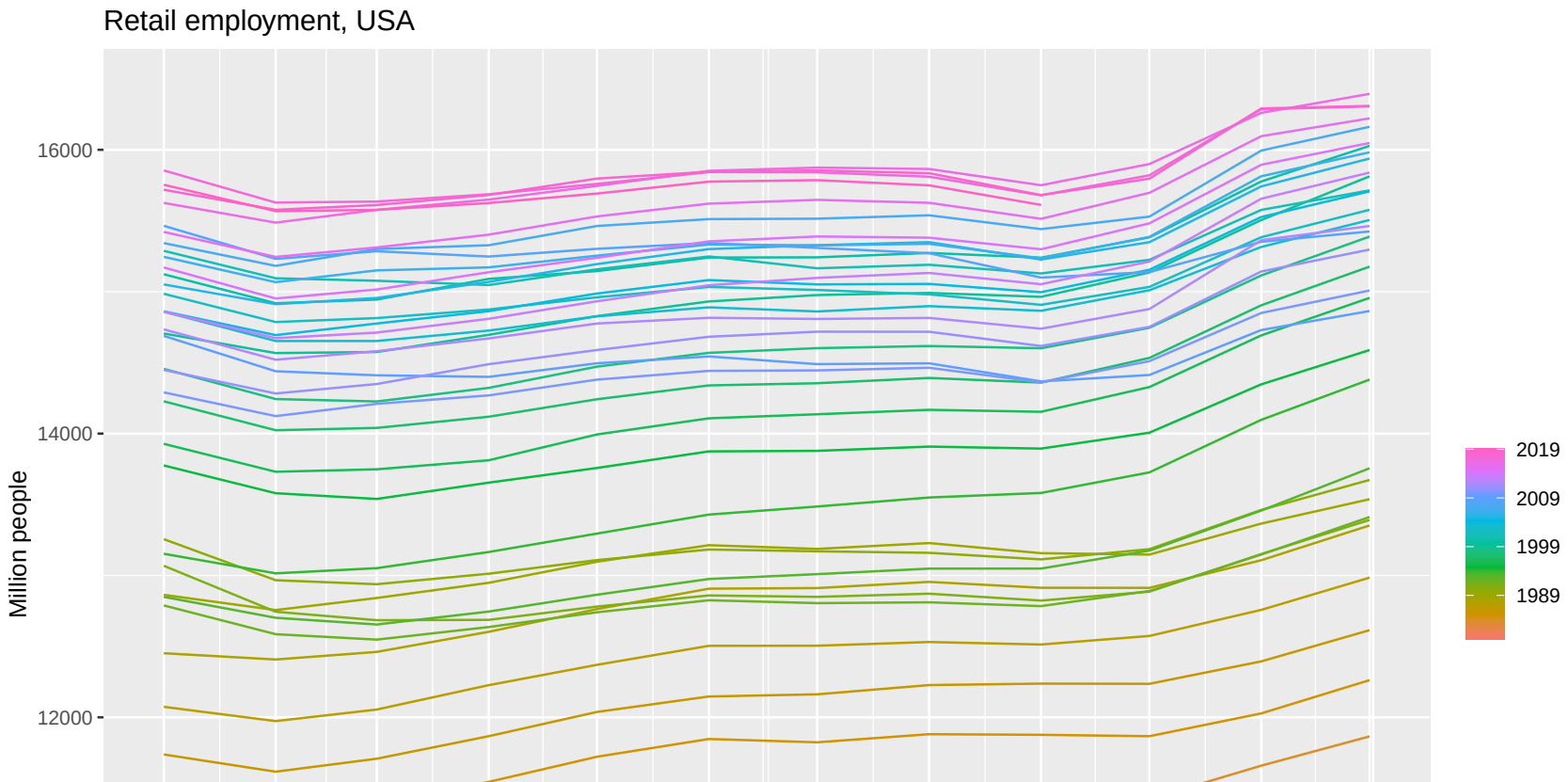
```
us_employment |>
  filter(Title == "Retail Trade", year(Month) >= 1980) |>
  autoplot(Employed / 1e3) + geom_point() +
  labs(y = "Million people", title = "Retail employment, US
```



The US Retail Employment

```
us_employment |>
  filter(Title == "Retail Trade", year(Month) >= 1980) |>
  gg_season()+
  labs(y = "Million people", title = "Retail employment, US
```

```
Plot variable not specified, automatically selected `y = En
```



