



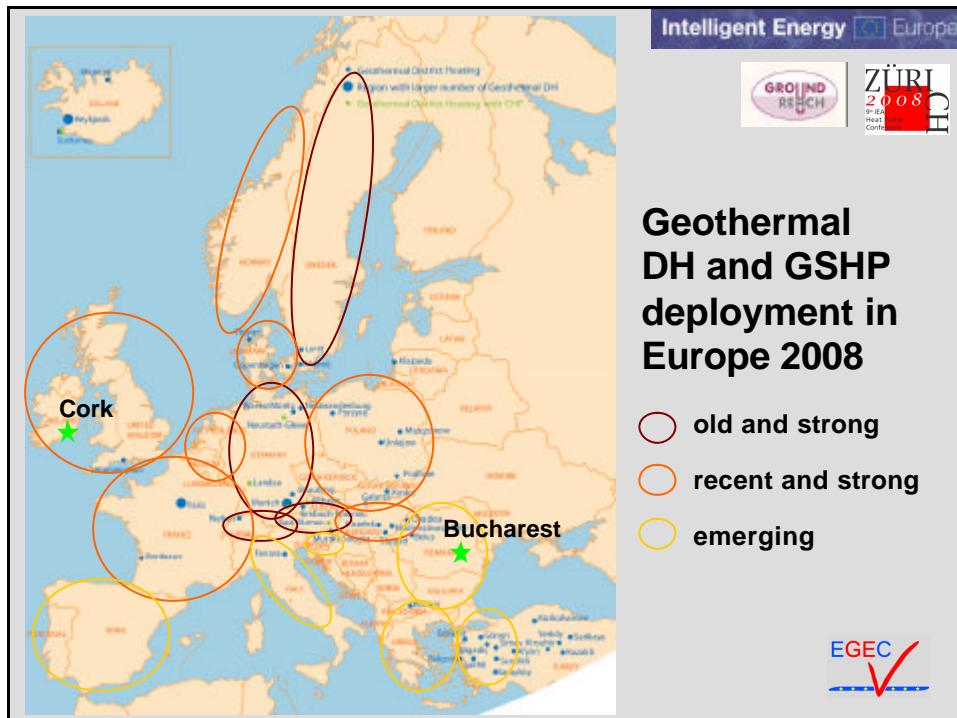
Groundreach Workshop
Zürich, Switzerland, May 23, 2008



**GSHP at the Eastern and Western
end of the EU :
Glucksman art gallery in Cork, Ireland, and
Porsche showroom in Bucharest, Romania**

Dr. Burkhard Sanner

European Geothermal Energy Council, Brussels



Lewis Glucksman Art Gallery University College Cork, IE



The gallery is a fine example of modern architecture,
providing sufficient space on a small footprint



Most photos and graphs
Glucksman gallery:
Kevin o'Regan, UCC,
and Dunstar Ltd.

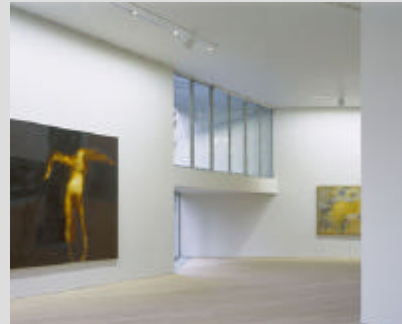
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Lewis Glucksman Art Gallery University College Cork, IE



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Lewis Glucksman Art Gallery University College Cork, IE



The gallery offers:

- 2350m² of room
- 4 Exhibition spaces
- Multifunction rooms
- Lecture facilities
- Café
- Gallery Store in the basement

The gallery requires:

- 190 kW heating
- 130 kW cooling
- Critical exhibition and storage space requires humidity control,
- Dehumidification requires that heating and cooling be supplied simultaneously to Close Control areas.



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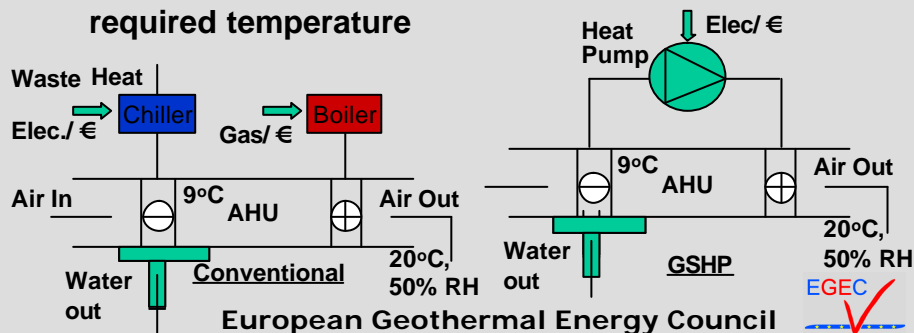


