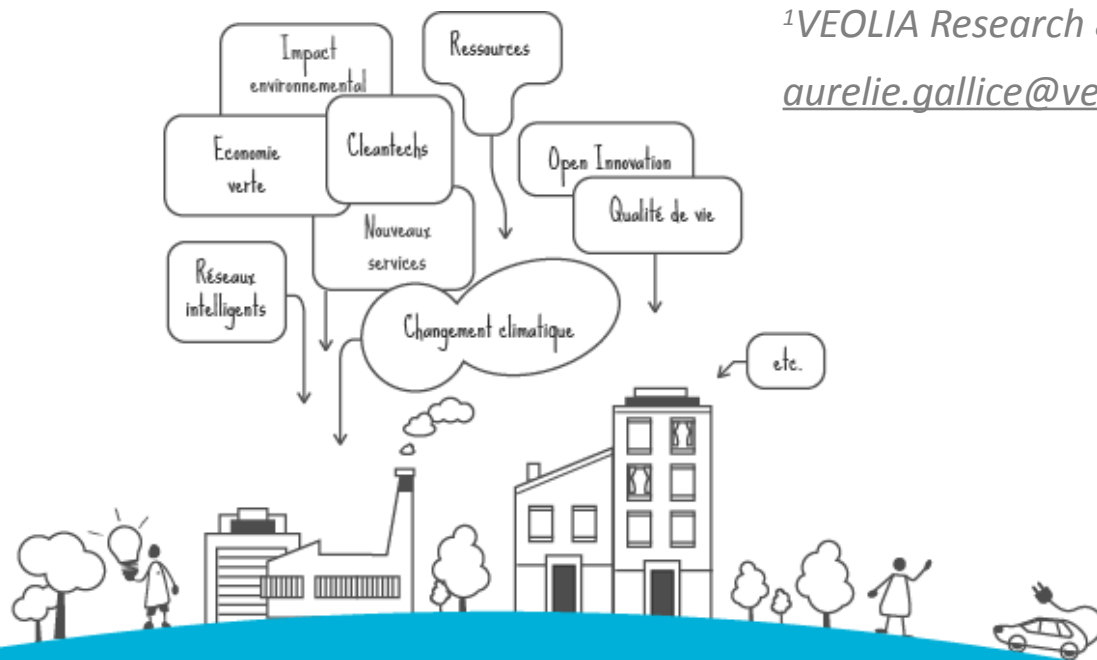


# A hybrid LCA methodology to assess the environmental footprint of a territory - A french case study

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# Content

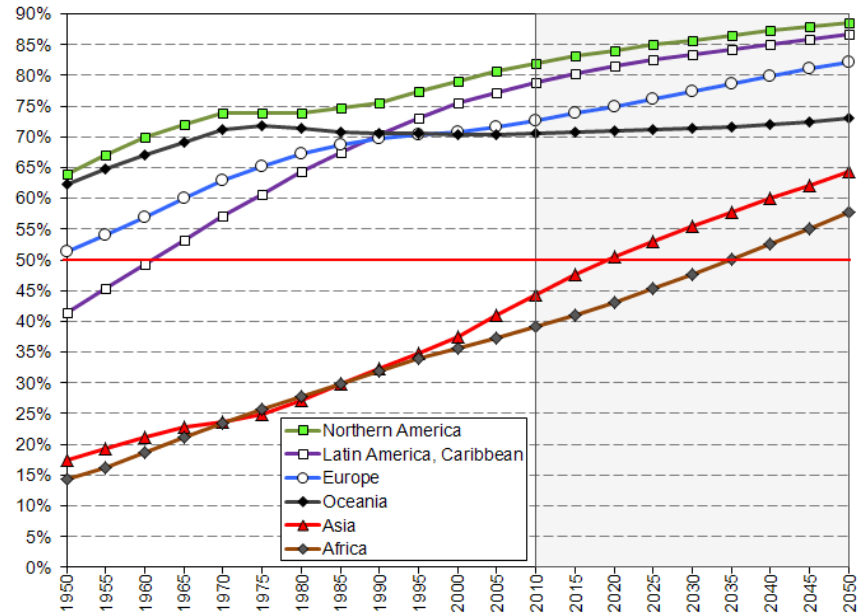
- 1. The Environmental Footprint from Veolia
- 2. Application of the footprint to a large scale territory
- 3. Some results
- 4. Conclusion

● Cities are major drivers of change, **gathering more than the half of the world population today.**

This proportion is expected to increase to 66% by 2050 (source: un.org)

### Urban population by major geographical area (in per cent of total population)

(United Nations, Department of Economic and Social Affairs, Population Division: World Urbanization Prospects, the 2011 Revision. New York, 2012)



● Territories must show their **exemplarity in terms of environmental strategy** to public authorities and economic actors.

