ASX Release

PETRATHERM LIMITED
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Spain and China Projects Update

- ***The Company's Madrid Geothermal Exploration License Area has been estimated as having 170 Petajoules (PJ) of exploitable energy potential, in a recent paper from GPC-IP, the Company's specialist French geothermal consultants***

- ***Geo-Madrid project commences market demand study (for heating and cooling) in cooperation with key customers***

- ***Spanish Federal and Madrid Regional Governments cooperate to lead the recent Inaugural Madrid Geothermal Energy Conference***

- ***Petratherm's China exploration team to undertake field trip in China with Chinese government institutions and provincial representatives***

Madrid energy potential estimate of 170 PJ comparable to the Cooper basin gas production

An assessment undertaken by GPC-IP (specialist geothermal consultants based in France that manage most of the Paris Basin 260 MW of district heating projects) and detailed in a paper recently presented at the Inaugural Madrid geothermal Energy Conference, indicates that;

- The broader Madrid basin area has an exploitable energy potential of 730 PJ and the Company's northeastern Madrid license area (refer Figure 1 overleaf) has an exploitable energy potential of 170 PJ (just over the annual gas production from SA's Cooper Basin)
- The Company's license area is considered the most prospective area having the hottest known zones with knowledge drawn from five existing deep wells and previous seismic and other geological studies
- The assessment was made over a 75 year period (demonstrating the expected longevity of the energy potential) and considers heat at shallow, medium, deep and ultra-deep geothermal environments

GPC-IP Principal Consultant – Mr Pierre Ungemach who presented the findings (refer attached technical paper) confirmed the excellent energy potential for both district heating and electricity production

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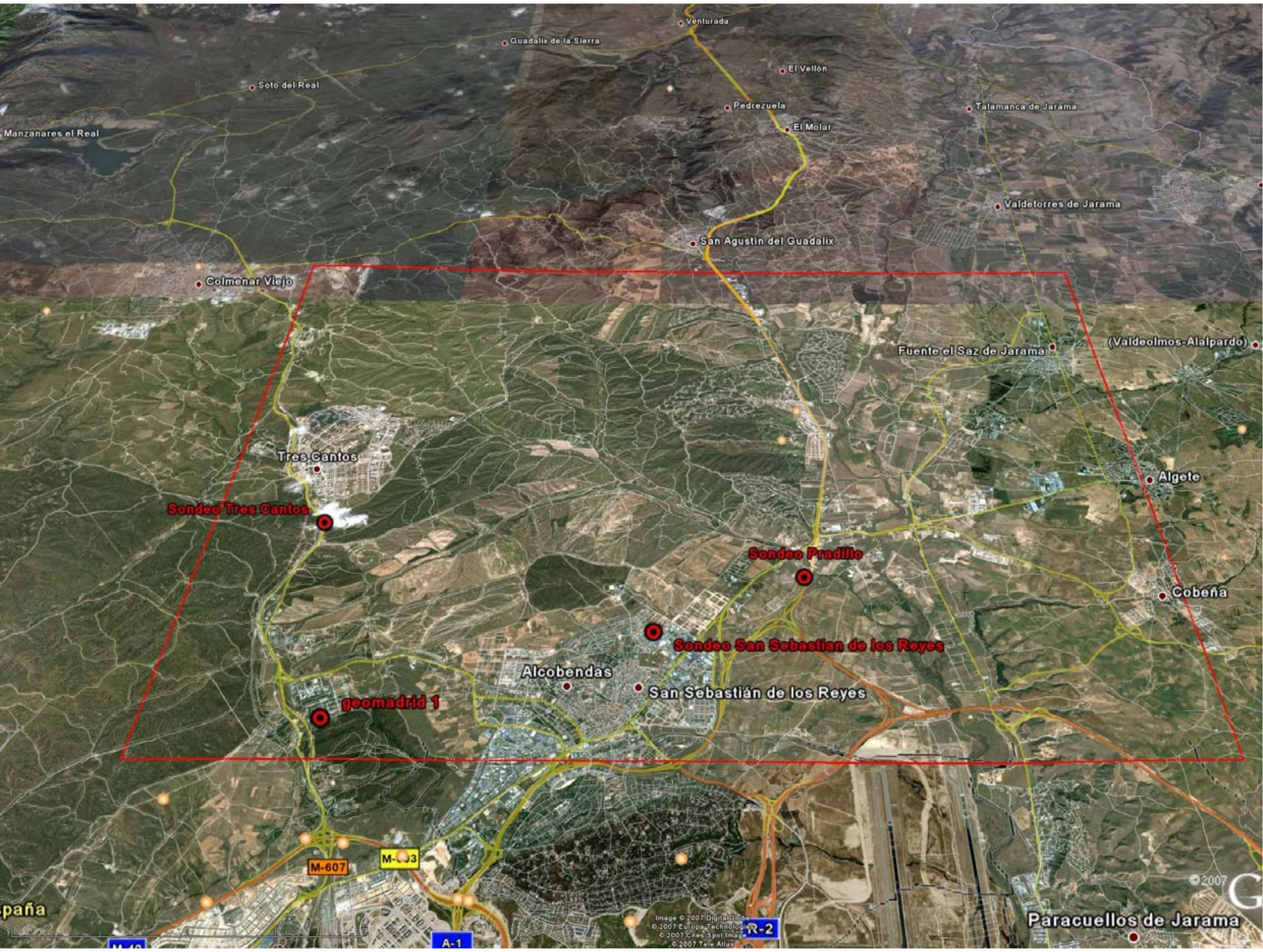

Figure 1 - Madrid Geothermal License Area – located 25 kms north of the City and covering over 300 square kms.

The Company plans to obtain an independent assessment of the Madrid GEL area energy potential that complies with the new Australian Geothermal Energy Code for Resources and Reserves Reporting.

Geo-Madrid Project commences market demand study

Energesis Geotermia, a large Spanish engineering group, has been engaged by Petratherm Espana to undertake a heating and cooling demand study to accurately quantify the local market demand for the Geo-Madrid project. The 8 MW Geo-Madrid demand study commenced in early November and is due for completion in mid December 2008. Following on from that study, work is planned with Energesis Geotermia to conduct the engineering design of the Geo-Madrid project, together with a detailed financial assessment.

