Summary Report for Assignment 1

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To write the object function, I processed the input "period" firstly. "Year", "start.date", and "end.date" were got from different situations of the length of "period". For example, the length of the annually period '2019A' is 5 and the length of the quarterly period '2019Q3' is 6. The start month and the end month of a quarter were calculated from the quarter number (3 for "Q3" for instance). The exact last day of the end month was calculated with the help of the first day of the next month.

```
1 = nchar(period) #length of the string period
if (is. na(as. numeric(substr(period, 1, 4)))) {stop("wrong input of period")}
Year = as. numeric(substr(period, 1, 4))
if (l==5) {#annually
    Year = as. numeric(substr(period, 1, 4))
    start. date = ymd(paste0(Year, "0101"))
    end. date = ymd(paste0(Year, "1231"))

}else if (l==6) {#quarterly
    Year = as. numeric(substr(period, 1, 4))
    Quarter = as. numeric(substr(period, 6, 6))
    start_month = 3*(Quarter-1) + 1
    end_month = start_month + 2
    start. date = ymd(paste0(Year, month. name[start_month], "01"))
    end. date = ymd(paste0(Year, month. name[end_month], "01")) %m+% months(1)%m-% days(1)
```

Then, I processed "peak.type". Given that peak types "flat" and "7x8" do not take holidays into account by their definitions, I calculated the result under these two situations.

```
if (peak. type == "flat") {
  include = 1
  hours = length(days)*24

} else if (peak. type=="7x8") {
  include = 1
  hours = length(days)*16
```

With other peak types, holidays' dates were obtained with *holidayNERC()* and "Year" I got from the "period" processing above. After that, I assigned "weekend" to 1 and 7 for Eastern markets and only 1 for Western markets which takes Saturday as a weekday. Then non-holiday weekdays are obtained by holidays and the "period" (with *wday()*). The hours can be calculated under "onpeak", "offpeak", and "2x16H" situations.

```
if(iso %in% c("PJMISO", "MISO", "ERCOT", "SPPISO", "NYISO")) {#Eastern market
  weekend = c(1,7)
}else if(iso %in% c("WECC", "CAISO")) {#Western market
  weekend = 1
}else {stop("wrong input of iso")}

non_holiday_weekdays =
  non_holidays[non_holidays%in%days[!weekdays%in%weekend]]
```

```
if (peak. type=="onpeak") {
  hours = length(non_holiday_weekdays)*16
}else if (peak. type=="offpeak") {
  include = 1
  hours = length(days)*24 - length(non_holiday_weekdays)*16
}else if (peak. type=="2x16H") {
  hours = length(unique(c(days[weekdays%in%weekend], holidays)))*16
}else {stop("wrong input of peak. type")}
```

Whether daylight-saving setting should be considered was marked as "include". "Flat", "7x8", "offpeak" turned "include" to 1. If the second Sunday of March is in the "period" then the result hours should minus one and if the first Sunday of November is in the "period" then the result hours should plus one.

```
if(iso!="MISO"&&include==1) {#daylight-saving setting
  march = seq(ymd(paste0(Year, "0301")), ymd(paste0(Year, "0331")), by = "day")
  mar_weekdays = wday(march)
  if(march[mar_weekdays==1][2]%in%days) {hours = hours - 1} #it begins at 2:00 a.m. on the second Sunday of March
  november = seq(ymd(paste0(Year, "1101")), ymd(paste0(Year, "1130")), by = "day")
  nov_weekdays = wday(november)
  if(november[nov_weekdays==1][1]%in%days) {hours = hours + 1} #it ends at 2:00 a.m. on the first Sunday of November
}
```

The return of the function is of correct format.

```
# test the type of the return
num.hours.ercot.onpeak.may19 <- get.hours("ERCOT", "onpeak", "2019May")
num.hours.ercot.onpeak.may19

## $iso
## [1] "ERCOT"
##
## $peak.type
## [1] "onpeak"
##
## $start.date
## [1] "2019-05-01"
##
## $end.date
## [1] "2019-05-31"
##
## $num.hour
## [1] 352
```

Wrong input situations are identified and showed.

```
# test wrong input situation
get.hours("wrong", "onpeak", "2019May")

## Error in get.hours("wrong", "onpeak", "2019May"): wrong input of iso

get.hours("ERCOT", "wrong", "2019May")

## Error in get.hours("ERCOT", "wrong", "2019May"): wrong input of peak.type

get.hours("ERCOT", "onpeak", "wrong")

## Warning in get.hours("ERCOT", "onpeak", "wrong"): 强制改变过程中产生了NA

## Error in get.hours("ERCOT", "onpeak", "wrong"): wrong input of period
```

