

31 August 2011

Hot Rock Announces Second Geothermal Resource in Chile

- **Inferred geothermal resource of 5,400 PJ declared at the Longavi project**
- **Sufficient for 135MWe of electricity generation for 30 years**
- **Resource volume remains open at depth with potential for extension**
- **Exploratory drill program planned for 2012**
- **Second HRL resource and only the third publicly declared resource to date within emerging Chilean geothermal sector**



■ **Figure 1: The Quaternary volcano Nevado de Longavi (viewed from the north)**

Hot Rock Limited (ASX:HRL) is pleased to announce an Inferred Geothermal Resource at its 100%-owned Longavi project located in Region 8, some 300km south of Santiago in Chile (Figures 1, 2 and 3).

Following the completion of geological, geochemical and geophysical studies, an inferred geothermal resource¹ of 5400PJ has been estimated for the project (Figure 2). This is considered to be sufficient for 135 MWe of electrical power generation for 30 years and would meet the electricity requirements of about 150,000 Chilean households.

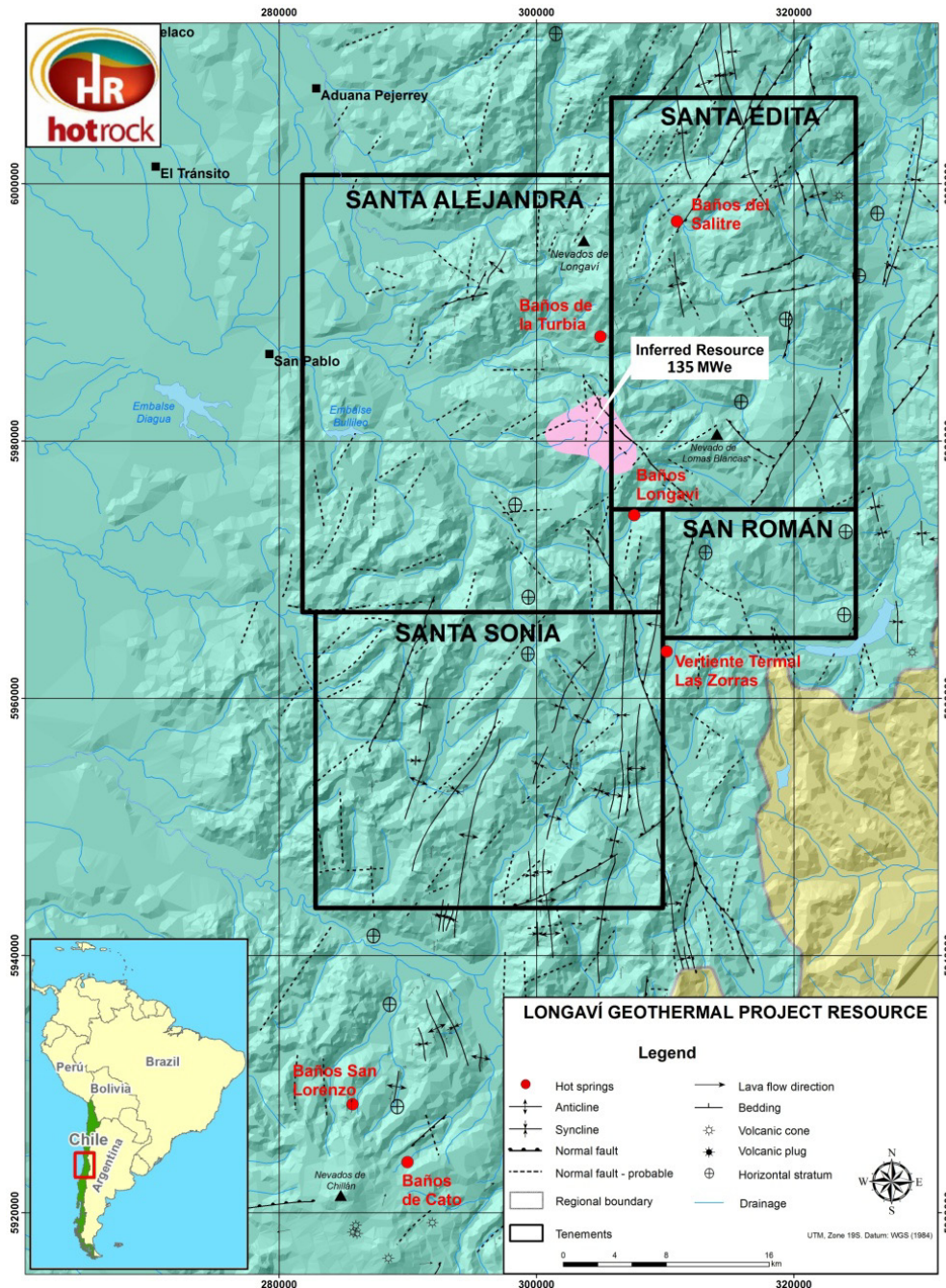
Longavi represents the second geothermal resource defined by Hot Rock in Chile, following the announcement of a 7,400PJ inferred resource at the Calerías project in July. Longavi is only the third project to have geothermal resources publically declared within Chile to date.

