

XIV INTERNATIONAL CONFERENCE ON SCIENCE, ARTS AND CULTURE

***WORKSHOP on GEOTHERMAL ENERGY
Status and future in the Peri-Adriatic Area***

**HEAT PUMPS
FOR THE EXPLOITATION OF GEOTHERMAL SOURCES
IN MILANO**



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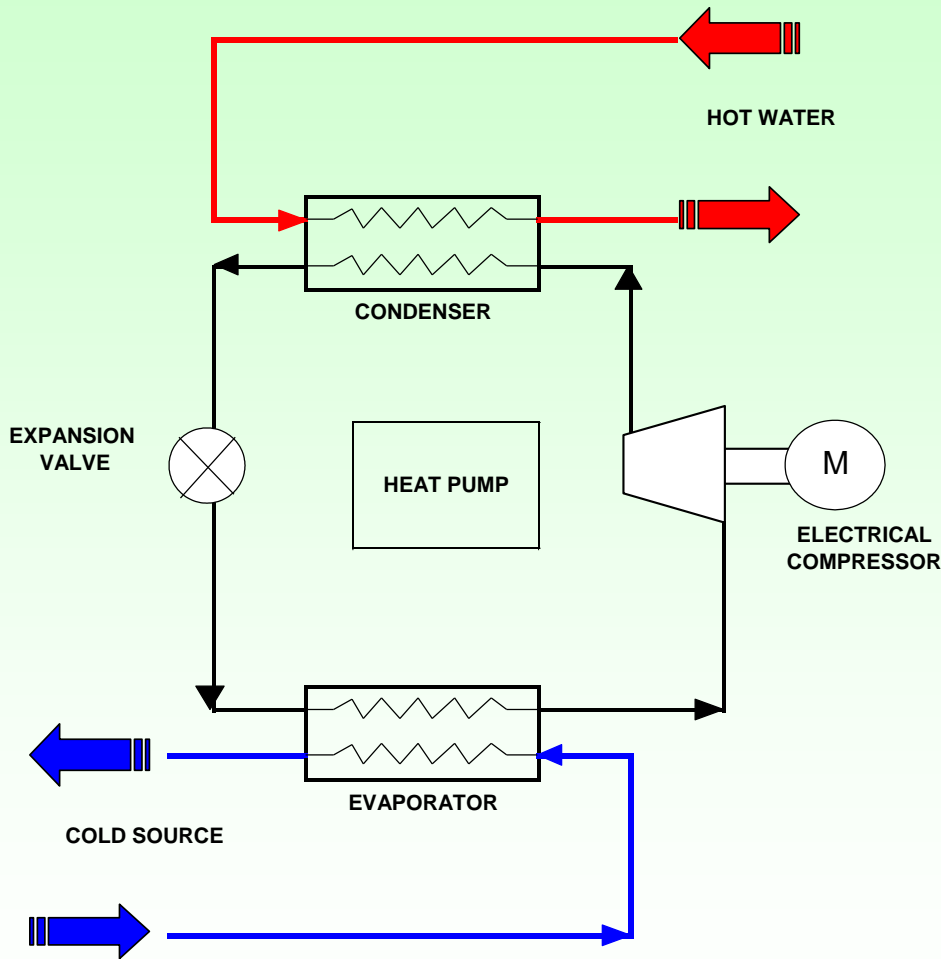
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Studio Associato di Ingegneria - Milano

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HEAT PUMP



- A PARTICULAR KIND OF REFRIGERATING CYCLE

- USED TO EXTRACT HEAT FROM COLD SOURCES

- PRODUCES HOT WATER

- ALLOWS AN EFFECTIVE USE OF THE THERMAL CONTENT OF THE COLD SOURCE SUITABLE FOR THERMAL USERS

HEAT PUMP

THE HEAT PUMPS CAN HAVE THE FOLLOWING COMPRESSOR TYPES:

