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TWEE TYPES VAN BODEMENERGIEOPSLAG TOEGEPAST IN DE ZIEKENHUISSECTOR

Study Day Shallow Energy

Februari 10th 2010

Speaker: Bart Van Nieuwenhove

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Geothermal Energy

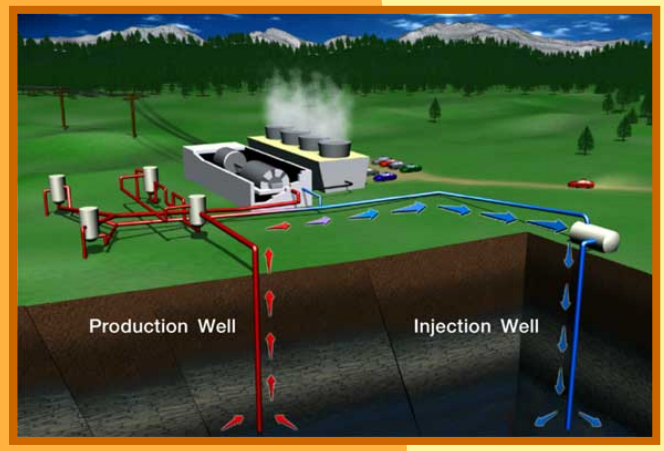
General

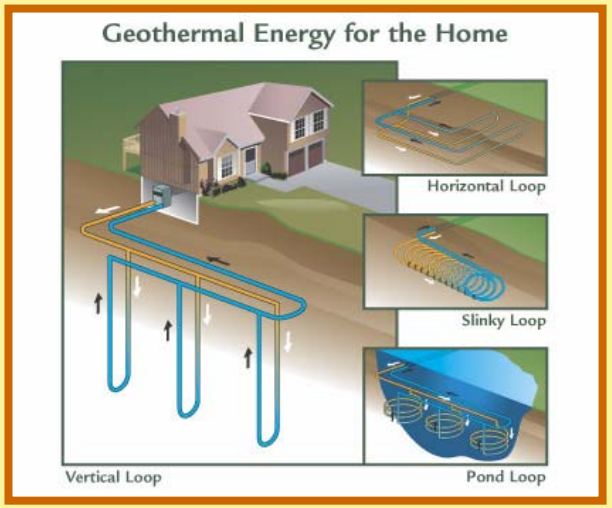
-Open system

- Sint-Elisabeth - Herentals

-Closed system – borehole heat exhangers

- Sint-Vincentius – Antwerp





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Geothermal Energy

Choice : Open system - closed system

- Geology and hydro-geology of the underground
- Geological differences in Belgium
- Energy demand
- Area and utilization of the surface
- Problems with licences / government

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⇨ **Open system: ATES (Aquifer Storage)**

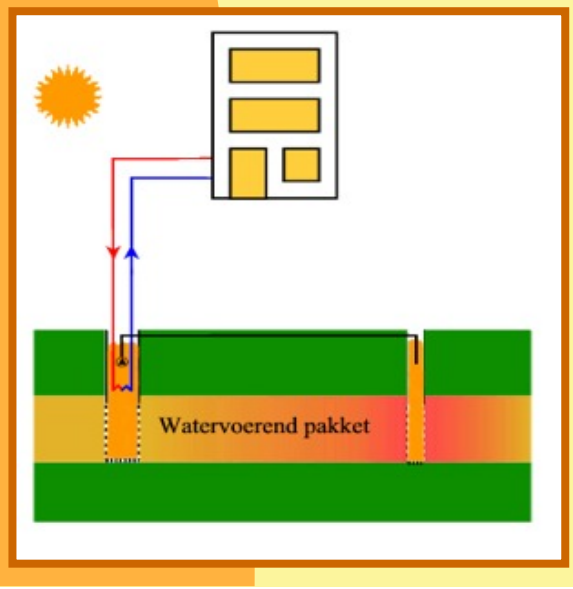
Principle

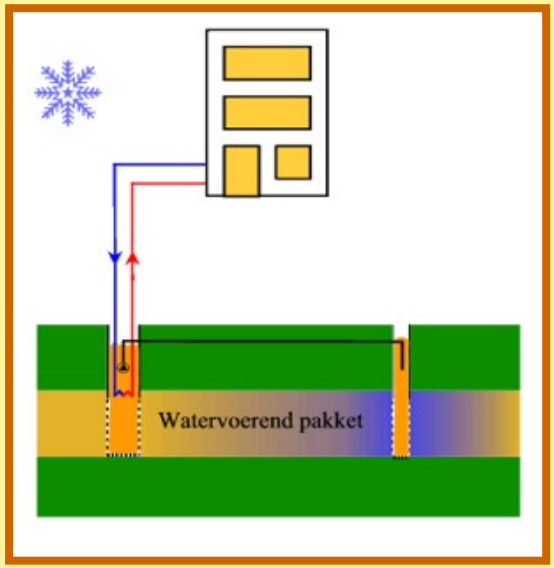
→ Two wells (“doublette”)