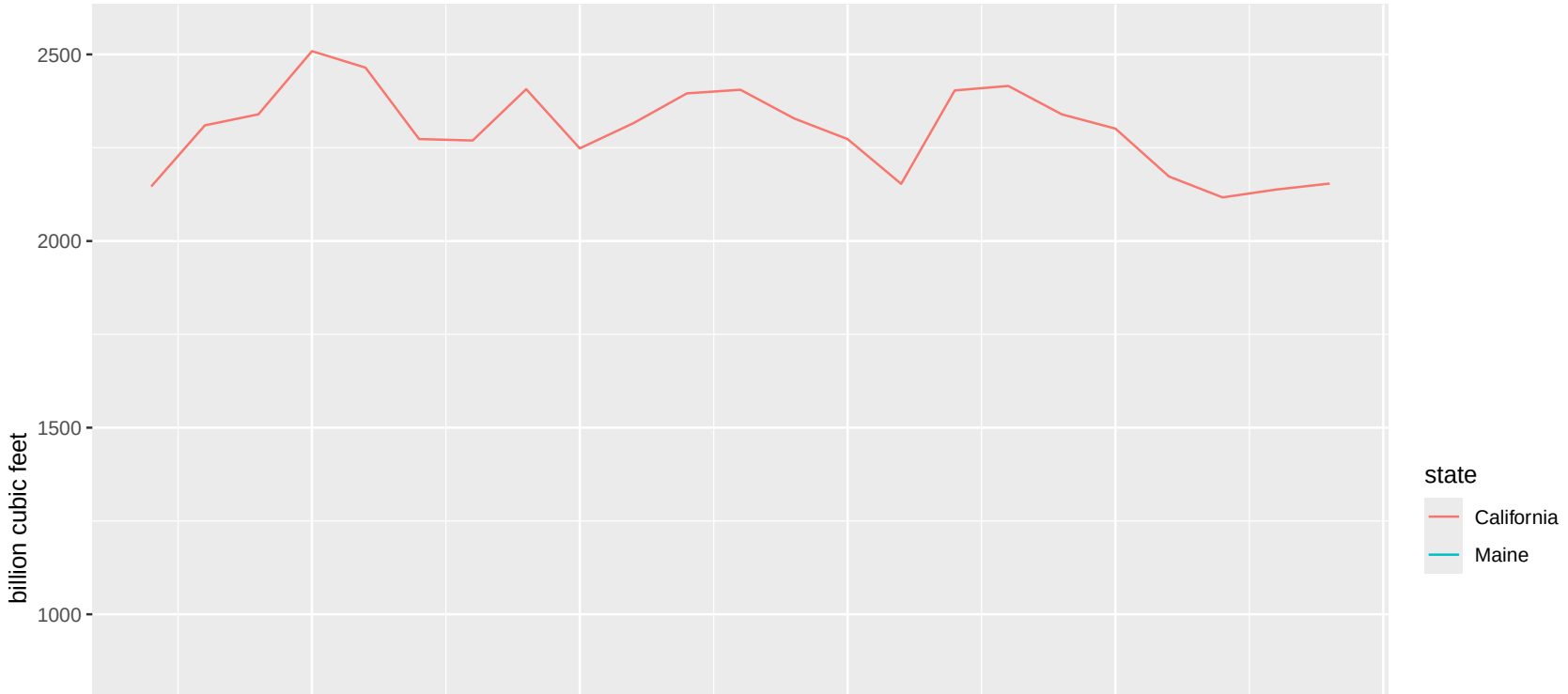
US Gas Consumption

```
#install.packages('USgas')
library(USgas)

us_total
```

	year	state	y
1	1997	Alabama	324158
2	1998	Alabama	329134
3	1999	Alabama	337270
4	2000	Alabama	353614
5	2001	Alabama	332693
6	2002	Alabama	379343
7	2003	Alabama	350345
8	2004	Alabama	382367
9	2005	Alabama	353156
10	2006	Alabama	391093
11	2007	Alabama	418512
12	2008	Alabama	404157

CA and ME gas consumption

```
us_tsibble <- us_total |>
  as_tsibble(index=year, key=state)
# Draw CA and ME gas consumption over time
us_tsibble |>
  filter(state %in% c("California","Maine")) |>
  autoplot(y/1e3) +
  labs(y = "billion cubic feet")
```



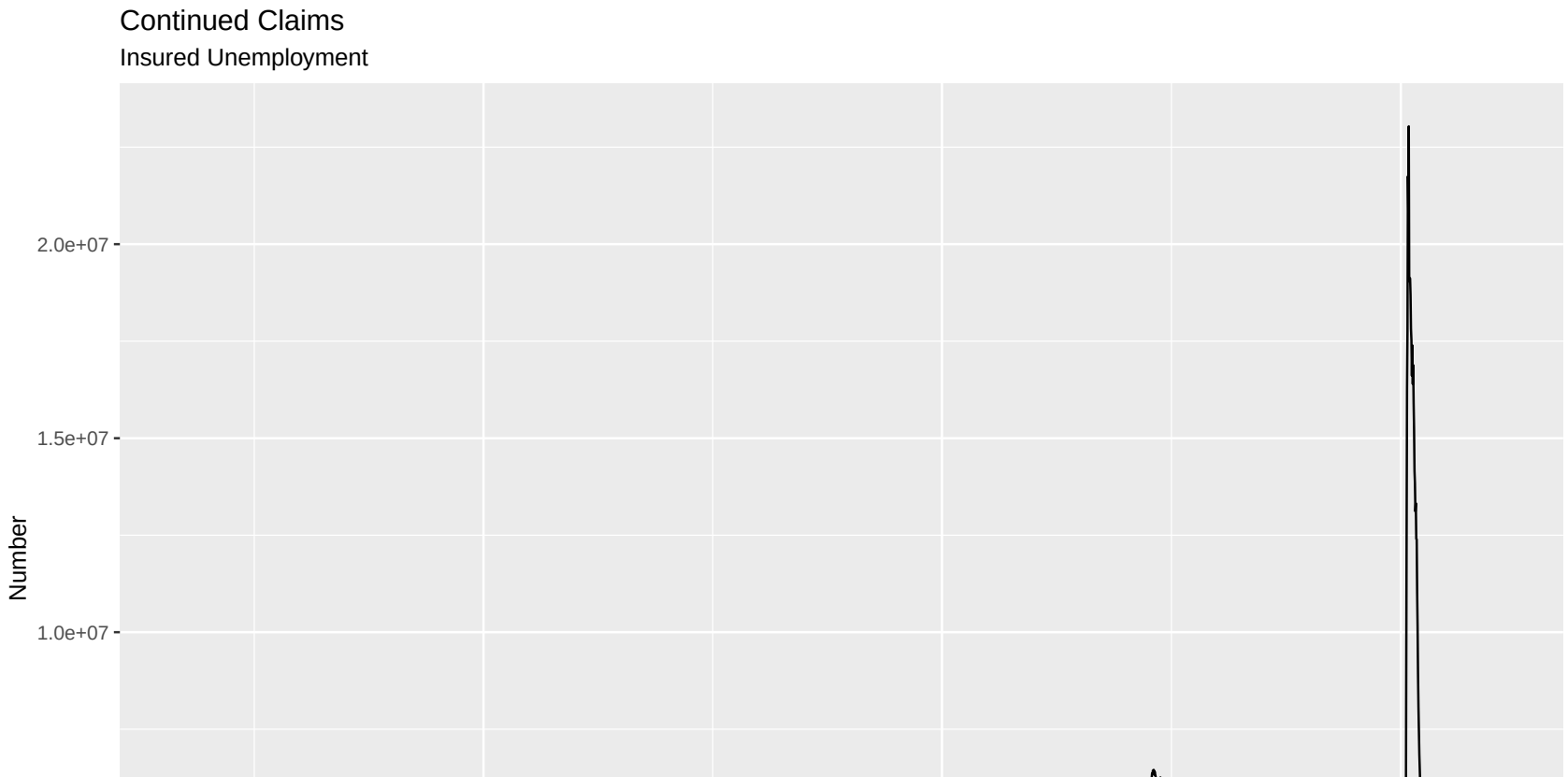
Unemployment Claims

```
un_claims <- fredr(
  series_id = "CCNSA"
)

un_claims<- un_claims|>
  mutate(date = yearweek(date)) |>
  as_tsibble(
    index = date
  )
```

