ARGENTINA COUNTRY UPDATE

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I. INTRODUCTION

Western Argentina. along the Andes mountain range, is underlain by a tectonic subducting zone. Magma bodies in the upper levels of the lithosphere of the oveniding plate cause the high-temperature anomalies observed in the region. On the other hand, outside the Andes there are many moderate to low thermal anomalies. Because of these general characteristics, good possibilities exist in Argentina for investing in the development of the geothermel resources of the country.

On-going studies in Argentina have surveyed many thermal manifestation areas and identified some important geothermal fields. The Geothermal Department of the Argentine Secretary of Mining is now assessing the country's geothermal resources, which then will be transferred to the private sector, including opportunities for foreign investment.

The objective of the research and development activities is to bring about the optimal exploitation of the low- and high-enthalpy geothermal resources of the country. and thus, assist in the development of regional economies.

II. CURRENT STATE OF DEVELOPMENT

To date the geothermal resources of an area of about 300,000 krn2 in the northwest, west-central. east-central and southem parts of the country have been evaluated. Reconnaissance surveys have been completed in 11 regions in the provinces of Jujuy. Salta. Catamarca, La Rioja, San Juan, Mendoza. Neuquén, Tucumán, Santiago del Estero. Tierra del Fuego and Buenos Aires (Fig. 1), identifying 42 geothermal areas.

Based on the results of Ihe reconnaissance surveys, pre-feasibility studies have been completed in six of these areas (Fig. 2). The volcanic areas of Tuzgle (Salta-Jujuy), Domuyo (Neuquén), Copahue (Neuquén) and Valle del Cura (San Juan) are considered favorable sites for high-enthalpy projects. Similarly. the areas of Bahia Blanca (Buenos Aires) and Río Valdez (Tierra del Fuego) are good prospects for developing their low-temperature resources.

Resulting from all the studies completed so far, the most advanced geothermal projects are Copahue. Rio Valdez and Bahia Blanca. Copahue is in its development phase (a 670 kW pilot plant came on line in 1966).

III. HIGH-ENTHALPY FIELDS

a. COPAHUE (Neuquén Province)

The Copahue geothermal field is on the eastern slopes of the Andes, near the border with Chile, at 37°50'S, 71°05'W. It is located in the western edge of a 15 to 20 km diameter megacaldera, by the 2977 m high Quaternary Copahue volcano.

The Copahue volcano corresponds to the last episode of the Copahue-Caviahue Effusive Complex whose activity began during the Pliocene and continued into the Quaternary. The volcanic materials are mainly lavas; pyroclastics are less abundant. They are predominantly calc-alkalic basalts, andesitic-basaits and andesites (Fig. 3) and, in smaller proportion, latites (Pesce, 1989).

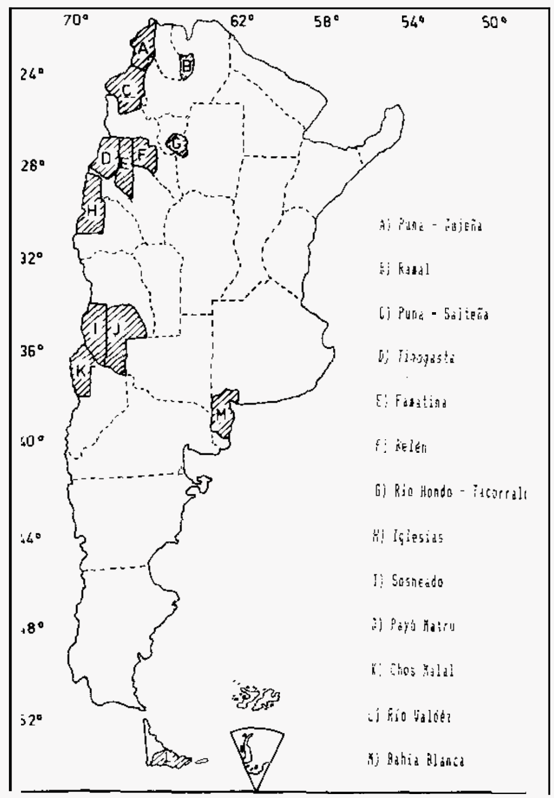

Fig. 1 Areas where pre-feasibility-Study have been completed

Within the geothermal field a 1.2km2 area with greatest commercial potential was defined. There, three exploratory wells were drilled (COP-1: 1414 m; COP-2: 1241 m; and COP-3: 1065 m deep) that penetrated 230°C boiling reservoirs of medium productivity in fractured mcks (EPEN, 1984). According to the geothermal model (Fig. 4) these are shallow secondary reservoirs; the existence of a main reservoir at an estimated depth of 1800 m has yet to be confirmed.

