

# ENPRODES

Management Consultancy by

## Better cities, better lives

De bijdrage van ondergronds ruimtegebruik aan duurzame stedelijke ontwikkeling

ENABLING PROJECTS THROUGH DIALOGUE BASED DECISIONS

## Introductie

- Han Admiraal
  - Zelfstandig adviseur op het gebied van ondergronds ruimtegebruik en omgevingsmanagement
  - Ruim 20 jaar gewerkt bij Rijkswaterstaat
  - 10 jaar directeur Centrum Ondergronds Bouwen
  - 8 jaar lector ondergronds ruimtegebruik
- Fascinatie met ondergronds ruimtegebruik vanuit maatschappelijk perspectief

## Mondiale verstedelijking



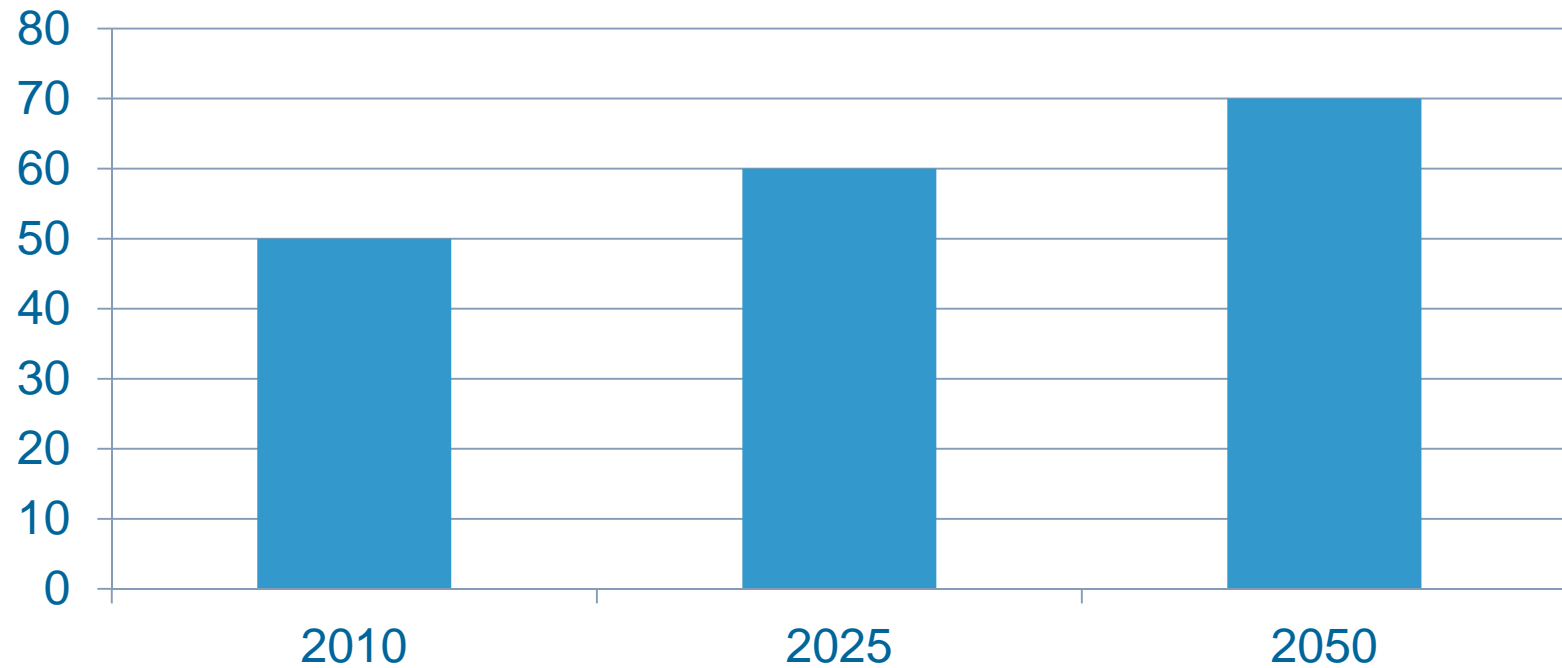
## Better City, Better Life

- Thema World Habitat Day 2010 & Shanghai Expo 2010
- UN HABITAT World Urban Campaign
- UN ISDR Resilient Cities Campaign
- Hoe kan ondergronds ruimtegebruik bijdragen?