Unemployment Claims

```
un_claims|>autoplot()+
    labs(title = "Continued Claims ",
       subtitle = "Insured Unemployment",
       y = "Number")
```

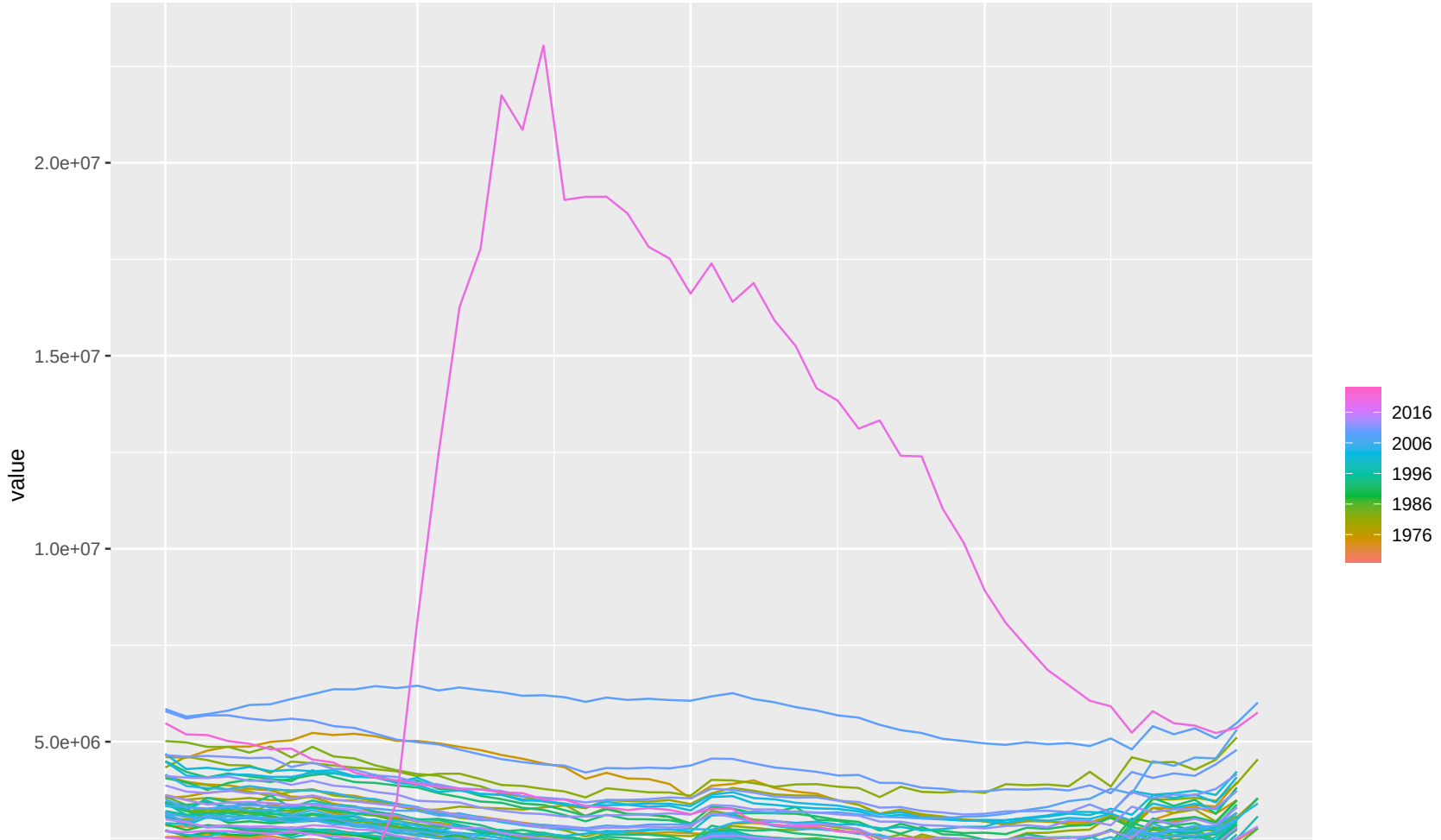
```
Plot variable not specified, automatically selected `.vars
```



Unemployment Claims

```
un_claims|>
  gg_season()
```

```
Plot variable not specified, automatically selected `y = va
```



