

*ITA Conference Amsterdam (January 2008):
"Enlightend Underground"*

The Urban Underground in the Deep City Project: For Construction but not only

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Priority program 2005 :

"The sustainable development of the built environment"

- 220 proposals
- 30 selected
- "Deep City" is the only one which includes underground and geological dimensions

Issue : urban development

- Rural migration and population increase leads to sprawling cities
 - Traffic congestion
 - Pollution
 - Lack of green space
 - Insufficient water supplies

⇒ **Not compatible with
Sustainable Development**

Our thesis

"Sustainable development of
cities cannot be achieved
without an increasing and
planned use of the 3rd space
dimension"

How to demonstrate this thesis ?

"DEEP CITY" PROJECT

2 working packages :

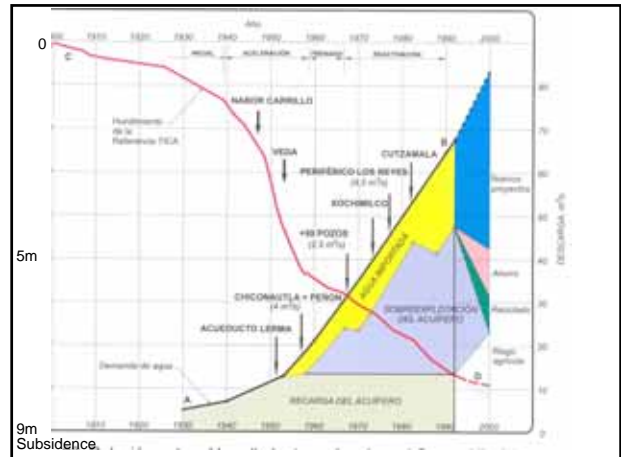
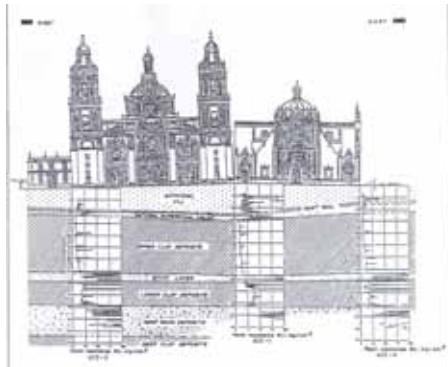
- "Lessons of the past"
- Development of a new methodology

Lessons of the past

- Example of Mexico-City



Settlement of the city



And in the future ?

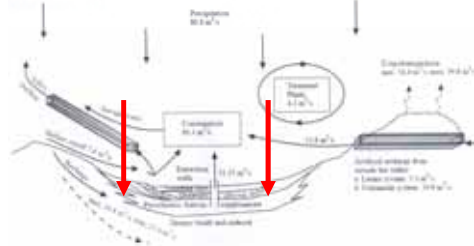
Two main worries (among the others) about the sustainable development of Mexico-City :

- Drinking water
- Settlement (land subsidence)

Towards a sustainable solution ?

- One possible large scale action to solve these two different problems:

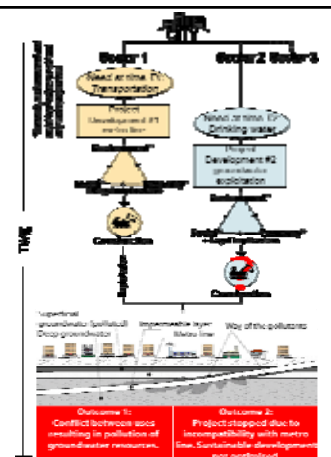
Artificial groundwater recharge



One conclusion from the "Lessons of the past" working package

- The "Sectorial approach" is the main responsible of the non-conformity to the principles of Sustainable Development.

Sectorial approach of urban underground use



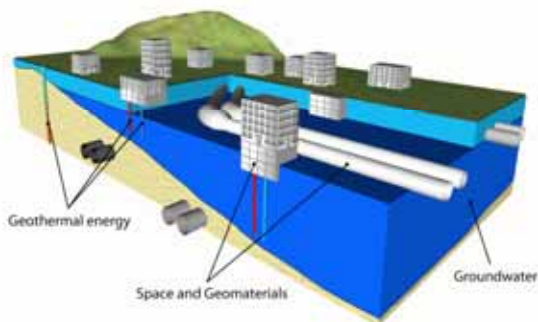
Characteristics of the sectorial approach :

- The **decision criteria** are generally priority criteria at **short term** (mainly technical and economical criteria)
- The **professionals** of these different sectors have very **few contacts** together.
- Their **understanding of the other domains** concerned by underground is often very **poor**.