## Demografische ontwikkeling

### Growth of Urbanisation



## Natuurrampen en klimaatverandering

- Steden moeten zich aanpassen en kunnen omgaan met
  - Aardbevingen
  - Stormen, orkanen
  - Overmatige regenval

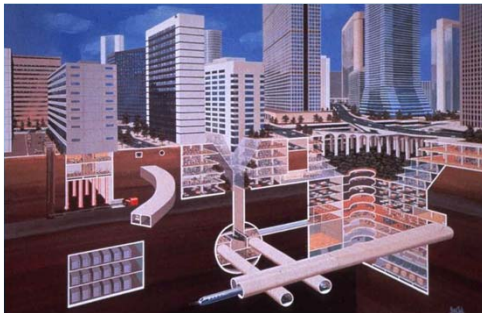
## Toekomst van Nederland



## Rol van ondergronds ruimtegebruik

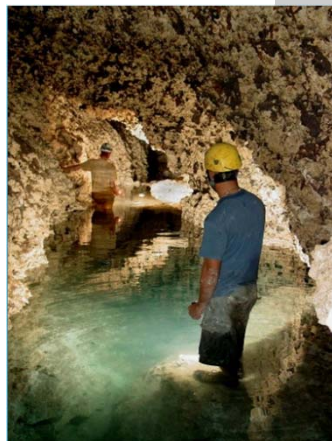
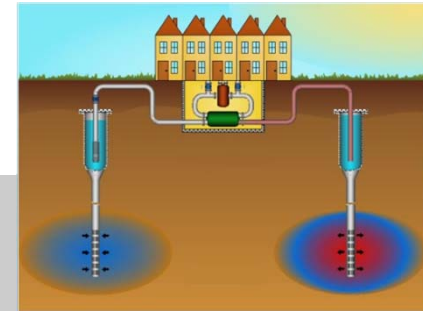
- Wat kan ondergronds ruimtegebruik bijdragen aan duurzame ontwikkeling van steden?
- Wat is nu eigenlijk ondergronds ruimtegebruik?
- Bestaat ondergronds ruimtegebruik alleen uit fysiek gebruik van de ondergrond?

## Ondergronds ruimtegebruik



Space

Geo-energy



Groundwater

Materials

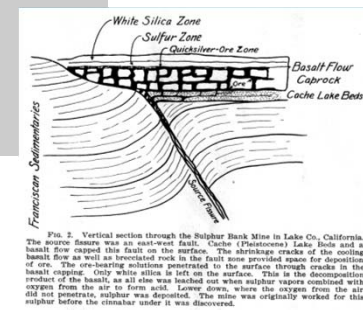


FIG. 2. Vertical section through the Sulphur Bank Mine in Lake Co., California. The source fissure was an east-west fault. Cache (Pleistocene) Lake beds and a basalt flow capped this fault on the surface. The shaly cracks of the cooling basalt flow as well as brecciated rock in the fault zone provided spaces for deposition of ore. The ore-bearing solutions penetrated to the surface through cracks in the basalt capping - only white silica is left on the surface. This is the decomposition product of the basalt, as all iron was leached out when sulphur vapors combined with oxygen from the air to form acid. Lower down, where the oxygen from the air did not penetrate, sulphur was deposited. The mine was originally worked for this sulphur before the clinchbar under it was discovered.