A demonstration ORMAT binary-cycle power plant came on line in April 1988; it uses isopentane as working fluid. The plant is portable and can be easily disassembled. It has been installed at 2000 masl, some 2 km from the town of Copahue. It is supplied by a well producing 6.7 tonnes/hr of saturated steam with 8% of non-condensable gases. The reservoir being produced is between E50 and 1000 m depth.

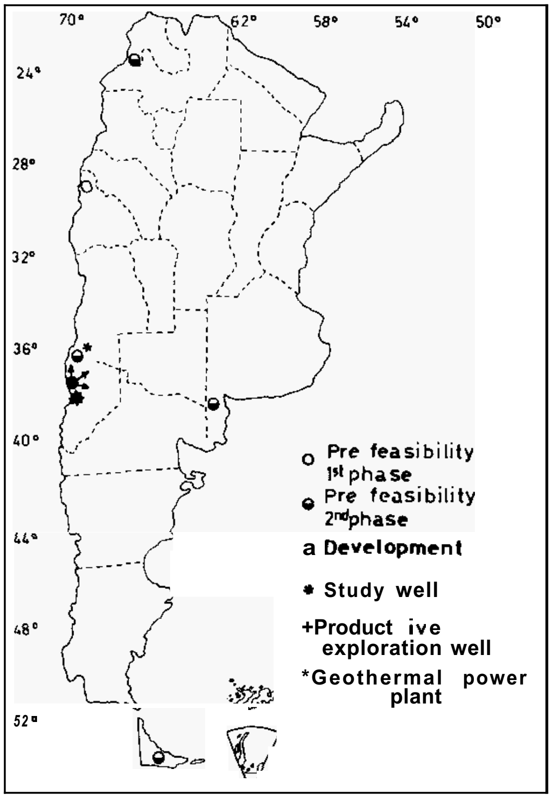

Fig. 2 Areas where reconnaissance-Study have been completed

The nominal power of the plant is 670 kW. The electricity that is generated is delivered to the 10 km long, 13.2 kV Copahue-Caviahue line which is connected to the 50 km-long, 33 kV Caviahue-Locopue line which. in turn, is connected to the 132 kV interprovincial system (URENF, 1988).

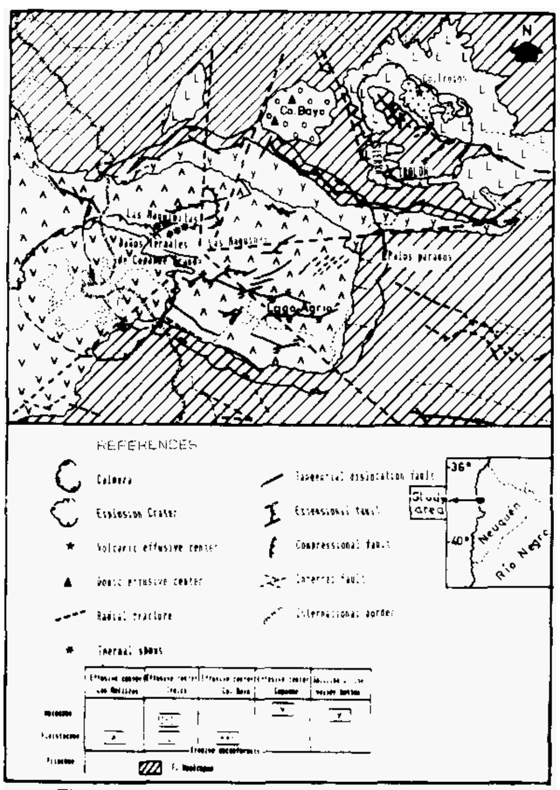

Fig. 3 Location map and geologic map of the Copahue Caviahue volcanic area

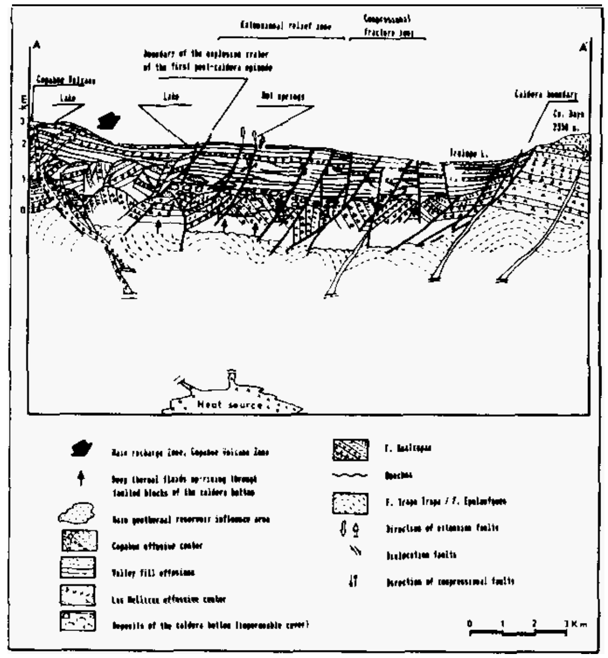

Fig. 4 Preliminaw geothermal model for the Copahue area

Figure 5 shows the basic outline of the plant's operation. Geothermal steam at 171°C and a rate of 6.7 tonnes/hr goes into the preheater and vaporizes the isopenlane making the turbine work at 3000 rpm to generate 670 kW. The isopentane is then liquefied in a water-cooled condenser to begin the cycle again.

