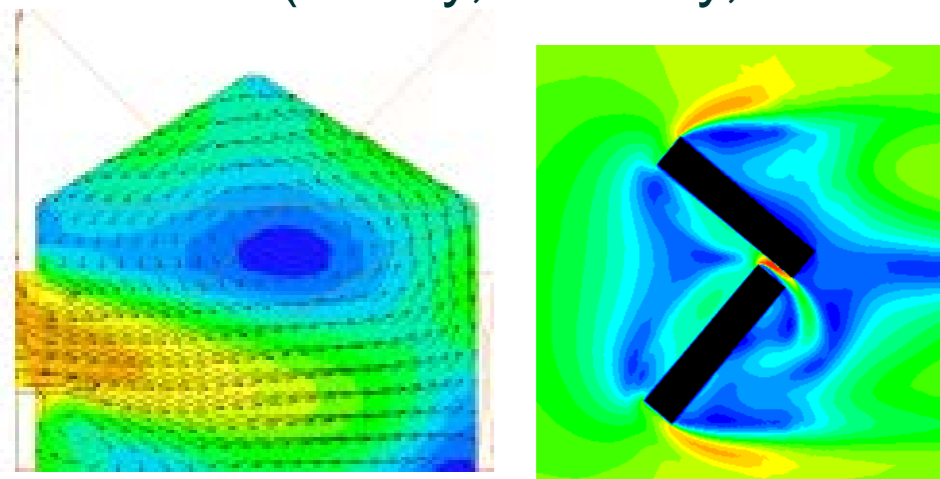


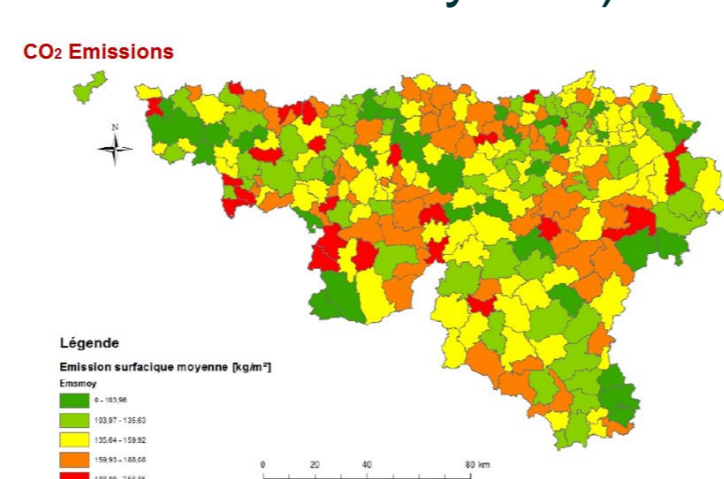
RESEARCH FIELD

Architectural and urban modeling with the goal to improve the sustainability of the built environment :

- **Development and validation** of new methods and **modeling tools** for the built environment.
- **Applications** of these tools (energy simulations, CFD, LCA, optimization, etc.) to **buildings, transport and urban networks**.
- Evaluation, analysis and mapping of the environmental characteristics of built areas **at various spatial scales** (individual building, neighborhood, city, region or country) and **temporal scales** (hourly, monthly, annually, for the next 30 years).