The 8 MW Geo-Madrid district heating project aims to service the heating and cooling needs of the nearby University and a number of large government buildings owned by the Madrid Regional Government (refer Figure 2 overleaf).

The Energesis Geotermia demand study is being undertaken with the co-operation of the project's two key customers - the Autonomous University and the Madrid Regional Government.

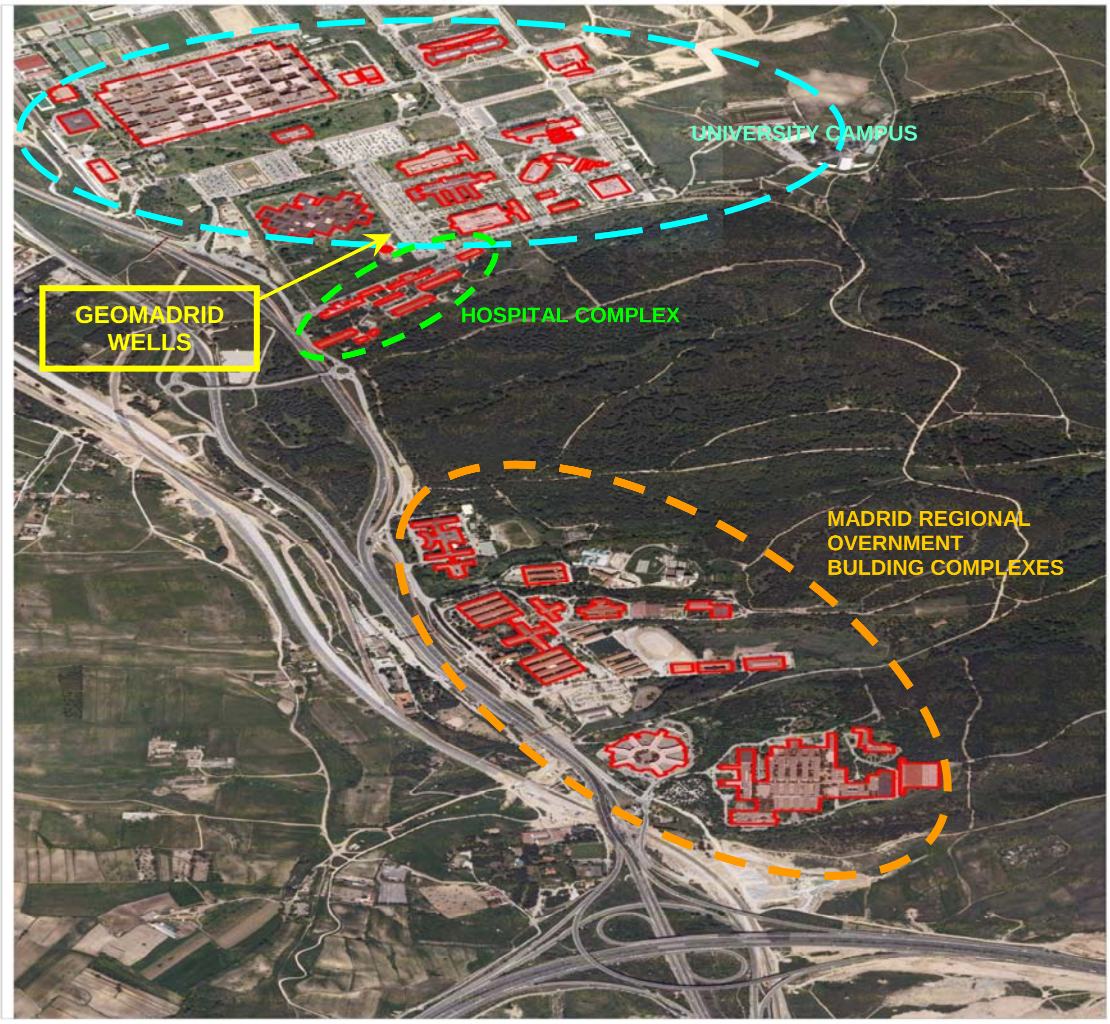

Figure 2 – Geo-Madrid project site located in the south-western part of the Madrid GEL

Inaugural Madrid Geothermal Energy Conference (October 2008)

The Spanish Federal and Madrid Regional Governments, together with a number of corporate sponsors (including Petratherm) hosted the inaugural Geothermal Energy Conference in Madrid. The conference held on October 15 & 16 in Madrid attracted over 400 delegates from across Spain and Europe with interests in exploiting geothermal energy opportunities – from small scale heat pumps through to large scale district heating and electricity production opportunities.

Petratherm was well represented in two sessions over the day and a half conference. Mr Raul Hidalgo, Petratherm's Spanish Manager, presented on the Madrid district heating project while Mr Pierre Ungemach presented on the energy potential of the broader Madrid area and Petratherm's Madrid license area (refer earlier section). Their presentations can be viewed on the Company's website www.petratherm.com.au

Both the Spanish Federal and Madrid Regional Governments expressed their strong support for geothermal energy and this augurs well for Petratherm's Geo-Madrid project

China Exploration Team field trip in November

The Company's China exploration team will undertake their third and most important field trip during November 2008 with the assistance of four Chinese government institutions, with which the Company has an exclusive agreement for the provision of geological and geothermal data.

The team, led by Mr Peter Reid, Petratherm's Exploration Manager, will meet with provincial representatives in three target provinces to progress the development of geothermal projects on mainland China.

Recently completed desktop analyses have highlighted good quality geothermal target areas and the focus of the field trip will be gather further information to make final assessment of project selections.

The Company has received great interest in its China ventures from both potential joint venture partners and government (both Chinese and Australia) under the Asia-Pacific Partnership program where the Company has been awarded a $75,000 grant.

Managing Director, Terry Kallis will be presenting to the PowerGen Conference in Beijing in mid March 2009 outlining the Company's strategy for China and its assessment of the potential for geothermal energy in China.

