Data processing and plots

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Data processing:

```r
df$day_of_week <- factor(df$day_of_week, ordered = TRUE,
                                  levels = c("Monday", "Tuesday", "Wednesday","Thursday",
                                        "Friday", "Saturday", "Sunday"))
df$month <- factor(df$month, ordered = TRUE, levels = c("Jan", "Feb", "Mar", "Apr", "May",
                                        "Jun", "Jul", "Aug", "Sep", "Oct",
                                        "Nov", "Dec"))
# Month and day of week specified as ordered factors

weekdays1 <- c("Monday", "Tuesday", "Wednesday", "Thursday", "Friday")
df$weekday <- factor((df$day_of_week %in% weekdays1),
                levels = c(FALSE, TRUE), labels = c('Weekend', 'Weekday'))
# Weekend/weekday established as factors

df$charging_rate <- factor((df$charge_power_kw >= 7),
                    levels = c(TRUE, FALSE), labels = c('Fast', 'Slow'),
                    ordered = TRUE)
# Fast/slow charging rate established as factors

df$halfHour <- format(as.POSIXct(hms::trunc_hms(df$time, 30*60)), "%H:%M")
# Time binned in half hour intervals, seconds removed
```

```r
df$id <- factor(df$id, ordered = TRUE)
levSeq <- seq(1:length(levels(df$id)))
levSeqChar <- as.character(levSeq)
df$id <- factor(df$id,
  labels = levSeqChar)
df$id <- as.character(df$id)
df$id <- paste("Vehicle", df$id, sep = " ")
# Hashed vehicle id's renamed to "Vehicle X" in a scalable fashion
```
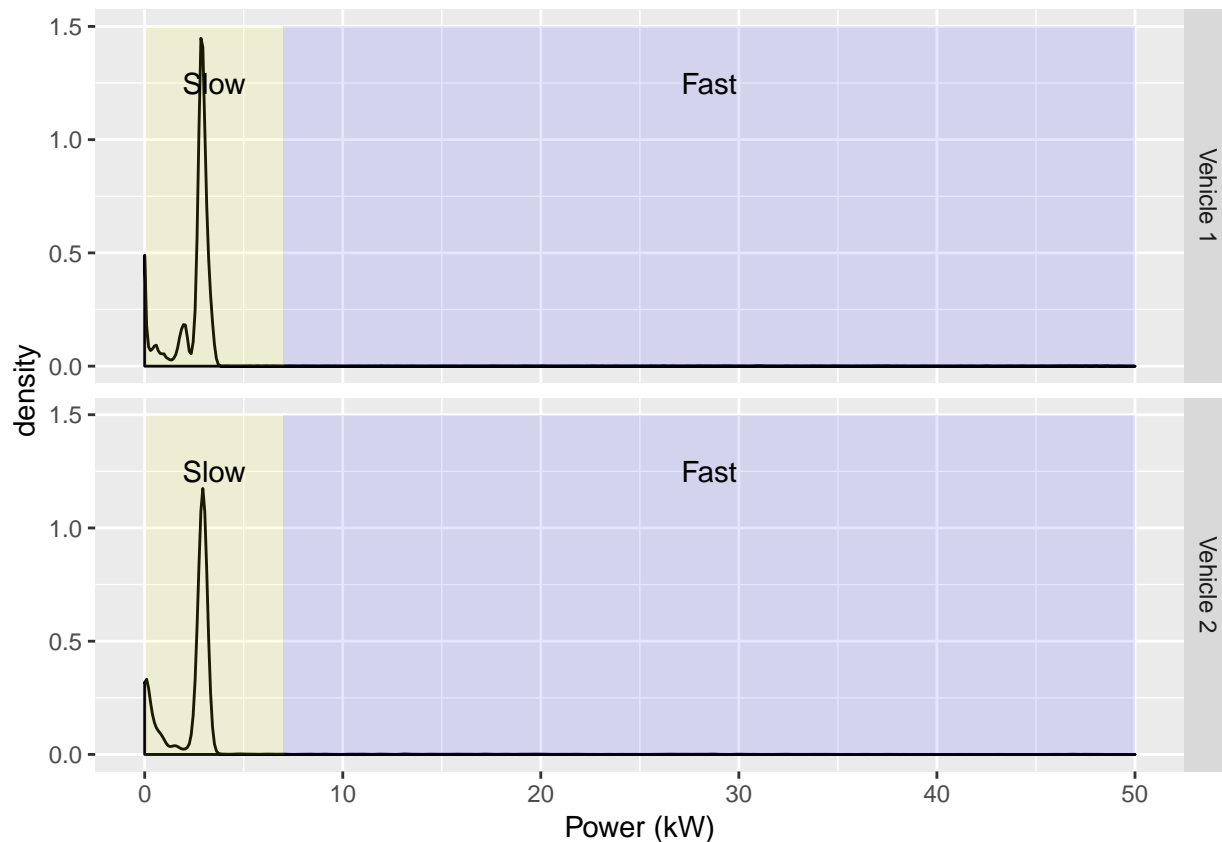
Plots

```r
