

607 Project 2 - Sheffield Land Analysis for Photovoltaics

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City of Sheffield Land Analysis

We will study the potential of using domestic and commercial rooftop area in the city of Sheffield to install Photovoltaic generators.

```
Shef.Land <- as_tibble(read.csv("https://raw.githubusercontent.com/JMawyin/MSDS2019-607/master/SheffieldLand.csv"))
```

The breakdown below shows the breakdown of surface area in Sheffield based on different types.

```
colnames(Shef.Land)
```

```
## [1] "LA.Code"           "District"
## [3] "LSOA"             "LSOA.Name"
## [5] "Total.Area.of.All.Land.Types" "Area.of.Domestic.Buildings"
## [7] "Area.of.Non.Domestic.Buildings" "Area.of.Road"
## [9] "Area.of.Path"       "Area.of.Rail"
## [11] "Area.of.Domestic.Gardens" "Area.of.Greenspace"
## [13] "Area.of.Water"       "Area.of.Other.Land.Uses"
## [15] "Area.of.Unclassified.Land" "Area.of.Admin.Geography"
## [17] "Quality.of.Fit.Indicator"
```

The dataset has an area breakdown below the District level of interest for us. First, we need to add up all the per District components and focus on the Total District Area, Total Domestic Area and Total Commercial Area. (Area in thousands of square meters)

```
##Using data.table to aggregate
require(data.table)
```

```
## Loading required package: data.table
```

```
##
## Attaching package: 'data.table'
```

```
## The following objects are masked from 'package:dplyr':
##
##      between, first, last
```

```
DT <- data.table(Shef.Land)
District.Sums <- DT[, .(Total.Area = sum(Total.Area.of.All.Land.Types), T.Area.Domestic = sum(Area.of.Domestic.Buildings)), by = District]
District.Sums
```

```
##           District Total.Area T.Area.Domestic
## 1:      Arbourthorne   6635.51         544.44
## 2:  Beauchief and Greenhill   7947.60         522.96
```

## 3:	Beighton	6791.17	472.90
## 4:	Birley	5481.80	395.36
## 5:	Broomhill	3133.54	372.77
## 6:	Burngreave	10320.14	659.80
## 7:	Central	4115.29	477.91
## 8:	Crookes	4814.41	435.30
## 9:	Darnall	16548.80	591.68
## 10:	Dore and Totley	16264.36	604.18
## 11:	East Ecclesfield	14716.62	633.90
## 12:	Ecclesall	8395.36	565.51
## 13:	Firth Park	4440.82	416.01
## 14:	Fulwood	32658.60	425.54
## 15:	Gleadless Valley	4090.05	385.61
## 16:	Graves Park	3905.23	292.16
## 17:	Hillsborough	5917.21	484.58
## 18:	Manor Castle	5158.55	384.93
## 19:	Mosborough	8062.89	416.41
## 20:	Nether Edge	2686.91	394.77
## 21:	Richmond	4131.29	331.48
## 22:	Shiregreen and Brightside	6023.37	392.38
## 23:	Southey	3570.70	334.87
## 24:	Stannington	148511.85	623.55
## 25:	Stocksbridge and Upper Don	21166.80	464.57
## 26:	Walkley	2830.01	338.06
## 27:	West Ecclesfield	7678.77	366.92
## 28:	Woodhouse	5264.64	344.98
##	District Total	Area	T.Area.Domestic
##	T.Area.Non.Domestic		
## 1:	151.05		
## 2:	75.19		
## 3:	220.47		
## 4:	70.18		
## 5:	225.00		
## 6:	1119.62		
## 7:	799.80		
## 8:	55.68		
## 9:	1500.24		
## 10:	80.20		
## 11:	360.32		
## 12:	97.63		
## 13:	81.14		
## 14:	109.26		
## 15:	112.58		
## 16:	100.61		
## 17:	437.48		
## 18:	308.25		
## 19:	116.71		
## 20:	93.03		
## 21:	49.79		
## 22:	271.94		
## 23:	64.78		
## 24:	332.56		
## 25:	314.17		
## 26:	195.25		

```
## 27:          45.28
## 28:          69.63
##      T.Area.Non.Domestic
```