Lewis Glucksman Art Gallery University College Cork, IE



Dehumidification, conventional vs GSHP

- Conventional, you pay twice: to cool, and to reheat; the heat from the chiller is dumped
- The Heat Pump uses the extracted heat as a renewable resource and heats the air to the required temperature



**Lewis Glucksman Art Gallery
University College Cork, IE**

**200 kW open loop (groundwater)
heat pump for precise temperature
($19 \pm 1/2^\circ\text{C}$) and humidity control**



Wellhead under construction



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**Lewis Glucksman Art Gallery
University College Cork, IE**

Very specific aquifer situation:

- “buried valley”**
- High permeability
 - Well defined boundary
 - One of those underlying most of Cork



Buried Valley just upstream of Cork



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Lewis Glucksman Art Gallery University College Cork, IE



200 kW open loop (groundwater)
heat pump for precise temperature
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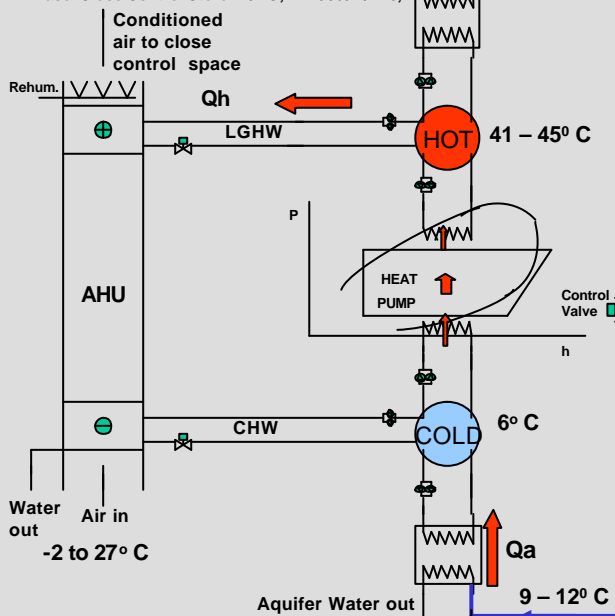


Heat Pump York YCWM, using R407C
2 peak boilers (gas)

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Close Control Gallery: 20°C ; RH $50\% \pm 5\%$,
Base. Close Control Store: 20°C ; RH $50\% \pm 2.5$,



Geothermal Heating

Heat Pumps Enabled
Heat Balance $Q_a = Q_h$
Heat input controlled by
speed of Submersible
Pumps.