p <- ggplot2::ggplot(df, aes(x = charge_power_kw)) +
  guides(colour = guide_legend(title = "Vehicle:")) +
  theme(legend.position="bottom") +
  scale_colour_manual(values=cbPalette) + # use colour-blind friendly palette
  geom_density() # <- make the plot in an object first

p + labs(x = "Power (kW)") + facet_grid(id ~ .) +
    annotate("rect", xmin = 0, xmax = 7, ymin = 0, ymax = 1.5,
          alpha = .1, fill="yellow") +
```

```
annotate("rect", xmin = 7, xmax = 50, ymin = 0, ymax = 1.5,
         alpha = .1, fill="blue") +
annotate("text",label="Slow", x=3.5, y=1.25, angle=0) +
annotate("text",label="Fast", x=(50-7)/2 + 7, y=1.25, angle=0)
```


This implies that most charging is "slow". Hardly groundbreaking but worthwhile to establish. It might pay to adjust how ggplot constructs this (reduce bin size?) to display more subtleties regarding fastcharges. Also not happy with how my annotations are, thinking of displaying them to one side as a legend. With large vehicle numbers it would pay to amalgamte these as one plot, however it's good to see if some vehicles do a lot of fast charging.

```
p <- ggplot2::ggplot(df, aes(x = halfHour, group = halfHour, y = charge_power_kw)) +
  guides(colour = guide_legend(title = "Vehicle:")) +
  theme(legend.position = "bottom", axis.text.x = element_text(angle = 90)) +
  scale_colour_manual(values=cbPalette) + # use colour-blind friendly palette
  geom_boxplot() # <- make the plot in an object first

p + labs(x = "Time of Day", y = "Power (kW)") + facet_grid(day_of_week ~ id)
```
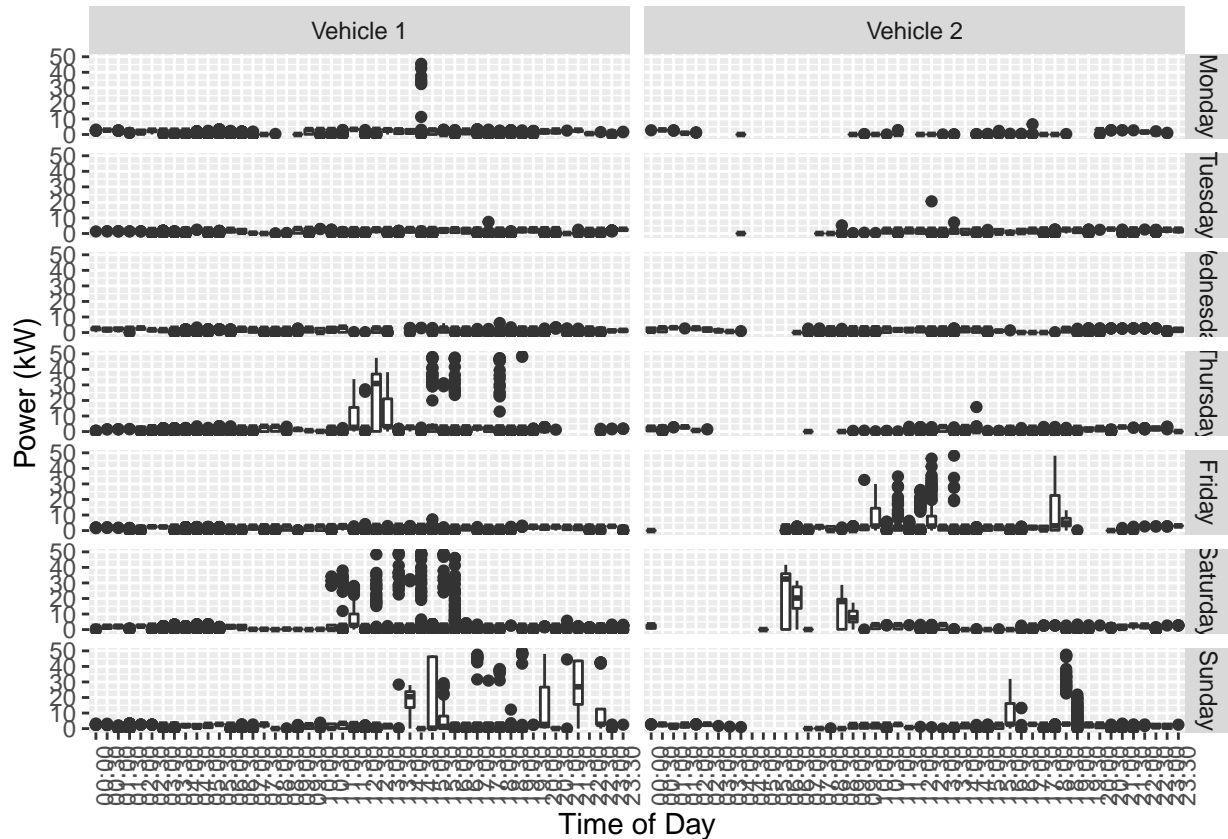