The test result of CAISO in 2022 to 2024 is consistent with the Power Calendar: https://www.energygps.com/HomeTools/PowerCalendar. Annually:

## 1 Jan 2022 744 400 344 01-Jan 2022 744 400 344 334			•										
### 2 Feb 2022 672 384 288 02-Feb 2022 672 384 288 ### 3 Mar 2022 743 432 311 03-Mar 2022 743 432 311 ### 4 Apr 2022 720 416 304 04-Apr 2022 720 416 304 ### 5 May 2022 744 400 344 05-May 2022 744 400 344 ### 6 Jun 2022 720 416 304 06-Jun 2022 720 416 304 ### 7 Jul 2022 720 416 304 07-Jul 2022 740 400 344 ### 8 Aug 2022 744 432 312 08-Aug 2022 744 432 312 ### 9 Sep 2022 720 400 320 09-Sep 2022 744 432 312 ### 10 Oct 2022 744 416 328 10-Oct 2022 744 416 328 ### 11 Nov 2022 721 400 321 11-Nov 2022 721 400 321 ### 12 Dec 2022 744 416 328 12-Dec 2022 744 416 328 ### 13 Jan 2023 744 400 344 01-Jan 2023 744 400 344 ### 14 Feb 2023 672 384 288 02-Feb 2023 672 384 288 ### 15 Mar 2023 743 432 311 03-Mar 2023 743 432 311 ### 16 Apr 2023 720 400 320 04-Apr 2023 720 400 320 ### 17 May 2023 744 416 328 05-May 2023 744 416 328 ### 18 Jun 2023 744 416 328 05-May 2023 744 416 328 ### 19 Jul 2023 744 416 328 05-May 2023 744 416 328 ### 20 Aug 2023 744 416 328 05-May 2023 744 416 328 ### 20 Aug 2023 744 400 344 07-Jul 2023 744 400 344 ### 20 Aug 2023 744 400 344 07-Jul 2023 744 400 344 ### 20 Aug 2023 744 416 328 05-May 2023 744 416 328 ### 21 Sep 2023 720 400 320 09-Sep 2023 744 432 312 ### 20 Aug 2023 744 416 328 05-May 2023 744 400 344 ### 20 Aug 2023 744 416 328 05-May 2023 744 400 344 ### 20 Aug 2023 744 416 328 05-May 2023 744 400 344 ### 21 Sep 2023 720 400 320 09-Sep 2023 740 400 320 ### 22 Oct 2023 744 416 328 10-Oct 2023 744 400 344 ### 23 Nov 2023 721 400 321 11-Nov 2023 720 400 320 ### 24 Dec 2023 744 416 328 01-Jan 2024 744 416 328 ### 25 Jan 2024 744 416 328 01-Jan 2024 744 416 328 ### 28 Apr 2024 744 416 328 01-Jan 2024 744 416 328 ### 28 Apr 2024 744 416 328 01-Jan 2024 744 416 328 ### 33 Nov 2024 744 416 328 01-Jan 2024 744 416 328 ### 34 Dec 2024 744 416 328 07-Jul 2023 720 400 320 ### 39 May 2024 744 416 328 01-Jan 2024 744 416 328 ### 31 Jul 2024 744 416 328 07-Jul 2024 744 416 328 ### 33 Jun 2024 720 416 304 04-Apr 2024 720 400 320 ### 31 Jul 2024 744 416 328 07-Jul 2024 744 416 328 ### 33 Nov 2024 724 44 416	##				flat	onpeak	offpeak	Me	onth	Year	Flat	Peak	Off-Peak
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## 9	##	7	Jul	2022	744	400	344	07	- Jul	2022	744	400	344
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## 13 Jan 2023 744 400 344 288	##	12	Dec	2022	744	416	328	12	- Dec	2022	744	416	328
## 13 Jan 2023 744 400 344 288								01	lan	2022	744	400	244
## 14	##	13	Jan	2023	744	400	344						
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## 23 Nov 2023 721 400 321 11-Nov 2023 721 400 321 ## 24 Dec 2023 744 400 344 12-Dec 2023 744 400 344 ## 25 Jan 2024 744 416 328 02-Feb 2024 696 400 296 02-Feb 2024 696 400 296 ## 27 Mar 2024 743 416 327 03-Mar 2024 743 416 327 ## 28 Apr 2024 720 416 304 04-Apr 2024 720 416 304 ## 29 May 2024 744 416 328 05-May 2024 744 416 328 ## 30 Jun 2024 720 400 320 06-Jun 2024 720 400 320 ## 31 Jul 2024 744 416 328 07-Jul 2024 744 416 328 ## 32 Aug 2024 744 432 312 08-Aug 2024 744 432 312 ## 33 Sep 2024 720 384 336 ## 34 Oct 2024 744 432 312 10-Oct 2024 744 432 312 ## 35 Nov 2024 721 400 321 11-Nov 2024 721 400 321					720								
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## 25 Jan 2024 744 416 328 01-Jan 2024 744 416 328 ## 26 Feb 2024 696 400 296 02-Feb 2024 696 400 296 ## 27 Mar 2024 743 416 327 03-Mar 2024 743 416 327 ## 28 Apr 2024 720 416 304 04-Apr 2024 720 416 304 ## 29 May 2024 744 416 328 05-May 2024 744 416 328 ## 30 Jun 2024 720 400 320 06-Jun 2024 720 400 320 ## 31 Jul 2024 744 416 328 07-Jul 2024 744 416 328 ## 32 Aug 2024 744 432 312 08-Aug 2024 744 432 312 ## 33 Sep 2024 720 384 336 09-Sep 2024 720 384 336 ## 34 Oct 2024 744 432 312 10-Oct 2024 744 432 312 ## 35 Nov 2024 721 400 321 11-Nov 2024 721 400 321						400							