● **Territories competition** encourages communities to seek tools to integrate environmental considerations into their decision-making processes.

# Can LCA be applied at city scale to guide and assess local environmental policies?

## ◆ In the literature, **city-scale studies**

- ❑ Are LCA based but focus on a specific field (waste management, water services, etc.)
- ❑ Or only tackle carbon / GHG emissions

## ◆ Focus of this study: a production and consumption-based approach, **capturing local economic specificities**:

- ❑ A combined footprint approach: Carbon\*, Water\*\*, Resources and Ecosystem quality\*\*\*,
- ❑ Impacts inside and outside the city boundaries,
- ❑ A first screening to target major drivers and guide policy.

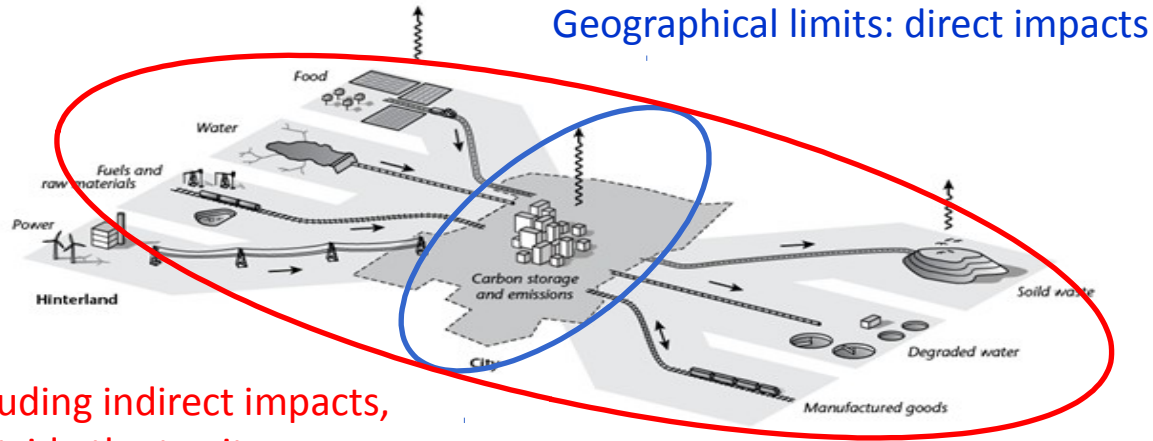
## ◆ Application to a large urban area, in France.

\*EcoInvent & IPPC 2007 ; \*\* Bayart et al. (submitted to Int J LCA) The Water Impact Index, a simplified single indicator for water footprinting;

\*\*\* Hamon et al. (SETAC 2012 poster) Development of biodiversity and resources indicators assessing potential impacts throughout the life cycle of products, processes and services .

Bugel et al. (Avnir 2012 poster) A new footprint method for territories and cities including resources use and biodiversity loss issues.