This shows charging behaviour for each day and each car. Not easy to get much from this with only a few months worth of data, however over time it would become more informative.

```
p <- ggplot2::ggplot(df, aes(x = halfHour, group = halfHour, y = charge_power_kw)) +
  guides(colour = guide_legend(title = "Vehicle:")) +
  theme(legend.position = "bottom", axis.text.x = element_text(angle = 90)) +
  scale_colour_manual(values=cbPalette) + # use colour-blind friendly palette
  geom_boxplot() # <- make the plot in an object first

p + labs(x = "Time of Day", y = "Power (kW)") + facet_grid(day_of_week ~ charging_rate)
```
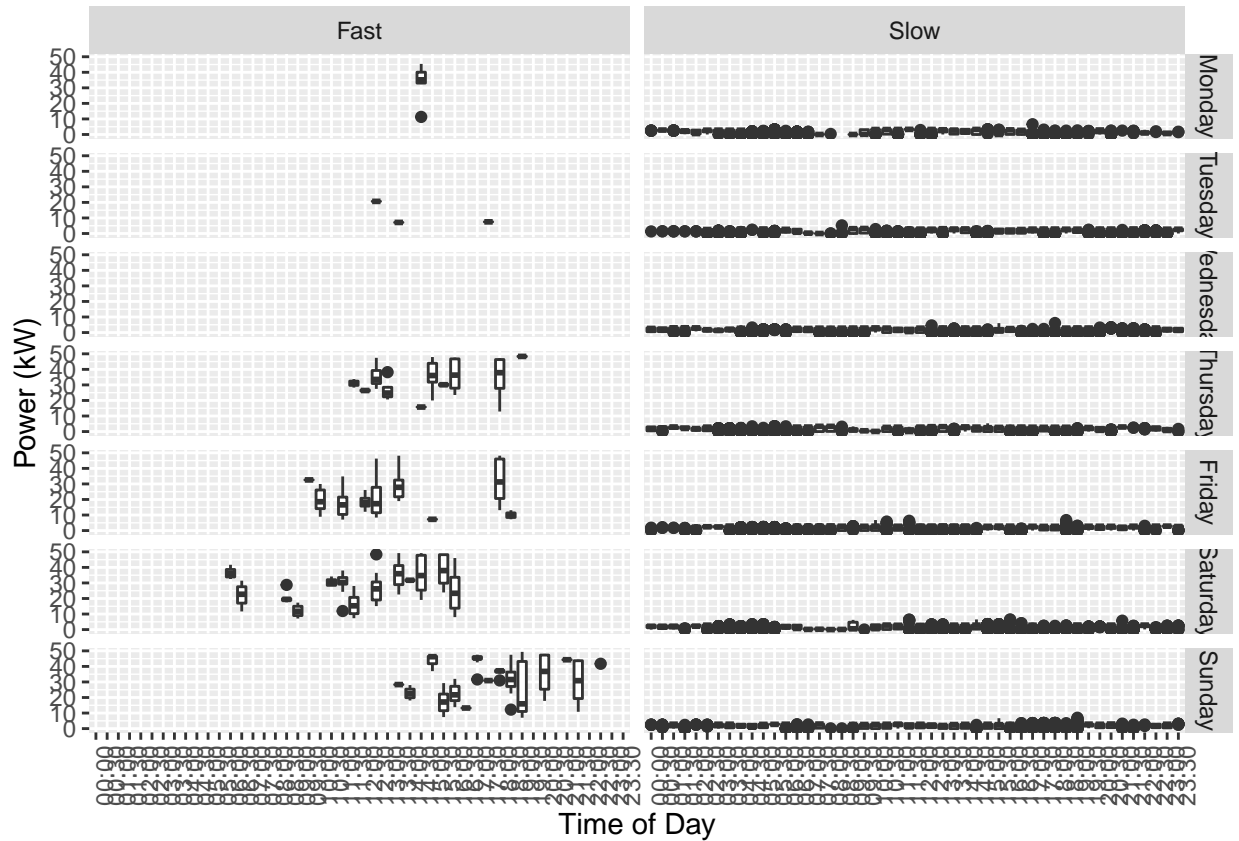
Same as above, but with different plot shown for fast/slow charging rate as opposed to different vehicles. Probably more useful than the previous one but still suffers a little from crampedness and insufficient data.

