

# KNOWLEDGE SESSION SUSTAINABLE ENERGY IN THE CITY

Mapping the city's energy potential

Aránzazu Galán González (ULB)



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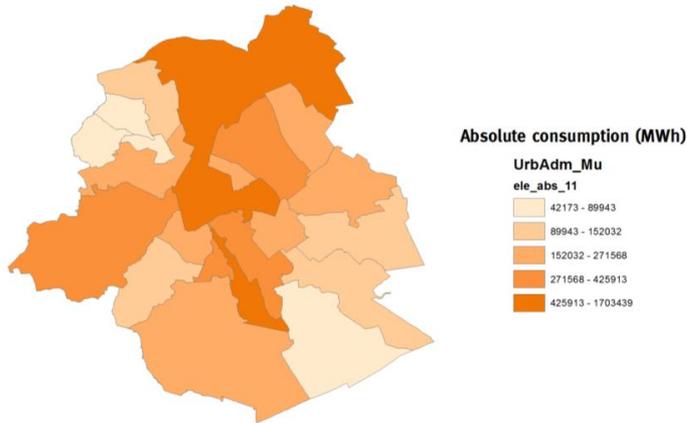


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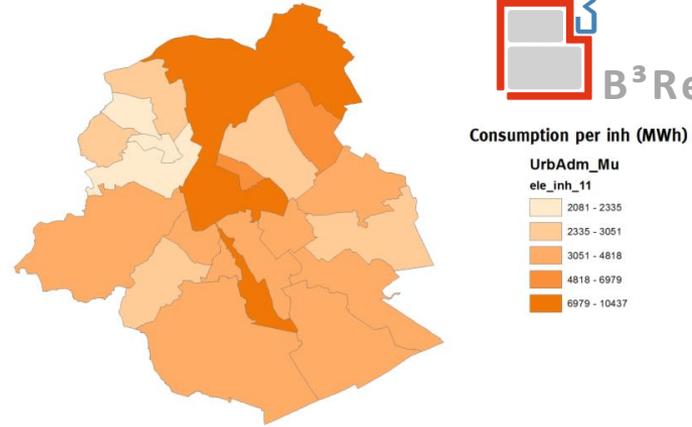
**POTENTIAL?**





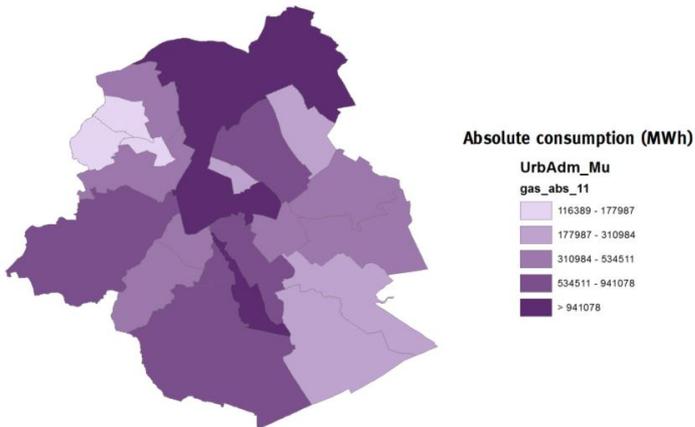
Absolute consumption of electricity in Brussels municipalities (2011)

 Author: Aristide Athanassiadis; BATir-ULB  
Source: SIBELGA



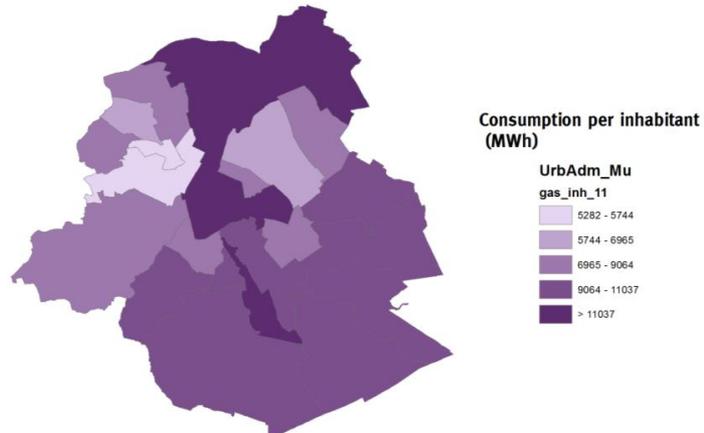
Consumption of electricity per inhabitant in Brussels municipalities (2011)

 Author: Aristide Athanassiadis; BATir-ULB  
Source: SIBELGA; DGSIE



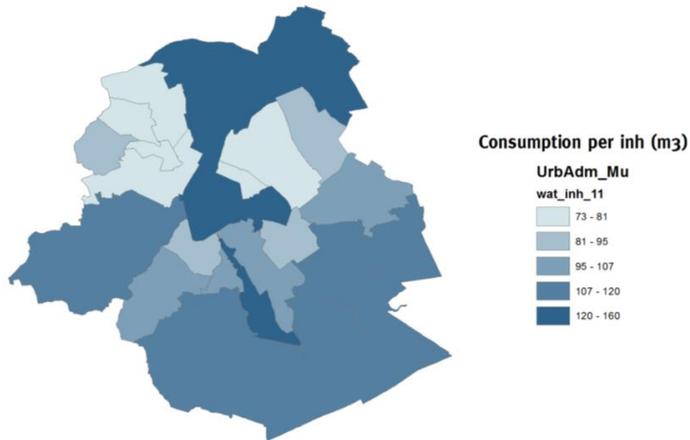
Absolute consumption of natural gas in Brussels municipalities (2011)

 Author: Aristide Athanassiadis; BATir-ULB  
Source: DGSIE; own calculations



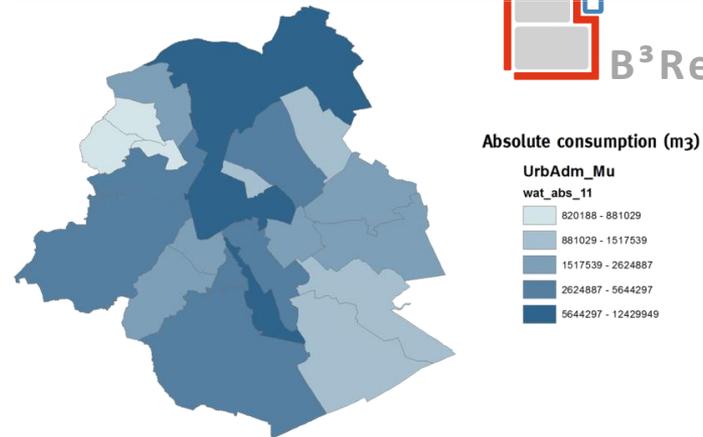
Consumption of natural gas per inhabitant in Brussels municipalities (2011)

 Author: Aristide Athanassiadis; BATir-ULB  
Source: DGSIE; SIBELGA



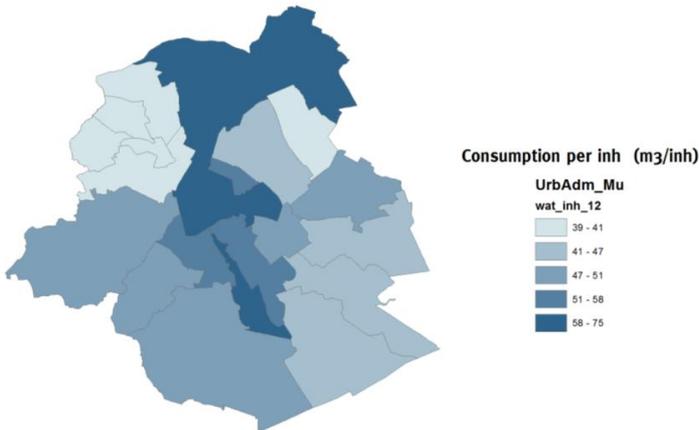
Consumption of water per inhabitant in Brussels municipalities (2011)

 Author: Aristide Athanassiadis; BATir-ULB  
Source: HYDROBRU; DGSIE



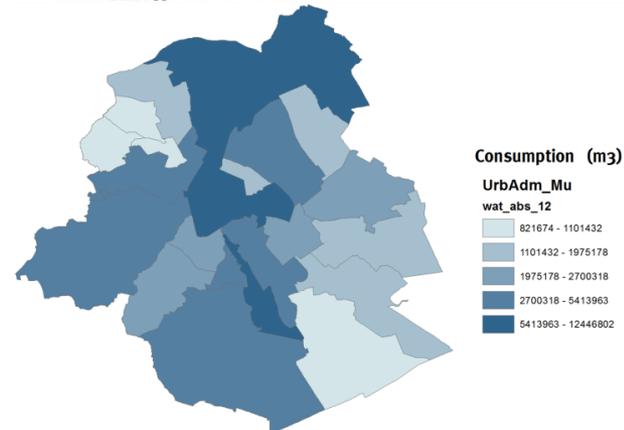
Absolute consumption of water in Brussels municipalities (2011)