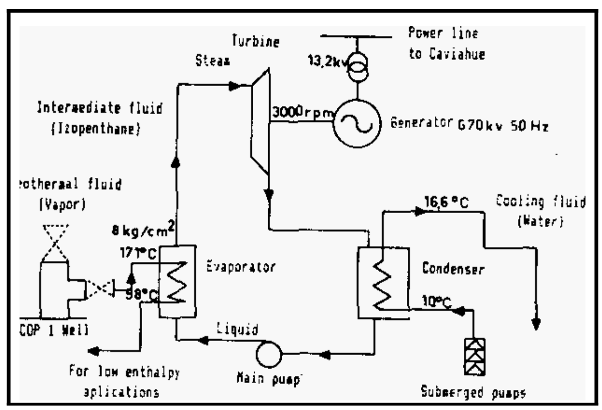

Fig. 5 Geothermal power plant al Copahue, Neuquén 670 kw demostration

The thermal manifestations at Copahue are of local and international fame and are being used in balneotherapy. Hotels with numerous thermal pools have been established in the area. Presently a project is under development to use Copahue geothermal fluids to Provide space heating to the town of Caviahue.

b. DOMUYO (Neuquen Province)

The Domuyo geothermal field displays fumaroles. hot springs and gas emanations and is located at 36°40'S, 70°40'W. It is associated with Quaternary shoshonitic volcanism. Detailed surveys covered about 600 km2 around Cerro Domo volcano, which is the largest manifestation of Quaternary volcanism in the area. The studies delimited a thermal anomaly (Fig. 6) probably related to magma bodies in the upper levels of the crust that are related to tensional structures (Pesce, 1985).

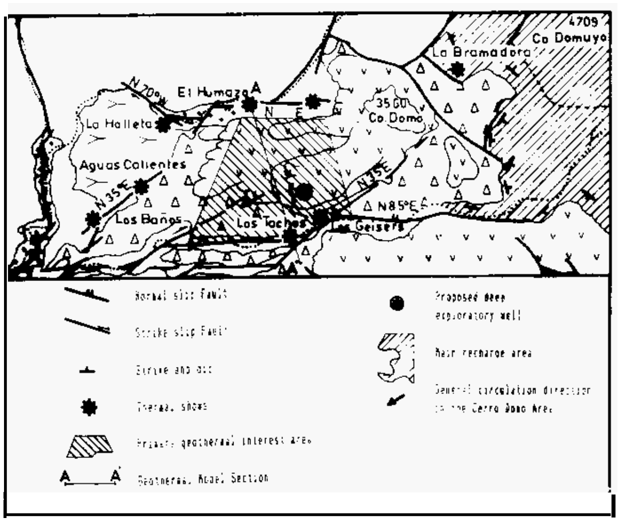

Fig. 6 Domuyo geothermal field. Geology of the Cerro Domo (area with main geothermal potential)

The pre-feasibility studies have been completed and the location for a deep exploratory well has been selected (Pesce. 1987). A model for the geothermal system has been developed (Fig. 7).

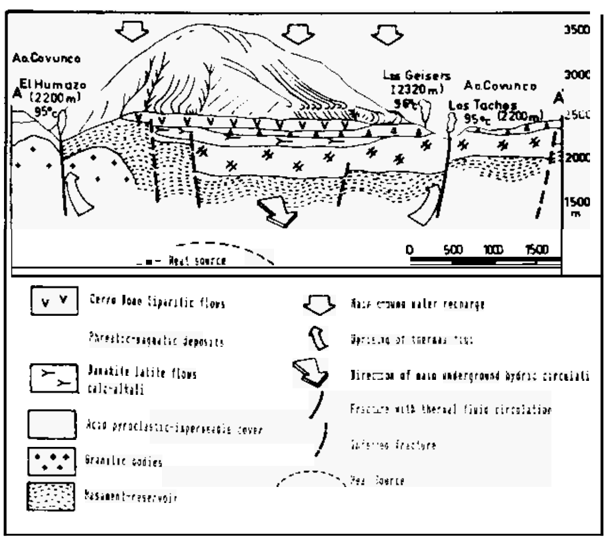

Fig. 7 Domuyo geothermal field
Preliminary Geothermal model

Stratigraphic analyses infer the existence of a shallow (at 650 to 750 m depth) reservoir. Hydrothermal fluids rising from depth create a geothermal system that includes a vapor-dominated region (fumaroles). a 218-226°C two–phase zone and a 186-190°C compressed liquid region.