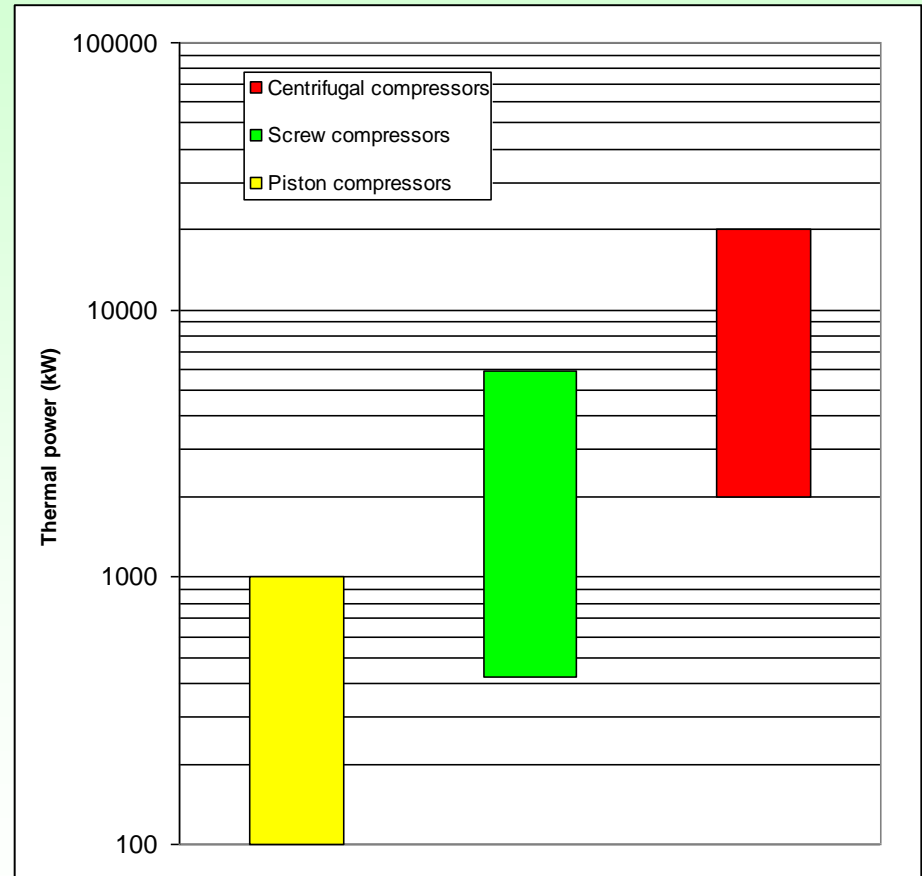
- PISTON COMPRESSOR
- SCREW COMPRESSOR
- CENTRIFUGAL COMPRESSOR

APPLICATION FIELD FOR DIFFERENT TYPE OF COMPRESSORS FOR HEAT PUMP CYCLES

- HEAT PUMPS WITH PISTON COMPRESSOR ARE SUITABLE ONLY FOR APPLICATIONS WITH THERMAL POWER LOWER THAN ABOUT 1 MW;