Yours faithfully

Terry Kallis
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GEOTHERMAL POTENTIAL OF THE MADRID AREA. A TENTATIVE RESOURCE/RESERVE ASSESSMENT

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Abstract: The Madrid area enjoys one of the most favourable geothermal environments identified to date in Spain. Geologically, it belongs to the Tajo sedimentary basin, o which it occupies its uppermost northern part. Its main hot aquifer unit consists of a thick multilayered sequence of tertiary detritic, consolidated, sandstones overlying a Mesozoic basement. The area is bound to the North by crystalline basement rocks delineating the North Madrid Sierras, marked by deep parallel faults trending SSW-NNE. Elsewhere, its limits result from the thinning of the sandstone aquifer.
The resource/reserve assessment rationale addresses:

(i) two selected areas, Grand Madrid(1,400 km^2) and NE Madrid(150 km^2), the latter matching the perimeter investigated by four(one hydrocarbon, three geothermal) deep exploration wells;
(ii) a 5,000 m depth, i.e. rock volumes amounting to 7,000(Grand Madrid) and 750 km^3(NE Madrid);
(iii) a multiple aquifer interbedded sequence, split into four resource classes and uses, namely shallow depth/ground coupled-groundwater heat pump(GCHP/GWHP), medium depth(heat pump assisted) and deep(heat exchange alone)/geothermal district heating and cooling(GDHC) systems, and, last but not least, frontier, ultra-deep/combined heat and power(CHP) enhanced geothermal schemes(EHS);
(iv) a sustainable reservoir management approach, aimed at a 75 year reservoir thermal life via adequate heat extraction designs;
(v) the evaluation criteria practiced by the mineral and geothermal industry.

Hence, the exercise leads to the following overall projections:

Item	Grand Madrid	NE Madrid
Heat in place(HIP) 10^{18} J	181	22
Recoverable heat(RCH) 75 yrs 10^{18} J	25	3.5
Exploitable heat(and power) (EXH) 75 yrs 10^{17} J	7.3	1.7
Heat resupply(assuming 90mWm^{-2} heat flow density) 10^{17} J	3.09	0.33

Given the foregoing, the energy deemed exploitable, according to existing and foreseeable technology standards and market demand, represents no more than 3 (Grand Madrid) and 5% (NE Madrid) of the recoverable heat potential.

Key words: Geothermal energy, resource & reserve assessments, Madrid, Spain.

1. INTRODUCTION

The Madrid area exhibits a long identified geothermal resource thanks to early hydrocarbon and geothermal exploration geophysics and drilling. Worth mentioning in this respect are the Pradillo (hydrocarbon), San Sebastian de los Reyes, Tres Cantos and Geomadrid (geothermal) wells which evidenced (i) higher than normal subsurface temperatures, ca 85 and 150°C at ca 1700 and 3400 m depths associated to tertiary sandstone and cretaceous sediments respectively, (ii) a dependable geothermal reservoir in the Triassic sandstone, and (iii) last but not least, a deeper seated low permeability horizon at the sedimentary/basement rock contact close to the Tajo Basin/North Madrid sierras border faults, eligible to the frontier EGS (enhanced geothermal system) CHP technology.

Given the energy demand of the fast growing Madrid metropolis, alongside persistently rising fossil fuel prices, and environmental clean air concerns it became timely to quantify the resource to market adequacy by assessing the local and regional geothermal potential.

As a result, the present paper will review the resource spectrum for various uses of the heat source to a depth of 5000 m in order to evaluate the resource base, recoverable heat and, ultimately, the exploitable reserve according to the standards applied by the mining industry and to state-of-the-art of geothermal extraction technologies.

2. GEOTHERMAL SETTING

The Madrid area enjoys one of the most favourable geothermal environments identified to date in Spain.

Geologically, it belongs to the Tajo sedimentary basin of which it occupies its uppermost Northern part. Its main hot aquifer unit consist of a thick multilayered sequence of tertiary detritic, consolidated, sandstones overlying a Mesozoic basement. The area is bound to the North by Crystalline basement rocks delineating the North Madrid Sierras, marked by deep parallel faults trending SSW-NNE. Elsewhere, its limits correspond to the thinning of the sandstone aquifer.

Within the area of concern, a specific area has been selected north-east of the capital city, which includes the exploratory well locations and densely urbanised suburban districts. Both areas, alongside their salient reservoir features (thickness, formation temperatures and transmissivities), are shown in fig. 1 location map. Their structure is sketched in fig. 2 NW-SE trending cross-sectional view. Their areas extend over 1400 and 150 km^2 respectively (table 1).