## 26 Feb 2024 696 400 296 02-Feb 2024 696 400 296 ## 27 Mar 2024 743 416 327 03-Mar 2024 743 416 327 ## 28 Apr 2024 720 416 304 04-Apr 2024 720 416 304 ## 29 May 2024 744 416 328 05-May 2024 744 416 328 ## 30 Jun 2024 720 400 320 06-Jun 2024 720 400 320 ## 31 Jul 2024 744 416 328 07-Jul 2024 744 416 328 ## 32 Aug 2024 744 432 312 08-Aug 2024 744 432 312 ## 33 Sep 2024 720 384 336 09-Sep 2024 720 384 336 ## 34 Oct 2024 744 432 312 10-Oct 2024 744 432 312 ## 35 Nov 2024 721 400 321 11-Nov 2024 721 400 321	##	24	Dec	2023	744	400	344	12	- Dec	2023	/44	400	344
## 26 Feb 2024 696 400 296 02-Feb 2024 696 400 296 ## 27 Mar 2024 743 416 327 ## 28 Apr 2024 720 416 304 04-Apr 2024 720 416 304 ## 29 May 2024 744 416 328 05-May 2024 744 416 328 ## 30 Jun 2024 720 400 320 06-Jun 2024 720 400 320 ## 31 Jul 2024 744 416 328 07-Jul 2024 744 416 328 ## 32 Aug 2024 744 432 312 08-Aug 2024 744 432 312 ## 33 Sep 2024 720 384 336 09-Sep 2024 720 384 336 ## 34 Oct 2024 744 432 312 10-Oct 2024 744 432 312 ## 35 Nov 2024 721 400 321 11-Nov 2024 721 400 321	##	25	Jan	2024	744	416	328	01	- Jan	2024	744	416	328
## 27 Mar 2024 743 416 327 03-Mar 2024 743 416 327 ## 28 Apr 2024 720 416 304 04-Apr 2024 720 416 304 ## 29 May 2024 744 416 328 05-May 2024 744 416 328 ## 30 Jun 2024 720 400 320 06-Jun 2024 720 400 320 ## 31 Jul 2024 744 416 328 07-Jul 2024 744 416 328 ## 32 Aug 2024 744 432 312 08-Aug 2024 744 432 312 ## 33 Sep 2024 720 384 336 09-Sep 2024 720 384 336 ## 34 Oct 2024 744 432 312 10-Oct 2024 744 432 312 ## 35 Nov 2024 721 400 321 11-Nov 2024 721 400 321	##	26	Feb	2024				02	- Feb	2024	696	400	296
## 28 Apr 2024 720 416 304 04-Apr 2024 720 416 304 ## 29 May 2024 744 416 328 05-May 2024 744 416 328 ## 30 Jun 2024 720 400 320 06-Jun 2024 720 400 320 ## 31 Jul 2024 744 416 328 07-Jul 2024 744 416 328 ## 32 Aug 2024 744 432 312 08-Aug 2024 744 432 312 ## 33 Sep 2024 720 384 336 09-Sep 2024 720 384 336 ## 34 Oct 2024 744 432 312 10-Oct 2024 744 432 312 ## 35 Nov 2024 721 400 321 11-Nov 2024 721 400 321	##				743	416		03	- Mar	2024	743	416	327
## 29 May 2024 744 416 328 05-May 2024 744 416 328 ## 30 Jun 2024 720 400 320 06-Jun 2024 720 400 320 ## 31 Jul 2024 744 416 328 07-Jul 2024 744 416 328 ## 32 Aug 2024 744 432 312 08-Aug 2024 744 432 312 ## 33 Sep 2024 720 384 336 09-Sep 2024 720 384 336 ## 34 Oct 2024 744 432 312 10-Oct 2024 744 432 312 ## 35 Nov 2024 721 400 321 11-Nov 2024 721 400 321	##	28	Apr	2024				04	- Apr	2024	720	416	304
## 30 Jun 2024 720 400 320 06-Jun 2024 720 400 320 ## 31 Jul 2024 744 416 328 07-Jul 2024 744 416 328 ## 32 Aug 2024 744 432 312 08-Aug 2024 744 432 312 ## 33 Sep 2024 720 384 336 09-Sep 2024 720 384 336 ## 34 Oct 2024 744 432 312 10-Oct 2024 744 432 312 ## 35 Nov 2024 721 400 321 11-Nov 2024 721 400 321	##	29					328	05	- May	2024	744	416	328
## 32 Aug 2024 744 432 312 08-Aug 2024 744 432 312 ## 33 Sep 2024 720 384 336 09-Sep 2024 720 384 336 ## 34 Oct 2024 744 432 312 10-Oct 2024 744 432 312 ## 35 Nov 2024 721 400 321 11-Nov 2024 721 400 321	##	30	Jun	2024	720	400	320	06	- Jun	2024	720	400	320
## 32 Aug 2024 744 432 312 08-Aug 2024 744 432 312 ## 33 Sep 2024 720 384 336 09-Sep 2024 720 384 336 ## 34 Oct 2024 744 432 312 10-Oct 2024 744 432 312 ## 35 Nov 2024 721 400 321 11-Nov 2024 721 400 321	##	31	Ju1	2024	744	416	328	07	- Jul	2024	744	416	328
## 33 Sep 2024 720 384 336 09-Sep 2024 720 384 336 ## 34 Oct 2024 744 432 312 10-Oct 2024 744 432 312 ## 35 Nov 2024 721 400 321 11-Nov 2024 721 400 321	##							08	- Aug	2024	744	432	312
## 34 Oct 2024 744 432 312 10-Oct 2024 744 432 312 ## 35 Nov 2024 721 400 321 11-Nov 2024 721 400 321	##							09	- Sep	2024	720	384	336
## 35 Nov 2024 721 400 321 11-Nov 2024 721 400 321	##	34	Oct	2024				10	- Oct	2024	744	432	312
## 36 Dec 2024 744 400 344 12-Dec 2024 744 400 344	##	35	Nov	2024		400		11	- Nov	2024	721	400	321
	##	36	Dec	2024	744	400	344	12	- Dec	2024	744	400	344