Electricity Consumption

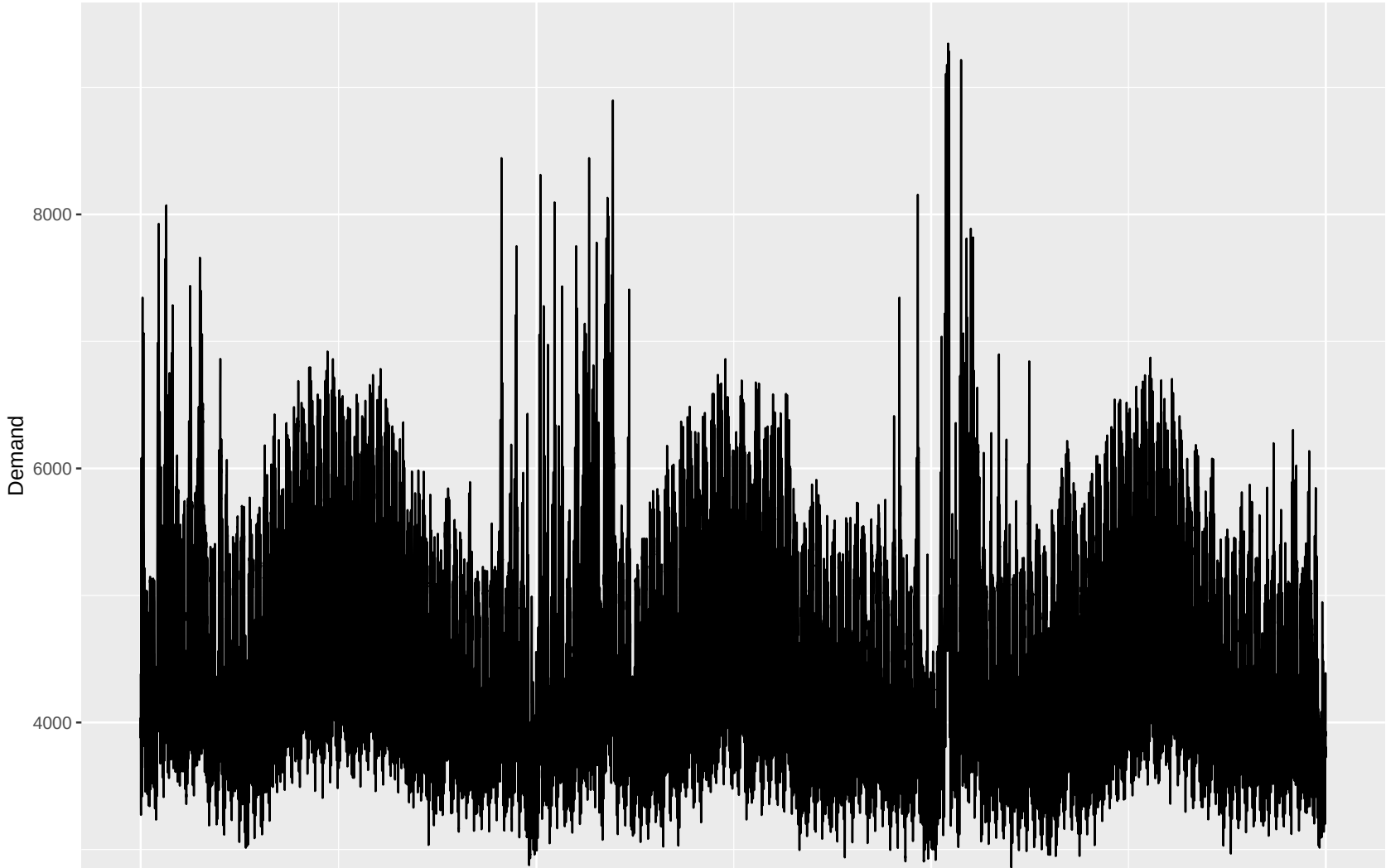
```
vic_elec
```

```
# A tsibble: 52,608 x 5 [30m] <Australia/Melbourne>
   Time                Demand Temperature Date       Holida
   <dttm>               <dbl>       <dbl> <date>     <lgl>
 1 2012-01-01 00:00:00  4383.        21.4 2012-01-01 TRUE
 2 2012-01-01 00:30:00  4263.        21.0 2012-01-01 TRUE
 3 2012-01-01 01:00:00  4049.        20.7 2012-01-01 TRUE
 4 2012-01-01 01:30:00  3878.        20.6 2012-01-01 TRUE
 5 2012-01-01 02:00:00  4036.        20.4 2012-01-01 TRUE
 6 2012-01-01 02:30:00  3866.        20.2 2012-01-01 TRUE
 7 2012-01-01 03:00:00  3694.        20.1 2012-01-01 TRUE
 8 2012-01-01 03:30:00  3562.        19.6 2012-01-01 TRUE
 9 2012-01-01 04:00:00  3433.        19.1 2012-01-01 TRUE
10 2012-01-01 04:30:00  3359.        19.0 2012-01-01 TRUE
# i 52,598 more rows
```

