Cologne CO2 Emissions

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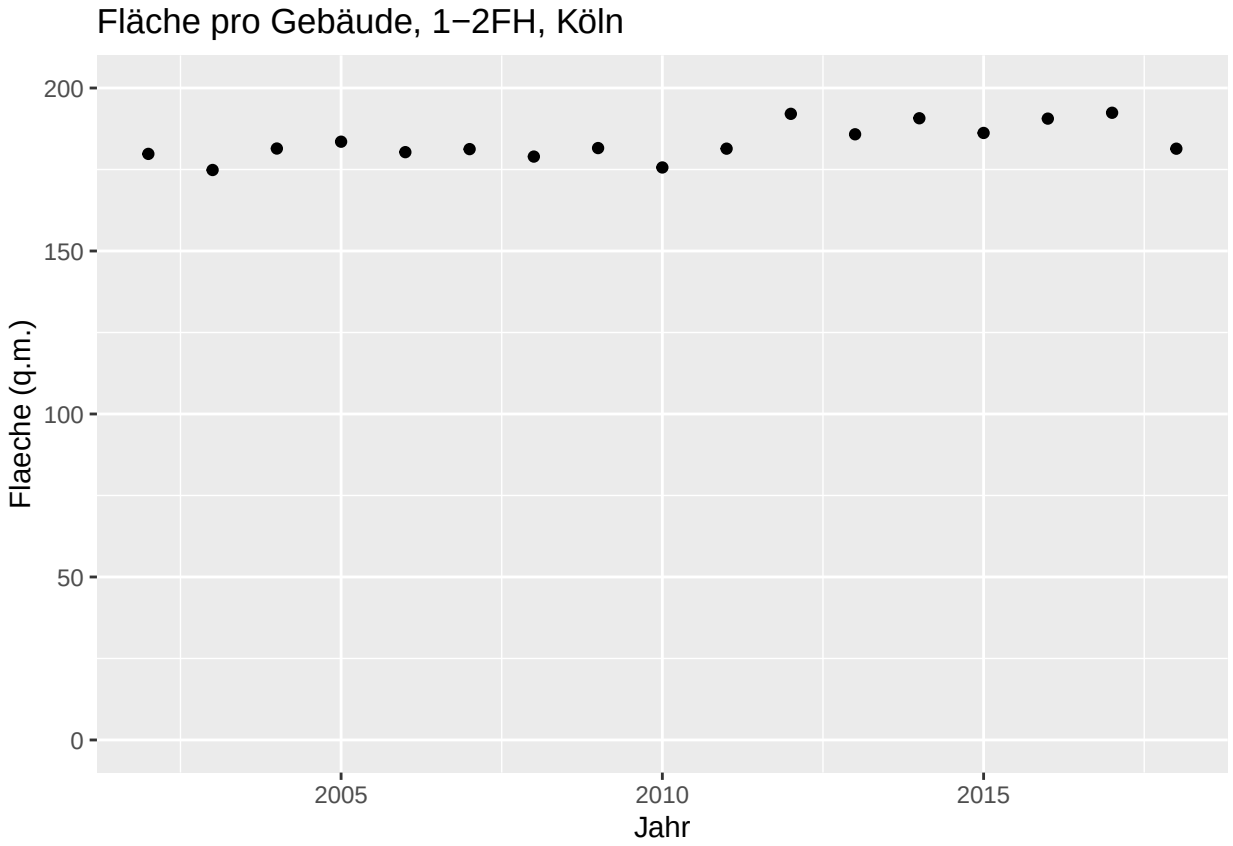
Get the data from co2online

```
source("/home/kbhaskar/Github_Repos/co2emissions/Berlin/BezirkAnalysis/energy_proportions_by_et.R")
source("/home/kbhaskar/Github_Repos/co2emissions/Berlin/BezirkAnalysis/appendLinearTrend.R")
source("/home/kbhaskar/Github_Repos/co2emissions/Berlin/BezirkAnalysis/area_proportions_by_et.R")
source("/home/kbhaskar/Github_Repos/co2emissions/Berlin/BezirkAnalysis/find_proportions.R")
source("/home/kbhaskar/Github_Repos/co2emissions/Berlin/BezirkAnalysis/getTotalConsumption.R")
source("/home/kbhaskar/Github_Repos/co2emissions/Berlin/BezirkAnalysis/getAbsoluteEnergyShares.R")
source("/home/kbhaskar/Github_Repos/co2emissions/Berlin/BezirkAnalysis/getCO2Emissions.R")
source("/home/kbhaskar/Github_Repos/co2emissions/Berlin/BezirkAnalysis/getRowSums.R")
source("/home/kbhaskar/Github_Repos/co2emissions/Berlin/BezirkAnalysis/getCumSums.R")