At the present time, at Domuyo the geothermal resources are being exploited for space heating and lo supply hot water to a small tourist complex (Villa Aguas Calientes). There, visitors bath in the numerous natural thermal pools

c. TUZGLE (Jujuy and Salta Provinces)

The Tuzgle geothermal field (23°55'S; 66°30'W) is located in the Altiplano of Salta and Jujuy. Present studies are in the pre-feasibility stage; an area of about 900 km2 has been studied in detail. The preliminary geothermal model suggests the existence of a shallow reservoir fed from deeper levels (Fig. 8) where two hydrothermal cells are interconnected by fractures. The geothermal fluids seem to be in old fractured extrusive rocks and their upward flow controlled by vertical structures (Hidroproyecto, 1985).

At depth, temperatures vary between 132 and 142°C. and the steam/water ratio is low. To date many studies have been carried out at Tuzgle, including the drilling of 17 thermal gradiint wells. Due to its distance from electrical distribution centers, the energy supply in the area, mainly for mining is not enough to cover the needs of the population. The potential for development will likely increase with a growing energy demand

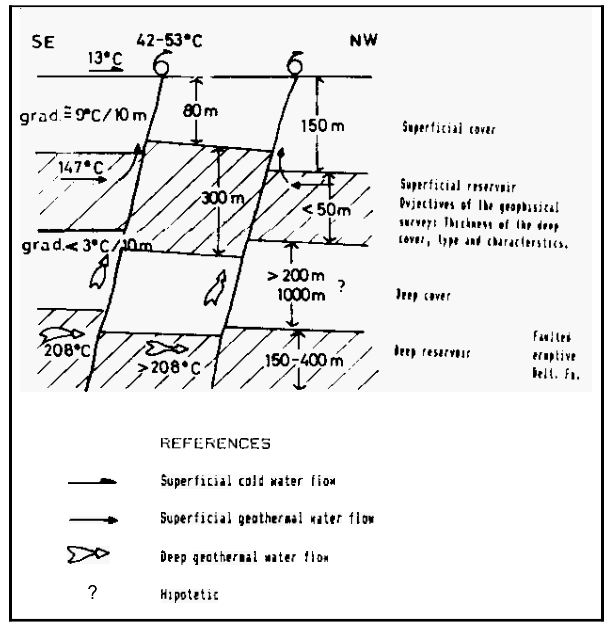

Fig. 8 Tuzgle geothermal area. Hydrologic model showing circulation of hot and cold waters.

d. Valle del Cura (San Juan Province)

The first phase of pre-feasibilly studies has been completed at Valle del Cura. Observed geochemical and isotopic anomalies suggest the existence, at drillable depths, of a boiling reservoir with temperatures above 200°C, as well as 130-150°C secondary shallower aquifers (ESIN, 1981).

The proven, but yet to be delimited, thermal anomaly is related to subvolcanic bodies associated with the neighboring Tortolas volcano

IV. LOW-ENTHALPY FIELDS

a. RIO VALDEZ (Tierra del Fuego Province)

At the southem tip of South America. in the Isla Grande de Tierra del Fuego one finds the Fueguina mountains, the continuation of the Patagonean Andes. Located in the northem-central area of the island, approximately at 54°S, 67°W, is the low-enthalpy Rio Valdez geothermal field.

In the area with greatest commercial possibilities altered rhyolites and crystalline tuffs of low metamorphic grade prevail. The rocks are highly deformed and sheared along a NE-SW belt. A structural analysis of the region showed that the thermal manifestations are associated with old reactivated faults which would allow the upflow of thermal waters.

The manifestations in the area comprise hot springs and gaseous emanations at 13 sites. All have similar chemical composition. including those of lowest temperature: sodium bicarbonate waters, with a pH between 7.8 and 8.2, and conductivities between 613 and 658 µS/cm. The temperatures of the springs vary between 31 and 40°C (average: 38.5%); their total flow is about 65,000 l/h (Pesce, 1983). In the reservoir the fluids have temperatures between 86 and 98°C; these are formed from infiltrated meteoric waters that are heated by conduction.

Considering the beauty of the region and the availability of thermal waters. it would *be* particularly interesting to build an international tourist center at Rio Valdez. In addition end because of the local climate. with its long winters end low average annual temperatures, there are excellent opportunities for using geothermal fluids to heat buildings, supply hot water for domestic and public use. dry lumber end wool, refrigerate food. grow vegetables in greenhouses, to raise fish and shrimp, etc. In other words, the start of a Rio Valdez geothermal project would initiate the development of this practically uninhabited area.

b. BAHIA BLANCA (Buenos Aires Province)

The large Bahía Blanca-Pedro Luro (or Colorado) sedimentary basin is located at the southwestern end of the Buenos Aires Province. The on-shore basin extends over more then 37,000 km2 and is characterized by its low-temperature (55-85°C) artesian aquifers. The heat is supplied by the thermal anomaly that resulted from the thinning of the crust as the basin was formed.