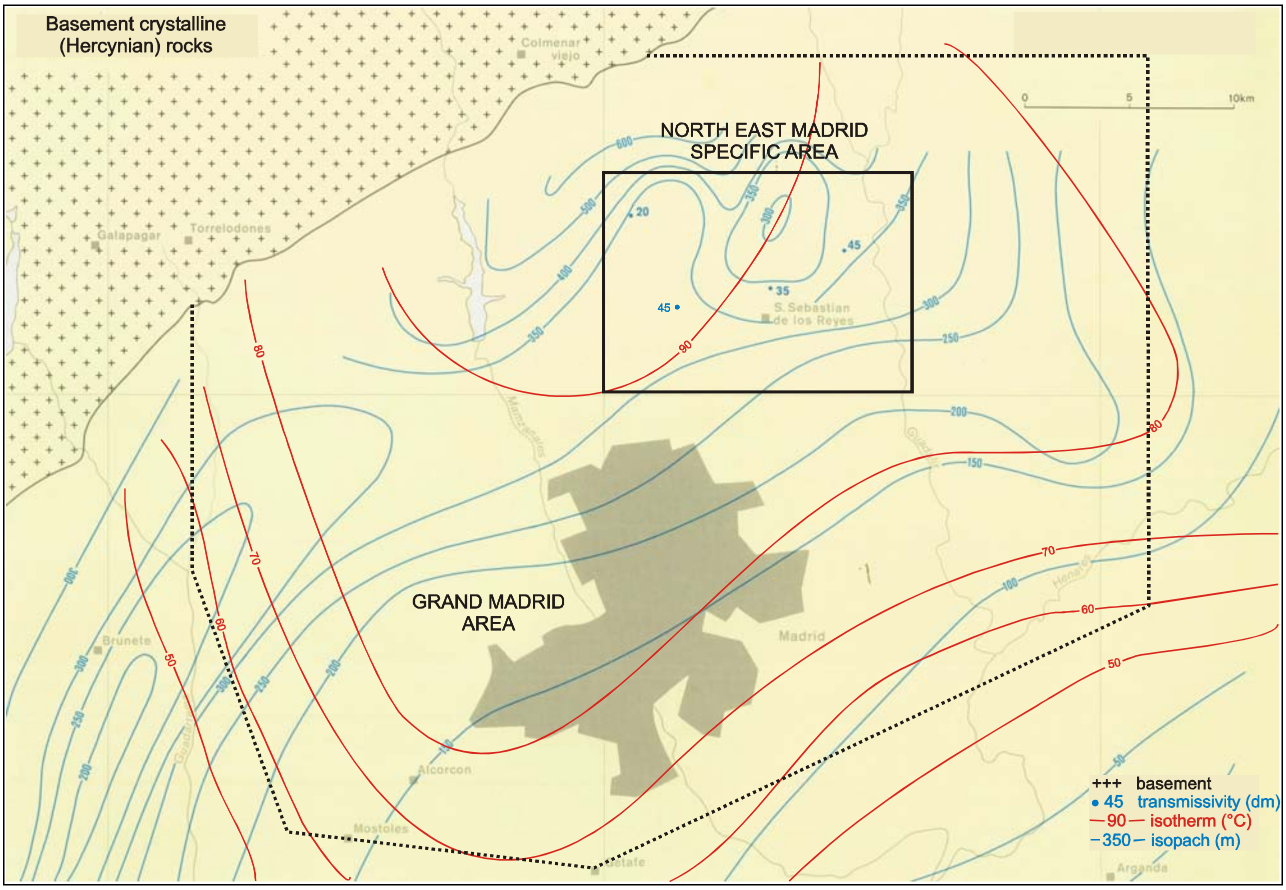


Figure 1. *Madrid Geothermal resources. Location of target assessment areas. Detritic Tertiary Sandstone Aquifer. (Adapted from : European Geothermal Atlas)*

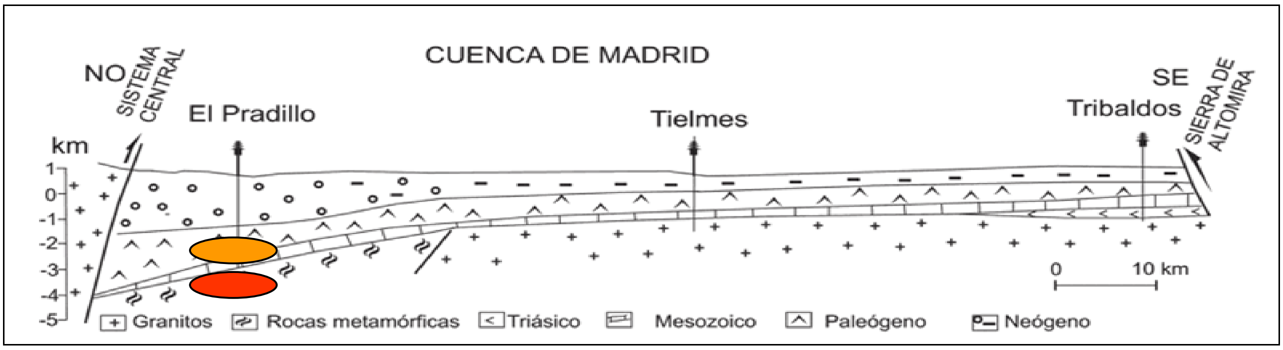


Figure 2. *Cross sectional sketch of the Madrid Basin*

3. RESOURCE ASSESSMENTS

The exercise addresses the 5 km deep sequence, resource classes and unit energy ratios displayed in fig. 3. and eligible heat extraction designs depicted in fig 4.

Sequences/classes. They concern five eligible resource environments, ranging from ground to 5 km depth, namely:

0-200 m. Known as the shallow geothermal field, it concerns chiefly ground source heat pump applications, which may be subdivided into ground coupled heat pump (GCHP) and groundwater heat pump (GWHP) and related borehole heat exchanger (BHE) and hydrothermal groundwater doublet (GWD) heat extraction technologies respectively. Note that, in the superficial layer, both conductive (BHE) and convective (GWD) transfers are contemplated, contrary to deeper seated layers where only convective heat extraction from porous/pervious aquifers will be considered.

500-1000 m. It concerns ground water heat pump assisted hydrothermal doublet/multiplet extraction systems, utilised for building heating/cooling purposes and, generally speaking, small to medium size district heating/cooling loads.

1500-2500 m. This interval covers the whole, well surveyed (particularly in its Northern/North Eastern sectors), multilayered detritic sandstone aquifer, of tertiary age, which stretches over the whole Madrid and surrounding areas. Petroleum and geothermal exploration have taken place North East of Madrid. It has been materialised by the drilling, completion, logging and testing of five exploratory wells of which the San Sebastian de los Reyes, Tres Cantos and Geomadrid geothermal ventures constitute the major geothermal stronghold and relevant database.
Hot water utilisation deals here with large, direct heat exchange, geothermal district heating and cooling (GDHC) applications.

3500-5000 m. Named ultra-deep geothermal, these horizons, seated in tight and poorly pervious basement rocks, are the field of excellence of the EGS (Enhanced Geothermal Systems) technology aimed at engineering man made geothermal reservoirs. It addresses combined heat and power (CHP) production at ca 30 MWt/ 3 MWe (assuming 10% conversion cycle efficiency) ratings respectively at present development stage of the technology.
Energy ratios can be associated with each application field. For instance, a borehole heat exchanger exhibits, under normal conditions, a ca 50 W/m capacity, i.e. a 10 kWt thermal power at 200 m depth. Similarly, a groundwater doublet would display a 1.16 $kW/m^3/h/°C$ unit capacity. Concerning power generation from an EGS compressed water system and a

binary (ORC) conversion cycle, unit energy density is expressed as $\phi x h_l \upsilon_l$ (kJ/m^3) where ϕ, x, h_l and υ_l are the porosity, steam fraction, liquid enthalpy and specific volume respectively. However, for the sake of simplicity it is recommended to derive EGS power figures from the heat potential, based on a given conversion cycle efficiency.