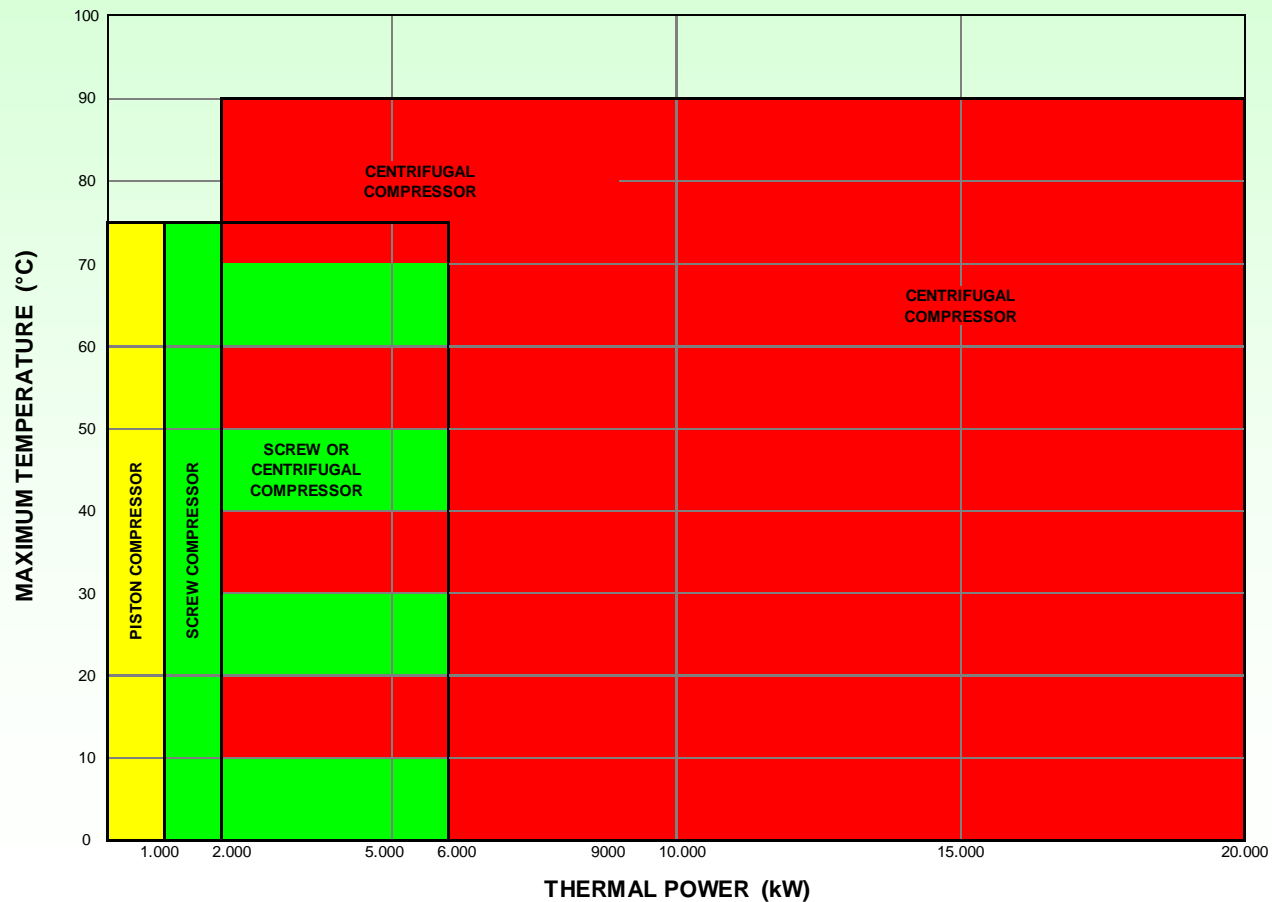
- HEAT PUMPS WITH SCREW COMPRESSOR ARE SUITABLE FOR APPLICATIONS WITH THERMAL POWER COMPRISED BETWEEN 500 KW AND 6 MW;

- HEAT PUMPS WITH CENTRIFUGAL COMPRESSOR ARE SUITABLE FOR APPLICATIONS WITH THERMAL POWER COMPRISED BETWEEN 2 MW AND 20 MW.