source("/home/kbhaskar/Github_Repos/co2emissions/Cologne/getSpecificConsumptionCologne.R")
```

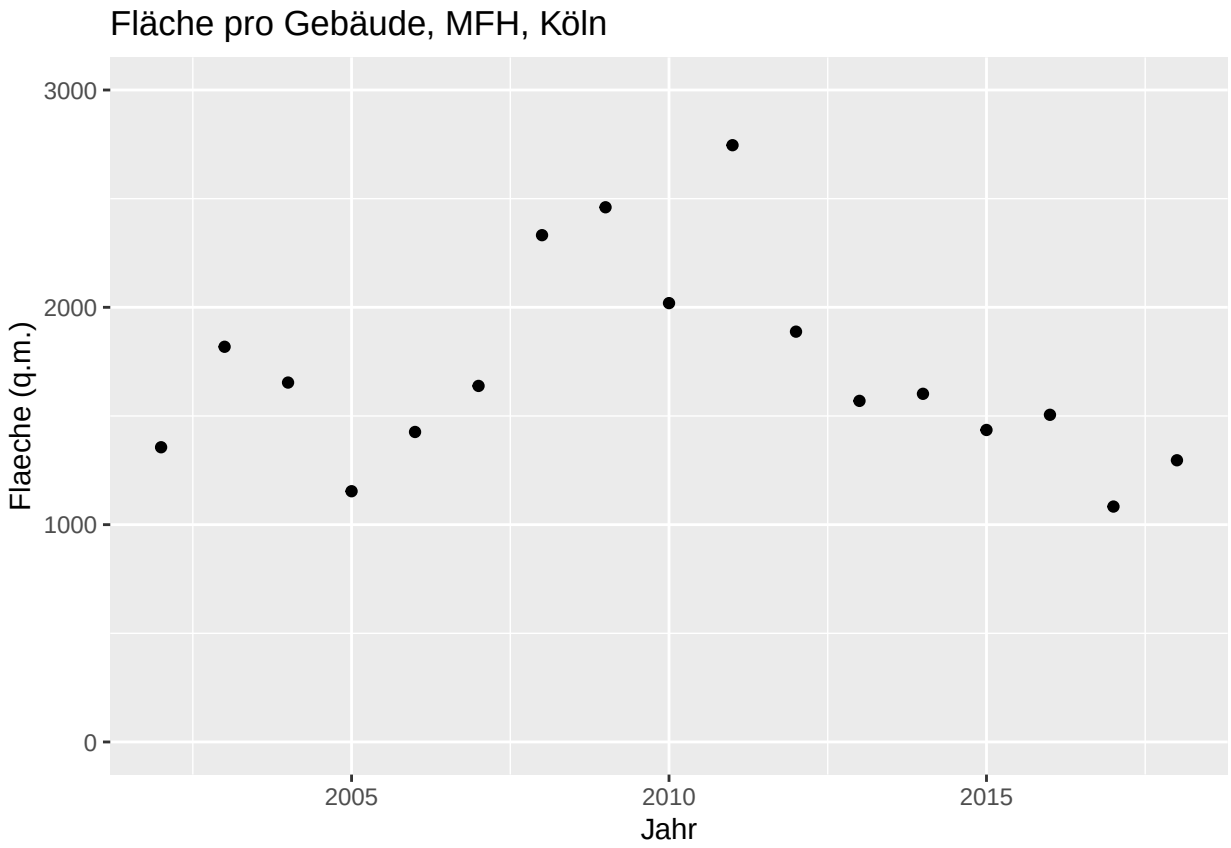
```
source("/home/kbhaskar/Github_Repos/co2emissions/RheinNeckarKreis/getRegionData.R")
source("/home/kbhaskar/Github_Repos/visualization-project2-smurfs/cleanData.R")
gtype <- "SFH"
region <- "KXln, Stadt"
region_data_sfh <- getRegionData(gtype,region)

gtype <- "MFH"
region <- "KXln, Stadt"
region_data_mfh <- getRegionData(gtype,region)
#2019 is an outlier - remove it
region_data_sfh <- region_data_sfh[region_data_sfh$abrechnungsjahr > 2000 , ]
region_data_sfh <- region_data_sfh[region_data_sfh$abrechnungsjahr <= 2018 , ]
```

Area per building for each year

```
require(dplyr)
require(ggplot2)
by_year <- group_by(region_data_sfh,abrechnungsjahr)
avgAreaSFH <- as.data.frame(summarize(by_year,mean(gebaeude_nutzflaeche)))
names(avgAreaSFH) <- c("abrechnungsjahr","meanArea")

ggplot()+geom_point(data=avgAreaSFH,aes(x=abrechnungsjahr,y=meanArea))+scale_y_continuous(lim=c(0,200))+
```