¹ An "Inferred Geothermal Resource" is declared in conformance with Australian Geothermal Resource Reporting Code (2nd Edition, 2010) within a fractured volcanic geothermal system having deep temperatures estimates obtained from spring chemistries.

Dr Mark Elliott, executive chairman of HRL, commented, “We are excited to have defined geothermal resources at our second Chilean project, and within only 6 months from having the two key tenements of Santa Alejandra and Santa Edita granted”.

“We have had a presence in Chile since 2008, providing an early mover advantage well before the more recent pegging rush by major geothermal companies into what is widely considered to be the most highly prospective, emerging geothermal region in the world today. As such, we are positioned as a leading geothermal tenement holder in the nation”

“The next 6 months will be very active, as we prepare to launch two drilling programs in Chile.”



■ **Figure 2: Location and key features of the Longaví Project and the area of Inferred Geothermal Resource now delineated**

The Longavi resource assessment was undertaken within HRL by Managing Director Peter Barnett and has been reviewed independently by Dr Subir Sanyal of GeothermEx, an international expert in geothermal resource and reserve estimation. GeothermEx is a highly regarded geothermal consulting and services firm located in the USA, now owned by Schlumberger. A copy of the GeothermEx's review, dated 25 August 2011, is attached.

A summary of the HRL resource assessment report is given below and a more detailed version is available on HRL's website.

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About Hot Rock Limited

Hot Rock Limited is a geothermal energy company that offers investors an opportunity to participate in socially responsible and ethical investment choices through the development of sustainable, clean, base-load power generation.

Strategically, HRL has elected to focus on the commercially proven Volcanic Geothermal and Hot Sedimentary Aquifer (HSA) type projects in its quest to become a leading supplier of geothermal power.

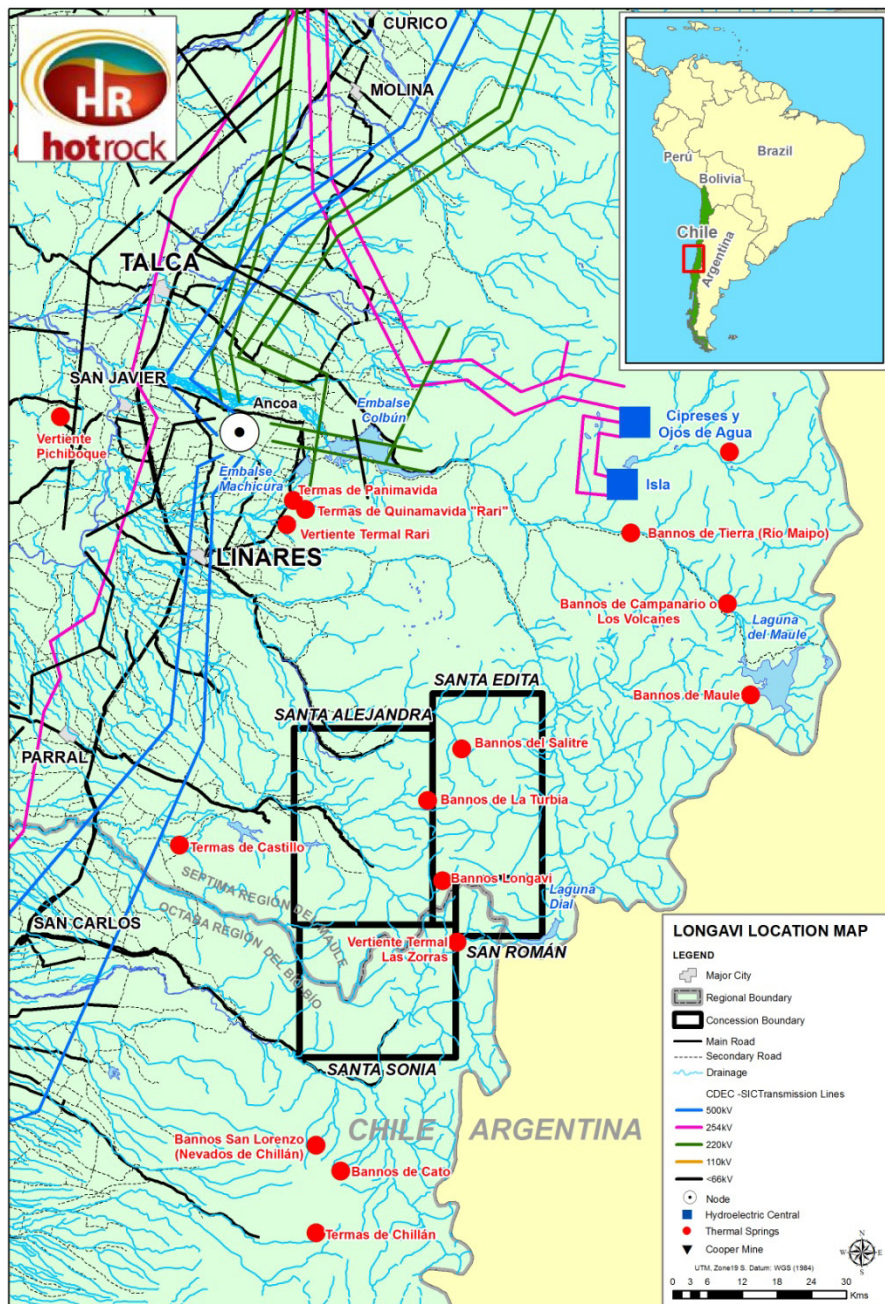
In Australia, the company is focused on developing HSA projects in its large Otway Basin tenements in south west Victoria. The flagship Koroit project is ready to drill and test and is awaiting the outcome of ongoing discussions with the Federal government and potential joint venture partners to fund this project.

