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BETEK R&D and Training Center

MED-ENEC PILOT-PROJECT-COMPETITION AWARDED

16 November 2006, Istanbul

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Location: Gebze, Kocaeli - Turkey



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Type of building: R&D and Training Center

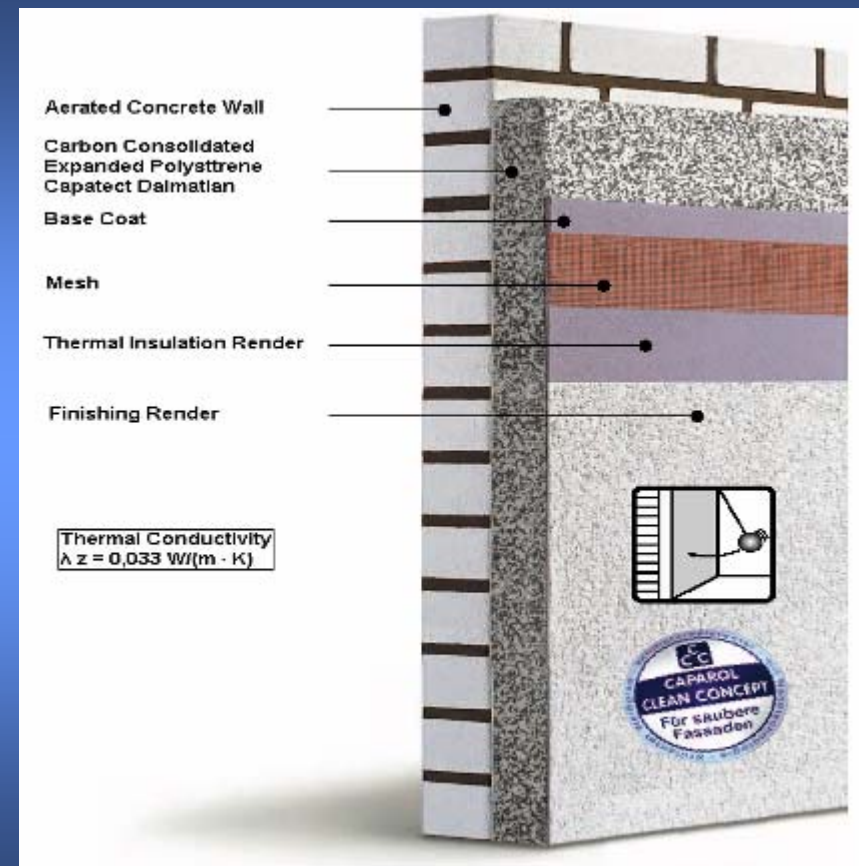
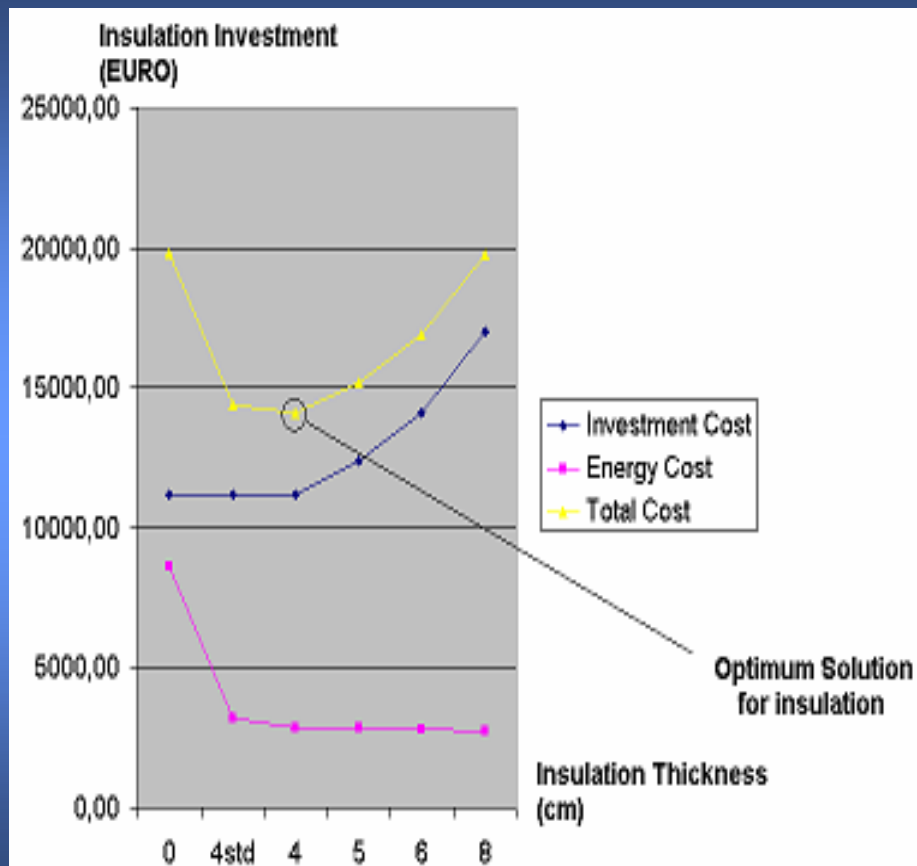
Specification: 1 unit w/ 3 floors / New Construction / 1763 net m²