```r
p <- ggplot2::ggplot(df, aes(x = halfHour, group = halfHour, y = charge_power_kw)) +
  guides(colour = guide_legend(title = "Vehicle:")) +
  scale_colour_manual(values=cbPalette) + # use colour-blind friendly palette
  geom_boxplot() +
  stat_summary(aes(group = weekday), fun.y=mean, geom="line", colour = "red", show.legend = TRUE) +
  coord_cartesian(xlim = c(0,24),ylim=c(0,15))

p + labs(x = "Time of Day", y = "Power (kW)") + facet_grid(~weekday) +  theme(legend.position = "bottom"
```
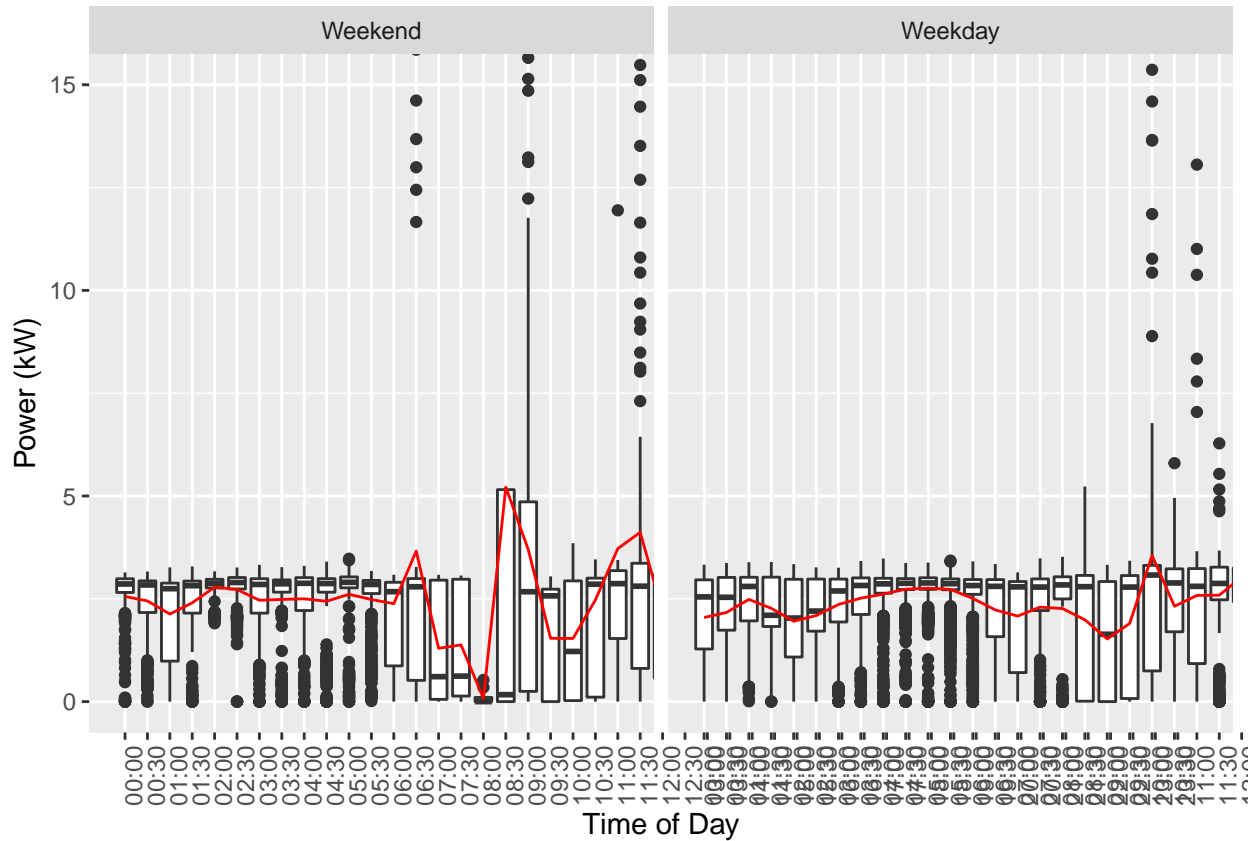
This shows weekend and weekday charging patterns. Have included fastcharge in the data but cropped the plot for clarity. Red is mean line, it needs a legend but show.legend isn't working for me.