HRL has expanded internationally via South America with the establishment of offices in Santiago and Lima in 2009. Exploration applications covering exciting volcanic prospects in Chile and Peru are being granted and exploration has commenced. HRL is consolidating its position in South America, where high quality geothermal resources exist and attractive regulatory environments and market conditions are present.

Assessment of Longavi Geothermal Resource – Summary

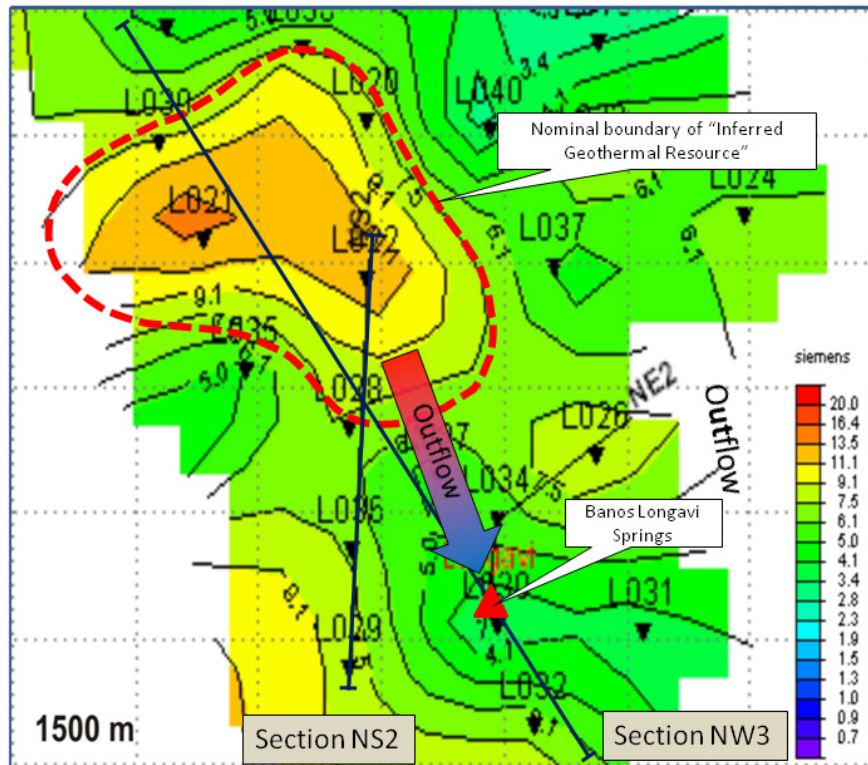
A geothermal resource has been discovered by Hot Rock Limited (HRL) at its Longavi geothermal concessions in South-Central Chile (Figure 3). This is the second geothermal resource assessment to be undertaken by HRL at its projects in Chile and complements a number of similar resource assessments undertaken at its geothermal projects in Australia.