## Stedelijke context

- Gebouwen
- Transport
- Energie
- Water
- Afval

## Gebouwen

- Gebruik van ruimte onder gebouwen
  - Parkeren
  - Ondergrondse voetgangersverbindingen tussen gebouwen en winkelcentra
  - Als een bron voor energie
  - Als een bron voor koud/warmte opslag

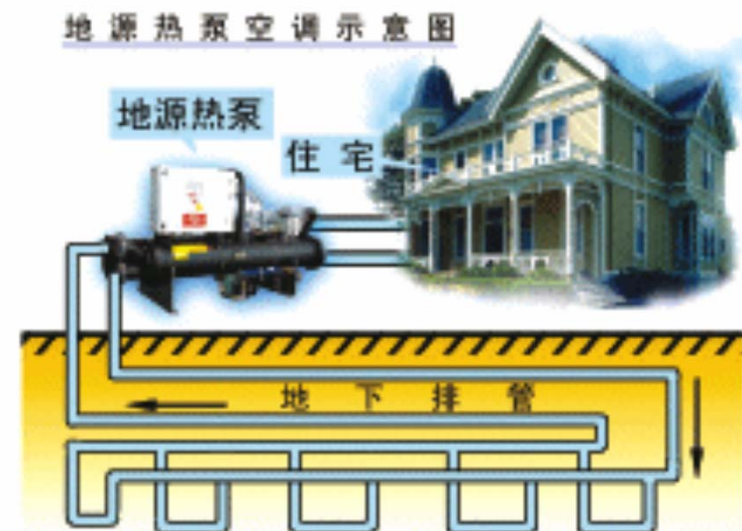
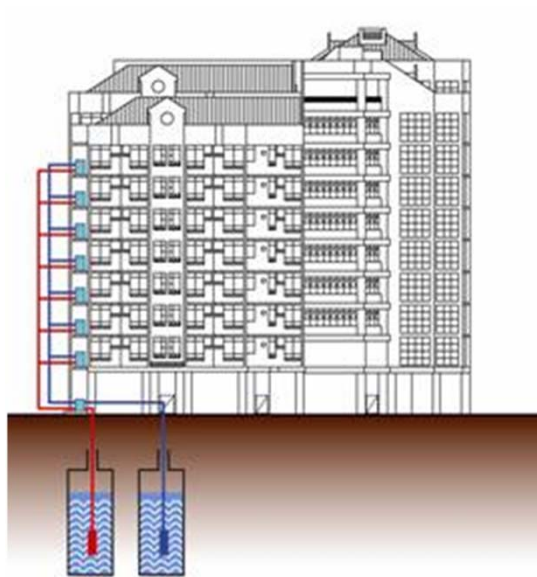
## Gebouwen

- De wijk van morgen
  - Studenten onderzoeken, ontwerpen en bouwen aan duurzame, energie neutrale, 0-impact gebouwen



## Gebouwen

- Bron voor verwarmen en koelen van gebouwen door koud/warmte opslag in de ondergrond



## Transport

- Metro systemen
- Kabels en leidingen



## Transport

- Ondergronds Logistieke Systemen
  - International Society for Underground Freight Transport
  - Onderzoek in Nederland (OLS), China, VS en Australië naar het gebruik in stedelijk maar ook havengebieden

## Energie

## IN-FOCUS

## Latin America and the Caribbean: News

## TRANSPORT

**Haiti**

The Inter-American Development Bank has approved two grants totalling USD 54 million for Haiti to repair highways and improve secondary roads. Transport is a key sector in the Haitian government's economic recovery plan following the destruction caused by the earthquake in January. USD 29 million will aid completing rehabilitation work on RN1, one of the busiest stretches of the country's principal highway, while USD 25 million will finance work to improve the secondary road network in Haiti's southern peninsula.

## HYDRO POWER

**Chile**

French transport and energy infrastructure company, Alstom, has signed a contract worth USD 123 million with Chilean utility Colbun for the supply of three turbines for the Angostura hydropower project being developed in Chile. As part of the agreement, Alstom will provide Colbun with two 136 megawatt (MW) turbines and one 48 MW turbine. The 320 MW Angostura hydropower project is planned for Chile's

**Geothermal energy**

## St. Lucia set to exploit its geothermal energy potential

Emerging renewable energy company, Qualibou Energy Inc., has announced its plan to develop as much as 170 megawatts (MW) of geothermal energy on the Eastern Caribbean island of St. Lucia.