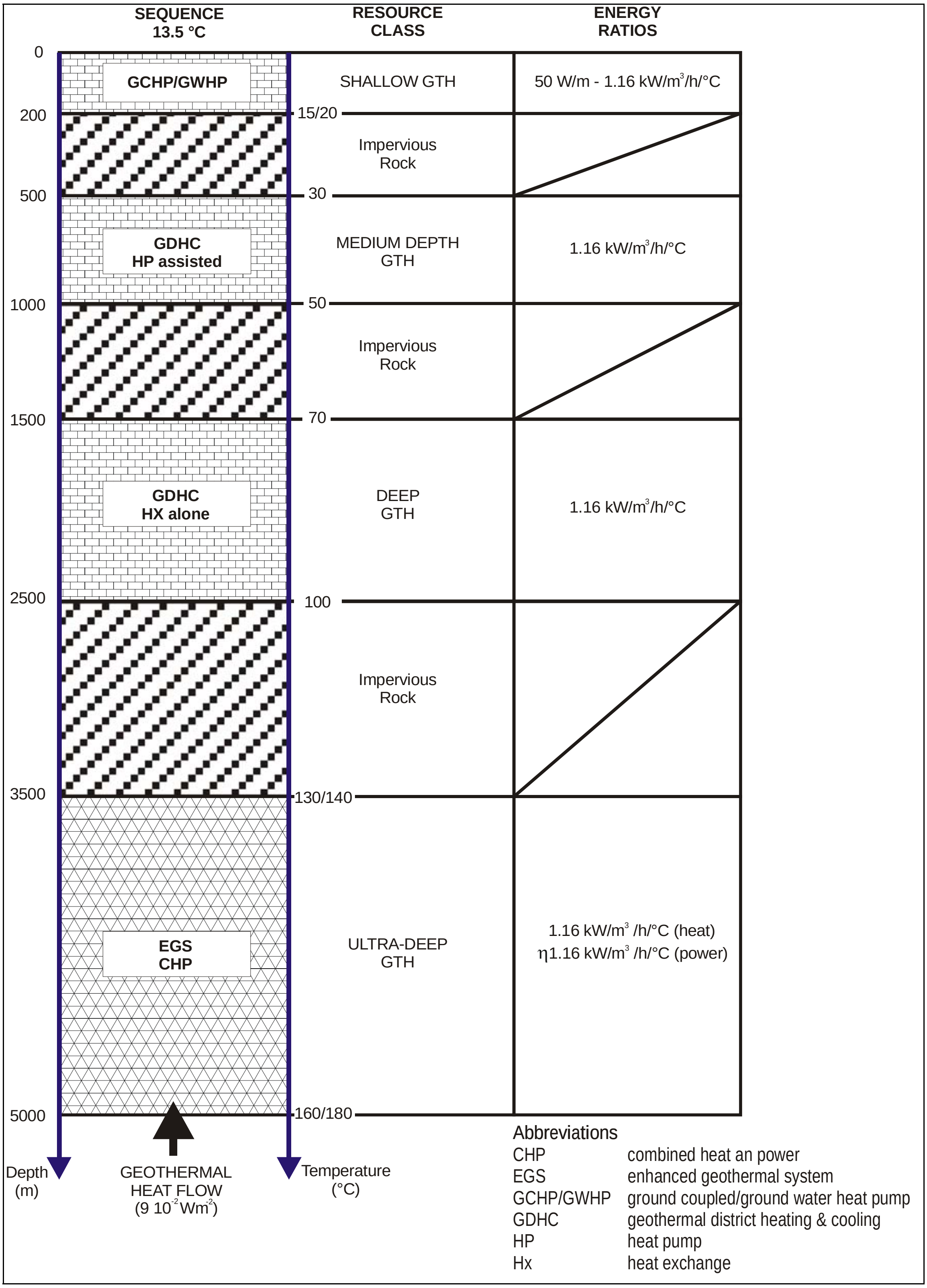
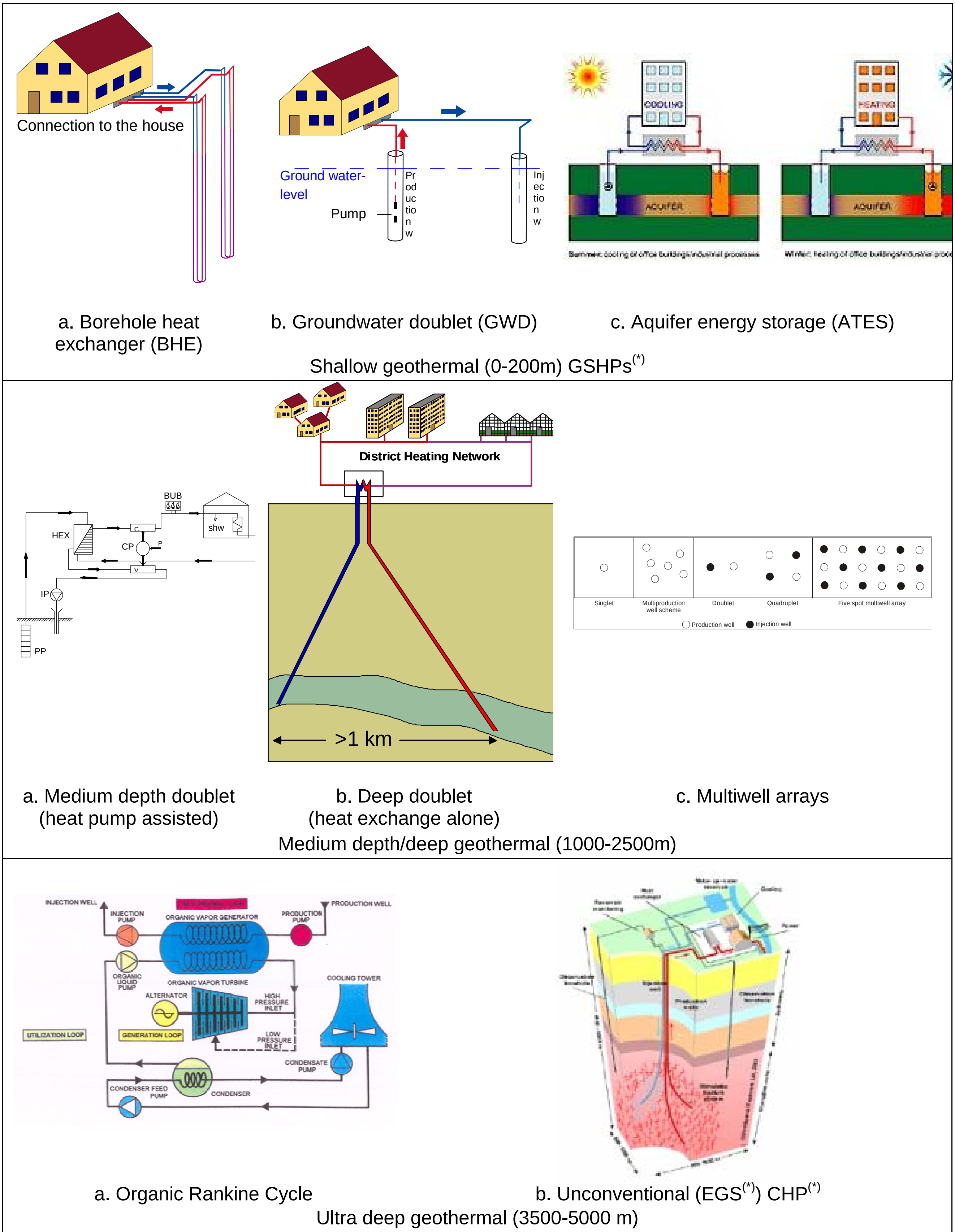