FRONT VIEW

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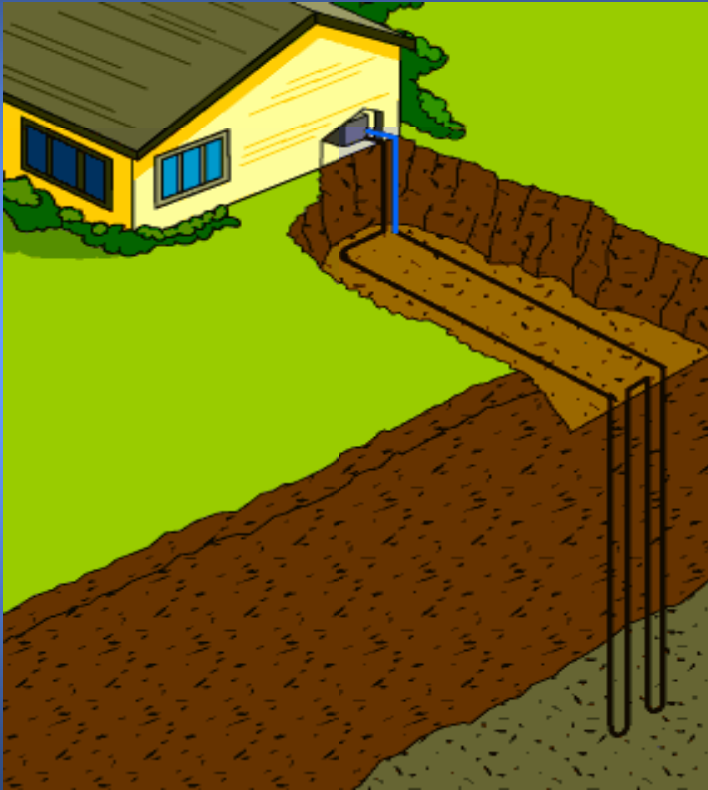
Energy Concept 1: Conservation (minimization) of energy by utilizing the most adequate thermal insulation material with optimum thickness (Betek Dalmaçyalı, 4cm thickness)



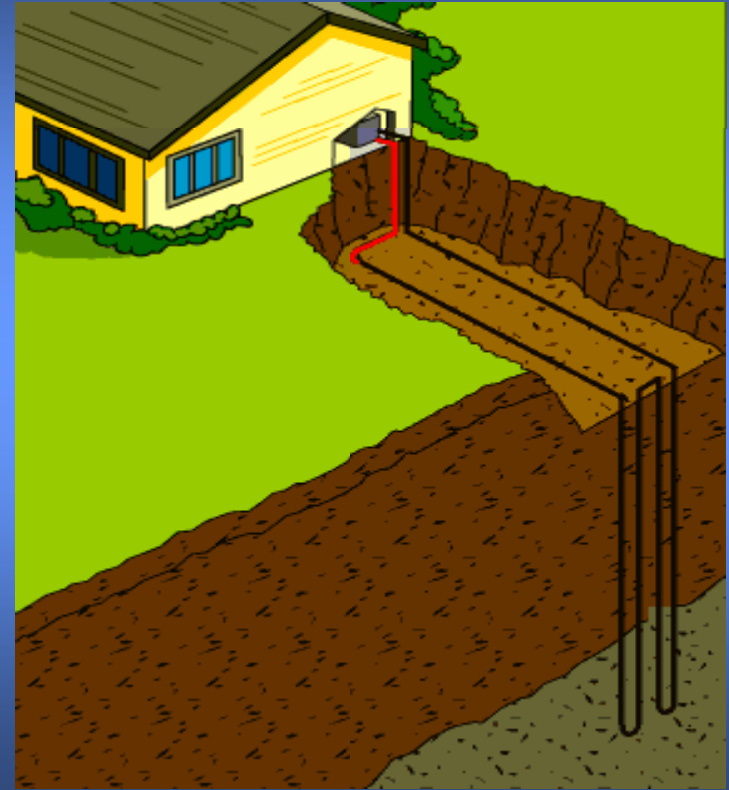
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Energy Concept 2: Utilization of renewable energy source : Heat Pumps (GSHPs)