The resource assessment is based on a review of the key characteristics of the Longavi geothermal resource deduced from existing data and recent field work undertaken by Hot Rock; in particular sampling and geochemical analysis of key hot springs, detailed geological field studies and a 40 station combined MT / TDEM resistivity survey carried out in February / March 2011.

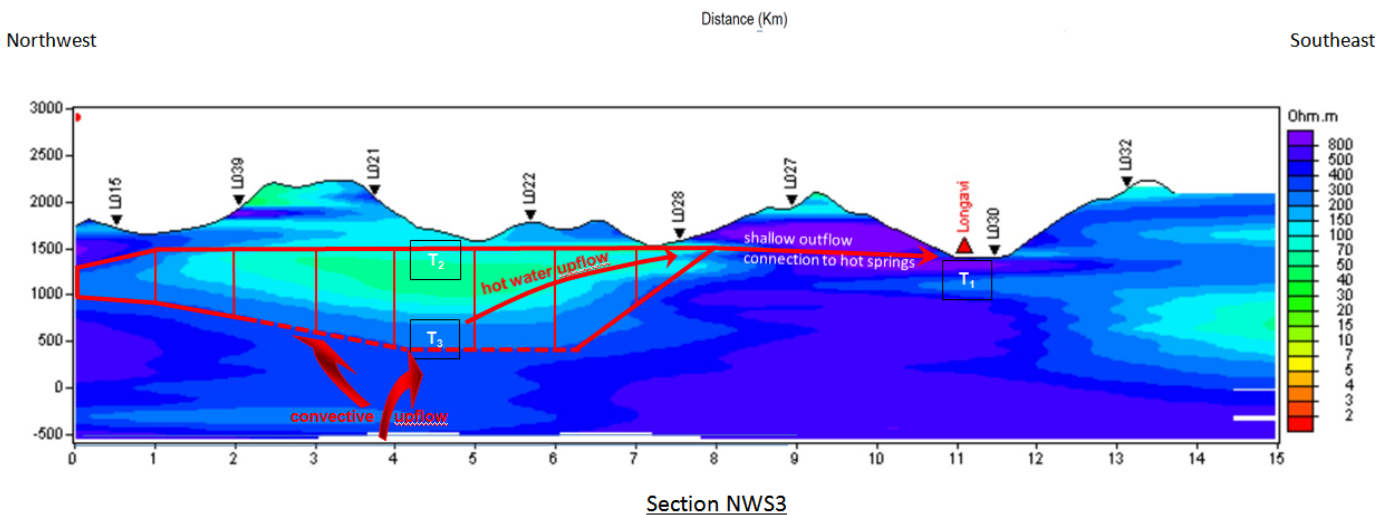


■ Figure 3: Location of the Longavi Geothermal Project and four concessions held by HRL

This work has allowed for the elaboration of the form and structure of a geothermal resource identified in the central area of HRL’s four concessions at Longavi. These results are summarised in the conceptual resource model shown in Figures 4 and 5.



■ **Figure 4:** Plan view of 1D MT TE-mode conductance at 1500m depth from surface showing interpreted boundary of the Longavi geothermal resource (red dashed line) and interpreted hydrology for a convective upflow of hot water in the vicinity of MT station L021 and outflow towards the Banos Longavi springs to the south



■ **Figure 5:** Section view along line NW3 through the Longavi geothermal resource showing the resource block model used for the calculation of stored heat in the resource. This is based on the MT / hydro geological model in Figure 4 and likely reservoir temperatures assessed from geochemical considerations

The resource model is consistent with the Banos Longavi springs, an area of significant geothermal hot spring activity with a surface heat flow of some 15MW_{thermal} (see Figures 6 and 7), being a shallow outflow of hot geothermal water from a deep geothermal resource centred some 7 km to the north of the springs. The resource is indicated to be a deep fractured volcanic convection system, located around cooling igneous intrusive rocks with retrograde hydrothermal alteration and a modest hydrothermal clay cap.

From a considered application of present geochemical and geological data, temperatures in the resource model at depth are estimated to range from a “most likely” value of 180°C, up to a “maximum likely” value of 220°C. A nominal distribution of temperature both vertically and laterally through the resource volume shown in Figure 5 has been estimated from a combined interpretation of the MT resistivity data, geology and temperature estimates above. This approach has allowed for the assessment of in-place heat energy within the delineated reservoir volume by a probabilistic Monte Carlo simulation method.

Based on these results, an “Inferred Geothermal Resource” can be declared in conformance with both the Australian Geothermal Resource Code¹ and consistent with the Canadian Geothermal Resource Code³.