# System definition and boundaries: accounting for impact inside and outside the territory



LCA perimeter: including indirect impacts, generated outside the territory

Impacts generated by **economic activities**



**Imported products for final demand**

**Consumption of local goods**

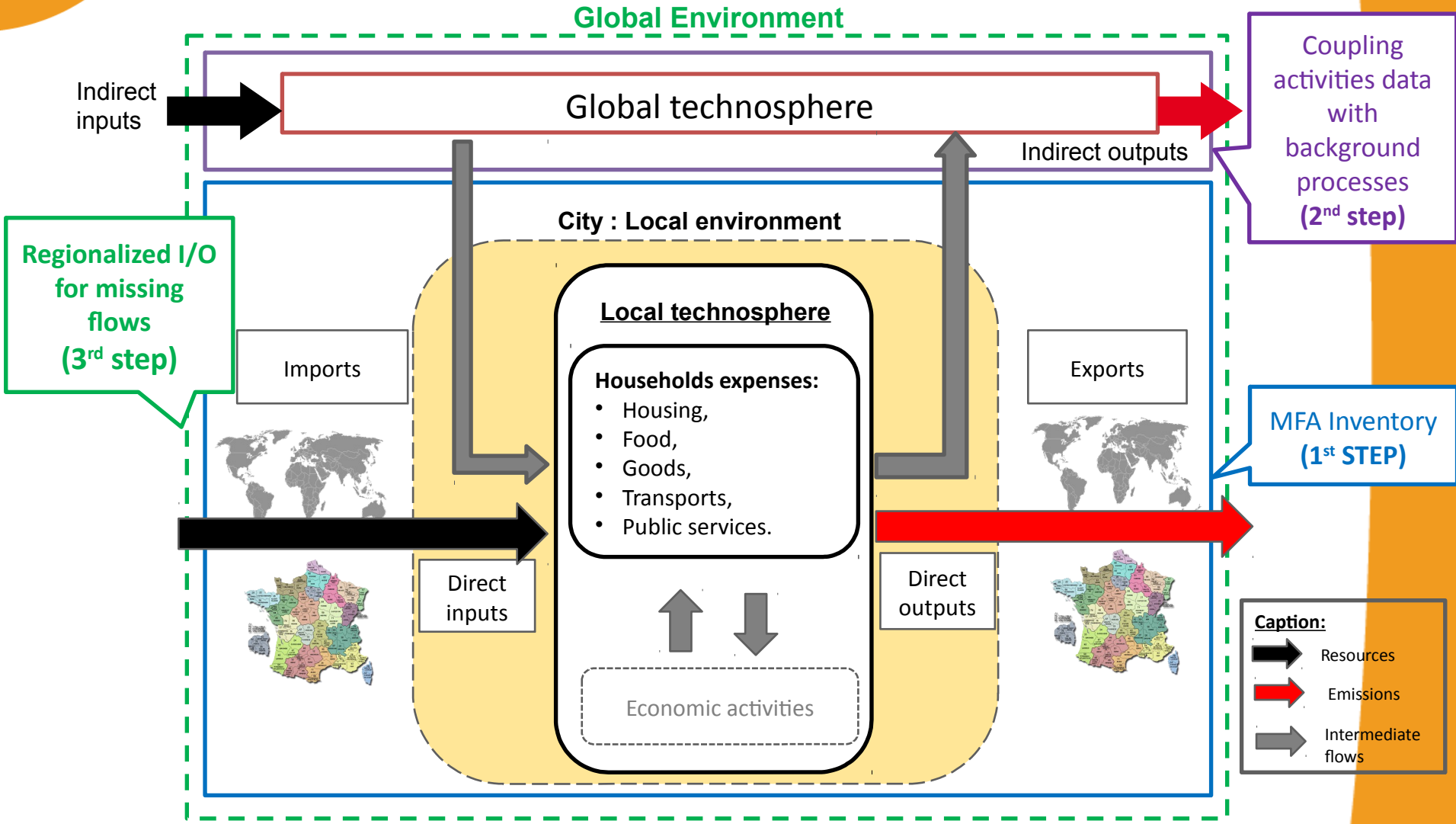
**Local activities producing exported goods**

**Imported goods used for exported products**

Impact generated by **households consumption**



# Methodological framework: coupling Material Flow Analysis with Environmental Extended I/O





## Environmental Extended Input-Output Analysis

◆ The EE-IOA analysis is an economic modeling using input-output tables and national environmental accounts to offer an inventory of emissions and resource use for one sector of activity.