Electricity Consumption

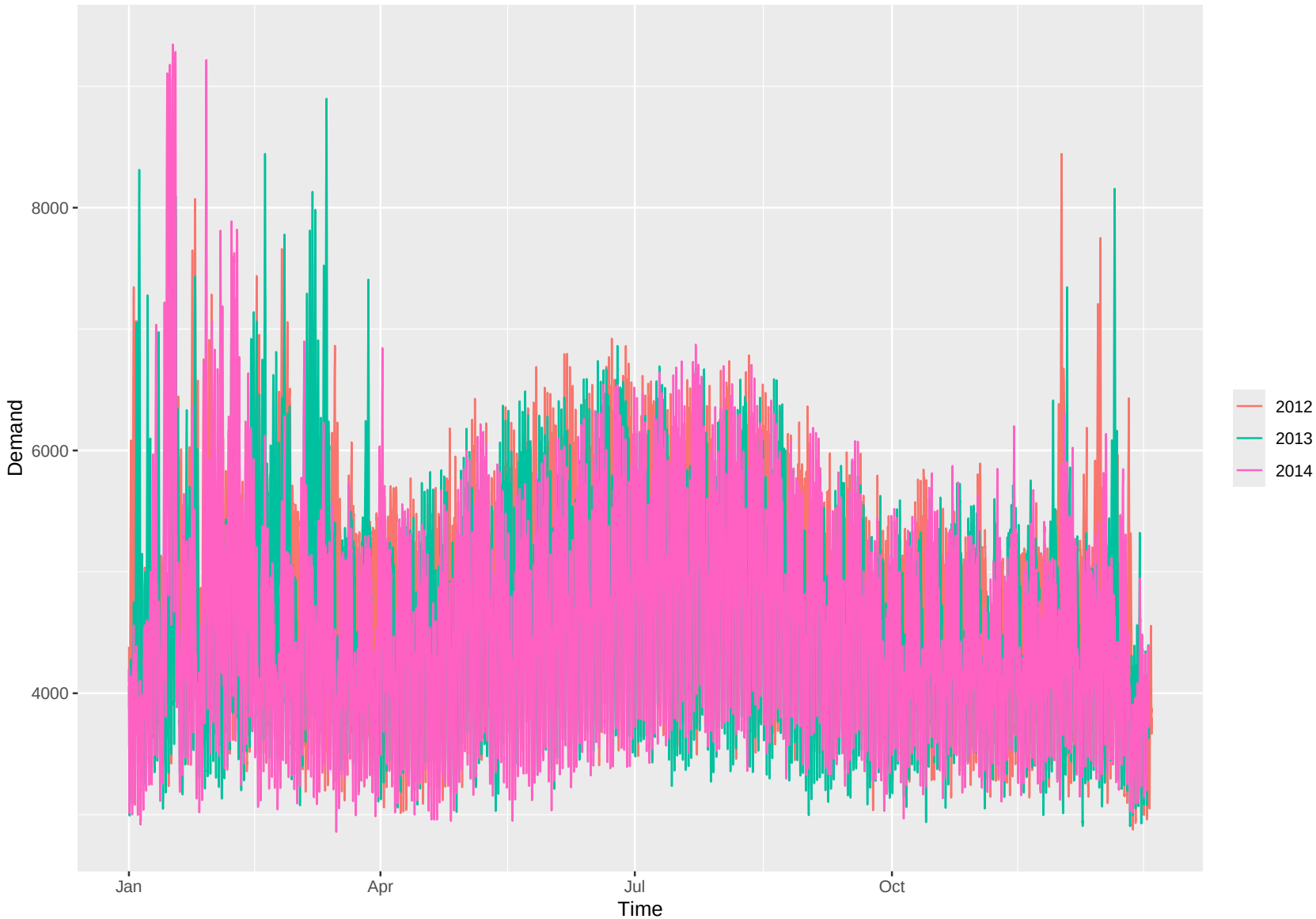
```
vic_elec |> autoplot()
```

```
Plot variable not specified, automatically selected `.vars
```



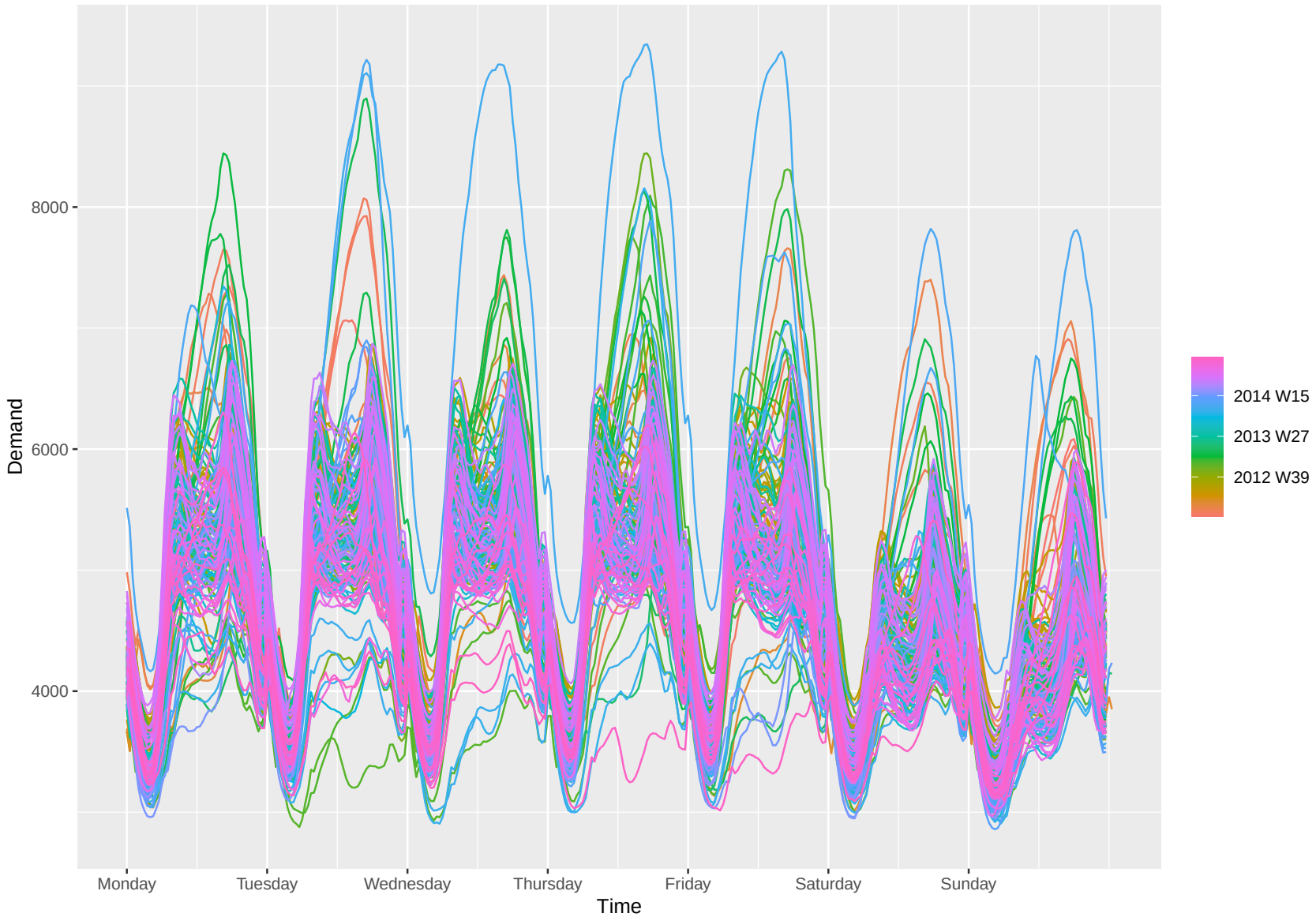
Electricity Consumption

```
vic_elec |> gg_season(Demand)
```