Example: 2 wells with a production of 90m³/h (500kW)

- Extract or inject water from/to water bearing layers in the underground

- Energy demand summer ↔ winter





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⇨ **Open system**

A. Main requirements :

- Sufficient permeability
- Good groundwater chemistry

→ By means of a pumping test and interpretation

B. Interaction between study – design - construction

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⇨ Procedure

A. Drilling of two wells : “doublette”

- Difference between extraction and injection
- Quality of the work is important

1. injection and extraction well can be switched
2. production of the desired amount of groundwater with little drawdown
3. avoid problems with scaling, clogging and corrosion

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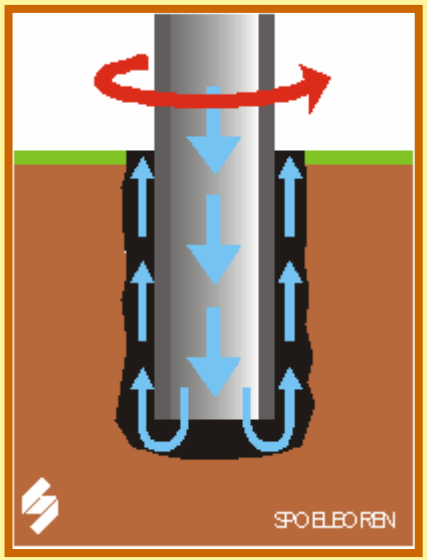
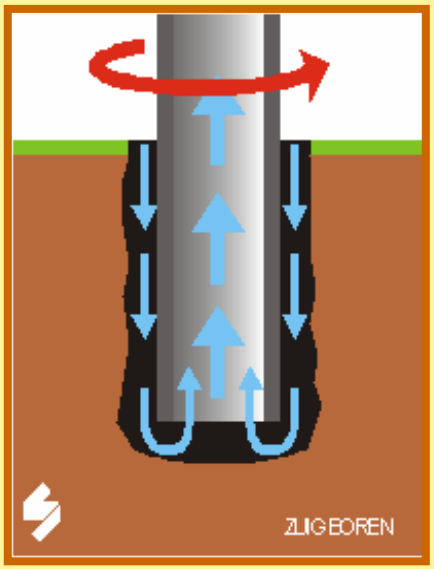
4. Drilling method

→ dependent on local geology / borehole diameter / borehole depth

Option 1 – direct rotary drilling



Option 2 – airlift



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4. Drilling method

→ Area and utilization of the surface

→ Drilling mud

→ Drill

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5. Well construction

→ quality work

→ depth, diameter of the well, backfilling materials

→ St Elisabeth: 2 wells of 75m
production: 90m³/h
PVC, diam 250mm
500kW

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B. Electro-mechanical equipment primary circuit :

1. Submersible pumps
2. Inspection chamber
3. Piping / wiring
4. Technical room
5. Low voltage switch box
6. Interaction with the building (HVAC), programmation

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Submersible pumps

- stainless steel pumps and accessories
- stainless steel piping
- injection valve
- hydrostatic water level measurements

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Submersible pumps

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Submersible pumps

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Submersible pumps

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Inspection chamber

- underground
- partly underground, partly aboveground
- hydraulic en electrical equipment
- instrumentation

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Inspection chamber

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Inspection chamber

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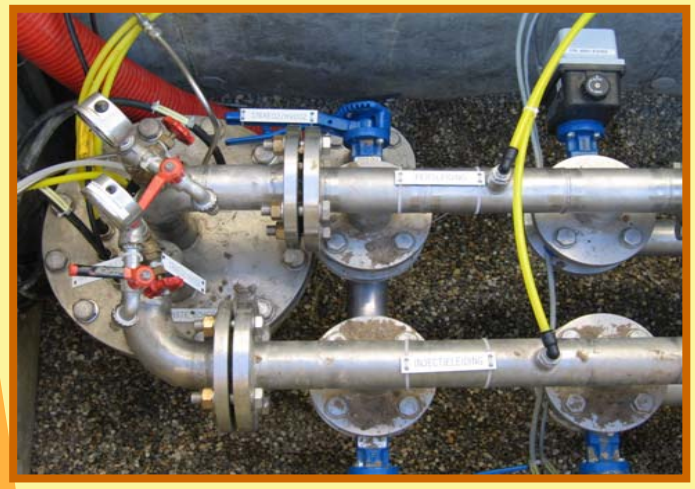
Inspection chamber