Heating Mode

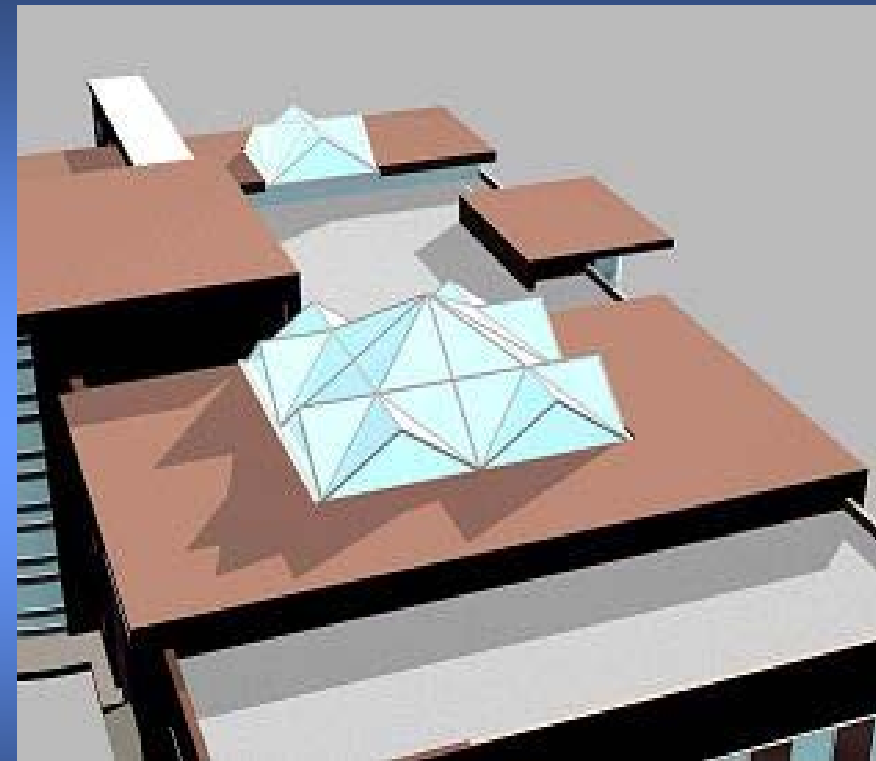
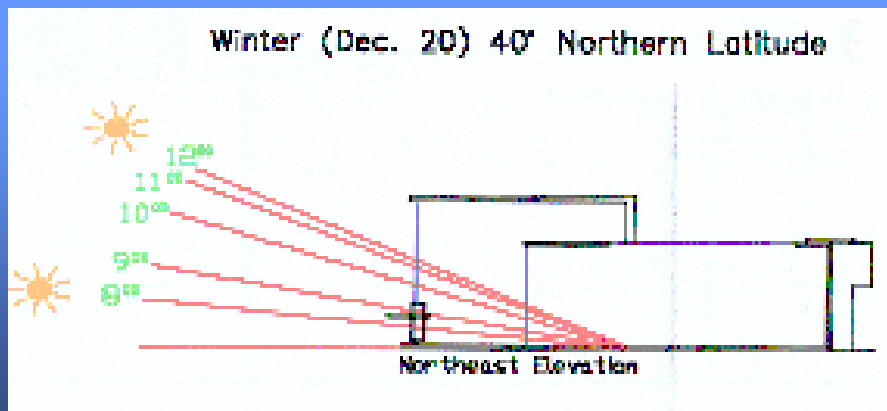
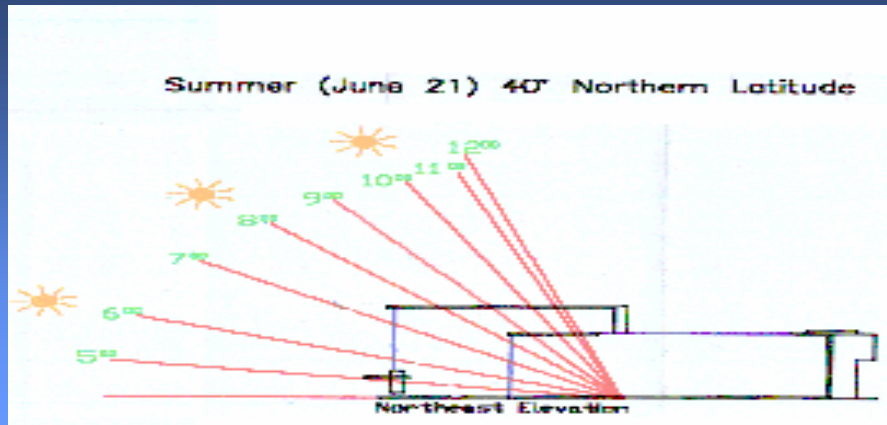