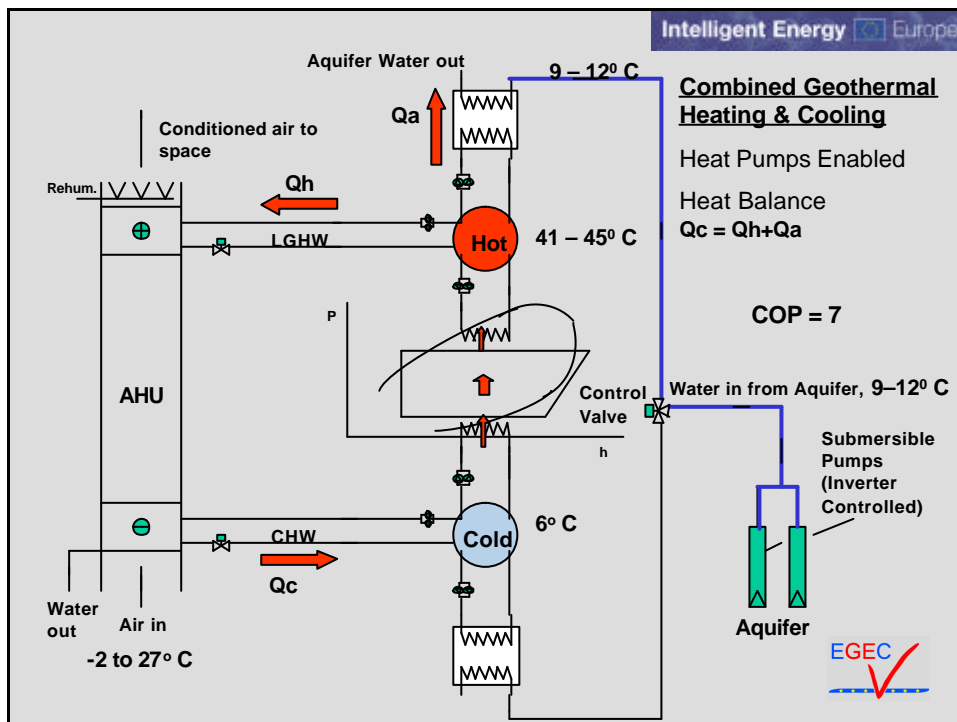
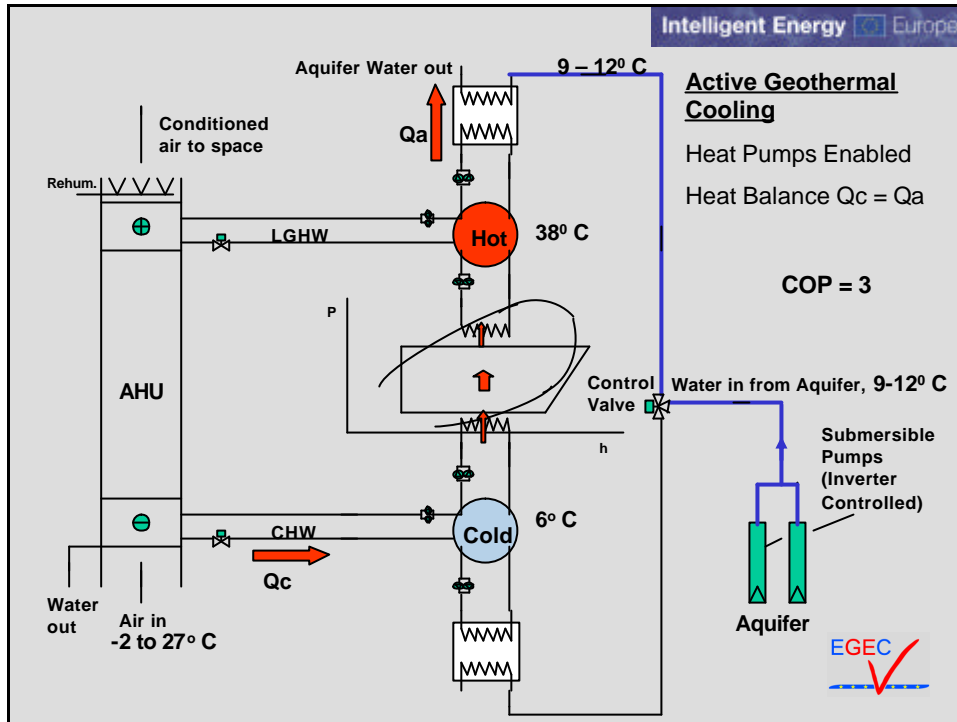
COP = 4