Then we will use a simple estimate to calculate the generation potential per district and per location.

```
#Roof Percentage Suitable for PV
N.Domestic.PV.Suitable.PC <- .60
Domestic.PV.Suitable.PC <- .22
#Generation capacity of one thousand square meters of PV in kilowatts
T.SM.Generation <- 150
District.Sums <- mutate(District.Sums, PV.Capacity.Domestic.KW = round((T.Area.Domestic*Domestic.PV.Sui
District.Sums
```

##	District	Total.Area	T.Area.Domestic
## 1	Arbourthorne	6635.51	544.44
## 2	Beauchief and Greenhill	7947.60	522.96
## 3	Beighton	6791.17	472.90
## 4	Birley	5481.80	395.36
## 5	Broomhill	3133.54	372.77
## 6	Burngreave	10320.14	659.80
## 7	Central	4115.29	477.91
## 8	Crookes	4814.41	435.30
## 9	Darnall	16548.80	591.68
## 10	Dore and Totley	16264.36	604.18
## 11	East Ecclesfield	14716.62	633.90
## 12	Ecclesall	8395.36	565.51
## 13	Firth Park	4440.82	416.01
## 14	Fulwood	32658.60	425.54
## 15	Gleadless Valley	4090.05	385.61
## 16	Graves Park	3905.23	292.16
## 17	Hillsborough	5917.21	484.58
## 18	Manor Castle	5158.55	384.93
## 19	Mosborough	8062.89	416.41
## 20	Nether Edge	2686.91	394.77
## 21	Richmond	4131.29	331.48
## 22	Shiregreen and Brightside	6023.37	392.38
## 23	Southey	3570.70	334.87
## 24	Stannington	148511.85	623.55
## 25	Stocksbridge and Upper Don	21166.80	464.57
## 26	Walkley	2830.01	338.06
## 27	West Ecclesfield	7678.77	366.92
## 28	Woodhouse	5264.64	344.98
##	T.Area.Non.Domestic	PV.Capacity.Domestic.KW	PV.Capacity.Non.Domestic.KW
## 1	151.05	17966.52	13594.5
## 2	75.19	17257.68	6767.1
## 3	220.47	15605.70	19842.3
## 4	70.18	13046.88	6316.2
## 5	225.00	12301.41	20250.0
## 6	1119.62	21773.40	100765.8
## 7	799.80	15771.03	71982.0
## 8	55.68	14364.90	5011.2
## 9	1500.24	19525.44	135021.6
## 10	80.20	19937.94	7218.0

```
## 11          360.32          20918.70          32428.8
## 12           97.63          18661.83           8786.7
## 13           81.14          13728.33           7302.6
## 14          109.26          14042.82           9833.4
## 15          112.58          12725.13          10132.2
## 16          100.61           9641.28           9054.9
## 17          437.48          15991.14          39373.2
## 18          308.25          12702.69          27742.5
## 19          116.71          13741.53          10503.9
## 20           93.03          13027.41           8372.7
## 21           49.79          10938.84           4481.1
## 22          271.94          12948.54          24474.6
## 23           64.78          11050.71           5830.2
## 24          332.56          20577.15          29930.4
## 25          314.17          15330.81          28275.3
## 26          195.25          11155.98          17572.5
## 27           45.28          12108.36           4075.2
## 28           69.63          11384.34           6266.7
```

Ordering Data Frame “District.Sums” by descending values of the column “PV.Capacity.Non.Domestic.KW”

```
District.Sums <- arrange(District.Sums, desc(PV.Capacity.Non.Domestic.KW))
```

What are the Residential, Comercial and Photovoltaic generation statistics of the City of Sheffield?

```
Shef.Area.Stats <- colSums(District.Sums[,2:6])
Shef.Area.Stats
```