The island is part of a volcanic arc known as the Lesser Antilles. Surface manifestations of geothermal activity are centred in the Sulphur Springs area and include hot springs, steam fumaroles and boiling mud pools. The resources have been extensively explored since the mid 1970s and nine wells have been drilled to date. Steam was found in five of the exploratory boreholes with one of the deeper wells returning steam and water at 235 degrees Celsius, creating ideal conditions for electricity generation.

"The resources on St. Lucia have proven reserves of 30 MW and probable reserves of an additional 140 MW," said Stephen Baker, President and CEO of Qualibou. "In oil terms, the proven and probable reserves are 60.1 million barrels of oil equivalent (BOE), representing a very significant asset for Qualibou."

Production drilling plans are underway and a drilling schedule will be announced in the near future. "We plan to generate 120 MW of power from this resource with the first phase being 15 MW," added Mr. Baker.

Qualibou will deliver all electricity from phase one of its geothermal power project to St. Lucia Electricity Services Limited (LUCELEC), the sole electric utility of the

## THE TIMES THE SUNDAY TIMES

Archive Article

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From [The Times](#)

February 11, 2010

### Computer power provides heat for Helsinki

[Robin Pagnamenta in Helsinki](#)

Outside, the temperature is a bone-chilling minus 14C and Helsinki is struggling with its iciest winter since 1982, but deep inside a former bomb shelter carved from the bedrock beneath an Orthodox cathedral, the city's power company is building what will soon be the world's most high-tech municipal heating system.

Here, surplus heat from hundreds of computer servers in a new data centre located beneath Uspenski Cathedral, one of the city's main tourist attractions, will be captured and pumped to heat hundreds of homes and businesses across the Finnish capital.

"This will be the greenest and most energy-efficient data centre in the world," Juha Sipila, the project manager for Helsingin Energia, the company behind the scheme, said.

In Helsinki, where winter temperatures often plunge to minus 30C, hardly anyone owns a domestic heating boiler. Instead, water is heated centrally at combined heat and power (CHP) plants to 115C and piped directly to tens of thousands of homes and public buildings.

#### RELATED LINKS

- ▶ [Energy regulator warns of blackouts](#)
- ▶ [Dream of cool-running is becoming a reality](#)

Helsingin Energia is the operator of Helsinki's district heating network, a 1,350km (850-mile) network of underground pipes, tunnels and pumping stations that supplies hot water to 450,000 people across one of the world's coldest capital cities.

The data centre will be cooled using seawater from the Baltic, which falls below 8C from November to May, with the excess heat pumped back into the city's heating system — a solution that Mr Sipila hopes will help to crack a pressing problem for the world's IT industry.

## Energie

- Waterkracht
- Koud-warmte opslag toepassingen
- Zero impact van transport netwerken van energie