On the continent. the basin presents a block-faulted Paleozoic granitic basement. that is overlain by Cretaceous-Cenozoic sediments. At Bahia Blanca the sedimentary column is about 2,000 m thick. In the upper levels of the sediments several aquifers are found. At 530-570 m depth the temperature of the groundwater is 55-60°C. The most productive aquifer is between 660 and 886 m depth (Garcia y Garcia, 1964), the temperalure of its waters varies from 65 to 85°C.

The groundwater resources at Bahia Blanca are abundant and of good qualty. The temperature of the water increases with depth. Shallow wells produce 50°C waters. while those of 1000 m deep wells reach temperatures above 85°C. Generally the groundwater temperature increases toward the south. in the direction of the aquifeh dip (Bonorino, 1988). Well flowrates vary between *30* and 50 m^3/hr (Pesce, 1994).

Based on the results of the studies that were completed, that included geophysical. isotopic and other surveys, a simple hydrologic model of the area was developed. It suggest that in the westem margins of the Sistema de Ventania hills (Sierras Australes. northern boundary of the basin) meteoric waters infiltrate and recharge the groundwater aquifers. A constant and slow circulation of waters is established in the subsurface. with preferential movement along paleochannels. Following the general dip of the layers toward the south. the discharge occurs along the Atlantic coast (Kostadinoff y Reartes, 1993). As the groundwater flows through the permeable layers it is heated by conduction.

At the present time, the possibility of growing shrimp using the low- enthalpy geothermal waters is being evaluated. Studies have shown that based on the technology and resources *of* the region, the species with greatest success possibilities for semi-intensiva cultivation is Penaeous monodon. Since this species requires very special and constant conditions (water temperature. salinity. aeration, etc.), the challenge iies in establishing and maintaining these conditions using the thermal waters of the area.

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TABLE 1. PRESENT AND PLANNED PRODUCTION OF ELECTRICITY

	Geothermal		Fossil Fuels		Hydro		Nuclear		Total	
	Capacity MW_e	Gross Prod. GWh/yr	Capacity MW_e	Gross Prod. GWh/yr	Capacity MW_e	Gross Prod. GWh/yr	Capacity MW_e	Gross Prod. GWh/yr	Capacity MW_e	Gross Prod. GWh/yr
In operation in January 1995	0.67	3.5	-	31160	-	26620	-	6620	-	64403.5
Under construction in January 1995	-	-	-	-	-	-	-	-	-	-
Funds committed, but not yet under construction in January 1995	-	-	-	-	-	-	-	-	-	-
Total projected use by 2000	-	-	-	-	-	-	-	-	-	76300

TABLE 2. UTILIZATION OF GEOTHERMAL ENERGY FOR ELECTRICAL GENERATION IN DECEMBER 1994

[1] DIP for 1994 if available, otherwise for 1993. Please specify which

Locality	Power Plant Name	Year Commissioned	No of Units	Status	Type of Unit	Unit Rating MW_e	Total Installed Cap. MW_e	Annual Energy Prod. [1] GWh/yr	Total under Constr. or Planned MW_e
Copahue	Copahue	1988	1	Operating	Pilot	-	0.67	3.52	-

TABLE 3. UTILIZATION OF GEOTHERMAL ENERGY FOR DIRECT HEAT IN DECEMBER 1994

[1] I = Industrial process heat | D = Space heating
C = Air conditioning | B = Bathing and swimming
A = Agricultural drying | G = Greenhouses
F = Fish and other animal farming | O = Other (please specify by footnote)
S = Snow melting

[2] Enthalpy information is given only if there is steam or two-phase flow

[3] Energy use (TJ/yr) = Annual average water flow rate (kg/s) x [Inlet temp.(°C) - Outlet temp.(°C)] x 0.1319

Locality	Type[1]	Maximum Utilization					Annual Utilization		
		Flow Rate	Temperature (°C)		Enthalpy[2] (kJ/kg)		Average Flow Rate	Energy Use[3]	Load Factor
		kg/s	Inlet	Outlet	Inlet	Outlet	kg/s	TJ/yr	
La Salada	B	-	-	-	-	-	-		-
Epecuen	B	-	-	-	-	-	-	-	-
Bahia Blanca	DBGP	-	-	-	-	-	-	-	-
Carhue	B	-	-	-	-	-	-	-	-
Copahue	D-B	-	-	-	-	-	-	-	-
Domuyo	D-B	-	65	-	-	-	-	-	-
Epulaufquen	B	-	-	-	-	-	-	-	-
Cacheuta	B	3.95	45/48	-	-	-	-	-	-
El Peralito	B	-	-	-	-	-	-	-	-
El Sosneado	B	7.53	33	-	-	-	-	-	-
Cerrillo	B	-	39/41	-	-	-	-	-	-
Cajon Grande	B	0.77	56	-	-	-	-	-	-
Los Molles	B	2.5	-	-	-	-	-	-	-
Puente del Inca	B	15.67	34/38	-	-	-	-	-	-