MAXIMUM HOT WATER TEMPERATURE OBTAINABLE

- HEAT PUMPS WITH PISTON AND SCREW COMPRESSOR: 75°C
- HEAT PUMPS WITH CENTRIFUGAL COMPRESSOR: 90°C

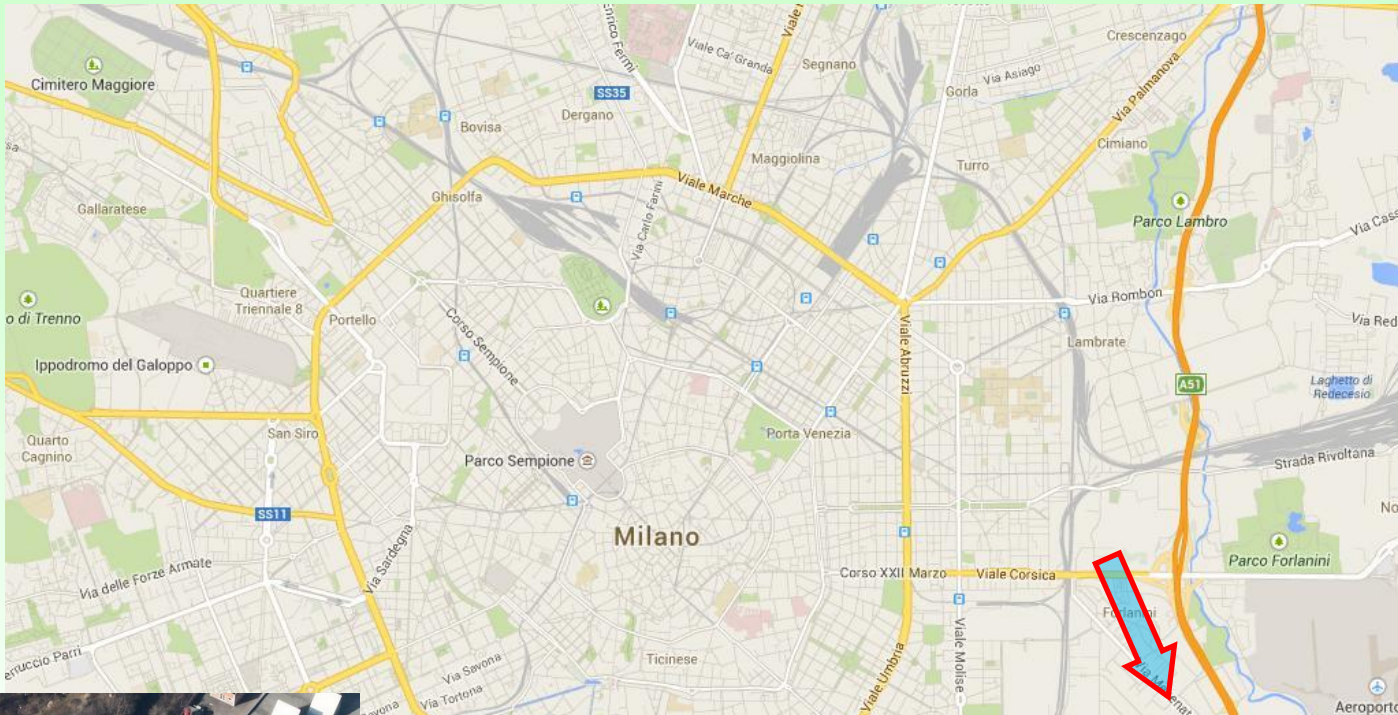


POSSIBLE COLD SOURCES FOR WATER-WATER HEAT PUMP

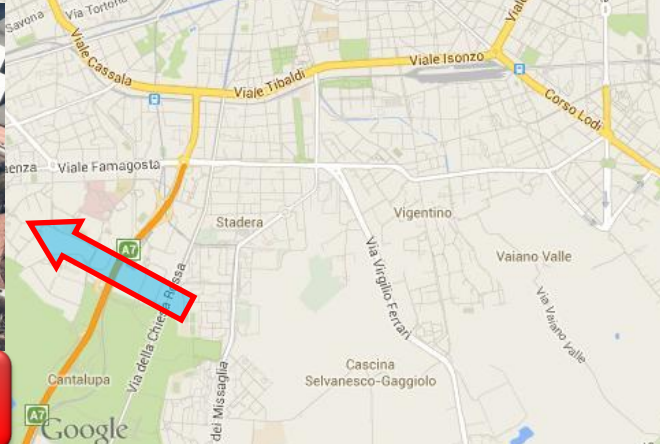
- SHALLOW WATER FROM RIVERS, LAKES AND SEA
- **LOW OR DEEP GEOTHERMAL SOURCES**
- WATER FROM DRINKABLE WATER NETWORK
- WATER FROM TREATMENT PLANT
- WASTE WATER FROM SEWAGE SYSTEM
- COOLING WATER FROM INDUSTRIAL WASTE
- COOLING WATER FROM COGENERATION PLANT

THE TECHNOLOGY OF HEAT PUMPS CAN BE EASILY APPLIED TO THE EXPLOITMENT OF GEOTHERMAL SOURCES.

District heating “A2A Milano”, Italy for Famagosta and Canavese



**FAMAGOSTA
PLANT**



**CANAVESE
PLANT**

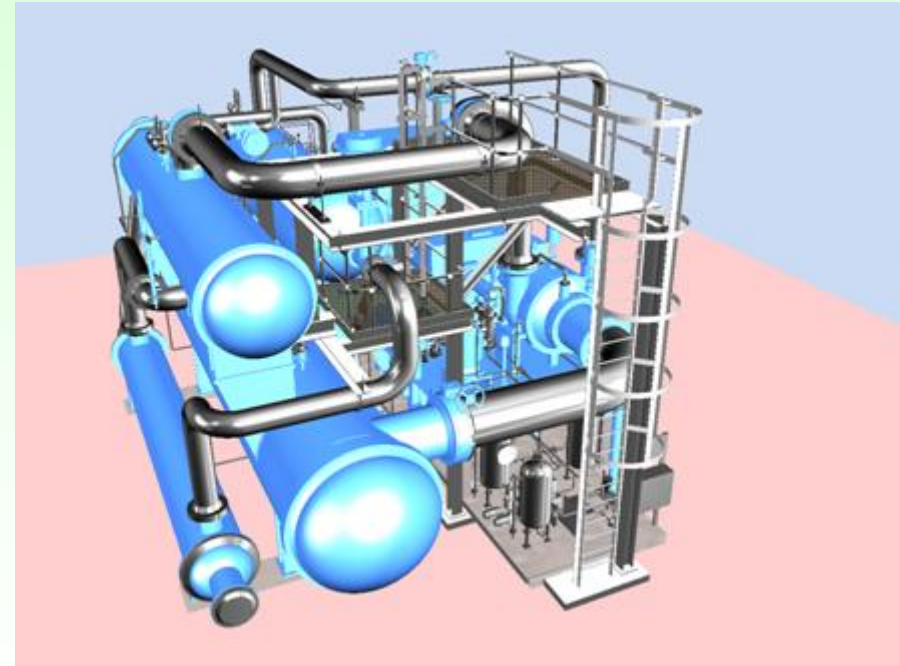
ADVANTAGES IN USING SHALLOW GEOTHERMAL RESOURCES IN COMPARISON WITH DEEP RESOURCES