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Inspection chamber

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Piping / wiring

- HDPE-fittings
- wiring: suitable for underground

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Technical room

- stainless steel piping
- manual or automatic
- elektro-magnetic flow meter
- sensors for registration of pressure, temperature

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Technical room

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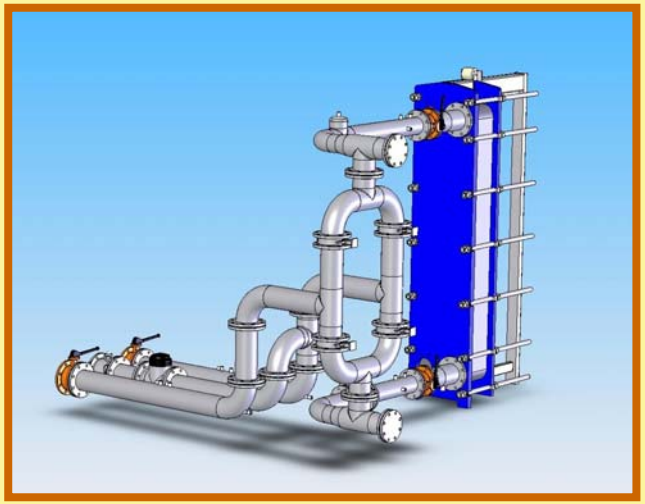
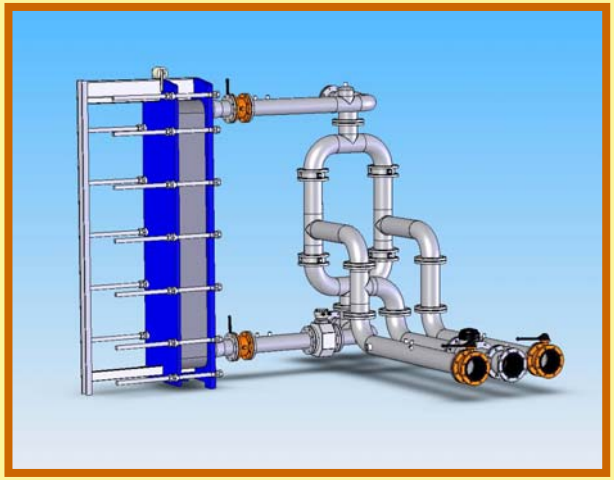
Technical room





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Technical room

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Low voltage switch box

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Interaction with the building (HVAC), programmation

- ! Separation between open system and HVAC

- Responsabilities

OPEN SYSTEMS ARE SEPARATE SYSTEMS

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References open systems

*proefboringen voor VITO, SCK
*Brasschaat, VZW KLINA
*Malle, ETAP
*Mol, VITO
*Turnhout, Kazerne Blairon
*Geel, OPZ
*Overpelt, Mariaziekenhuis
*Geel, OPZ (46m³/h – 175kW)
*Tienen, BEBAT (15m³/h – 170kW)
*Herentals, St-Elisabeth (90m³/h – 800kW)
*Mol, RVT Ten Hove (46m³/h – 270kW)
*Sint-Truiden, AZ St Trudo (40m³/h – 375kW)
*Turnhout, AZ St-Jozef (60m³/h – 560kW)
*Heusden-Zolder, St-Franciscusziekenhuis (90m³/h)
*Tienen, Sociaal Huis (30m³/h – 450kW))

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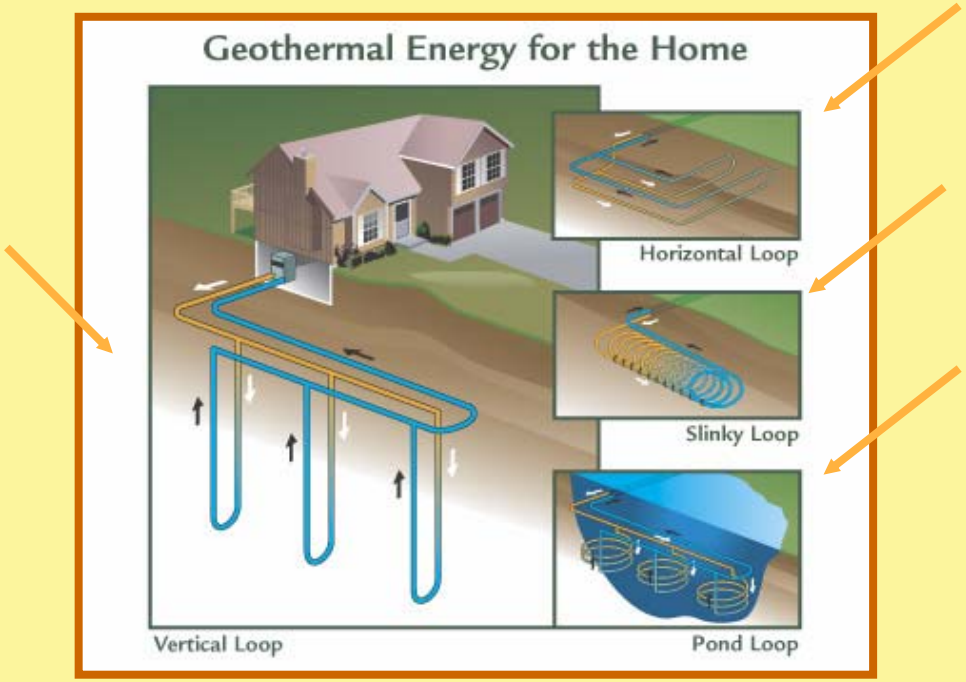
⇨ Closed systems: BTES (Borehole Storage)