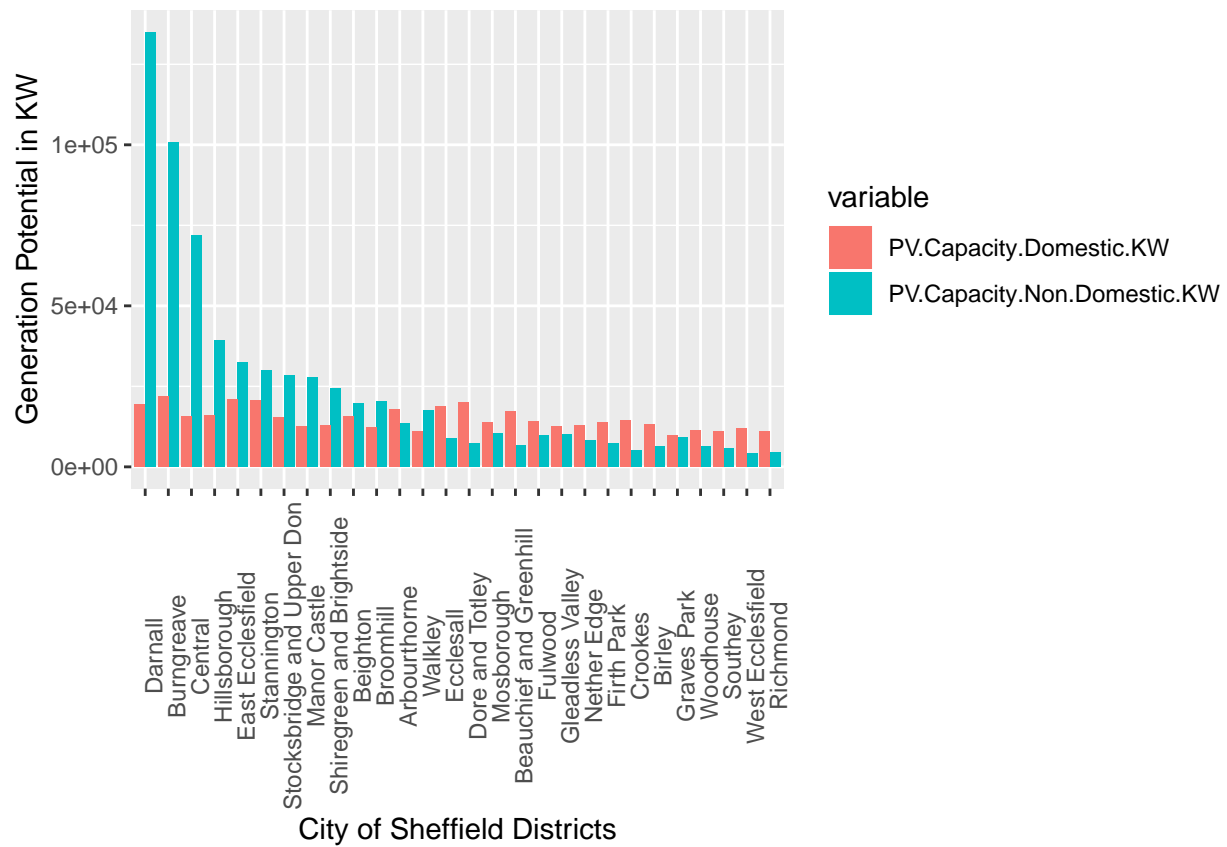
```
##          Total.Area          T.Area.Domestic
##          371262.29          12673.53
##          T.Area.Non.Domestic  PV.Capacity.Domestic.KW
##          7457.84          418226.49
## PV.Capacity.Non.Domestic.KW
##          671205.60
```

```
#colnames(Shef.Area.Stats) <- c("Total Area", "Residential Area", "Commercial Area", "PV Potential Dome
```

What is the PV Generation Potential in KiloWatts of the different areas in the City of Sheffield.

```
dfm <- melt(District.Sums[,c('District','PV.Capacity.Domestic.KW','PV.Capacity.Non.Domestic.KW')],id.vars = 'District')

#reorder(,-value) orders the bars from high to low.
ggplot(dfm,aes(x = reorder(District, -value),y = value)) +
  geom_bar(aes(fill = variable),stat = "identity",position = "dodge") + theme(axis.text.x = element_t
```



We have shown a way to calculate the PV generation potential of the different districts in Sheffield.