## Regionalization of national data

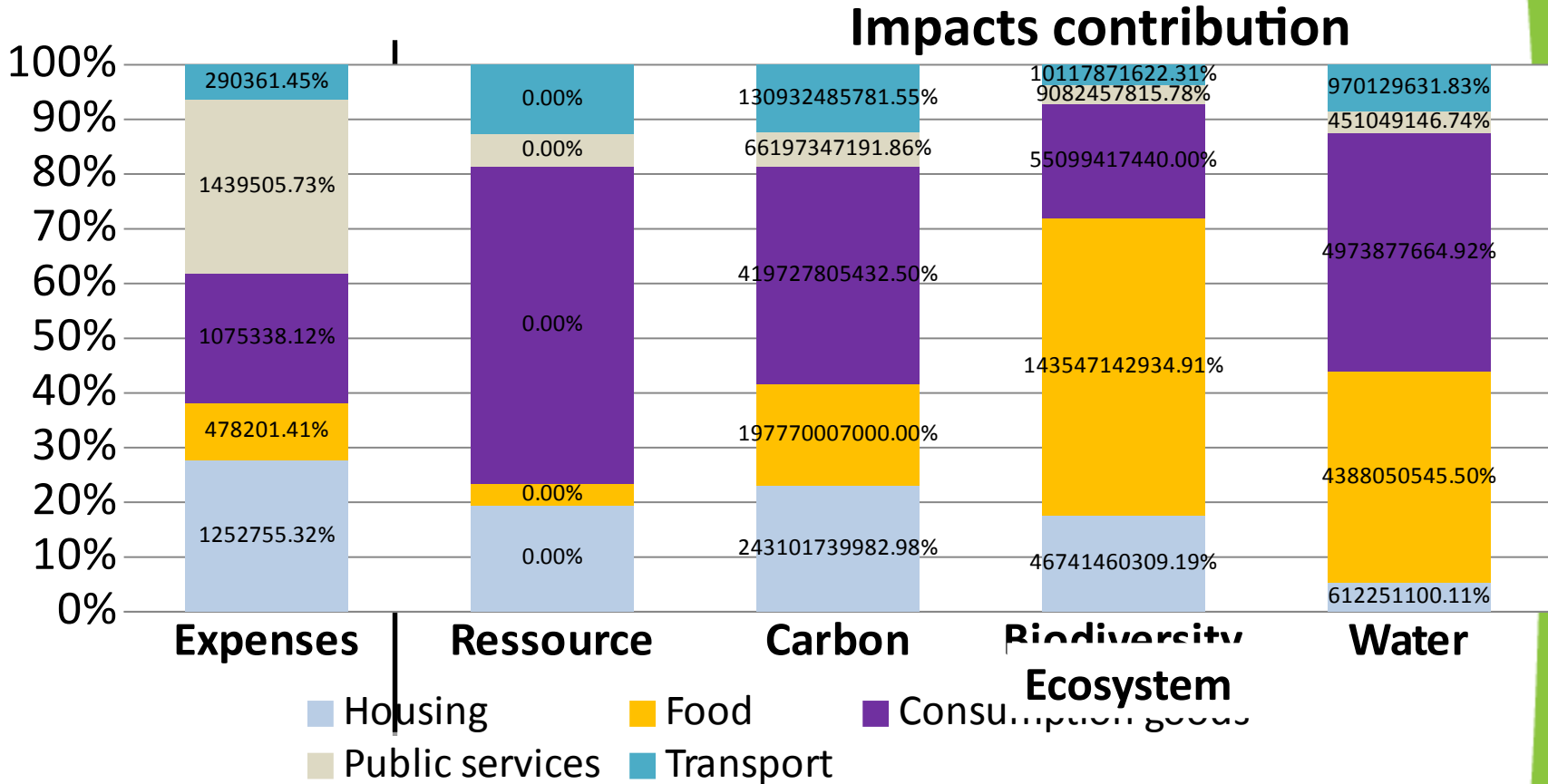
◆ The concept of regionalization refers to bottom up or top-down approaches that allow to calculate economic data at a certain scale, starting from local or national data.

◆ Goal: Creation of a territory's specific input-output table.

◆ Use of national statistical IO data.

◆ Use of local employment data by sector for this study.