Quarterly:

##		Quarter	Year	flat	onpeak	offpeak
##	1	Q1	2022	2159	1216	943
##	2	Q2	2022	2184	1232	952
##	3	Q3	2022	2208	1232	976
##	4	Q4	2022	2209	1232	977
##	5	Q1	2023	2159	1216	943
##	6	Q2	2023	2184	1232	952
##	7	Q3	2023	2208	1232	976
##	8	Q4	2023	2209	1216	993
##	9	Q1	2024	2183	1232	951
##	10	Q2	2024	2184	1232	952
##	11	Q3	2024	2208	1232	976
##	12	Q4	2024	2209	1232	977

Quarter	Year	Flat	Peak	Off-Peak
Q1	2022	2159	1216	943
Q2	2022	2184	1232	952
Q3	2022	2208	1232	976
Q4	2022	2209	1232	977
Q1	2023	2159	1216	943
Q2	2023	2184	1232	952
Q3	2023	2208	1232	976
Q4	2023	2209	1216	993
Q1	2024	2183	1232	951
Q2	2024	2184	1232	952
Q3	2024	2208	1232	976
Q4	2024	2209	1232	977

Yearly:

##		Year	flat	onpeak	offpeak
##	1	2022	8760	4912	3848
##	2	2023	8760	4896	3864
##	3	2024	8784	4928	3856

Year	Flat	Peak	Off-Peak
2022	8760	4912	3848
2023	8760	4896	3864
2024	8784	4928	3856

