# Underground resources management and urban sustainable development: a comparison between Swiss and Chinese contexts

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Urban form is expanding horizontally on the surface, and extending vertically in the subsurface. Beneath our urban area, we have mainly four invisible but valuable natural resources: 1) *underground space*: a third spactial dimension to welcome the urban infrastructures, such as metro, parking, stock, leisure centers, etc. It contribute to liberate more surface area that will be useful for more functions, espacially making more green public space available and improve our environmental and social quality; 2) *groundwater*: a main drinking water resource in most of the countries, which is worth to be protected for sustainable use by means of long-term urban resources planning; 3) *geomaterials*: constructions depend on the availablity of materials, which are extraited from underground and worth to be valorized and reused in a economical way, in order to maintain the long-term supply; 4) *geothermal energy*: a renewable clean energy for heating and cooling the building and infrastructures, which will also redue the life cycle cost of energy consumption. To be more important, the *combined use* of these resources become problematic, for example, how to protect the groundwater under the city while planning a metro line across the aquifers? how to make use of the construction opportunity to combine the exploitation of geothermal energy with building piles or tunnel lining? Such kinds of conflts and synergies are the targets of this research project, in order to find out the best way to integrate urban underground into the whole urban planning. As the availability of the natural resources determine the urban destiny, this degree of urbain subsurface can not be ignored during the territorial management process.

Based on the case of Geneva uran area, the project named Deep City has developped a unique methology and proved its contribution to the sustainabe urban development(Aurèle Parriaux, Pascal Blunier et al. 2010).

Furthermore, the sociale perception has been revealed a weak argument to promote this concept, but it will be changed by architectural improvement and better public education. Finally, the economic utility of underground space development releases the tension of land price and therefore reduces the opportunity cost of many public functions(O'Sullivan 2009).

A developping country like China has the most rapid development of underground transportation system and potential energy exploitation. Its demographical challenges are also forcing the government to find better ways to meet the need of speed urbanisation. The emphirical study of the city Suzhou (Jiangsu Province), shows a real potential of underground resources management and a real challenge for the social aspects and political feasibility(Lichtenberg and Ding 2009).

#### References:

1. Aurèle Parriaux, Pascal Blunier, et al. (2010). Projet Deep City – Ressources du sous-sol et développement durable des espaces urbains.
2. O'Sullivan, A., Ed. (2009). Urban Economics 7/e. NEWYORK, Douglas Reiner.
3. Lichtenberg, E. and C. Ding (2009). "Local officials as land developers: Urban spatial expansion in China." *Journal of Urban Economics* **66**(1): 57-64.