





Variable Energy Supply CO2 Transport CO2 Industry CO2 Buildings CO2 AFOLU CO2 Non-CO2 emissions

R visualisation

From laRge datasets to something nice

22 March, 2018 | Heleen van Soest



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 - Getting started
 - Basics
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From here...

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IND	AIM/CGE - NPi_V3	Emissions CO2	Mt CO2/yr	1551.370	1639.666	1890.660	2238.844	2561.641	2798.198	3081.032	3356.311	3608.597	3861.353	4546.937	5250.010	5890.226	6367.034	6767.134
IND	AIM/Enduse 3.0 - NPi_V3	Emissions CO2	Mt CO2/yr	1329.830	1809.814	2371.041	2883.435	3452.886	3987.642	4766.255	5043.653	5329.458	5656.468					
IND	COPPE-COFFEE 1.0 - NPi_V3	Emissions CO2	Mt CO2/yr		2045.611	2163.599	2447.445	3069.519	3733.273	3899.297	4379.881	4711.023	5081.418	5696.634	6496.662	6858.231	7836.028	8654.876
IND	DNE21+ V.14 - NPi_V3	Emissions CO2	Mt CO2/yr	1337.326	1888.971	2460.703	3312.458	4283.804	5331.157		7657.878		9445.651					
IND	GEM-E3 - NPi_V3	Emissions CO2	Mt CO2/yr		1748.666	1856.449	2021.193	2283.393	2745.840	3242.662	3704.007	4257.403	4792.089					
IND	GEM-E3_V1 - NPi_V3	Emissions CO2	Mt CO2/yr		1748.666	1917.304	2052.245	2274.705	2739.922	3242.170	3681.984	4204.905	4712.798					
IND	IMAGE 3.0 - NPi_V3	Emissions CO2	Mt CO2/yr	1324.022	1765.116	2126.397	2605.589	3201.090	3828.011	4301.583	4931.997	5651.294	6564.792	8260.945	9888.447	10931.077	11612.359	11640.937
IND	India MARKAL - NPi_V3	Emissions CO2	Mt CO2/yr	1235.275	1837.536	2075.991	3144.183	4373.667	5908.423	7484.640	9186.044	10924.130	12430.990					
IND	MESSAGEix-GLOBIOM_1.0 - NPi_V3	Emissions CO2	Mt CO2/yr	1561.624	1873.528		2764.863		4204.545		5972.117		7884.821	9776.721	11192.187	12801.522	13360.365	13817.526
IND	POLES CDL - NPi_V3	Emissions CO2	Mt CO2/yr	967.354	1529.538	2121.367	2610.738	3243.643	4009.682	4790.031	5506.345	6139.637	6813.354	7951.506	9273.600	10650.606	11334.332	11843.803
IND	REMIND-MAgPIE 1.7-3.0 - NPi_V3	Emissions CO2	Mt CO2/yr	2239.358	2492.859	3268.074	3960.418	4393.331	4823.187	5429.485	6184.452	6964.030	7690.642	8731.392	9089.801	9551.663	9632.733	9744.993
IND	WITCH2016 - NPi_V3	Emissions CO2	Mt CO2/yr	1770.284	1828.423	2300.589	2793.632	3392.522	4002.826	4634.442	5234.249	5763.843	6319.036	7431.365	8467.143	8958.992	9128.964	9152.126
© CDL gener	INKS Stock Taking Database (Version 1.0) ated: 2018-02-26 10:59:08)																

Notes:

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Output Options:

Portable Network Graphics

Scalable Vector Graphics

XLS







Cumulative CO₂ emissions (2011-2050) relative to 2010















Share of electricity in FE [%]













But also e.g.













