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Socio-spatial differentiations of energy consumption in the metropolitan area of Paris

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Rodrigue Houesse ⁽¹⁾ Cécilia Bobée ⁽¹⁾, Frédéric Alexandre ⁽²⁾, Catherine Mering ⁽¹⁾

(1) UMR LIED – Université Paris Diderot

(2) EA 7338 Pléiade - Université Paris 13

Contact: [rhousse@yahoo.fr](mailto:rhousse@ yahoo.fr)

Introduction

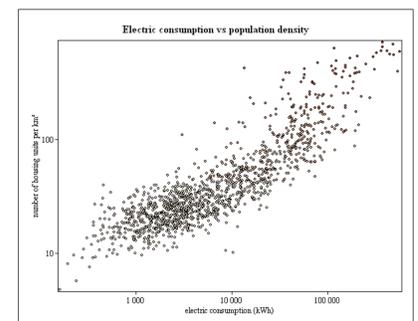
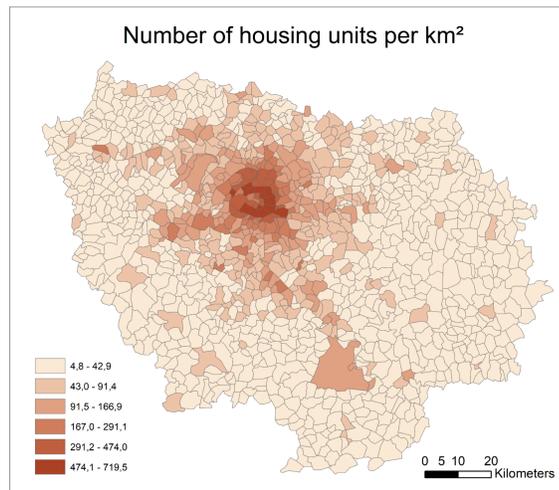
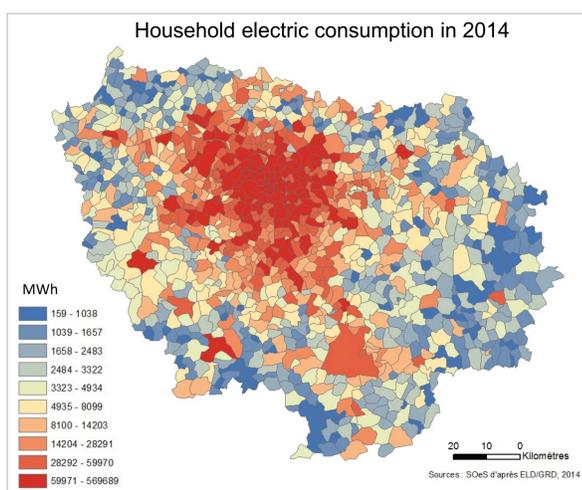
The reconfiguration of rural suburban areas is the most immediate effect of the metropolization process in the Île-de-France region. It also has consequences in terms of energy consumption, which is significantly differentiated in landscape, depending both in household incomes and in the way of living.

Material and methods

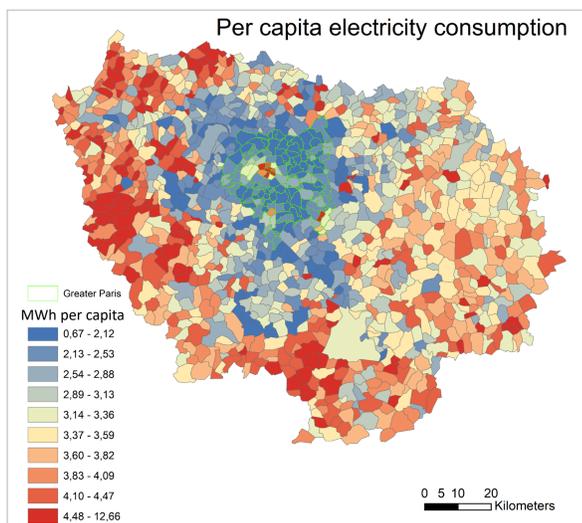
Electric consumption data (SOEs) as well as socio-economic and demographic datasets (INSEE) were collected at the municipal and sub-municipal (IRIS, aggregated unit for statistical information) scales, and integrated in a Geographical information System (GIS). Cross analyses and bivariate analyses were performed using geomatic tools.

Household energy consumption vs density of population

The domestic electric consumption (given in MWh) reveals to be highly variable: Paris and its inner suburbs present the highest values of household electric consumption, which can reach till $5 \cdot 10^5$ MWh for several Parisian districts. At a regional scale, this tendency follows the surface density of housing units, showing a power law behavior.