```
by_year <- group_by(region_data_mfh,abrechnungsjahr)
avgAreaMFH <- as.data.frame(summarize(by_year,mean(gebaeude_nutzflaeche)))
names(avgAreaMFH) <- c("abrechnungsjahr","meanArea")

ggplot()+geom_point(data=avgAreaMFH,aes(x=abrechnungsjahr,y=meanArea))+scale_y_continuous(lim=c(0,3000))
```



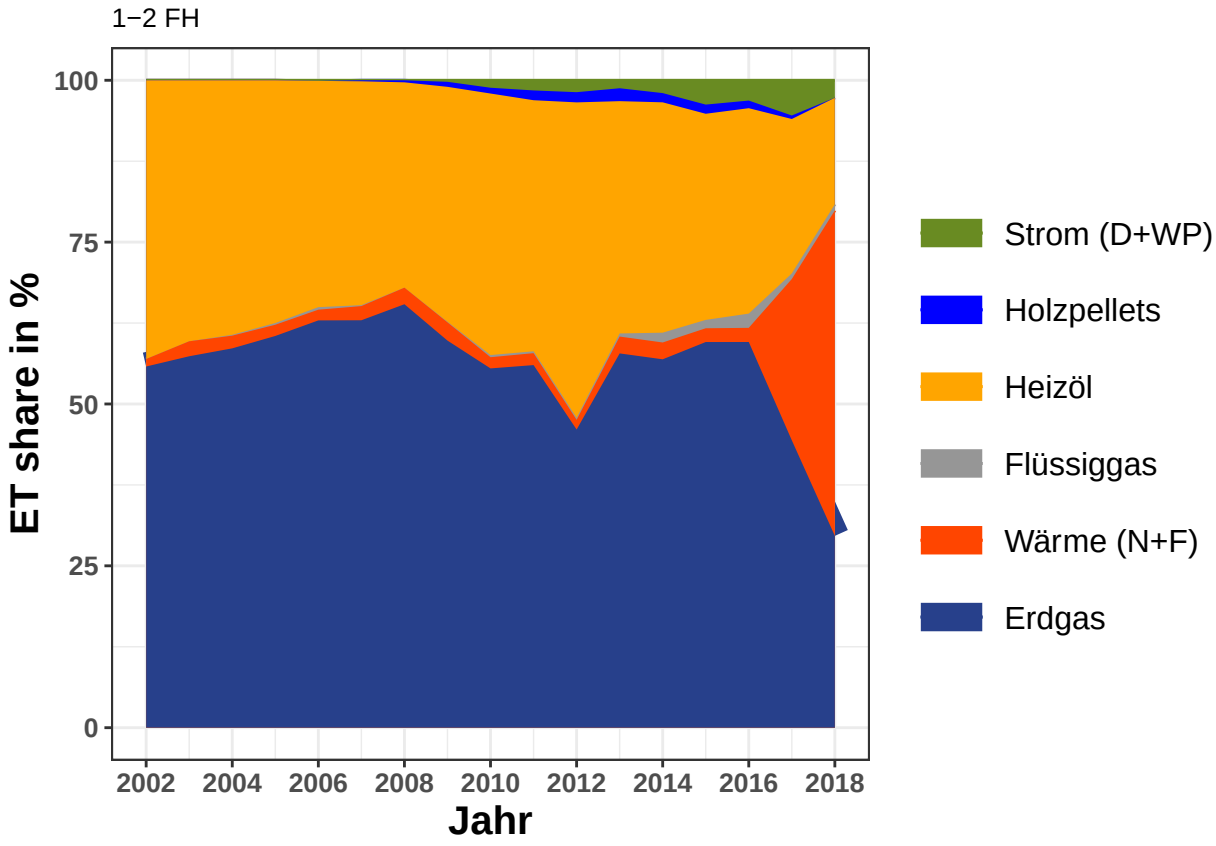

```
et_list <- c("erdgas","waerme","fluessiggas","heizoel","holzpellets","strom")

energy_prop_table_mfh <- energy_proportions_by_et(region_data_mfh,et_list)

energy_prop_table_sfh <- energy_proportions_by_et(region_data_sfh,et_list)
```

```
ET_shares_sfh <- getCumSums(energy_prop_table_sfh , "abrechnungsjahr")
ET_shares_mfh <- getCumSums(energy_prop_table_mfh , "abrechnungsjahr")
```

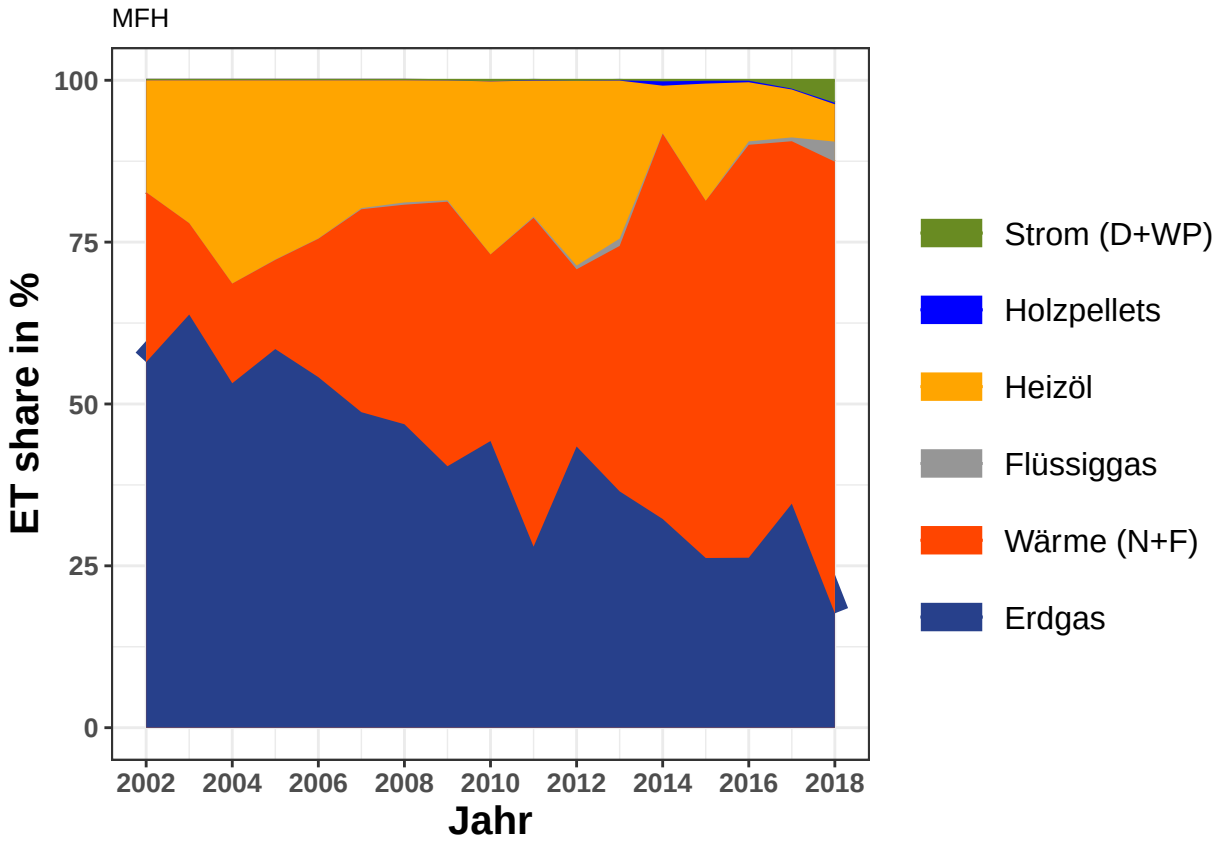
```
col_list <- c("royalblue4","orangered1","gray59","orange","blue","olivedrab4")
cols <- c(
          "erdgas"      = "royalblue4",
          "waerme"      = "orangered1",
          "fluessiggas" = "gray59",
          "heizoel"     = "orange",