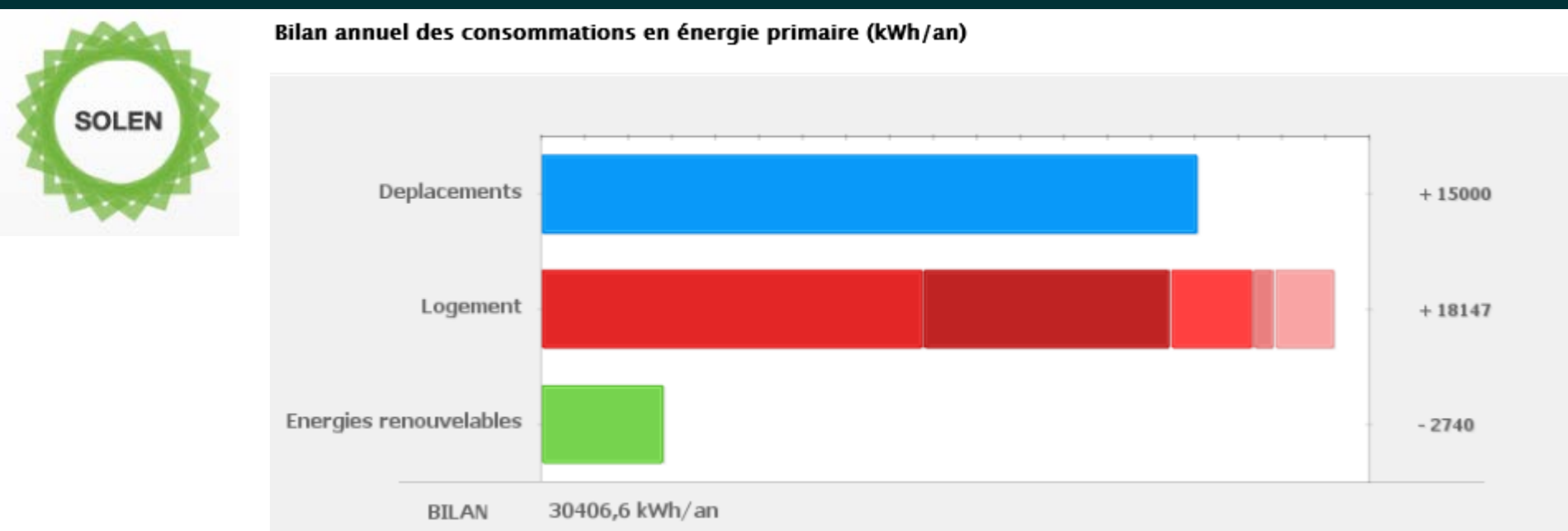


CFD modeling of airflows in and around buildings (Nguyen A.-T., Reiter S., 2011; Reiter 2010)

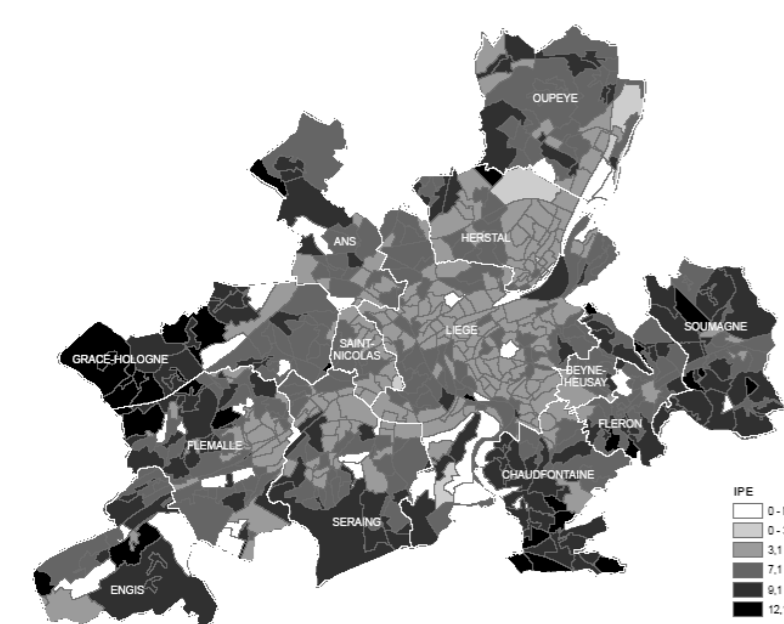


CO2 emissions due to commercial buildings at the regional scale (Barbason M., Reiter S., 2013)