Figure 3. *Resource classification vs. depth, temperature and aquifer occurrence*



(*)GHSP: ground source heat pump
CHP: combined heat and power
EGS: enhanced geothermal system

Figure 4. *Eligible heat extraction schemes. Madrid area*

4. RESOURCE/RESERVE CALCULATIONS

They comply with the concepts used in the mining industry and illustrated in the well known Mac Kelvey diagram adapted to geothermal resource environments (Muffler & Cataldi, 1978). Geothermal energy however, although it is often and legally regarded as a mineral, shows distinctive attributes among which the presence of a geothermal heat flow and related density and resupply capacity, makes it, contrary to ore deposits, a renewable, though exhaustible, energy source.

The foregoing may be expressed as follows (see fig. 5 definitions and calculation sheet):

4.1 Accessible resource base (ARB).

It includes the whole heat stored in a given rock volume, in our case the uppermost 5 km of the Earth crust.
Therefore:

(1) ARB (5 km) = $A*z*\gamma*(\theta_z - \theta_0)/2$

where:

(2)
A = area (m2)
z = depth (m)
γ = rock heat capacity (J/m3 °C)
θ_0 = average ground surface temperature (°C)
θ_z = temperature at depth z (°C)

4.2 Heat in place (HIP).

It expresses the quantity of heat contained in a given aquifer volume i.e.

(3) $HIP = \gamma_t * (\theta_i - \theta_0) * Ah$

where:

(4)
$\gamma_t = \phi * \gamma_w + (1-\phi) * \gamma_r$ = total reservoir heat capacity ($Jm^{-3}°C^{-1}$)
γ_w, γ_r = water and rock heat capacities ($Jm^{-3}°C^{-1}$)

and:

(5)
ϕ = effective porosity
θ_i, θ_0 = reservoir and mean ground temperatures
A = reservoir area (m^2)
h = net reservoir thickness (m)

4.3 Recoverable heat (RCH).

It represents that fraction of the heat in place that can be recovered via adequate heat extraction schemes, for instance single production (singlet), dual production/injection (doublet) wells or, better, multiwell production/injection well arrays (such as the emblematic petroleum five spot waterflooding scheme).
Hence:

(6) $RCH = r*HIP$

with r a recovery factor

Heat withdrawn over a time period t^*

$$(7)\quad RCH = \eta\gamma_t(\theta_i - \theta_r)Ah = q\gamma_w(\theta_i - \theta_r)t^*$$

with:
η = system efficiency factor
θ_r = rejection (or reinjection) temperature
q = flowrate (m^3/h)
t^* = time (h)

By combining equations (6) and (7) it comes:

$$(8)\quad r = \eta\frac{\theta_i - \theta_r}{\theta_i - \theta_0}$$

$$(9)\quad \eta = \frac{q}{Ah}\frac{\gamma_w}{\gamma_t}t^*$$

5. RESULTS

Table 1 displays the resources assessed from fig. 3 sequences and section 3 definitions and equations, the latter illustrated in fig. 5. Table 1 figures call for the following comments with respect to heat in place and resource appraisals.

5.1 Shallow geothermal.

HIP = ARB (z = 200 m)
Here, no distinction is made whatsoever between rocks and aquifers since BHEs may extract heat by conductive transfer whether or not there is an aquifer.

Regarding recoverable heat which, owing to sustainability issues, extends over a 75 year system life, two candidate extraction systems are considered, borehole heat exchangers (BHEs) and ground water doublets (GWDs) respectively.
BHE capacity = 10 kW and density = 1 BHE/ha
GWD capacity = 290 kW and density = 1 GWD/25 km^2

5.2 Medium depth geothermal.

Eligible aquifers, intermediate between surface and tertiary sandstone reservoirs, are likely and their occurrence often mentioned and reported in several instances on deep well drilling records. They ought, nevertheless, to be regarded as more or less site specific if not erratic. As a result, they will be considered as effective over 30% of the overall Madrid and 60% of the, better documented, NE Madrid specific areas respectively. Their lithology is dominantly sandy and clayey and their effective thickness close to 50 m and porosity to 20%; water and fluid heat capacities are set at 4180 and 3000 $kJm^{-3}°C^{-1}$ (density = 2; specific heat = 1.5 kJ/kg°C) respectively. These assumptions lead to the HIP figures listed in table 1.

With respect to recoverable heat estimates, given identical heat extraction schemes and sustainability issues, the system efficiency and recovery factors calculated for the deep aquifer case were extended to medium depth/temperature settings i.e. recovery and efficiency coefficients, equal to 35% and 54% respectively.