 Author: Aristide Athanassiadis; BATir-ULB  
Source: HYDROBRU



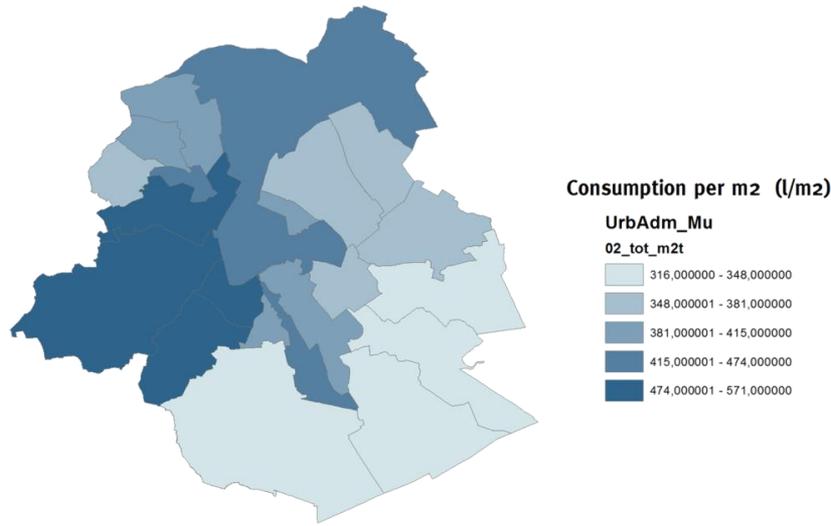
Absolute consumption of water per inhabitant in Brussels municipalities (2012)

 Author: Aristide Athanassiadis; BATir-ULB  
Source: VIVAQUA; IBSA



Absolute consumption of water in Brussels municipalities (2012)

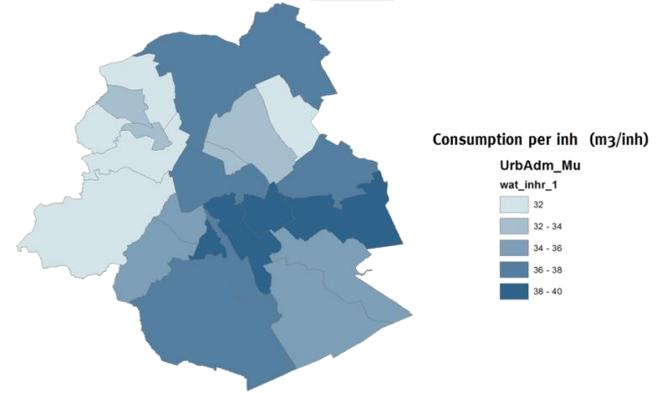
 Author: Aristide Athanassiadis; BATir-ULB  
Source: VIVAQUA



Absolute consumption of water per total m2 in Brussels municipalities (2012)



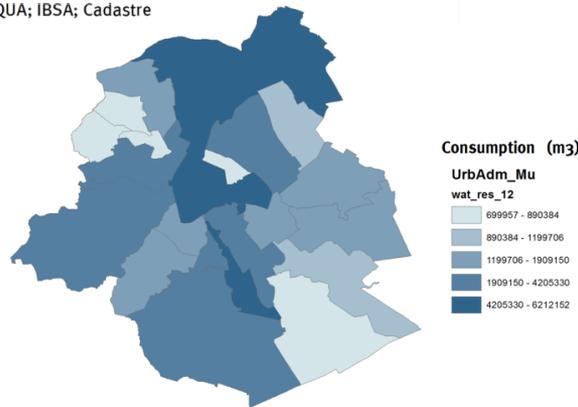
Author: Aristide Athanassiadis; BATir-ULB  
Source: VIVAQUA; IBSA; Cadastre



Residential consumption of water per inhabitant in Brussels municipalities (2012)



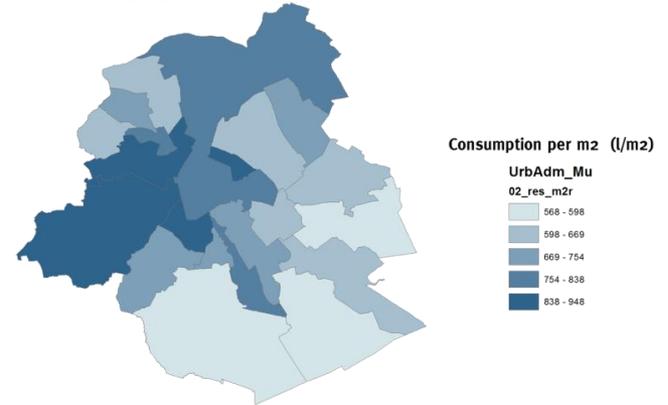
Author: Aristide Athanassiadis; BATir-ULB  
Source: VIVAQUA; IBSA



Residential consumption of water in Brussels municipalities (2012)



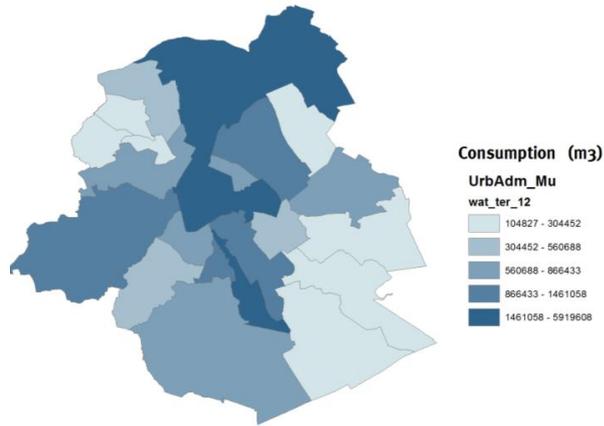
Author: Aristide Athanassiadis; BATir-ULB  
Source: VIVAQUA



Residential consumption of water per residential m2 in Brussels municipalities (2012)



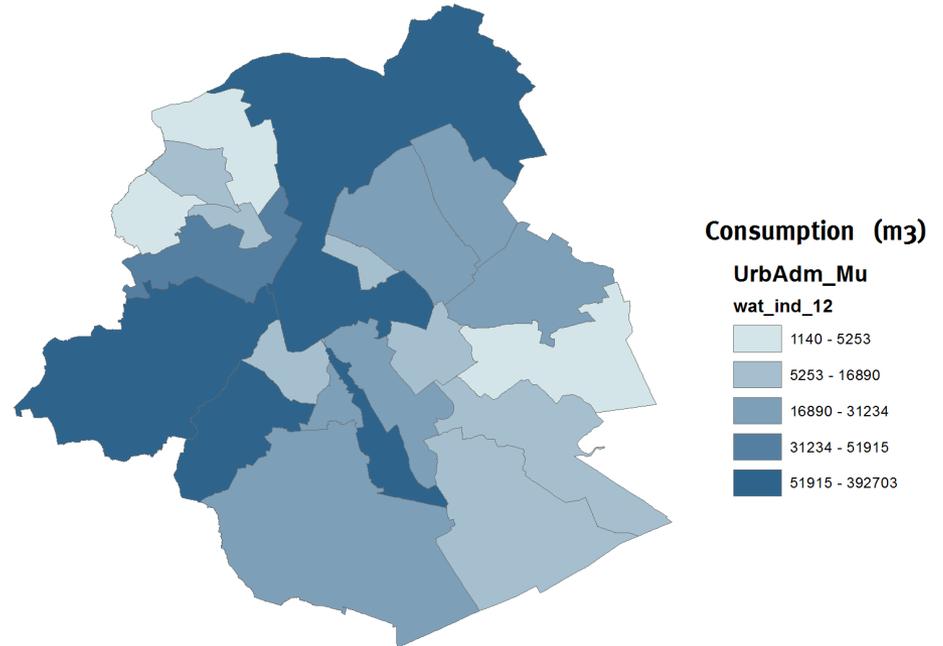
Author: Aristide Athanassiadis; BATir-ULB  
Source: VIVAQUA; Cadastre



Tertiary consumption of water in Brussels municipalities (2012)