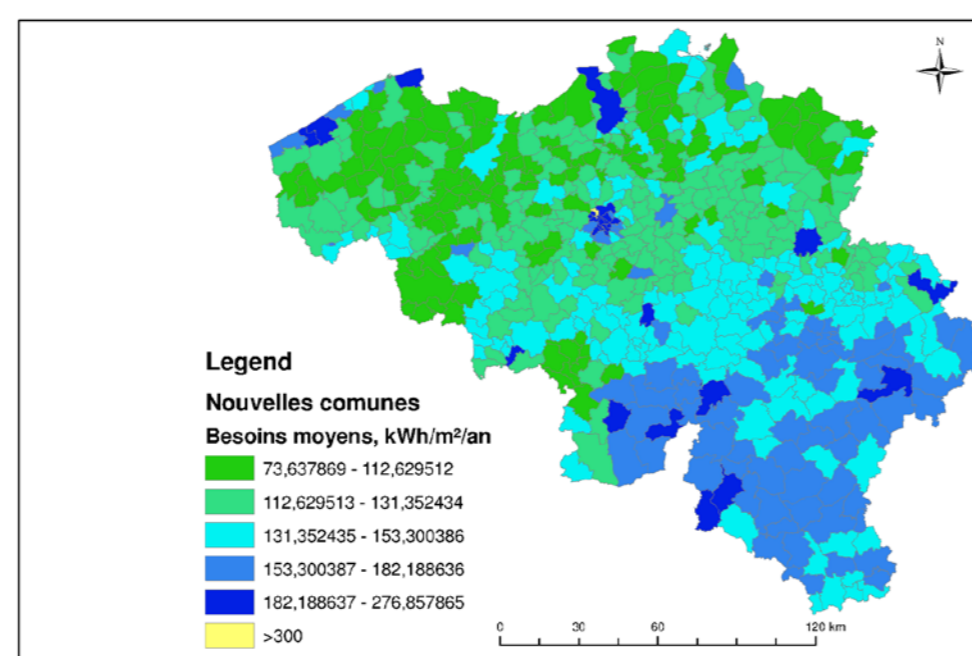
Energy consumption : some examples of results



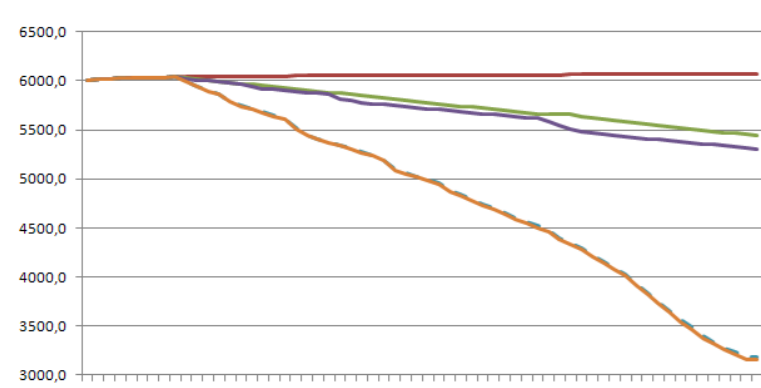
Development of the interactive tool SOLEN: solen-energie.be (Marique A.-F., Cuvelier S., De Herde A., Reiter, S., 2015)



Mapping of the energy performance index related to energy consumption due to daily mobility at the urban scale of Liège (Reiter S., Marique A.-F., 2012)