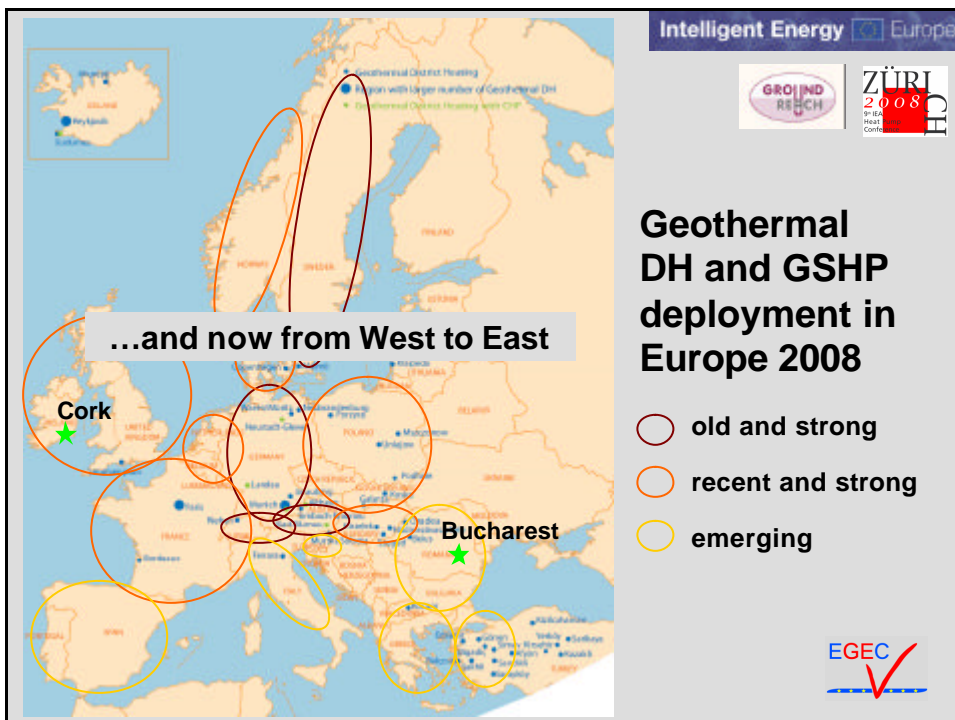
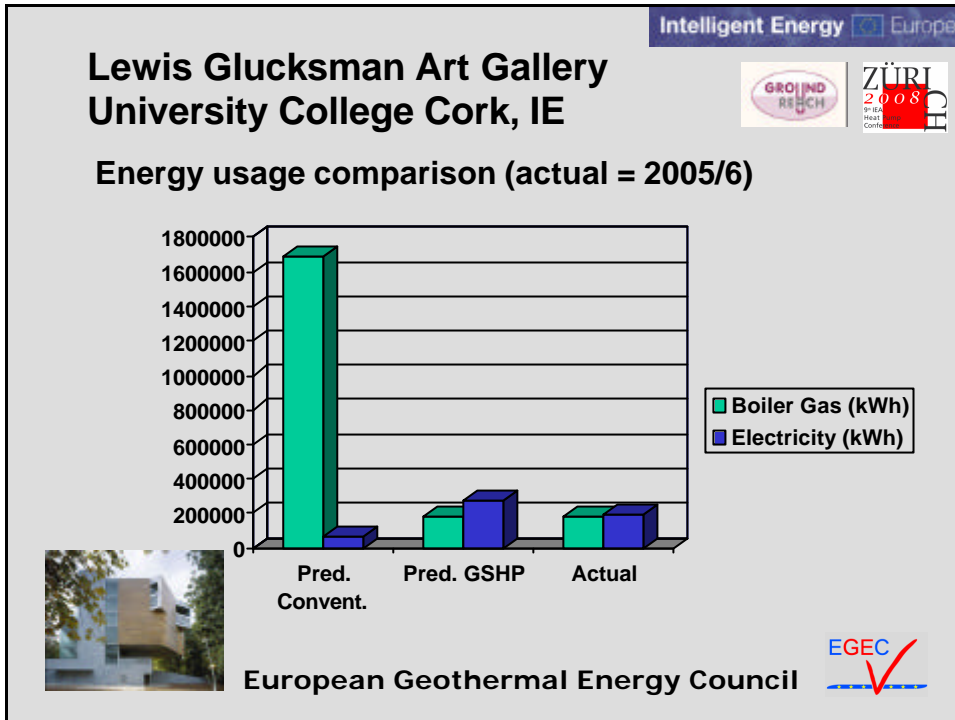
Water in from Aquifer, $9-12^\circ\text{C}$

Submersible
Pumps
(Inverter
Controlled)

Aquifer







PORSCHE Bucharest West 2 – Showroom and Service, RO



Showroom, service workshops, and offices for Audi and SEAT cars, constructed 2006

Project developed by



Member of EGEC

Photos and graphs
Porsche Showroom:
Doina Cucueteanu, ASA,
and Radu Polizu, RGS



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PORSCHE Bucharest West 2 – Showroom and Service, RO



Metallic construction - total unfolded area of 3.507 m², structured in four distinctive parts:

- SEAT showroom of 360 m², made of steel and glass
- AUDI showroom of 795 m² (650 m² area of car presentation; 145 m² - office area, on two levels)
- Middle section of metal and glass of 421 m² (links the two showrooms)
- Workshop of 1931 m², with thermally insulated lateral walls



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PORSCHE Bucharest West 2 – Showroom and Service, RO



Metallic construction - total unfolded area of 3.507 m²

Spec. thermal loss: 0,209 W/(m³K)
Heating load: 308 kW_{th}
Cooling load: 313 kW_{th}
DHW: 200 kWh/day
Fresh air flow: 3000 m³/h



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PORSCHE Bucharest West 2 – Showroom and Service, RO



Building equipment:

- 17 water-to-water and 12 water-to-air heat pumps (Florida Heat Pump), using R410A
- 750 m² of special surfaces of under-floor piping system for heating and cooling
- Ventilation channels connected to several water-to-air heat pumps, located mainly in the false ceilings of the building



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PORSCHE Bucharest West 2 – Showroom and Service, RO