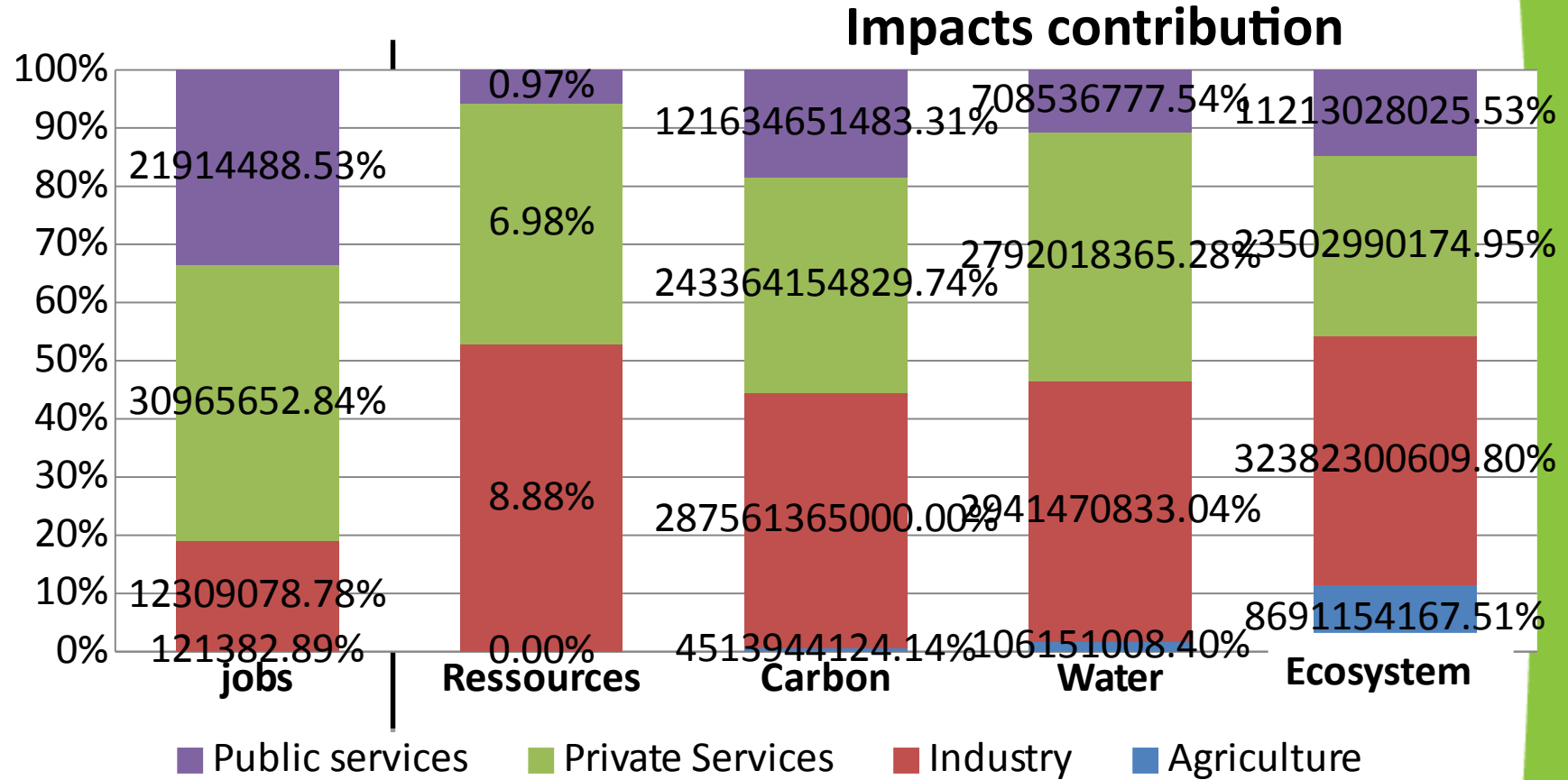
Food and consumption goods account for 1/3 of expenses, but more than 2/3 of every impacts



- Ecosystem quality is mainly impacted by food production.
- Consumption goods are a major driver of resource depletion