          "holzpellets" = "blue",
          "strom"       = "olivedrab4"
          )
plot_title <- NULL
order_legend <- rev(c("erdgas","waerme","fluessiggas","heizoel","holzpellets","strom"))
order_labels <- rev(c("Erdgas","Wärme (N+F)","Flüssiggas","Heizöl","Holzpellets","Strom (D+WP)"))
et_list <- c("erdgas","waerme","fluessiggas","heizoel","holzpellets","strom")
plot_byET <- function(obj,xlabel,ylabel,plottitle,kt_to_mt=FALSE) {
  if (kt_to_mt) {
    source("/home/kbhaskar/Github_Repos/co2emissions/Berlin/BezirkAnalysis/convert_kilo_to_megaton.R")
    obj <- convert_kilo_to_megaton(obj , "abrechnungsjahr")
```

```
  }
  ggplot()+geom_line(data=obj,aes(x=abrechnungsjahr,y=get(et_list[1]),color=et_list[1]),size=5
  )+geom_line(data=obj,aes(x=abrechnungsjahr,y=get(et_list[2]),color=et_list[2])
  )+geom_line(data=obj,aes(x=abrechnungsjahr,y=get(et_list[3]),color=et_list[3])
  )+geom_line(data=obj,aes(x=abrechnungsjahr,y=get(et_list[4]),color=et_list[4])
  )+geom_line(data=obj,aes(x=abrechnungsjahr,y=get(et_list[5]),color=et_list[5])