> Household energy consumption is relevant for studying metropolization processes and their inherent increase in global energy needs due to the way of living. Electric consumption (C) vs population density (ρ) present a power law dependence, such as $\rho = A \cdot C^\alpha$, $A > 0$ and $\alpha > 0$

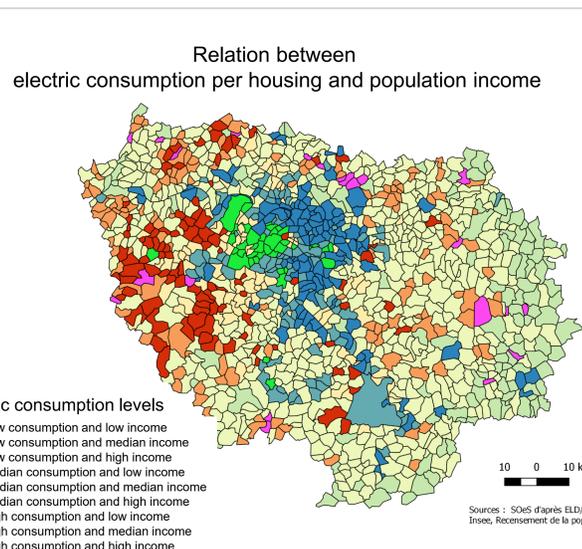


Household per capita electric consumption reveals to be higher in peri-urban and rural areas, where scattered individual housing constitutes the main way of living. Central Parisian districts still present a high energy consumption.

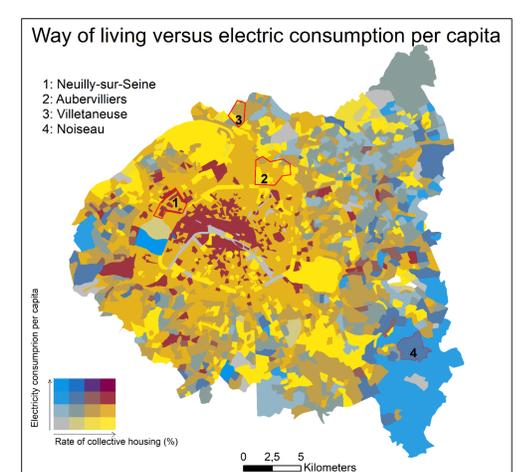
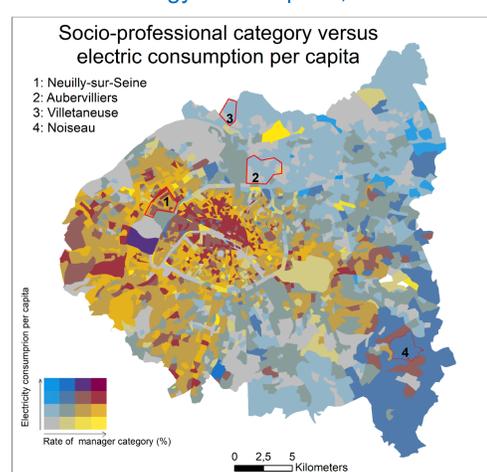
>> Spatial differences in energy needs can be explained by housing spatial distribution, with a higher electricity consumption for individual housing than for collective housing, except for the central districts of Paris, the latter being very energy-intensive.

Household energy consumption vs population incomes

Cross-correlation between domestic electric consumption and household incomes shows that living standards of population can in certain cases explain the differences in energy consumption. However, no evident correlation can be extracted at a regional scale.



Energy consumption, a focus on the the Greater Paris at the IRIS scale



	Neuilly-sur-Seine (1)	Aubervilliers (2)	Villetaneuse (3)	Noisieu (4)
Demography in en 2015	60 910	83 782	12658	4671
Electric consumption (MWh)	183 041	153 565	23 918	12 811
Electric consumption per capita (MWh/hab)	3	1,83	1,77	1,91
Electric consumption per housing unit (MWh/hu.)	5,21	4,64	4,87	6,66
Median income (€/year)	42 765	13 061	14574	26043
Poverty rate (%)	8,2 %	44,3 %	25%	5%

- In areas densely populated, the differential of energy consumption is lower in the first-ring of Parisian suburbs, despite the living standard gaps (deep blue and green areas).
- The low domestic energy consumption in « rich » municipalities (green areas), a sign of housing efficiency energy improvement ?