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		kg/s	Inlet	Outlet	Inlet	Outlet	kg/s	TJ/yr	
Villavil	B	-	-	-	-	-	-	-	-
Taco Ralo	B	-	-	-	-	-	-	-	-
Caimancito	B	-	-	-	-	-	-	-	-
Termas de Reyes	B	-	-	-	-	-	-	-	-
R. de la Frontera	B	-	-	-	-	-	-	-	-
Villavicencio	D-B		26/36	-	-	-	-	-	-
Agua Hedionda	B		41	-	-	-	-	-	-
La Laja	B		25/42	-	-	-	-	-	-
Pismanta	B		42/48	-	-	-	-	-	-
Talacasto	B		26	-	-	-	-	-	-
San Jeronimo	B			-	-	-	-	-	-
Aguila Blanca	B			-	-	-	-	-	-
Saldan	B			-	-	-	-	-	-
San Marcos Sierra	B			-	-	-	-	-	-
Tanti Viejo	B			-	-	-	-	-	-
Roque Saenz Peña	B			-	-	-	-	-	-
Rio Hondo	B			-	-	-	-	-	-
Santa Teresita	B			-	-	-	-	-	-
Fiambala	B			-	-	-	-	-	-
Hualfin	B			-	-	-	-	-	-
Total									

TABLE 6. INFORMATION ABOUT GEOTHERMAL LOCALITIES

1) Main type of reservoir rock

2) Total dissolved solids (TDS) in water before flashing. Put v for vapor dominated

3) N = Identified geothermal locality, but no assessment information available
R = Regional assessment
P = Pre-feasability studies
F = Feasability studies (Reservoir evaluation and Engineering studies)
U = Commercial utilization

Locality	Location To Nearest 0.5 Degree		Reservoir		Status[3] in January 1995	Reservoir Temp. (°C)	
	Latitude	Longitude	Rock[1]	Dissolved Solids[2] mg/kg		Estimated	Measured
Cerro Granada	66° 25' 66° 40'	22° 30' 22° 50'	Piroclastic/ sedimentary	-	R	-	-
Laguna Vilama	66° 40' 67° 10'	22° 30' 22° 50'	Piroclastic/ sedimentary	-	R	-	-
Cerro Cayamboy	66° 30' 66° 45'	22° 20' 23° 05'	Piroclastic/ sedimentary	-	R	-	-
Cerrro Tuzgle	66° 15' 66° 35'	23° 55' 24° 15'	Sedimentary	-	F	214	-
Rosario de Susque	66° 48'	22° 58'	Met/Sedimentary	-	R	-	-
Tocomar	66° 32'	24° 11'	Metamorphic	-	F	214	-
Baños de Pompeya	66° 21'	24° 14'	Metamorphic	-	R	-	-
Incachule	66° 27'	24° 16'	Metamorphic	-	R	181	-

TABLE 6. (co t.d)