  )+geom_line(data=obj,aes(x=abrechnungsjahr,y=get(et_list[6]),color=et_list[6])
  )+scale_color_manual(labels=order_labels,name=" ",values=cols,breaks=order_legend
  )+geom_ribbon(data=obj,aes(x=abrechnungsjahr,ymin=0,ymax=get(et_list[6])),fill=col_list[6]
  )+geom_ribbon(data=obj,aes(x=abrechnungsjahr,ymin=0,ymax=get(et_list[5])),fill=col_list[5]
  )+geom_ribbon(data=obj,aes(x=abrechnungsjahr,ymin=0,ymax=get(et_list[4])),fill=col_list[4]
  )+geom_ribbon(data=obj,aes(x=abrechnungsjahr,ymin=0,ymax=get(et_list[3])),fill=col_list[3]
  )+geom_ribbon(data=obj,aes(x=abrechnungsjahr,ymin=0,ymax=get(et_list[2])),fill=col_list[2]
  )+geom_ribbon(data=obj,aes(x=abrechnungsjahr,ymin=0,ymax=get(et_list[1])),fill=col_list[1])+theme_bw(
    plot.title=element_text(size=10),
    axis.title.x=element_text(size=15, face="bold"),
    axis.title.y = element_text(size=15, face="bold"),
    legend.text = element_text(size=12),
    axis.text.x=element_text(size=10,face="bold"),