The size of the Inferred geothermal resource identified at Longavi is estimated at a P50 level of probability to have a volume of 33 km³ and to contain an estimated 5,400 PJ of in-place heat energy (Table 1).

■ **Table 1: Summary of resource assessment results**

Resource Name	Resource Type	Resource Classification	Resource Area (km ²)	Resource Vol (km ³)	In-place stored	MWe
<i>(at P50 level of probability)</i>						
Longavi	Fractured, volcanic	Inferred	33	25	5,400	135

The amount of electricity that could potentially be generated from a geothermal resource of this size depends critically on the amount of heat that can be recovered from the resource, the type of power plant utilised at the surface to convert the geothermal heat into electricity and the thermal efficiency for the conversion process.

Based on the values of these parameters and a number of other variables, defined in Table 2, it is assessed that for a recovery factor of 15% and a power plant thermal efficiency of 14% operating with a capacity factor of 90%, the Longavi geothermal resource of 5,400 PJ would be sufficient for 135MWe of continuous geothermal power generation over a period of 30 years. It is assumed in this assessment that an Organic Rankine cycle power plant would be utilised rather than steam plant.

This resource assessment has a number of data limitations, the most significant being the limited depth to which the geothermal resource has been assessed due to the generally poor quality of the TDEM field data that was acquired. For this reason, the current resource assessment has been taken to a depth of only +400m MSL. The second limitation is that the MT survey covered a relatively large area of the Longavi prospect with a limited number of MT stations, averaging 0.2 stations / km².

This has resulted in a relatively coarse level of resolution of the resistivity structure of the geothermal and does not allow for 2D or 3D modelling.

Nonetheless, the current MT survey and 1D modelling studies have successfully delineated a geothermal resource of a significant size in the central Longavi area. The overall results of the multi-discipline geoscientific exploration program are very encouraging and warrant commencing an exploration drilling program to characterise in detail the Longavi geothermal system at depth through direct well measurements and flow testing.

Prior to commencing exploration drilling, HRL will undertake an infill MT / TDEM field measurement program to increase the MT station density over the now identified Longavi resource. This will allow for a higher level of resolution of the resistivity structure and aid in final decision making on exploration well targeting. An important additional component of this infill program will be to apply a more refined and reliable field method for the acquisition of TDEM data.

It is expected that the results of the infill program may significantly increase the current resource assessment through providing resolution of the resource volume down to depths of at least -1000 m MSL and more refined estimates on the lateral boundaries of the resource.

- **Table 2: Parameters used in the Monte Carlo simulation assessment of the geothermal resource located in the central-southern area of Calerías and other assumptions**

Parameter	Units	Most Likely Value	Probability Distribution		
			Type of Distribution	Min	Max
Variable Parameters:					
Resource area	km ²	100%	Normal	80%	110%
Resource thickness	km	100%	Normal	80%	110%
Porosity	%	15%	Triangular	10%	20%
Central reservoir T, 1500m MSL	°C	150	Normal	120	180
Central reservoir T, 400m MSL	°C	180	Normal	120	220
Outflow T, at Banos Longavi	°C	120	Fixed	-	-
Recovery factor	%	15%	Triangular	12%	20%
Conversion efficiency	%	14%	Triangular	12%	15%
Fixed Parameters:					
Rock specific heat	kJ/kg°C	0.9	Constant		
Rock density	kg/m ³	2600	Constant		
Fluid specific heat	kJ/kg°C	Calculated from WINSTEAM as a function of temperature			
Fluid density	kg/m ³	Calculated from WINSTEAM as a function of temperature			
Minimum geothermal production temperature	°C	120	Constant		
Resource cut-off temperature	°C	70	Constant		
Plant Capacity factor	%	90%	Constant		
Plant life	Years	30	Constant		

HRL expects to commence exploration drilling at Longavi in 2012 at which stage a further update to this resource assessment will be prepared and issued. This will be carried out on the basis of temperatures measurements made in exploration wells drilled into the geothermal reservoir and the results of flow testing these wells. This will allow for upgrading the resource assessment to “Indicated Resource” and subsequently “Measured Resource”, respectively, from that of “Inferred Resource” declared here.

Statement by Competent Person

The information in this Statement that relates to Geothermal Resources has been compiled by Peter Barnett, an employee of Hot Rock Limited. Mr Barnett qualifies as a Competent Person as defined by the Australian Code of Reporting of Exploration Results, Geothermal Resources and Geothermal Reserves (2nd Edition, 2010).