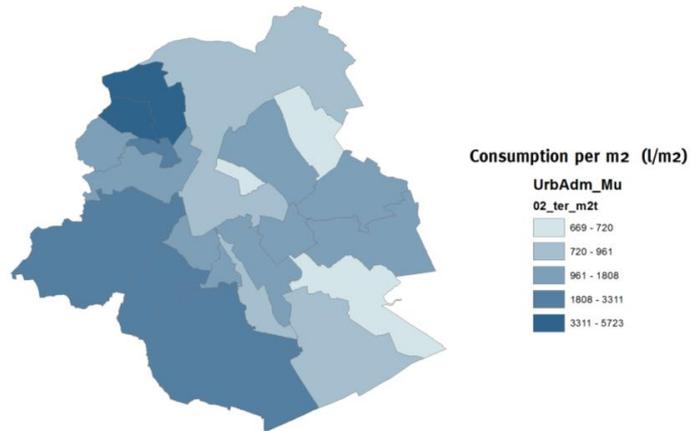
Author: Aristide Athanassiadis; BATir-ULB  
Source: VIVAQUA



Industry consumption of water in Brussels municipalities (2012)



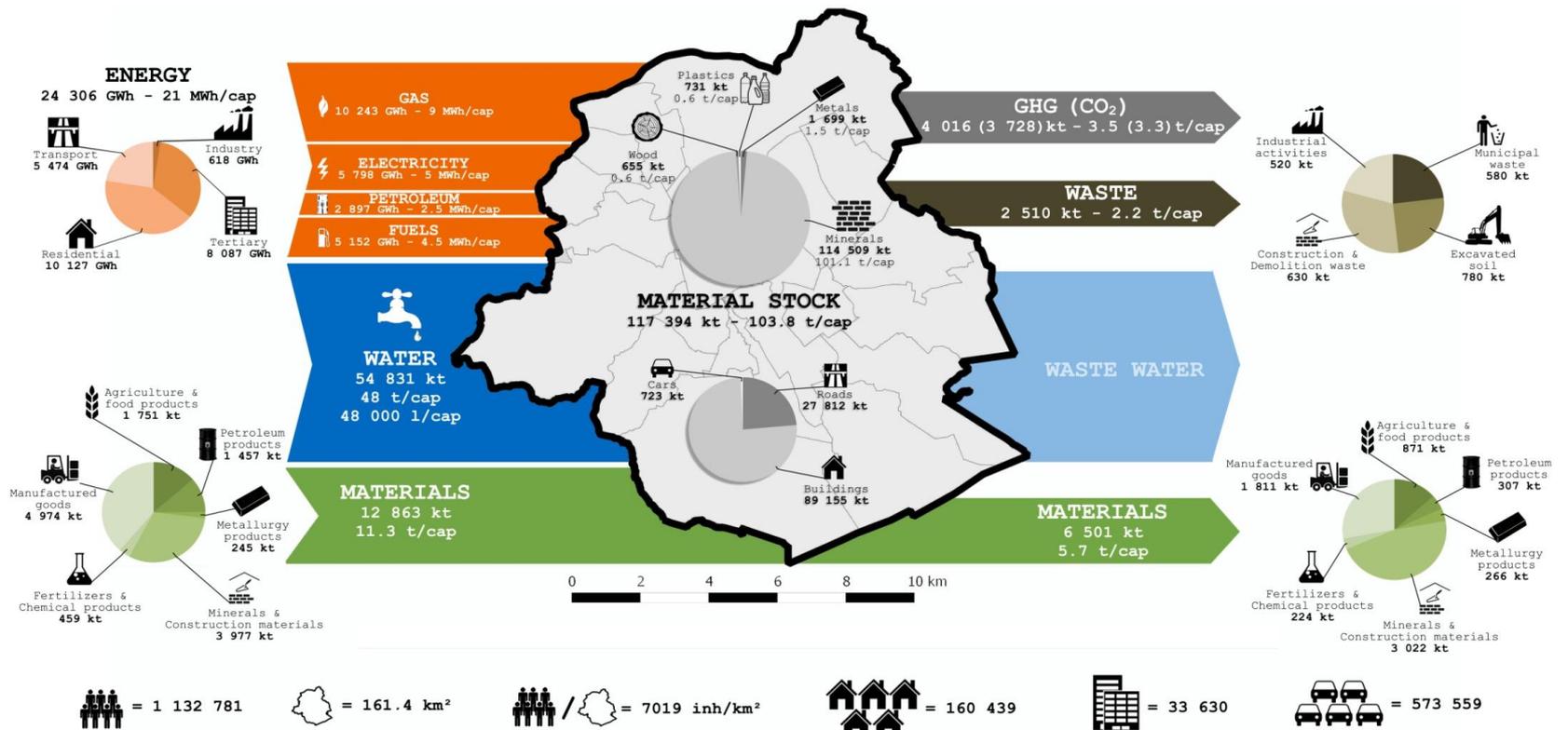
Author: Aristide Athanassiadis; BATir-ULB  
Source: VIVAQUA

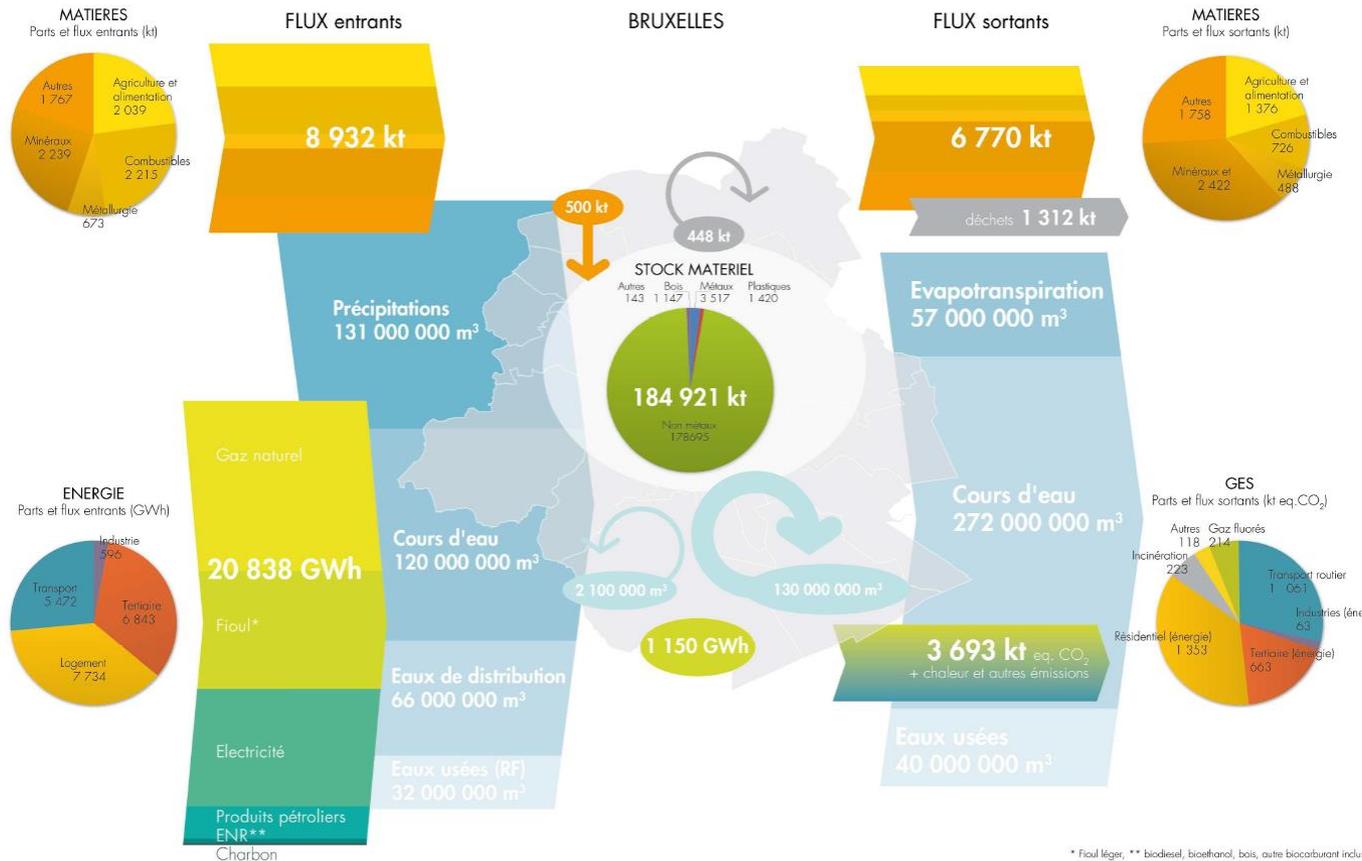


Tertiary consumption of water per tertiary m2 in Brussels municipalities (2012)



Author: Aristide Athanassiadis; BATir-ULB  
Source: VIVAQUA; IBSA





\* Fioul léger, \*\* biodiesel, bioethanol, bois, autre biocarburant inclu  
Source : ICEDD - ECORES - BATir, pour le compte de la Région de Bruxelles Capitale, bilan provisoire avril 2014