5.3 Deep geothermal.

Based on the following figures:

$$q = 200\ m^3/h$$
$$\gamma_w = 4180\ kJm^{-3}K^{-1}$$
$$\gamma_r = 2700\ kJm^{-3}K^{-1}$$
$$\phi = 0.15 \quad (10)$$
$$\gamma_t \# 2920\ kJm^{-3}K^{-1}$$
$$A = 3.5\ km^2$$
$$h = 100\ m$$
$$t^* = 75\ yrs$$

Efficiency and recovery coefficients stand as follows:

$$\eta = 0.54 \quad (11)$$
$$r = 0.35$$

Formation temperatures have been set at 85°C (specific area) and 80°C (overall area) and rejection temperature at 35°C.

5.4 Ultra-deep geothermal.

It is quite clear that, at the present stage of EGS undertakings, any related resource assessment remains a highly speculative exercise.

Resource estimates are based on, a rock, stimulated, porosity equal to 5%, a rock density of 2700 kgm^{-3}, a rock specific heat of 0.95 kJ m^3K^{-1} , a 200 m man made reservoir thickness and bottom hole temperatures close to 170 °C. The heat recovery factor has been set, somewhat arbitrarily, at 5%. More information on thermal properties of various rock types and their variations with depths, water content and temperatures may be found in: Schon, 2004 and Economides & Ungemach, 1987.

5.5 Sustainability issues.

It has been shown (Ungemach et al, 2007) that unchanged production temperatures can be sustained over a minimum 75 year period provided the mining scheme be (re)scheduled according to the production/injection well arrays depicted in fig. 4.

Regarding sustainability of Ground Source Heat Pump systems, useful guidelines may be sought in Rybach and Eugster (2002) and Signorelli et al (2005).

5.6 Exploitable reserves.

Related assessments are often regarded as merely speculative. In the present case, however, such a statement would be inappropriate if not misleading and estimates deemed reliable accordingly.

As a matter of fact, figures produced in table 1 stick as much possible to realistic appraisals, reflecting what score could effectively be achieved via available technology and taking into account public awareness and support, economic and physical constraints.

- ***Shallow geothermal.***

  It has been assumed that 18,000 BHEs, splitted as follows:

  15,000 family houses (1 BHE/home) 15,000
  100 collective dwellings (20 BHEs/building) 2,000
  10 large office buildings/industrial (100 BHEs/building) 1,000

  could be implemented over the Grand Madrid area.

  Regarding GDWs, a number of 28 units (i.e. a density of 1/50 km2) has been selected, i.e. 50% of the estimated potential.

  Unit energy demands have been set at 7.5 (BHE) and 850 MWh_t/yr (GWD) respectively.

  The areal ratio, adopted for recoverable heat assessments have been reconducted here.

- ***Medium depth geothermal.***
  The individual doublet installed capacity and yearly heat and cold loads are estimated at 3.5 MWt (150 m^3/h, 40-20°C) and 15,000 MWht/yr (assuming a 90% utilisation factor) respectively, thus leading (bearing in mind that the specific area should allow for twice more doublets, whatever the cascading opportunities offered by deeper drilled doublets), given the higher medium depth aquifer occurrence in the specific area, to $1.3 \cdot 10^{17}$ (overall area) and $2.84 \cdot 10^{16}$ J (specific area) exploitable source over a 75 year life

- ***Deep geothermal.***
  A realistic projection over the specific northeast Madrid area would estimate at ten the number of GDHC doublets which could effectively be operated locally (Geomadrid: 2; San Sebastian de los Reyes:3; Tres Cantos:2-3;other locations:2-3). Assuming a unit doublet production of 40,000 MWht/yr (144,000 GJ/yr), total heat withdrawn from the tertiary sandstone aquifer over 75 years would amount to 30 TWht (i.e # 110 PJ) for the specific area alone.
  This figure would rise to 120 TWht (i.e. 440 PJ) for the overall area, assuming 40 GDHC doublets online.

- ***Ultra-deep geothermal.***
  At the present stage of the EGS technology any forecast on future development issues is a risky exercise.
  Nevertheless, the following projections can be contemplated, bearing in mind that the most promising prospects should trend along the Mesozoic basement/tertiary sandstone contact and associated border faults likely to favour deeply enhanced hydrothermal convection as sketched in fig 2 cross section:
    - unit installed power: 30 MWt/3 MWe (10% heat to power conversion cycle efficiency)
    - power plant utilisation factor: 0.85
    - heat demand: 15,000 MWh_t/yr
    - system lifetime 25 yrs (completion of these successive EGS required over 75 years)
    - number of EGS plants
        - overall area: 12
        - specific area: 3

  The foregoing lead to the following heat and power outputs:

Supply (PJ/TWh^(*))| Zone	**Overall**	**Specific**
Power	72/20	18/5
Heat	50/13.5	12/3.4
Total	**122 PJ/13.5 TWh**	**30 PJ/8.4 TWh**

(*) 1TWh=3.65 PJ

Note that the 0.1 heat to power conversion efficiency could be regarded pessimistic given the fairly high (170°C) inlet temperature and the performance expected from upgraded binary cycles (ORC, Kalina).

DEFINITIONS

- Heat in place HIP
  $HIP = \gamma_t * Ah(\theta_i - \theta_0)$
- Recoverable heat RCH
  $RCH = \eta\gamma_t * Ah(\theta_i - \theta_r) = r * HIP$
- Heat recovery factor r
  $r = RCH / HIP = \eta(\theta_i - \theta_r)/(\theta_i - \theta_0)$
- Efficiency of the heat extraction scheme η
  $\eta = (q / Ah) * (\gamma_w / \gamma_t) * t^*$
- EGS power (W) and energy supply (E)
  $W = \eta' q' \gamma_w (\theta_i - \theta_c) / 3600$
  $E = W * t'^*$

NOMENCLATURE

A = area (m^2)
h = effective thickness (m)
q, q' = flowrates (m^3/h)
r = recovery factor
t^*, t'^* = system life (hrs)
$\gamma_t = \phi\gamma_w + (1-\phi)\gamma_r$ = total (fluid + rock) heat capacity ($kJm^{-3}K^{-1}$)
γ_t, γ_r = rock and water heat capacities ($kJm^{-3}K^{-1}$)
$\theta_i, \theta_0, \theta_r, \theta_c$ = reservoir, mean ground, rejection and condensing temperatures (°K)
η, η' = efficiencies