He has over 30 years’ experience in the determination of crustal temperatures and stored heat for the style relevant to the style of geothermal play outlined in this release. He is a member of the Geothermal Resources Council and the International Geothermal Association, a current board member of the New Zealand Geothermal Association, a current member of both the Economics and the Geothermal Resource Code Reporting Code sub committees of the Australian Geothermal Energy Association (AGEA) and a past board member of the Auckland University Geothermal Institute Board of Studies.

In this work Mr Barnett has drawn freely from reports on the Calerías geothermal resource prepared under his supervision, by both staff of HRL and by external consultants. The estimation on in place has been undertaken directly by Mr Barnett. Mr Barnett consents to the public release of this report in the form and context in which it appears. Neither Mr Barnett nor HRL takes any responsibility for selective quotation of this Statement or if quotations are made out of context.



■ Figure 6: Near boiling “Longavi-1” spring at Banos Longavi. Flow rate approx 20 l/sec



■ Figure 7: Near boiling *Piedra* spring at Banos Longavi. Total flow from all of the Banos Longavi springs is approx. 60 l/sec which represents a heat flow at surface of $15\text{MW}_{\text{thermal}}$

Mr. Peter Barnett,
Managing Director
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August 25, 2011

via email: Peter.Barnett@hotrockltd.com

Subject: Review of “Assessment of Inferred Geothermal Resource: Longavi Project, Chile”

Dear Mr. Barnett

We have reviewed the subject report, Issue 1, Rev 0, August 2011 (Final Draft, date issued 08 Aug 2011), prepared by Hot Rock Limited (“HRL”) and have also reviewed communications between ourselves and you, regarding the contents and conclusions therein. This review leads us to the following relevant observations and conclusions regarding the resource:

- The project area comprises four adjacent geothermal concessions that are 100% held by HRL: Santa Alejandra and Santa Edita to the N, and Santa Sonia and San Roman to the S. Together, these concessions cover a total area of 2,195 km². This excludes an area of 32 km² that is bounded by the four concessions and included in none.
- The inferred resource covers an area of 33 km² (the P50 value) within the Santa Alejandra and Santa Edita concessions, being crossed by the N-S boundary between them¹. This inferred area lies about 10 km S of the summit of Nevados de Longavi volcano, 5 km W of the Lomas Blancas volcano and 3.5 km N of Baños de Longavi hot springs, which lies at the northern end of the 32 km² excluded area.
- Nevados de Longavi and Lomas Blancas each started to grow over a basement of older (Tertiary) volcanic rocks about 800,000 years ago (the start of the Late Pleistocene) and eruptions continued until less than 10,000 years ago (the start of the Holocene). Neither volcano has erupted during historic times, but fumarolic activity (steam discharges) were reported to exist on Nevados de Longavi until the 1930’s.
- The inferred resource area includes a number of small surface exposures of intrusive magmatic rocks that are (probably) coeval with the two volcanoes.

¹ Santa Alejandra lies to the W and Santa Edita to the E. The concessions will expire respectively on 31 January and 1 February 2013.

- Considering the presence of these features, HRL believes that the inferred geothermal system is heated by late-stage cooling of intrusive magma that has been emplaced along (probably) a NW-trending fault or fault system. We consider this to be reasonable, but also believe that the background heat flow in the area may be relatively high, and that heat may also be coming from beneath the two volcanoes.
- The topography of the inferred resource area is rugged and characterized by branching networks of U-shaped glaciated valleys that are separated by knife-edge ridges. Elevations range from about 2,400 m asl (mostly central and towards the E) down to 1,200 m asl (mostly towards the NW, W and SW).
- All weather road access is said to be available, coming from the W into the central area of the Santa Alejandra concession and also into the central area of Santa Sonia to the S. Satellite images support this allegation: in the central area of Santa Alejandra at about 750 m asl there are numerous habitations that are clearly reached by unpaved roads. The western edge of the inferred resource area lies about 4 km further E.
- The subject report presents a comprehensive and competent assessment of the geothermal resource that is inferred to exist, relative to the amount of resource information and data that are available at the current stage of exploration.
- There are three hot springs in the concession area, none of which is the typical discharge of a deep-seated, Na-Cl (sodium-chloride) dominated high temperature reservoir in young volcanic rocks. The springs are co-linear on a 25 km-long, NNW-SSE trend that passes through the inferred resource area and may be a significant result of deep-seated structural weakness (faulting, fracturing) that has been a conduit of magmatic intrusions and, currently, thermal fluid circulation.
 1. To the N: La Turbia (flowing 41°C at 2 l/sec) lies on the southern flank of Nevados de Longavi and 200 to 300 m above a glaciated valley to the S.
 2. In the center and just S of the inferred resource: Baños de Longavi (spanning ~250 m with a total discharge of 60 l/s to 74°C) and
 3. To the S: Las Zorras (discharging 10 l/s at 82°C).
- The water of La Turbia contains elevated bicarbonate (HCO_3 at 1830 mg/kg) and probably has been heated by steam containing elevated carbon dioxide (CO_2). Chloride (Cl) at 257 mg/kg might represent a thermal component of deeper origin.