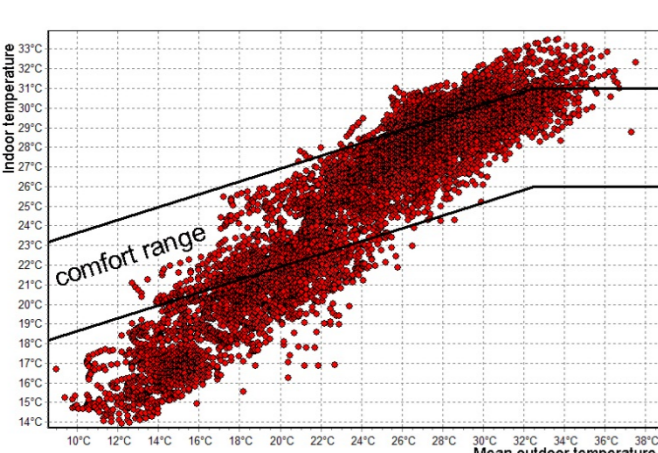


Mapping of the mean heating loads of residential buildings in Belgium at the country scale (Pacot P.-E., Reiter S., 2012)

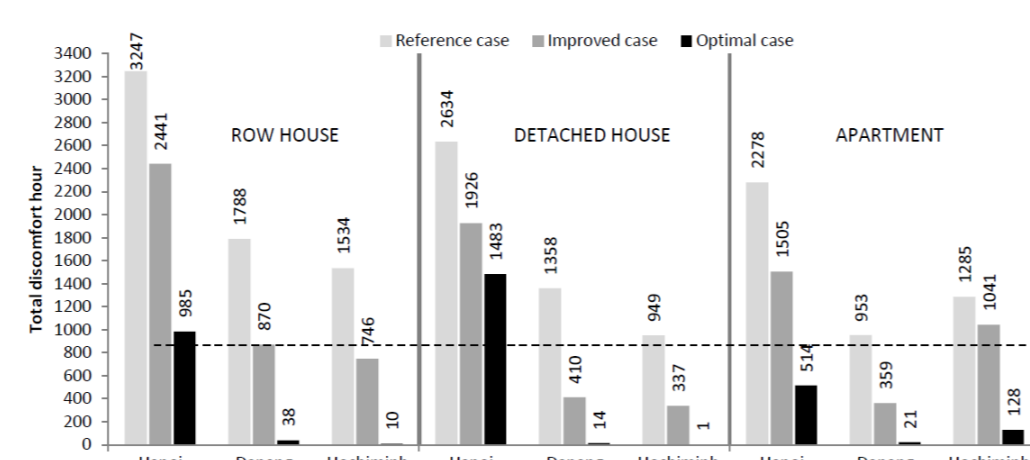


Forecast scenarios on future energy policies for Liège's building stock show that the European Directive on the Energy Performance of Buildings and even more selective energy policies applied only to new buildings are not sufficient to widely decrease building energy consumption at the city scale. Increasing the renovation rate of the existing building stock has a much larger positive impact on city energy consumption reductions (Reiter S., Marique A.-F., 2012)

Thermal comfort : some examples of results



Hourly plot of air temperature in Vietnam and comparison with the adaptive comfort model developed by the authors for South-East Asia (Nguyen, A.T., Singh, M.K., Reiter, S., 2012)