**Chiffres clés du schéma et renvois aux explications techniques du rapport :**

- **20.838 GWh** : consommation de flux d'importation d'énergie en RBC en 2011 (Figure 19) ;
- **349 10<sup>6</sup> m<sup>3</sup>** : somme des flux d'eau entrants en RBC en 2011 (voir Figure 46 incluant les précipitations, les cours d'eau entrant, l'eau de distribution et les eaux à traiter en provenance de la Région flamande) ;
- **8.932 kt**: flux de matière importée en RBC (internationaux + interrégionaux) en 2011 (Figure 24) ;
- **1.150 GWh**: production primaire d'énergie en RBC en 2011 (Figure 19) ;
- **2 10<sup>6</sup> m<sup>3</sup>** et **130 10<sup>6</sup> m<sup>3</sup>** : quantité d'eau prélevée en RBC et quantité d'eaux usées traitées en RBC en 2011 (Figure 46) ;
- **184.921 kt** : masse totale du stock matériel qui a été évalué dans le cadre de cette étude en RBC en 2011 (Tableau 36 qui inclut le stock matériel des bâtiments résidentiels, de bureaux et commerciaux, ainsi que les différents types de véhicules et d'infrastructures) ;
- **448 kt** : déchets traités par l'incinérateur en 2011 (Figure 24, cette valeur n'intervient pas directement dans l'équilibre des flux de matières puisqu'il s'agit d'une réduction de la quantité de déchets sortant du système. Cependant, les déchets issus de l'incinération sont inclus dans la quantité de déchets sortants de RBC);
- **500 kt** : ajout au stock matériel pour l'année 2011 (Figure 24) ;
- **3.693 kt** : rejet de GES en eq CO<sub>2</sub> en RBC en 2011 (Figure 19);
- **369 10<sup>6</sup> m<sup>3</sup>** : somme des flux d'eau sortants en RBC en 2011 (Figure 46);
- **1.312 kt** : somme de la quantité de déchets sortants de RBC en 2011 (comprenant des déchets provenant des ménages et assimilés, des parcs à conteneurs communaux, de l'économie sociale, des déchets de construction et de démolition, d'HoReCa, des STEPs, des bureaux, d'industries et d'incinération, du secteur de santé, des commerces, d'éducation et de nettoyage) – remarquons qu'une partie de ces déchets sont triés et font l'objet de flux de recircularisation (Figure 24) ;
- **6.770 kt** : flux de matériaux exportés en RBC (internationaux + interrégionaux) en 2011 (Figure 24).

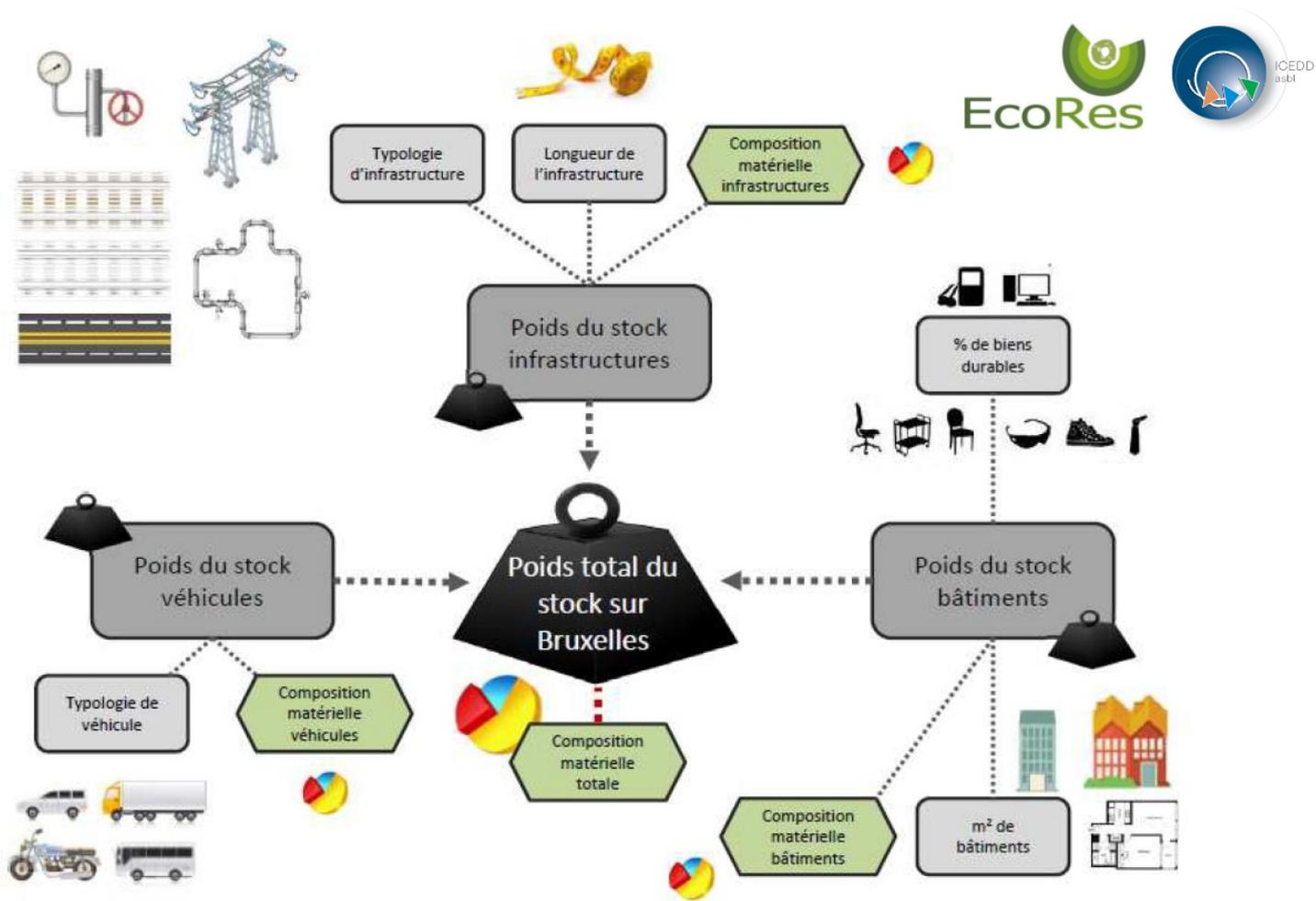


Figure 33 - Représentation du stock matériel dans la Région de Bruxelles Capitale (Source : élaboration BATir)

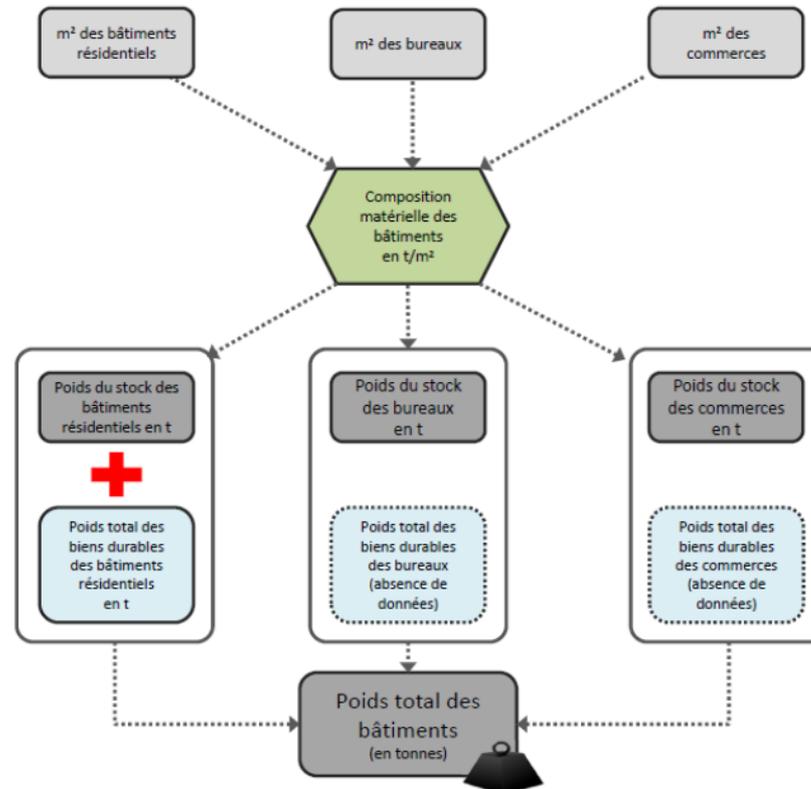


Figure 36 - Représentation de la méthode pour estimer le poids total des bâtiments résidentiels, de bureaux et commerciaux (Source : élaboration BATir)