- Longavi and Zorras are not chemically identical but nevertheless similar in terms of probable origins at depth. They are somewhat alkaline (pH 8~8.3) and carry sodium (Na) at 135~167 mg/kg, calcium (Ca) at 12~144 mg/kg, low levels of potassium (K) and magnesium (Mg), chloride (Cl) at 76~144 mg/kg, sulfate (SO₄) at 198~410 mg/kg, bicarbonate (HCO₃) at 82~200 mg/kg and silica (SiO₂) at 82~116 mg/kg.
 1. Thermal waters of this type are commonly found in areas of older (Tertiary) volcanic rocks (such as the basement beneath Nevados de Longavi and Lomas Blancas) where there is elevated heat flow. They may have been heated by steam from a deeper source and/or simply by deep circulation. Heating by steam tends to produce acidic conditions that would be neutralized during outflow and up-flow to the surface, provided that the length of the flow path is sufficient. The conceptual model of Baños de Longavi (based on MT resistivity data, geology and topography) includes an outflow path that starts beneath the inferred resource area and is about 6 km long. This may be sufficient for neutralization. Zorras (little-studied thus far) may represent an additional part of this outflow, or a separate discharge.
 2. If heating by steam is occurring, the probable source of the steam is boiling in a hotter aquifer of the Na-Cl type that lies beneath the inferred resource area and beneath the aquifer that feeds the hot springs. If the hot springs are heated only by deep circulation, the deeper, hotter aquifer may yet be present. In any case, this postulated deep aquifer is considered to be the ultimate drilling target for resource exploitation.
- The subsurface temperature conditions in the inferred resource area are not certain. Chemical geothermometers that can be applied to Baños de Longavi and Las Zorras allow predicting that conditions to about 120°C are very possible to likely. This is not a precise value because for these two waters the estimates of different geothermometers do not converge particularly well. One of the applicable geothermometers (based on Na/K) yields results that span about 50°C depending upon the calibration chosen for use; the highest estimate obtained is about 180°C.
- Due to these ambiguities, HRL has supplemented the chemical geothermometers by considering the implications of silica sinter deposits that are found at Baños de Longavi. Sinter deposition is not active but HRL reports being told that the spring temperature was higher, flow was stronger and silica was (probably?) being deposited until a major earthquake in the early 1990s. Sinter deposition requires concentrations of silica in solution at that usually are established only at 180°C and, under certain conditions, even

higher than 200°C. Assuming that the sinter has been properly identified and its direct relationship to the hot springs properly established (both are probable), we consider the use of the sinter evidence to be reasonable. There are hot spring locations elsewhere, particularly in arid regions and at high elevations, where relatively small changes of conditions at the surface and in the shallow subsurface create changes in discharge (flow rates, temperatures, deposits), yet evidence suggests that the deeper hot water source conditions have probably not changed.

- The geothermometers and evidence of sinter do not provide any constraints on the areal extent, thickness and depth-to-bottom of the inferred resource. These parameters have been estimated from results of the MT (magneto-telluric resistivity) survey that was done by HRL, using the services of Wellfield Services Ltd to collect the data, and the services of a highly qualified geophysical consultant to design and oversee the survey and model and interpret the results.
- The MT survey comprised 40 stations located within an area of ~300 km². This density was a compromise between cost and effective results using basic techniques that allowed “1D” modeling only² (a more detailed fill-in survey is planned). The results of 1D modeling can be limited by effects of the different topographic settings of adjacent stations. These effects can be only partially mitigated at best, but it was concluded that the quality of MT data acquired was generally good enough to meet the needs of an imaging analysis. The MT measurements were supplemented by TDEM (time-domain electromagnetic) measurements that can provide a basis for refining the MT data, but high resistivities in the shallow subsurface prevented getting useful TDEM results.
- The interpreted MT results show only slight evidence for the characteristic low resistivity smectite clay alteration that caps most geothermal reservoirs in andesitic rocks. This can happen if: there is little to no alteration; there has been previous alteration to a higher metamorphic grade; there is a low water/rock ratio and/or; fluids are confined within near-vertical fracture networks.
- Nevertheless the MT results have defined a volume at depth of generally low resistivity and the conformation of this body has been regarded as consistent with (not proving) the presence of a hot resource. The resource appears to be deepest about seven km N