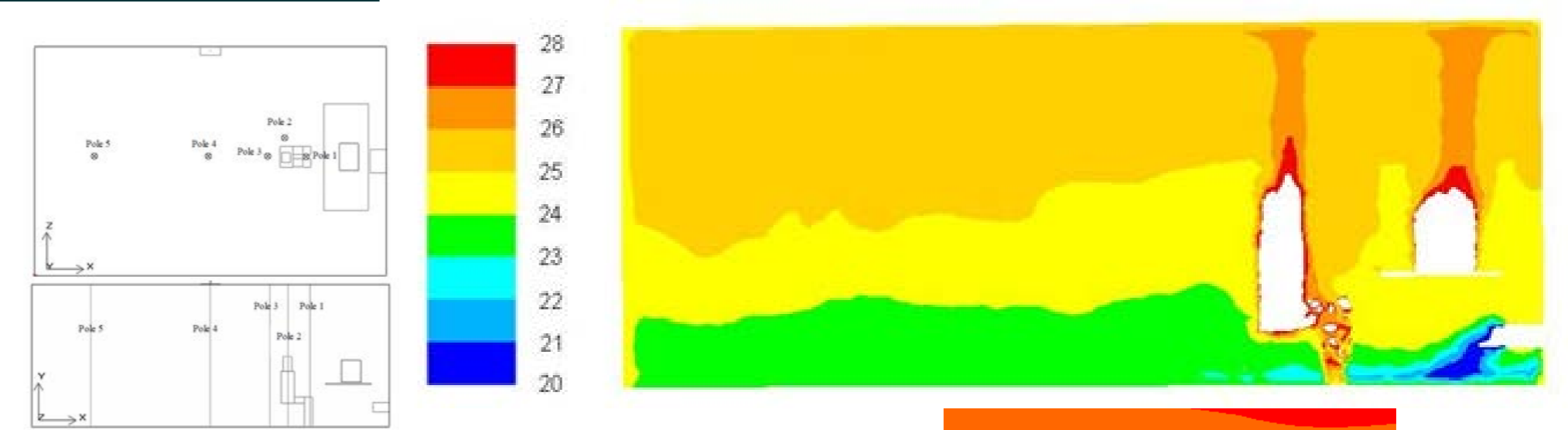
Comparing the efficiency of the parametric simulation method (PSM) and the simulation-based optimization method (SOM) in improving building performance, this study found that the SOM is almost two times more efficient than the PSM in improving thermal comfort in naturally ventilated houses and improving life cycle cost in air-conditioned houses (Nguyen, A.T., Reiter, S., 2014)

Daylighting : some examples of results

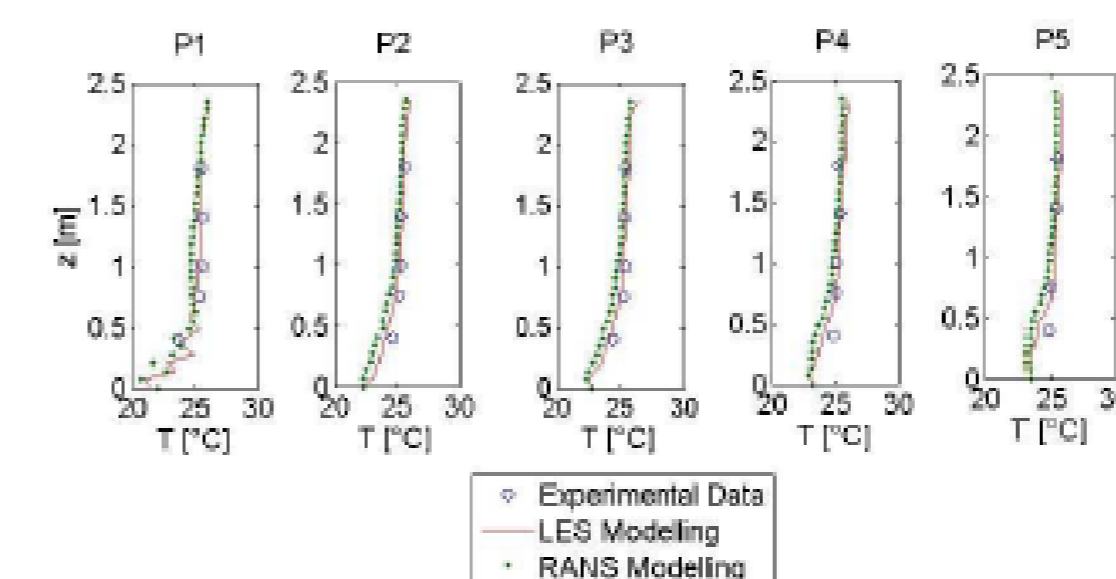


Quantitative and qualitative assessment of daylighting simulations compared with measurements in real buildings and in scaled models (Reiter S., De Herde, A. 2004).