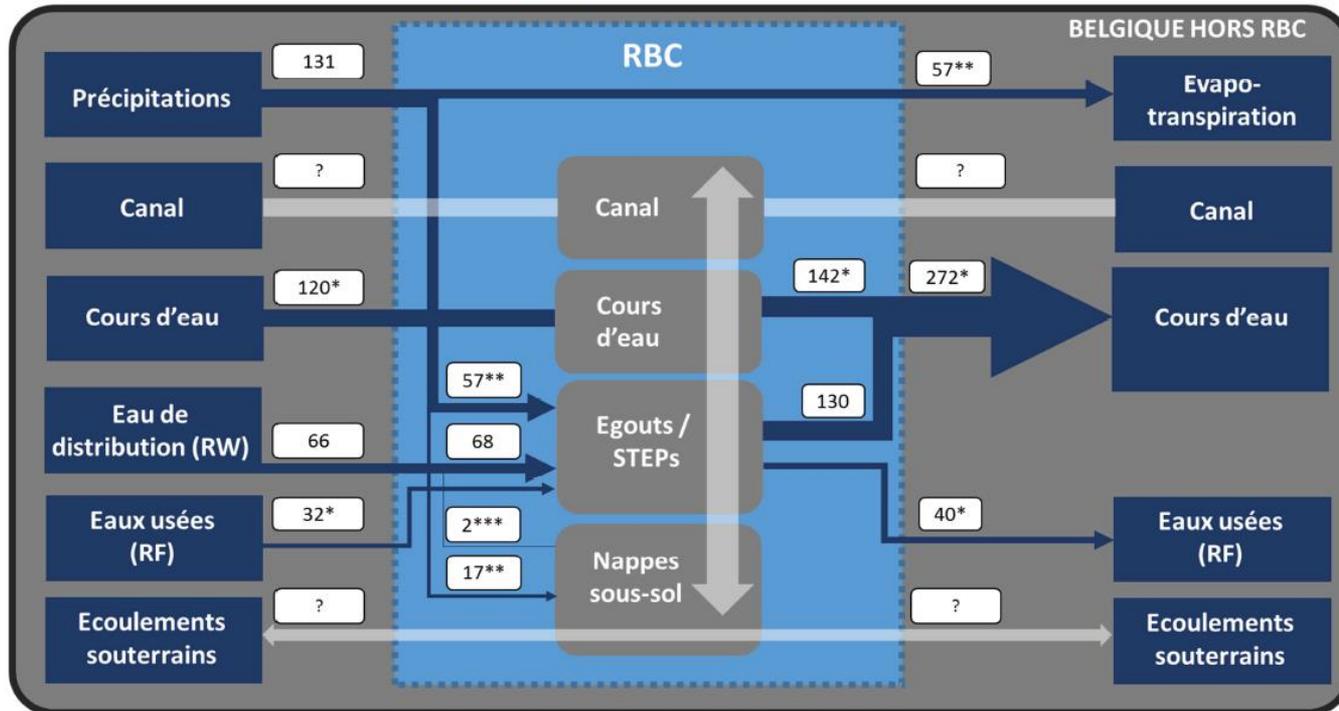
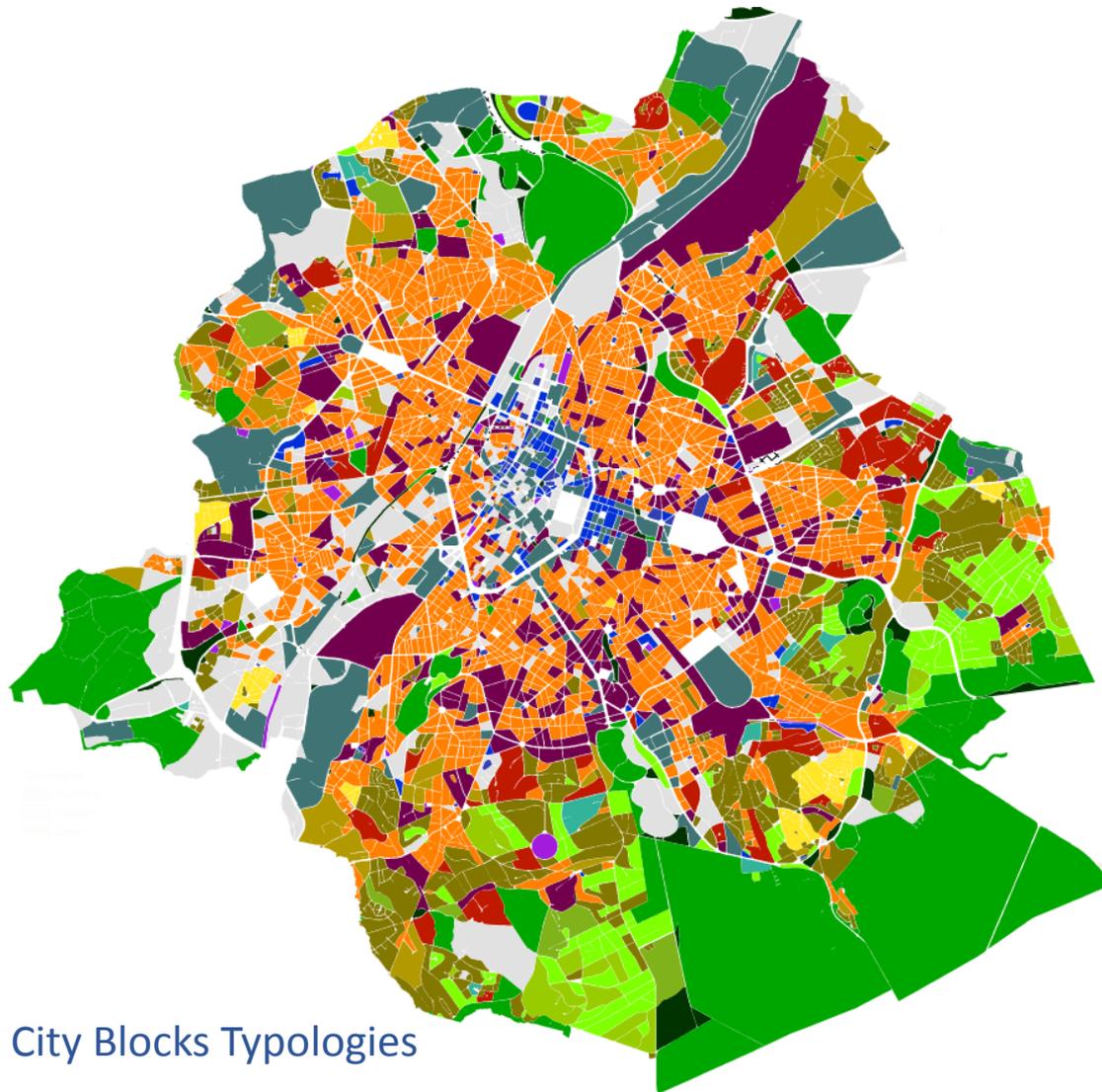


Figure 46 - Estimation du bilan d'eau de la Région de Bruxelles Capitale pour l'année 2011 (en millions de m³/an)  
Sources : Bruxelles Environnement (2014)\*\*\*; VIVAQUA (2012); SBGE (2011); IBGE (2011)\*; Flowbru (2010)\*; Verbanck (1995)\*\*; Calculs BATir