² 1D evaluates in isolation the measurements made at each individual station without considering at the same time the measurements made at adjacent stations. In other words, at each station it is assumed that resistivity changes only in the Z direction and not in X and Y. Results from the separate stations can still be used to draw cross-sections and contour maps, but can be inaccurate especially in regions of irregular topography and other horizontal discontinuities.

of Baños de Longavi and becomes progressively shallower moving southwards towards the Baños, near which it occurs at relatively shallow depths beneath deep valleys. The contoured shape of this anomaly (on maps and cross-sections) has been used by HRL to assign the dimensions of the inferred resource.

- Considering jointly the evidence of geology, topography, fluids chemistry (including the silica sinter) and the MT survey, HRL has established certain values of minimum, maximum and most-likely temperature within three representative parts of the inferred resource volume. These are:
 1. a fixed 120°C at the “peripheral resource” of the Baños de Longavi outflow zone;
 2. a most-likely 150°C (minimum 120°C and maximum 180°C) at about 1,500 m asl in the “shallow central resource” at the top of the center of the inferred resource volume and;
 3. a most-likely 180°C (minimum 120°C and maximum 220°C) at about 500 m asl in the “deep central resource” at the bottom of the center of the inferred resource volume.
- On the basis of the evidence from silica sinter at Baños de Longavi and the shape of the MT resistivity low, these temperature values and locations can be considered reasonable as inferences but with certain ambiguities. For example: (a) the depth of the “shallow central resource” beneath overlying valley floors appears to be small and raises the question: why is it not manifested directly above by surface points of discharge (fumaroles, etc; a strong cap is required); (b) the high temperatures suggested by the silica sinter (to maximum possible 220°C) are not at all well-supported by the chemical compositions of Longavi and Zorras, and (c) the inferred resource model is ambiguous with respect to the postulated Na-Cl deep aquifer that is regarded as the ultimate deep drilling target. The MT survey results as presented do not distinguish between this deep aquifer and the (overlying) aquifer that feeds the hot springs.
- Based on the inferred model of the geothermal resource as outlined above, and gridding of the stratigraphy and temperature, HRL has conducted volumetric estimation of the stored heat in the geothermal system using a probabilistic approach (Monte Carlo simulation). This estimation methodology is a generally accepted practice in geothermal industry, and is one of methodologies described in the Lexicon of the Australian Geothermal Reporting Code (Edition 1, 2008).

- We find the details of the resource assessment methodology and parameter estimates presented by HRL are appropriate given the resource model and parameters referred to above. Furthermore, based on our knowledge of the Australian Geothermal Reporting Code (2008) and our experience in geothermal resource exploration and estimation at many projects in Chile, Turkey, the United States and elsewhere on behalf of various geothermal developers, we confirm that the resource classification used by HRL in their report adheres to the letter and spirit of the Code.
- Although we have not conducted an independent probabilistic estimation of resource for the Longavi project, we concur with the assessment by HRL that the inferred resource has a volume of 33 cubic km and an Inferred Resource of 5,400 PJ, equivalent to 135 MWe of electrical power capacity for a 30-year project life.
- HRL expects to refine and increase the magnitude of the present resource assessment in the near future through:
 - (a) undertaking a further detailed MT survey to fill-in the existing grid at higher density and to investigate the area S of Baños de Longavi to Las Zorras;
 - (b) subsequent deep exploration drilling at the Longavi prospect to be carried out by HRL.

We believe these are reasonable next steps to take and should allow declaration of the resource assessment as “Indicated Resource” rather than “Inferred Resource”.

- We understand that the HRL report has been prepared under the supervision of Mr. Peter Barnett, a fulltime employee of HRL. We note that Mr. Barnett is a Competent Person as per the guidelines of the Australian Geothermal Reporting Code (Edition 1, 2008). The undersigned would like to state further that he has professionally known Mr. Barnett for more than 30 years and has complete confidence in his technical competence and professional judgment.

Sincerely yours,
GeothermEx, Inc.



Subir K. Sanyal, Ph.D

President

About GeothermEx:

GeothermEx (a Schlumberger Company) is a geothermal energy consulting and service company based in California that has provided services in 55 countries since 1973. It has been associated with the development of more than 7,000 MW of electric power capacity and has conducted due diligence for financing of nearly U.S. \$13 billion to date.