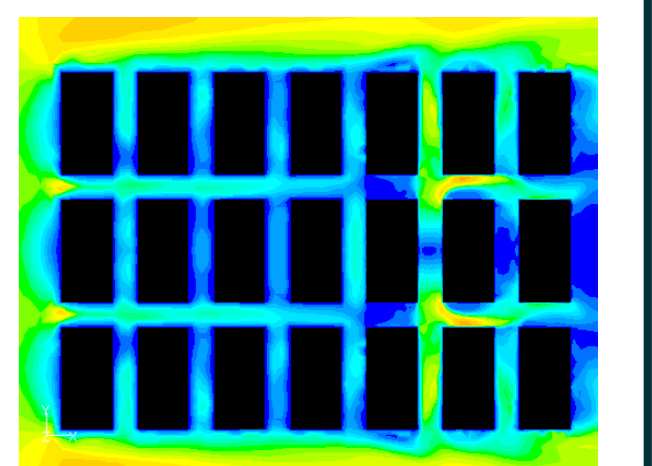
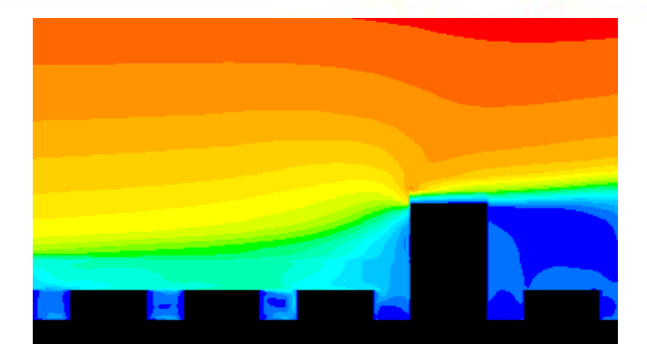
Airflows : some examples of results



CFD modeling of air temperature in buildings and comparison with measurements in real buildings and with wind tunnel tests (Barbason, M., Reiter S., 2010)

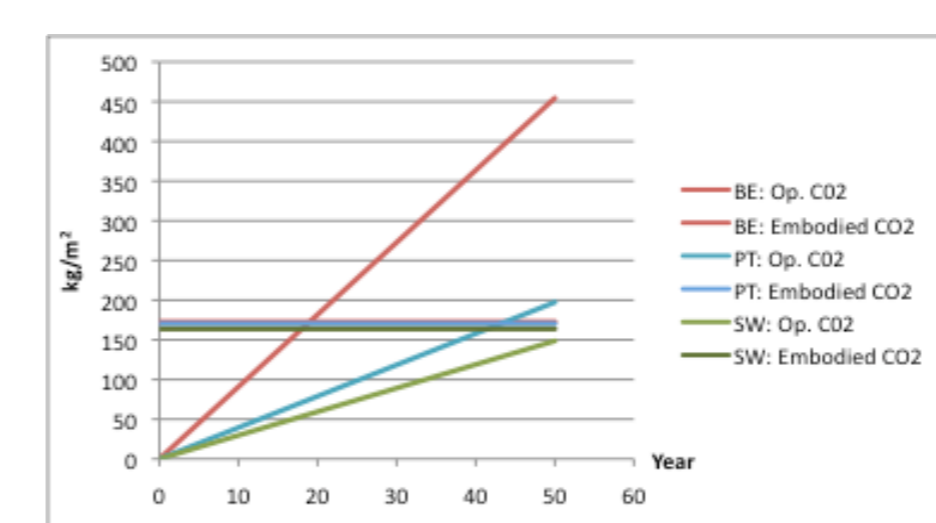


Coupling CFD and Multizone tools for complex thermo-aeratic simulations (Barbason M., Reiter S., 2014)