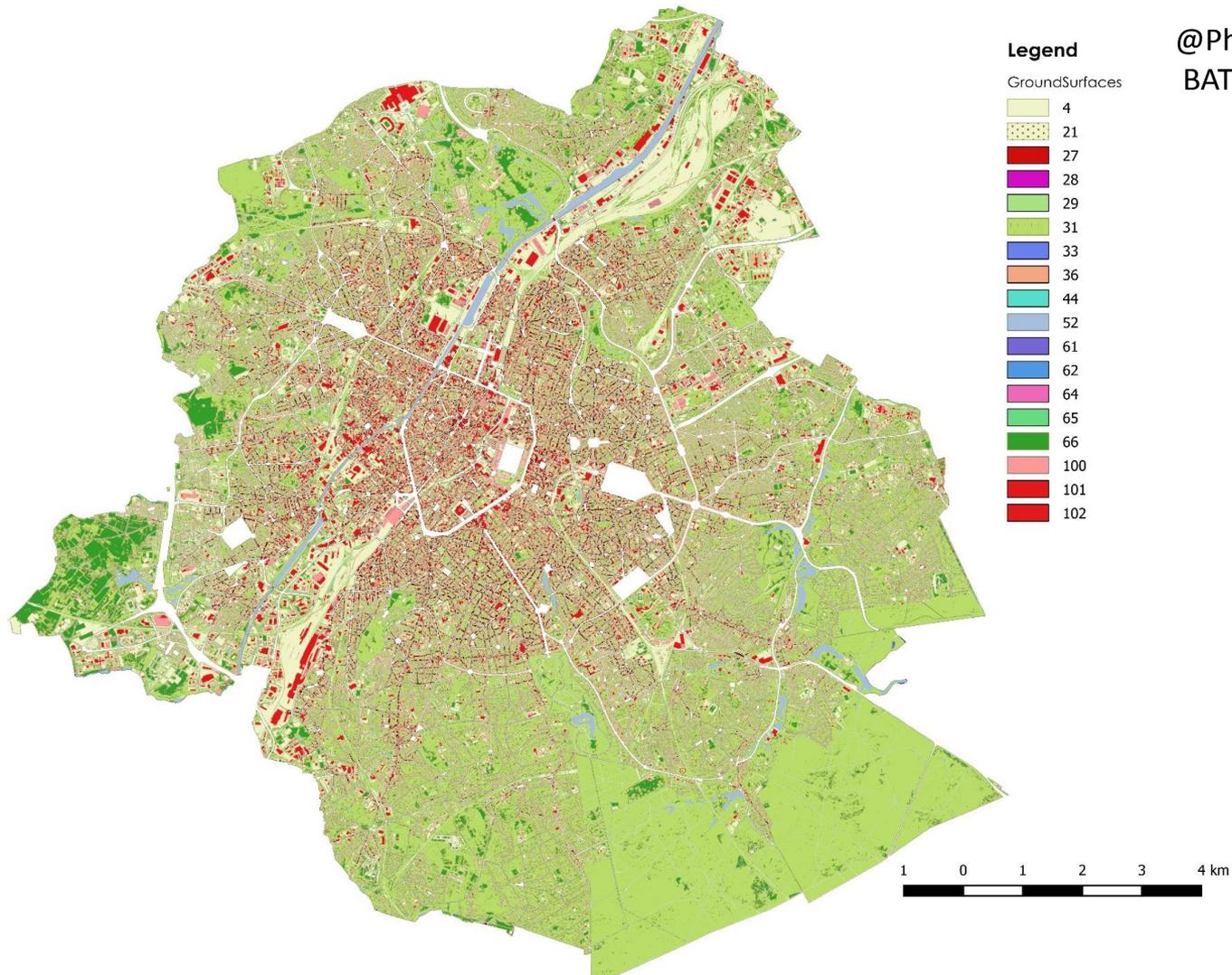


**Typologies**

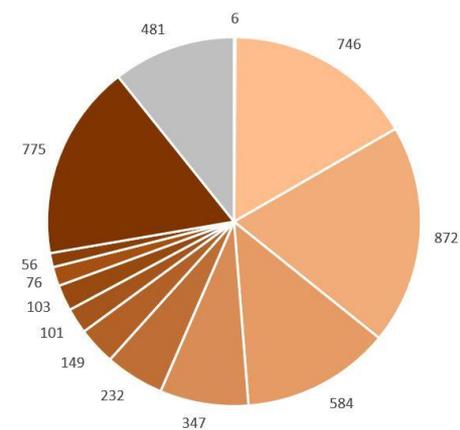
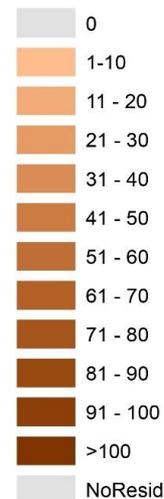
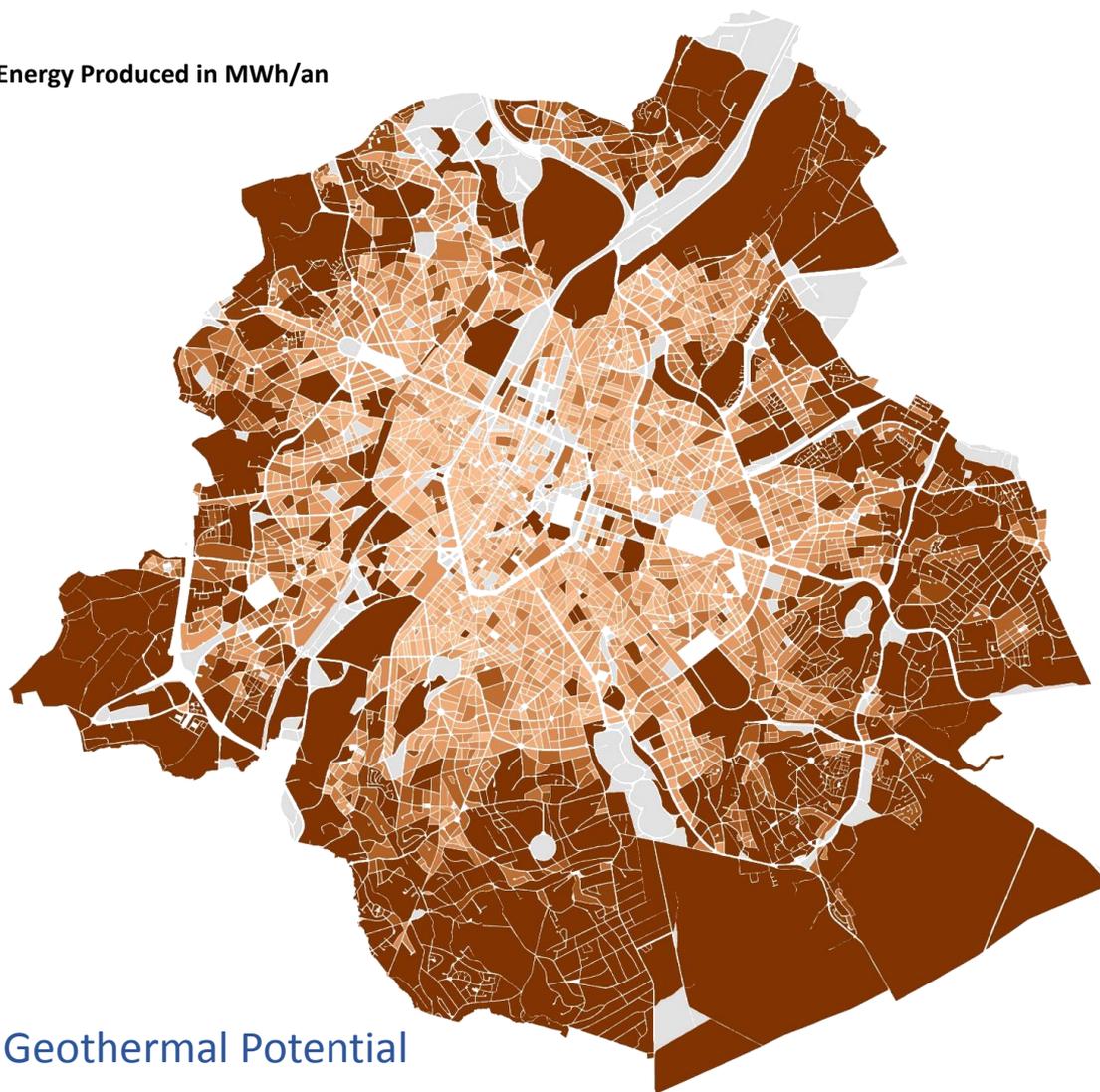
- Traditional
- Detached
- Garden City
- HighRise
- Empty Block
- Extremely low densification
- Interregional Block
- BlockPlot
- Hyb(BlockPlot-Highrise)
- Hyb(Detached-Highrise)
- Hyb(Green-Detached)
- Hyb(Green-Tradi-Detached)
- Hyb(Green-Traditional)
- Hyb(Highrise - Traditional)
- Hyb(Traditional - Detached - Highrise)
- Hyb(Traditional - Detached)
- Hyb(Traditional-Highrise)
- Not classified
- No Data