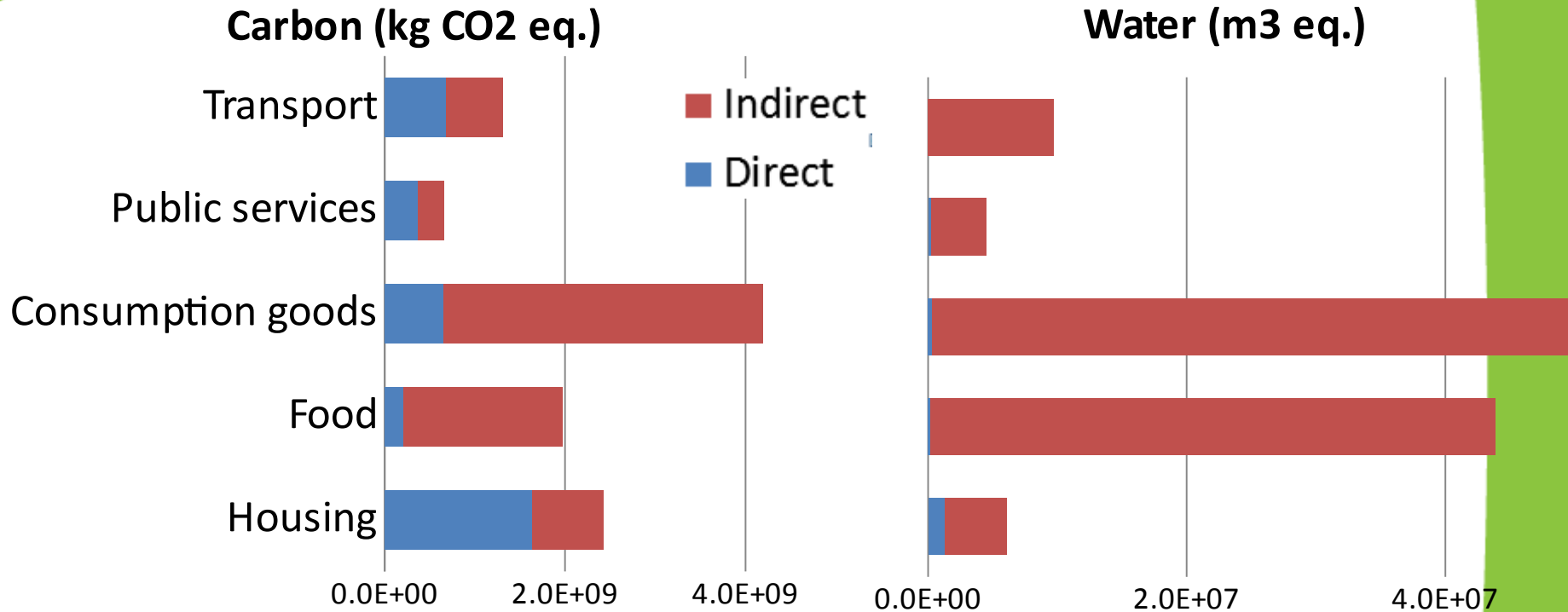


# The city economy relies on services, but impacts of industrials activities generate nearly half of the impacts



- Impact on ecosystem quality are mainly driven by land use, but there is almost no agricultural activity on the territory.

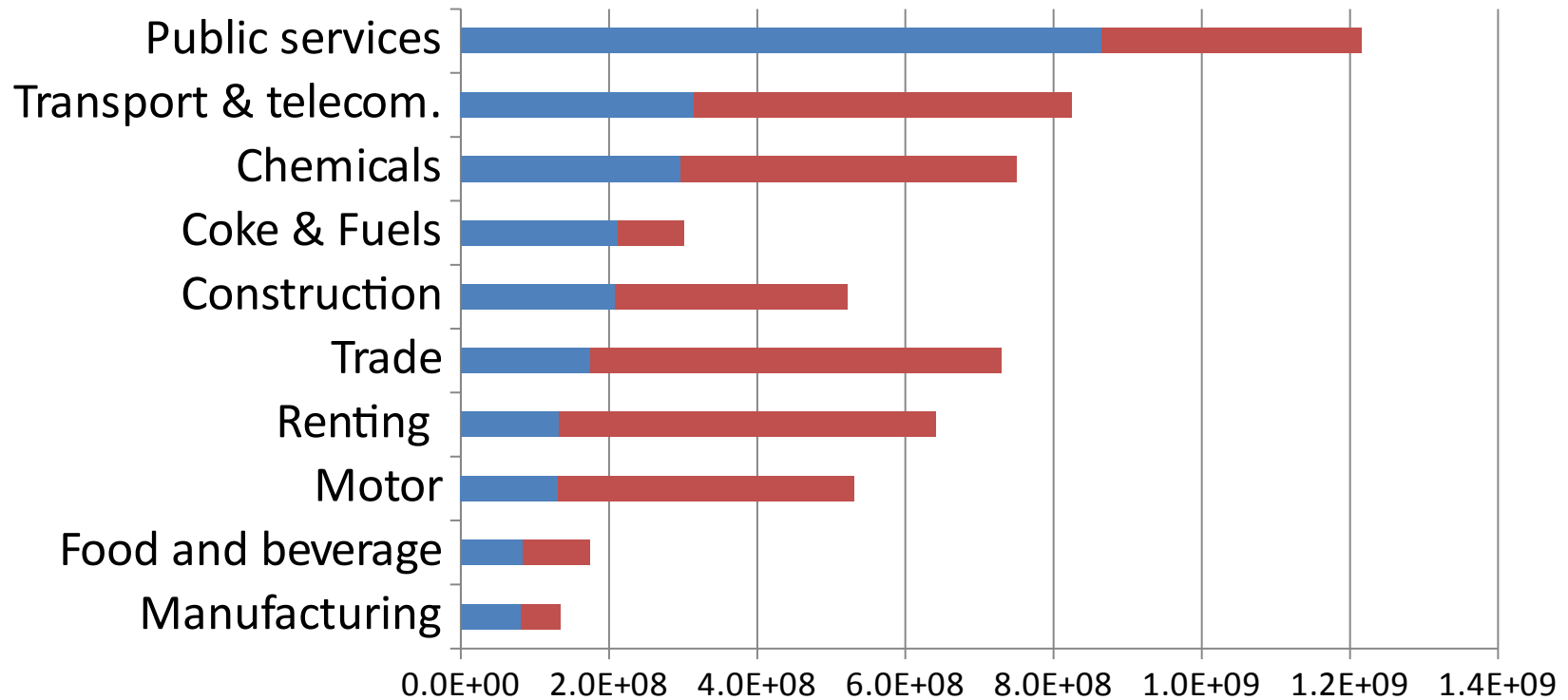
## Households consumption mainly generate impacts outside the city.