Corral Colorado	66° 33'	24° 22'	Metamorphic	-	R	100	-
Antuco	66° 40'	24° 10'	Metamorphic	-	F	235/239	-
Cerro Coranzuli	66° 10'	22° 55'	Metamorphic	-	R	-	-
	66° 30'	23° 10'					
Socompa	67° 47'	24° 37'	Andesites	-	R	215	-
Llullaillaco	68° 00'	24° 47'	Andesites	-	R	140	-
Archibarca	67° 34'	24° 53'	Andesites	-	R	205	-
	68° 00'	25° 25'					
Antofalla	67° 30'	25° 15'	Andesites	-	R	135	-
	68° 00'	25° 40'					
Tinogasta	68° 20'	28° 02'	Sedimentary	-	R	-	-
Cerro Galan	66° 45'	25° 45'	Andesites	-	R	108	-
	67° 26'	26° 06'					
V.de S. Francisco	68° 05'	26° 55'	Granite	-	R	160	-
Sierra de Hualfin	66° 43'	27° 00'	Granite	-	R	140	-
	66° 53'	27° 15'					
Sierra de Belen	66° 57'	27° 30'	Sedimentary	-	R	90	-
Suriyaco	66° 20'	28° 25'	Sedimentary	-	R	90/130	-
	66° 28'	28° 42'					
Agua de Dionisio	66° 45'	27° 15'	Granitic	-	R	98	-
	66° 40'	27° 20'					
Vis - Vis	66° 30'	27° 22'	Schists	-	R	98	-
	66° 37'	27° 28'					
Sosneado-C.Colorado	69° 53'	34° 40'	Gypsum/Volcanic	-	R	92/135	-
	70° 07'	34° 50'					
Puente del Inca	69° 56'	32° 41'	Sedimentary	-	R	-	-
Molles - La Huenco	69° 49'	35° 15'	Gypsum	-	R	91/100	-
	70° 07'	34° 50'					
Peteroa- B.del Cura	70° 19'	35° 20'	Volcanic/Gypsum	-	R	85/100	-
Pehuenche-Campanario	70° 11'	35° 55'	Gypsum	-	R	150	-
Mojotes Colorados	67° 06'	29° 50'	-	-	R	-	-
	67° 20'	30° 05'					
Aguadita-Higuerita	67° 30'	27° 45'	Sedimentary	-	R	84	-
	67° 48'	28° 10'					
Fiambala	67° 25'	27° 05'	Metamorphic	-	R	80	-
	67° 40'	27° 15'					
Valle de Chaschuil	68° 00'	26° 58'	Sedimentary	-	R	90/150	-
	68° 20'	27° 15'					
Laguna Verde	68° 30'	27° 45'	-	-	R	-	-
Volcan Bonete	68° 46'	27° 55'	Andesites	-	R	-	-
Ojos del Salado	68° 20'	27° 00'	Andesites	-	R	-	-
	68° 45'	27° 15'					
El Ramal	64° 30'	24° 04'	Sedimentary	-	R	-	-
Llancanelo-C.Nevado	68° 40'	35° 30'	Andesites	-	R	-	-
	69° 00'	35° 35'					
Borbaran	68° 30'	35° 30'	Andesites	-	R	-	-
	58° 40'	35° 40'					
Payun Matru	68° 58'	35° 55'	*Andesites*	-	R	-	-
	69° 48'	36° 10'					
Chachahuen	68° 40'	37° 05'	Andesites	-	R	90	-
	69° 00'	37° 15'					
R.Blanco y Taguas	69° 40'	29° 20'	-	-	R	140/190	-
	70° 00'	29° 27'					
Termas del Cerrado	70° 10'	31° 05'	Sedimentary	-	R	163/169	-
Pismanta	69° 00'	30° 10'	Sedimentary	-	R	70	-
	69° 20'	30° 30'					
Buta - Mallin	70° 00'	36° 50'	Sedimentary	-	R	-	-
	70° 10'	37° 05'					
Cajon Chenques	70° 40'	36° 25'	*Sedimentary*	-	R	-	-
	70° 50'	36° 35'					
Picunleo	71° 05'	37° 30'	Piroclastic	-	R	-	-
	71° 10'	37° 35'					
Pilunchaya	71° 05'	37° 35'	*Piroclastic*	-	R	-	-
	71° 12'	37° 38'					
Cullun-Co	71° 05'	39° 55'	Piroclastic	-	R	-	-
	71° 15'	40° 10'					
Domuyo	70° 23'	36° 39'	*Sedimentary*	-	P	200	-
Copahue	71° 05'	37° 50'	Volcanic	-	F	230	-
Rio Valdez	54° 00'	67° 00'	Metamorphic	-	P	88/98	-
Bahia Blanca	62° 17'	38° 45'	Sandstone	-	U-P	-	-
Rio Hondo	64° 58'	27° 33'	-	-	U-P	-	-

TABLE 7. WELLS DRILLED FOR ELECTRICAL AND COMBINED USE OF GEOTHERMAL RESOURCES FROM JANUARY 1, 1990 TO DECEMBER 31, 1994

(Do not include thermal gradient wells less than 100 m deep)

[1] Type or purpose of well

T = Thermal gradient or other scientific purpose
E = Exploration
P = Production
I = Injection
C = Combined electrical and direct use

[2] Tout flow rate at given wellhead pressure (WHP)

Locality	Year Drilled	Well Number	Type of Well[1]	Total Depth m	Mu. Temp. °C	Fluid Enthalpy kJ/kg	well Output[2] Flow Rate kg/s	WHP bu
Copahue	1981 1986 1991	COP-1 COP-2 COP-3	E-P E E	1414 1241 1065	250 235 240	- 2816 -		

TABLE 8. WELLS DRILLED FOR DIRECT HEAT UTILIZATION OF GEOTHERMAL RESOURCES FROM JANUARY 1,1990 TO DECEMBER 31, 1994

(Do not include thermal gradient wells less than 100 m deep)

[1] Type or purpose of well and manner of production
Use one symbol from colomn (a) and one from column (b)

(a)	(b)
T = Thermal gradient or other scientific purpose	A = Artesian
E = Exploration	P = Pumped
P = Production	F = Flashing
I = Injection	