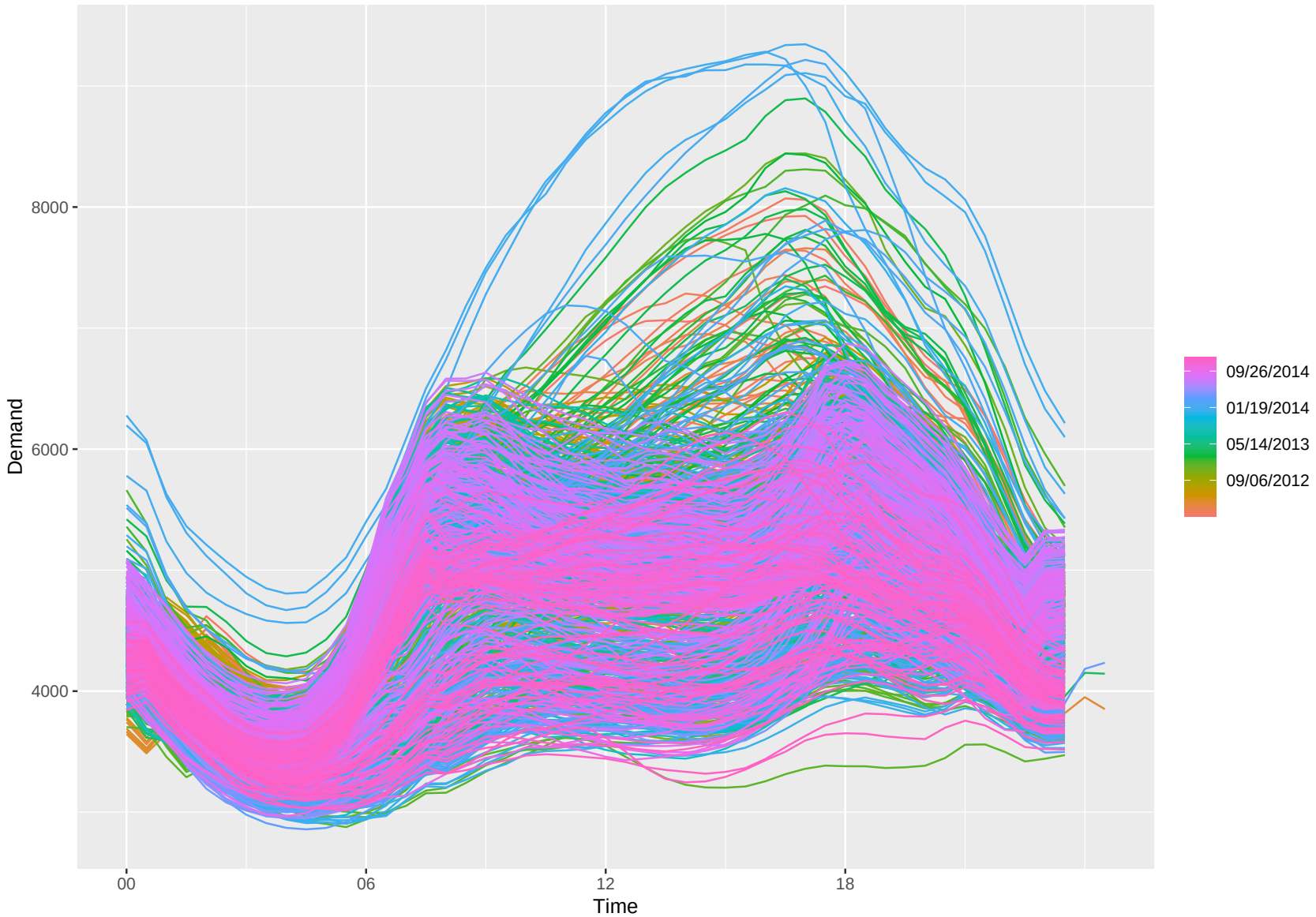
Electricity Consumption

```
vic_elec |> gg_season(Demand, period = "week")
```