Other plots

The following plots can be made by running blocks in the scripts "weekendweekday.R", "fast_charge_plots.R" and "fast_slow_charging.R". These may require "initial_processing.R" to be run before hand, and were written in base R, so need updating to work with dyplr, hms etc, as well as other aesthetic/visual improvements (on the to do list).

This shows only the fast-charging events. Could be improved. From script fast_charge_plots.R, written in base R, needs updating to work nicely with dplyr etc.
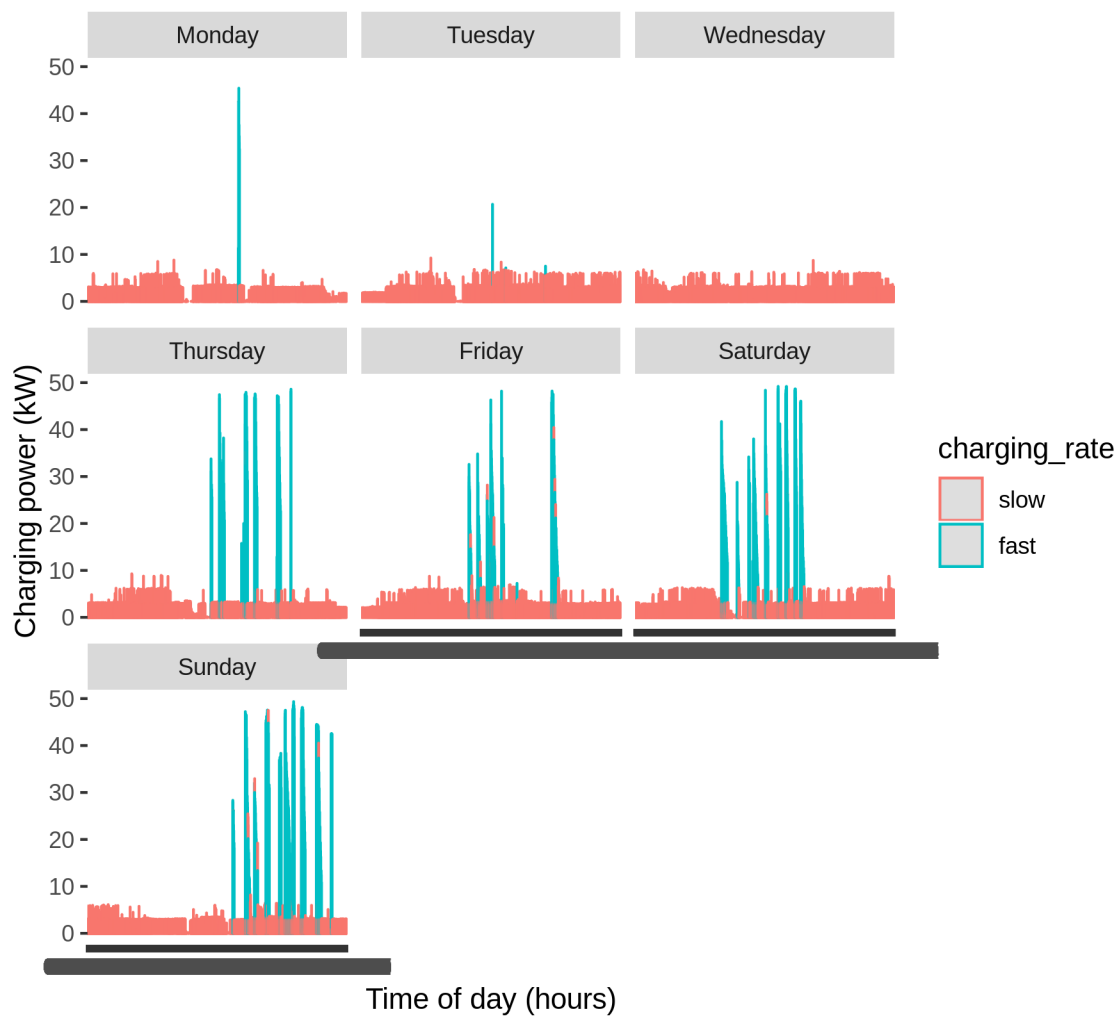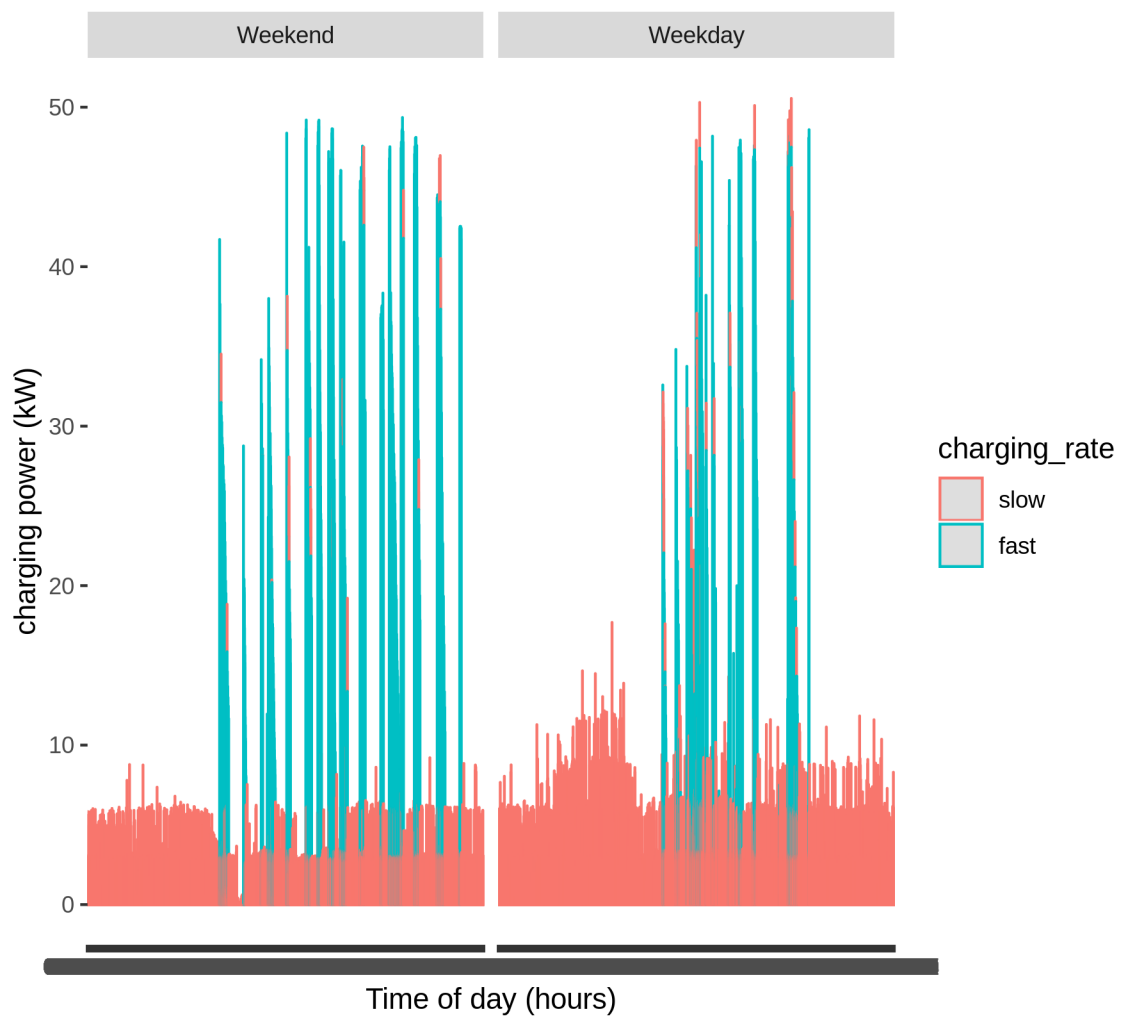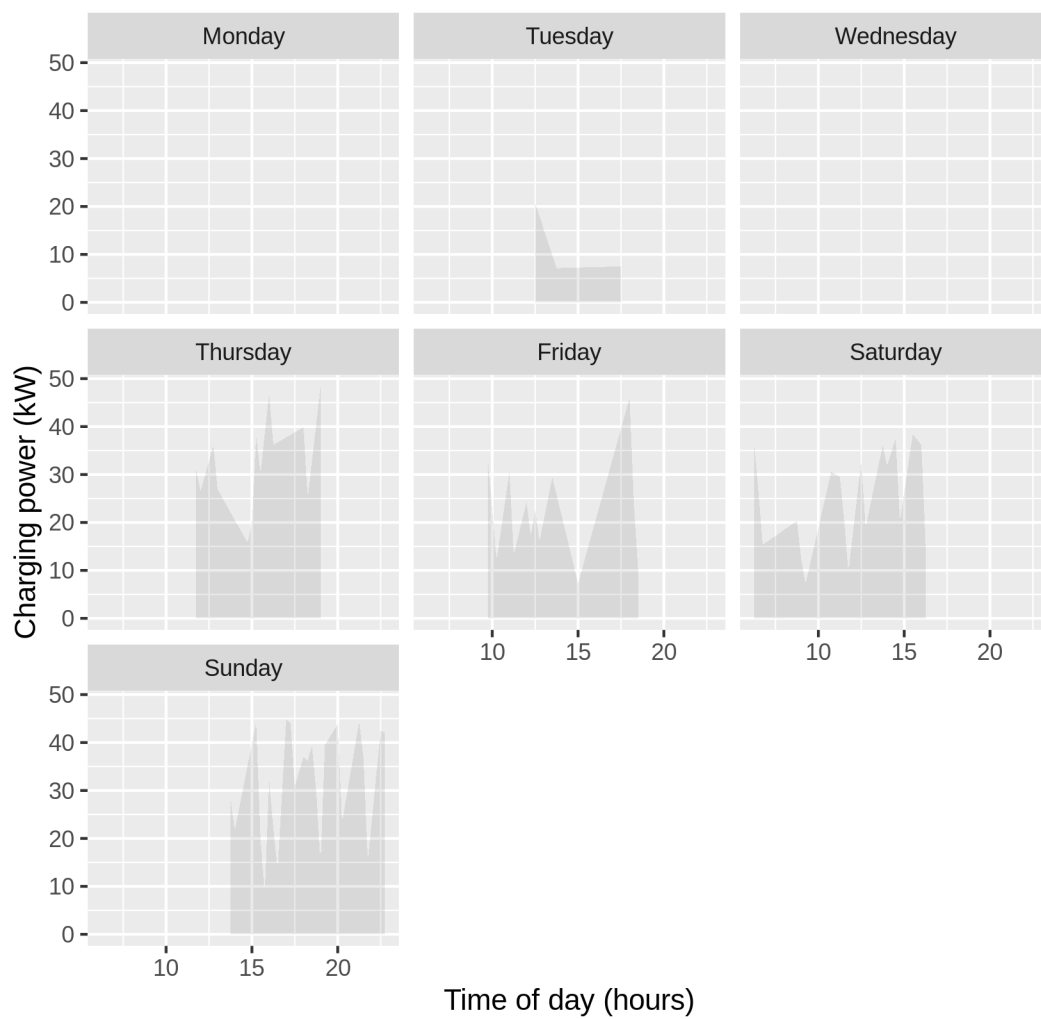
Figure 1: Fast/slow charging by day

Figure 2: Fast/slow charging by weekend/weekday

Figure 3: Fast-charging times