[2] Total flow rate at given wellhead pressure (WHP)

Locality	Year Drilled	Well Number	Type of Well"	Total Depth m	Mu. Temp. °C	Fluid Enthalpy kJ/kg	Well Output[2] Flow Ra kg/s	WHP bar
G. Cerri	1971		P-A			-	8,33	-
G. Cerri	1959	B.Blanca I	P-A	131	59	-	13,88	-
Bahia Blanca	1957			111	55	-	-	-
Carcel	1956	B.Blanca 8	P-A	1248	59	-	47,22	-
Sta Margarita	1955	B.Blanca 1	-	160	57	-	18,05	-
Irel	1954		P-A	101	56	-		-
Parque Mayo	1951		P-A	703		-		-
Paso Yanoli	1951	B.Blanca 9	-	1730	55	-	18,05	-
Pta. Patagonia	1949		P-A	720	58	-	5,83	-
Grunbein	1950			116	51	-	1.38	-
H. Barragan	1941		P-A	968	67	-	3,33	-
Ombucta	1914	Ombucta I	P-A	861	65	-	2,77	-
Vivero Chasico	1954		Q-A	510	50	-	11,11	-
Medanos	1956	Medanos I	P-A	1174	11	-	5,55	-
Vivero Argerich	1915	Argerich 2	P-A	703	62	-	2,77	-
G. Cerri	19611		P-A	674	57	-	14,54	-
Pto. Belgrano	1926		P-A	815	57	-	3,33	-
Pto. Belgrano	1955		P-A	933	65	-		-
Pto. Belgrano	1951		P-A	1001	61	-	1,94	-
Villa del Mar	1967		P-A	810	60	-		-
Baterias	1952		P-A	1274	71	-		-
Baterias	1963		Q-A	1165	71	-		-
Baterias	1978		P-A	1080	12	-	20,83	-
G. Cerri	1956		P-A	139	58	-		-
V. Bordeu	1957		P-A	618	55	-	-	-
Bahia Blanca	1967	B.Blanca10	P-A	111	59	-	0,55	-
P° Galvan	1969		P-A	113	57	-	16,66	-
Bahia Blanca	1950		P-A	618	58	-	11,94	-
Spurr	1961	Spurr Nol	P-A	168	63	-	61,11	-
Total								

TABLE 8. (cont.d)

Locality	Year Drilled	Well Number	ype of Well[1]	Total Depth m	Mu . Temp. °C	Fluid Enthalpy kJ/kg	Well Output[2] Flow Rate kg/s	WHP bar
Bo Coca Cola	1952	B.Blanca	P-A	115	61		34,72	-
Bahia Blanca	1959	-	P-A	111	57			-
Villa Nadir	1982	-	P-A	870	55		1,38	-
Ing. White	1953	-	Q-A	111	62			-
Bahia Blanca	1950	B.Blanca	P-A	691	60		50	-
Bahia Blanca	1946	B.Blanca	P-A	731	56			-
B° Miramar	1952	-	-	746	51			-
B° Patagonia	1949	-	P-A	740	56			-
Hospital	1956	-	P-A	718	56		1,11	-
BAC Espora	1950	-	Q-A	717	19			-
Rio Hondo	-	-	P-A	-				-
Copahue	1981	COP-1	P-F	1414	250			-
	1986	COP-2	E-F	1241	235	816		-
	1991	COP-3	E-F	1065	240			-
Domuyo	1984	-	T	400	-			-
Tuzgle	1989	N° 2	T	100	-			-
	1988	N° 3	T	100	-			-
	1988	N° 10	T	100	-			-
	1988	N° 11	T	100	-			-
	1988	N° 15	T	180	-			-
	1988	N° 16	T	100	-			-

TABLE 9. ALLOCATION OF PROFESSIONAL PERSONNEL TO GEOTHERMAL ACTIVITIES (Restricted to personnel with a University degree)

(1) Government
(2) Public Utilities
(3) Universities
(4) Paid Foreign Consultants
(5) Contributed Through Foreign Aid Programs
(6) Private Industriy

Year	Professional Man Years of Effort (1)	(2)	(3)	(4)	(5)	(6)
1990	13	4	10	-	1	15
1991	13	4	9	-	1	17
1992	19	-	12	-	1	19
1993	22	-	12	-	-	19
1994	23	-	12	-	2	19

TABLE 10. TOTAL INVESTMENTS IN GEOTHERMAL IN (1994)US$

Period	Research & Development Incl. Surf. Exp. & Exp. Drilling Million US$	eld Development cl. Prod. Drilling Surf. Equipment Million US$	Utilization Direct Million US$	Electrical Million US$	Funding Type Private %	Public %
1975 - 1984	4.55	1.89	0.78	-	-	100
1985 - 1994	9.17	4.85	1.10	2.40	-	100