    axis.text.y=element_text(size=10,face="bold"),
    legend.key.size=unit(2, "lines")
  )+scale_x_continuous(breaks=seq(2002,2018,2))
}
```

```
plot_byET(obj = ET_shares_sfh,
          xlabel = "Jahr",
          ylabel = "ET share in %",
          plottitle = "1-2 FH")
```

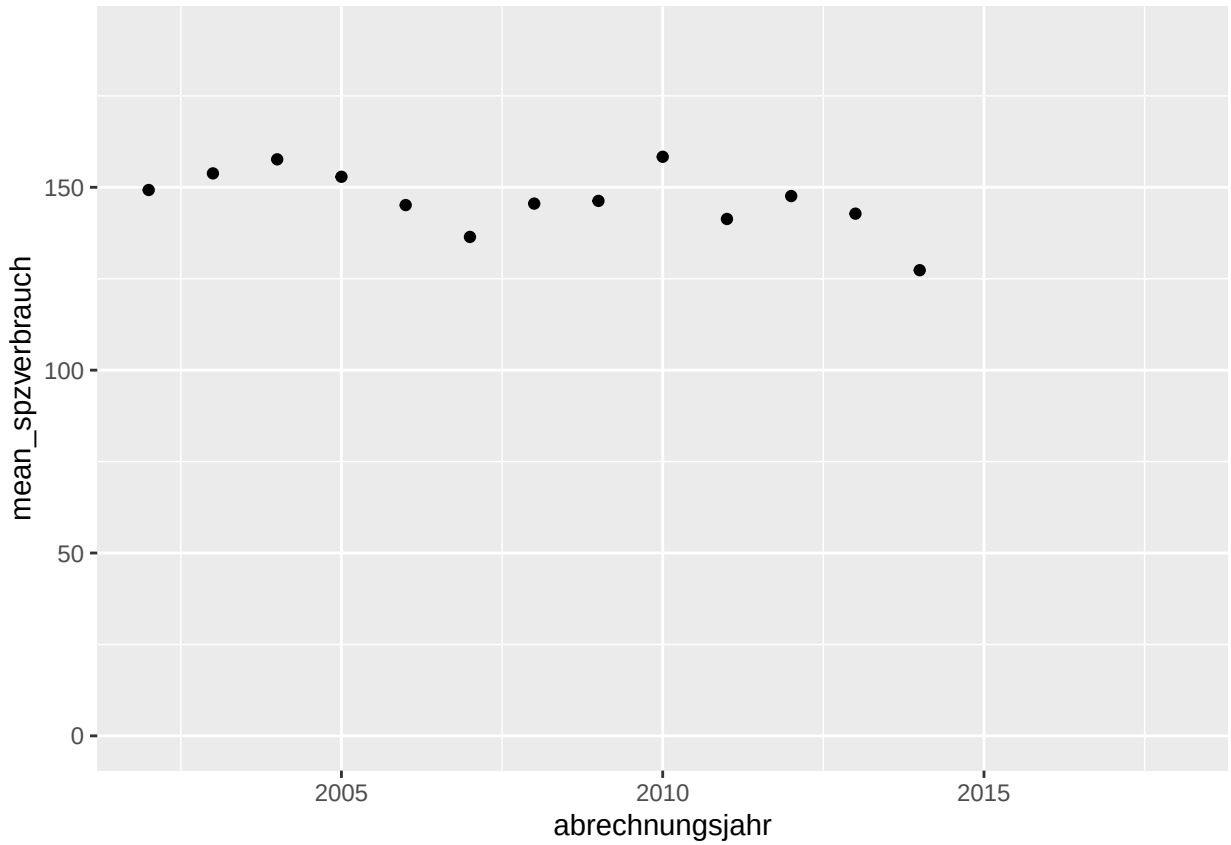



```
plot_byET(obj = ET_shares_mfh,
          xlabel = "Jahr",
          ylabel = "ET share in %",
          plottitle = "MFH")
```

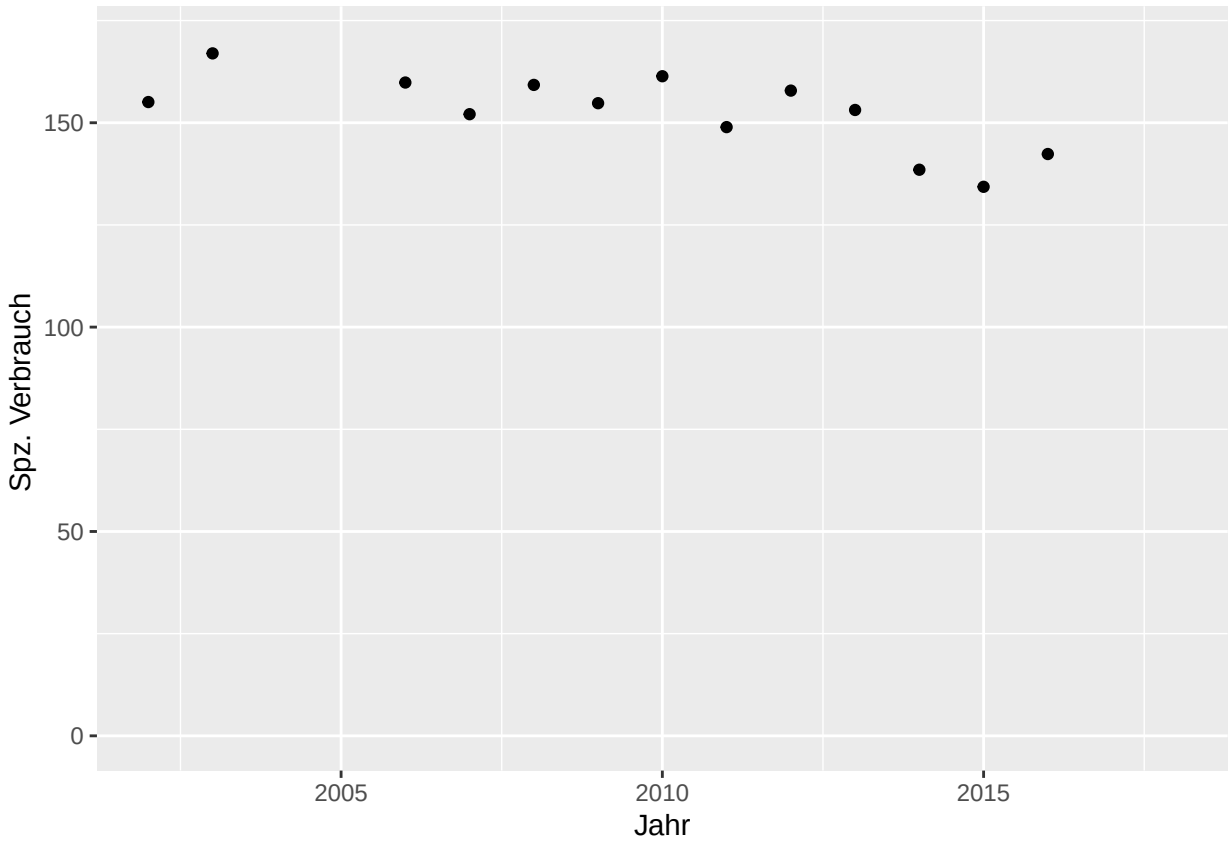



```
spz_verbrauch_mean_mfh <- getSpecificConsumptionCologne(region_data_mfh , FALSE)
spz_verbrauch_mean_sfh <- getSpecificConsumptionCologne(region_data_sfh , FALSE)
```

```
ggplot(spz_verbrauch_mean_mfh , aes(x=abrechnungsjahr,y=mean_spzverbrauch))+geom_point()+ylim(c(0,190))
```




```
ggplot(spz_verbrauch_mean_sfh , aes(x=abrechnungsjahr,y=mean_spzverbrauch))+geom_point()+ylim(c(0,170))+
```



Gebaeude Baujahr

```
mfhbaujahr <- region_data_mfh$gebaeude_baujahr
sfhbaujahr <- region_data_sfh$gebaeude_baujahr