Electricity Consumption

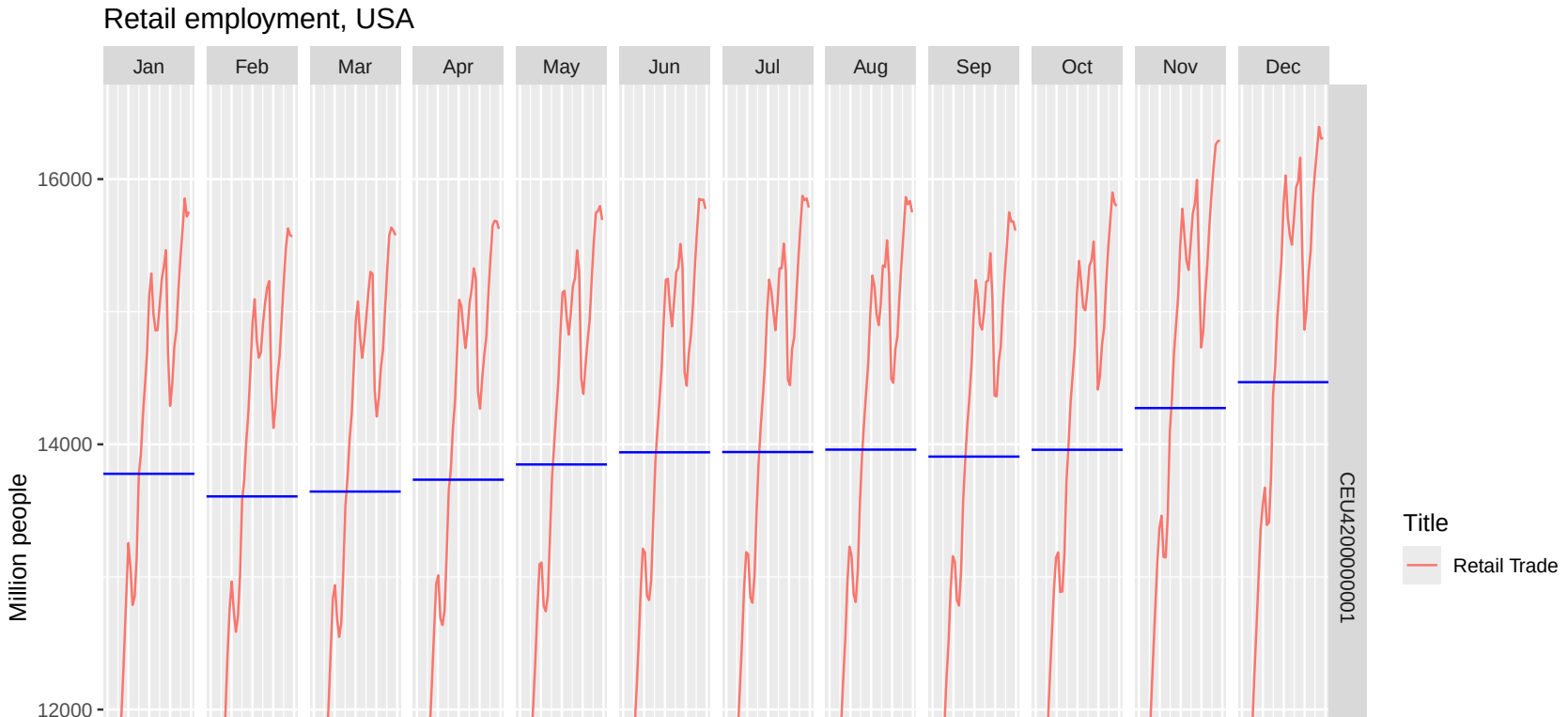
```
vic_elec |> gg_season(Demand, period = "day")
```



The US Retail Employment

```
us_employment |>
  filter(Title == "Retail Trade", year(Month) >= 1980) |>
  gg_subseries()+
  labs(y = "Million people", title = "Retail employment, US
  aes(color=Title)
```

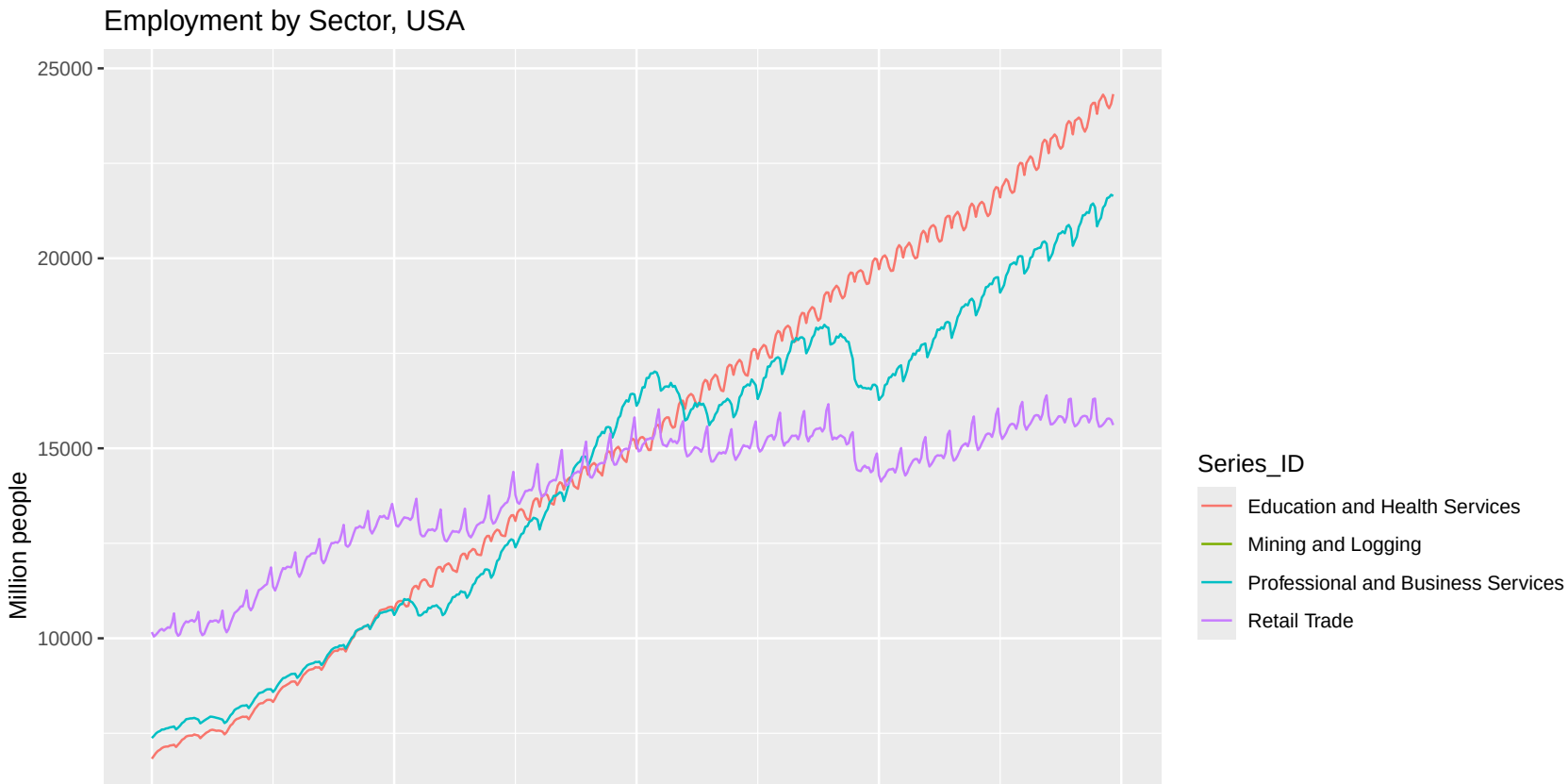
```
Plot variable not specified, automatically selected `y = Em
```