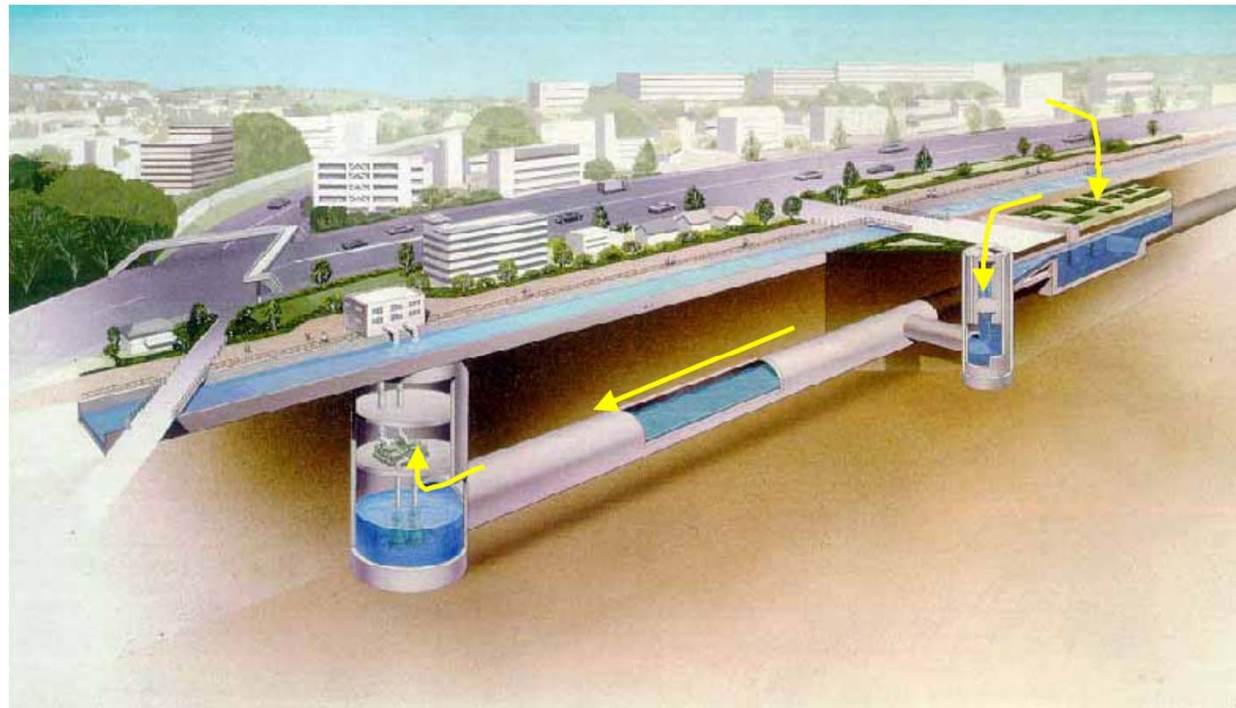


## Water

- Omgaan met overmatige regenval als gevolg van klimaatverandering
  - Voorkomen onder water lopen van ondergrondse infrastructuur
  - Bewust onder water laten lopen van ondergrondse infrastructuur
  - Bezinkbassins onder ondergrondse parkeergarages
  - Ondergrondse rivieren (Japan)
  - SMART concept - Kuala Lumpur, Malaysia