Step by step: getting started

- Download <u>R</u> & <u>Rstudio</u>
- New project with *packrat* (library version compatibility)
- Version control: git or svn (cooperate, or for yourself)
 - Create a <u>Github</u> account
 - Setting it up: <u>http://www.molecularecologist.com/2013/11/using-github-with-r-and-rstudio/</u>
 - > Download <u>Git</u>
 - > Configure Git
 - > Set path to Git executable
 - CD-LINKS scripts: <u>https://github.com/CD-LINKS/factsheet</u>
- Help: <u>Stackoverflow</u> & ggplot <u>cheat sheet</u>



Step by step: some basics

- Set working directory (via Session or add line in script setwd)
- New script insert section (ctrl-shift-R)
- Install.packages()
- Library() / require()
 - Data.table
 - Ggplot2
 - Tidyr
 - Dplyr
 - reshape2

- Source on Save 🔍 🖉 🖌 Run •• Source • 2 - ########## Main file that loads and processes data ########### 3 - ########## for x-Cut analyisis ########### 6 library(reshape2) # melt library(data.table) # setnames, nice view option library(dplyr) # 1,>5 library(tidyr) # spread library(ggplot2) # ggplot library(rmarkdown) # render pdf library(directlabels) # year labels for scatter plots 13 library(stringr) #str replace all 15 #set working directory for R right if it is not by default (it is the right one by default if you open Rstudio by clicking on this main.R file) 16 #setwd("D:/location-of-srcfolder-on-your-system") 18 #source configuration file for region-specific data 19 source("settings/config_xCut.R") 20 cfg5infile <- "cdlinks_compare_20171127-154822" #source function for factorizing data frames 23 source("functions/factor.data.frame.R")
 24 # source functions process data() and add variables() source("functions/data_processing.R") 26 #source function overwrite for overwriting a dataframe for a subset of variables 27 source("functions/overwrite.R") #source file with plot function 29 source("functions/plot_functions.R") 31 # flag to process data, reprocess even if _proc.rdata file is available 32 # set to true if you always want data re-processed b.procdata - 1 35 # Create plot directory
- Source (... .R) settings, functions (general plotting, data processing etc.)
- Ctrl-shift-C (#): comment
- Ctrl-enter: run selected