## City Blocks Typologies

@Philip Stessens PhD  
BATir Department



## Energy Produced in MWh/an

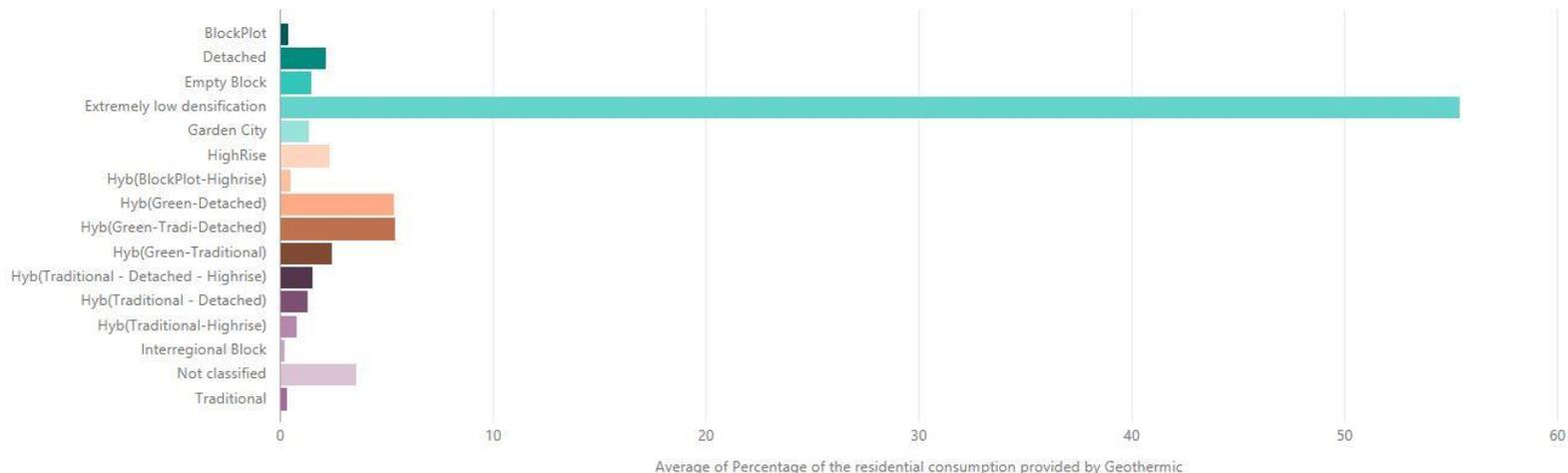


## Geothermal Potential



| BLOCKS' TYPOLOGIES                     | Heating demand MWh/an | Average of Heating demand MWh/an | Average of Probes 10m | Average of Energy Produced 10m | Average of Probes 8m | Average of Energy Produced 8m |
|--|-----------------------|----------------------------------|-----------------------|--------------------------------|----------------------|-------------------------------|
| Interregional Block                    | 16.351,77             | 212,36                           | 2,42                  | 24                             | 0,83                 | 8                             |
| Empty Block                            | 1.832,01              | 916,01                           | 8,00                  | 80                             | 5,50                 | 55                            |
| BlockPlot                              | 8.432,36              | 1.204,62                         | 19,29                 | 193                            | 19,43                | 194                           |
| Hyb(BlockPlot-Highrise)                | 24.616,63             | 1.893,59                         | 41,15                 | 412                            | 50,00                | 500                           |
| Traditional                            | 201.810.889,32        | 2.180,42                         | 62,39                 | 624                            | 77,76                | 778                           |
| Garden City                            | 4.594.553,95          | 1.321,79                         | 166,62                | 1666                           | 228,21               | 2282                          |
| Not classified                         | 9.308.103,86          | 1.581,67                         | 183,26                | 1833                           | 258,27               | 2583                          |
| Hyb(Traditional - Detached)            | 59.133.654,98         | 2.891,48                         | 364,09                | 3641                           | 519,30               | 5193                          |
| Hyb(Traditional-Highrise)              | 69.473.080,64         | 4.275,79                         | 371,73                | 3717                           | 543,22               | 5432                          |
| Detached                               | 10.038.531,66         | 2.037,87                         | 463,90                | 4639                           | 666,72               | 6667                          |
| Hyb(Green-Traditional)                 | 13.895.152,66         | 2.621,73                         | 615,45                | 6155                           | 895,44               | 8954                          |
| Hyb(Traditional - Detached - Highrise) | 664.491,55            | 4.343,08                         | 665,00                | 6650                           | 961,00               | 9610                          |
| HighRise                               | 43.954.548,85         | 6.786,25                         | 1.278,69              | 12787                          | 1.914,24             | 19142                         |
| Hyb(Green-Detached)                    | 2.397.401,14          | 3.677,00                         | 2.012,72              | 20127                          | 3.014,01             | 30140                         |
| Hyb(Green-Tradi-Detached)              | 3.808.464,57          | 4.655,82                         | 2.088,71              | 20887                          | 3.131,54             | 31315                         |
| Extremely low densification            | 7.590.513,77          | 4.752,98                         | 24.756,39             | 247564                         | 38.296,95            | 382969                        |
| <b>Total</b>                           | <b>426.720.619,73</b> | <b>2.689,90</b>                  | <b>487,94</b>         | <b>4879</b>                    | <b>726,31</b>        | <b>7263</b>                   |

Average of Percentage of the residential consumption provided by Geothermic por BLOCKS' TYPOLOGIES

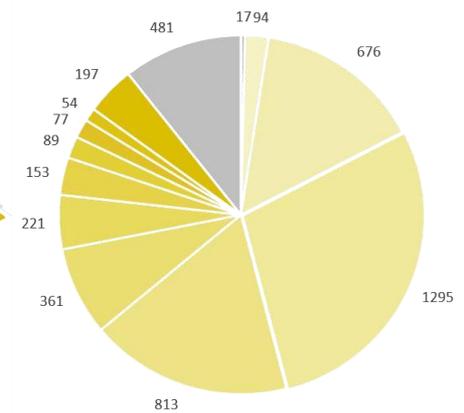
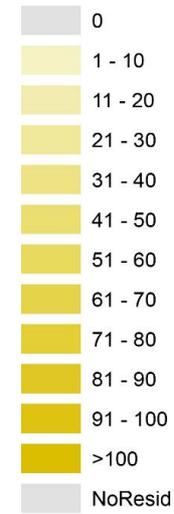
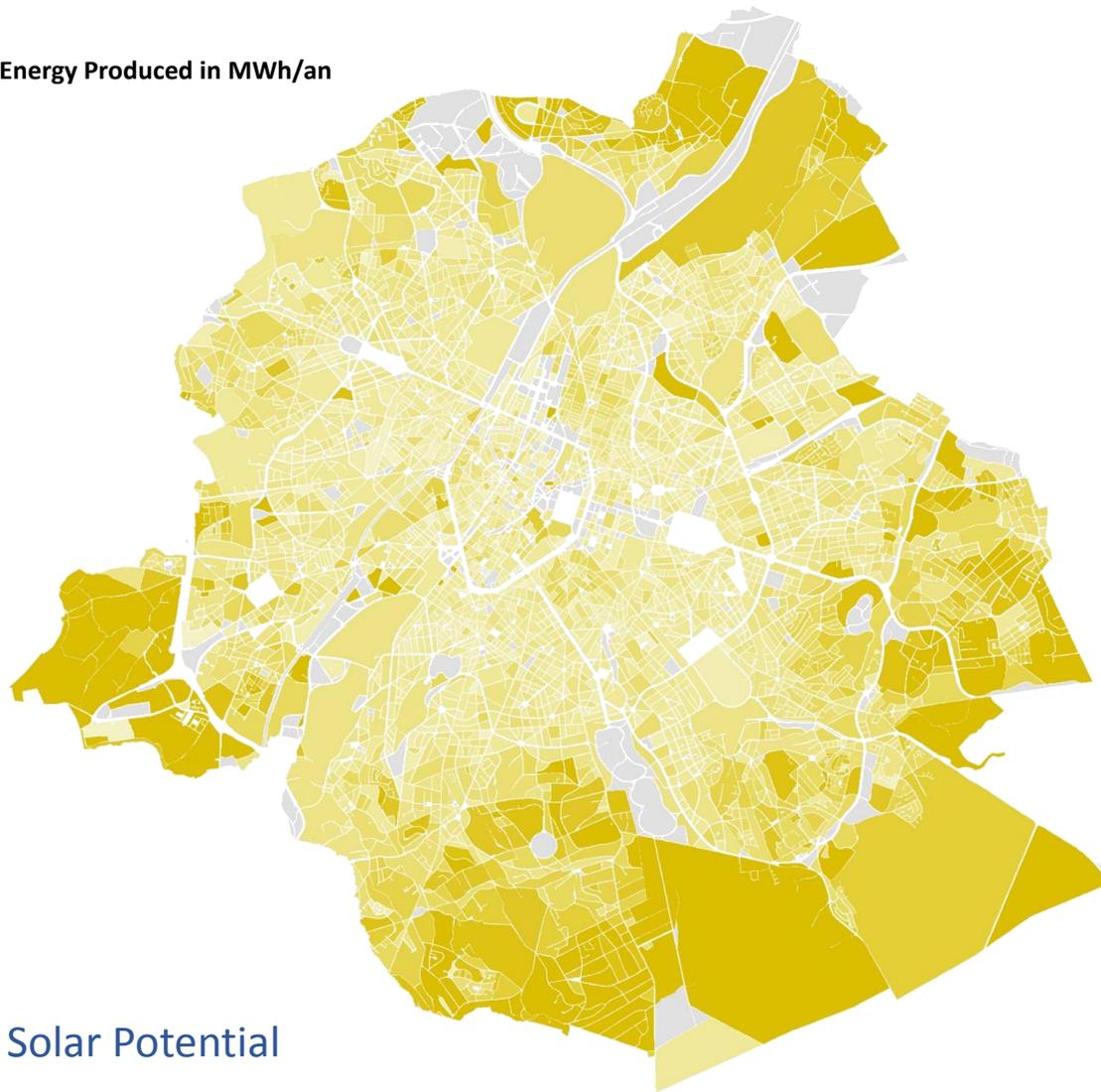