Assignment1

Henghui Qi

2022/5/15

```
library(lubridate)
```

```
##
## 载入程辑包: 'lubridate'
```

```
## The following objects are masked from 'package:base':
##

date, intersect, setdiff, union
```

```
library (timeDate)
get.hours = function(iso, peak.type, period) {
  #process date
  1 = nchar(period) #length of the string period
  if (is. na (as. numeric (substr(period, 1, 4)))) {stop ("wrong input of period")}
  Year = as. numeric(substr(period, 1, 4))
  if (1==5) {#annually
    Year = as. numeric (substr(period, 1, 4))
    start.date = ymd(paste0(Year, "0101"))
    end. date = ymd(paste0(Year, "1231"))
  else if (1==6)  {#quarterly}
    Year = as. numeric (substr(period, 1, 4))
    Quarter = as. numeric (substr(period, 6, 6))
    start_month = 3*(Quarter-1) + 1
    end month = start month + 2
    start.date = ymd(paste0(Year, month.name[start_month], "01"))
    end.date = ymd(paste0(Year, month.name[end_month], "01"))%m+% months(1)%m-% days(1)
 else if (1==7) \{\#monthly\}
    Year = as. numeric (substr(period, 1, 4))
    Month = which (month. abb == substr (period, 5, 7))
    start.date = ymd(paste0(Year, month.name[Month], "01"))
    end.date = ymd(paste0(Year, month.name[Month], "01"))%m+% months(1)%m-% days(1)
  else if (1>7&&1<11) {\#daily}
    period = ymd(period)
    Year = year (period)
    Month = month(period)
    Day = day(period)
    start.date = period
    end.date = period
  }else {stop("wrong input of period")}
  #process peak type
  include = 0#whether this kind of peak type take daylight-saving into consideration
  days = seq(start.date, end.date, by = "days")
  if (peak. type == "flat") {
    include = 1
    hours = length(days)*24
  }else if (peak. type=="7x8") {
    include = 1
    hours = length(days)*16
  } e 1 s e {
    interval = interval(start.date, end.date)
    weekdays = wday(days)
    year holidays = as. Date(holidayNERC(Year))
    holidays = year holidays[year holidays%within%interval]
    non holidays = days[!days%in%holidays]
    #process ISO
    if(iso %in% c("PJMISO", "MISO", "ERCOT", "SPPISO", "NYISO")){#Eastern market
      weekend = c(1,7)
```

```
}else if(iso %in% c("WECC", "CAISO")) {#Western market
      weekend = 1
   }else {stop("wrong input of iso")}
   non_holiday_weekdays =
      non_holidays[non_holidays%in%days[!weekdays%in%weekend]]
    if (peak. type=="onpeak") {
      hours = length(non_holiday_weekdays)*16
   }else if (peak. type=="offpeak") {
      include = 1
      hours = length(days)*24 - length(non holiday weekdays)*16
   }else if (peak. type=="2x16H") {
      hours = length(unique(c(days[weekdays%in%weekend], holidays)))*16
   }else {stop("wrong input of peak.type")}
 if (iso!="MISO"&&include==1) {#daylight-saving setting
    march = seq(ymd(paste0(Year, "0301")), ymd(paste0(Year, "0331")), by = "day")
   mar_weekdays = wday(march)
    if (march[mar_weekdays==1][2]%in%days) {hours = hours - 1}#it begins at 2:00 a.m. on the sec
ond Sunday of March
   november = seq(ymd(paste0(Year, "1101")), ymd(paste0(Year, "1130")), by = "day")
   nov_weekdays = wday(november)
    if (november[nov_weekdays==1][1]%in%days) {hours = hours + 1} #it ends at 2:00 a.m. on the fi
rst Sunday of November
 }
  #present the result
  result = list(iso = iso,
                peak. type = peak. type,
                start.date = start.date,
                end. date = end. date,
                num. hour = hours)
 return (result)
```

```
# test the type of the return
num.hours.ercot.onpeak.may19 <- get.hours("ERCOT", "onpeak", "2019May")
num.hours.ercot.onpeak.may19</pre>
```

```
## $iso
## [1] "ERCOT"
##
## $peak.type
## [1] "onpeak"
##
## $start.date
## [1] "2019-05-01"
##
## $end.date
## [1] "2019-05-31"
##
## $num.hour
## [1] 352
```

```
# test wrong input situation
get.hours("wrong", "onpeak", "2019May")
## Error in get.hours("wrong", "onpeak", "2019May"): wrong input of iso
get.hours("ERCOT", "wrong", "2019May")
## Error in get.hours("ERCOT", "wrong", "2019May"): wrong input of peak.type
get.hours("ERCOT", "onpeak", "wrong")
## Warning in get.hours("ERCOT", "onpeak", "wrong"): 强制改变过程中产生了NA
## Error in get.hours("ERCOT", "onpeak", "wrong"): wrong input of period
# test CAISO of 2022 to 2024
## monthly
peaktype = c("flat", "onpeak", "offpeak")
CAISO_calender_monthly = data.frame(Month = month.abb,
                                    Year = rep(2022:2024, each = 12),
                                    flat = 0,
                                    onpeak = 0,
                                    offpeak = 0)
for (y in 1:3) {
  for (i in 1:12) {
   period = paste0(y+2022-1, month.abb[i])
   for (j in 1:3) {
      peak = peaktype[j]
     result = get.hours("CAISO", peak, period)
     CAISO_calender_monthly[(y-1)*12+i, j+2] = result$num.hour
print(CAISO calender monthly)
```

```
##
      Month Year flat onpeak offpeak
## 1
        Jan 2022
                   744
                           400
                                    344
## 2
        Feb 2022
                   672
                           384
                                    288
## 3
        Mar 2022
                   743
                           432
                                    311
## 4
        Apr 2022
