sector\_summary

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sector\_totals <- left\_join(data,indirect\_CO2\_countries,by = c("ISO", "country", "region\_ar6\_10", "year", "chapter\_title", "subsector\_title"))  
  
world\_totals <- sector\_totals %>%   
 filter(year==2018) %>%   
 group\_by(chapter\_title,year) %>%   
 summarise(GHG=sum(GHG,na.rm=TRUE),CO2\_indirect=sum(CO2\_indirect,na.rm=TRUE)) %>%   
 mutate(GHG\_indirect=sum(GHG,CO2\_indirect))  
  
world\_totals\_totals <- sector\_totals %>%   
 filter(year==2018) %>%   
 group\_by(year) %>%   
 summarise(GHG=sum(GHG,na.rm=TRUE),CO2\_indirect=sum(CO2\_indirect,na.rm=TRUE)) %>%   
 mutate(GHG\_indirect=sum(GHG)) %>%   
 mutate(chapter\_title="Total")  
  
world\_totals <- rbind(world\_totals,world\_totals\_totals)  
  
sector\_totals\_totals <- sector\_totals %>%   
 filter(year==2018) %>%   
 group\_by(region\_ar6\_10,region\_ar6\_10\_short,year) %>%   
 summarise(GHG=sum(GHG,na.rm=TRUE),CO2\_indirect=sum(CO2\_indirect,na.rm=TRUE)) %>%   
 mutate(chapter\_title="Total") %>%   
 mutate(GHG\_indirect=sum(GHG))  
  
sector\_totals <- sector\_totals %>%   
 filter(year==2018) %>%   
 group\_by(region\_ar6\_10,region\_ar6\_10\_short,chapter\_title,year) %>%   
 summarise(GHG=sum(GHG,na.rm=TRUE),CO2\_indirect=sum(CO2\_indirect,na.rm=TRUE))  
  
sector\_totals <- sector\_totals %>%   
 mutate(GHG\_indirect=sum(GHG,CO2\_indirect))  
  
sector\_totals <- rbind(sector\_totals,sector\_totals\_totals)  
  
sector\_totals <- left\_join(sector\_totals,world\_totals %>% select(chapter\_title,year,world\_total=GHG\_indirect),by = c("chapter\_title", "year"))  
  
  
sector\_totals <- sector\_totals %>%   
 mutate(fraction=GHG\_indirect/world\_total)  
  
  
p1<- sector\_totals %>% ggplot(.,aes(x=region\_ar6\_10\_short,y=fraction\*100,fill=region\_ar6\_10\_short)) +  
 geom\_bar(stat="identity",color="#737373") +  
 facet\_grid(factor(chapter\_title,levels=c("AFOLU","Buildings","Energy systems","Industry","Transport","Total"))~.,scales="free",switch = "both") +  
 scale\_fill\_manual(values=colorRampPalette(brewer.pal(8, "Set2"))(10)) +  
 scale\_y\_continuous(position = "right") +  
 theme(legend.position="none",  
 legend.title=element\_blank(),  
 axis.title.y = element\_blank(),  
 axis.title.x=element\_blank(),  
 axis.text.x = element\_text(angle=45,hjust=1),  
 title = element\_text(size=9)) +  
 ggtitle('a. Regional contributions to sector emissions (%)')

per\_capita <- left\_join(data,indirect\_CO2\_countries,by = c("ISO", "country", "region\_ar6\_10", "year", "chapter\_title", "subsector\_title"))  
  
per\_capita\_world <- per\_capita %>%   
 group\_by(year,chapter\_title) %>%   
 summarise(GHG=sum(GHG,na.rm=TRUE),CO2\_indirect=sum(CO2\_indirect,na.rm=TRUE)) %>%   
 mutate(GHG\_indirect=GHG+CO2\_indirect) %>%   
 mutate(ISO="WLD")  
  
per\_capita\_world <- left\_join(per\_capita\_world,wdi\_data\_gdp\_pop %>% select(ISO=iso3c,year,population), by = c("year", "ISO"))  
  
per\_capita\_world <- per\_capita\_world %>%   
 mutate(GHG\_indirect\_pc=GHG\_indirect/population) %>%   
 filter(year==2018) %>%   
 mutate(label="World average")  
  
total\_world <- per\_capita\_world %>%   
 group\_by(year,label) %>%   
 summarise(GHG=sum(GHG,na.rm=TRUE),CO2\_indirect=sum(CO2\_indirect,na.rm=TRUE),population=nth(population,1)) %>%  
 mutate(GHG\_indirect\_pc=GHG/population) %>%   
 mutate(chapter\_title="Total")  
  
per\_capita\_world <- rbind(per\_capita\_world,total\_world)  
  
totals <- per\_capita %>%   
 filter(year %in% c(2010,2018)) %>%   
 group\_by(ISO,country,region\_ar6\_10,region\_ar6\_10\_short,year) %>%   
 summarise(GHG=sum(GHG),population=nth(population,1),CO2\_indirect=sum(CO2\_indirect,na.rm=TRUE)) %>%   
 mutate(GHG\_indirect=GHG+CO2\_indirect) %>%   
 mutate(GHG\_pc=GHG/population) %>%   
 mutate(GHG\_indirect\_pc=GHG\_indirect/population) %>%   
 mutate(year=as.factor(year)) %>%   
 filter(population>1e6) %>%   
 mutate(chapter\_title="Total")  
  
per\_capita <- per\_capita %>%   
 filter(year %in% c(2010,2018)) %>%   
 group\_by(ISO,country,region\_ar6\_10,region\_ar6\_10\_short,chapter\_title,year) %>%   
 summarise(GHG=sum(GHG),population=nth(population,1),CO2\_indirect=sum(CO2\_indirect,na.rm=TRUE)) %>%   
 mutate(GHG\_indirect=GHG+CO2\_indirect) %>%   
 mutate(GHG\_pc=GHG/population) %>%   
 mutate(GHG\_indirect\_pc=GHG\_indirect/population) %>%   
 mutate(year=as.factor(year)) %>%   
 filter(population>1e6)  
  
per\_capita <- rbind(per\_capita,totals)  
  
p2 <- per\_capita %>%   
 filter(year==2018) %>%   
 ggplot(aes(x=region\_ar6\_10\_short,y=GHG\_indirect\_pc,fill=region\_ar6\_10\_short)) +  
 geom\_boxplot(outlier.alpha = 0.5,color="#737373",show.legend=FALSE) +  
 geom\_hline(data=per\_capita\_world,aes(yintercept=GHG\_indirect\_pc,color=label),alpha=0.8,linetype="dashed") +  
 facet\_grid(factor(chapter\_title,levels=c("AFOLU","Buildings","Energy systems","Industry","Transport","Total"))~.,scales="free") +  
 scale\_fill\_manual(values=colorRampPalette(brewer.pal(8, "Set2"))(10)) +  
 ylab("GHG emissions per capita (tCO2eq/capita)") +  
 scale\_y\_continuous(position = "right") +  
 theme(legend.position = "bottom",  
 legend.title=element\_blank(),  
 legend.background = element\_blank(),  
 legend.margin = margin(t = 0, unit='cm'),  
 axis.title.x=element\_blank(),  
 axis.title.y=element\_blank(),  
 strip.background = element\_blank(),  
 strip.text = element\_blank(),  
 axis.text.x = element\_text(angle=45,hjust=1),  
 title = element\_text(size=9)) +  
 ggtitle("b. Per capita sector emissions in 2018 (tCO2eq/capita)")

p1 + p2 + plot\_layout(width = c(1,1.05))