Cooling Mode



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Energy Concept 3: Use of solar energy - Increased input of natural light by two skylights / and passive solar gain by orienting building architecture



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Comparison of Energy Consumptions

Total Heating and Cooling Loads:

Winter: 174.92 kW / Summer: 163.84 kW

Conventional System (Chiller + Boiler burns oil)

ENERGY COSTS

HEATING (winter)		2.100,00 hours/year
Fan-Coil Fans	2,70 kW	
Burner	2,50 kW	
Circulation Pumps for Fresh Air	1,25 kW	
Circulation Pumps for Heating System	0,70 kW	
Fresh Air Fans	12,50 kW	
TOTAL	19,65 kW	
Electricity Energy Cost in Winter	3.301,20 EUR	

Total Heating Needs	174,92 kW
Oil Energy Cost in Winter	21.407,52 EUR
TOTAL Energy Cost in Winter	24.708,72 EUR

COOLING (summer)		880,00 hours/year
Fan-Coil Fans	2,70 kW	
Chiller Compressor (163.84/COP of Chiller)	65,54 kW	
Condenser Fan	6,60 kW	
Circulation Pumps for Cooling System	4,00 kW	
Fresh Air Fans	12,50 kW	
TOTAL	91,34 kW	
Electricity Energy Cost in Summer	6.430,05 EUR	
TOTAL Energy Cost in Summer	6.430,05 EUR	

TOTAL Energy Cost in a Year **31.138,78 EUR**

Electricity 0,080 EUR/kW h
Oil 0,058 EUR/kW h

Ground Source System (with 29 GSHPs)

ENERGY COSTS

HEATING (winter)		2100 hours/year
GSHPs TOTAL Operational Power	41,3 kW	
Circulation Pumps for Fresh Air	1,25 kW	
Fresh Air Fans	12,5 kW	
Circulation Pumps for Earth Coupling	2 kW	
TOTAL	57,05 kW	
Oil Energy Cost in Winter	9584,4 EUR	
TOTAL Energy Cost in Winter	9584,4 EUR	

COOLING (summer)		880 hours/year
GSHPs TOTAL Operational Power	35,38 kW	
Circulation Pumps for Fresh Air	1,25 kW	
Fresh Air Fans	12,5 kW	
Circulation Pumps for Earth Coupling	2 kW	
TOTAL	51,13 kW	
Electricity Energy Cost in Summer	3599,552 EUR	
TOTAL Energy Cost in Summer	3599,552 EUR	

TOTAL Energy Cost in a Year **13183,952 EUR**

AVG COPs
Summer: 4.63
Winter: 4.23

Electricity 0,08 EUR/kW h

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Economics

Boiler+Chiller Items	Equipment Prices EURO	GSHPs + Solar Collector Items	Equipment Prices EURO
Chiller	29100	Drilling (10 times 150 m bore hole)	47706,13
Cooling Circulation Pumps	6700	Bore Holes Piping	14908,17
Boiler (fuel oil or natural gas)	9610	Ground Source Heat Pumps(GSHPs) and their accessories	92974,8
Heating Circulation Pump	1675	Fresh Air Generators	26950
Funnel	17250	Heat Exchanger Pumps	3300
Domestic Hot Water Cylinder	1020	Inner Circulation Pump	1150
Fan-Coils	10454	Outer Circulation Pump	1300
Fresh Air Generators	26950	Domestic Hot Water Cylinder	1565
Heat Exchanger Pumps	3300	Pipes, valves, fittings, insulation etc.	33610,89
Expansion Tanks	700	Air ducts	22666,4
Pipes, Valves, Fittings, Insulation etc.	31065,79	Automation	7080
Air Ducts	22666,4	Others	5862
Automation	7080		
Others	1500		
TOTAL	169071,19	TOTAL	259073,39