                   720
                           416
                                    304
        May 2022
## 5
                   744
                           400
                                    344
## 6
        Jun 2022
                   720
                           416
                                    304
## 7
        Jul 2022
                   744
                           400
                                    344
## 8
        Aug 2022
                   744
                                    312
                           432
## 9
        Sep 2022
                   720
                           400
                                    320
        Oct 2022
## 10
                   744
                           416
                                    328
        Nov 2022
## 11
                   721
                           400
                                    321
## 12
        Dec 2022
                   744
                           416
                                    328
        Jan 2023
## 13
                   744
                           400
                                    344
## 14
        Feb 2023
                   672
                           384
                                    288
## 15
        Mar 2023
                   743
                           432
                                    311
## 16
        Apr 2023
                   720
                           400
                                    320
## 17
        May 2023
                   744
                           416
                                    328
## 18
        Jun 2023
                   720
                           416
                                    304
## 19
        Jul 2023
                   744
                           400
                                    344
## 20
        Aug 2023
                   744
                           432
                                    312
## 21
        Sep 2023
                           400
                                    320
                   720
## 22
        Oct 2023
                   744
                           416
                                    328
## 23
        Nov 2023
                   721
                           400
                                    321
## 24
        Dec 2023
                   744
                           400
                                    344
                                    328
## 25
        Jan 2024
                   744
                           416
                                    296
## 26
        Feb 2024
                   696
                           400
## 27
        Mar 2024
                   743
                           416
                                    327
## 28
        Apr 2024
                   720
                           416
                                    304
## 29
        May 2024
                           416
                                    328
                   744
## 30
        Jun 2024
                   720
                           400
                                    320
        Jul 2024
## 31
                                    328
                   744
                           416
## 32
        Aug 2024
                   744
                           432
                                    312
## 33
        Sep 2024
                   720
                           384
                                    336
## 34
        Oct 2024
                                    312
                   744
                           432
## 35
        Nov 2024
                   721
                           400
                                    321
## 36
        Dec 2024
                   744
                           400
                                    344
```

```
##
      Quarter Year flat onpeak offpeak
## 1
           Q1 2022 2159
                          1216
                                    943
## 2
           Q2 2022 2184
                          1232
                                    952
## 3
           Q3 2022 2208
                          1232
                                    976
## 4
           Q4 2022 2209
                          1232
                                    977
## 5
           Q1 2023 2159
                          1216
                                    943
## 6
           Q2 2023 2184
                          1232
                                    952
## 7
           Q3 2023 2208
                          1232
                                    976
## 8
           Q4 2023 2209
                          1216
                                    993
           Q1 2024 2183
                          1232
## 9
                                    951
           Q2 2024 2184
                          1232
## 10
                                    952
           Q3 2024 2208
                          1232
## 11
                                    976
## 12
           Q4 2024 2209
                          1232
                                    977
```

```
## Year flat onpeak offpeak
## 1 2022 8760 4912 3848
## 2 2023 8760 4896 3864
## 3 2024 8784 4928 3856
```