```

```
as.data.frame(t(t(table(cut(mfhbaujahr,breaks=10)))))
```

```
##                    Var1 Var2 Freq
## 1  (1.64e+03,1.67e+03]    A    3
## 2  (1.67e+03,1.71e+03]    A    0
## 3  (1.71e+03,1.75e+03]    A    0
## 4  (1.75e+03,1.79e+03]    A    0
## 5  (1.79e+03,1.83e+03]    A    2
## 6  (1.83e+03,1.87e+03]    A   12
## 7   (1.87e+03,1.9e+03]    A  301
## 8   (1.9e+03,1.94e+03]    A  920
## 9  (1.94e+03,1.98e+03]    A 4709
## 10 (1.98e+03,2.02e+03]    A 1504
```

```
as.data.frame(t(t(table(cut(mfhbaujahr,breaks=seq(from=min(mfhbaujahr),to=max(mfhbaujahr),
                                                  length.out=10))))))
```

```
##                   Var1 Var2 Freq
```

```
## 1 (1.64e+03,1.68e+03]    A    0
## 2 (1.68e+03,1.72e+03]    A    0
## 3 (1.72e+03,1.76e+03]    A    0
## 4 (1.76e+03,1.81e+03]    A    0
## 5 (1.81e+03,1.85e+03]    A    5
## 6 (1.85e+03,1.89e+03]    A   55
## 7 (1.89e+03,1.93e+03]    A  974
## 8 (1.93e+03,1.98e+03]    A 4580
## 9 (1.98e+03,2.02e+03]    A 1834
```