Energy Type	Additional Investment	Pay - Back Period
	EURO	Year
Fuel Oil	$(259.073 - 169.071) = 90.002$	$90002 / 17955 = 5$

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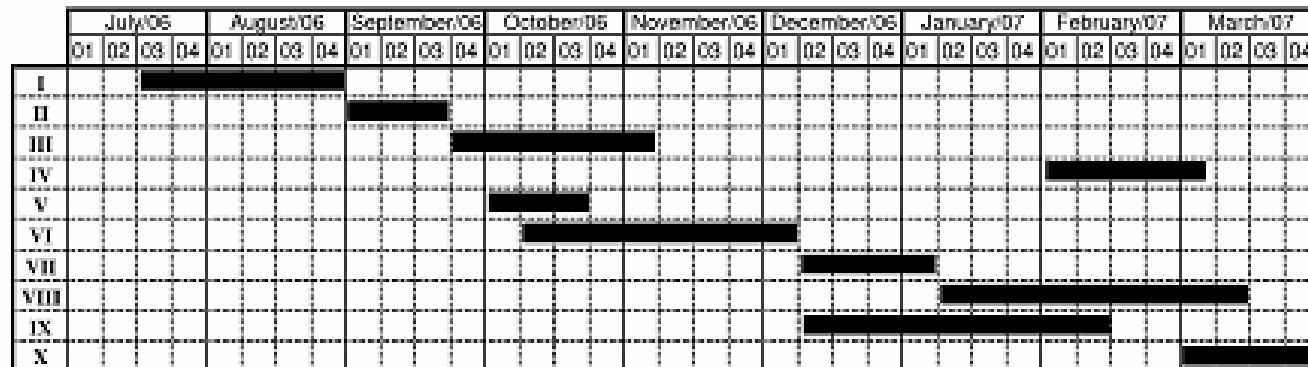
Consortium

- Project team will be composed of the experts of the following institutions:
 - • Sinan Üstünel / Mustafa Macit: BETEK Boya ve Kimya San.A.S.- Turkey /
 - • Prof. Dr. Ali Beba / Güzay Balcık: R&R Scientific and Technical Services
- Consultants from the following institutions will be available on the need basis:
 - • Dr. Engin Bağda: Caparol – Germany
 - • Erkan Aker, Architect, EFEKTA Architecture & Construction Teams and
- Özcan Dumral, DUKA, Mechanical, Air Conditioning, Heating and Ventilation
- • Univ.-Prof. Dr.-Ing. Gerd Hauser: Director of Fraunhofer Institute of Building Physics and Chair of Building Physics, Technical University Munich

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Implementation plan

Excavation for building foundation	I
Reinforced concrete foundation	II
Founding basement	III
Bore-hole digging for ground-source system	IV
Ordering GSHP A/C systems	V
Manufacturing steel construction and installation	VI
Walls, roof, insulation, stucco-work, flashings, etc...	VII
Floor levelling, indoor structural jobs	VIII
Mechanical (A/C, sanitary, etc...) and electrical (lighting, automation etc...) installations	IX
Landscape arrangement	X



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Budget for implementation

Excavation for building foundation	I	€ 25.000
Reinforced concrete foundation	II	€ 75.000
Founding basement	III	€ 150.000
Bore-hole digging for ground-source system	IV	€ 50.000
Mechanical (GSHP A/C, sanitary, etc...) installations	V	€ 260.000
Ordering, manufacturing steel construction and installation	VI	€ 175.000
Walls, roof, insulation, stucco-work, flashings, floor levelling, indoor structural jobs, etc...	VII	€ 75.000
Electrical (lighting, automation etc...) installations	VIII	€ 50.000
Landscape arrangement	IX	€ 75.000
	TOTAL	€ 935.000

	July/06	August/06	September/06	October/06	November/06	December/06	January/07	February/07	March/07
I		€ 25.000							
II		€ 75.000							
III			€ 75.000	€ 75.000					
IV			€ 50.000						
V				€ 80.000			€ 80.000	€ 100.000	
VI		€ 87.500			€ 42.500	€ 45.000			
VII							€ 25.000	€ 25.000	€ 25.000
VIII								€ 25.000	€ 25.000
IX									€ 75.000
TOTAL	€ 0	€ 187.500	€ 125.000	€ 155.000	€ 42.500	€ 45.000	€ 105.000	€ 150.000	€ 125.000

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Present Status