NUMERICAL APPLICATIONS

- Heat (deep hydrothermal)
  q = 200 m^3/h; t^* = 25 yrs; $\gamma_w = 4{,}180 kJm^{-3}K^{-1}$; $\gamma_r = 2{,}700 kJm^{-3}K^{-1}$;
  θ_i = 75°C ; θ_0 = 15°C ; θ_r = 35°C
  Values of η and r vs A (km^2) and h (m)

$\eta =$

h \ A	5	10	20
20	0.61	0.31	0.15
50	0.24	0.12	0.06
100	0.12	0.06	0.03

$r =$

h \ A	5	10	20
20	0.41	0.21	0.10
50	0.16	0.08	0.04
100	0.08	0.04	0.02

- Power (ultra-deep EGS)
  q' = 180 m^3/h (50 l/s) ; $\gamma_w = 4{,}180 kJm^{-3}K^{-1}$; θ_i = 170°C ; θ_c = 50°C
  η' = 0.12 ; t'^* = 25 yrs
  W # 3,000 kWe; E # 657 GWhe
  q' = 300 m^3/h (83 l/s)
  W # 5,000 kWe; E # 1.1 TWhe

Figure 5. *Geothermal reservoir heat and power. Assessments summary sheet*

Table 1. ***Summary of Resource/Reserve Assessments***

ZONE	OVERALL (Grand Madrid)	SPECIFIC (NE Madrid)
AREA (km^2)	**1400**	**150**
VOLUME 5 km depth (km^3)	**7000**	**750**
HEAT FLOW DENSITY (Wm^{-2})	**$9\ 10^{-2}$**	**$9\ 10^{-2}$**
SUBSURFACE TEMPERATURES (°C)		
500 m	35	35
1500 m	60-70	60-70
2500 m	80-100	80-100
5000 m	160-180	160-180
ACCESSIBLE RESOURCE BASE (ARB) 5 km 10^{19} J	**560**	**6.2**
HEAT RESUPPLY		
Power (MWt)	126	13.5
Energy (GWht/yr)	**1130**	**104**
HEAT IN PLACE (HIP) (10^{18} J)		
Shallow GTH	21	2.2
Medium depth GTH	18	3.9
Deep GTH	27	3.1
Ultra-deep GTH	115	13.1
TOTAL	**181 10^{18} J**	**22.3 10^{18} J**
RECOVERABLE HEAT (RCH) OVER 75 yrs		
Shallow GTH (BHE/GWD) (10^{18} J)	3.3/1	0.35/0.1
Medium depth GTH (10^{18} J)	6.3	1.4
Deep GTH (10^{18} J)	9.5	1.1
Ultra-deep GTH (10^{18} J)	5.8	0.7
TOTAL	**24.9/22.6 10^{18} J**	**3.6/3.3 10^{18} J**
EXPLOITABLE HEAT (AND POWER) OVER 75 yrs		
Shallow GHT (BHE/GWD) (10^{17} J)	0.36/0.07	0.04/0.007
Medium depth GTH (10^{17} J)	1.3	0.3
Deep GTH (10^{17} J)	4.4	1.1
Ultra-deep GTH CHP (10^{17} J)	1.2	0.3
TOTAL	**7.3/7 10^{17} J**	**1.7/1.7 10^{17} J**
HEAT RESUPPLY (10^{17} J)	**3.09**	**0.33**

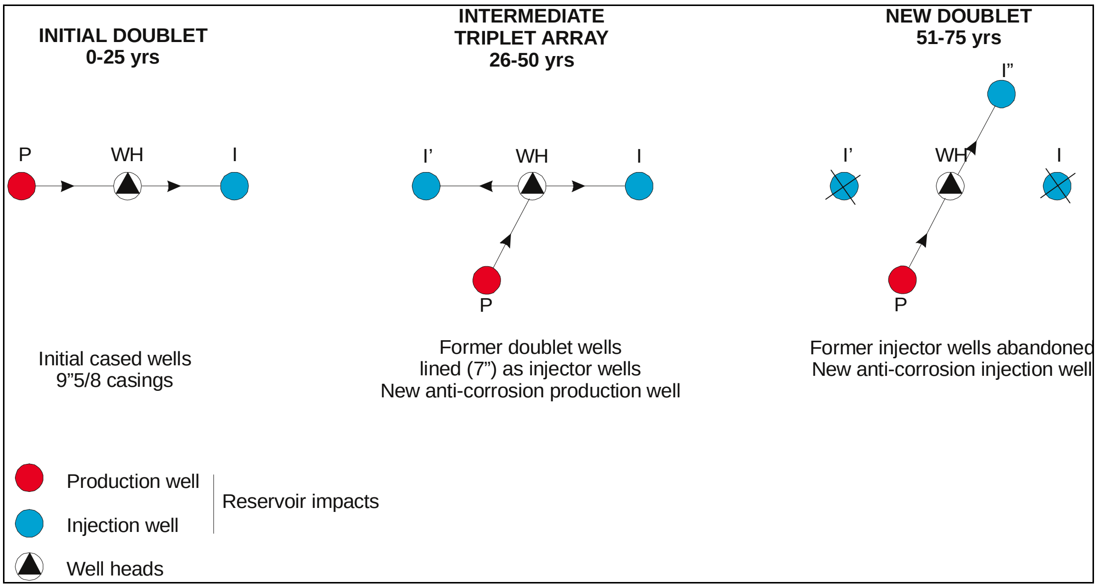


Figure 6. *Production/Injection Well Arrays configurations (75 years life)*

6. CONCLUSIONS

The previous assessment exercise has enabled the evaluation of the geothermal potential recoverable via uses and extraction technologies addressing, shallow, medium depth, deep and ultra-deep seated geothermal environments within the Madrid metropolitan area.

The exploitable heat (and power) potential deemed exploitable over the Grand Madrid (1400 km^2) and North East Madrid (150 km^2) areas amounts to ca 730 and 170 PJ respectively i.e. 3 (Grand Madrid) and 5% (NE Madrid) of recoverable heat assessed according to current evaluation criteria practiced by the mineral and geothermal industry.

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