Statement of the DEEP CITY project

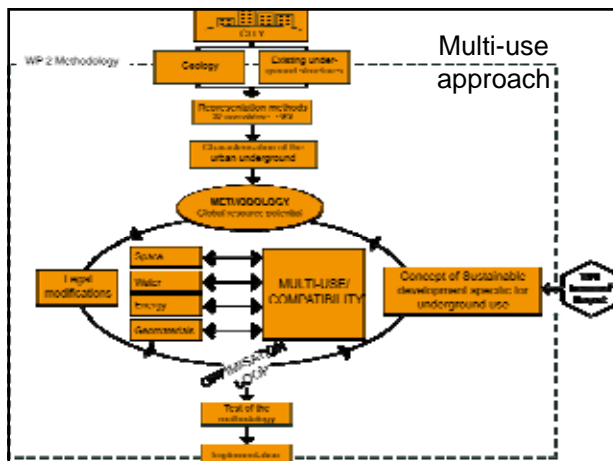
“A **planned multiple-uses approach** allows exploiting the full resources potential of the underground in a better sustainability”

The **four main resources** of the urban underground



« Deep City »

From the sectorial approach to the multi-use approach

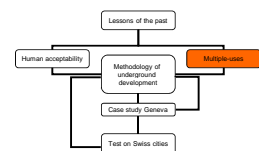


Multi-use Concept

Analysis of the **long term interactions** in the concept of multi-use of resources (positive and negative) =>

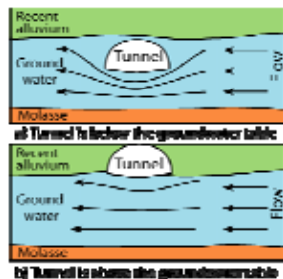
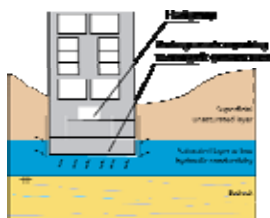
What is compatible with what and in which boundary conditions

=> **GENERAL RULES**



Synergies and conflicts

Space and geothermy
Space and groundwater
2 variants for subway (Geneva)



Methodology of underground development

- Underground development scenarios according to multi-use concept for main typical geological structures (including modelling and analysis of the scenarios)



Example of a 3D planning

Potential use of the Geological Volume nb...

- GV1 : construction and energetic geostructures (no geothermal probes)
- GV2 : construction, shallow aquifer used for geothermal doublets
- GV3 : tunnelling corridor without geothermal probes
- GV4 : geothermal probes
- GV5 : groundwater protection and drinking water supply (only catchment structures)
- GV6 : deep geothermal systems

Validation through case studies

Geneva

- Aim : Test of the complete methodology on a real well documented case
- => improvement loops of the methodology

Swiss cities

- Aims :
 - Gross assessment of the urban underground potential in Switzerland
 - Test of the methodology for various contexts
- => improvement of the robustness of the methodology

Foreign cities

- Test on larger cities around the world



From the theory to the practice

- Legal field** : mission from the Federal Office of Territorial Development to introduce the 3rd dimension of territory in the new law in preparation
- Technical field** : recommendations for the various professional associations (urban planners, architects, civil engineers, geologists, specialists of geothermy, drinking water suppliers etc...)

New mission for Land Planning

At the country scale :

Principles in the law

At the agglomeration scale :

The introduction of the 3rd dimension of territory implies some new task for the urban planners:

4 main steps

Step 1 : The 3D model

- Geological data collection
- existing underground infrastructure collection
- storage under a usable form
- establishment of the **3D urban underground model**

Step 2 : Long term resources management

- Specific potential of every type of possible resources (space, geothermics, groundwater, geomaterial)
- Integral multi-use resource potential by optimization of synergies and minimization of conflicts (according to the methodology of Deep City project)

This is the main step

Step 3 : Assessment of existing structures

- Are existing structures compatible with the long term planning ?
- **If not**, planning of their adaptation, abandon or destruction

Step 4 : Dynamic updating

- Dynamic updating of the planning concept according to
 - - new data
 - - new needs
 - - new technologies
 - - new socio-economical conditions etc.

Lessons of Deep City projet (1)

- Underground must be considered as a **whole**: a volume containing **fundamental resources** for the sustainable development of the city, **for construction but not only**.

Lessons of Deep City projet (2)

- This geologic volume can offer a **multi-use** of these resources **if it is planned by defining synergies and incompatibilities** (according to « Deep City Methodology »)

Lessons of Deep City projet (3)

- If it is **not** planned, continuing the « sectorial approach », the city will **lost** definitively one of its last degree of freedom for its harmonious development (repairing errors in underground is much more difficult than at the surface)

Conclusion

This more holistic way to consider the underground below the city should be adopted without delay by urban planners and all the actors of its future.

It is urgent !

Late could be too late !

Underground
management
needs
GEOLOGY.

Perhaps you
too...

<http://ppur.epfl.ch/>