- SHALLOW RESOURCES ARE EASIER TO BE FOUND
- NO MINING RISK (OR AT LEAST REDUCED MINING RISK)
- LOWER DRILLING COSTS
- EASIER AUTHORIZATION PROCEDURES
- LOWER PROBLEMS FOR THE CHEMICAL COMPOSITION OF THE GEOTHERMAL FLUID
- POSSIBLE COMPENSATION OF THE REDUCED TEMPERATURE DROP WITH A HIGHER AVAILABLE FLOW

LARGE TWO STAGE CENTRIFUGAL HEAT PUMPS

District heating “A2A Milano”, Italy for Famagosta and Canavese

- Operating only during heating period
- Number of units 1xFamagosta 1x Canavese
- Compressor Type Centrifugal
- Refrigerant R134a
- Cooling medium **Groundwater**
- Technical data for each unit
- Cooling capacity 9'732 kW
- Cold water temp. in/out 15.0 / 7.6 °C
- Cold water flow 1'150 m³/h
- Heating water temp. in/out 65.0 / **90.0** °C
- Heating water flow 546 m³/h
- Power at terminal 5'768 kW
- Heating capacity 15'500 kW
- Coeff. of performance 2.68





**15 MW GROUND WATER HEAT PUMP
WITH CENTRIFUGAL COMPRESSOR
FOR A2A CANAVESE DISTRICT HEATING SYSTEM IN MILAN**



**15 MW GROUND WATER HEAT PUMP
WITH CENTRIFUGAL COMPRESSOR
FOR A2A CANAVESE DISTRICT HEATING SYSTEM IN MILAN**

15 MW GROUND WATER HEAT PUMP WITH CENTRIFUGAL COMPRESSOR FOR A2A FAMAGOSTA DISTRICT HEATING SYSTEM IN MILAN



ADDITIONAL BENEFITS USING GROUND WATER ALREADY PUMPED OUT FOR FEEDING DRINKABLE WATER SYSTEM, AS COLD SOURCE FOR HEAT PUMP

- NO NEED OF NEW GEOTHERMAL WELLS BECAUSE THE PRODUCTION WELLS ARE ALREADY BUILT AND THE OUTLET WATER FROM EVAPORATOR OF HEAT PUMP RETURNS TO A DRINKABLE WATER NETWORK.
- IT IS NOT NECESSARY TO HAVE A SPECIFIC PERMISSION OR AUTHORIZATION
- THE ELECTRICAL COSTS OF THE PUMPS TO EXTRACT THE GEOTHERMAL WATER ARE ALREADY INCLUDED FOR THE USE OF THE DRINKABLE WATER PLANT.
- THERE IS NOT A REAL ENVIRONMENTAL IMPACT, EXCEPT FOR THE NOISES PRODUCED BY THE COMPRESSOR OF THE HEAT PUMP, HOWEVER IT CAN BE MINIMIZED BY AN ACOUSTIC INSULATION.

“PALAZZO LOMBARDIA” MILAN GEOHERMAL HEAT PUMP WORLD RECORD FOR A SINGLE BUILDING CONDITIONING



PALAZZO LOMBARDIA





MAIN TECHNICAL DATA

GROUND WATER, SCREW COMPRESSOR HEAT PUMPS

n. of production wells	8
Wells depth	50 m
Groundwater flow	8 x 40 l/s = 320 l/s
Groundwater temperature (inlet / outlet)	15 / 6 °C
Groundwater discharge	surface channel
n. of heat pumps	3
Compressor type	Screw
Thermal capacity	3 x 2.150 kW
Winter heat need coverage by means of heat pumps	100%
Winter mode COP	4,5
Summer mode COP	6,0

PALAZZO LOMBARDIA GROUND WATER HEAT PUMP