- Vertical – horizontal - oblique
- Example: Sint-Vincentius at Antwerp
  - 84 boreholes of 150meter



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⇨ **Closed systems :borehole heat exhangers**

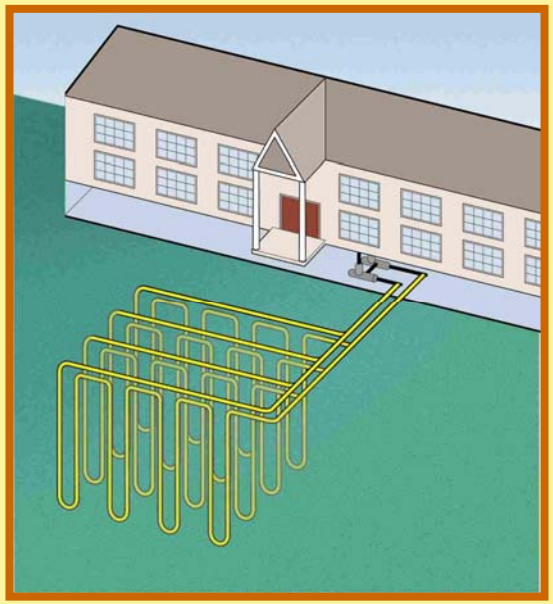
- Execution of a Geothermal Respons Test (Terra Energy)
- Study – design:

→ Amount of boreholes

→ Depth of the boreholes

→ Configuration

→ Horizontal connections



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⇨ Procedure

1. Drill site

2. Technical / materials

3. Drilling works

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1. Drill site

- Levelling

- Trenches

- Building excavation

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Consultation with architect, contractor,…

- planning
- area and utilization of the surface
- configuration
- stability of the underground and structures

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2. Technical / materials

- Double U-pipes: straight pipes connected by a 180° U-turn at the bottom

- PE100, SDR11, PN16, diameter 32 x 26,2 mm

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- installation of several weights
- installation with care and experience

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- Backfilling of the boreholes

→ From bottom to top

→ With a filling pipe

→ Thermal grout

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3. Drilling works

- Drilling method = direct rotary drilling
- Depth : dependent on
  - permits
  - geology
  - prize
  - size of the drilling machine
- Transport of mud

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Quality :

- Diameter < 180 mm
  → Maximal heat conductivity
- Verticality of the drilling machine (89,50° - 90,50°)
- Sequence of the boreholes
- Quality of the mud
- Borehole depth

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⇨ Horizontal connections of the U-pipes :

- HDPE

→ SDR11

→ Type of connections :

1. Tichelmann method
2. Parrallel-serial method

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1. Tichelman method :

   → Equilibrium of the system

   → Pressure losses are the same

2. Parallel-serial method :

   → 2 U-pipes parallel
   → 2 boreholes serial

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→ HDPE collector

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→ HDPE collector

→ Link seals

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→ Central collector in excavation

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References closed systems

*Barendrecht, BAM-groep – 16 st tot 125m
*Mol, Vito – 144 st tot 35m
*Lelystad, Nordic – 10 st tot 100m
*Zuidschermer, Nordic – 8 st tot 130m
*Londerzeel – 8 st tot 120m
*Watermael-Bosvoorde, Herpain – 50 st tot 100m
*Antwerpen, St-Vincentius – 84 st tot 150m
*Brugge, WZC De Vliedberg – 68 st tot 100m
*Hasselt, Infrabel (Seinhuis) – 24 st tot 100m
*UZ Gent, REVA – 34 st tot 150m

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QUESTIONS ?