Step by step: from data to graphs

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	193	# Two separate y-axis limits	▲ III
	194	F3a = ggplot()	(fill Approach) alaba (2) Harrows into
	195	F3a = F3a + geom_ribbon(data=epw3[Region%in%c(USA , EU , JPN , RUS)],de5(X=Year,ymin=mini,ymax=max. F3a = fac = deom_nzhb/data=epw3[Region%in%c("USA" "EU" "IDN" "RUS")]aes(x=Year,ymin=mini,ymax=max.	roach) size=2 alpha=0 8) #linetyne=Cate
	197	F3a = F3a + scale colour manual(values=c("BAU*"="#b37400","CO*"="#000000", """#E69F00","ECPC*"="#	56B4E9", "GDR*"="#009E73", "GF*"="#CC79A7
# 🕻	198	"IEPC*"="#0072B2","PCC*"="#D55E00"))	
e	199	F3a = F3a + scale_fill_manual(valves=c("BAU*"="#b37400","CO*"="#0000000","AP*"="#E69F00" SCPC*"="#56	B4E9","GDR*"="#009E73","GF*"="#CC79A7",
ep_	200	$EPC^* = \#00/2B2$, $PCC^* = \#055600$)) E3a = E3a + scale x continuous(breaks=c(1970 1990 2010 2030 2050 2070 2090 2100))	
ep_	202	F3a = F3a + xlab("") + ylab ("GHG emissions indexed to 2010") + theme_bw()	Ribbon (different
ep_	203	F3a = F3a + theme(axis.text.x = element_text(angle=90)) + theme(axis.text=element_text(size=16)) +	
er_	204	theme(legend.text = element_text(size=16)) + theme(legend.title=element_text(size=18)) + theme(ctrin text = element_text(size=18)) +	per variable), path
ep_	205	F3a = F3a + vlim(-1.5, 2, 5)	
εν_ # p	207	F2a = F3a + facet_grid(Category~Region,scales="free_x")	(line), lavout
ep	208		
ep_	209	H3D = ggplot() E2b = E3b + geom nibbon(data-enw3[Pegion%in%c("CHN" "TND" "PRA")] aes(x-Yean ymin-mini ymax-maxi fil	-Approach) alpha-0 2) #group-interact(
ep_	210	F3b = F3b + geom_ribbon(data=epw3[Region%in%c("CHN", "IND", "BRA")],aes(x=Year,y=defaulti.color=Approach).size=2.alpha=0.8) #linetype=Category
ep_	212	F3b = F3b + scale_colour_manual(values=c("BAU*"="#b37400","CO*"="#000000","AP*"="#E69F00","ECPC*"="#	56B4E9","GDR*"="#009E73","GF*"="#CC79A7
ep_	213	"IEDC*"-"#007282", "PCC*"="#D55E00"))	
set	214	F3D = F3D + SCALE_TIIL_MANUAI(VALUES=C(BAU* = #D3/400 , CU* = #0000004 _ AP* = #E69F00 , ECPC* = #56 "TEPC*"-"#067282" "PCC*"-"#D55E00"))	$34E9$, $GDK^* = \#009E/3$, $GF^* = \#CC/9A/$,
on	216	T3b = F3b + scale_x_continuous(breaks=c(1970,1990,2010,2030,2050,2070,2090,2100))	
ep_	217	F3b = F3b + xlab("") + ylab ("GHG emissions indexed to 2010") + theme_bw()	
erk	218	F3b = F3b + theme(axis.text.x = element_text(angle=90)) + theme(axis.text=element_text(size=16)) + theme(legend_text_size=16)) + theme(legend_text_siz=16)) + theme(legend_text_size=16))	
	219	theme(strip.text = element_text(size=16)) + theme(agis.title = element_text(size=18)) +	
#As	221	$F_{3b} = F_{3b} + ylim(-1,6)$	
еры	222	F3b = F3b + facet_grid(Category~Region,scales="free_x")	
epw	223	Desany(gnid)	
	225	tmp<-ggplot_gtable(ggplot_build(F3a))	Dutting different
	226	<pre>leg<-which(sapply(tmp>grobs, function(x) x\$name) =="guide_box")</pre>	Putting different
	227	<pre>legend<-tmp\$grobs[[leg]]</pre>	aranh alamanta
	228	F3a=F3a+tneme(legend.position = none) F3b=F3b+theme(legend.position = "none")	graph elements
	230	lay<-rbind(c(1,1,1,1),c(2,2,2,3))	togothor
	231	h=grid.arrange(F3a,F3b,legend,layout_matrix=lay)	logethei
	232	<pre>ggsave(file=paste0(out,"/","F3_emissionpathways_1000_grid_arrange.png"),h,width=20,height=12,dpi=300</pre>	
	233		



Common graph types: ribbon & lines, facet



Common graph types: point(range)





Common graph types: scatter

plot_scatter <- function(reg, dt, vars_to_spread, cats, out=cfg\$outdir, title="Title", file_pre="scatter",connect=T,ylim=NA,xlog=F,ylog=F,yearlab=T,year





Common graph types: boxplots



[}] else if(h multivar) 4



Common graph types: bar





Common graph types: stacked bar





Common graph types: area





Summing up

- Set working directory, load libraries, load data, edit dataset / prepare for plotting
- Fig1 = ggplot ()
- Fig1 = Fig1 + geom_[your graph type](data=[your dataset], aes(x= ..., y=...), color=..., ...)
- Fig1 = Fig1 + facet_grid(...~..)
- Fig1 = Fig1 + scale_colour_manual(values=c())
- Fig1 = Fig1 + scale_x_continuous(values=c())
- Fig1 = Fig1 + ylab ("") + xlab("")
- Fig1 = Fig1 + theme(axis.text = element_text())
- Etc. etc.: add layers, elements
- Ggsave(Fig1.png)