```
as.data.frame(t(t(table(cut(sfhbaujahr,breaks=10)))))
```

```
##                    Var1 Var2 Freq
## 1   (1.8e+03,1.82e+03]    A    2
## 2  (1.82e+03,1.84e+03]    A    4
## 3  (1.84e+03,1.87e+03]    A   28
## 4  (1.87e+03,1.89e+03]    A   72
## 5  (1.89e+03,1.91e+03]    A  415
## 6  (1.91e+03,1.93e+03]    A 1011
## 7  (1.93e+03,1.95e+03]    A 1433
## 8  (1.95e+03,1.97e+03]    A 6308
## 9     (1.97e+03,2e+03]    A 4693
## 10    (2e+03,2.02e+03]    A 1154
```

```
as.data.frame(t(t(table(cut(sfhbaujahr,breaks=seq(from=min(sfhbaujahr,na.rm=T),to=max(sfhbaujahr,na.rm=T
                                                  length.out=10)))))))
```

```
##                   Var1 Var2 Freq
## 1  (1.8e+03,1.82e+03]    A    1
## 2 (1.82e+03,1.85e+03]    A    4
## 3 (1.85e+03,1.87e+03]    A   53
## 4  (1.87e+03,1.9e+03]    A  104
## 5  (1.9e+03,1.92e+03]    A  736
## 6 (1.92e+03,1.95e+03]    A 1372
## 7 (1.95e+03,1.97e+03]    A 5977
## 8 (1.97e+03,1.99e+03]    A 5314
## 9 (1.99e+03,2.02e+03]    A 1558
```