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Energy Produced in MWh/an



Solar Potential



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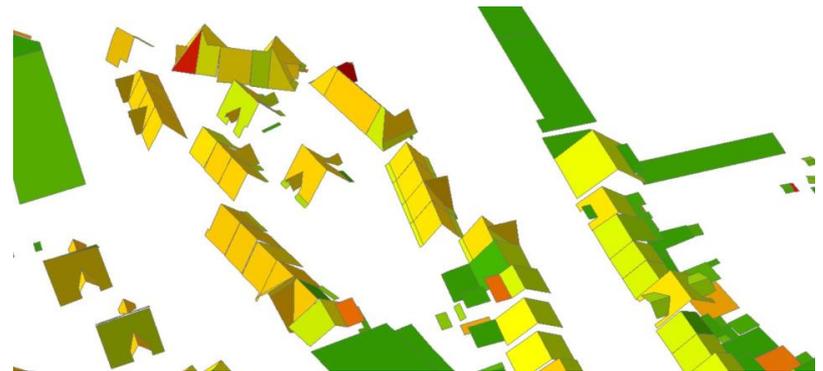
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Orientation



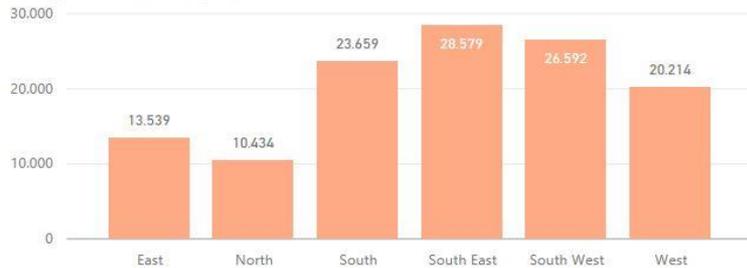
Inclination



BCR general overview

| Average of Inclination | Average of Orientation | Average of Solar Production Total | Solar Production Total | Average of Area | Area         |
|------------------------|------------------------|-----------------------------------|------------------------|-----------------|--------------|
| 23,80                  | 178,93                 | 18.353,09                         | 433.646.871,67         | 42,25           | 2.006.426,25 |

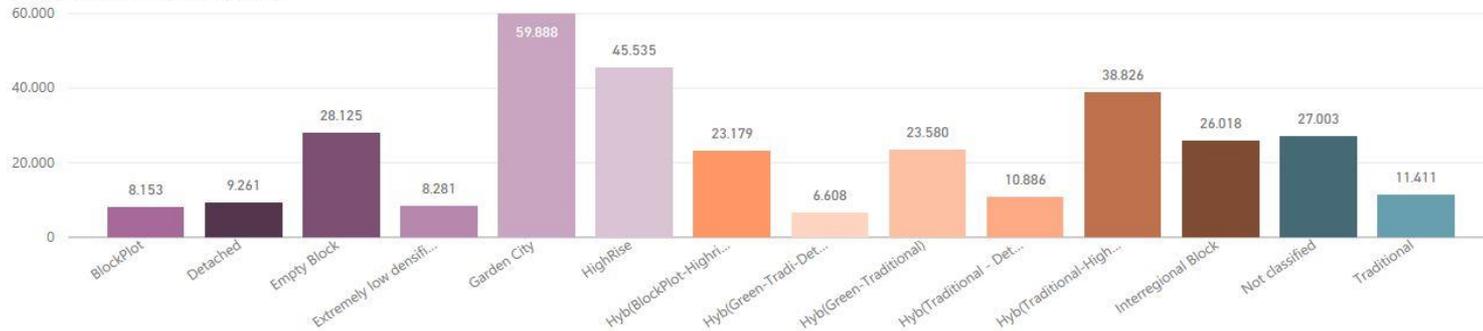
Average Solar Production by Orientation (Kwh/m<sup>2</sup>)



Solar Production by Orientation (Kwh/m<sup>2</sup>)



Average Solar Production by Typology



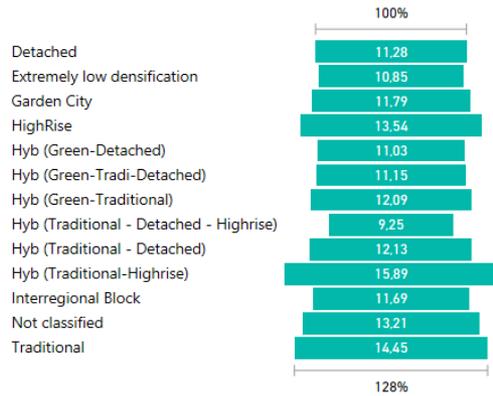
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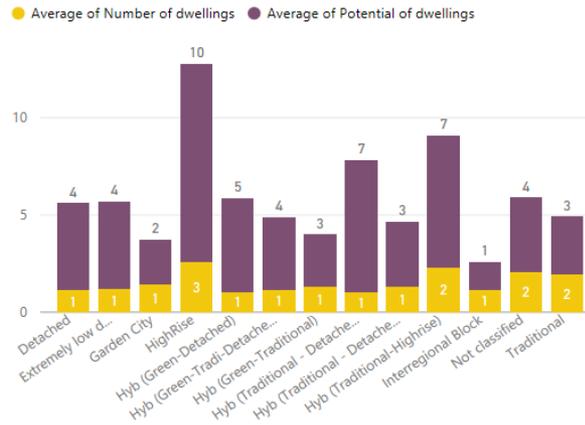
Brussels Capital Region City Blocks Typologies

| Typology                                | Average of Height | Average of Number of dwellings | Average of Potential Floors | Average of Potential of dwellings | Average of Superficie utile |
|---|-------------------|--------------------------------|-----------------------------|-----------------------------------|-----------------------------|
| Hyb (Traditional - Detached - Highrise) | 9,25              | 1,00                           | 7,00                        | 6,82                              | 106,71                      |
| HighRise                                | 13,54             | 2,58                           | 4,13                        | 10,18                             | 318,45                      |
| Hyb (Traditional-Highrise)              | 15,89             | 2,31                           | 3,14                        | 6,78                              | 288,39                      |
| Not classified                          | 13,21             | 2,07                           | 1,85                        | 3,83                              | 230,45                      |
| Extremely low densification             | 10,85             | 1,21                           | 1,75                        | 4,50                              | 223,67                      |
| Hyb (Green-Tradi-Detached)              | 11,15             | 1,15                           | 1,74                        | 3,75                              | 192,75                      |
| Hyb (Traditional - Detached)            | 12,13             | 1,32                           | 1,73                        | 3,33                              | 205,93                      |
| Traditional                             | 14,45             | 1,93                           | 1,62                        | 3,00                              | 217,17                      |
| Hyb (Green-Traditional)                 | 12,09             | 1,30                           | 1,59                        | 2,68                              | 171,47                      |
| Garden City                             | 11,79             | 1,41                           | 1,49                        | 2,30                              | 160,38                      |
| Detached                                | 11,28             | 1,12                           | 1,45                        | 4,49                              | 278,06                      |
| Hyb (Green-Detached)                    | 11,03             | 1,05                           | 1,41                        | 4,83                              | 315,38                      |
| Interregional Block                     | 11,69             | 1,15                           | 1,08                        | 1,45                              | 144,69                      |
| <b>Total</b>                            | <b>14,06</b>      | <b>1,88</b>                    | <b>1,91</b>                 | <b>3,81</b>                       | <b>228,17</b>               |

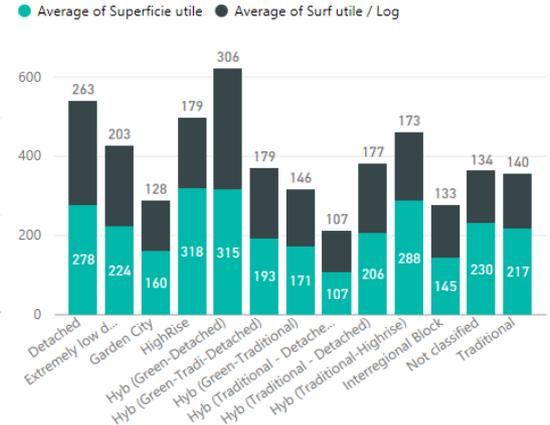
Average of Height by Typology



Average of Number of dwellings and Average of Potential of dwellings by Typology



Average of Superficie utile and Average of Surf utile / Log by Typology



## Heightening Potential



# Thank you for your attention!

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