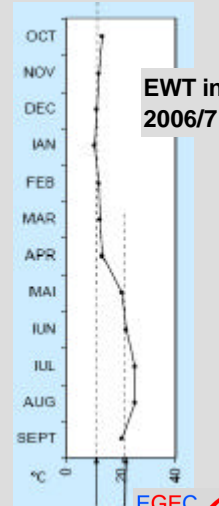
Ground side equipment:

- 128 vertical borehole heat exchanger
- each 70–75 m deep
- under a field of 3.500 m²



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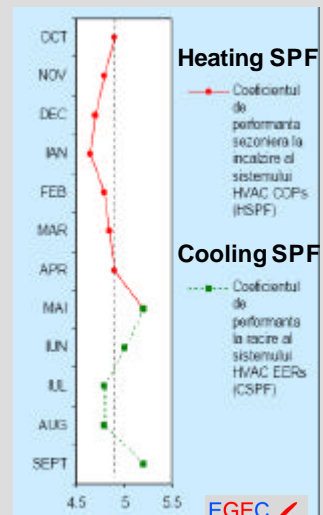
System performance:

- 475 MWh for heating (and hot water) annually
- 393 MWh for cooling annually
- For the time period under survey (2006/7), the coefficient of performance of the HVAC system was higher than COP=4,8 (see graph to the right)
- H&C is 100 % geothermal



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Comparison with conventional system:

- PBW1 is another Porsche facility for SKODA and VOLKSWAGEN cars with classic HVAC system and 5231 m² (similar construction in very close area, with identic solar orientation, same functions, commissioned in January 2006).
- PBW1 uses natural gas for heat and hot water, and last generation Air-to-Air VRV (Variable Refrigerant Volume) multisplit systems for ventilating and air conditioning during winter and summer.



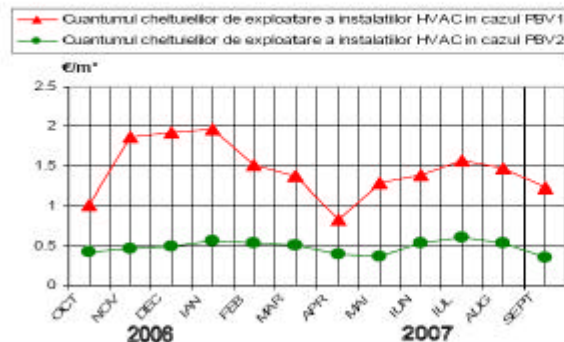
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CHETUIELI SPECIFICE LUNARE SI ANUALE DE EXPLOATARE A INSTALATIILOR HVAC
PORSCHE BUCURESTI VEST 1 - PORSCHE BUCURESTI VEST 2
CONFORM FACTURILOR LUNARE DE UTILITATI



The specific HVAC annual costs

PBW1 – 17.39 Euro/sqm

PBW2 – 5.8 Euro/sqm

The specific costs are calculated at the average prices for electricity and natural gas in the survey period of time in Romania:

Electricity

72.86 Euro/MWh

Natural gas

316.8 Euro / 1000 m³N

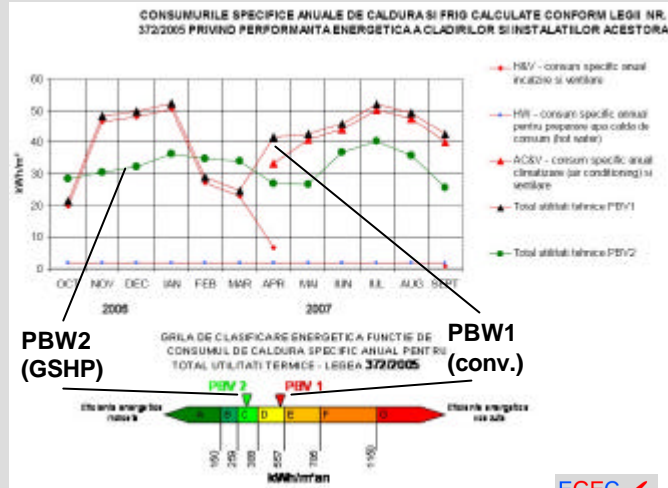


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**GSHP
advances
building to
category C
of energy
efficiency
law!**



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Conclusions:

- If properly designed, implemented and used, the GSHP HVAC system brings important economical and ecological advantages, compared to the classic HVAC solution
- The consumption of resources for heating, ventilation and hot water in winter season in the GSHP HVAC system is 5 times smaller, and
- the CO₂ pollution in GSHP HVAC system is 10 times smaller than in classic system with natural gas



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For more information:

www.egec.org

www.groundreach.eu



***Thank you for your
attention!***

European Geothermal Energy Council