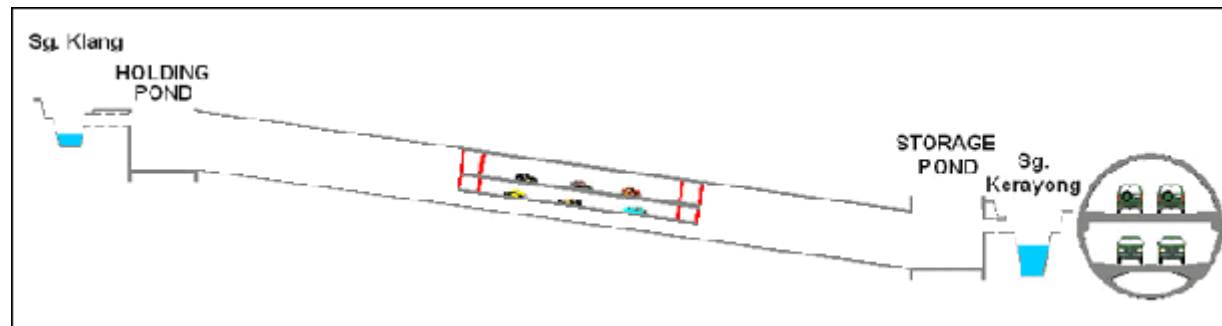
## Water

- Yokohama, Japan



## Water

- Stormwater Management and Road Tunnel – SMART, KL, Maleisie



## Afval

- RWZI, Dokhaven, Rotterdam



## Afval

- OAT – Ondergronds Afval Transportsysteem



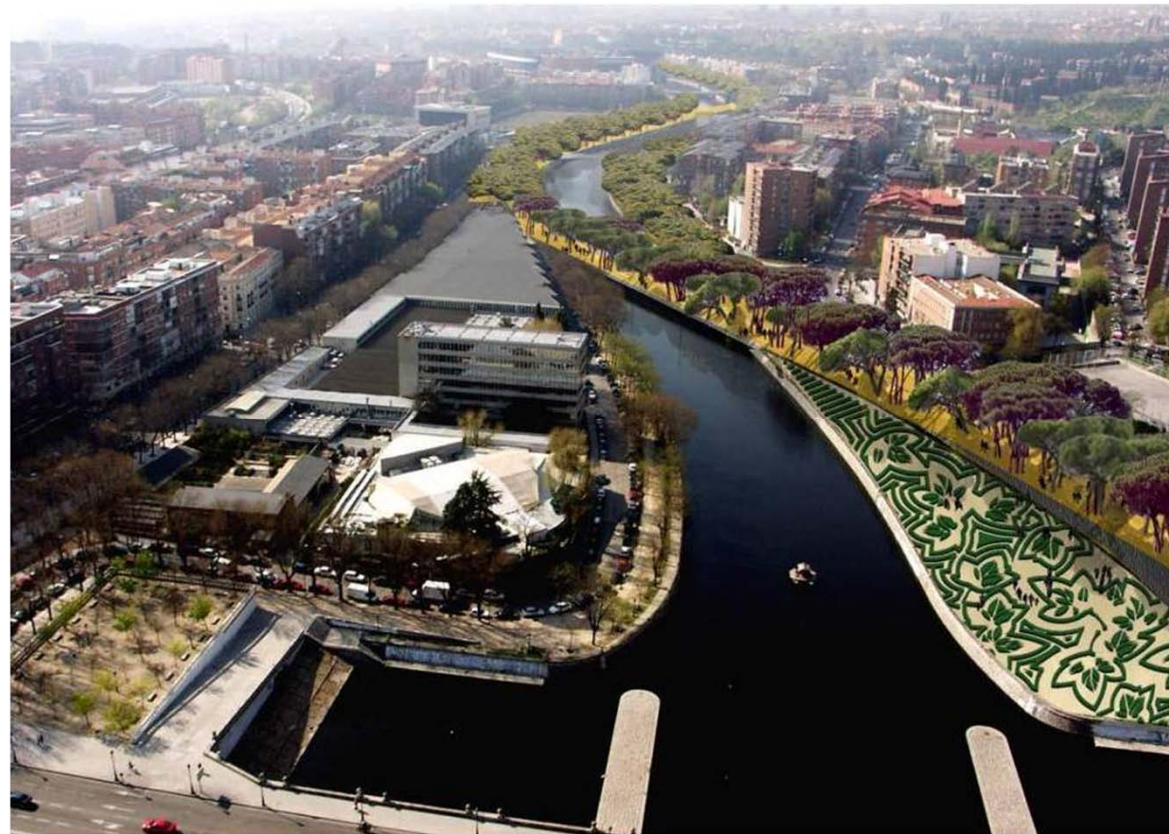
## Better Cities, Better Lives

- Ondergronds ruimtegebruik kent veel potentieel
- Het draagt bij aan een duurzame stedelijke ontwikkeling
- Draagt bij aan klimaatbestendigheid van steden
- Kan in potentie bijdrage aan zero-impact (grondgebruik, gebouwen, energie)

## Integratie van concepten

- SMART concept: integratie van water management en verkeer
- Combineer infrastructuur van OAT met stadsverwarming
- Leg tunnels aan die multi-functioneel in gebruik zijn, schone lucht produceren en energie opleveren

## Madrid – M30 project



## Creating Better Life for People