- Few local production of food and consumption goods.
- Some budget items as housing, transports or publics services are more locally centered.

## Carbon footprint present significant reduction potentials for economic activities at local level.

### Carbon Footprint, economic activities (kg CO2 eq.)



- The territory can control the major part of its carbon footprint.
  - Shares in carbon footprint reduction in local companies will have a significant effect on reducing the Carbon Footprint of the territory.

- ◆ Accounting for **impacts outside city's boundaries** is essential in a life cycle perspective.
- ◆ **Coupling local MFA with regionalized EE-IOA** offers a first screening to target major hotspots to improve environmental performances and define potential ways of reducing the environmental footprint of the territory.
- ◆ **Economic specificities**, trade partners and local environmental context (water availability, local resources... ) **have key influences**.

- ◆ Replicability of the methodology to be applied to other territories
- ◆ Is EE-IOA sufficient to cover environmental impacts at a territory level ?
- ◆ State of art of regionalization method (from economical perspective) vs What about other regionalization method in terms of relevance ?

# THANK YOU FOR YOUR ATTENTION

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## Some references:

1. GALLI, Alessandro, WIEDMANN Thomas, ERCIN, Ertug, KNOBLAUCH, Doris, EWING, Brad, GILJUM, Stefan. OPEN :EU. Integrating Ecological, Carbon and Water Footprint: Defining the Footprint Family and its Application in Tracking Human Pressure on the Planet. 2011, 73 p.
2. GILJUM, Stefan, BURGER, Eva, HINTERBERGER Friedrich, LUTTER, Stephan, BRUCKNER, Martin. A comprehensive set of resource use indicators from the micro to the macro level. *Resources, Conservation and Recycling*. 2011, vol. 55, p. 300-308.
3. HENDRICKSON, C.T., LAVE, L.B., MATTHEWS, H.S. Environmental Life Cycle Assessment of Goods and Services: An Input-Output Approach. 2006.
4. RAMASWAMI, Anu, HILLMAN Tim, JANSON, Bruce, REINER, Mark, THOMAS, Gregg. A demand-centered, hybrid life-cycle methodology for city-scale greenhouse gas inventories. *Environmental Science & Technology*. 2008, vol. 42, p 6455-6461.
5. RAMASWAMI, Anu, CHAVEZ Abel, Progress toward low carbon cities: approaches transboundary GHG emissions' footprinting, *Future Science*, 12p.
6. WIEDMANN, Thomas, WILTING, Harry, LUTTER, Stephan, PALM, Viveka, GILJUM, Stefan, WADESKOG, Anders, NIJDAM Durk. SKEP ERA-NET Project EIPOT. Development of a methodology for the assessment of global environmental impacts of traded goods and services. 2009. 84p. ISBN: 978-1-84911-121-8.
7. HEINONEN, J., JUNNILA, S., Case study on the carbon consumption of two metropolitan cities, *The International Journal of Life Cycle Assessment*. 2011, vol. 16, n°6, p. 569-579.
8. KENNEDY, C., STEINBERGER, J., GASSON, B., HANSEN, Y., HILLMAN, T., HAVRANEK, M., PATAKI, D. PHDUNGSILP, A., RAMASWAMI, A., MENDEZ, G.V. Greenhouse Gas emissions from Global Cities. *Environmental Science & Technology*. 2009, vol. 43, n°19, p. 7297-7302.