The US Retail Employment

```
us_employment |>
  filter(Title %in% c("Retail Trade", "Mining and Logging",
  autoplot()+
  labs(y = "Million people", title = "Employment by Sector,
```

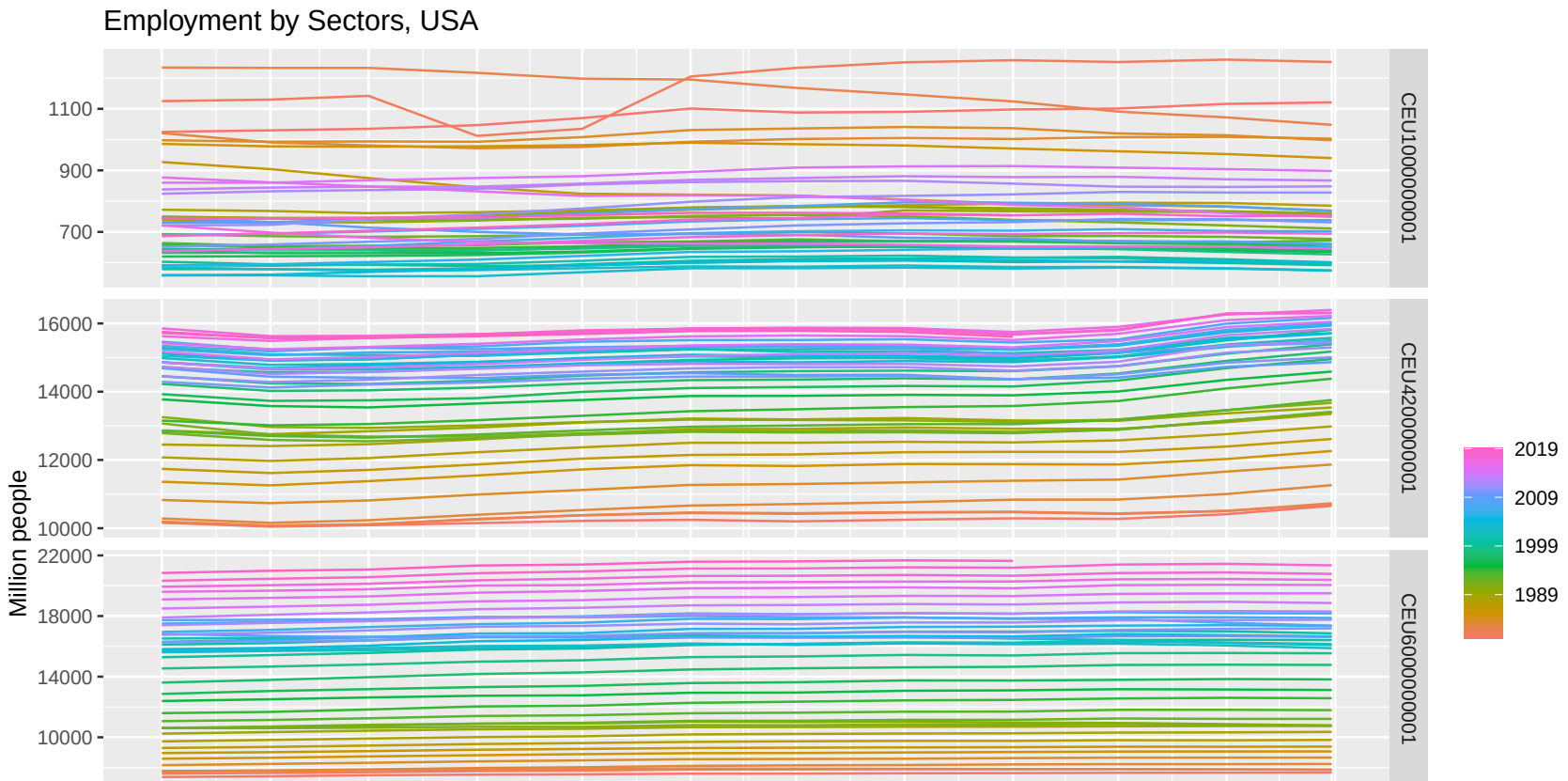
```
Plot variable not specified, automatically selected `.vars
```



The US Retail Employment

```
us_employment |>
  filter(Title %in% c("Retail Trade", "Mining and Logging",
  gg_season()+
  labs(y = "Million people", title = "Employment by Sectors
```

```
Plot variable not specified, automatically selected `y = Em
```



The US Retail Employment

```
us_employment |>
  filter(Title %in% c("Retail Trade", "Mining and Logging"
  gg_subseries(period="month")+
  facet_wrap(vars(Title), nrow = 2, scales = "free_y")+
  labs(y = "Million people", title = "Employment by Sectors
```

```
Plot variable not specified, automatically selected `y = Em
```