DIY: CD-LINKS fact sheets



CD-LINKS fact sheets: clone Git Repository

 File – New project – Version Control – Git -<u>https://github.com/CD-LINKS/factsheet</u> - Choose your location – Create Project

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CD-LINKS fact sheets: structure

- Main folder: src
 - Scripts
 - Data folder
 - Functions folder
 - Graphs / paper graphs / plots (output) folders
 - Settings folder

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ah_V3	2030_high	NoPOL_V3	AIM/Enduse 3.0	IND	Final Energy Hydrogen	EJ/yr	2005	0.000000e+00	glc
jh_V3	2030_high	NoPOL_V3	AIM/Enduse 3.0	IND	Final Energy Industry	EJ/yr	2005	6.445087e+00	glc
₃h_V3	2030_high	NoPOL_V3	AIM/Enduse 3.0	IND	Final Energy Industry Electricity	EJ/yr	2005	9.224295e-01	glc
3h_V3	2030_high	NoPOL_V3	AIM/Enduse 3.0	IND	Final Energy Industry Gases	EJ/yr	2005	4.601233e-01	glc
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```
plot line <- function(reg, dt, vars, cats, out=cfg$outdir, title="Title", file pre="def",ylim=NA,xlim=NA){</pre>
 #select data
 dt <- dt[region==reg & Category %in% cats & variable %in% vars]</pre>
 #create string with y-axis units for axis label
 unitsy <- paste0("(",unique(dt[variable%in%vars]$unit),")</pre>
                                                                ···)
 unitsy <- paste(rev(unitsy),sep='',collapse='')</pre>
 # For each variable count models and add to data and variable name
 models=dt[,list(number=length(unique(model))),by=c('region','variable')]
 dt=merge(dt, models, by=c('region','variable'))
 dt$variable <- paste(dt$variable,' [',dt$number,' models]',sep="")</pre>
 minmax=dt[,list(ymax=max(value),ymin=min(value)),by=c('region','period','Category','variable')]
 minmax=minmax[!period %in% c("2015","2025","2035","2045","2055","2065","2075","2085","2095")]
 minmax<-minmax[order(region, Category, period),]</pre>
 p = ggplot()
 p = p + geom ribbon(data=minmax,aes(x=period,ymin=ymin,ymax=ymax),alpha=.3,fill='grey')
 p = p + geom path(data=dt,aes(x=period,y=value,color=model,group=paste(model,scenario),size=Scope))
 p = p + scale shape manual(values=cfq$man shapes)
 p = p + scale size manual(values=c("national"=2, "global"=.2))
 p = p + scale colour manual(values=plotstyle(as.character(unique(dt$model))))
 p = p + geom path(data=dt[Scope=="national"],aes(x=period,y=value,color=model,group=paste(model,scenario),size=
 if (!all(is.na(ylim))){p = p + ylim(ylim)} #manual y-axis limits
 if (!all(is.na(xlim))){p = p + xlim(xlim)} #manual x-axis limits
 p = p + facet grid(variable~region, scales="free y")
 p = p + ylab(paste(unitsy))
 p = p + qqtitle(title) + qqplot2::theme bw()
  acceve(file_neste0(out "/" file_nre " " red_cfa@formet) n_width=7_height=8_dni=120)
    vars=c("Policy Cost|Consumption Loss","Policy Cost|GDP Loss","Policy Cost|Area under MAC Curve")
    cats=c("2030 high")
```

if(dim(all[Scope=="national" & variable %in% vars & cats %in% cats])[1]>0){
 plot_line(reg=cfg\$r,dt=all,vars=vars,cats=cats,title="Policy Costs in 2030_high
 scenarios".file_pre="cons_gdp_loss_line")

Call the general function







22 March, 2018 | Heleen van Soest



CD-LINKS fact sheets: paper graphs





Other possibility: Shiny – interactive data viewer





Thank you

- Happy R-ing!
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