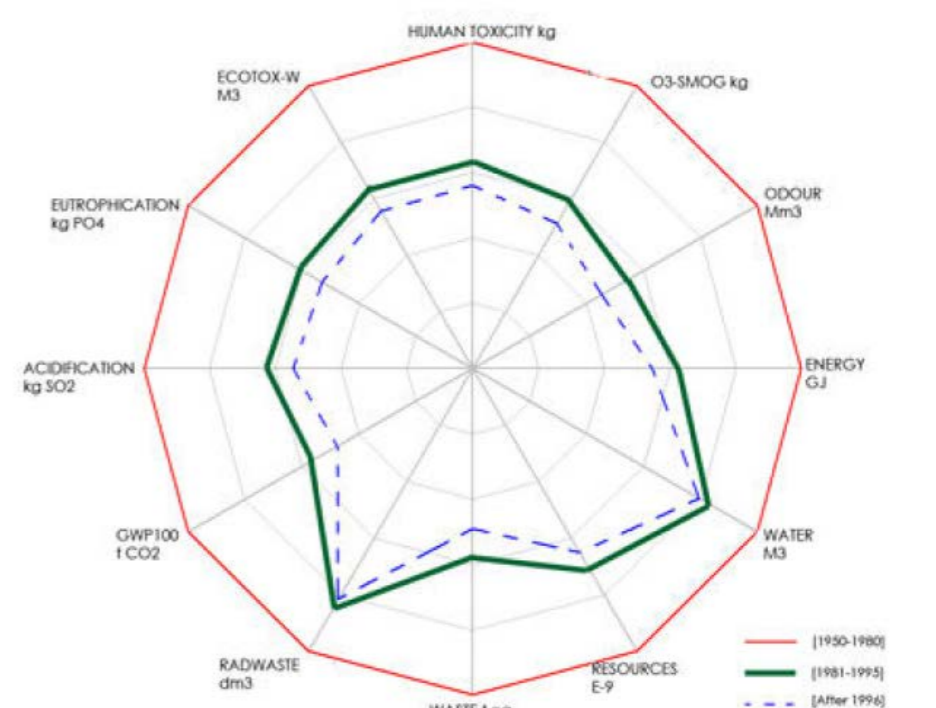


CFD modeling of airflows around buildings and comparison with wind tunnel tests (Reiter S., 2010)

Life Cycle Assessment : some examples of results



Embodied and Operational (over 50 years) Carbon of a building, depending on its location in Belgium, Portugal or Sweden (Rossi B., Marique A.-F., Reiter S., 2012).



LCA of traditional buildings in Belgium with different energy performance levels (Marique A.-F., Reiter S., 2010).

Nine examples of subjects for future PhD thesis

- 1/ Energy:** Advanced performance optimization (energy+comfort+cost) of buildings under various climates, using dynamic simulations coupled with a genetic optimization algorithm.
- 2/ Energy:** Hourly modeling of the energy consumption and production of a territory (buildings + transport+ renewable energy) and identification of the most useful strategies towards a zero-energy territory
- 3/ Energy:** Modeling the impact of "smart lighting" technologies on energy consumption of public lighting in Belgium and on the perception of public spaces by citizens at night
- 4/ Thermal comfort & airflows:** Using CFD (simulations of airflows) to improve the passive cooling (thanks to an intensive natural ventilation) and reduce the risk of overheating in energy-efficient buildings
- 5/ Thermal comfort :** Modeling the urban heat island effect (UHI) on cities and their impacts on energy consumption, comfort and health of citizens: current state and forecasts for 2050
- 6/ Airflows :** Modeling the distribution of air pollution in urban environments: quantification, forecasts and improvement strategies.
- 7/ Daylighting :** Using dynamic metrics to improve the assessment of natural light in architecture at different stages of the architectural design process
- 8/ Life cycle assessment (LCA):** Development of a LCA tool suitable for the environmental assessment of urban projects, from the scale of the neighborhood to the scale of the city
- 9/ Health:** Impact of different architectural and urban settings on occupant health (daylighting, air quality, limitation of overheating, urban density, ...)